

University of California San Diego
Division of Trauma, Surgical Critical Care,
Burns, & Acute Care Surgery



Handbook

Edition 5.1 – May 10, 2021





Division of Trauma, Surgical Critical Care,
Burns and Acute Care Surgery

Handbook

Department of Surgery,
University of California San Diego

*by Drs. Jay Doucet, Todd Costantini, Jeanne Lee,
Leslie Kobayashi, Laura Godat, Allison Berndtson, Amy Liepert,
Jessica Weaver, Sara Higginson and UCSD Faculty and Fellows*

Edition 5.1 (May 10, 2021)

San Diego, CA

© 2021, Regents of the University of California

<http://trauma.ucsd.edu>

ISBN 978-163901311-1



Download the current version of the Handbook using this QR Code:

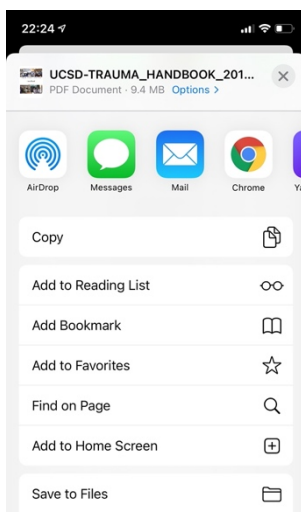


To add to your iPhone as a bookmark icon on your desktop:

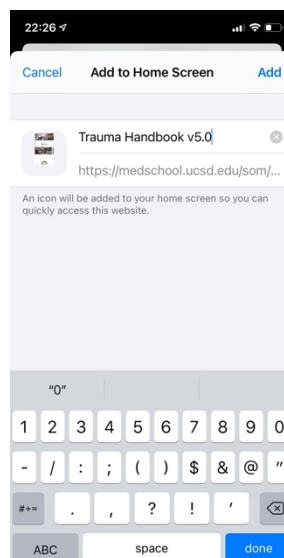
- When the file opens click on the middle box with the top arrow:



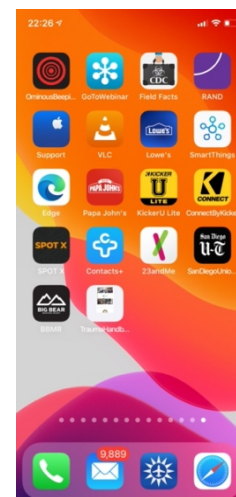
- Click “Add to Home Screen”



- Name the bookmark



- Click Add – the bookmark is added



UC San Diego Health

Trauma, Surgical ICU & Acute Care Surgery Team

2020 - 2021

FACULTY SURGEONS



Dr Jay Doucet



Dr Todd Costantini



Dr Jeanne Lee



Dr Amy Liepert



Dr Laura Godat



Dr Leslie Kobayashi



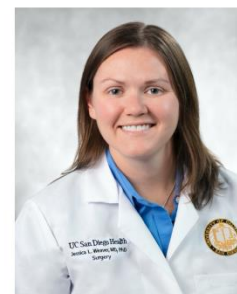
Dr Allison Berndtson



Dr Sara Higginson



Dr Matt Tadlock



Dr Jessica Weaver

PHYSICIAN FELLOWS IN SURGICAL CRITICAL CARE



Dr Laurie Adams

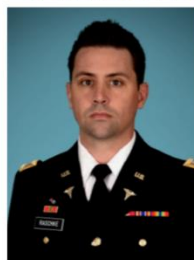


Dr Franchesca Hwang



Dr George Ventro

PHYSICIAN CLINICAL INSTRUCTORS IN ACUTE CARE SURGERY



Dr Eric Raschke



Dr Jarrett Santorelli

NURSE PRACTITIONERS AND PHYSICIAN ASSISTANTS



Andrea Bianco NP



Sara Couch NP



Samantha
Gambles-Farr NP



Jean Luansing PA



Kevin Maxwell NP



Matt Wallace NP



Gabriela Riviello NP



Jennifer
Shackelford NP



Stefan Schulz PA



Jesse Van Leeuwen-
Beloussow NP



Yahveh Carloz NP

Table of Contents

Mission Statement / Introduction	11
MUST CALL ATTENDING CRITERIA	13
Overview of Trauma Service	14
Conferences and Responsibilities	15
Contact Information	16
Telephone Numbers	17
Trauma Service Protocols Overview	18
The Resuscitation Room	21
Trauma page and Trauma Team Activation	22
Transfers	24
Trauma Bypass	25
Operating Room Resuscitation	26
Resuscitative Thoracotomy (EDT) Algorithm	27
Resuscitative Thoracotomy (EDT) Notes	28
BSI/Universal Precautions	29
Initial Assessment and Resuscitation	30
Resuscitation Room Coordination	31
Obtaining Blood samples	32
Ordering Blood units	33
Femoral Stick indications	34
Indications for DRE	35
Massive Transfusion Protocol	36
Low Titer Group O Whole Blood	38
MIVT Report	41
Responsibilities of Team Members	42
Physicians Orders in Resuscitation Room	44
Resuscitation Room Lab Investigations	46
Radiology	47
Radiology Request Form	48
Organ Injury Scale	49
Non-Operative Management of Major Trauma	50
Trauma Resuscitation Debriefing	51
Intimate partner violence/SART/Abuse Reporting	53
Airway with C-Spine Control	55
Airway Management	56
King LTA and EOTA Airways	58
CMAC Video Laryngoscope	59
Esophageal Tube Introducer	59
Rapid Sequence Intubation Protocol	60

Traumatic Brain Injury	61
Traumatic Brain Injury: Level of Care	62
Guidelines for the Management of Traumatic Brain Injury	63
Intracranial Hypertension Management	70
Management of Patients with Suspected or Confirmed Syncope	71
Reversal of Anticoagulation	72
Trauma patient on anticoagulation with CHI	73
Guideline to Emergent Bleeding Reversal	74
Factor Algorithm for life-threatening bleeding due to Warfarin	75
Blood product and Factor Algorithm - not on warfarin	76
Interpreting Thromboelastograms (TEG)	77
Adexanet alfa	78
Thromboelastography	79
Patient on Anticoagulant or Antiplatelets	80
Concussion Screening	81
Acute Concussion Evaluation	82
Concussion Return to Play Protocol	85
Current Concepts in Concussion	87
C-Spine Workup and Management	90
Cervical and Thoracolumbar Spinal Precautions	91
C Spine Clearance Algorithm	94
Neck Trauma	95
Blunt neck trauma	96
Blunt Cerebrovascular Screening	97
Denver BCVI Grading Scale	98
Penetrating Neck trauma	99
Penetrating Neck Wound - Exploration Zones	100
Esophageal Injury	102
Penetrating Neck Wound Algorithm	103
WTA Penetrating Neck Wound Algorithm	104
Facial fractures	105
Facial Fractures without CHI	106
Facial Fractures with Mild CHI	108
Chest Trauma	110
Non-op Management Chest Trauma	
Blunt Chest Trauma	116
Blunt chest trauma algorithm	117
Chest tube insertion/removal	118
Rib fracture management protocol	119
Penetrating Chest Trauma	120
Penetrating Chest Injuries Algorithm - Stable	121
Penetrating Chest Injuries Algorithm - Unstable	122
Retained Hemothorax	123

Prophylaxis Against PostPericardotomy Syndrome (PPS) Protocol	127
Abdominal Trauma	128
Blunt Abdominal Trauma	129
Non-op Management of Liver injury	130
Operative Management of Liver injury	132
Non-op Liver Injury Algorithm	134
Overview of Splenic Injuries	140
Non-op Splenic Injury management	141
Operative Splenic Injury management	143
Zones of Abdomen and Diaphragm Injury	145
Stab Wound Abdomen management	146
Pancreatic Injury	147
Pancreatic injury Algorithm	148
Non-op management of Renal Injuries	149
Operative Management of Renal Injuries	150
Renal Injury on CT Scan Algorithm	152
Zone II Retroperitoneal Hemotoma in OR	153
Pelvic Fractures	154
Pelvic Fracture Algorithm	155
T-POD Application	156
REBOA Protocol	160
Indications	161
REBOA Aortic Zones	162
ER-REBOA Quick Reference Guide	163
Ultrasound	164
Enhanced FAST Ultrasound	165
Positive FAST Images	166
FATE Limited Echo	168
Peripheral Vascular Injury and Compartment Syndrome	172
Vascular Trauma Protocol Overview	173
Extremity Vascular injury algorithm	176
Mangled Extremity Algorithm	177
Consulting Services	178
Neurosurgery	179
Plastic Surgery / Head and Neck Surgery	179
Hand Surgery	179
General Guidelines for Traumatic Orthopedic Injuries	180
Guideline for Orthopedic Procedures on TBI patients	182
OB-GYN - Post-partum hemorrhage	184
Service Responsibilities	185
Tertiary Survey of Trauma Patients	186
Handoffs /I-PASS	189
Daily SICU Huddle	191

Brief Operative Note	192
Trauma deaths	193
Reporting Deaths and Complications for M&M conference	194
Trauma Video Protocol	195
Discharge planning	197
Trauma Clinic Follow-up	
Burns	200
Lund & Browder Burn Area Chart	201
Adult Burn Resus Pathway	202
Pediatric Burn Resus Pathway	204
Burn Photo Triage pathway	210
Pediatric Trauma	211
Pediatric Trauma Hemodynamics	212
Approach to child with multiple injuries	212
Pediatric Transfer Considerations	213
Child Abuse Screening, Assessment, and Reporting – Trauma Team Guidelines:	214
Classification of Hemorrhagic Shock in Pediatric Trauma	216
Drugs used in Pediatric ALS	217
Geriatric Trauma	219
G-60/ACS/TQIP Geriatric Protocol	220
Geriatrics Consultation	225
Venous Thromboembolism prophylaxis	227
Summary of Trauma VTE Protocol	231
Venous Thromboembolism (VTE) Prophylaxis	
VTE Risk factors	232
Weight-based Lovenox dosing	233
Enoxaparin Guideline for Special Populations	235
Post Discharge VTE Prophylaxis	238
Surgical Critical Care	240
ICU Nurse-led rounding	241
mFASTHUGGs / RASS Score	242
Talking to SICU Families / Family meetings	243
HC SICU Indications for GOC/ACP/Howell Service consult:	244
Family Presence During Resuscitations	245
Universal Upset Patient Protocol	250
ARDS Protocol	253
Initiation of Mechanical Ventilation	259
Discontinuation of Mechanical Ventilation	260
Ventilator STEER protocol	265
Ventilator Extubation Protocol	266
Extubation Algorithm	268
Additional notes - Extubation	269
Timing of Tracheostomy	270

Anemia and Transfusion in Stable patients	275
Death by Whole Brain Criteria	276
Central Venous Catheter Insertion	289
Don't Hub the line!	290
Antibiotics & Antifungals in Trauma/SICU patients	296
Guideline for Antibiotic Duration in Hospitalized Patients	296
Guideline: Stress Ulcer Prophylaxis and Proton Pump Inhibitor (PPI) Use	301
Nutrition Notes	302
NPO Guidelines for Preop patients	303
Cortrak post-pyloric feeding	303
Nutrition on Hold Unexpectedly Guideline	305
Pain-Agitation-Delirium-Guideline	306
Pain-Agitation-Delirium-Algorithm	307
Ketamine: Tips	308
Three ways to use ketamine in Trauma/SICU/Burn/ACS:	310
Pain Ladder	311
Confusion-Assessment Method in ICU (CAM-ICU)	313
Guideline for Intravenous Administration of Hypertonic Saline	315
Disaster Planning	318
Health System Codes	319
Ten Predictable Surprises in Disasters	320
Functional Areas / Teams	320
Hospital Command Post	322
Hillcrest Triage Area	323
Limited Treatment Area	324
Trauma Resuscitation Room	325
Acute & Delayed Areas of ER	326
Shock and Holding Area (PACU)	327
Disaster Treatment Record (Paper)	328
Chemical, Biological, Radiological Terrorism	329
Radiologic Weapons	330
Potential Biologic Agents	332
Potential Chemical Agents	333
Acute Radiation Syndrome	334
Burn Surge Plan	335
Acute Care Surgery	336
UCSD ACS/EGS Clinic Follow-Up Protocol:	338
Appendicitis - Uncomplicated	339
Appendicitis - Complicated	340
Appendectomy & Wound Class	341
Acute Diverticulitis	342
Acute Calculous Cholecystitis	343
Suspected necrotizing fasciitis	345

LRINEC Score	346
Extremity Infection Algorithm	347
Truncal Necrotizing Fasciitis Algorithm	350
Opioid Prescribing Guidelines	351
Counseling Patients on opioids	353
Pediatric opioid prescribing	354
Video Links	355

Mission Statement

The UC San Diego Division of Trauma, Surgical Critical Care, Burns & Acute Care Surgery is part of the Department of Surgery. The Division was designed to respond to any emergency call 24/7 with fully equipped, state-of-the art trauma bays and operating room. Any patient with an acute surgical problem, whether trauma, critical surgical illness, burns or surgical emergency, will be seen by a multidisciplinary team of specialists including trauma surgeons, trauma nurses, neurosurgeons, orthopedic surgeons, plastic surgeons and spine specialists. All aspects of care and all subspecialties in medicine are coordinated in the care of each acute surgical patient under the direction of the Division Chief, Jay Doucet MD, FACS, and the acute care surgery faculty and fellows. Our team is present 24 hours a day at the UC San Diego Hillcrest campus and ready to provide care to critically ill and injured patients. Our mission is to save patients' lives and health and return patients back to their families and loved ones.

Introduction

The care of the most severely ill or injured patients requires the cooperation of multiple specialties and disciplines, but we at UC San Diego believe that surgeons with advanced knowledge and training are the vital central element. Our educational philosophy is to teach not only the individual basics of care of surgical patients, but to teach the integration of care through a team multiple practitioners using interdisciplinary process. By providing truly comprehensive care for trauma patients – from intensive care through intermediate care, acute care, and rehabilitation – the UC San Diego Trauma Center remains committed to decreasing the mortality rate from traumatic injuries and acute surgical illness in San Diego County and region. I would like to recognize all members of the Division for their constant efforts and commitment to our vital mission.

Jay Doucet MD MSc FRCSC FACS RDMS
Professor and Chief,
Division of Trauma, Surgical Critical Care, Burns & Acute Care
UC San Diego Health

MUST CALL ATTENDING CRITERIA

MUST CALL ATTENDING CRITERIA

Please do not hesitate to call the attending with any questions or concerns

- New Admission or Consult
- Deteriorating Clinical Condition
- Transfer to Higher Level of Care (or patient leaves AMA)
- New Critical Test Result (i.e. new acidosis, significant HGB drop, K[>] 6, etc.)
- Procedures (Central line, A-line, Bronch, etc.)
- Compartment Syndrome suspected
- Change or Loss in Pulse/Doppler exam
- Wound complication
- New Oliguria (<10ml/hr over 4 hours)
- Unplanned Transfusion OR Unplanned Anticoagulation
- Change in Code Status
- Code Blue, Death, Rapid Response, Code Sepsis
- Discovered treatment error
- Consulting another service, except Neurosurgery or Orthopedics at admission
- Patient fall with LOC or head strike
- Respiratory:
 - Unplanned Intubation / Extubation
 - Increased work of breathing
 - Tachypnea
 - Escalating oxygen requirements
 - Any tracheostomy change
- Cardiovascular:
 - Sustained Hypotension (SBP <90) or Hypertension (SBP >200)
 - Escalating Pressor Requirements
 - New Sustained Arrhythmia, Tachycardia (>120), or Bradycardia (<60)
 - Cyanosis, mottled extremities (Change in Pulse/Doppler exam)
 - Myocardial Infarction
- Neuro:
 - Seizure, TIA, or Stroke
 - Mental Status Change
 - Unexplained / New Weakness or Paralysis
 - Delirium requiring new medication
 - Poorly controlled pain
- Specific Request of another attending

Overview of the Trauma Service

CONFERENCES AND RESPONSIBILITIES

Name of Conference	Frequency	Location	Responsible for Organization of Sessions	Presenters
Trauma & Acute Care Surgery Handover Rounds	Daily 0645	UCSD Hillcrest Main Hospital	ACS Faculty and Fellows	Surgery Residents
SICU Teaching Rounds	Daily a.m.	UCSD Hillcrest Main Hospital	Surgical Critical Care Attending	Surgical Critical Care Attending and Surgical ICU Fellow
AAST Meet the Masters	Tuesday, noon-1pm PT	Zoom Conference	AAST - for declared AAST fellows	AAST Masters
PD's ACS Practice Rounds with Fellows	Tuesday, 1pm-2pm PT	Division Offices	ACS Fellowship Program Director	ACS Fellowship Program Director
SICU Daily Sit Down Conference	M, T, Th ~11 a.m.	UCSD Hillcrest Main Hospital	Surgical Critical Care Attending	Surgery Residents
General Surgery M&M	Weekly, Wednesday 6:30 a.m.	UCSD Moores Cancer Center, 2 nd Floor, Goldberg Auditorium	General Surgery Faculty	Surgery Residents
General Surgery Grand Rounds	Weekly, Wednesday 7:30 a.m.	UCSD Moores Cancer Center, 2 nd Floor, Goldberg Auditorium	General Surgery Faculty	Surgery Residents
Surgical Critical Care/ACS Journal Club	Weekly, Thursday 12:00 p.m.	MPF Bloom Conference Room, Rm 2-256	ACS Fellows and Faculty	Surgical ICU Fellow & ACS Fellow
Trauma Resuscitation Review & ACS Conference	Weekly, Thursday 7:00 a.m.	UCSD Hillcrest Main Hospital, Inpatient Tower, ACR, Rm 1-117	ACS Faculty	Surgical Critical Care Fellow, ACS Fellow or Trauma-SCC Faculty
Trauma-Surgical Critical Care-ACS Research Committee	Thursday 1:00pm	MPF Bloom Conference Room, Rm 2-256	ACS Faculty and Fellows	ACS Faculty and Fellows
Basic Science Research Conference	Weekly (Optional) Friday 11:00 a.m.	Clinical Teaching Facility (CTF) B, 3 rd Floor, Rm 313A	ACS Faculty	Surgery Residents
Division Business Meeting	Bi-weekly, Tuesday 7:00 a.m.	MPF Bloom Conference Room, Rm 2-256	ACS Faculty	ACS Faculty
San Diego County Medical Audit Committee	Monthly, 3 rd Monday 3:00 pm	County of San Diego EMS Services, 6255 Mission Gorge Road, San Diego, CA 92120	County of San Diego Emergency Medical Services	Trauma- Faculty
Combined Trauma/ Radiology Conference	Monthly, 4 th Thursday 3:00 p.m.	UCSD Hillcrest, Main Hospital, Lasser Conference Room, 1-115	Surgical Critical Care/ Radiology Faculty	Surgical ICU Fellow and Radiology Resident
Combined Trauma/ ED Conference	Monthly, 4 th Thursday 4:00 p.m.	UCSD Hillcrest Main Hospital, Inpatient Tower, 3 rd Floor, Rm 3-310	Surgical Critical Care/ ED Faculty	Emergency Medicine Residents
Combined Neuro/Trauma Conference	Monthly, Last Thursday 7:00 a.m.	UCSD Hillcrest Main Hospital, Inpatient Tower, ACR, Rm 1-117	Surgical Critical Care Faculty /Neurosurgery Faculty	Alternately Surgical ICU Fellow & Neurosurgery residents
Combined Trauma/Ortho Conference	Bi-monthly, Friday 7:00 a.m.	UCSD Hillcrest Main Hospital, ACR, Rm 1-117	Critical Care/Orthopedics Faculty	Alternately Surgical ICU Fellow & Orthopedics residents

**Division of Trauma, Surgical Critical Care, Burns & Acute Care Surgery
Contact Information**

Faculty	Office	Pager 290-	e-mail
Dr. Jay Doucet, Division Chief	37100	1490	jdoucet@health.ucsd.edu
Dr. Allison Berndtson	35706	9288	aberndtson@health.ucsd.edu
Dr. Todd Costantini	32997	5710	tcostantini@health.ucsd.edu
Dr. Laura Godat	13918	4107	lgodat@health.ucsd.edu
Dr. Sara Higginson	37200	7520	s2higginson@health.ucsd.edu
Dr. Leslie Kobayashi	37120	0185	lkobayashi@health.ucsd.edu
Dr. Jeanne Lee	37200	2623	jglee003@health.ucsd.edu
Dr. Amy Liepert	37200	8136	aliepert@health.ucsd.edu
Dr. Jessica Weaver	37200	8089	jlweaver@health.ucsd.edu
Dr. Matthew Tadlock	37200	7822	matthewtadlockmd@gmail.com
Fellows			
Dr Laura Adams, Trauma/SCC Fellow	37095/ 37287	9126	ladams@health.ucsd.edu
Dr Franchesca Hwang, Trauma/SCC Fellow		6985	fjhwang@health.ucsd.edu
Dr George Ventro, Trauma/SCC Fellow		0618	gventro@health.ucsd.edu
Dr Eric Raschke, AAST ACS Fellow	37200	1553	eraschke@health.ucsd.edu
Dr Jarrett Santorelli, AAST ACS Fellow		7354	jsantore@health.ucsd.edu
Trauma APPs			
Samantha Gambles Farr, RN, MSN	37821	2687	sgambles@health.ucsd.edu
Sara Couch, RN, MSN	35284	6919	scouch@health.ucsd.edu
Gabriela Riviello, RN, MSN	33434	4989	griviello@health.ucsd.edu
Jenny Shackelford, RN, MSN	10449	2481	jshackelford@health.ucsd.edu
Stefan Schultz, PA	33434	1968	ssschulz@health.ucsd.edu
Matt Wallace, RN	35284	7402	mawallace@health.ucsd.edu
Trauma Program			
Theresa Alivero, Administrator	37162		talivero@health.ucsd.edu
Angela Kilty, Trauma Program Manager	37523	5057	akilty@health.ucsd.edu
Lori Herman, APM/Prevention Coordinator	33171		leherman@health.ucsd.edu
Alan Smith, Programmer/Analyst	36666		a6smith@health.ucsd.edu
Burn Program			
Eli Strait, Coordinator	32352		estrait@health.ucsd.edu

Frequently Used Telephone Numbers			
Location	Extension	Location	Extension
Anesthesia Code Pager	2622	Operator	36222
Angiography	35214	Resus Room- Trauma Bay	36747
Blood Bank	35640	Resus Room- Radiology	35306
Case Manager Pager	5069	Security	33762
CT Scan Room	36893	SICU	37428 (3-SICU)
Main OR	36040	Trauma Clinic	36886
MICN Radio Room	37644	Trauma Office	37200

Trauma Service Routines and Protocols Overview

No patient is to be transferred to another service or facility during the first 24 hours of admission. The only exception may be a trauma patient with single system orthopedic injury after a tertiary exam has been completed.

Pregnant women at a viable gestational age without significant traumatic injury that require additional fetal monitoring may be admitted to OB-GYN after a tertiary exam has been completed, they must be followed by Trauma for 24 hours minimum.

Documentation on the Trauma Service

- a. No medical student is to complete the formal H & P form. *Only* residents should fill out the hospital H&P. The Attending Physician must cosign the H&P. The pain score should be noted, when possible.
- b. A note should be made to document clinical and radiographic clearance of the cervical spine.
- c. A goals of care note must be completed under the “Advanced Care Planning” tab in EPIC for all patients with an ICU stay ≥ 72 hours or patients with a change in code status.

Admission Orders

Admission order should be placed into EPIC as soon as possible, after the initial imaging work-up has been completed and a level of care determined. The patient must be placed in either Observation or Inpatient status based on the degree of injury and acute medical issues. The inpatient/observation status of patients on the trauma service will be reviewed daily by the Trauma Case Manager using interQuol criteria. The Trauma Case Manager will communicate daily with the Trauma Attending or Fellow to discuss changes in admission status.

Observation Status

Patients with an expected hospital length of stay less than 2 midnights should be made observations status. Patients may be changed to inpatient status if additional injuries or acute medical issues are identified that justify an inpatient admission.

Inpatient Status

Patients with an expected hospital length of stay greater than two midnights, and acute medical or surgical issues that require inpatient care should be placed under inpatient status.

Types of Documentation

Resuscitation Room Orders Sheet

(see Resuscitation Room Orders Sheet)

Preoperative Notes

Documentation of a discussion with the patient or their family regarding risks/benefits/alternative choices of the proposed operation should be documented in the patient's chart.

Blood Product Transfusion Consents

Patients who are able to sign must sign a blood transfusion consent form.

Emergent Operative Informed Consent

If a patient is unable to provide informed consent for her/himself, the operating surgeon *MUST* write a progress note stating specifically the indications for the surgery (i.e. life- threatening/emergent), the patient's inability to consent, and inability to contact family.

Bedside Procedures

The procedure note is expected to be placed in EPIC immediately following any bedside procedure. The supervising attending should be a co-signer on any procedure note

Surgical Time-out

Medical Center Policy (MCP) 561.2 requires that a time-out be conducted every time an invasive procedure is to be performed. *At a minimum*, the surgical timeout will include verification of the correct:

- i. patient identity
- ii. side and site
- iii. procedure to be performed

If a discrepancy is discovered, the discrepancy shall be resolved **before** the surgery/procedure is started.

Operative Cases

A Brief Operative Note (see Brief Operative Note) is to be placed in the chart immediately following any operative procedure. It is essential that this be done by the time the patient is in the recovery room or ICU. Until the dictated operative note is transcribed, it is the only record of the operative procedure. This should be filled out in the EPIC electronic system using the brief operative note template and include the wound classification.

Dictated operative notes should be completed as soon as the operation is over. The dictated note must be done within 24 hours by the Fellow or Attending Surgeon.

OR Resuscitations

OR resuscitations are considered operations. Therefore, a brief op note and operative dictation are required.

Transfer/Off-Service Notes

A transfer or off-service note should be included in the following situations:

- i. transfer of a patient from the SICU to a lower level of care

- ii. during the change of rotations

This note should be brief and include a list of injuries, studies and interventions performed, as well as follow-up/studies to be completed.

Discharge Summary

The discharge summary must be completed within 24 hours of discharge and lists the:

- i. admission and discharge diagnoses
- ii. operations
- iii. Summary of hospital course
- iv. condition at discharge
- v. activity
- vi. medications
- vii. follow-up clinic appointments
- viii. laboratory tests to be done before follow-up.

This note facilitates rehabilitation and clinical follow-up and should provide concise information to consultants and housestaff who will be rotating on the trauma service in the future. This should be completed on the EPIC electronic system where a trauma discharge outline is available and should be used.

The Resuscitation Room

Trauma Group Page & Trauma Team Activation (TTA)

- a. When there is an admission to trauma, the trauma nurse will call the page operator (x36440) and request a Trauma Group Page. The trauma nurse will indicate the ETA and mode of arrival (ground, air, or from the ED) to the page operator.
- b. The Trauma Group Page includes:
 - i. Trauma Service Physicians, Nurse Practitioners, Physician Assistants
 - ii. SICU and OR Charge Nurses
 - iii. Trauma Program Managers
 - iv. Nursing Supervisor
 - v. Radiology resident
 - vi. ED Attending/ED resident
 - vii. Respiratory Therapy
 - viii. X-ray Technologist
 - ix. Ultrasound Technologist
 - x. Case Managers
 - xi. OB/Trauma registration
 - xii. Telecommunications
 - xiii. Social Worker
 - xiv. Clinical Study Nurses
- c. If PTA information about a patient suggests the need for intubation or for the neurosurgery physician to be present on admission, the trauma nurse should confer with the Trauma Service and ask the page operator to page anesthesia or the neurosurgeon on call to respond to the resuscitation room.
- d. If the trauma nurse or trauma physician determines that the patient will be an OR resuscitation, the trauma nurse will direct the page operator to input "OR Resus" on the group page. (See "OPERATING ROOM RESUSCITATION")
- e. As a courtesy, the trauma nurse receiving the call should notify the OR of an expected admission and provide a brief report.
- f. Trauma patients initially triaged to the ED may subsequently be "upgraded" and transferred to the resuscitation room as a Trauma Team Activation. The request must be from the ED Attending to the Trauma Fellow/Attending.
- g. *Trauma Consult Protocol in ED*
The Chief Resident, Trauma Fellow or Attending must see the patient **within 5 minutes** of consult requests by the ED.
- h. Any pediatric trauma patients admitted by the ED to the hospital are to be seen by the Trauma Service, who will be notified by the ED.
- i. The most frequently used Trauma Group Pages include:

- i. "Trauma Admission ETA (x many minutes by ground or by air)"
- ii. "Trauma Admission Now"
- iii. "OR Resus ETA (x many minutes by ground or by air)"
- iv. "Trauma Admission Cancelled"

Transfers – Eligible facilities and transfer centers

- The trauma attending/fellow on call is the initial point of contact for transfer requests routed through the transfer center. They will contact the MD requesting transfer to discuss the case and decide whether the transfer will be accepted.
- When a transfer is accepted, the following must happen immediately:
 - o Notify the transfer center that the patient is coming (13868 or 35709). Provide patient name, age, hospital and name of MD requesting transfer
 - o For trauma transfers also notify a *trauma nurse* (36747 or 36746) and give report
 - o Notify the appropriate Attending - Note: if the patient will arrive after handover of the service, also notify the oncoming Attending.
- Trauma transfers typically come to the Resuscitation Room
- General surgery transfers may be admitted to any level of care. Bed arrangements are handled by the transfer center. They do not go to the Resuscitation Room.
- Transfers are accepted for a higher level of care at the discretion of the on call surgeon. Specific facilities we accept transfers from are listed below:
 - o Trauma – Accept El Centro Regional Medical Center, Sharp Coronado, Scripps Chula Vista, and anything from Mexico. Requests from within San Diego County, but outside our enchantment area, may be considered on a case by case basis.
 - o General surgery – Accept El Centro Regional Medical Center. Other requests considered on a case by case basis. Preference may also be given by attendings to UC San Diego “Affiliated” facilities – TriCity Regional, Inland Valley Medical Center, Eisenhower Medical Center.

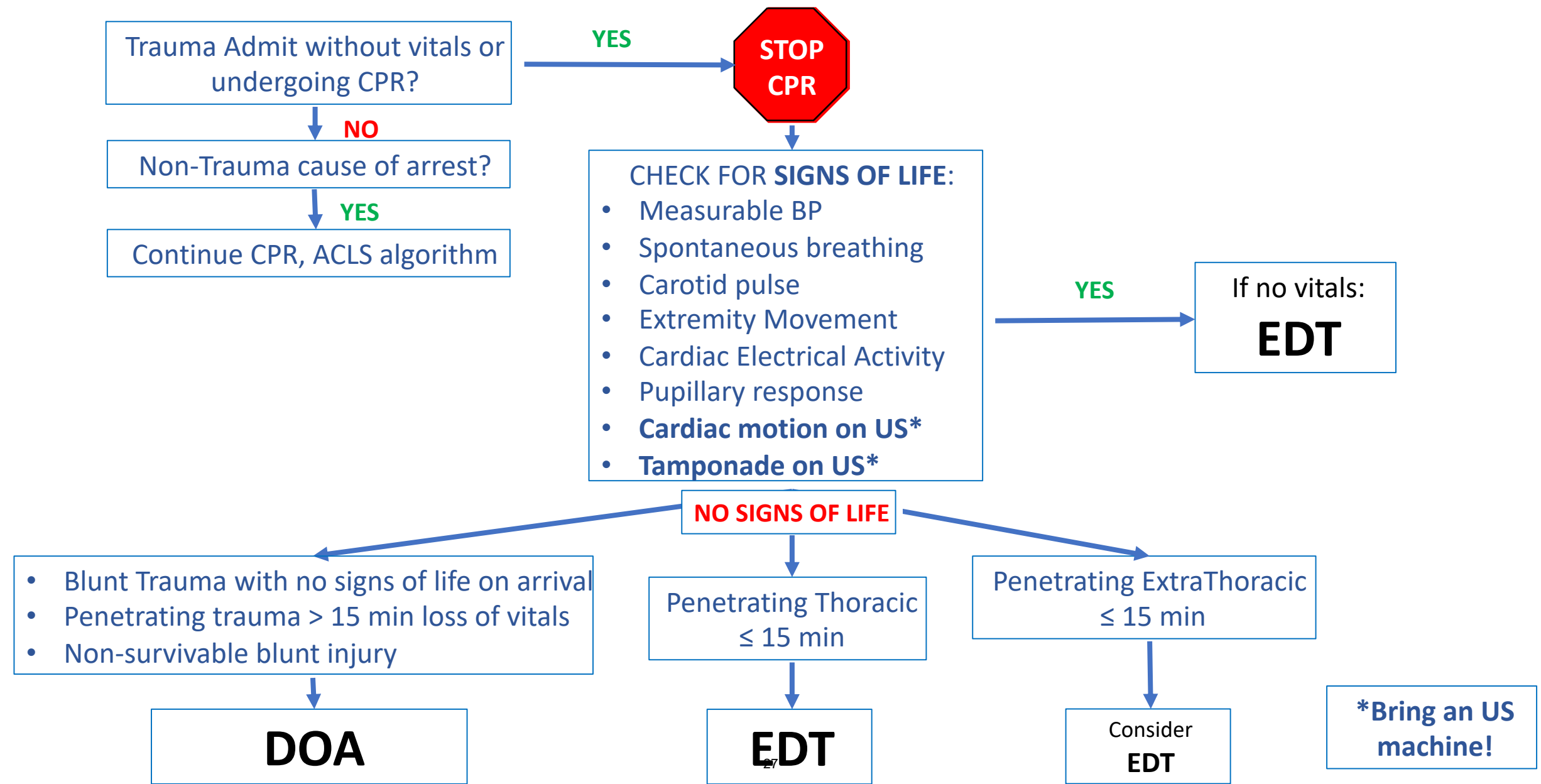
Trauma Center Bypass Status

- a. *Only* the Attending Trauma Surgeon can place the Trauma Center on Trauma Bypass. If a fellow initiates Trauma Bypass, they must get Trauma Attending approval ASAP. Trauma Bypass means that the prehospital personnel (MICN radio nurse, paramedics, Base Hospital physician) will divert injured major trauma victims from UC San Diego- Hillcrest to other Trauma Centers in San Diego County. This is tracked closely and excess bypass hours will have consequences.
- b. The Trauma Fellow/Attending must personally contact the MICN to take the Trauma Center *off* Trauma bypass at 543-7644.
- c. Trauma Bypass is *different* from other county bypass reasons/statuses (i.e. ED saturation, Hospital full, Stroke Bypass, STEMI divert, or No ICU beds). Even if the hospital is on ED saturation, Hospital full or No ICU beds bypass status, this does not mean we are automatically on Trauma Bypass.
- d. On occasion, Children's Hospital Trauma Center will have no ICU beds. When this occurs they will call the UC San Diego Trauma Surgeon on call, and notify him/her that the "Pediatric Age Specific bypass" plan is enacted. Therefore, ALL pediatric patients 10 to 14 years of age will be sent to the UC San Diego- Hillcrest Trauma Center until Children's Trauma Center is off bypass.
- e. **It is important when calling the MICN to indicate slowly and clearly WHO you are, WHAT kind of bypass you mean ("TRAUMA BYPASS") and whether you are going ON or OFF bypass. Only give ONE reason we are going on bypass even if there is more than one reason.**

Operating Room Resuscitation

- a. Criteria for OR Resus (Direct transport to OR #11)
 - i. Penetrating trauma with hypotension
 - ii. Witnessed traumatic cardiac arrest
 - iii. Hypotensive patients who are unresponsive to fluid challenges in the prehospital setting. (i.e. < 90mmHg systolic BP)
 - iv. Major external hemorrhage - uncontrolled (i.e. amputation above knee or elbow)
 - v. Direct injury to neck with serious airway compromise
- b. While still enroute to the hospital, do not change patient's place of destination at the last minute. A resuscitation nurse or senior trauma physician can call an OR Resus as long as the patient is more than 5 minutes ETA. Once the decision has been made, do not change the decision. There is often not enough time to move either the trauma team or paramedics to another destination.
- c. If trauma resuscitations are actively in progress in the trauma bay at the time a new patient meeting OR Resus criteria is enroute, it may be necessary to bring that patient to the trauma bay rather than the OR to prevent splitting the team between 2 different locations. This decision should be made at the discretion of the Trauma Fellow/Attending on-call.

Resuscitative Thoracotomy (EDT) Algorithm



RESUSCITATIVE THORACTOMY (EDT) NOTES

- Closed chest CPR has no proven efficacy in traumatic arrest, so you can stop it.
- The ultrasound machine is indispensable in decision making for EDT, make sure you bring one.
- Have a very low threshold to convert immediately to clamshell with any difficulty or delay.
- Antisepsis is unnecessary.
- The only required starting tools are a knife and forceps.
- Cut along the ribs in the inframammary folds, avoid cutting straight across the chest.
- The sternum can be divided with a Lebsche knife, trauma shears, rib cutter or saw.
- Be bold, the pericardium should be open in less than 90 seconds.
- The pericardium must always be opened, even if you doubt tamponade exists.
- The pericardium is usually tough and may be difficult to initially open with scissors, a knife can be used to start a hole.
- Myocardial wounds are most easily closed with 3-0 Prolene, double-armed on a MH needle. Pledgets are usually unnecessary.
- Clamp the aorta above the diaphragm early.
- Passing an NG helps differentiate the aorta from the esophagus – both will be empty tubes.
- If the heart is fibrillating after repair of cardiac wounds, defibrillation paddles are placed directly on the heart
- With ROSC, internal mammaries and intercostal arteries will bleed, look for them and ligate them.
- Consider REBOA for SBP < 90 with abdominal or pelvic trauma.
- Outcomes are worse when the patient is not intubated in the prehospital phase
- Outcomes after ED thoracotomy in kids are even more dismal than in adults. This is particularly true for children arriving without vital signs and for penetrating abdominal trauma.
- Be careful not to cut yourself on broken ribs, knives or bullet fragments.
- Practice careful sharps control.

Body Substance Isolation (BSI)/Universal Precautions in the Resuscitation Room

Do not stick needles in mattresses. There are needle disposal units in the room.

Double gloving is strongly recommended for procedures.

Universal precautions are to be worn for all Trauma patients. This includes mask, eye protection, gloves and a gown. About 25% of trauma patients have a history of blood-borne diseases at UCSD.

Trauma patients arrive with incomplete histories, they may have been exposed to hazardous materials including chemical and radiation agents, or may have skin parasites or communicable diseases.

Trauma patients may vomit, bleed, spit or expel body fluids unexpectedly, protect yourself!



Figure 1 – Example of Universal precautions for a trauma admission

Initial Assessment and Resuscitation

Resuscitation Room Coordination

(see MIVT Report & Responsibilities of Trauma Team Members)

- a. Daytime and OR resuscitations are loud and crowded. The trauma fellow or attending should ask extraneous people to leave as needed.
- b. A plan for the resuscitation should be articulated by Doc #1 to the rest of the team before arrival of the patient and all necessary equipment made readily available according to the severity of the resuscitation (chest tubes, central line kits, IO catheters, level 1 infuser, blood in room, thoracotomy tray, REBOA kit, etc.).
- c. Doc #1 should articulate patient's plan of diagnostic work up within first 5 minutes of admission and then ensure that patient is transferred to CT scanner in a timely fashion.
 - i. All CT scans and laboratory tests will be input into EPIC by the trauma techs. A list of X-rays needed should be communicated verbally to the X-ray techs. Paper order forms are provided to be filled out by the medical team.
 - ii. All patients must be accompanied to the CT scanner by a member of the medical team. Patients with significant injuries, concern for intracranial hemorrhage, or potential need for urgent operative intervention should not be sent with the most junior member of the team, but rather with someone capable of reviewing images in the scanner and dictating further care immediately.
- d. Housestaff and med students should be familiar with the room and all supplies.
- e. The ED or anesthesia staff typically intubate patients, but all Trauma Service physicians should be comfortable intubating patients.
 - i. If the senior ED resident (not intern) is present, the ED attending is called (x32130) to supervise the intubation. The trauma nurses should get an RSI kit from the Pyxis and pull up all medications.
 - ii. If the senior ED resident is not available, ask the trauma techs to page anesthesia for intubation. They will bring their own medications.
 - iii. The most senior surgeon (trauma fellow or attending) holds cricoid pressure during intubation, and is thus positioned for a surgical airway if intubation fails.
- f. *Techniques/Routines*
Everyone should feel comfortable and know how to assist/perform the following at their level of responsibility:
 - i. cricothyroidotomy
 - ii. chest tube placement/removal
 - iii. central line placement
 - iv. venous cutdown technique
 - v. resuscitative thoracotomy

g. *Burn/Pediatric/Elderly (>65 years old) Patients*

Unless otherwise specified, all IV fluids will be put immediately on infusion pumps. The nurse will need the order for the fluid maintenance rate early in resus (and supplement with IV fluid boluses, as required).

h. Blood alcohol level and urine toxicology is to be sent routinely in all trauma resuscitations.

i. All female patients of childbearing age should have a pregnancy screening test sent to the lab, although this should not delay any necessary diagnostic workup.

j. *Procedure for Obtaining Blood Sample*

i. When a patient is admitted to the resuscitation room, blood will be obtained as soon as possible for blood typing and other laboratory studies. Doc #1 will determine which blood studies are to be obtained.
(see Resuscitation Room Lab Investigations)

ii. The needle and syringes for blood drawing are located on the bedside table next to the patient. Blood should be drawn immediately after rolling the patient and should happen concurrently with the FAST examination. Typically the left groin is used for the femoral arterial blood draw unless injury preclude this, since the FAST examiner stands on the patient's right. Use a betadine swab, NOT ALCOHOL to prep the patient.

1. Patients who are on blood thinners: aspirin, clopidogrel, warfarin or IIa and Xa inhibitors should have blood drawn from an existing IV rather than a femoral stick so as to prevent hematoma formation.

iii. After the blood is drawn, cap the needle and inform the trauma tech that the blood is available to be sent to the lab. It is important to get verbal confirmation from the trauma tech that he/she knows that blood has been drawn. The trauma tech will then distribute blood in the proper tubes and take the samples to the lab.

iv. The patient labels should be crosschecked with the patient ID band. This crosscheck must be done by the Trauma Tech who handles the blood sample.

k. *Ordering Blood*

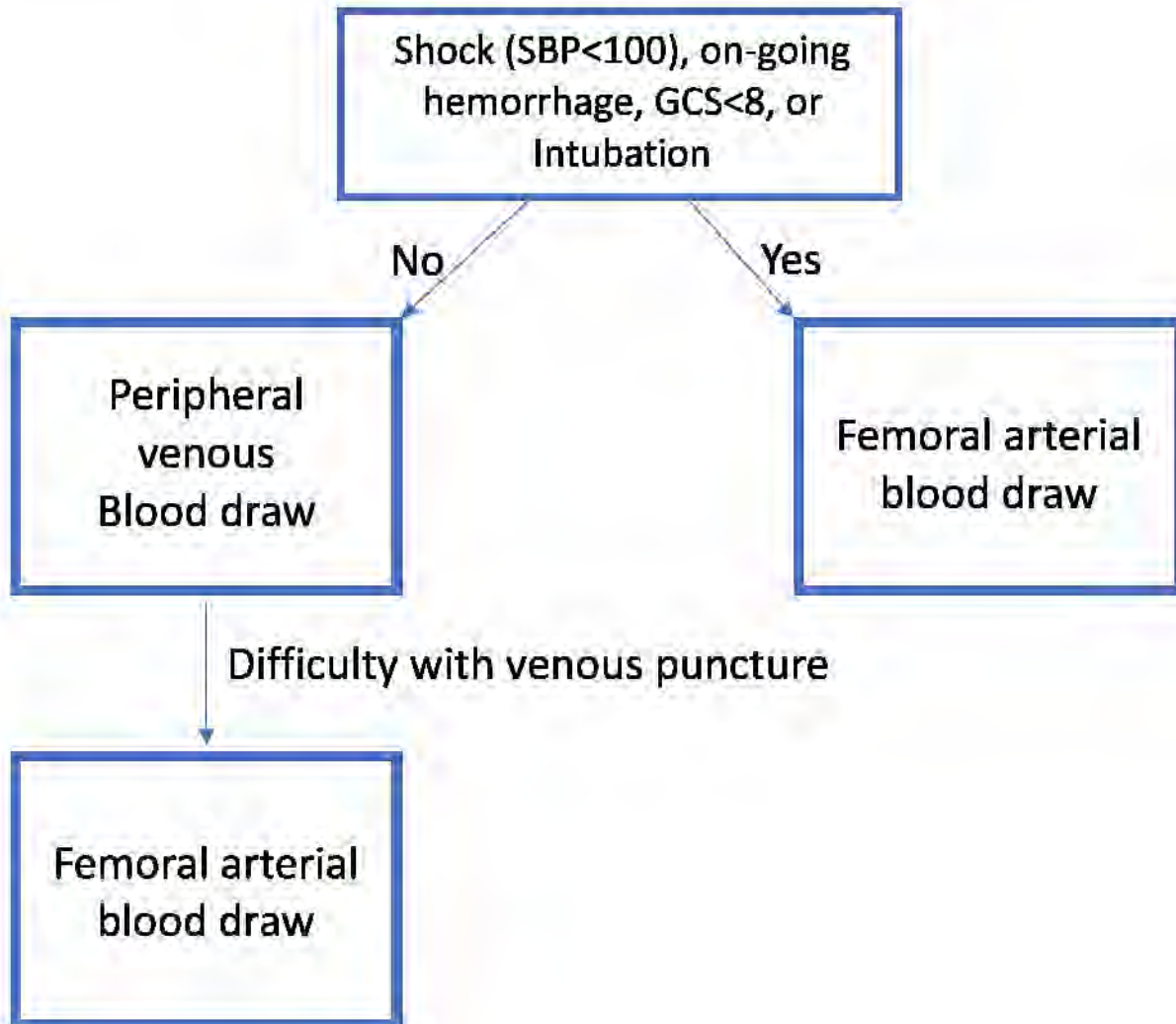
i. One person should be delegated to communicate with the Blood Bank. In most cases this is the Trauma Tech or Circulating Resus Nurse; in OR resuscitations, it is the Circulating OR Nurse.

ii. If transfusion is emergently required (whether a blood sample has been sent to the blood bank or not), the Trauma Fellow or Attending may request blood

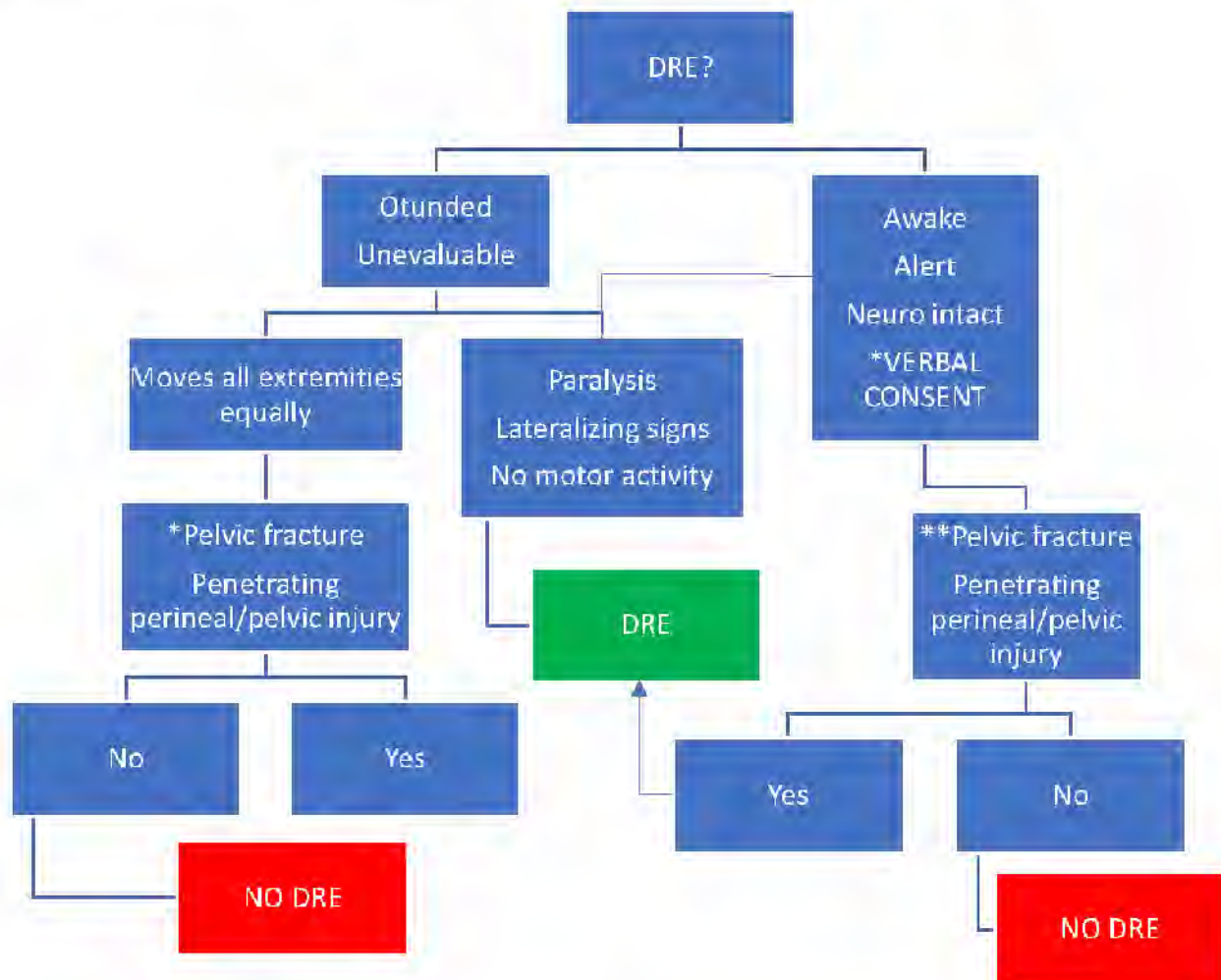
for emergency released, specifying the patient's name, number of units required and how rapidly they need to be delivered. The trauma fellow or attending must then sign and write their provider ID on the emergency blood request form. The Massive Transfusion Protocol is activated using the same form, but the Blood Bank must specifically be called and told "activate the massive transfusion protocol".

- iii. The Blood Bank will release up to 4 units of type O- blood and 4 units of AB- or A- FFP. A labeled blood sample should be obtained if at all possible, before administration of uncrossmatched O- blood.
- iv. These 4 units of type O- blood and 4 units of AB- or A- FFP can be obtained by calling the Blood Bank directly at **35640/35641** and request **"Emergency Release"**. The runner going to pick up blood should go the Blood Bank with a patient label. (see Massive Transfusion Protocol). An Emergency Blood Release form is not required for Massive Transfusion.
 - 1. If the patient needs blood immediately, do not specify whether or not crossmatched, unmatched or type specific blood is needed; this will slow the time to transfusion. (Based on time constraints, the Blood Bank as per their protocol *will release the most appropriate and most compatible blood with the patient's blood type, if known.*)
- v. After the first 4 units of O- blood the Blood Bank may release type O+. (*The Blood Bank may provide Type O+ for males or females of non-childbearing age.*)
- vi. Consider giving units of AB/A/Type specific plasma for 1:1 resuscitation.
 - 1. These are provided automatically when the Massive Transfusion Protocol is initiated.
- vii. During routine sampling, non-emergent transfusion, or during a resuscitation that does not require stat blood release, the surgeon can continue to specify the status of the blood he/she would like "set up" on the patient (i.e. type and crossmatch or type and screen).
- viii. A patient's ABO/Rh type must be determined twice, on two separately drawn blood specimens in order for patients to receive type specific PRBCs for transfusion at UC San Diego Health System. This policy does not apply to patients requiring emergent transfusions

FEMORAL STICK VERSUS PERIPHERAL BLOOD DRAW:



INDICATIONS FOR DIGITAL RECTAL EXAMINATION:



* Conscious patient must verbally consent to DRE

**with concerning physical exam findings

- perineal/scrotal hematoma
- blood at urethral meatus
- vaginal bleeding
- perineal lacerations

Massive Transfusion Protocol

1. When it is anticipated that more than 10 units of packed red blood cells (PRBCs) will be used for a patient, or if 4 units of PBCS and FFP are needed at once activate the Massive Transfusion Protocol by calling the Blood Bank (35640/35641). **THIS IS A CRITICAL STEP!**
2. Tell technologist: "Activating Massive Transfusion Protocol"
 - a. The technologist will indicate if a signed "Emergency Blood Release will be eventually needed;
3. Provide this information to the technologist:
 - a. Patient's Name
 - b. MRN
 - c. Date of Birth
 - d. Location of Patient
 - e. Ordering Physician (Full Name)
4. Send a Runner with MRN immediately to Blood Bank (2nd floor) to pick up blood.
5. Runner should bring a patient label (or at least MRN) and should go to the front of the Blood Bank line to ask for "Massive Transfusion Protocol" blood.
6. First pick-up will include 4 units of low titer whole "O" blood (LTOWB), unless unavailable, then 4 RBC units + 4 FFP units.
7. If needed, alert your charge RN to activate overhead Code paging to get help.
8. The Blood Bank will then mobilize 45 units each of PRBCs and plasma, and 4-6 units of apheresis platelets ASAP.
9. If not LTOWB, the initial 4 units of RBCs may be O- along with 4 units of AB or A plasma.
10. Immediately following this, 4-6 units of RBCs, 4-6 units of plasma, and 1 apheresis platelet unit will be supplied, followed by batches of 10 RBCs, 10 plasma, and 1-2 platelets.
11. Type-specific blood will be initiated as soon as possible and depends on the availability of a second blood specimen for ABO/Rh confirmation.
12. If necessary, in order to provide sufficient blood without delay, the decision to switch blood types (eg, to O for type B; A or O for type AB) will be made by the Blood Bank.
13. In the OR, the Trauma Service should plan with Anesthesia to continue to communicate with Blood Bank to stay 10 units ahead with both RBCs and FFP.

14. Obtain a clot to send to Blood Bank even if the heart is empty (i.e. from a clot in a basin or from a hemothorax).
15. When possible, obtain a blood sample for **Thromboelastography** (see TEG) to detect coagulopathy and fibrinolysis.
16. It is the Trauma Fellow/Attending's and/or Senior Resident's responsibility to determine when FFP, platelets, cryoprecipitate, etc., will be ordered as part of the Massive Transfusion Protocol.
17. For patients presenting within 3 hours of injury, consideration should be given to the administration of tranexamic acid (**TXA**) (loading dose of 1g IV over 10 minutes followed by an infusion of 1g IV over the next 8 hours).
18. When the patient is stabilized, call the Blood Bank to cancel the Massive Transfusion Protocol.
19. If the patient is pronounced, call the Blood Bank immediately to cancel the Massive Transfusion Protocol.

Low-Titer Whole O Blood (LTOWB) Trauma Massive Transfusion-Frequently Asked Questions:

- What is LTOWB?
 - LTOWB stands for low-titer type O-positive whole blood. LTOWB donations come from “low titer” donors who have O-positive blood and low levels of antibodies known as anti-A and anti-B.
- Why do we need LTOWB?
 - There are many advantages of using whole blood (LTOWB) in trauma resuscitation. LTOWB contains less physiologically inert fluid, that is, fluid that does not carry oxygen or contribute to hemostasis, compared to reconstituting WB using additive solution containing red blood cells (RBCs) and a unit of plasma and WB platelets (PLTs), it provides balanced 1:1:1 RBC-Plasma-PLT resuscitation while simplifying the logistics of the resuscitation as one bag can be administered instead of three, and the cold-stored PLTs in bleeding patients may provide improved hemostasis compared to standard stored PLTs.
- Are there any safety concerns with LTOWB over RBC transfusions?
 - No. This was the only blood product available from the inception of blood transfusion from the 1950’s into the 1970’s. Patient transfusion risks may actually decrease since they are receiving a transfusion from one donor source instead of three.
- How much volume is in a unit of LTOWB?
 - Each bag contains roughly 520 cc of total volume. About the same as 1 unit of PRBCs and 1 FFP, the bag will appear “fuller” than a pRBC bag. 4 units of LTOWB is 2080ml of blood product.
- How is LTOWB issued?
 - LTOWB is only issued as part of a massive transfusion protocol (MTP) for trauma patients at the Hillcrest campus. When available, up to 4 units of LTOWB will be issued in a Hemoroam cooler. It should be administered as the first MTP blood products used. If additional blood products are needed, then additional components transfusions can continue.
- Do we still need to send a blood sample for crossmatch?
 - Massive transfusion is ordered in the same way, by calling the blood bank, bringing a sticker and/or MTP form to the Blood Bank. A blood sample should be sent for blood grouping
- How much LTOWB is available?
 - Initially there will be just 4 units of LTOWB issued by the Red Cross weekly. Once those units are used, there will be no resupply until the weekly supply is restocked.
- Is LTOWB irradiated?
 - No. It is also not leukocyte reduced. This is less of concern in massive transfusion.
- Can LTOWB be given to women of childbearing age?

- Yes. The risk benefit to the patient in MTP favors risk of antibody formation versus death due to hemorrhage.
- If a woman of childbearing age has Rh- blood type receives a LTOWB MTP should they receive Rhlg (RhoGAM)?
 - You should consult with your transfusion medicine experts, Dr Patricia Kopko or Dr Elizabeth Allen.
- What kind of reactions can occur to LTOWB?
 - The same kind of reactions that can occur during transfusion of any blood product.
- Does LTOWB interfere with the administration of other, additional blood products or medications?
 - No. Administration is the same as with all other blood/blood products, generally no medications are mixed in line with blood products.
- Will transfusion of O+ whole blood impact a patient's blood type?
 - With 4 units LTOWB, this may not happen. However, just as with any uncrossmatched, emergency release blood product, this issue can arise if the patient approaches or exceeds replacement of their full blood volume. However, this is not typically not a life-threatening condition.
- If the recipient is not Blood Group O, won't the plasma in LTOWB cause a reaction?
 - So far, published studies have not demonstrated that LTOWB is associated with hemolysis in civilian trauma patients.
- What about use in children?
 - There are no prospective studies of transfusion resuscitation in pediatric trauma and very limited data showing the safety of LTOWB in children in the setting of hemorrhagic shock. Most US hospitals do not allow use of LTOWB in patients under 3 years or 15 kg.
- How is LTOWB administered?
 - It is given in the same manner as other blood products:
 - the unit should be administered using a standard 170-210 micron filter. There is no need to prime the administration set with a crystalloid, it is perfectly appropriate to use blood only. Blood products given during massive transfusion should be given via a blood warmer (Belmont, Level 1, etc...)
- LTOWB contains platelets, can I infuse it via rapid infuser tubing?
 - Yes, LTOWB is administered like pRBCS and can be given via rapid infuser tubing.
- What is the shelf life of LTOWB?
 - 21 days.

If you have questions about the Low-Titer Whole O Blood (LTOWB) Trauma Massive Transfusion, please contact Jay Doucet MD jdoucet@ucsd.edu or Patricia Kopko MD pkopko@health.ucsd.edu

REQUEST FOR BLOOD PRODUCTS EMERGENCY RELEASE OR MASSIVE TRANSFUSION

Patient Name: _____

MRN: _____

Attach a label or handwrite the information

Date / Time: _____

Location: _____

The patient's condition warrants the use of uncrossmatched, least incompatible or untested blood products or activating the massive transfusion protocol. I hereby request the Blood Bank to supply the unit(s) requested below:

Check One Below:

No. of Units

- ☐ Uncrossmatched blood - O Negative _____ (up to 4 units)
- ☐ Plasma AB/Type Specific _____ (up to 4 units)
- ☐ Uncrossmatched blood - type specific _____
- ☐ Blood product _____ Untested for _____
- ☐ Massive Transfusion Protocol

1st Batch: 4 units of RBCs and 4 units of Thawed Plasma; 2nd Batch: 6 units of RBCs, 6 units of Thawed Plasma and 1 unit of Plateletpheresis; 3rd Batch: 10 units of RBCs, 10 units of Thawed Plasma and 1 unit of Plateletpheresis. **Note: Order Cryoprecipitate as needed.**

MTP Initiated by: _____ MTP Discontinued by: _____

- ☐ Neonatal Emergency Transfusion _____

Note: Blood Bank Tech will issue the freshest O Negative, CMV Negative adult RBC (the product will NOT be irradiated or issued in a syringe). If CMV Negative RBC is not available, the freshest O Negative RBC unit preferably CPD, CPDA1 or AS3 will be issued.

- ☐ Least incompatible crossmatch

Note: Transfuse first 50-100 mL slowly over 1/2 hour and monitor the patient closely

- ☐ Other: _____

Physician Signature/PID#

Date & Time

Courier Signature

Issue Date & Time

MIVT Report

1. The MIVT Report is given by the lead EMT.
2. Doc One should be at the head of the bed and greet the EMT with:
“HI, I AM DOC ONE. I AM READY FOR YOUR REPORT”
3. Doc One will look at the Lead EMT and listen to the report actively.
4. Doc One will acknowledge the report, ask any needed questions and give feedback.
5. The remainder of the Trauma Team is quiet and listens to the report. The exception is the Trauma Nurse who may palpate and report the presence or absence of the radial pulse.
6. The EMT is given **45 seconds** before the patient is moved to give an MIVT report. The only time the paramedic will not be allowed to give the MIVT report is when patients have a need for CPR (no radial pulse), or are in need of immediate airway control. In those instances, the team will proceed with moving the patient over and continuing with CPR and intubating the patient and then subsequently get reports from the paramedics.

As a reminder, here are the elements of the MIVT report:

M = Mechanism of injury

Include all mechanisms of injury, including a description of all blunt mechanisms as well as penetrating injuries.

I = Injuries identified or injuries suspected

EMTs usually describe, in addition to obviously identified injuries, areas where the patient has complained of pain or soreness.

V = Vital signs including level of consciousness

If the patient's vital signs have been stable the EMT does not need to specify lost blood pressure or pulse. The EMT can simply state vital signs have been stable throughout. It is very important for the EMT to state level of consciousness and if possible, Glasgow Coma Scale. If the level of consciousness has waxed and waned, or decreased in any way, it is important to make note of this. It is also at this point that the paramedic should note unequal or fixed and dilated pupils, if he is aware of them.

T = Treatment or therapies and response to therapies

If the patient had low blood pressure and received a fluid challenge of crystalloid to which his blood pressure responded, it should be noted here. If the patient had lack of a distal pulse prior to traction splint application which returned or did not return after application of the splint, it should be noted here.

Responsibilities of Trauma Team Members

Team Member	Pre-admission	Primary Assessment	Secondary Assessment
DOCTOR 1 (Head of Bed)	<ul style="list-style-type: none"> • Puts on lead apron/universal precautions • Assigns roles • Checks intubation equipment • Gives pre-admission plan 	<ul style="list-style-type: none"> • Identifies self to paramedics • Initial evaluation • Manages airway • Immobilizes neck/C-spine • Directs team members • Decides type and # of IVs • Prioritizes x-rays • Prioritizes procedures • Orders type & amount of blood • Orders lab work 	<ul style="list-style-type: none"> • Orders consults • Does head to toe/back exam including rectal if indicated • Orders relevant imaging • Reads imaging studies • Decides disposition • Talks with family • Updates trauma team and nurses of plans as they evolve • Participates in Debrief and escort to CT
DOCTOR 2 (side opposite Monitoring Nurse)	<ul style="list-style-type: none"> • Puts on lead apron/universal precautions 	<ul style="list-style-type: none"> • Assists with airway • Undresses patient • Establishes additional IV access • Manual control of bleeding from head/neck/torso • Performs diagnostic procedures • Inserts monitoring lines • Applies warm blankets 	<ul style="list-style-type: none"> • Assists with clinical exam • Assists with drawing blood • Participates in Debrief and escort to CT
DOCTOR 3 (Left leg)	<ul style="list-style-type: none"> • Puts on lead apron/universal precautions 	<ul style="list-style-type: none"> • Undresses patient 	<ul style="list-style-type: none"> • Draws arterial blood from groin • Immobilizes fractures • Assists with procedures • Participates in Debrief and escort to CT

Team Member	Pre-admission	Primary Assessment	Secondary Assessment
MONITORING NURSE	<ul style="list-style-type: none"> • Posts MIVT on screen at HOB • Puts out Trauma Page • Puts on lead apron/universal precautions • Flushed IV's • Pulls pre-stamped AKA packet 	<ul style="list-style-type: none"> • Assesses radial pulse • Assists with airway • Takes blood pressure • Gives vital signs Q 2-3 minutes • Assesses IV patency • Numbers IV bags • Applies ID arm band 	<ul style="list-style-type: none"> • Gives meds and IVs • Updates hemodynamic monitoring information (Fluids, ABG, MEDS) • Participates in Debrief • Accompanies & monitors patients on transports
CIRCULATING NURSE	<ul style="list-style-type: none"> • Puts on lead apron/universal precautions • Turns suction on high (connects Yankauer) • Gets warm blankets 	<ul style="list-style-type: none"> • Ensures bloods are processed • Readies Pleurevacs PRN • Uses autotransfusion • Directs attainment of supplies • Assists with procedures • Obtains 2nd IV if needed 	<ul style="list-style-type: none"> • Places EKG leads • Ensures equipment for transport • Interfaces with other departments • Takes temperature • Participates in Debrief
TRAUMA TECH	<ul style="list-style-type: none"> • Readies (ice, tubes, syringes) for blood drawing • Receives pre-stamped AKA packet • Places patient info in Log Book 	<ul style="list-style-type: none"> • Assists with obtaining equipment • Collects valuables and clothes • Assists with obtaining blood from groin 	<ul style="list-style-type: none"> • Processes valuables and clothes • Receives blood tubes to prepare labs • Takes lab work to Blood Bank and Labs as "Trauma STAT" • Answers telephones • Pages consults • Places patient info in log book
TRAUMA FELLOW / ATTENDING	<ul style="list-style-type: none"> • Briefs team on expected roles, actions, special needs, maintains "shared mental model" for team 	<ul style="list-style-type: none"> • Maintains "big picture" for team • Provides Cricoid pressure during intubation 	<ul style="list-style-type: none"> • Calls for backup prn. • Notifies MICN of Bypass Status • Calls OR to book case • Participates in Debrief

TRAUMA RESUSCITATION Weight _____ kg Allergies _____

Patient Identification

PHYSICIAN: Use ball point pen. Use the metric system when filling in blanks or writing additional orders. Do not use abbreviations. To reinstate or add additional orders after signing and dating this set, use blank Physician's Orders

NURSE: Remove Nursing and Pharmacy orders. Retain Nursing copy. Check drugs needed, then forward Pharmacy copy, whether or not medications are ordered or appear on that page.

Admit to Trauma Resuscitation Room

Orders are in effect for duration of stay in trauma room

Medications (Please check all that apply)

Analgesia	Sedation/agitation (RASS > +1)
Morphine ____ mg IVP q 10 min prn pain score ≥ 4 x ____ doses HydroMorphone ____ mg IVP q 15 min pain score ≥ 4 x ____ doses Fentanyl ____ mcg IVP q 5 min prn pain score > 4 x ____ doses	Haloperidol 5 mg IVP q 10 min x ____ doses Lorazepam ____ mg IVP q 10 min prn RASS $\geq +1$ x ____ doses Midazolam ____ mg IVP q 10 min prn RASS $> +1$ x ____ doses
Rapid Sequence Intubation/ Neuromuscular Blockade	Antibiotics
Etomidate 20 mg or ____ mg (0.2-0.6 mg/kg) IVP x1 Rocuronium 100 mg or ____ mg (0.6-1.2 mg/kg) IVP x1 Succinylcholine 120 mg or ____ mg (1-2 mg/kg) IVP x1 Vecuronium 10 mg or ____ mg (0.1mg/kg) IVP x1	Cefazolin 1 gm in 50 mL NS IV over 30 min x1 Clindamycin 600 mg in 50mL D5W IV over 30 min x1 Gentamicin ____ mg IV in 100 mL NS over 1 hour (3-5 mg/kg)x1
IV Fluids	Elevated ICP/Seizures
Lactated ringers IV: ____ mL/hr Normal saline IV: ____ mL/hr Other: _____	Fosphenytoin ____ mg in 50 mL NS(15 mg/kg) IV over 30 min Lorazepam ____ mg IVP q10 min prn seizure Mannitol 20% ____ gm (1 gm/kg) IV over 10 min x1
Steroids	Blood Pressure Meds
Methylprednisolone 30 mg/kg in 100ml NS IV over 15 min Methylprednisolone 5.4 mg/kg/hr IV x ____ hours (24-48 hrs) Famotidine 40 mg/100 mL NS IV at 4.2 mL/hr	Hydralazine 10 mg or ____ mg IVP x1 Labetalol 10 mg or ____ mg IVP x1 Metoprolol 5 mg or ____ mg IVP x1
Miscellaneous	Anti-Nausea
Lidocaine 1% for MD use to site(s): _____ Lidocaine 1% with epinephrine 1:100,000 for MD use to site(s): _____	Ondansetron 4 mg IVP x1
NS= 0.9% sodium chloride IVP= IV push over 1-2 minutes	Vaccines
Other meds: _____	Tdap 0.5 mL IM x1

Labs (MD may check box to order additional labs below)

1. Hold specimen to blood bank
2. ABG or VBG with hematocrit/hemoglobin
3. Urine tox immunoassay
4. Blood alcohol level

Head Labs	Elder Labs	Other:
All regular labs above, plus: 1. PT/PTT/INR 2. CBC	All regular labs above, plus: 1. PT/PTT/INR 2. CBC 3. Chem 10	Stool hemocult (POC) Urine dip for blood (POC) Urinalysis CPK with isoenzymes P2Y12 (Plavix) assay
Burn Labs	Pregnancy Labs	
All regular labs above, plus: 1. ABG with H/H and carboxyhemoglobin 2. CBC 3. PT/PTT/INR 4. Chem 10 with LFT's and albumin	All regular labs above, plus: 1. ABG or VBG with an H/H 2. CBC 3. PT/PTT and fibrinogen 4. Kleihauer-betke 5. Type and screen	_____ _____ _____

Physician Signature/PID #

Date/Time

Nurse Signature

Date/Time

PHYSICIAN'S ORDERS

Patient Identification

TRAUMA RESUSCITATION

PHYSICIAN: Use ball point pen. Use the metric system when filling in blanks or writing additional orders. Do not use abbreviations. To reinstate or add additional orders after signing and dating this set, use blank Physician's Orders
 NURSE: Remove Nursing and Pharmacy orders. Retain Nursing copy. Check drugs needed, then forward Pharmacy copy, whether or not medications are ordered or appear on that page.

Blood

Type & screen

Type & crossmatch: _____ units PRC's _____ units FFP _____ units Platelet pheresis

Transfuse: _____ units PRC's _____ units FFP _____ units Platelet pheresis

Massive transfusion protocol

Imaging

X-ray	CT scan	CT Angiography
AP chest _____	Head _____	Neck _____
Lateral C-spine _____	C-spine _____	Chest _____
AP lateral T-spine _____	Chest _____	Pelvis _____
AP lateral L-spine _____	Abdomen/Pelvis _____	Extremity: _____
Pelvis _____	Other	
_____	FAST _____	
_____	Angioembolization: _____	

Procedures

Vascular Access/Lines

____ gauge IV catheter
 Arterial line to pressure monitoring with lidocaine 1% for insertion
 Central venous catheter placement w/ lidocaine 1% for insertion

Other

Intraosseus line

Chest tube with lidocaine 1% with epi 1:100,000 to water seal and _____ cm H₂O suction _____ Left side _____ Right side
 Foley catheter (#16 FR silicone) to dependent drainage _____
 Gastric tube (#18 FR) to low constant suction _____
 Diagnostic peritoneal lavage _____
 12 lead ECG _____

Sutures

Sutures with lidocaine 1%:

Site(s): _____

Sutures with lidocaine 1% with epi 1:100,000:

Site(s): _____

Airway

Ventilator Settings

Oxygen

Ventilator Settings		Oxygen
Mode: _____	FiO ₂ : _____ %	
Volume _____	PEEP: _____ cm/H ₂ O	_____ L/min nasal prong
Pressure _____	Tidal volume: _____ mL	_____ L/min face mask
	Inspiratory pressure _____ cm/H ₂ O	
Respiratory Rate _____		

Physician Signature/PID #

Date/Time

45

Nurse Signature

Date/Time

TRAUMA BAY LABS:

<u>Baseline Labs</u>	<u>Syncope Labs</u>	<u>Anticoagulation Labs</u>	<u>Cirrhosis Labs</u>	<u>Bleeding Labs</u>
ABG or VBG CBC PT\INR Chem 10 BAL UTox Pregnancy test (if appropriate) Type and Hold specimen for blood bank	ALL Baseline , plus: Cardiac Enzymes UA \ Culture	ALL Baseline , plus: Appropriate drug assay (Plavix vs Aspirin vs. Anti-Xa) Type and Screen	ALL Baseline , plus: LFTs TEG Fibrinogen	ALL Baseline , plus: LFTs TEG Fibrinogen Type and Cross PRBCs x4 FFP x4 Platelets x2 OR Massive Transfusion

- Note that PTT is removed from all lab categories.
- “Burn Labs” and “Pregnancy Labs” unchanged (remove PTT).
- “Regular Labs” and “Head Labs” no longer in use.

Radiology

- a. Preliminary readings by Radiology should be documented as such by the Trauma Service in the progress notes - especially since subsequent care is based on these readings. If *final readings* by Attending Radiologists **are different from preliminary** (aka “*prelim*” or “*wet*” readings), the radiologist will immediately notify the Trauma Fellow or Attending. If a team member suspects a final reading has changed from a preliminary reading, they should notify the Trauma Fellow or Attending asap.
- b. Patients admitted as a transfer with outside CT scans or x-rays must have their films and disks uploaded into the PACS system. A green request form must be filled out in order to have images uploaded to PACS. (see Imaging Request).
- c. Do not tolerate any CDs or films being left lying about in trauma bay or SICU –have those disks uploaded to PACS. Attach a green **Imaging Request** form (151-182) and give/leave for Rad tech in their booth, or use the **Ambra Image Share** app found in Epic to upload immediately.
- d. Final reads must be obtained from the transferring facility. These paper records should be placed the patient’s chart for reference. However, an over-read of imaging studies may be obtained by our in-house radiologist if an order is written and Radiology notified.
- e. A physician/PA/NP must accompany each trauma patient to the CT scanner.
- f. Use the American Association for the Surgery of Trauma-Organ Injury Scale (AAST- OIS) for documentation of all intra-abdominal injuries, wherever possible. These may be found at the following website:
<http://www.aast.org/Library/TraumaTools/InjuryScoringScales.aspx>

UC San Diego

HEALTH SYSTEM

IMAGING REQUEST

RADIOLOGY SCHEDULING (619) 543-3405
RADIOLOGY FAX (619) 543-2152

DEPARTMENT/LOCATION	DATE
---------------------	------

Patient Identification

(Please print clearly) REQUIRED INFORMATION

AUTHORIZATION REQUIRED? <input type="checkbox"/> No <input type="checkbox"/> Yes: If yes, enter authorization number:		DO YOU WISH TO BE CONTACTED ASAP WITH RESULTS? <input type="checkbox"/> No <input type="checkbox"/> Yes	
REQUESTOR: (IF RESIDENT OR N.P., <u>MUST</u> FILL IN ATTENDING BLOCK)	PROVIDER NUMBER	PAGER NUMBER	MAIL CODE
ATTENDING PHYSICIAN	PROVIDER NUMBER	PAGER NUMBER	MAIL CODE

HISTORY	EXAM(S) REQUESTED	PATIENT DIAGNOSIS OR SYMPTOM (one per exam) <i>"R/O" NOT PERMITTED</i>
CREATININE LEVEL (FOR CONTRAST STUDIES)		
PATIENT PREGNANT? <input type="checkbox"/> No <input type="checkbox"/> Yes		
PATIENT ALLERGIES	HAVE PRIOR, RELATED STUDIES BEEN DONE? <input type="checkbox"/> No <input type="checkbox"/> Yes, when and where:	COMMENTS

151-182 (9-08)/LHS

- 1 Complete and attach this green paper form to any imaging that arrives with patient (disks, films) - under Exam Requested write "PLEASE ADD TO PACS"
- 1 Give form and images to Xray tech in Trauma Bay to add to PACS
- 1 DO NOT LEAVE DISKS OR IMAGES UNATTENDED IN TRAUMA OR SICU

AAST ORGAN INJURY SCALES



Grade I

Nonexpanding subcapsular hematoma, < 10% surface area

Capsular tear, nonbleeding, < 1 cm in depth

Incidence: common
Mortality: essentially 0%



Grade II

Nonexpanding hematoma, subcapsular or intra-parenchymal, 10-50% of surface area or < 10 cm in diameter

Bleeding capsular tear
Laceration 1-3 cm in depth, < 10 cm
Incidence: 75%
OR Mortality: < 10%



Grade III

Subcapsular hematoma, > 50% of surface area expanding or ruptured with bleeding

Intraparenchymal hematoma >10 cm or expanding
Laceration > 3 cm deep

Incidence: 15%
OR Mortality: 25%



Grade IV

Ruptured intraparenchymal hematoma with bleeding

Parenchymal disruption involving 25-75% of lobe or 1-3 segments

Incidence: 7%
OR Mortality: 46%



Grade V

Parenchymal disruption of > 75% of lobe or >3 segments
Juxtahepatic venous injury
Incidence: 3%
Mortality: >80%

Grade VI

Hepatic avulsion
Incidence: rare
OR Mortality: ~100%



Grade I:

Subcapsular hematoma <10% surface area
Laceration/Capsular tear <1cm deep



Grade II:

Subcapsular hematoma 10-50% surface area
Intra-parenchymal hematoma < 5cm
Laceration 1-3cm without vessel involvement



Grade I:

Contusion: hematuria without x-ray abnormalities
Subcapsular hematoma: no parenchymal laceration



Grade II:

Perinephric hematoma: confined to the retroperitoneum
Laceration: < 1cm in depth of renal of cortex



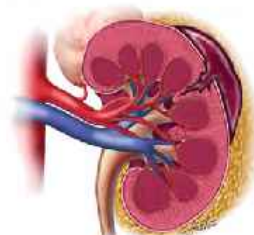
Grade III:

Subcapsular hematoma >50% surface area or expanding
Intra-parenchymal hematoma >5cm
Ruptured hematoma
Laceration >3cm or with trabecular vessel involvement



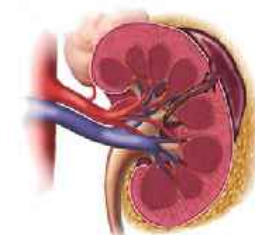
Grade IV:

Laceration of segmental or hilar vessels causing major devascularization (>25% of spleen)



Grade III:

Laceration > 1cm in depth



Grade IV:

Laceration through collecting system

Grade V:

Shattered spleen
Injury of hilar vessels with completely devascularized spleen



Grade V:

Vascular avulsion
Shattered kidney



Nonoperative Management (NOM) of Major Trauma

A. **Key Patient Centered Outcomes**

- Provide care that respects and responds to the patient's preferences, needs and values
- Timely diagnosis of injury
- All potential injuries accurately diagnosed within 12 hours
- Prompt intervention for identified injuries
- Alcohol Screening and Brief Intervention (SBI), as appropriate
- Ensure that patient values guide all clinical decisions

B. **Goal Length of Stay ≥ 24 hours**

- Exceptions: associated injuries requiring additional treatment

C. **Proposed Hospital Course**

- Prior to Arrival at Care Destination
 - ATLS protocol; workup as mechanism and presentation dictate
- At the Time of Hospitalization
 - Timely diagnosis and treatment plan of injuries
 - Admit to appropriate level of care (ICU/IMU/Floor)

Hospital Day #1

- Rule out major traumatic injury
- Complete initial survey with full physical exam documented
- H&P completed and signed by resident/Attending
- Consultation(s) as appropriate
- Administer appropriate therapies (i.e. wound care, pulmonary toilet, spinal precautions, neurologic/neurovascular checks as indicated)
- Serial abdominal exam documented
- Obtain final staff radiology x-ray readings
- Additional labs and radiographic imaging as required
- C spine clearance per protocol

Hospital Day #2

- Perform tertiary survey to rule out possibility of missed injuries
- Follow up on and clarify consultants' plans for treatment
- D/C Foley (if placed)
- Initiate/continue with regular diet
- Anticipate needs for PT, OT, case management and request as necessary
- Discuss discharge planning
- Patient and family education regarding wound care, diet, and activity

D. **Discharge Planning**

- Tolerating regular diet
- Pain adequately controlled
- Activity as tolerated based on injuries
- Clinic follow-up as injuries dictate

E. **Disposition**

Per PT/OT recommendations

Trauma Resuscitation Debriefing – 100% compliance

After every trauma resuscitation there should be a quick debrief to assess the team's performance and ongoing needs of the patient. For the average patient this should take less than 60 seconds, for more complex cases it may take longer. This is a brief "pause" to ensure the team is on the same page as they move forward:

Debriefing benefits:

1. Surgical/patient safety – reviews patient disease/injury
2. Reduces communication gaps between team members
3. Education/teaching – identifies areas for improvement, i.e. efficiency and task completion

Participants:

1. Team leader: Fellow, Attending or Doc 1
2. Trauma Nurse
3. Residents/Students
4. Person transporting the patient to the scanner
5. Any other pertinent team member, participants in the resuscitation

Debrief will occur at the end of all trauma resuscitations prior to transitioning to the next phase of care (CT scanner, operating room, etc).

Debrief – "Pause"

1. Recap the resus – and ongoing plan
 - a. CXR, PXR reviewed
 - b. Imaging & labs ordered, orders signed
 - c. Consults
 - d. Anticipated Disposition
2. Any concerns from the team regarding the plan, additional w/u needed or timing of other intervention.
3. Any process or equipment failures that need further attention? *These items should be noted for addressing at a later time.*
4. Confirm who will accompany the RN to the scanner.

Events with unstable patients, cardiac arrest, multiple intervention or death may need a more formal, extended debrief. If more extended discussion is needed schedule a time to meet up with the group and discuss the resus in more detail. This can be facilitated by the attending, fellow or charge nurse.

Debrief

1. What went well?
2. What can we improve?
3. What should we do differently next time?
4. Additional comments from the group?
5. What are the personal needs of the team, does anyone need time to regroup?

References:

- Brindle ME, Henrich N, Foster A, Marks S, Rose M, Welsh R, Berry W. **Implementation of surgical debriefing programs in large health systems.** BMC Health Serv Res. 2018 Mar 27; 18 (1): 210
- El-Shafy IA, Delgado J, Akerman M, Bullaro F, Christopherson NAM. **Closed – Loop communication improves task completion in Pediatric Trauma Resuscitation.** J Surg Educ. 2018 Jan-Feb; 75(1):58-64.
- Sullivan S, Campbell K, Ross JC, Underwood A, LeGare A, Osman I, Agarwal SK, Jung HS. **Identifying Nontechnical Skill Deficits in Trainees through Interdisciplinary Trauma Simulation.** J Surg Educ. 2017 Nov 16 pii: S1931-7204(17)30439-7
- Anderson CI, Basson MD, Ali M, Davis AT, Osmer RL, McLeod MK, Haan PS, Molnar RG, Peshkepija AN, Hardaway JC, Chojnacki KA, Pfeifer CC, Gauvin JM, Jones MW, Mansour MA. **Comprehensive Multicenter Graduate Surgical Education Initiative Incorporating Entrustable Professional Activities, continuous Quality Improvement Cycles, and a Web-Based Platform to Enhance Teaching and Learning.** J Am Coll Surg. 2018 Mar 16. pii: S1072-7515(18)30200-X.
- Sparks JL, Crouch DI, Sobba K, Evans D, Zhang J, Johnson JE, Saunders I, Thomas J, Bodin S, Tonidandel A, Carter J, Westcott C, Martin RS, Hildreth A. **Association of a surgical Task During Training with Team skill acquisition among surgical residents, the Missing piece in Multidisciplinary Team Training.** JAMA Surg. 2017 Sep 1; 152 (9): 818-825
- Boet S, Sharma B, Pigford AA, Hladkowitz, E, Rittenhouse N, Grantcharov T. **Debriefing decreases mental workload in surgical crisis: A randomized controlled trial.** Surgery. 2017 May; 161 (5): 1215-1220.
- Boet S, Pigford AA, Fitzsimmons A, Reeves S, Triby E, Bould MD. **Interprofessional team debriefings with or without an instructor after a simulated crisis scenario: An exploratory case study.** J Interprof Care. 2016 Nov;30(6):717-725
- Briggs A, Raja AS, Joyce MF, Yule SJ, Jiang W, Lipsitz SR, Havens JM. **The role of nontechnical skills in simulated trauma resuscitation.** J Surg Educ. 2015 Jul-Aug; 72(4): 732-9.
- Paige JT, Arora S, Fernandez G, Seymour N. **Debriefing 101: training faculty to promote learning in simulation based training.** Am J Surg. 2015 Jan; 209(1): 126-31.
- Kolbe M, Grande B, Spahn DR. **Briefing and debriefing during simulation based training and beyond content structure attitude and setting.** Best Pract Res Clin Anaesthesiol. 2015 Mar; 29(1):87-96.
- Cook MR, Watters JM, Barton JS, Kamin C, Brown SN, Deveney KE, Kiraly LN. **A flexible postop debriefing process can effectively provide formative resident feedback.** J Am Coll Surg. 2015 May;220(5):959-67

Intimate Partner Violence

All health care providers, including physicians, nurses, PAs, and NPs, are mandatory reporters of suspected domestic violence (DV)/intimate partner violence (IPV). This includes physical violence, sexual violence, stalking, and psychological aggression by a current or former partner. An intimate partner includes a person with whom the patient has a close, personal relationship which can include emotional connectedness, regular contact, ongoing physical contact, familiarity and knowledge of each other's lives, and identification as being part of a couple.

1. All trauma patients must be screened for IPV
 - a. Patients seen in the ED should be screened for IPV at the time of consultation
 - b. Patients seen in the trauma bay should be screened after their initial resuscitation if their condition allows
 - c. Patients that could not be screened in the trauma bay should be questioned during their tertiary survey
 - d. Screening results should be documented promptly to avoid repeated questioning, which can be traumatic for victims
2. All cases of suspected IPV must be reported (this does not require confirmation from the patient)
 - a. Cases should be reported within 48 hours of admission
 - b. Patients accompanied by the police do not require a separate report if the police report suspected IPV at the time of admission
3. Reporting procedure
 - a. Any physician, nurse, NP, or PA can fill out the reporting paperwork
 - b. Social workers can assist with filing the report with the appropriate police department
 - c. For patients admitted to the ICU, the ICU residents are responsible for ensuring the report has been filed
 - d. For patients admitted to the floor, the trauma NPs and fellow are responsible for ensuring the report has been filed
 - e. For all patients the attending physician is ultimately responsible for ensuring the report has been completed
4. Forms/Fax info
 - a. The reporting form can be found on page 10 of DV/IPV policy at <https://pulse.ucsd.edu/policies/UCSDHPS/MCPolicy/305-6.pdf#search=domestic%20violence%20policy>
 - b. The appropriate police department should be contacted via telephone and form should be faxed to the appropriate police department based on where the IPV took place

Local Jurisdiction Law Enforcement Agency	Phone Number	Local Jurisdiction Law Enforcement Agency	Phone Number
Carlsbad PD	760) 931-2197 Fax (760) 930-1264 (Investigations Unit)	Oceanside PD	(760) 435-4900 Fax (760) 435-4938 (Records dept)
Chula Vista PD	(619) 691-5151 Fax (619) 691-5229 (DV/Family Protection Unit) Fax (619) 585-5736 (SA, other crimes)	Poway (SD Sheriff)	(858) 565-5200
Coronado PD	(619) 522-7350 Fax (619) 435-2193 (Dispatch)	San Diego PD	(619) 531-2000 Fax (619) 533-3502 (DV Unit.) (SA, other crimes, call dispatch for fax#)
Del Mar (SD Sheriff)	(858) 565-5200	San Marcos (SD Sheriff)	(858) 565-5200
El Cajon PD	(619) 579-3311 Fax (619) 444-8312 (Records dept)	Santee (SD Sheriff)	(858) 565-5200
Encinitas (SD Sheriff)	(858) 565-5200	Solana Beach (SD Sheriff)	(858) 565-5200
Escondido PD	(760) 839-4722 Fax (760) 75-3432 (Records dept)	Valley Center (SD Sheriff)	(858) 565-5200
Fallbrook (SD Sheriff)	(858) 565-5200	Vista (SD Sheriff)	(858) 565-5200
Imperial Beach (SD Sheriff)	(858) 565-5200	4S Ranch (SD Sheriff)	(858) 565-5200
La Mesa PD	(619) 469-6111 Fax (619) 667-7519 (Records dept)	**Unincorporated areas (SD Sheriff)	(858) 565-5200
Lemon Grove (SD Sheriff)	(858) 565-5200	Naval Criminal Investigative Service	(619) 524-6999
National City PD	(619) 336-4411 Fax (619) 336-4282 (Dispatch)		

*****If SDSO Dept. is not listed here, call SDSO unincorporated number to provide location of assault. Appropriate SDSO dept. contact and fax numbers will be given to you.**

San Diego Child and Welfare Services

Report suspected child abuse, call (858) 560-2191

Within the State of California you may call toll free 1(800) 344-6000

SDPD Elder and Dependent Adult Abuse Unit

(619) 446-1070 Weekdays 0800-1700

(619) 531-2000 24/7

For suspected instances of caregiver abuse call

San Diego County Aging & Independent Services at 1 (800) 339-4661

Airway with C-Spine Control

Airway Management –

Protocol:

Doc #1 is responsible for determining the necessity of obtaining an airway by means of intubation or cricothyroidotomy after discussion with the Trauma Fellow/Attending.

For any trauma bay patient in need of Anesthesia for airway management, including those patients who arrive already intubated, a text message will be sent via web paging with 'TRAUMA BAY STAT' to the code pager 290-2622.

If a computer is unavailable, the page operator will be called at x36111 and a request will be made to place message 'TRAUMA BAY STAT' to the Anesthesia code pager 290-2622.

Anesthesia is expected to respond to the trauma bay within five minutes. If they do not respond, call the OR (36040) and then call to have the operator (x36111) page the Anesthesiologist on call and page overhead.

When on service, the senior ED resident may intubate the patient when acting as Doc #1. The ED resident must be present with the trauma team prior to the patient's arrival and will page the ED attending to staff the intubation.

The ED resident may also intubate burn patients admitted via the trauma bay. However, an Anesthesia provider may also be asked to be present and/or at the discretion of the Burn/Trauma Attending asked to intubate the patient (i.e. in the case of severe facial burns).

Ultimately, the Trauma Fellow/Attending is in charge of the resuscitation and airway decisions.

Procedure:

a) Rapid Sequence Intubation Procedure: (see Rapid Sequence Intubation Algorithm)

- a. All patients should be considered to require C-spine precautions and to have a full stomach. Manual C-spine precautions will be held by Doc #2.
- b. Cricoid pressure will be held until the tube placement is confirmed and the cuff inflated. The most senior surgeon available (usually the Trauma Attending/Fellow) will hold cricoid pressure.
- c. Placement of the O2 sat monitor, EKG leads, and suction availability will be a priority for nursing.
- d. A Trauma Attending will be at the bedside for all intubations and is in charge of the intubation procedure.
- e. Use of airway adjuncts such as the Glidescope, CMAC (Figure 3), endotracheal tube introducers (i.e. gum elastic bougie, Eschmann, Figure 4) for emergency intubation increases first-pass success and should be used.

- f. In order to standardize stocked medications, the following drugs from the RSI kit will be used for intubation in the resus suite:
 - i. Etomidate
 - ii. Succinylcholine or Rocuronium
 - iii. These are available as an RSI kit in the Pyxis.
 - iv. Propofol **MUST NOT** be used in the Trauma Bay or OR 11 due to the risk of circulatory collapse in under-resuscitated patients.
- g. Oral intubation attempts should be limited to a maximum of 3. (For example, in the case of the ED resident intubating, he can attempt twice and his attending could attempt once.)
- h. When the intubator finds that the patient has a “difficult airway” (i.e. anterior airway or unable to have a good view due to secretions, blood, or edema, he/she should *tell the team immediately*. The resus nurse will respond by having the cricothyroidotomy set out and available.
- i. The Trauma Attending will make the decision as to whether to do a surgical airway/cricothyroidotomy.
- j. After intubation, physical exam in conjunction with a disposable CO2 detector and/or ETCO2 monitor will be used to confirm the adequacy of tube placement. *Cricoid pressure must be maintained* until confirmation of appropriate tube placement has been verified.
- k. An NG tube and Foley catheter should be placed followed by a CXR to verify ETT and NG tube placement.
- l. Presence of a King Laryngotracheal Airway or Esophageal Obturator Airway – these are NON-definitive airways placed by EMS and indicate a potential difficult airway and high risk of aspiration (See Figure 2A and 2B). These airways should be removed only by a skilled intubator under adequate relaxation and with immediate presence of a surgeon capable of a surgical airway.

Note *Repositioning of the ETT mandates confirmation of position radiographically prior to leaving the resuscitation room.

Fig 2A: KING Laryngotracheal Airway

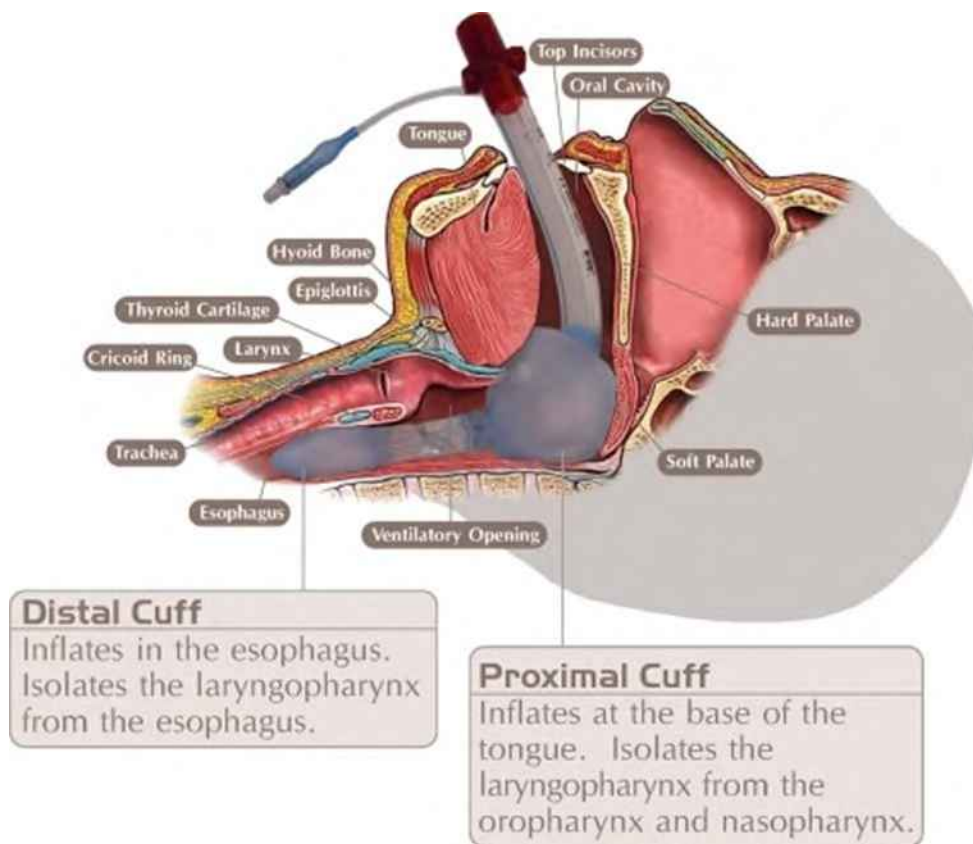


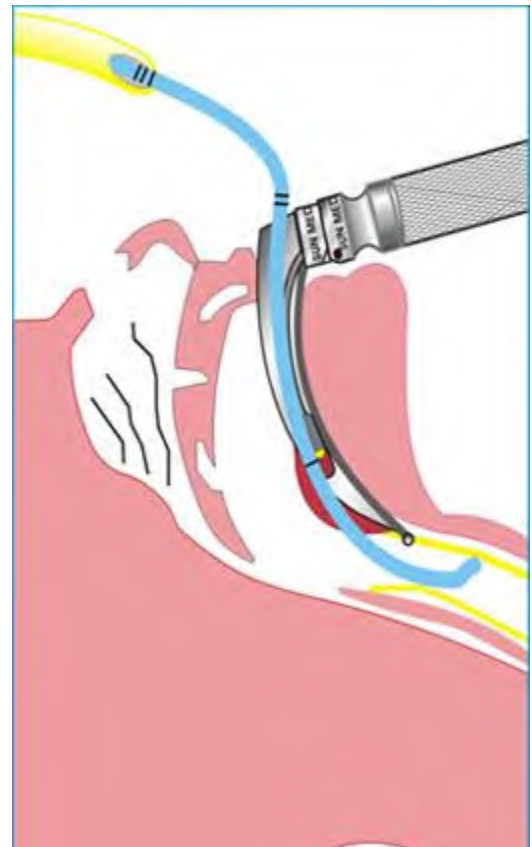
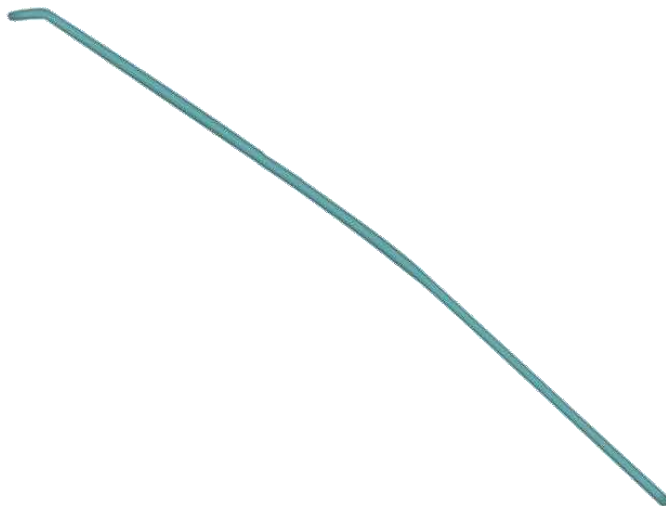
Fig 2B: Esophageal Obturator Airway



Figure 3: CMAC Video Laryngoscopes

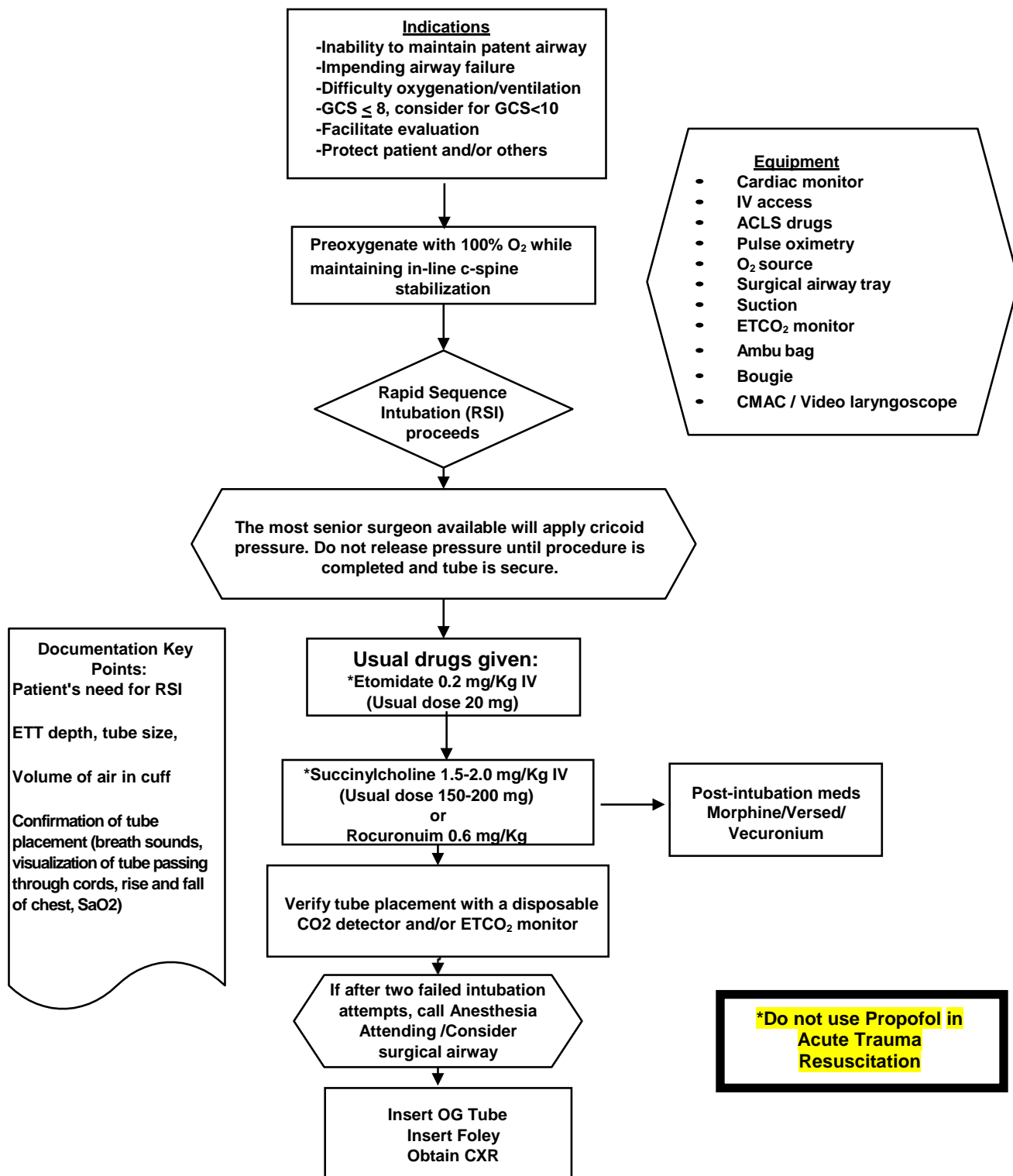


Figure 4: Endotracheal tube introducer
(a.k.a.: gum elastic bougie, Eschmann)



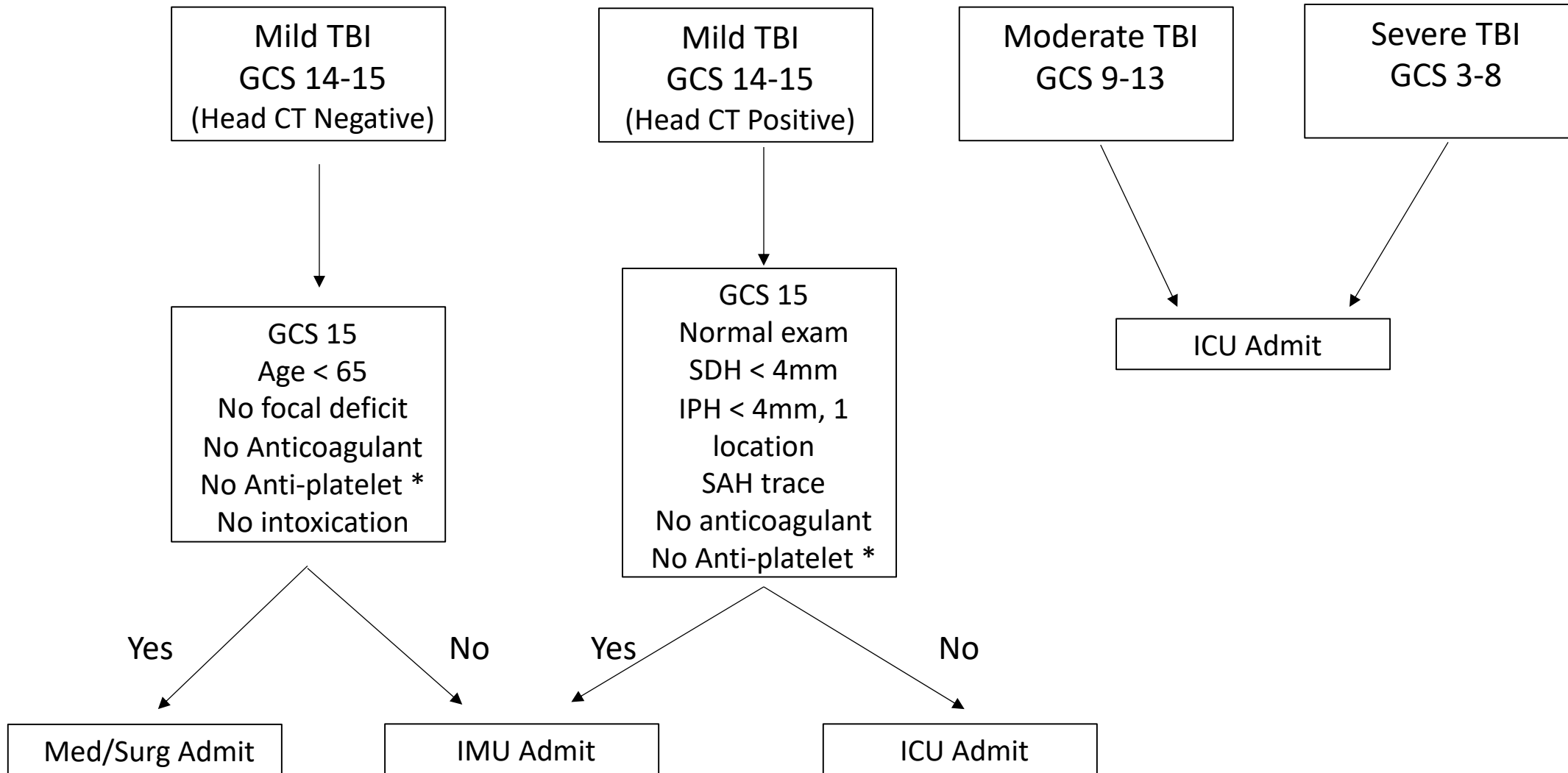
UC San Diego Division of Trauma

RAPID SEQUENCE INTUBATION (RSI) ADULT - TRAUMA



Traumatic Brain Injury

Traumatic Brain Injury: Level of Care



* Excluding Aspirin

UCSD Clinical Guidelines for the Management of Traumatic Brain Injury

A. Resuscitation and Basic Physiological Goals

The following physiological parameters should be maintained as part of goal-directed traumatic brain injury (TBI) treatment.

Primary Parameters		Secondary Parameters
Pulse Ox $\geq 90\%$	ICP < 20 mmHg	CPP ≥ 60 mmHg
PaO ₂ ≥ 100 mmHg	Temp 36.0-38.3°C	PbtO ₂ ≥ 15 mmHg
PaCO ₂ 35-40mmHg	Glucose ≤ 160 mg/dL	
SBP ≥ 100 mmHg	INR ≤ 1.3	
pH 7.35-7.45		

1. Airway Management

- i. Patients with a GCS ≤ 8 should be intubated for airway protection
 - Patients with a GCS < 10 should be considered for intubation.
 - Intubation should be performed with in-line cervical spine immobilization.
 - Rapid sequence intubation (RSI) is the preferred method.
 - An attempt to contact the neurosurgery team to allow for evaluation of the patient's neurological status before intubation is recommended.
- ii. Sedative and analgesic choices should favor short acting agents throughout the initial resuscitation, as temporal assessment of neurological status is critical. In general the following agents are recommended:
 - **Etomidate** - sedation for induction (RSI)
 - **Succinylcholine** - paralytic for induction (RSI)
 - **Propofol** - maintenance of sedation and prevention of agitation. Propofol is not an induction agent and is to be discontinued if its use is causing persistent hypotension requiring vasopressor agents.
 - **Benzodiazepines**- (i.e. midazolam or lorazepam) can be utilized as an initial or substitute sedative agent for propofol.

2. Oxygenation/Ventilation

- i. Avoidance of hypoxia
Efforts should be made to avoid hypoxia at all times.
 - Patients with TBI should have pulse oximetry maintained at a **SaO₂ $\geq 90\%$** and an attempt for **PaO₂ ≥ 100 mmHg**.
- ii. Ventilation
Hyperventilation should be intensively monitored during the initial resuscitation.
 - The target **PaCO₂ is 35-40 mmHg**. An ETCO₂ monitor and serial ABGs should

be used as needed should be used to prevent profound hypocarbia/ hypercarbia.

- Therapeutic hyperventilation may be necessary for brief periods when there is acute neurological deterioration that coincides with a cerebral herniation syndrome or for refractory elevations in ICP (see Section III on management of ICP)

3. Blood Pressure, Volume Resuscitation, Anemia, and Coagulopathy

i. Blood Pressure

Systolic blood pressure (SBP) and mean arterial pressure (MAP) readings should be recorded from a functioning arterial line when present and from the non-invasive blood pressure (NIBP) cuff when an arterial line is not present or presumed inaccurate.

- Any patient with intracranial hypertension must have an **arterial line**. A systolic blood pressure (SBP) should be kept between 100 mmHg and 160 mmHg.
- It should be recognized that lower blood pressures can represent a “relative” hypotensive state in TBI patients (especially with elevated ICP)
- Normal Saline, PRBCs and plasma (when needed) should be used as the initial method of maintaining euvolemia to achieve the target blood pressure.
- Use of vasopressors should be considered for treatment of refractory hypotension only after appropriate volume resuscitation has been given. Vasopressors or Inotropes including Phenylephrine (Neosynephrine), Levophed, Epinephrine, Dobutamine, and Vasopressin **should not** be used to counteract the hemodynamic effects of propofol.

ii. Euvolemia

The primary target is euvolemia through resuscitation. In many cases, a central venous pressure (CVP) will need to be obtained. CVP or other types of invasive monitoring are mandatory in patients with severe TBI requiring ventriculostomy, intubation or in patients with hypotensive events requiring optimization of volume status.

iii. Coagulation

Coagulation panels (PT/INR, PTT, TEG, fibrinogen) should be followed closely, particularly in patients on anti-coagulation medications or with pre-existing bleeding dyscrasias. It is acceptable to use a stricter transfusion criteria, such as a platelet count of $\geq 80 \times 10^3/\text{mm}^3$.

- The target INR is less than or equal to 1.3 and platelets should be maintained above $80 \times 10^3 / \text{mm}^3$.
- FFP, Vitamin K, prothrombin complex concentrate/Kcentra, Factor VII, or DDAVP should be administered, as clinically indicated, in order to

correct coagulopathy irrespective of need for surgical intervention.

- INR and platelet count should be corrected in anticipation of operative intervention or bedside procedures such as placement of ventriculostomy or other ICP monitors.

4. Imaging

- i. All patients with suspected TBI (i.e. LOC, significant mechanism) must undergo urgent CT of the brain (CTH) during the initial resuscitation barring emergent operative management. Timing of repeat imaging is suggested below. MRI brain scans should be utilized for assessment of ischemic CVA, DAI, tumor assessment or per research protocols. MRI can also be used to help determine potential for neurologic viability particularly in patients with a persistent vegetative state.

B. Intracranial Pressure (ICP) Monitoring

All patients with signs and symptoms of increased intracranial pressure (ICP) and/or GCS ≤ 8 should receive a ventriculostomy (EVD) (primarily) or other form of ICP monitoring (bolt).

ICP should be monitored in patients with TBI if the GCS is ≤ 8 following initial resuscitation and the admission CT scan of the brain is abnormal (hematomas, contusions, edema or compressed cisterns).

All patients with suspected increased intracranial pressure and GCS ≤ 8 should receive a ventriculostomy as the primary ICP monitor unless the clinical situation mandates a sub-dural bolt device.

Contraindications for ventriculostomy include 1) coagulopathy 2) mass lesion with mass effect at the site of the ventriculostomy site.

1. ICP monitoring should additionally be considered for those patients with a normal admission CT scan of the brain if two or more of the following criteria are met:

- age > 40 y/o
- unilateral or bilateral motor posturing
- documented episode of hypotension (SBP < 90 mmHg)

In addition, ICP monitoring should be highly considered in all patients undergoing emergent surgical procedures (orthopedic repair, etc) in whom a moderate to severe brain injury is suspected (GCS 3-12) to guide appropriate intraoperative CPP management.

- i. Increased ICP is defined as ≥ 20 mmHg.
- ii. Prophylactic antibiotic use, and routine surveillance cultures for ICP monitors are not recommended, but its use is under the discretion of the trauma and neurosurgical teams.
- iii. Cerebral Perfusion Pressure (CPP) of ≥ 60 mmHg should be targeted. Neosynephrine infusion or other vasoactive adjuncts may be used to improve the CPP in the euvolemic, resuscitated patient.

C. Treatment of Increased Intracranial Pressure (ICP)

(see Trauma Protocol Algorithms>Intracranial Hypertension)

Treatment for intracranial hypertension should be initiated when **ICP ≥ 20 mmHg.**

A leveled algorithm will be used for increased ICP. Each level represents increased levels of intensity for the treatment of elevated ICP, and patients should be initiated in Level I, then staged through Level 3 as indicated. If the treatments in a given Level have not sufficiently lowered the ICP within 20 minutes of implementation, then advancement to the next Level should be promptly initiated.

Level 1

- **Notify Neurosurgery**
- **Elevate head of patient's bed** to ≥ 30 degrees or reverse trendelenberg position if the T/L spine has not been cleared or there is a known fracture precluding upright positioning.
- **Sedation and analgesia** using recommended agents (propofol, fentanyl, and versed) in intubated patients. Pain relief and sedation are appropriate initial modalities for treatment of intracranial hypertension.
- **Ventriculostomy** – extra-ventricular drain (EVD) is the preferred method of ICP monitoring. Other forms of ICP monitoring i.e. bolt placement, should be used when EVD is not technically or physiologically feasible.
- **Mannitol** – 0.25-1.0g/kg; IV bolus x 1 dose for lateralizing lesions or blown pupil with impending herniation.
- **If the above maneuvers have not resolved the elevated ICP move to Level 2**

Level 2

- **Hyperosmolar therapy**
 - **Hypertonic saline:** intermittent boluses of 3% saline (250ml) may be given

in the setting of increased ICP and is preferred if the patient has hypotension or is hypovolemic. Serum sodium and osmolality must be assessed every 6 hrs and additional doses should be held if the serum sodium exceeds 160mEq/L.

- **Mannitol:** intermittent boluses of mannitol (0.25 - 1gm/kg body weight) may also be administered. Attention must be placed upon maintaining a euvolemic state when osmotic diuresis is instituted with mannitol. The serum sodium and osmolality must be assessed frequently (every 6hrs) and additional doses should be held if the serum osmolality exceeds 320mOsm/L. Maintain a serum OSM <320mOsm with targeted serum Na⁺ of <160mEq/L.
 - **Neuromuscular paralysis:** pharmacologic paralysis with a continuous infusion of a neuromuscular blocking agent should be considered if the above measures fail to adequately lower the ICP and restore CPP. The infusion should be titrated to maintain at least two twitches (out of a train of four) using a peripheral nerve stimulator. Adequate sedation must be utilized if pharmacologic paralysis is employed and can be confirmed with BIS monitoring
 - **If the above maneuvers have not resolved the elevated ICP move to Level 3**
-

Level 3

- Patient with Level 3 intracranial hypertension should undergo imaging evaluate for cerebral sinus thrombosis.
 - **Decompressive hemi-craniectomy or bilateral craniectomy** should only be performed if Levels 1 and 2 are not sufficient.
 - **Barbiturate coma:** an induced coma is an option for those patients who have failed to respond to aggressive measures to control malignant ICP including decompressive craniectomy. The use of BIS monitoring or equivalent is needed for assurance of adequate sedation and coma. Side effects include sudden hemodynamic collapse and a high incidence of pneumonia. Appropriate volume resuscitation and hemodynamic monitoring is mandatory. Utilizing vasopressor therapy may be warranted.
-

D. Adjunctive Medications and Prevention of Complications

1. Antiseizure Prophylaxis

Keppra (Levetiracetam) is the preferred anti-seizure medication given its lower side-effect profile and less need for tight monitoring of serum levels. Phenytoin also has efficacy in preventing early post-traumatic seizures in patients with traumatic brain injury. Medication should be considered for discontinuation after 7 days if no seizure activity occurs, however, a longer duration should be considered in patients with temporal lobe injuries.

2. Stress Ulcer Prophylaxis

Patients with significant traumatic brain injury requiring mechanical ventilation as well as those with coagulopathies or a history of gastric or duodenal ulcers should receive stress ulcer prophylaxis with an intravenous H-2 blocking agent (famotidine).

3. Deep Venous Thrombosis (DVT) Prophylaxis

All patients with significant traumatic brain injury requiring mechanical ventilation and sedation should receive DVT prophylaxis in the form of sequential compression stockings upon admission. Subcutaneous low molecular weight heparin (Lovenox) may also be initiated within 24 hours of admission, unless contraindicated due to evidence of bleeding, need for surgery, or indwelling intracranial monitor.

4. Early Tracheostomy

Tracheostomy within 7 days of admission is recommended in ventilator dependent patients to reduce total days of ET intubation. This is at the discretion of the trauma and neurosurgery services.

5. Nutritional Support

Nutritional support should be initiated via enteral route within 48 hours post injury. Frequent assessment of residual volumes of gastric nutrition should be performed, as patients with TBI frequently do not tolerate intragastric feeding, and are at risk for emesis and aspiration. Efforts should be made to obtain small bowel feeding access (i.e. Cortrak) when possible.

E. Surgical Management of TBI

1. Epidural Hematomas

An epidural hematoma (EDH) of greater than 30 cm² should be surgically removed regardless of GCS. Continued non-operative management should be considered in posterior EDH of venous origin. Patients with an acute EDH, GCS <9, and anisocoria should undergo emergent EDH evacuation. EDH of less than 5 mm midline shift in patients with GCS >8 and no focal neurological deficit can be closely monitored in an ICU with serial CT scans. Judicious use of narcotics and sedatives is important as not to alter the neurologic exam. Repeat CTH should be within 4-6 if patient are to be managed non-operatively.

2. Acute Subdural Hematomas

Acute subdural hematomas (SDH) with a thickness of greater than 10 mm or 5 mm of midline shift on CT scan should be evacuated emergently regardless of the GCS

(clinical judgment should be used in patients with significant underlying atrophy). A SDH less than 10 mm thickness and less than 5 mm midline shift should be evacuated emergently if the patient has: GCS decrease by 2 points, asymmetric pupils or fixed pupils, or ICP >20 mmHg. Repeat CTH should be within 4-6 if patient are to be managed non-operatively.

3. Subarachnoid Hemorrhage

All patients with GCS <9 and SAH should have ICP monitoring with an EVD as the preferred monitoring of choice. Repeat CTH should be within 4-6 if patient are to be managed non-operatively.

4. Parenchymal Lesions

Intraparenchymal hemorrhage (IPH) causing progressive neurological deterioration, medically refractory ICP elevations, or significant mass effect should be emergently evacuated. Frontal or temporal contusions with IPH >3.0 cm³ and >5 mm shift or cistern compression in patients with GCS 6-8 should be evacuated. **Normal ICP should not preclude operative evacuation since herniation can occur without intracranial hypertension.** Repeat CTH should be within 4-6 if patient are to be managed non- operatively.

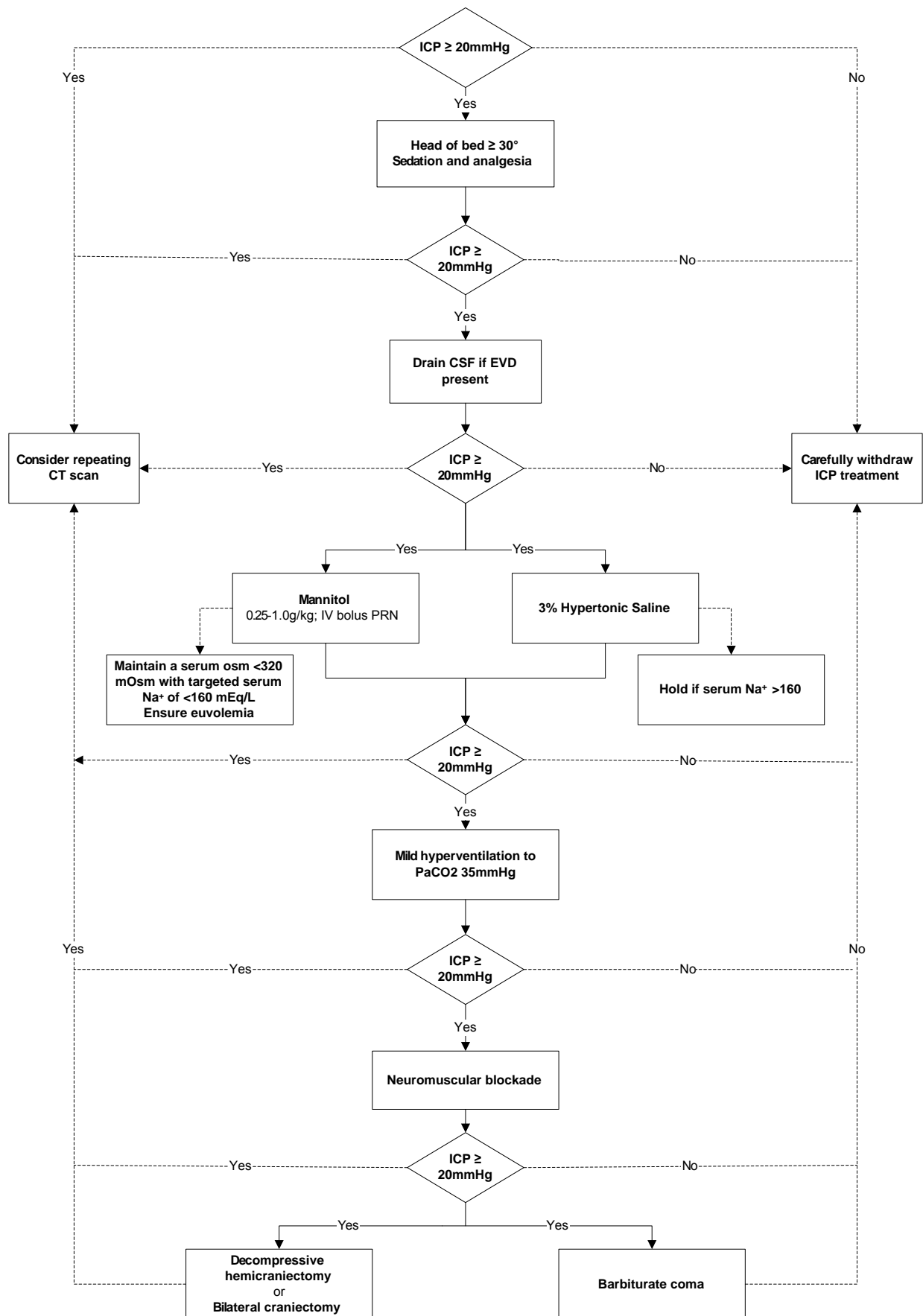
5. Diffuse Medically-Refractory Cerebral Edema and Elevated ICP

Decompressive craniectomy (unilateral or bilateral) within 48 hours of injury should be considered for patients with elevated ICP (>20) refractory to medical management. Ultra early decompressive craniectomy prior to ICP monitoring is not recommended, unless surgery is performed for a mass occupying lesion (hematoma) and the bone flap is not replaced.

6. Depressed Skull Fractures

Open skull fractures depressed greater than the thickness of the inner and outer table should undergo operative management. Referable symptoms attributed to the fracture site are an **absolute indication** for operative management. Open depressed fractures that are less than 1cm depressed and have no dural penetration, no significant intracranial hematomas, no frontal sinus involvement, no gross cosmetic deformity, no pneumocephalus, and/or no gross wound contamination may be managed non- operatively. All open skull fractures should be treated with prophylactic IV antibiotics.

Intracranial Hypertension Management



UC San Diego Trauma- Management of Patients with Suspected or Confirmed Syncope

Syncope is defined as an abrupt, complete, transient loss of consciousness associated with the inability to maintain postural control that resolves rapidly. Traditional full “syncope workups” are associated with limited yield and significant healthcare costs. The following work-up should be performed for patients with confirmed or suspected syncope in the absence of focal or lateralizing neurologic signs or evidence of seizure activity.

Syncope Evaluation in Trauma Bay:

- History and Physical Exam
- 12-lead ECG
- Baseline trauma labs
- CT Head
- Urinalysis with culture if indicated

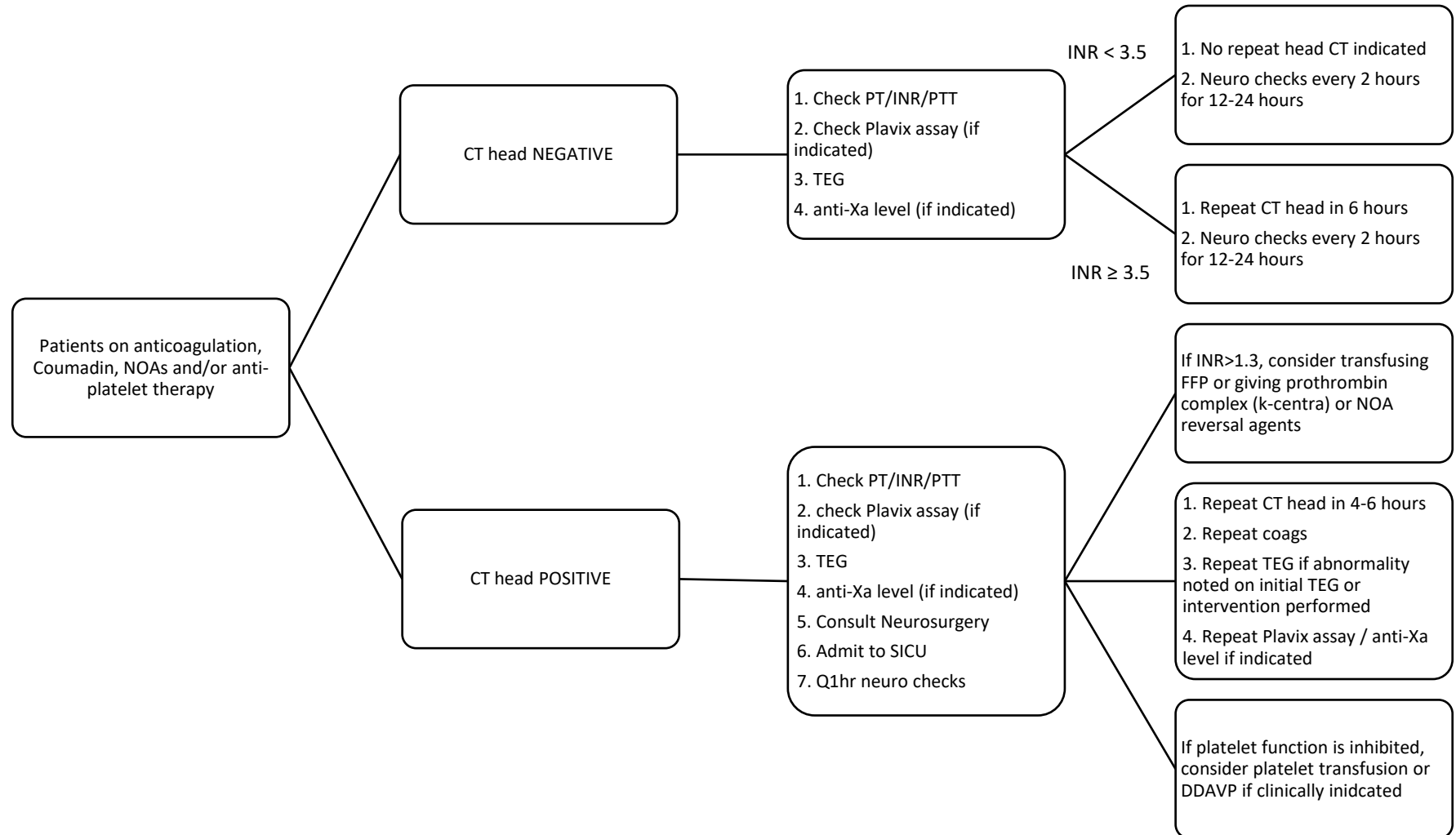
Syncope Evaluation after Admission:

- Cardiac monitoring for patients with concern for cardiac etiology
- Consider orthostatic vital signs
- Consider further infectious work-up
- Medication review
 - Consider Geriatric consult for elderly patients with polypharmacy
- Further diagnostic work-up is unnecessary unless specific findings on initial evaluation
 - Chest pain- Cardiac enzymes
 - Concern for new diagnosis of heart failure or structural cardiac abnormality- Cardiac echo

References:

1. Maung AA, Kaplan LJ, Schuster KM, Johnson DC, Davis KA. Routine or protocol evaluation of trauma patients with suspected syncope is unnecessary. J Trauma. 2011 Feb;70(2):428-32. PMID: 21307745
2. Biffl W, Ferkich A, Biffl S, Dandan T. Syncope, “Mechanical Falls”, and the Trauma Surgeon. J Trauma and Acute Care Surgery. 2020, May 26, epub. PMID: 32467461
3. Shen WK, Sheldon RS, Benditt DG, Cohen MI, Forman DE, Goldberger ZD, Grubb BP, Hamdan MH, Krahn AD, Link MS, et al. 2017 ACC/AHA/HRS guideline for the evaluation and management of patients with syncope. J Am Coll Cardiol. 2017 May;70(5):e39-e110. PMID: 28286222

Reversal of Anticoagulation



Guidelines for Emergent Bleeding Reversal for Non-Hemophiliac Patients

I. Factor Guidelines for Non-Hemophiliac Patients

Prothrombin complex concentrates, such as 4-factor PCC (factors II, VII, IX, X) (Kcentra®), are effective in reversing bleeding secondary to vitamin-K antagonists (warfarin) compared to fresh frozen plasma (FFP). Idarucizumab is available to reverse the effects of dabigatran. Andexanet alfa is available to reverse the effects of rivaroxaban and apixaban. Treatment may vary from these guidelines according to the discretion of the treating prescriber.

- A.** Reversal agents, including 4F-PCC, idarucizumab and andexanet alfa are quite costly and should only be used to reverse life threatening bleeding or if an urgent, invasive procedure planned.
 1. Per MCP 380.6, hold anticoagulation and monitor patients. <https://supplychain.ucsd.edu/Documents/formDocs/WD1104.pdf>.
- B.** Kcentra® + vitamin K is FDA-indicated for life-threatening bleeding caused by **warfarin (Attachment 1)** or warfarin reversal in patients needing urgent surgical or invasive intervention. See **Attachment 1** for Kcentra® dosing for coagulopathic patients with acute major bleeding reversal secondary to warfarin.
- C.** Kcentra® (± vitamin K) may be considered in patients with profuse or life-threatening bleeding **with no known history of warfarin consumption (Attachment 2)**
 1. The patients include profuse or life-threatening bleeding, or extreme risk of life-threatening bleeding, due to liver failure, intracranial hemorrhage, trauma, or critical illness or profuse or life-threatening bleeding, unresponsive or intolerant (fluid overload) to conventional therapy
 2. Limited efficacy data exists supporting the use of Kcentra® to reverse anticoagulation from direct thrombin inhibitors, i.e. dabigatran (Pradaxa®), or oral factor Xa-inhibitors, i.e. rivaroxaban (Xarelto®), apixaban (Eliquis®), or edoxaban (Sayvaysa®), who have life-threatening bleeding or require anticoagulation reversal for emergent invasive interventions.
- D.** Idarucizumab (Praxbind®), 5 g via IV infusion, should be used to reverse life-threatening bleeding associated with dabigatran.
 1. Idarucizumab is a monoclonal antibody specific to dabigatran and should not be expected to work for other oral or intravenous anticoagulants.
- E.** Andexanet alfa is approved for reversal of anticoagulant effects of rivaroxaban and apixaban, when known consumption occurred within previous 18 hours and the patient has a life-threatening gastrointestinal or intracranial hemorrhage. Attending approval is required. Please see **Attachment 4** for andexanet alfa dosing
- F.** Urgent invasive procedure for coagulopathic patients **with no evidence of bleeding**
 1. For patients taking warfarin who require surgical intervention, please refer to FDA-approved Kcentra® dosing (**Attachment 1**).
 2. Check fibrinogen, PT/INR and thromboelastograph (TEG). See **Attachment 3** for TEG interpretation assistance.
 3. If fibrinogen level is low (<200 mg/dL), replace fibrinogen with cryoprecipitate or FFP, as appropriate, prior to administering Kcentra®.
 4. Recommended to start with a single agent first (Kcentra®, 4-factor PCC preferred).
 5. For invasive procedures such as surgery or invasive intracranial pressure monitoring device, consider FFP or Kcentra® (25 units/kg) once. Kcentra® may be repeated one more time if inadequate response to first dose. Inadequate response is failure of PT/INR to normalize (INR ≤1.5) 30 minutes after first dose. For less invasive procedures (i.e. bronchoscopy or line placement, consider utilizing Kcentra 500 units once fibrinogen is optimized).
- G.** Suggested monitoring and follow-up after any Kcentra® administration
 1. Check PT/INR within one hour of administration, then PT/INR and TEG every 6 hours for 24 hours → then every 12 hours for 24 hours → then daily until stabilized.
- H.** Consider hematology consult for bleeding that continues after Kcentra® or other factor product administration. Contact hematology fellow on call, Hematology attending on call.

Attachment 1: Factor Algorithm for life-threatening bleeding due to warfarin or urgent surgical or invasive intervention for patients on warfarin (Coumadin)

Note: Factor products should not be given to patients who have no evidence of bleeding and do not have an invasive procedure planned

Pre-Treatment INR	2 – <4	4 – 6	>6
Dose* of Kcentra (units† of Factor IX) / kg actual body weight	25	35	50
Maximum dose‡	2500 units	3500 units	5000 units

‡ Dose is based on actual body weight up to but not exceeding 100 kg. For patients weighing more than 100 kg, maximum dose should not be exceeded.

Co-administration with 2-10 mg intravenous (IV) vitamin K is recommended with Kcentra®.

Attachment 2: Blood Product and Factor Algorithm in Non-Hemophiliac Patients not on warfarin***Does this patient have life-threatening bleeding?**

No Utilize standard blood product administration or if patient is taking an oral anticoagulant or heparin product, refer to MCP 380.6, attachment D

Yes**Blood Product and Factor Guidelines in Non-Hemophiliacs with life-threatening bleeding**

Check CBC/coags/fibrinogen and thromboelastograph (TEG)

Platelets <50,000/uL **or low MA on TEG**

Administer platelets

Fibrinogen <200 mg/dL **(or low angle or K on TEG)**

Administer FFP or cryoprecipitate until fibrinogen is >200 mg/dL

INR/PT >1.5/15 **(or prolonged R on TEG)**

Consider FFP

Consider Kcentra†

Consider tranexamic acid, **(esp if Fibrinolysis on TEG)**

Tranexamic acid 1000 mg bolus, then 1000 mg infused over 8 hours

Kcentra 25 units/kg x1 (NTE 2500 units). If inadequate response, may repeat dose 25 units/kg x1 (NTE 2500 units). In nearly all clinical scenarios, do not exceed 5000 units/48 hrs

*Extremely limited efficacy data exists to support Kcentra to reverse bleeding caused by rivaroxaban, apixaban, or edoxaban.

At this time literature DOES NOT SUPPORT the use of Kcentra to reverse bleeding caused by dabigatran. **Please use idarucizumab (Praxbind®)**

† For patients with confirmed or suspected heparin induced thrombocytopenia (HIT) who require bleeding reversal, please use Profilnine (3-factor PCC) 25 units/kg. If inadequate response to first dose, may repeat 25 unit/kg ± factor VIIa 40 mcg/kg. Note factor VIIa is an activated product and may increase thrombosis risk in these patients.

Attachment 3: Interpreting Thromboelastographs (TEGs)

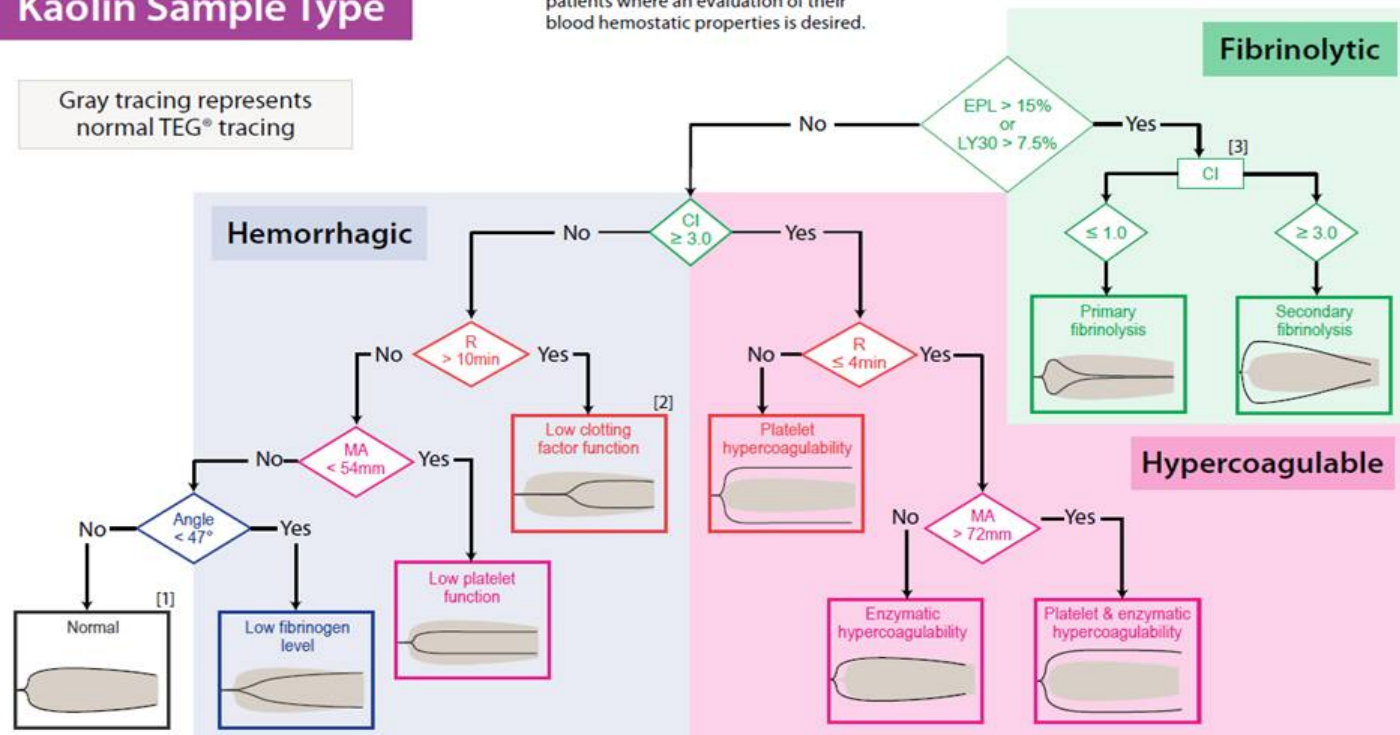
TEG® Analysis Tree

Kaolin Sample Type

Gray tracing represents normal TEG® tracing

The TEG is indicated for use with adult patients where an evaluation of their blood hemostatic properties is desired.

HAEMONETICS®
THE Blood Management Company



US Patent 6,787,363

TEG Value	Normal Value	Description	Affected Factor
R time	2-8 minutes	Reactive time. Time to initial clot formation.	Clotting factors
K TIME	1-3 minutes	Clot formation. Time from initial clot formation to fixed clot strength.	Fibrinogen
α-angle	55-78 degrees	Rate of clot strengthening (fibrin buildup and cross-linking).	Fibrinogen
MA	51-69 mm	Maximum amplitude. Clot strength. Platelet function and number.	Platelets
LY30	0-8%	Clot stability. Rate of clot lysis 30 minutes after maximum strength is achieved	Fibrinolysis

Attachment 4: Andexanet Alfa (Andexxa™)**UC San Diego Health P&T Committee Consensus**

- Andexanet alfa is approved for addition to formulary for a 6 month trial period
- Restricted to patients with a life-threatening bleed with **KNOWN** consumption of apixaban or rivaroxaban
- Andexanet alfa is not indicated for any other FXa inhibitor or anticoagulant at this time
- Re-address use and formulary status in 6 months pending further clinical data

FDA Indication

- Reversal of anticoagulation in patients with life-threatening or uncontrolled bleeding who were treated with **apixaban or rivaroxaban only**; not currently indicated for any other Factor Xa (FXa) inhibitors

Mechanism

- Recombinant modified human FXa decoy protein that binds to circulating FXa inhibitors with higher affinity versus native FXa protein and is not intrinsically active, therefore neutralizing the anticoagulant effects of apixaban and rivaroxaban

Clinical Efficacy and Safety Data

- ANNEXA-A and ANNEXA-R trials in healthy volunteers demonstrated efficacy in rapidly reversing anti-FXa levels and activity only; no data on efficacy in achieving hemostasis or clinical outcomes (ANNEXA-4 trial is ongoing and pending results)
- **BBW (derived from ANNEXA-4 interim safety analysis):** Treatment with andexanet alfa has been associated with serious and life-threatening adverse events, including: 1) arterial and venous thromboembolic events, 2) ischemic events, including myocardial infarction and ischemic stroke, 3) cardiac arrest, and 4) sudden deaths
- More infusion related reactions versus placebo demonstrated in ANNEXA-A and ANNEXA-R trials

Dosing

- Dosing is dependent upon the specific FXa inhibitor, dose of FXa inhibitor, and time since last dose

FXa Inhibitor	FXa Inhibitor Last Dose	Timing of FXa Inhibitor Last Dose Before Andexanet Alfa Initiation	
		<8 Hours or Unknown	≥8 Hours
Rivaroxaban	≤10 mg	Low Dose	Low Dose
	>10 mg or unknown	High Dose	
Apixaban	≤5 mg	Low Dose	
	>5 mg or unknown	High Dose	

Dose	Initial IV Bolus	Subsequent IV Infusion
Low Dose	400 mg (given at a rate of 30 mg/min)	480 mg (given over 2 hours)
High Dose	800 mg (given at a rate of 30 mg/min)	960 mg (given over 2 hours)

Preparation and Allocation Considerations

- Reconstitution of each 100 mg vial requires 5-10 mins per vial; total preparation time can be up to 45-60 mins
- Due to limited supply from manufacturer, UC San Diego Health expects to be only allocated 2-3 doses per month

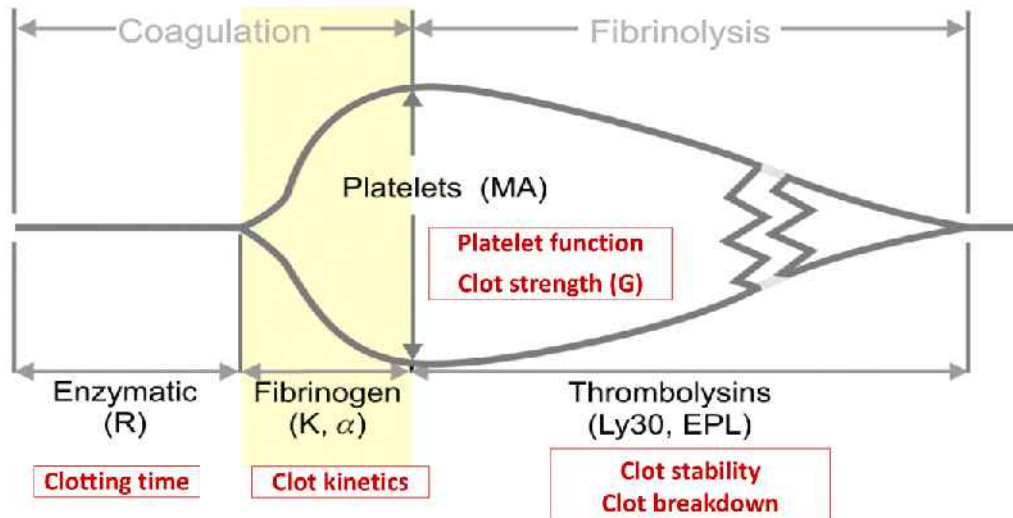
Approximate Drug Cost (Point of reference: Kcentra™ 50 units/kg=\$5080)

- Low dose bolus + infusion: \$24,750
- High dose bolus + infusion: \$49,500

Bottom Line

Pros	Cons
Only medication FDA approved for reversal of rivaroxaban and apixaban in life-threatening or uncontrolled bleeds	An improvement in hemostasis or other clinical outcomes has not been established
Effective reversal of rivaroxaban and apixaban levels	High cost of treatment
Safe in healthy volunteers except for more infusion related reactions	BBW associated with thromboembolic events and sudden death

Thromboelastography (TEG)



Component	Definition	Normals	Problem	Therapy
R time (Citrated Kaolin)	Time to start clotting	5-10 min	Coag. factors	FFP / KCentra
TEG-ACT (Rapid TEG)	Time to start clotting	80-140 sec	Coag. factors	FFP / KCentra
K Time	Time until fixed strength	1-3 min	Fibrinogen	Cryo / FFP
Alpha angle	Speed of fibrin accumulation	53-72°	Fibrinogen \pm platelets	Cryo / FFP / platelets
Maximum amplitude (MA)	Highest strength	50-70 mm	Platelets	Platelets or DDAVP
Lysis at 30 min (LY30)	% reduction MA @ 30 min	0 - 3%	Fibrinolysis	Tranexemic acid (TXA)

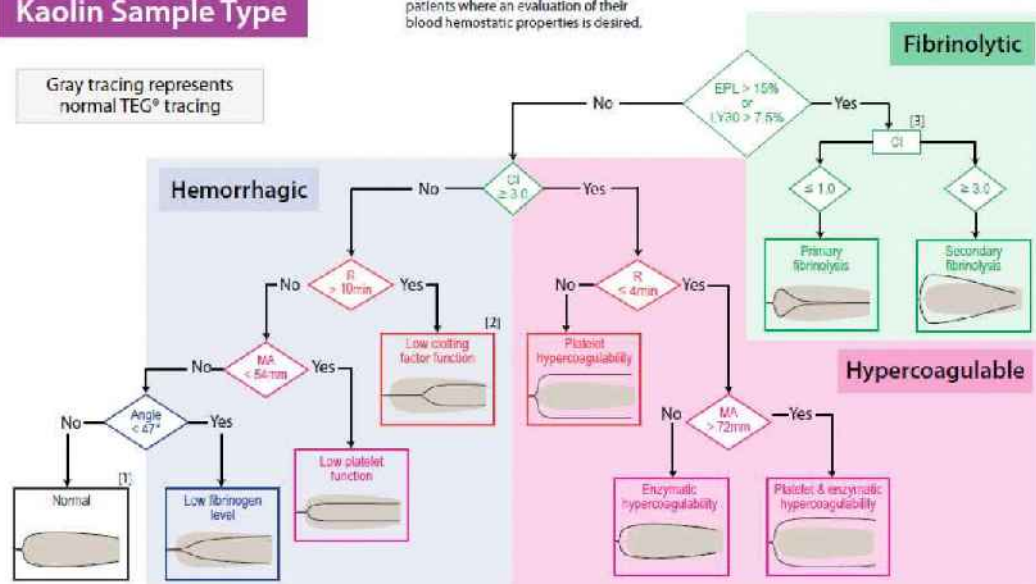
TEG® Analysis Tree

Kaolin Sample Type

Gray tracing represents normal TEG® tracing

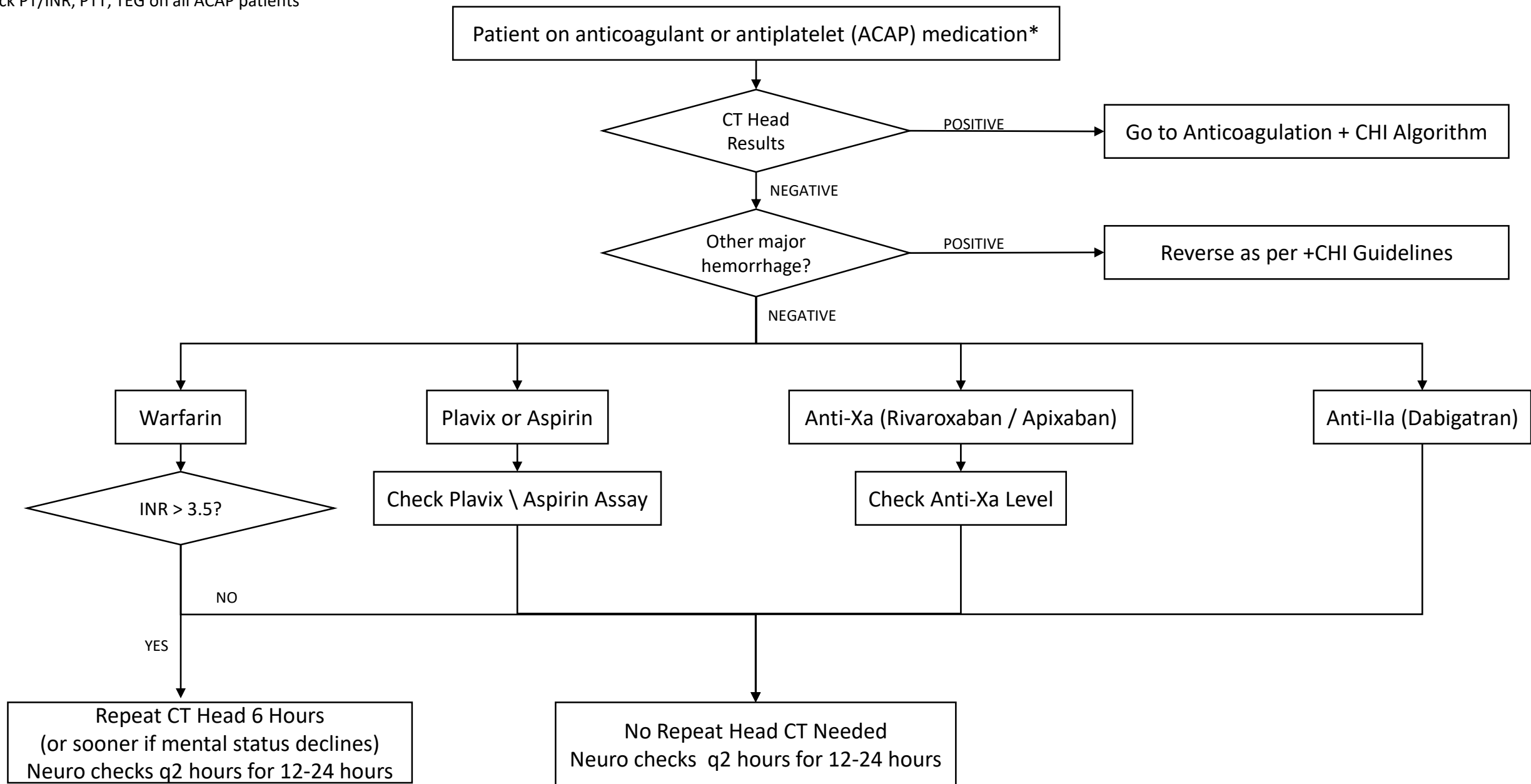
The TEG is indicated for use with adult patients where an evaluation of their blood hemostatic properties is desired.

HAEMONETICS®
THE Blood Management Company



1, 2, 3 See footnotes section on other side. References for TEG analysis tree can be found at www.haemonetics.com

US Patent 6,787,363



Concussion Screening

Concussion Screening

(See also: *PDF on Current Concepts in Concussion Management, ACE Symptom Checklist, SCAT3 PDF, CIF Concussion Return to Learn and Return to Play handouts, CDC What to Expect After a Concussion handout*)

A. Key Outcomes

- Timely diagnosis of concussion and associated injuries
- Appropriate Neurocognitive therapy
- Education and prevention of recurrent concussions

B. Goal Length of Stay

- 1-3 days
- Primarily dependent upon severity of associated injuries

C. Proposed Hospital Course

- All patients with loss of consciousness, mental status changes, or external signs of significant head trauma should be screened for concussion
- Hospital Day #1
 - i. CT head to rule out intracranial hemorrhage or other cause of symptoms
 - ii. If CT head negative for other cause and patient +LOC or with altered mental status on arrival, diagnose concussion
 - iii. Admit to IMU
 - iv. Scheduled neurologic checks q2 hours
- Hospital Day #2
 - i. Perform tertiary survey to rule out possibility of missed injuries
 - ii. C-spine clearance as per protocol
 - iii. Speech/cognitive therapy consult
 - iv. Concussion severity screening using SCAT3 assessment tool and Acute Concussion Evaluation (ACE) questionnaire

D. Discharge Planning

- Tolerating adequate oral intake
- Activity as tolerated based on associated injuries
- Patient and family educated on concussion prevention, signs and symptoms
 - i. Please provide:
 1. Pediatric patients: CIF Concussion Return to Learn and Return to Play handouts
 2. Adult patients: CDC What to Expect After a Concussion handout
- Post-concussive symptoms managed
- Referral for primary care physician or Concussion clinic (858-543-0555

—

Physician Access line to make referral) follow-up

E. Disposition

- Home in uncomplicated cases
- Per PT/OT recommendations if additional injuries present

F. Post-discharge Management

- Remove from play
- Consider graded return-to-play protocol
 - i. No return to impact sports until cleared by primary care physician
or concussion clinic
- Prevention of Second Impact Syndrome

Patient Name: _____	
DOB: _____	Age: _____
Date: _____	ID/MR# _____
Date of Injury: _____	

Symptom Evaluation: To be filled out by the patient

How do you feel?

“You should score yourself on the following symptoms, based on how you feel now”.

	None	Mild		Moderate		Severe	
Headache	0	1	2	3	4	5	6
“Pressure in head”	0	1	2	3	4	5	6
Neck pain	0	1	2	3	4	5	6
Nausea or vomiting	0	1	2	3	4	5	6
Dizziness	0	1	2	3	4	5	6
Blurred vision	0	1	2	3	4	5	6
Balance Problems	0	1	2	3	4	5	6
Sensitivity to light	0	1	2	3	4	5	6
Sensitivity to noise	0	1	2	3	4	5	6
Feeling slowed down	0	1	2	3	4	5	6
Feeling like “in a fog”	0	1	2	3	4	5	6
“Don’t feel right”	0	1	2	3	4	5	6
Difficulty concentrating	0	1	2	3	4	5	6
Difficulty remembering	0	1	2	3	4	5	6
Fatigue or low energy	0	1	2	3	4	5	6
Confusion	0	1	2	3	4	5	6
Drowsiness	0	1	2	3	4	5	6
Trouble falling asleep	0	1	2	3	4	5	6
More emotional	0	1	2	3	4	5	6
Irritability	0	1	2	3	4	5	6
Sadness	0	1	2	3	4	5	6
Nervous or anxious	0	1	2	3	4	5	6
Sleeping more than usual	0	1	2	3	4	5	6
Sleeping less than usual	0	1	2	3	4	5	6
Difficulty sleeping soundly	0	1	2	3	4	5	6
Ringing in the ears	0	1	2	3	4	5	6
Numbness or tingling	0	1	2	3	4	5	6
Total number of symptoms (maximum possible 27)							
Symptom severity score (maximum possible 162)							
Do the symptoms get worse with physical activity?						Y	N
Do the symptoms get worse with mental activity?						Y	N

(Patient’s signature)

(Date)

CIF Concussion Return to Play (RTP) Protocol

CA STATE LAW AB 2127 (Effective 1/1/15) STATES THAT RETURN TO PLAY (I.E., COMPETITION) CANNOT BE SOONER THAN 7 DAYS AFTER EVALUATION BY A PHYSICIAN (MD/DO) WHO HAS MADE THE DIAGNOSIS OF CONCUSSION.

Instructions:

- This *graduated return to play protocol* **MUST** be completed before you can return to FULL COMPETITION.
 - A certified athletic trainer (AT), physician, and/or identified concussion monitor (e.g., coach, athletic director), must monitor your progression and initial each stage after you successfully pass it.
 - Stages I to II-D take a *minimum* of 6 days to complete.
 - You must be back to normal academic activities before beginning Stage II, unless otherwise instructed by your physician.
 - You must complete one full practice *without restrictions* (Stage III) before competing in first game.
- After Stage I, you cannot progress more than one stage per day (or longer if instructed by your physician).
- If symptoms return at any stage in the progression, IMMEDIATELY STOP any physical activity and follow up with your school's AT, other identified concussion monitor, or your physician. In general, if you are symptom-free the next day, return to the previous stage where symptoms had not occurred.
- Seek further medical attention if you cannot pass a stage after 3 attempts due to concussion symptoms, or if you feel uncomfortable at anytime during the progression.

You must have written physician (MD/DO) clearance to begin and progress through the following Stages as outlined below (or as otherwise directed by physician)				
Date & Initials	Stage	Activity	Exercise Example	Objective of the Stage
	I	No physical activity for at least 2 full symptom-free days AFTER you have seen a physician	<ul style="list-style-type: none">No activities requiring exertion (weight lifting, jogging, P.E. classes)	<ul style="list-style-type: none">Recovery and elimination of symptoms
	II-A	Light aerobic activity	<ul style="list-style-type: none">10-15 minutes (<i>min</i>) of walking or stationary biking.Must be performed under <i>direct supervision by designated individual</i>	<ul style="list-style-type: none">Increase heart rate to no more than 50% of perceived maximum (<i>max</i>) exertion (e.g., < 100 beats per min)Monitor for symptom return
	II-B	Moderate aerobic activity (<i>Light resistance training</i>)	<ul style="list-style-type: none">20-30 min jogging or stationary bikingBody weight exercises (squats, planks, push-ups), max 1 set of 10, no more than 10 min total	<ul style="list-style-type: none">Increase heart rate to 50-75% max exertion (e.g., 100-150 bpm)Monitor for symptom return
	II-C	Strenuous aerobic activity (<i>Moderate resistance training</i>)	<ul style="list-style-type: none">30-45 min running or stationary bikingWeight lifting ≤ 50% of max weight	<ul style="list-style-type: none">Increase heart rate to > 75% max exertionMonitor for symptom return
	II-D	Non-contact training with sport-specific drills (<i>No restrictions for weightlifting</i>)	<ul style="list-style-type: none">Non-contact drills, sport-specific activities (cutting, jumping, sprinting)No contact with people, padding or the floor/mat	<ul style="list-style-type: none">Add total body movementMonitor for symptom return
Minimum of 6 days to pass Stages I and II. Prior to beginning Stage III, please make sure that written physician (MD/DO) clearance for return to play, after successful completion of Stages I and II, has been given to your school's concussion monitor				
	III	Limited contact practice	<ul style="list-style-type: none">Controlled contact drills allowed (no scrimmaging)	<ul style="list-style-type: none">Increase acceleration, deceleration and rotational forcesRestore confidence, assess readiness for return to playMonitor for symptom return
		Full contact practice Full unrestricted practice	<ul style="list-style-type: none">Return to normal training, with contactReturn to normal unrestricted training	
MANDATORY: You must complete at least ONE contact practice before return to competition, or if non-contact sport, ONE unrestricted practice (If contact sport, highly recommend that Stage III be divided into 2 contact practice days as outlined above)				
	IV	Return to play (competition)	<ul style="list-style-type: none">Normal game play (competitive event)	<ul style="list-style-type: none">Return to full sports activity without restrictions

Athlete's Name: _____ Date of Concussion Diagnosis: _____

CIF Concussion Return to Learn (RTL) Protocol

Instructions:

- Keep brain activity below the level that causes worsening of symptoms (e.g., headache, tiredness, irritability).
- If symptoms worsen at any stage, stop activity and rest.
- Seek further medical attention if your child continues with symptoms beyond 7 days.
- If appropriate time is allowed to ensure complete brain recovery before returning to mental activity, your child may have a better outcome than if he or she tries to rush through these guidelines.
- Please give this form to teachers/school administrators to help them understand your child's recovery.

Stage	Home Activity	School Activity	Physical Activity
Brain Rest	Rest quietly, nap and sleep as much as needed. Avoid bright light if bothersome. Drink plenty of fluids and eat healthy foods every 3-4 hours. Avoid "screen time" (text, computer, cell phone, TV, video games).	No school. No homework or take-home tests. Avoid reading and studying.	Walking short distances to get around is okay. No exercise of any kind. No driving.
	<p style="text-align: center;"><i>This step usually ends 3-5 days after injury.</i> <i>Progress to the next stage when your child starts to improve, but s/he may still have some symptoms.</i></p>		
Restful Home Activity	Set a regular bedtime/wake up schedule. Allow at least 8-10 hours of sleep and naps if needed. Drink lots of fluids and eat healthy foods every 3-4 hours. Limit "screen time" to less than 30 minutes a day.	No school. May begin easy tasks at home (drawing, baking, cooking). Soft music and 'books on tape' ok. Once your child can complete 60-90 minutes of light mental activity without a worsening of symptoms he/she may go to the next step.	Light physical activity, like walking. No strenuous physical activity or contact sports. No driving.
	<p style="text-align: center;"><i>Progress to the next stage when your child starts to improve and s/he has fewer symptoms.</i></p>		
Return to School - PARTIAL DAY	Allow 8-10 hours of sleep per night. Avoid napping. Drink lots of fluids and eat healthy foods every 3-4 hours. "Screen time" less than 1 hour a day. Spend limited social time with friends outside of school.	Gradually return to school. Start with a few hours/half-day. Take breaks in the nurse's office or a quiet room every 2 hours or as needed. Avoid loud areas (music, band, choir, shop class, locker room, cafeteria, loud hallway and gym). Use sunglasses/ earplugs as needed. Sit in front of class. Use preprinted large font (18) class notes. Complete necessary assignments only. No tests or quizzes. Limit homework time. Multiple choice or verbal assignments better than lots of long writing. Tutoring or help as needed. Stop work if symptoms increase.	Light physical activity, like walking. No strenuous physical activity or contact sports. No driving.
	<p style="text-align: center;"><i>Progress to the next stage when your child can complete the above activities without symptoms.</i></p>		
Return to School - FULL DAY	Allow 8-10 hours of sleep per night. Avoid napping. Drink lots of fluids and eat healthy foods every 3-4 hours. "Screen time" less than 1 hour a day. Spend limited social time with friends outside of school.	Progress to attending core classes for full days of school. Add in electives when tolerated. No more than 1 test or quiz per day. Give extra time or untimed homework/tests. Tutoring or help as needed. Stop work if symptoms increase.	Light physical activity, like walking. No strenuous physical activity or contact sports. No driving.
	<p style="text-align: center;"><i>Progress to the next stage when your child has returned to full school and is able to complete all assignments/tests without symptoms.</i></p>		
Full Recovery	Return to normal home and social activities.	Return to normal school schedule and course load.	May begin and must complete the CIF Return to Play (RTP) Protocol before returning to strenuous physical activity or contact sports.

**Guidelines adapted from Cincinnati Children's Hospital Return to Learn Protocol

CIFSTATE.ORG

CIF 5/2015

Current Concepts in Concussion: Evaluation and Management

Table 6.
Elements of Concussion Management

<i>ELEMENT</i>	<i>RECOMMENDATIONS</i>	<i>COMMENTS</i>
Cognitive rest	Avoid text messaging or video games	Avoid activities that require attention or concentration
	Limit television and computer use	
	Decrease schoolwork	
Physical rest	Avoid any physical activity that exacerbates symptoms (e.g., aerobic exercise, lifting weights, household chores, sexual activity)	Severe or worsening headache, persistent vomiting, or seizures may suggest a need for neuroimaging
Medications/interventions	Wear sunglasses for photophobia	There is poor evidence for use of medications for postconcussive symptoms; therefore, medication choices are the same for those without concussion
	Wear earplugs or noise canceling headphones for phonophobia	
	Take medications to alleviate specific symptoms (e.g., nonsteroidal anti-inflammatory drugs, acetaminophen, or amitriptyline for persistent headaches; sleep aids, anxiolytics, selective serotonin reuptake inhibitors for depressive symptoms)	
	Be aware that some medications may mask postconcussive symptoms	

Avoid acute use of nonsteroidal anti-inflammatory drugs if there is potential for intracranial bleeding

Transition back to school

Alert school personnel to injury, and initiate slow reintegration

Usually can be accomplished informally, but formal interventions may be required (e.g., IEP, 504 plan)

Consider the following:
forgiveness of missed assignments and more time to complete tests and schoolwork, standard breaks and rest periods as needed, decreased schoolwork, distraction-free work areas, note taker

Avoid standardized testing during recovery

Monitor carefully for two to three months after concussion for scholastic difficulties

Graded return to play

After rest and resolution of symptoms, athletes may progress through a return-to-play protocol; each of the following steps should take 24 hours:

Nonimpact aerobic exercise

Sport-specific exercise (nonimpact drills)

Noncontact training drills

Full contact practice

Return to normal play

Patient must be symptom-free and medication-free before starting return-to-play protocol. If any symptoms develop, activity should be stopped immediately; 24 hours after symptoms resolve, protocol may resume at the last step for which the athlete was asymptomatic.

Higher-risk patients

Factors that may suggest prolonged recovery or caution for return to play:

More than three symptoms at presentation

Consider multidisciplinary approach (e.g., referral to health care professional experienced in concussion management, formal

at presentation

Specific symptoms (i.e.,
fatigue, tiredness, or
fogginess)

neuropsychological testing,
communication with coach and
training staff)

Headache lasting more
than 60 hours

Loss of consciousness for
more than 60 seconds

Amnesia

History of concussion

Age younger than 18
years

Comorbid conditions

Medication use
(psychotropic drugs,
anticoagulants)

Dangerous style of athletic
play

High-risk sport (contact,
collision)

IEP = individualized education program.

Information from references 1, 9, 10, 12, 18, and 20.

Copyright © 2012 by the American Academy of Family Physicians.

This content is owned by the AAFP. A person viewing it online may make one printout of the material and may use that printout only for his or her personal, non-commercial reference. This material may not otherwise be downloaded, copied, printed, stored, transmitted or reproduced in any medium, whether now known or later invented, except as authorized in writing by the AAFP. Contact afpserv@aafp.org for copyright questions and/or permission requests.

C-Spine Workup and Management

Cervical and Thoracolumbar Spinal Precautions

Protocol:

In all cases of trauma team activations and admissions, spinal injury will be assumed *until proven otherwise* in all patients, including those with:

- a. neurologic spinal or CNS deficits
- b. spinal pain and/or tenderness
- c. significant mechanism of injury, including (as examples):
 - i. two or more proximal long bone fractures
 - ii. evidence of high impact
 - iii. victim ejection
 - iv. comatose state secondary to head trauma *or* those patients requiring induced pharmacologic neuromuscular blockade

Patients arriving with suspected spinal injury and immobilization by a semi-rigid cervical orthosis and/or spine board will not have them removed until appropriate clinical radiographic evaluations are obtained. If the patient is not immobilized upon presentation, appropriate immobilization will be applied.

Procedure:

- a. Patients admitted with suspected spinal injury or high index of suspicion, due to mechanism of injury or by physical exam, will have semi-rigid cervical collars applied and a spinal board placed. These will not be removed until radiographic and clinical evaluations are completed. Special consideration regarding pain perception should be given to the intoxicated or drugged patient and to the patient with “competing” pain.
- b. In patients with concern for spinal cord injury, a complete neurologic examination should be performed including motor/sensory/reflexes and rectal examination and documented. Presence or absence of the bulbocavernosus reflex should be noted.
- c. If possible, obtaining spinal x-rays and determination of the presence or absence of injury should be done prior to any surgical procedure. Should an emergency condition preclude complete evaluation, spinal immobilization will continue until evaluation is completed.
- d. If a patient is undergoing a CT scan for evaluation of another injury, a CT C-spine should be obtained to rule out an injury. If not, appropriate cervical spine x-rays include a lateral (which is taken first, and has priority over other views,) A/P and open-mouth view. A/P and lateral of thoracic and lumbar spine will be obtained when indicated. Lateral cervical x-rays must visualize C7. Swimmers views will be obtained where necessary, except in patients with high risk or severe pain.
- e. Patients with any spinal fracture should have a radiologic exam of the entire spine.

f. Patients with penetrating trauma without a history of significant blunt trauma or neurologic symptoms do not require spinal immobilization or clearance.

g. Physician's orders will reflect spine precautions as follows:

- i. *Full Spine Precautions*- CTL spine injury has not been cleared or an injury has been identified:
 1. patient requires rigid cervical collar at all times
 2. full log roll when moving the patient
 3. patient may not be placed on an air fluidized or air loss specialty bed
 4. mattress to remain flat at all times (reverse Trendelenburg acceptable)
 5. bedrest only
- ii. *Cervical Spine Precautions*
 1. bedrest
 2. head flat
 3. C-spine immobilization in a rigid cervical collar (Philadelphia collar or Miami J) at all times
 4. transport flat on a gurney
- iii. *CTL Spines Cleared*- Patient may be mobilized as appropriate

h. Cervical Spine Clearance-

- i. *Obtunded/Intubated Patients*- For adult blunt trauma patients that are obtunded, the cervical collar can be removed after a negative high-quality C-spine CT if there are no focal neurologic deficits (EAST PMG, Patel et al. J Trauma Acute Care Surg. 2015;78:430-441).
- ii. *Clinically Evaluable Patients*- Normal trauma routine for clearing C-spine includes 3-4 radiographic x-ray views or CT C-spine initially, combined with clinical exam of the C-spine. A patient with competing pain, acutely intoxicated, or any head injury should not have the clinical motion exams attempted until sensorium is cleared (usually the next morning).
 1. If midline pain or tenderness is absent on examination, the patient should be instructed to slowly move his head side to side (without assistance) then to the back and then to the front and to stop at any time if he has any pain.
 2. After negative cervical spine imaging, if a patient complains of cervical pain or soreness, they should be kept in a Philadelphia collar or Miami J. These patients may undergo MRI of the cervical spine or discharged with a c-collar until follow-up in clinic.
- iii. Discontinuing cervical spine precautions will be documented in the physician's orders and progress notes.

i. Thoracolumbar Spine Clearance-

Initial clinical evaluation

If GCS 13 to 15 reliable with no distracting injury:

- may clear clinically with negative tertiary exam

If GCS 13 to 15 with clinical deficits:

- obtain CT imaging of spine followed by specialty consultation

If obtaining CT of chest or abdomen/pelvis, reconstruct spinal imaging if other indication for XR imaging

If tenderness, distracting injury, or suspicious mechanism with GCS < 13, obtain XR imaging

If high clinical suspicion due to exam and/or mechanism may proceed directly to CT imaging

Follow-up on initial imaging

- If XR demonstrates a fracture, obtain CT scan
- If XR demonstrates an irregularity with clinical tenderness, obtain a CT scan.
- TL spine read that is prelim negative and reviewed by Attending can be cleared and patient placed in C-spine only or no precautions with order.

Tertiary exam

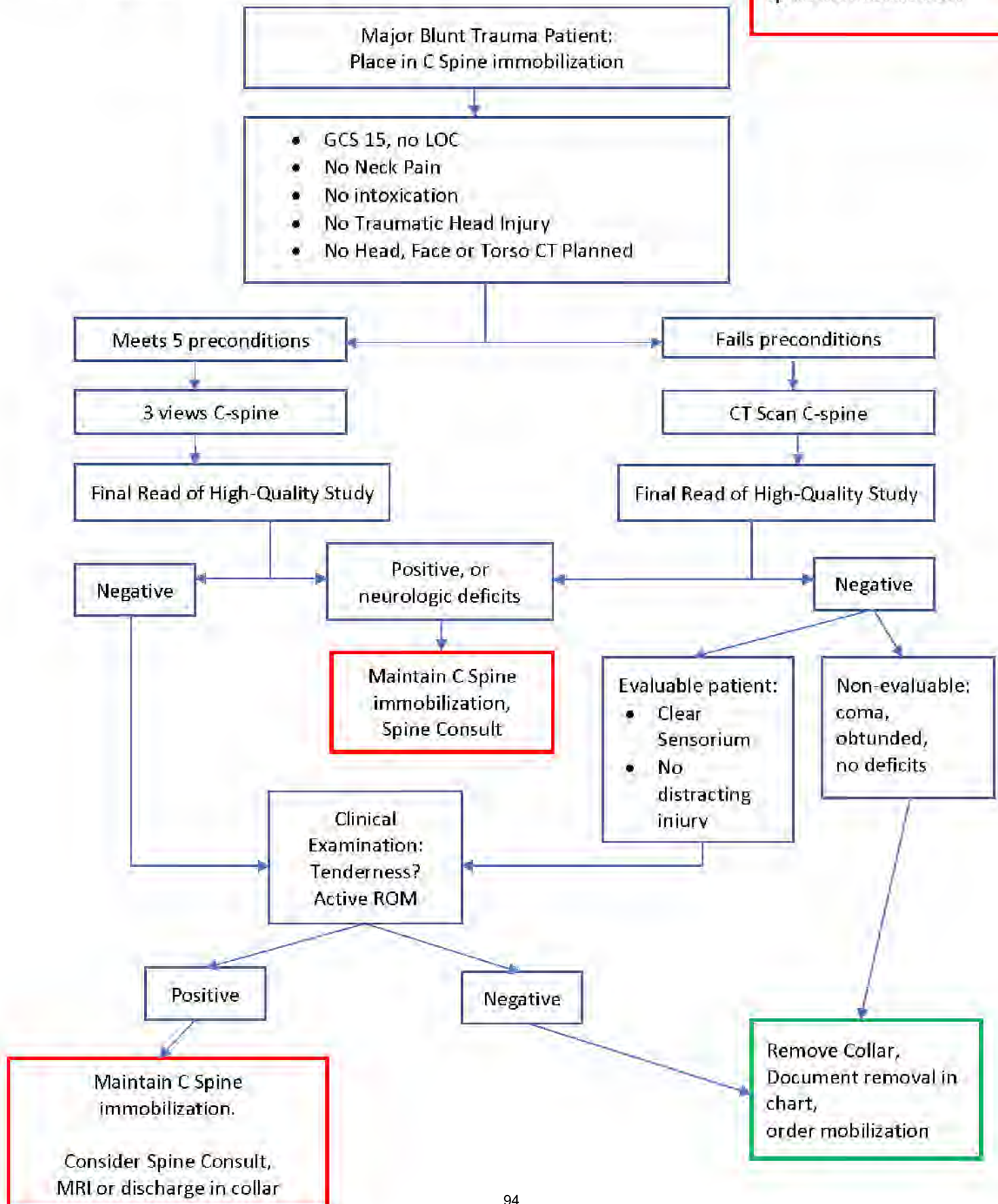
If continued clinical tenderness or new deficit:

- obtain CT imaging and consult spine service

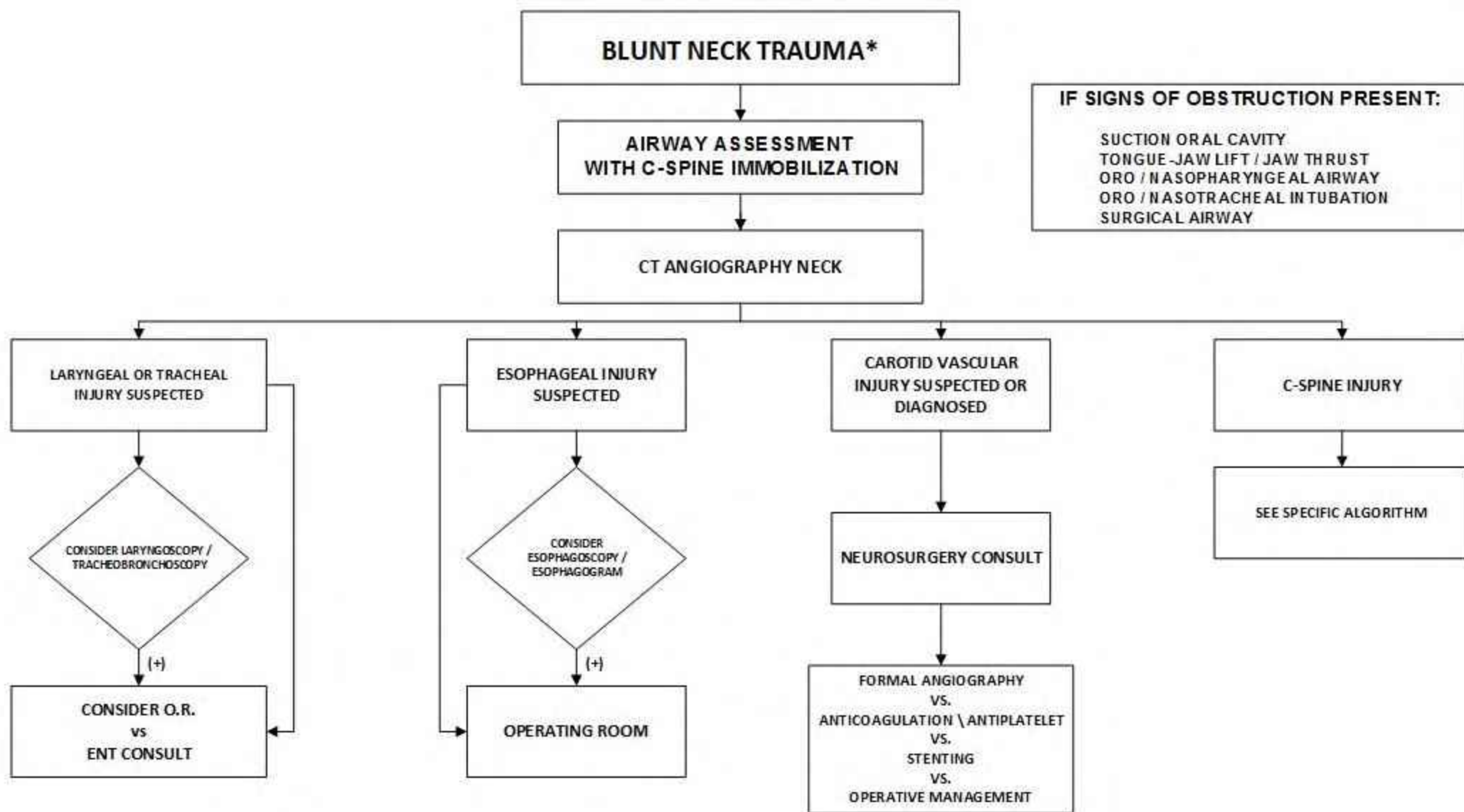
If clinically negative and GCS 15 may clear spine

C Spine Clearance Algorithm

Penetrating Trauma only patients without deficits do not need collars or spine immobilization!



Neck Trauma



* Seat belt sign on neck,
strangulation, choking, etc.

UCSD Blunt Cerebrovascular Injury Screening & Acute Treatment Algorithm (Denver 2012).

Screening Criteria

Signs/Symptoms of BCVI

Potential arterial hemorrhage from neck/nose/mouth
Cervical Bruit in pt < 50 yrs old
Expanding cervical hematoma
Focal neurologic defect: TIA, hemiparesis, vertebrobasilar symptoms, Horner's Syndrome
Neurologic deficit inconsistent with head CT (DAI, etc.)
Stroke on CT or MRI

Risk Factors for BCVI

Mandatory Screening:

High energy transfer mechanism associated with:
Cervical spine fracture
Cervical spine ligamentous injury
Displaced mid-face fracture (LeFort II or III)
Mandible fracture
Basilar skull fracture
Temporal bone fracture
Hanging, strangulation, or clothesline injury
Seatbelt sign on neck

Consider Screening:

Hyperextension mechanism
TBI with thoracic injuries
Scalp degloving
Thoracic vascular injuries
Blunt cardiac rupture

Yes

Yes

No

No

Multi-Slice CTA*

Positive ‡

Negative

Equivocal Finding or High Clinical Suspicion ‡

Arteriogram vs. MRA

Stop

Carotid Artery Injury (common or internal)

Vertebral Artery Injury

Grade I Injury

Grade II-V Injury

Grade I Injury

Grade II-IV Injury

Grade V Injury

Antithrombotic or Antiplatelet Therapy

Antithrombotic or Antiplatelet Therapy

Endovascular Treatment

Surgically Accessible?

Yes

No

Operative or Endovascular Treatment

Endovascular Treatment

* CTA with multidetector-row CT, 16-channel or higher. If fewer than 16 channels, interpret CTA with caution; digital subtraction arteriography is gold standard.

‡ Neurosurgery consult required

Table: Denver Grading Scale for Blunt Cerebrovascular Injuries

Grade I: irregularity of the vessel wall or a dissection/intramural hematoma with <25% luminal stenosis

Grade II: intraluminal thrombus or raised intimal flap is visualized, or dissection/intramural hematoma with >25% luminal stenosis

Grade III : pseudoaneurysm

Grade IV : vessel occlusion

Grade V: vessel transection

Penetrating Neck Trauma

Penetrating Neck Wound- Exploration, Vascular Repair/Ligation

The neck can be divided into 3 zones

- Zone I—inferior the clavicles and manubrium and encompasses all structures in the thoracic outlet
- Zone II—between the thoracic outlet and the angle of the mandible
- Zone III—between the angle of the mandible and base of the skull

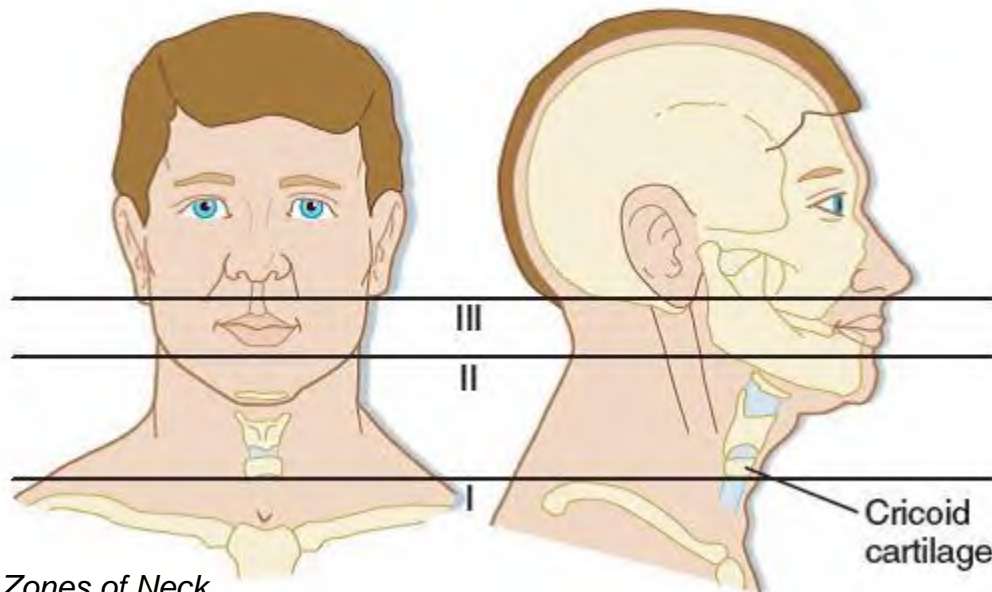


Figure – Zones of Neck

Management of a penetrating neck wound depends on the location/zone, depth of the wound and associated symptoms.

Initial evaluation of evaluation of penetrating neck wounds should proceed per ATLS protocol by first addressing ABCDEs.

For patients with hard/overt signs of hemorrhage or asphyxiation, securing the airway and initial hemorrhage control is often followed by emergent operative intervention.

Operative exploration is indicated for all symptomatic penetrating injuries to Zone II that violate the platysma. It can also expediently rule out injury in asymptomatic Zone II injuries.

A chest x-ray and cardiac ultrasound are useful in Zone I injuries to evaluate for hemothorax or hemopericardium.

In stable patients without hard/overt signs of injury, a CTA of the neck may be helpful in further evaluating the extent of injury. The addition of contrast esophagograms, endoscopy or bronchoscopy should be considered based on clinical signs/symptoms and CTA findings.

A. Key Outcomes

- Timely diagnosis of esophageal injury and associated injuries
- Prompt intervention for esophageal injury and identified injuries
- Optimal pain management; aggressive pulmonary toilet; early mobilization

B. Goal Length of Stay

- **24-48 hours** (depends on severity of injury/complexity of surgery)

C. Proposed Hospital Course

- i. Prior to Arrival at Hospitalization Destination
 - ATLS protocol; workup as mechanism and presentation dictate
 - Operative exploration of Zone II injury
 - Antibiotics and tetanus prophylaxis as needed

Hospital Day #1

- Start clear liquid diet

Hospital Day #2

- Remove drain
- Discharge
- Patient and family education regarding wound care, diet, and activity
- Tolerating regular diet
- Activity as tolerated based on injuries
- Clinic follow-up as injuries dictate

D. Disposition

- Home in uncomplicated cases
- Home care facility in complex cases
- Per PT/OT recommendations

Penetrating Neck Wound-Esophageal Injury

A. Key Outcomes

- Timely diagnosis of esophageal injury and associated injuries
- Prompt intervention for esophageal injury and identified injuries.
- Optimal pain management; aggressive pulmonary toilet; early mobilization

B. Goal Length of Stay

5 days (depends on severity of injury/complexity of surgery/presence or absence of leak on postop contrast study)

C. Proposed Hospital Course

Prior to Arrival at Hospitalization Destination

- ATLS protocol; workup as mechanism and presentation dictate
- Operative exploration of Zone II injury with violation of platysma in cases of hemodynamic instability or hard signs of vascular/aero digestive injury
- Order appropriate adjunct examinations including CTA neck, bronchoscopy, EGD, UGI contrast study as dictated by injury
- Refer to treatment algorithm below for further details
- Early mediastinal washout and drainage with tube thoracostomy when necessary
- Broad spectrum antibiotics and tetanus prophylaxis as needed

Hospital Day #1-4

- NPO
- Broad spectrum antibiotics
- Drainage

Hospital Day #5

- Contrast study. If negative, start clear liquid diet **AND** continue drainage

Hospital Day #6

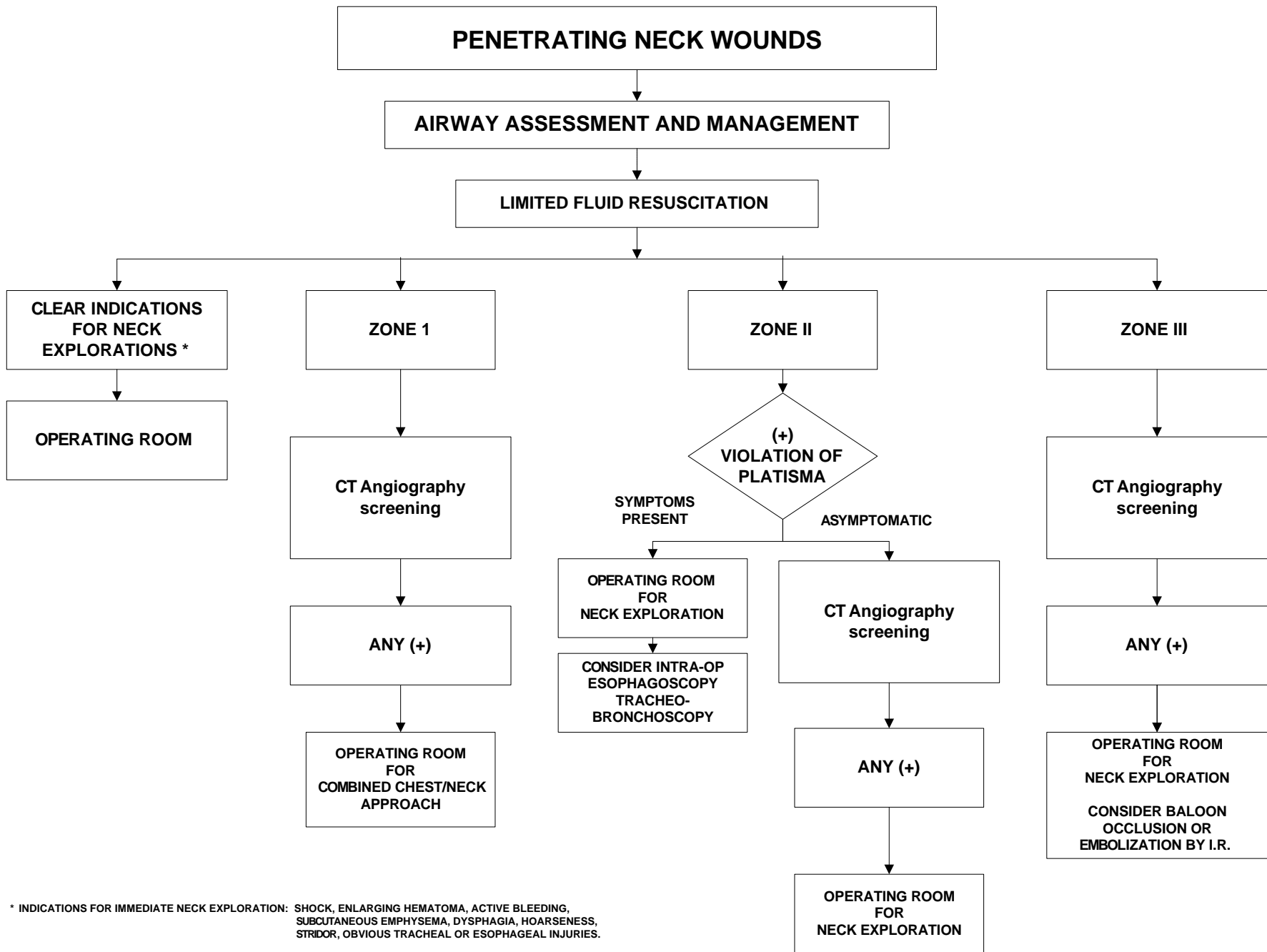
- If no evidence of esophageal leak with clear liquid diet, remove drain
- Discharge
- Patient and family education regarding wound care, diet, and activity

D. Discharge Planning

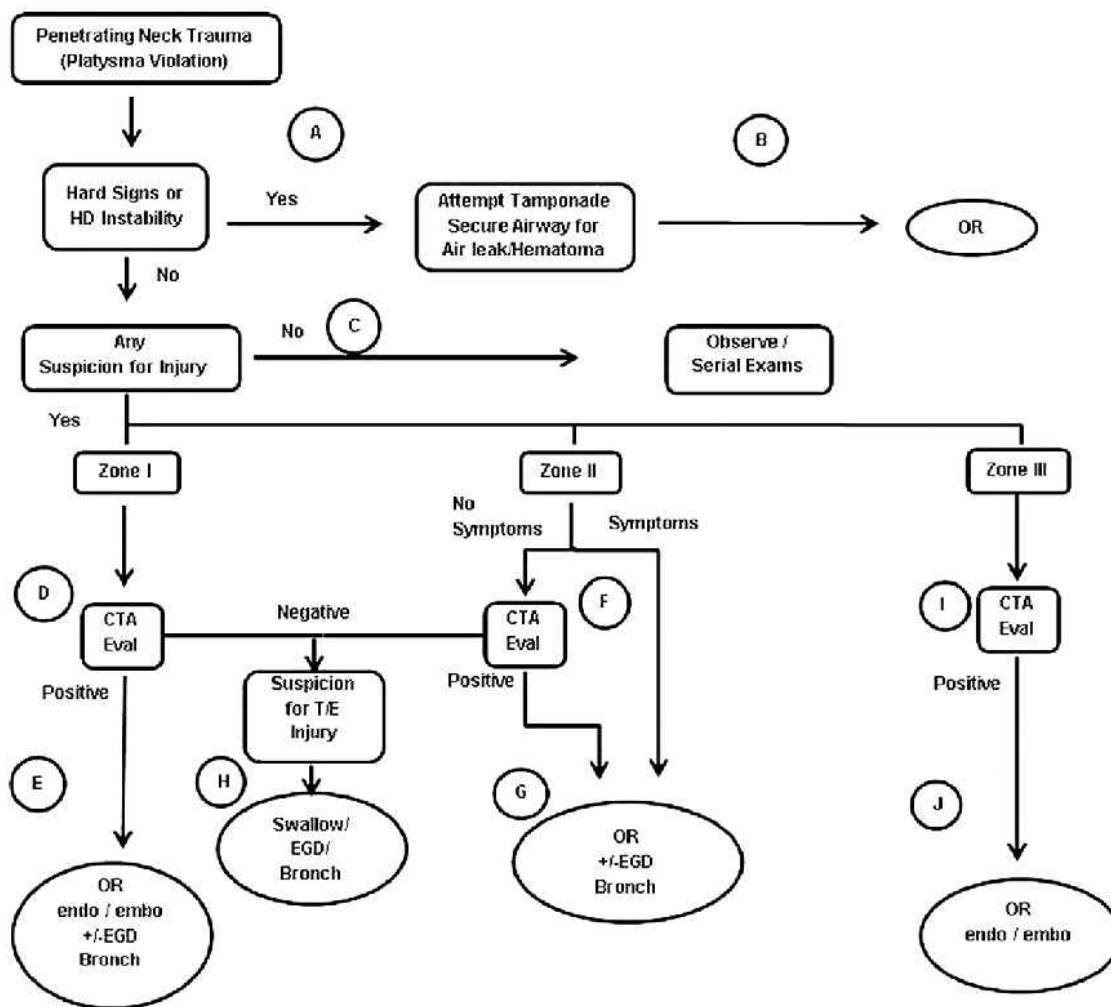
- Tolerating regular diet
- Activity as tolerated based on injuries
- Clinic follow-up as injuries dictate

E. Disposition

- Home in uncomplicated cases
- Home care facility in complex cases
- Per PT/OT recommendations



* INDICATIONS FOR IMMEDIATE NECK EXPLORATION: SHOCK, ENLARGING HEMATOMA, ACTIVE BLEEDING, SUBCUTANEOUS EMPHYSEMA, DYSPHAGIA, HOARSENESS, STRIDOR, OBVIOUS TRACHEAL OR ESOPHAGEAL INJURIES.



Sperry JL, Moore EE, Coimbra R, Croce M, Davis JW, Karmy-Jones R, McIntyre RC Jr, Moore FA, Malhotra A, Shatz DV, Biffi WL. Western Trauma Association critical decisions in trauma: penetrating neck trauma. J Trauma Acute Care Surg. 2013 Dec;75(6):936-40. doi: 10.1097/TA.0b013e31829e20e3. Review. PubMed PMID: 24256663.

Facial Fractures

Facial Fractures without Closed Head Injury

A. Key Outcomes

- Timely diagnosis of and intervention for facial fractures and associated injuries
- Early establishment of operative vs. non-operative management
- Optimal pain management; aggressive pulmonary toilet; early mobilization

B. Goal Length of Stay

24-48 hours (depends on associated injuries, type of fracture, complexity of surgery if required)

C. Proposed Hospital Course

- i. Trauma Bay – Initial Workup
 - ATLS protocol; workup as mechanism and presentation dictate
 - ENT (even days) or Plastics (odd days) consultation and evaluation
 - Note: all temporal bone fractures require ENT consult regardless of date
 - Antibiotics and tetanus prophylaxis as needed (antibiotics per consulting service recommendations)
 - See Blunt Cerebrovascular Trauma protocol – does patient meet BCVI screening criteria based upon injury pattern?
- ii. At the Time of Admission
 - Ensure all workup has been completed and consults called
 - Follow-up with consulting service to determine plan of care for all injuries
 - Admit to ward (ICU/IMU/Floor) as appropriate
 - NPO for surgery if necessary
- iii. Postoperative
 - If jaw wired shut:
 1. Wire cutters at bedside AT ALL TIMES (scissors adequate for rubber band MMF)
 2. Oral rinses
 3. Jaw fracture diet
 4. Dietary consult
 - Pain control
 - Antibiotics per consulting team recommendations
- iv. Hospital Day #1-2
 - Perform tertiary survey to rule out possibility of missed injuries
 - C-spine clearance as per Protocol (pre-operatively if possible)
 - Patient and family education regarding wound care, diet, and activity restrictions

D. Discharge Planning

Tolerating diet (texture as per injury pattern – often requires soft or jaw fracture diet)

Activity as tolerated based on injuries

Clinic follow-up with ENT or Plastics as injuries dictate

E. Disposition

Home in uncomplicated cases

Skilled nursing facility in complex cases \ other severe injuries \ complicated social situation

Per PT/OT recommendations

Facial Fractures with Mild Closed Head Injury

Definition of Mild CHI: Concussion OR Intracranial Hemorrhage with GCS 13-15

A. Key Outcomes

- Timely diagnosis of facial fractures, TBI, and associated injuries
- Prompt intervention for facial fractures, TBI, and identified injuries as needed
- Early recognition of neurological deterioration and immediate institution of appropriate workup and treatment
- Optimal pain management; aggressive pulmonary toilet; early mobilization

B. Goal Length of Stay

Depends on associated injuries, type of fracture, complexity of surgery (if required)

C. Proposed Hospital Course

- i. Trauma Bay – Initial Workup
 - ATLS protocol; workup as mechanism and presentation dictate
 - ENT (even days) or Plastics (odd days) consultation and evaluation for facial fractures
 - Note: all temporal bone fractures require ENT consult regardless of date
 - Neurosurgery consultation and evaluation if intracranial hemorrhage present
 - Antibiotics and tetanus prophylaxis as needed (antibiotics per consulting service recommendations)
 - See Blunt Cerebrovascular Trauma protocol – does patient meet BCVI screening criteria based upon injury pattern?
- ii. At the Time of Admission
 - Ensure all workup has been completed and consults called
 - Follow-up with consulting service(s) to determine plan of care for all injuries
 - Admit to ICU (any intracranial hemorrhage) / IMU (concussion only) as appropriate
 - Scheduled neurologic checks (q1hr ICU, q2hr IMU) for 24 hours
 - NPO for all ICU patients, for IMU patients only if surgery is planned
 - If intracranial hemorrhage present – repeat CT head in 4-6 hours, or sooner if mental status declines
 - No operative intervention for facial fractures until cleared by trauma team AND neurosurgery
- iii. Postoperative
 - If jaw wired shut:
 1. Wire cutters at bedside AT ALL TIMES (scissors adequate for rubber band MMF)

- 2. Oral rinses
- 3. Jaw fracture diet
- 4. Dietary consult
- Pain control
- Antibiotics per consulting team recommendations

iv. Hospital Day #1-2

- Perform tertiary survey to rule out possibility of missed injuries
- C-spine clearance as per Protocol (pre-operatively if possible)
- Patient and family education regarding wound care, diet, and activity restrictions

D. Discharge Planning

Tolerating diet (texture as per injury pattern –often requires soft or jaw fracture diet)

Activity as tolerated based on injuries

Clinic follow-up with ENT, Plastics and \ or Neurosurgery as injuries dictate

E. Disposition

Home in uncomplicated cases

Skilled nursing facility in complex cases \ other severe injuries \ complicated social situation

Per PT/OT recommendations

Chest Trauma

NOM Blunt or Penetrating Chest Trauma - Hemo/pneumothorax with Chest Tube

A. Key Outcomes

- Timely diagnosis and treatment of hemo/pneumothorax and associated injuries
- Optimal pain management; aggressive pulmonary toilet; early mobilization
- Respiratory parameters maintained within acceptable limits
- Full expansion of lung and adequate evacuation of hemothorax
- No retained hemothorax at discharge
- Patient demonstrates and verbalizes understanding of wound/dressing care at discharge

B. Goal Length of Stay

2-4 days (persistent air leak or ongoing chest tube output may lengthen stay)

C. Proposed Hospital Course

Hospital Day #1

- Consider IMU/ICU admission for elderly patients or if other complicating factors exist
- NPO
- Chest tube to -20 cm H₂O suction
- Closely monitor chest tube output and assess for air leak
- Adequate analgesia, **consider need for epidural**
- Aggressive pulmonary toilet; weaning parameters BID by RT
- OOB to chair while CT on suction
- There is insufficient evidence for routine prophylactic antibiotics for chest tubes, however consider if patient was transferred with outside tubes, has open wounds or evidence of infection.

Hospital Days #2-3

- AM chest x-ray
 - if persistent hemo/pneumothorax OR continuous air leak, continue chest tube to suction and monitor
 - if hemo/pneumothorax resolved AND no continuous air leak, place chest tube to straight drainage and repeat chest x-ray in 4-6 hrs
 - if chest x-ray stable after 4-6 hrs on water seal and output <150cc/24hr, remove tube
 - if Retained Hemothorax (diaphragm not clearly seen) see "RETAINED HEMOTHORAX."
- Advance diet
- Adequate analgesia (IV or po)
- Aggressive pulmonary toilet; weaning parameters BID by RT
- OOB to chair while CT on suction; may ambulate while on water seal

Hospital Day #4

- AM chest x-ray
 - if persistent hemo/pneumothorax OR continuous air leak, continue chest tube to suction and monitor
 - if hemo/pneumothorax resolved AND no continuous air leak, place chest tube to straight drainage and repeat chest x-ray in 4-6 hrs
 - if chest x-ray stable after 4-6 hrs on water seal and output <150cc/24hr, remove tube
 - if Retained Hemothorax (diaphragm not clearly seen) see “RETAINED HEMOTHORAX.
- Change analgesia to oral route
- Ambulate TID once chest tube is off suction; may ambulate while on water seal
- Keep site dressing in place x 48hr

D. Discharge Planning

Tolerating regular diet

Activity as tolerated based on injuries

Clinic follow-up as injuries dictate

* Patients admitted with a pneumothorax should be instructed to abstain from air travel for a **minimum of 4 weeks** following clinical and radiographic resolution of a pneumothorax.

**** DO NOT DISCHARGE PATIENTS WITH RETAINED HEMOTHORAX****

E. Disposition

Care facility required for complex cases

May require home care for assistance with wounds or other therapies

Per PT/OT recommendations

F. Retained Hemothorax

Retained hemothorax (RH) is complication of chest trauma that can lead to empyema, entrapped lung, and fibrothorax. When initial tube thoracostomy does not evacuate a hemothorax, options for management include a second tube thoracostomy, video-assisted thoracoscopy (VATS), or intrapleural fibrinolytic therapy. Early VATS for retained hemothorax has been shown to decrease rates of empyema, decrease both intensive care unit and hospital days, and decrease the rate of conversion to thoracotomy.

RECOMMENDATIONS

- **Level 1**

- Ø VATS should be performed after initial chest tube thoracostomy has failed to evacuate a hemothorax.
 - Ø VATS performed within 3-7 days has been shown to decrease complications of retained hemothorax.
- **Level 2**
 - Ø There is no difference in hemothorax evacuation rate using a chest tube greater than 28 French.
 - Ø In patients with penetrating trauma, antibiotics with Gram positive coverage are effective at reducing infectious complications of tube thoracostomy including pneumonia and empyema.
 - Ø Chest computed tomography is the gold standard for diagnosing retained hemothorax.
- **Level 3**
 - Ø Bedside ultrasound is superior to portable chest radiograph in diagnosing pleural fluid collections in blunt thoracic trauma.

For patients who cannot undergo VATS, fibrinolytic therapy is an alternative for retained hemothorax.

INTRODUCTION

The definition of retained hemothorax varies throughout the literature. It is often defined as residual pleural blood >500ml in volume, blood occupying greater than one-third of the thoracic cavity, or any residual blood that cannot be drained after 72 hours of thoracotomy treatment (1). The incidence varies and can be as high as 20%, but in most studies is found to be 1-4% after initial tube thoracostomy for chest trauma (1,2). The most accepted complication of retained hemothorax is empyema. DuBose et al. found that the overall incidence of empyema in retained hemothorax was 27% when defined by the presence of purulent pleural fluid, pleural fluid with a pH less than 7.2, or signs of infection or proven bacterial invasion of the pleural space on Gram stain or culture. Independent risk factors for the development of empyema included presence of rib fractures, Injury Severity Score >25, and need for additional therapeutic intervention. Patients with empyema had longer intensive care unit (ICU) and hospital stays, enforcing the need for prevention of empyema and other complications of retained hemothorax (3). The literature suggests that VATS is an ideal way to evacuate blood from the pleural space and earlier rather than later intervention is beneficial in decreasing the morbidity of retained hemothorax (4,5).

LITERATURE REVIEW

Initial Chest Tube Management

Chest tubes should be placed in all patients with hemothorax except those who meet criteria for operative intervention. The only prospective randomized controlled trial comparing chest tube size for traumatic hemothorax found no statistically significant differences in pain at site of insertion, efficacy of drainage, or rate of complications

including retained hemothorax, need for additional tube drainage, or invasive procedures. The chest tubes in this study were all placed non-emergently, and the sizes compared were 28-Fr to 32-Fr and 36-Fr to 40-Fr (6). A smaller study found a 50% decrease in insertion site pain and a trend toward lower analgesia requirements with 14-Fr pigtail drains compared to 28-Fr chest tubes; however, this paper was not powered to compare outcomes and the authors did not advocate for the use of 14-Fr pigtail drains for hemothorax (7).

Currently, there is insufficient evidence to recommend one specific size or system over another for traumatic hemothorax; however, there is no difference in the effectiveness or pain associated with chest tubes from 28-Fr to 40-Fr, and only chest tubes of 14-Fr or smaller have demonstrated statistically less pain at time of insertion, but these have not been evaluated for effectiveness in traumatic hemothorax.

Use of Antibiotics

The use of antibiotics to reduce the risk of infectious complications of tube thoracostomy is controversial. The Eastern Association for the Surgery of Trauma (EAST) concludes that, “there is insufficient published evidence to support any recommendation either for or against this practice” (8). The Western Trauma Association concludes, “it is not clear whether ‘prophylactic’ antibiotics independently reduce the risk. Nevertheless, most centers administer ... antibiotics” (9).

The largest meta-analysis to date to answer this question includes 1,241 chest tubes, making it far larger and comprehensive than the previous meta-analyses and largest individual randomized controlled trials. This study found antibiotics with Gram-positive coverage reduced the overall infectious complication rate and lowered the risk of empyema. While this study was limited by heterogeneity in the antibiotics studied, the definitions of infectious complications, the types and sizes of chest tubes, and the method of placement, it is the most definitive publication on this topic to date (10). In patients with penetrating trauma, antibiotics with Gram-positive coverage are effective at reducing infectious complications of tube thoracostomy including pneumonia and empyema.

Diagnosis of Retained Hemothorax

The gold standard imaging modality for diagnosing retained hemothorax is computed tomography (CT) of the chest, but alternative modalities have been studied. Karmy-Jones found that 33% of those with residual fluid on chest radiograph (CXR) obtained immediately after chest tube placement developed an empyema. They suggest when this finding is present, one should perform early thoracoscopic drainage within 48 hours of admission and that chest CT is unnecessary unless clarity is needed to distinguish between fluid and a pulmonary contusion (11). The accuracy of CXR in detecting clinically significant retained hemothorax was questioned in a prospective study by Velmahos in which a CXR was obtained on hospital day 2 and compared to a CT scan obtained the same stay. They found management decisions based upon CXR on the second day of admission would change in 31% of patients after obtaining the CT scan. They found CXR will overcall a retained fluid collection (>500cc) or would be interpreted

as parenchymal damage instead of retained hemothorax later confirmed on CT. They concluded that CXR could not reliably select patients for surgical evacuation of retained hemothorax and guide management decisions (12). Additional imaging such as ultrasound (US) has been suggested with a diagnostic accuracy for retained hemothorax of 98% after 48 hours of thoracostomy treatment (13). More studies will be needed to show clinical superiority. The current evidence is insufficient to show any benefit of CXR or US over CT.

Role of VATS

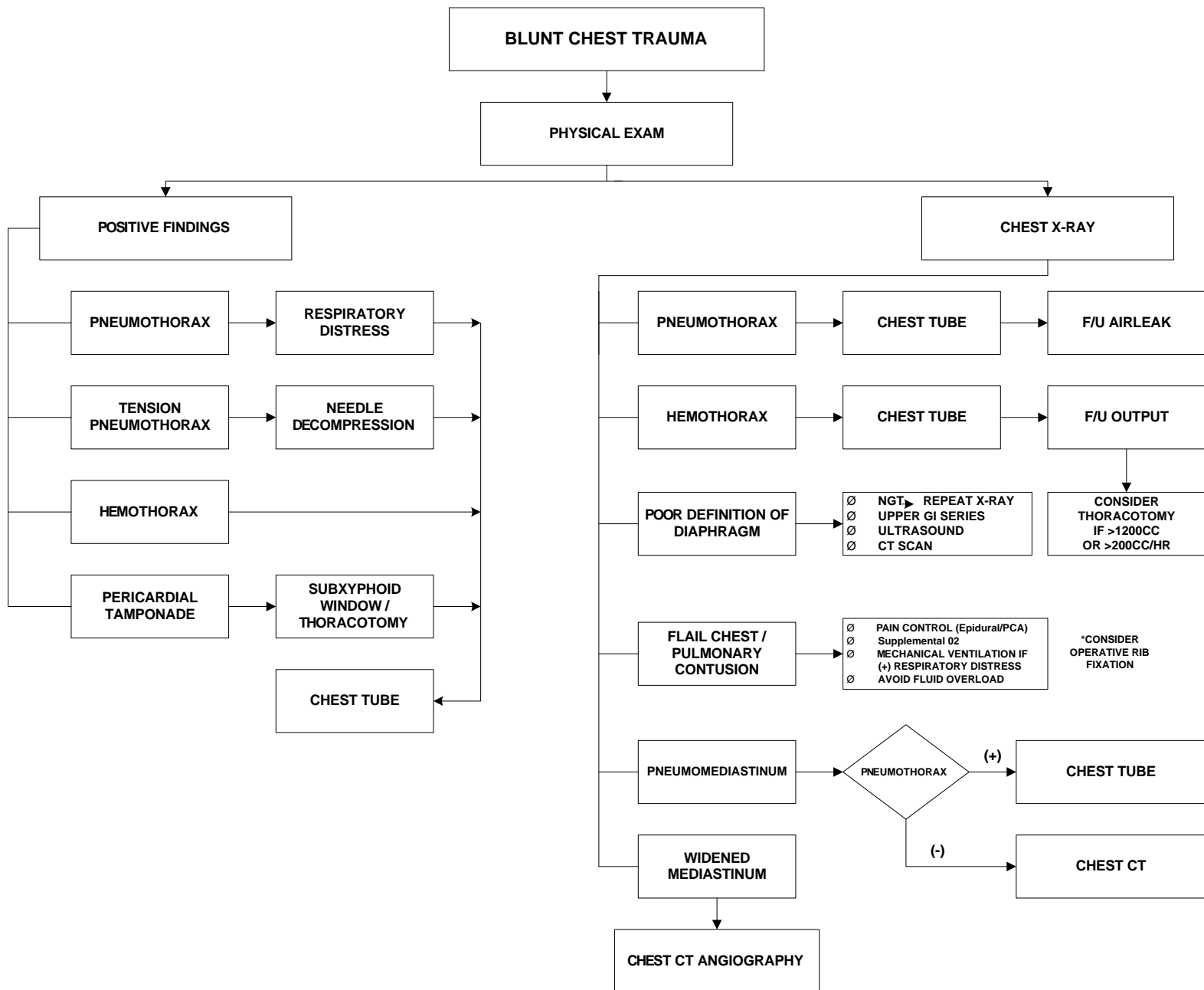
Early VATS is an alternative treatment for retained hemothorax with evidence that it is a superior intervention when compared to a second tube thoracostomy. In 1997, Meyer et al. performed a small prospective, randomized controlled trial of 39 patients comparing VATS and additional tube thoracostomy (4). All patients randomized to the VATS group had successful evacuation of their retained hemothorax. Those initially randomized to VATS had a shortened duration of chest tube drainage (2.5 vs. 4.5 days), fewer post-procedure hospital days (5.4 vs. 8.1 days), and decreased hospital cost (\$7.7K vs. \$13.3K). A small retrospective review of 25 patients demonstrated that those with retained hemothorax who received VATS within 7 days of injury had no evidence of empyema at the initial operation (14). VATS performed after 7 days had a higher rate of empyema and a high rate of conversion to thoracotomy. This conclusion was augmented 13 years later when Smith et al. retrospectively evaluated those who underwent VATS after retained hemothorax and demonstrated that intervention with VATS within 5 days was associated with a lower conversion to thoracotomy, decreased rates of persistent empyema (0%) and decreased length of hospital stay. Those who received VATS > 5 days after injury required additional interventions for empyema and had higher conversion to open thoracotomy (1).

A larger randomized controlled trial is needed, but these small studies do demonstrate that VATS is superior to a second tube thoracostomy for adequate drainage of retained hemothorax, decreased rates of empyema, decreased conversion to open thoracotomy, and decreased hospital costs and length of stay, with VATS performed within 5-7 days of injury showing the most benefit.

Role of Fibrinolytic Therapy

Numerous observational studies have reported success rates of 92-94% for intrapleural fibrinolytic therapy (IT) in resolving undrained retained hemothorax (15-18). Despite the high rate of reported success for IT, a comparative study by Oguzkaya found IT was inferior to VATS. Oguzkaya found 22 of 31 patients (71%) had radiological improvement with IT compared to VATS which resulted in improvement in 32 out of 36 patients (89%) and only 2 required decortication. The differences for length of hospital stay and number of thoracotomies was statistically significant (19). While fibrinolytic therapy appears to have a high rate of success for resolving retained hemothorax, VATS may have superior outcomes. Insufficient data exists to favor one strategy over the other, and given the high rate of success of IT, which is a less invasive procedure, this should be considered when clinically warranted.

Blunt Chest Trauma



Chest Tube Insertion/Removal

- a. All chest tube insertions are to be supervised by an R3 or above.
- b. Unless being placed in a Code situation, sterile technique with a full body drape should be used for all chest tube placements
- c. Conscious sedation may be administered to awake patients under the direct supervision of a Trauma fellow or attending.
- d. A CXR must be completed immediately after chest tube placement to confirm proper position. A daily CXR should be completed for any patient with a chest tube and an additional CXR should be performed whenever the chest tube setting is changed from suction to water-seal or remove
- e. For a hemothorax consider asking for senior help in posterior placement of the tube in effort to facilitate complete evacuation of the hemothorax.
- f. For incomplete evacuation of a hemothorax, early VATS (Video Assisted Thoracoscopic Surgery) should be considered.
 - VATS is most useful in the treatment of clinically significant retained hemothorax, diagnosed at 48-72 hours after chest tube placement.
 - A CT of the chest should be obtained to make the diagnosis; the finding of ≥ 300 cc's of blood qualifies it as a clinically significant retained hemothorax

VATS should then be performed early and aggressively (within 48-72 hours of diagnosis) to facilitate recovery and prevent additional morbidity.

- Intra-pleural thrombolytic may be used to improve drainage of subacute (6-day to 13-day duration) loculated or exudative collections, particularly patients where risks of thoracotomy are significant.
- See "Management of Retained Hemothorax"

g. Chest tube removal

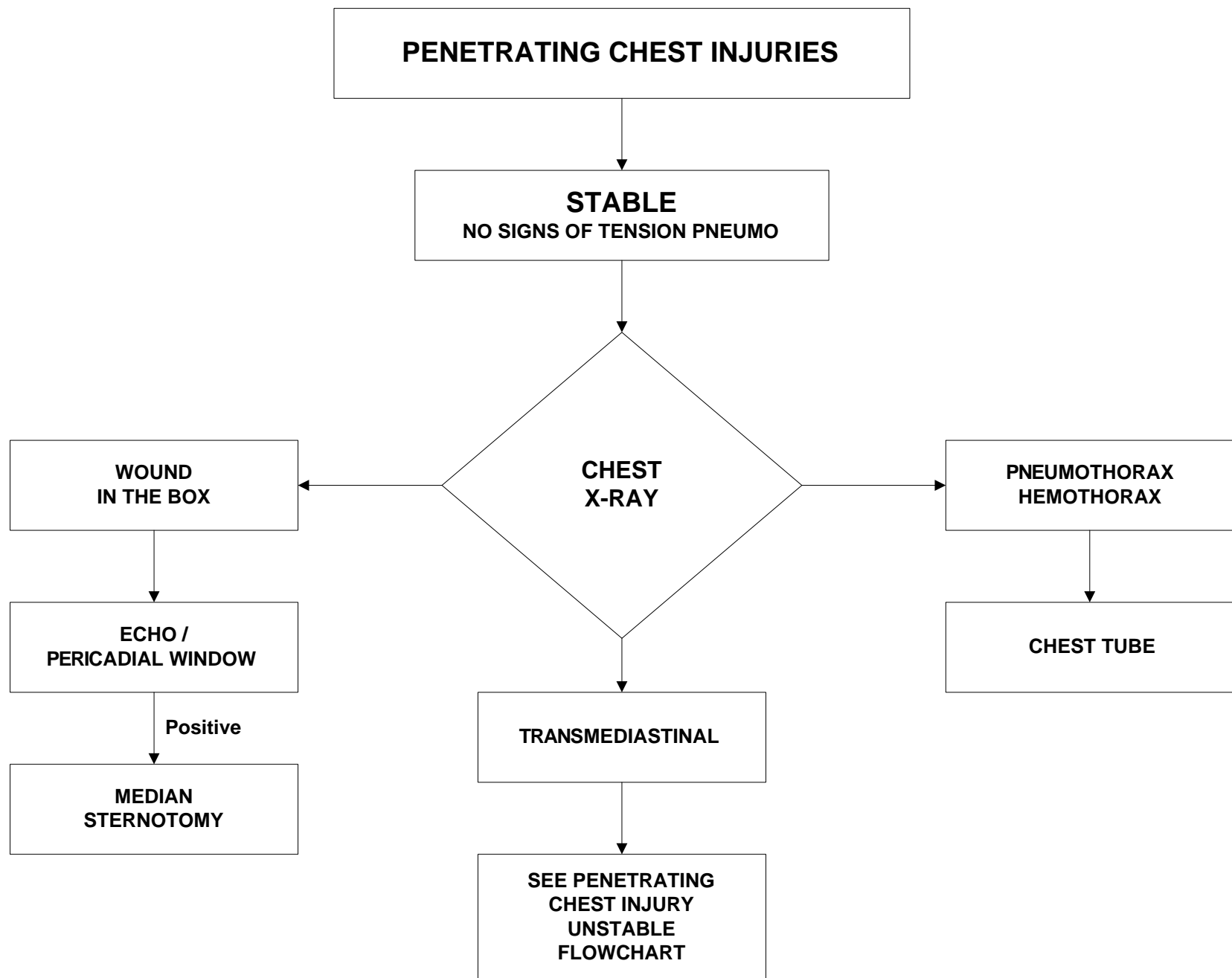
- Chest tube removal is a 2-person procedure requiring the presence of either an NP/PA or R2 and above.
- A chest x-ray must be obtained after removal of the chest tube to confirm the absence of recurrent pneumothorax
- Patients requiring air travel-
 - Patients with a chest x-ray demonstrating absence of pneumothorax after chest tube removal and a 24-hour observation period in the hospital are safe for air travel 72 hours after chest tube removal
 - (Zonies et al. J Trauma Acute Care Surg. 2018;85:491-494).

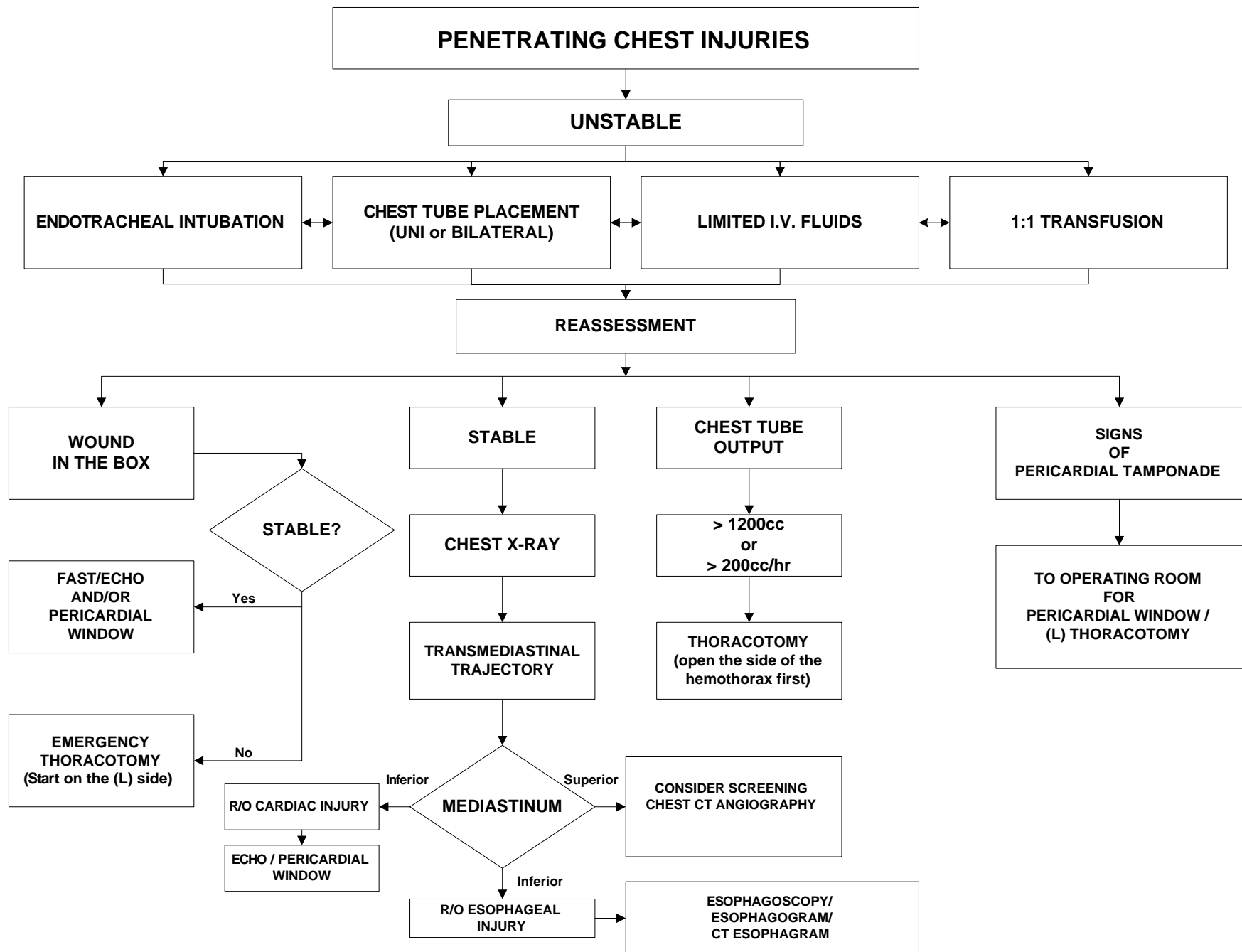
RIB FRACTURE MANAGEMENT PROTOCOL

Respiratory Interventions and Monitoring

Respiratory Therapist	Intake assessment, set Incentive Spirometer Goals with <6 hours admission (< 1 hour in ICU)
	Set IS goal level of 80% of inspiratory capacity and alert level of 15 ml/kg (maximum 1500ml)
Nursing	Elevate HOB 30 degrees
	Educate patient in deep breathing, Incentive Spirometry and Deep breathing
	Encourage Hourly Incentive Spirometer, Coughing and Deep Breathing
	Mobilize at least 3X daily unless contraindicated
	Pain scores, Respiratory rate q4h (q1h in SICU)
	Educate family members
Provider	Ongoing evaluation, coordination of care, pain scores and Incentive Spirometer results on daily team rounds
	Minimize IV fluids if able
	Multimodal Pain Control: <ul style="list-style-type: none"> • Home meds and psychotropic meds • Gabapentin • Acetaminophen, oral or IV • Lidocaine patch • Ketorolac IV or celecoxib oral • PCA or Oral opioid
	Consult Acute Pain service, consider epidural if pain not controlled after 6-8 hours
	Careful consideration of geriatric patients who may not tolerate multimodal systemic analgesia
Team Notification	Team is notified of patients with severe pain, poor cough or poor incentive spirometry performance
ICU admission	Patients over 65 with ≥ 3 rib fractures are admitted to SICU, in addition to standard indications

Penetrating Chest Trauma





RETAINED HEMOTHORAX

SUMMARY

Retained hemothorax (RH) is complication of chest trauma that can lead to empyema, entrapped lung, and fibrothorax. When initial tube thoracostomy does not evacuate a hemothorax, options for management include a second tube thoracostomy, video-assisted thoracoscopy (VATS), or intrapleural fibrinolytic therapy. Early VATS for retained hemothorax has been shown to decrease rates of empyema, decrease both intensive care unit and hospital days, and decrease the rate of conversion to thoracotomy.

RECOMMENDATIONS

- **Level 1**
 - Ø **VATS should be performed after initial chest tube thoracostomy has failed to evacuate a hemothorax.**
 - Ø **VATS performed within 3-7 days has been shown to decrease complications of retained hemothorax.**
- **Level 2**
 - Ø **There is no difference in hemothorax evacuation rate using a chest tube greater than 28 French.**
 - Ø **In patients with penetrating trauma, antibiotics with Gram positive coverage are effective at reducing infectious complications of tube thoracostomy including pneumonia and empyema.**
 - Ø **Chest computed tomography is the gold standard for diagnosing retained hemothorax.**
- **Level 3**
 - Ø **Bedside ultrasound is superior to portable chest radiograph in diagnosing pleural fluid collections in blunt thoracic trauma.**
 - Ø **For patients who cannot undergo VATS, fibrinolytic therapy is an alternative for retained hemothorax.**

INTRODUCTION

The definition of retained hemothorax varies throughout the literature. It is often defined as residual pleural blood >500ml in volume, blood occupying greater than one-third of the thoracic cavity, or any residual blood that cannot be drained after 72 hours of thoracotomy treatment (1). The incidence varies and can be as high as 20%, but in most studies is found to be 1-4% after initial tube thoracostomy for chest trauma (1,2). The most accepted complication of retained hemothorax is empyema. DuBose et al. found that the overall incidence of empyema in retained hemothorax was 27% when defined by the presence of purulent pleural fluid, pleural fluid with a pH less than 7.2, or signs of infection or proven bacterial invasion of the pleural space on Gram stain or culture. Independent risk factors for the development of empyema included presence of rib fractures, Injury Severity Score >25, and need for additional therapeutic intervention. Patients with empyema had longer intensive care unit (ICU) and hospital stays, enforcing the need for prevention of empyema and other complications of retained

EVIDENCE DEFINITIONS

- **Class I:** Prospective randomized controlled trial.
- **Class II:** Prospective clinical study or retrospective analysis of reliable data. Includes observational, cohort, prevalence, or case control studies.
- **Class III:** Retrospective study. Includes database or registry reviews, large series of case reports, expert opinion.
- **Technology assessment:** A technology study which does not lend itself to classification in the above-mentioned format. Devices are evaluated in terms of their accuracy, reliability, therapeutic potential, or cost effectiveness.

LEVEL OF RECOMMENDATION DEFINITIONS

- **Level 1:** Convincingly justifiable based on available scientific information alone. Usually based on Class I data or strong Class II evidence if randomized testing is inappropriate. Conversely, low quality or contradictory Class I data may be insufficient to support a Level I recommendation.
- **Level 2:** Reasonably justifiable based on available scientific evidence and strongly supported by expert opinion. Usually supported by Class II data or a preponderance of Class III evidence.
- **Level 3:** Supported by available data, but scientific evidence is lacking. Generally supported by Class III data. Useful for educational purposes and in guiding future clinical research.

hemothorax (3). The literature suggests that VATS is an ideal way to evacuate blood from the pleural space and earlier rather than later intervention is beneficial in decreasing the morbidity of retained hemothorax (4,5).

LITERATURE REVIEW

Initial Chest Tube Management

Chest tubes should be placed in all patients with hemothorax except those who meet criteria for operative intervention. The only prospective randomized controlled trial comparing chest tube size for traumatic hemothorax found no statistically significant differences in pain at site of insertion, efficacy of drainage, or rate of complications including retained hemothorax, need for additional tube drainage, or invasive procedures. The chest tubes in this study were all placed non-emergently, and the sizes compared were 28-Fr to 32-Fr and 36-Fr to 40-Fr (6). A smaller study found a 50% decrease in insertion site pain and a trend toward lower analgesia requirements with 14-Fr pigtail drains compared to 28-Fr chest tubes; however, this paper was not powered to compare outcomes and the authors did not advocate for the use of 14-Fr pigtail drains for hemothorax (7).

Currently, there is insufficient evidence to recommend one specific size or system over another for traumatic hemothorax; however, there is no difference in the effectiveness or pain associated with chest tubes from 28-Fr to 40-Fr, and only chest tubes of 14-Fr or smaller have demonstrated statistically less pain at time of insertion, but these have not been evaluated for effectiveness in traumatic hemothorax.

Use of Antibiotics

The use of antibiotics to reduce the risk of infectious complications of tube thoracostomy is controversial. The Eastern Association for the Surgery of Trauma (EAST) concludes that, "there is insufficient published evidence to support any recommendation either for or against this practice" (8). The Western Trauma Association concludes, "It is not clear whether 'prophylactic' antibiotics independently reduce the risk. Nevertheless, most centers administer ... antibiotics" (9).

The largest meta-analysis to date to answer this question includes 1,241 chest tubes, making it far larger and comprehensive than the previous meta-analyses and largest individual randomized controlled trials. This study found antibiotics with Gram-positive coverage reduced the overall infectious complication rate and lowered the risk of empyema. While this study was limited by heterogeneity in the antibiotics studied, the definitions of infectious complications, the types and sizes of chest tubes, and the method of placement, it is the most definitive publication on this topic to date (10). In patients with penetrating trauma, antibiotics with Gram-positive coverage are effective at reducing infectious complications of tube thoracostomy including pneumonia and empyema.

Diagnosis of Retained Hemothorax

The gold standard imaging modality for diagnosing retained hemothorax is computed tomography (CT) of the chest, but alternative modalities have been studied. Karmy-Jones found that 33% of those with residual fluid on chest radiograph (CXR) obtained immediately after chest tube placement developed an empyema. They suggest when this finding is present, one should perform early thoracoscopic drainage within 48 hours of admission and that chest CT is unnecessary unless clarity is needed to distinguish between fluid and a pulmonary contusion (11). The accuracy of CXR in detecting clinically significant retained hemothorax was questioned in a prospective study by Velmahos in which a CXR was obtained on hospital day 2 and compared to a CT scan obtained the same day. They found management decisions based upon CXR on the second day of admission would change in 31% of patients after obtaining the CT scan. They found CXR will overcall a retained fluid collection (>500cc) or would be interpreted as parenchymal damage instead of retained hemothorax later confirmed on CT. They concluded that CXR could not reliably select patients for surgical evacuation of retained hemothorax and guide management decisions (12). Additional imaging such as ultrasound (US) has been suggested with a diagnostic accuracy for retained hemothorax of 98% after 48 hours of thoracostomy treatment (13). More studies will be needed to show clinical superiority. The current evidence is insufficient to show any benefit of CXR or US over CT.

Role of VATS

Early VATS is an alternative treatment for retained hemothorax with evidence that it is a superior intervention when compared to a second tube thoracostomy. In 1997, Meyer et al. performed a small prospective, randomized controlled trial of 39 patients comparing VATS and additional tube thoracostomy (4). All patients randomized to the VATS group had successful evacuation of their retained hemothorax. Those initially randomized to VATS had a shortened duration of chest tube drainage (2.5 vs. 4.5 days), fewer post-procedure hospital days (5.4 vs. 8.1 days), and decreased hospital cost (\$7.7K vs. \$13.3K). A small retrospective review of 25 patients demonstrated that those with retained hemothorax who received VATS within 7 days of injury had no evidence of empyema at the initial operation (14). VATS performed after 7 days had a higher rate of empyema and a high rate of conversion to thoracotomy. This conclusion was augmented 13 years later when Smith et al. retrospectively evaluated those who underwent VATS after retained hemothorax and demonstrated that intervention with VATS within 5 days was associated with a lower conversion to thoracotomy, decreased rates of persistent empyema (0%) and decreased length of hospital stay. Those who received VATS > 5 days after injury required additional interventions for empyema and had higher conversion to open thoracotomy (1).

A larger randomized controlled trial is needed, but these small studies do demonstrate that VATS is superior to a second tube thoracostomy for adequate drainage of retained hemothorax, decreased rates of empyema, decreased conversion to open thoracotomy, and decreased hospital costs and length of stay, with VATS performed within 5-7 days of injury showing the most benefit.

Role of Fibrinolytic Therapy

Numerous observational studies have reported success rates of 92-94% for intrapleural fibrinolytic therapy (IT) in resolving undrained retained hemothorax (15-18). Despite the high rate of reported success for IT, a comparative study by Oguzkaya found IT was inferior to VATS. Oguzkaya found 22 of 31 patients (71%) had radiological improvement with IT compared to VATS which resulted in improvement in 32 out of 36 patients (89%) and only 2 required decortication. The differences for length of hospital stay and number of thoracotomies was statistically significant (19). While fibrinolytic therapy appears to have a high rate of success for resolving retained hemothorax, VATS may have superior outcomes. Insufficient data exists to favor one strategy over the other, and given the high rate of success of IT, which is a less invasive procedure, this should be considered when clinically warranted.

REFERENCES

1. Smith, J.W., et al., Early VATS for blunt chest trauma: a management technique underutilized by acute care surgeons. *J Trauma*, 2011. 71(1): p. 102-5; discussion 105-7.
2. de Rezende-Neto, J.B., et al., [Management of retained hemothoraces after chest tube thoracostomy for trauma]. *Rev Col Bras Cir*, 2012. 39(4): p. 344-9.
3. DuBose, J., et al., Development of posttraumatic empyema in patients with retained hemothorax: results of a prospective, observational AAST study. *J Trauma Acute Care Surg*, 2012. 73(3): p. 752-7.
4. Meyer, D.M., et al., Early evacuation of traumatic retained hemothoraces using thoracoscopy: a prospective, randomized trial. *Ann Thorac Surg*, 1997. 64(5): p. 1396-400; discussion 1400-1.
5. Morrison, C.A., et al., Use of a trauma service clinical pathway to improve patient outcomes for retained traumatic hemothorax. *World J Surg*, 2009. 33(9): p. 1851-6.
6. Inaba, K., et al., Does size matter? A prospective analysis of 28-32 versus 36-40 French chest tube size in trauma. *J Trauma Acute Care Surg*, 2012. 72(2): p. 422-7.
7. Kulvatunyou, N., et al., Randomized clinical trial of pigtail catheter versus chest tube in injured patients with uncomplicated traumatic pneumothorax. *Br J Surg*, 2014. 101(2): p. 17-22.
8. Moore, F.O., et al., Presumptive antibiotic use in tube thoracostomy for traumatic hemopneumothorax: an Eastern Association for the Surgery of Trauma practice management guideline. *J Trauma Acute Care Surg*, 2012. 73(5 Suppl 4): p. S341-4.
9. Karmy-Jones, R., et al., Western Trauma Association critical decisions in trauma: penetrating chest trauma. *J Trauma Acute Care Surg*, 2014. 77(6): p. 994-1002.
10. Bosman, A., et al., Systematic review and meta-analysis of antibiotic prophylaxis to prevent infections from chest drains in blunt and penetrating thoracic injuries. *Br J Surg*, 2012. 99(4): p. 506-13.

11. Karmy-Jones, R., et al., Residual hemothorax after chest tube placement correlates with increased risk of empyema following traumatic injury. *Can Respir J*, 2008. 15(5): p. 255-8.
12. Velmahos, G.C., et al., Predicting the need for thoracoscopic evacuation of residual traumatic hemothorax: chest radiograph is insufficient. *J Trauma*, 1999. 46(1): p. 65-70.
13. Rocco, M., et al., Diagnostic accuracy of bedside ultrasonography in the ICU: feasibility of detecting pulmonary effusion and lung contusion in patients on respiratory support after severe blunt thoracic trauma. *Acta Anaesthesiol Scand*, 2008. 52(6): p. 776-84.
14. Heniford, B.T., et al., The role of thoracoscopy in the management of retained thoracic collections after trauma. *Ann Thorac Surg*, 1997. 63(4): p. 940-3.
15. Inci, I., et al., Intrapleural fibrinolytic treatment of traumatic clotted hemothorax. *Chest*, 1998. 114(1): p. 160-5.
16. Jerjes-Sanchez, C., et al., Intrapleural fibrinolysis with streptokinase as an adjunctive treatment in hemothorax and empyema: a multicenter trial. *Chest*, 1996. 109(6): p. 1514-9.
17. Kimbrell, B.J., et al., Intrapleural thrombolysis for the management of undrained traumatic hemothorax: a prospective observational study. *J Trauma*, 2007. 62(5): p. 1175-8; discussion 1178-9.
18. Moulton, J.S., P.T. Moore, and R.A. Mencini, Treatment of loculated pleural effusions with transcatheter intracavitary urokinase. *AJR Am J Roentgenol*, 1989. 153(5): p. 941-5.
19. Oguzkaya, F., Y. Akcali, and M. Bilgin, Videothoracoscopy versus intrapleural streptokinase for management of post traumatic retained haemothorax: a retrospective study of 65 cases. *Injury*, 2005. 36(4): p. 526-9.

Surgical Critical Care Evidence-Based Medicine Guidelines Committee

Primary Authors: Kathleen Cannon, MD, Kyle Checchi, MD, Paul Wisniewski, DO
 Editor: Michael L. Cheatham, MD
 Last revision date: April 27, 2016

Please direct any questions or concerns to: webmaster@surgicalcriticalcare.net

Prophylaxis Against PostPericardotomy Syndrome (PPS) Protocol

Patients who require a surgical pericardotomy are at risk of developing postpericardotomy syndrome (i.e. pericarditis, 10-40%)

Prophylaxis with colchicine has been shown to reduce the incidence of postpericardotomy syndrome and of post-op tamponade in cardiac surgery patients.

All patients requiring a surgical pericardotomy (median sternotomy, thoracotomy with opening of the pericardium, pericardial window, etc.) shall receive post-op prophylaxis.

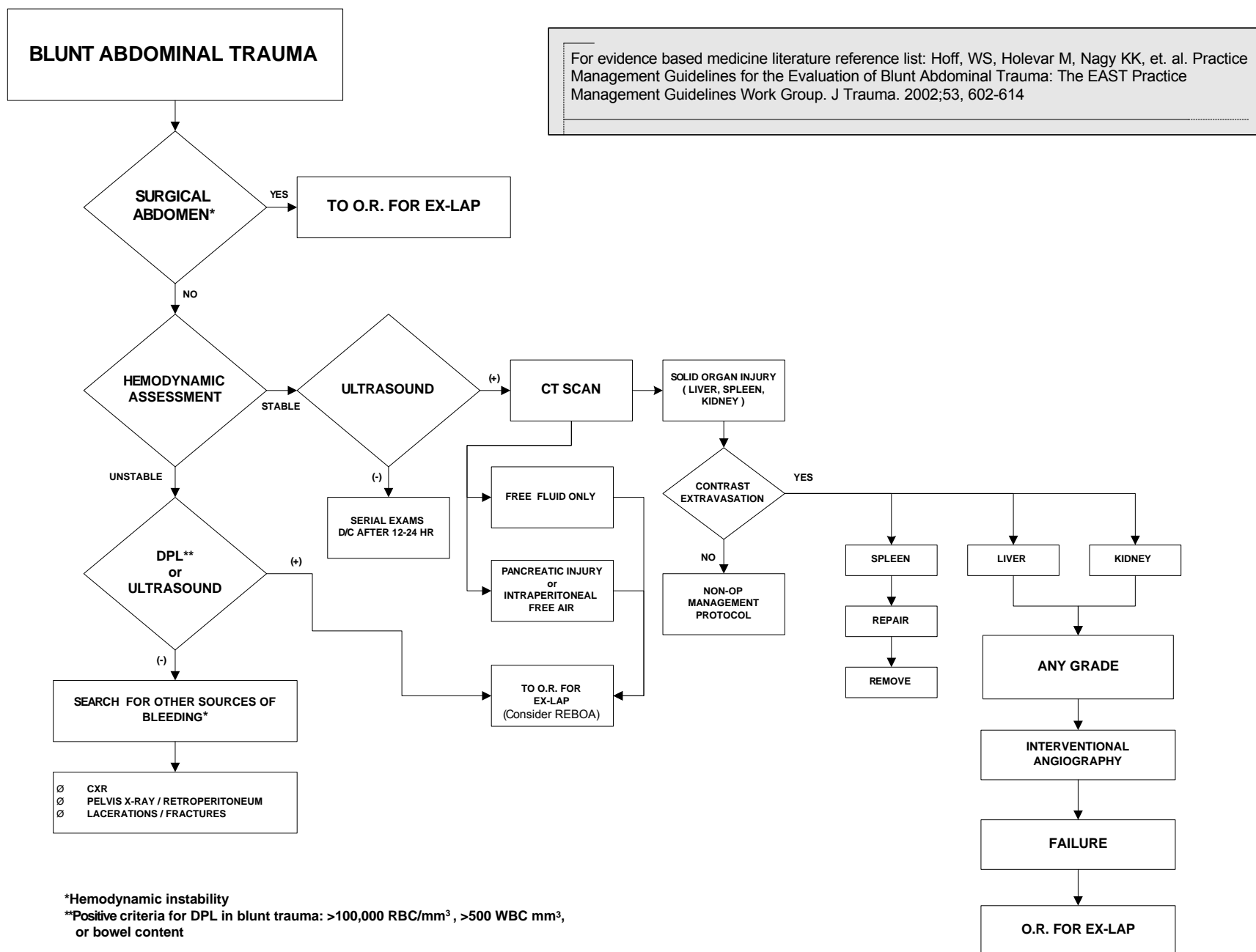
Starting POD#3:

- Colchicine 0.5mg BID (for patients ≥ 70 kg) or Colchicine 0.5mg daily (if < 70 kg)
- Continue colchicine for 30 days (if tolerated)
- Concurrent PPI or H2 blocker should be given to help prevent GI side effects
- Additional use of NSAIDs (i.e. ibuprofen, toradol) is recommended for post-op pain control if not otherwise contra-indicated (requires renal monitoring)
- All patients shall follow-up in trauma clinic within 7-10 days of discharge, and shall have labs including creatinine checked in time to review at that visit.
- Patients shall only be discharged with a supply of colchicine to last until this follow-up appointment. The remainder of the 30 day supply will be prescribed if the patient follows up in clinic and does not have a contra-indication to continuing the medication (renal insufficiency, GI intolerance, etc.).
- All patients shall receive a repeat TTE 3-4 weeks post-operatively to assess for recurrent pericardial effusion.

Reference:

Imazio et al. Colchicine for Prevention of Postpericardotomy Syndrome and Postoperative Atrial Fibrillation (The COPPS-2 Randomized Clinical Trial). JAMA. 2014;312(10):1016-1023.

Abdominal Trauma



NOM of Liver Injury

A. Key Outcomes

- Timely diagnosis of liver injury and associated injuries
- Prompt recognition of failure of nonoperative management
- Prompt intervention for failure of nonoperative management
- Optimal pain management; aggressive pulmonary toilet; early mobilization

B. Goal Length of Stay

3-5 days

Exceptions: Unsatisfactory resolution of organ injury *OR* associated injuries requiring additional treatment

C. Proposed Hospital Course

i. Prior to Admission to ICU or IMU

1. ATLS protocol; work-up as mechanism and presentation dictate
2. Patient must be hemodynamically stable
3. Abdominal ultrasound and CT abdomen/pelvis with contrast delays
4. Labs: ABG, H & H, type and cross, coagulation factors

ii. See Table 1 NOM of Liver Injury.

1. Suggest strict protocol adherence for injuries Grade 3 and higher.
2. MD may use discretion with lower grade injuries to expedite the hospital course as appropriate and tolerated by the patient

- iii. Repeat imaging of liver injuries Grade 3 or higher with a multi-phase CT abdomen/pelvis with IV contrast should be considered on hospital day 5 or prior to discharge to evaluate for development of post-traumatic pseudoaneurysms.

D. Discharge Planning

Regular diet

Clinic follow-up q1-2 weeks x4 weeks; every month thereafter or at discretion of Trauma Attending

Restricted activity for 8-12 weeks total or at discretion of Trauma Attending

May require home care follow-up

E. Disposition

Dependent on needs at discharge (home vs. SNF vs. rehabilitation)

Per PT/OT recommendations

NOM of Liver Injury

	Day 1	Day 2	Day 3	Day 4	Day 5
Location	SICU	SICU	IMU	IMU	Floor
Diet	NPO	NPO	Clears	DAT	DAT
Activity	Bedrest Pulmonary toilet	Up to Chair Pulmonary toilet	Up to Chair Pulmonary toilet	AAT Pulmonary toilet	AAT Pulmonary toilet
Vitals	Q6H	Q6H	Q6H	Routine	Routine
IV fluids	Yes	Yes	Yes	No	No
Labs	Q6H	Q6-12H	BID	QD	QD
DVT	SCDs Duplex protocol	SCDs Duplex protocol	LMWH Duplex protocol	LMWH Duplex protocol	LMWH Duplex protocol
Disposition				Discharge	Discharge

Operative Management of Liver Injury

A. Key Outcomes

- Timely diagnosis of liver injury and associated injuries
- Prompt intervention for identified injuries
- Optimal pain management; aggressive pulmonary toilet; early mobilization

B. Proposed Hospital Course (see table below)

i. Preoperative

1. Initial evaluation per ATLS protocol
2. Chest x-ray, pelvis x-ray and FAST
3. Work-up as mechanism and presentation dictate
4. Ensure adequate IV access (large bore peripheral IVs x 2, IO access, central line, etc.)
5. CT head and CT c-spine as indicated
6. Additional Imaging:
 - Multi-phase CT abd/pelvis with contrast
 - If patient is hemodynamically stable CT abd/pelvis to further evaluate extent of injuries and presence of active bleeding. However, if the patient is hemodynamically unstable with findings consistent with intra-abdominal solid organ injury, proceed straight to OR for surgical exploration and management.
7. Labs: ABG, H & H, type and cross
8. Additional work-up:
 - Diagnostic peritoneal lavage (DPL)
 - Rapid and safe method for determining presence of intra-abdominal blood or succus in the setting of trauma
 - Consider performing in hemodynamically unstable patients with altered mental status who are unable to provide a reliable abdominal exam.
9. Massive transfusion protocol (MTP)
 - If patient is hemodynamically unstable and felt to require more than 4 units of blood products transfusion during the initial resuscitation, the MTP should be activated.
 - 1:1 FFP-RBC ratio transfusion with TEG guidance

ii. Operative:

1. Exploratory laparotomy
 - Supine position, arms out
 - Wide prep from sternal notch down to mid-thigh
 - Systematic 4-quadrant packing followed by exploration
2. Liver injury management options:
 - Packing
 - Hemostatic agents (Surgicel, Snow, Flo-seal, etc)
 - Cauterization (bovie, argon beam)

- Pringle maneuver
 - Suture hepatorrhaphy (0-chromic figure of eight stitch)
 - Finger fracture with direct ligation of bleeding parenchymal vessels
 - Omental packing
 - Balloon tamponade (foley, penrose drain placed into bleeding tract)
 - Liver resection - stapling
3. If there are concerns for ongoing hepatic bleeding, consider interventional radiology for hepatic angioembolization.
- iii. Postoperative
1. admit to SICU, q1hr vitals
 2. serial postoperative CBC/coagulations, chemistries/LFTs as indicated until coagulopathies and initial resuscitation complete (q4-6hr)
 3. ensure adequate vascular access (introducer catheter, CVL, PIV, etc.)
 4. arterial line +/- Vigileo or Swan-Ganz catheter
 5. NGT
 6. aggressive pulmonary toilet
 7. pain management
 8. early enteral nutrition (depending on clinical status)
 9. plans for return to OR if indicated
 10. evaluate daily for initiation of chemoprophylaxis for VTE and initiate once felt to be stable from a bleeding risk standpoint.
 11. all patients with liver injury undergoing operative management and those undergoing successful nonoperative management with injuries \geq Grade III should have a repeat CT scan of the abdomen with iv contrast to evaluate for pseudoaneurysm formation prior to discharge.
 12. Consider angiography and embolization for continued bleeding, blush, hemobilia, AV fistula.

C. Discharge Planning

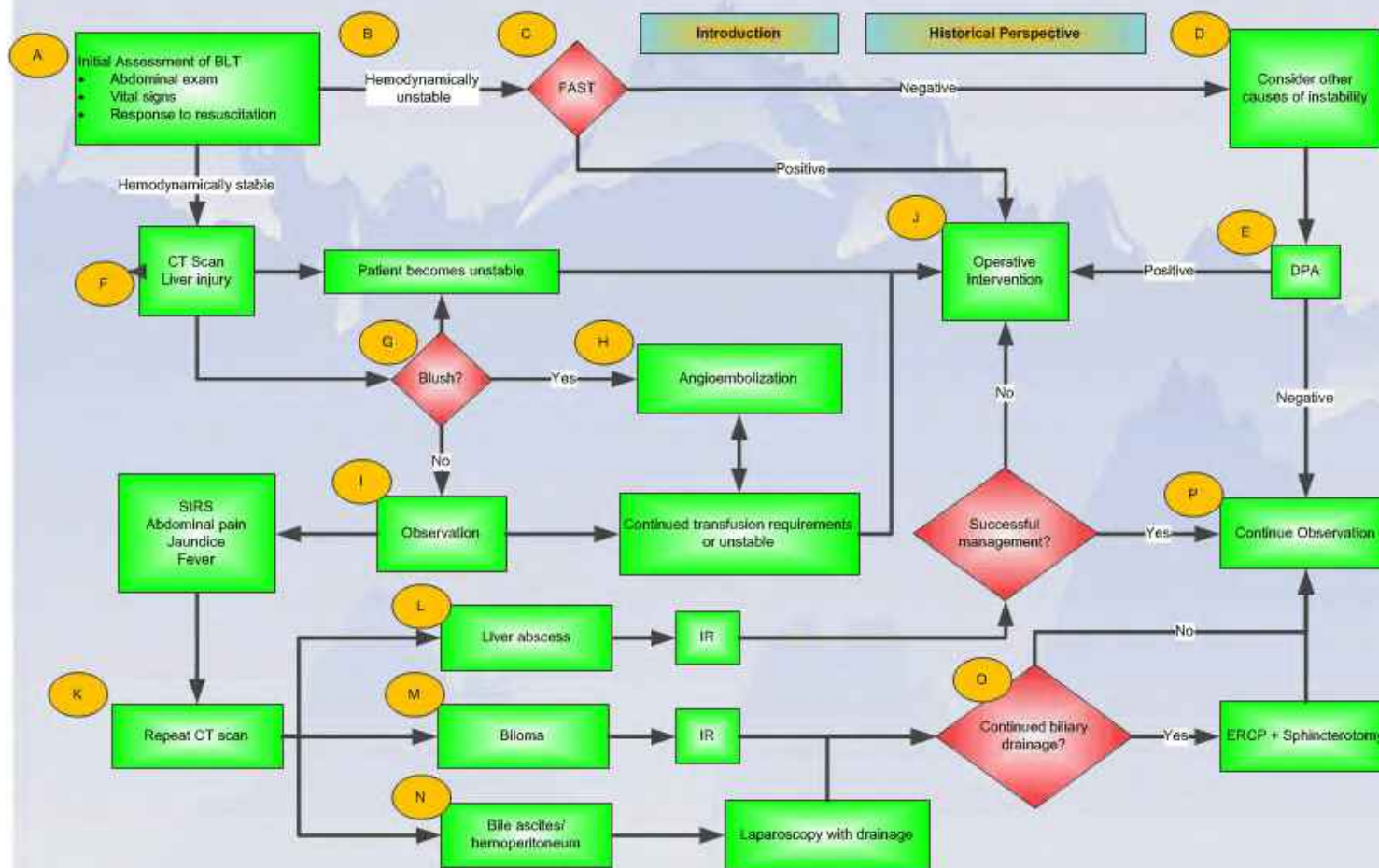
Regular diet

Activity as tolerated based on associated injuries. Follow-up in clinic

May require home health follow-up

D. Disposition

Dependent on needs at discharge (home vs. SNF vs. rehabilitation) Per PT/OT recommendations.



Nonoperative Management of Adult Blunt Hepatic Trauma

Annotation for Point A

The initial assessment of patients with suspected blunt abdominal trauma should focus on the patient's abdominal examination, vital signs, and response to resuscitation. General principles of advanced trauma life support should be instituted, and the response to resuscitation closely monitored. Peritonitis remains an indication for exploration after blunt abdominal trauma.

Annotation for Point B

Although there is no well-accepted definition of hemodynamic instability, the traditionally accepted value is 90 mm Hg. However, recent studies demonstrate that patients are at risk for hemorrhage and death with a blood pressure 110 mm Hg and a base deficit of 4.^{13,14} To assist in early triage decisions, a hemodynamic instability score has been proposed for patients with blunt splenic trauma.² Initial evaluation should also include an assessment of admission coagulopathy. The early use of a massive transfusion protocol, rather than the excessive use of crystalloids, is encouraged for patients with ongoing transfusion needs and has been shown to reduce mortality.¹⁵ Recent data also support the early use of plasma to packed red blood cells in a ratio approaching 1:1, although a prospective randomized trial has not yet been performed.^{16,17} The association between plasma- and transfusion-related acute lung injury suggests the need for further investigation into this practice.¹⁸

Annotation for Point C

Hemodynamically unstable patients should have a focused abdominal sonogram for trauma (FAST) if not performed as part of their initial evaluation and if available and reliable. Hemoperitoneum diagnosed by a positive FAST examination in a persistently unstable patient should prompt operative intervention. If the initial FAST is negative, a second should be repeated as part of the secondary survey.¹⁹

Annotation for Point D

Patients with persistent hemodynamic instability and a negative FAST pose a diagnostic dilemma and should not be triaged to the CT scanner, rather resuscitation should continue as the differential diagnosis of refractory shock is pursued. Patients with blunt hepatic injuries are at risk for both associated abdominal and extra-abdominal injuries.^{8,20} Extra-abdominal sources of exsanguinating hemorrhage include massive hemothorax and severe pelvic fracture, whereas nonhemorrhagic shock from cardiogenic (tension pneumothorax, cardiac tamponade, and myocardial contusion or infarct) or neurogenic (spinal shock) causes may be present either as the sole source or in addition to hemorrhagic sources of instability. Rather than continuing shock resuscitation in the trauma bay, an alternative is to proceed to the operating room for an exploratory laparotomy in patients at risk for imminent cardiac arrest.

Annotation for Point E

If hemoperitoneum remains a concern in an unstable patient with a negative FAST, a diagnostic peritoneal aspirate should be considered. A positive diagnostic peritoneal aspirate is aspiration greater than 10 mL of gross blood and warrants operative exploration in an unstable patient.²¹

Annotation for Point F

A CT scan of the abdomen is the optimal diagnostic modality to aide in both the diagnosis and management of blunt hepatic trauma in hemodynamically stable patients.²² Liver injuries are graded per the American Association for the Surgery of Trauma liver injury scale, which was developed as part of the transition to nonoperative management and remains valid today.²³ A recent report using data from the National Trauma Data Bank demonstrated that increasing injury severity was associated with increasing organ injury scale grades.¹² In addition, organ-specific operative rates increased with increasing grade, although grade alone did not accurately predict the need for operation. When patients with isolated liver injuries were analyzed, 91.5% of grade I and II injuries, 79% of grade III, 72.8% of grade 4, and 62.6% of grade 5 injuries were successfully managed without operative intervention. Therefore, even high-grade injuries have a high likelihood of successful nonoperative management.

Annotation for Point G

The finding of a “blush,” or pooling of intravenous contrast material within the liver parenchyma, on CT scanning is indicative of active hemorrhage. Earlier studies suggested that these patients should undergo operative intervention, regardless of hemodynamic stability, though the availability of angiographic embolization may have successfully managed the hemorrhage.^{9,24,25} More recently, Fang et al.^{22,26} reported on the significance of a blush in stable patients with blunt hepatic trauma. Their initial study in 1998 followed up eight hemodynamically stable patients with pooling into the peritoneal cavity.²⁵ Six of these patients rapidly became unstable and underwent emergent laparotomy, and the other two required delayed operations for liver-related complications. In a later study, they attempted to categorize pooling of contrast material into free extravasation with pooling into the peritoneal cavity, intraparenchymal contrast pooling with associated hemoperitoneum, and intraparenchymal contrast pooling without hemoperitoneum.²⁶ Although the sample size was very low, all patients (6/6) with free pooling required laparotomy for hemodynamic deterioration, 66% (4/6) of patients with intraparenchymal pooling and hemoperitoneum required operation, while no patient (3/3) with intraparenchymal pooling alone required surgery or angioembolization. Finally, a larger study by this group confirmed that intraperitoneal extravasation was the most specific sign to predict the need for surgery by both univariate and logistic regression analysis.²² Although data are very limited, it seems logical to suggest that hemodynamically stable patients with free intraperitoneal extravasation undergo immediate angiography if readily available, performed in a monitored setting, and at an institution where blood products and an operative team are immediately available. More

controversial is the group of stable patients with intraparenchymal contrast pooling. It is not clear from available data whether immediate angiographic embolization is required. Close observation alone with planned angiographic embolization for signs of ongoing bleeding, such as a drop in hematocrit or need for transfusion, is also an option in appropriate facilities.²⁶⁻²⁸ Neither the true incidence of pseudoaneurysm or arteriovenous fistula nor their natural history (regression or rupture) are well defined. With the current use of multichannel detector CT scanners, pooling of contrast is an increasingly common finding. A well-performed clinical trial to address the optimal management of hemodynamically stable patients with contrast pooling on CT scanning is needed.

Annotation for Point H

Neither the presence nor the absence of active bleeding on CT scanning absolutely predicts the need for angiography. Vasospasm at the time of CT and delayed clot lysis can both contribute to an initial lack of contrast extravasation, whereas active bleeding may be due to hemorrhage from portal or hepatic vein lesions. Bleeding seen during the arterial phase of the scan, however, confirms bleeding from an arterial source. Angioembolization is an important adjunct to management of patients managed both operatively and nonoperatively with high-grade liver injuries. Early angioembolization can decrease the need for transfusions and liver-related operations.^{29,30} Conflicting data exist as to whether it can improve outcome in patients requiring operative intervention.^{20,31,32} Unless angiography is immediately available, most would consider preoperative angiography only for stable patients with pooling seen on CT scanning. There are several reports, however, suggesting that angiography be used as an extension of resuscitation in patients with ongoing resuscitative needs.^{33,34} This practice cannot be advocated except in selected centers.

Annotation for Point I

Carillo et al.³⁵ proposed criteria for nonoperative management of hepatic trauma to include: hemodynamically stable (not defined) patients with liver injuries diagnosed on CT scan, hepatic-related transfusion limited to 4 units of blood, and absence of other abdominal injuries that required exploration. The hepatic-related transfusion limit has not been verified. The morbidity of ongoing transfusions in an otherwise hemodynamically stable patient versus the morbidity of hepatic surgery remains to be well defined. Transfusion requirement in the first 24 hours postinjury has been shown to predict the development of liver-related complications.³⁶

Annotation for Point J

Operative intervention is still required for the patients sustaining blunt hepatic trauma, primarily related to hemodynamic instability on presentation. Christmas et al.³⁷ confirmed higher liver-related morbidity and mortality for the patients undergoing operative intervention. When surgery is indicated, management should

focus on cessation of bleeding, applying the principles of damage control surgery and hemostatic resuscitation.³⁸ Different from operative intervention for blunt splenic injuries, bleeding from blunt hepatic injuries may actually be exacerbated by operation. In fact, Richardson et al.³ suggested that the primary reason for the decrease in hepatic-related mortality over the past several decades is the shift to nonoperative management. A detailed description of operative management is beyond the scope of this text but will be a future topic for critical decisions.

Annotation for Point K

Not surprisingly, because more aggressive nonoperative management is being pursued, more liver-related complications are being diagnosed. Although routine follow-up CT scans are not necessary, persistent systemic inflammatory response syndrome, abdominal pain, jaundice, or an unexplained drop in hemoglobin should prompt an evaluation by CT scanning.³⁹ Complications are primarily related to the grade of liver injury and the need for transfusion.³⁶ Reported complication rates range from 0% to 7% when all grades are considered, but can be as high as 14% when only high-grade injuries are considered. Paramount to the successful management of hepatic complications is a multimodality treatment strategy to include endoscopic retrograde cholangiographic embolization (ERCP) and stenting, transhepatic angioembolization, and image guided percutaneous drainage techniques. Despite these advances, operative intervention still plays a role. When patients not requiring laparotomy within the first 24 hours after injury were examined, complications that required delayed operative intervention included bleeding, abdominal compartment syndrome, and failure of percutaneous drainage techniques.³⁶ Delayed hemorrhage is the most frequent, although still rare, postinjury complication.^{9,36,38} "Late" bleeds from blunt hepatic injuries generally occur within the first 72 hours postinjury.³⁶ Management principles discussed earlier should be applied and may include angioembolization or operative stabilization.

Annotation for Point L

A hepatic or perihepatic abscess appears on CT scan as a focal collection with gas bubbles or a fluid collection with an air fluid level. The incidence is low and can usually be managed by percutaneous catheter drainage, though operative drainage may still be needed for failures.

Annotation for Point M

Biliary complications include biloma, biliary fistula, bile leak, and bile peritonitis. Approximately, one-third of liver-related complications are biliary in nature with an overall incidence of approximately 3%, although higher rates have been reported.^{28,36,40} Typically, biliary complications present in a delayed fashion in patients with grade 4 injuries.³⁶ A biloma results when bile leaks into the hepatic parenchyma, increasing pressure leads to necrosis, and eventual formation of a biloma.⁴¹ Management consists of percutaneous catheter drainage. It is not known whether all asymptomatic bilomas require treatment.

Annotation for Point N

Bile peritonitis, defined as peritoneal and systemic signs of inflammation, typically presents several days after injury. Patients develop systemic inflammatory response syndrome in response to devitalized liver tissue rather than sepsis.⁴² Although laparotomy remains an option, drainage can be safely and effectively performed by laparoscopy.^{28,43–45} Although these signs may prompt consideration of a missed bowel injury, the incidence is very low even in patients with high grade injuries.³⁶

Annotation for Point O

Although most peripheral biliary leaks will seal without treatment, continued high output biliary drainage may warrant adjunctive ERCP to aid in healing. Ponsky and coworkers⁴⁶ suggest stenting rather than sphincterotomy for more effective resolution of biliary leaks. Neither the optimal duration of leak before ERCP nor the duration of leak before operative consideration has been studied

Annotation for Point P

Continued observation is necessary, as multiple and recurrent late complications occur.²⁸ The Pittsburgh group recently reported the safety of hepatic resection in the management of complex liver injuries.⁴⁷ Although patients in this series underwent primary operative therapy and the majority were not major resections, their excellent results suggest that delayed resection for necrotic or devitalized hepatic tissue or major intraparenchymal bile leaks may be an option in select cases at institutions with the appropriate hepatic expertise.

UC San Diego Trauma: Overview of Blunt Splenic Injury Protocol

Blunt splenic injury may be managed with observation, angiographic embolization, or surgery depending on the degree of injury, clinical scenario and associated injuries. The following guidelines should be adhered to:

Hemodynamically Unstable:

- Patients with hemodynamic instability or peritonitis should be taken to the operating room for splenectomy – See OPERATIVE MANAGEMENT OF SPLENIC INJURY

Hemodynamically Stable:

- Patients with imaging confirmed splenic laceration should be admitted to the SICU for serial exams and to trend Hemoglobin.
(see algorithm for NON-OPERATIVE MANAGEMENT OF SPLENIC INJURIES based on grade)
- Contrast extravasation on CT scan does not mandate splenectomy in a hemodynamically stable patient.
- Patients with Grade V splenic laceration should undergo splenectomy unless there are significant peri-operative risk factors that preclude operative intervention.
- Patients with contrast extravasation from the spleen should undergo prompt, selective or preferably sub-selective embolization. Proximal embolization should be avoided to minimize splenic infarction.
- Routine angiography should be considered in patients with Grade IV-V splenic injury
Patients with ongoing transfusion requirement or hemodynamic instability after non-operative management (observation or splenic angioembolization) should undergo prompt splenectomy.

Post-Injury Imaging:

- All patients with Grade III-V splenic injury that were managed non-operatively should undergo CT angiogram either prior to discharge or at 1 week post-injury to evaluate for splenic pseudoaneurysm. Any pseudoaneurysms identified should be evaluated by Interventional Radiology for possible treatment with angioembolization.

Stassen NA et al. Selective nonoperative management of blunt splenic injury: An EAST practice management guideline. J Trauma Acute Care Surg. 2012;73:S294.

Miller PR, et al. Prospective trial of angiography and embolization for all grade II to V blunt splenic injuries: nonoperative management success rate is significantly improved. J Am Coll Surg. 2014;218:644.

Non-operative Management of Splenic Injury

A. Key Outcomes

- Timely diagnosis of splenic injury and associated injuries
- Prompt recognition of failure of nonoperative management
- Prompt intervention for failure of nonoperative management and identified injuries
- Optimal pain management; aggressive pulmonary toilet; early mobilization

B. Goal Length of Stay

3-5 days

Exceptions: Unsatisfactory resolution of organ injury, associated injuries requiring additional treatment

C. Proposed Hospital Course

- i. Prior to Admission to ICU or IMU
 1. ATLS protocol
 2. work-up as mechanism and presentation dictate
 3. patient must be hemodynamically stable
 4. FAST/ CT scan abdo/pelvis
 5. Labs: ABG, H & H, type and screen
 6. ***Prior to discharge a repeat CT abd/pelvis for all patient with \geq Grade 3 lacerations, if pseudoaneurysm found patient should proceed to splenectomy.***
- ii. See **NOM of Splenic Injury**

D. Discharge Planning

Regular diet

Clinic follow-up q1-2 weeks x4 weeks; every month thereafter or at discretion of Trauma Attending

Restricted activity for 8-12 weeks total or at discretion of Trauma Attending

May require home care follow-up

E. Disposition

Dependent on needs at discharge (home vs. SNF vs. rehabilitation).

Per PT/OT recommendations

Table Non-operative Management of Splenic Injury Plan

	Day 1	Day 2	Day 3	Day 4	Day 5
Location	SICU	SICU/IMU	IMU	IMU/Floor	Floor
Diet	NPO	NPO	Sips/CF	CF/DAT	DAT
Activity	Bedrest Pulmonary toilet	Bedrest Pulmonary toilet	Up to Chair Pulmonary toilet	AAT Pulmonary toilet	AAT
Vitals	Q4-6H	Q6H	Q6-8H	Routine	Routine
IV fluids	Yes	Yes	Yes	No	No
Labs	Q6H	Q6-12H	BID-QD	QD	QD
DVT	SCDs Duplex protocol	SCDs Duplex protocol	LMWH Duplex protocol	LMWH Duplex protocol	
Imaging				If grade 3 injury or higher CT A/P prior to d/c to evaluate for pseudoaneurysm	If grade 3 injury or higher CT A/P prior to d/c to evaluate for pseudoaneurysm
Dispo				Discharge	Discharge

Operative Management of Splenic Injury

A. Key Outcomes

- Timely diagnosis of splenic injury and associated injuries
- Prompt intervention for identified injuries
- Optimal pain management; aggressive pulmonary toilet; early mobilization
- Administration of appropriate vaccinations prior to discharge from hospital

B. Goal Length of Stay 5 days

Exceptions: Associated injuries requiring additional treatment and/or postoperative complications

C. Proposed Hospital Course

- i. Preoperative
 1. ATLS protocol
 2. work-up as mechanism and presentation dictate
 3. CT head as indicated
 4. Rule out pelvic fracture if indicated
 5. FAST/ diagnostic peritoneal lavage/CT scan abdo/pelvis
 6. Labs: ABG, H & H, type and cross.
- ii. Postoperative
 1. Admit to SICU/IMU
 2. Daily postoperative CBC/coagulations, chemistries/LFTs as indicated
 3. Arterial line as indicated
 4. Possible NGT
 5. Aggressive pulmonary toilet
 6. Pain management
- iii. See **Operative Management of Splenic Injury**

D. Discharge Planning

Regular diet
Activity as tolerated based on associated injuries
Follow-up in clinic
May require home health follow-up

E. Disposition

Dependent on needs at discharge (home vs. SNF vs. rehabilitation).
Per PT/OT recommendations

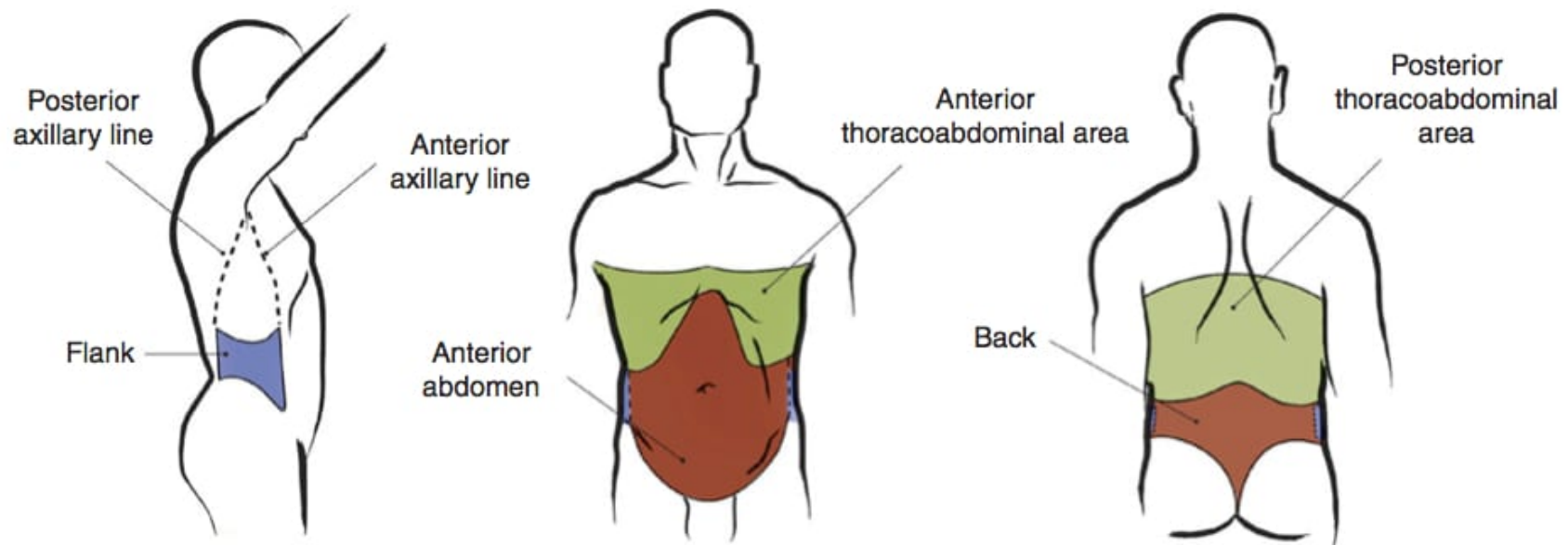
Table Operative Management of Splenic Injury

	Day 1	Day 2	Day 3	Day 4	Day 5
Location	SICU/IMU	SICU/IMU	IMU	IMU/Floor	Floor
Diet	NPO/NGT	NPO/NGT	Sips/CF	CF/DAT	DAT
Activity	Bedrest Pulmonary toilet	Bedrest Pulmonary toilet	Up to Chair Pulmonary toilet	AAT Pulmonary toilet	AAT
Vitals	Q4-6H	Q6H	Q6-8H	Routine	Routine
IV fluids	Yes	Yes	Yes	No	No
Labs	Q6H	Q6-12H	BID-QD	QD	QD
DVT	SCDs Duplex protocol	SCDs Duplex protocol	LMWH Duplex protocol	LMWH Duplex protocol	
Vaccines				Splenic vaccines prior to d/c	Splenic vaccines prior to d/c*
Disposition					Discharge

*Four immunizations required:

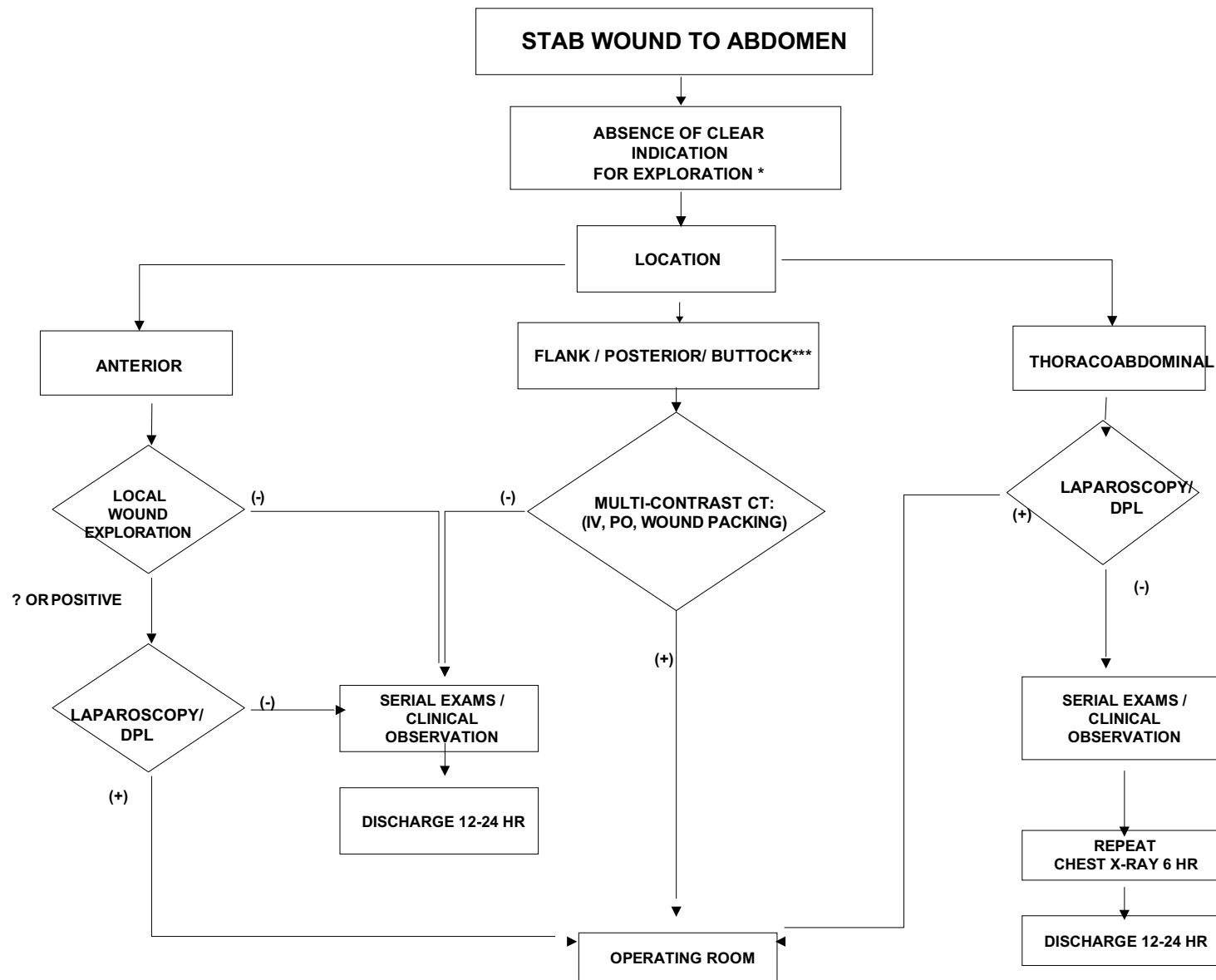
1. Quadavalent meningococcus (Menactra or Menomune)
2. Pneumococcus (Pneumovax 23)
3. H. influenzae B (HIB, ActHiB)
4. Viral Influenza vaccine

PENETRATING TRAUMA – STAB WOUND / DIAPHRAGM EVALUATION



- Stable anterior stab wounds can be locally explored to rule out fascial violation, but not flank or back wounds.
- Thoracoabdominal SW or any abdominal SW with associated pneumo/hemothorax = diaphragm injury.
- CT with blood/fluid/air on either side of diaphragm = diaphragm injury.
- The risk is higher on the left side due to the protective effect of the liver on the right.
- If another indication for immediate operation is present, then examine/repair the diaphragm at that time.
- If no immediate operation is otherwise indicated, then a laparoscopic diaphragm evaluation is indicated.
 - If stable, this can be delayed (>8-12 hrs) perform serial exams and ensure no hollow viscus or other operative injury is present.
- Thoracoscopic evaluation/repair is an acceptable alternative, and procedure of choice if a retained hemothorax is present.

STAB WOUND ABDOMEN PROTOCOL



*Hemodynamic instability, evisceration, peritoneal signs, multiple wounds, hematuria, blood in Foley or NG

** Positivity criteria for DPL: >1000 RBC/mm³ , >500 WBC/mm³

***Buttock wound: DRE, UA, may need Foley, Rigid Sigmoidoscopy

Pancreatic injury

A. Key Outcomes

- Timely diagnosis of pancreatic injury and associated injuries
- Prompt intervention for pancreatic injury and identified injuries.
- Optimal pain management; aggressive pulmonary toilet; early mobilization

B. Goal Length of Stay

5 days (depends on severity of injury, complexity of surgery if performed, associated injuries)

Proposed Hospital Course

Prior to Arrival at Admission Destination

- ATLS protocol; workup as mechanism and presentation dictate
- Order appropriate adjunct examinations including fine cut pancreas protocol CT, MRCP (if ductal injury unclear), or ERCP as dictated by injury
- Operative exploration is indicated in the following situations
 - Pancreatic transection or severe peripancreatic fluid on CT
 - Main duct injury on MRCP
- Non operative management is appropriate in the following situations
 - Peripancreatic edema
 - Pancreatic laceration without main duct injury
 - Absence of other indications or associated injuries that warrant laparotomy
- Refer to treatment algorithm below for further details
- Be cognizant of the high risk of associated injuries. Identify and treat without delay

Hospital Course

- NPO
- Trial of diet as tolerated
- Adequate analgesia
- Patient and family education regarding wound care, diet, and activity

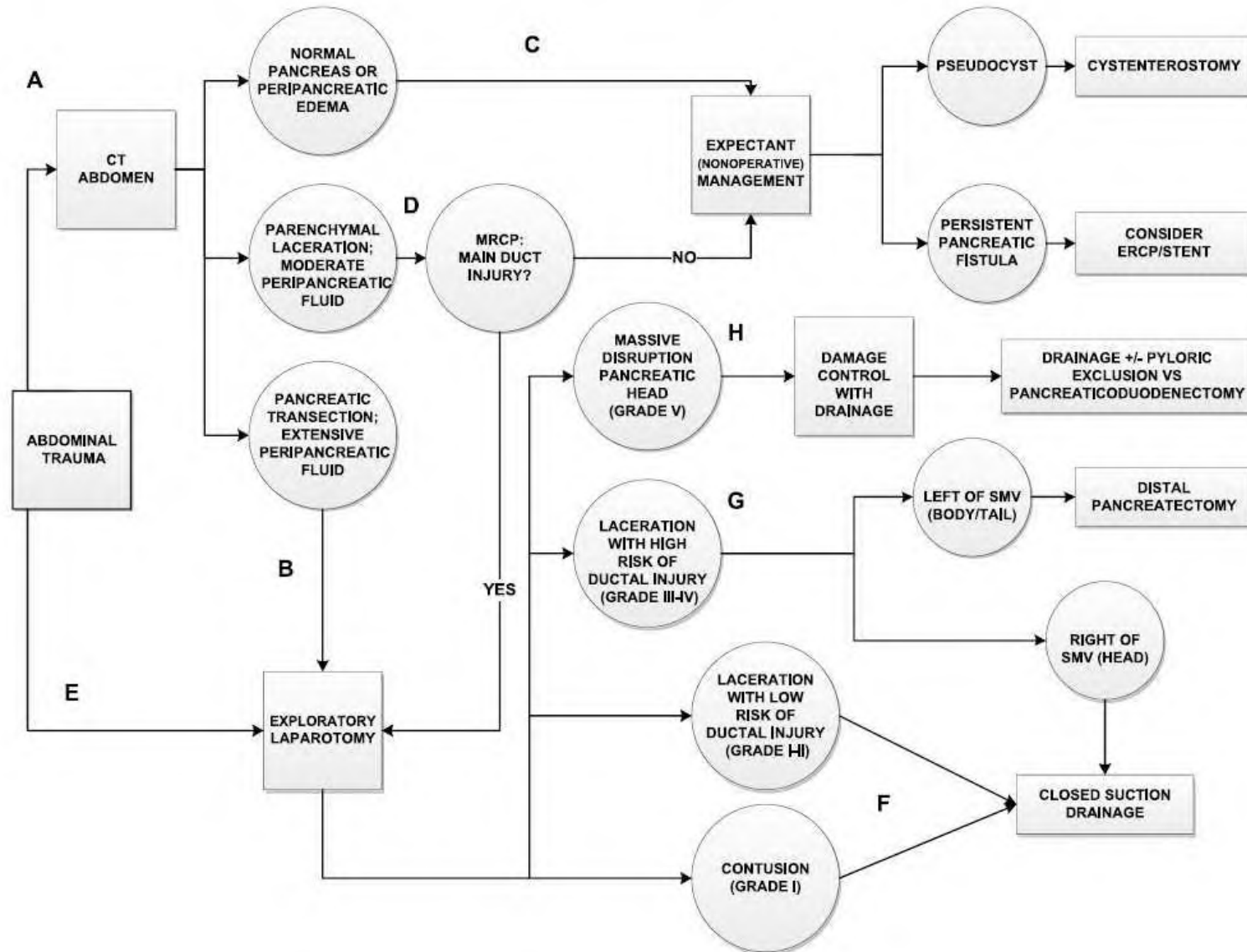
D. Discharge Planning

- Tolerating regular diet
- Activity as tolerated based on injuries
- Clinic follow-up as injuries dictate

E. Disposition

- Home in uncomplicated cases
- Home care facility in complex cases
- Per PT/OT recommendations

Pancreatic injury Algorithm



Non-operative Management of Renal Injuries

(See also flowcharts for Renal Injury Identified on CT Scan and Zone II Hematoma Identified at Laparotomy)

A. Key Outcomes

- Timely diagnosis of renal injury and associated injuries
- Prompt recognition of failure of non-operative management
- Prompt intervention for failure of non-operative management

B. Goal Length of Stay

- 2-4 days
- Exceptions: unsatisfactory resolution of organ injury, failure of non-operative management, associated injuries requiring additional treatment

C. Proposed Hospital Course

- Workup per ATLS protocol and division standards
 - i. Renal injury identified on CT scan – see appropriate algorithm
 - ii. Zone II hematoma identified at laparotomy – see appropriate algorithm
- Proceed with non-operative management if appropriate per above algorithms
 - i. Admit to SICU for all solid organ injuries
 - ii. Serial CBC, coags
 - iii. Patient must be hemodynamically stable
 1. Alert trauma attending \ fellow immediately if patient becomes unstable
 - iv. Serial abdominal exams
 - v. Aggressive pulmonary toilet
 - vi. Pain management

D. Discharge Planning

- Regular diet
- Activity as tolerated based on associated injuries
- Trauma clinic follow-up in 2-4 weeks

E. Disposition

- Dependent on needs at discharge (home vs. SNF vs. rehabilitation)
- Per PT/OT recommendations

Operative Management of Renal Injuries

A. Key Outcomes

- a. Timely diagnosis of renal injury and associated injuries
- b. Rapid determination of need for operative management
- c. Prompt operative treatment

B. Goal Length of Stay

- a. 3-5 days
- b. Exceptions: unsatisfactory resolution of organ injury, associated injuries requiring additional treatment, postoperative complications

C. Proposed Hospital Course

- a. Preoperative
 - i. Workup per ATLS protocol and division standards
 - ii. Renal injury identified on CT scan – see appropriate algorithm, proceed to OR as indicated
 - iii. Labs: CBC, BMP (Cr), coags, type and cross, β HCG in women of childbearing age
 - iv. Determine viability of contralateral kidney if considering nephrectomy
 - 1. If CT abdomen-pelvis done, assess venous phase images for contrast excretion into ureters
- b. Intraoperative
 - i. Zone II hematoma identified at laparotomy – see appropriate algorithm
 - ii. Determine viability of contralateral kidney if not done preoperatively
 - 1. Palpation +/- IV pyelogram
- c. Postoperative
 - i. Admit to SICU or IMU as dictated by constellation of injuries or hemodynamic stability
 - ii. Daily CBC, BMP, coags as indicated
 - iii. Aggressive pulmonary toilet
 - iv. Pain management

D. Discharge Planning

- a. Tolerating sufficient oral intake
- b. Activity as tolerated based on associated injuries
- c. Trauma clinic follow-up in 2-4 weeks

E. Disposition

- a. Dependent on needs at discharge (home vs. SNF vs. rehabilitation)
- b. Per PT/OT recommendations

References:

AAST Renal Injury Grading Scale:

<http://www.aast.org/Library/TraumaTools/InjuryScoringScales.aspx#kidney>

Western Trauma Association Renal Injury Algorithms:

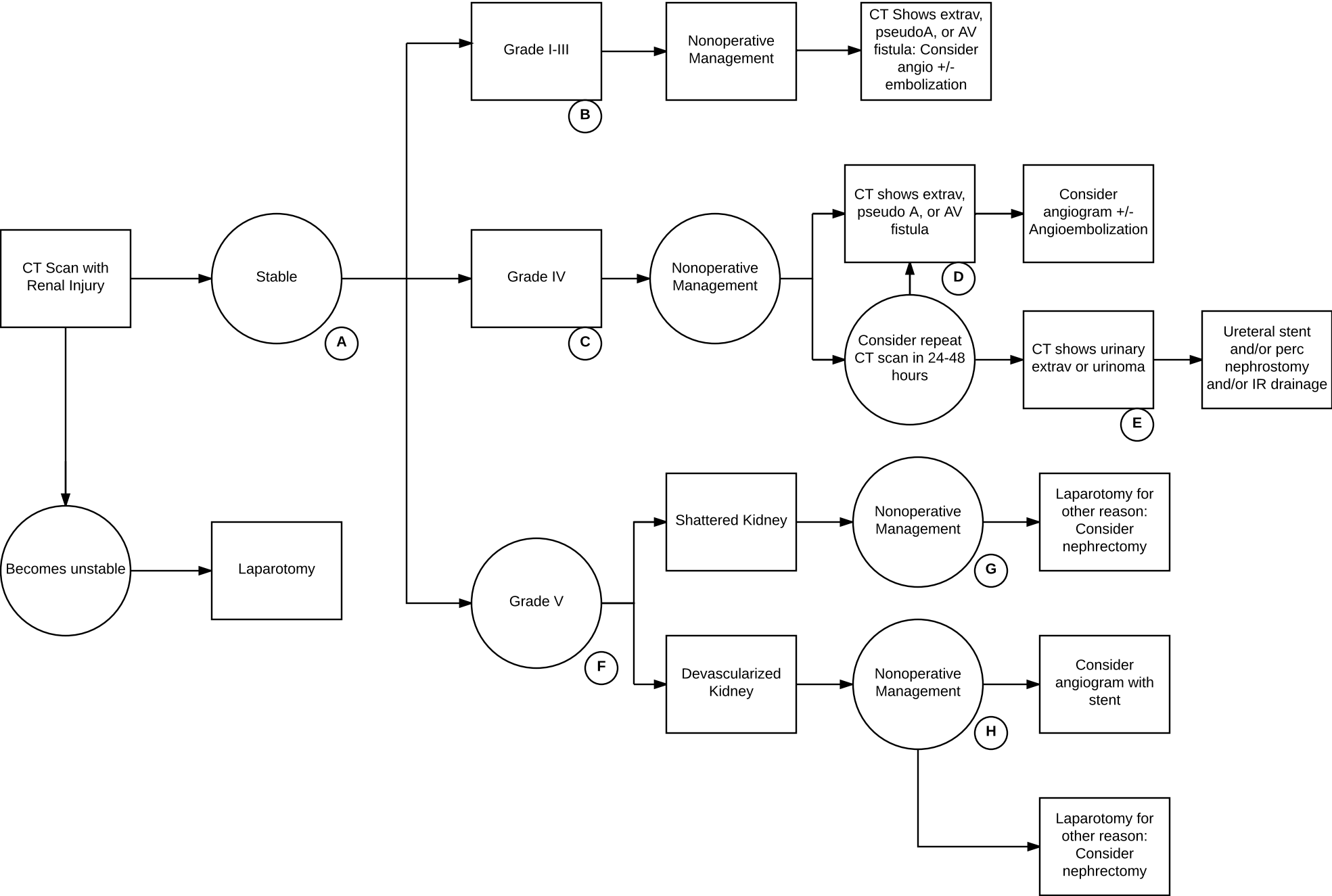
Identified on CT Scan:

<http://www.westerntrauma.org/documents/meeting/2017/AlgorithmDrafts/2017-WTA-ALGORITHM-RENAL-II-CT-SCAN.pdf>

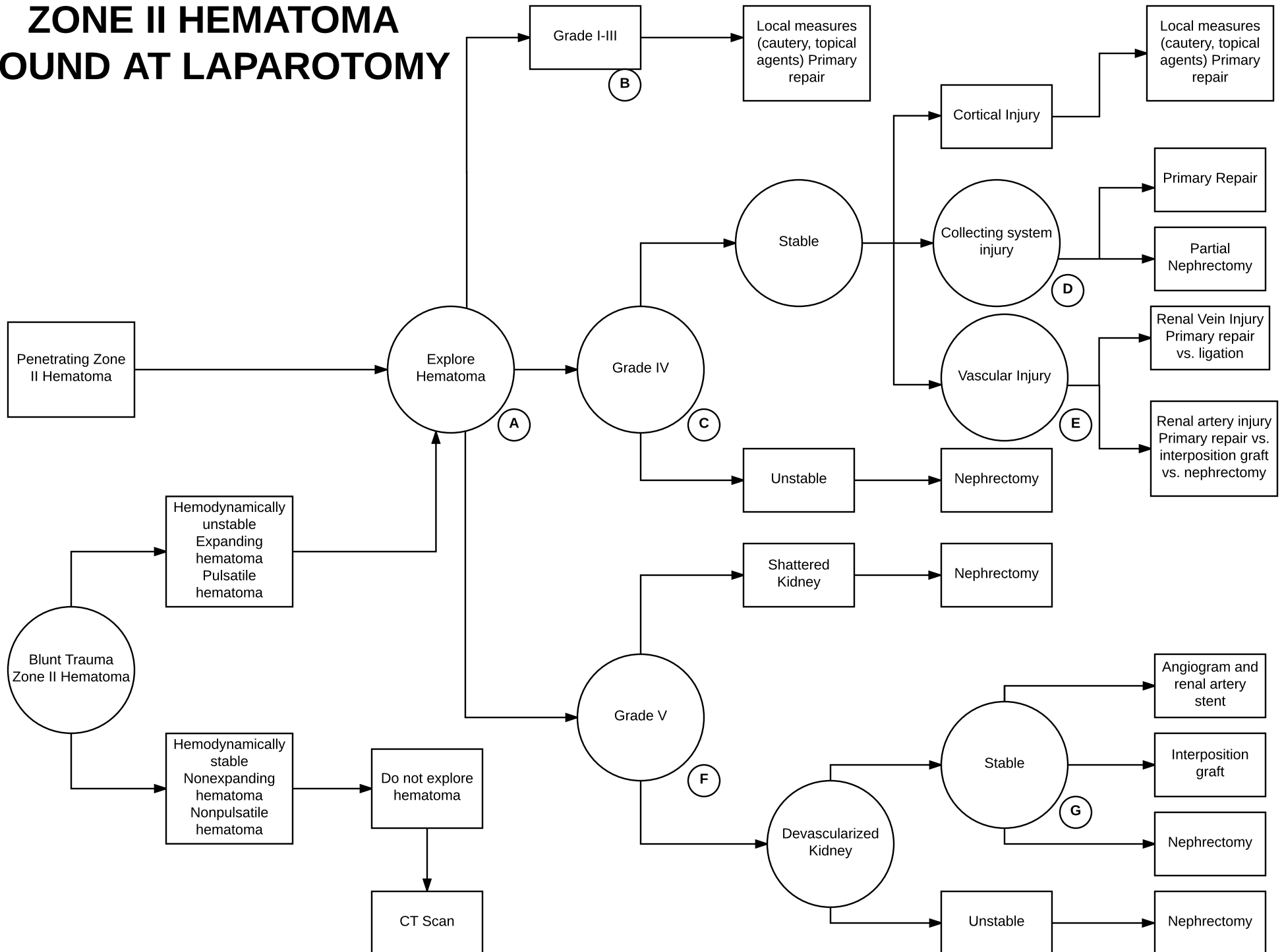
Identified at Laparotomy:

<http://www.westerntrauma.org/documents/meeting/2017/AlgorithmDrafts/2017-WTA-ALGORITHM-RENAL-I-LAPAROTOMY.pdf>

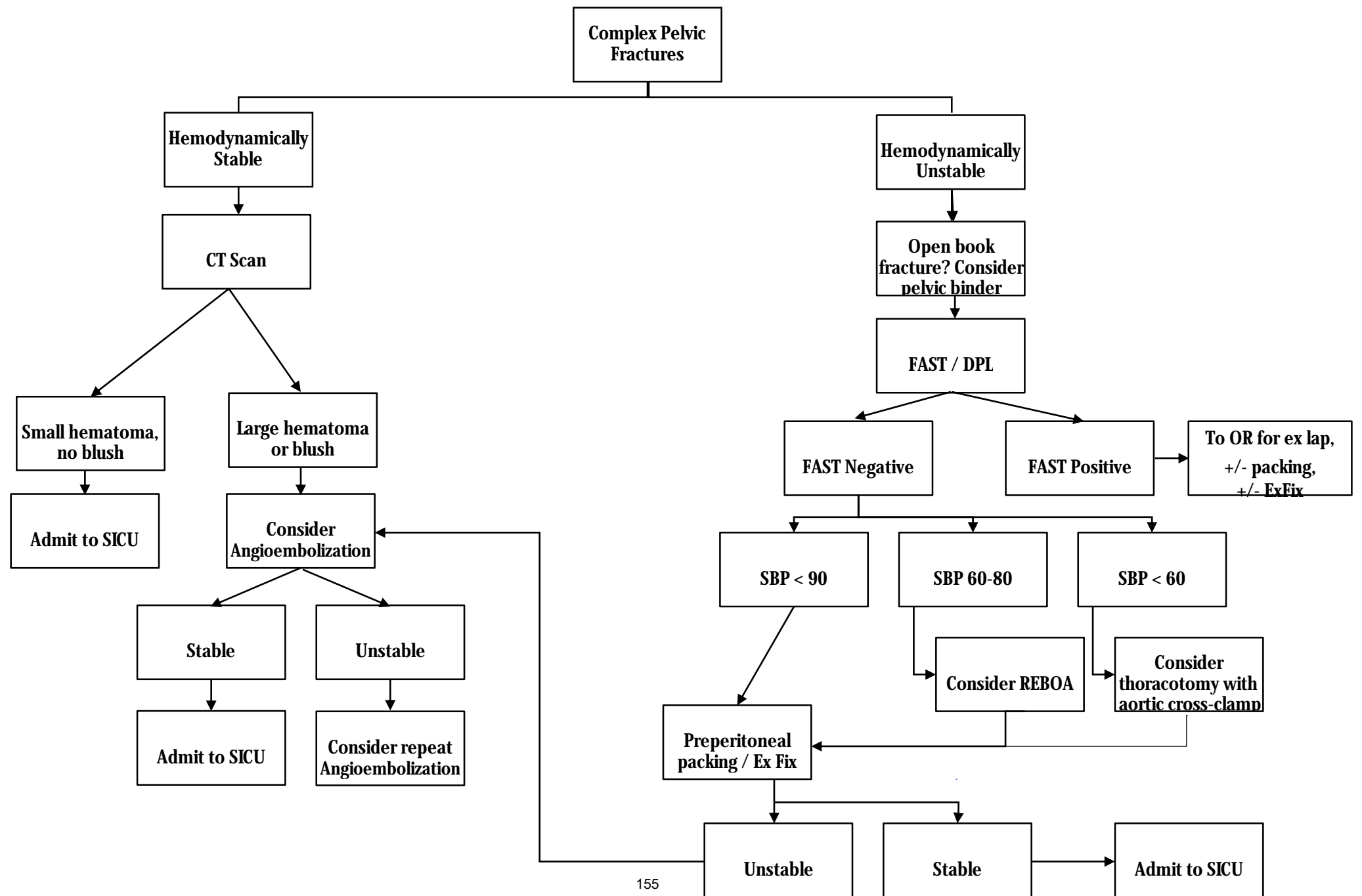
RENAL INJURY FOUND ON CT SCAN



ZONE II HEMATOMA FOUND AT LAPAROTOMY



Pelvic Fractures



T-PODResponder Explained



Pre-application
of
T-PODResponder



Post-application
of
T-PODResponder



Radio-density of
T-PODResponder

www.pyng.com

Application Procedure

1. Slide Belt under supine patient and into position under the pelvis. Smoothly and with minimal force roll the patient to aid in positioning the Belt. Align the top edge of the Belt at the level of the iliac crest. Alternatively the Belt can be centered at the level of the greater trochanters.



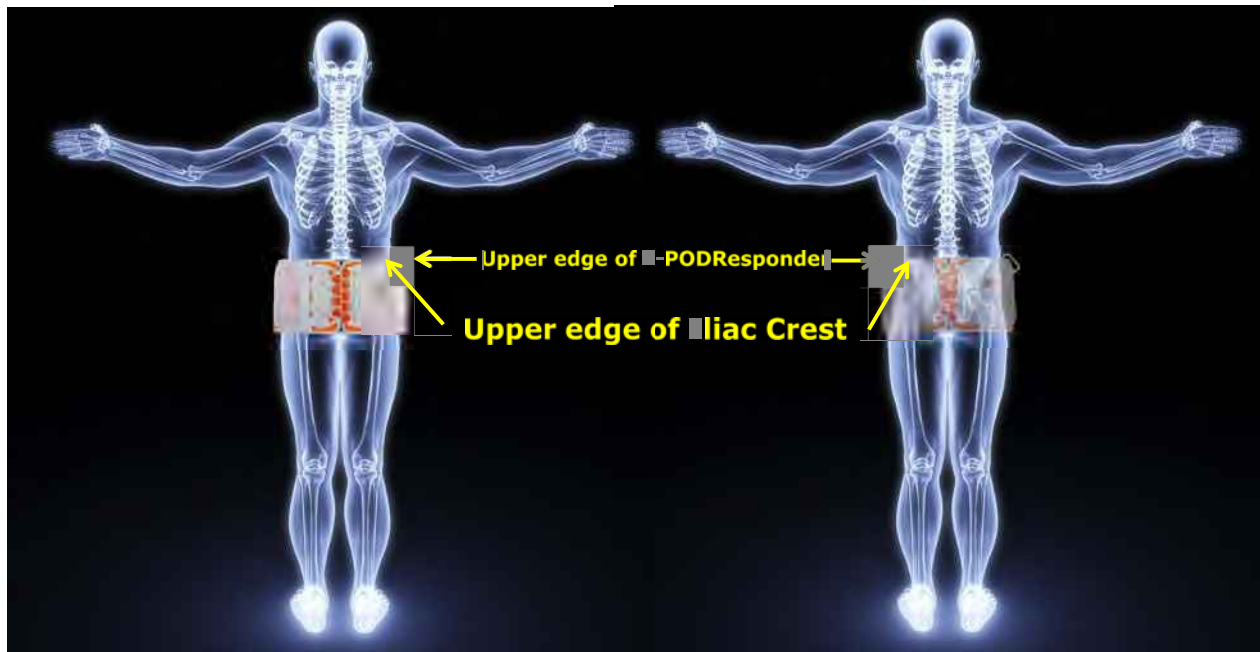
The ProSlide may be used to aid in sliding the Belt.



www.pyng.com

Placement of T-PODResponder

The upper edge of the T-PODResponder should align with the upper edge of the Iliac Crest



www.pyng.com

Application Procedure

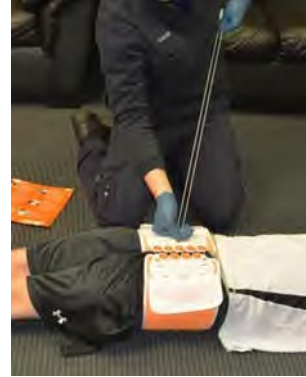
2. Trim the Belt, leaving a 6-8" (15.2-20.3cm) gap over the center of the pelvis.
3. Apply Velcro-backed Mechanical Advantage Pulley System to each side of the trimmed Belt.



www.pyng.com

Application Procedure

4. Slowly draw tension on the Pull Tab, creating simultaneous, circumferential compression.



5. Secure the chord to the hooks and the Velcro-backed Pull Tab to the Belt.



www.pyng.com

Application Procedure

6. Record the date and time of application on the space provided.



www.pyng.com

Re-applying **T-PODResponder**

Circumferential compression should be released every 12 hours to check for skin integrity and provide wound care, as necessary. To re-tighten, draw Velcro-backed Pull Tab, secure and attach to Belt.

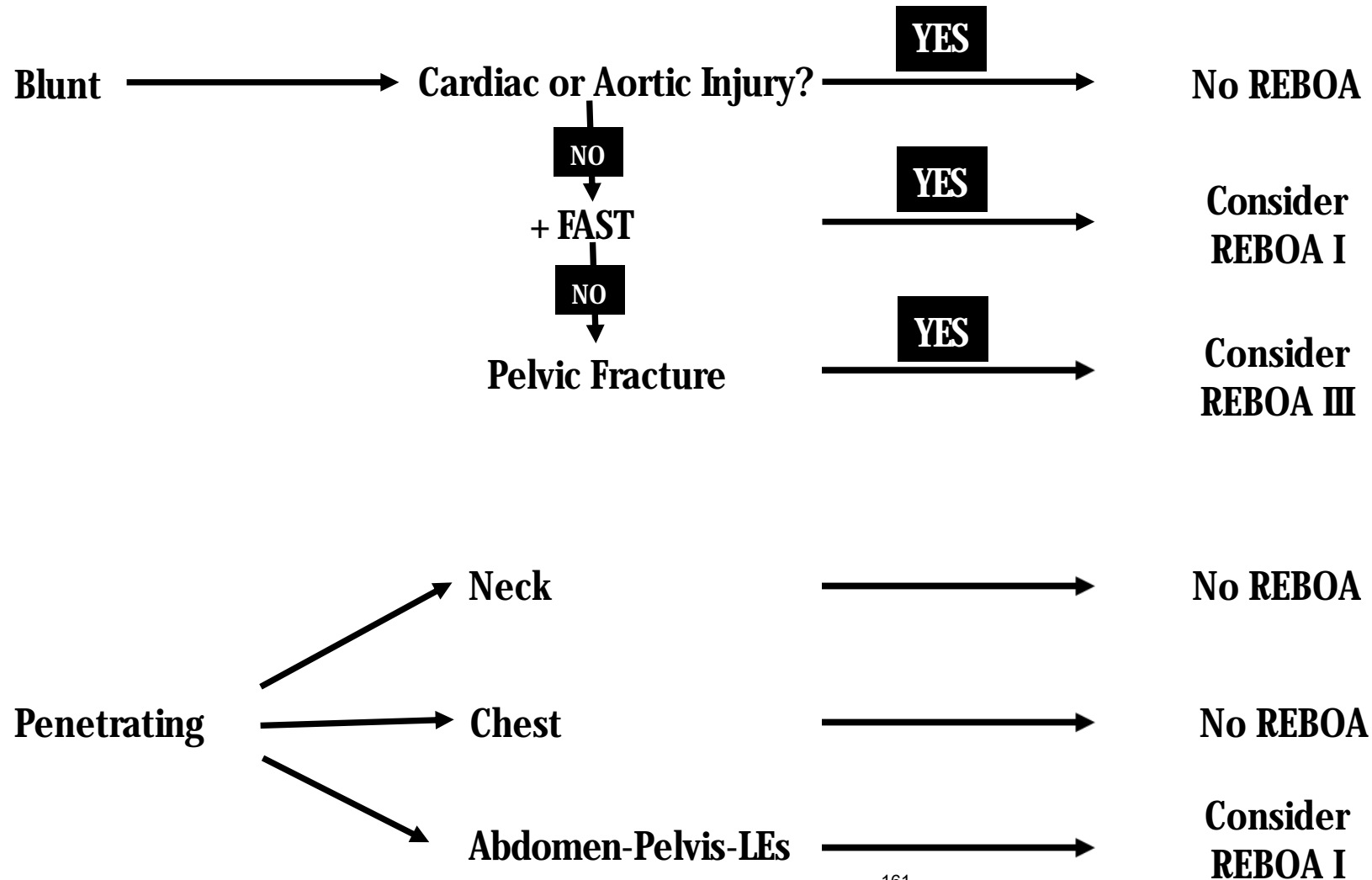
T-PODResponder release time should also be noted on the label.



www.pyng.com

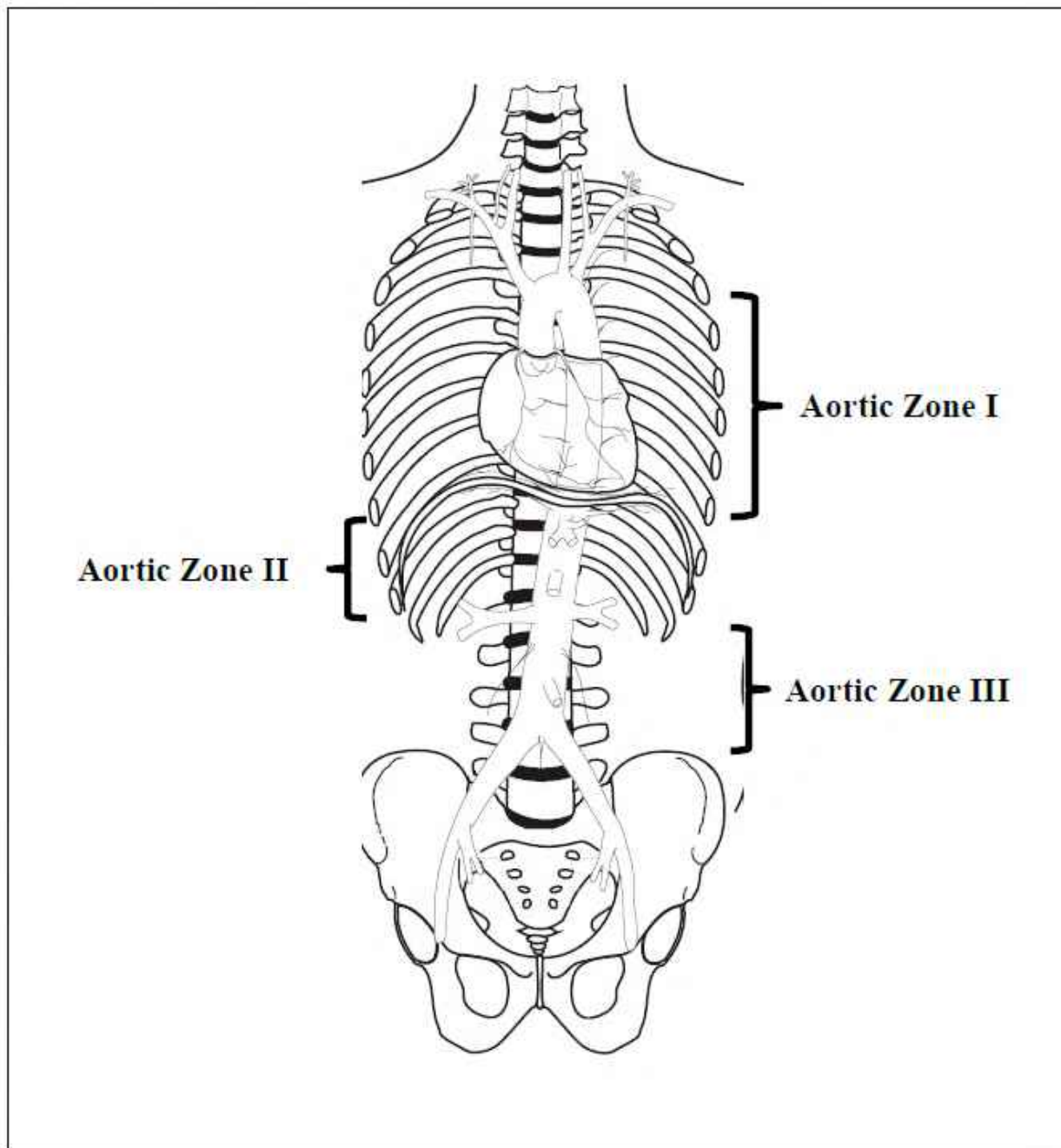
REBOA Protocol

- **SBP <90 with Transient or No Response to IVF**
- **CPR pre hospital with ROSC**



REBOA PROTOCOL

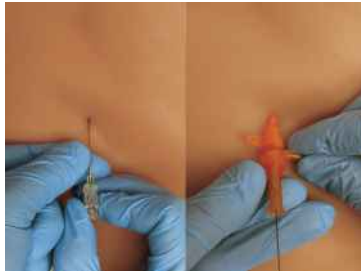
AORTIC ZONES



The ER-REBOA™ Catheter Quick Reference Guide

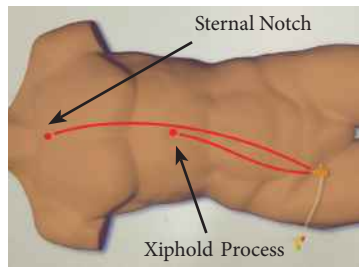
6 REBOA Steps: ME-FIIS (Pronounced ME-FIZZ)

Get Access Early



Obtain access using standard techniques

1. Measure



Placement depth^{1,2,3,4,5,6}

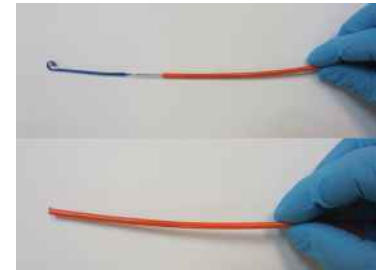
- Zone 1: Approximately 46 cm
- Zone 3 : Approximately 28 cm

2. Empty



Flush & deflate balloon

- Ensure balloon is fully deflated
- Hold vacuum for **5 seconds**
- Close stopcock with vacuum held



Advance & twist peel-away to cover P-tip®

- Ensure the balloon and P-tip® are captured

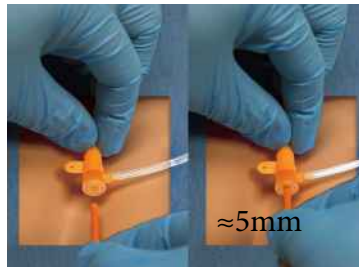
3. Flush



Attach & flush arterial line

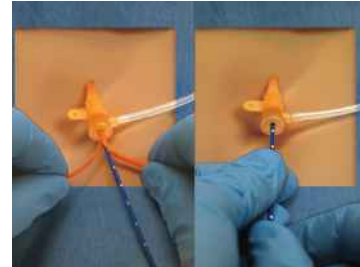
- Use standard techniques
- Ensure all air is purged

4. Insert



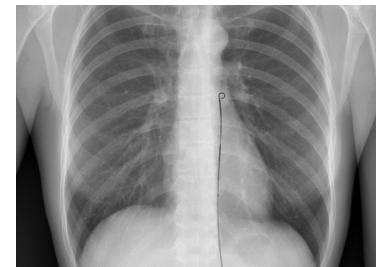
Insert sheath into valve

- Approximately 5 mm
- Insert into the common femoral artery



Advance catheter into vessel

- Hold orange sheath
- Advance blue Catheter
- Remove sheath after balloon passes valve

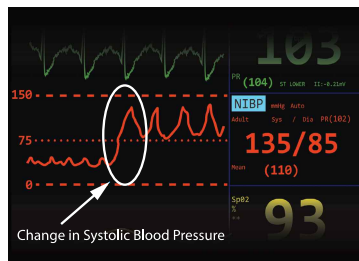


Position catheter

If available, use conventional x-ray or fluoroscopy to confirm position using radiopaque markers

5. Inflate^{1,2,3,4,5,6}

Inflation Volume	
Zone 1	Start with 8 cc
Zone 3	Start with 2 cc



Start small then check

"2 or 8, don't overinflate."

Monitor arterial waveform feedback

- Look for change in blood pressure above balloon
- Use other standard techniques

6. Secure



Secure Catheter close to the introducer sheath

Provide Definitive Treatment



Provide definitive hemorrhage control

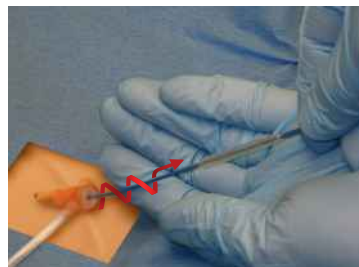
- Mark time of inflation
- The clock is ticking!
- Move quickly to definitive control

Remove



Fully deflate balloon

- Hold vacuum for **5 seconds**
- Close stopcock with vacuum held



Remove catheter

- Corkscrew twist the catheter to facilitate removal
- If necessary, remove catheter and introducer sheath as a unit

Caution



Check for full and equal pulse in each leg using your standard technique

PRYTIME MEDICAL™

The REBOA Company™

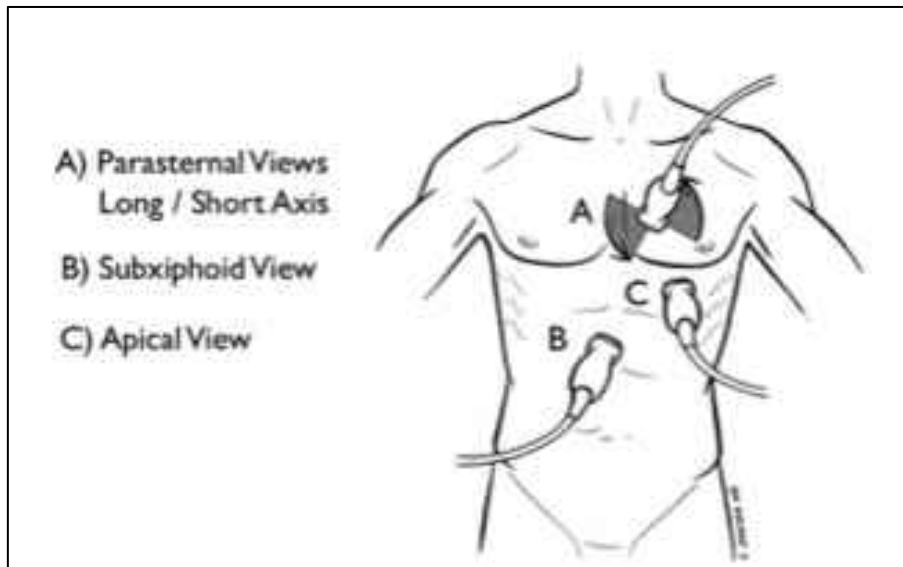
www.prytimemedical.com

This instruction is not a replacement for the instruction for use (IFU). The ER-REBOA™ Catheter IFU should be read in its entirety before using the device

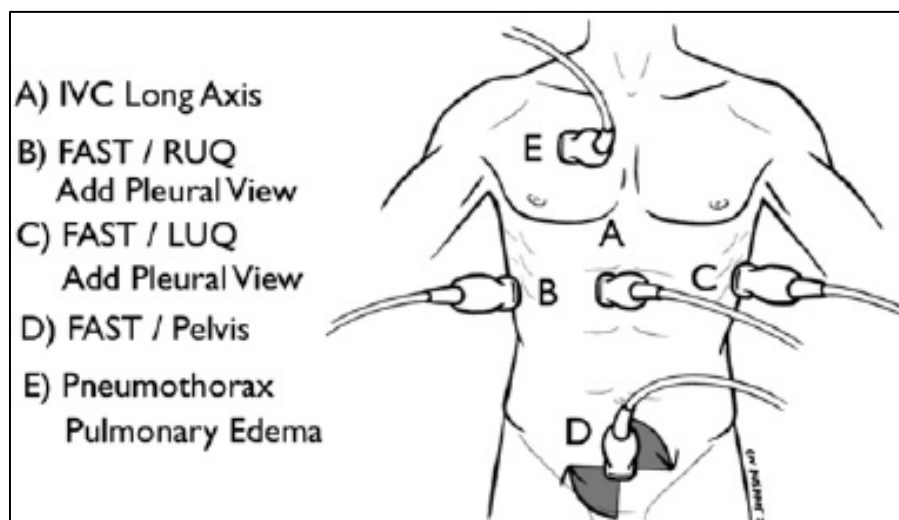
1. Joint Trauma System Clinical Practice Guideline (JTS CP) REBOA for Hemorrhagic Shock (CPG ID: 38)
2. Peay P, Flaris AN, Post NJ, Cotton F, Lundberg PW, Callot JL, David JS, Voiglio EJ. Fixed-Distance Model for Balloon Placement During Fluoroscopy-Free Resuscitative Endovascular Balloon Occlusion of the Aorta in a Civilian Population. JAMA Surg. 2016 Dec 14.
3. Linnebur M, Inaba K, Halmeier T, Rasmussen TE, Smith J, Mendelsohn R, Grabb D, Demetriades D. Emergency non-image-guided resuscitative endovascular balloon occlusion of the aorta (REBOA) catheter placement: A cadaver-based study. J Trauma Acute Care Surg. 2016 Sep;81(3):453-7.
4. MacTaggart JN, Poulson WE, Akhtar M, Sees A, Thorson K, Phillips NY, Deyagova AS, Samensky AV. Morphometric roadmaps to improve accurate device delivery for fluoroscopy-free resuscitative endovascular balloon occlusion of the aorta. J Trauma Acute Care Surg. 2016 Jun;80(5):941-6.
5. Morrison JJ, Stannard A, Midwinter MJ, Sharon DJ, Eliaison JL, Rasmussen TE. Prospective evaluation of the correlation between torso height and aortic anatomy in respect of a fluoroscopy-free aortic balloon occlusion system. Surgery. 2014 Jun;156(6):104-51.
6. Stannard A, Morrison JJ, Sharon DJ, Eliaison JL, Rasmussen TE. Morphometric analysis of torso arterial anatomy with implications for resuscitative aortic occlusion. J Trauma Acute Care Surg. 2013 Aug;75(2 Suppl 2):S169-72.

Ultrasound

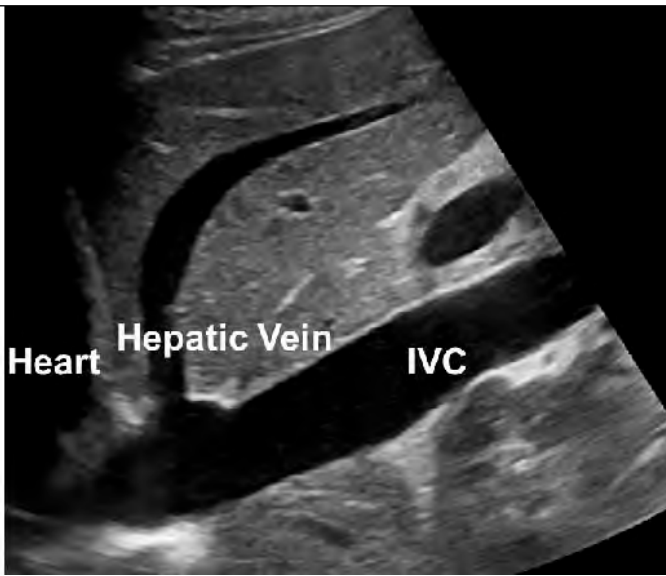
ENHANCED FAST ULTRASOUND



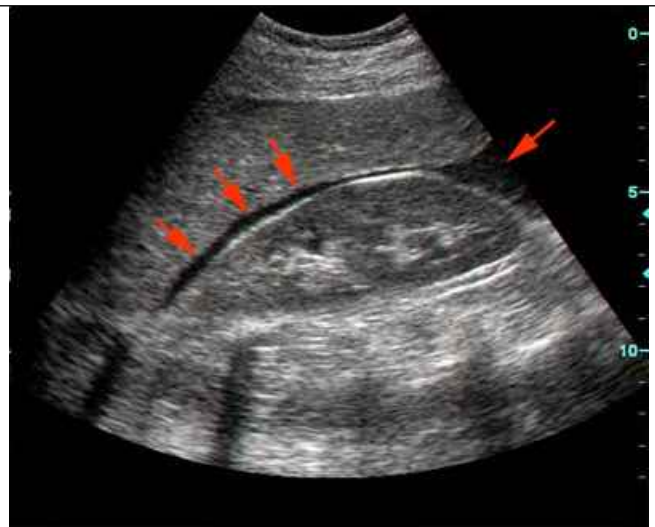
1. Cardiac VIEWS – See FATE echo



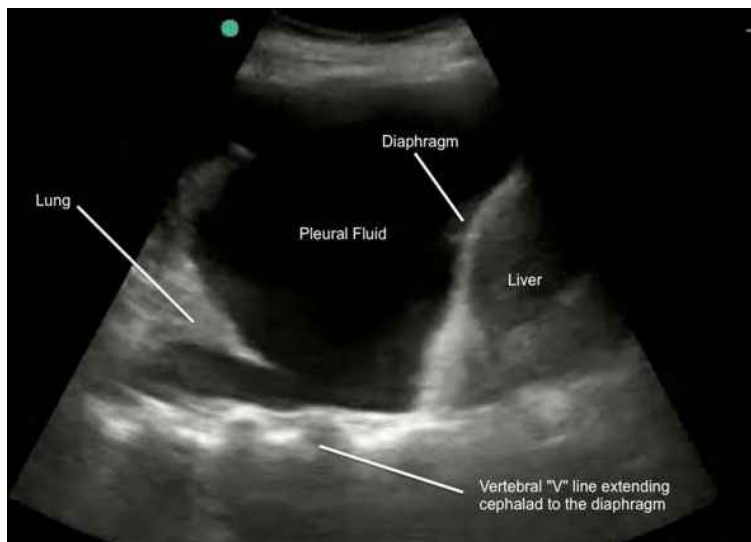
2. Abdominal and Lung Views



A: Long Axis IVC view – IVC looks full



B: Hepatorenal View (Morrison's Pouch) red arrows indicate Positive - Blood



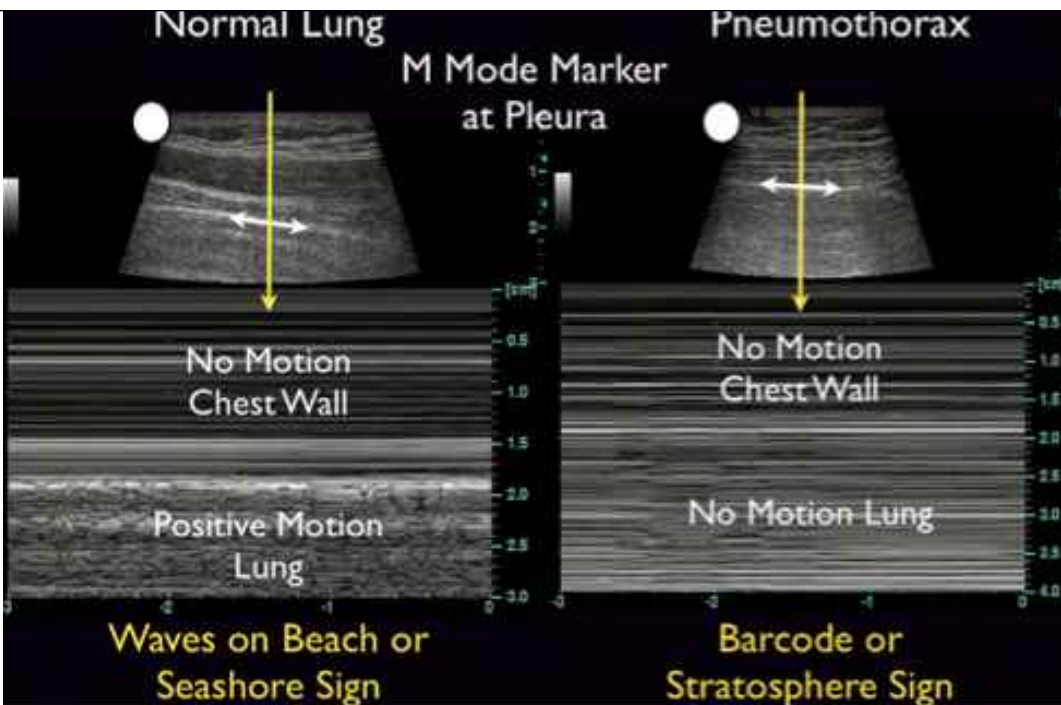
B: Right lateral chest pleural view – massive pleural fluid



C; Splenorenal fossa – free fluid over kidney



D: Pelvis transverse with full bladder and free fluid

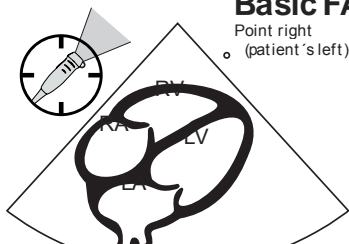


E. Normal Lung and Pneumothorax in 2D and M mode

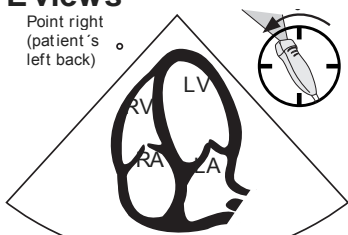
Focus Assessed Transthoracic Echo (FATE)

Scanning through position 1-4 in the most favourable sequence

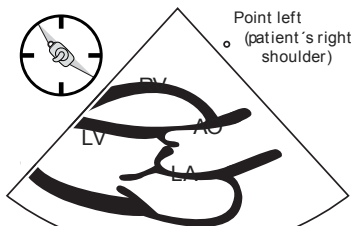
Basic FATE views



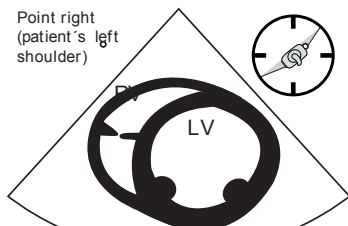
Pos 1: Subcostal 4-chamber



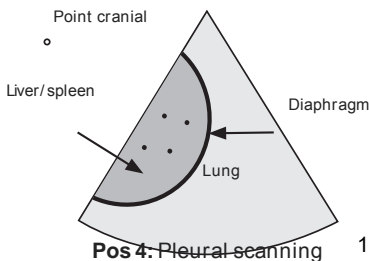
Pos 2: Apical 4-chamber



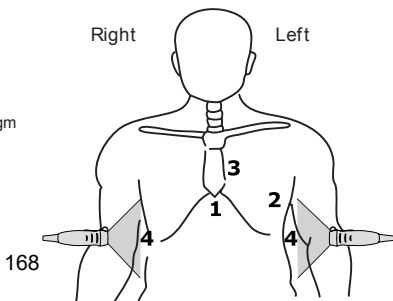
Pos 3: Parasternal long axis



Pos 3: Parasternal LV short axis



Pos 4: Pleural scanning



Focus Assessed Transthoracic Echo (FATE)

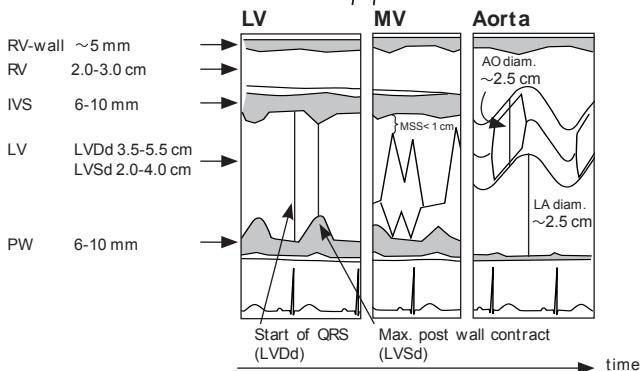
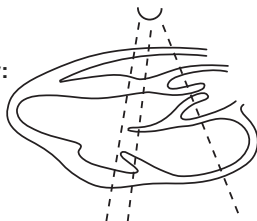
(European Journal of Anaesthesiology 2004; 21: 700-707)

1. Look for obvious pathology
2. Assess wall thickness + chamber dimensions
3. Assess bi-ventricular function
4. Image pleura on both sides
5. Relate the information to the clinical context
6. Apply additional ultrasound

Dimensions and contractility:

$$FS = \frac{(LVDd - LVsd)}{LVDd}$$

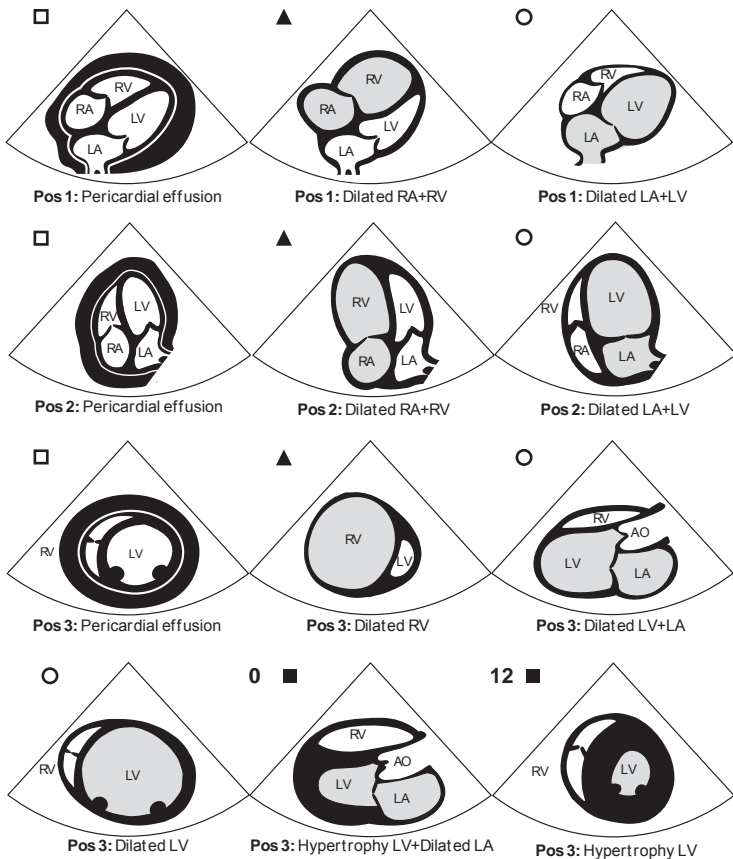
$$EF \sim 2 \times FS$$



The global function of the heart is determined by the interaction between:

Right ventricle		Left Ventricle	
Systole:	Diastole:	Systole:	Diastole:
Preload	Compliance	Preload	Compliance
Afterload	Relaxation	Afterload	Relaxation
Contractility	Heart rate	Contractility	Heart rate
Heart rate		Heart rate	

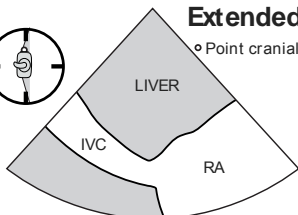
Important pathology



PATHOLOGY TO BE CONSIDERED IN PARTICULAR:

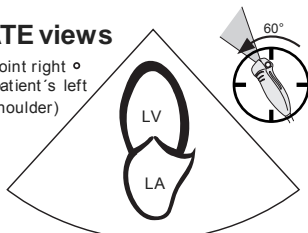
- Post OP cardiac surgery, following cardiac catheterisation, trauma, renal failure, infection.
- ▲ Pulmonary embolus, RV infarction, pulmonary hypertension, volume overload.
- Ischemic heart disease, dilated cardiomyopathy, sepsis, volume overload, aorta insufficiency.
- Aorta stenosis, arterial hypertension, LV outflow tract obstruction, hypertrophic cardiomyopathy, myocardial deposit diseases.

Extended FATE views

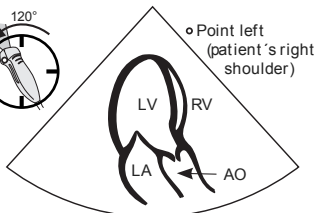


Pos 1: Subcostal Vena Cava

Point cranial
Point right
(patient's left
shoulder)

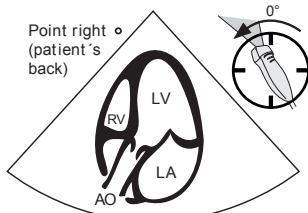


Pos2: Apical 2 - Chamber

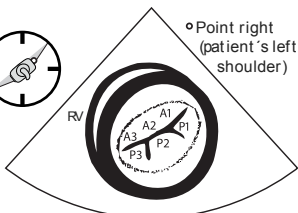


Pos 2: Apical Long - axis

Point right
(patient's
back)

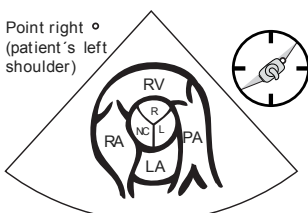


Pos 2: Apical 5 - Chamber



Pos 3: Parasternal short axis mitral plane

Point right
(patient's left
shoulder)



Pos 3: Parasternal aorta short axis

CW: Peak pressure: $V^2 \times 4$; AO < 2 m/s; PA < 1 m/s; TI < 2.5 m/s

PW: Mitral Inflow desc. time 140 - 240 ms; MAX E < 1.2 m/s; E/A > 1 (Age dependent)

TVI: E/e' < 8-10; IVC < 20 mm; 50% collaps during inspiration is normal

Systolic Ventricular Function

Ventricle	M-Mode	Normal	Mild ↓	Moderately ↓	Severely ↓
LV Pos 3, PS long	EF (%)	≥ 55	45 - 54	30 - 44	< 30
LV Pos 3, PS long	FS (%)	≥ 25	20 - 24	15 - 19	< 15
LV Pos 3, PS long	MSS (mm)	< 10	7 - 12	13 - 24	> 24
LV Pos 2, AP 4ch	Mapse (mm)	≥ 11	9 - 10	6 - 8	< 6
RV Pos 2, AP 4ch	Tapse (mm)	16 - 20	11 - 15	6 - 10	< 6

Right and left ventricle Eye Balling use all views



GE Healthcare

For additional information: www.usabcd.org

Peripheral Vascular Injury & Compartment Syndrome

UC San Diego Trauma- Vascular Trauma Protocol Overview

The Trauma Surgery team is primarily responsible for the management of vascular trauma including diagnosis, bleeding control and vascular reconstruction. It is expected that Trauma Surgeons with limited vascular experience call a senior Trauma Surgeon that is comfortable with vascular reconstruction to participate in operative decision making and to proctor the vascular repair. Based on the limited number of vascular repairs per year, it is highly recommended that the fellow on call be called in to participate in the operative procedure as well.

Upper Extremity Vascular Injuries

Major trauma patients with upper extremity trauma will be evaluated by the Trauma team according to ATLS protocol. For patients with active hemorrhage from the upper extremity, the Trauma team will obtain hemorrhage control using either direct pressure or tourniquet placement. If there is concern for arterial, nerve, or ligament injury distal to the bifurcation of the brachial artery, the Hand Surgery Attending on-call should be paged promptly. A decision will be made between the Trauma Attending and Hand Surgery Attending regarding timing of operative intervention, need for additional trauma work-up for other injuries, and to facilitate a complete neuro-vascular exam by the Hand Surgeon prior to operative intervention (if possible). If emergent operative intervention is needed for an upper extremity injury distal to the brachial artery, the Trauma Surgery Attending will take the patient to the operating room while the Hand Surgeon is en route to the Trauma Center. Any plans for operative intervention will be discussed directly between the Trauma Surgeon and Hand Surgeon.

Lower Extremity Vascular Injuries

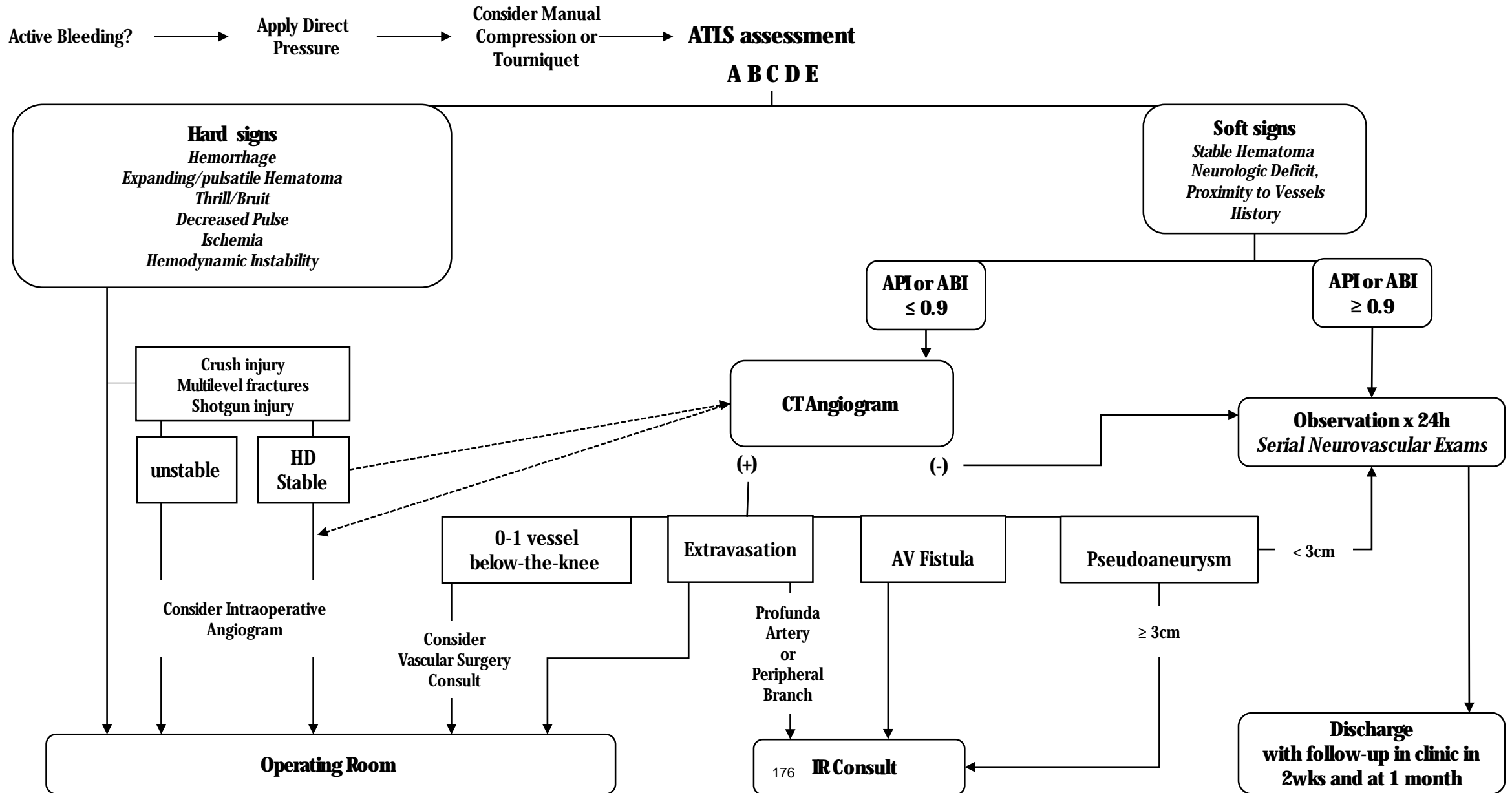
The Trauma team will be responsible for the diagnostic work-up and diagnosis of lower extremity vascular injuries. For patients with active hemorrhage from the lower extremity, the Trauma Surgeon will be responsible for obtaining vascular control. The Trauma Surgeon will be responsible for vascular reconstruction of injuries proximal to the trifurcation. The Vascular Surgery team should be consulted for any injury distal to the popliteal vessels, excluding patients with single vessel distal lower extremity injury with normal 2 vessel run-off. The Vascular Surgeons should be responsible for any vascular reconstruction that includes any vessel distal to the popliteal artery.

Peripheral Vascular Injury / Compartment Syndrome

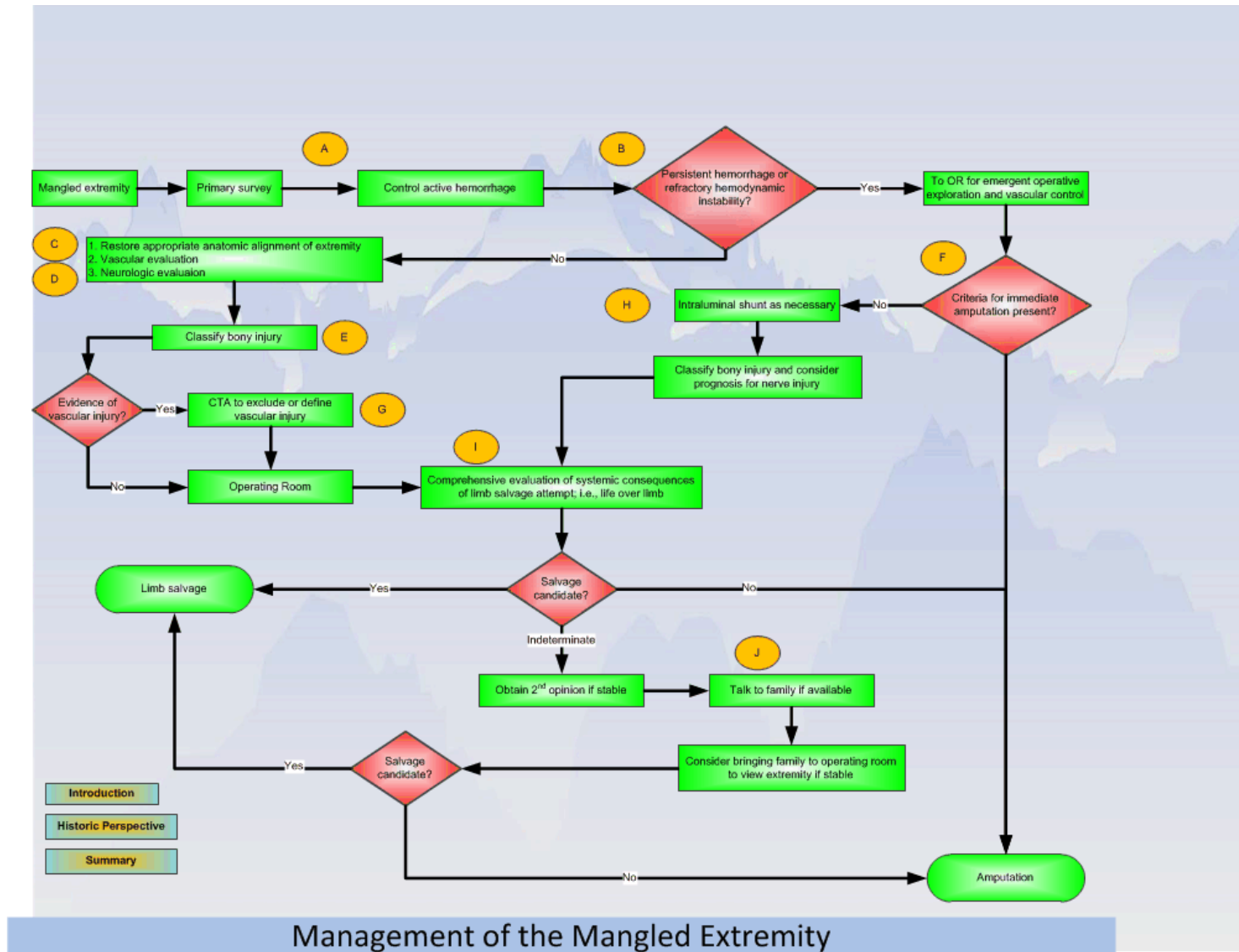
- a. All patients with “hard signs” of vascular injury should be surgically explored
 - i. “Hard signs” of vascular injury include:
 - Pulse deficit
 - Pulsatile bleeding
 - Audible bruit
 - Palpable thrill
 - Expanding hematoma
 - Evidence of regional ischemia (pallor, paresthesia, paralysis, pain out of proportion to exam, poikilothermia)
 - ii. There is NO role for CTA or arteriogram in this setting unless the patient has an associated skeletal injury or shotgun injury
- b. Patients with “soft signs” of vascular injury should be evaluated further with CTA extremity or arteriogram.
 - i. “Soft signs” of vascular injury include:
 - History of moderate hemorrhage
 - Injury (fracture, dislocation, or penetrating wound)
 - Diminished pulses (weakly palpable or Doppler signals only)
 - Peripheral nerve deficit
- c. **Ankle-Brachial Index (ABI)** should be performed in all lower extremity trauma proximal to the ankle (penetrating wounds, femur fractures, knee dislocations, tibial plateau and proximal tib-fib fractures, etc).
- d. **Brachial-Brachial Index (BBI)** should be performed in upper extremity trauma proximal to the wrist (penetrating wounds, humerus fractures, elbow dislocations, etc).
- e. CT angiogram of the extremity should be performed in stable patients with ABI or BBI <0.9 or in those with soft signs of vascular injury.
- f. Patients with CTA findings of vascular injury should be evaluated for surgical or endovascular repair of the injury as soon as possible.
- g. Restoration of perfusion to an extremity with arterial injury should be performed in less than 6 hours in order to maximize limb salvage.
- h. Absence of hard or soft signs of vascular injury reliably excludes surgically significant arterial injury and does not require CTA/arteriography
- i. Fasciotomies of the affected extremity should be performed liberally when there has been prolonged ischemia (>4 -6hrs) or clinical concerns/evidence of compartment syndrome, and in patients with combined arterial and venous injuries.

j. Patients without vascular injury but with high risk musculoskeletal injuries such as severe tibial fractures, crush injuries, and supracondylar humeral fractures in children should have routine serial examinations including measurements of compartment pressures and consideration for prophylactic fasciotomy.

Traumatic injury of an extremity



MANGLED EXTREMITY



Supporting Article:

<http://www.westerntrauma.org/documents/PublishedAlgorithms/WTACriticalDecisionsManagementOfTheMangledExtremity.pdf>

Consulting Services

Consultation Services

Neurosurgery

- a. **No neurosurgical consultation** will be required for patients with a GCS \geq 14, normal CT scan *and* normal state of alertness. Imaging must be reviewed by Trauma Attending & Radiologist.
- b. Indications for CT head
 - i. Any patient with a traumatic mechanism of injury with known or suspected (amnesic) loss of consciousness.
- c. If GCS does not improve to 15 or patient baseline within 8 hours of injury, *or* if state of alertness is abnormal, obtain a neurosurgical consult.
- d. If the clinical picture is obscured by drugs, toxins or alcohol, the patient should undergo CT scan and be followed with neuro checks for 12 to 24 hours.
- e. Indications for Neurosurgery consultation
 - i. Unexplained neurological deficit
 - ii. Deterioration in GCS or state of alertness
 - iii. GCS \leq 13 (head CT scan will also be obtained)
 - iv. Abnormal head CT scan
 - v. Evidence of skull fracture including clinical signs such as CSF leak, raccoon eyes, Battle sign
 - vi. Spine fracture or spinal cord injury (only if on spine call)
 - vii. Evidence of peripheral nerve injury
 - viii. Other patients at discretion of the trauma attending/fellow

Plastic Surgery and Head & Neck Surgery

All simple lacerations are to be managed and repaired by the Trauma Service. For patients sustaining complex lacerations or fractures to the face, the Plastic Surgery Service is to be consulted on all *odd days* of the month and the Head & Neck Service is to be consulted on all *even days* of the month.

Hand Surgery

Hand surgery consult is indicated for upper extremity injuries below the elbow that may require operative intervention. For patients with upper extremity/hand injury being transferred from an outside facility, *early consultation prior to patient arrival* is mandatory to ensure timely availability of required staff and personnel.

Orthopedic Surgery

General Guidelines for Traumatic Orthopedic Injuries

Open Fractures 4/21/2020:

An open fracture occurs when fractured bone is exposed to the external environment through a disruption in the skin and subcutaneous tissue. Prompt identification and treatment of open fractures are required to limit infection and optimize fracture healing.

Antibiotic Treatment:

- Intravenous antibiotics should be administered within one hour of infection based on Gustilo Classification.
 - a. Gustilo Type 1 and 2:
 - i. First-generation Cephalosporin (i.e Cefazolin)
 - <80 kg: 1g IV q 8 hours
 - >80 kg: 2g IV q 8 hours
 - b. Gustilo Type 3:
 - i. First-generation Cephalosporin + Gram negative coverage (i.e Gentamycin: 5mg/kg IV x 1)
 - c. High dose penicillin should be added for severe contamination and concern for clostridia contamination.
 - i. <80 kg: 2 million units IV
 - ii. >80 kg: 4 million units IV

Antibiotic Duration:

- Antibiotics should be administered for no longer than 24 hours after operative intervention.
- In cases with severe contamination, antibiotics can be continued for 72 hours post-surgery.

Tetanus Toxoid Administration:

- Tetanus toxoid should be given in the trauma bay if immunization history is unknown or it has been >10 years since the last Tetanus booster dose.
- For patients with contaminated or dirty wounds with no prior immunization to tetanus: Treat with Tetanus immune globulin (TIG)
 - TIG dose for prophylaxis: 250 IU intramuscular

Operative Intervention:

- Patients with open fracture should be taken to the operating room for irrigation and debridement within 24 hours of initial presentation unless unstable for operative intervention.
- If required, bedside irrigation and debridement must be clearly documented in the EMR by the orthopedic team.

References:

1. ACS TQIP- Best practices in the management of Orthopedic Trauma. November 2015
2. Hoff WS, Bonadies JA, Cachecho R, Dorlac W. East practice management guidelines work group: Update to practice management guidelines for prophylactic antibiotic use in open fractures. J Trauma. 2011;70:751-54.

Gustilo-Anderson Classification of open fractures:

Gustilo classification	Description
Type I	An open fracture with a wound <1 cm long and clean.
Type II	An open fracture with a laceration >1 cm long without extensive soft tissue damage, flaps, or avulsions.
Type III	Massive soft tissue damage, compromised vascularity, severe wound contamination, marked fracture instability.
Type IIIA	Adequate soft tissue coverage of fracture despite extensive soft tissue laceration or flaps, or high-energy trauma irrespective of the size of the wound.
Type IIIB	Extensive soft tissue injury loss with periosteal stripping and bone exposure; usually associated with massive contamination.
Type IIIC	Open fracture associated with arterial injury requiring repair.

Compartment Syndrome

- When the diagnosis of compartment syndrome has been made, the patient must be taken to the operating room immediately for fasciotomies.
- Alternatively, these may be performed in the SICU in cases of hemodynamic instability or when transfer is unsafe.
 - The first procedure includes releasing all compartments and no effort is made to close the wound.
 - The patient will then return to the operating room 2 to 3 days later for delayed closure +/- split thickness skin grafting.
- The threshold to perform fasciotomies in a polytrauma patient with an unreliable physical exam should be low. If you are considering performing a fasciotomy, it is probably wise to do it.

Orthopedic Operative Procedures on Head Injured Patients

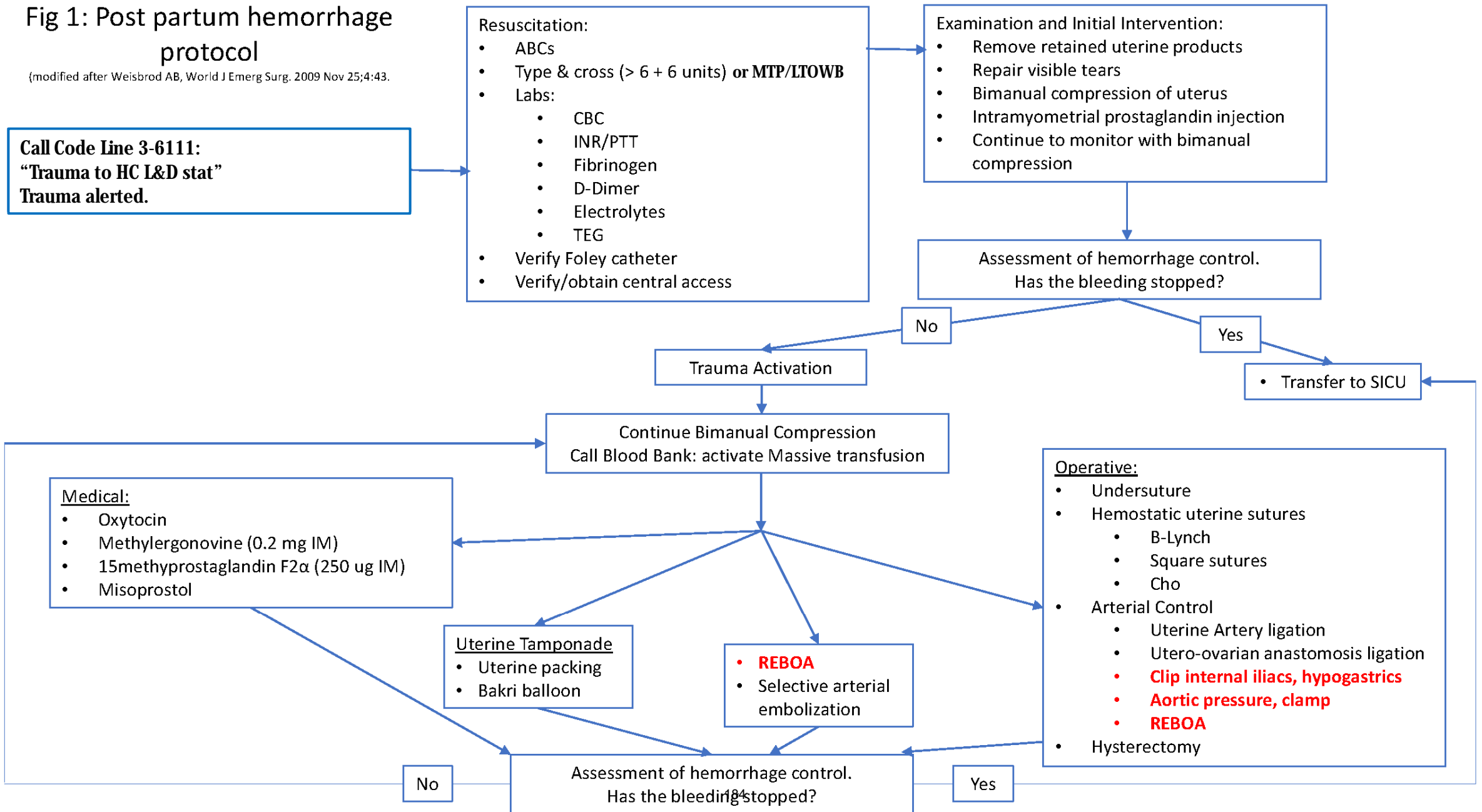
- Trauma patients who have sustained multi-system injury often have many services involved in their treatment. The Trauma Service provides the coordination for decision making and priority setting for the multiple specialties.
- The patient who has sustained both orthopedic and neurologic injury requires a planned approach.
- All patients with open fractures, severe soft tissue injury, open joint lacerations, irreducible dislocations, progressive neurologic or vascular deficits, compartment syndromes, and pelvic fractures requiring fixation to assist in hemorrhagic shock management should be taken to the Operating Room as soon as possible and after approval of the Trauma Attending.
- Every effort should be made to address any issues preventing such patients from going to the operating room in a timely fashion
- When the head injury evaluation determines that the patient is at risk for a secondary brain injury, anesthesia management must be continuously supervised by an attending anesthesiologist experienced in trauma anesthesia.
- Patients with head injury should undergo a postoperative head CT to evaluate for secondary brain injury prior to returning to the SICU.
- When a decision regarding operation is required, the merits and risks of ICP monitoring, the type and techniques of anesthesia, and the routes of fixation will be explored to accomplish the best combination of orthopedic stabilization while maintaining optimal overall patient care.
- If the operative plans (procedure or approximate length of the surgery) change either preoperatively or intraoperatively, the Ortho Service should notify the Trauma Service Fellow or Attending.

Guidelines for Joint Decision-Making - Orthopedic Operative Procedures on Head Injured Patients

Glasgow Coma Scale	CT Results	Non-urgent Orthopedic Injuries	Urgent Orthopedic Injuries
14-15	Normal	Proceed with appropriate fixation	Proceed with appropriate fixation
11-13	Normal but persistent ABNORMAL level of consciousness	Consider repeat CT scan in 12-24h versus Proceed with appropriate fixation after discussion of ICP placement for intra-operative monitoring. Requires discussion by the 3 surgery attendings & anesthesia	ICP placement for intra-operative monitoring
11-15	Abnormal, without evidence of increased ICP	Proceed with appropriate fixation after discussion re: time and potential EBL. Requires discussion by the 3 surgery attendings and anesthesia.	ICP placement for intra-operative monitoring.
11-15	Abnormal, with evidence of increased ICP	Wait 72 hours, then discuss operative procedure based on patient course. Requires discussion by the 3 surgery attendings & anesthesia.	ICP monitoring; attempt rapid I&D, reduction or fasciotomy, possible rapid Ex Fix or pinning. Requires discussion by the 3 surgery attendings & anesthesia.
3-10		Case by case determination by discussion with 3 surgery attendings & anesthesia. (Possible Neurosurgical resident to go to O.R.)	ICP monitoring (Possible Neurosurgical resident to go to O.R.); minimum orthopedic procedures unless unable to tolerate or able to tolerate more intervention

Fig 1: Post partum hemorrhage protocol

{modified after Weisbrod AB, World J Emerg Surg. 2009 Nov 25;4:43.



Service Responsibilities

Tertiary Survey of Trauma Patient

The Tertiary Survey is a thorough head-to-toe physical examination performed on an awake, alert and interactive patient. The goal is to identify any injuries that may have been missed during the primary and secondary surveys due to distracting injuries, altered mental status or patient intoxication. Any gaps present in the patient's medical history should also be filled in at this time. ALL trauma patients are required to undergo this evaluation prior to discharge, and any new findings should undergo further evaluation as needed. The Tertiary Survey should be performed as soon as a patient's mental status permits, so that any new findings do not delay discharge.

The Tertiary Survey form is now available in EPIC as a Smart Text, meant to be incorporated into a new progress note.

The screenshot displays the EPIC 'My Note' interface. At the top, there are tabs for 'Primary', 'Handoff', 'Patient Chart A...', and 'Edit Note'. Below the tabs, the 'My Note' title is followed by 'Bookmark', 'Details', and a share icon. The form includes fields for 'Type: Progress Notes', 'Service: Trauma Surgery', 'Date of Service: 4/19/2017', and '0727'. There is a checkbox for 'Cosign Required' and a 'Case ID' field. A toolbar contains various icons, including a star, bold (B), italic (i), underline (u), link, unlink, and a plus sign. The 'Tertiary Survey' Smart Text option is highlighted with a red arrow. At the bottom, there are buttons for 'Pend', 'Share', 'Sign', and 'Cancel'.

The text highlighted in blue will auto-fill from the patient's EPIC record. Please ensure that these fields (i.e. Past Medical History and Home Medications) are appropriately filled out in EPIC so that the auto-populated data is accurate. Several fields have drop-down boxes – choose the appropriate answer or delete the text and fill in by hand if necessary. Please be as thorough as possible.

Type: Service: Date of Service:

☐ Cosign Required Case ID:

Insert SmartText

UCSD Trauma Tertiary Survey

Date of injury: ***

Mechanism of injury: ***

Injuries Identified on Primary and Secondary Surveys:

1. ***

Past Medical History:
No past medical history on file.

Home Medications:
No prescriptions prior to admission.

Objective Findings

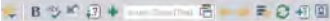
Vital Signs:

Latest Entry	Range (last 24 hours)
Temperature: 99 °F (37.2 °C)	Temp Avg: 98.5 °F (36.9 °C) Min: 97.5 °F (36.4 °C) Max: 99.1 °F (37.3 °C)
Blood pressure (BP): (I) 150/93	BP Min: 107/81 Max: 156/83
Heart Rate: 91	Pulse Avg: 82.2 Min: 68 Max: 94
Respirations: 28	Resp Avg: 22.9 Min: 11 Max: 31
SpO2: 100 %	SpO2 Avg: 99.1 % Min: 96 % Max: 100 %
	No Data Recorded
	No Data Recorded
	No Data Recorded
Pain Score: Patient Sleeping, Respiratory Assessment Done	

Glasgow Coma Scale:
 Eyes: {GCS, EYES:10219}
 Verbal: {GCS, Verbal:10220}
 Motor: {GCS, Motor:10221}
 GCS = ***

Type: Progress Notes Service: Trauma Surgery Date of Service: 4/19/2017 0727 [Bookmark](#)

Design Required Case ID:



Physical Exam

HEENT: (HEENT NORMAL BRIEF:120983)
 Neck: (NECK BRIEF EXAM:15095)
 C Spine: (CSPINE CLEARANCE:15996 "No pain on palpation, flexion, extension, or rotation.", "No stepoffs", "No Neurologic Injury", "No distracting injuries", "No evidence of acute osseous abnormalities on imaging", "Final interpretations of radiographs complete and reports reviewed")
 Chest Wall/Lungs: (CHEST EXAM TRAUMA:15789)
 Cardiac: (HEART EXAM TRAUMA:15792 "regular rate and rhythm, S1 S2 normal, no murmur, click, rub or gallop")
 Abd. (ABDOMEN EXAM TRAUMA:15794 "Abdomen soft, non-tender, BS normal. No masses, organomegaly")
 T & L Spine: (TSPINE CL:15958 "No pain on palpation", "No stepoffs", "No neuro deficits", "Final interpretations of radiographs complete and reports reviewed")
 Posterior Skin: (POSTERIOR SKIN:16000)
 Wounds Present: (WOUND TYPES TRAUMA:15795)
 Wound Infection Suspected: (YES/NO:120090)

Extremities

Left Upper Extremity: (EXTREMITY EXAM:15786)
 Right Upper Extremity: (EXTREMITY EXAM:15786)
 Left Lower Extremity: (EXTREMITY EXAM:15786)
 Right Lower Extremity: (EXTREMITY EXAM:15786)

Neurovascular

Carotid: R (PULSE GRADE:520) L (PULSE GRADE:520)
 Radial: R (PULSE GRADE:520) L (PULSE GRADE:520)
 Posterior Tibial: R (PULSE GRADE:520) L (PULSE GRADE:520)
 Dorsalis Pedis: R (PULSE GRADE:520) L (PULSE GRADE:520)

Motor/Sensory Exam:

Motor: (MOTOR EXAM TRAUMA TERTIARY:15798)
 Sensory: (SENSORY EXAM TRAUMA TERTIARY:15799)
 Ambulation: (AMBULATION TERTIARY TRAUMA:15783)

Imaging Review

Available Imaging Reviewed: (YES/NO/NO:120094)
 Radiologist Final Results Posted and Reviewed: (YES/NO/NO:120094)
 Additional Imaging Indicated: (YES/NO/NO:120090)

Spine Clearance

C Spine Cleared: (YES/NO/NO:120094)
 T-L Spine Cleared: (YES/NO/NO:120094)

History Review

The following portions of the patient's history were reviewed and updated as necessary:

{TRAUMA TERTIARY HISTORY REVIEW:15800}

Assessment/Plan

Certify that the history has been reviewed, and update the assessment and plan as needed to reflect any new findings. Discuss any questions or concerns with the trauma fellow or attending surgeon.

Morning and evening Handoffs/iPASS

- Morning report is at 0645, 7 days a week, in the Acute Care Surgery Conference Room
- Morning report covers the following overnight events
 - o New trauma admissions from overnight. This includes an overview of mechanism, injuries, review of imaging studies, plans and any acute events
 - o New White Surgery admissions from overnight, including the same details listed above
 - o Any acute events occurring in the SICU overnight
 - o Sign out of incoming transfers
- Morning report is attended by the attending surgeon/fellow on both trauma and White Surgery, trauma night float residents, trauma ICU residents and the White Surgery senior resident
- Evening sign out occurs as follows
 - o Trauma attending/fellow on the trauma service and White Surgery service sign out to the on call attending at 1700 Monday-Friday. On the weekend, they will sign out to the on call attending when leaving the premises after rounds.
- Night float residents/extenders working overnight sign out to the daytime trauma floor residents/extenders at 0600 in the ACS Conference room
- Night float residents/extenders working overnight sign out to the daytime White Surgery residents at 0600 in the resident room
- Sign outs follow the iPASS handoff model
 - o I – Illness severity
 - o P – Patient summary
 - o A – Action items
 - o S – Situation awareness and contingency planning
 - o S – Synthesis by receiver



IPASS

BETTER HANDOFFS. SAFER CARE.

TeamSTEPPS™

- Briefs
- Huddles
- Debriefs
- Cross Monitoring
- Advocate & Assert
- Checkback
- Feedback

Verbal Handoff

- Begin with overview of entire service
- Need proper environment – limit interruptions
- Use IPASS mnemonic
- Employ closed loop communication

Written Handoff

- Supplements verbal handoff
- May import elements from EMR
- Keeps information current with updates
- Ongoing assessment
- Plan



Illness Severity

- Stable / Watcher / Unstable

Patient Summary

- Summary statement
- Events leading up to admission
- Hospital course
- Ongoing assessment
- Plan

Action Items

- To-Do List
- Timeline and Ownership

Situation Awareness & Contingency Planning

- Know what's going on
- Plan for what might happen

Synthesis by Receiver

- Receiver summarizes what was heard
- Asks questions
- Restates key action/to do items

Daily SICU Huddle

There is a daily huddle in the SICU between:

- the SICU attending, SICU NP or SICU fellow, and
- the SICU Nurse Manager or Charge Nurse,

The morning huddle must happen every day, preferably by 0900, ideally not later than 1100.

The evening huddle will usually occur 1930-2030.

The huddle can be brief.

Topics to be covered:

1. Patients/families with significant care issues (likely deaths, need for palliative care, organ donation, violent/abusive, Code Pink, Code ECMO, minor patient, etc..)
2. Status of census – especially likelihood of expansion to PACU.
3. Likely transfers out / discharges.
4. Expected transfers in / OR case admits.
5. Any contingencies that might be necessary during shift (VIPs, nursing shortfalls, equipment issues, surge risks, etc...)

The **red logbook** kept at the desk should contain for that day, at a minimum, the names of those present at the daily huddle.

Any issues that cannot be resolved during the Huddle should be escalated to the SICU Nurse Manager and SICU Director.

Brief Operative Note

A brief operative note **MUST** be completed for each operative case, per hospital policy. The note must be completed before the patient is delivered to the PACU. Notes can be completed by residents, fellows or attendings.

Please use the template below, which contains all required data elements.

- 1) Create a new note (Type: Brief Op Note).
- 2) Residents or fellows should click "Cosign Required" and choose the appropriate attending
- 3) Chose the Case ID to correspond with the correct case (click on the magnifying glass icon to choose)
- 4) In the "Insert SmartText" box search select "IP SUR BRIEF OPERATIVE NOTE"
- 5) Fields containing {} are drop-down menus. *** must be filled in by hand.

BRIEF OPERATIVE NOTE

DATE: (will auto-populate)

TIME: (will auto-populate)

PREOPERATIVE DIAGNOSIS: ***

POSTOPERATIVE DIAGNOSIS: ***

PROCEDURE: ***

ATTENDING SURGEON: ***

ASSISTANTS(s): ***

ANESTHESIA: ***

FINDINGS: ***

WOUND CLASSIFICATION: {Wound Class:15022}

WOUND CLOSURE STATUS: {Wound Closure Status:15193}

SPECIMENS: ***

Fluids/Blood Products:

IV Fluids: ***

Blood Products: ***

EBL: ***

Urine Output: ***

COMPLICATIONS: ***

DISPOSITION: ***

Trauma Deaths

(see Reporting Deaths, Complications, and M&M)

- a. As soon as the death of a patient is anticipated, the Howell Service should be consulted if practicable.
- b. For every death, a death packet AND a discharge summary/death note must be completed by the resident involved in the case.
- c. All trauma deaths in the OR are medical examiner's cases. It is important to note the time of death and the surgeon that pronounced the patient. Leave all lines/tubes in place.
- d. **Notify the Medical Examiner's Office** (858-694-2895) of any death based on criteria in death packet
- e. **Until a patient is declared brain dead**, the Trauma Service writes all orders on the patient; Lifesharing is an assistive service only.

M&M CONFERENCES

- The Department of Surgery conducts a weekly Morbidity and Mortality Conference, Wednesday at 0630 at the La Jolla campus.
 - i. Cases will be submitted to the Department M&M if they meet high level triggers including but not limited to unexpected death, unplanned return to the OR, code blue, and significant provider-related errors, as well as any cases that may have significant educational value.
 - ii. Trauma, SCC, Burn, & ACS Faculty and the Division will bear responsibility for submission of cases to the Department M&M, however residents can and should suggest cases that they feel may be appropriate for submission.
 - iii. Once submitted, a date for presentation will be assigned by the Department.
 - iv. The Resident that participated in the care of the patient will present the case using the [SBAR format](#) with 8 – 10 minutes for presentation and 5 – 7 minutes for discussion (max 4 presentations per hour).
 - v. The resident will be responsible for a concise, complication-focused presentation of the patient's evaluation and management and will be responsible for obtaining all pertinent imaging studies (x-rays, CT scans, etc.)
 - vi. Each case should include a "teaching point" at the end, with support from the literature, textbooks, or expert guidelines as appropriate. See residency documentation for more information on the SBAR format.
 - vii. Residents are expected to discuss and review their M&M presentation with the Trauma/Burn/ACS attending for the case *at least 4 days prior* to M&M to ensure accuracy and completeness of data.
- Select Trauma and ACS M&M cases are also reviewed in a monthly "Select Case Review" as an internal process of the Division of Trauma, SCC, Burn, & ACS. These will be presented by the Trauma/ACS Fellow on service for the month.
 - i. Select Case Review cases will be chosen by the faculty and assigned to the Fellow by the trauma program manager and/or ACS Clinical Nurse Coordinator. Only cases with educational potential are presented.
 - ii. Presentations should cover a concise reconstruction of the case and include imaging and Medical Examiner report findings, as above.
 - iii. Cases should be presented in an interactive fashion, with focus on educational opportunities for the students and residents in attendance.

**UC SAN DIEGO- HILLCREST MEDICAL CENTER
DIVISION OF TRAUMA
PROTOCOL AND GUIDELINES**

=====

SUBJECT: Video recording of trauma resuscitations in the Trauma Resuscitation Suite and in the Operating Room.

=====

DEFINITION/PURPOSE: To describe the process for recording resuscitations and the personnel involved and to specify the measures for protection of video recordings and patient confidentiality. The video recordings provide valuable subject material for quality assurance, peer review, and faculty/trainee education.

POLICY: All video recording and review will protect the confidentiality and privacy of the patient. Video recording of trauma resuscitation and the resulting digital video recording are to be done for the purposes of quality assurance review and peer review education. All videos and any resulting information is confidential and protected under California Law Section 1157.7.

SCOPE:

Resuscitation Nurses
Trauma Service Physicians
Trauma Program Staff

EQUIPMENT: Video cameras, digital recording device

Action

1. The video camera will be mounted so that the patient's face cannot be seen on the screen.

Rationale

Camera position will ensure that the patient's face and recognizable features will not be identifiable.

Action

2. Video recorders in the trauma bay are motion activated and will record when there is activity in the trauma bay

Action

3. Digital video recorders will be stored temporarily on a secure server managed by UC San Diego Health

Action

4. The Trauma Coordinator and Attending will select videos for review at educational forums based on the team's educational needs.

Action

5. At the time of a review, any of the quality assurance issues which are identified will be forwarded through the Division of Trauma Quality Assurance process. All materials resulting from this process are to be considered confidential and protected.

Action

6. All video recordings are automatically erased after 30 days. Hard copies of videos will not be stored.

Rationale

Recordings are not permanently retained. Videos are not part of documentation for the trauma registry.

Todd W. Costantini, MD, FACS
Trauma Medical Director

Angela Kilty, RN
Trauma Program Manager

Discharge Planning

- a. Every morning, the Residents and Advanced Practice Providers should review all patients who could be potentially ready for discharge that day. They should discuss with the Trauma Fellow/Attending any details that might be needed for discharge and ensure that all such concerns are addressed so as to facilitate an early, prompt, and safe discharge.
 - i. The following items should be considered prior to discharge:
 - 1. Does the patient need PT/OT evaluation and clearance?
 - 2. Will the patient need home health care, DME or IV medications (antibiotics) following discharge?
 - 3. What is the patient's current living environment and level of supervision and will this be adequate following discharge?
 - 4. Does case management and/or social work need to be involved for assistance in placement, illicit substance/ETOH/violent crime counseling, or arranging post-hospital care needs?
- b. Once the approval for discharge is given, the Case Managers and nursing staff on the units should be notified so that they may assist in the process.
- c. The Resident should also anticipate date of discharge and discharge needs for patients and discuss this with the Fellow/Attending in advance to avoid unforeseen circumstances.
- d. Discharge orders should be written as early as is safe to do so, allowing patients to leave the hospital in a timely fashion.
- e. All labs, imaging studies and PT/OT orders should specify "PENDING DISCHARGE" if the patient's discharge is dependent upon these items.

Trauma Clinic Follow-up

1. Place order for outpatient Trauma Clinic Visit
2. Send Epic In Basket message to Trauma Clinic Staff
 - a. Open Epic In Basket
 - b. Click new message
 - c. Click the magnifying glass to the right of the “To” section

The screenshot shows the Epic In Basket Staff Message interface. At the top, there's a navigation bar with 'Epic' logo and various links like 'Web Links', 'UpToDate', 'Sign My Visits', 'In Basket', 'OR Reports', 'Chart', 'Patient Station', and 'Patient Look'. Below this is a 'Staff Message' header with a 'High Priority' button and a 'Low Priority' button. The main form has fields for 'To:', 'Subject', and 'Patient'. A blue arrow points to the magnifying glass icon next to the 'To:' field. Below these fields is a toolbar with icons for undo, redo, insert smart text, and a zoom slider set to 100%.

- d. Select “Pools”
- e. Type MON SURG GENERAL TRIAGE

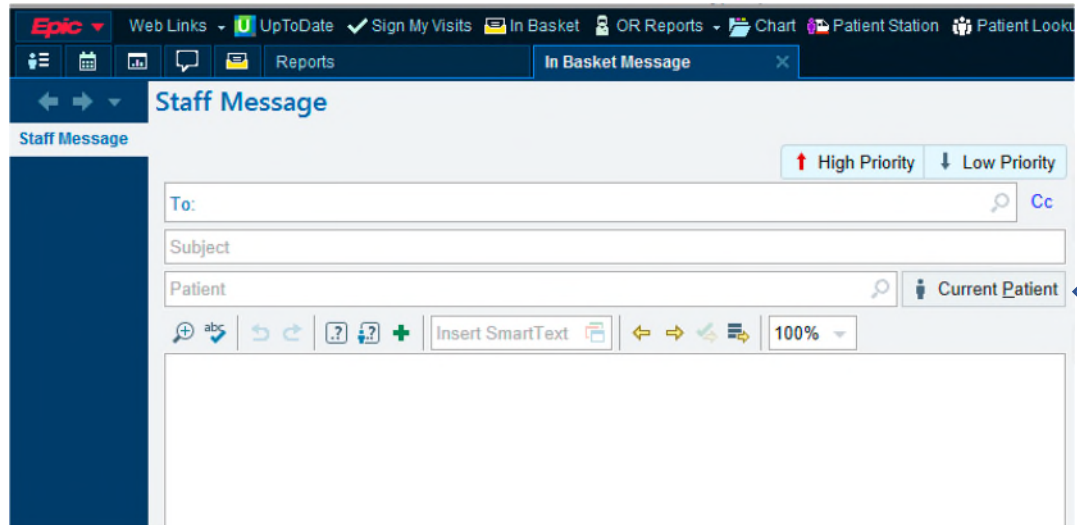
The screenshot shows the 'In Basket Recipients' dialog box. On the left, there are three input fields: 'Individual Recipients', 'Pools', and 'Classes', each with a 'Find' button. A blue arrow points to the 'Pools' field. On the right, there is a 'Search Results' table with columns '%', 'Registry Name', and 'Registry ID'. The table contains four rows: 'MON SURG GENERAL ATTENDING STA...', 'MON SURG GENERAL SCHEDULING', 'MON SURG GENERAL TRIAGE' (highlighted in blue), and 'MON SURG PLASTICS AUTHORIZATION'. Below the table are buttons for '+ Add To' and '+ Add Cc'. At the bottom, there are two tables: 'To Recipients' and 'Cc Recipients'. The 'To Recipients' table has one row with 'P' as the recipient and 'MON SURG GENERAL TR...' as the ID. The 'Cc Recipients' table is empty. At the bottom right, there are buttons for 'Restore', 'Accept', and 'Cancel'.

%	Registry Name	Registry ID
	MON SURG GENERAL ATTENDING STA...	202637
	MON SURG GENERAL SCHEDULING	202643
	MON SURG GENERAL TRIAGE	202645
	MON SURG PLASTICS AUTHORIZATION	202717

Recipient	ID
P	MON SURG GENERAL TR...

Recipient	ID
-----------	----

- f. Hit accept in the bottom right
- g. In the patient section, type MRN or hit the “Current Patient” button if that patient’s chart is open
- h. Type message stating timing for clinic visit (i.e. 2 weeks) and reason for visit (post-op check s/p laparotomy). Please be specific with the reason for visit (especially post-op patients) as this will help limit authorization issues.



- 3. The clinic staff will schedule an appointment time. If done before discharge, this can be given to the patient and documented in the discharge summary
 - a. If patients are expected to be discharged on the weekend, please schedule the clinic appointment during the week prior to anticipated discharge so an appointment can be obtained.
- 4. If there are any questions, call the Trauma Clinic Staff
 - a. Jessica 619-543-7649
 - b. Amanda 619-471-9499

Burns

K. Lund & Browder Burn Area Chart

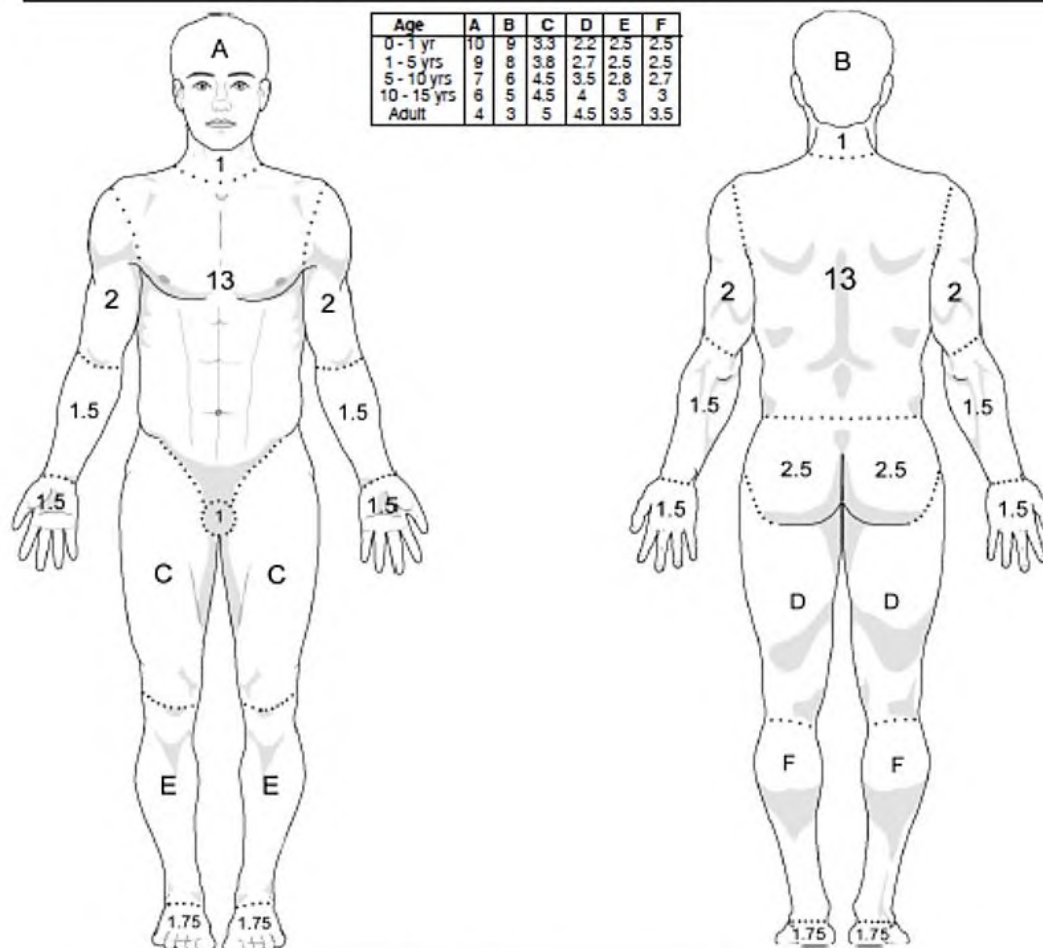
UC San Diego
HEALTH SYSTEM

BURN AREA CHART

Patient Identification

Shade images accordingly: ☐ 2° ☐ 3°

Lund & Browder Chart - estimate to the nearest 10th%											
Area	% 2°	% 3°	Area	% 2°	% 3°	Area	% 2°	% 3°	Area	% 2°	% 3°
Head			R. buttock			RL arm			L thigh		
Neck			L. buttock			LL arm			R leg		
Ant. trunk			Genitalia			R hand			L leg		
Post. trunk			RU arm			L hand			R foot		
			LU arm			R thigh			L foot		
Total % 2° _____ + Total % 3° _____ = Total % Burn _____											



0043(12-06)

Physician Signature/PID#

Date & Time

Admit Time to BICU: _____ am/pm

Dry Weight: _____ kg

TBSA: _____ %

Inhalation Injury? _____ Y / N _____

Pre-Admission Fluids: _____ ml

{Place patient sticker here}

Parkland Formula Calculations (2-4ml x kg x TBSA)

Round numbers to closest 25ml/hr

If patient has inhalation injury and burns add 10% to TBSA to calculate starting rate

If TBSA ≤ 50% (if patient has ONLY inhalation injury calculate Parkland as a 20% TBSA burn):

2ml x _____ kg x _____ TBSA = _____ ml ÷ 2 = _____ ml ÷ 8 = _____ ml/hr starting rate

If TBSA > 50% or patient has electrical injury:

4ml x _____ kg x _____ TBSA = _____ ml ÷ 2 = _____ ml ÷ 8 = _____ ml/hr starting rate

FFP Trigger

6ml x _____ kg x _____ TBSA = _____ ml ÷ 2 = _____ ml ÷ 8 = _____ ml/hr

CRRT Trigger

8ml x _____ kg x _____ TBSA = _____ ml ÷ 2 = _____ ml ÷ 8 = _____ ml/hr

Maintenance IV Fluid Rate = _____ ml/hr

If ≤ 50kg = 100ml/hr

If > 50kg and ≤ 75kg = 125ml/hr

If >75kg and ≤ 100kg = 150ml/hr

If > 100kg = 175 ml/hr

If patient meets FFP Trigger OR Albumin ≤ 2.2 g/dl start FFP gtt @ _____ ml and subtract from LR rate:

LR Rate	FFP Starting Rate
≥ 500 ml/hr	150 ml/hr
≥ 750 ml/hr	250 ml/hr
≥ 1000 ml/hr	300 ml/hr

Goal VS Parameters

HR 60-140

SBP ≥ 90

MAP ≥ 55

CVP ≥ 9

If not within goal parameters **notify MD**

Revised Baux Score

Age + TBSA + (17 if patient has an inhalation injury)
= _____

If patient is ≥ 60 years old and has a Revised Baux Score of ≥ 110; OR any adult patient with Revised Baux ≥ 130; request order for Palliative Care consult for Advanced Care Planning at 48 hours post-burn

Bladder Pressure Monitoring

Start bladder pressure monitoring **q4h** on all patients with **TBSA ≥ 20% or with circumferential trunk burns or with high index of suspicion for increased abdominal pressure.** Connect primed transducer to foley sampling port on insertion and **leave in place** until resuscitation is complete.

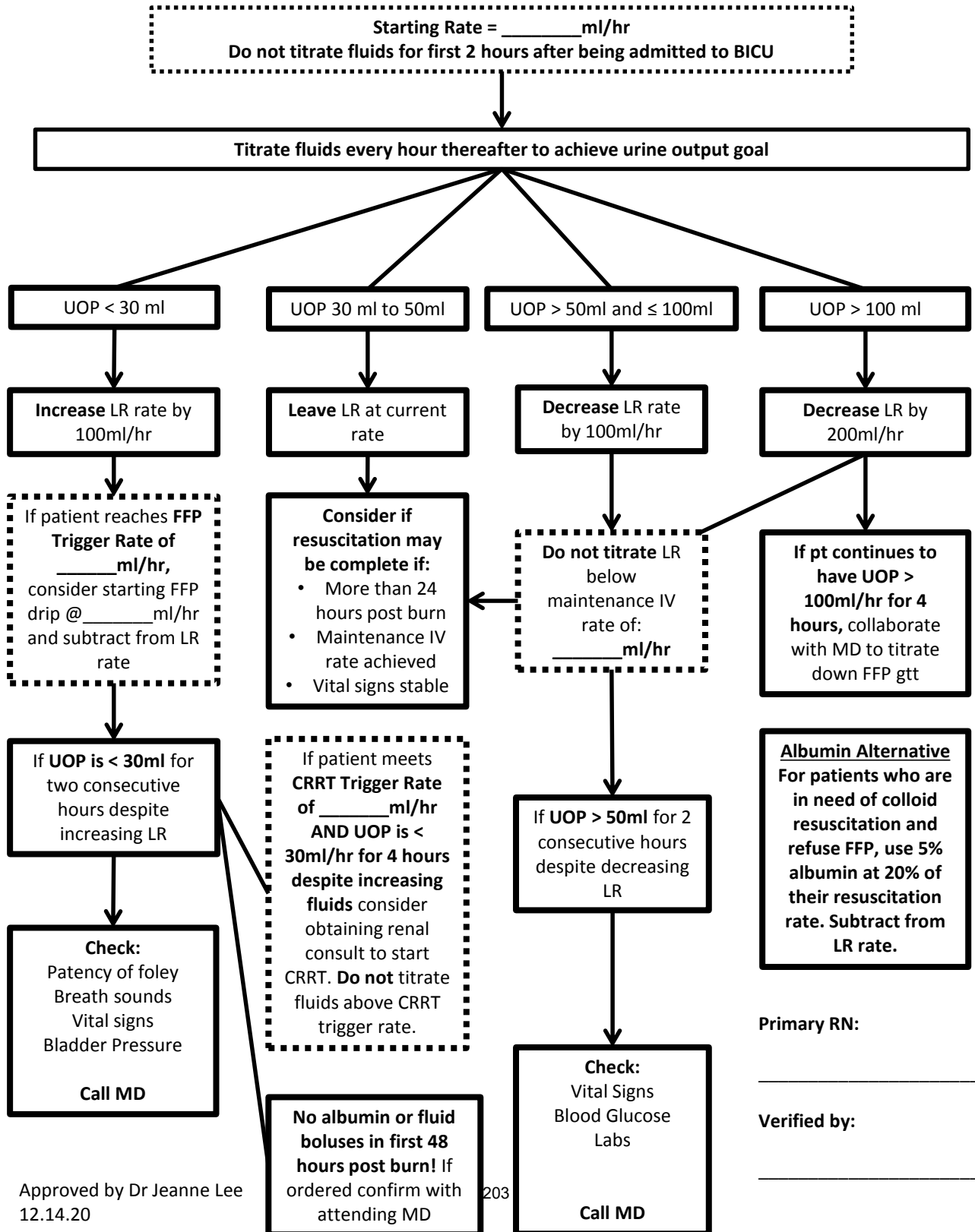
Intra-abdominal HTN > 12mmHg and ≤ 25 mmHg

Abdominal Compartment Syndrome > 25mmHg

with symptoms or organ dysfunction

See GU Guideline of Care for procedure

Nurse Driven Fluid Resuscitation Clinical Pathway



Pediatric Nurse Driven Fluid Resuscitation Clinical Pathway (< 50 kg)

Parkland Formula Calculations $((2-4\text{ml} \times \text{kg} \times \text{TBSA})/2)/8$

Round numbers to closest 10 ml/hr

If patient has inhalation injury add 10% to TBSA to calculate starting rate

If TBSA $\geq 20\%$ and $< 30\%$:

3ml \times _____ kg \times _____ TBSA = _____ ml $\div 2 =$ _____ ml $\div 8 =$ _____ ml/hr starting rate

If TBSA $> 30\%$ and $\leq 50\%$:

4ml \times _____ kg \times _____ TBSA = _____ ml $\div 2 =$ _____ ml $\div 8 =$ _____ ml/hr starting rate

If TBSA $> 50\%$:

LR - 3ml \times _____ kg \times _____ TBSA = _____ ml $\div 2 =$ _____ ml $\div 8 =$ _____ ml/hr

FFP - 1ml \times _____ kg \times _____ TBSA = _____ ml $\div 2 =$ _____ ml $\div 8 =$ _____ ml/hr

(Start FFP as soon as available from blood bank)

FFP Trigger

6ml \times _____ kg \times _____ TBSA = _____ ml $\div 2 =$ _____ ml $\div 8 =$ _____ ml/hr

If patient meets FFP Trigger OR Albumin ≤ 2.2 g/dl discuss with MD starting FFP gtt @ 20% of starting resuscitation rate. Subtract FFP from LR rate.

Max LR Resuscitation Rate

8ml \times _____ kg \times _____ TBSA = _____ ml $\div 2 =$ _____ ml $\div 8 =$ _____ ml/hr

Highlight appropriate line in the chart below based on the patient's age.

Notify MD if vital signs are outside of normal ranges listed.

Age	Awake HR (beats/min)		SBP (mm Hg)		DBP (mm Hg)		MAP (mm Hg)		RR (Breaths/min)	
	Min	Max	Min	Max	Min	Max	Min	Max	Min	Max
< 1 yo	100	190	72	104	37	56	50	62	30	53
1 to 2 yo	98	140	86	106	42	63	49	62	22	37
3 to 5 yo	80	120	89	112	46	72	58	69	20	28
6 to 9 yo	75	118	97	115	57	76	66	79	18	25
10 to 11 yo	75	118	102	120	61	80	?	?	18	25
12 to 15 yo	60	100	110	131	64	83	73	84	12	20

Admit Time to BICU: _____ am/pm

Dry Weight: _____ kg

TBSA: _____ %

{Place patient sticker here}

Inhalation Injury? _____ Y / N

Pre-Admission Fluids: _____ ml

Broselow color: _____

Maintenance IV Fluid Rate = _____ ml/hr

- **10 kg and under**: Receive D5LR at maintenance rate in addition to their resuscitation fluids(LR) until discontinued by MD
- **>10kg and <30kg**: Discuss if MIVF are needed with MD
- **>30kg**: Do not start MIVF. Resuscitation fluids (LR) should not be titrated below MIVF rate until discontinued by MD

Bladder Pressure Monitoring

Start bladder pressure monitoring **q4h** on all patients with **TBSA $\geq 20\%$ or with circumferential trunk burns or with high index of suspicion for increased abdominal pressure.** Connect primed transducer to foley sampling port on insertion and **leave in place** until resuscitation is complete.

Use 1ml/kg of fluid to measure

Intra-abdominal HTN $> 12\text{mmHg}$ and $\leq 25\text{ mmHg}$

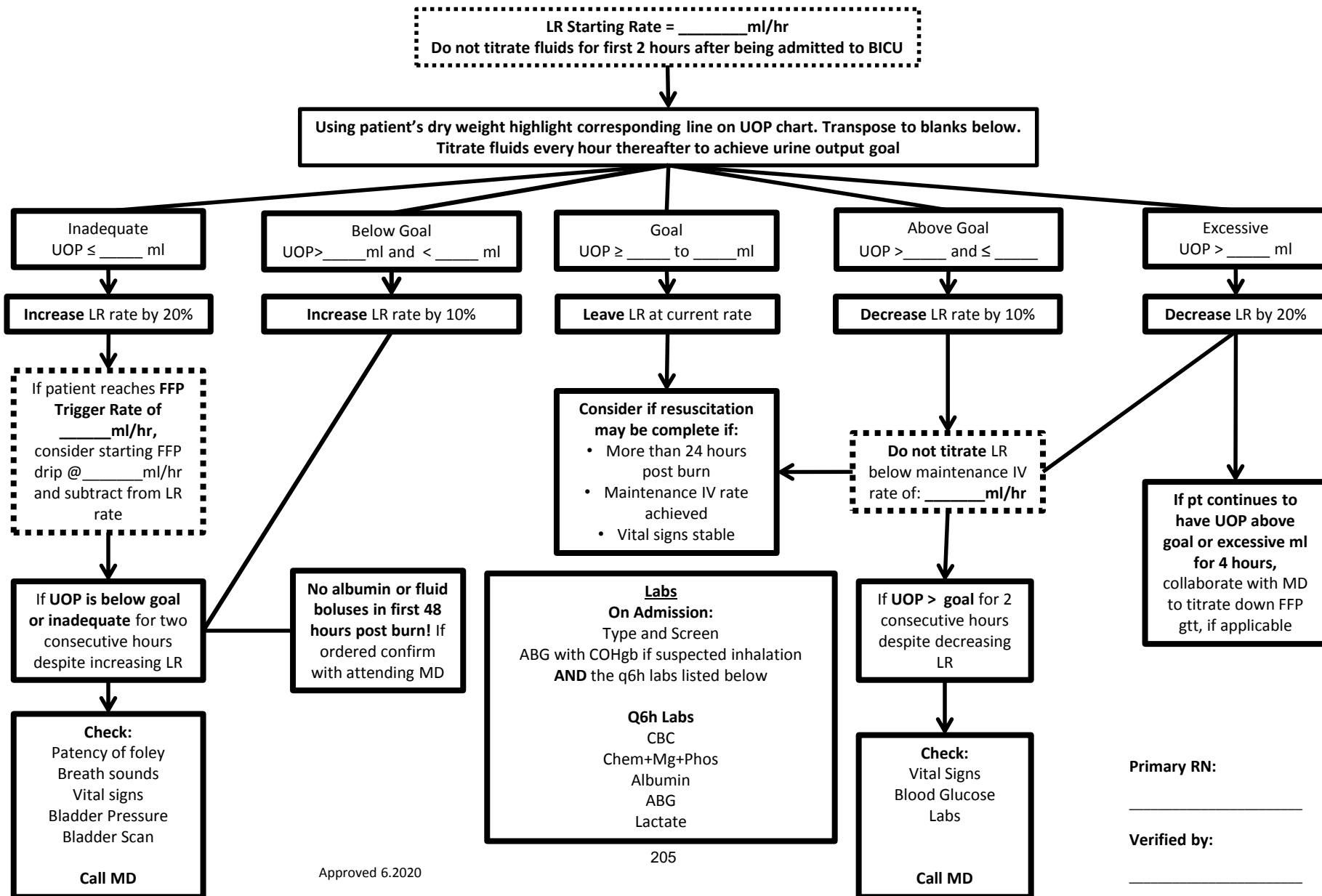
Abdominal Compartment Syndrome $> 25\text{mmHg}$ with symptoms or organ dysfunction

See GU Guideline of Care for procedure

FFP Starting Rate = 20% of starting resuscitation fluid rate

- Starting LR rate = _____ $\times 0.2 =$ _____ ml/hr FFP starting rate

Take starting LR rate and multiply by 0.2 to get FFP starting rate. Subtract from resuscitation fluids when FFP is initiated.

Pediatric Nurse Driven Fluid Resuscitation Clinical Pathway

Pediatric Nurse Driven Burn Resuscitation Pathway

Weight Based Urine Output and Maintenance IV Fluid Charts

Weight (kg)	Inadequate (ml/kg/hr)	Below Goal (ml/kg/hr)	Goal (ml/kg/hr)	Above Goal (ml/kg/hr)	Excessive (ml/kg/hr)
0 to 10	≤0.5	> 0.5 and <1	≥1 to 1.2	>1.2 and ≤ 1.5	>1.5

Weight (kg)	Inadequate (ml/hr)	Below Goal (ml/hr)	Goal (ml/hr)	Above Goal (ml/hr)	Excessive (ml/hr)	MIVF rate (ml/hr)
1	0 to 0.5	>0.5 to <1	≥ 1 to 1.2	>1.2 to ≤1.5	>1.5	4
2	0 to 1	>1 to <2	≥ 2 to 2.4	>2.4 to ≤3	>3	8
3	0 to 1.5	>1.5 to <3	≥ 3 to 3.6	>3.6 to ≤4.5	>4.5	12
4	0 to 2	>2 to <4	≥ 4 to 4.8	>4.8 to ≤6	>6	16
5	0 to 2.5	>2.5 to <5	≥ 5 to 6	>6 to ≤7.5	>7.5	20
6	0 to 3	>3 to <6	≥ 6 to 7.2	>7.2 to ≤9	>9	24
7	0 to 3.5	>3.5 to <7	≥ 7 to 8.4	>8.4 to ≤10.5	>10.5	28
8	0 to 4	>4 to <8	≥ 8 to 9.6	>9.6 to ≤12	>12	32
9	0 to 4.5	>4.5 to <9	≥ 9 to 10.8	>10.8 to ≤13.5	>13.5	36
10	0 to 5	>5 to <10	≥ 10 to 12	>12 to ≤15	>15	40

Weight kg	Inadequate (ml/kg/hr)	Below Goal (ml/kg/hr)	Goal (ml/kg/hr)	Above Goal (ml/kg/hr)	Excessive (ml/kg/hr)
11 to 30	≤0.5	> 0.5 and <1	≥1 to 1.1	>1.1 and ≤ 1.2	>1.2

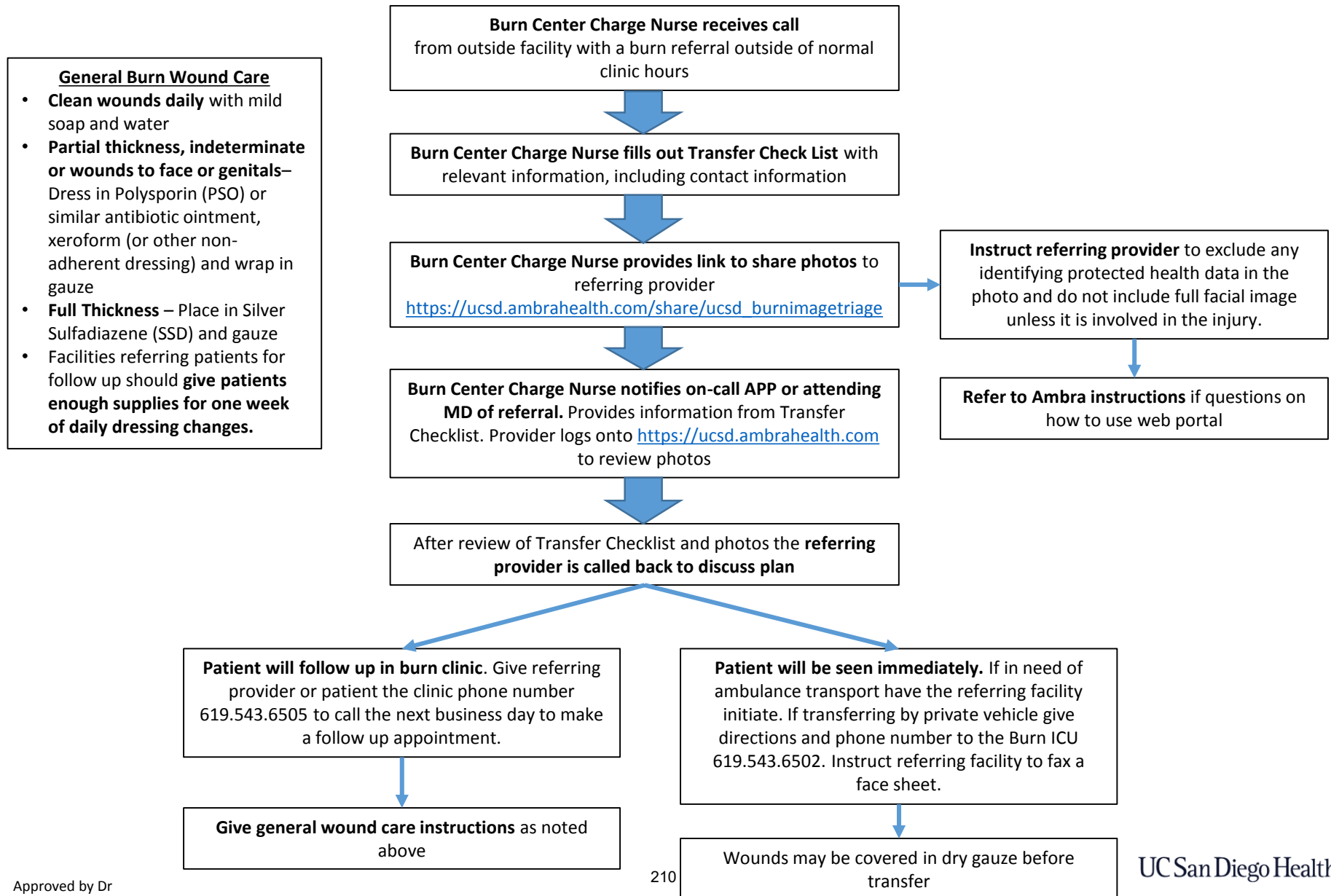
Weight (kg)	Inadequate (ml/hr)	Below Goal (ml/hr)	Goal (ml/hr)	Above Goal (ml/hr)	Excessive (ml/hr)	MIVF rate (ml/hr)
11	0 to ≤6	>6 to <11	≥11 to 12	>12 to ≤13	>13	42
12	0 to ≤6	>6 to <12	≥12 to 13	>13 to ≤14	>14	44
13	0 to ≤7	>7 to <13	≥13 to 14	>14 to ≤16	>16	46
14	0 to ≤7	>7 to <14	≥14 to 15	>15 to ≤17	>17	48
15	0 to ≤8	>8 to <15	≥15 to 17	>17 to ≤18	>18	50
16	0 to ≤8	>8 to <16	≥16 to 18	>18 to ≤19	>19	52
17	0 to ≤9	>9 to <17	≥17 to 19	>19 to ≤20	>20	54
18	0 to ≤9	>9 to <18	≥18 to 20	>20 to ≤22	>22	56
19	0 to ≤10	>10 to <19	≥19 to 21	>21 to ≤23	>23	58
20	0 to ≤10	>10 to <20	≥20 to 22	>22 to ≤24	>24	60
21	0 to ≤11	>11 to <21	≥21 to 23	>23 to ≤25	>25	61
22	0 to ≤11	>11 to <22	≥22 to 24	>24 to ≤26	>26	62
23	0 to ≤12	>12 to <23	≥23 to 25	>25 to ≤28	>28	63
24	0 to ≤12	>12 to <24	≥24 to 26	>26 to ≤29	>29	64
25	0 to ≤13	>13 to <25	≥25 to 28	>28 to ≤30	>30	65
26	0 to ≤13	>13 to <26	≥26 to 29	>29 to ≤31	>31	66
27	0 to ≤14	>14 to <27	≥27 to 30	>30 to ≤32	>32	67
28	0 to ≤14	>14 to <28	≥28 to 31	>31 to ≤34	>34	68
29	0 to ≤15	>15 to <29	≥29 to 32	>32 to ≤35	>35	69
30	0 to ≤15	>15 to <30	≥30 to 33	>33 to ≤36	>36	70

Weight (kg)	Inadequate (ml/kg/hr)	Below Goal (ml/kg/hr)	Goal (ml/kg/hr)	Above Goal (ml/kg/hr)	Excessive (ml/kg/hr)
31 to 50	≤0.3	> 0.3 and <0.5	≥0.5 to 1	>1 and ≤ 1.2	>1.2

Weight (kg)	Inadequate (ml/hr)	Below Goal (ml/hr)	Goal (ml/hr)	Above Goal (ml/hr)	Excessive (ml/hr)	MIVF rate (ml/hr)
31	0 to ≤9	>9 to <16	>16 to 31	>31 and ≤37	>37	71
32	0 to ≤10	>10 to <16	>16 to 32	>32 and ≤38	>38	72
33	0 to ≤10	>10 to <17	>17 to 33	>33 and ≤40	>40	73
34	0 to ≤10	>10 to <17	>17 to 34	>34 and ≤41	>41	74
35	0 to ≤11	>11 to <18	>18 to 35	>35 and ≤42	>42	75
36	0 to ≤11	>11 to <18	>18 to 36	>36 and ≤43	>43	76
37	0 to ≤11	>11 to <19	>19 to 37	>37 and ≤44	>44	77
38	0 to ≤12	>12 to <19	>19 to 38	>38 and ≤46	>46	78
39	0 to ≤12	>12 to <20	>20 to 39	>39 and ≤47	>47	79
40	0 to ≤12	>12 to <20	>20 to 40	>40 and ≤48	>48	80
41	0 to ≤12	>12 to <21	>21 to 41	>41 and ≤49	>49	81
42	0 to ≤13	>13 to <21	>21 to 42	>42 and ≤50	>50	82
43	0 to ≤13	>13 to <22	>22 to 43	>43 and ≤52	>52	83
44	0 to ≤13	>13 to <22	>22 to 44	>44 and ≤53	>53	84
45	0 to ≤14	>14 to <23	>23 to 45	>45 and ≤54	>54	85
46	0 to ≤14	>14 to <23	>23 to 46	>46 and ≤55	>55	86
47	0 to ≤14	>14 to <24	>24 to 47	>47 and ≤56	>56	87
48	0 to ≤14	>14 to <24	>24 to 48	>48 and ≤58	>58	88
49	0 to ≤15	>15 to <25	>25 to 49	>49 and ≤59	>59	89
50	0 to ≤15	>15 to <25	>25 to 50	>50 and ≤60	>60	90

BURN ASSIST (Acute Sub-Specialty Imaging Supported Triage)

Photo Triage Pathway

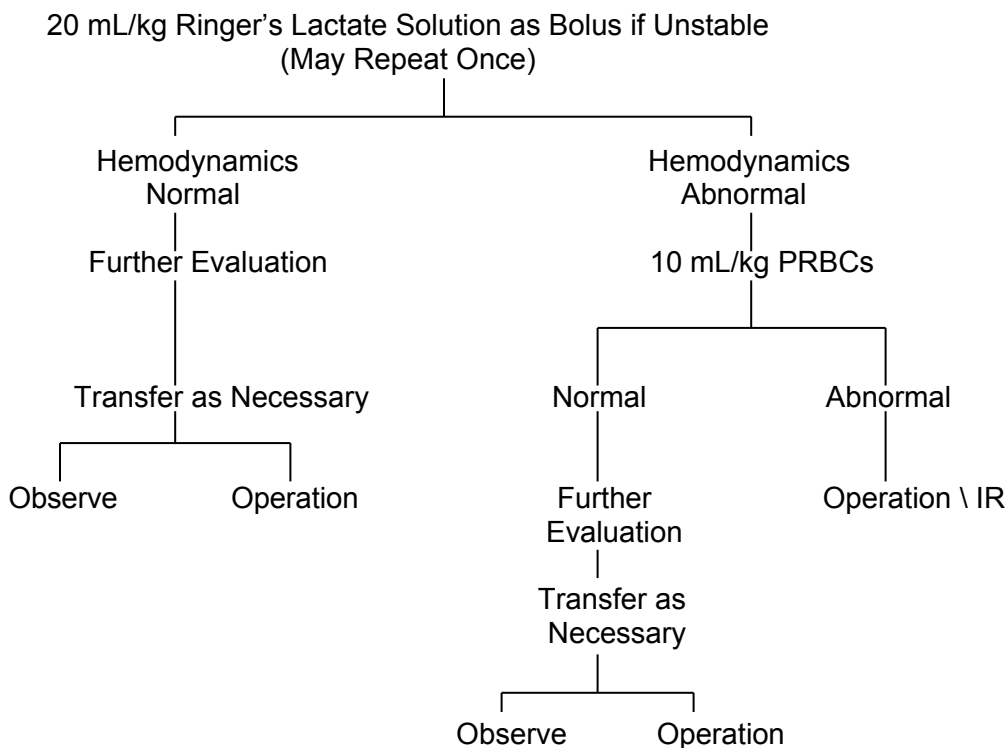


Pediatric Trauma

Pediatric Trauma

Pediatric Patient with Normal and Abnormal Hemodynamics

Surgical Consultation



Approach to the Child with Multiple Injuries

1) Airway:

- Open airway with modified jaw thrust while maintaining manual in-line cervical spine stabilization.
- Clear oropharynx with rigid suction device and pediatric Magill forceps as indicated.
- Maintain airway patency using appropriate suction device and oropharyngeal airway as necessary.
- If child is unresponsive or has signs of respiratory failure, intubate while holding cricoid pressure.
 - Emergency airway if necessary. Note: children aged 8 or less should not undergo cricothyroidotomy (needle cricothyroidotomy and jet ventilation preferred).

2) Breathing:

- Administer 100% oxygen via nonrebreather mask if child is awake and breathes spontaneously.
- Hyperventilate with 100% oxygen using bag-valve mask if child has altered mental status or respiratory distress.

- 3) Circulation:
 - a. Initiate CPR and control external bleeding as indicated. The pediatric crash cart with Broselow tape and age appropriate equipment is next to the main trauma bay.
 - b. Examine chest for tension/open pneumothorax; treat if found.
 - c. Establish venous access; obtain type and crossmatch.
 - d. Rapidly infuse 20mL/kg isotonic crystalloid solution if signs of inadequate systemic perfusion are present.
 - i. Repeat once if patient remains unstable, then proceed to blood transfusion if further resuscitation is required.
 - e. Initiate massive transfusion protocol early if patient unstable. Bolus 10-20 mL/kg PRBCs initially, then repeat as needed along with FFP in 1:1 ratio.
- 4) Disability:
 - a. Immobilize neck with semirigid collar or head immobilizer and tape.
- 5) Exposure \ Environment:
 - a. Remove clothes and proceed with full examination as per adult protocol.
 - b. Warm room to prevent heat loss.
- 6) Insert nasal or orogastric tube and decompress stomach if intubation was necessary.
- 7) Workup with CXR, PXR, FAST, additional imaging as per adult protocol. Rapid identification of life-threatening injuries is critical.
- 8) Ensure that *pediatric trauma surgeon* has been notified (see below)

Transfer Considerations

UCSD is not a pediatric trauma center. Patients aged 14 and younger are considered pediatric age. If you are receiving a pediatric trauma, it may be for the following reasons:

1. Rady Children's Hospital will occasionally be on age specific bypass (if there are limited beds, they are reserved for the youngest patients.)
2. The pediatric patient is in extremis and cannot make it to Rady Children's Hospital
3. If a parent is involved in a trauma with the child, the parent may refuse transport of the child to Rady's and the child will be brought with the parent to UCSD. This should not happen routinely but only if the parents refuse to be separated.
4. The child also has a burn injury.

Note: If you treat a pediatric trauma patient, work them up as appropriate and then the fellow or attending **MUST** call Rady Children's Hospital and ask that the pediatric trauma surgeon be paged. Notify the pediatric trauma surgeon that you have a pediatric trauma patient and he/she will advise whether the patient can stay at UCSD or if the patient should be transferred to Rady's. You need to document the name of the pediatric trauma surgeon that you discussed the case with.

If a pediatric patient is admitted, they must be admitted to a floor with pediatric capabilities. These include the Burn ICU, the Surgical ICU, or the burn floor. If admitting to the ICU, consult the Pediatric Anesthesia Critical Care Attending on call for a pediatrics consult.

Child Abuse Screening, Assessment, and Reporting – Trauma Team Guidelines:

UCSD Abuse MCP; policy number: UCSDHP 305.4, should be referred to for additional details of the complete policy.

https://mcpolicy.ucsd.edu/NewMCPFile/305-4_2017_12_4%20-%20final.pdf

Policy:

- Mandated Reporters at all points of entry to the health system must comply with the reporting obligations imposed by federal and state law.
- Reporting is mandated for any person who reasonably believes he or she has observed murder, rape, and certain lewd or lascivious acts where the victim is a child under the age of 14 years. A Peace officer must be notified of the potential crime. Reporting is mandated whether or not the witness is a mandated reporter and regardless of his or her affiliation with UCSDH. Violations of this obligation may result in criminal penalties.
- Effectiveness in such matters is predicated upon a sound team effort concept with standard monitoring and follow-up methods. The statutes are explicit as to professional and institutional responsibility therefore, awareness and compliance are mandatory.

In general if abuse is suspected, ***no matter the age of the patient***, Social Work must be contacted, you must document your findings. They will help with the process of filing a report.

Procedure:

1. Risk Assessment (any of the following)
 - a. <18yo and >65yo
 - b. Dependent: physical or cognitive disability
 - c. Inappropriate affect
 - d. Bruises or scratches of varying stages of healing
 - e. Changes in the injury story
 - f. Lack of adult presence while hospitalized
 - g. Observation of caregiver impairment or inability to comprehend care instructions.
2. Physical Assessment
 - a. Scald burn with clear immersion lines; no splash marks or mirror image
 - b. Scald burns involving perineum, genitalia, buttocks
 - c. Other signs of abuse: bruises, welts, fractures

- d. Injury/burns appear older than reported.
 - e. History of multiple/recurrent injuries
3. Action/Reporting
- a. Charge RN and attending review
 - b. *Notify Social Work (SW) immediately***
 - c. Contact Chadwick Group for review of pediatric cases reported to Child Welfare Services (CWS)
 - d. Document findings in writing and with photographs
 - e. If telephone report made to CWS a written report must be sent within 2 working days
 - f. Inform family of report filed with CWS (Security to be present as needed)
 - g. Notify Security you are placing patient in a protective hold
 - h. If child is placed on a CWS hold, they are restricted from leaving the unit
 - i. Report any new findings to CWS
 - j. CWS will notify Police Department as needed.
4. Patient Care
- a. Attempt to establish therapeutic alliance with family
 - b. Inform family of all decisions
 - c. Obtain history
 - d. Assess for substance abuse
 - e. Support Family and teach caretaking skills
 - f. Establish discharge plan and follow-up requirements
 - g. Record names and phone numbers of visitors
 - h. Continue Assessment including, skeletal survey, sexual abuse, history of previous injuries to patient or siblings
 - i. Admit to Burn Care,
 - i. For any trauma/non-burn patient <15, contact Rady's Trauma surgeon on-call to discuss transfer of care***
 - j. Observe and document patient/family interactions
 - k. Document progress notes and photos for child advocacy/PD for possible court presentation
 - l. Consult with Social Worker.
- Contact social work to assist with this process. All the details of the policy for suspected abuse is outlined in a detailed manner under the UCSD Abuse MCP,
[https://mcpolicy.ucsd.edu/NewMCPFile/305-4 2017 12 4%20-%20final.pdf](https://mcpolicy.ucsd.edu/NewMCPFile/305-4%202017%2012%204%20-%20final.pdf)

Classification of Hemorrhagic Shock in Pediatric Trauma Patients Based on Systemic Signs

	Class I	Class II	Class III	Class IV
Blood Loss	Very mild hemorrhage ($<15\%$ blood volume loss)	Mild Hemorrhage ($15\%-25\%$ blood volume loss)	Moderate Hemorrhage ($26\%-39\%$ blood volume loss)	Severe Hemorrhage ($\geq 40\%$ blood volume loss)
Cardiovascular	Heart rate normal or mildly increased Normal pulses	Tachycardia Peripheral Pulses may be diminished	Significant tachycardia Thready peripheral pulses	Severe tachycardia Thready central pulses
Respiratory	Rate normal	Tachypnea	Moderate tachypnea	Severe tachypnea
Central Nervous System	Slightly anxious	Irritable, confused	Irritable or lethargic	Lethargic
Skin	Warm, pink Capillary refill brisk	Cool extremities, mottling Delayed capillary refill	Cool extremities, mottling, or pallor Prolonged capillary refill	Cold extremities, pallor, or cyanosis
Kidneys	Normal urine output	Oliguria, increased specific gravity	Oliguria, increased BUN	Anuria

Modified from American College of Surgeons. *Advanced Trauma Life Support Course*. 4th ed. Chicago, Ill; American College of Surgeons; 1992, and Fleisher GR, Ludwig S. *Textbook of Pediatric Emergency Medicine*. 2nd ed. Baltimore, Md: Williams & Wilkins; 1998.

Reproduced with permission from Soud T, Pieper P, Hazinski MF. Pediatric Trauma. In: Hazinski, MF, ed. *Nursing Care of the Critically Ill Child*. 2nd ed. ST. Louis, Mo: Mosby Year Book; 1992.

Drugs Used in Pediatric Advanced Life Support[#]

Drug	Dosage (Pediatric)	Remarks
Adenosine	0.1-0.2 mg/kg Maximum single dose: 12 mg	Rapid IV bolus
Amiodarone (SVT, VT with pulses)	5 mg/kg IV/IO <i>load</i> over 20 to 60 minutes (max 300mg)	Repeat to daily max 15 mg/kg (2.2g in adolescents)
Amiodarone (VF, pulseless VT)	5 mg/kg IV/IO bolus (max 300 mg) May repeat up to 2 times for refractory VF/pulseless VT	Repeat to daily max 15 mg/kg (2.2g in adolescents)
Atropine sulfate*	0.02 mg/kg IV/IO (may repeat once in 3-5 minutes)	Minimum dose: 0.1 mg Maximum single dose: 0.5 mg in child, 1.0 mg in adolescent
Calcium chloride 10%	20 mg/kg IV/IO (repeat prn)	Give slowly.
Calcium gluconate	60 mg/kg IV/IO (repeat prn)	Give slowly.
Dobutamine hydrochloride	2-20 µg/kg per min	Titrate to desired effect
Dopamine hydrochloride	2-20 µg/kg per min	α-Adrenergic action dominates at ≥ 15-20 µg/kg per min.
Epinephrine for bradycardia*	IV/IO: 0.01 mg/kg (1:10,000, 0.1 mL/kg) ET: 0.1 mg/kg (1:1000, 0.1 mL/kg) (may repeat every 3-5 minutes)	
Epinephrine for asystolic or pulseless arrest*	First dose: IV/IO: 0.01 mg/kg (1:10,000, 0.1 mL/kg) ET: 0.1 mg/kg (1:1000, 0.1 mL/kg) IV/IO doses as high as 0.2 mg/kg of 1:1000 may be effective. <ul style="list-style-type: none"> Repeat every 3-5 min until ROSC 	
Epinephrine infusion	0.1 - 1 µg/kg per min Higher infusion dose used if asystole present	Titrate to desired effect Preferred vasopressor in pediatrics
Etomidate	0.2 – 0.4 mg/kg IV/IO	Infuse over 30 –60 seconds (max 20 mg) Lasts 10 – 15 minutes
Lidocaine*	1 mg/kg IV/IO bolus 2–3 mg/kg ETT if no IV present	For VF, pulseless VT or wide-complex tachycardia with pulses Consider cardiology consult
Lidocaine infusion	20-50 µg/kg per min	Repeat bolus if infusion initiated > 15 minutes after initial bolus

Naloxone*	0.1 mg/kg IV/IO/IM/subQ (max 2 mg)	Repeat prn
Norepinephrine	0.1 – 2 µg/kg per min	Titrate to desired effect
Sodium bicarbonate	1 mEq/kg IV/IO	Infuse slowly and only if ventilation is adequate
Vasopressin	0.0002 to 0.002 unit/kg per minute	Titrate to effect

* For ET administration dilute medication with normal saline to a volume of 3 to 5 mL and follow with several positive-pressure ventilations.

#Call pharmacy code pager immediately for all pediatric codes or major trauma resuscitations

Geriatric Trauma

G-60/ACS/TQIP Geriatric Protocol

Trauma Patients ≥ 65 or < 65 with preexisting End-stage organ failure (CHF, ERSD, Cirrhosis with MELD > 10 , COPD):

Within the first 24 hours:

- | | | | | |
|----|--|--|-----------------------------------|---|
| A. | Identify
Health Care
Proxy (HCP) | Identify and acquire
Advanced Directive/POLST | Review and clarify
Code status | |
| B. | Identify
extent of
injuries | Determine
pre-trauma
functional status | Complete prognostic
assessment | Provide update
to patient and/or
Family/proxy |

Obtain a FRAILTY SCORE

Table 6. 5-Item FRAIL Scale

F: Fatigue	Does the patient fatigue or get exhausted easily?
R: Resistance	Can the patient walk up one flight of stairs independently?
A: Ambulation	Can the patient walk one block (1/4 mile)?
I: Illnesses	Does the patient have five or more illnesses (comorbidities)?
L: Loss of weight	Has the patient lost weight (5 to 10 percent) over the last six months to one year?

Scoring

- Three or more "Yes" answers indicates possible frailty
- One to two "Yes" answers indicates possible pre-frailty

Source: Abellan van Kan G, Rolland Y, Bergman H, et al. The I.A.N.A. Task Force on frailty assessment of older people in clinical practice. *J Nutr Health Aging*. 2008;12:29-37. Used with permission.

C. Reconcile Home Medications

- Continue Beta Blocker if no hypotension
- Continue Statins
- Adjust medication for renal function
- Continue meds with withdrawal potential
- D/C nonessential meds
- Reference Beers Criteria

D. Analgesia

- Limit opiates
- Avoid benzos
- Consider Epidural, block

E. Mentation

- Assess baseline
- Address delirium
 - Reinforce sleep-wake cycle
 - Early mobilization
 - Consult PT/OT for all patients:
 - with FRAILITY SCORE ≥ 3
 - presenting after fall
 - Ambulation w/in 48 hours of admission
 - CPT, Incentive Spirometry
 - Aspiration assessment
 - Bowel Regimen
 - Daily documentation of skin integrity

Trauma Patients ≥ 65 with preexisting End-stage organ failure (CHF, ERSD, Cirrhosis with MELD >10 , COPD) and patients with FRAILITY SCORE ≥ 3 :

- Geriatric Service Consultation

Within 72 hours of admission:

Trauma Patients :

- ≥ 65 admitted to the SICU (TBI, Spinal Cord injury, polytrauma, CVA, MI...)
- ≥ 65 with Multiple rib fractures, polytrauma, requiring any surgery
- ≥ 65 with **FRAILITY SCORE ≥ 3**
- <65 with preexisting End-stage organ failure (CHF, ERSD, Cirrhosis with MELD >10 , COPD) with **FRAILITY SCORE ≥ 3**
 1. Goals of Care conversation
 - HCP identified
 - Existing ACP documentation reviewed
 - Prognosis discussed
 - Code Status Clarified
 - Offer Social Work, Pastoral Services
 2. Document updated Code status
 3. If not Full Code or if time limited trial established, complete a POLST
 - Revisit with any change in status
 - 3 Copies: delivered to patient/HCP, PMD, chart

Indications for Palliative Care consultation:

- By Patient or Family request
- Patient/HCP wishes do not align with recommendations

- Time limited trial is established
- Prognosis is uncertain
- TBI with GCS ≤ 12 , para/quadriplegia, amputation
- Hospice patient with Full Code status

Documentation of Advanced Care Planning:

- All advanced care planning should be documented in the ACP tab
 - Set note type to “Goals of Care”
 - Major ACP conversations should be documented using the *.advancedcareplanning* template.
 - Document time duration of discussion

Billing of Advanced Care Planning:

- Billing Surgeon must be present
 - Bill Critical Care time for patient/HCP/family conversations. This time is admissible at full critical care value, if you are billing critical care that day.
 - Write separate note documenting time duration
 - Reference in Progress Note
 - Add time to other critical care time/progress note total
 - If not billing critical care (i.e. Trauma Attg), can bill time spent discussing goals of care as CPT **codes** 99497 for the first half hour and then 99498 for time to follow.
 - 99497 may be billed for conversations ≥ 16 minutes

Outcomes research:

- Geriatric Trauma Outcome Score and Frailty Score will be capture for all patients ≥ 65

GTO Score= $\text{age} + (2.5 \times \text{ISS}) + 22$ (if given PRBCs)

References:

1. ACS TQIP Palliative Care Best Practice Guideline.
https://www.facs.org/~media/files/quality%20programs/trauma/tqip/palliative_care.ashx
2. ACS TQIP Geriatric Trauma Management Guidelines
<https://www.facs.org/~media/files/quality%20programs/trauma/tqip/geriatric%20guide%20tqip.ashx>
3. Abellan van Kan G, Rolland Y, Bergman H, et al. The I.A.N.A. Task Force on frailty assessment of older people in clinical practice. *J Nutr Health Aging*. 2008;12:29.
4. Chen CC¹, Chen SW², Tu PH¹, Huang YC¹, Liu ZH¹, Yi-Chou Wang A¹, Lee ST¹, Chen TH³, Cheng CT⁴, Wang SY⁴, Chou AH⁵. Outcomes of chronic subdural hematoma in patients with liver cirrhosis. *J Neurosurg*. 2018 Feb 2:1-10. doi: 10.3171/2017.8.JNS171103. [Epub ahead of print]
5. Demetriades D¹, Constantinou C, Salim A, Velmahos G, Rhee P, Chan L. Liver cirrhosis in patients undergoing laparotomy for trauma: effect on outcomes. *J Am Coll Surg*. 2004 Oct;199(4):538-42.
6. Ezaz G¹, Murphy SL², Mellinger J³, Tapper EB⁴. Increased Morbidity and Mortality Associated with Falls Among Patients with Cirrhosis. *Am J Med*. 2018 Jun;131(6):645-650.e2. doi: 10.1016/j.amjmed.2018.01.026. Epub 2018 Feb 14.
7. Joseph B, Pandit V, Zanbar B, et al. Superiority of frailty over age in predicting outcomes among geriatric trauma patients: A prospective analysis. *JAMA Surg*. 2014;149(8):766-772.
8. Lustenberger T¹, Talving P, Lam L, Inaba K, Branco BC, Plurad D, Demetriades D. Liver cirrhosis and traumatic brain injury: a fatal combination based on National Trauma Databank analysis. *Am Surg*. 2011 Mar;77(3):311-4.
9. Talving P¹, Lustenberger T, Okoye OT, Lam L, Smith JA, Inaba K, Mohseni S, Chan L, Demetriades D. The impact of liver cirrhosis on outcomes in trauma patients: a prospective study. *J Trauma Acute Care Surg*. 2013 Oct;75(4):699-703. doi: 10.1097/TA.0b013e31829a2c19.
10. Zhao FZ, Wolf SE, Nakonezny PA, et al. Estimating geriatric mortality after injury using age, injury, and performance of a transfusion: The Geriatric Trauma Outcome Score. *J Palliative Med*. 2015;18(8):677-681.
11. <https://www.cms.gov/Medicare/Medicare-Fee-for-Service-Payment/PhysicianFeeSched/Downloads/FAQ-Advance-Care-Planning.pdf>
12. <https://paltc.org/publications/cms-publishes-faqs-about-billing-advance-care-planning>
13. <http://g60trauma.org/professionals/protocols-and-guidelines/>

ADDITIONAL CONSIDERATIONS FOR REVIEW:

- An attending or fellow from the SICU, Trauma or Geriatrics service should be present for initial 24h and 72h conversations and for any conversations that mark an acute change in anticipated patient outcome.
- FRAILITY SCORE will be obtained by bedside nursing in initial assessment/within 24 hours
 - Document in ACP tab
- The following information (A) will be documented in the ACP with a “Goals of Care” note
 - This information will be required as a component of the *Tertiary Survey*.

A.	Identify Health Care Proxy (HCP)	Identify and acquire Advanced Directive/POLST	Review and clarify Code status
----	--	--	-----------------------------------

Other misc recs from G60 guidelines:

Rib plating (?)

Syncope work-up (?)

Anticoagulant reversal

Hip blocks

How to Submit a Geriatrics Consultation:

- Call via Web-Paging system in progress – for the month of June page Dr. James Templeman directly (619-290-8313) from 8am to 5pm (Monday – Friday)
- AND**
- Enter in order in EPIC for Geriatrics Consultation (Px Code: CON97): **IP Consult to Geriatrics**
-

When to call for a Geriatrics Consultation:

- Patients ≥65
- Patients 55-64 (at least one of the following):
 - Mentation:
 - Confusion state concerning for Dementia and/or Delirium
 - Cognitive-Behavioral Disturbance
 - Mobility:
 - Frailty/Debility
 - Falls
 - Requires Assistance with ≥3 Activities of Daily Living (ADL)
 - Supplement to PT/OT/ST for early mobility
 - Medications:
 - Polypharmacy ≥4 medications
 - Inappropriate medications (Beer's List)
 - What Matters:
 - Goals of Care
 - Complex Patient/Family Communication
 - Palliative Care
 - Hospice/End-of-life concerns
 - Multicomplexity/Multimorbidity
 - Geriatric Syndromes
 - Pain Management
 - Pressure Ulcers/Wounds
 - Transitions of Care Optimization
 - Discharge disposition recommendations (ABU/SNF/RCFE/Home)

In table form: (see attached)

Expectations with Consults:

Time: consult requests to be submitted during 8am – 5pm (Monday – Friday)

Turn around: patient will be seen within 24 hours (exception is weekend)

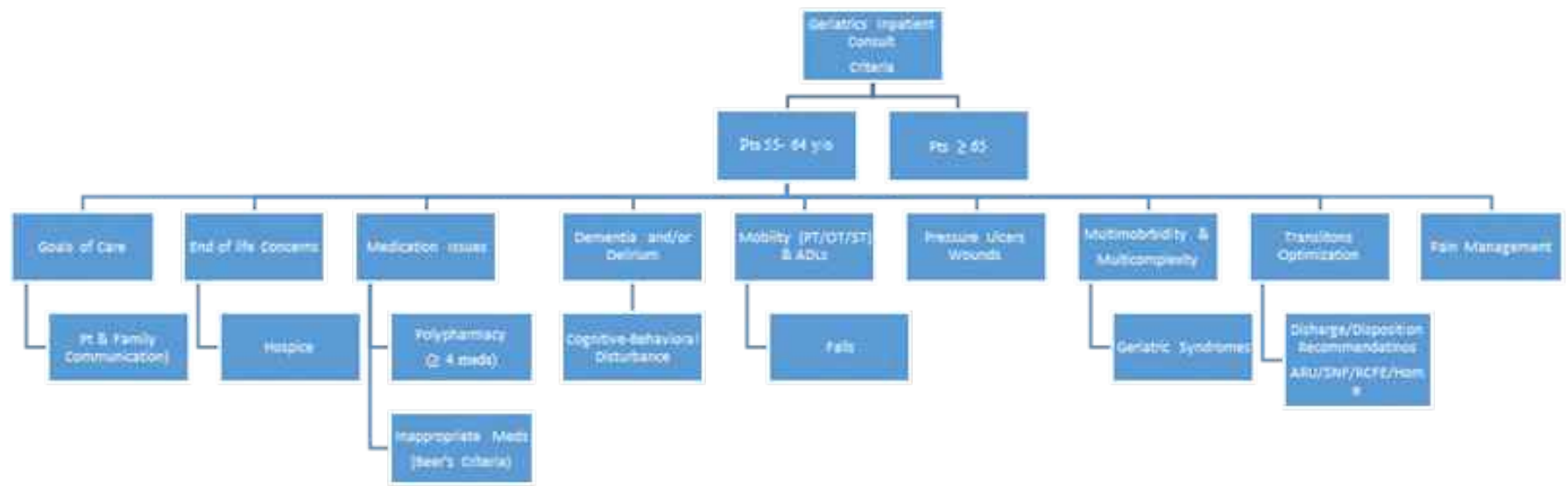
- Notes written within 24 hours and/or communicated to consulting physician

On-call (afterhours/weekends) coverage: defer to Trauma Coverage

Metrics/Screening Instruments:

(in progress – looking into ACS TQIP for Geriatrics and current geri-trauma/ortho literature)

- LOS, Survival, Post-DC residential status, time to surgery, complications, readmission rate, functional status, costs/charges/utility/DALY, falls, pain score, Hgb level, admission into ICU, quality of care transition, urinary retention/constipation, use of restraints, etc...)
- ISAR/CAM etc...



Venous Thromboembolism (VTE) Prophylaxis

Venous Thromboembolism (VTE) Prophylaxis

(see Trauma Protocols & Guidelines VTE Prophylaxis Protocol)

In general, trauma patients (with injuries) should be considered at increased risk for development of VTEs and should receive some form of prophylaxis unless contraindicated.

a. Low risk patients:

- i. Trauma patients who are admitted for observation, have sustained no injuries or very minor injuries, are fully ambulatory and are expected to be discharged within 24hrs are considered low risk for VTE and do not require VTE prophylaxis.

b. Moderate risk patients:

- i. Trauma patients who are admitted with acute injury, have reduced mobility, plans to undergo a surgical procedure, or have an expected length of stay >48 hours are considered moderate risk for VTE and should receive mechanical (SCDs) and pharmacologic (Lovenox or Heparin) VTE prophylaxis unless contraindicated.

c. High risk patients:

- i. Trauma patients who have sustained major orthopedic or spinal cord injury, require ICU admission, have significantly reduced mobility or paralysis, have a traumatic brain injury requiring surgical intervention, or have a history of VTE are considered high risk for VTE and should receive mechanical (SCDs) and pharmacologic (Lovenox or Heparin) VTE prophylaxis unless contraindicated.

d. Mechanical VTE prophylaxis

- i. Sequential compression devices (SCDs) should be ordered for all trauma patients considered moderate to high risk for VTE.
- ii. SCDs should be worn while the patient is in bed or nonambulatory and may be removed when the patient is out of bed or ambulating.
- iii. If the patient has sustained a lower extremity injury or has a known VTE in the lower extremity, a SCD should not be placed on the affected extremity.

e. Pharmacologic VTE prophylaxis

- i. Weight based lovenox dosing given every 12 hours is the preferred pharmacologic agent for VTE prophylaxis. (See table for appropriate weight based dose)
- ii. Anti-Xa levels will be checked after the 3rd or 4th dose of lovenox to ensure the patient is receiving the appropriate prophylactic dose.
- iii. If lovenox is contraindicated (renal insufficiency, history of HIT, etc), other options for pharmacologic prophylaxis include heparin or arixtra. Please consult with the trauma attending/fellow and/or pharmacist if alternative VTE

prophylaxis is being considered.

Weight based lovenox dosing for VTE prophylaxis in trauma patients:

Weight (kg)	<60 kg	60 – 100 kg	>100 kg
Lovenox dose	30 mg q12hrs	40 mg q12 hrs	50 mg q12 hrs

f. Contraindications to initiating pharmacologic VTE prophylaxis upon admission:

- i. Traumatic brain injury with intracranial hemorrhage
- ii. Solid organ injury with nonoperative management
- iii. Pelvic fractures with active extravasation
- iv. Patients presenting in hemorrhagic shock
- v. Significant coagulopathy
- vi. Spinal fracture/cord injury

g. Guidelines for high risk patients

- i. Orthopedics: Pharmacologic VTE prophylaxis will be initiated at the time of admission and will **NOT** be held prior to most operative orthopedic fixations.
 - Exception: Lovenox should be held the morning prior to operative repair for certain high risk orthopedic procedures due to soft tissue hematoma risk including:
 - Calcaneus fracture
 - Pilon fracture
 - Tibial plateau fracture
- ii. Neurosurgery: Pharmacologic VTE prophylaxis should be initiated 48 hours after stable head CT in patient with ICH.
- iii. Spine Fracture:
 - Non-operative: Pharmacologic VTE prophylaxis should be initiated at the time of admission, if possible, and no later than within 48 hours of admission.
 - Operative: Pharmacologic VTE prophylaxis should be initiated at the time of admission, if possible, and should be initiated within 48 hours post-surgery unless contra-indicated.
 - Spinal epidural hematoma: Discussion should be held between the trauma and spine attendings to determine the appropriate time to initiate Pharmacologic VTE prophylaxis. If initiation of Lovenox will be delayed > 48 hours, consideration should be given to IVC filter placement due to high risk of VTE.

h. Trauma Duplex Protocol

- i. The Trauma Routine Duplex Protocol should only be ordered for patients with High Risk or Extreme Risk. (expected to stay >48 hours)
- ii. The initial screening lower extremity duplex should be performed within the first 48 hours of admission with serial lower extremity duplexes performed

weekly/every 7 days thereafter.

- iii. Upper extremity duplexes should be performed if there is clinical suspicion for an upper extremity VTE (unilateral arm swelling, erythema, presence of CVLs)
- i. IVC filters should be considered in trauma patients with known VTE and a contraindication to therapeutic anticoagulation, spinal cord injury with para- or quadriplegia, or severe pelvic or orthopedic trauma and prolonged immobility and contra-indication for pharmacologic VTE prophylaxis.
 - i. Patients with IVC filters still require Venodynes and weekly Duplex screening.
- j. When immobile patients or patients who have undergone an orthopedic surgical intervention are discharged home or transferred to nursing homes, SNF, extended care facilities, etc., the discharge summary/orders should include recommendations for DVT prophylaxis-either low molecular weight heparin (i.e. Lovenox) or unfractionated heparin.

Summary of Trauma Protocol for VTE Prophylaxis

Risk Level	Risk Factors*	Screening	Prophylaxis
Low Risk (rare in Trauma)	Not a Major Trauma Victim, no risk factors	No routine screening required	Mandatory ambulation in 1 st 24-36 hours In-bed mobility and lower extremity exercises NO SCDs or anticoagulation
Moderate Risk (rare in Trauma)	Not a Major Trauma Victim, other risk factors	No routine screening required	LMWH (weight based dosing of lovenox sc bid) ^{1, 2} started within 24 hours of admission <i>or</i> fondaparinux 2.5mg qd started within 6-8 hours of admission
High Risk	Major Trauma Victims (presence of >1 of following): 1. likelihood of bedrest >3 days, head injury, spine or pelvic fracture, lower extremity fracture 2. laparotomy, thoracotomy or laparoscopy co-morbid risk factors* including: history of prior DVT or PE, obesity, known sepsis, malignancy, hypercoagulable state, pregnancy	1 st Duplex in 24 hours; 2 nd in first week; then weekly by the Radiology duplex lab. If patient needs a study prior to placing Venodynes, call Radiology Department Duplex Lab.	SCDs <u>and</u> LMWH (weight based dosing of lovenox sc bid) [CE4] ^{1, 2} started within 24 hours of admission <i>or</i> fondaparinux 2.5mg qd started within 6-8 hours of admission
Consider IVC Filter	Major Trauma Victims – High risk plus: (presence of >1 of following): 1. severe head injury with therapeutic paralysis and aggressive ICP control >5-7 days 2. spinal fracture with para- or quadriplegia 3. unstable pelvic fracture with bedrest >6 weeks 4. multiple lower extremity fractures 5. patient in High Risk group where usual measures cannot be employed	Same as High Risk	Consider IVC filter: 1. Head injury w/ chemoprophylaxis for >5-7 days with LE or pelvic fracture should have IVC filter after 4 th or 5 th day (Neuro + Trauma discussion) 2. Isolated head injury requiring paralysis >5-7 days will be considered for prophylactic IVC filter or anticoagulation 3. SCI will receive IVC filter after consensus between Neurosurgery and Trauma. 4. All other high risk patients consider IVC filter

1: If impaired renal function, consult pharmacy. 2: adjust dose if BMI > 30, consider pharmacy consult, see WEIGHT BASED DOSING. 3: in liver patients, may start up 48-96 hours post-op, if no major risk of bleeding

***VTE Risk Factors:**

1. Age greater than 50 years
2. History of prior VTE
3. History of myocardial infarction
4. History of cancer
5. History of atrial fibrillation
6. History of ischemic stroke
7. History of diabetes mellitus
8. History of CHF
9. History of obesity
10. History of paralysis
11. History of varicose veins
12. History of inhibitor deficiency state:
 - a. Factor V Leiden
 - b. prothrombin gene mutation
 - c. protein S deficiency
 - d. protein C deficiency
 - e. antithrombin III deficiency
 - f. anticardiolipin antibodies

Weight Based Dosing of Enoxaparin/Factor Xa

- A. Chemical thromboprophylaxis shall be given to all moderate or greater risk trauma patients to reduce the incidence of venous thromboembolism
- All trauma patients are considered high or extreme risk for VTE
 - Chemical thromboprophylaxis should be withheld in the setting of active hemorrhage or intracranial hemorrhage
 - i. Initiation of thromboprophylaxis in patients with intracranial hemorrhage should first be cleared and approved by the neurosurgery consulting team
- B. Weight-based, anti-Xa adjusted enoxaparin is the division standard of care for most trauma patients
- Non-hemodialysis patients with a Creatinine Clearance (CrCl) < 30 may be treated with anti-Xa adjusted enoxaparin OR subcutaneous heparin per trauma attending or fellow preference
 - Hemodialysis patients should receive subcutaneous heparin for chemoprophylaxis
- C. Enoxaparin thromboprophylaxis dosing will be initiated utilizing a weight based scale:
- 50-60 kg: 30 mg q12 hours
 - 61-99 kg: 40 mg q12 hours
 - >100 kg: 50 mg q12 hours
 - * Patients < 50kg or with a CrCl < 30 should receive individualized dosing
- D. An anti-Xa level for low molecular weight heparin will be drawn 3-5 hours after at least the 3rd dose to determine adequate prophylaxis:
- Prophylactic range: 0.2-0.4 IU/mL
 - If subprophylactic: increase dose by 10mg q12 hours and re-check anti-Xa level after at least 3 doses
 - If supraphylactic: decrease dose by 10mg q12 hours and re-check anti-Xa level after at least 3 doses
 - Once in range there is no need to re-check anti-Xa levels unless a patient's renal function changes
- E. For patients with DVT \ PE requiring treatment:
- A heparin drip should be used for patients on hemodialysis \ CRRT
 - Therapeutic enoxaparin may be used for most patients
 - i. Initial dose 1mg/kg q 12hours
 - ii. Check anti-Xa level 3-5 hours after at least the 3rd dose
 - iii. Goal therapeutic range: 0.6 – 1.0 IU/mL
 - Patients with a CrCl < 30 may be treated at the attending \fellow's discretion, based upon the patient's individual risk of hemorrhage

References:

- 1) Costantini TW, et al. Dose adjusting enoxaparin is necessary to achieve adequate venous thromboembolism prophylaxis in trauma patients. *J Trauma Acute Care Surg* 2013;74(1):128-33.
- 2) Berndtson AE, et al. If some is good, more is better: An enoxaparin dosing strategy to improve pharmacologic venous thromboembolism prophylaxis. *J Trauma Acute Care Surg* 2016;81(6):1095-1100.

Enoxaparin Guideline for Special Populations

Low Molecular Weight Heparins (LMWH) are widely used in treatment and prevention of VTE. Standard dosing and lack of need for routine monitoring are major advantages of these agents (over unfractionated heparin). **This guideline lists special patient populations where use of adjusted dosing and Anti-Factor Xa monitoring may be considered.**

Obesity (BMI > 40 kg/m²)	
<ul style="list-style-type: none"> Twice daily regimen is preferred Peak Anti-Xa level around 3rd or 4th dose 	
VTE Prophylaxis	<ul style="list-style-type: none"> 0.5 mg/kg SC q24h or 30% increase from standard prophylaxis dose with close Anti-Xa monitoring*
VTE Treatment	<ul style="list-style-type: none"> 0.75 mg/kg q12h based on total body weight with close Anti-Xa monitoring*

***Peak Anti-Xa levels** (once steady state concentration is reached, Anti-Xa monitoring is optional)

Low Total Body Weight (<50kg)	
<ul style="list-style-type: none"> Use unfractionated heparin if possible Peak Anti-Xa level around 3rd or 4th dose 	
VTE Prophylaxis	<ul style="list-style-type: none"> 30 mg SC q24h with close Anti-Xa monitoring*
VTE Treatment	<ul style="list-style-type: none"> 1 mg/kg q12h based on total body weight with close Anti-Xa monitoring*

***Peak Anti-Xa levels** (once steady state concentration is reached, Anti-Xa monitoring is optional)

Trauma*	
<ul style="list-style-type: none"> Twice daily regimen is preferred Peak Anti-Xa level around 3rd or 4th dose 	
VTE Prophylaxis	<ul style="list-style-type: none"> < 50 kg: team to discuss with clinical pharmacist < 60 kg: 30 mg SC q12h 61-99 kg: 40 mg SC q12h >100 kg: 50 mg SC q12h
VTE Treatment	<ul style="list-style-type: none"> 1 mg/kg q12h based on total body weight with close Anti-Xa monitoring**

*Based on UCSDH internal data

** **Peak Anti-Xa levels** (once steady state concentration is reached, Anti-Xa monitoring is optional)

Renal Dysfunction (CrCl < 30 ml/min)	
<ul style="list-style-type: none"> UFH is preferred Anti-Xa levels (peak OR trough) after 2nd or 3rd dose, then q2-3 days until steady state concentration is reached* 	
VTE Prophylaxis	<ul style="list-style-type: none"> 30 mg SC once daily Hemodialysis: avoid, use UFH instead <ul style="list-style-type: none"> INPATIENTS ONLY: If enoxaparin is used, monitor Peak Anti-Xa levels closely*
VTE Treatment	<ul style="list-style-type: none"> CrCl 20-30 ml/min: 1 mg/kg SC once daily CrCl < 20 ml/min or hemodialysis: <ul style="list-style-type: none"> UFH preferred INPATIENTS ONLY: If enoxaparin is used, 0.7 mg/kg SC once daily (range: 0.4-1 mg/kg/day); sample Trough Anti-Xa to check for drug accumulation**

*Due to the prolonged half-life of enoxaparin in patients with renal dysfunction time to steady state may vary significantly

** Goal Trough Anti-Xa is < 0.4 Units/mL in severe renal dysfunction

Pregnancy	
<ul style="list-style-type: none"> • PK of Enoxaparin may be altered in pregnant patients • Monitor Anti-Xa levels (especially during 3rd trimester) • Twice daily regimen is preferred 	
VTE Prophylaxis	<ul style="list-style-type: none"> • Management is based on risk stratification – please refer to the below UCSDH OB guideline https://pulse.ucsd.edu/departments/EDR/Resources/Policies/Women%20%20Infant%20Policies/VTE%20Prevention%20Obstetrical.pdf
VTE Treatment	<ul style="list-style-type: none"> • 1 mg/kg SC twice daily*

*Peak Anti-Xa levels (once steady state concentration is reached, Anti-Xa monitoring is optional)

Peak Anti-Xa Monitoring		
Timing <ul style="list-style-type: none"> • 4 hrs after 3rd or 4th dose 	Anti-Xa goal for BID dosing <ul style="list-style-type: none"> • Prophylaxis: 0.2-0.5 Units/mL • Treatment: 0.5-1 Units/mL 	Anti-Xa goal for once daily dosing <ul style="list-style-type: none"> • Prophylaxis: 0.2-0.5 Units/mL • Treatment: 1-2 Units/mL
Trough Anti-Xa Monitoring (renal dysfunction ONLY)		
Timing <ul style="list-style-type: none"> • Immediately prior to 3rd or 4th dose 	Anti-Xa goal for one daily dosing <ul style="list-style-type: none"> • Treatment: <0.4 Units/mL 	

Sample Dosing Nomogram: Peak Anti-Xa Activity for Therapeutic Anticoagulation with Enoxaparin*

Anti-Factor Xa Level	Dose Change
<0.35 Units/mL	Increase by 25%
0.35 – 0.49 Units/mL	Increase by 10%
0.5 – 1 Units/mL	No Dose Change
1.1 – 1.5 Units/mL	No Dose Change if once daily regimen (1.5 mg/kg) Decrease by 20% if twice daily regimen (1 mg/kg)
1.6 – 2 Units/mL	No Dose Change if once daily regimen (1.5 mg/kg) Decrease by 30% if twice daily regimen (1 mg/kg)
> 2 Units/mL	Hold 1-2 doses, decrease by 40%
Repeat anti-Xa level with 3rd or 4th dose after adjustment	

*adapted from University of Illinois Hospital and Clinics Clinical Care Guideline on Enoxaparin use in adults

References:

- Nutescu EA, Spinler SA, Wittkowsky A, Dager WE. Low-molecular-weight heparins in renal impairment and obesity: available evidence and clinical practice recommendations across medical and surgical settings. *Ann Pharmacother*. 2009;43(6):1064-83.
- Shelkrot M, Miraka J, Perez ME. Appropriate enoxaparin dose for venous thromboembolism prophylaxis in patients with extreme obesity. *Hosp Pharm*. 2014;49(8):740-7.
- Ludwig KP, Simons HJ, Mone M, Barton RG, Kimball EJ. Implementation of an enoxaparin protocol for venous thromboembolism prophylaxis in obese surgical intensive care unit patients. *Ann Pharmacother*. 2011;45(11):1356-62.
- Freeman A, Horner T, Pendleton RC, Rondina MT. Prospective comparison of three enoxaparin dosing regimens to achieve target anti-factor Xa levels in hospitalized, medically ill patients with extreme obesity. *Am J Hematol*. 2012;87(7):740-3.
- Fox KA, Antman EM, Montalescot G, et al. The impact of renal dysfunction on outcomes in the ExTRACT-TIMI 25 trial. *J Am Coll Cardiol*. 2007;49(23):2249-55.
- Pon TK, Dager WE, Roberts AJ, White RH. Subcutaneous enoxaparin for therapeutic anticoagulation in hemodialysis patients. *Thromb Res*. 2014;133(6):1023-8.
- Lalama JT, Feeney ME, Vandiver JW, et al. Assessing an enoxaparin dosing in morbidly obese patients. *J Thromb Thrombolysis*. 2015; 39:516-521
- Deal EN, Hollands JM, Riney JN, et al. Evaluation of therapeutic anticoagulation with enoxaparin and associated anti-Xa monitoring in patients with morbid obesity: a case series. *J Thromb Thrombolysis* 2011; 32:188-194

- Bates SM, Greer IA, Middeldrop S, et al. VTE, thrombophilia, antithrombotic therapy, and pregnancy. Antithrombotic therapy and prevention of thrombosis, 9th ed: American College of Chest Physicians Evidence-Based Clinical Practice Guidelines. CHEST 2012; 141(2)(Suppl):e691S-e736S

Post-Discharge VTE Prophylaxis

For many patients with severe traumatic injuries the risk of venous thromboembolism does not cease at the time of hospital discharge (1,2). Extended duration VTE prophylaxis has shown efficacy in patients undergoing major orthopedic procedures as well as those requiring abdominopelvic surgery for cancer (3). Ongoing pro-thrombotic states and impaired mobility also leave trauma patients at persistent risk of VTE events. We recommend continuation of VTE prophylaxis beyond the time of discharge in select, high-risk patients.

Patients at high ongoing risk of VTE include patients with pelvic fractures, bilateral lower extremity fractures, spinal cord injury, or those unable to ambulate independently as a result of their injury. The specific dosing regimen and duration of thromboprophylaxis after discharge in trauma patients has yet to be clearly defined. In high risk patients, we recommend an additional 4 weeks of pharmacologic prophylaxis beyond the acute hospitalization (4). Low molecular weight heparin (LMWH) is the preferred method of prophylaxis using a dose of 30mg twice daily due to the lack of outpatient anti-Xa and renal function monitoring (4,5). In patients unable to receive LMWH (i.e. due to heparin-induced thrombocytopenia, cost, availability, unwillingness to take injections, etc.) aspirin 81mg twice daily is suggested as an alternative (6). Patients with other conditions increasing their risk of VTE, such as prior thrombotic events or active cancer, should undergo individualized risk assessment and additional prophylaxis may be considered.

Patients with spinal cord injury and resultant motor dysfunction are at particularly high risk. Acute spinal cord injury increases the risk of venous thromboembolism for up to 6 months post-injury (7). Consensus guidelines recommend ongoing VTE prophylaxis for at least 3 months post-injury (8), with LMWH more efficacious than UFH during the rehabilitation phase (9).

Post-Discharge VTE Prophylaxis Recommendations	
High Risk Patients	
	Pelvic Fracture
	Bilateral Lower Extremity Fracture
	Non-Weight Bearing Status on Bilateral Lower Extremities
	Spinal Cord Injury
	Venous Injury
Medication	
Recommended	Enoxaparin 30mg twice daily
Alternative	Aspirin 81mg twice daily
Duration	4 weeks
Spinal Cord Injury	3 months

References:

1. Olufajo OA, Yorkgitis BK, Cooper Z, Rios-Diaz A, Metcalfe D, Havens JM, Kelly E, Haider AH, Gates JD, Salim A. How long should we fear? Long-term risk of venous thromboembolism in patients with traumatic brain injury. *J Trauma Acute Care Surg.* 2016;81(1):71–78. PMID 27015575.
2. Godat LN, Kobayashi L, Chang DC, Coimbra R. Can we ever stop worrying about venous thromboembolism after trauma? *J Trauma Acute Care Surg.* 2015;78:475-80. PMID 25710416.
3. Najjar PA, Madenci AL, Zogg CK, Schneider EB, Dankers CA, Pimentel MT, Chabria AS, Goldberg JE, Sharma G, Piazza G, Bleday R, Orgill DP, Kachalia A. Implementation of a comprehensive post-discharge venous thromboembolism prophylaxis program for abdominal and pelvic surgery patients. *J Am Coll Surg.* 2016;223(6):804–813. PMID 27693288.
4. Falck-Ytter Y, Francis CW, Johanson NA, Curley C, Dahl OE, Schulman S, Ortel TL, Pauker SG, Colwell CW Jr. Prevention of VTE in orthopedic surgery patients: antithrombotic therapy and prevention of thrombosis, 9th ed: American College of Chest Physicians Evidence-Based Clinical Practice Guidelines. *Chest.* 2012;141(Suppl 2):e278S–e325S. PMID 22315265.
5. Gould MK, Garcia DA, Wren SM, Karanickolas PJ, Arcelus JJ, Heit JA, Samama CM. Prevention of VTE in nonorthopedic surgical patients: antithrombotic therapy and prevention of thrombosis, 9th ed: American College of Chest Physicians Evidence-Based Clinical Practice Guidelines. *Chest.* 2012;141(Suppl 2):e227S–e277S.
6. Haac BE, Van Besien R, O'Hara NN, Slobogean GP, Manson TT, O'Toole RV, Johal H, Berger PZ, Reahl GB, Marinos D, Degani Y, Mascarenhas D, Connelly D, Scalea TM, Stein DM. *J Trauma Acute Care Surg.* 2018;84:564-574. PMID 29251700.
7. Lamb GC, Tomski MA, Kaufman J, Maiman DJ. Is chronic spinal cord injury associated with increased risk of venous thromboembolism? *J Am Paraplegia Soc.* 1993;16:153-6. PMID 8366336.
8. Thromboprophylaxis in spinal trauma surgery: consensus among spine trauma surgeons. Ploumis A, Ponnappan RK, Bessey JT, Patel R, Vaccaro AR. *Spine J.* 2009 Jul;9:530-6. PMID 19251486.
9. Spinal Cord Injury Thromboprophylaxis Investigators. Prevention of Venous Thromboembolism in the Rehabilitation Phase after Spinal Cord Injury: Prophylaxis with Low-Dose Heparin or Enoxaparin. *J Trauma.* 2003;54:1111-115. PMID 12813331.

General guideline references:

-AAOS: https://www.aaos.org/globalassets/quality-and-practice-resources/vte/vte_full_guideline_10.31.16.pdf-guideline_5

-AACP ortho: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3278063/>

-ASCO: https://ascopubs.org/doi/10.1200/JCO.2013.49.1118?url_ver=Z39.88-2003&rfr_id=ori%3Arid%3Aacrossref.org&rfr_dat=cr_pub++0pubmed&

-ACCP cancer: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3278061/>

-AmSocHematology: <https://ashpublications.org/bloodadvances/article/3/23/3898/429211/American-Society-of-Hematology-2019-guidelines-for>

Surgical Critical Care

ICU Nurse-led Rounds

Step 1: CCRN Presents Brief Patient Data:

Presented by RN to begin rounds

- ☐ **PATIENT:**
- ☐ **DIAGNOSIS** (1 or 2 Words):
- ☐ **VITAL SIGNS** (Trend for past 24 hrs):
- ☐ **CURRENT VENT SETTINGS:**
- ☐ **I & O's** (Net past 24 hrs):
- ☐ **CURRENT IV INFUSIONS** (Include goal):
- ☐ **ACUTE OVERNIGHT EVENTS:**

Step 2: FASTHUGS or ABCDEFGs:

This is done AFTER the MD presents his/her part (usually labs, physical assessment, problem list, and plan of care). To wrap-up rounds the RN presents ABCDEFG'S to ensure ALL key items have been addressed.

- ☐ **ASSESS Pain/Sedation:**
 - ☐ Is pain under control?
 - ☐ Orders appropriate to treat?
 - ☐ Patient at RASS goal for sedation?
 - ☐ Choice of sedation appropriate?
- ☐ **BREATHE:**
 - ☐ SAT performed?
 - ☐ SBT Performed?
 - ☐ VAP protocol in place?
- ☐ **CATHETERS:**
 - ☐ Can they be removed? (Central Line, foley)
 - ☐ Can Ultrasound guided PIV be placed instead of Central line?
 - ☐ Can Purewick or condom cath be used instead of foley?
- ☐ **DELIRIUM/ICU DIARY:**
 - ☐ Is patient CAM +?
 - ☐ Interventions in place to prevent/reduce Delirium?
 - ☐ If in restraints, are they last resort/necessary?
 - ☐ Do they need an ICU Diary started?
 - ☐ If they have an ICU Diary, did someone write in it today?
- ☐ **EARLY mobilization/DVT Prophylaxis:**
 - ☐ Can patient be mobilized?
 - ☐ Is early mobilization protocol in place?
 - ☐ DVT Prophylaxis? (SCD's, heparin, etc.)
- ☐ **FAMILY:**
 - ☐ Are the patient's and families wishes and goals known?
 - ☐ Is a family meeting needed?
 - ☐ Goals of Care (GOC) tab updated?
 - ☐ Is Palliative care consult needed?
 - ☐ What needs to be done to transfer out?
- ☐ **GUT:**
 - ☐ Is patient taking PO/NG?
 - ☐ Do they need tube feeds started?
 - ☐ Supplements ordered and appropriate?
 - ☐ Ulcer prophylaxis in place?
 - ☐ Glycemic control ok?
- ☐ **SKIN:**
 - ☐ Does pt have pressure-related injuries?
 - ☐ Are they high risk for breakdown?
 - ☐ Is an Air Mattress needed?

Step 3: Reconcile Orders:

- ☐ Any orders that need d/c'd, entered, modified?
- ☐ Are IV drip goals and titration orders appropriate

mFASTrHUGS for SICU Team Rounds:

Team ensures all aspects of mFASTrHUGS or contraindications are documented daily.

Mouthcare	Teeth cleaning and oral moistening q4h.
Feeding	Commence by day 1 in ICU, follow protocol.
Analgesia	Review med record, Give pain score using visual or nonverbal scale.
Sedation	Review ventilation, GCS, and reason for sedation. Assess and specify target RASS score. Daily waking qAM.
ThromboPx	Prescribe SCDs and/or heparin type or alternative.
Restraints	Assess, reorder or discontinue restraints. Universal consent obtained.
Head >30°	Head of bed up 30° or more. Get C-Spine cleared!
Ulcer	Review ulcer prophylaxis.
Glucose & Gut	Maintain tight glucose control per protocol. Last BM is specified, appropriate bowel protocol.
Skin care	Braden scale: note areas of pressure breakdown, progress to healing. Does patient need special bed?

Document: Any Family Discussions
Goals of Care ≥ 72 hours after ICU admission
Daily Need for Foley
Daily Location and Need for Central Line

Richmond Agitation Sedation Scale (RASS)	
Target RASS Value	RASS Description
+4 Combative	Combative, violent, immediate danger to staff
+3 Very Agitated	Pulls or removes tubes or catheter; aggressive
+2 Agitated	Frequent non-purposeful movement; fights ventilator
+1 Restless	Anxious, apprehensive but movements not aggressive or vigorous
0 Alert and Calm	
-1 Drowsy	Not fully alert, sustained awakening to voice (eyes open and contact > 10 seconds)
-2 Light Sedation	Briefly awakens to voice (eye opening and contact < 10 seconds)
-3 Moderate Sedation	Movements or eye opening to voice (but no eye contact)
-4 Deep Sedation	No response to voice; moves or eyes open to physical stimulation
-5 Unarousable	No response to voice or physical stimulation

Talking with SICU Families

1. Communicate regularly, using family meetings prophylactically. Beware of family members who are non-participants. Involve the staff, especially the nurse.
2. **Listen, listen, listen** - for family understanding, affect, and how they make decisions. Establish trust. Acknowledge emotions. Avoid jargon. Lecture less and let the family guide you to further topics.
3. Provide psychosocial and spiritual support. Offer hope, not false hope. Bad news is a shock. Use support from the team. Culture & religion play key roles.
4. Inform family regularly about goals of care and how we know if goals are met.
5. Convey uncertainty; avoid false certainty.
6. Describe treatment as a "therapeutic time trial aimed at specific short-term goals.
7. "Care" always continues, but treatments may be withdrawn or withheld. (We never "withdraw care", we stop non-beneficial treatments.)
8. Don't ask the family to decide about each diagnostic or treatment option; ask them what the patient would want and allow them to concur with a plan consistent with patient values.

Guide to SICU Family Meetings

1. Prepare agenda and setting. Assure team consensus on facts. Decide who comes to the meeting and who leads the discussion. SICU nurse and SICU team MD should be there.
2. Introduce participants.
3. Assess family understanding and what they want to know.
4. Summarize the patient's medical condition & key clinical decisions.
5. What is it like for the patient now?
6. What was the patient like before illness? What would the patient want in such circumstances? (a.k.a.: "substituted judgment").
7. Explore and address family fears and concerns.
8. Frame recommendations.
9. Plan for follow-up.
10. Document meeting and communicate content to team.

Adopted from Mass. General Hospital Palliative Care Service

HC SICU Indications for GOC/ACP/Howell Service consult:
(Webpage: “Howell Service”)

Consider a consult if there is:

1. Family request.
2. Non-Beneficial Care (formerly “medical futility:) considered or declared by SICU team (MCP 381.1).
3. Death expected during SICU stay.
4. SICU stay >1 month.
5. A diagnosis with median survival <6 months or patient with metastatic malignancy.
6. 3+ ICU admissions during same hospitalization.
7. Glasgow Coma Score <8 for > 7d in a patient ≥ 75 years.
8. Glasgow Outcome Score (GOS) <3
9. Multisystem organ failure >3 systems
10. Family disagreement with team or the advance directive; or with each

N.B.: “Goals of Care” or “Advanced Care Planning” notes:

1. All patients admitted to the SICU with a stay expected to be longer than 72 hours, or with any of the criteria listed above should have a “Goals of Care” note on a weekly basis at a minimum.
2. Notes on Family and patient discussions about Goals of care can be copied into the “Advanced Care Planning” tab in EPIC.
3. Notes on Code Status changes can be copied into the “Advanced Care Planning” tab in EPIC.

Family Presence During Resuscitations

- Some institutions have policies that encourage family presence during CPR in the ED and ICU settings.
- **PROs:**
 - Supporters of family presence during resuscitation argue that it provides family members with the following benefits:
 - Eases family member grief
 - Families have a feeling of being supportive and helpful to the patient and staff
 - Sharing of critical information about the patient's condition
 - Family members are more likely to believe that "everything" was done for their loved one.
 - The patient feels "comforted" by the presence of family members.
 - Provides a sense of "closure" to families
 - Supported by the Emergency Nurses Association, American Academy of Pediatrics, American Association of Critical Care Nurses and American Heart Association
 - No evidence to suggest that there is increased litigation, worse patient outcomes, or increased morbidity/mortality associated with family presence.
- **CONS:**
 - Those who disagree with family presence during resuscitation argue the following:
 - The first responsibility should be to the patient. While family presence during resuscitation may provide benefit to family members, it may ignore the wishes and safety of the patient.
 - Family members may be disruptive or too emotional
 - Event may be too traumatic for family members
 - Potentially harm the patient by creating a situation with increased chance for interruptions by family members, increased stress of health care providers, inhibits opportunities for teaching and limits communication during the resuscitation.
 - Potential HIPPA violations if the patient has not explicitly given permission for family members or friends to be present. Also, if patients are unresponsive, it may be difficult to ascertain the true relationship between patient and said family member.
 - Potential for family members to be injured or exposed to blood-borne pathogens as code situations are often chaotic and involve many people working in small spaces with sharp objects.
 - Risk of litigation

- Staffing shortages may not allow for a dedicated person to be with family members during the resuscitation.
 - Family members and the status of their relationship with the patient may not be able to accurately ascertained during trauma and acute resuscitation settings.
- **EVIDENCE:**
 - Limited evidence. Most studies are small/observational/single site in nature and based on surveys of patients/family members/healthcare providers, include elderly patients with chronic diseases, and mostly limited to the ED setting.
 - **Important steps** in creating a “Family Presence” program:
 - Safe space for family members to stand
 - Designated support staff (medical social worker, chaplain, nurse, etc) to be available to family members to help relay/interpret medical information, explain interventions, provide information about expected outcomes, supply comfort measures, etc.
 - Patient’s health care providers must have the ability to “veto” presence of family members during procedures or resuscitations.
 - The person responsible for making the decision about whether to offer the option of presence during resuscitation to the family member should know the patient well enough to be able to judge whether or not the patient would want him/her present or not.
 - **Limitations/barriers** to family presence during resuscitations at UCSD:
 - Limited space in both the trauma bay and SICU rooms
 - Often multiple trauma resuscitations occurring concurrently
 - Limited staffing may not allow for the presence for chaperone/dedicated staff to be with the family member throughout the resuscitation
 - Given the acuity and emergent presentations of our patient population, identifying family members and ascertaining current relationships with the patient is often difficult.

REFERENCES:

Traylor, M. Should family be permitted in a trauma bay? [AMA J Ethics](#). 2018 May 1;20(5):455-463.

Brasel K, Entwistle J, Sade RM. Should family presence be allowed during cardiopulmonary resuscitation. *Ann Thorac Surg*. 2016 November; 102(5):1438-1443.

Leske JS, McAndrew NS, Brasel KJ, Feetham S. Family presence during resuscitation after trauma. *J Trauma Nurs*. 2017; 24(2): 85-96.

Goldberger ZD, Nallamotheu BK, Nichol G, Chan PS, Curtis RJ, Cooke CR. Family presence during resuscitation and patterns of care during in-hospital cardiac arrest. *Circ Cardiovasc Qual Outcomes*. 2015 May; 8(3): 226-234.

Tudor K, Berger J, Polivka BJ, Chlebowy R, Thomas B. Nurses' perception of family presence during resuscitation. *Am J Crit Care*. 2014 Nov;23(6):e88-96.

Jabre P, Belpomme V, Ezoulay E, Jacob L et al. Family presence during cardiopulmonary resuscitation. *N Engl J Med*. 2013 Mar 14;368(11):1008-18.

McAlvin SS, Carew-lyons AC. Family presence during resuscitation and invasive procedures in pediatric critical care: a systematic review.

1	
---	--

[Am J Crit Care](#). 2014 Nov;23(6):477-84

Proposed UCSD Protocol for Family Presence During Trauma and Cardiopulmonary Resuscitations in Pediatric and Adult Patients:

PURPOSE: To provide guidelines for the healthcare team in permitting families the option of being present during resuscitation.

DEFINITIONS:

- Family Member: A relative or significant other with an established relationship with the patient.
- Family Support Facilitator: A staff member such as, Physician, RN, Chaplain, Social Worker, Case Specialist and/or Behavioral Health Response Team member, who has been designated to support the emotional and psychological needs of the family. This staff member should ideally, not be needed for the immediate resuscitation process. This person's exclusive role is to assist the family member during resuscitation.

POLICY:

- Department staff will collaborate with the physician and other healthcare team members in offering the family presence option.
 - In the case of pediatric patients, attempts will be made to allow a parent or family member stay with the child whenever feasible.
 - The final decision to allow the presence of family during the resuscitation will be at the discretion of the attending physician.
- Family Support Facilitator will be designated and be responsible for the following:
 - Determining family preference if possible.
 - Assessing family behavior:
 - Family member's perception and understanding of the situation.
 - Acceptable behaviors for family presence include quiet, distressed, crying but consolable, distracted but able to focus on answers, anxious but cooperative and able to follow instructions.
 - Behaviors such as combativeness, extreme emotional instability, intoxication, altered mental status, hysterical and loud outbursts that cannot be redirected or calmed **will preclude family presence during resuscitation.**
 - Prior to entering the resuscitation area with the family member.
 - Explain to the family the patient's appearance, treatments, and any equipment that may be in use during resuscitation.
 - Communicate to family member the patient's care is a priority.
 - Communicate to the family they can leave at any time during the resuscitation.
 - Upon entering the resuscitation area:
 - Inform healthcare team of arrival.
 - Direct family to a location while maintaining a safe environment.

- Explain interventions, medical terminology, provide comfort measures, and give family an opportunity to ask questions during resuscitation.
 - Facilitate an opportunity for the family to touch the patient when appropriate.
 - Facilitate communication between physician, the healthcare team, and the family member.
 - If family member is faint, or exhibits disruptive behavior the facilitator will escort the family member away from the immediate area and provide support.
 - In the event of an unsuccessful resuscitation, the facilitator will communicate to family, the post-mortem process.
- Following resuscitation efforts, the healthcare team will perform a debriefing regarding the case.

The Universal Upset Patient Protocol

Step 1) You find yourself facing an upset person.

This person can be a patient, however the UUPP works for patients, co-workers, colleagues, your significant other, children and even complete strangers. Breathe, stick to the script below and see how it instantly defuses what used to be very difficult encounters.

NOTE:

The UUPP works no matter who or what the person is upset about. It works if they are upset AT YOU, your nurse, the office, their husband, the tax man ... it doesn't matter. The UUPP works every time.

Regardless what/who they are upset with ... the upset usually comes in one of two flavors.

- 1 The person is openly and verbally upset. It is obvious and they are obvious about it.
- 1 The person is upset and NOT talking. They are "seething". You can tell it clearly by their body language and they are not saying anything about it. DO NOT ignore their obvious non-verbal signals. You will waste a lot of time and energy unless you use the UUPP with these people too.

Step 2) Say ... "You sound/look really upset."

Step 3) The upset person will say one of two things

"You bet I am"

Or

"No I'm not ... I am ANGRY/FRUSTRATED/HURT/SAD/FURIOUS."

They may name a different emotion. There is a part of you that will think you have "made a mistake" here. You didn't name the right emotion! Just let that go. The simple act of you commenting on their upset ... caused them to look inside and clarify exactly what they were feeling. That clarification is the first start of them venting and moving forward.

Step 4) You say, "Tell me about it." or "Tell me what happened."

The upset person does not usually hesitate given your invitation. They will take right off into an emotion filled description of what happened. Your job here is simple ... LISTEN. Really listen. Look to understand their viewpoint here. Muster up as much empathy as you can. Help them “get it all out of their system”.

Step 5) When they are all done ... look them in the eyes and say,

“I am so sorry that happened to you” or “I am so sorry you feel this way”.

Step 6) Ask, “What would you like me to do to help you?”

Most of the time, the upset person will have a specific request. Listen carefully as they make it and notice whether or not you are willing to do what they want you to. This is your opportunity to notice your boundaries for the next step.

Some of the time the upset person will be done here. They simply wanted to be heard and are done now. Thank them for trusting you with their feelings - see step 8 below. You can move on to your clinical issues at this point with a clean slate.

Step 7) Tell them what you suggest be done now.

If the upset person has asked you to take a specific action - and you are willing to do it - tell them so.

If the upset person’s request is NOT something you are willing to do - set your boundaries and communicate them clearly. Tell them you are NOT willing to do what they request and do not stop there. Think about what you are willing to do that will address their upset and tell them what you ARE willing instead. Ask if your proposal works for them. It usually only takes a minute or two to come to an agreement here.

Step 8) Thank the upset person for being open with you,

“Thank you for telling me how you really feel ... it is important to me that we be understand each other clearly”.

Step 9) MOVE ON

You have now effectively “cleared the air” with this patient and you can move on to the clinical reasons for their visit today.

Even though the full UUPP above has 9 steps, the whole protocol conversation may take only 2-4 minutes

IF YOU DON'T FOLLOW THE UUPP - and either try to defend or fix the problem up front -- you are in for a 20 minute kerfuffle every time ... because people really don't care how much you know until they know how much you care.

Here's the UUPP again in bullets

- "You look really upset"
- "Tell me about it"
- "I am so sorry that happened to you / you feel that way"
- "What would you like me to do to help you"
- "Here's what I suggest we do next"
- "Thanks for telling me how you are really feeling"

ARDS Protocol

- I. DEFINITIONS
 - a. ARDS – Acute Respiratory Distress Syndrome.
 - b. Exudative phase – early (< 7 days).
 - c. Fibroproliferative phase – late (> 7 days).
- II. Diagnosis (Berlin Definition¹)
 - a. Timing – within 1 week or known insult or new\worsening respiratory symptoms.
 - b. Imaging – bilateral opacities
 - i. Not fully explained by effusions, collapse or nodules.
 - c. Origin of edema
 - i. Not fully explained by cardiac failure or fluid overload.
 1. Need objective assessment (i.e. Echo) to exclude hydrostatic edema if no ARDS risk factors present.
 - d. Oxygenation
 - i. Mild ARDS– $200 \text{ mmHg} < \text{PaO}_2/\text{FiO}_2 \leq 300 \text{ mmHg}$ with $\text{PEEP} \geq 5 \text{ cm H}_2\text{O}$.
 - ii. Moderate ARDS – $100 \text{ mmHg} < \text{PaO}_2/\text{FiO}_2 \leq 200 \text{ mmHg}$ with $\text{PEEP} \geq 5 \text{ cm H}_2\text{O}$.
 - iii. Severe ARDS – $\text{PaO}_2/\text{FiO}_2 \leq 100 \text{ mmHg}$ with $\text{PEEP} \geq 5 \text{ cm H}_2\text{O}$.
- III. TREATMENT
 - a. Diagnose and treat underlying cause of ARDS.
 - b. Lung-protective ventilation
 - i. Mainstay of treatment, will be sufficient for the majority of patients.
 - ii. Goal: avoid ventilator-induced lung injury (barotrauma and volutrauma).
 1. Tidal volumes should be limited to $5\text{-}7 \text{ mL/kg}^2$ (predicted body weight).
 - a. Plateau pressures $<30 \text{ cm H}_2\text{O}$ if possible.
 2. BOTH volumes and pressures must be monitored closely whether using VC or PC modes of ventilation. Worsening compliance may be a sign of worsening disease.
 - iii. Goals: Saturations 88-95% or PaO_2 55-80mmHg³
 1. Higher goals unnecessary, can lead to complications from high PEEP or FiO_2 .
 2. Oxygenation should be prioritized over ventilation if unable to normalize both.
 - a. CRRT can be used to control severe hypercapnea \ respiratory acidosis, if this is necessary in order to maintain oxygenation.
 - b. Goal: $\text{pH} > 7.2$
 - iv. Severe ARDS ($\text{PaO}_2/\text{FiO}_2 \leq 100 \text{ mmHg}$) – consider adjunctive therapies as below.
 - c. APRV (Airway Pressure-Release Ventilation)
 - i. Useful alternative in patients requiring high PEEP, may limit barotrauma and atelectasis due to short exhalation times.

- ii. Consider trial APRV if patient is requiring PEEP ≥ 14 (***??).
 - iii. May be limited by hypercapnea (consider CRRT as above if so).
- d. High-frequency or oscillatory ventilation
 - i. Not currently available on UCSD ventilators. Mixed data for benefit in adults.
- e. Deep Sedation
 - i. Often required in patients with significant ARDS – ventilator dyssynchrony can limit ability to oxygenate \ ventilate and should be avoided. Sedation for comfort and to limit dyssynchrony is recommended.
 - ii. See Pain-Agitation-Delirium guidelines.
- f. Prone positioning
 - i. Should be considered early in the course of severe ARDS as it may improve survival^{4,5}.
 - ii. Risks \ considerations:
 1. May be impractical in patients with recent thoracic or abdominal surgery, open abdomen, pregnancy, etc. – should be evaluated on a case by case basis.
 2. Risks of accidental extubation or line dislodgement must be considered. This is a very nursing-intensive intervention and we may not have adequate experienced CCRN staff to prone the patient safely.
 3. Patients with significant hemodynamic instability are poor candidates.
 - iii. Logistics:
 1. Rotaprone bed preferred over proning in standard ICU bed. Must be ordered from company and can take several hours to deliver, call early.
 2. Goal – prone 12-16 consecutive hours per day.
 3. Prone patients must be paralyzed to minimize the risk of self-harm.
- g. Neuromuscular blockade
 - i. There is some evidence of overall mortality benefit with neuromuscular blockade in patients with severe ARDS, as well as reductions in barotrauma and pneumothorax⁶.
 1. This is presumably due to a decrease in ventilator dyssynchrony and thus plateau pressures, though this has not been explicitly studied.
 2. The cited study was limited by a steady-rate infusion of cisatracurium rather than titration to effect, and the infusion was limited to 48 hours thus limiting long-term muscular weakness.
 - ii. Neuromuscular blockade with cisatracurium is recommended in patients with significant desynchrony despite sedation and optimal mode selection, and should be considered in all patients with severe ARDS.
- h. Steroids
 - i. Steroids remain very controversial in the treatment of ARDS. Initial studies showed no overall benefit^{7,8}, but were limited by poor definitions of ARDS and small sample size. More recent studies, including a 2018 re-analysis of the original ADRSnet data, demonstrate reduced times to extubation⁹ and shorter ICU lengths of stay¹⁰ but contain similar limitations. No definitive trial showing

improvement in mortality has been done; outcomes of meta-analyses have been mixed¹¹⁻¹⁵.

1. The most recent SCCM guidelines offer a conditional recommendation for steroid use in patients with early moderate to severe ARDS¹⁶.
- ii. Steroid risks must be considered very carefully in a surgical population. The risk of contributing to complications after recent surgery (i.e. anastomotic leak after bowel resection, GI perforation, GI hemorrhage) must be carefully considered and weighed against any possible improvement in pulmonary function.
- iii. Recommendations:
 1. Steroids should be used if they are part of the treatment of the underlying disease process.
 2. Steroids may be considered in all patients with moderate-severe ARDS if the risk is judged to be low.
 3. If used, steroids should be started early. The most promising data is in patients started on steroids <72 hours from the onset of ARDS¹⁰. Starting steroids ≥ 14 days after the onset of ARDS may increase the risk of death⁸.
 4. If started, steroids should be tapered slowly to avoid rebound inflammation and worsening ARDS. If symptoms worsen after steroids are stopped, they should be restarted⁹.
- i. Inhaled nitric oxide (iNOS)
 - i. While useful in pulmonary hypertension, data for use in ARDS is mixed and has not become routine.
 - ii. The majority of studies demonstrate improvements in oxygenation without reductions in morbidity or mortality; there is some risk of renal impairment^{17, 18}.
 - iii. Consider iNO if there is another indication for use (i.e. pulmonary hypertension).
 - iv. Otherwise, use should be limited to refractory hypoxemia.
 - v. Costly, inhaled Flolan is cheaper, with slightly less effect.
- j. Prostacyclin (PGI₂, i.e. Flolan)
 - i. Prostacyclin has been studied as an alternative to iNO, but has also not been shown to improve overall outcomes despite a decrease in PA pressures and increase in oxygenation¹⁹.
 - ii. May be considered as a last-ditch effort in refractory hypoxemia.
- k. Extracorporeal Membrane Oxygenation (ECMO)
 - i. Despite initial poor results in randomized trials, more recent study of adult ECMO for severe ARDS is promising²⁰, including in trauma patients²¹. Optimal timing of initiation remains controversial but ECMO is an option for patients failing other treatment modalities.
 1. Estimated current overall survivability on ECMO 50-70%.
 - ii. Contraindications:
 1. Conditions incompatible with normal life even if patient recovers.
 2. Underlying etiology of ARDS must be reversible.
 3. Inability to tolerate systemic anticoagulation.
 4. Futility.

iii. Logistics:

1. VV ECMO is standard (if patient requires VA ECMO then survivability must be re-assessed).
2. Consult cardiothoracic surgery for input, recommendations, cannula placement.
 - a. Setup takes time, consult CT surgery early to discuss options and coordinate.
 - b. **"CODE ECMO"** notifies ECMO team of impending ECMO case
 - c. Also need cardiac anesthesiologist to do TEE during placement.
3. Hillcrest **CODE ECMO** cart is kept in 2nd Floor MON Cath lab (Accessible between Hillcrest Main ORs #4 and #5).
4. Requires perfusionist or nurse with ECMO experience to float from CVICU to Hillcrest to care for patient.
5. Patient will need to be transferred to Sulpizio CVICU for nurse-led ECMO protocol when possible.
6. Heparin infusion is standard for anticoagulation (follow PTT, anti-Xa, fibrinogen and AT III levels q6 hours until stable).
 - a. May require AT III replacement if a non-responder to heparin and AT III levels are low.
 - b. Discuss with CT surgery and pharmacy if there is a concern for HIT – Argatroban likely second line agent.

iv. UCSD ECMO / CODE ECMO protocols:

<https://pulse.ucsd.edu/departments/EDR/education/CVed/Pages/ECMO.aspx>

v. Good overview information:

https://www.else.org/Portals/0/ELSO%20Guidelines%20General%20All%20ECLS%20Version%201_4.pdf

IV. Interventions with no data \ disproven \ routine use not recommended

- a. Albuterol – does not improve clinical outcomes²². Can be used selectively based on patient history and exam.
- b. Rosuvastatin – did not improve clinical outcomes, may contribute to hepatic and renal dysfunction²³.
- c. Intravenous prostaglandins
- d. Anti-oxidants
- e. Neutrophil elastase inhibitors
- f. Ketoconazole
- g. Surfactant
- h. Keratinocyte growth factor

References

1. Ranieri VM, Rubenfeld GD, Thompson BT, et al. Acute respiratory distress syndrome: the Berlin Definition. *Jama* 2012;2526-2533. DOI: 10.1001/jama.2012.5669.
2. Brower RG, Matthay MA, Morris A, et al. Ventilation with lower tidal volumes as compared with traditional tidal volumes for acute lung injury and the acute respiratory distress syndrome. *The New England journal of medicine* 2000;1301-1308. DOI: 10.1056/nejm200005043421801.
3. Fan E, Brodie D, Slutsky AS. Acute Respiratory Distress Syndrome: Advances in Diagnosis and Treatment. *Jama* 2018;698-710. DOI: 10.1001/jama.2017.21907.
4. Guerin C, Reignier J, Richard JC, et al. Prone positioning in severe acute respiratory distress syndrome. *The New England journal of medicine* 2013;2159-2168. DOI: 10.1056/NEJMoa1214103.
5. Guerin C, Beuret P, Constantin JM, et al. A prospective international observational prevalence study on prone positioning of ARDS patients: the APRONET (ARDS Prone Position Network) study. *Intensive care medicine* 2018;22-37. DOI: 10.1007/s00134-017-4996-5.
6. Papazian L, Forel JM, Gacouin A, et al. Neuromuscular blockers in early acute respiratory distress syndrome. *The New England journal of medicine* 2010;1107-1116. DOI: 10.1056/NEJMoa1005372.
7. Bernard GR, Luce JM, Sprung CL, et al. High-dose corticosteroids in patients with the adult respiratory distress syndrome. *The New England journal of medicine* 1987;1565-1570. DOI: 10.1056/nejm198712173172504.
8. Steinberg KP, Hudson LD, Goodman RB, et al. Efficacy and safety of corticosteroids for persistent acute respiratory distress syndrome. *The New England journal of medicine* 2006;1671-1684. DOI: 10.1056/NEJMoa051693.
9. Meduri GU, Bridges L, Siemieniuk RAC, et al. An Exploratory Reanalysis of the Randomized Trial on Efficacy of Corticosteroids as Rescue Therapy for the Late Phase of Acute Respiratory Distress Syndrome. *Critical care medicine* 2018;884-891. DOI: 10.1097/ccm.0000000000003021.
10. Meduri GU, Golden E, Freire AX, et al. Methylprednisolone infusion in early severe ARDS: results of a randomized controlled trial. *Chest* 2007;954-963. DOI: 10.1378/chest.06-2100.
11. Meduri GU, Marik PE, Chrousos GP, et al. Steroid treatment in ARDS: a critical appraisal of the ARDS network trial and the recent literature. *Intensive care medicine* 2008;61-69. DOI: 10.1007/s00134-007-0933-3.
12. Peter JV, John P, Graham PL, et al. Corticosteroids in the prevention and treatment of acute respiratory distress syndrome (ARDS) in adults: meta-analysis. *BMJ (Clinical research ed.)* 2008;1006-1009. DOI: 10.1136/bmj.39537.939039.BE.
13. Agarwal R, Nath A, Aggarwal AN, et al. Do glucocorticoids decrease mortality in acute respiratory distress syndrome? A meta-analysis. *Respirology (Carlton, Vic.)* 2007;585-590. DOI: 10.1111/j.1440-1843.2007.01060.x.
14. Tang BM, Craig JC, Eslick GD, et al. Use of corticosteroids in acute lung injury and acute respiratory distress syndrome: a systematic review and meta-analysis. *Critical care medicine* 2009;1594-1603. DOI: 10.1097/CCM.0b013e31819fb507.
15. Meduri GU, Bridges L, Shih MC, et al. Prolonged glucocorticoid treatment is associated with improved ARDS outcomes: analysis of individual patients' data from four randomized trials and trial-level meta-analysis of the updated literature. *Intensive care medicine* 2016;829-840. DOI: 10.1007/s00134-015-4095-4.
16. Annane D, Pastores SM, Rochwerg B, et al. Guidelines for the diagnosis and management of critical illness-related corticosteroid insufficiency (CIRCI) in critically ill patients (Part I): Society

- of Critical Care Medicine (SCCM) and European Society of Intensive Care Medicine (ESICM) 2017. *Intensive care medicine* 2017;1751-1763. DOI: 10.1007/s00134-017-4919-5.
17. Afshari A, Brok J, Moller AM, et al. Inhaled nitric oxide for acute respiratory distress syndrome and acute lung injury in adults and children: a systematic review with meta-analysis and trial sequential analysis. *Anesthesia and analgesia* 2011;1411-1421. DOI: 10.1213/ANE.0b013e31820bd185.
 18. Adhikari NK, Burns KE, Friedrich JO, et al. Effect of nitric oxide on oxygenation and mortality in acute lung injury: systematic review and meta-analysis. *BMJ (Clinical research ed.)* 2007;779. DOI: 10.1136/bmj.39139.716794.55.
 19. Fuller BM, Mohr NM, Skrupky L, et al. The use of inhaled prostaglandins in patients with ARDS: a systematic review and meta-analysis. *Chest* 2015;1510-1522. DOI: 10.1378/chest.14-3161.
 20. Peek GJ, Mugford M, Tiruvoipati R, et al. Efficacy and economic assessment of conventional ventilatory support versus extracorporeal membrane oxygenation for severe adult respiratory failure (CESAR): a multicentre randomised controlled trial. *Lancet (London, England)* 2009;1351-1363. DOI: 10.1016/s0140-6736(09)61069-2.
 21. Bosarge PL, Raff LA, McGwin G, Jr., et al. Early initiation of extracorporeal membrane oxygenation improves survival in adult trauma patients with severe adult respiratory distress syndrome. *The journal of trauma and acute care surgery* 2016;236-243. DOI: 10.1097/ta.0000000000001068.
 22. Matthay MA, Brower RG, Carson S, et al. Randomized, placebo-controlled clinical trial of an aerosolized beta(2)-agonist for treatment of acute lung injury. *American journal of respiratory and critical care medicine* 2011;561-568. DOI: 10.1164/rccm.201012-2090OC.
 23. Truwit JD, Bernard GR, Steingrub J, et al. Rosuvastatin for sepsis-associated acute respiratory distress syndrome. *The New England journal of medicine* 2014;2191-2200. DOI: 10.1056/NEJMoa1401520.

Initiation of Mechanical Ventilation:

- A. Intubation as per Airway protocol
- B. If patient presents with endotracheal tube to Trauma bay
 - a. Interrogate tube with direct visualization or video-assisted evaluation of tube passing through cords
 - b. Confirm EtCO₂ >30
 - c. Chest Xray to confirm position above the carina
- C. Intubated postoperative patients receive a Chest Xray within 1 hour of ICU presentation
- D. Initial ventilator settings are based on ideal body weight
 - a. Vt= 6mL/kg ideal body (IBW) weight rounded up to nearest increment of 10
- E. CALCULATION OF IBW
 - a. Determine Patient height by:
 - i. Patient statement (if able)
 - ii. Ulnar/Tibial measurement
 - 1. Ulnar
 - a. MUST online calculator
http://www.bapen.org.uk/pdfs/must/must_page6.pdf
 - 2. Tibial
 - a. Men
 - i. 18–60 years Predicted height (cm)=[knee height (cm)×1.88]+71.85
 - ii. 60–90 years Predicted height (cm)=knee height (cm)×2.08]+59.01
 - b. Women
 - i. 18–60 years Predicted height (cm)=[knee height (cm)×1.87] – [age (years) ×0.06]+70.25
 - ii. 60–90 years Predicted height (cm)=[knee height (cm)×1.91] – [age (years) ×0.17]+75.0
 - b. Calculate IBW:
 - i. Women: 49 kg + 1.7 kg for each inch over 5 feet (Robinson)
 - ii. Men: 50 + 2.3 kg per inch over 5 feet (Devine)
 - c. Vt= 6mL/kg ideal weight rounded up to nearest increment of 10
 - d. Titrate respiratory rate before volume
 - e. Calculation cards located on all unit vents

Bojmehrani et al. Comparison of usual and alternative methods to measure height in mechanical ventilated pts: potential impact on protective ventilation. *Respiratory Care*; 59:7 2014.

Collier et al. Provider bias impacts tidal volume selection and ventilator days in trauma patients. *J Am Coll Surg*. 2015 ISSN 1072-7515/16

Finch et al. Assessing the accuracy and reliability of direct height measurement for use in adult neurological pts w contractures: comparison w height from ulna length. *J Human Nutrition and Dietitians*. 2013. Doi: 10.1111/jhn.12103

Gajic et al. Ventilator-associated lung injury in pts w/out acute lung injury at the onset of mechanical ventilation. *Crit Care Med*. 2004 Sep; 32(9): 1817-24.

Guay et al. Intraoperative use of low volume ventilation to decrease postoperative mortality, mechanical ventilation, lengths of stay and lung injury in patients without acute lung injury. *Cochrane Database Syst Rev*. 2015 Dec 7; (12): CD011151

Serpa et al. Association between tidal volume size, duration of ventilation, and sedation needs in patients without acute respiratory distress syndrome: an individual patient data meta-analysis. *Intensive Care Med*. 2014 Jul; 40(7):950-7.

Discontinuation of Mechanical Ventilation

Ventilator Steer SBT Protocol

(2016 RC PDP)

I : DEFINITIONS

STEER:

- Screen for contraindications
- Test readiness by utilizing preliminary SBT
- Exercise using long SBT
- Evaluate progress and assign category
- Report information to clinicians

SBT: Spontaneous Breathing Trial

SAT: Spontaneous Awakening Trial

II: POLICY:

- 1) All mechanically ventilated patients, regardless of underlying pathology, initial ventilator mode or parameters, will be screened daily by a RCP for spontaneous breathing readiness. A physician order is not required for daily screening of the STEER exclusion criteria. However, a physician order is required to execute the STEER Spontaneous Breathing Trial (SBT). The Epic ventilator order set automatically enrolls patient into the Ventilator STEER SBT Protocol unless the default STEER order is deselected. If the patient meets criteria for STEER SBT Protocol and does not have a current order, the RCP will ask the physician to enroll the patient into the Ventilator STEER SBT Protocol.
- 2) The Ventilator STEER SBT Protocol will be initiated on patients by physician order using the Epic ventilator order set
- 3) All patients entered into the STEER Protocol or who remain on mechanical ventilation the following day, will proceed directly to the STEER SBT Protocol after 24 hours.

III. PROCEDURES AND RESPONSIBILITIES

A. Screen

During scheduled ventilator rounds at 0000-0400, the RCP will screen all mechanically ventilated patients for spontaneous breathing readiness using the STEER screening criteria. If the patient meets one or more of the below criteria, the patient will be classified as a **“Level 4/ do not complete SBT.”** The RCP will then document on the SBT flow sheet. The RCP will repeat the screening BID.

STEER Screening exclusion Criteria

- Peep > 10 cmH₂O
- FiO₂ > 0.45
- Hemodynamic Instability
- HR > 140
- Unstable Angina
- Increased ICP
- Neuromuscular blockers
- HFOV
- APRV with P-High > 24 cmH₂O
- Physician has requested patient not to have measurement or trials completed (order deselected)

The RCP will notify the RN if the patient qualifies for a SBT. The RN will conduct a Spontaneous Awakening Trial (SAT) safety screen. If the patient passes the SAT safety screening, the RN will proceed with the actual SAT.

B. Test

Brief Minimal Support SBT

If the patient demonstrates adequate spontaneous respiratory efforts, then patient performs a brief (one minute) SBT on minimal support: PS = 0 or PS = 5 cm H₂O based on physician preference. If the Rapid Shallow Breathing Index (RSBI) on the brief minimal support SBT is less than 105 and the patient does not meet any of the *Stop Criteria*, then the RCP will begin a 30-120 minute *Minimal Support SBT* (see section C. Exercise).

Brief Augmented Support SBT

If the RSBI on the brief minimal support SBT is greater than 105 or the patient meets other *Stop Criteria* other than arrhythmia or hemodynamic instability, the RCP will perform brief augmented support SBTs. The therapist will start with PSV at a driving pressure of 20 cmH₂O and decrease the driving pressure 2 cm H₂O increments until patient is at the

lowest tolerated driving pressure (at which he/she can complete a brief SBT with RSBI less than 105 and does not meet the Stop Criteria).

Stop Criteria and Termination for SBT

The RCP will monitor patient response for stop criteria. A trial will be terminated if a patient presents one or more of the following clinical signs:

- RSBI > 105
- SpO₂ < 90% or within physician specified limits
- Respiratory distress defined as: Increase work of breathing, diaphoretic, RR > 35 or RR < 10
- Agitation or panic unrelieved by reassurance and adjustment of the mechanical ventilation system
- Hemodynamically unstable with significant increase or decrease of heart rate or blood pressure. (Stop SBT and do not restart without physician order.)
- New or worsening arrhythmias. (Stop SBT and do not restart without physician order.)
- RCP judgement from patient assessment.

Note: If the patient experiences arrhythmias or hemodynamic instability during the RSBI trial, the physician/RN should be notified and the trial should not be repeated until approval has been given by the physician to proceed. If the RCP notes contraindications and/or observes an adverse response, the responsible physician and RN will be immediately informed.

C. Exercise

Minimal Support SBT

If the patient had completed a brief minimal support SBT during the Test phase with RSBI less than 105 and did not meet the *Stop Criteria*, then the RCP will initiate an SBT on PSV driving pressure of 0-5 cmH₂O and PEEP of 0-5 cmH₂O. The trial will continue for at least 30 minutes, so long as the patient's RSBI does not exceed 105 and Stop Criteria are not met. The RCP will record the RSBI at the end of 30 minutes. If the physician does not give an order to extubate or go to trach collar at that time, the RCP will continue the SBT for a total of 120 minutes unless the patient meets Stop Criteria or the physician gives an order to extubate or begin trach collar. After the trial has been completed, the RCP will record the RSBI. The therapist will then return the patient to the previous ventilator settings and notify physician.

If the patient completes minimal support SBT with RSBI of less than 105 and did not meet the Stop Criteria, then the RCP will contact the physician to request an order for extubation protocol or for further direction. If the physician chooses not to extubate, the RCP will document the reason for no extubation. (See Evaluate section, Level 1b).

Augmented Pressure Support

If the patient had completed a brief augmented support SBT during the Test phase with RSBI less than 105 and did not meet the Stop Criteria, then the RCP will initiate an SBT on PSV with driving pressure equal to the lowest tolerated driving pressure during the Test phase. The trial will continue for at least 30 minutes, so long as the patient's RSBI does not exceed 105 and Stop Criteria are not met. The RCP will record the RSBI at the end of 30 minutes. The therapist will then return the patient to the previous ventilator settings and notify physician.

D. Evaluate the patient's SBT performance and assign STEER category

Level 1A: Completed minimal Support SBT with low RSBI, awaiting extubation

Patient performed a SBT on minimal support (PS = 0 or PS = 5 cm H₂O based on physician preference) for a minimum of 30 minutes without reaching stop criteria. If the SBT was up to 120 minutes, the patient did not reach stop criteria during that time either. The physician has not given an order to withhold extubation/trach collar.

Level 1b: Completed minimal Support SBT with low RSBI, withholding extubation

Same as Level 1A, except that the physician has given an order to withhold extubation/trach collar. The RCP will document the reason for no extubation in Epic.

Level 2: Not Level 1, but improving SBT performance

The patient unable to complete a minimal support SBT without meeting Stop Criteria, but are improving over the last 48 hours. This level includes patients who meet Stop Criteria during Minimal Support SBT and patients who undergo Augmented Support SBT. Within the last 48 hours, the patient must have improved his/her performance on at least one SBT: gone from one driving pressure on Augmented Support SBT to a lower driving pressure or increased the tolerated time on Minimal Support SBT to at least 30 minutes.

Level 3: Not Level 1, and not improving SBT performance

Same as Level 2, except that, within the last 48 hours, the patient has not improved his/her performance on at least one SBT: gone from one driving pressure on Augmented Support SBT to a lower driving pressure or increased the tolerated time on Minimal Support SBT to at least 30 minutes. Patients in this category may require more extensive evaluations due to their inability for readiness to being taken off mechanical ventilation. They will, however continue to undergo daily SBT screening

and be initiated on trials unless the patient is taken out of the protocol by an order from their physician.

E. Report:

The results will be documented in the Epic flow sheet. The results should include the therapist determination of the STEER level, as well as the results of the last SBT: the driving pressure required, duration and reason for stopping (meeting Stop Criteria or completion of the planned SBT).

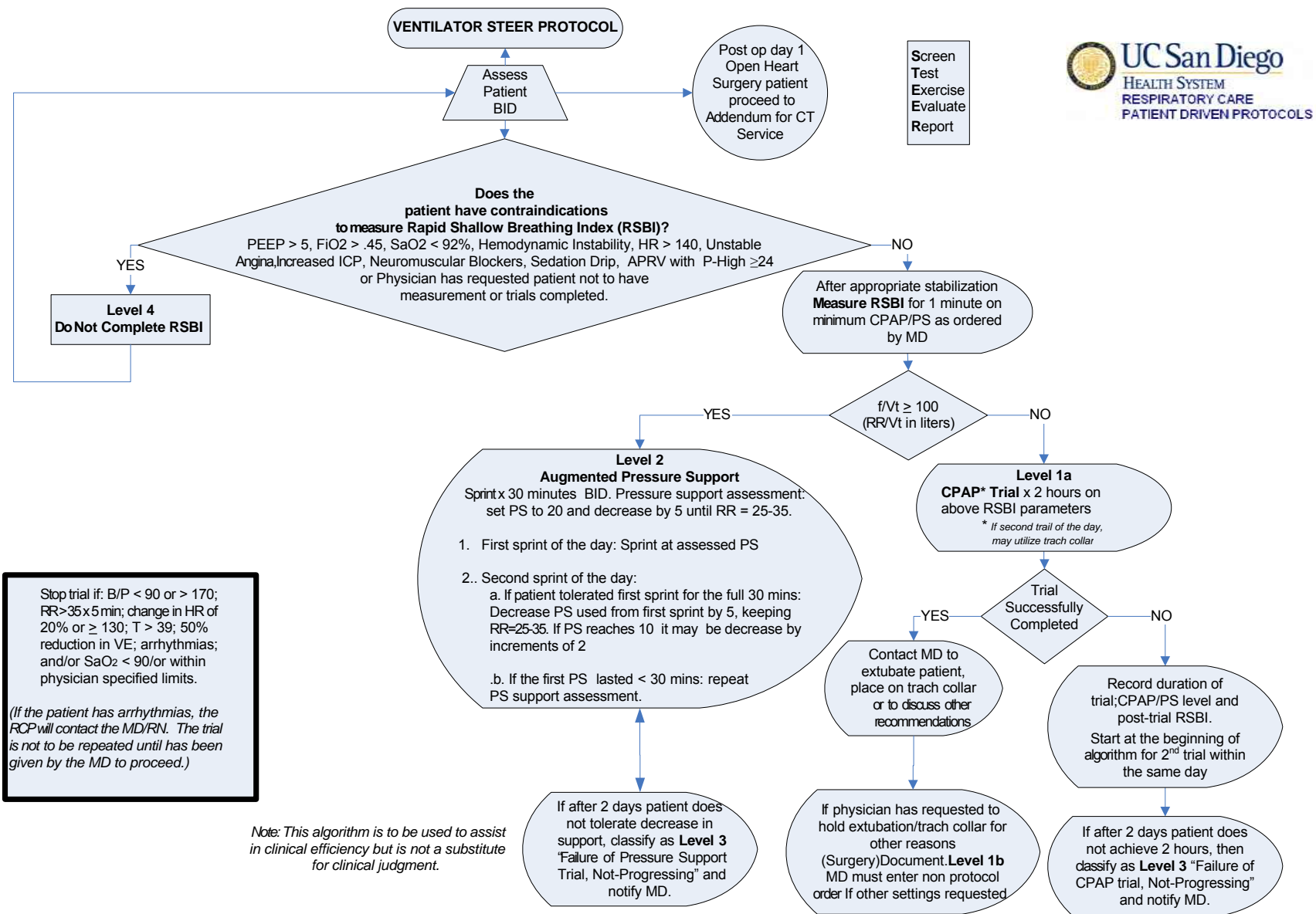
The therapist will report the results (STEER level, and latest SBT results) to the physicians during multidisciplinary rounds.

The therapist will be prepared to discuss the results (STEER level, and latest SBT results) to Respiratory Care team lead and to the Medical Director during respiratory care rounds.

As requested by the ICU leadership, a list of patients who are Level 1A will be delivered to rounding physicians in the AM Huddle.

Boundaries/Interactions:

After a STEER SBT protocol order has been entered, the RCP may initiate and discontinue trials per RT Protocol. Physicians and nurses will be informed of the patient's progress by the RCP through direct communication and appropriate documentation on the SBT trial flow sheets. The RCP and RN should coordinate activities that will optimize the schedule for the trials. Ideally, this care coordination planning should take place during the midnight vent RCP rounds. Modalities outside the limits of the protocol require a physician's order. The RCP will also notify the physician and RN of any acute changes in the patient's condition.



Ventilator Extubation Protocol

(2016 RC PDP)

Purpose:

To provide protocol-driven respiratory therapy to meet the special requirements of the ICU patient by addressing the needs of the patient pre- and post-extubation

Policy:

1. The Extubation Protocol will be initiated on patients by an order from the physician for extubation. The Extubation Protocol may be ordered as follows:
 - a) Extubation Protocol
 - b) RT Protocol for Extubation
 - c) RT Consult for Extubation

Upon receipt of the physician's order, the RCP will:

- a) Determine if a patient is a high-risk extubation (i.e., airway burn, s/p head/neck surgery, difficult intubation)
 - b) Be responsible for preparing equipment for extubation
 - c) Enter the plan within the patient driven protocol evaluation form
 - d) Patients on the Extubation Protocol will proceed directly to the Oxygen Protocol post-extubation
2. If the physician desires to extubate their patient outside the Extubation Protocol, the physician will enter the following parameters:
 - a) An order for a specific oxygen delivery device
 - b) Desired oxygen liter flow or FIO₂
 - c) A statement that the RT Protocol is not to be initiated

Equipment: See Extubation Policy and Procedure, Respiratory Care Services

- Oxygen system: See Oxygen Delivery Device protocol, Respiratory Care Services

Extubation Procedure: See Extubation Policy and Procedure, Respiratory Care Services

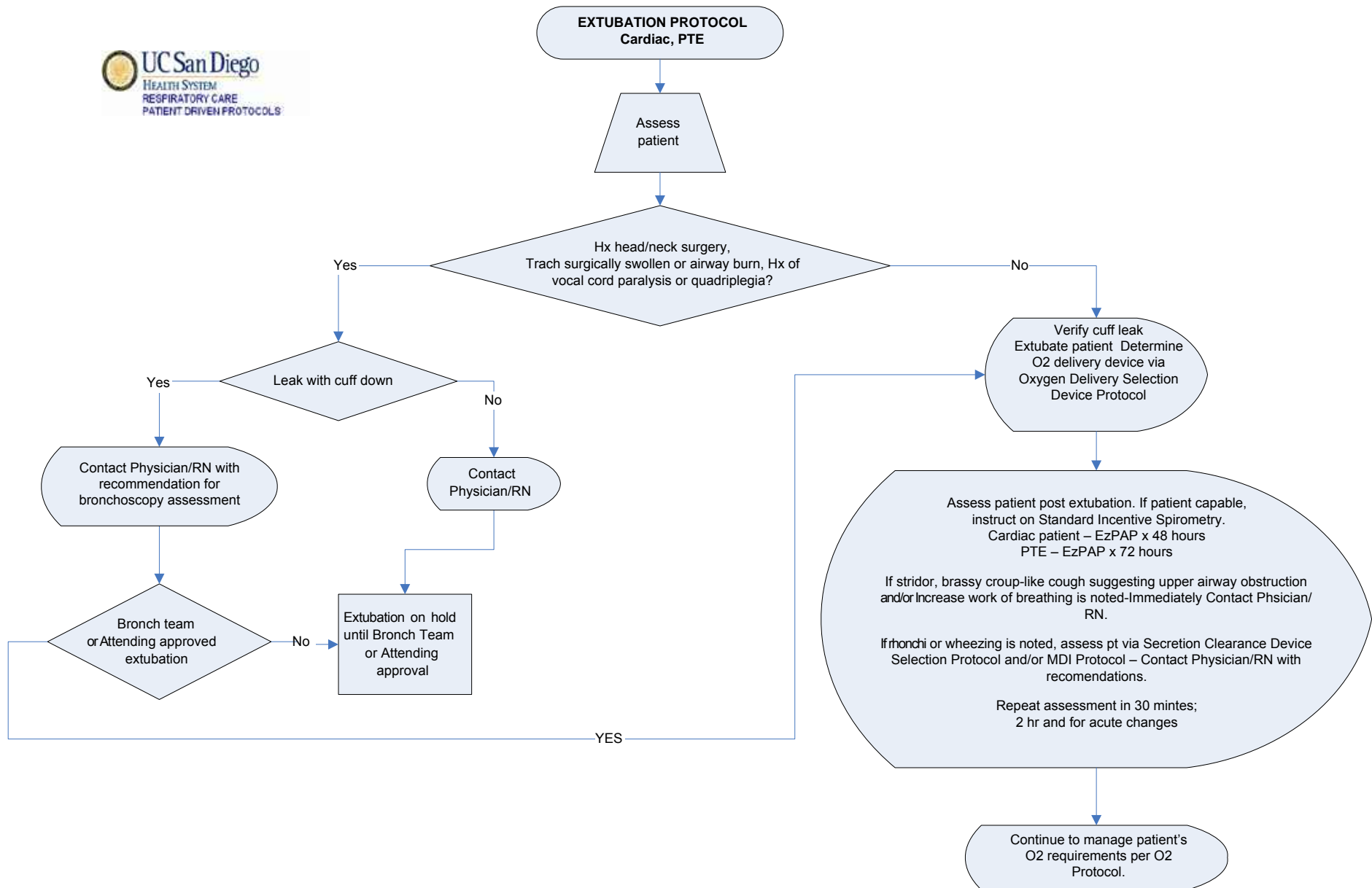
Protocol:

1. For patients post-extubation (except cardiac and pulmonary thromboendarterectomy (PTE) patients), The RCP will:
 1. Instruct the patient on the use of the Incentive Spirometer and observe 10 inspiratory maneuvers followed by cough (if patient is able)
 2. Instruct the patient to continue to perform 10 inspiratory maneuvers Q1hr, while awake and the nurse will be informed to encourage compliance.

3. The RCP will assess the patient post-extubation to determine if additional lung expansion therapy is required.

Post-Extubation:

1. Reassess patient 30 minutes post-extubation
2. Repeat assessment 2 hours post-extubation
3. Manage patient's oxygen requirements per the Respiratory Care Oxygen Protocol



Note: This algorithm is to be used to assist in clinical efficiency but is not a substitute for clinical judgment.

Additional Notes: Extubation of Trauma Patients

- a. DO NOT EXTUBATE patients under the following circumstances without the approval and presence of a trauma attending/fellow:
 - i. after 1900 hours.
 - ii. patients with a known history of a “difficult airway” or “difficult intubation” (Includes patients who are status post anesthesia with difficult airway/intubation and/or significant soft tissue neck injury.)
 - iii. patients status postoperative neck surgery (spine surgery cases included)

TIMING OF TRACHEOSTOMY

SUMMARY

The appropriate timing of tracheostomy in the patient suspected to require prolonged mechanical ventilation remains a subject of controversy. Multiple retrospective and prospective studies have been performed to evaluate this clinical question. These studies suggest that early tracheostomy (within 7-10 days of intubation), especially among patients with traumatic brain injury, is associated with significant improvements in duration of mechanical ventilation, intensive care unit and hospital length of stay, reduced ventilator-associated pneumonia, reduces hospital costs, and improves patient survival.

RECOMMENDATIONS

- **Level 1**
 - **None**
- **Level 2**
 - **Tracheostomy should be considered in patients who require more than 7-10 days of mechanical ventilation in order to reduce the duration of mechanical ventilation and decrease intensive care unit and hospital length of stay, duration of sedation, and hospital cost.**
 - **The reason for mechanical ventilation should be considered when deciding the timing of tracheostomy.**
- **Level 3**
 - **Tracheostomy before 7 days is contraindicated in patients with a probability of survival less than 25%.**
 - **Early tracheostomy may reduce the risk of ventilator-associated pneumonia and may improve patient survival.**

INTRODUCTION

Airway access for mechanical ventilation can be provided either by endotracheal or tracheostomy tube. During episodes of acute respiratory failure, patients are generally ventilated through an endotracheal tube. The transition to a tracheostomy tube is often considered when the need for mechanical ventilation is expected to be prolonged. The most common indications for tracheostomy are acute respiratory failure and need for prolonged mechanical ventilation and traumatic or catastrophic neurologic insult requiring airway control, mechanical ventilation or both. Upper airway obstruction is a less common indication for tracheostomy. Observational studies document that approximately 10% of mechanically ventilated patients will require tracheostomy, but there is significant variability regarding optimal timing and patient selection.

LITERATURE REVIEW

Several retrospective and prospective studies have been performed to examine the optimal timing for

tracheostomy. These studies evaluated the potential benefits of reduced length of stay (LOS), mortality, and intensive care unit (ICU) stay. A 2020 study performed at a tertiary medical center showed that patient's managed by Trauma and Neurology services had a significantly shorter time to tracheostomy than those managed by other services (1). In addition to the objective data points studied in most of the following studies, a study in Australia showed that patients who received tracheostomy had earlier returns to walking, talking, out of bed exercise, and required less sedation and analgesia. This study however compared patients with tracheostomy to intubated patients (2).

Arabi et al. published a retrospective study of 531 mechanically ventilated subjects in a mixed medical/surgical ICU (3). The mean time to tracheostomy was 12 days and mean ICU LOS was 23 days. Time to tracheostomy was associated with an increased duration of mechanical ventilation, ICU LOS, and hospital LOS for each day tracheostomy was delayed. Time to tracheostomy was not associated with increased ICU or hospital mortality.

Beltrame et al. performed a single-center study evaluating the outcomes of bedside percutaneous dilatational tracheostomy (PDT) and surgical tracheostomy (ST) (4). Five hundred twenty-eight mechanically ventilated patients underwent tracheostomy. 161 patients received ST and 367 underwent PDT. STs were performed significantly later than PDT (12.4 days vs. 8.7, $p<0.05$). Overall ICU LOS (18.4 vs. 23.3 days, $p<0.05$) and mean duration of mechanical ventilation (14.2 vs. 20.1 days, $p<0.05$) were lower in the PDT than in the ST group.

Möller et al. performed a study to determine whether early tracheostomy (ET) of severely injured patients reduces duration of mechanical ventilation, the frequency of ventilator-associated pneumonia (VAP), and ICU LOS (5). The study was a retrospective review that included 185 surgical ICU patients with acute injuries requiring mechanical ventilation and tracheostomy. There were no differences in the rate of acute respiratory distress syndrome (ARDS) or acute lung injury between groups. ET was defined as ≤ 7 days, and late tracheostomy (LT) as > 7 days. The incidence of VAP was significantly higher in the LT group (42.3% vs. 27.2%, respectively; $p<0.05$). They also found that APACHE II scores, hospital and ICU LOS, and the number of ventilator days were significantly higher in the LT group.

In 2005, a systematic review and meta-analysis included 5 randomized controlled trials (RCT) evaluating the timing of tracheostomy in 406 adult patients on ventilatory support (6). ET did not significantly alter mortality (relative risk 0.79, 95% confidence interval 0.45 to 1.39) or the risk of pneumonia (0.90, 0.66 to 1.21). ET did however significantly reduce the duration of mechanical ventilation (weighted mean difference 8.5 days) and ICU LOS (weighted mean difference 15.3 days).

In 2008, a large retrospective analysis from Ontario compared mechanically ventilated patients who underwent ET vs. LT. A total of 10,927 patients received tracheostomy during the study of which one-third ($n=3758$) received ET ≤ 10 days) and two-thirds ($n=7169$) received LT (>10 days). Patients in the ET group had lower unadjusted 90-day (34.8% vs. 36.9%; $p=0.032$), 1 year (46.5% vs. 49.8%; $p=0.001$), and study mortality (63.9% vs. 67.2%; $p<0.001$) than patients in the LT group (7).

Terragni et al. conducted a multicenter prospective RCT in 12 Italian ICUs from June 2004 to June 2008 (8). The study enrolled 600 adult patients without pneumonia who had been ventilated for 24 hours. Subjects were monitored for 48 hours and those with worsening respiratory failure and no pneumonia were then randomized to either early (6–8 days, $n=209$) or late tracheostomy (13–15 days, $n=210$). The study included both medical and surgical subjects with no demographic differences. Thirty-one percent in the early group and 43% of the late group did not undergo tracheostomy due to proximity to either extubation or death. In the early group, 69% underwent tracheostomy compared with 57% in the late group. All tracheostomies were performed using bedside percutaneous techniques (Griggs technique in 72% early vs. 73% late, PercuTwist technique in 25% vs. 22%). VAP developed in 14% of early vs. 21% of late tracheostomy patients ($p=0.07$). The number of ICU-free and ventilator-free days was higher in the early tracheostomy group, but 28-day survival (74% vs. 68%; $p=0.25$) did not differ. The authors concluded that early tracheostomy did not result in significant reduction in the incidence of VAP compared with late tracheostomy and was associated with an adverse event related to the tracheostomy procedure in more than one third of subjects. It should be noted that both percutaneous insertion techniques utilized in this

study have been noted in other studies to have an increased rate of procedural complications.

Young et al. performed the largest open multi-center randomized controlled trial on timing of tracheostomy (9). This study was conducted from 2004 through 2011 in 70 general adult and 2 cardiothoracic ICUs in 72 hospitals in the United Kingdom. Nine hundred nine patients were enrolled. Inclusion criteria were mechanically ventilated subjects in adult ICUs who were identified in the first 4 days after admission as likely to require at least an additional 7 days of mechanical ventilation. Exclusion criteria included those patients receiving immediate tracheostomy or were contraindicated due to anatomical or other reasons or those with respiratory failure due to chronic neurological diseases. Patients were randomized to either ET (within 4 days after intubation, n=455) or LT (after 10 days if still indicated, n=454). Most subjects were admitted with a medical diagnosis (79.2%), with respiratory failure as the primary admission diagnosis (n=59.5%). Interestingly, in the early group, 91.9% of subjects received tracheostomy as planned as compared to the late group where only 45.5% of subjects required tracheostomy. Many subjects in the late tracheostomy group no longer required mechanical ventilation and were successfully extubated. Ninety percent of the tracheostomies were performed by the percutaneous technique, with 88.7% performed in the ICU at the bedside, and the majority (77.3%) performed by the single tapered dilator technique. There was no difference in 30-day mortality (30.8% ET vs. 31.5% LT), 2-year mortality (51.0% vs. 53.7%), or median ICU stay among survivors (13.0 days vs. 13.1 days). There was also no difference in hospital stay or duration of mechanical ventilation between the two groups. However, ET was associated with significantly decreased sedation use. The median number of days during which any sedatives were received in survivors at 30 days after randomization was 5 days in the early group and 8 in the late group ($p<0.001$), with a mean difference between groups of 2.4 days (95% CI 1.6–3.6).

Patient selection is a key factor in determining timing to tracheostomy. Barquist et al. performed one of the few prospective RCTs looking at timing to tracheostomy in trauma patients (10). This was a single-center trial comparing trauma patients who received a tracheostomy within 8 days of intubation vs. those whose tracheostomy was delayed until after day 28. The study was halted after the first interim analysis (after 60 patients) as there was no significant difference between groups in number of mechanical ventilator days, ICU length of stay, incidence of VAP, or hospital mortality. They concluded that tracheostomy before day 8 post-injury in trauma patients did not reduce the number of days of mechanical ventilation, frequency of pneumonia or ICU LOS as compared with a tracheostomy strategy involving the procedure at 28 days post-injury or more.

In 2009, Schauer et al. performed a retrospective multi-institutional study looking back over a 5-year period (11). They analyzed the relationship between the timing of tracheostomy in trauma patients and mortality, ICU and hospital LOS, and incidence of pneumonia. This relationship was investigated in the context of expected survival based on probability of survival (Ps) greater than 25%. The study examined 685 trauma patients who received tracheostomy and stratified patients into low and high probability of survival and early (0–3 days), early intermediate (4–7 days), late intermediate (8–12 days), and late (>12 days) tracheostomy. ET was associated with decreased ICU stay, hospital stay, total ventilator days, and rates of pneumonia among trauma patients with a high Ps. There was a significantly higher mortality rate (48.9%) associated with patients with low Ps (<25%) receiving tracheostomy less than 4 days injury. This study demonstrated that ET in patients with low Ps may not be beneficial given the high mortality rate before post injury day 4. However, in patients with high probability of survival, there is an increased benefit to ET.

Arabi et al. also showed a benefit to ET (12). They evaluated trauma patients who received tracheostomy over a 5-year period. Tracheostomy was considered early if it was performed by day 7 of mechanical ventilation. Multivariate analysis was performed on duration of mechanical ventilation, ICU LOS, and outcome between ET and LT patients. Six hundred fifty-three trauma ICU patients were identified, of which 21% required tracheostomy. Twenty-nine patients underwent ET and 107 received LT. ET patients were more likely to have maxillofacial injuries and to have a lower Glasgow Coma Scale score. Duration of mechanical ventilation was significantly shorter with ET (mean 9.6 versus 18.7 days; $p<0.0001$). Similarly, ICU LOS was significantly shorter (10.9 vs. 21.0 days; $p<0.0001$). There was no significant difference regarding ICU LOS after tracheostomy. ICU and hospital mortality rates were similar. LT was found to be an independent predictor of prolonged ICU stay (>14 days).

These results were duplicated by Hyde et al. (13). ET was defined as a tracheostomy performed by the fifth hospital day. Patients in the ET group had significantly shorter ICU LOS (21.4 vs. 28.6 days, $p<0.0001$) and significantly fewer ventilator days (16.7 vs. 21.9 days, $p<0.0001$) compared to the LT group. ET patients also had significantly less VAP (34% vs. 64.2%, $p=0.0019$). In the current era of increased healthcare costs, the authors concluded that ET significantly decreased both pulmonary morbidity and critical care resource utilization translating to a cost savings of \$52,173 per patient. They concluded that for trauma patients requiring prolonged ventilator support, ET should be performed.

Patients with traumatic brain injury (TBI) commonly tracheostomy. In 2004, Boudierka et al. published a study that evaluated whether ET (by the fifth day post-injury) reduces duration of mechanical ventilation, ICU LOS, incidence of VAP, and mortality in comparison with prolonged intubation among patients with head injury (14). Randomization was performed on the fifth day into two groups: ET and prolonged endotracheal intubation (PEI). The two groups were comparable in terms of age, sex, and Simplified Acute Physiologic Score (SAPS). The mean time of mechanical ventilation was shorter in the ET group (14.5 days) vs. PEI group (17.5 days) ($p=0.02$). After pneumonia was diagnosed, mechanical ventilatory time was 6 days for the ET group vs. 11.7 days for PEI group ($p=0.01$). There was no difference in frequency of pneumonia or mortality between the two groups. Khan et al. recently demonstrated that in patients with cervical spine injuries without traumatic brain injury (TBI), ET (prior to intubation day 7) had lower rates of VAP, shorter duration of mechanical ventilation, and ICU and hospital LOS (15).

Rizk et al. collected data from the Pennsylvania Trauma Society Foundation statewide trauma registry from January 1990 until December 2005 (16). 3,104 patients met criteria for inclusion in the study ($GCS \leq 8$, documented TBI, and tracheostomy). Patients in the ET group (< 7 days) had higher ISS and lower GCS scores when compared to the LT group (> 7 days). ICU and hospital LOS were significantly lower and functional independence at discharge significantly greater in the ET group. However, LT patients were more likely to be discharged alive (93% vs. 85%, $p<0.0001$). The authors concluded that a strategy of ET (1-7) days, particularly when performed on patients with a reasonable chance of survival, results in a better overall clinical outcome than when the tracheostomy is performed in a delayed manner.

In a small 2002 study, Saffle et al. randomized patients to either ET, or to conventional therapy with tracheostomy on intubation day 14. They showed that although there were some benefits in terms of patient comfort, there was no benefit in mortality (17). This work was seemingly confirmed by a 2018 study by Tsuchiya et al. who retrospectively reviewed severely burned patients who underwent ET. They initially predicted that those patients would have improved outcomes with decreased mortality, but no difference in mortality was demonstrated between the groups (18)

REFERENCES

- 1) Gillis, A., Pfaff, A., Ata, A., Giammarino, A., Stain, S., & Tafen, M. Are there variations in timing to tracheostomy in a tertiary academic medical center? *Am J Surgery* 2020; 219(4):566–570.
- 2) Sutt, A.-L., Tronstad, O., Barnett, A., Kitchenman, S., & Fraser, J. Earlier tracheostomy is associated with an earlier return to walking, talking, and eating. *Australian Critical Care* 2020. <https://doi.org/10.1016/j.aucc.2020.02.006>
- 3) Arabi YM, Alhashemi JA, Tamim HM, Esteban A, Haddad SH, Dawood A, et al. The impact of time to tracheostomy on mechanical ventilation duration, length of stay, and mortality in intensive care unit patients. *J Crit Care* 2009; 24(3):435–440.
- 4) Beltrame F, Zussino M, Martinez B, Dibartolomeo S, Saltarini M, Vetrugno L, et al. Percutaneous versus surgical bedside tracheostomy in the intensive care unit: a cohort study. *Minerva Anestesiol* 2008; 74(10):529–535
- 5) Möller MG, Slaikeu JD, Bonelli P, Davis AT, Hoogeboom JE, Bonnell BW. Early tracheostomy versus late tracheostomy in the surgical intensive care unit. *Am J Surg* 2005; 189(3):293–296.
- 6) Griffiths J, Barber VS, Morgan L, Young JD. Systematic review and meta-analysis of studies of the timing of tracheostomy in adult patients undergoing artificial ventilation. *BMJ* 2005; 330(7502):1243.
- 7) Scales DC, Thiruchelvam D, Kiss A, Redelmeier DA. The effect of tracheostomy timing during critical illness on long-term survival. *Crit Care Med* 2008; 36(9):2547–2557.
- 8) Terragni PP, Antonelli M, Fumagalli R, Faggiano C, Berardino M, Pallavicini FB, et al. Early vs. late tracheostomy for prevention of pneumonia in mechanically ventilated adult ICU patients: a randomized controlled trial. *JAMA* 2010; 303(15):1483–1489.
- 9) Young D, Harrison DA, Cuthbertson BH, Rowan K. TracMan Collaborators. Effect of early vs. late tracheostomy placement on survival in patients receiving mechanical ventilation: the TracMan randomized trial. *JAMA* 2013; 309(20):2121–2129.
- 10) Barquist ES, Amortegui J, Hallal A, Giannotti G, Whinney R, Alzamel H, MacLeod J. Tracheostomy in ventilator dependent trauma patients: a prospective, randomized intention-to-treat study. *J Trauma* 2006; 60(1):91–97.
- 11) Schauer JM, Engle LL, Maugher DT, Cherry RA. Does acuity matter? Optimal timing of tracheostomy stratified by injury severity. *J Trauma* 2009; 66(1):220–225.
- 12) Arabi Y, Haddad S, Shirawi N, Al Shimemeri A. Early tracheostomy in intensive care trauma patients improves resource utilization: a cohort study and literature review. *Crit Care* 2004; 8(5):R347–R352.
- 13) Hyde GA, Savage SA, Zarzaur BL, Hart-Hyde JE, Schaefer CB, Croce MA, Fabian TC. Early tracheostomy in trauma patients saves time and money. *Injury* 2015; 46(1):110–4.
- 14) Boudier MA, Fakhir B, Bouaggad A, Hmamouchi B, Hamoudi D, Harti A. Early tracheostomy versus prolonged endotracheal intubation in severe head injury. *J Trauma* 2004; 57(2):251–254.
- 15) Khan, M., Prabhakaran, K., Jehan, F., Anderson, P., Con, J., Lombardo, G., Latifi, R. Early tracheostomy in patients with cervical spine injury reduces morbidity and improves resource utilization. *Am J Surgery* 2020 (In press).
- 16) Rizk EB, Patel AS, Stetter CM, Chinchilli VM, Cockroft KM. Impact of tracheostomy timing on outcome after severe head injury. *Neurocrit Care* 2011; 15(3):481–489.
- 17) Saffle JR, Morris SE, Edelman L. Early tracheostomy does not improve outcome in burn patients. *J Burn Care Rehabil* 2002; 23(6):431–438.
- 18) Tsuchiya, A., Yamana, H., Kawahara, T., Tsutsumi, Y., Matsui, H., Fushimi, K., & Yasunaga, H. Tracheostomy and mortality in patients with severe burns: A nationwide observational study. *Burns* 2018; 44(8):1954–1961.

Surgical Critical Care Evidence-Based Medicine Guidelines Committee

Primary Author: Lucy Woodley, MD; Kevin Treto, MD

Editor: Michael L. Cheatham, MD

Last revision date: April 24, 2020

Please direct any questions or concerns to: webmaster@surgicalcriticalcare.net

Anemia and Transfusions in Stable Trauma patients

The UC San Diego Division of Trauma, Surgical Critical Care, Burns and Acute Care Surgery follows the “Choosing Wisely” campaign, include Transfusing wisely:



Transfusing Wisely: Save Blood—Save Lives—Know the indications for transfusion

KNOW THE “4S” INDICATIONS

SEVEN: Lower Hgb targets have always been equal or better in trials. If you transfuse for a Hb

target, a Hgb of **7** is the trigger at UCSD.

(IN) STABILITY: Bleeding patients who become hemodynamically unstable can be transfused without waiting for a low Hgb. In GI Bleeding, aiming for Hb > 7 costs lives.

SIGNIFICANT SYMPTOMS: However, it’s best to transfuse patients, not numbers. Consider the clinical picture and whether symptoms are important, eg, angina. And use...

SINGLE UNITS: The adage “no one needs one unit of blood” is a myth. Each unit carries risk and must be necessary. Check Hgb between units unless starting Hb < 6.

KNOW THE RISKS

REACTIONS: Transfusion Related Acute lung Injury (TRALI) (1 in 5-10k) is the #1 cause of transfusion related death. Hemolysis (1 in 25-50k acute, 1 per 2500 late) is #3.

Anaphylaxis (1 per 50-150k), and fever (1 per 200) are also important.

VOLUME OVERLOAD: Transfusion-Associated Cardiac Overload (TACO) (1 per 1-10k) is the #2 killer.

INFECTION: VIRUSES AND PARASITES are very uncommon, <1/million, but bacterial sepsis occurs in 1/30k PRBC and 1/100k platelet transfusions. In trials, the risk of hospital-acquired infection (HAI), including pneumonia, increased to 1 in 20 after transfusion.⁴

KNOW THE SIGNS

Consider **TRALI**, **TACO**, hemolysis, and sepsis with any significant change in vital signs or dyspnea and follow the instructions on the transfusion record sent with the unit. Immediately report any reaction.

QUESTIONS?

Call Transfusion Services at Hillcrest (x3-5640/1) or Thornton (x7-6161/2) if you have any questions, or contact the SICU Medical Director.

Anemia in Non-Critically Ill Trauma Patients

1. Patients with low hematocrits (<30%) on the medical-surgical ward who can tolerate oral intake should receive ferrous sulfate 325mg po tid and docusate sodium 50-500mg po divided in 1-4 doses while in hospital.
2. If eating normally at the time of discharge, patients should be instructed to take over the counter ferrous sulfate.

Policy Name:	Death by Whole Brain Criteria
Policy Number:	UCSDHP 832.1
Authoring Department:	Neuroscience
Last Revised Date:	March 14, 2018

APPLICABILITY:

The University of California San Diego Health (UCSDH) policies (UCSDHPs) are organizational policies are applicable to all parts of UC San Diego which report to the Vice Chancellor of Health Sciences. UCSDHPs apply to all faculty, staff, clinicians, students, contractors and volunteers at UCSDH. UCSDH clinical locations include (but are not limited to): UC San Diego Health Hillcrest – Hillcrest Medical Center and UCSDH’s affiliated clinics and clinical practices, UC San Diego Health La Jolla – Jacobs Medical Center and Sulpizio Cardiovascular Center (SCVC).

Departmental policies and procedures (DPPs) are unit specific within a single department, unit or service area.

PURPOSE:

This document establishes the policy for the determination of death by whole brain criteria. This is also referred to as “brain death,” but must be understood to be no different than a diagnosis of death made by other criteria.

This policy and the implementing procedures are intended to provide a description of recommended courses of action to address a specific diagnosis/clinical condition or need of a particular patient population. While this policy represents the institution’s judgment regarding the provision of patient care services, it is not necessarily the only acceptable and appropriate approach to patient care. Patient care continues to require the exercise of judgment and individualization based on patient needs and responses.

POLICY:

Determination of Death: Based on current medical standards, an individual who has sustained either (A) irreversible cessation of circulatory and respiratory functions or (B) irreversible cessation of all functions of the entire brain including those of the brain stem, is dead (California Code, Health and Safety Code 7180 Determination of Death Act). A determination of death by whole brain criteria must be made in accordance with accepted medical standards. Note that the policy for death by whole brain criteria is defined separately for infants and adults below.

Death by whole brain criteria is a medical and legal definition. It does not require consent or participation by family or surrogate decision - makers. Appropriate efforts will be made to discuss the patient’s medical condition and the process of determining death by brain criteria with family or surrogate decision-makers prior to evaluating whether or not the patient is dead.

UC San Diego Health

Policy Name:	Death by Whole Brain Criteria
Policy Number:	UCSDHP 832.1
Authoring Department:	Neuroscience
Last Revised Date:	March 14, 2018

Determination of death should be accomplished as early as practical in the patient's clinical course for the benefit of both family/surrogate decision-makers and staff.

Two licensed attending physicians must independently confirm the diagnosis of death by brain criteria (California Health and Safety Code, Section 7181). At least one of these physicians must be a board-eligible or board-certified attending neurologist, neurosurgeon, or neurointensivist. The second physician would ideally be the patient's attending physician. At least one attending physician must participate in the process of determining death by whole brain criteria (including apnea testing) and sign the death note in the patient's chart. Other attending physicians may become involved in the determination of death at the discretion of the primary service attending of record. Neither physician making the determination of death shall participate in the procedure for organ/tissue procurement or transplantation. The patient is declared dead at the time of the determination of death by whole brain criteria.

Although it is possible for medical trainees at the level of a resident or above to perform the clinical examination with immediate and direct physical supervision of an attending physician, the documentation of death by whole brain criteria should be completed by the attending physician. The attending of record is responsible for notifying and discussing the patient's death with the patient's family. This may not be delegated to house staff alone, but house staff may be present for educational purposes.

In the event there is any delay in reaching a board-eligible or board - certified neurologist, neurosurgeon, or neurointensivist, the chain of command should be immediately utilized, including a call or page to the Division Chief.

UCSDH will follow California law, which requires that a "reasonably brief period of accommodation" after death by whole brain criteria is provided for family or next of kin to gather at the bedside prior to discontinuation of cardiopulmonary support for the patient. A period of 48 - 72 hours may be considered prior to extubation. No other medical intervention is required during this time period (California Health and Safety Code, Section 1254.4).

UC San Diego Health

Policy Name:	Death by Whole Brain Criteria
Policy Number:	UCSDHP 832.1
Authoring Department:	Neuroscience
Last Revised Date:	March 14, 2018

PROCEDURES:

I. Death Due To Irreversible Cessation of Cardio-Respiratory Function.

A. Responsible person(s):

The responsible person shall be a staff physician, or a licensed resident who is functioning as surrogate for this physician.

B. Procedure:

The physician shall examine the patient to determine a lack of cardio-pulmonary function, and then certify death by entering a note in the chart.

C. Criteria:

This assessment will take place after all appropriate resuscitation efforts are completed. Absence of cardiac function will be demonstrated by the absence of pulses by palpation, and the absence of cardiac contractions by chest auscultation. Absence of respiratory function will be demonstrated by the absence of ventilation by inspection and auscultation. Additional methods of determination may be used to supplement this clinical examination, if appropriate.

D. Documentation:

The physician determining death shall enter and sign a progress note in the chart which details the date, time, and basis of determination of death, and also clearly indicates the physician responsible for this determination. A death certificate must also be completed.

II. Death due to Irreversible Cessation of All Functions of the Brain, including Brain Stem (Brain Death). (THE FOLLOWING FOUR CRITERIA MUST ALL BE MET.)

A. Before considering the use of whole brain criteria for determining whether a patient has died, the following two requirements must be met:

1. Establishment of irreversible and proximate cause of coma by history, examination, neuroimaging, and laboratory testing.
2. Reversible medical conditions that may confound the clinical assessment of coma have been excluded or corrected:

Policy Name:	Death by Whole Brain Criteria
Policy Number:	UCSDHP 832.1
Authoring Department:	Neuroscience
Last Revised Date:	March 14, 2018

- i. No drug intoxication or poisoning by history, drug screen, calculation of clearance using 5 times the drug's half-life (assuming normal hepatic and renal function) or, if available, drug plasma levels below the therapeutic range.
 - ii. Arterial PO₂ must be above 50 mm Hg, with or without supplemental oxygen administration. If PO₂ is below this value, or substantially below the patient's chronic baseline oxygen status, a patient may still be declared brain dead using other surrogate laboratory procedure (see below) but apnea testing may not be used as part of the criteria for establishing death by brain criteria.
 - iii. Core temperature must be above 36°.
 - iv. No neuromuscular blockade or continued presence of neuromuscular blocking agents (defined by the presence of a train of 4 twitches with maximal nerve stimulation).
 - v. Systolic blood pressure must be ≥ 100 mm Hg. Vasoactive medications are allowable to maintain system blood pressure.
 - vi. No severe electrolyte abnormalities.
 - vii. No severe metabolic/acid-base disorders.
 - viii. No "Locked-in" syndrome.
- B. If the patient has suffered a hypoxic-ischemic event sufficient to be the cause of coma, at least 24 hours must elapse before clinical determination of death by brain criteria. If the cause of coma is known with certainty not to be hypoxia-ischemia an observation period should pass since the onset of the brain insult to exclude the possibility of recovery (in practice, usually several hours). Ancillary tests may be used to shorten the duration of the observation period.
- C. Clinical Exam: Once potentially confounding factors have been excluded or corrected, careful clinical examination of the patient is performed to demonstrate cerebral unresponsiveness, absence of ALL brainstem reflexes, and apnea:
- 1. Cerebral Unresponsiveness

Policy Name:	Death by Whole Brain Criteria
Policy Number:	UCSDHP 832.1
Authoring Department:	Neuroscience
Last Revised Date:	March 14, 2018

- i. Deep Coma: Patients must lack all evidence of responsiveness. No eye opening or eye movement to noxious stimuli (e.g. nail-bed pressure and supraorbital pressure) is present. No motor response to noxious stimuli (e.g. nail-bed pressure and supraorbital pressure) except for spinally mediated reflexes is present.
2. Absence of all brainstem reflexes
 - i. No decerebrate or decorticate posturing;
 - ii. No pupillary response;
 - iii. No gag reflex;
 - iv. No corneal reflex;
 - v. No oculocephalic reflex;
 - vi. No oculovestibular reflex;
 - vii. No jaw reflex;
 - viii. No grimacing to noxious stimuli (e.g. nail bed, supraorbital ridge, or temporomandibular joint pressure);
 - ix. No cough response to bronchial suctioning;
 - x. No swallowing or yawning.

D. Apnea

1. Purpose of apnea test: To demonstrate that there are no respiratory efforts despite the stimulus of marked acidemia, indicating severe damage to the medulla.
2. Indication for apnea test: If the other clinical criteria for the diagnosis of death by whole brain criteria (above) have been fulfilled, then an apnea test is required to complete the clinical diagnosis of death by brain criteria. Children with cyanotic congenital heart disease may not be candidates for apnea testing.

Policy Name:	Death by Whole Brain Criteria
Policy Number:	UCSDHP 832.1
Authoring Department:	Neuroscience
Last Revised Date:	March 14, 2018

3. Apnea Test Procedure

- i. Prerequisites Core temperature $\geq 36^{\circ}\text{C}$ and Systolic blood pressure ≥ 100 mm Hg
- ii. Specific procedures and set-up are detailed in the Respiratory Therapy manual.
- iii. Expose patient's chest and diaphragmatic area.
- iv. Adjust ventilation for $\text{PCO}_2 = 35$ to 45 and obtain baseline arterial blood gas.
- v. Pre-oxygenate for 10 minutes with 100% O_2 to a PaO_2 of ≥ 200 mm Hg
- vi. Disconnect the ventilator from the patient and connect to system which delivers at least 8-10 liters per minute of oxygen flow by T-piece, or provide 100% O_2 without ventilator pressure support while maintaining PEEP.
- vii. Watch for signs of respiratory effort.
- viii. Draw arterial blood gases according to the specifications detailed in the Respiratory Therapy manual. Serial blood gases are drawn until apnea is confirmed (see below). If at any time respiratory effort is observed, or the patient develops hemodynamic instability (SBP falls < 90 mmHg or age appropriate normative values), marked desaturation ($< 85\%$ for more than 30 seconds), or arrhythmia, the test should be terminated and the patient returned to assisted ventilation (in those cases, the apnea test is therefore not confirmed).

4. Results of Apnea Test

- i. Apnea confirmed: Respiratory movements are absent and any one or more of the following is found:
 - a. $\text{PaCO}_2 > 60$ mmHg
 - b. PaCO_2 at least 20 mmHg over baseline blood gas
- ii. Apnea not confirmed - Respiratory effort is observed.

Policy Name:	Death by Whole Brain Criteria
Policy Number:	UCSDHP 832.1
Authoring Department:	Neuroscience
Last Revised Date:	March 14, 2018

iii. Apnea unable to be confirmed - Indeterminate result

If during the apnea test, the systolic blood pressure falls below 90 mmHg, or below age appropriate normative values, pulse oximetry indicates marked desaturation (<85% for more than 30 seconds), or cardiac arrhythmias occur, an arterial blood gas should be immediately drawn and the ventilator reconnected pending analysis of the blood gas. If this blood gas fulfills the above mentioned criteria, then apnea is confirmed. Otherwise, apnea is unable to be confirmed. The apnea test may be repeated after 1 hour, with attention to prior circumstances which resulted in the aborted test. Otherwise, consideration may be given to the use of ancillary testing.

III. Clinical Manifestations compatible with the Determinations of Brain Death

A. The following clinical manifestations are occasionally seen and should not be interpreted as evidence for brainstem function (presence of these is compatible with a diagnosis of death):

1. Deep tendon reflexes; superficial abdominal reflexes; triple flexion response; Babinski reflex. Respiratory-like movements (shoulder elevation and adduction, back arching, intercostal expansion without significant tidal volumes).
2. Movement of the abdomen from ventricular contractions or abdominal aortic pulsations should not be confused with diaphragmatic movement during apnea test.
3. Sweating, blushing, tachycardia.
4. Absence of diabetes insipidus.
5. Normal blood pressure without pharmacologic support; sudden increases in blood pressure or heart rate.

IV. Ancillary Testing Procedures

A. Death is a clinical diagnosis. Ancillary testing is not mandatory but is recommended in patients in whom the clinical examination or apnea test cannot be reliably performed or completed. It should be emphasized that any of the suggested ancillary tests may produce similar results in patients with catastrophic brain damage who do not (yet) fulfill the clinical criteria of death.

B. Ancillary testing is not required for the diagnosis of death by whole brain criteria, but may

Policy Name:	Death by Whole Brain Criteria
Policy Number:	UCSDHP 832.1
Authoring Department:	Neuroscience
Last Revised Date:	March 14, 2018

be used as supportive data after all other clinically testable criteria have been satisfied. If an ancillary test is performed, only one is required. Ancillary testing cannot supersede the clinical criteria. For example, if all other neurologic function is absent, except that an apnea test demonstrates respiratory effort, or one pupil has some reaction to light stimulus, an abnormal ancillary test would be considered a false positive. An ancillary test may be considered in the case of an indeterminate apnea test, or in the case where medications may confound clinical criteria (e.g. high-dose barbiturates).

- C. The following ancillary test findings are listed in the order of the most sensitive test first. Consensus criteria are identified by individual tests:

1. Conventional Angiography.
 - i. No intracerebral filling at the level of the carotid bifurcation or circle of Willis.
 - ii. The external carotid circulation is patent, and filling of the superior longitudinal sinus may be delayed.
2. Electroencephalography, (EEG).
 - i. No electrical activity during at least 30 minutes of recording that adheres to the minimal technical criteria for EEG recording in suspected death as adopted by the American Electroencephalographic Society, including 16-channel EEG instruments.
 - ii. EEG may not be used as an ancillary test if intoxication or anesthetic effect is a possible explanation for the patient's clinical condition.
3. Technetium - 99m hexamethylpropyleneamineoxime brain scan.
 - i. No uptake of isotope in brain parenchyma ("hollow skull phenomenon")

- V. Documenting that death by whole brain criteria has been diagnosed:

- A. A note shall be entered in the medical record by the attending physician completing each exam at the time of determination of death by brain criteria. This note shall include:
 1. Etiology and irreversibility of condition

UC San Diego Health

Policy Name:	Death by Whole Brain Criteria
Policy Number:	UCSDHP 832.1
Authoring Department:	Neuroscience
Last Revised Date:	March 14, 2018

2. Documentation of examination to include:
 - i. Cerebral unresponsiveness
 - ii. Absence of brainstem reflexes
 - iii. Absence of motor response to pain
 3. Results of apnea test, including arterial blood gas determinations. (Absence of respiration with $pCO_2 \geq 60$ mmHg or rise of >200 mmHg)
 4. Justification for ancillary test(s), if necessary, and result of that test(s).
 5. Repeat neurologic examination. Option: the interval is arbitrary, but a 6-hour period is reasonable.
 6. Name and title of the attending physician performing each examination.
 7. Time of determination of death by brain criteria.
- B. Completion of the "UCSDH Post Mortem Death Information" form (may be performed by house staff).

VI. Special Considerations in Infants and Children

- A. The criteria for the clinical diagnosis of death in infants and children are the same as adults with the following important exceptions regarding criteria, personnel, repeat testing, observation periods and the use of ancillary studies:
1. Criteria (MUST be met):
 - i. Normothermic: Core temperature $>35^{\circ}C$ ($95^{\circ}F$)
 - ii. Normotensive for age (systolic blood pressure not less than 2 standard deviation below age-appropriate norm) and without signs of volume depletion.
 2. Personnel: Two licensed attending physicians must independently confirm the

Policy Name:	Death by Whole Brain Criteria
Policy Number:	UCSDHP 832.1
Authoring Department:	Neuroscience
Last Revised Date:	March 14, 2018

diagnosis of death by brain criteria. At least one of these physicians must be a pediatric neurologist, pediatric intensivist and neonatologist, pediatric trauma surgeon, pediatric anesthesiologist with critical care training, or pediatric neurosurgeon. Adult specialists should have appropriate neurologic and critical care training to diagnose brain death when caring for the pediatric patient from birth to 18 years of age. The other physician would ideally be the patient's attending physician.

3. TWO EXAMINATIONS by EACH licensed attending (including apnea testing with each examination) separated by an observation period are required for all infants and children up to the age of 18 years.
 - i. In newborns < 37 weeks gestational age, formal criteria for the determination of death by whole brain criteria have not been established.
 - ii. In term newborns > 37 weeks gestational age to 30 days of age, an observation period of 24 hours between brain death exams is recommended.
 - iii. In infants and children (31 days to 18 years), an observation period of 12 hours between brain death exams is recommended.

All examinations must be consistent with brain death. The first examination determines the infant or child has met accepted criteria for brain death, whereas the second examination confirms brain death based on an irreversible condition.

4. Ancillary studies (EEG and radionuclide cerebral blood flow) are NOT required to establish brain death and are not a substitute for the neurologic examination. Ancillary studies should be used to assist in the diagnosis of brain death in the following circumstances:
 - i. When components of the examination or apnea testing cannot be completed safely due to the underlying medical condition of the patient.
 - ii. If there is uncertainty about the results of the neurologic examination.
 - iii. If a medication effect may be present.
 - iv. To reduce the inter-examination observation period.

UC San Diego Health

Policy Name:	Death by Whole Brain Criteria
Policy Number:	UCSDHP 832.1
Authoring Department:	Neuroscience
Last Revised Date:	March 14, 2018

- a. When ancillary studies are used, a second clinical examination and apnea test should be attempted and components that can be completed must remain consistent with brain death. In this instance the observation interval may be shortened and the second neurologic examination and apnea test (or all components that are able to be completed safely) can be performed at any time thereafter. If the ancillary study is equivocal or if there is concern about the validity of the study, the patient CANNOT be pronounced dead.

VII. Reasonable Period of Accommodation for Family to Gather

- A. After determination of Death by whole brain criteria, when requested by a patient's family, UCSDH will allow a Reasonable Period of Accommodation (as defined in Section I above) when requested by a patient's family for next of kin or family to gather at the patient's bedside, before withdrawing cardiopulmonary support.
- B. During this period, UCSDH will continue previously ordered cardiopulmonary support and compassionate nursing care. No other medical intervention will be required. However, UCSDH policy on treatment recommendations for potential organ donors should be followed until the patient's legally recognized health care decision maker, if any, or the patient's family or next of kin, if available, has been approached by a designee of The Organ Procurement and Transplant Network.
- C. Upon request, and shortly after UCSDH physicians have declared death by whole brain criteria, UCSDH will provide the patient's legally recognized health care decision maker, if any, or the patient's family or next of kin, if available, with a written statement of this policy's provision for a Reasonable Period of Accommodation.
- D. UCSDH will make reasonable efforts to accommodate those religious and cultural practices in accordance with the values and beliefs of the patient.

DEFINITIONS:

- I. Death: An individual who has sustained either (1) irreversible cessation of circulatory and respiratory functions, or (2) irreversible cessation of all functions of the entire brain, including the brain stem, is dead (California Health & Safety Code Sections 7180).
- II. Brain Death: An individual, who has sustained irreversible cessation of all functions of the entire

UC San Diego Health

Policy Name:	Death by Whole Brain Criteria
Policy Number:	UCSDHP 832.1
Authoring Department:	Neuroscience
Last Revised Date:	March 14, 2018

brain, including the brainstem, as determined by accepted medical standards, is dead.

There shall be independent confirmation of the death by two (2) physicians. (Two licensed physicians must examine the patient and declare brain death. Neither the physician making the determination of death nor the physician making the independent confirmation shall participate in the procedures for removing or transplanting organs/tissues) (California Health & Safety Code Sections 7180- 7182). Also see UCSDHP [360.1](#), Organ and Tissue Donation. Both physicians must document in the medical record that the patient is brain dead. These notes must state, unequivocally, that the patient is brain dead and must include the date and time of declaration. The official time of death on the death certificate is at the declaration time by the second physician. The death certificate should be completed by the primary medical service.

- III. California Health and Safety Code Definition: The California Health and Safety Code, Section 7181 et. seq. states that an individual who has sustained “irreversible cessation of all functions of the entire brain, including the brain stem, is dead.” Brain death is a clinical diagnosis and specific clinical criteria must be satisfied in order for this diagnosis to be made. In certain circumstances, the use of ancillary test(s) may be desirable, but the use of any of these tests is not mandatory in making the diagnosis of death by brain criteria in adults. The following policy does not replace the physician’s judgment in individual cases, but may be considered reasonable, current, and generally accepted brain criteria for use in the diagnosis of death.
- IV. Donation after Cardiac Death (DCD): A patient for whom medical support was withdrawn, and once meeting the criteria for circulatory death may donate solid organs (See UCSDHP [360.1](#), Organ and Tissue Donation).
- V. Period of Reasonable Accommodation: A reasonably brief amount of time following declaration of death - consider 48 to 72 hours - that may be needed for next of kin or family to gather at the bedside. In determining what is reasonable, the UC San Diego Health System (UCSDH) will take into account the needs of the family, but also the needs of other patients and prospective patients in need of urgent care.

FORMS:

None.

REFERENCES/RESOURCES/RELATED DOCUMENTS:

[Title 22 California Code of Regulations](#)

UC San Diego Health

Policy Name:	Death by Whole Brain Criteria
Policy Number:	UCSDHP 832.1
Authoring Department:	Neuroscience
Last Revised Date:	March 14, 2018

The Joint Commission, ([TJC](#))

[Uniform Determination of Death Act, Health & Safety Code § 7180](#)

[Confirmation of Death, Health & Safety Code § 7181](#)

[Licensing Provisions, Health & Safety Code § 1254.4](#)

ATTACHMENTS:

None.

RELATED POLICIES:

UCSDHP [360.1](#) "Organ and Tissue Donation"

UCSDHP [380.1](#) "Do Not Attempt to Resuscitate"

UCSDHP [381.1](#) "Limitation of Life Sustaining Treatment"

CONTACT(S):

Neuroscience

APPROVALS:

Nursing Policy & Procedure Committee, (NPP): June 4, 2018

Nurse Executive Council, (NEC): July 16, 2018

Medical Staff Executive Committee, (MSEC): August 16, 2018

UC San Diego Health Executive Governing Body, (EGB): August 28, 2018

REVISION HISTORY:

ORIGINAL: 7/26/2004

REVISED: 10/26/2004, 6/26/2007, 7/17/2008, 8/20/2009, 3/20/2014, 3/14/2018

Central Venous Catheter Insertion

- 1) Residents must receive appropriate training before placing central lines independently.
 - a) All residents must be credentialed in Central Line Insertion by their Residency Program Director to insert lines without immediate supervision.
 - b) This requires completion of:
 - i) Online Training Course, and
 - ii) Practical Training Course, and
 - iii) Supervision of insertion of 5 proctored line each at subclavian, internal jugular and femoral locations, and
 - iv) Completion of at least two years of residency (i.e. R3 or above.)
- 2) Line proctoring must be performed by an authorized senior resident, fellow or attending.
- 3) A nurse must be present for insertion of routine central lines.
- 4) Ultrasound must be used for insertion of routine central lines.
- 5) A “Timeout” must be completed for insertion of routine central lines.
- 6) The CLIP (Central Line Insertion Protocol) form must be followed and completed in EPIC for all line insertions.
- 7) The Central Line note must be completed in EPIC and must be sent to an attending for cosign.
- 8) Use of a BioPatch is a CDPH requirement. Central lines are preferably secured with a “Stat-Lock” rather than sutures to allow placement of the BioPatch. The BioPatch must be around the catheter on the skin.
 - a) Avoid “Hubbing” the line – lines inserted tightly with the hub pushing into the skin will require the nurse to cut the sutures to place the BioPatch.
 - b) Place lines in such a way that they can be dressed occlusively with a transparent dressing by the nurse. (i.e. avoid IJ insertions high on the neck)
- 9) The CDPH hospital fine for an internally lost guidewire is \$50,000 to \$100,000.
- 10) The UCSD Central Line Blood Stream Infection rate is publically reportable.
- 11) The necessity of a Central Line or PICC must be documented daily by state law.
- 12) Use of peripheral IVs placed with ultrasound guidance reduces need for central lines and PICCs and the CLABSI rate.

The UCSD Central Line online training course can be found at <http://mycourses.ucsd.edu/>

Non UCSD personnel can use the SICU Central Line Course at <http://surgery.ucsd.edu/som/surgery/divisions/trauma-burn/training/courses/Pages/sicu-central-line.aspx>

DON'T HUB THE LINE!

FAIL! HUBBED!
NO ROOM FOR BIOPATCH



GOOD!
ROOM FOR BIOPATCH ON SKIN



GOOD!
STATLOCK ALLOWS ADJUSTMENT



- There is no medical need to “hub” a CVC.
- Biopatch reduces CLABSI – but it must be placed around the CVC, on the skin.
- STATLOCKS allow sutureless placement of CVCs in many cases.

J Doucet, SICU Director, 4/17

Antibiotics and Antifungals for the Trauma/Surgical Intensive Care Unit Patient

The following guidelines have been developed to assist physicians with the appropriate selection of prophylactic and empiric antibiotic therapy for common infections seen in SICU patients at UCSD. These guidelines were developed with knowledge of “nosocomial” pathogens seen in this unit.

Treatment should be directed by patient-specific parameters which include: gram stain, culture and sensitivity information (when they are known), previous infectious diseases and antibiotic courses, and other pertinent medical history, including immunosuppression and drug allergies. Duration of antibiotic treatment should be based on specific organism(s), site of infection, and clinical scenario.

The drug(s) of choice listed below are the most active, least toxic and most cost-effective agents currently on the UCSD Formulary. Dosing guidelines are for patients with “normal” renal and liver function. Many antibiotic dosages must be adjusted with altered renal function, we recommend working closely with the SICU pharmacists in these cases.

Infectious Disease consultation should be obtained for patients with unusual isolates, complicated infectious disease management problems, and those who are responding poorly to empiric therapy.

MRSA Screening: California State Law requires all admissions to an ICU undergo MRSA screening via a nasal swab. The only exemption is those patients already known to be MRSA positive.

ICU Antibiotics Rules of Thumb:

1. *How sick is the patient?*

Patients with signs and symptoms of sepsis or who are immunocompromised need early, broad spectrum therapy. Delay can be fatal. Prolonged invasive ventilation and prior antibiotic use (especially of broad-spectrum agents) predispose to resistance. If you suspect sepsis you should call a “code sepsis” to ensure timely administration of antibiotics (within one hour).

2. *Identify the organism*

Ideally you should be treating a known organism with an appropriate dose of antibiotic to which that organism is likely to respond, based on sensitivity testing. This ideal will often not be met, at least initially. Sometimes you will obtain an organism and its sensitivity on routine microbiological surveillance and then the patient will show features of infection likely to be due to that organism. More often, you will have to rely on empiric therapy.

3. *Know the environment*

Know the patterns of resistance and the organisms prevalent in our ICU environment. This helps with antibiotic choice. The current UCSD Antibigrams are available on the Infection Control pages via links on the intranet homepage (go to Pulse Intranet à Departments & Services à Infection Control / Epidemiology Unit à ICC Information Reports à Quarterly Reports à choose the latest quarter à Antibigram)

4. *Identify the site of infection*

Positive blood cultures are simply not good enough. Identify the site of infection (i.e. respiratory tract, urinary tract, a sub-diaphragmatic collection, etc.) and address any surgically remediable pathology right away. An infection will not improve without source control.

5. *Don't overtreat*

Never treat a "fever" or a "leukocytosis" with antibiotics. Assess the patient as a whole, including their predisposition to infection and likely sites of infection. Ask whether the patient is sick enough to justify antibiotics, rather than treating laboratory values! If you are going to start 'empiric' therapy, first obtain microbiological specimens for culture. Document your reasons for starting therapy, and choose as narrow an antibiotic spectrum as possible for the clinical scenario.

When you get the results of culture and sensitivity testing, revise your treatment to narrow the spectrum as much as possible, or stop antibiotics completely if no infections are identified. With new DNA and mass-spectroscopy based testing we often receive preliminary culture results in **less than 24 hours** – antibiotics can be narrowed at this time (i.e. stopping vancomycin or transitioning to ceftriaxone if DNA testing shows no genes for methicillin resistance). An antibiotic "time out" should be performed after 48 hours of treatment to ensure that treatment is appropriate.

6. *Don't delay*

If the patient clearly needs antibiotics for treatment, give the antibiotics and do not wait for sensitivity results. The primary lesson of Rivers' EarlyGoal-Directed Therapy in Sepsis trial is to be EARLY!

7. *Don't undertreat*

Even more important than giving adequate doses of an antimicrobial is not to give an agent that has a substantial likelihood of failure. In a critically ill patient, you may not get a second chance. The wrong antibiotic can increase mortality risk greater than threefold.

8. *Know how critical illness interacts with the antibiotic*

The pharmacokinetics of antimicrobials are often substantially altered in the critically ill, especially with renal failure. Pharmacy should assist with dosing in complex patients, and can follow levels and titrate doses when appropriate.

9. *In vitro* response is not the same as *in vivo*

There are some agents that appear to be effective *in vitro*, but will not work *in vivo*. Always look at sensitivity results in the light of your knowledge of the microbe and the patient (and especially the site of infection!).

Antibiotic Prophylaxis

a. Ventriculostomy or ICP Monitor in Place

- Routine prophylaxis: cefazolin 1 g IV q8h
- Allergy to penicillin: vancomycin 1g q12 hours, pharmacy to adjust dosing by level, especially if renal insufficiency

b. Posttraumatic Open Fracture

- *Gustilo Grade I & II*: cefazolin 1-2g IV q8h x 24h (2gm for patients > 70 kg)
- *Gustilo Grade III*: cefazolin 1-2gm IV q8h **and** gentamicin x 72h (or continue for 23 hours after soft tissue coverage is achieved.)

Gentamicin Dosing Regimen		
CrCl (mL/min)	Dose	Interval
≥60	5 mg/kg	q24h
30-59	5 mg/kg	q48h

- Dose is based on actual (or if patient is obese, then adjusted) body weight - **max dose 500 mg**
- Patients in an ICU should receive **6 mg/kg**
- Alternative therapy if patient is allergic to Penicillins or Cephalosporins:
 - Vancomycin (patient-specific dose), usual 15 mg/kg IV q12h
 - Plus or minus gentamicin (dosing as above)

c. Penetrating Abdominal Trauma and/or Surgical Procedure

- Cefazolin 1-2g IV x1 pre-op
 - Add metronidazole 500mg IV x1 pre-op if high-risk of hollow viscus injury
- If penicillin allergy: ciprofloxacin 400mg and metronidazole 500mg (for colon pathology) or clindamycin 600mg and ciprofloxacin 400mg
- Continue x 24h post-surgical procedure or definitive therapy **only if** hollow viscous injury identified (non-contaminated cases do not require any additional antibiotics)

d. Routine Chest Tube Insertion

- No prophylactic antibiotic therapy required

e. Ventilator Associated Pneumonia (VAP)

Criteria:

- Patient has been ventilated more than 48 hours

- **AND** a new and persistent infiltrate or consolidation on chest X-ray
- **AND** one of the following:
 - Febrile > 38° C (100.4° F)
 - Leukopenia (<4000 WBC/mm³) or leukocytosis (≥12,000 WBC/mm³)
 - Altered mental status with no other recognized cause (adults ≥70 years only)
- **PLUS TWO** of the following:
 1. Increased or purulent sputum (ask nurse\RT about suctioning)
 2. New onset or worsening cough \ dyspnea \ tachypnea
 3. Rales or bronchial breath sounds
 4. Worsening gas exchange

If yes, this is a suspect VAP case (PNU1):

1. Order Bronchoscopy + quantitative bronchoalveolar lavage (BAL) – gram stain, culture and sensitivities (C&S).
2. Start antibiotics after BAL: piperacillin / tazobactam 3.375 g IV q8h **and** vancomycin 1g IV q12h (pharmacy will adjust dose)
3. If positive C&S (PNU2), narrow antibiotics for sensitivities and continue 7 days. (14 days for *pseudomonas*.)
4. If negative C&S and WBC and fever resolve, discontinue antibiotics

f. Presumed Aspiration

Witnessed or presumed aspiration after traumatic event (i.e. loss of consciousness, vomitus in oropharynx, vomitus seen on intubation, or suspect infiltrate on initial CXR): clindamycin 600 mg IV q8h **and** ciprofloxacin 400 mg IV q12h x 72h

- If signs \ symptoms of pneumonia develop, continue treatment for 7 days, narrow to cover identified organism

g. Drowning

Drowning is unfortunately common in San Diego, and exposes patients to potential aspiration of unusual organisms, particularly if immersed in stagnant water (i.e. the river). Initial prophylaxis begins with clindamycin 600mg IV q8h **and** ciprofloxacin 400mg IV q12h x 72h as above. There should be a low threshold to obtain bronchoscopy \ BAL and widen coverage (usually adding azithromycin or transitioning to vancomycin and piperacillin\tazobactam if a patient's condition worsens.

h. Intra-abdominal abscess

After source control is achieved (via surgical or IR guided drainage), initiate treatment with piperacillin / tazobactam 3.375 g IV q 8 hours. Narrow antibiotics per culture and sensitivity data when available. Most patients should receive 5-7 days of antibiotic therapy.

Empiric Therapy for Fungal Infections

a. Fungal Overgrowth on Mucous Membranes

Often seen after administration of broad-spectrum antibiotics and does not necessarily require treatment. If desired, nystatin 5-10cc oral swish & swallow/ spit q6h is usually sufficient.

b. Candidal Cystitis

Remove or change Foley catheter. Except in neutropenic patients, Candida in the bladder rarely disseminates and does not infect the kidneys. If asymptomatic candiduria, no treatment is required other than removing or changing indwelling catheter. If neutropenic or symptomatic, treat with amphotericin bladder washes (amphotericin B 20mg in 200cc sterile water; infuse into bladder q d for 3-5 days.)

c. Abdominal Sepsis

Many nosocomial Candida species are resistant to fluconazole, which should not be used for empiric treatment. Significant fungal infection in abdominal sepsis following surgery is rare and usually only seen in “tertiary peritonitis” – persistent abdominal sepsis after surgery and antibiotics, usually accompanied by multiple organ failure and/or in immunocompromised states. In such patients, optimal drainage should be ensured and cultures obtained. Obtain ID consult in all cases. Options include micafungin 100 mg IV q24h or voriconazole 6 mg/kg IV q12h first day, followed by 3 mg/kg q12h. All of these patients will require long-term treatment and close follow-up with infectious disease.

d. Disseminated Fungal Infection or Systemic Disease Suspected

Suspect systemic disease with:

1. Positive blood cultures (<50% sensitive).
2. Multiple deep site isolation in a patient with fevers and not doing clinically well
3. Isolation from urine plus wound or multiple sites.

Obtain Infectious disease consult. Treatment options include micafungin 100 mg IV q24h or voriconazole at 6 mg/kg IV q12h first day, followed by 3 mg/kg q12 h.

Note: An isolated positive sputum for *C. albicans* is ***not an indication*** for antifungal therapy.

UC San Diego Health Guideline for Antibiotic Duration in Hospitalized Patients

Approved by P&T Committee 12/2015; updated 2/2018

This chart is to serve as a guide for the appropriate duration of treatment and its use should be combined with clinical judgment taking into account patient specific responses to therapy. Infectious Diseases service should be consulted for complex patients and duration of antimicrobial therapy can vary widely from these recommendations in these patients.

Catheter-related Bloodstream Infections (CR-BSI): Consult Infectious Diseases Service

CNS Infections: Consult Infectious Diseases Service

Endocarditis: Consult Infectious Diseases Service

***Helicobacter pylori* Infection^{1, 21}:**

Initial infection	10-14 days
Recurrent infection	14 days

Intra-abdominal Infections¹⁻⁵: Consult Infectious Diseases Service for any **complicated** infection

General; Complicated [infection extends into the peritoneal space and is associated with either abscess or peritonitis]		Consult ID service; 4-7 days after source control >7 days if poor response or unable to achieve source control
Appendicitis ^[23-26]	No appendectomy	At least 10 days
Biliary tract infection [cholecystitis and cholangitis]	Uncomplicated	No antibiotics required after obstruction is relieved
	Complicated [presence of SIRS*]	Consult ID service; 4-7 days after source control >7 days if unable to achieve source control
Diverticulitis ⁵	Mild pain/tenderness; no SIRS*	7-14 days oral antibiotics
	Complicated [presence of abscess, free air or fistula, SIRS*]	7-10 days of IV antibiotics
Pancreatitis; necrotic		14 days after source control achieved
Primary peritonitis	Spontaneous bacterial peritonitis (SBP)	5 days
	Prophylaxis of SBP	7 days if upper gastrointestinal bleed (uGIB); Indefinitely if history of SBP
Secondary peritonitis; uncomplicated	Gastric, proximal jejunum perforation	24 hours if source control achieved < 24 hours
	Small bowel, colon perforation	≤ 24 hours if repaired <12 hours
		4-7 days if repaired ≥12 hours
Peritonitis associated with peritoneal dialysis (PD)		10-14 days

*SIRS ≥ 2 of the following criteria: temperature > 38°C or < 36°C, HR > 90 beats/min, RR > 20 breaths/min or PaCO₂ < 32 mmHg; or WBC > 12 or < 4 or ≥ 10% bands

***Clostridium difficile* Infection⁶:**

Initial episode or first recurrence	Vancomycin PO	10-14 days
Second recurrence	Vancomycin PO	10-14 days of vancomycin 125 mg PO four days per day, then 7 days of vancomycin PO 125 mg PO twice daily, then 7 days of vancomycin 125 mg PO daily, then 2-8 weeks of vancomycin 125 mg PO every 2 to 3 days
	Fidaxomicin	10 days

*Note: Anticipate update to IDSA *C. difficile* guideline in 2018

Infectious Diarrhea^{1,7,29}:	
Note: Avoid antibiotics in the presence of Shiga-toxin (such as Shiga-toxin producing <i>E. coli</i> , aka STEC). Therefore, antibiotics should be avoided for bloody diarrhea in immunocompetent adults until the infecting bacteria is identified unless the patient is septic	
<i>Campylobacter</i> spp.	5 days
<i>Escherichia coli</i> (non-STE ^C)	3 days
<i>Salmonella</i> spp.	5-7 days 14 days if immunocompromised
<i>Shigella</i> spp.	3 days 7 days if immunocompromised
<i>Vibrio parahaemolyticus</i>	1-3 days
<i>Giardia</i> spp.	7 days
*Note: most updated version of IDSA guideline (Oct 2017) does not address antibiotic durations for infectious diarrhea	

Respiratory Infections ^{1-3,8-13} :			
Community-acquired pneumonia	Afebrile for 48-72 hours AND stable; Non- <i>Staph. aureus</i> spp.		3-5 days ^{2,8}
	Persistent instability; <i>Staph. aureus</i> or <i>Legionella</i> spp.; Presence of empyema, lung abscess or necrotizing pneumonia		≥ 7 days ⁸
Hospital-acquired pneumonia (HAP) Ventilator-associated pneumonia (VAP) Aspiration pneumonia	7 days, but shorter or longer courses may be indicated depending on rate of improvement* ²²		
Ventilator-associated tracheobronchitis	None		
Group A <i>Streptococcal</i> pharyngitis ^{11,12}	3-6 days	Azithromycin, cephalosporins	
	10 days	PCN, amoxicillin	
COPD exacerbation; infectious etiology ¹³ [positive for dyspnea, sputum production, and sputum purulence]	5-10 days		
*There may be situations in which a SHORTER or LONGER duration of antibiotics may be indicated, depending upon the rate of improvement of clinical, radiologic, and laboratory parameters			

Urinary Tract Infection (UTI) 1-3,14-18			
Asymptomatic bacteriuria ¹⁴		No antibiotic therapy recommended except in pregnancy and certain sub-populations (i.e. urologic instrumentation, immunosuppressed), then 3-7 days	
Uncomplicated cystitis in women ¹⁵		3 days	Sulfamethoxazole-trimethoprim, fluoroquinolones
		5 days	Nitrofurantoin
		3-7 days	β-lactam agent
Complicated ^a cystitis in men and women ¹⁵		10 days	
Pyelonephritis ^{15,26-28}		7 days ²⁶⁻²⁸	Sulfamethoxazole-trimethoprim, fluoroquinolones
		10 days	β-lactam agent
Catheter-associated (CA-UTI) ^{16,17}	Asymptomatic	If bacteriuria persists > 48 hours after catheter removal, treat for 3-7 days	
	Symptomatic ^b	If prompt resolution of symptoms, treat for 7 days PLUS remove/replace catheter If delayed response, treat for 10-14 days PLUS remove/replace catheter	
a. Complicated: presence of co-morbidities that increase risk of failing therapy including diabetes; pregnancy; symptoms for ≥ 7 days prior to seeking care; hospital-acquired infection; renal failure; urinary tract obstruction; presence of urinary catheter, stent, nephrostomy tube; recent urinary tract instrumentation; functional abnormality of the urinary tract; history of UTI; renal transplantation; immunosuppression b. Symptomatic CA-UTI: Patient has at least one of the following signs or symptoms: fever (>38.0 C), suprapubic tenderness, cosovertebral angle pain or tenderness, urinary urgency, frequency, dysuria			

Bone and Joint Infections: Consult Infectious Diseases Service; requires OPAT [Outpatient Parenteral Antimicrobial Therapy]

Diabetic Foot Ulcer¹⁹: Manage jointly by wound, orthopedic, and ID services with antibiotics & surgical debridement

Soft tissue involvement <u>without</u> debridement	Mild [local cellulitis < 2 cm, limited to skin and subcutaneous tissue]	1-2 weeks
	Moderate [local cellulitis > 2 cm, involving deep structures; no SIRS*]	1-3 weeks
	Severe [local cellulitis + SIRS*]	2-4 weeks
Bone or joint involvement s/p amputation	No residual tissue or bone	2-5 days
	Residual soft tissue (no bone)	1-3 weeks
	Residual tissue and viable, infected bone	4-6 weeks
	Residual dead bone	> 12 weeks
Bone or joint involvement <u>without</u> amputation		> 12 weeks

*SIRS >= 2 of the following criteria: temperature > 38C or < 36 C, HR > 90 beats/min, RR > 20 breaths/min or PaCO₂ < 32 mmHg; or WBC > 12 or < 4 or >= 10% bands

Skin and Soft Tissue Infections (SSTI)^{1-3,20}:

Cellulitis	General [including impetigo, ecthyma]	5 -7 days > 5 days if inadequate response or complicating issues such as morbidly obese, lymphedema
	Orbital involvement	7 days; up to 6 weeks if evidence of bone involvement
	Recurrent [3-4 episodes per year]	4-52 weeks (prophylaxis)
Purulent SSTI [cutaneous abscesses, furuncles, carbuncles, inflamed epidermoid cysts]		Variable; dependent on presence of SIRS and clinical response
Surgical site infection (SSI)	Uncomplicated	No antibiotic therapy recommended; Incision and drainage only
	Complicated [erythema, induration > 5 cm from wound edge, temp >38.5°C, HR > 110 beats/min, WBC > 12]	Variable duration, dependent on clinical response
Deep tissue infection [Necrotizing fasciitis, Fournier Gangrene, Clostridial gas gangrene, myonecrosis]		Continue for duration of surgical debridement, clinical improvement, and afebrile x 48-72 hours
Animal bites	Prophylaxis	3-5 days
	Treatment	5-10 days

References:

- Essentia Health, "Antimicrobial Duration of Therapy," May 2013
- Hayashi Y, Paterson DL. "Strategies for Reduction in Duration of Antibiotic Use in Hospitalized Patients," *Clin Infect Dis*. 2011;52:1232-39.
- Esposito S, Esposito I, Leone S. "Considerations of antibiotic therapy duration in community- and hospital-acquired bacterial infections," *J Antimicrob Chemother*. 2012;67:2570-75.
- Solomkin JS, Mazuski JE, Bradley JS, et al. "Diagnosis and management of complicated intra-abdominal infection in adults and children: guidelines by the Surgical Infection Society and the Infectious Diseases Society of America. *Clin Infect Dis*. 2010;50:133-164
- World Gastroenterology Organization core review team. WGO Practice Guidelines: Diverticular Disease. 2007
- Cohen SH, Gerding DN, Johnson S, et al., "Clinical practice guidelines for Clostridium difficile infection in adults: 2010 update by the Society of Healthcare Epidemiology of America (SHEA) and the Infectious Diseases Society of America (IDSA). *Infect Control Hosp Epidemiol*. 2010;21:431-455.
- Guerrant RL, Van Gilder T, Steiner TS, et al., "Practice guidelines for the management of infectious diarrhea." *Clin Infect Dis*. 2001;32:331-50.
- Mandell LA, Wunderinkm RG, Anzueta A, et al., "Infectious Diseases Society of America/American Thoracic Society consensus guidelines on the management of community-acquired pneumonia in adults. *Clin Infect Dis*. 2007;44:27-72.
- Havey TC, Fowler RA, Daneman N. "Duration of antibiotic therapy for bacteremia: a systematic review and meta-analysis". *Critical Care* 2011;15:R267.
- American Thoracic Society. Guidelines for the management of adults with hospital-acquired, ventilator-associated, and health-care associated pneumonia. *Am J Respir Crit Care Med*. 2005;171:388-416.
- Shulman ST, Bisno AL, Clegg HW, et al., "Clinical practice guidelines for the diagnosis and management of Group A Streptococcal Pharyngitis: 2012 update by the Infectious Diseases Society of America. *Clin Infect Dis*. 2012;55(10):e86-e102.
- Altamimi S, Khalaiwi KA, Milner RA, et al. "Short versus standard duration antibiotic therapy for acute streptococcal pharyngitis in children (Review)." *The Cochrane Library*. 2009. Jan 21 (1):CD004872.
- Global Initiative for Chronic Obstructive Lung Disease. "Global strategy for the diagnosis, management, and prevention of chronic obstructive pulmonary disease." Updated 2015.
- Nicolle LE, Bradley S, Colgan R, et al., "Infectious Diseases Society of America guidelines for the diagnosis and treatment of asymptomatic bacteriuria in adults." *Clin Infect Dis*. 2005;40:643-54

15. Gupta K, Hooten TM, Naber KG, et al., "International clinical practice guidelines for the treatment of acute uncomplicated cystitis and pyelophenitis in women: a 2010 update by the Infectious Disease Society of America and the European Society for Microbiology and Infectious Diseases. *Clin Infect Dis*. 2011;52:103-20.
16. Hooten TM, Bradley SF, Cardenas DD, et al., "Diagnosis, prevention, and treatment of catheter-associated urinary tract infection in adults: 2009 International Clinical Practice Guidelines from the Infectious Diseases Society of America. *Clin Infect Dis*. 2010;50:625-63.
17. CDC. Device-associated Module: CA-UTI. Published January 2015. <http://www.cdc.gov/nhsn/pdfs/pscManual/7pscCAUTICurrent.pdf>
18. Dellinger RP, Levy MM, Rhodes A, et al, "Surviving Sepsis Campaign: International Guidelines for Management of Severe Sepsis and Septic Shock: 2012," *Critical Care Medicine*. 2013;41(2):580-637.
19. Lipsky BA, Berendt AR, Corina PB, et al., "2012 Infectious Diseases Society of America clinical practice guideline for the diagnosis and treatment of diabetic foot infections. *Clin Infect Dis*. 2012;54:132-173
20. Stevens DL, Bisno AL, Chambers HF, et al., "Practice guidelines for the diagnosis and management of skin and soft tissue infections: 2014 update by the Infectious Diseases Society of America. *Clin Infect Dis*. 2014;59(2):147-159.
21. Tunkel AR, Hasbun R, Bhimraj A, et al. 2017 Infectious Diseases Society of America's Clinical Practice Guidelines for Healthcare-Associated Ventriculitis and Meningitis. *CID*. 2017;64(6):e34-e65
22. Kalil AC, Metersky ML, Klompas M, et al. Management of Adults with Hospital-acquired and Ventilator-associated Pneumonia: 2016 Clinical Practice Guidelines by the Infectious Diseases Society of America and the American Thoracic Society. *CID*. 2016;63(5):e61-111.
23. Flum, DR. Acute Appendicitis – Appendectomy or the "Antibiotics First" Strategy. *NEJM*. 2015;372:1937-43.
24. Rollins KE, Varadhan KK, Neal KR, et al. Antibiotics Versus Appendectomy for the Treatment of Uncomplicated Acute Appendicitis: An Updated Meta-Analysis of Randomised Controlled Trials. *World J Surg*. 2016;40:2305-2318
25. Salimen P, Paajanen H, Rautio T, et al. Antibiotic Therapy Vs Appendectomy for Treatment of Uncomplicated Acute Appendicitis – The APPAC Randomized Clinical Trial. *JAMA*. 2015;313(23):2340-2348.
26. Varadhan KK, Neal KR, Lobo DN. Safety and efficacy of antibiotics compared with appendectomy for treatment of uncomplicated acute appendicitis: meta-analysis of randomized controlled trials. *BMJ*. 2012; 344:e2156.
27. Fox M, Melia MT, Same RG, et al. A Seven-Day Course of TMP-SMX May Be as Effective as a Seven-Day Course of Ciprofloxacin for the Treatment of Pyelonephritis. *The American Journal of Medicine*. 2017;130(7): 842-845.
28. Sandberg T, Skoog G, Hermanson AB, et al. Ciprofloxacin for 7 days versus 14 days in women with acute pyelonephritis: a randomized, open-label and double-blind, placebo-controlled, non-inferiority trial. *The Lancet*. 2012;380:484-490.
29. Shane AL, Mody RK, Crump JA, et al. 2017 IDSA Practice Guidelines for the Diagnosis and Management of Infectious Diarrhea. *CID*. 2017;XX(00):1-26. Ahead of Print

UC San Diego Health System Medication Use Guideline: Stress Ulcer Prophylaxis and Proton Pump Inhibitor (PPI) Use

Approved by P&T Committee January 2011, November 2013, April 2015, December 2018

Introduction

Proton pump inhibitors (PPI) are a commonly used class of medications used to reduce gastric acid secretion for up to 36 hours. While historically thought to be a relatively safe medication class, recent data suggest that PPIs increase the risk of community acquired pneumonia, *Clostridium difficile* colitis and bone fractures.¹⁻³ In addition, studies have shown that inappropriate use of PPIs is relatively common.⁴⁻⁶

1) Stress ulcer prophylaxis:

- a) Histamine H₂ receptor antagonists (H₂-antagonists) should be used FIRST for stress ulcer prophylaxis in ICU patients⁷.
- b) PPI's should ONLY be considered if patients match one of the following conditions:
 - Intensive care patients with coagulopathy (INR>1.5 or PTT>2X normal or platelet count<50)^{8,9}
 - Patients requiring mechanical ventilation¹⁰
 - Glasgow Coma Score <10¹¹
 - Burn injury>35% of body surface
 - Acute spinal cord injury¹²
 - Transplant patients in the immediate peri-operative period¹³
 - Hepatic failure¹⁴
 - Multiple trauma (Injury Severity Score >15)^{15*}
 - History of GI ulceration or bleeding **plus** Two or more of the following risk factors
 - Sepsis
 - ICU stay>1 week
 - Occult bleeding lasting 6 days or more
 - High dose corticosteroids (>250 mg hydrocortisone or equivalent)^{16,17}
- c) Pharmacist has P&T authority to discontinue stress ulcer prophylaxis in the absence of evidence of stress-related mucosal bleeding. Discontinue prophylaxis as soon as any of the following criteria are met:
 - Patient is tolerating enteral feeds
 - Patient is extubated
 - Patient is downgraded from the ICU
- d) Pharmacist has P&T authority to change route of administration of PO H₂-antagonists and PPIs, per MCP 321.2, attachment A

2) Other appropriate indications for PPI therapy

- a) Treatment
 - Symptomatic/uncontrolled Gastro Esophageal Reflux Disease (GERD)^{18,19}
 - Active upper GI bleeding^{20,21}
 - Documented peptic ulcer disease²²
 - Documented erosive esophagitis/ hypersecretory conditions (Zollinger –Ellison syndrome)²³
 - Treatment of *Helicobacter Pylori*^{24,25}
- b) Prophylaxis:
 - Gastro-protection as a result of prolonged nonsteroidal anti-inflammatory drug (NSAID) use:
 - (Anticipated) duration of NSAID use of more than 1 month AND
 - At least one of the following GI Risk factors
 - (a) History of gastrointestinal ulcer or hemorrhage
 - (b) Age >60 years old
 - (c) Corticosteroid use
 - (d) Anticoagulant use (e.g. warfarin, heparinoids, dabigatran, rivaroxaban, apixaban)
 - (e) Dual antiplatelet therapy²⁶⁻³⁰ (e.g. aspirin, clopidogrel, prasugrel, dipyridamole)
- c) IV PPI use has no know advantage over oral/enteral PPIs unless the patient in NPO.

UC San Diego Health System Medication Use Guideline: Stress Ulcer Prophylaxis and Proton Pump Inhibitor (PPI) Use

Approved by P&T Committee January 2011, November 2013, April 2015, December 2018

IMPORTANT: IV PPIs have no known advantage over oral/enteral PPIs for stress ulcer prophylaxis. There is a rapidly dissolvable ("SoluTab") formulation of lansoprazole that may be mixed with 10 mL of water and administered via a gastric tube, or dissolved sublingually, reducing the need for IV administration.

References

1. Laheij RJ, Sturkenboom MC, Hassing RJ, Dieleman J, Stricker BH, Jansen JB. Risk of community-acquired pneumonia and use of gastric acid-suppressive drugs. *JAMA* 2004;292:1955-60.
2. Gulmez SE, Holm A, Frederiksen H, Jensen TG, Pedersen C, Hallas J. Use of proton pump inhibitors and the risk of community-acquired pneumonia: a population-based case-control study. *Arch Intern Med* 2007;167:950-5.
3. Dial S, Delaney JA, Barkun AN, Suissa S. Use of gastric acid-suppressive agents and the risk of community-acquired *Clostridium difficile*-associated disease. *JAMA* 2005;294:2989-95.
4. Molloy D, Molloy A, O'Loughlin C, Falconer M, Hennessy M. Inappropriate use of proton pump inhibitors. *Ir J Med Sci* 2010;179:73-5.
5. Regal RE, Osta AD, Parekh VI. Interventions to curb the overuse of Acid-suppressive medications on an inpatient general medicine service. *P T* 2010;35:86-90.
6. Ramirez E, Lei SH, Borobia AM, et al. Overuse of PPIs in patients at admission, during treatment, and at discharge in a tertiary Spanish hospital. *Curr Clin Pharmacol* 2010;5:288-97.
7. Cook DJ, Reeve BK, Guyatt GH, et al. Stress ulcer prophylaxis in critically ill patients. Resolving discordant meta-analyses. *JAMA* 1996;275:308-14.
8. Quenot JP, Thiery N, Barbar S. When should stress ulcer prophylaxis be used in the ICU? *Curr Opin Crit Care* 2009;15:139-43.
9. Marik PE, Vasu T, Hirani A, Pachinburavan M. Stress ulcer prophylaxis in the new millennium: a systematic review and meta-analysis. *Crit Care Med* 2010;38:2222-8.
10. Kahn JM, Doctor JN, Rubenfeld GD. Stress ulcer prophylaxis in mechanically ventilated patients: integrating evidence and judgment using a decision analysis. *Intensive Care Med* 2006;32:1151-8.
11. Burgess P, Larson GM, Davidson P, Brown J, Metz CA. Effect of ranitidine on intragastric pH and stress-related upper gastrointestinal bleeding in patients with severe head injury. *Dig Dis Sci* 1995;40:645-50.
12. Lasky MR, Metzler MH, Phillips JO. A prospective study of omeprazole suspension to prevent clinically significant gastrointestinal bleeding from stress ulcers in mechanically ventilated trauma patients. *J Trauma* 1998;44:527-33.
13. Martin LF, Booth FV, Reines HD, et al. Stress ulcers and organ failure in intubated patients in surgical intensive care units. *Ann Surg* 1992;215:332-7.
14. Cook DJ, Fuller HD, Guyatt GH, et al. Risk factors for gastrointestinal bleeding in critically ill patients. Canadian Critical Care Trials Group. *N Engl J Med* 1994;330:377-81.
15. Dellinger RP, Levy MM, Carlet JM, et al. Surviving Sepsis Campaign: international guidelines for management of severe sepsis and septic shock: 2008. *Crit Care Med* 2008;36:296-327.
16. ASHP Therapeutic Guidelines on Stress Ulcer Prophylaxis. ASHP Commission on Therapeutics and approved by the ASHP Board of Directors on November 14, 1998. *Am J Health Syst Pharm* 1999;56:347-79.
17. Hatch JB, Schulz L, Fish JT. Stress ulcer prophylaxis: reducing non-indicated prescribing after hospital discharge. *Ann Pharmacother* 2010;44:1565-71.
18. Heidelbaugh JJ, Nostrant TT, Kim C, Van Harrison R. Management of gastroesophageal reflux disease. *Am Fam Physician* 2003;68:1311-8.
19. Kahrilas PJ, Shaheen NJ, Vaezi MF, et al. American Gastroenterological Association Medical Position Statement on the management of gastroesophageal reflux disease. *Gastroenterology* 2008;135:1383-91, 91.e1-5.
20. Dorward S, Sreedharan A, Leontiadis GI, Howden CW, Moayyedi P, Forman D. Proton pump inhibitor treatment initiated prior to endoscopic diagnosis in upper gastrointestinal bleeding. *Cochrane Database Syst Rev* 2006;CD005415.
21. Barkun AN, Bardou M, Kuipers EJ, et al. International consensus recommendations on the management of patients with nonvariceal upper gastrointestinal bleeding. *Ann Intern Med* 2010;152:101-13.
22. Pang SH, Graham DY. A clinical guide to using intravenous proton-pump inhibitors in reflux and peptic ulcers. *Therap Adv Gastroenterol* 2010;3:11-22.
23. Garud SS, Keilin S, Cai Q, Willingham FF. Diagnosis and management of Barrett's esophagus for the endoscopist. *Therap Adv Gastroenterol* 2010;3:227-38.
24. Talley NJ, Li Z. *Helicobacter pylori*: testing and treatment. *Expert Rev Gastroenterol Hepatol* 2007;1:71-9.
25. Talley NJ. Step-up and step-down treatment strategies did not differ for symptom relief at 6 months in new onset dyspepsia. *Evid Based Med* 2009;14:114.
26. Abraham NS, Hlatky MA, Antman EM, et al. ACCF/ACG/AHA 2010 expert consensus document on the concomitant use of proton pump inhibitors and thienopyridines: a focused update of the ACCF/ACG/AHA 2008 expert consensus document on reducing the gastrointestinal risks of antiplatelet therapy and NSAID use. *J Am Coll Cardiol* 2010;56:2051-66.
27. Bhatt DL, Scheiman J, Abraham NS, et al. ACCF/ACG/AHA 2008 expert consensus document on reducing the gastrointestinal risks of antiplatelet therapy and NSAID use: a report of the American College of Cardiology Foundation Task Force on Clinical Expert Consensus Documents. *J Am Coll Cardiol* 2008;52:1502-17.
28. Chariot M, Ahlehoff O, Norgaard ML, et al. Proton-pump inhibitors are associated with increased cardiovascular risk independent of clopidogrel use: a nationwide cohort study. *Ann Intern Med* 2010;153:378-86.
29. Lanza FL, Chan FK, Quigley EM, Gastroenterology PPCotAco. Guidelines for prevention of NSAID-related ulcer complications. *Am J Gastroenterol* 2009;104:728-38.
30. [The gastrointestinal risk of antiplatelet agents and nonsteroidal anti-inflammatory agents. A report of the American College of Cardiology Foundation (ACCF), the American College of Gastroenterology (ACG) and the American Heart Association (AHA)]. *Recent Prog Med* 2009;100:277-8.

Nutrition

Notes on Basic Principles of Provision of Nutrition in the SICU

Nutrition is very important for the critically ill patient, but the majority of SICU patients are underfed. It is critically important to feed early and interrupt feedings as little as possible. The following guidelines are designed to maximize nutrition in the critically ill patient:

- a. In the absence of contraindications to enteral feeding, feeding should be initiated within the first 24 hours of admission
- b. Post-pyloric feeding tubes are the “preferred” route and location for providing nutrition, but gastric feeds are appropriate if a post-pyloric tube cannot be placed in a timely fashion.
- c. Placement of post-pyloric feeding tubes may be achieved via:
 - i. Cortrak (by credentialed nurses – mostly in the ICU)
 - ii. Interventional radiology
 - iii. Endoscopy
- d. Tube placement (post-pyloric or gastric) must be documented via KUB, and an order “OK to use feeding tube” written by an MD. Always ensure that the tube is appropriately placed (NOT in the lung!) prior to authorizing use.
- e. Consult nutrition for recommendations of tube feed formula and rates of feeding. Nutrition should also be consulted and calorie count obtained for any patient that is at risk for insufficient oral nutritional intake.
- f. Obtain “nutrition labs” weekly for all critically ill ICU patients or ward patients with significant malnutrition (albumin, prealbumin, C-reactive protein)
- g. When initiating feedings, obtain a daily metabolic panel (including magnesium and phosphorus) to assess for electrolyte derangement or refeeding syndrome
- h. Consider comorbid conditions when choosing a tube feeding formula (diabetes, end stage renal disease, cirrhosis, etc.)
- i. In the absence of abdominal surgery or overt signs of ileus, bowel sounds or bowel movement is not required before starting enteral nutrition.
- j. Feeds should be held in the unstable patient until the patient is adequately resuscitated and vasopressors are being weaned.
- k. Patients should be advanced to their nutrition goal quickly and should meet their nutrition goal within 24-48 hours (while monitoring for signs of refeeding syndrome.)
- l. Hold tube feeding for gastric residual volumes >500cc
- m. If patients have high gastric residuals or other signs of intolerance of enteral feeding, initiate Reglan or erythromycin therapy to promote motility if not contraindicated.
- n. Elevate the head of bed 30 degrees in all patients being fed unless contraindicated to decrease the risk of aspiration.
- o. Consider the addition of fiber in patients with diarrhea associated with tube feeding (once infectious diarrhea has been ruled out).
- p. Consider TPN in any patient NPO ≥ 7 days or with malnutrition prior to admission.

NPO Guidelines for Patients Requiring an Operation

The Primary Registered Nurse and Physician can refer to the following guidelines for criteria to make patient NPO prior to operative procedures.

PROCEDURE:

All surgical critical care and trauma patients will be use the following NPO guidelines.

The guidelines may be used for all critical care patients, per RN and MD discussion:

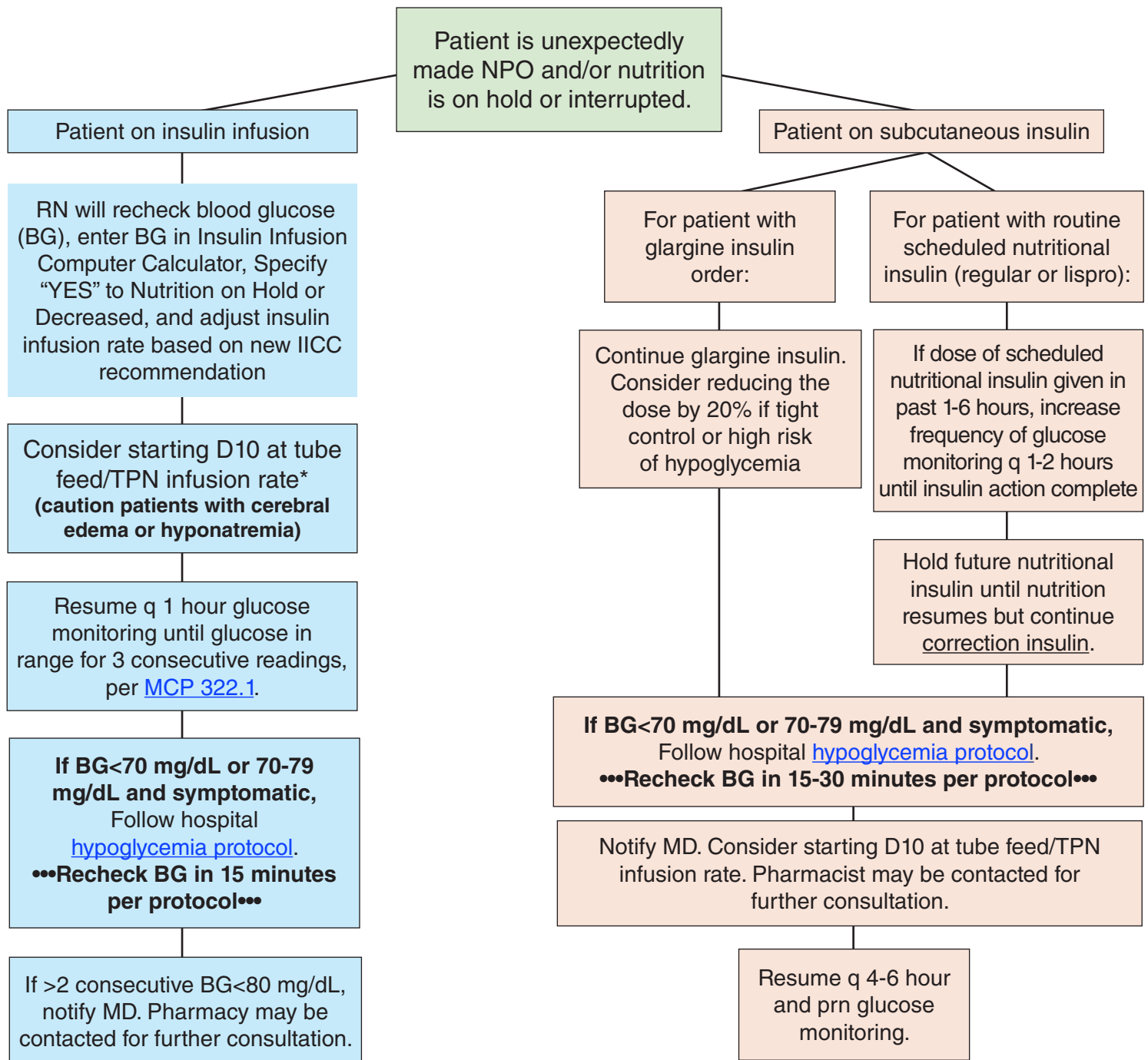
1. For patients with ~~cuffed~~ endotracheal tube or cuffed tracheostomy tube, ~~post-pyloric~~ enteral feeds should be ~~continued until time of surgery~~.
2. For patients with cuffed endotracheal tube or cuffed tracheostomy tube, ~~gastric enteral~~ feeds should be ~~held four (4) hours prior to anticipated surgery~~.
3. For patients with a cuffed endotracheal tube that will undergo tracheostomy, or any cuffed tube exchange where the tube is removed or the cuff deflated as a part of the procedure, should have gastric or post-pyloric feeds held eight (8) hours prior to anticipated procedure.
4. For patients who DO NOT have cuffed endotracheal or tracheostomy tube, feeds need be stopped eight (8) hours prior to anticipated surgery.
5. In patients where enteral feeds are held, significant effort should be placed to
 - a. adjust feeding rate to compensate
 - b. hold or adjust insulin accordingly
 - c. add or start D10 infusion –refer to Guideline for Nutrition on Hold Unexpectedly
 - d. start feeds as early as possible after surgery

Cortrak Post Pyloric Feeding

The CORTRAK Enteral Access system uses electromagnetic technology to enhance the safety of bedside placement of small-bore nasoenteric feeding tubes. The guidance system directs feeding tube placement by tracking the relative location of the tube as it proceeds down the alimentary tract. This visual guidance aids in avoiding placement in the pulmonary system and facilitates postpyloric placement of feeding tubes. Proper and timely placement of small-bore nasoenteric feeding tubes using the CORTRAK□□system will assist with the safety of bedside placement procedure and assist with implementation of enteral nutrition therapy for critically ill patients.

1. Critical Care RN's who have completed CORTRAK training, including placements supervised by a Super User will be authorized to insert small bore feeding tubes using the CORTRAK device in the critical care units.
2. Optimal goal is for tube tip to have placement verified in the jejunum via abdominal X-ray by radiologist. Acceptable goal is for the tip of the tube to be placed postpyloric.

3. Residuals volume assessment can continue and may indicate movement of catheter out of post pyloric placement, or other reasons for not absorbing enteral nutrition.
4. The operator must clean the unit after every patient use, per UC San Diego standard & manufacturer's instructions.
5. RESPONSIBLE PARTY - Critical Care RN's that have completed device and procedure training.
6. DOCUMENTATION – CCRN initiates LDA charting in EPIC with tube type, size, depth inserted. A note should indicate name of inserter (if other than assigned RN), patient response to insertion, unexpected outcomes and nursing interventions, medications administered, patient and family education, as appropriate.
7. Paper form: Use MD progress note, include tube size, length inserted, and anatomic landmarks associated with placement. Place a strip of the Cortrak feeding tube insertion path on the note.



*Alternative:

1. Stop insulin drip and start regular insulin subcutaneous insulin correction scale with q 6 hour and prn monitoring. (Patients with Type 1 DM need basal insulin at all times; do NOT use correction scale alone for Type 1 DM.)
2. Contact Pharmacist for additional questions if an interruption in nutrition occurs.

Pain, Agitation, and Delirium in the Adult ICU Patient

(see SICU PAD Protocol)

Clinical Practice Guidelines for the Management of Pain, Agitation, and Delirium in Adult Patients in the Intensive Care Unit

Agitation may result from inadequately treated pain, inadequate sedative therapy, ventilator dysynchrony, and/or ICU delirium.

- The need for the ongoing management of pain, agitation, and delirium should be reassessed often in ICU patients (1B).
- ICU patients should be awake and able to purposefully follow commands, unless a clinical indication for deeper sedation exists (1B).
- Use a multidisciplinary team approach, including: 1) provider education; 2) preprinted and/or computerized protocols and order forms; and 3) a quality ICU rounds checklist, to implement and facilitate pain, agitation, and delirium management guidelines and protocols in adult ICUs (1B).

1. Assess and treat Pain:

- Pain assessment should be routinely performed in all ICU patients (1B).
- Self-report is preferred over the use of behavioral pain scales in patients who are able to communicate (B).
- The BPS and CPOT* are the most valid and reliable behavioral pain scales for use in ICU patients who cannot self-report (B).
- Vital signs should not be used alone to assess pain, but they may be used adjunctively for pain assessments (2C).
- Preemptively treat chest tube removal with either analgesic and/or non-pharmacologic therapy (1C).
- Suggest preemptively treating other types of procedural pain with either analgesic and/or non-pharmacologic therapy (2C).
- Use opioids as first-line therapy for treatment of non-neuropathic pain (1C).
- Use gabapentin or carbamazepine, in addition to opioids, for treatment of neuropathic pain (1A).
- Use thoracic epidural anesthesia/analgesia for postoperative analgesia in abdominal aortic surgery patients (1B).
- Suggest thoracic epidural analgesia for patients with traumatic rib fractures (2B).

2. Assess and treat Agitation:

- Depth and quality of sedation should be routinely performed in all ICU patients (1B).
- The RASS and SAS† are the most valid and reliable scales for assessing quality and depth of sedation in ICU patients (B).
- Target the lightest possible level of sedation and/or use daily sedative interruption (1B).
- Use sedation protocols and checklists to facilitate ICU sedation management (1B).
- Suggest using analgesia-first sedation for intubated and mechanically ventilated ICU patients (2B).
- Promote sleep in ICU patients by controlling light and noise, clustering patient care activities, and decreasing stimuli at night (1C).

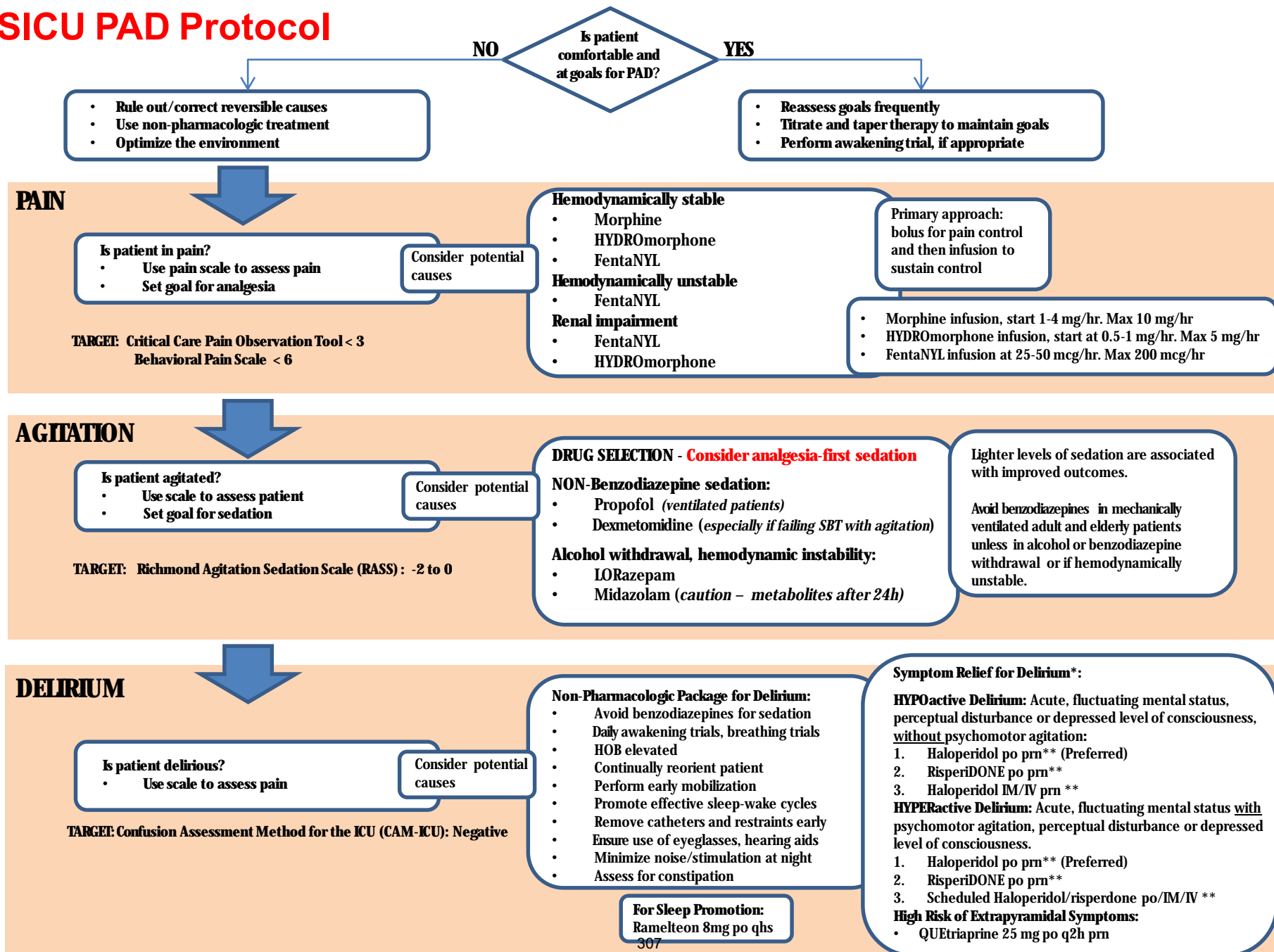
3. Assess and treat Delirium:

- Delirium assessment should be routinely performed in all ICU patients (1B).
- The CAM-ICU and ICDSC delirium monitoring tools are the most valid and reliable in ICU patients (A).
- Mobilize early when feasible to reduce the incidence and duration of delirium, and to improve functional outcomes (1B).
- Avoid antipsychotics in ICU patients who are at risk for torsades de pointes.
- Avoid benzodiazepines in ICU patients with delirium unrelated to ETOH/benzodiazepine withdrawal (2B).
- Suggest using dexmedetomidine over benzodiazepines for sedation of ICU patients with delirium (2B).

*: Behavioral Pain Scale (BPS) and the Critical-Care Pain Observation Tool (CPOT).

†: Richmond Agitation-Sedation Scale (RASS) and Sedation-Agitation Scale (SAS).

SICU PAD Protocol



Ketamine: Tips

An All-Purpose Drug for Trauma/EMS/Surgery.

A unique triple threat:

- Hypnotic, analgesic, amnestic

Multiple uses and applications

- pain control, agitation, sedation, anesthesia, depression
- Ideally suited for pre-hospital & ER use
- “preferred agent” for children and burn patients

Dosage Effects:¹

Dose	Effect	Use
0.1 – 0.3 mg/kg	Analgesia	Multimodal Pain Therapy
0.2 – 0.5 mg/kg	“Recreational”	“ketamine high”, unreality
0.4 – 0.8 mg/kg	Partially dissociated	Enter the “K-hole”?
1-2 mg/kg	Fully dissociated	Anesthesia / Surgery

The “K” hole – Dissociation:

- Loss of physical sensations
- Inability to move
- Inability to speak
- Out-of-body experiences
- Hallucinations
- Disorientation
- Feelings of invincibility

Effects on Body Systems

Cardiovascular:

- INCREASED blood pressure, heart rate 20% increase

Respiratory:

- bronchodilation (potent)

Brain:

- Vasodilation, increases Cerebral blood flow by up to 60%, Does not raise ICP!

Other effects:

- Excessive salivation, esp. children, which can be mistaken as an airway disaster prompting intubation. It is usually transient and easily controlled by suction. Preoperative atropine has no proven value.
- In children, vomiting is common after awakening, even after several hours, can be controlled with ondansetron.
- increased muscle tone

Ketamine Myths:

Ketamine is Bad for TBI

- Metanalysis of 900 trauma cases shows no difference in cerebral perfusion pressures or patient-centered outcomes²

~~Ketamine should not be used in cases of elevated intra-ocular pressure~~

- Studies show no difference in IOP at doses used in ED^{3,4}

~~Ketamine should not be used in patients with psychosis~~

- In the severely agitated patient, whose agitation poses an immediate threat to themselves or others, the prospect of unmasking or exacerbating underlying psychosis is unfounded. The dominating priority in these circumstances is immediately and safely achieving control of the patient, so that the threat of uncontrolled agitation is abated. A
- Additionally, this allows management of dangerous medical conditions that often are present. Dissociative-dose ketamine is unequalled in its ability to quickly, reliably and safely calm patients with severe agitation, and though adverse effects can occur (most importantly, hypoventilation), the presence of psychiatric disease is not a relevant concern when ketamine would otherwise be the best tranquilization agent. In my own experience I have given ketamine to agitated trauma patients who on subsequently obtained history had schizophrenia, no adverse events associated with ketamine were detected.




~~Ketamine must be used only in patients on a monitor~~

- May be safer than opioids in non-monitored settings
- Has been safely used in EMS, pre-hospital, austere, humanitarian settings.

The “Scary” Part:

- “Emergence delirium”
- disoriented, restless, crying
- May have nightmares
- Can occur up to 24 hours later
- Uncommon!
- Less common in children and elderly
- Routine prophylactic benzos may benefit adults but not children
- Midazolam 0.03 mg/kg IV effective to prevent and terminate emergence in adults

Three ways to use ketamine in Trauma/SICU/Burn/ACS:

 <p>500mg Ketamine vial in Pyxis <u>For violent/agitated delirium</u> use 2-4 mg/kg IM – (intramuscular)</p>	 <p>50mg/5ml Ketamine stick in Pyxis <u>For acute severe pain</u> give 0.1-0.3mg IV (repeat q5min) <u>Burn dressing changes:</u> Intubated - 50mg IV Non-intubated - 0.3mg/kg</p>	 <p>Ketamine infusion <u>For multimodal pain control</u> – i.e. add-on to PCA: 0.1-0.3mg IV/hour</p>
--	---	---

Three ways to use ketamine in Trauma/Critical Care patients

1. Sub-dissociative dose –
 - Additive as secondary in multimodality pain control (ketamine drip)
 - Acute pain (ketamine stick – 50mg in 5ml)
2. Dissociative dose – extreme/violent agitation (the big 500mg vial)

Sub-dissociative dose – multimodality pain control⁶⁻⁸

How to use it:

- Whenever using PRN opioids in ICU, and especially if considering using PCA
- Use the “Analgesic Ladder” of multi-modality critical care pain control:⁹
- Start at 0.1 mg/kg, a few patients might need 0.15 or 0.2 mg/kg.
- Often start seeing dysphoria, “dizziness” at 0.3 mg/kg, but resolves quickly with cessation.
- Frequent titration is usually unnecessary

Epic Ketamine Order Set:

Orders
Clear All Orders

IP/ED GEN Ketamine Orders by Indication

This order set is to provide guidance on ordering and dosing of ketamine by indication. Please select the appropriate indication to order ketamine. Note this order set is a general guideline so clinical judgement is warranted.

IMPORTANT: Ketamine order is restricted to Pain/Anesthesiology, Palliative Care (Doris A. Howell) Service, Psychiatry, Critical Care providers, Emergency Department providers
- Ketamine Pain Guideline
- Ketamine Refractory Depression Guideline

Ketamine Orders

Ketamine Orders

☐ Ketamine for ANESTHESIA/INDUCTION
☐ Ketamine for ACUTE AGITATION
☒ Ketamine for PAIN

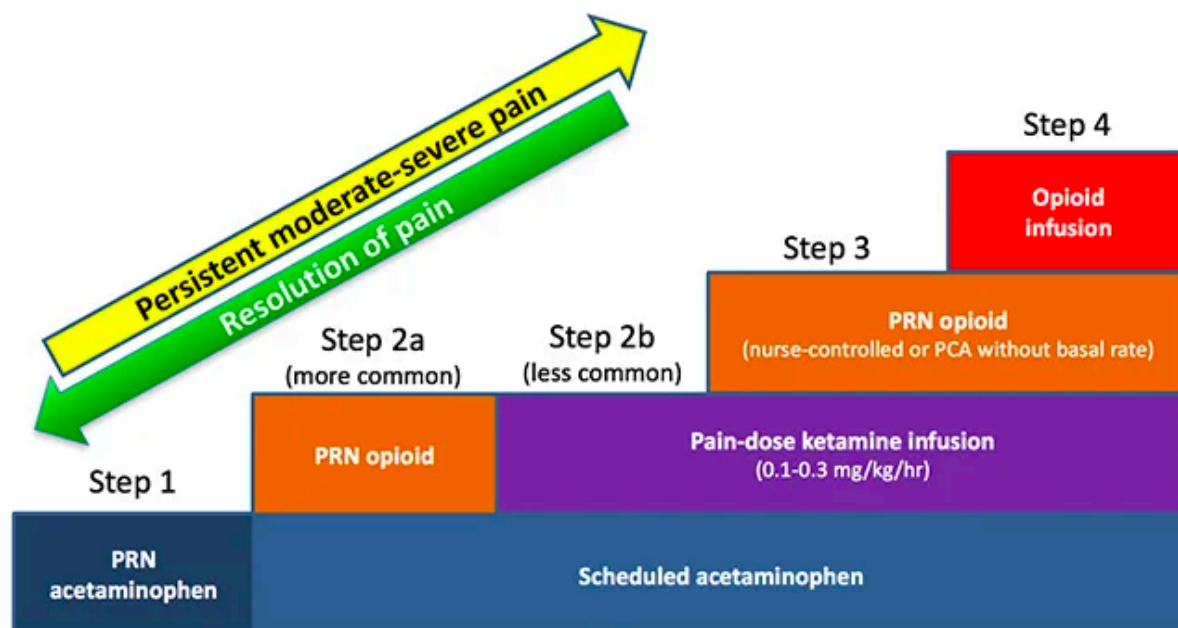
☒ Ketamine for PAIN (IVPB)

☒ ketamine (KETALAR) 33 mg in sodium chloride 0.9 % 100 mL IVPB
0.3 mg/kg × 108.8 kg (32.64 mg, rounded to 33 mg), IntraVENOUS, ONCE, 1 dose, today at 2030, Administer over 40 Minutes
Indication: Pain

☐ Ketamine for PAIN (Continuous Infusion)
☐ Ketamine for WOUND DRESS CHANGE - FOR BURN PROVIDERS ONLY
☐ Ketamine for REFRACTORY DEPRESSION
☐ Ketamine for SEDATION
☐ Ketamine for STATUS ASTHMATICUS
☐ Ketamine for STATUS EPILEPTICUS/SEIZURES

Additional Orders

Analgesic ladder for acute non-neuropathic pain in critical illness



Strategy for designing balanced analgesic regimens. Most patients with pain refractory to PRN acetaminophen will receive PRN opioids (Step 2a), motivated partially by convenience. However, some patients with increased risk of opioid side-effects (e.g. hypercapnia with tenuous respiratory drive) may benefit from a combination of acetaminophen plus ketamine infusion instead (Step 2b).

Dissociative dose – extreme/violent agitation

- IM ketamine (4-5 mg/kg) can be given IM/SC through clothes into the thigh in wildly agitated, violent, uncontrollable patients, even without a diagnosis.
- Rapid sedation occurs in less than two minutes, and it lasts about 30 minutes, during which time a controlled approach to diagnosis and testing can be done
- Faster than any other IM/SC usual sedative or combination

Time to Control of Severely Agitated ED Patients ¹⁰ (IM dose)	Time (± SD)
ketamine	6.57 min (± 8.65)
haloperidol	13.43 min (± 15.46)
midazolam	14.95 min (± 10.47)
lorazepam	17.73 min (± 24.78)
haloperidol + benzodiazepine	23.30 min (± 25.12)

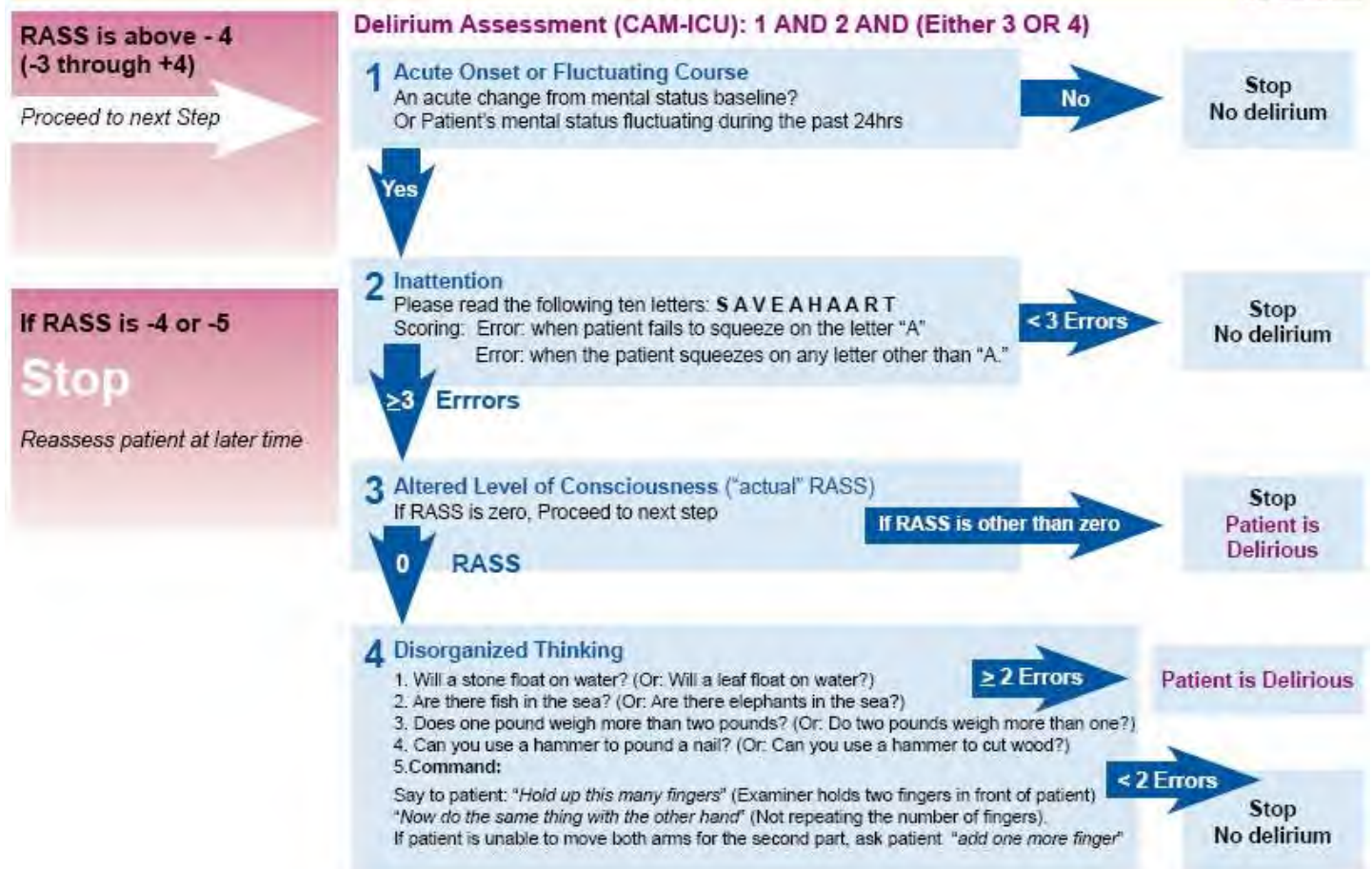
REFERENCES

1. Strayer R. SMACC Presentation 2015: Ketamine: How to use it fearlessly for all its indications. <https://www.smacc.net.au/2015/12/ketamine-how-to-use-it-fearlessly-for-all-its-indications-by-reuben-strayer/>. Published 2015. Accessed.
2. Cohen L, Athaide V, Wickham ME, Doyle-Waters MM, Rose NG, Hohl CM. The effect of ketamine on intracranial and cerebral perfusion pressure and health outcomes: a systematic review. *Ann Emerg Med*. 2015;65(1):43-51 e42.
3. Drayna PC, Estrada C, Wang W, Saville BR, Arnold DH. Ketamine sedation is not associated with clinically meaningful elevation of intraocular pressure. *Am J Emerg Med*. 2012;30(7):1215-1218.

4. Halstead SM, Deakne SJ, Bajaj L, Enzenauer R, Roosevelt GE. The effect of ketamine on intraocular pressure in pediatric patients during procedural sedation. *Acad Emerg Med*. 2012;19(10):1145-1150.
5. Lahti AC, Koffel B, LaPorte D, Tamminga CA. Subanesthetic doses of ketamine stimulate psychosis in schizophrenia. *Neuropsychopharmacology*. 1995;13(1):9-19.
6. Beaudoin FL, Lin C, Guan W, Merchant RC. Low-dose ketamine improves pain relief in patients receiving intravenous opioids for acute pain in the emergency department: results of a randomized, double-blind, clinical trial. *Acad Emerg Med*. 2014;21(11):1193-1202.
7. Bowers KJ, McAllister KB, Ray M, Heitz C. Ketamine as an Adjunct to Opioids for Acute Pain in the Emergency Department: A Randomized Controlled Trial. *Acad Emerg Med*. 2017;24(6):676-685.
8. Sin B, Tatunchak T, Paryavi M, et al. The Use of Ketamine for Acute Treatment of Pain: A Randomized, Double-Blind, Placebo-Controlled Trial. *J Emerg Med*. 2017;52(5):601-608.
9. Farkas J. The Analgesic Ladder. Pulm-Crit Web site. <https://emcrit.org/pulmcrit/analgesic-ladder/>. Published 2017. Accessed 1-2-2020, 2020.
10. Riddell J, Tran A, Bengiamin R, Hendey GW, Armenian P. Ketamine as a first-line treatment for severely agitated emergency department patients. *Am J Emerg Med*. 2017;35(7):1000-1004.

CONFUSION ASSESSMENT METHOD IN THE ICU (CAM-ICU)

Directions: If patient's RASS is above -4 (-3 through +4), refer to the following chart and assess for delirium using the Confusion Assessment Method in the ICU (CAM-ICU) on the next page.



Harvard CAM-ICU Flowsheet (by Houman Amirfarzan, M.D., Wes Ely, M.D.) Copyright © 2003, Vanderbilt Medical Center

CONFUSION ASSESSMENT METHOD FOR THE INTENSIVE CARE UNIT (CAM-ICU)

Table 3: Confusion Assessment Method for the Intensive Care Unit (CAM-ICU)

FEATURE 1: Acute Onset or Fluctuating Course		Positive, if answer 'yes' to either 1A or 1B.	YES	NO
1A: Is the patient different than his/her baseline mental status?				
OR				
1B: Has the patient had any fluctuation in mental status in the past 24 hours as evidenced by fluctuation on a sedation scale (e.g. RASS), GCS, or previous delirium assessment?				
FEATURE 2: Inattention		Positive, if either score for 2A or 2B is less than 8	Positive	Negative
First, attempt the Letters (ASE). If patient is able to perform this test and the score is clear, record this score and move to Feature 3. If patient is unable to perform this test or the score is unclear, then perform the Pictures ASE. If you perform both tests, use the ASE Pictures' results to score this Feature.				
2A: AUDITORY (Letter – ASE)	Record score (enter NT for not tested)	Score (out of 10):		
<p><u>Directions:</u> Say to the patient, "I am going to read you a series of 10 letters. Whenever you hear the letter 'A' indicate by squeezing my hand."</p> <p>Read letters from the following letter list in a normal tone:</p> <p style="text-align: center;">S A V E A H A A R T</p> <p>Scoring: Errors are counted when patient fails to squeeze on the letter "A" and when the patient squeezes on any letter other than "A."</p>				
2B: VISUAL (Pictures - ASE)	Record score (enter NT for not tested)	Score (out of 10):		
<u>Directions:</u> Use the Picture Packets (A and B) on the next page.				
FEATURE 3: Disorganized Thinking		Positive, if the combined score is less than 4	Positive	Negative
3A: Yes/No Questions		Combined Score (3A + 3B):		
(Use either Set A or B, alternate on consecutive days if necessary):		_____ (out of 5)		
Set A		Set B		
1. Will a stone float on water?	1. Will a leaf float on water?			
2. Are there fish in the sea?	2. Are there elephants in the sea?			
3. Does one pound weigh more than two pounds?	3. Do two pounds weigh more than one pound?			
4. Can you use a hammer to pound a nail?	4. Can you use a hammer to cut wood?			
(Patient earns 1 point for each correct answer out of 4)		3A Score _____		
3B: Command				
Say to patient: "Hold up this many fingers: (Examiner holds two fingers in front of patient) "Now do the same thing with the other hand: (Not repeating the number of fingers). *If patient is unable to move both arms, for the second part of the command ask patient to "Add one more finger")				
(Patient earns 1 point if able to successfully complete the entire command)		3B Score _____		
FEATURE 4: Altered level of Consciousness		Positive	Negative	
Positive if the actual RASS score is anything other than "0" (zero)				
Is the patient's current level of consciousness anything other than alert such as vigilant, lethargic, or stupor (e.g., score on Richmond Agitation Sedation Scale other than 0 at time of assessment)?				
Alert	Spontaneously fully aware of environment and interacts appropriately			
Vigilant	Hyper alert			
Lethargic	Drowsy but easily aroused, unaware of some elements in the environment, or not spontaneously interacting appropriately with the interviewer; becomes fully aware and appropriately interactive when prodded minimally			
Stupor	Becomes incompletely aware when prodded strongly; can be aroused only by vigorous and repeated stimuli, and as soon as the stimulus ceases, stuporous subject lapses back into the unresponsive state.			
(Features 1 and 2 and either Feature 3 or 4):		Overall CAM-ICU:	Positive	Negative

Copyright © 2002, E. Wesley Ely, MD, MPH and Vanderbilt University, all rights reserved.

UC San Diego Health Guideline for Intravenous Administration of Hypertonic Saline (3%, 23.4% sodium chloride)

Approved by the Pharmacy and Therapeutics Committee 4/21/17

Indications for Hypertonic Saline

- Treatment of increased intracranial pressure
- Treatment of cerebral edema
- Clinical signs of cerebral herniation
- Treatment of acute and chronic euvolemic hyponatremia

		23.4% NaCl [^]	3% NaCl [*]
Line Access		Central line only	Central line preferred due to high osmolarity For emergent situations, peripheral (large gauge with good blood flow) may be utilized
Usual Dosing	Bolus	30 mL over 5 min (Brain Code only)	100-250 mL over 15-30 min
	Infusion	Inappropriate to infuse	5-150 mL/hr (start at 5-30 mL/hr)
Who may prescribe	Bolus	Authorized prescriber under supervision of an attending intensivist, critical care fellow, attending neurosurgeon, or attending neurologist	Neurology, Neurosurgery, Neuro Critical Care, Trauma, or Pulmonary Critical Care Prescriber
	Infusion	Inappropriate to infuse	Any prescriber
Who may administer	Bolus	Authorized prescriber under supervision of an attending intensivist, critical care fellow, or attending neurologist in the ICU (any location in emergent situation)	RN or MD in the ICU/ED (RN or MD in any location in emergent situation)
	Infusion	Inappropriate to infuse	RN or MD in ICU/ED, IMU, telemetry unit, Med/Surg

[^]23.4% NaCl is available in 30 mL vial (23.4 g NaCl/100 mL = 7 g NaCl/30 mL = 120 mEq NaCl/30 mL = 240 mEq/100 mL)

^{*}3% NaCl is available in 500 mL bag (3 g NaCl/100 mL = 15 g NaCl/500 mL = 513 mEq NaCl/1000 mL = 1027 mEq/1000 mL)

Dosing and Monitoring Guidance

1. **For neurologic indications, including acute hyponatremia (<48 hrs):**
 - The dose/rate of 3% sodium chloride to be decided by treating team
 - Rate of sodium correction may be higher than for chronic hyponatremia
 - Recommended monitoring serum sodium a minimum of every 6 hours
 - For acute hyponatremia (<48 hrs), rate of correction may be faster than for chronic hyponatremia
2. **For treatment of euvolemic hyponatremia of chronic (≥ 48 hrs) or unknown duration:**

- Etiology may include SIADH, hypothyroidism, or glucocorticoid deficiency
- 3% saline boluses are rarely required
- Calculate the total body sodium deficit by:
 - a. $0.6 \times \text{Weight}^{**} \text{ (in kg)} \times (140 - \text{patient's Na})$
 **For weight > 30% of ideal body weight (IBW), use adjusted weight
 Adjusted weight = $0.5 \times (\text{ABW} - \text{IBW}) + \text{IBW}$ up to maximum of 100 kg
- Replacement formula for the first 24 hours:
 - a. $0.6 \times 10 \times \text{kg} = \text{mEq sodium to be replaced}$
 - b. 3% sodium chloride contains 513 mEq/L sodium and 513 mEq/L chloride
 - c. Volume of 3% sodium chloride = $\text{mEq sodium} / 513 \times 1000 = \text{mL} / 24 \text{ hours}$
 - d. Rate (mL/hour) = total number of mL per 24 hours / 24 hours
- Infuse the calculated dose for first 24 hours, over 24 hours
- The order should be a one-time replacement and be reassessed daily by the physician to see if it needs to be continued.
- **For chronic hyponatremia (≥ 48 hrs), rate of correction should generally not exceed 10-12 mEq/L in first 24 hours and 18 mEq/L in first 48 hours to prevent osmotic demyelination syndrome**

Precautions

- Severe neurologic complications may result from rapid changes in serum sodium concentration and serum osmolality
- Patients with a history of cirrhosis or alcoholism may be at increased risk for osmotic demyelination syndrome with rapid sodium correction
- Rapid withdrawal of hypertonic saline infusion may result in rebound cerebral edema
- Plasma volume expansion may worsen pre-existing heart failure or cause pulmonary edema
- Administration of hypertonic saline via peripheral line may result in phlebitis and skin necrosis

Monitoring

Therapy goals and frequency of monitoring to be determined by treatment team based on patient condition and indication

- Electrolytes
 - Serum sodium, recommended minimum of every 6 hours
 - Recommend serum sodium check 30-60 minutes after bolus
 - Chloride, potassium, bicarbonate
 - Serum osmolality
- Neurologic complications
 - Osmotic demyelination syndrome
 - Encephalopathy
 - Seizures
 - Coma
 - Subdural and intraparenchymal hemorrhage
- Cardiac/Pulmonary complications
 - Hypotension due to vessel irritation (with 23.4% NaCl)

- Heart failure exacerbation
- Pulmonary edema
- Other
 - Phlebitis, especially if using peripheral line or 23.4% NaCl
 - Non-gap metabolic acidosis
 - Hemolysis from rapid changes in osmotic gradients
 - Bleeding and coagulopathy

*****This guideline is intended to be used as a resource and should not replace clinical judgment***

References

- Brigham and Women's Hospital and Dana Farber Cancer Institute Hypertonic Sodium Chloride Drug Monograph. Revised February, 2003.
- Culpepper M, Clements B, Pence S. Hypertonic saline: Patterns and guidelines for use. South Med J. 1994 Dec;87(12):1203-7.
- Froelich M, Ni Q, Wess C, et al. Continuous hypertonic saline therapy and the occurrence of complications in neurocritically ill patients. Crit Care Med. 2009 Apr;37(4):1433-41.
- Huang SJ, Chang L, Han YY, et al. Efficacy and safety of hypertonic saline solutions in the treatment of severe head injury. Surg Neurol. 2006 Jun;65(6):539-46.
- Mayer SA. Columbia University Neurocritical Care Hypertonic Fluid Protocol. Revised April 1, 2010.
- Qureshi AI and Suarez JL. Use of hypertonic saline solutions in treatment of cerebral edema and intracranial hypertension. Review. Critical Care Medicine. 2000;28:3301-3313.
- Qureshi AL, Suarez JL, Bhardwaj A, et al. Use of hypertonic (3%) saline/acetate infusion in the treatment of cerebral edema: Effect on intracranial pressure and lateral displacement of the brain. Crit Care Med. 1998;26:440-446.
- Shorr AF, Rhoney DH, Provencio JJ. Sodium challenges in the critically ill patient. 41st Critical Care Congress Review. June/July 2012. Accessed at www.sccm.org.
- Vaidya C, Ho W, Freda BJ. Management of hyponatremia: providing treatment and avoiding harm. Cleve Clin J Med. 2010 Oct;77(10):715-26.
- Verbalis JG, Goldsmith SR, Greenberg A, et al. Hyponatremia treatment guidelines 2007: expert panel recommendations. Am J Med. 2007 Nov;120(11 Suppl 1):S1-21.

Disaster Planning

UC San Diego Health System Codes

Active shooter: An armed person who is using deadly force or is actively causing death, great bodily injury, or physical damage. Location given if known.

Code Adam: Missing or abducted infant or child within the hospital.

Code Blue: Life-threatening cardiac or respiratory problems.

Code Gray: Any person in danger of injuring themselves or others intentionally or unintentionally.

Code Orange: Significant incident within the hospital that interrupts normal hospital functions such as major utility outages.

Code Pink: Maternal/infant emergency response. Newborn in distress or an unexpected delivery complication outside the Labor and Delivery area.

Code Red: Any fire, smoke or smoldering material.

Code Stroke: Onset of one or more stroke warning signs such as numbness, weakness, dizziness, headache, and confusion.

Code Triage: Any external event that generates multiple casualties which may exceed capacity of the Emergency Department (ED) and Trauma Center to manage. Activated by the ED attending physician and/or Administrator on Call (AOC).

Code 10: Bomb threat and/or Suspicious Package.

Ten Predictable Surprises Disrupting Hospital Processes in Disasters

1. Communications breakdown creates confusion at the hospital
 - Hallmark of a Mass Casualty Incident
2. Minimally injured arrive in the first wave of patients
 - Self-transport and “home-boy” ambulance
3. “Convergers” descend on hospital
 - Media, Families, Worried Well, Poseurs and Ghouls
 - Lockdown, perimeter, direct to predetermined areas
4. Mass volunteers appear
 - Need an Emergency credentialing plan, drill.
5. Surge Capability needed
 - Need for more specialized supplies, equipment, personnel
 - “No time for Pyxis!”
6. Surge Capacity needed
 - More beds, ORs, ER, ICU space, cancel elective OR, discharge/transfers.
7. Record keeping becomes overloaded
 - Paper backup to EHR, Admissions drills, premade kits with armbands, tags.
8. Need to adopt Population Based Standard
 - Difficult decision by providers and ICS
 - Need for compassionate care for expectant
9. Caregiver needs return to the forefront
 - Need to watch each other, stress reaction, personal disaster kits, debrief, later PTSD.
10. The Hospital becomes the final victim
 - Overwhelmed, Triage Hospital, possible ruined reputation and finances.

Adapted from Potter C: Trauma System News, 7/22/2016

Disaster Planning

MCP 801.3, Attachment D

Functional Teams-Hillcrest

3/2016

FUNCTIONAL AREAS/TEAMS UC San Diego Health

UC SAN DIEGO HEALTH-(UCSDH)-HILLCREST

Hillcrest Functional Areas / Team Listings (Key sites are underlined):

- ☐ Hospital Command Center
- ☐ Triage Area
- ☐ Labor Pool and Credentialing
- ☐ Limited Treatment Center
- ☐ Family Assistance Center (see Annex for expanded version)
- ☐ Trauma Resuscitation Room
- ☐ Acute and Delayed Treatment Areas of the Emergency Department
- ☐ Shock and Holding Area
- ☐ Media Center
- ☐ Morgue
- ☐ Victim Search Team
- ☐ Damage Assessment Team
- ☐ Hazardous Material/Radiation Incident Response Team
- ☐ Clergy, Emergency Response
- ☐ Critical Incident Stress Management Team
- ☐ Pulmonary Screening Team
- ☐ Childcare Center
- ☐ Dependent Care (Adult)
- ☐ Mass Prophylaxis Team
- ☐ Pharmacy Security and Evacuation
- ☐ CDC ChemPack
- ☐ Palliative Care (see Annex for expanded version)
- ☐

Hospital Command Center (Hillcrest)

Rationale:

To establish a centralized command and resource function for Code Orange and Code Triage activities.

Primary Location: Administrative Conference Room (ACR)

Secondary Location: Facilities Engineering Conference Room, 330 Dickinson

Contact Phone Number: 543-7000 (during activation); analog back-up line in the ACR (Hospital Command Center - Hillcrest) as a backup FAX that can be activated if needed. The FAX/Scanner/printer machine is located in the ACR closet and phone number is on the machine and the wall jack. The number is (619) 471-0672 (X10672)

Recorded Information: 619-543-6555

FAX Number: (619) 543-2454 (Staffing Office room 1-111 located at Nursing Administration –room 1-110); If ICC FAX line is activated (location ACR) during incident HCC to publish (619) 471-0672 (X10672)

Responsible Departments: As designated under the Hospital Incident Command System (HICS)

Primary Responsibilities:

1. Make certain the HCC has been established.
2. Make certain assignments/job action sheets have been issued.
3. Coordinate resources in response to requests from the Scene Commander.
4. Expand HCC staffing as emergency dictates.
5. Maintain accurate records of HCC decisions and resource allocations.
6. Activate functional modules as needed.
7. Deactivate code when appropriate.
8. Provide critique of HCC function following resumption of normal operations.

Suggested Team Membership:

- ☐ Administrator-on-Call (AOC)
- ☐ Director of Security
- ☐ Emergency Management personnel
- ☐ Facilities Engineering
- ☐ On Duty Nursing Supervisor
- ☐ Safety Officer
- ☐ Telecommunications
- ☐ Administrative Services and Regulatory Affairs

Activation Procedure:

Personnel will be notified by MNS, overhead speaker system, or paging system by text paging generated via the Telecommunications Office.

Deactivation Procedure:

~~The Incident Commander~~ will notify Telecommunications at the point at which HICS is to be deactivated. At conclusion of the Code, the "ALL CLEAR" status will be broadcast via MNS, overhead paging or text paging system.

Activation Authority:

~~Code Triage - E.D.~~ Attending Physician or designee and /or Administrator on Call
Code Orange - Any employee

Hillcrest Triage Area

Rationale:

For rapid assessment and sorting of multiple victims by injury type and severity.

Primary Location: Medical Offices North - Outpatient Center Loop

Secondary Location: Outside of the Emergency Department entrance, covered area.

Contact Phone Number: 619 543-3509 (at Triage Loop); 543-2154 ED – Nurses’ Station inside ED

FAX Number: 619 543-3122 (location ED Nurses’ Station)

Responsible Department: Emergency Department

Primary Responsibilities: Notify HCC when area/team is ready and functional.

1. Patient reception.
2. Rapid assessment and triage, tagging.
3. Initiate patient tracking.
4. Initiate transport of patients per Code Triage plan:
 - a. Shock and Holding (PACU) x36130: for patients in shock, or multi-trauma and needing operation.
 - b. Trauma Resuscitation Room x36746; X36747: for patients in shock, or multi-trauma and needing operation.
 - c. Emergency Department x36400: For primary medical problems, surgical problems not requiring operation; primary orthopedic injuries; psychiatric patients; and overflow of Shock and Holding area.
 - d. Limited Treatment Area (Cast Room) x33760: For walking wounded, minor psychiatric patients.
 - e. Burn Unit x36502
 - f. Labor and Delivery x32533
5. Record and report numbers of patients, triage category, and destination to bed assignments/patient tracking at regular intervals.

Team Membership:

- ☐ Emergency Department Attending Physician
- ☐ Emergency Medicine Resident
- ☐ Nurse
- ☐ Admissions and Registration Team

Other Personnel:

- ☐ Transport Personnel assigned by Labor Pool
- ☐ Security

Activation Procedure:

Personnel will be notified by MNS, overhead speaker system, or paging system by text paging generated via the Telecommunications Office.

Deactivation Procedure:

The Incident Commander will notify Telecommunications at the point at which HICS is to be deactivated. At conclusion of the Code, the “ALL CLEAR” status will be broadcast via the overhead paging and text paging system.

Activation Authority:

Code Triage – Automatically set up following code activation by ED Attending Physician
Code Orange – Incident Commander

**Hillcrest
Limited Treatment Center**

Rationale:

Treatment of minor injuries and/or medical problems not requiring hospitalization. Retrieve limited treatment disaster cart from MON Room 3-124 to augment care supplies.

Primary Location: First Floor Outpatient Center, Orthopedic Clinic (Orthopedic Technology Services Department "Cast Room")

Contact Phone Number: 619-543-2876 (Cast Room)
619-543-6312 (Orthopedic Clinic- main line front desk; 471-0769 backline)
FAX Number: 619-471-0738 (Ortho Clinic Fax)

Secondary Location: Third Floor Medical Offices North Room 1, Surgery Clinic
Contact Phone Number: 543-6886 Main desk); 543-6958 Nurses' Station
FAX Number: 543-6832

Responsible Department: Ambulatory Care Services Administration

Primary Responsibilities: Notify HCC when area/team is ready and functional.

1. Wound care, "walking wounded" injuries.
2. Minor suturing.
3. Oxygen administration.
4. Treatment of minor medical problems.
5. Treatment of minor psychiatric problems not requiring restraint.

Team Membership:

- ☐ Two treatment teams consisting of one physician, one nurse, and one recorder. One backup patient treatment team.

Code Triage: Personnel will be notified by overhead speaker system and with the Medical Center's paging system by text paging generated via the Telecommunications Office.

Deactivation Procedure:

The Incident Commander will notify Telecommunications at the point at which HICS is to be deactivated. At conclusion of the Code, the "ALL CLEAR" status will be broadcast via the overhead paging and text paging system.

Activation Authority:

Code Triage – Automatically set up following activation by ED Attending Physician
Code Orange – Incident Commander

**Hillcrest
Trauma Resuscitation Room (TRR)**

Rationale:

To provide primary receiving area for patients in need of emergency surgery evaluation and operative treatment.

Primary Location: **Second Floor adjacent to SICU**

Secondary Location: To be announced by the Hospital Command Center

Contact Phone Number: 619 543-6747; X36746 Resus Room; 543-7428 SICU

FAX Number: 543-5716 (SICU)

Responsible Departments: Department of Surgery, Division of Trauma; Department of Anesthesiology

Primary Responsibilities: Notify HCC when area/team is ready and functional.

1. Resuscitate severely injured patients.
2. Perform basic diagnostic studies (lab, x-ray) on trauma patients.
3. Triage patients in order of severity of injury.
4. Make appropriate dispositions (OR, ICU, Floor).
5. Expedite transfer of patients out of TRR once workup is complete to allow new patients to be admitted.
6. Report all patient movements and transfers to the ICC.

Team Membership:

- ☐ On call trauma attending physician or fellow
- ☐ Additional trauma staff as available or on call back
- ☐ Chief, senior, and junior residents on Trauma Service
- ☐ Junior residents on other general surgery services, neurosurgery, and cardiothoracic surgery services
- ☐ Resuscitation Room nurses from SICU
- ☐ Two Trauma RNs per shift
- ☐ Trauma coordinators

Activation Procedure:

Code Triage: Personnel will be notified by overhead speaker system and with the Health System paging system by text paging generated via the Telecommunications Office.

Deactivation Procedure:

The Incident Commander will notify Telecommunications at the point at which HICS is to be deactivated. At conclusion of the Code, the "ALL CLEAR" status will be broadcast via the overhead paging and text paging system.

Activation Authority:

Code Triage – Automatically set up following code activation by Attending Physician
Code Orange – Incident Commander

Acute and Delayed Treatment Areas of the Emergency Department

Rationale:

Site for management of medical cases requiring acute or delayed care until admission, transfer or discharge during an emergency situation. Patients will be triaged into ED depending on injury/illness type and severity.

Primary Location: **Emergency Department and Urgent Care**

Secondary Location: Surge tents when activated.

Contact Phone Number: 619 543-2154 ED – Nurses’ Station inside ED

FAX Number: 543-3122 (location ED Nurses’ Station)

Responsible Department: Emergency Department

Primary Responsibilities: Notify HCC when area/team is ready and functional.

1. Triage and either treat or send home patients already in waiting room who have minor complaints, to clear patient surge.
2. Patient management.
3. Ongoing assessment and re-triage
4. Documentation patient care in electronic record or hard copy.
5. Record and report numbers of patients, triage category, and destination to bed assignments/patient tracking at regular intervals.

Team Membership:

- ☐ Emergency Department Physicians and Staff
- ☐ Augmented physicians and staff via labor Pool as requested

Other Personnel:

Transport personnel assigned by Labor Pool

Activation Procedure:

Personnel will be notified by overhead speaker system and with the Health System paging system by text paging generated via the Telecommunications Office.

Deactivation Procedure:

The Incident Commander will notify Telecommunications at the point at which HICS is to be deactivated. At conclusion of the Code, the “ALL CLEAR” status will be broadcast via the overhead paging and text paging system.

Activation Authority:

Code Triage – Automatically set up following

Shock and Holding Area - Hillcrest

Rationale:

To provide secondary receiving area for patients in need of emergency surgery evaluation and operative treatment.

Primary Location: Second Floor Recovery Room (PACU)

Secondary Location: To be announced by the Incident Command Center

Contact Phone Number: 619 543-6130

FAX Number: 619 543-2586

Responsible Department: Department of Surgery, Division of Trauma, Department of Anesthesiology, and Department of Nursing

Primary Responsibilities: Notify HCC when area/team is ready and functional.

1. Resuscitate severely injured patients.
2. Perform basic diagnostic studies (lab, x-ray) on trauma patients.
3. Triage patients in order of surgical priority, for operating room time.
4. Make appropriate dispositions (OR, OR pre-op holding, ICU, Floor).
5. Hold and stabilize patients requiring surgery for whom Operating Rooms are not yet available. A pre-operative area will be set aside for this purpose. If needed, patients can be transferred to the ICU/Floor while awaiting surgery.
6. Report all patient movement and transfers to the HCC.

Team Membership:

- ☐ On call trauma attending physician
- ☐ Trauma Fellow
- ☐ Attending physicians and residents on General Surgery Services
- ☐ Surgery Attending physicians and residents
- ☐ Neurosurgery Attending physicians, chief resident and Neurosurgery residents
- ☐ All Attending physicians and residents from Plastic Surgery, ENT, and Urology Services
- ☐ Anesthesia staff and residents
- ☐ PACU nurses

Activation Procedure:

Code Triage: Personnel will be notified by overhead speaker system and with the Health System paging system by text paging generated via the Telecommunications Office.

Deactivation Procedure:

The Incident Commander will notify Telecommunications at the point at which HICS is to be deactivated. At conclusion of the Code, the "ALL CLEAR" status will be broadcast via the overhead paging and text paging system.

Activation Authority:

Code Triage – Automatically set-up following code activation by ED Physician.
Code Orange – Incident Commander

DISASTER TREATMENT RECORD

Name

MR#

DOB

PREHOSPITAL TRIAGE TAG #		Source		Date	
Patient Identification					
DECONTAMINATION Performed at: <input type="checkbox"/> SCENE Decontamination needed: <input type="checkbox"/> YES Decontamination done: <input type="checkbox"/> YES <input type="checkbox"/> UCSD Medical Center <input type="checkbox"/> NO <input type="checkbox"/> NO					
PRIMARY ROUTING NOTE: do not use "OR Resuscitation" during Code Triage. <input type="checkbox"/> TRAUMA RESUS ROOM <input type="checkbox"/> BURN UNIT <input type="checkbox"/> OTh ER (specify): <input type="checkbox"/> MORg UE <input type="checkbox"/> Sh OCk AND h OLDIng <input type="checkbox"/> LIMITED TX CENTER Medical Examiner notified <input type="checkbox"/> E.D. <input type="checkbox"/> LABOR & DELIVERY Date/Time:					
CARE CLASSIFICATION <input type="checkbox"/> IMMEDIATE <input type="checkbox"/> DELAYED <input type="checkbox"/> MINOR <input type="checkbox"/> DECEASED					
PATIENT NAME (LAST, FIRST, MIDDLE INITIAL)				DATE OF BIRTH	
STREET ADDRESS				SEX r Male r Female	
CITY	STATE	ZIP	PHONE	RELIGION	
DESCRIPTION, FOR USE IF PATIENT UNABLE TO PROVIDE INFORMATION (HAIR, EYES, HEIGHT, w EIGHT, RACE, MARKS, BUILD, ARTICLES OF CLOTHING)			I refuse medical examination and treatment at this time. Patient Signature _____ Date/ Time _____		
NEXT OF KIN			RELATIONSHIP	PHONE	
ADDRESS					
LOCATION OF INCIDENT/ACCIDENT			NDMS CLASSIFICATION	RECEIVED FROM	
PRE-HOSPITAL TREATMENT r Airway (type and time) _____ r Chest tube r IV (type and time) _____ r Meds/narcotics (type/amt) _____ r Other (specify): _____		CHIEF COMPLAINT INITIAL HISTORY		ALLERGIES REACTIONS CURRENT MEDICATIONS LAST TETANUS SHOT r < 5 years r > 5 years	
PROBLEM ORIENTED INJURY LIST Specific or Suspected Injury		Orders	MD Initials	Date/Time Completed	RN Initials
FINAL DISPOSITION: <input type="checkbox"/> ADMITTED <input type="checkbox"/> TRANSFERRED <input type="checkbox"/> DISCh ARg ED <input type="checkbox"/> MORg UE					
PHYSICIAN'S SIGNATURE/ PID #		DATE & TIME	NURSE'S SIGNATURE		DATE & TIME
PHYSICIAN'S SIGNATURE/ PID #		DATE & TIME	NURSE'S SIGNATURE		DATE & TIME

Chemical, Biological, and Radiological Terrorism

VERY USEFUL WEBSITES AND APPS ARE AVAILABLE FROM THE NATIONAL LIBRARY OF MEDICINE:

1. CHEMM + WISER
 - a. <https://www.chemm.nlm.nih.gov/>
2. REMM
 - a. <https://www.remm.nlm.gov/>
3. These sites and Apps are kept up to date.

Chemical, Biological Weapons:

Diagnosis: Be alert to the following –

- Groups of individuals becoming ill around the same time
- Sudden increase of illness in previously healthy individuals
- Sudden increase in the following non-specific illnesses:
 - Pneumonia, flu-like illness, or fever with atypical features
 - Bleeding disorders
 - Unexplained rashes, and mucosal or dermal irritation, blisters, sloughing
 - Neuromuscular illness, unexplained weakness in previously healthy individuals
 - Simultaneous disease outbreaks in human and animal populations
 - Unusual temporal or geographic clustering of illness (for example, patients who attended the same public event, live in the same part of town, etc.).

Confirmation and technical support

- Alert laboratory, consult infectious disease specialist
- Alert Trauma Director, hospital leadership, to consider Code Orange, Disaster Plan
- Call San Diego County Division of Community Epidemiology: Mon-Fri - (619) 515-6620, Weekends, after hours - (858) 565-5255
- Epidemiology will call FBI: (858) 499-7904 or (858) 565-1255 & CDC :(800) 311-3435
- For help in clinical diagnosis call CDC hotline (770-488-7100)

Decontamination considerations

- Chemical Decontamination is best done before patient enters hospital, treating patients in ER or Trauma bay before decontamination may contaminate hospital
- Clothing removal & biosafety bagging is recommended, patient is washed off in shower outside ER
- Radiologic decontamination may done be after initial trauma care. Plastic sheeting is used to cover the trauma or OR table. Radiation survey meters are kept in the trauma bay.

Standard Precautions (Mask, gown and gloves) should be worn for all trauma victims

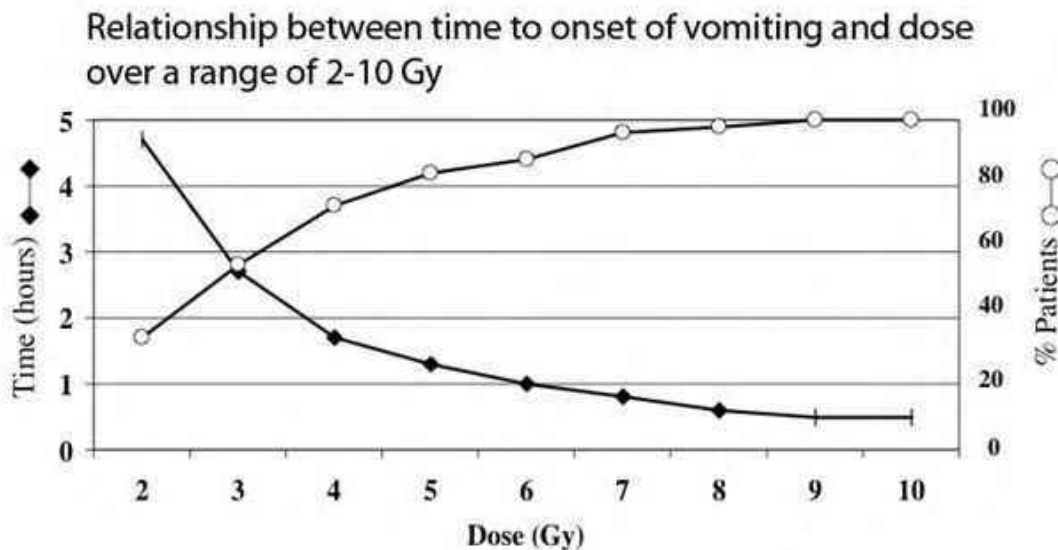
- Follow infection control practices in Table 1
- Handle equipment used according to standard infection control practices

Treatment considerations

- See Tables 1 and 2
- **The terrorist may be one of the initial/index cases!**

Radiologic Weapons:

Triage – time to first vomiting determines prognosis, the higher the radiation dose absorbed, the greater the severity of symptoms and the more rapid the onset of vomiting. Vomiting within 1 hour of exposure portends a grim prognosis.



Diagnosis: Be alert to the following –

Acute radiation syndrome follows predictable pattern (Table 3), symptoms of concern:

- 2-3 week prior history of nausea and vomiting
- thermal burn-like skin effects without thermal exposure
- immune dysfunction with secondary infections
- tendency to bleed (epistaxis, gingival bleeding, petechiae)
- marrow suppression (neutropenia, lymphopenia, thrombocytopenia)
- epilation (hair loss)

Radiation exposure may be known and recognized or clandestine through

- large recognized exposures, such as a nuclear bomb or damage to a nuclear power station

- small radiation source emitting continuous gamma radiation producing group or individual chronic intermittent exposures (such as radiological sources from medical treatment devices or environmental water or food pollution)

Radiation exposure may result from any one or combination of the following

- external sources (such as radiation from an uncontrolled nuclear reaction or radioisotope outside the body)
- skin contamination with radioactive material (“external contamination”) OR internal radiation from absorbed, inhaled, or ingested radioactive material (“internal contamination”)

Confirmation and technical support

- Contact radiation safety officer (RSO) for help, consult nuclear medicine physician
- Medical Radiological Advisory Team (MRAT) at Armed Forces Radiobiology Research Institute (AFRRI) 301-295-0530 will offer advice.

Alert Trauma Director, hospital leadership, to consider Code Orange, Disaster Plan

- Obtain CBC:
 - absolute lymphocyte count <1000 mm³ suggests moderate exposure
 - absolute lymphocyte count <500 mm³ suggests severe exposure
 - Acute, short-term rise in neutrophil count suggests exposure
- Swab mucosa (all body orifices –each nostril, both ears, mouth, rectum) for counts
- Collect 24-hour stool if GI contamination considered
- Collect 24-hour urine if contamination is considered

Decontamination considerations

- Radiologic decontamination may be done after initial trauma care. Plastic sheeting is used to cover the trauma or OR table. Radiation survey meters are kept in the trauma bay.
- Exposure without contamination requires no decontamination (RSO measurement)
- Exposure with contamination requires Standard Precautions, removal of patient clothing, and decontamination with water
- For internal contamination, contact the RSO and/or Nuclear Medicine Physician
- Patient with life-threatening condition: treat, then decontaminate
- Patient with non-life-threatening condition: decontaminate, then treat

Treatment considerations

If radioiodine (reactor accident) is present, consider giving prophylactic potassium iodide (Lugol’s Solution or KI tablets) within first 24 hours only (ineffective later).

Anxiety amongst victims, bystanders, families and providers will be considerable. Appropriate reassurance and information sharing is necessary, debriefings should be provided regularly. Frequent contact with Incident Command is important.

Table 1 Some Potential Biological Warfare Agents

Disease	Incubation	Symptoms	Signs	Diagnostic tests	Transmission and Precautions	Treatment (Adult dosage)	Prophylaxis
Inhaled Anthrax	2-6 days Range: 2 day to 8 weeks	Flu-like symptoms Respiratory distress	Widened mediastinum on chest X-ray (from adenopathy) Atypical pneumonia Flu-like illness followed by abrupt onset of respiratory failure	Gram stain ("boxcar" shape) Gram positive bacilli in blood culture ELISA for toxin antibodies to help confirm	Aerosol inhalation <i>No person-to-person transmission</i> Standard precautions	Mechanical ventilation Antibiotic therapy Ciprofloxacin 400 mg iv q 8-12 hr Doxycycline 200 mg iv initial, then 100 mg iv q 8-12 hr Penicillin 2 mil units iv q 2 hr -- possibly add gentamicin	Ciprofloxacin 500 mg or Doxycycline 100 mg po Q 12 h ~ 8 weeks (shorter with anthrax vaccine) Amoxicillin in pregnancy and children Vaccine if available
Botulism	12-72 hours Range: 2 hrs – 8 days	Difficulty swallowing or speaking (symmetrical cranial neuropathies) Symmetric descending weakness Respiratory dysfunction No sensory dysfunction No fever	Dilated or un-reactive pupils Drooping eyelids (ptosis) Double vision (diplopia) Slurred speech (dysarthria) Descending flaccid paralysis Intact mental state	Mouse bioassay in public health laboratories (5 – 7 days to conduct) ELISA for toxin	Aerosol inhalation Food ingestion <i>No person-to-person transmission</i> Standard precautions	Mechanical ventilation Parenteral nutrition Trivalent botulinum antitoxin available from State Health Departments and CDC	Experimental vaccine has been used in laboratory workers
Plague	1-3 days by inhalation	Sudden onset of fever, chills, headache, myalgia Pneumonic: cough, chest pain, hemoptysis Bubonic: painful lymph nodes	Pneumonic: Hemoptysis; radiographic pneumonia -- patchy, cavities, confluent consolidation Bubonic: typically painful, enlarged lymph nodes in groin, axilla, and neck	Gram negative coccobacilli and bacilli in sputum, blood, CSF, or bubo aspirates (bipolar, closed "safety pin" shape on Wright, Wayson's stains) ELISA, DFA, PCR	<i>Person-to-person transmission in pneumonic forms</i> Droplet precautions until patient treated for at least three days	Streptomycin 30 mg/kg/day in two divided doses x 10 days Gentamicin 1-1.75 mg/kg iv/im q 8 hr Tetracycline 2-4 g per day	Asymptomatic contacts or potentially exposed Doxycycline 100 mg po q 12 h Ciprofloxacin 500 mg po q 12 h Tetracycline 250 mg po q 6 hr all x 7 days Vaccine production discontinued
Tularemia "pneumonic"	2-5 days Range: 1-21 days	Fever, cough, chest tightness, pleuritic pain Hemoptysis rare	Community-acquired, atypical pneumonia Radiographic: bilateral patchy pneumonia with hilar adenopathy (pleural effusions like TB) Diffuse, varied skin rash May be rapidly fatal	Gram negative bacilli in blood culture on BYCE (Legionella) cysteine- or S-H-enhanced media Serologic testing to confirm: ELISA, microhemagglutination DFA for sputum or local discharge	Inhalation of agents <i>No person-to-person transmission but laboratory personnel at risk</i> Standard precautions	Streptomycin 30 mg/kg/day im divided bid for 10-14 days Gentamicin 3-5 mg/kg/day iv in equal divided shoulders x 10-14 days Ciprofloxacin possibly effective 400 mg iv q 12 hr (change to po after clinical improvement) x 10-14 days	Ciprofloxacin 500 mg po q 12 hr Doxycycline 100 mg po q 12 hr Tetracycline 250 mg po q 6 hr All x 2 wks Experimental live vaccine
Smallpox	12-14 days Range: 7-17 days	High fever and myalgia; itching; abdominal pain; delirium Rash on face, extremities, hands, feet; confused with chickenpox which has less uniform rash	Maculopapular then vesicular rash -- first on extremities (face, arms, palms, soles, oral mucosa) Rash is synchronous on various segments of the body	Electron microscopy of pustule content PCR Public health lab for confirmation	<i>Person-to-person transmission</i> Airborne precautions Negative pressure Clothing and surface decontamination	Supportive care Vaccinate care givers	Vaccination (vaccine available from CDC)

Table 2 Some Potential Chemical Terrorism Agents and Syndromes (including biologic toxins)

Agents	Symptom Onset	Symptoms	Signs	Clinical Diagnostic Tests	Decon-tamination	Exposure route and treatment (adult dosages)	Differential diagnostic considerations
Nerve agents	Vapor: seconds Liquid: minutes to hours	Moderate exposure: Diffuse muscle cramping, runny nose, difficulty breathing, eye pain, dimming of vision, sweating, High exposure: The above plus sudden loss of consciousness, flaccid paralysis, seizures	Pinpoint pupils (miosis) Hyper-salivation Diarrhea Seizures	Red Blood Cell or serum cholinesterase (whole blood) Treat for signs and symptoms; lab tests only for later confirmation Collect urine for later confirmation and dose estimation	Rapid disrobing Water wash with soap and shampoo	Inhalation & dermal absorption Atropine (2mg) iv or im (titrate to effect up to 6 to 15 mg) 2-PAMCl 600mg injection or 1.0 g infusion over 20-30 minutes Additional doses of atropine and 2-PAMCl depending on severity, Diazepam or lorazepam to prevent seizures if >4 mg atropine given Ventilation support	Pesticide poisoning from organophosphorous agents and carbamates cause virtually identical syndromes
Cyanide	Seconds to minutes	Moderate exposure: Dizziness, nausea, headache, eye irritation High exposure: Loss of consciousness	Moderate exposure: non-specific findings High exposure: convulsions, cessation of respiration	Cyanide (blood) or thiocyanate (blood or urine) levels in lab. Treat for signs and symptoms; lab tests only for later confirmation	Clothing removal	Inhalation & dermal absorption Oxygen (face mask) Amyl nitrite Sodium nitrite (300mg iv) and sodium thiosulfate (12.5g iv)	Similar CNS illness results from: Carbon monoxide (from gas or diesel engine exhaust fumes in closed spaces) H ₂ S (sewer, waste, industrial
Blister Agents	2-48 hours	Burning, itching, or red skin Mucosal irritation (prominent tearing, and burning and redness of eyes) Shortness of breath Nausea and vomiting	Skin erythema Blistering Upper airway sloughing Pulmonary edema Diffuse metabolic failure	Often smell of garlic, horseradish, and mustard on body Oily droplets on skin from ambient sources No specific diagnostic tests	Clothing removal Large amounts of water	Inhalation & dermal absorption Thermal burn type treatment Supportive care For Lewisite and Lewisite/Mustard mixtures: British Anti-Lewisite (BAL or Dimercaprol)	sources) Diffuse skin exposure with irritants, such as caustics, sodium hydroxides, ammonia, etc., may cause similar syndromes. Sodium hydroxide (NaOH) from trucking accidents
Pulmonary agents (phosgene, etc)	1 – 24 (rarely up to 72 hours)	Shortness of breath Chest tightness Wheezing Mucosal and dermal irritation and redness	Pulmonary edema with some mucosal irritation (more water solubility = more mucosal irritation)	No tests available but source assessment may help identify exposure characteristics (majority of trucking incidents generating exposures to humans have labels on vehicle)	None usually needed	Inhalation Supportive care Specific treatment depends on agents	Inhalation exposures are the single most common form of industrial agent exposure (eg: HCl, Cl ₂ , NH ₃) Mucosal irritation, airways reactions, and deep lung effects depend on the specific agent, especially water-solubility
Ricin (castor bean toxin)	18 – 24 hours	Ingestion: Nausea, diarrhea, vomiting, fever, abdominal pain Inhalation: , chest tightness, coughing, weakness, nausea, fever	Clusters of acute lung or GI injury; circulatory collapse and shock	ELISA (from commercial laboratories) using respiratory secretions, serum, and direct tissue	Clothing removal Water rinse	Inhalation & Ingestion Supportive care For ingestion: charcoal lavage	Tularemia, plague, and Q fever may cause similar syndromes, as may CW agents such as Staphylococcal enterotoxin B and phosgene
T-2 myco-toxins	2-4 hours	Dermal & mucosal irritation, blistering, and necrosis Blurred vision, eye irritation Nausea, vomiting, and diarrhea Ataxia Coughing and dyspnea	Mucosal erythema and hemorrhage Red skin, blistering Tearing, salivation Pulmonary edema Seizures and coma	ELISA from commercial laboratories Gas chromatography/Mass spectroscopy in specialized laboratories	Clothing removal Water rinse	Inhalation & dermal contact Supportive care For ingestion: charcoal lavage Possibly high dose steroids	Pulmonary toxins (O ₃ , NO _x , phosgene, NH ₃) may cause

similar syndromes though with less mucosal irritation.

Table 3 Acute Radiation Syndrome

Whole body radiation from external radiation or internal absorption							
Phase or Syndrome	Feature	Subclinical range		Sublethal range		Lethal range	
		0 – 100 rad (cGy)	100 – 200 rad (cGy)	200-600 rad (cGy)	600-800 rad (cGy)	600-3000 rad (cGy)	>3000 rad (cGy)
Initial or prodromal	Nausea, vomiting	none	5-50%	50 – 100%	75-100%	90-100%	100%
	Time of onset		3-6 hrs	2-4hrs	1-2 hrs	<1 hr	<1 hr
	Duration		<24 hrs	<24 hrs	<48 hrs	<48 hrs	<48 hrs
	Lymphocyte count			< 1000 at 24 h	< 500 at 24h		
	CNS function	No impairment	No impairment	Routine task performance Cognitive impairment for 6-20 hrs	Simple and routine task performance Cognitive impairment for >24 hrs	Progressive incapacitation	
Latent	Duration	> 2 wks	7-15 days	0-7 days	0-2 days	none	
“Manifest illness” (obvious illness)	Signs and symptoms	none	Moderate leukopenia	Severe leukopenia, purpura, hemorrhage Pneumonia Hair loss after 300 rad (cGy)		Diarrhea Fever Electrolyte disturbance	Convulsions, ataxia, tremor, lethargy
	Time of onset		> 2 wks	2 days – 2 wks		2-3 days	
	Critical period		none	4-6 wks		5-14 days	1-48 hrs
	Organ system	none		Hematopoietic and respiratory (mucosal) systems		GI tract Mucosal systems	CNS
Hospitalization	% Duration		<5% 45-60 days	90% 60-90 days	100% 90+ days	100% 2 weeks	100% 2 days
Fatality		0%	0%	0-80%	90-100%	90-100%	
Time to death				3 wks – 3 months		1-2 wks	1-2 days

Table 3A: Intermittent/Chronic Exposure and Effects

Headache	1°, 2°, 3° burns
Fatigue	Epilation
Weakness	Ulceration
Anorexia	Lymphopenia
Nausea	Neutropenia
Vomiting	Thrombocytopenia
Diarrhea	Purpura
	Opportunistic infections

Burn Surge Plan

The Burn Surge Plan is activated in the event of a mass casualty incident that results in large numbers of patients with burns. It is designed to filter the most severely burned patients to UCSD with non-burn centers caring for less severely burned patients. The goal of the Burn Surge Plan is to get patients with >20% TBSA burns to a designated burn center within 72 hours.

There are three stages of the Burn Surge Plan:

1. Stage I: Activated for surge of 10-29 simultaneous patients. 4-6 patients are distributed to each of the five trauma centers in San Diego County with the most severely burned prioritized to UCSD Regional Burn Center. Pediatric patients (14 and younger) are preferentially triaged to Rady Children's Hospital (if there is a pediatric burn disaster, all trauma centers will accept pediatric burn patients with priority of the youngest to go to Rady Children's Hospital). After the initial triage and stabilization of 4-6 patients per hospital, UCSD will then accept transfer of the most severely burned patients. All burn patients should be transferred to UCSD or other California burn centers if needed within 48-72 hours post-burn.
2. Stage II: Activated for surge of 30-79 patients. 4-8 patients are distributed to each of the five trauma centers as above. 4-8 patients each are distributed amongst area non-trauma center hospitals. Any hospital may receive a patient if the burn is <10% TBSA. If hospitals are overwhelmed, patients are distributed as in stage III. UCSD will then accept transfer of burn patients as able as in Stage I. Patients with burn wounds requiring inpatient stay should be transferred to a burn center (UCSD or other California burn center) within 72 hours. More critically ill burn patients at non-trauma centers should be transferred to non-burn trauma centers if unable to be transferred to a burn center. Hospitals are expected to manage up to 10 burn admissions each.
3. Stage III: Activated for surge of 80 or more patients. 4-8 burn patients are distributed amongst each of the trauma centers as in stage I. 4-8 patients each are distributed amongst non-trauma centers. 4-8 patients each are distributed to remaining area hospitals.

Note: Minor burns (<10% TBSA) can be treated and released from the field. Some patients of advanced age or >90% burns may be expected to expire and should be treated with palliation.

Acute Care Surgery

Acute Care Surgery

These documents:

- **Resident and Medical Student Guide**
- **Didactic Topics in ACS and Trauma**

Can be found at

<https://medschool.ucsd.edu/som/surgery/divisions/trauma-burn/training/Pages/didactic.aspx>



UCSD ACS/EGS Clinic Follow-Up Protocol:

Outpatient cases

- follow-up appointments to be made at time of OR scheduling.
- All cases: 2 weeks
- Except inguinal hernias: 4 weeks

Inpatient Complex Patients

- Follow Up Appointment to be made prior to DC
- Appt. date and time to be on DC Summary
- Danielle C. can be called by the residents OR sent an EPIC In-Box Message
- Night/Weekend/Holiday: send Danielle an In-Box.
 - Patient will be called next business day with appointment.

Routine/Low Acuity Inpt EGS pts (i.e. non-complicated appys/choles/I&Ds)

- Regular referral for appt or InBox to Danielle C.

Amy E. Liepert Medical Director
8/01/2020

Appendicitis (Uncomplicated)

A. Key Outcomes

- Timely diagnosis of acute uncomplicated appendicitis
- Recognition of patients appropriate for non-operative management of appendicitis (phlegmon, perforated appendicitis with abscess)
- Prompt initiation of antibiotic therapy
- Prompt operative treatment

B. Goal Length of Stay

- 24 hours

C. Proposed Hospital Course

- History and physical exam
 - i. May diagnose appendicitis by H&P alone
 - ii. Obtain abdominal ultrasound or CT scan abdomen/pelvis with IV contrast if diagnosis in question or patient is at risk of complicated appendicitis
- Labs: CBC, consider BMP, coags or LFTs based upon age/comorbidities
 - i. β HCG in women of childbearing age
- Operating Room for laparoscopic vs open appendectomy
- Early cessation of antibiotics
 - i. Most patients require no additional post-operative antibiotics
 - ii. May provide up to 24 hours antibiotics at attending discretion

D. Discharge Planning

- Regular diet
- Pain management
- Clinic follow-up in 2-4 weeks post op

E. Disposition

- Home, self care

Appendicitis (Complicated - perforated, phlegmon, abscess)

A. Key Outcomes

- Timely diagnosis of complicated appendicitis
- Prompt initiation of antibiotic therapy
- Prompt operative treatment or consultation of Interventional Radiology if appropriate

B. Goal Length of Stay

- 1-5 days
- Exceptions: unsatisfactory resolution of ileus or severe sepsis resulting in hemodynamic instability and protracted complicated hospital course

C. Proposed Hospital Course

- History and physical exam
 - Identify factors concerning for complication – length of symptoms, severity of illness, etc.
- CT abdomen/pelvis with IV contrast
- Labs: CBC, BMP, coags
 - β HCG in women of childbearing age
- Decision for operative vs interventional vs medical management
 - Perforation without phlegmon \ abscess – OR for laparoscopic vs open appendectomy
 - Phlegmon – IV antibiotics, monitor for development of drainable abscess
 - Abscess – IR consultation for percutaneous drainage
- Drain care if applicable
- Antibiotics
 - Course dependent upon level of contamination

D. Discharge Planning

- Regular diet or adequate caloric intake
- Pain management
- Completion of antibiotic course or plan for home antibiotics vs. SNF
- Resolution of fevers
- Resolution of ileus
- Clinic follow-up in 1-2 weeks, every month thereafter or at discretion of surgery attending
- Timing of interval appendectomy
- May require home health follow-up

E. Disposition

- Dependent on needs at discharge (home vs. SNF vs. rehabilitation)
- Per PT/OT recommendations

Appendectomy Wound Class

Appendectomy & Wound Class

Wound Class I (Clean)

- Never



Wound Class II (Clean/Contaminated)

- No inflammation



Wound Class III (Contaminated)

- Gross Inflammation, Acute Inflammation, Acute Appendicitis, and/or Necrosis present



Wound Class IV (Dirty/Infected)

- Pus, Purulence, Abscess, Suppuration, and/or Ruptured Appendix Present



Generic Wound Class Chart

Clean	Uninfected operative wounds without inflammation; respiratory, alimentary, genital or uninfected urinary tracts are not entered
Clean/ Contaminated	Operative wounds in the respiratory, alimentary, genital or uninfected urinary tracts are electively entered; without unusual contamination
Contaminated	Open, fresh, accidental wounds, operations with major breaks in sterile technique or gross spillage from the gastrointestinal tract, and incisions in which acute, non-purulent inflammation is encountered
Dirty	Old traumatic wounds with retained devitalized tissue or those that involve existing clinical infection or perforated viscera

Correct Wound Class assessment is vital for a number of risk adjustment models (not just SSI).

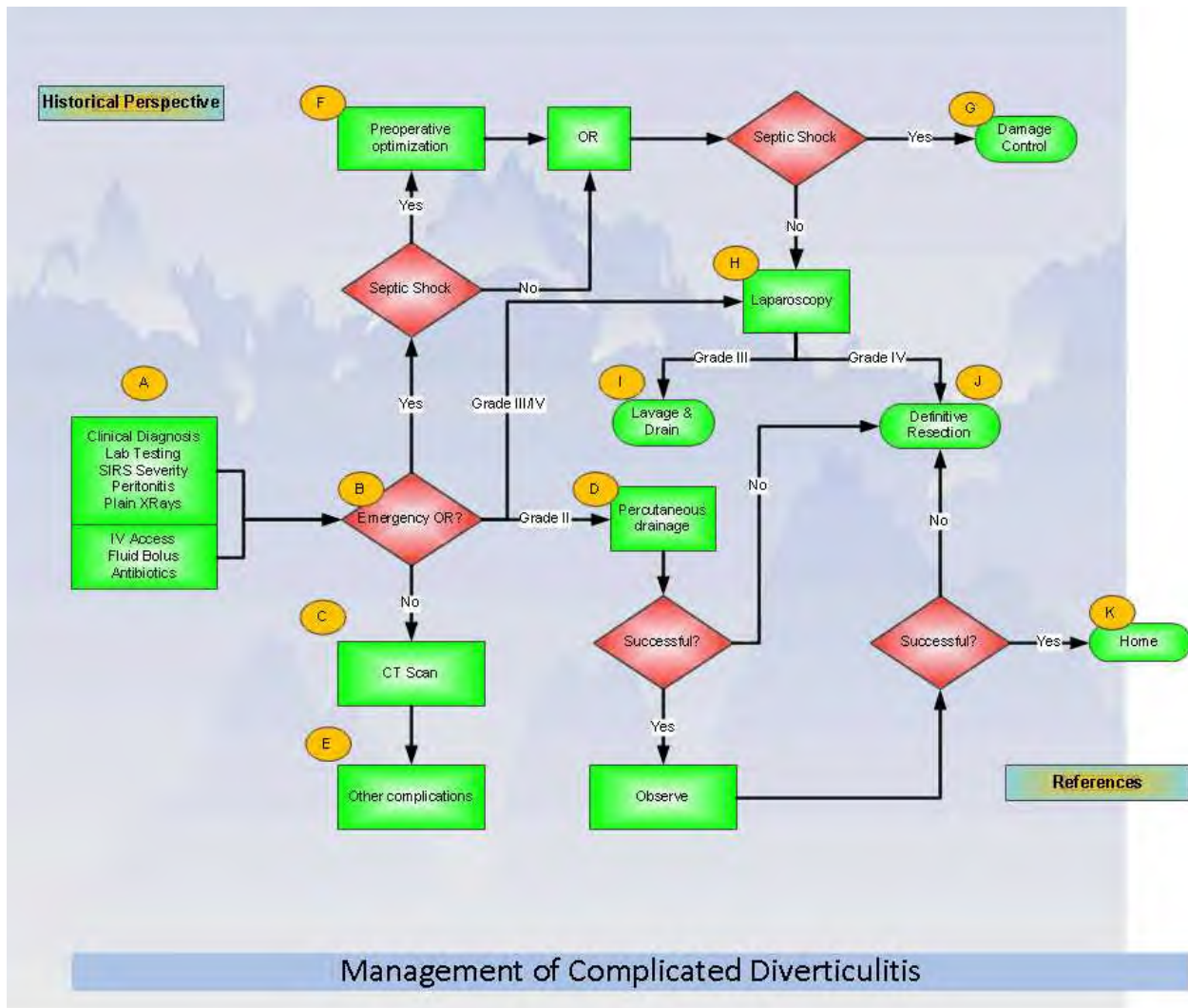
There is a trend in general surgery at UC San Diego Health to classify appendectomy procedures as a Wound Class 1, which should never be the case (see below for detailed examples for this procedure).

While our NSQIP abstractors are catching many of these incorrect wound classes, not all surgeries are assessed within this database thus allowing some to be missed.

Important to Note: A Wound Class IV (Dirty/Infected) **with** documented evidence of infection (pus/purulence/suppuration, abscess, etc.) will exclude the case from SSI and Sepsis models, as this indicates high suspicion of an infection present at the time of surgery.

A Wound Class IV **without** this evidence of infection (pus/purulence/suppuration/abscess, etc.) *does not* exclude the infection in the models. Again, one or two cases make a big difference in SIR and O/E, so please ensure the reality of the procedure is documented/dictated in full.

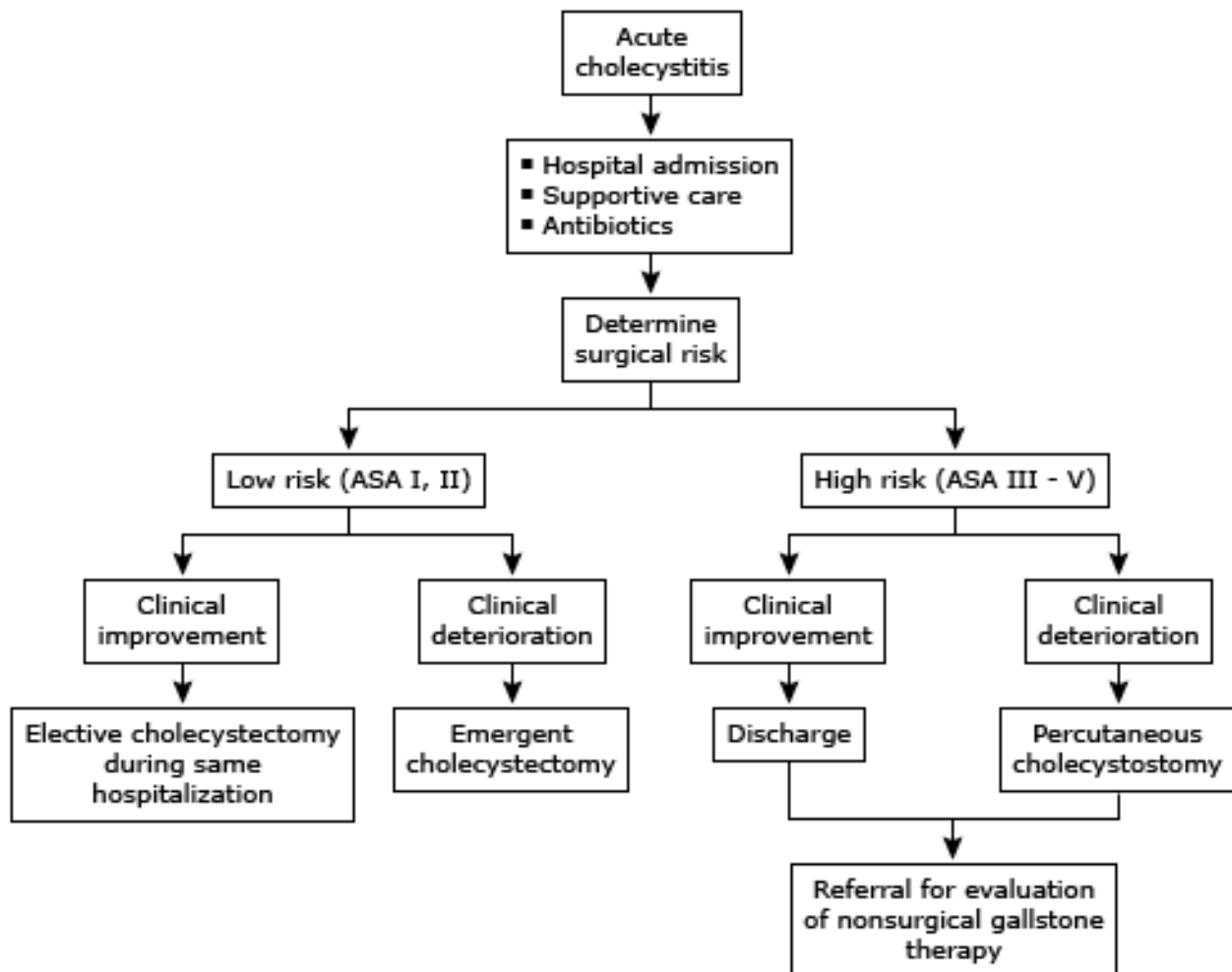
Acute Diverticulitis



<http://westerntrauma.org/algorithms/ComplicatedDiverticulitis/NoteA.html>

Reference: Moore FA, Moore EE, Burlew CC, Coimbra R, McIntyre RC Jr, Davis JW, Sperry J, Biffi WL. Western Trauma Association critical decisions in trauma: management of complicated diverticulitis. J Trauma Acute Care Surg. 2012 Dec;73(6):1365-71. doi: 10.1097/TA.0b013e31827826d8. PubMed PMID: 23188229.

Acute Calculous Cholecystitis



LOW-RISK PATIENTS

Timing of cholecystectomy — Early cholecystectomy, rather than delayed cholecystectomy (>7 days after admission), is preferable for patients who require hospitalization for acute cholecystitis and who are good candidates for cholecystectomy. Evidence from large database reviews and randomized trials show that cholecystectomy performed early during the initial hospitalization may be associated with reduced perioperative morbidity and mortality in some patients, and reduces the length of hospital stay and cost. Even after 72 hours of symptoms, cholecystectomy in the same admission leads to good results [1].

HIGH-RISK PATIENTS

Patients categorized as ASA classes III, IV, or V, have perioperative mortality rates ranging from 5 to 27 percent, and are considered high risk for cholecystectomy

For these patients, the risk of cholecystectomy likely outweighs the potential benefits, and an initial non-operative approach should be undertaken that includes antibiotic therapy and bowel rest. For those who fail to improve, gallbladder drainage should be implemented with the eventual goal of performing cholecystectomy. Once cholecystitis resolves, the patient's risk for surgery should be reassessed. Patients who have become reasonable candidates for surgery should undergo elective cholecystectomy. Medical management with interval cholecystectomy only for recurrent acute cholecystitis may be appropriate in some patients [1].

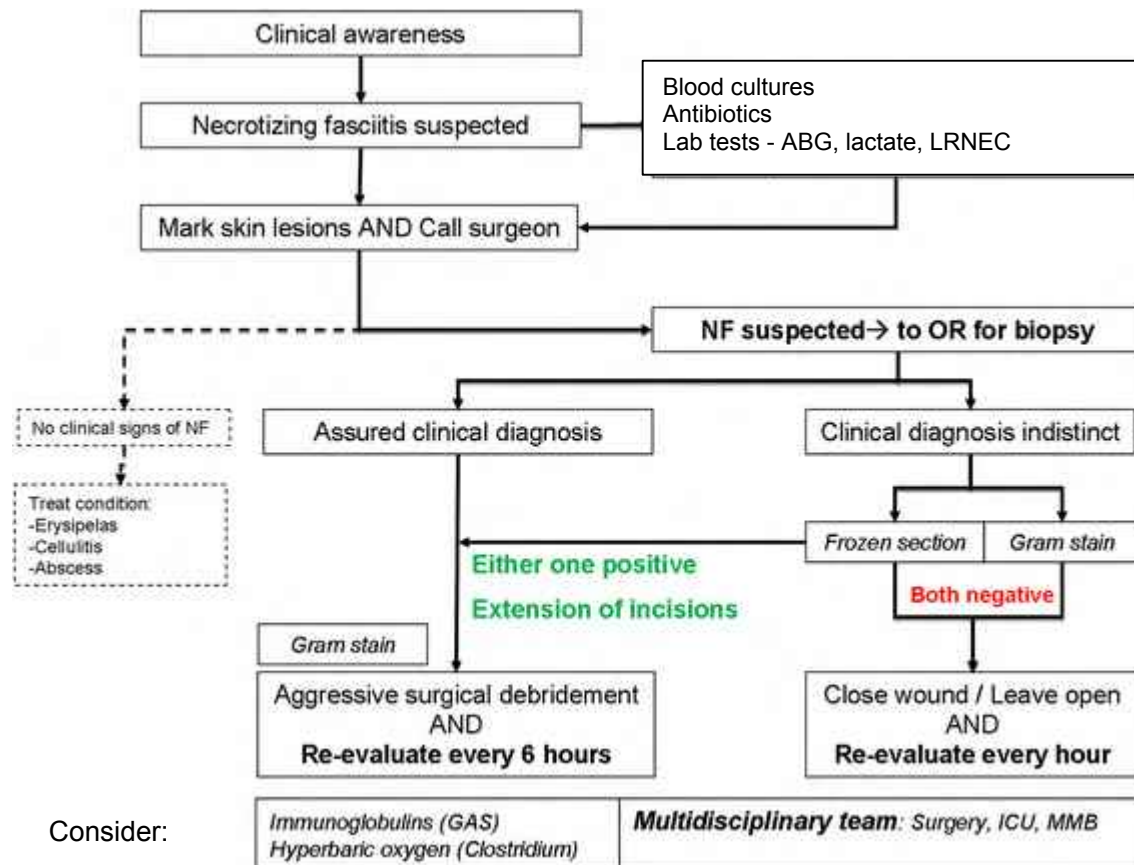
However, an initial surgical approach may be preferred in some high-risk patients (eg, gangrenous or emphysematous cholecystitis) for whom the burden of the ongoing systemic effects of cholecystitis is deemed to be greater than the risk of surgery. In a study of 483 patients undergoing cholecystectomy for acute cholecystitis, gangrenous cholecystitis was found in 24 (5 percent) [52]. Patients with gangrenous gallbladders had a much higher mortality rate than patients who had inflamed but non-gangrenous gallbladders (12.5 versus 0.9 percent). In the same study, gallbladder gangrene was associated with an older age, male sex, and a higher preoperative bilirubin level, as well as comorbid medical conditions such as diabetes, coronary artery disease, and systemic inflammatory response syndrome.

1: Roulin D, Saadi A, Di Mare L, Demartines N, Halkic N. Early Versus Delayed Cholecystectomy for Acute Cholecystitis, Are the 72 hours Still the Rule?: A Randomized Trial. *Ann Surg*. 2016 Nov;264(5):717-722. PubMed PMID: 27741006.

2: McGillicuddy EA, Schuster KM, Barre K, Suarez L, Hall MR, Kaml GJ, Davis KA, Longo WE. Non-operative management of acute cholecystitis in the elderly. *Br J Surg*. 2012 Sep;99(9):1254-61. doi: 10.1002/bjs.8836. Epub 2012 Jul 24. PubMed PMID: 22829411.

3:: Bourikian S, Anand RJ, Aboutanos M, Wolfe LG, Ferrada P. Risk factors for acute gangrenous cholecystitis in emergency general surgery patients. *Am J Surg*. 2015 Oct;210(4):730-3. doi: 10.1016/j.amjsurg.2015.05.003. Epub 2015 Jun 27. PubMed PMID: 26186803.

Suspected necrotizing fasciitis



Necrotizing fasciitis:

Linezolid or vancomycin
+
Piperacillin/tazobactam

Or

Daptomycin
+
Piperacillin/tazobactam
+
Clindamycin

Fournier's gangrene:

If signs and symptoms of severe sepsis are not present:

Piperacillin/tazobactam
+
Clindamycin

If signs and symptoms of severe sepsis are present

Meropenem
+
Linezolid or vancomycin

Sartelli M, Malangoni MA, May AK, Viale P, Kao LS, Catena F, Ansaloni L, Moore EE, Moore FA, Peitzman AB, Coimbra R, Leppaniemi A, Kluger Y, Biffl W, Koike K, Girardis M, Ordonez CA, Tavola M, Cainzos M, Di Saverio S, Fraga GP, Gerych I, Kelly MD, Taviloglu K, Wani I, Marwah S, Bala M, Ghnnam W, Shaikh N, Chiara O, Faro MP Jr, Pereira GA Jr, Gomes CA, Coccolini F, Tranà C, Corbella D, Brambillasca P, Cui Y, Segovia Lohse HA, Khokha V, Kok KY, Hong SK, Yuan KC. World Society of Emergency Surgery (WSES) guidelines for management of skin and soft tissue infections. World J Emerg Surg. 2014 Nov 18;9(1):57. Doi: 10.1186/1749-7922-9-57. eCollection 2014. Review. PubMed PMID: 25422671; PubMed

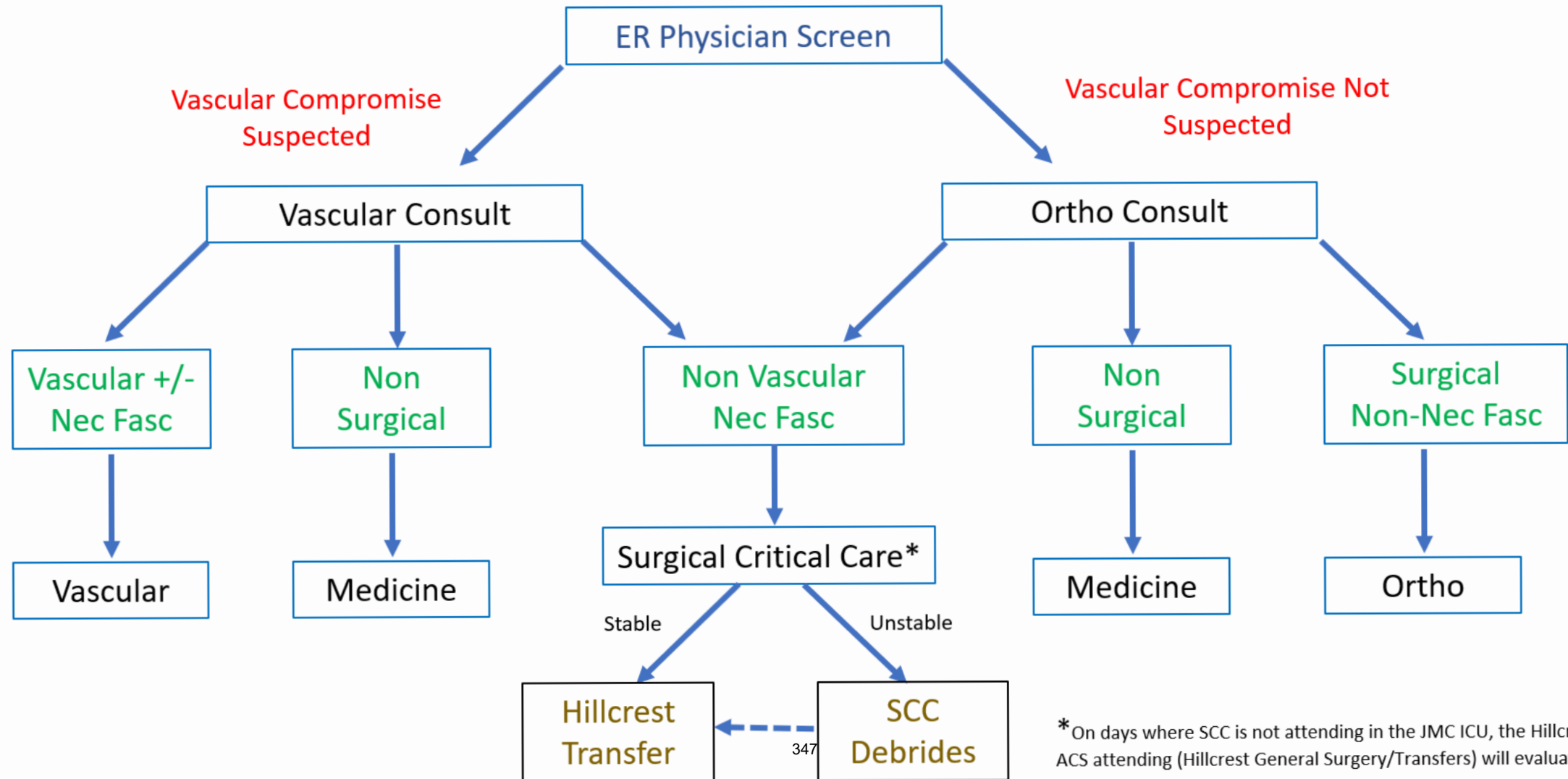
Central PMCID: PMC4242587.

LRINEC Score

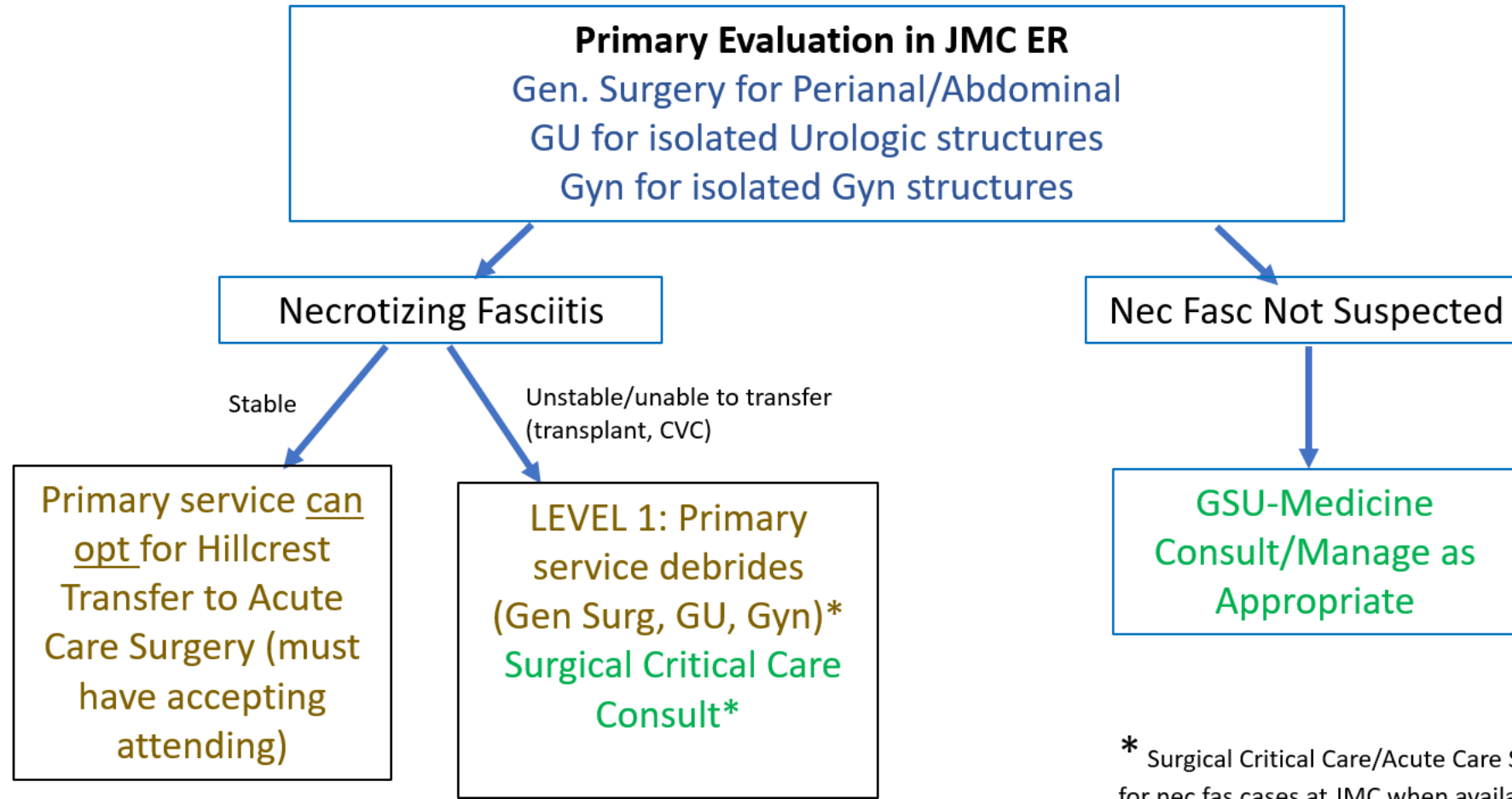
Table. Laboratory Risk Indicator for Necrotizing Fasciitis Score

Variable	Value	Points
C-Reactive Protein (mg/L)	< 150	0
	≥ 150	4
WBC (cells/mm ³)	< 15	0
	15-25	1
	> 25	2
Hemoglobin (g/dL)	> 13.5	0
	11-13.5	1
	< 11	2
Serum sodium (mmol/L)	≥ 135	0
	< 135	2
Serum creatinine (mg/dL)	≤ 1.6	0
	> 1.6	2
Plasma glucose (mg/dL)	≤ 180	0
	> 180	2
Risk	Probability	Total Score
Low	< 50%	≤ 5
Moderate	50-75%	6-7
High	> 75%	≥ 8

Extremity Infection Algorithm: La Jolla

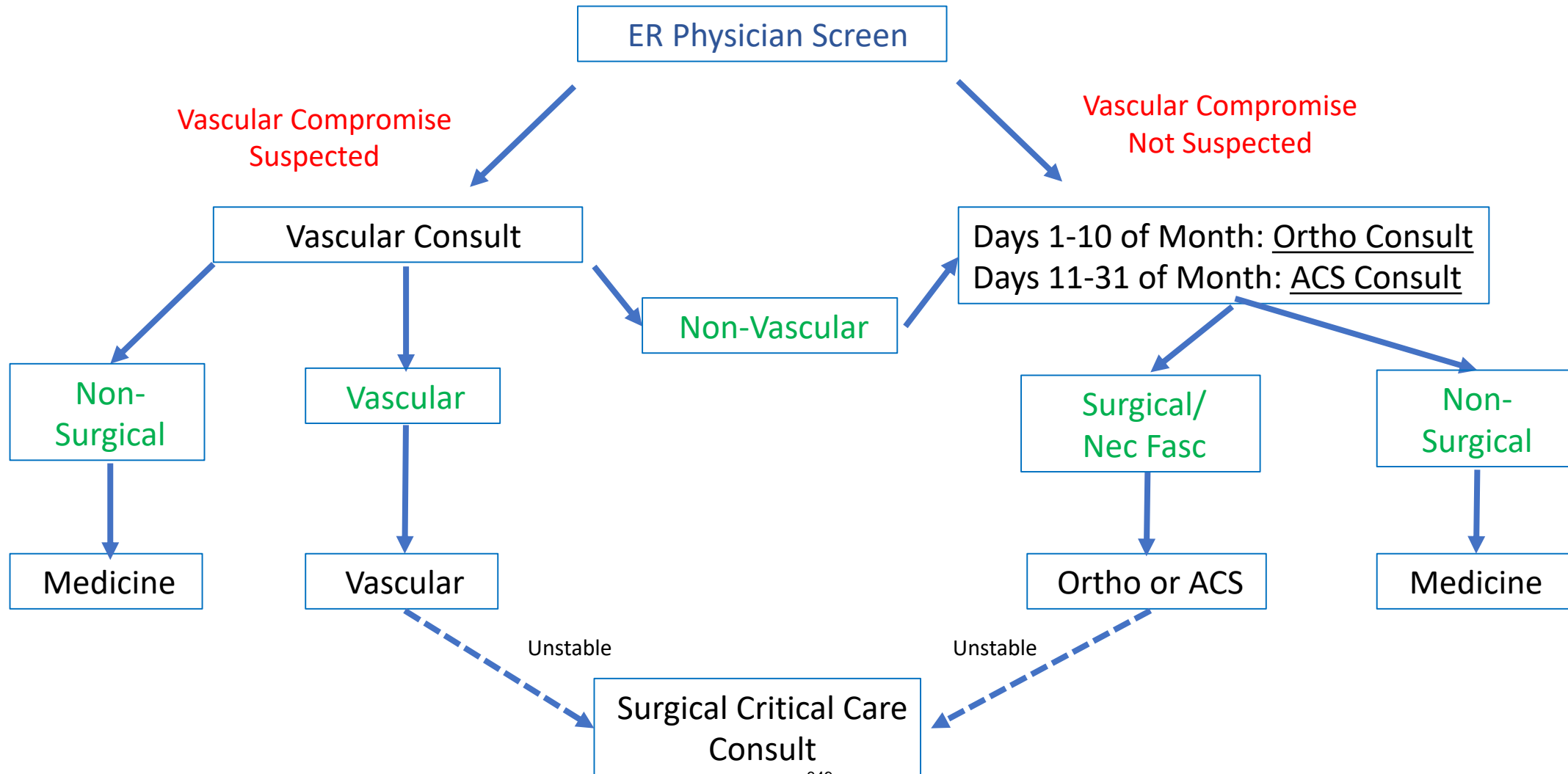


Truncal Necrotizing Fasciitis Algorithm: JMC-La Jolla

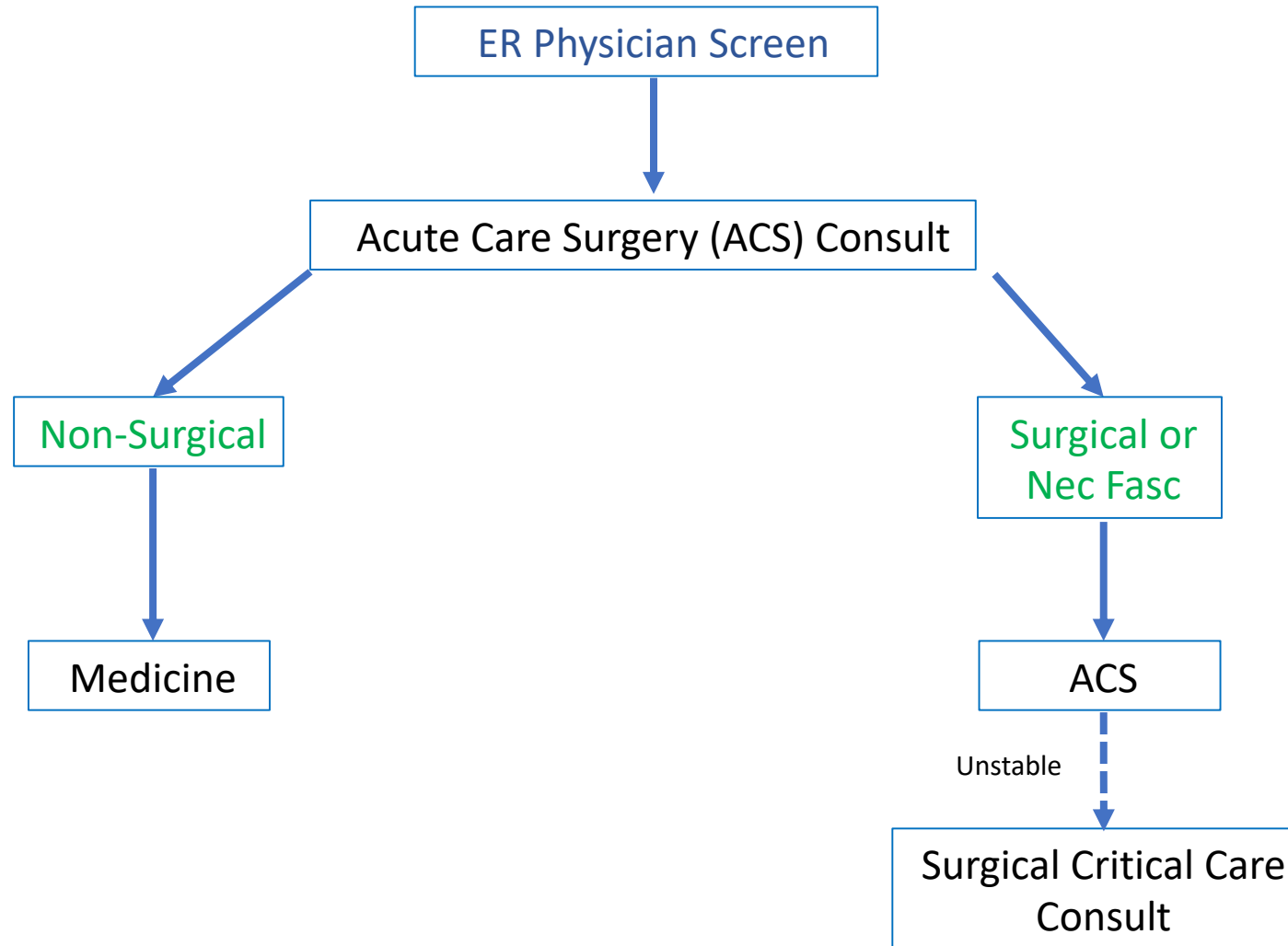


* Surgical Critical Care/Acute Care Surgery (SCC/ACS) is available to assist for nec fasc cases at JMC when available. On days where SCC/ACS is not attending in the JMC ICU, the primary service must assume responsibility for non-transferable patients

Extremity Infection Algorithm- Hillcrest



Truncal Infection Algorithm- Hillcrest



Prescribing Recommendations

Procedure	Oxycodone* 5mg Tablets
Dental Extraction	0
Thyroidectomy	0 - 5
Laparoscopic Anti-reflux (Nissen)	0 - 10
Appendectomy – Lap or Open	0 - 10
Laparoscopic Donor Nephrectomy	0 - 10
Hernia Repair – Minor or Major	0 - 10
Sleeve Gastrectomy	0 - 10
Laparoscopic Cholecystectomy	0 - 10
Open Cholecystectomy	0 - 15
Laparoscopic Colectomy	0 - 10
Open Colectomy	0 - 15
Ileostomy/Colostomy Creation, Re-siting, or Closure	0 - 15
Open Small Bowel Resection or Enterolysis	0 - 15

Procedure	Oxycodone* 5mg Tablets
Prostatectomy.	0 - 10
Carotid Endarterectomy.	0 - 10
Cardiac Surgery via Median Sternotomy.	0 - 25
Caesarean Section	0 - 20
Hysterectomy – Laparoscopic or Vaginal	0 - 15
Hysterectomy – Abdominal	0 - 20
Breast Biopsy or Lumpectomy.	0 - 5
Lumpectomy + Sentinel Lymph Node Biopsy.	0 - 5
Sentinel Lymph Node Biopsy Only.	0 - 5
Wide Local Excision ± Sentinel Lymph Node Biopsy.	0 - 20
Simple Mastectomy ± Sentinel Lymph Node Biopsy.	0 - 20
Modified Radical Mastectomy or Axillary Lymph Node Dissection	0 - 30
Total Hip Arthroplasty.	0 - 30
Total Knee Arthroplasty.	0 - 50

Updated February 25, 2020

*If prescribing hydrocodone 5mg, the number of tablets remains the same as listed above.

Counseling Patients

As we write for fewer opioids, there may be concern that we will see an increase in phone calls for refills or inadequate pain control. In fact, single institution studies found that with appropriate patient education, not only did patients consume less medication, but requests for refills did not increase.

To ensure appropriate pain management, **all patients** should receive counseling addressing the following items:

SET EXPECTATIONS: "Some pain is normal. You should be able to walk and do light activity, but may be sore for a few days. This will gradually get better."

SET NORMS: "Half of patients who have this procedure take under 10-15 pills."

NON-OPIOIDS: "Take acetaminophen and ibuprofen around the clock, and use the stronger pain pills only as needed for breakthrough pain."

Avoid NSAIDs in patients with peptic ulcer disease and associated risk factors (smoking, drinking), bleeding disorders, renal disease, and specific operations at surgeon discretion.

APPROPRIATE USE: "These pills are for pain from your surgery, and should not be used to treat pain from other conditions."

ADVERSE AFFECTS: "We are careful about opioids because they have been shown to be addictive, cause you harm, and even cause overdose if used incorrectly or abused."

SAFE DISPOSAL "Disposing of these pills prevents others, including children, from accidentally overdosing. You can take pills to an approved collector (including police stations), or mix pills with kitty litter in a bag and throw them in the trash."

Pediatric

Prescribing Recommendations

Procedure	Doses
Dental Extraction	0
Adenoidectomy	0
Appendectomy	0
Inguinal Hernia	0
Umbilical Hernia	0
Circumcision ¹	0 - 5
Orchiopexy	0 - 5
Supracondylar Humerus Fracture	0 - 5

These guidelines apply to patients < 18 years old

¹Consider 0 doses for children ≤ 5 y.o.

Video links

Videos can be found on <https://www.youtube.com/user/UCSDTraumaBurn>



Video Links

UCSD Trauma Burn Youtube Channel:

<https://www.youtube.com/channel/UCRB5EunenkaDJenXQghom7w>

The Resuscitation Room

Roles of Team Members: <https://youtu.be/HcR4enuaEK0>

Video Review: <https://youtu.be/tJSqLUBWxOk>

Codes in the Resuscitation Room: https://youtu.be/JFphgFSsm_Q

Operating Room Resuscitation

OR Resuscitation: When, How, Why? - <https://youtu.be/9cTfSsG3v0I>

Surgical Procedures:

Chest tube Insertion: <https://youtu.be/xwp57E9NJg>

Surgical Airway – Cricothyroidotomy: <https://youtu.be/Kg14kdIycDE>

Diagnostic Peritoneal Lavage (DPL): <https://youtu.be/O9BZamRlXVA>

Resuscitative Thoracotomy: <https://youtu.be/naUT46aLlDM>

Trauma Bay Surgical Emergencies: <https://youtu.be/D7v-Z3RCohY>

EZ-IO intraosseous needle: <https://youtu.be/jTdyOllrZlA>

Damage Control Surgery

Dr Rotondo: https://youtu.be/IyoyDU4D_Hk

Dr Coimbra: https://youtu.be/kTsYDGi-_Dc

Airway

Pediatric Airway Management: <https://youtu.be/H9D0CcQ7kS4>

Head:

Management of TBI - <https://youtu.be/l8Ig9NHdmE0>

Reversal of anticoagulation: <https://youtu.be/v56OLC9PxGQ>

Stroke Codes / BCVI in the Trauma Bay: <https://youtu.be/iXbKv0AjjjE>

Neck Trauma

Penetrating neck trauma: <https://youtu.be/GrBneF4MYQc>

Chest Trauma

Thoracic Trauma - <https://youtu.be/TWOIXp01eZY>

Penetrating Cardiac Injuries: <https://youtu.be/nR2ZdmQQVKE>

Abdominal Trauma

Liver injuries: <https://youtu.be/D6PoBqKzCfM>

Splenic injuries: <https://youtu.be/cpaQzY8mtRQ>

Abdominal Vascular injuries: <https://youtu.be/cpaQzY8mtRQ>

Pelvic Trauma

Pelvic Fractures – A complicated Injury: <https://youtu.be/y1kPy-lk608>

Pelvic Fractures with a focus on hemorrhage control: <https://youtu.be/Tyxk1GxKYi0>

T-POD application: https://youtu.be/PO-gLZXxZ_E

REBOA

REBOA of the aorta for major abdominal venous injury <https://youtu.be/2JlbnHvjWPU>

Best Practices for Using The ER-REBOA™ Catheter <https://youtu.be/3SAulha8Nb4>

The ER-REBOA™ Catheter & The ER-REBOA™ Catheter Convenience Kit https://youtu.be/dx1Nxbq0K_Q

How I do it – Joe Dubose MD part I <https://youtu.be/-U7MkU3eA7E>

How I do it – Joe Dubose MD part II <https://youtu.be/DZ5LCet7PBk>

Extremity Trauma

Short leg Bulky Jones Splint <https://youtu.be/XPxXLBriDZE>

MSK Trauma: <https://youtu.be/yvFqcnDo6uw>

Pediatric Trauma

Pediatric Airway Management: <https://youtu.be/H9D0CcQ7kS4>

Pediatric Abdominal Trauma: <https://youtu.be/xopGFuhog6c>

Pediatric Trauma Transfers: https://youtu.be/r_yaMzup7dk

Trauma in Pregnancy

Trauma in Pregnancy: <https://youtu.be/5HztHtAC3qU>

FAST Ultrasound Examination

FAST: <https://youtu.be/TCNvHfPYPBc>

FAST 2: <https://youtu.be/jfsLo35aMuU>

Ultrasound identification of Pneumothorax: <https://youtu.be/Ec2pRYOQ2II>

Limited Echo: <https://youtu.be/a0pZDeffblU>

Ultrasound for the Acute/Trauma Surgeon: <https://youtu.be/hwjmULp2fxQ>

Radiology

Radiology Review: <https://youtu.be/-hV13QLeDcA>

Initial Management of Burns

Part I – Prehospital Care https://youtu.be/_JLeErQpFHc

Part II – Smoke Inhalation <https://youtu.be/JdC5aeodKIM>

Part III – Initial management <https://youtu.be/4Ikrz1jQKjw>

Part IV: - Resuscitation and Wound Care <https://youtu.be/4oTz0mFE7Z8>

Disaster & Mass Casualties

Stop the Bleed Course: <https://youtu.be/LXQete07O5U>

Physician's Responsibilities During Disasters: https://youtu.be/QOa_SqPB-sE

Active Shooter: <https://youtu.be/iN2q9baUCGM>

Chemical & Biologic Events: <https://youtu.be/PmEAhdJRE4>

The Trauma System

Trauma deaths: <https://youtu.be/jkZm65Ywy-U>

EMS System: https://youtu.be/BBNb_9jDk7E

Central Venous Access:

Part I: <https://youtu.be/7s5f0TX5eCA>

Part II: <https://youtu.be/9JZNyme3h34>

Part III: <https://youtu.be/9JZNyme3h34>

Part IV: <https://youtu.be/cUq4grLFrqw>

Severe Complicated Pancreatitis:

<https://youtu.be/pIkEBn-QMOo>