University of California San Diego

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

Handbook

Edition 6.0 – July 25, 2024

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 Haines, Allison Berndtson, Jessica Weaver, Jarrett Santorelli, Laura Adams, Kendra Black, Lisa Kurth, Jessica Masch, Stephen Stopenski, Brandon Harris and UCSD Faculty and Fellows

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UC San Diego Health

Trauma, Surgical ICU & Acute Care Surgery Team

2023 - 2024

FACULTY SURGEONS


Dr. Jay Doucet

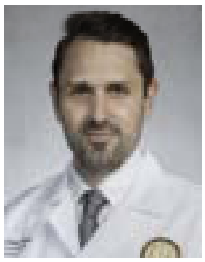

Dr. Todd Costantini


Dr. Jeanne Lee


Dr. Laura Haines


Dr. Leslie Kobayashi


Dr. Allison Berndtson


Dr. Jarrett Santorelli


Dr. Jessica Weaver


Dr. Laurie Adams


Dr. Erik Olson


Dr. Matt Tadlock

PHYSICIAN FELLOWS IN SURGICAL CRITICAL CARE


Dr. Brandon Harris


Dr. Jessica Masch


Dr. Stephen Stopenski

PHYSICIAN CLINICAL INSTRUCTORS IN ACUTE CARE SURGERY


Dr. Kendra Black


Dr. Lisa Kurth

NURSE PRACTITIONERS AND PHYSICIAN ASSISTANTS


Maria Amos NP


Andrea Bianco NP


Natalie Bilotta NP


Sara Couch NP


Samantha Gambles-Farr NP


Jean Luansing PA


Kevin Maxwell NP


Gabriela Riviello NP


Jennifer Shackelford NP


Stefan Schulz PA


Marcus Brazel NP


Sara Wells NP

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

First Year Fellows:

Most importantly we are a team, when in doubt call. We are invested in the care of our patients and want to know what's going on. It is critical to keep faculty in the loop during the day and when on call.

We are here to ensure first and foremost optimal patient care, in addition to providing you with the skills and knowledge for success. We operate in a complex system, let us help you understand the best way to navigate.

Trauma bay

1. Patient's with OR resuscitation criteria
2. Clinically significant hypotension/tachycardia
3. Airway compromise
4. Need for intubation
5. ICU admission
6. Solid organ injury, free fluid on imaging without solid organ injury
7. Penetrating injuries
8. Open book pelvic fractures
9. Significant TBI, GCS<8
10. Difficult or Negative Patient/Family interaction
11. Multiple activations
12. Any case that is likely to of interest to the public or press (i.e. VIP, legal intervention, abuse, children, mass events)
13. Any time resources are spread too thin, (i.e. multiple sick patients needing attention, needing to keep the trauma center operating and off bypass while operating)
14. When in doubt call, over communication is preferred.
15. Considering going on bypass
16. Questions regarding transfer requests

ICU

1. **Major clinical changes**
2. **Major family decision making changes, i.e. transition to comfort care**
3. Unplanned intubation
4. Unplanned admission, return to ICU
5. Unplanned operative needs
6. Need for new consults
7. Worsening refractory hypoxemia
8. Significant elevation of pressor support
9. Unstable arrhythmia
10. Refractory acidosis
11. Difficult or Negative Patient/Family interaction
12. Difficult interactions with consultants

On Call

1. Any new consults, go see the patient make a plan and then call (do not depend on the resident's assessment).
    - *For unstable patients notify your faculty immediately, if needed on your way to see the patient.*
2. Unclear or odd transfer requests.
3. EGS transfer requests, take the information and tell the provider you will get back to them.
4. Systems issues, bed management, patient flow etc.
5. Anything you are unsure of, just call.

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
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 7:00 a.m.	UCSD Moores Cancer Center, 2nd Floor, Goldberg Auditorium	General Surgery Faculty	Surgery Residents
General Surgery Grand Rounds	Weekly, Wednesday 7:00 a.m.	UCSD Moores Cancer Center, 2nd 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**
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, 3rd 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, 4th 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, 4th Thursday 4:00 p.m.	UCSD Hillcrest Main Hospital, Inpatient Tower, 3rd Floor, Rm 3-310	Surgical Critical Care/ ED Faculty	Emergency Medicine 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. Laura Adams	37024	8136	ladams@health.ucsd.edu
Dr. Allison Berndtson	35706	9288	aberndtson@health.ucsd.edu
Dr. Todd Costantini	32997	5710	tcostantini@health.ucsd.edu
Dr. Laura Haines	13918	4107	lhaines@health.ucsd.edu
Dr. Leslie Kobayashi	37120	0185	lkobayashi@health.ucsd.edu
Dr. Jeanne Lee	37200	2623	jglee003@health.ucsd.edu
Dr. Jarrett Santorelli	37200	8136	jsantorelli@health.ucsd.edu
Dr. Jessica Weaver	37200	8089	jlweaver@health.ucsd.edu
Dr. Matthew Tadlock	37200	7822	matthewtadlockmd@gmail.com
Trauma APPs			
Maria Amos, DNP, NP	35284	6930	mfamos@health.ucsd.edu
Andrea Bianco, MSN, NP	35284	3345	abianco@health.ucsd.edu
Natalie Bilotta, MSN, NP	35284	6957	nbilotta@health.ucsd.edu
Marcus Brazel, MSN, NP	35284	3740	mbrazel@health.ucsd.edu
Brittany Clark, NP	35284	7346	Bbc001@health.ucsd.edu
Sara Couch, MSN, NP	35284	6919	scouch@health.ucsd.edu
Emma Fields, MNS, NP	35284	2091	emfields@health.ucsd.edu
Samantha Gambles Farr, MSN, NP	37821	2687	sgambles@health.ucsd.edu
Kevin Maxwell, DNP	35284	1251	kemaxwell@health.ucsd.edu
Stefan Schultz, PA	33434	1968	sschulz@health.ucsd.edu
Jenny Shackelford, RN, MSN	10449	2481	jlshackelford@health.ucsd.edu
Gabriela Waters, MSN, NP	33434	4989	griviello@health.ucsd.edu
Sarah Wells, MSN, NP	35284	2323	sawells@health.ucsd.edu
Trauma Program			
Christina Richardson, Administrator	37162		C3richardson@healh.ucsd.edu

Angela Kilty, Trauma Program Manager	37523	5057	akilty@health.ucsd.edu
Misti Rodriguez-Gyamfi, Prevention Coordinator	33171		mrodriguezgyamfi@health.ucsd.edu
Alan Smith, Programmer/Analyst	36666		a6smith@health.ucsd.edu
Burn Program			
Eli Strait, Coordinator	32352		estrait@health.ucsd.edu
Nurse Managers			
Stephanie Grayson, SICU			sgarrick@health.ucsd.edu
Trisha Weers, Trauma PCU			tweers@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 Documentation Overview

Admission Documentation:

History and Physical (H&P)

An H&P should be completed at the time of initial evaluation in the trauma bay or emergency department. H&Ps should be updated to include key imaging findings and documentation of injuries identified.

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.

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.

- *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.

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.

Post-Admission Documentation:

Daily progress notes should include a grid that lists all injuries diagnosed and plans of care for those injuries. This grid should be updated daily.

A note should be made to document clinical and radiographic clearance of the cervical

spine.

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.

Bedside Procedure Documentation:

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.

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

Perioperative Documentation:

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.

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 and before the patient leaves the operating room. 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.

Change in Level of Care / Transfer to Another Service:

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 or care
ii. transfer to another service

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

No patient is to be transferred to another service or facility during the first 24 hours of admission. The only exception may be a patient with no evidence of traumatic injury and evidence of CVA or acute neurologic issue more appropriate for the neurocritical care service.

Discharge Documentation:

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 Senior Resident, Trauma Fellow or Attending must see the patient **within 15 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.

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:
    - Notify the transfer center that the patient is coming (13868 or 35709). Provide patient name, age, hospital and name of MD requesting transfer
    - For trauma transfers also notify a *trauma nurse* (36747 or 36746) and give report
    - 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:
    - 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.
    - 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 – East Campus, 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, or Stroke/STEMI bypass status, this <u>does not mean</u> 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.**

f. Bypass duration and indication for bypass will be confirmed via email by the Trauma Program staff.

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)

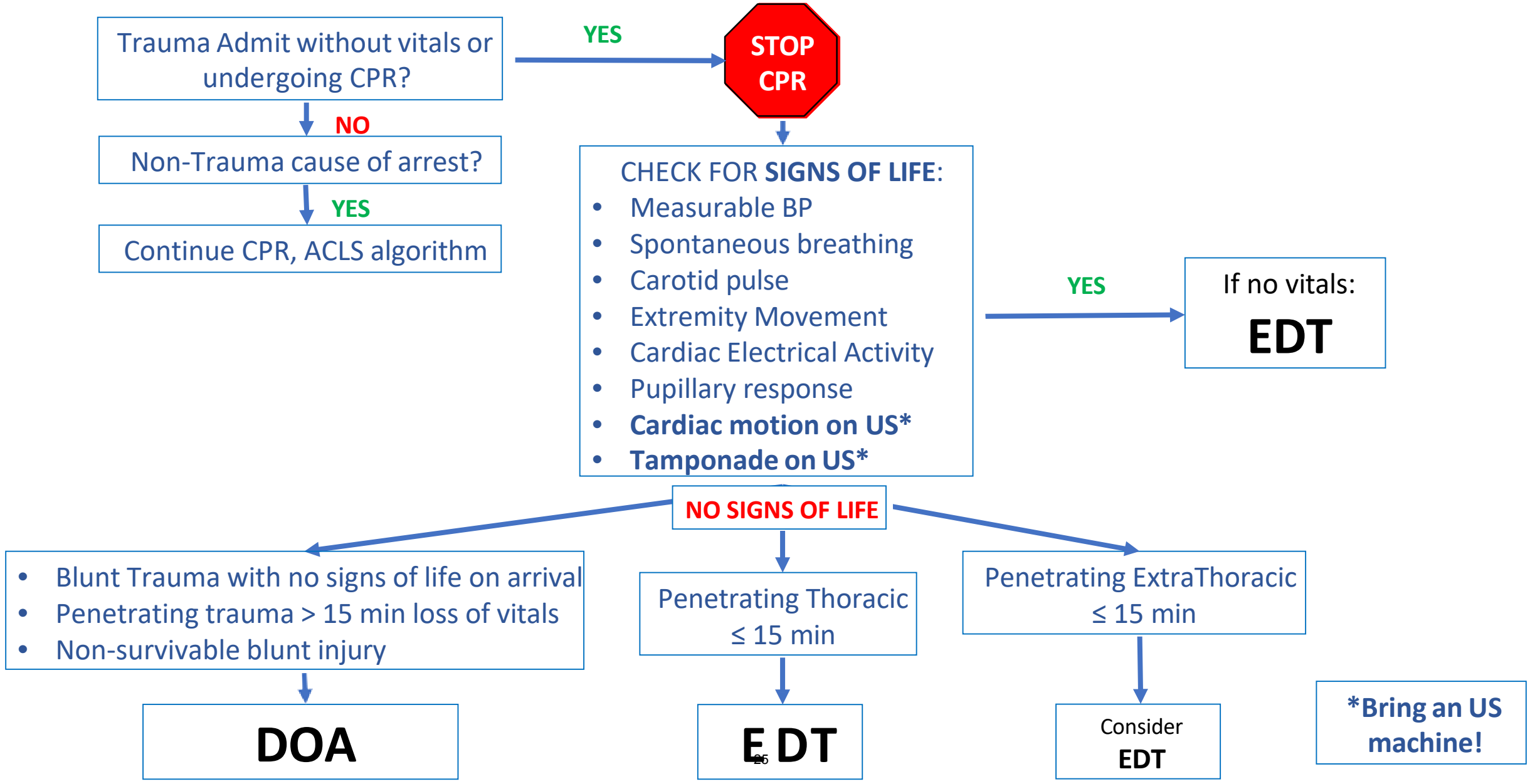
   iv. Major external hemorrhage - uncontrolled (i.e. amputation above knee or elbow)

   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



J Trauma. 79(1):159–173, July 2015

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

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*.)

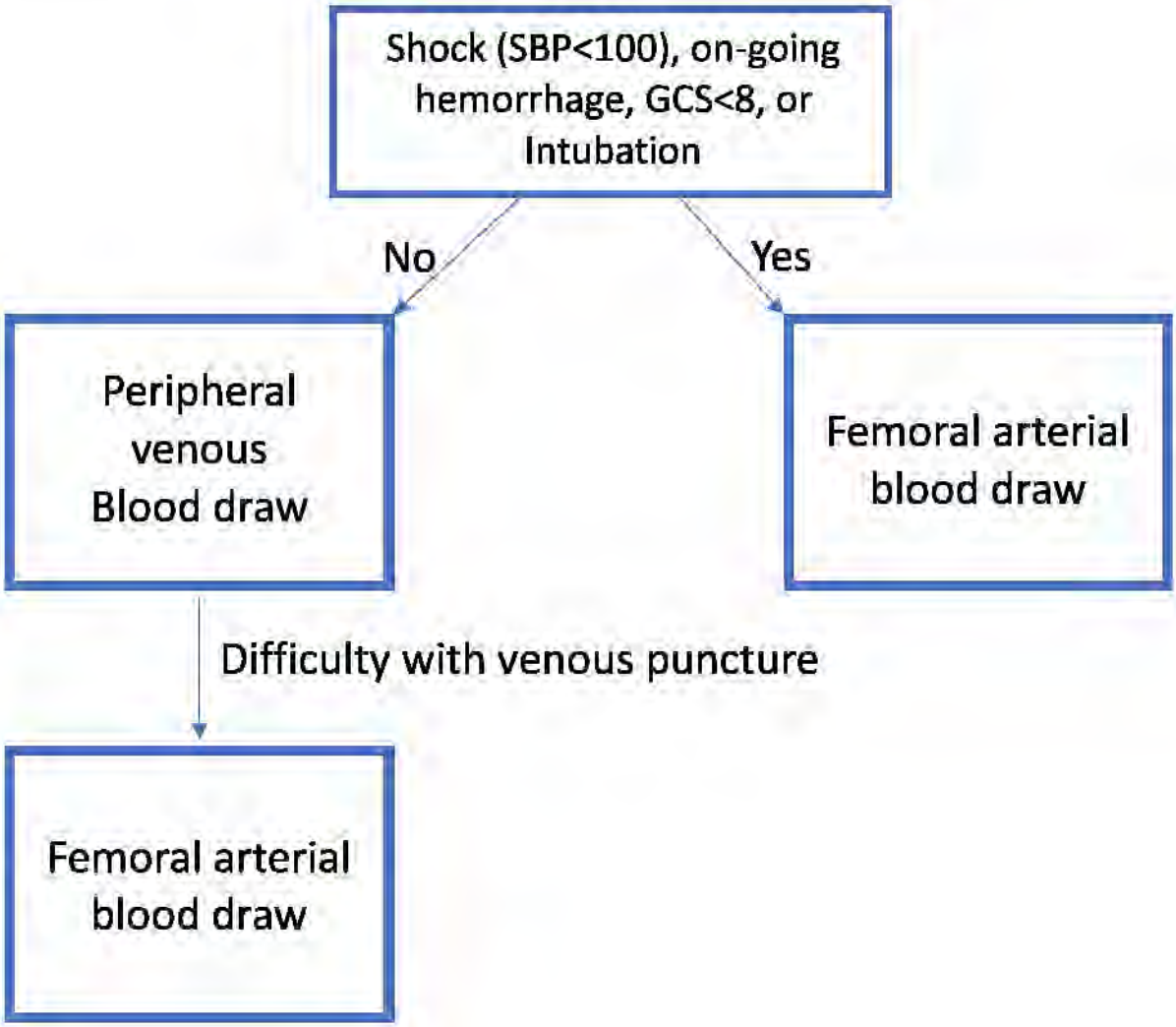
v. After the first 4 units of O- blood the Blood Bank may release type O+. (*The Blood Bank may provide Type O+ for males or females of non-childbearing age.*)

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.

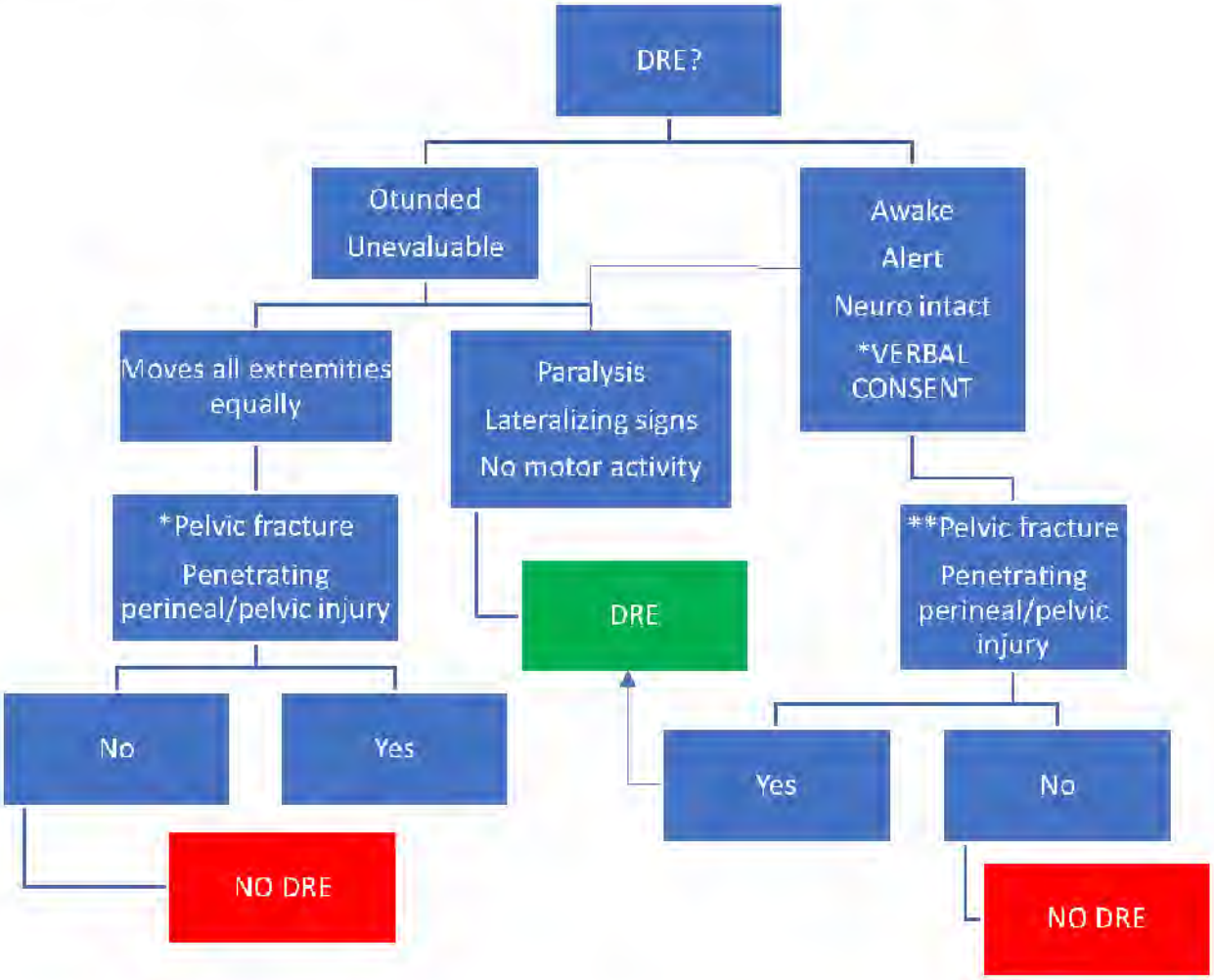
vii. During routine sampling, non-emergent transfusion, or during a resuscitation that does not require stat blood release, the surgeon can continue to specify the status of the blood he/she would like "set up" on the patient (i.e. type and crossmatch or type and screen).

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 (e.g., 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. LTWOB 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 RhIg (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@health.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)**	• Puts on lead apron/universal precautions • Assigns roles • Checks intubation equipment • Gives pre-admission plan	• 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	• 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)**	• Puts on lead apron/universal precautions	• 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	• Assists with clinical exam • Assists with drawing blood • Participates in Debrief and escort to CT
DOCTOR 3 **(Left leg)**	• Puts on lead apron/universal precautions	• Undresses patient	• 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	• Posts MIVT on screen at HOB • Puts out Trauma Page • Puts on lead apron/universal precautions • Flushed IV's • Pulls pre-stamped AKA packet	• 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	• Gives meds and IVs • Updates hemodynamic monitoring information (Fluids, ABG, MEDS) • Participates in Debrief Accompanies & monitors patients on transports
CIRCULATING NURSE	• Puts on lead apron/universal precautions • Turns suction on high (connects Yankauer) • Gets warm blankets	• Ensures bloods are processed • Readies Pleurevacs PRN • Uses autotransfusion • Directs attainment of supplies • Assists with procedures • Obtains 2nd IV if needed	• Places EKG leads • Ensures equipment for transport • Interfaces with other departments • Takes temperature • Participates in Debrief
TRAUMA TECH	• Readies (ice, tubes, syringes) for blood drawing • Receives pre-stamped AKA packet • Places patient info in Log Book	• Assists with obtaining equipment • Collects valuables and clothes • Assists with obtaining blood from groin	• 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	• Briefs team on expected roles, actions, special needs, maintains "shared mental model" for team	• Maintains "big picture" for team • Provides Cricoid pressure during intubation	• Calls for backup prn. • Notifies MICN of Bypass Status • Calls OR to book case • Participates in Debrief

UC San Diego Health

PHYSICIAN'S ORDERS

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 ≥ +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/kgin 100ml NS IVover 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
	Vaccines
	Tdap 0.5 mL IM x1
NS= 0.9% sodium chloride IVP= IV push over 1-2 minutes	

Other meds: _____

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 hemoccult (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

UC San Diego Health

PHYSICIAN'S ORDERS

TRAUMA RESUSCITATION

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.

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

AP chest _____
Lateral C-spine _____
AP lateral T-spine _____
AP lateral L-spine _____
Pelvis _____
_____ _____
_____ _____

CT scan

Head
C-spine
Chest
Abdomen/Pelvis

CT Angiography

Neck
Chest
Pelvis
Extremity: _____

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

Sutures

Sutures with lidocaine 1%:
Site(s):_____

Sutures with lidocaine 1% with epi 1:100,000:
Site(s):_____

Other

Intraosseus line

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

Airway

Ventilator Settings

Mode:
Volume
Pressure

FiO2: ____%
PEEP: ____cm/H_2O
Tidal volume: ____ mL
Inspiratory pressure _____ cm/H_2O
Respiratory Rate _____

Oxygen

_____L/min nasal prong
_____L/min face mask

Physician Signature/PID # Date/Time

Nurse Signature Date/Time

TRAUMA BAY LABS:

Baseline Labs	Syncope Labs	Anticoagulation Labs	Cirrhosis Labs	Bleeding Labs
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

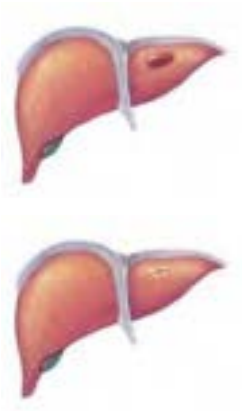
AUTHORIZATION REQUIRED? ☐ No ☐ Yes: if yes, enter authorization number:			DO YOU WISH TO BE CONTACTED ASAP WITH RESULTS? ☐ No ☐ Yes
REQUESTOR: (IF RESIDENT OR N.P., MUST FILL IN ATTENDING BLOCK)	PROVIDER NUMBER	PAGER NUMBER	MAIL CODE
ATTENDING PHYSICIAN	PROVIDER NUMBER	PAGER NUMBER	MAIL CODE

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

151-182 (9-08)LHS

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

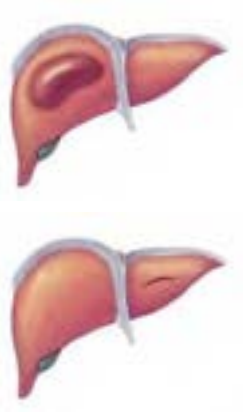
AAST ORGAN INJURY SCALES



Grade I
Nonexpanding subcapsular hematoma, < 10% surface area

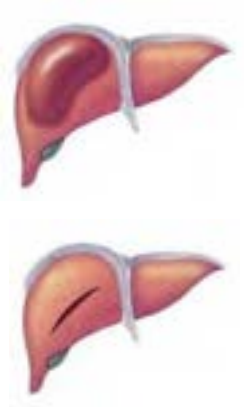
Capsular tear, nonbleeding, < 1 cm in depth

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%

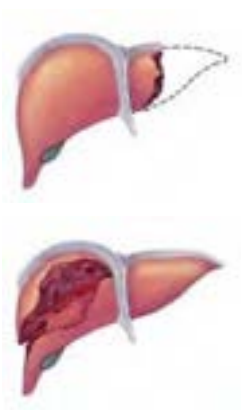


Grade III
Subcapsular hematoma, > 50% of surface area expanding or ruptured with bleeding

Intraparenchymal hematoma >10 cm or expanding

Laceration > 3 cm deep

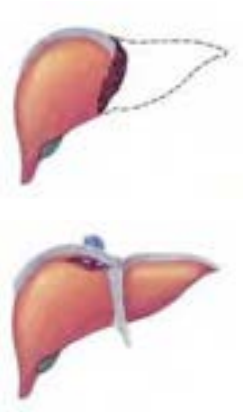
Incidence: 15%
OR Mortality: 25%



Grade IV
Ruptured intraparenchymal hematoma with bleeding

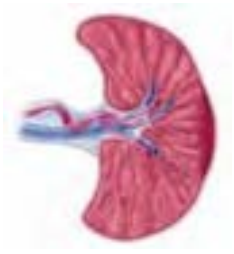
Parenchymal disruption involving 25-75% of lobe or 1-3 segments

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

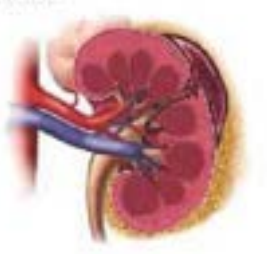
Grade I:
Contusion: hematuria without x-ray abnormalities
Subcapsular hematoma, no parenchymal laceration

Grade II:
Perinephric hematoma: confined to the retroperitoneum
Laceration: < 1cm in depth of renal of renal 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?

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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 he 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.

Figure 2: Supraglottic (non-definitive) EMS Airways:

Fig 2A: KING Laryngotracheal Airway

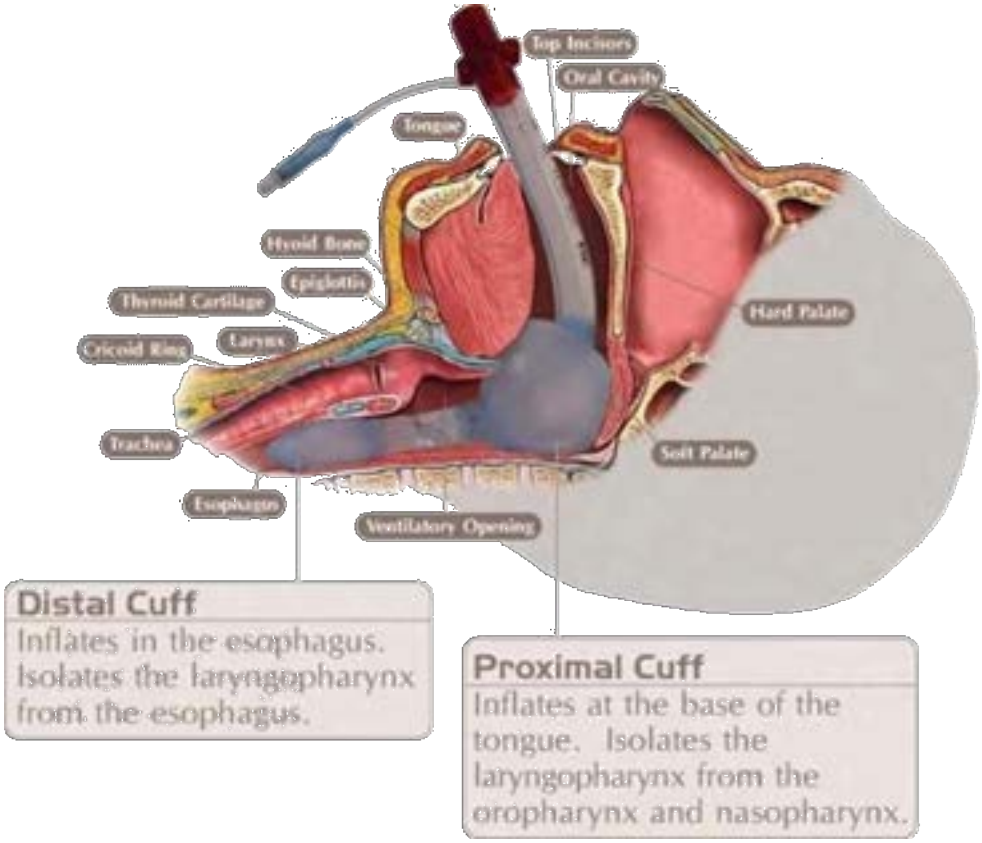


Fig 2B: Esophageal Obturator Airway

Fig 2C: iGel Supraglotic Airway

Figure 3: GLIDESCOPE Video Laryngoscopes – w/special stylet

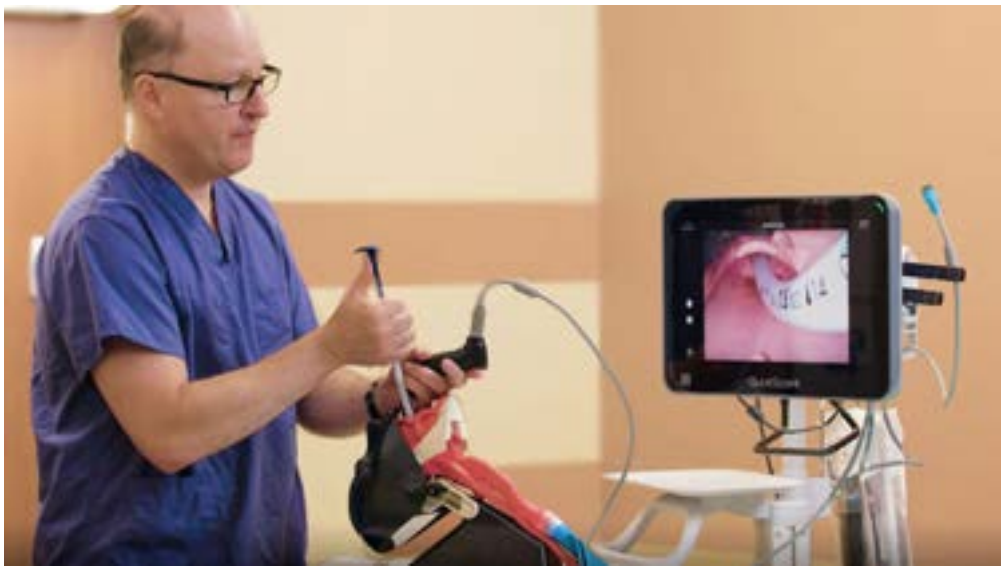
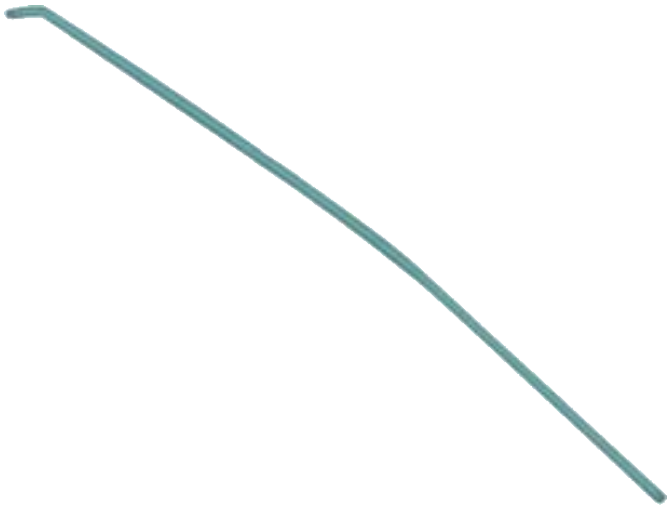
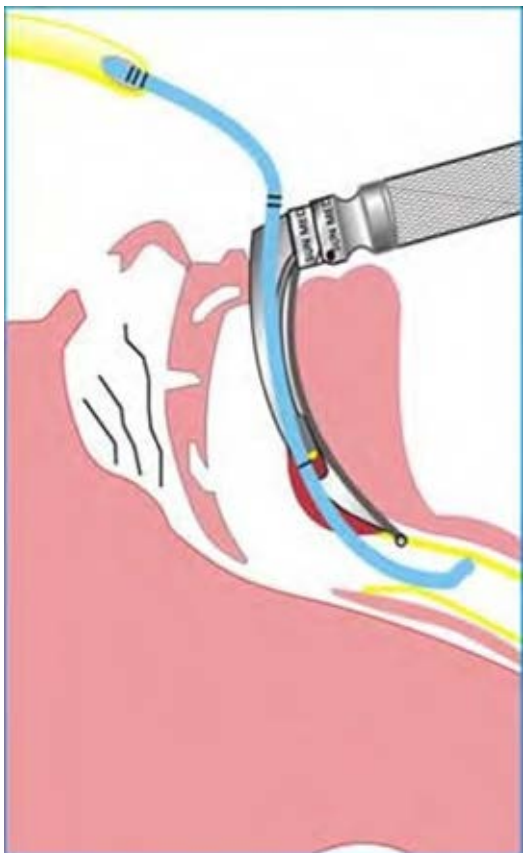


Figure 4: Endotracheal tube introducer

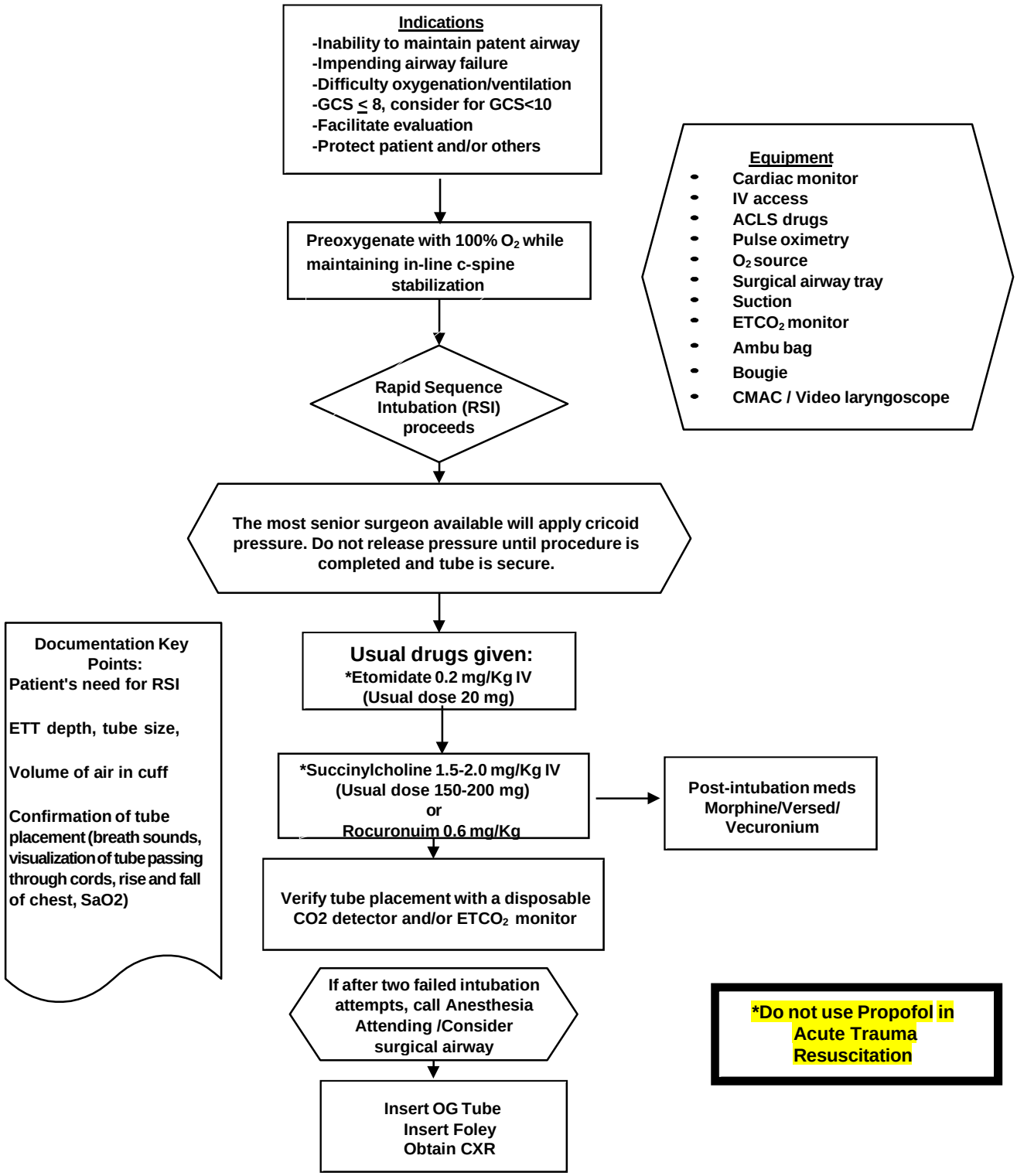
(a.k.a.: gum elastic bougie, Eschmann)





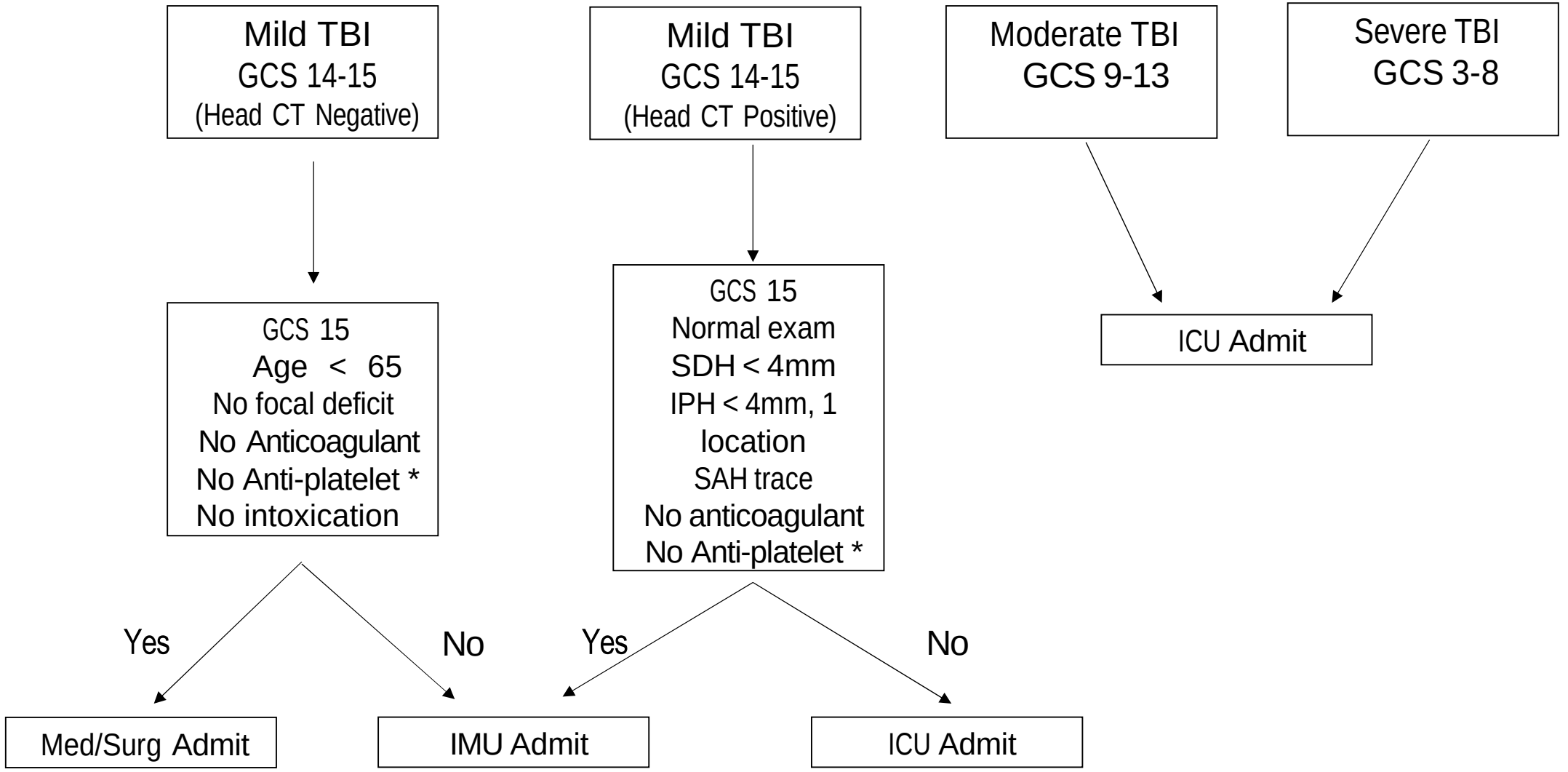
UC San Diego Division of Trauma

RAPID SEQUENCE INTUBATION (RSI) ADULT - TRAUMA



Traumatic Brain Injury

Traumatic Brain Injury: Level of Care



* Excluding Aspirin

Brain Injury Guidelines			
Variables	**BIG 1**	**BIG 2**	**BIG 3**
LOC	Yes/No	Yes/No	Yes/No
Neurologic examination	Normal*	Normal*	Abnormal
Intoxication	No	No/Yes	No/Yes
CAMP	No	No	Yes
Skull Fracture	No	Non-displaced	Displaced
SDH	$\leq$ 4mm	5 - 7 mm	$\geq$ 8 mm
EDH	$\leq$ 4mm	5 - 7 mm	$\geq$ 8 mm
IPH	$\leq$ 4mm, 1 location	5 - 7 mm, 2 locations	$\geq$ 8 mm, multiple locations
SAH	Trace	Localized	Scattered
IVH	No	No	Yes
UCSD Disposition	IMU	SICU	SICU

BIG, brain injury guidelines; CAMP, Coumadin, Aspirin, Plavix; EDH, epidural hemorrhage; IVH, intra-ventricular hemorrhage; IPH, intra-parenchymal hemorrhage; LOC, loss of consciousness; NSC, neurosurgical consultation; RHCT, repeat head computed tomography; SAH, subarachnoid hemorrhage; SDH, subdural hemorrhage, * GCS=15

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.

Pulse Ox ≥95%	ICP <25 mmHg	CPP ≥ 60 mmHg
PaO_2 ≥100 mmHg	Temp 36.0-38°C	$PbtO_2$ ≥ 15 mmHg
$PaCO_2$ 35-45mmHg	Glucose 80-180mg/dL	Plts ≥75
SBP ≥100 mmHg	INR≤ 1.4	Sodium 135-145
pH 7.35-7.45	Hgb ≥7	

Severity of TBI should be assessed using the **Glasgow Coma Score** (GCS) 3-15

Eye opening (E)	
None	1
To pressure	2
To sound	3
Spontaneous	4
Untestable	Reason:
Verbal response (V)	
None	1
Sounds	2
Words	3
Confused	4
Oriented	5
Untestable	Reason:
Motor response (M)	
None	1
Extension	2
Abnormal flexion	3
Normal flexion	4
Localizing	5
Obey commands	6
Untestable	Reason:

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 but should not delay intubation in an unstable patient

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)
- **Rocuronium**- 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.
- **Ketamine –** rapid acting sedative/analgesic/anesthetic suitable for severe agitation episode or procedural sedation without hypotension.

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 ≥95%** and an attempt for **PaO_2 ≥ 100 mmHg**.

ii. Ventilation
ventilation should be intensively monitored during the initial resuscitation.
- The target **$PaCO_2$** is **35-45 mmHg**. An $ETCO_2$ 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) but should not be prolonged

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.
- Beta-blockers should preferentially be used for treatment of hypertension as long as HR is >60 due to their beneficial effects on mortality

ii. 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 ≥ 75 x 10^3/mm^3.

- The target INR is less than or equal to 1.4 and platelets should be maintained above 75 x 10^3 / mm^3 in patients with normal platelets and INR at baseline
- 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.

4. INR and platelet count should be corrected in anticipation of operative intervention or bedside procedures such as placement of ventriculostomy or other ICP monitors. Electrolytes
   i. Hyponatremia should be avoided due to the risk of cerebral edema
   ii. Sodium goals should be maintained at 135-145
   iii. Normal saline and/or 3% saline may be given the raise sodium levels. However, levels should not increase faster than 8-12 mmol in 24 hours
   iv. Patients should be monitored for signs of SIADH or Diabetes insipidus including frequent serum sodium and osmolality checks

5. 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. MRI brain scans should be utilized for assessment of ischemic CVA, DAI, anoxic brain injury, 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.

6. **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).

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

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), or in patients with GCS >8 and high risk of progression. to guide appropriate intraoperative CPP management.

i. Increased ICP is defined as ≥ 20-25 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 ≥60mmHg should be targeted. Vasopressor infusion 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 ≥ 20-25mmHg.**

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.
- **Ventriculostomy** – extra-ventricular drain (EVD) is the preferred method of ICP monitoring. The EVD may be intermittently drained for elevated ICP, but should not be continuously drained as its readings are less accurate when open
- **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.

- Repeat imaging should be considered
- A temporary PaCO2 goal of 30-35 should be maintained as long as jt does not result in cerebral hypoxia

- **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. A bolus "test dose" can be given, and if the patient responds positively then the infusion started. 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. Continuous EEG measurement can assist in assessing adequate burst suppression
- Hypothermia is not currently routinely recommended, but can be a salvage therapy for those with continued refractory ICP

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 or in patient who underwent surgical treatment for their TBI.

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) or a proton pump inhibitor.

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 48 hours of stable head CT

4. Early Tracheostomy

Tracheostomy within 8 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 post-pyloric feeding access (i.e. Cortrak) when possible. Glucose should be monitored and euglycemia maintained, especially as nutrition is being initiated.

E. Surgical Management of TBI

1. Epidural Hematomas

Any large traumatic epidural hematoma (EDH) should be considered for evacuation. EDH with less than 5 mm midline shift and less than 15mm thickness 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 patients are to be managed non-operatively.

2. Acute Subdural Hematomas

Acute large traumatic subdural hematomas (SDH) should be considered for evacuation. Evacuation is recommended for those with a thickness > 10mm or midline shift >5mm regardless of GCS, if the patient has fixed or asymmetric pupils, or ICP > 20.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 cm^3 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, though evidence is unclear as to whether this improves outcomes

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.

F. Prognostication

i. Age alone should not be used as a reason to limit treatment
ii. Caution should be used when discussing prognosis or when using prognostic calculators with individual patients
iii. Full treatment is recommended for 72 hours after injury except in cases of a pre-existing advance directive stating otherwise, family objection, or if the patient progresses to brain death

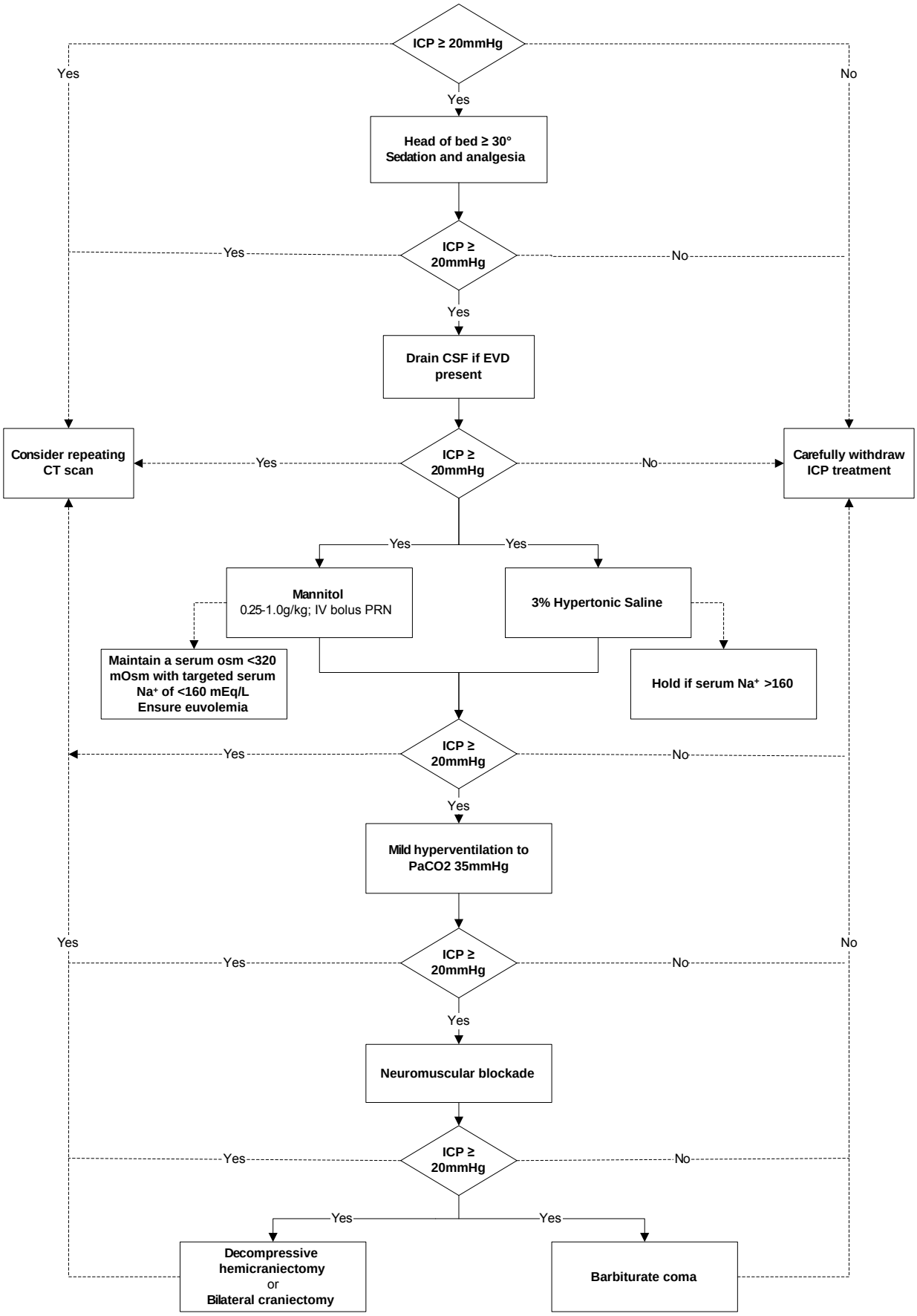
References

ACS TQP guidelines for the management of traumatic brain injury
https://www.facs.org/media/mkej5u3b/tbi_guidelines.pdf

Alali AS, Mukherjee K, McCredie VA, Golan E, Shah PS, Bardes JM, Hamblin SE, Haut ER, Jackson JC, Khwaja K, Patel NJ, Raj SR, Wilson LD, Nathens AB, Patel MB. Beta-blockers and Traumatic Brain Injury: A Systematic Review, Meta-analysis, and Eastern Association for the Surgery of Trauma Guideline. Ann Surg. 2017 Dec;266(6):952-961.

Brain Trauma Foundation guidelines for the surgical management of TBI
https://braintrauma.org/coma/guidelines/guidelines-for-the-surgical-management-of-tbi

Intracranial Hypertension Management



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

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

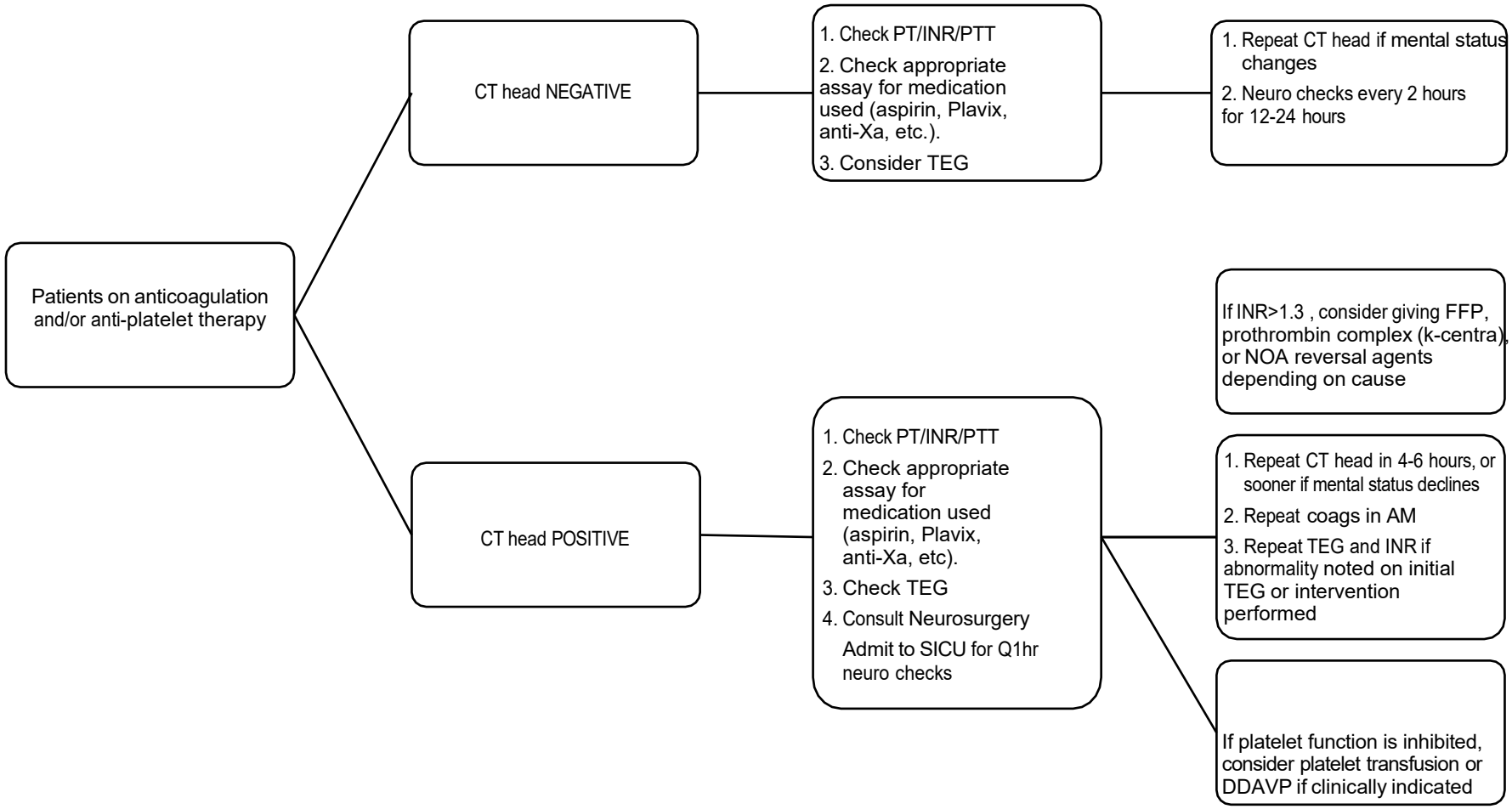
References:

1. ACS TQIP Geriatric Trauma Management Guidelines https://www.facs.org/media/ubyj2ubl/best-practices-guidelines-geriatric-trauma.pdf
2. 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
3. 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
4. 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

Trauma patient on anticoagulation with Closed Head Injury

(Edition 5.0)



UCSD Guidelines for Emergent Bleeding Reversal for Patients Without Hemophilia:
https://pulse.ucsd.edu/departments/supplychain/Documents/formDocs/WD1084.pdf

UC San Diego Health

Figure 1. Guidelines for Emergent Bleeding Reversal for Patients Without Hemophilia

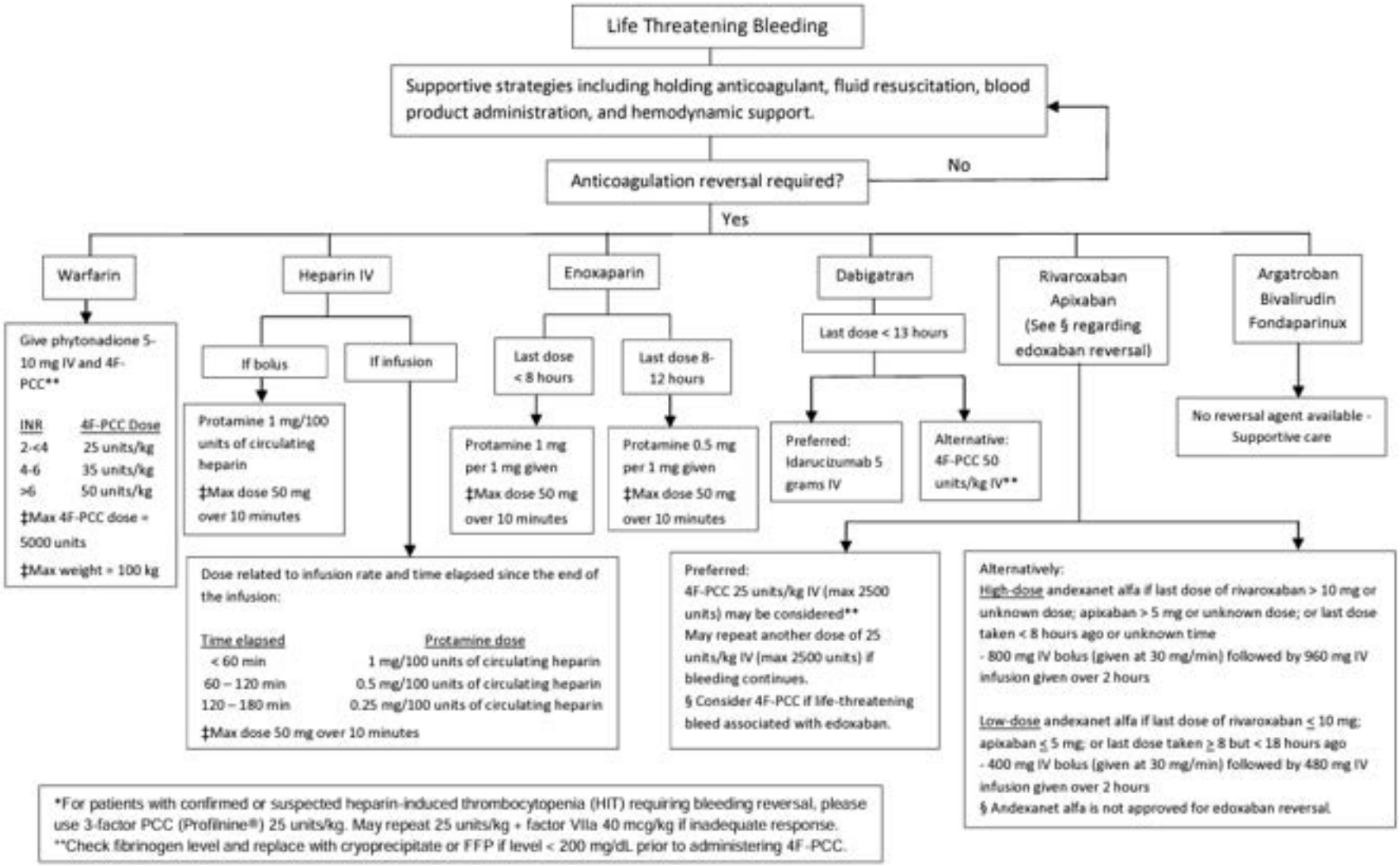


Table 1. Anticoagulant Medication Overview and Reversal Strategies[1-12]

Medication	Half-life	Reversal Agent	Lab Assay	Comment
Apixaban (Eliquis®)	6 – 15 hours	4F-PCC Andexanet alfa	Anti-factor Xa	Non-dialyzable Life-threatening bleed or urgent procedural reversal: • 4F-PCC 25 units/kg (max 2500 units) once, may repeat another dose • Andexanet alfa
Argatroban	45 minutes	None Supportive care	aPTT	20% removed by dialysis
Bivalirudin	25 minutes	None Supportive care	aPTT	20% removed by dialysis
Dabigatran (Pradaxa®)	12 – 17 hours	Idarucizumab 4F-PCC Activated PCC	Thrombin time	Non-dialyzable Life-threatening bleed or urgent procedural reversal: • Idarucizumab 5 grams IV • 4F-PCC/aPCC 50 units/kg IV if idarucizumab is not available
Edoxaban (Savaysa®)	11.5 hours	4F-PCC Supportive care	Anti-factor Xa	Non-dialyzable May consider 4F-PCC 25 – 50 units/kg (max 5000 units) for life-threatening bleeding reversal Andexanet alfa is not approved for edoxaban reversal
Enoxaparin (Lovenox®)	3 – 5 hours	Protamine	Anti-factor Xa	Last dose < 8 hours: protamine 1 mg per enoxaparin 1mg Last dose 8 – 12 hours: protamine 0.5 mg per enoxaparin 1 mg *May repeat protamine dose x1 (repeat ≤ 0.5 mg of protamine for every 100 units of heparin) if bleeding continues
Fondaparinux (Arixtra®)	17 – 21 hours	None Supportive care	Anti-factor Xa	Non-dialyzable
Heparin IV	1 – 1.5 hours	Protamine	aPTT Anti-factor Xa	Heparin bolus: protamine 1 mg per 100 units of circulating heparin Heparin infusion: protamine dose depending on heparin rate and time elapsed since the end of the infusion *May repeat protamine dose x1 (repeat ≤ 0.5 mg of protamine for every 100 units of heparin) if bleeding continues
Rivaroxaban (Xarelto®)	5 – 12 hours	4F-PCC Andexanet alfa	Anti-factor Xa	Non-dialyzable Life-threatening bleed or urgent procedural reversal: • 4F-PCC 25 units/kg (max 2500 units) once, may repeat another dose • Andexanet alfa
Warfarin (Coumadin®)	20 – 60 hours	Vitamin K Fresh frozen plasma 4F-PCC	PT/INR	Life-threatening bleed or urgent procedural reversal: Pre-treatment INR: 2 - < 4 → 4F-PCC dose: 25 units/kg, Max 2500 units 4 – 6 → 35 units/kg, Max 3500 units > 6 → 50 units/kg, Max 5000 units

† Please contact pharmacist to discuss the timing of repeat levels as they may be falsely high if obtained prior to the reversal agent reaching its peak effect.
† **Consider hematology consult for bleeding that continues after 4F-PCC or other factor product administration. Contact hematology fellow or attending on call.**

This guideline was developed to ensure the safe and effective administration of the reversal agents for the treatment of emergent bleeding events in patients on anticoagulant or antiplatelet therapy. The guideline provides reversal recommendations for the following: warfarin, oral direct thrombin inhibitor, direct oral anticoagulants, heparin products, and anti-platelet agents.

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Definitions[11]

1. Major bleed – Acute major bleeding that meets at least one of the following criteria: bleeding at a critical site; hemodynamic instability; clinically overt bleeding with hemoglobin decrease ≥ 2 g/dL or administration of ≥ 2 units of RBCs.
2. Non-major bleed – any bleed that does not meet the criteria for major bleed.

I. 4-Factor Prothrombin Complex Concentrate (4F-PCC)[11-16,26]

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).

1. Reversal agents, including 4F-PCC, idarucizumab and andexanet alfa are costly and should only be used to reverse life threatening bleeding or if an urgent, invasive procedure planned.
   1) Per UCSDHP 380.6, hold anticoagulation and monitor patients. https://supplychain.ucsd.edu/Documents/formDocs/WD1104.pdf.
2. 4F-PCC + vitamin K is FDA-indicated for life-threatening bleeding caused by **warfarin** or warfarin reversal in patients needing urgent surgical or invasive intervention. See **Table 2** for 4F-PCC dosing for patients with acute major bleeding secondary to warfarin.
3. The use of 4F-PCC has been recommended by several national practice guidelines for the reversal of direct oral anticoagulant-associated life-threatening bleeding. However, clinical trials that have supported such practice have all been limited by small sample size and/or lack of comparison group(s).
4. 4F-PCC (± vitamin K) may be considered in patients with profuse or life-threatening bleeding **with no known history of warfarin consumption** (**Figure 3**).

1) Such patients include those with profuse or life-threatening bleeding, or at high risk for life-threatening bleeding due to liver failure, intracranial hemorrhage, trauma, or critical illness, who are unresponsive or intolerant (fluid overload) to conventional therapy.
2) Check fibrinogen level and replace with cryoprecipitate or FFP if level < 200 mg/dL prior to administering 4F-PCC.
3) Suggested monitoring and follow-up after any 4F-PCC administration include the following:
   a. 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.

TABLE 2: Factor Algorithm for life-threatening bleeding due to warfarin or urgent surgical or invasive intervention for patients on warfarin (Coumadin)[13]
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 4F-PCC (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 of 5000 units should not be exceeded.
Co-administration with 5-10 mg intravenous (IV) vitamin K is recommended with 4F-PCC.[15]

II. Idarucizumab (Praxbind®)[5,11,17,18]

Idarucizumab, 5 g via IV infusion, should be used to reverse life-threatening bleeding associated with dabigatran.

1. Dabigatran is an oral direct thrombin inhibitor with a half-life of approximately 13 hours, and up to 27 hours in renal dysfunction.
2. Idarucizumab is a monoclonal antibody specific to dabigatran and should not be expected to work for other oral or intravenous anticoagulants.
3. The recommended dose is 5g, provided as 2 separate vials each containing 2.5 g/50 ml of idarucizumab.
4. May consider 4F-PCC or activated PCC (FEIBA) 50 units/kg for one dose for dabigatran reversal if idarucizumab is not available.

III. Andexanet alfa[11,19-21,27]

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.

1. Rivaroxaban has a half-life of 5-9 hours and up to 19 hours in elderly patients. Apixaban has a half-life of 9-12 hours. The half-life of andexanet alfa is far shorter than either of the oral factor Xa inhibitor (approximately 1 hour). Anti-factor Xa activity is expected to go back to baseline approximately 4 hours after the initiation of the infusion.
2. A specific antidote for rivaroxaban and apixaban is not available. The use of activated charcoal to reduce absorption may be considered if overdose is suspected. Due to high plasma protein binding of both rivaroxaban and apixaban, it is not expected that either medication can be removed by hemodialysis.
3. Please see **Figure 1** for andexanet alfa dosing.

IV. Protamine Guidelines for Therapeutic Heparin Reversal in Patients without Hemophilia [14,22,23]

1. Unfractionated Heparin:

1) To reverse the effects of a recent heparin bolus
   a. 1 mg protamine will neutralize ~ 100 units of circulating heparin.
   b. For example: immediately reversing the effects of a 5,000-unit bolus of heparin would require ~ 50 mg protamine.

2) To reverse the effects of a continuous infusion of heparin
   a. Heparin has a half-life of ~ 60 minutes and protamine sulfate dosing is related to the duration of the heparin infusion.
   b. Example: for a patient receiving 1,000 units/hr of heparin by a continuous IV infusion who did not recently receive a bolus of heparin, this patient would require enough protamine sulfate to neutralize all of the circulating heparin in the last hour (1,000 units), plus half the dose in the preceding hour (500 units), plus a quarter of the dose received the hour before that (250 units). This patient would require ~ 17.5 mg of protamine sulfate to neutralize a total of 1,750 units of circulating heparin

3) There is no reversal agent for prophylactic dose of subcutaneous unfractionated heparin given its short half-life.

2. Low Molecular Weight Heparin:

1) There is no proven method of neutralizing enoxaparin, but the 2012 *CHEST* guideline (9th edition) recommends the following:
   a. If enoxaparin was given within 8 hours, consider giving 1 mg of protamine sulfate per 100 anti-Xa units (1 mg) of enoxaparin to a maximum dose of 50 mg.
   b. If enoxaparin was administered greater than 8 hours previous to the protamine sulfate dose or if a second dose if needed, give protamine sulfate 0.5 mg IV per 100 anti-Xa units (1 mg) of enoxaparin.

3. Protamine sulfate key points:

1) Administer intravenously as a slow IV push over at least 1-3 minutes.
2) If further dilution is required, you may dilute in NS or D5W,
3) No more than 50 mg should be administered in a 10-minute period.
4) Bradycardia, severe hypotension, and anaphylactoid reactions have resulted from rapid administration of protamine.

V. 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 4F-PCC dosing (**Table 3**).
2. Check fibrinogen, PT/INR and thromboelastograph (TEG). See **Table 4** for TEG interpretation assistance.
3. If fibrinogen level is low (<200 mg/dL), replace fibrinogen with cryoprecipitate or FFP, as appropriate, prior to administering 4F-PCC.
4. Recommended to start with a single agent first (4F-PCC preferred).
5. For invasive procedures such as surgery or invasive intracranial pressure monitoring device, consider FFP or 4F-PCC (25 units/kg) once. 4F-PCC 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 4F-PCC 500 units once fibrinogen is optimized).

TABLE 3: Factor Algorithm for non-life-threatening bleeding due to warfarin

Pre-Treatment INR	Recommendations
2 – < 4	1. Lower the warfarin dose or omit a dose 2. Monitor INR more frequently 3. Resume warfarin at lower dose when INR therapeutic No dose reduction may be required if only minimally above therapeutic range.
4 – < 10	1. Omit next 1 or 2 doses 2. Monitor INR more frequently 3. Resume warfarin at a lower dose when INR therapeutic Alternatively - Omit next dose and give Vitamin K (1 - 2.5 mg orally) if at a high risk for bleeding If a more rapid reversal is required, Vitamin K (2 - 4 mg orally) can be given with the expectation that a reduction in the INR will occur in 24 hours. If the INR is still high, additional Vitamin K (1 - 2 mg orally) can be given.
≥ 10	1. Hold warfarin therapy and give Vitamin K (2.5 - 5 mg orally) with the expectation that the INR will be reduced within 24 - 48 hours. 2. Monitor INR more frequently and use additional Vitamin K if necessary 3. Resume warfarin at a lower dose when INR therapeutic

VI. Aspirin reversal for life-threatening bleed[18,24,25]

1. Consider single dose of desmopressin (DDAVP) 0.4 mcg/kg IV in life-threatening bleed or intracranial hemorrhage.
2. Platelet transfusion may be considered for patients with aspirin- or clopidogrel-associated intracranial hemorrhage who will undergo neurosurgical procedure. A platelet function test is recommended prior to platelet transfusion.
3. DDAVP can be used in addition to platelet transfusion.

VII. P2Y12 ADP receptor antagonists reversal for life-threatening bleed (clopidogrel, prasugrel, ticagrelor)[18,24,25,28]

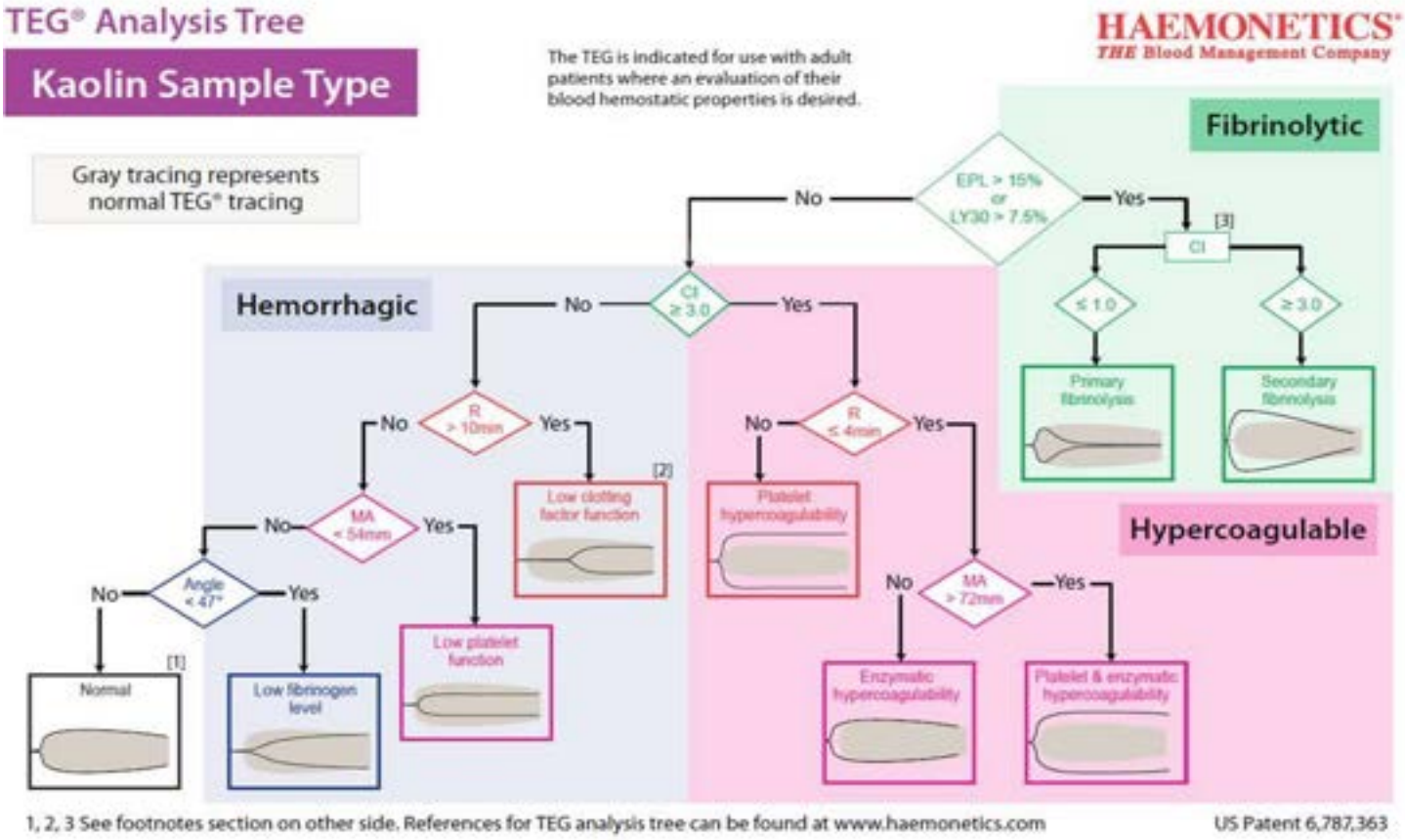
1. Both clopidogrel and prasugrel are irreversible inhibitors at P2Y12 receptor site. Ticagrelor is a reversible P2Y12 inhibitor.
2. Consider single dose of desmopressin (DDAVP) 0.4 mcg/kg IV in life-threatening bleed or intracranial hemorrhage.
3. Platelet transfusion may be considered for patients with P2Y12 inhibitor-associated intracranial hemorrhage who will undergo neurosurgical procedure.
    a. The decision to transfuse platelet(s) should be made judiciously since recent literature has linked platelet transfusion to worsening clinical outcomes when compared to standard care in patients presenting with antiplatelet-associated cerebral hemorrhage.
    b. It is recommended to wait 3 – 5 half-lives of reversible antiplatelet agent to elapse before platelet infusion to prevent further inhibition of the transfused platelet.
    c. The effect of irreversible platelet inhibitors can be relatively long-lasting. For these agents, the restoration of platelet function is more dependent on platelet half-life.

4. DDAVP can be used in addition to platelet transfusion

VIII. Glycoprotein IIb/IIIa inhibitor reversal for life-threatening bleed (eptifibatide, abciximab)[18,24,25]

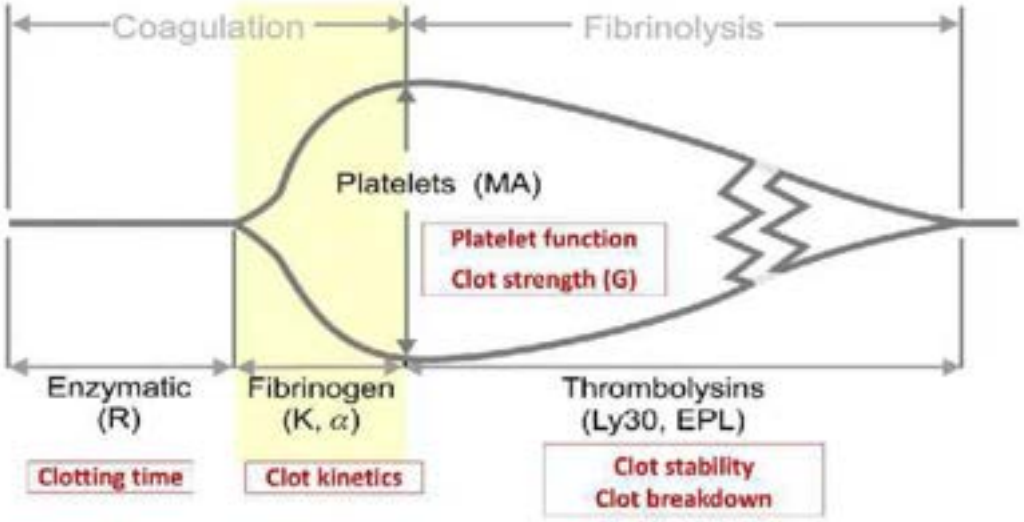
1. Supportive measures only to control bleeding.

Table 4: Interpreting Thromboelastographs (TEGs)

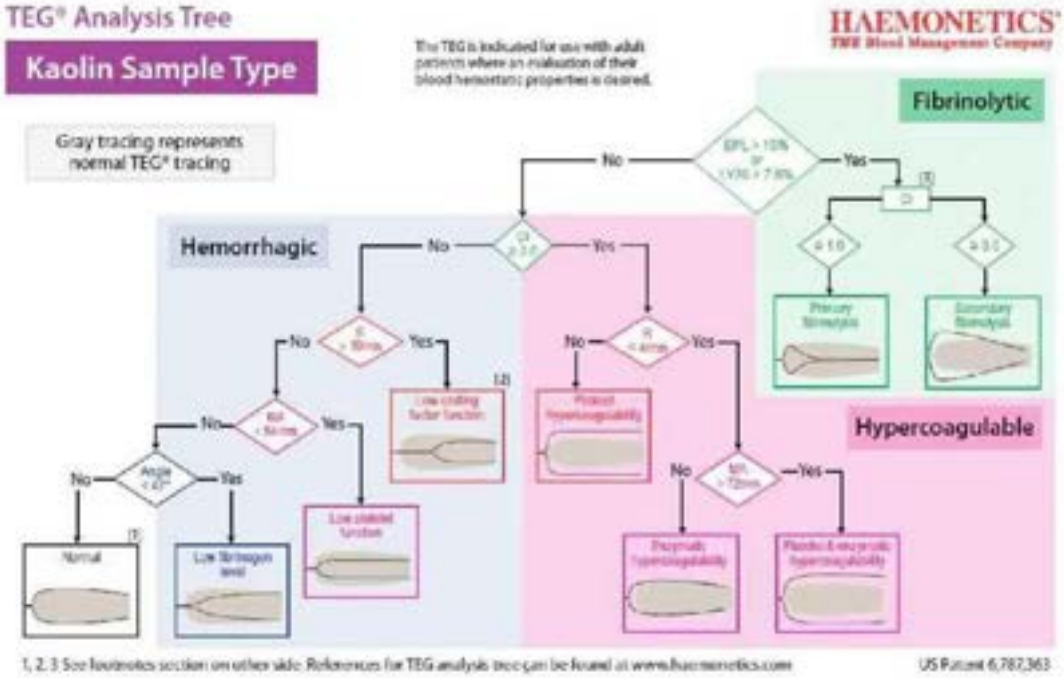


TEG Value	Normal Value	Description	Affected Factor
R time	2-8 minutes	Reactive time. Time to initial clot formation.	Clotting factors
K TIME	1-3 minutes	Clot formation. Time from initial clot formation to fixed clot strength.	Fibrinogen
α-angle	55-78 degrees	Rate of clot strengthening (fibrin buildup 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

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 ± 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)



Concussion Screening

Concussion Screening
(See also: PDF on Current Concepts in Concussion Management, 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

- 1-2 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 floor, med/surg for patients 18-65yo with GCS 15, no anticoagulant use, not intoxicated, and no associated injuries or requiring IMU admission, IMU for all other patients
- Scheduled neurologic checks q4 hours for med/surg patients, q2 hours for IMU patients Hospital Day #1-2
    i. Perform tertiary survey to rule out possibility of missed injuries
    ii. C-spine clearance as per protocol
    iii. Speech/cognitive therapy consult if symptoms persist
    iv. If GCS 15, 16yo or older, no anticoagulant use, not intoxicated, and no associated injuries requiring continued admission, observe while inpatient for at least 6 hours prior to discharge[1]

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 , Concussion clinic (858-543-0555)

–

- Physician Access line or Clinic #844-377-7678 to make referral, or Joel Castellanos with PM&R for follow-up, Patients with persistent headaches or other symptoms after discharge should be referred to the concussion clinic if previously seen only by their primary care physician[2]

E. Disposition

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

F. Post-discharge Management

- Remove from play for at least 2 days, then gradually increase activity per graded return-to-play protocol. Rest more than 3 days is discouraged[2]
    i. No return to impact sports until cleared by primary care physician
        or concussion clinic
- Prevention of Second Impact Syndrome

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	• No activities requiring exertion (weight lifting, jogging, P.E. classes)	• Recovery and elimination of symptoms
	II-A	Light aerobic activity	• 10-15 minutes *(min)* of walking or stationary biking. • **Must be performed under *direct***	• Increase heart rate to no more than 50% of perceived maximum *(max)* exertion (e.g.,< 100 beats per min)
	II-B	Moderate aerobic activity *(Light resistance training)*	• 20-30 min jogging or stationary biking • Body weight exercises (squats, planks, push-ups), max 1 set of 10, no more than 10 min total	• Increase heart rate to 50-75% max exertion (e.g.,100-150 bpm) • Monitor for symptom return
	II-C	Strenuous aerobic activity *(Moderate resistance training)*	• 30-45 min running or stationary biking • Weight lifting ≤ 50% of max weight	• Increase heart rate to > 75% max exertion • Monitor for symptom return
	II-D	Non-contact training with sport-specific drills *(No restrictions for weightlifting)*	• Non-contact drills, sport-specific activities (cutting, jumping, sprinting) • No contact with people, padding or the floor/mat	• Add total body movement • Monitor 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	• Controlled contact drills allowed (no scrimmaging)	• Increase acceleration, deceleration and rotational forces • Restore confidence, assess readiness for return to play • Monitor for symptom return
		Full contact practice Full unrestricted practice	• Return to normal training, with contact • Return 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)	• Normal game play (competitive event)	• 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.
	This step usually ends 3-5 days after injury. Progress to the next stage when your child starts to improve, but s/he may still have some symptoms.		
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	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	Light physical activity, like walking. No strenuous physical activity or contact sports. No driving.
	a e		
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.
	e v		
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.
	Progress to the next stage when your child has returned to full school and is able to complete all assignments/tests without		
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.

Current Concepts in Concussion: Evaluation and Management

Table 6.
Elements of Concussion Management

ELEMENT	*RECOMMENDATIONS*	*COMMENTS*
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)

Headache lasting more than 60 hours

Loss of consciousness for more than 60 seconds

Amnesia

History of concussion

Age younger than 18 years

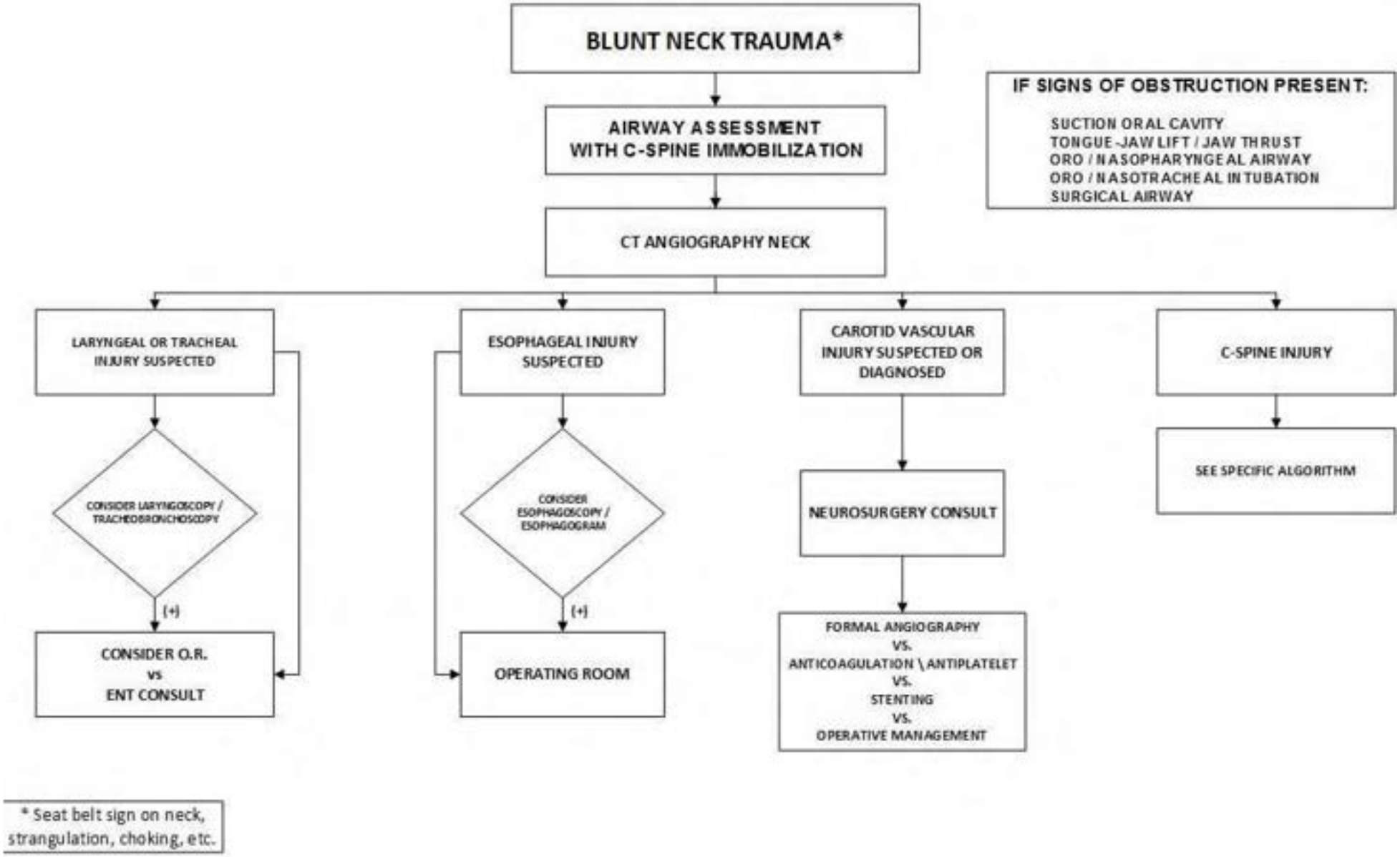
Comorbid conditions

Medication use (psychotropic drugs, anticoagulants)

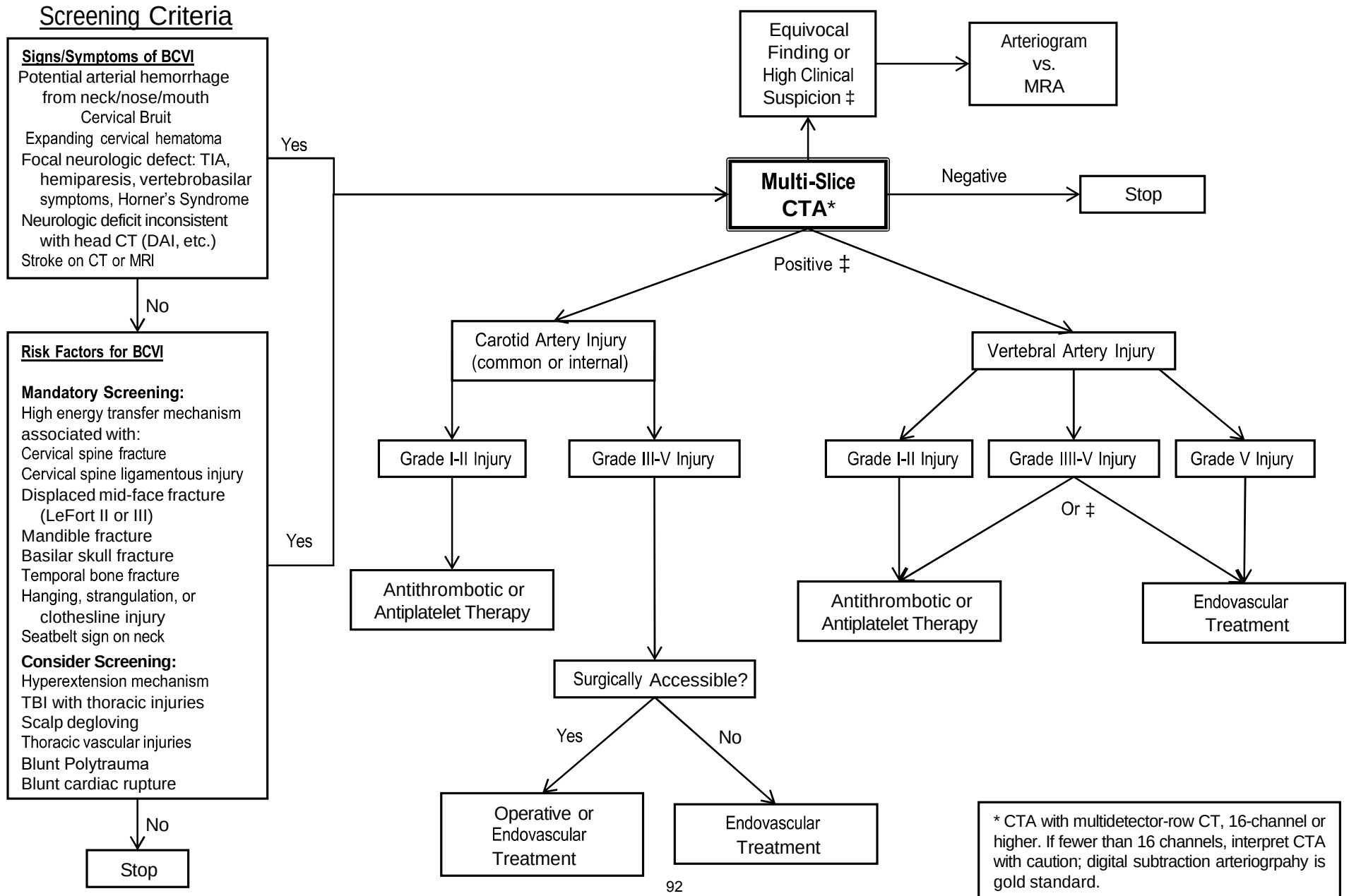
Dangerous style of athletic play

High-risk sport (contact, collision)

NECK TRAUMA


BLUNT NECK TRAUMA*
AIRWAY ASSESSMENT WITH C-SPINE IMMOBILIZATION
CT ANGIOGRAPHY NECK
IF SIGNS OF OBSTRUCTION PRESENT:
SUCTION ORAL CAVITY
TONGUE-JAW LIFT / JAW THRUST
ORO / NASOPHARYNGEAL AIRWAY
ORO / NASOTRACHEAL INTUBATION
SURGICAL AIRWAY
LARYNGEAL OR TRACHEAL INJURY SUSPECTED
CONSIDER LARYNGOSCOPY / TRACHEOBRONCHOSCOPY
(+)
CONSIDER O.R. vs ENT CONSULT
ESOPHAGEAL INJURY SUSPECTED
CONSIDER ESOPHAGOSCOPY / ESOPHAGOGRAM
(+)
OPERATING ROOM
CAROTID VASCULAR INJURY SUSPECTED OR DIAGNOSED
NEUROSURGERY CONSULT
FORMAL ANGIOGRAPHY VS. ANTICOAGULATION \ ANTIPLATELET VS. STENTING VS. OPERATIVE MANAGEMENT
C-SPINE INJURY
SEE SPECIFIC ALGORITHM
* Seat belt sign on neck, strangulation, choking, etc.

UCSD Blunt Cerebrovascular Injury Screening & Acute Treatment Algorithm



Adapted from: J trauma June 2020 88(6): 875-887

Table: Denver Grading Scale for Blunt Cerebrovascular Injuries

Grade I: Luminal irregularity or dissection/intramural hematoma with <25% luminal stenosis

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

Grade III : Pseudoaneurysm

Grade IV : Vessel occlusion

Grade V: Vessel transection

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 lumber 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.

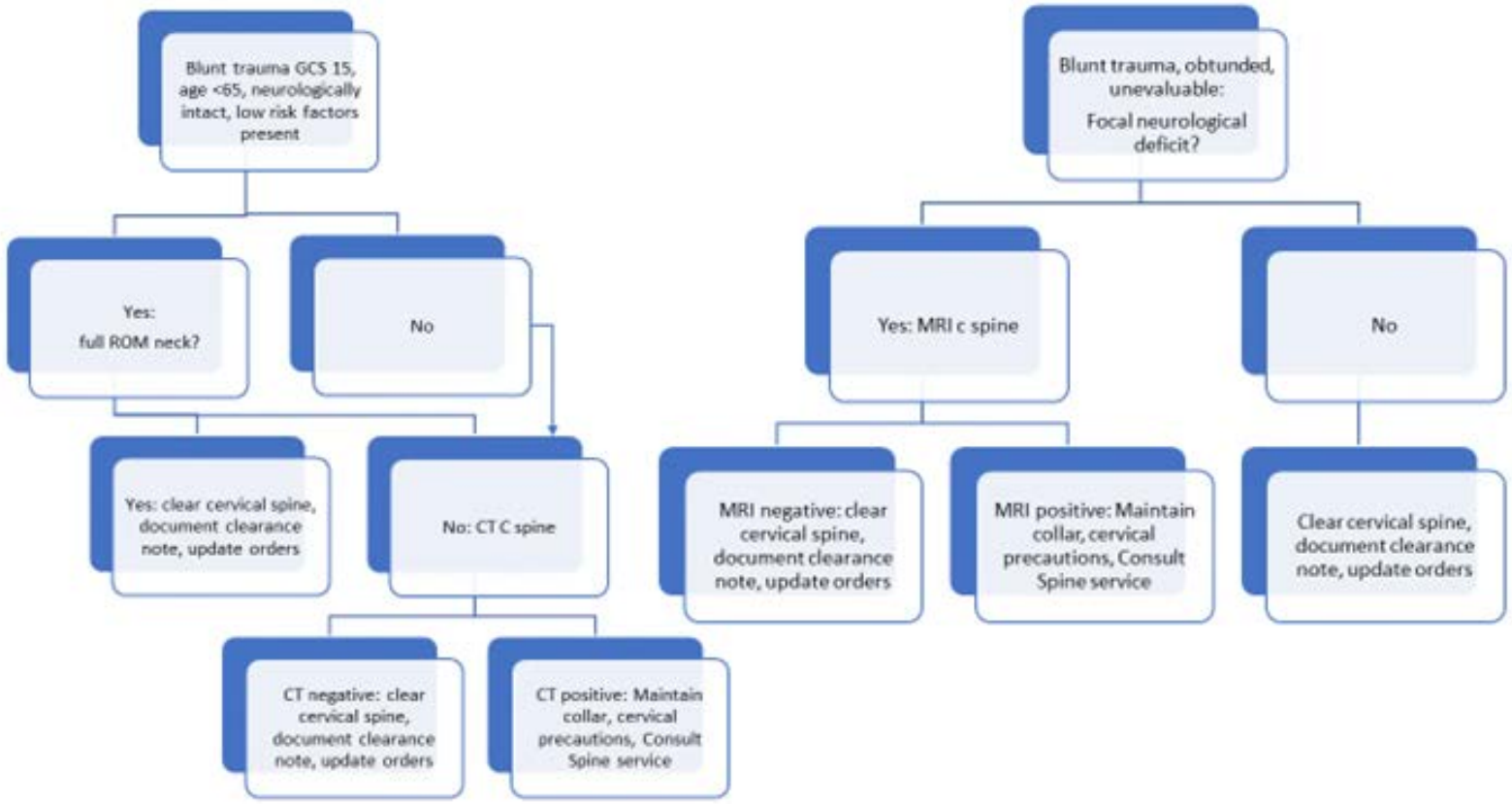
Tertiary exam

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



*Low risk factors: low impact MVA, GLF, ambulatory after trauma, already sitting upright at presentation, absent or delayed midline TTP or cervical spine

**High risk mechanism: fall from ≥3ft or 5 stairs, axial load to head, MVC at high speed, MVA with rollover or ejection, MVA vs bus or truck, collision of motorized recreational vehicle, bicycle collision

Penetrating Neck Trauma

Penetrating Neck Wound- Exploration, Vascular Repair/Ligation

The neck can be anatomically 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

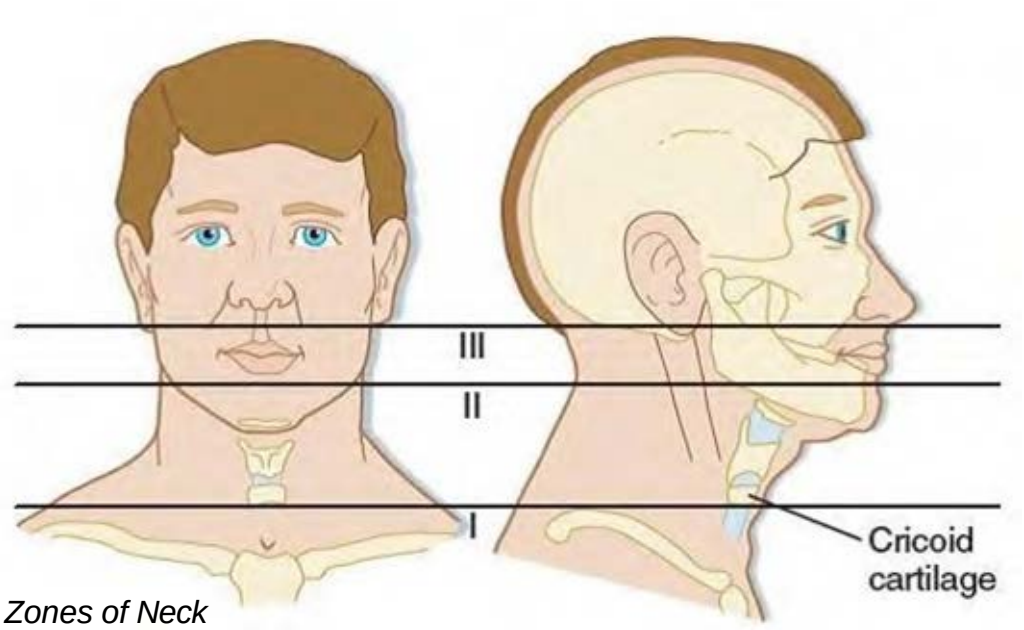


Figure – Zones of Neck

Historically penetrating injuries to the neck were separated by anatomic zones, and management was determined by location, with zone I and III injuries undergoing angiography, endoscopy, and bronchoscopy; and zone II injuries undergoing mandatory operative exploration. However, this resulted in an unacceptably high rates of negative explorations and exposure to radiation and invasive diagnostic tests. Currently, management has moved to a "no zone" approach, and the primary determinant of operative versus conservative management is clinical presentation.

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

Patients with hard signs of injury (active bleeding, instability, expanding/pulsatile hematoma, bruit/thrill, hematemesis, and air escaping from the wound) should undergo exploration in the OR. Intubation should not be attempted in the trauma bay. Direct laryngoscopy is likely to be technically challenging due to distortion of the airway from the hematoma and/or bloody secretions. Risk for needing a surgical airway is high, therefore, the patient should be taken to the OR for any attempt to secure the airway. The OR has several advantages over the ED; it is a sterile environment, has anesthesia and extra nursing personnel, specialized surgical equipment, better positioning, and improved lighting.

Patients with soft signs (minor hemoptysis, hematemesis, dysphonia, dysphagia, subcutaneous or mediastinal air, non-expanding hematoma) should be screened with CT angiography. CT angiography gives information on bony and vascular structures and can easily demonstrate the trajectory of penetrating injuries. Use of invasive tests like endoscopy, bronchoscopy, and contrast studies can then be obtained based on symptoms and trajectory of injury seen on screening CT angiogram. CT esophagram is an excellent non-invasive option for screening with a sensitivity and specificity of 95% and 91%, respectively. CT esophagram is more sensitive than traditional gastrografin esophagram, which can miss 22-30% of injuries.

Asymptomatic patients with penetrating neck injuries without **any** hard or soft signs of injury can be safely observed with a very low likelihood of a missed injury.

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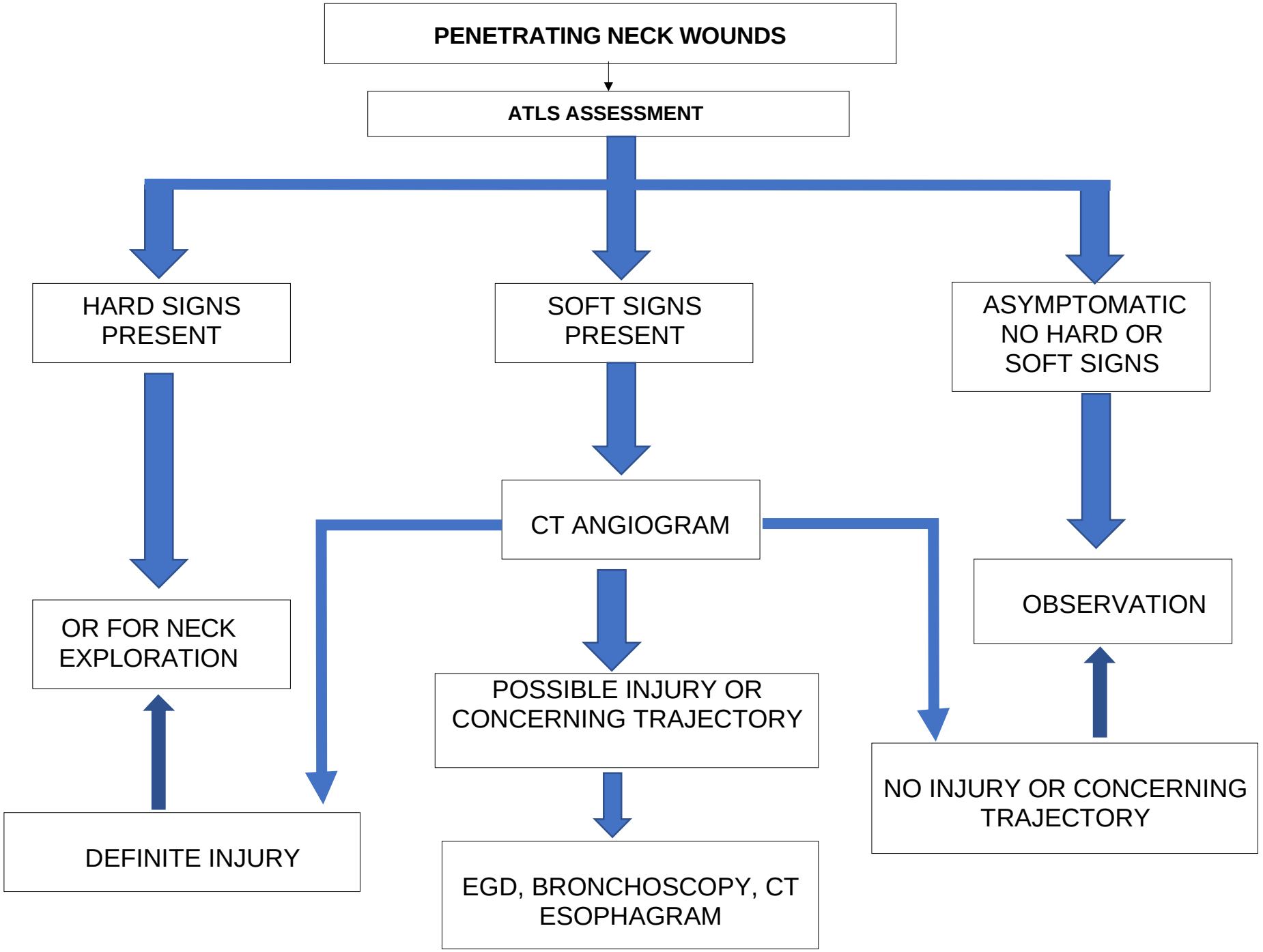

PENETRATING NECK WOUNDS
ATLS ASSESSMENT
HARD SIGNS PRESENT
SOFT SIGNS PRESENT
ASYMPTOMATIC NO HARD OR SOFT SIGNS
OR FOR NECK EXPLORATION
CT ANGIOGRAM
OBSERVATION
POSSIBLE INJURY OR CONCERNING TRAJECTORY
NO INJURY OR CONCERNING TRAJECTORY
DEFINITE INJURY
EGD, BRONCHOSCOPY, CT ESOPHAGRAM

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
- Tetanus prophylaxis as needed and antibiotic prophylaxis depending on type of fracture
- Per 2021 SIS guidelines, operative and nonoperative upper face, midface fractures and mandibular fractures do not require antibiotics prophylactic, preop nor post op. (open fractures and fractures associated with sinuses not discussed) *Forrester JD, et al. Surgical Infection Society Guidelines for Antibiotic Use in Patients with Traumatic Facial Fractures. Surg Infect (Larchmt). 2021 Apr;22(3):274-282*.
- 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 dietActivity 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
- Tetanus prophylaxis as needed and antibiotic prophylaxis depending on type of fracture
- 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 vs IMU (see TBI admission guidelines) 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

Management of Hemothorax/Pneumothorax

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)

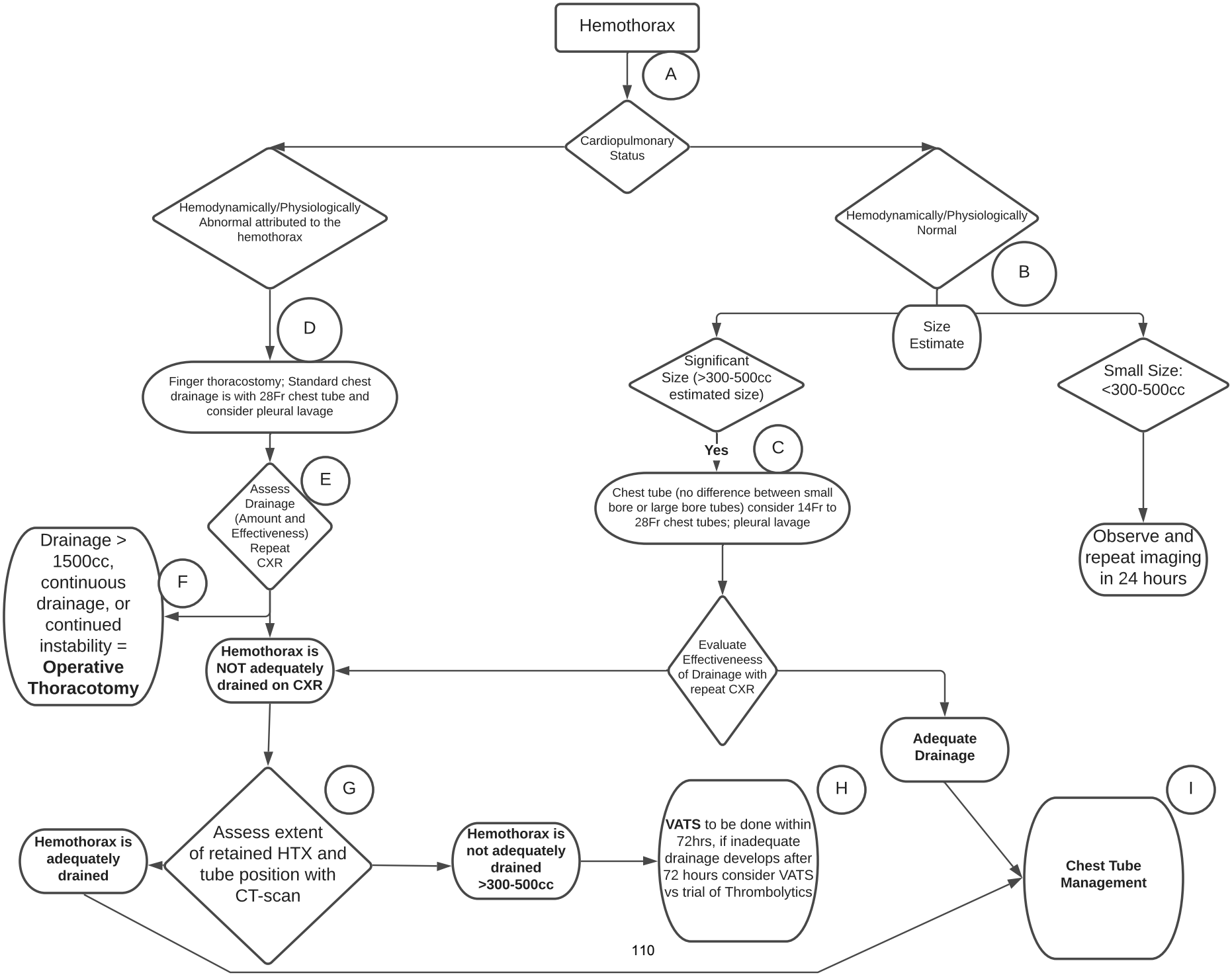
C. **Proposed Hospital Course**

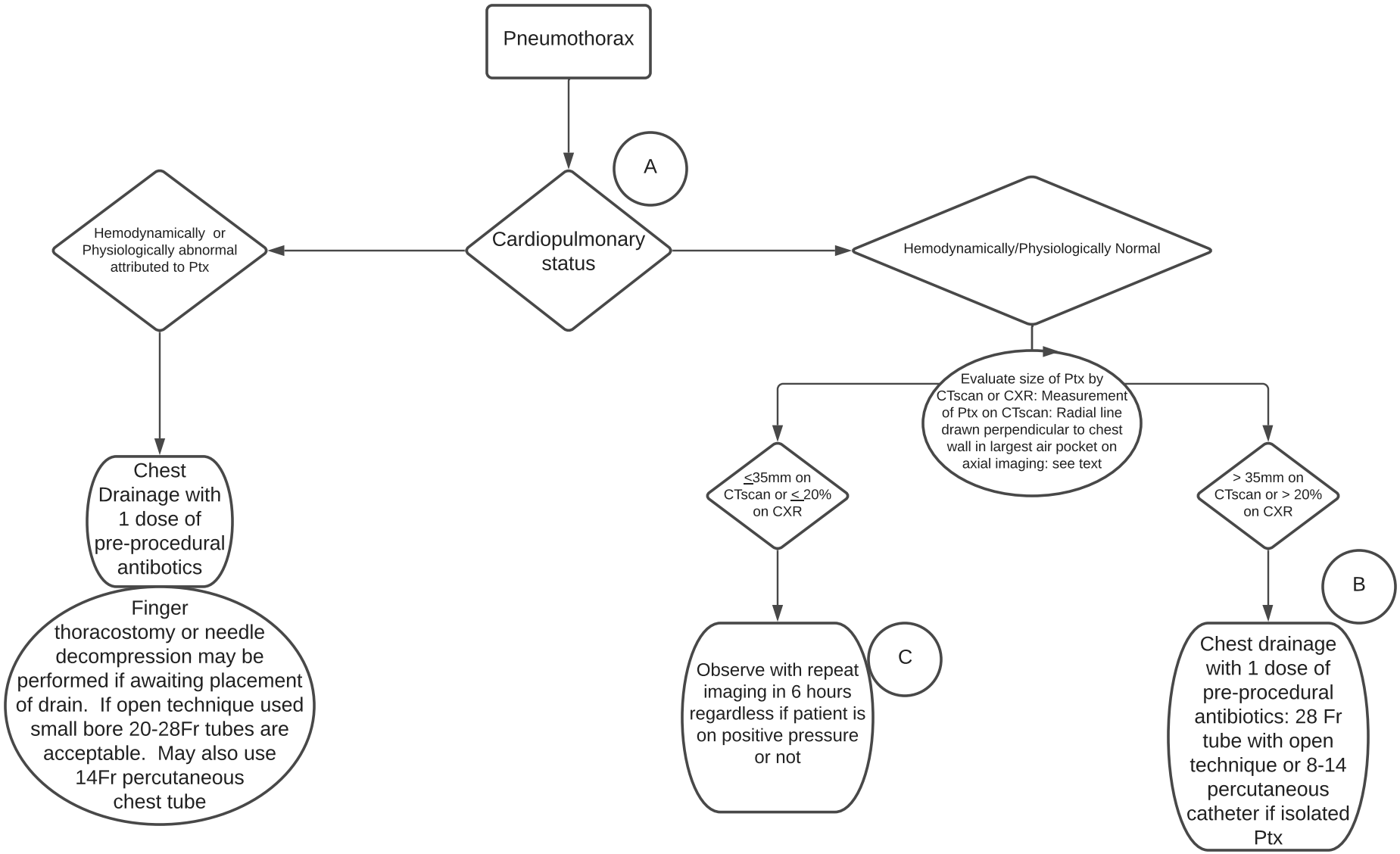
Hospital Day #1

- Consider IMU/ICU admission for elderly patients or if other complicating factors exist
- NPO
- Chest tube to -20 cm H20 suction
- Closely monitor chest tube output and assess for air leak
- Adequate analgesia, **consider Regional Pain Consult for epidural**
- Aggressive pulmonary toilet; weaning parameters BID by RT
- OOB to chair while CT on suction

Hospital Days #2-3

- AM chest x-ray
    - if persistent pneumothorax OR continuous air leak, continue chest tube to suction and monitor (check circuit and evaluate thoracostomy site)
    - if hemo/pneumothorax resolved AND no continuous air leak, place chest tube to straight drainage (waterseal) 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 (see “chest tube insertion/removal” section)
    - if Retained Hemothorax (diaphragm not clearly seen) see “RETAINED HEMOTHORAX” guidelines
- Advance diet
- Adequate analgesia
- Aggressive pulmonary toilet; weaning parameters BID by RT
- OOB to chair while CT on suction; may ambulate while on water seal


Hemothorax
A
Cardiopulmonary Status
Hemodynamically/Physiologically Abnormal attributed to the hemothorax
Hemodynamically/Physiologically Normal
B
D
Size Estimate
Finger thoracostomy; Standard chest drainage is with 28Fr chest tube and consider pleural lavage
Significant Size (>300-500cc estimated size)
Small Size: <300-500cc
Yes
C
E
Assess Drainage (Amount and Effectiveness) Repeat CXR
Chest tube (no difference between small bore or large bore tubes) consider 14Fr to 28Fr chest tubes; pleural lavage
Observe and repeat imaging in 24 hours
Drainage > 1500cc, continuous drainage, or continued instability = Operative Thoracotomy
F
Hemothorax is NOT adequately drained on CXR
Evaluate Effectiveneess of Drainage with repeat CXR
Adequate Drainage
G
H
I
Hemothorax is adequately drained
Assess extent of retained HTX and tube position with CT-scan
Hemothorax is not adequately drained >300-500cc
VATS to be done within 72hrs, if inadequate drainage develops after 72 hours consider VATS vs trial of Thrombolytics
Chest Tube Management


Pneumothorax
A
Cardiopulmonary status
Hemodynamically or Physiologically abnormal attributed to Ptx
Hemodynamically/Physiologically Normal
Chest Drainage with 1 dose of pre-procedural antibotics
Finger thoracostomy or needle decompression may be performed if awaiting placement of drain. If open technique used small bore 20-28Fr tubes are acceptable. May also use 14Fr percutaneous chest tube
Evaluate size of Ptx by CTscan or CXR: Measurement of Ptx on CTscan: Radial line drawn perpendicular to chest wall in largest air pocket on axial imaging: see text
≤35mm on CTscan or ≤ 20% on CXR
> 35mm on CTscan or > 20% on CXR
B
C
Observe with repeat imaging in 6 hours regardless if patient is on positive pressure or not
Chest drainage with 1 dose of pre-procedural antibiotics: 28 Fr tube with open technique or 8-14 percutaneous catheter if isolated Ptx

Hospital Day #4

- AM chest x-ray
  - if persistent pneumothorax OR continuous air leak, continue chest tube to suction and monitor (check circuit and evaluate thoracostomy site)
  - 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 *(see above for chest tube removal guidelines)*
  - if Retained Hemothorax (diaphragm not clearly seen) see "RETAINED HEMOTHORAX" section
- 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 after chest tube removal

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 2 weeks** following clinical and radiographic resolution of a pneumothorax.

- *Bunch A, Duchateau FX, Verner L, Truwit J, O'Connor R, Brady W. Commercial air travel after pneumothorax: a review of the literature. Air Med J. 2013 Sep-Oct;32(5):268-74.*

**** 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 a 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 video- assisted thoracoscopy (VATS), a second tube thoracostomy or intrapleural fibrinolytic therapy. Early VATS (≤4 days: EAST) 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**
  - VATS should be performed after initial chest tube thoracostomy has failed to evacuate a hemothorax.
  - Early VATS has been shown to decrease complications of retained

hemothorax.

- **Level 2**
  - There is no difference in hemothorax evacuation rate using a chest tube greater than 28 French.
  - In patients with *penetrating trauma*, antibiotics with Gram positive coverage are effective at reducing infectious complications of tube thoracostomy including pneumonia and empyema.
  - Chest computed tomography is the gold standard for diagnosing retained hemothorax.

- **Level 3**
  - 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 thoracostomy 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 patients with significant hemothorax (>300-500cc estimated size) 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 Eastern Association for the Surgery of Trauma (EAST) conditionally recommends the use of prophylactic antibiotics for tube thoracostomy placement in trauma Prophylactic antibiotic administration in patients with penetrating and blunt chest injuries that require tube thoracostomy placement was associated with reduced risk of pneumonia and empyema (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 (within 4 days) is superior to a second tube thoracostomy for adequate drainage of retained hemothorax as it decreases rates of empyema, decreases conversion to open thoracotomy, and decreases hospital costs and length of stay.

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).

Role of Fibrinolytic Therapy

- IT should be considered when clinically warranted such as in elderly patient with significant co-morbidities or a critically ill patient unable to undergo surgical intervention. (EAST 2021) IT 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.

  Numerous observational studies have reported success rates of 92-94% for intrapleural fibrinolytic therapy (IT) in resolving undrained retained hemothorax (15-18); however, when compared to early VATS, IT was shown to have a longer LOS. 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.

Blunt Chest Trauma

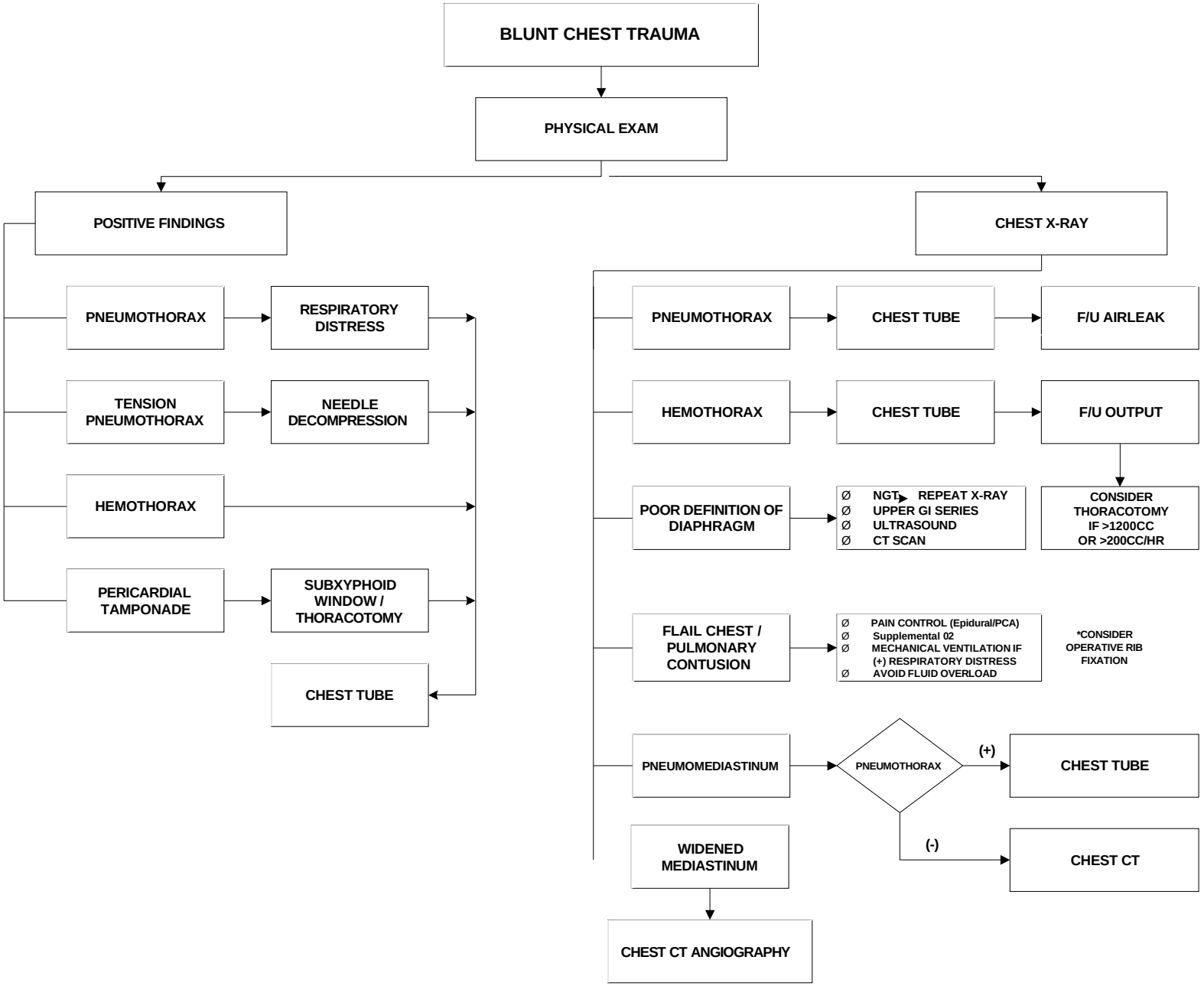


Figure: Blunt Chest Trauma

Chest Tube Insertion/Removal

b. All chest tube insertions are to be supervised by an R3 or above (senior resident must be signed off to supervise procedure per residency requirements) .

c. Unless being placed in a Code situation, sterile technique with a full body drape should be used for all chest tube placements

d. Conscious sedation may be administered to awake patients under the direct supervision of a Trauma fellow or attending.

e. 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 removed

f. For incomplete evacuation of a hemothorax, early VATS (Video Assisted Thoracoscopic Surgery) should be considered. See "RETAINED HEMOTHORAX" section

g. Chest tube Removal

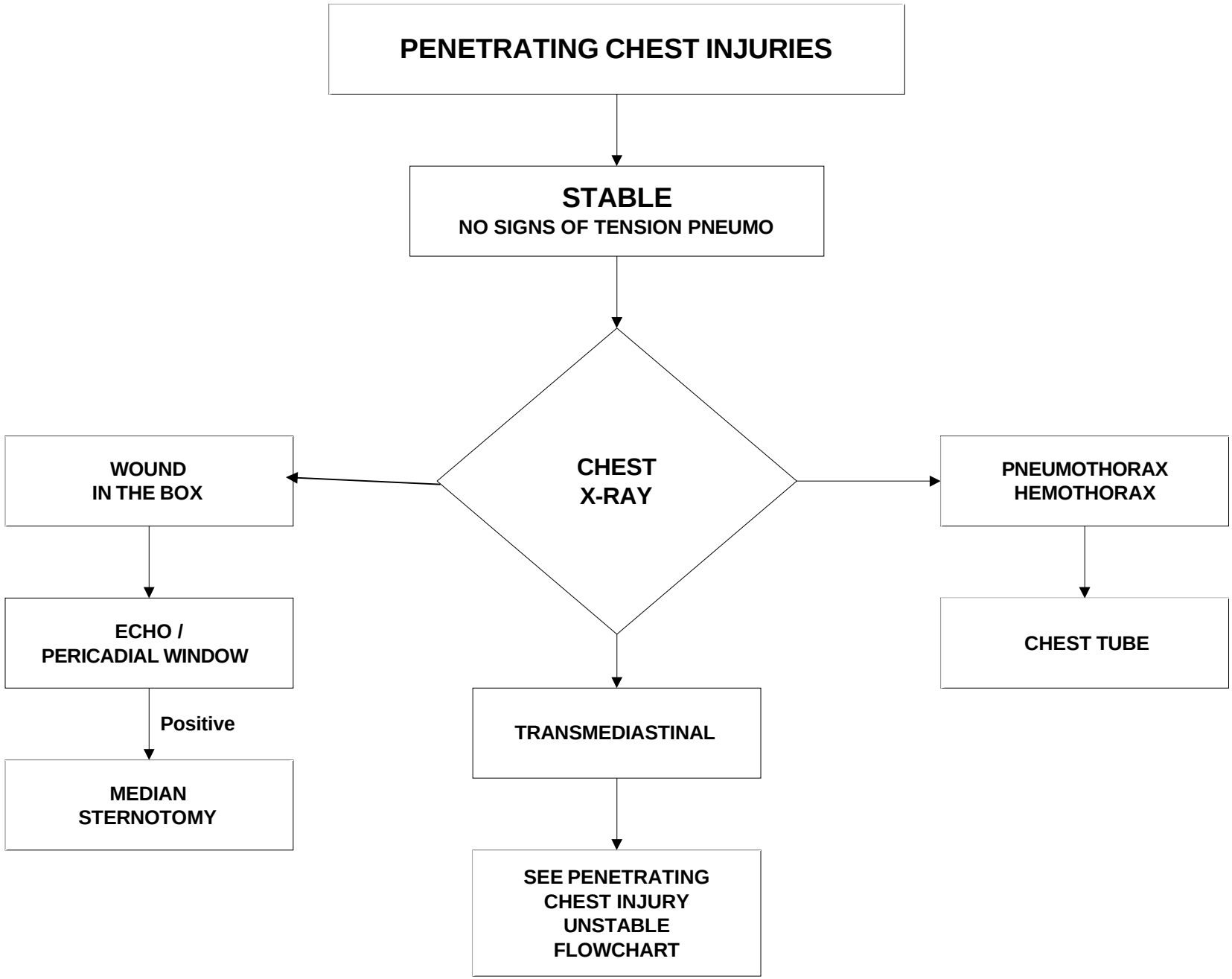
- Chest Tube Removal can be performed by attending, fellow, APP or R2 and above)
- Obtain CXR after removal of chest tube to confirm the absence of recurrence pneumothorax

RIB FRACTURE MANAGEMENT PROTOCOL

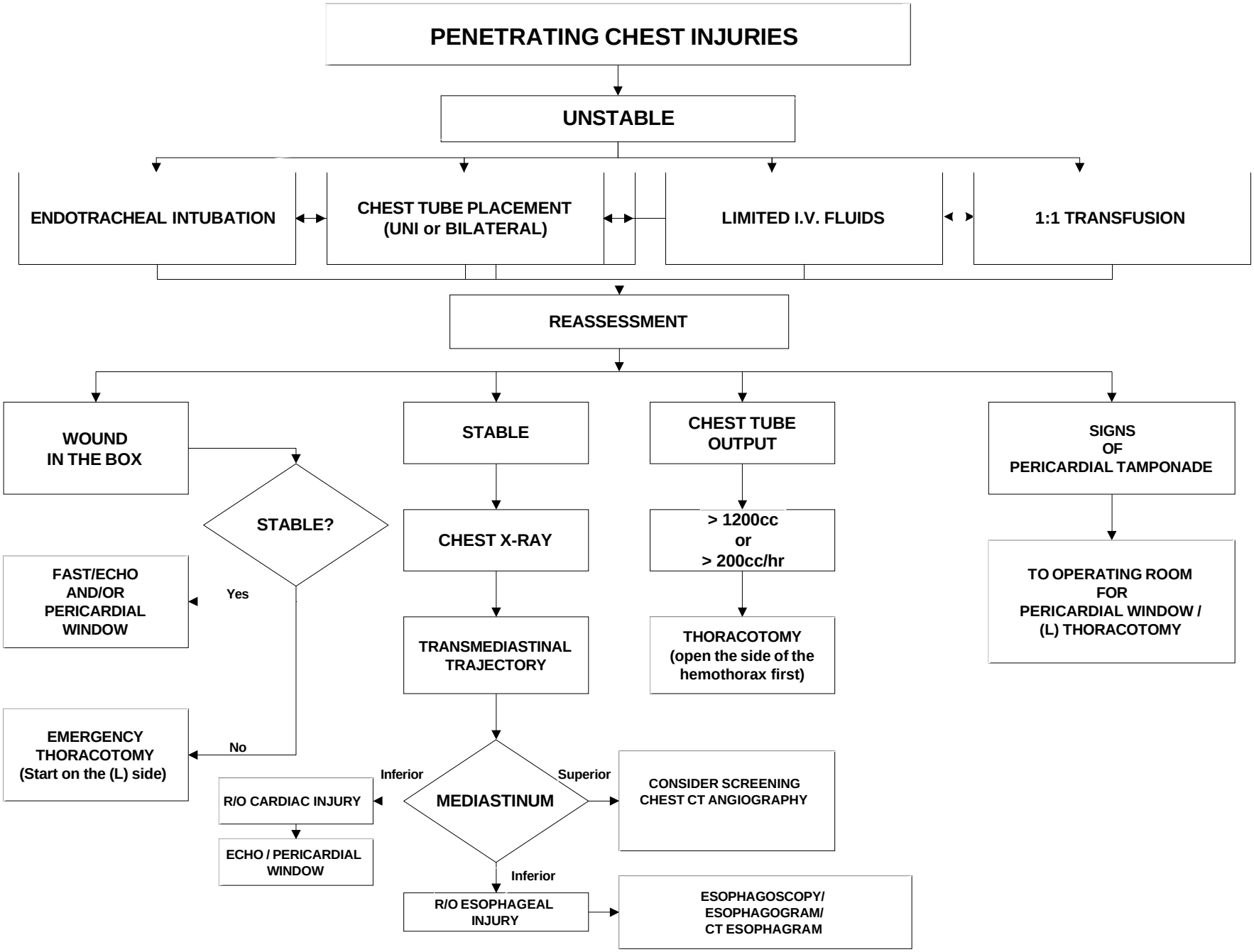
Respiratory Interventions and Monitoring	
Respiratory Therapist	Intake assessment, set Incentive Spirometer Goals with <6 hours admission (< 1 hour in ICU)
	Set IS goal level of 80% of inspiratory capacity and alert level of 15 ml/kg (maximum 1500ml)
Nursing	Elevate HOB 30 degrees
	Educate patient in 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: • Home meds and psychotropic meds • Gabapentin • Acetaminophen, oral or IV • Lidocaine patch • Ketorolac IV or celecoxib oral • PCA or Oral opioid
	Consult **REGIONAL Pain service for CYROBLOCKS**, consider epidural if pain not controlled after 6-8 hours
	Careful consideration of geriatric patients who may not tolerate multimodal systemic analgesia
Team	Team is notified of patients with severe pain, poor cough or poor Notification incentive spirometry performance
ICU admission	Patients over 65 with ≥3 rib fractures are admitted to SICU, in addition to standard indications

After Cordelie E Witt, and Eileen M Bulger Trauma Surg Acute Care Open 2017;2:e000064

Penetrating Chest Trauma



Penetrating Chest Trauma-Stable



Penetrating Chest Trauma-Unstable

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.

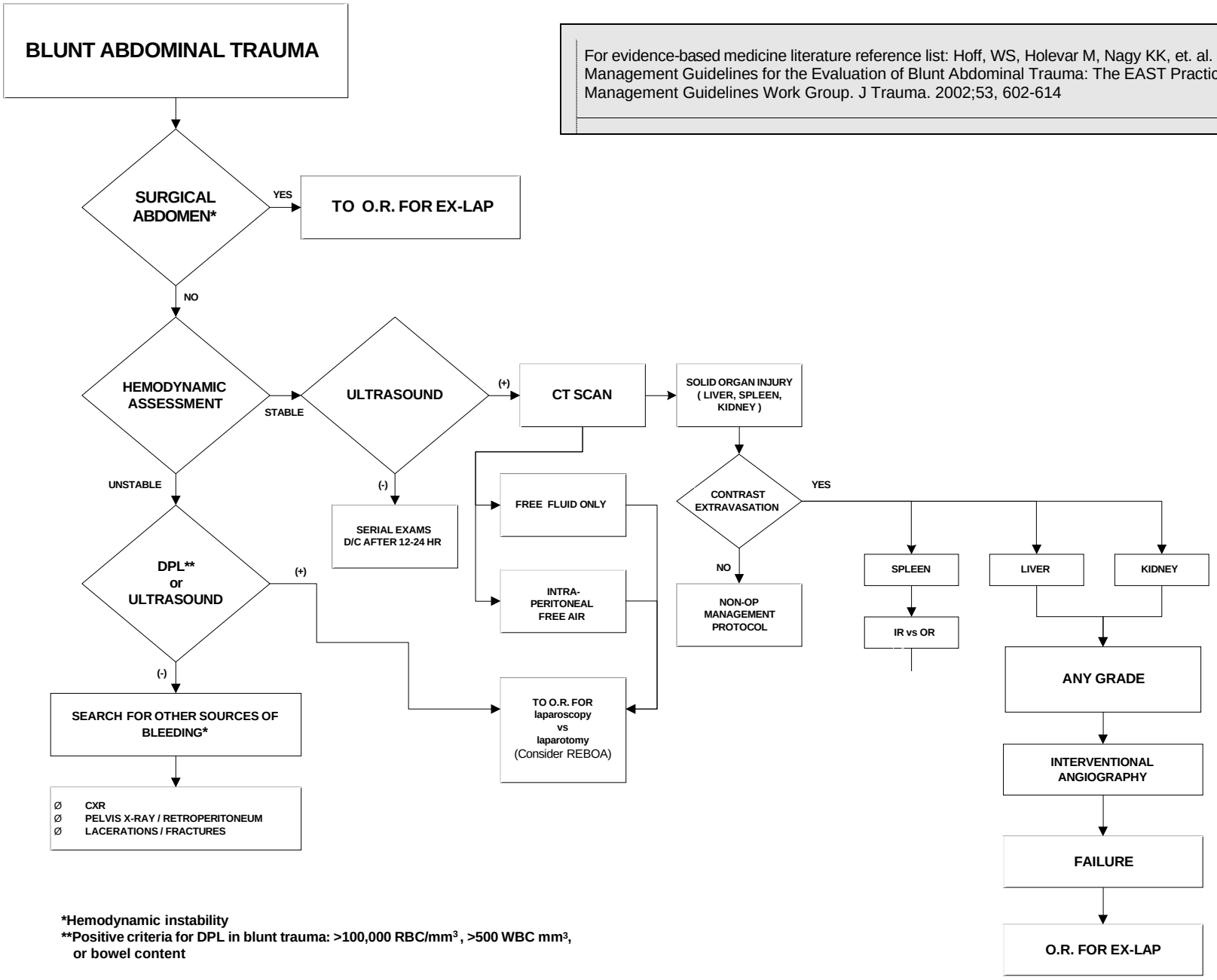
Starting POD#3:

- Colchicine 0.5mg BID (for patients >=70kg) or Colchicine 0.5mg daily (if <70kg)
- 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



For evidence-based medicine literature reference list: Hoff, WS, Holevar M, Nagy KK, et. al. Practice Management Guidelines for the Evaluation of Blunt Abdominal Trauma: The EAST Practice Management Guidelines Work Group. J Trauma. 2002;53, 602-614

***Hemodynamic instability**
****Positive criteria for DPL in blunt trauma: >100,000 RBC/mm^3, >500 WBC mm^3, or bowel content**

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

1. ATLS protocol; work-up as mechanism and presentation dictate
2. Patient *must be hemodynamically stable*
3. CT abdomen/pelvis with contrast delays (FAST may but done in addition but all patients should receive CT with contrast)
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 AAST grade I or II injuriesto expedite the hospital course as appropriate and tolerated by the patient

iii. Repeat imaging of liver injuries Grade 3 or higher with CT Angiogram abdomen/pelvis 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 2 weeks from discharge; additional follow-up at discretion of Trauma Attending

Restricted activity suggestion (limited evidence):

Injury Grade	Injury Type	Activity Restriction
Grade I	Hematoma	1 week
Grade II	Hematoma	6 weeks
	Laceration	4 weeks
Grade III	Hematoma	16 weeks
	Laceration	5 weeks
Grade IV	Laceration	12 weeks

E. **Disposition**

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

Per PT/OT recommendations

Typical NOM Flow of High-grade (AAST Grade III-V) Liver Injury
(*N.B.: low quality evidence)

	Day 1 (0-6 hours)	Day 1 (7-24 hours)	Day 2	Day 3	Day 4-5
Location	**SICU**	SICU	IMU	IMU	Med/surg
Diet	**NPO**	clears	DAT	DAT	DAT
Activity	AAT Pulmonary toilet	AAT Pulmonary toilet	AAT Pulmonary toilet	AAT Pulmonary toilet	AAT Pulmonary toilet
Vitals	**Q1h**	Q1H	Q2H	Q4H	Routine
Labs	**On admission**	Q12h	daily	daily	daily
DVT	SCDs Duplex protocol	SCDs Duplex protocol	LMWH Duplex protocol	LMWH Duplex protocol	LMWH Duplex protocol
Disposition					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 ≥ 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.

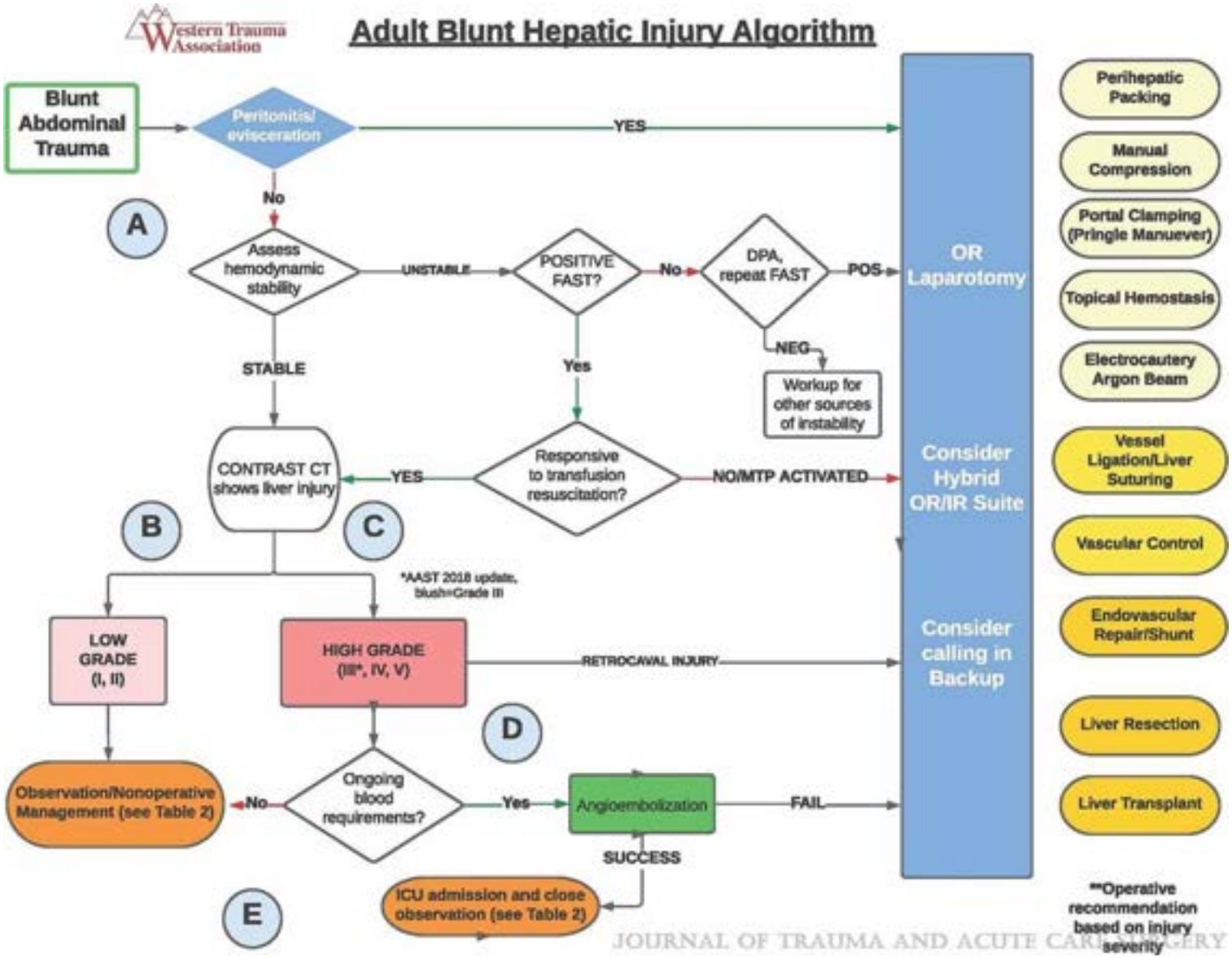
C. Discharge Planning

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.

Management Blunt Hepatic Trauma (WTA 2023)



Blunt Hepatic Trauma Decision Points (WTA 2023: DOI: 10.1097/TA.0000000000004141)

A. Initial Assessment
Initial evaluation of all adult patients with blunt abdominal injury should follow the principles outlined in Advanced Trauma Life Support. If there is peritonitis or evisceration on physical examination, the patient should be taken emergently to the operating room for an exploratory laparotomy. Unstable patients should undergo continued resuscitation and rapid evaluation to determine the source of hemodynamic instability. In the unstable patient, with signs on physical examination of intra-abdominal hemorrhage or a positive Focused Assessment with Sonography in Trauma (FAST) examination, immediate laparotomy is warranted. An equivocal or negative FAST examination should prompt ongoing evaluation for hemorrhage with either a repeat FAST examination or a diagnostic peritoneal aspiration (DPA), which has utility in unstable blunt trauma patients with no other obvious sources of instability. Patients who have a positive FAST examination or DPA and who remain unstable despite aggressive blood product resuscitation should also go emergently to the operating room. If a repeat FAST examination or DPA is negative, workup for other sources of hemodynamic instability should continue. Computed tomography (CT) imaging after an emergent operative intervention could help identify additional injuries, even if they might not warrant subsequent interventions.7,8 Patients with a positive FAST examination who are responding to blood transfusion resuscitation using contemporary hemodynamic monitoring and end points of resuscitation should undergo contrast-enhanced CT imaging.

B. Management of Low-Grade Liver Injuries (AAST Grades I and II)
In hemodynamically normal patients with low-grade liver injuries and no other injuries requiring operative intervention, observation and nonoperative management are the treatment of choice. Patients with low-grade injuries generally do not require intensive care unit (ICU) admission and should undergo serial clinical evaluation and scheduled or on-demand hematocrit testing for at least 24 hours (Table 1).

C. Management of High-Grade Liver Injuries (AAST Grades III, IV, and V)
The revised Organ Injury Scale for liver injury in 2018 incorporated CT-diagnosed vascular injury (contrast blush, pseudoaneurysm, or arteriovenous fistula) to the existing imaging criteria. Any injury, in the presence of a liver vascular injury or active bleeding in the liver parenchyma, is defined as at least an American Association for the Surgery of Trauma Grade III injury.10 An injury with active bleeding extending beyond the liver parenchyma into the peritoneum is considered a Grade IV injury. Patients who are severely injured with a high-grade liver injury and have hemodynamic instability after initial resuscitation (transient responders) would benefit from being in a hybrid operating suite with both major operative and interventional radiology capabilities.11

Simple maneuvers to control bleeding should first be used, such as perihepatic packing and manual compression. If packing fails to control the bleeding, the next step is the Pringle maneuver, which can help identify the anatomic injury. Bleeding that is controlled with the clamping of the porta hepatis is likely coming from the parenchyma, and hemorrhage can be controlled with electrocautery or argon beam coagulator, or vessel ligation with sutures or staplers. If bleeding continues despite portal triad clamping, it is likely arising from the hepatic veins, which need to be ligated, or from the retrohepatic inferior vena cava. At any point, the surgeon should consider calling an experienced colleague for intraoperative assistance and/or intraoperative consultation with a hepatobiliary specialist surgeon. Injury to the hilar structures, severe fractures, or total hepatic avulsion may require liver resection, portocaval shunt, or, in rare extreme circumstances, a liver transplant. Transfer to a transplant center should be considered if there are no available resources in the face of a devastating liver injury.

Patients who have sustained a high-grade liver injury and have responded to initial resuscitation may be considered for nonoperative management in select settings with availability of resources such as angiography. The role of angioembolization in the management of blunt hepatic injury continues to be controversial and nuanced. Recent literature suggests that the use of angioembolization in severe hepatic injuries is associated with decreased mortality, especially for patients who also undergo an exploratory laparotomy. Complications after angioembolization are not insignificant, and there is still no consensus on whether injuries with a "contrast blush" (free extravasation of contrast suggesting active hemorrhage) need immediate angiographic embolization. Most experts agree that angioembolization is indicated for hepatic trauma as an adjunct to nonoperative management in hemodynamically stable patients with evidence of ongoing hemorrhage. Patients with high-grade liver injuries should be admitted to the ICU for continued observation.

D. Nonoperative Management

Most patients, including those with a high-grade blunt hepatic injury and hemodynamic stability can be managed successfully with nonoperative management.1,13,16 A recent systematic review reports failure rates of nonoperative management up to 9.5%. Hemodynamic instability, missed associated intra-abdominal injuries, and presence of peritoneal signs have been found to be significant risk factors for failure of nonoperative management. Many studies have reported a higher risk for failure of nonoperative management in high grade injuries, but to date, data are lacking to support grade of injury as an independent risk factor. Despite an improvement in mortality with modern management, morbidity rates of more than 50% have been reported with high-grade liver injuries.16 Potential complications of nonoperative management include delayed hemorrhage, bile leaks, hemobilia, bile peritonitis, bilious ascites, hemoperitoneum, hepatic abscess, and hepatic necrosis. Hepatic bleeding tends to occur early, and although the incidence of delayed hemorrhage is low, it continues to be the most common complication and cause of mortality in nonoperative management.

Complications After Nonoperative Management

Angioembolization has become the mainstay of hemorrhage control in patients who are hemodynamically stable with reported efficacy rates of 83%.13 Rebleeding after initial successful embolization has been reported to occur in 5% to 12% of cases. The majority of these rebleeding episodes occur within the first 24 to 48 hours postangioembolization, and thus, careful observation and monitoring during this timeframe are essential.

The incidence of hepatic complications after angioembolization is 40% to 70%. One of the more common complications is hepatic necrosis, with risk up to 43%.15,16,18,19 One study has found major hepatic necrosis in up to 63% of patients who underwent embolization, which correlated with grade of liver injury. Several other studies have also demonstrated hepatic necrosis rates increasing with higher grades of injury.

Biliary complications can occur in up to 22% of patients after angioembolization. However, such complications are not always specific to angioembolization and can occur in up to 30% in patients with hepatic trauma managed without embolization, either operative or nonoperative.1,16,18,19 Biliary complications develop later (mean of 12 days post injury) and can generally be managed nonoperatively with endoscopic retrograde cholangiopancreatography, percutaneous drainage, and endobiliary stents.1,16 Bile peritonitis may require operative washout and drainage, which can be achieved laparoscopically or via laparotomy.1

Development of a hepatic abscess in the setting of nonoperative management is rare with reported rates of up to 7%; however, significantly higher rates up to 22% have been reported after angioembolization.1,16,19 Perihepatic abscesses are usually

successfully managed by image-guided percutaneous drainage.1 Risk factors contributing to hepatic complications after angioembolization are multifactorial and difficult to define given the lack of a randomized control study.15,19

E. Post Admission Management

There is a paucity in the literature regarding the specific details of postinjury management including the duration of observation, need for serial abdominal examinations, frequency of laboratory measurements, timing to initiate feeding, required period of bed rest, and use of chemical VTE prophylaxis.

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 grades 1-2 may be monitored in the IMUS. AAST grade III-V injuries should be admitted to the SICU for monitoring (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 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:

- <u>All patients with Grade III-V splenic injury that were managed non-operatively should undergo CT angiogram approximately 72 hours after injury</u> to evaluate for splenic pseudoaneurysm. Any pseudoaneurysms identified should be evaluated by Interventional Radiology for possible treatment with angioembolization. (*N.B.: low quality evidence)

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**
2-5 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. ***Approximately 72 hours after injury a repeat CT abd/pelvis for all patient with ≥ Grade 3 lacerations*, if pseudoaneurysm found patient should proceed to splenectomy.***
    - ***If proximal embolization was performed on admission repeat imaging not required to evaluate pseudoaneurysm.***
    - ***(*N.B. low quality evidence):***

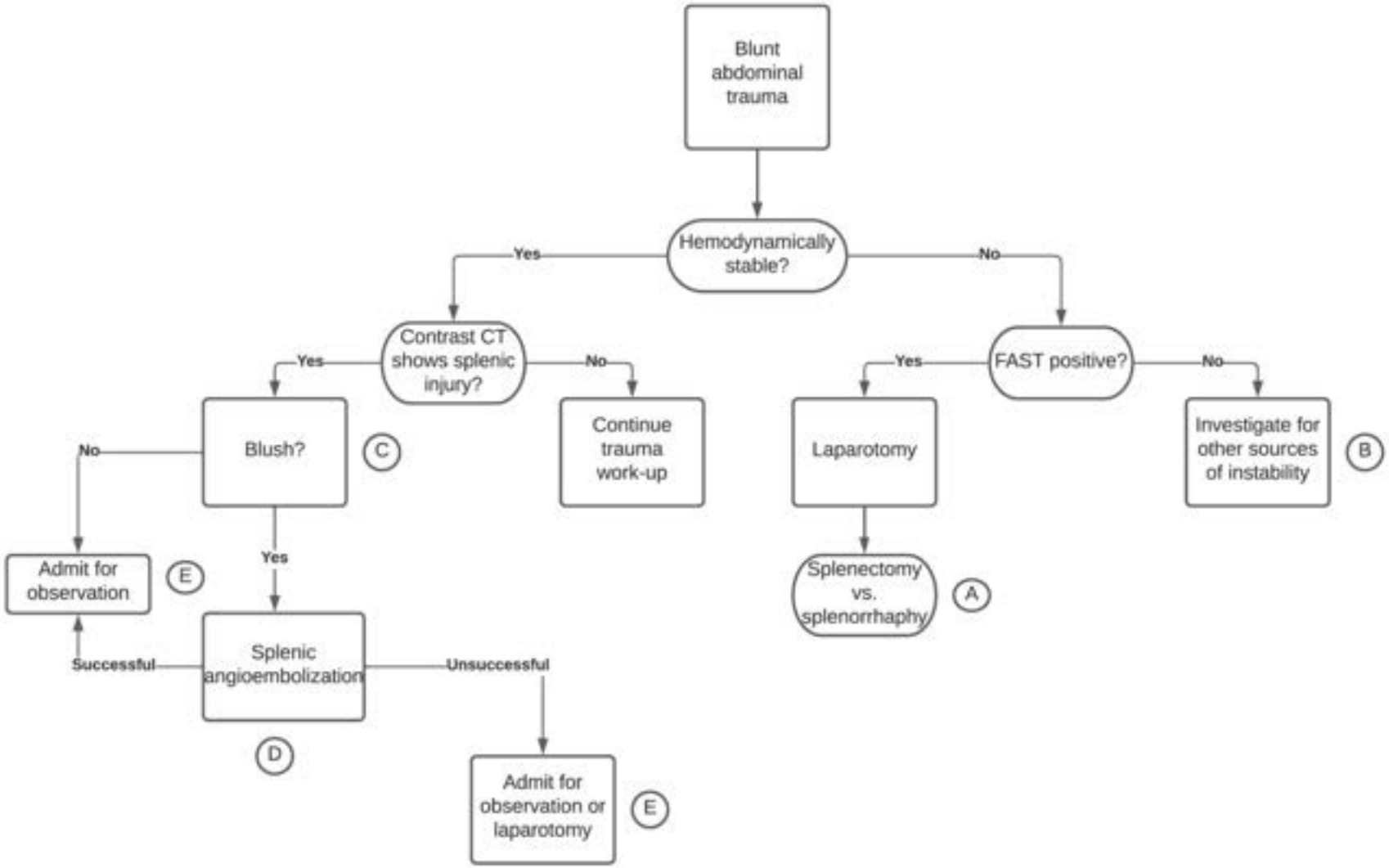
ii. See **NOM of Splenic Injury**

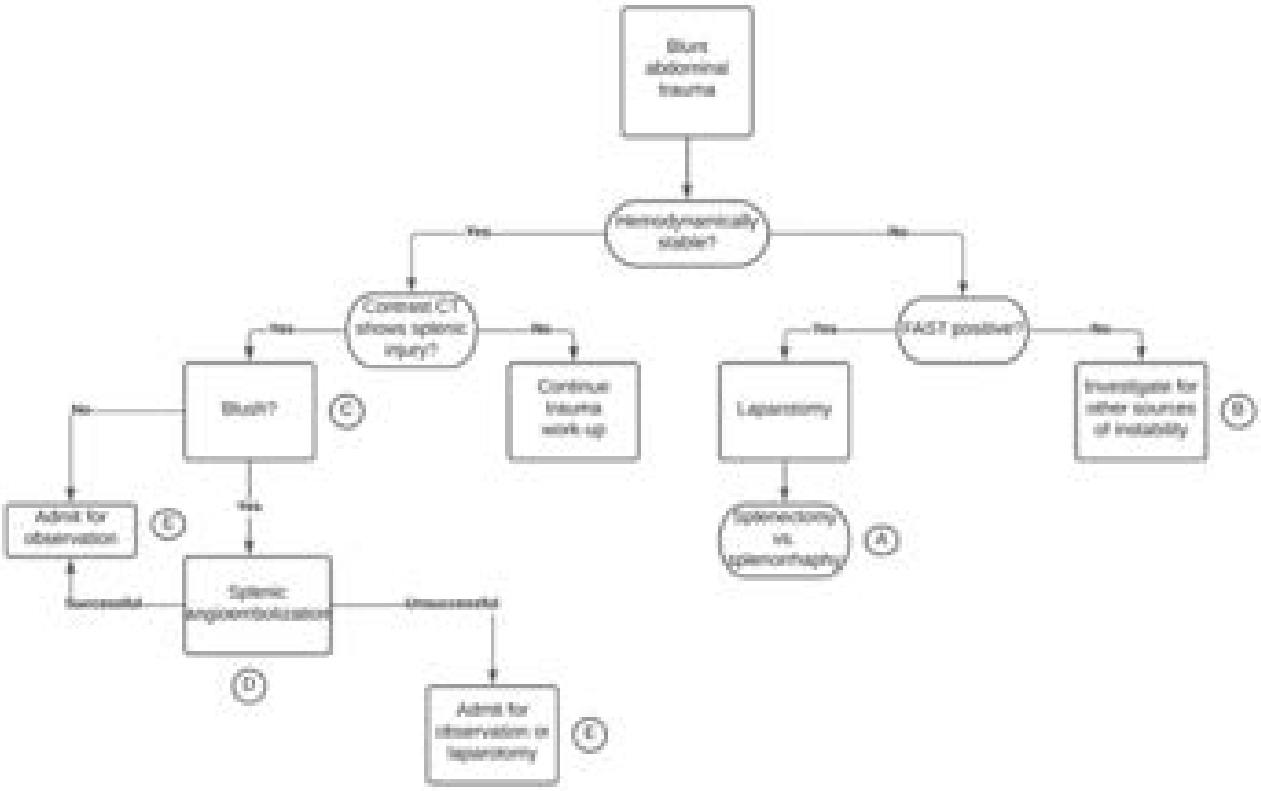
D. **Discharge Planning**
Regular diet
Clinic follow-up q1-2 weeks x4 weeks; every month thereafter or at discretion of Trauma Attending
Restricted activity suggestions (N.B.: low quality evidence):
- For grades 1-2 may return to activity after 2 weeks. No sports for 6 weeks
- For Grades 3-5 may return to activity after 4 weeks. Minimum 6 weeks for any sports or strenuous activity or longer at discretion of Trauma Attending

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

Table: Suggested Flow- Non-operative Management of Splenic Injury Plan

	Low Grade	**High Grade**
AAST Grade	**I-II**	**III-V**
ICU	No	yes
Labs (cbc)	Q12h until stable x2	Q12h until stable x2
monitoring	Vitals q4	Continuous HR, Q1 BP
Diet	Clear liquids x 12h	NPO x12 h
DVT prophylaxis	Start within 24h in the absence of major hemorrhagic component	Start within 24-48 h of stable hemoglobin
Follow Up CT scan	Only when decrease hgb observed	72 hours after injury
Discharge Criteria	Stable hgb, 24 h from injury, tolerating PO	Stable repeat CT, stable hgb, tolerating PO
Return to Activity	2 weeks, 6 weeks for all sports and strenuous activity	4 weeks, minimum 6 weeks for all sports and strenuous activity or longer based on surgeon discretion


Blunt abdominal trauma
Hemodynamically stable?
Yes
No
Contrast CT shows splenic injury?
Yes
No
Continue trauma work-up
Blush?
C
No
Yes
Admit for observation
E
Splenic angioembolization
Successful
Unsuccessful
D
Admit for observation or laparotomy
E
FAST positive?
Yes
No
Laparotomy
Investigate for other sources of instability
B
Splenectomy vs. splenorrhaphy
A



A. Laparotomy The initial evaluation of all blunt abdominal trauma patients begins with a systematic examination and simultaneous resuscitation. Unstable patients should undergo an extended focused assessment with sonography in trauma (FAST) examination to determine if the source of hemodynamic instability resides within the abdominal cavity. If the FAST examination shows free intraperitoneal fluid, the unstable patient should be taken for emergent laparotomy, with appropriate splenic management as needed. If the patient responds quickly to fluid resuscitation, CT scanning can be considered, although with careful monitoring and a low threshold for immediate surgery
B. B. Splenectomy versus splenorrhaphy for those who proceed promptly to laparotomy, if a splenic injury is encountered, the decision between splenectomy and attempts at splenorrhaphy are dictated by the extent of damage to the spleen, the degree of continued hemodynamic instability, and the presence of associated injuries. Hemodynamically unstable patients who do not respond to initial resuscitation or require ongoing rapid blood transfusion should undergo expedient removal of the spleen. Although most patients who require laparotomy for hemorrhage control will require splenectomy, an occasional patient may be amenable to splenic salvage techniques, including suture repair, mesh, thermal coagulation with electrocautery or argon beam laser coagulation, or hemostatic agents such as thrombin, fibrin glue, or commercial agents such as TachoSil Fibrin Sealant Patch (Takeda Pharma A/S, Vellensbaek Strand, Denmark).1,2 The need for ongoing anticoagulation/antiplatelet therapy, for example, recent coronary stent, high-grade blunt carotid, or vertebral artery injury, may also become important in the decision making process for splenectomy versus splenorrhaphy. Assessment of the coagulation status of the patient should be considered as well.

C. C. Investigate for other sources of instability While a negative FAST examination does not entirely exclude an intra-abdominal organ as the source of hemodynamic instability, the lack of intraperitoneal fluid should lead to an expanded search to include other sources including neurogenic, cardiogenic, and obstructive etiologies. Workup should include lactate and/or base deficit analysis, chest and pelvis x-rays, extended FAST/bedside echocardiogram, and electrocardiogram. Abnormalities found on these ancillary examinations may better

D. direct appropriate resuscitation efforts. Simultaneous resuscitation following massive transfusion guidelines may return the patient to at least temporary hemodynamic stability and, with due caution, may provide a window during which CT imaging of the torso can be a viable option to identify additional, or alternate, sources of instability. D. Blush? Hemodynamically stable patients typically undergo contrast enhanced CT imaging shortly after their initial evaluation and resuscitation in the trauma bay. If no splenic injury is noted, the standard trauma workup should continue. If a splenic injury is seen, three important findings are critical: (1) the grade of the injury, (2) the presence of splenic vascular injury (pseudoaneurysm, arteriovenous fistula, or contrast extravasation), and (3) the degree of hemoperitoneum. The original American Association for the Surgery of Trauma (AAST) organ injury scoring system for splenic injuries in 1989 was based on the amount of hematoma and parenchymal disruption.3 The 2018 revisions not only incorporated imaging, operative, and pathologic criteria but also included vascular injury (Table 2).4 Any injury that includes evidence of pseudoaneurysm, arteriovenous fistula, or free extravasation (active bleeding) becomes a Grade IVor V injury. The specific inclusion of vascular injury and designation as a high-grade injury has eliminated prior debate regarding the need to embolize low-grade injuries despite the presence of contrast extravasation. Hemodynamically stable patients with no evidence of vascular injury may be considered for admission and observation.

E. (E) Hemodynamically stable patients with high-grade injuries defined by the presence of a vascular injury should undergo angiography and embolization of abnormal structures. In addition, data do exist to suggest that higher-grade injuries (III–V) even without evidence of vascular injury may have improved nonoperative failure rates with preemptive or prophylactic splenic angioembolization (SAE).4,5 Failure of nonoperative management of Grades III to V blunt splenic injuries without embolization has been reported as high as 31%, compared with 5% in patients who underwent embolization whether a vascular injury was identified on CT.6,7 Conversely, one large, prospective multi-institutional European study randomized patients with high-risk BSI (Grades III–V) to prophylactic SAE versus surveillance with SAE as needed and showed an equivalent splenic rescue rate (98.2% vs. 93.3%, respectively; p = 0.37) at 1 month.8 E. Admit for observation While embolization is recommended for Grade IV and V injuries, admission and observation alone can generally safely be recommended for Grades I and II splenic injuries. The management of Grade III injuries is debatable. A recent meta-analysis of three prospective and 20 retrospective studies (no randomized controlled trials were available) showed no significant difference in the risk of treatment failure using nonoperative versus SAE techniques in Grade III injuries.9 With no demonstrable benefit seen with embolization of Grade III injuries, the authors suggested that these patients can be admitted and observed closely. Failure of nonoperative management of splenic injuries can result from a variety of coexisting conditions. Many predictive factors of failure have been suggested, such as older age defined as greater than 40 to 55 years, high Injury Severity Scores (>25), higher-grade splenic injury (Grades III–V), patients taking anticoagulants at the time of injury, subcapsular hematoma in any grade, and moderate to large hemoperitoneum.10–13 In an Eastern Association for the Surgery of Trauma multi-institutional study of 1,488 adults with splenic injuries, 61% of the patients who suffered failure of nonoperative management did so within 24 hours of admission. Detailed analysis of these patients in a subsequent study identified that 30% to 40% of these patients were selected inappropriately for nonoperative management, with underlying hemodynamic instability or misinterpretation of initial diagnostic studies.15 In addition, most of the study deaths were a result of delayed treatment of intra-abdominal injuries. These observations emphasize the importance of clinical vigilance when selecting patients for nonoperative management of splenic injury. Clinical judgment and close hemodynamic monitoring are required to prevent potential catastrophic consequences in any patient undergoing observation-only

management, particularly those with severe TBI or physiologic frailty. Available resources should also be considered in the decision for observational management.

F. Splenic angioembolization Patients with splenic vascular injuries (Grade IV or V) carry a high failure rate of nonoperative observational management and should therefore undergo either operative management in unstable patients or AE for stable patients.16–19 Stable patients with CT evidence of vascular injury should undergo angiography and main splenic artery or selective embolization of the damaged vessel(s). Those with multiple scattered lesions may require main splenic artery embolization. Clinical judgment regarding embolization should be used in patients with CT evidence of injury but without active contrast extravasation on angiography.

G. Observation or laparotomy Following successful SAE, patients can be admitted for observation (E), while those with questionable success should be observed closely or, in cases of hemodynamic instability, should lead to splenectomy. (G) Although hemorrhage control can be successful, some patients will undergo laparotomy and splenectomy due to ongoing and concerning abdominal pain and tenderness from hemoperitoneum, splenic ischemia, or rebleeding

H. AE capabilities not available Facilities without access to AE capabilities may consider the transfer of the patient to a center that does have the resources, but very careful thought must be given regarding the movement between hospitals of a patient who is actively bleeding or has other life-threatening injuries. If it is deemed safer that the patient remains in the originating hospital, the decision then must be made between splenectomy versus very close observation. If the latter is chosen, the surgeon should commit to a low threshold to operate.

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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 (hove vs. SNF vs. rehabilitation).
Per PT/OT recommendations

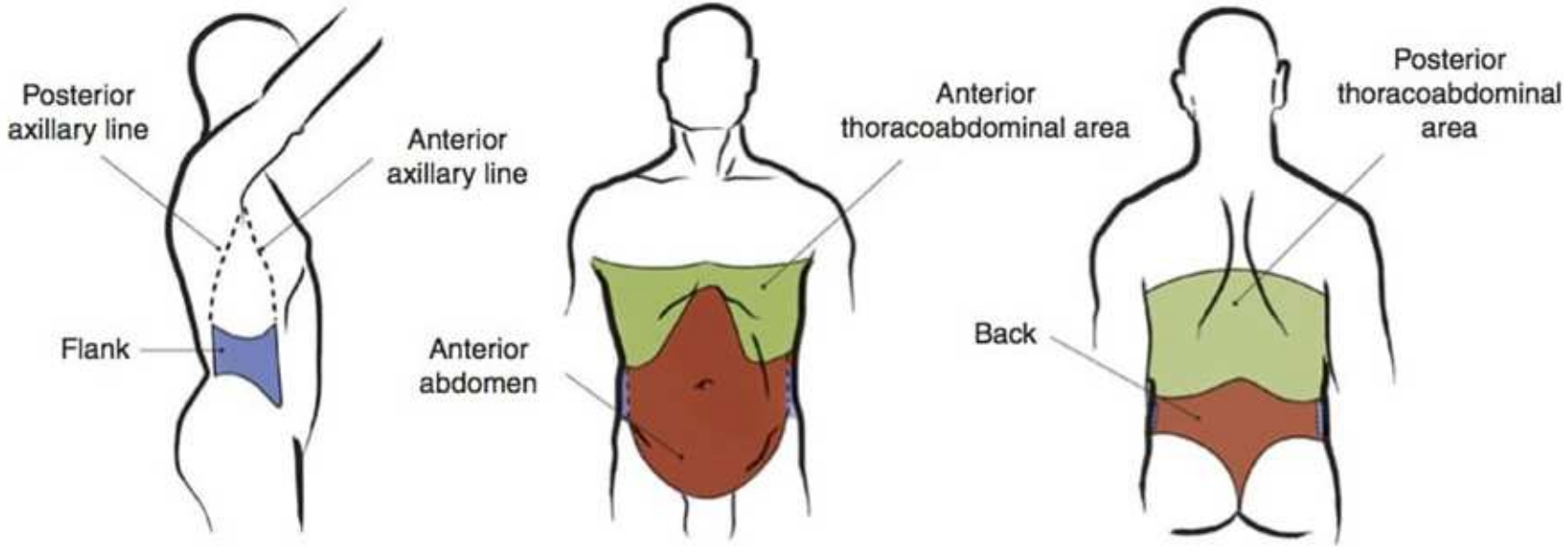
Table: Suggested Flow - Operative Management of Splenic Injury

	Day 1	Day 2	Day 3	Day 4	Day 5
Location	SICU/IMU	SICU/IMU	IMU	IMU/Floor	Floor
Diet	NPO/NGT	Sips/CF	CF/DAT	DAT	DAT
Activity	Up to chair Pulmonary toilet	Up to Chair Pulmonary toilet	AAT Pulmonary toilet	AAT Pulmonary toilet	AAT
Vitals	Q4-6H	Q6H	Q6-8H	Routine	Routine
IV fluids	Yes	Yes/No	No	No	No
Labs	Q6H-Q12h	Q12H	BID-QD	QD	QD
DVT	SCDs Duplex protocol	LMWH 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. Quadravalent meningococcus (Menactra or Menomune)
2. Pneumococcus (Pneumovax 23)
3. H. influenzae B (HIB, ActHiB)
4. Viral Influenza vaccine

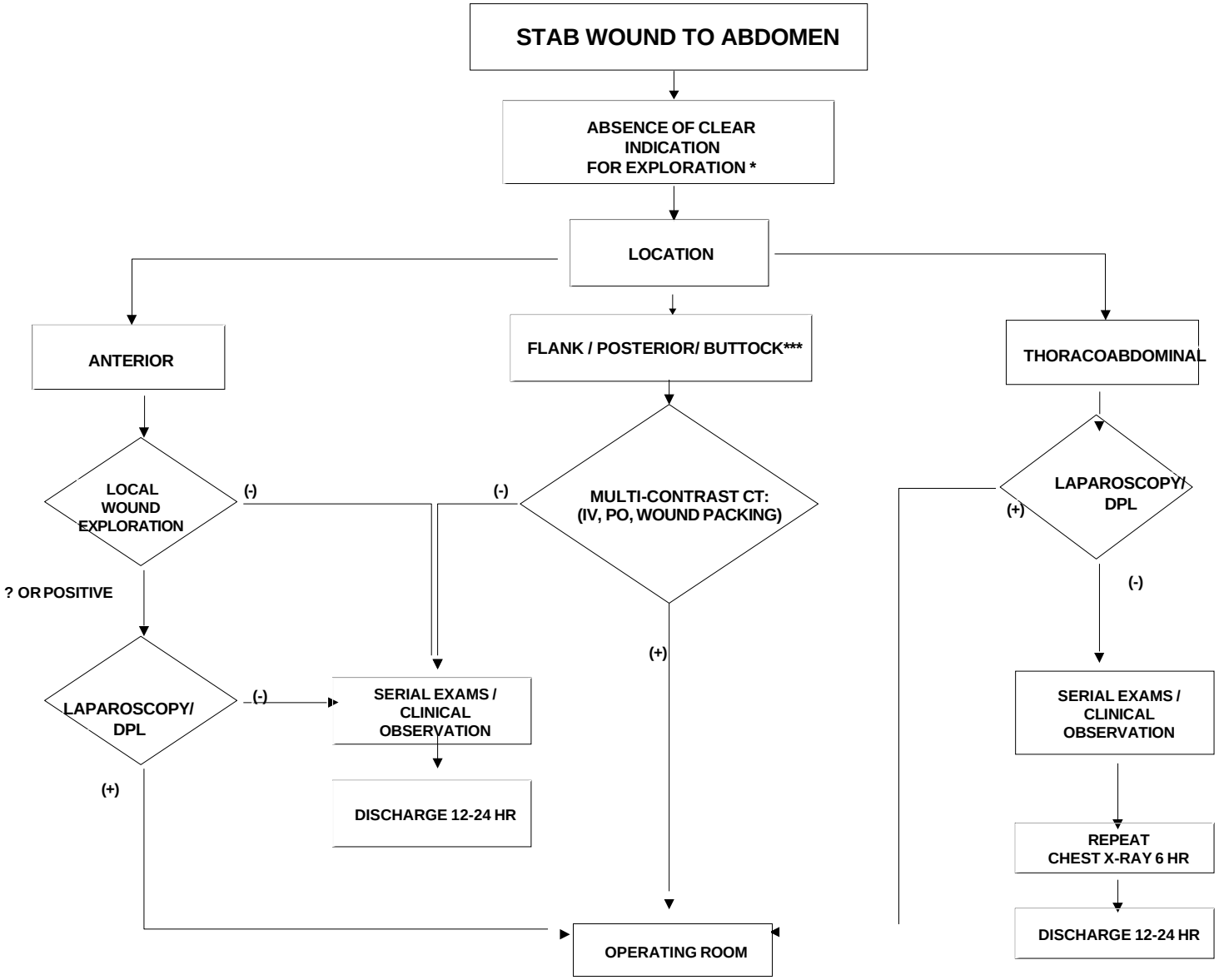
PENETRATING TRAUMA – STAB WOUND / DIAPHRAGM EVALUATION



- 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: consider 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.

Jan 2021

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/mm^3

***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

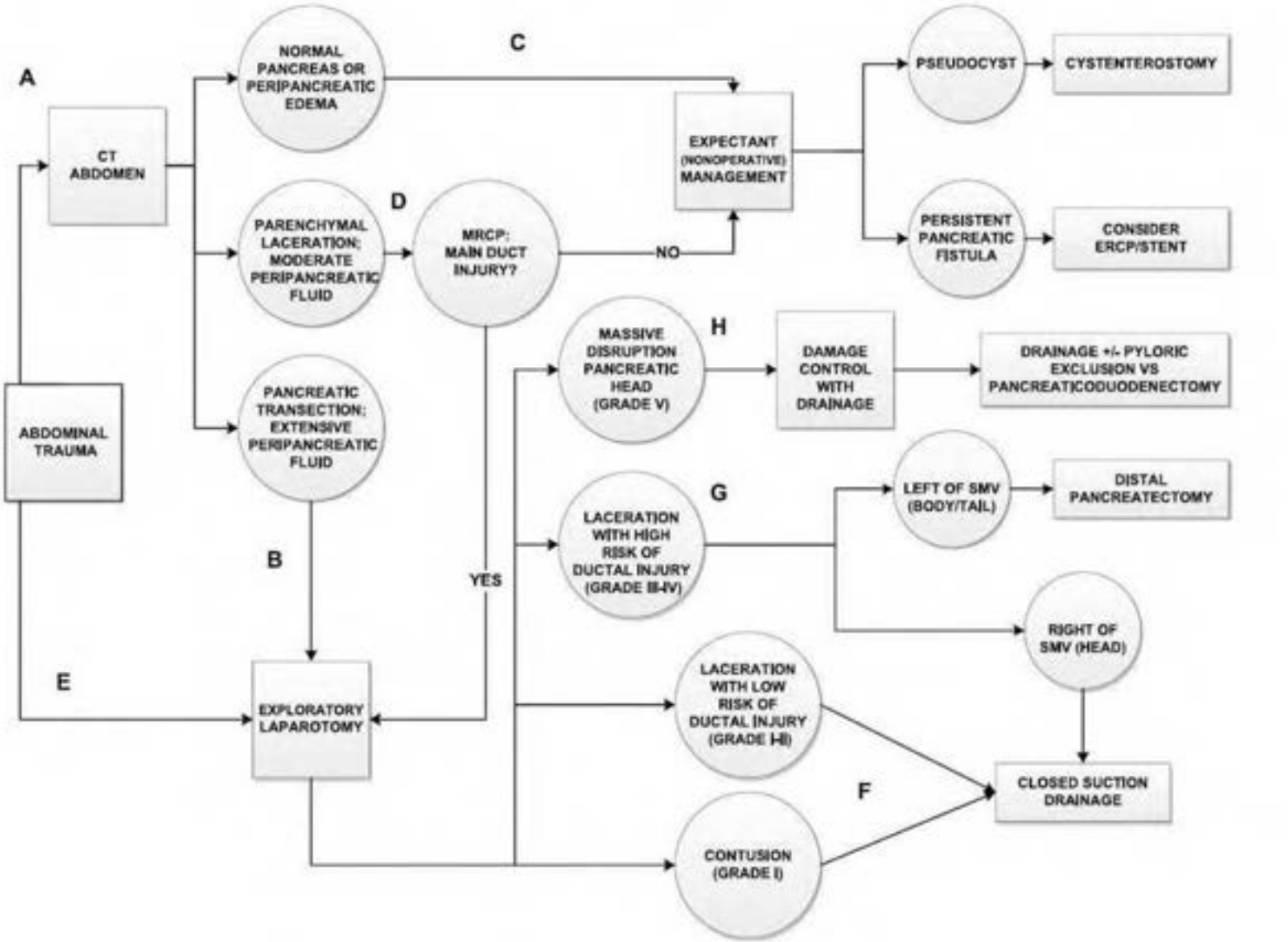
D. **Discharge Planning**

- 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

- 2-7 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 grade 3 and above solid organ injuries
  ii. Serial CBC, coags
  iii. Consider IR consult for angioembolization
  iv. Patient must be hemodynamically stable
    1. Alert trauma attending \ fellow immediately if patient becomes unstable
  v. Serial abdominal exams
  vi. Aggressive pulmonary toilet
  vii. Pain management
  viii. Repeat CT imaging performed based on symptoms.

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, βHCG 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

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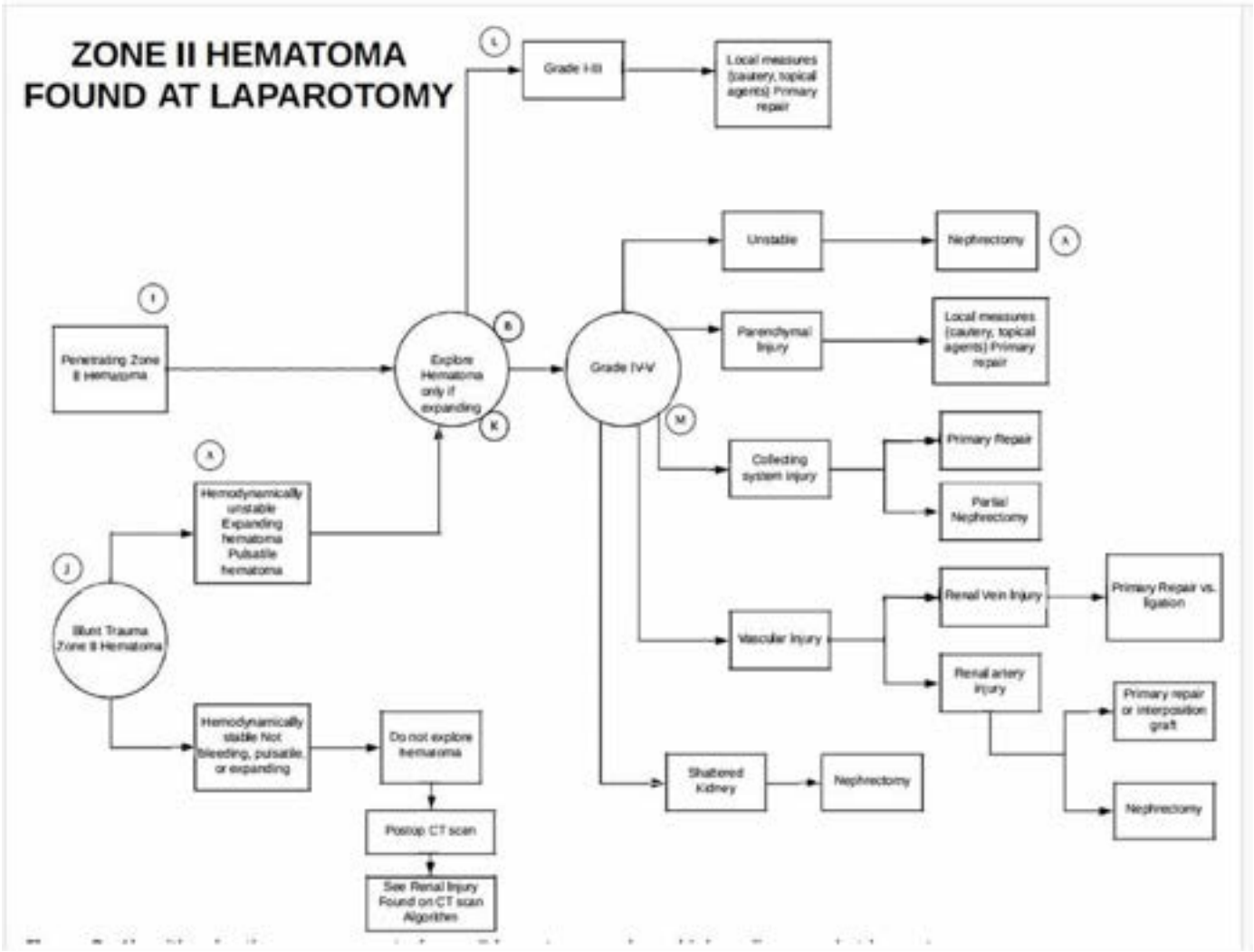
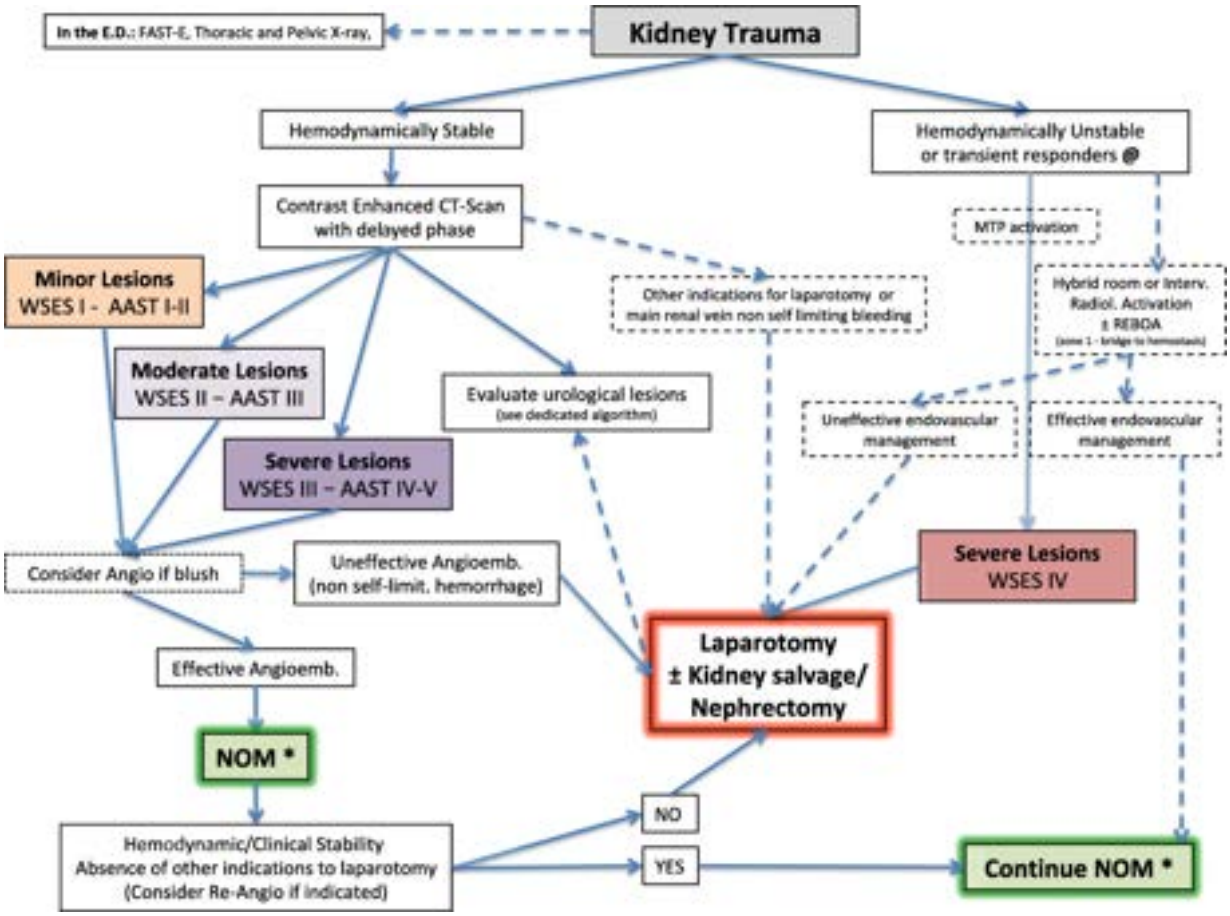
AAST Renal Injury Grading Scale:
http://www.aast.org/Library/TraumaTools/InjuryScoringScales.aspx#kidney

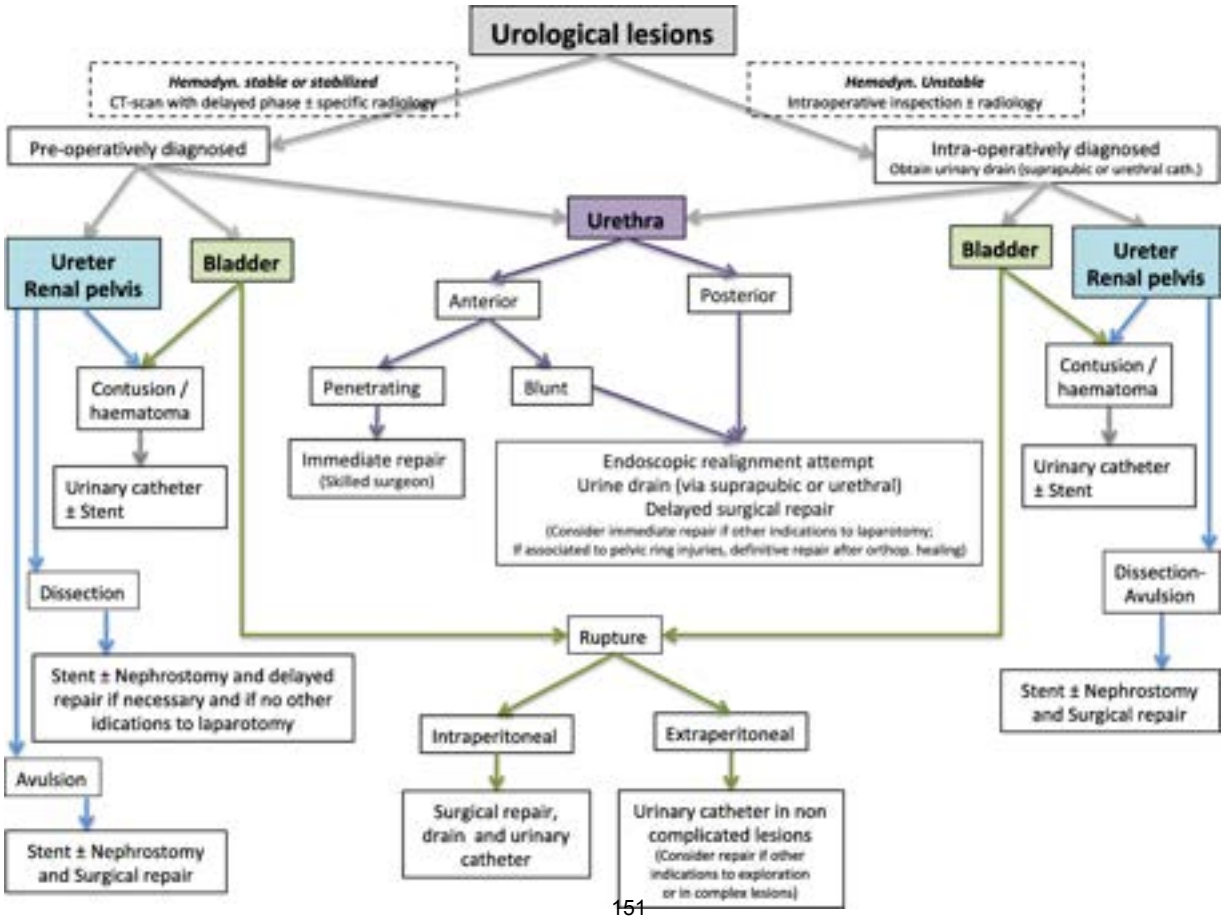
Western Trauma Association Renal Injury Algorithms:
Identified on CT Scan:
http://www.westerntrauma.org/documents/meeting/2017/AlgorithmDrafts/2017-WTA-ALGORITHM-RENAL-II-CT-SCAN.pdf

Identified at Laparotomy:
http://www.westerntrauma.org/documents/meeting/2017/AlgorithmDrafts/2017-WTA-ALGORITHM-RENAL-I-LAPAROTOMY.pdf


ZONE II HEMATOMA FOUND AT LAPAROTOMY
L
Grade I-III
Local measures (cautery, topical agents) Primary repair
Unstable
Nephrectomy
A
I
Penetrating Zone II Hematoma
Explore Hematoma only if expanding
B
K
Grade IV-V
Parenchymal Injury
Local measures (cautery, topical agents) Primary repair
M
Collecting system injury
Primary Repair
Partial Nephrectomy
A
Hemodynamically unstable Expanding hematoma Pulsatile hematoma
J
Blunt Trauma Zone II Hematoma
Vascular Injury
Renal Vein Injury
Primary Repair vs. ligation
Renal artery injury
Primary repair or interposition graft
Nephrectomy
Hemodynamically stable Not bleeding, pulsatile, or expanding
Do not explore hematoma
Shattered Kidney
Nephrectomy
Postop CT scan
See Renal Injury Found on CT scan Algorithm

RENAL / UROLOGIC INJURIES ON CT

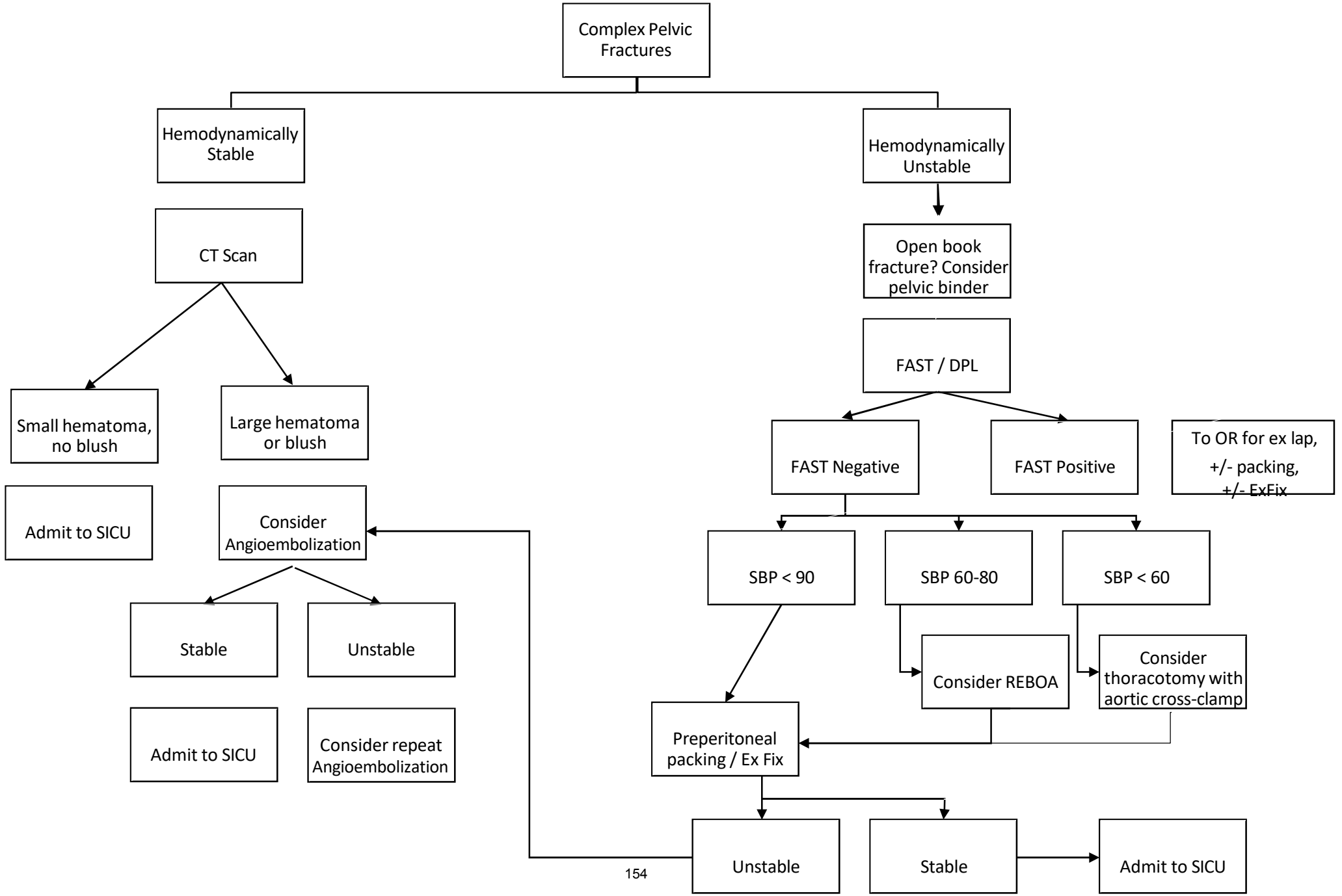




Pelvic Fractures

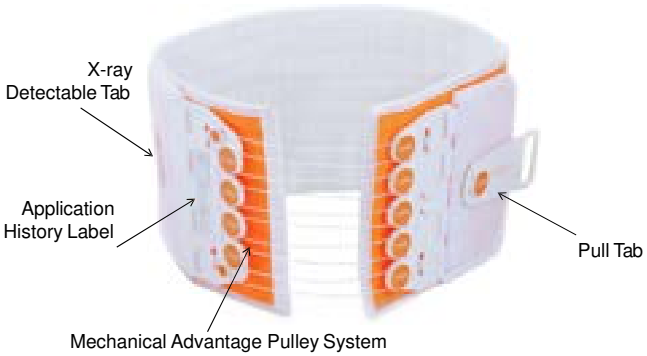
Principles of Pelvic Fracture Management:

a) A pelvic binder should be applied promptly if pelvic volume can be decreased. Repeat pelvis xray imaging should be obtained post-binder to ensure appropriate reduction.
b) Close attention should be applied to the perineum to evaluate for open pelvic fracture, perineal laceration, rectal injury, or genitourinary injury.
c) Patients with pelvic fracture and hypotension are at high risk for bleeding in other body cavities. A high index of suspicion is required. FAST exam should be obtained. If patient is unstable and requires operative intervention, pelvic packing +/- abdominal exploration may be required.
d) Patients with pelvic fracture who are hemodynamically unstable or only transiently responding to resuscitation should be brought to the operating room for pelvic packing. **Unstable patients should not be brought to the CT scanner.**
e) REBOA can be considered in order to improve hemodynamics prior to transport to the OR.
f) Orthopedics should be consulted promptly to allow for potential external fixator placement if the patient is being transported to the OR.
g) Patients who are stabilized after initial resuscitation may be candidates for angioembolization. The trauma attending/fellow should contact the IR attending on call directly to discuss the case and activate the IR suite.

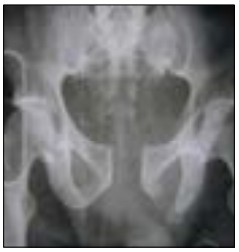


BLUNT PELVIC FRACTURES

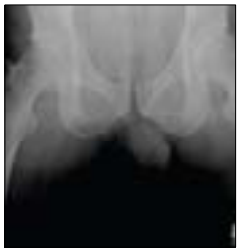
T-POD®
Pelvic Stabilization Device



T-POD® Explained



Pre-application
of *T-POD*®



Post-application
of *T-POD*®

Application Procedure

1. Slide Belt under supine patient and into position under the pelvis.

2. Trim the Belt, leaving a 6-8" gap over the center of the pelvis.

Application Procedure

3. Apply Velcro-backed Mechanical Advantage Pulley System to each side of the trimmed Belt.

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

Application Procedure

5. Secure the Velcro-backed Pull Tab to the Belt.

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

sovmed.com

Re-applying *T-POD*®

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-POD® release time should also be noted on the label.

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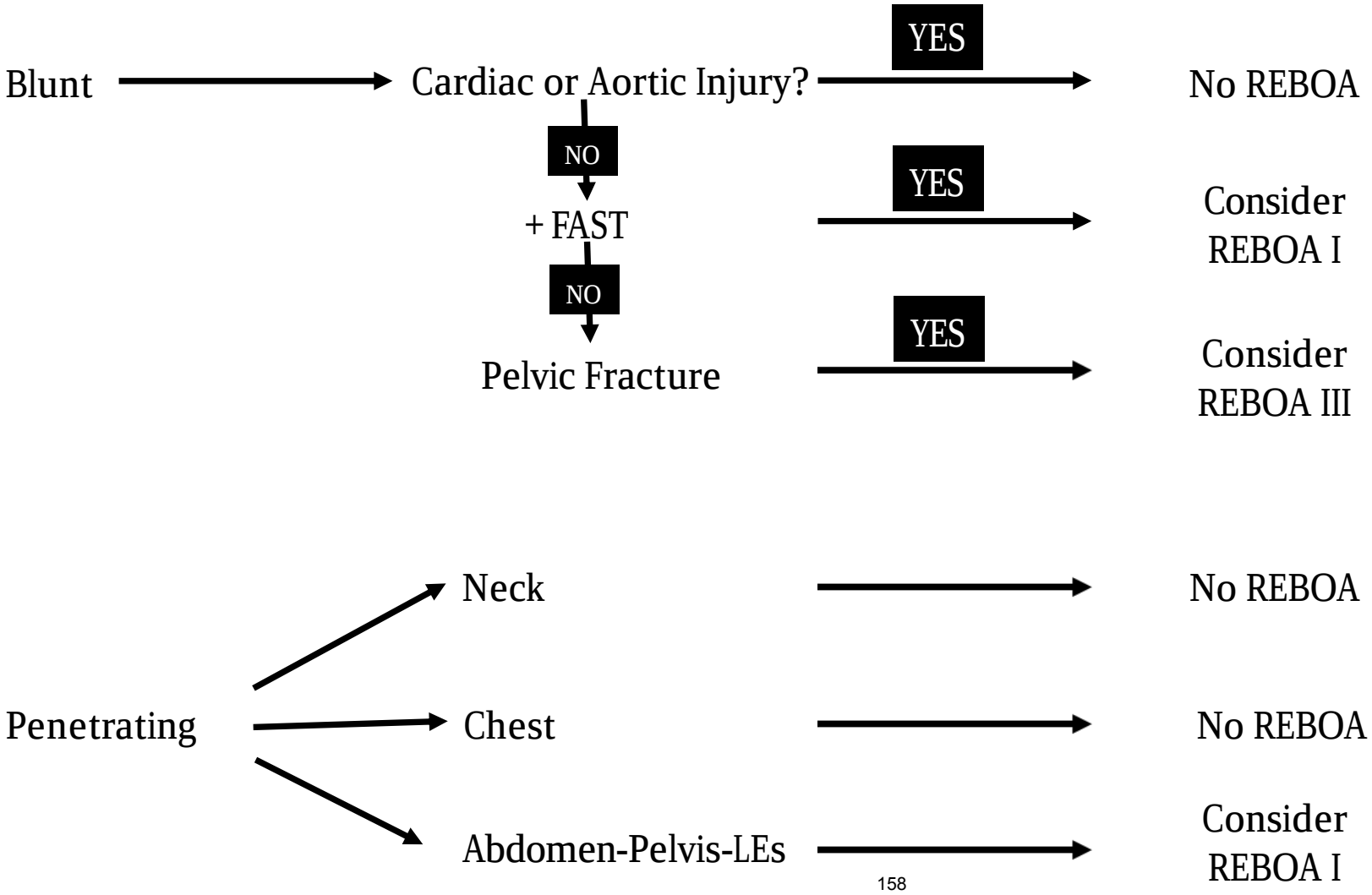
TPOD TRAINING VIDEO

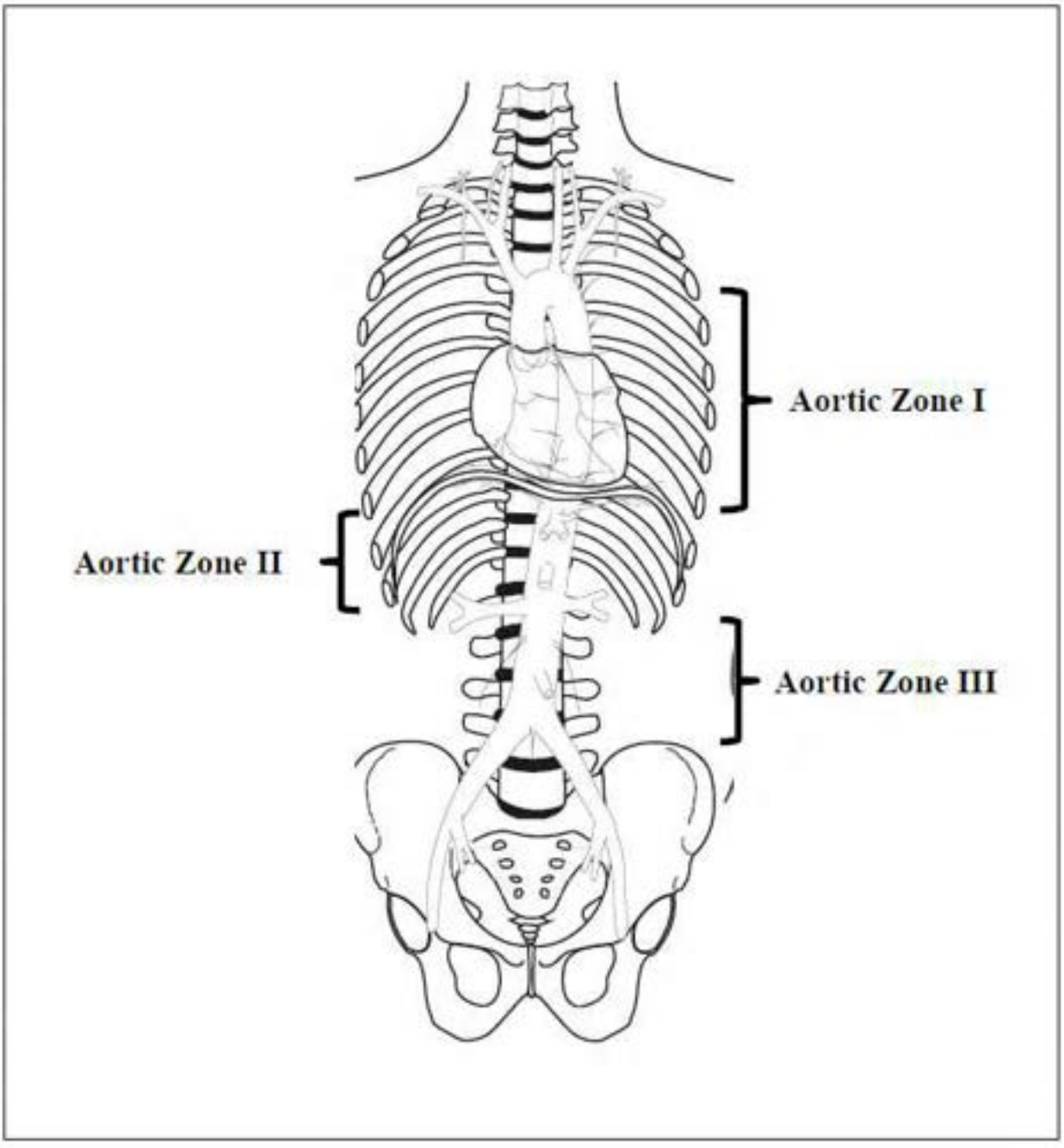
REBOA Protocol

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



REBOA PROTOCOL

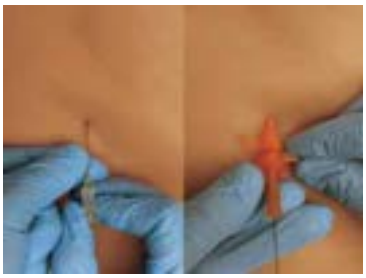
AORTIC ZONES



The ER-REBOA™ Catheter Quick Reference Guide

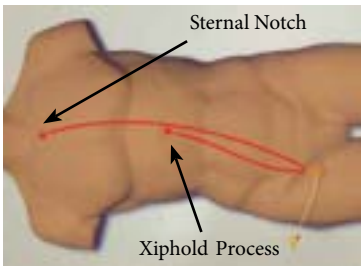
6 REBOA Steps: ME-FIIS (Pronounced ME-FIZZ)

Get Access Early



Obtain access using standard techniques

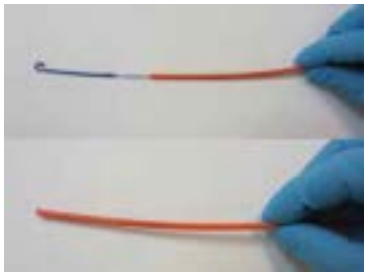
1. Measure



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

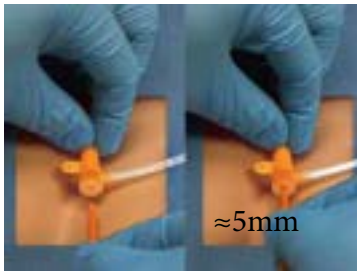


Advance & twist peel-away to cover P-tip®
- Ensure the balloon and P-tip® are captured

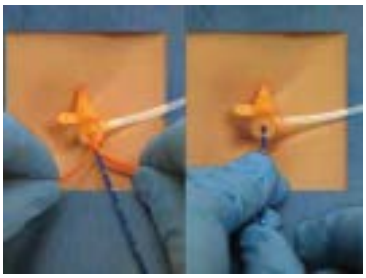
3. Flush

Attach & flush arterial line
- Use standard techniques
- Ensure all air is purged

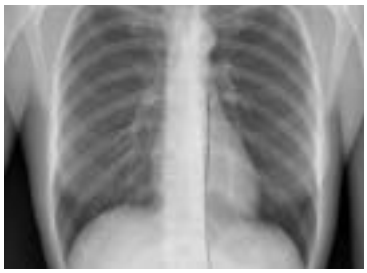
4. Insert



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



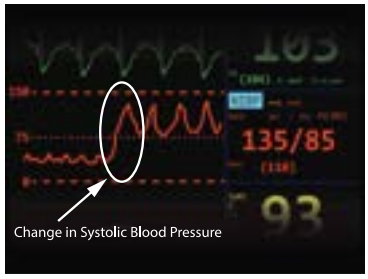
Position catheter
If available, use conventional x-ray or fluoroscopy to confirm position using radiopaque markers

5. Inflate[1,2,3,4,5,6]

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

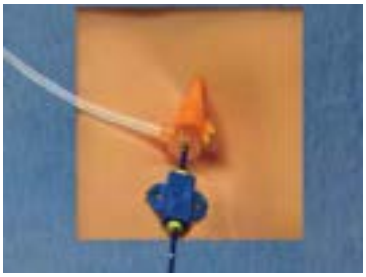
Start small then check

"2 or 8, don't overinflate."



Monitor arterial waveform feedback
- Look for change in blood pressure above balloon
- Use other standard techniques

6. Secure



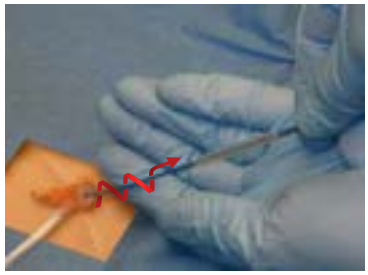
Secure Catheter close to the introducer sheath

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

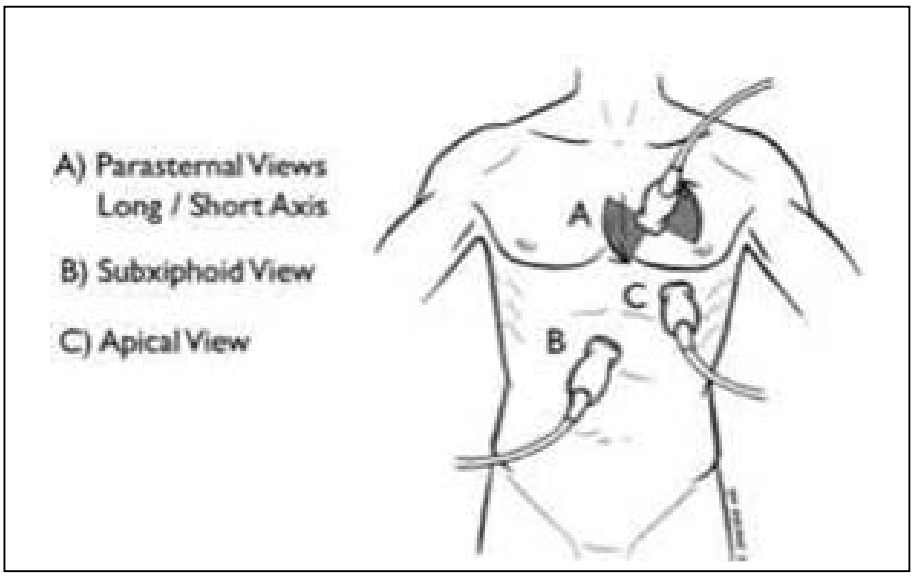
This instruction is not a replacement for the instruction for use (IFU). The ER-REBOA™ Catheter IFU should be read in its entirety before using the device

1. **Joint Trauma System Clinical Practice Guidline (JTS CPG)** REBOA for Hemorrhagic Shock (CPG ID: 38)
2. **Pezy P,** Flaris AN, Prat NJ, Cotton F, Lundberg PW, Caillot 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, Haltmeier T, Rasmussen TE, Smith J, Mendelsberg R, Grabo D, Demetriades D. Emergent 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, Akhter M, Seas A, Thorson K, Phillips NY, Desyatova AS, Kamenskiy 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(6):941-6.
5. **Morrison JJ,** Stannard A, Midwinter MJ, Sharon DJ, Eliason 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;155(6):1044-51.
6. **Stannard A,** Morrison JJ, Sharon DJ, Eliason 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.

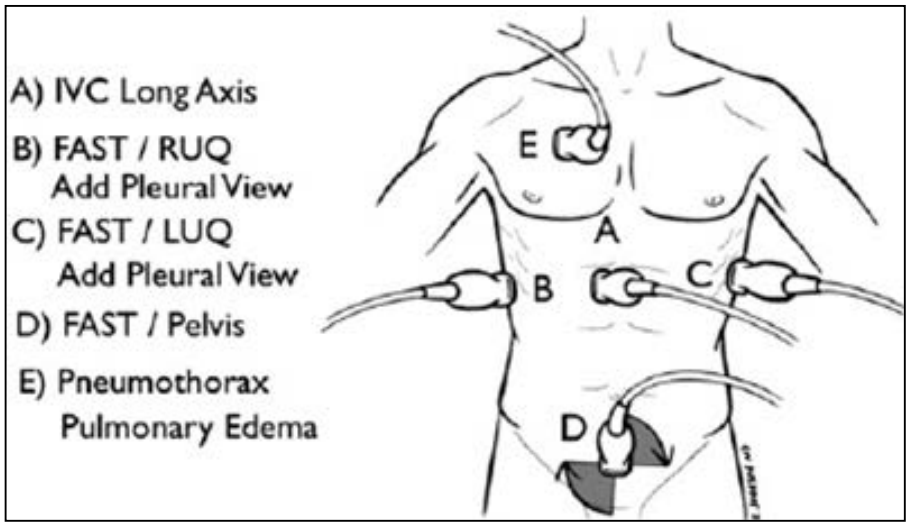
ADV-006 | Revision F

Ultrasound

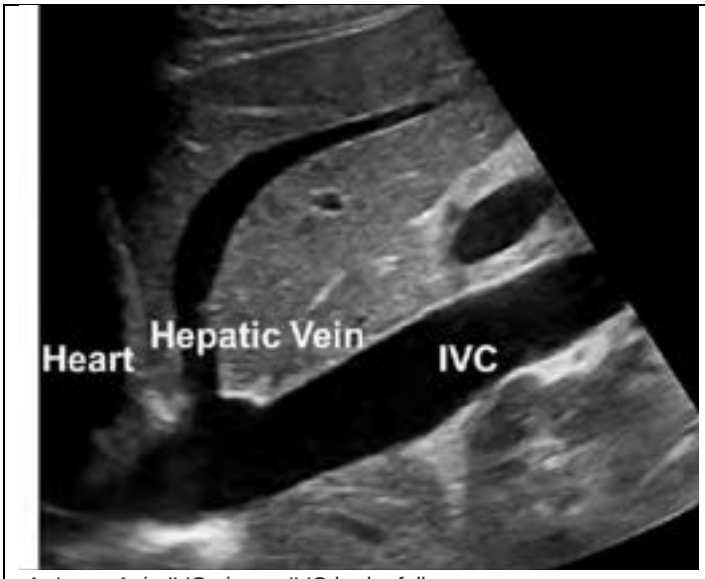
ENHANCED FAST ULTRASOUND



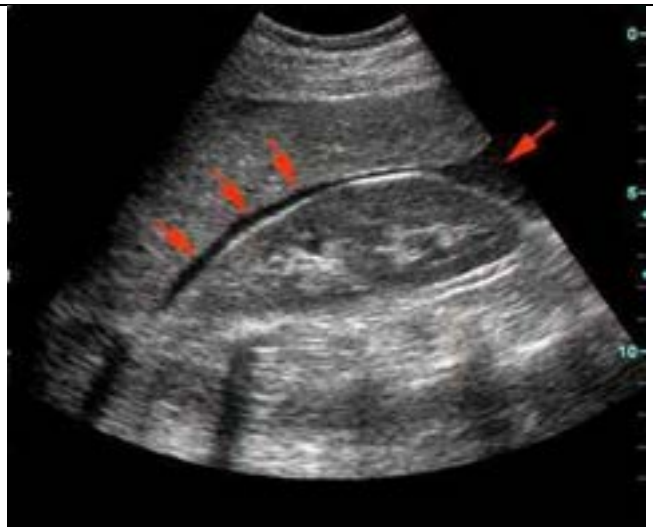
1. Cardiac VIEWS – See FATE echo



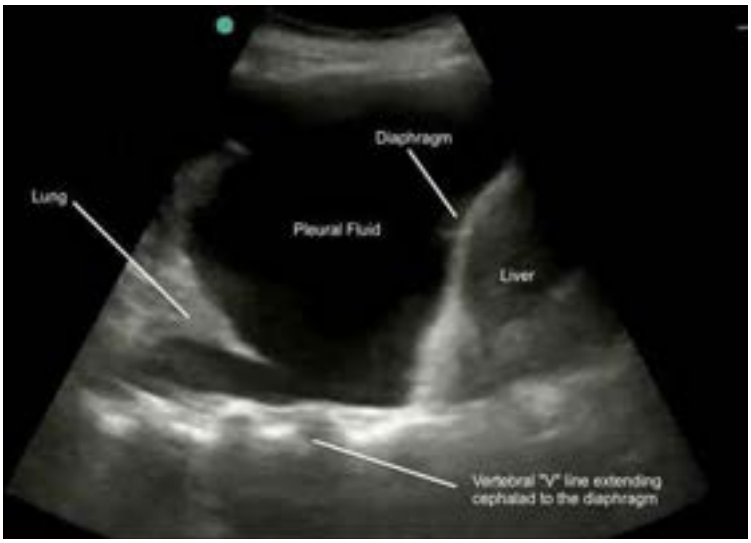
2. Abdominal and Lung Views



A: Long Axis IVC view – IVC looks full

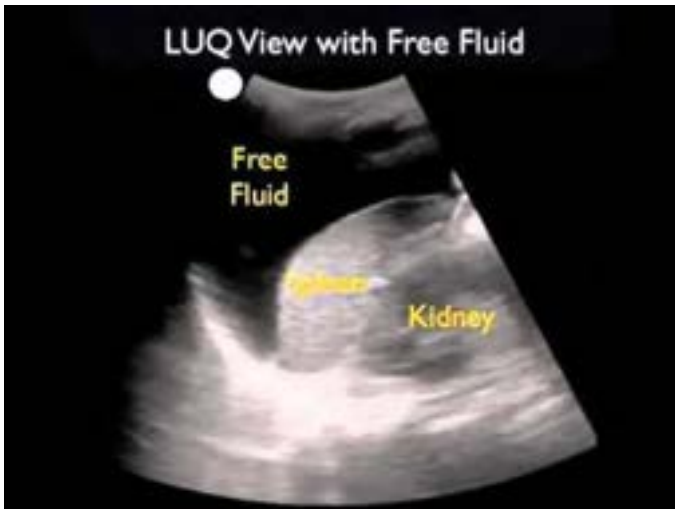


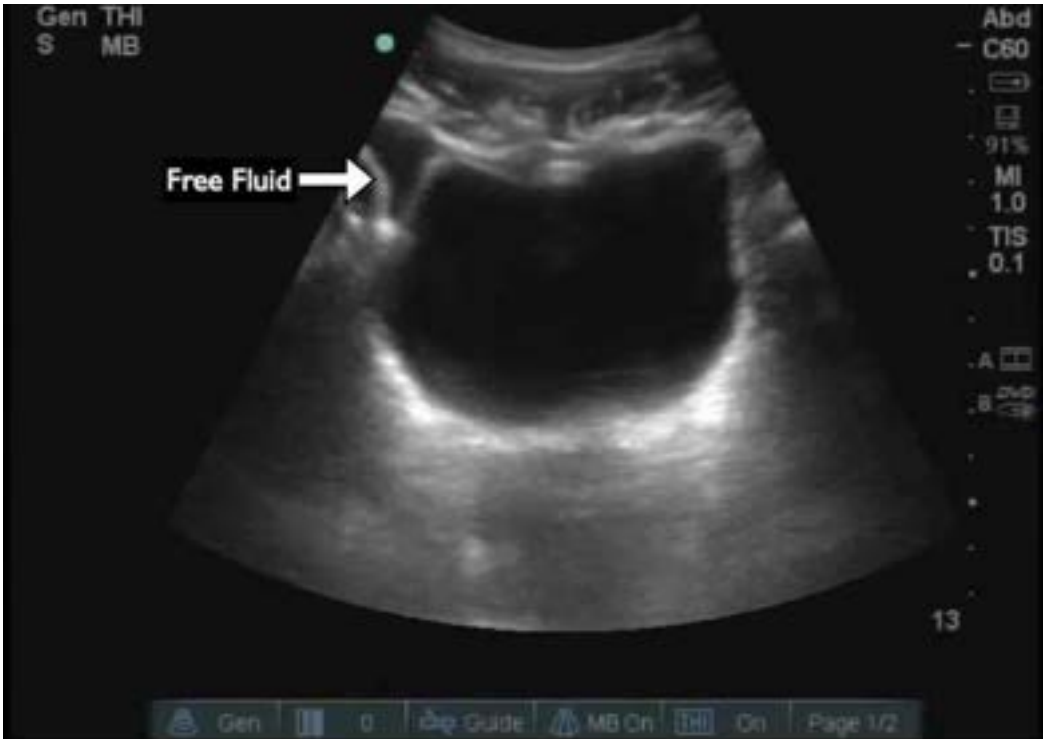
B: Hepatoremal View (Morrison's Pouch) red arrows indicate Positive - Blood



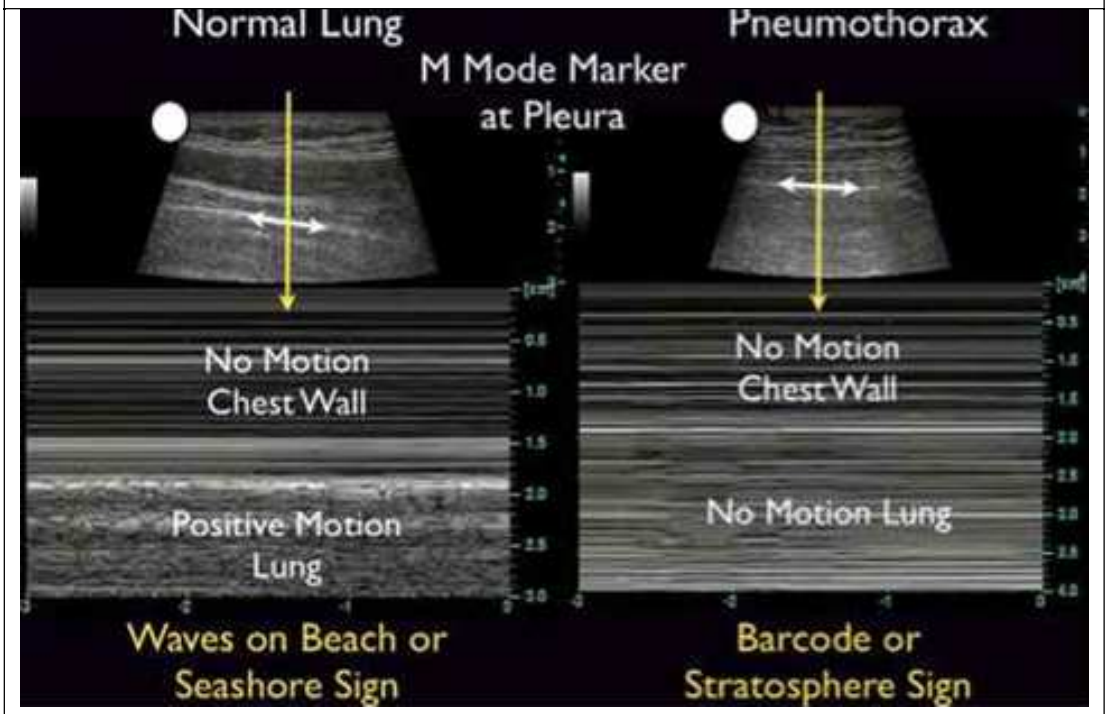
B: Right lateral chest pleural view – massive pleural fluis

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

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 as 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.

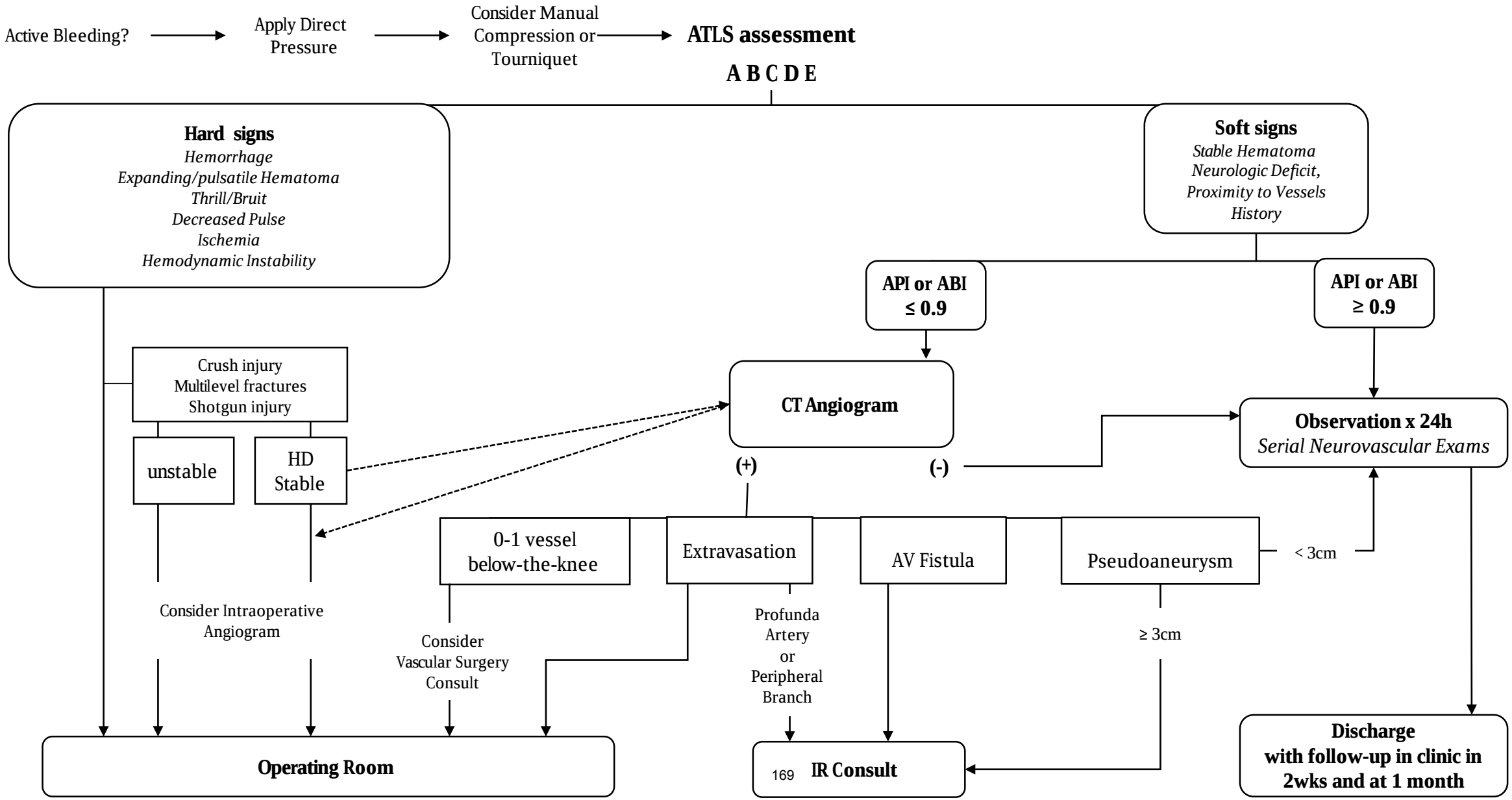
g. Restoration of perfusion to an extremity with arterial injury should be performed in less than 6 hours in order to maximize limb salvage.

h. Absence of hard or soft signs of vascular injury reliably excludes surgically significant arterial injury and does not require CTA/arteriography

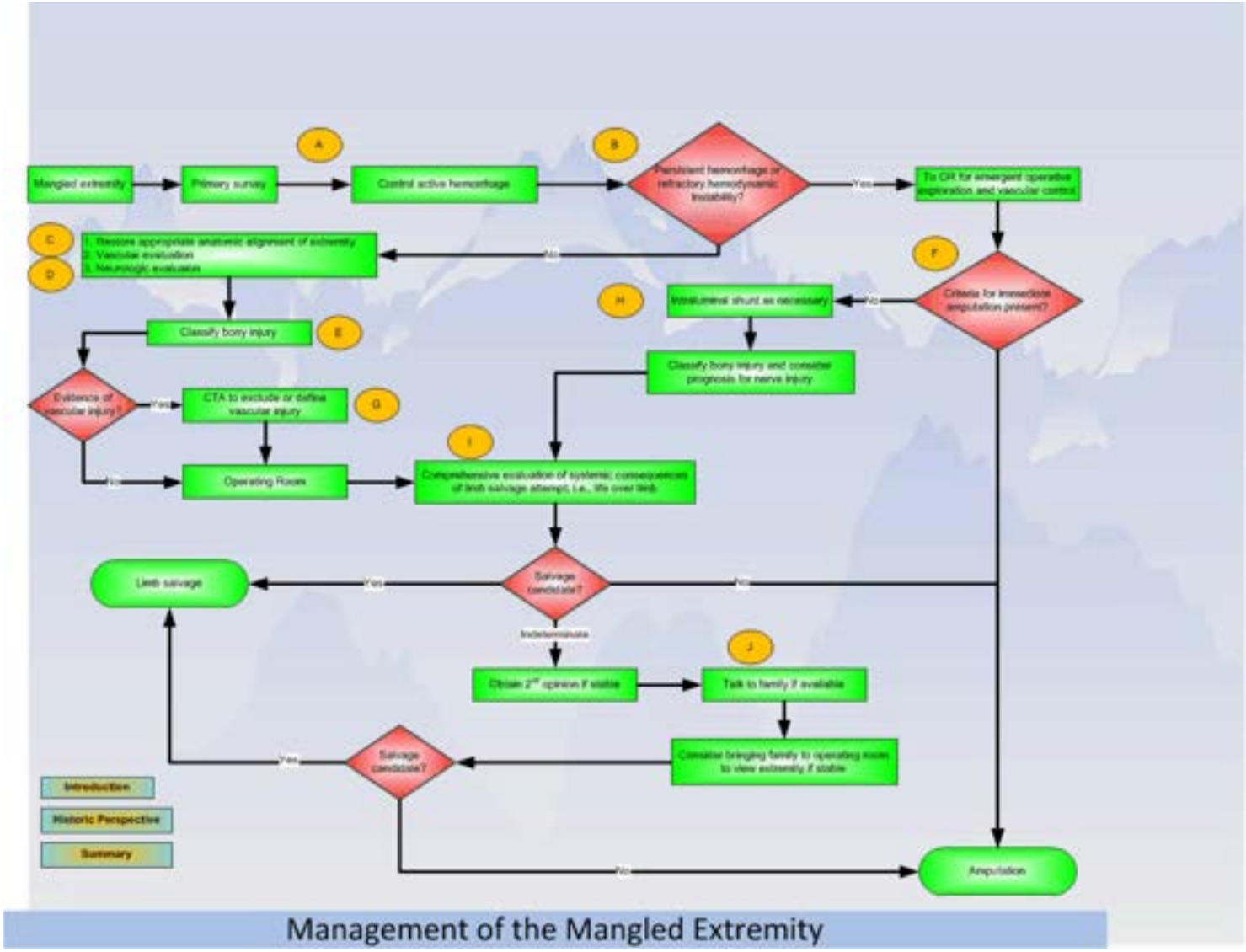
i. Fasciotomies of the affected extremity should be performed liberally when there has been prolonged ischemia (>4-6hrs) or clinical concerns/evidence of compartment syndrome, and in patients with combined arterial and venous injuries.

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

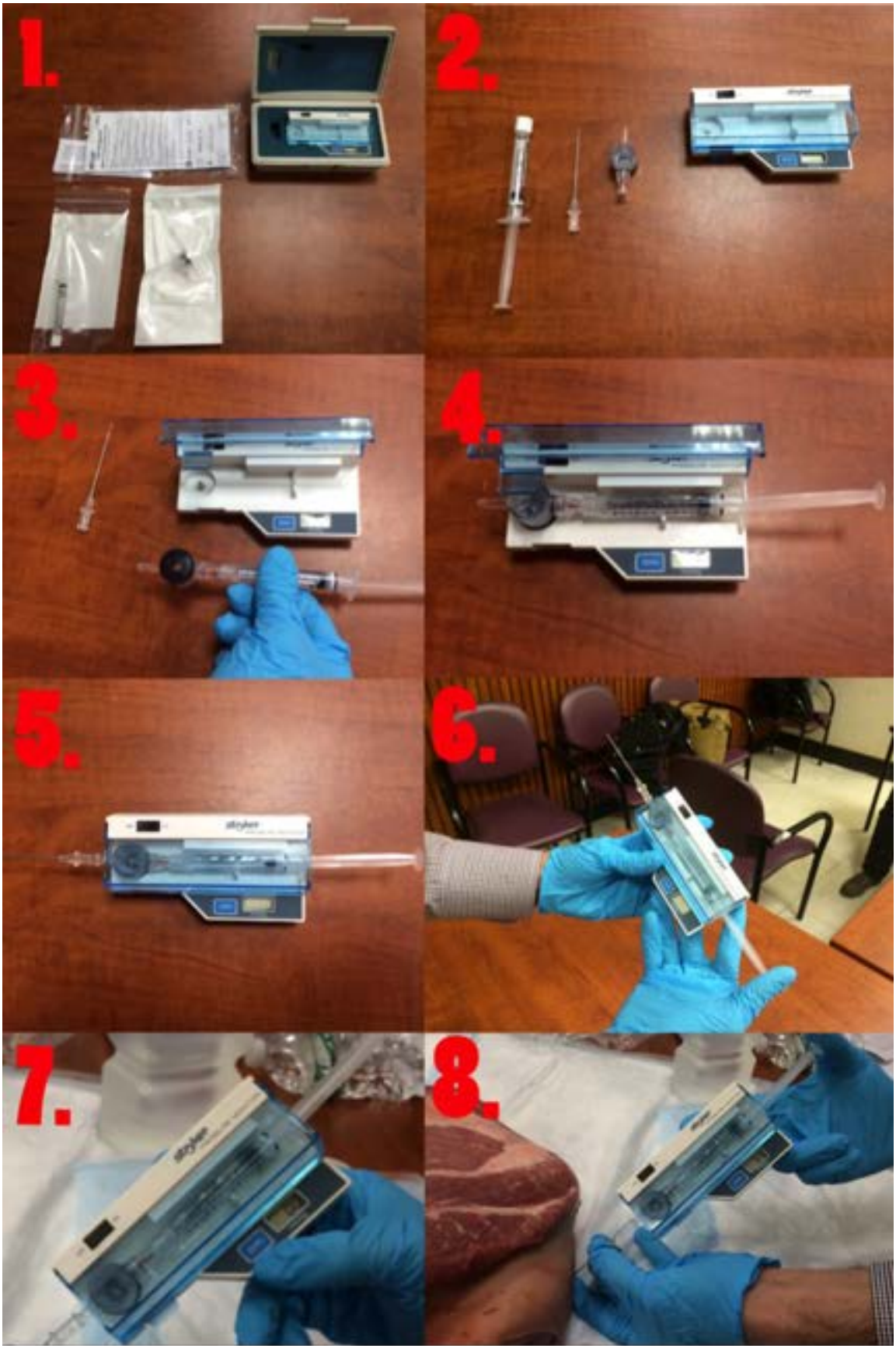


MANGLED EXTREMITY



Supporting Article:
http://www.westerntrauma.org/documents/PublishedAlgorithms/WTACriticalDecisionsManagementOfTheMangledExtremity.pdf

STRYKER NEEDLE FOR COMPARTMENT PRESSURE MEASUREMENT



Compartment pressure measurement

Equipment Needed: All cases

- Chloroprep or other skin prep solution
- Lidocaine 1% without epi
- 5cc syringe

- Stryker available (White safe in SICU MD Area)
    - Stryker Intra-Compartmental Pressure Monitor and need;e/refill
- or, Arterial line setup
    - 22g or 25g needle with enough length to reach compartment
    - Prefilled syringe with saline
    - Intracompartment needle (simple 18-gauge needle or 18-gauge spinal needle)
    - High-pressure tubing
    - Pressure transducer with cable
    - Pressure monitor/module
    - 1L NS with pressure bag
    - Two 3-way stopcocks

Procedure:

1. Timeout
2. Remove contents from wrapping
3. Attach chamber to the pre-filled saline syringe
4. Place the aforementioned into the monitor/unit
5. Place needle onto chamber
6. Eject excess air, if present, from syringe
7. Zero the assembled unit at the angle you will be entering compartment
8. Determine the appropriate site of injection to measure the desired compartment pressure
9. Clean the area with alcohol prep or chlorhexidine.
10. Insert, inject 2-3 drops of saline, and await measurement

Technique

1. Should be performed within 5cm of fracture site
2. Anterior compartment
    a. entry point: 1 cm lateral to anterior border of tibia
    b. needle should be perpendicular to skin
3. Deep posterior compartment
    a. entry point: just posterior to the medial border of tibia
    b. advance needle perpendicular to skin towards fibula
4. Lateral compartment
    a. entry point: just anterior to the posterior border of fibula
5. Superficial Posterior compartment
    a. entry point: middle of calf

Interpretation of Compartment Pressure

- Normal is <10 mm Hg
- Pressures <20 mmHg can be tolerated w/o significant damage
- Exact level of pressure elevation that causes cell death is unclear.
- Previously thought pressure >30 mmHg was toxic although the "delta pressure" may be better predictor than absolute pressure:

- **ΔPressure = [Diastolic Pressure] – [Compartment Pressure]**
- ΔPressure < 30 mm Hg is suggestive of compartment syndrome

Consulting Services

Consultation Services

Neurosurgery

a. Indications for Neurosurgery consultation
    i. Intracranial hemorrhage
    ii. Skull fracture
    iii. Penetrating skull \ brain injury
    iv. Unexplained neurological deficit with evidence of head trauma (at trauma attending discretion)
    v. Spine fracture or spinal cord injury (only if on spine call)
    vi. Evidence of peripheral nerve injury
    vii. 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 *even days* of the month and the Head & Neck Service is to be consulted on all *odd days* of the month.

Head and neck surgery should be consulted for all temporal bone fractures, regardless of the day of the month.

Consider plastic surgery consultation for lower extremity peripheral nerve injuries or open fractures that may require flap coverage.

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.
Hand surgery should be consulted early for all suspected brachial plexus injuries.

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 patient arrival.
    a. First-generation Cephalosporin (i.e. Cefazolin)
        i. <80 kg: 1g IV q 8 hours
        ii. >80 kg: 2g IV q 8 hours
    b. Gram negative coverage (i.e. Gentamycin: 5mg/kg IV x 1) may be added at the discretion of the orthopedics service, and should be considered in all highly contaminated fractures.

Antibiotic Duration:

- Antibiotics should be administered for no longer that 24 hours after operative intervention for clean wounds and closed fractures.
- 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 strippingand bone exposure; usually associated with massive contamination.
Type IIIC	Open fracture associated with arterial injury requiring repair.

Compartment Syndrome

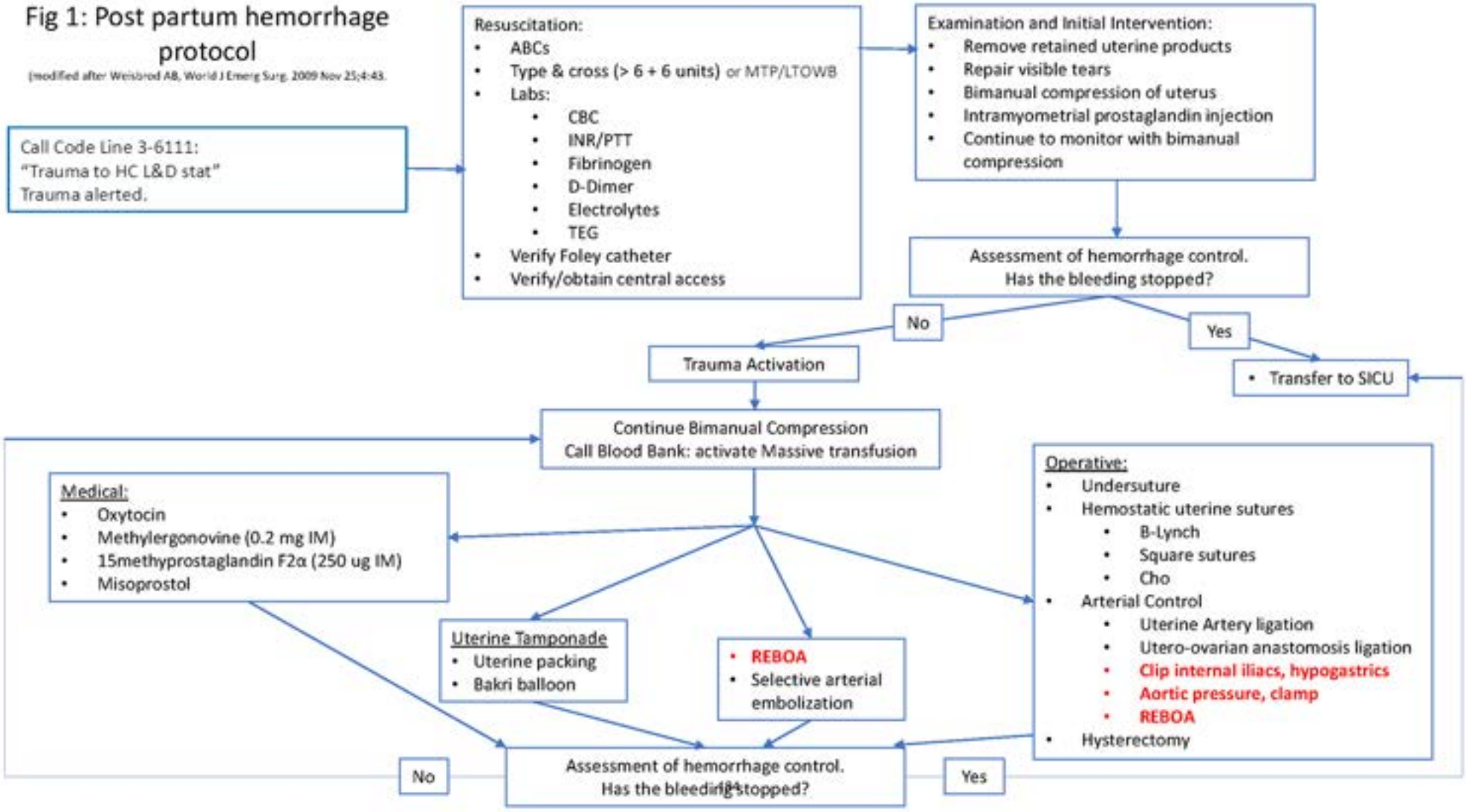
- When the diagnosis of compartment syndrome has been made, the patient must be taken to the operating room immediately for fasciotomies.
- Alternatively, these may be performed in the SICU in cases of hemodynamic instability or when transfer is unsafe.
    - The first procedure includes releasing all 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. Serial closure may be required
- 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.
- A Stryker needle is kept in the SICU MD area in the white safe.
- Fasciotomies may be performed by the trauma service, orthopedic service, or vascular service depending on the reason for compartment syndrome and associated injuries.

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.

Fig 1: Post partum hemorrhage protocol

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



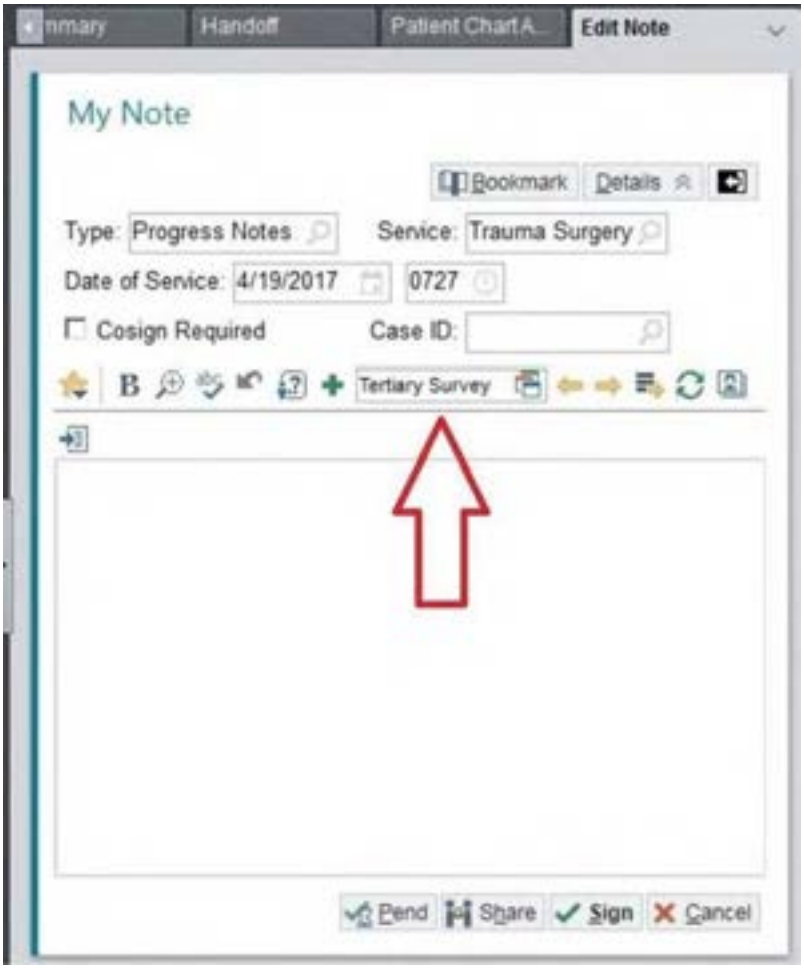
https://pulse.ucsd.edu/departments/EDR/Resources/Policies/Women%20%20Infant%20Policies/Hemorrhage%20Management%20OB.pdf

Service Responsibilities

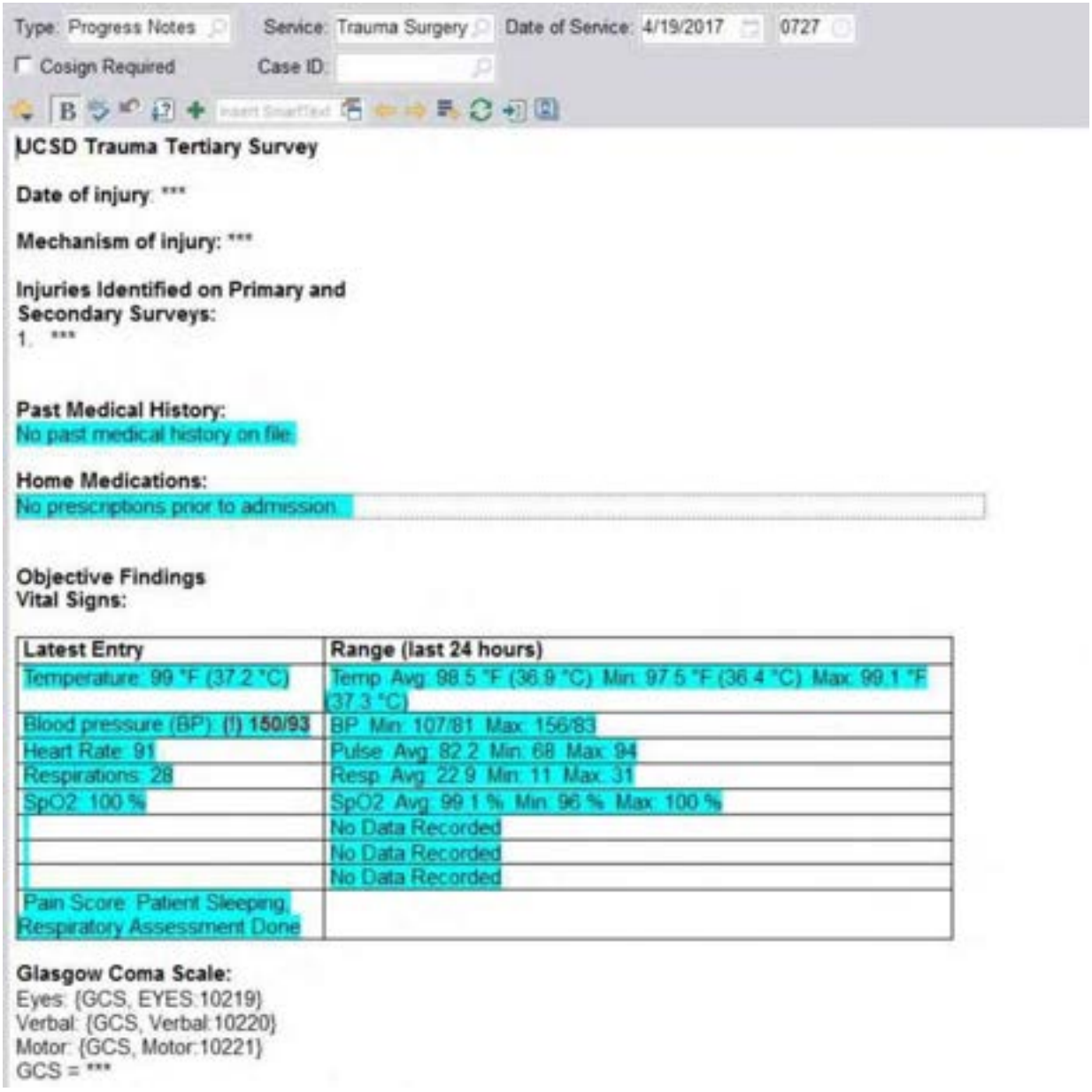
Tertiary Survey of Trauma Patient

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 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: Progress Notes Service: Trauma Surgery Date of Service: 4/19/2017 0727

Cosign Required Case ID:

UCSD Trauma Tertiary Survey

Date of injury: ***

Mechanism of injury: ***

Injuries Identified on Primary and Secondary Surveys:
1. ***

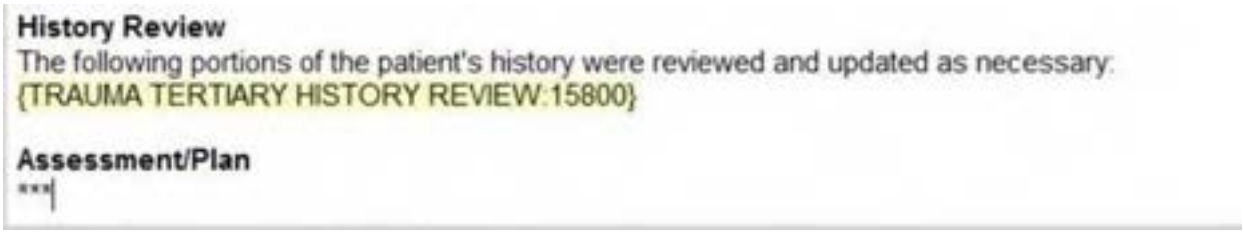
Past Medical History:
No past medical history on file.

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): (!) 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 = ***



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
    - New trauma admissions from overnight. This includes an overview of mechanism, injuries,
      review of imaging studies, plans and any acute events
    - New White Surgery admissions from overnight, including the same details listed above o Any acute events occurring in the SICU overnight
    - 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
    - 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
    - I – Illness severity
    - P – Patient summary
    - A – Action items
    - S – Situation awareness and contingency planning
    - S – Synthesis by receiver

I-PASS

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 and in the HC Bloom conference room.

    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

<u>Action</u>
1. The video camera will be mounted so that the patient's face cannot be seen on the screen.

<u>Rationale</u>
Camera position will ensure that the patient's face and recognizable features will not be identifiable.

<u>Action</u>
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

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

<u>Action</u>
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.

_____

Trauma Medical Director

_____

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.

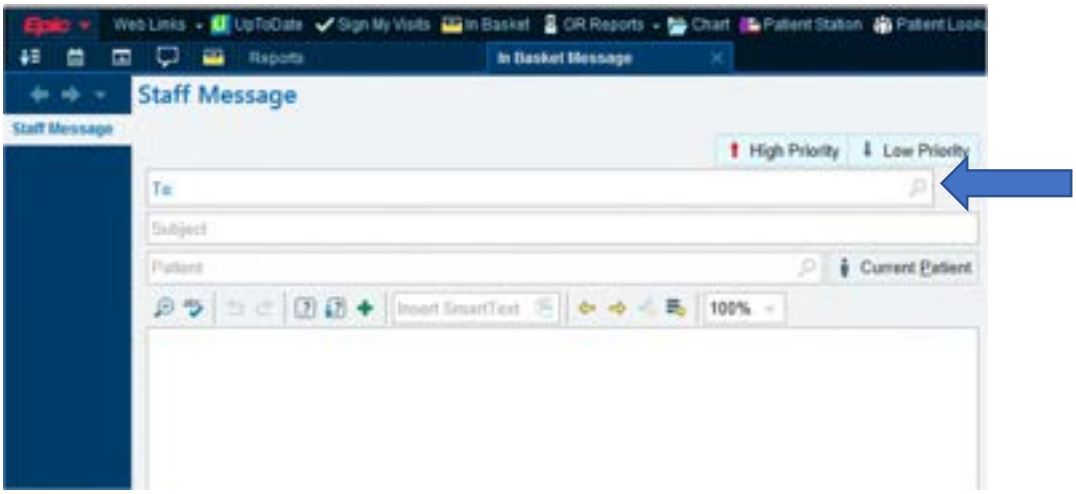
d. Discharge orders should be written as early as is safe to do so, allowing patients to leave the hospital in a timely fashion.

e. All labs, imaging studies and PT/OT orders should specify "PENDING DISCHARGE" if the patient's discharge is dependent upon these items.

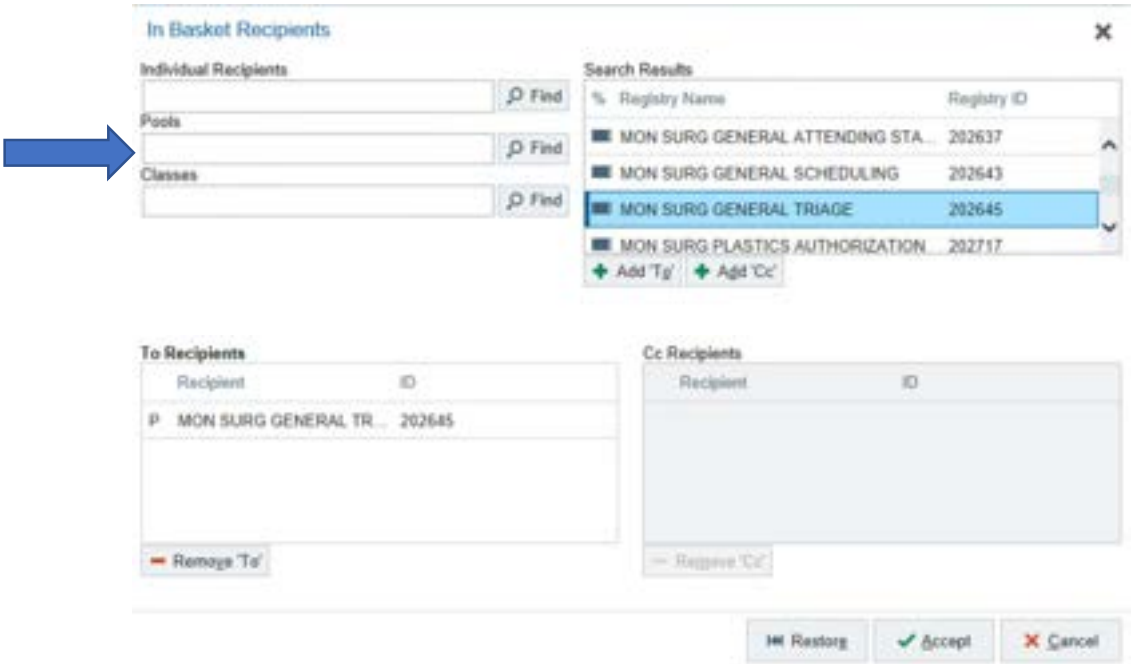
Trauma Clinic Follow-up

1. Place order for outpatient Trauma Clinic Visit

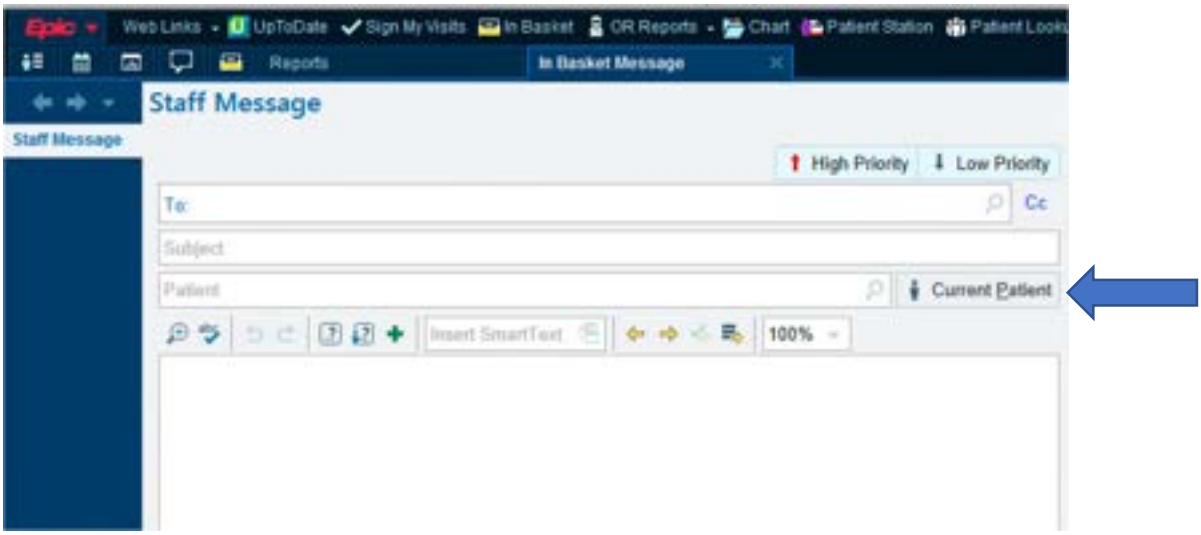
2. Send Epic In Basket message to Trauma Clinic Staff
    a. Open Epic In Basket
    b. Click new message
    c. Click the magnifying glass to the right of the “To” section



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



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

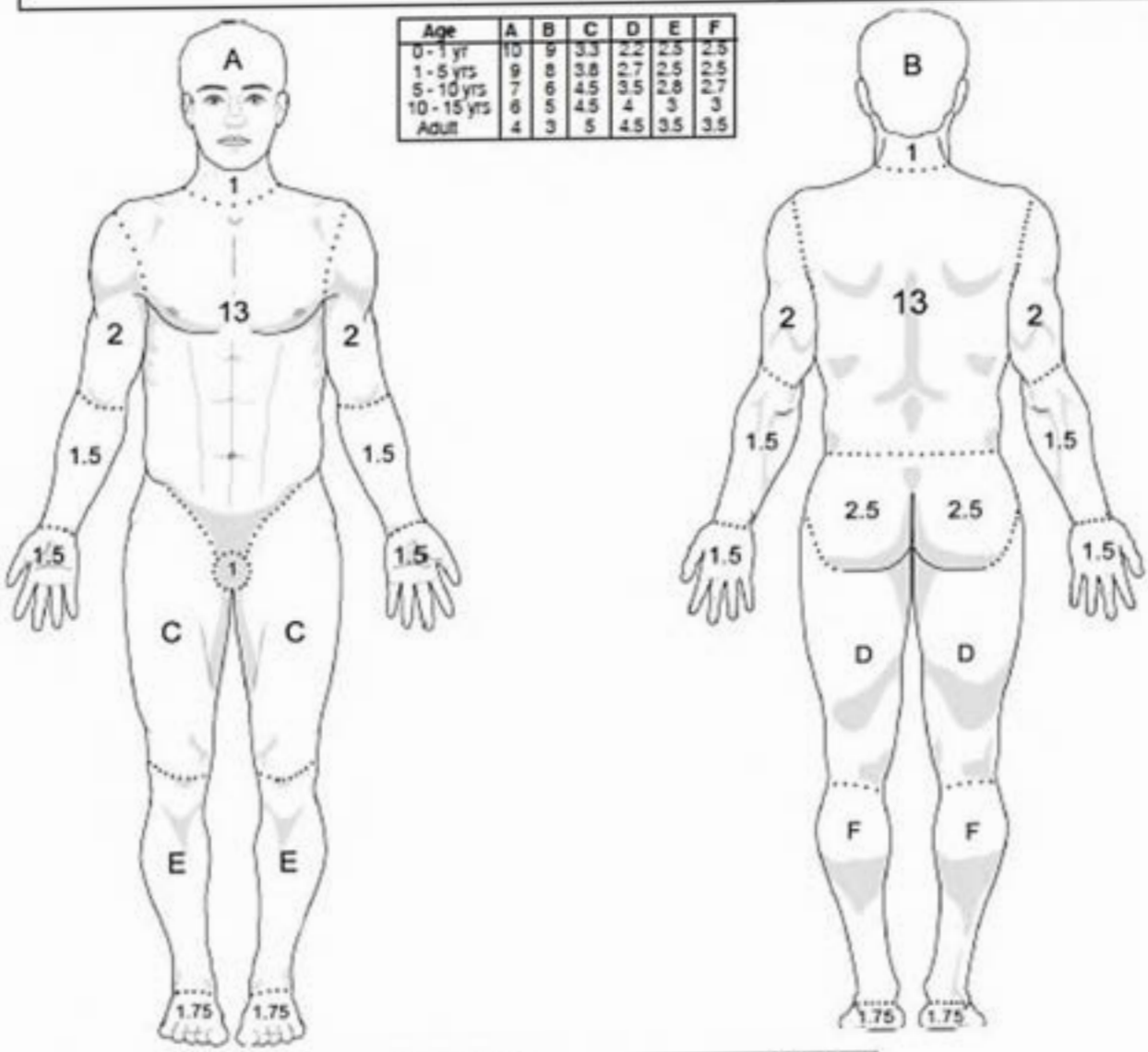
Shade images accordingly: ▒ 2° ■ 3°

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 _____

Age	A	B	C	D	E	F
0 - 1 yr	10	9	3.3	2.2	2.5	2.5
1 - 5 yrs	9	8	3.8	2.7	2.5	2.5
5 - 10 yrs	7	6	4.5	3.5	2.8	2.7
10 - 15 yrs	6	5	4.5	4	3	3
Adult	4	3	5	4.5	3.5	3.5



Physician Signature/PID#

Date & Time

0043(12-06)

UC San Diego Health

Regional Burn Center

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 ≥ 20% and < 30% (if patient has ONLY inhalation injury calculate Parkland as a 20% TBSA burn):

2ml x _____kg x _____TBSA = _____ml ÷ 16 = _____ml/hr starting rate

FFP Trigger

6ml x _____kg x _____TBSA = _____ml ÷ 16 = _____ml/hr

If TBSA ≥ 30% and < 50% or patient has a major electrical injury:

LR - 2ml x _____kg x _____TBSA = _____ml ÷ 16 = _____ml/hr starting rate
FFP - 1ml x _____kg x _____TBSA = _____ml ÷ 16 = _____ml/hr
(Max FFP rate 350ml/hr. Start FFP as soon as available from the blood bank)

If TBSA ≥ 50%:

LR - 3ml x _____kg x _____TBSA = _____ml ÷ 16 = _____ml/hr starting rate
FFP - 1ml x _____kg x _____TBSA = _____ml ÷ 16 = _____ml/hr
(Max FFP rate 350ml/hr. Start FFP as soon as available from the blood bank)

CRRT Trigger

8ml x _____kg x _____TBSA = _____ml ÷ 16 = _____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

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

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	350 ml/hr

Bladder Pressure Monitoring

Start bladder pressure monitoring **q4h** on all patients with **TBSA ≥ 30% 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

Adjusted Body Weight Resuscitation

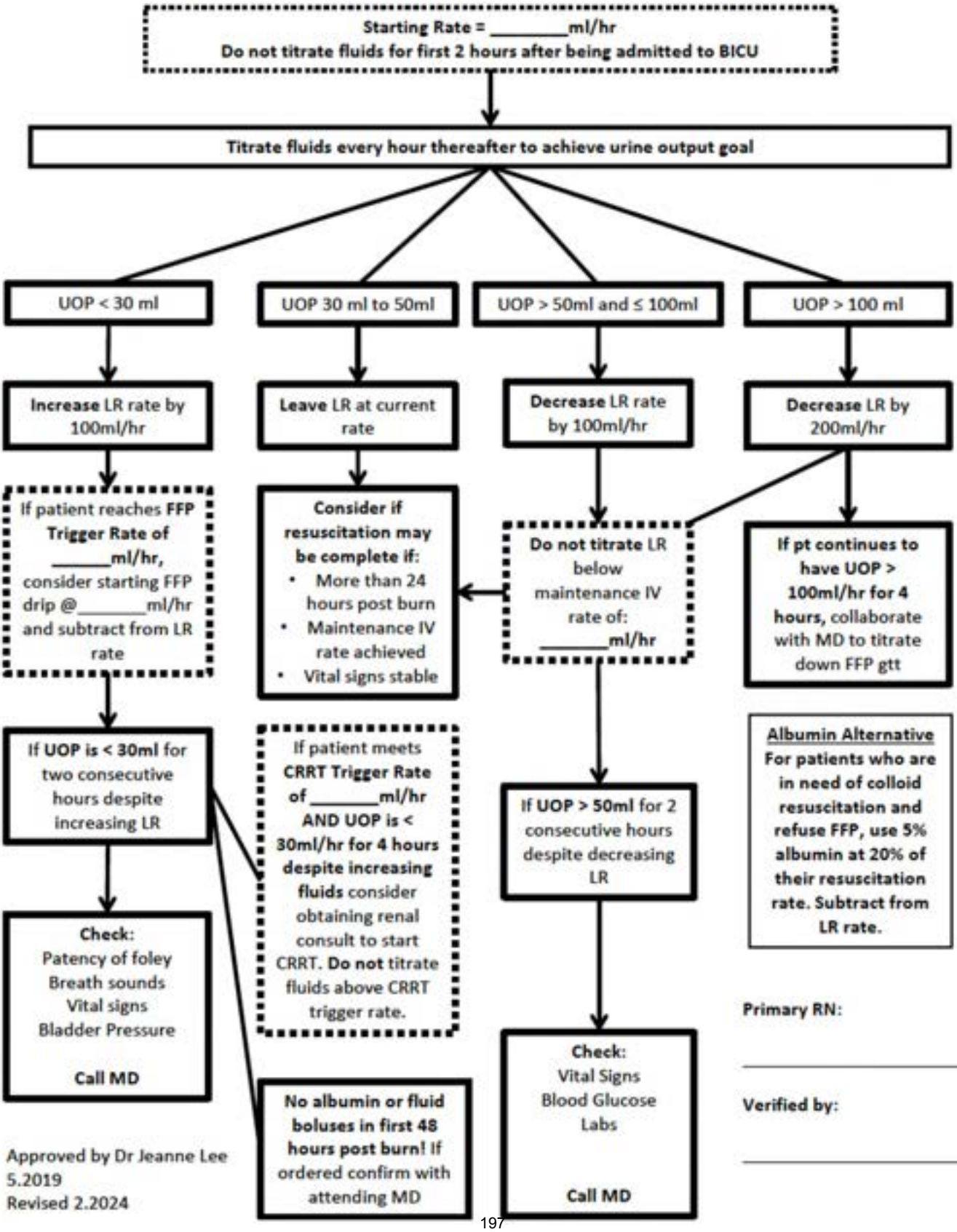
Input measured height and weight into Epic
Ensure patient's sex is assigned in Epic as either male or female
If BMI ≥ 30 then use Adjusted Body Weight to calculate Parkland Formula above

UC San Diego Health

{Place patient sticker here}

Regional Burn Center

Nurse Driven Fluid Resuscitation Clinical Pathway



Primary RN: _____

Verified by: _____

Approved by Dr Jeanne Lee
5.2019
Revised 2.2024

UC San Diego Health

Regional Burn Center

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

Admit Time to BICU:_____am/pm
Dry Weight:_____kg
TBSA: _____%
Inhalation Injury? Y / N
Pre-Admission Fluids:_____ml
Broselow color:_____

(Place patient sticker here)

Parkland Formula Calculations ((2-4ml x kg x TBSA)/2)/8)
Round starting rate numbers to closest 10 ml/hr
If patient has inhalation injury and burns add 10% to TBSA to calculate starting rate

If TBSA >20% and < 30%:

2ml x _____kg x _____TBSA = _____ml ÷ 16 = _____ml/hr starting rate

If TBSA > 30% and ≤ 50%:

3ml x _____kg x _____TBSA = _____ml ÷ 16 = _____ml/hr starting rate

If TBSA > 50%:

LR - 3ml x _____kg x _____TBSA = _____ml ÷ 16 = _____ml/hr

FFP - 1ml x _____kg x _____TBSA = _____ml ÷ 16 = _____ml/hr

(Start FFP as soon as available from blood bank)

FFP Trigger – for patients < 50% (do not round starting rate)

6ml x _____kg x _____TBSA = _____ml ÷ 16 = _____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 x _____kg x _____TBSA = _____ml ÷ 16 = _____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 mon	100	205	67	84	35	53	45	60	30	53
1-12 mon	100	180	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	72	18	25
10 to 11 yo	75	118	102	120	61	80	71	79	18	25
12 to 14 yo	60	100	110	131	64	83	73	84	12	20

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 ≥ 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 > 12mmHg and ≤ 25 mmHg

Abdominal Compartment Syndrome > 25mmHg with symptoms or organ dysfunction

See GU Guideline of Care for procedure

FFP Starting Rate = 20% of starting resuscitation fluid rate

- **Starting LR rate =_____ x 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.

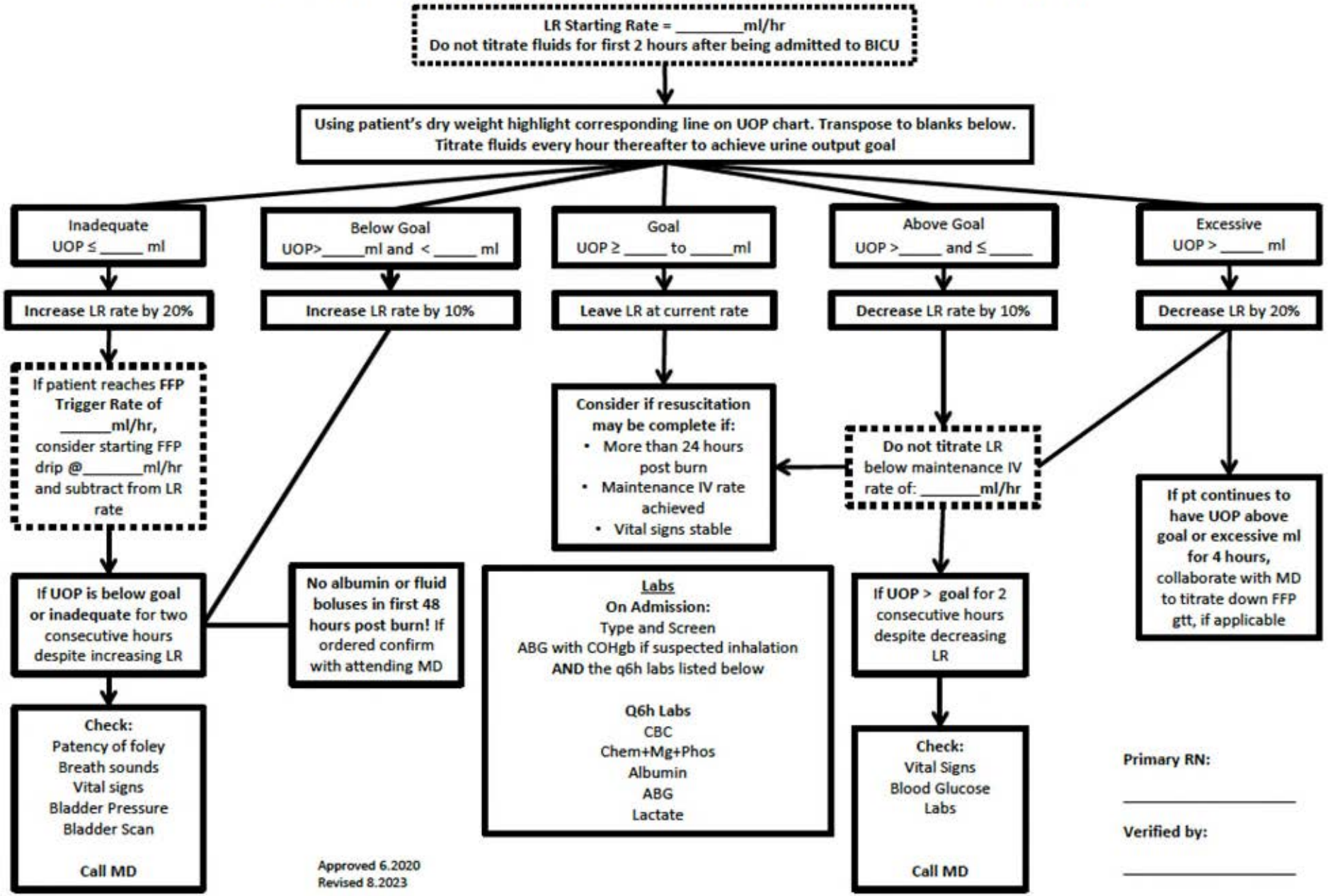
Do not round starting rate for FFP.

UC San Diego Health

Regional Burn Center

(Place patient sticker here)

Pediatric Nurse Driven Fluid Resuscitation Clinical Pathway



Approved 6.2020
Revised 8.2023

Primary RN:

_____

Verified by:

_____

Transfer of Burn Patients

UCSD Regional Burn Center serves all of San Diego and Imperial Counties. Because of this, we receive referral requests from both regions. In general, these transfer requests will be handled by the BICU charge nurse in consultation with the APP/resident covering burn and the burn attending of the week.

There are specific guidelines for who should be referred to a burn center as follows:

Guidelines for Burn Patient Referral

(Advice on Transfer and Consultation)

- These guidelines are designed to be used to aid in clinical decision making. If you have sustained a burn injury, please seek medical advice from a medical professional.
- Local and regional infrastructure, resources, and relationships may determine the necessity and timeliness of burn center referral.
- These guidelines are not meant to be definitive care recommendations. They may facilitate building the proper referral network within the local healthcare community.

	Immediate Consultation with Consideration for Transfer	Consultation Recommendation
Thermal Burns	• Full thickness burns • Partial thickness ≥10% TBSA* • Any deep partial or full thickness burns involving the face, hands, genitalia, feet, perineum, or over any joints • Patients with burns and other comorbidities • Patients with concomitant traumatic injuries • Poorly controlled pain	• Partial thickness burns <10% TBSA* • All potentially deep burns of any size
Inhalation Injury	• All patients with suspected inhalation injury	• Patients with signs of potential inhalation such as facial flash burns, singed facial hairs, or smoke exposure
Pediatrics (≤14 years, or <30 kg)	• All pediatric burns may benefit from burn center referral due to pain, dressing change needs, rehabilitation, patient/caregiver needs, or non-accidental trauma	
Chemical Injuries	• All chemical injuries	
Electrical Injuries	• All high voltage (≥1,000V) electrical injuries • Lightning injury	• Low voltage (<1,000V) electrical injuries should receive consultation and consideration for follow-up in a burn center to screen for delayed symptom onset and vision problems

Burn Severity Determination

SUPERFICIAL
- Dry, red, easily blanching, sometimes painful
- Example: Sunburn
- NOT counted in calculations of total burn surface area (TBSA)

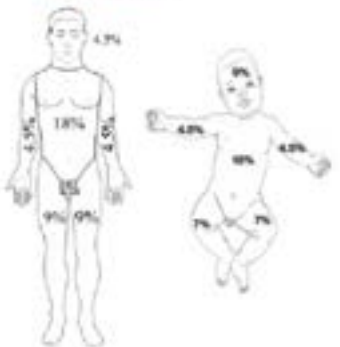
SUPERFICIAL PARTIAL THICKNESS
- Moist, red, blanching, blisters, very painful
- Counted in calculations of total burn surface area (TBSA)

DEEP PARTIAL THICKNESS
- Drier, more pale, less blanching, less pain
- Counted in calculations of total burn surface area (TBSA)

FULL THICKNESS
- Dry, leathery texture, variable color (white, brown, black), loss of pin prick sensation
- Counted in calculations of total burn surface area (TBSA)

*Percentage Total Body Surface Area (TBSA)

"RULE OF NINES"



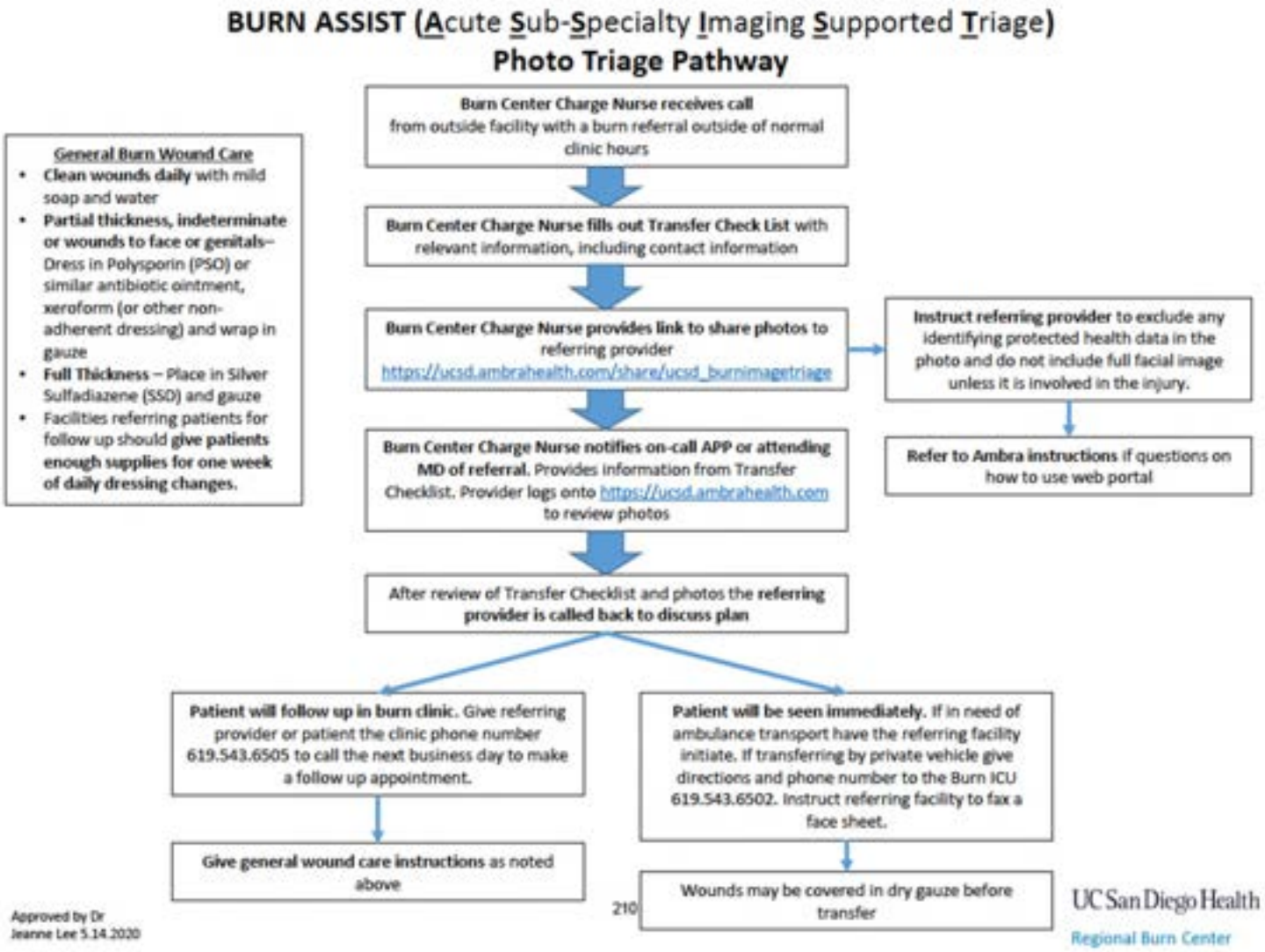
"PALMAR METHOD"

Patient's entire palmar surface is approximately 1%

For more information visit **ameriburn.org/burnreferral**

American Burn Association | 311 S. Wacker Drive, Suite 960 | Chicago, IL 60606 | ameriburn.org

To help guide the staff to triaging appropriately, there is also a system using Ambra which allows us to see pictures of the patient's injuries prior to transfer. This system is medicolegally covered and not a violation of any patient privacy laws. If there are any questions regarding any patients or the transfer process, please call the burn attending of the week or the in house attending if they are also a burn surgeon.

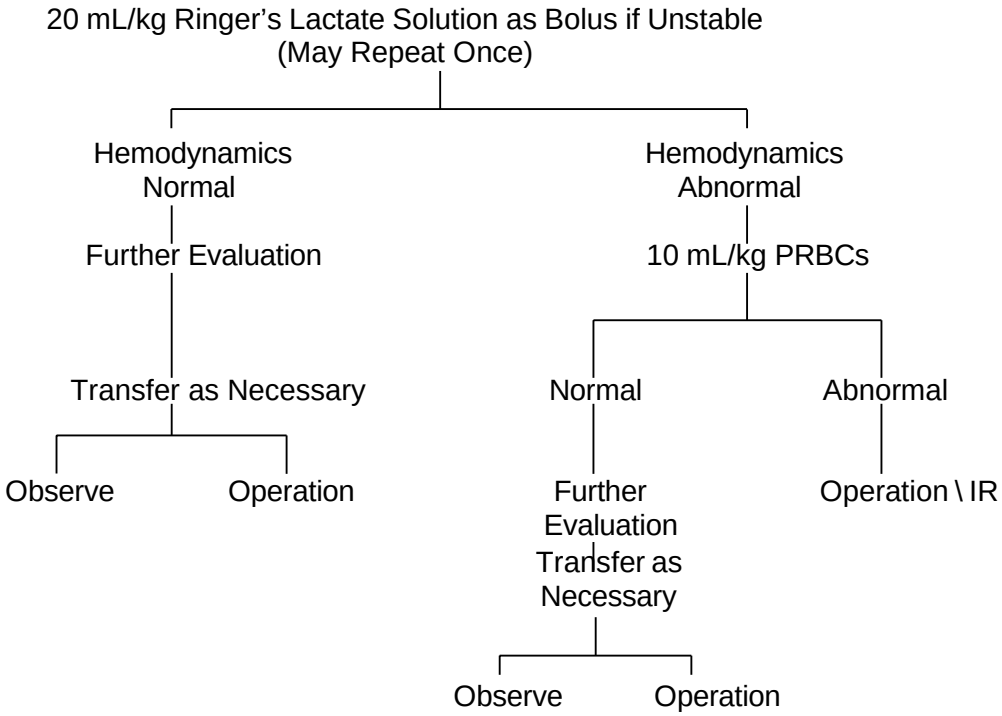


Pediatric Trauma

Pediatric Trauma

Pediatric Patient with Normal and Abnormal Hemodynamics

Surgical Consultation



Approach to the Child with Multiple Injuries

1) Airway:
    a. Open airway with modified jaw thrust while maintaining manual in-line cervical spine stabilization.
    b. Clear oropharynx with rigid suction device and pediatric Magill forceps as indicated.
    c. Maintain airway patency using appropriate suction device and oropharyngeal airway as necessary.
    d. If child is unresponsive or has signs of respiratory failure, intubate while holding cricoid pressure.
        i. Emergency airway if necessary. Note: children aged 8 or less should not undergo cricothyroidotomy (needle cricothyroidotomy and jet ventilation preferred).
2) Breathing:
    a. Administer 100% oxygen via nonrebreather mask if child is awake and breathes spontaneously.
    b. Hyperventilate with 100% oxygen using bag-valve mask if child has altered mental status or respiratory distress.

1) 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.
2) Disability:
    a. Immobilize neck with semirigid collar or head immobilizer and tape.
3) Exposure \ Environment:
    a. Remove clothes and proceed with full examination as per adult protocol.
    b. Warm room to prevent heat loss.
4) Insert nasal or orogastric tube and decompress stomach if intubation was necessary.
5) Workup with CXR, PXR, FAST, additional imaging as per adult protocol. Rapid identification of life-threatening injuries is critical.
6) 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. UCSD, on occasion, does receive pediatric patients. If you receive a pediatric trauma, it may be for one of 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. The child will then be brought with the parent to UCSD. This should not happen routinely, 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. 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. Please document the name of the pediatric trauma surgeon that you discussed the case with. You can reach the pediatric trauma surgeon on call by calling the Rady's operator at (858) 576-1700.

If a pediatric patient is admitted, they must be admitted to a floor with pediatric capabilities and PALS certified nurses. 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 by 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 statues 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

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 (≥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 *load* 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. • 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

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.
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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.

Geriatric Trauma

A. Trauma work-up of geriatric patients should proceed via ATLS protocol, with the following additional considerations:
    - High index of suspicion for shock as age-related changes may mask symptoms
    - Ventilators should use low volume, low pressure settings
    - IV fluids should be minimized in patients who are not found to have significant bleeding
    - If auditory/visual aids must be removed, they should be kept nearby and returned when possible
    - Backboards, c-collars etc. should be removed as soon as is safe to avoid skin breakdown
    - CT scanning should be used liberally to identify injuries and contrast should not be withheld when there is concern for bleeding, regardless of renal function
B. On admission, a home medication reconciliation should be performed with the patient or their family as soon as possible
    - Continue beta blocker if no hypotension
    - Continue statins
    - Continue dementia/Parkinson's medications
    - Continue medications with withdrawal potential
    - Review Beers list, consider discontinuing non-essential meds
C. Analgesia
    - Multimodal pain control with Tylenol, low-dose gabapentin
    - Limit opioids
    - Consider regional pain consult for epidural/block for rib or extremity fractures
D. Mentation
    - Assess baseline mental status
    - Prevent/address delirium
        a. Reinforce sleep-wake cycle including window shades up, lights on during day
        b. Ensure the patient has access to glasses, hearing aids, and other assistive devices
        c. Early mobilization
        d. Aggressive pulmonary hygiene
        e. Bowel regimen
        f. Document skin integrity daily
    - Assess capacity to make decisions. Patients with capacity should be able to:
        a. Demonstrate understanding of the medical problem
        b. Express that they have a choice
        c. Appreciate the condition for which treatment is being offered
        d. Have the ability to compare options and the consequences of those choices
E. Frailty
    - Frailty will be assessed in all patients ≥65 within 24h of admission and documented in the chart by nursing
    - Frailty will be assessed using the Trauma Specific Frailty Index (see table), adding the total points and dividing by 15. ≥0.25 is considered frail
    - All patients that meet criteria for frailty will receive PT/OT evaluation
F. Falls
    - All patients ≥65 admitted for a fall from standing should receive PT/OT evaluation
    - Medications should be reviewed for polypharmacy
    - Geriatrics consultation should be considered, particularly if polypharmacy is the suspected cause of the fall

- Patients and families should be provided with information on reducing fall risk in the future, including links to the CDC STEADI program (*www.cdc.gov/steadi/index.html*) and "stay independent" brochure (*www.cdc.gov/ steadi/patient.html*)

15 Variable Trauma Specific Frailty Index					
Comorbidities					
Cancer History	Yes (1)			No (0)	
Coronary Heart Disease	MI (1)	CABG (0.75)	PCI (0.5)	Medication (0.25)	None (0)
Dementia	Severe (1)	Moderate (0.5)		Mild (0.25)	No (0)
Daily Activities					
Help with grooming	Yes (1)			No (0)	
Help with managing money	Yes (1)			No (0)	
Help doing housework	Yes (1)			No (0)	
Help toileting					
Help walking	Wheelchair (1)	Walker (0.75)		Cane (0.5)	No (0)
Health Attitude					
Feel less useful	Most time (1)	Sometimes (0.5)		Never (0)	
Feel sad	Most time (1)	Sometimes (0.5)		Never (0)	
Feel effort to do everything	Most time (1)	Sometimes (0.5)		Never (0)	
Feel lonely	Most time (1)	Sometimes (0.5)		Never (0)	
Falls	Within last month (1)	Present not in last month (0.5)		None (0)	
Function					
Sexually active	Yes (0)			No (1)	
Nutrition					
Albumin	<3g/dL (1)			> 3g/dL (0)	
SCORE					
SCORE		**FI (Score/15)**			**>0.25 = Frail**

Indication for Geriatrics Consultation

Trauma Patients with the following should receive a Geriatrics Service Consultation within 72h of admission:

- ≥65 admitted to the SICU
- ≥65 with multiple rib fractures, polytrauma, or requiring major surgery
- Isolated hip fracture

- ≥65 with frailty score ≥0.25 (see table), or <65 with end-stage organ disease with frailty score ≥0.25

How to Submit a Geriatrics Consultation:

- Call via Web-Paging system 8am-5pm M-F

AND

- Enter order in EPIC for Geriatrics Consultation (Px Code: CON97): IP Consult to Geriatrics

Advanced Care Planning

Advanced Care Planning Discussion includes:

- Goals of Care conversation
    a. Identify primary care provider, HCPOA
    b. Existing ACP documentation reviewed
    c. Injuries/prognosis discussed
    d. Determine pre-trauma functional status
    e. Clarify code status
    f. Offer social work, pastoral services
- Document updated code status
- If not full code, or if a time-limited trial is established, complete a POLST
    a. Deliver to patient or HCPOA, primary MD, and place in chart

Documentation of Advanced Care Planning:

- All advanced care planning should be documented in the ACP tab
- Note type: Goals of Care
- Significant conversations should use *.advancedcareplanning* template
- Document duration of discussion

Billing of Advanced Care Planning

- Billing surgeon must be present for conversation
- If billing critical care:
    a. Write separate note documenting time
    b. Reference in progress note
    c. Add time to other critical care time and use total in progress note
- If not billing critical care:
    a. Can use CPT code 99497 for first half hour and 99498 for subsequent time

Indications for Palliative Care Consultation

- Patient/family request
- Patient/HCPOA wishes do not align with provider recommendations
- Time-limited trial is established
- Prognosis uncertain
- Significant burn
- TBI with GCS ≤12, paralysis, or amputation
- Trauma patient with end-stage organ disease or malignancy
- Hospice patient with full code status

Elder Abuse

- Patients with confirmed for suspected elder abuse should receive a social work consultation and have a report filed with Adult Protective Services (https://sandiego.leapsportal.net/LEAPSIntake/NewPublicIntakeReport.aspx)
- Elder abuse can include physical abuse, sexual abuse, neglect, psychological abuse, or financial exploitation
- Signs of abuse include:
    a. Different accounts from patient, family
    b. Caregiver interrupts/answers for patient
    c. Patient appears fearful of caregiver
    d. Caregiver appears unengaged or inattentive
    e. Caregiver appears frustrated, tired, angry, or overwhelmed with the patient
    f. Caregiver lacks knowledge of the patient's needs
    g. Evidence of alcohol/drug abuse in patient or caregiver
    h. Unexplained injuries
    i. Frequent admissions/ED visits for injuries
    j. Delay in presentation for injuries
    k. Suspicious injuries (see table)

Type of Abuse	Physical Findings
Physical Abuse	• Bruising in atypical locations (on lateral arms, back, face, ears, or neck rather than on bony prominences) • Patterned injuries (bite marks or injury consistent with the shape of a belt buckle, fingertip, or other object) • Wrist or ankle lesions or scars (suggesting inappropriate restraint) • Burns (particularly stocking/glove pattern suggesting forced immersion or cigarette/cigarette lighter pattern) • Multiple fractures or bruises of different ages • Traumatic alopecia or scalp hematomas • Subconjunctival, vitreous or retinal hemorrhages • Intra-oral soft tissue injuries
Sexual Abuse	• Genital, rectal, or oral trauma (including erythema, bruising, lacerations) • Evidence of sexually-transmitted disease
Neglect	• Cachexia/malnutrition • Dehydration • Pressure sore/decubitus ulcers • Poor body hygiene, unchanged diaper • Dirty, severely worn clothing • Elongated toenails • Poor oral hygiene

References:

1. ACS TQIP Abuse Best Practice Guideline. www.facs.org/media/o0wdimys/abuse_guidelines.pdf
2. ACS TQIP Geriatric Trauma Management Guidelines

https://www.facs.org/media/ubyj2ubl/best-practices-guidelines-geriatric-trauma.pdf
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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 VTE and should receive 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 (enoxaparin 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 (enoxaparin 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 below the knee 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 enoxaparin dosing given every 12 hours is the preferred pharmacologic agent for VTE prophylaxis. (See table for appropriate weight based dose)

Weight based enoxaparin dosing for VTE prophylaxis in trauma patients:

Weight (kg)	50-60 kg	61 – 100 kg	>100 kg
Enoxaparin dose	30 mg q12hrs	40 mg q12 hrs	50 mg q12 hrs

ii. Anti-Xa enoxaparin levels will be checked after the 3rd or 4th dose of enoxaparin to ensure the patient is receiving the appropriate prophylactic dose (peak level, to be drawn 3-5 hours after a dose is given). Enoxaparin doses should be adjusted if anti-Xa levels are out of range.
iii. Patients with a CrCl < 30mL/min may be given heparin 5000u q8 hours instead of enoxaparin to prevent systemic accumulation.
iv. If enoxaparin and heparin are contraindicated (history of HIT, etc.) other options for pharmacologic prophylaxis such as argatroban, fondaparineux, aspirin, oral anticoagulation, etc. may be considered. Please consult with the trauma attending/fellow and/or pharmacist if alternative VTE prophylaxis is being considered.

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: Enoxaparin should be held the morning prior to operative repair only if requested by orthopedics for certain high risk orthopedic procedures.

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 enoxaparin will be delayed > 48 hours, consideration should be given to IVC filter placement due to high risk of pulmonary embolism.

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 SCDs 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 enoxaparin, unfractionated heparin, or aspirin. In patients with orthopedics injuries these recommendations are made in conjunction with the orthopedic surgery team.

VTE References

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Surgical Critical Care

SICU – Nurse Involved Rounds

The nurse involved rounds process is intended to ensure that necessary information and orders needed are provided. The intent of this process is to ensure optimal patient care and streamline communication during rounds. In addition, this will provide a structured and streamlined approach to communication and collaboration during rounds. The goal is to assist with nursing workflow and improve nurse to provider communication.

Process:

- The form will be at each bedside for the night shift and dayshift RN to complete.
- The bedside nurse will be asked to join the team for rounds.
- After the provider completes their presentation of the patient the RN will review FASTHUGS+ and any clarifications, questions for the plan.

RN Involved Rounding Tool (to be completed by the bedside RN)	
F eeding	
A nalgesia	
S edation	Spontaneous awakening trial performed? Delirium Review
T hromboembolic prophylaxis	
H ead of bed elevation	Spine precautions? Progressive mobility?
S pontaneous breathing trial	
I ndwelling catheter removal	Nurse driven protocol?
L ines	Central line removal? Foley catheter removal?
S kin	Air mattress? C-collar removal/change to occiput? Dressing care instructions.
R estraints	Renewal order? Change to mittens?
F amily	
P lan of day	
O rders Needed	

FASTHUGS & ABCDEFGs:

These areas well be covered in the RNs report AFTER the MD presents (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?

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

☐ **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?

Goals of Care Communication:

Every patient admitted to the SICU should be considered for a Goals of Care (GOC) conversation. Early in a patients stay it is important to determine their desires for care including advanced resuscitation (CPR, Ventilator support, Feedings, etc.). If a patient has a POLST or Advanced Directive those should be obtained and documented in the EMR.

GOC Communications Advance Care Planning and/or Howell Service (palliative care) consult:

Consider 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 other

“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, or anytime there is a GOC discussion.
2. Notes on Family and patient discussions about Goals of care should be filed under the “Advanced Care Planning” tab in EPIC.
3. Notes on Code Status changes should be documented under the “Advanced Care Planning” tab in EPIC.
4. Note template **.GOALSOFCARE** may be used to guide documentation.

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

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 to 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.

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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.

- The person is openly and verbally upset. It is obvious and they are obvious about it.
- 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"

ETHICS

Ethics Consultation Service

UCSD has an ethics consultation service available 24/7 and can be reached via paging. Anybody involved in the care of a patient can contact the service directly. This can be done confidentially if requested to discuss concerns or questions.

Common reasons to request an ethics consult:
1. Treatment of unrepresented patients, when a patient who lacks capacity and has no surrogate to consent to treatment, ethics consult service should be contacted.

2. Disagreements about the determination that a particular treatment has been determined to be non-beneficial (futile), ethics consultation leads the conflict resolution process.

3. Uncertainty regarding the appropriateness of a surrogate decision maker, or who can serve as a surrogate.

4. Conflicts between advance directives, POLST forms, and surrogate decision makers choices, such as attempts to override the patient's previously stated preferences.

ETHICS ROUNDS

The Ethics service conducts weekly SICU Ethics rounds to discuss cases with the team.

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 Definition[1])

TABLE 1. Definition of ARDS

The Berlin criteria definition of ARDS includes:

- Onset of hypoxemia within 7 d of a known clinical insult or worsening respiratory symptoms
- Chest imaging with bilateral opacities not fully explained by effusions, lobar/lung collapse, or nodules
- Pulmonary edema not fully explained by cardiac failure or fluid overload
- Hypoxemia defined as a PaO_2/FIO_2 ratio ≤300 mmHg with PEEP or CPAP ≥5 cm H_2O
  - Mild ARDS: PaO_2/FIO_2 ratio 201–300 mm Hg
  - Moderate ARDS: PaO_2/FIO_2 ratio 101–200 mm Hg
  - Severe ARDS: PaO_2/FIO_2 ratio ≤100 mm Hg

From: The ARDS Definition Task Force. *Acute respiratory distress syndrome: The Berlin Definition.* JAMA 2012;307:2526–2533.

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 or 4 mL/kg (predicted body weight).
            a. Plateau pressures ≤30 cm H_2O if possible.
         2. Consider maintaining driving pressure ≤12-15 cm H2O
         3. 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 55-80mmHg[3]
         1. Higher goals unnecessary, can lead to complications from high PEEP or FiO2.
         2. PEEP/FiO2 Table for guidance

FIO_2 /PEEP Tables

Lower PEEP/Higher FIO2 table:

Step:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
FIO_2	0.3	0.4	0.4	0.5	0.5	0.6	0.7	0.7	0.7	0.8	0.9	0.9	0.9	1.0	1.0	1.0	1.0
PEEP	5	5	8	8	10	10	10	12	14	14	14	16	18	18	20	22	24

Higher PEEP/Lower FIO_2 table (from ROSE study):

Step:	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
FIO_2	0.3	0.4	0.4	0.4	0.4	0.4	0.4	0.5	0.5	0.5	0.6	0.7	0.8	0.8	0.9	1.0	1.0
PEEP	5	5	8	10	12	14	16	16	18	20	20	20	20	22	22	22	24

3. 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: pH > 7.2

iv. Severe ARDS ($PaO_2/FiO_2 \leq 100$ mmHg) – consider adjunctive therapies as below.

c. Vent Asynchrony
    i. Consider minor ventilator adjustments, i.e. flow rates and pattern, inspiratory pause.
    ii. Assess need for additional sedation or neuromuscular blockage

ci. 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).

cii. High-frequency or oscillatory ventilation
    i. Not currently available on UCSD ventilators. Mixed data for benefit in adults.

ciii. 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.

civ. Prone positioning
    i. Should be considered early (within 12-24 hours)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 <u>we may not have adequate experienced CCRN staff to prone the patient safely.</u>
        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.
4. Discontinue when:
    a. Instability in prone position
    b. Supine x4h, PaO2/FiO2>150 on FiO2<= 0.6 & PEEP <=10

h. 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 pneumothorax[6].
        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.

i. Steroids
    j. 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 extubation[9] and shorter ICU lengths of stay[10] but contain similar limitations. No definitive trial showing improvement in mortality has been done; outcomes of meta-analyses have been mixed[11-15].
        1. The most recent SCCM guidelines offer a conditional recommendation for steroid use in patients with early moderate to severe ARDS[16].
    i. 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.
    ii. 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 or ARDS[10]. Starting steroids ≥ 14 days after the onset of ARDS may increase the risk of death[8].
        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 restarted[9].

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.

k. Prostacyclin (PGI_2, 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 oxygenation[19].
   ii. May be considered as a last-ditch effort in refractory hypoxemia.

l. Extracorporeal Membrane Oxygenation (ECMO)

i. Consider for: EOLIA criteria
   1. PaO2/FiO2<50 x 3 hours
   2. PaO2/FiO2<80 x 6 hours
   3. pH<7.25 with PaCO2>60 x 6hours

ii. Despite initial poor results in randomized trials, more recent study of adult ECMO for severe ARDS is promising[20], including in trauma patients[21]. 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%.

iii. 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.

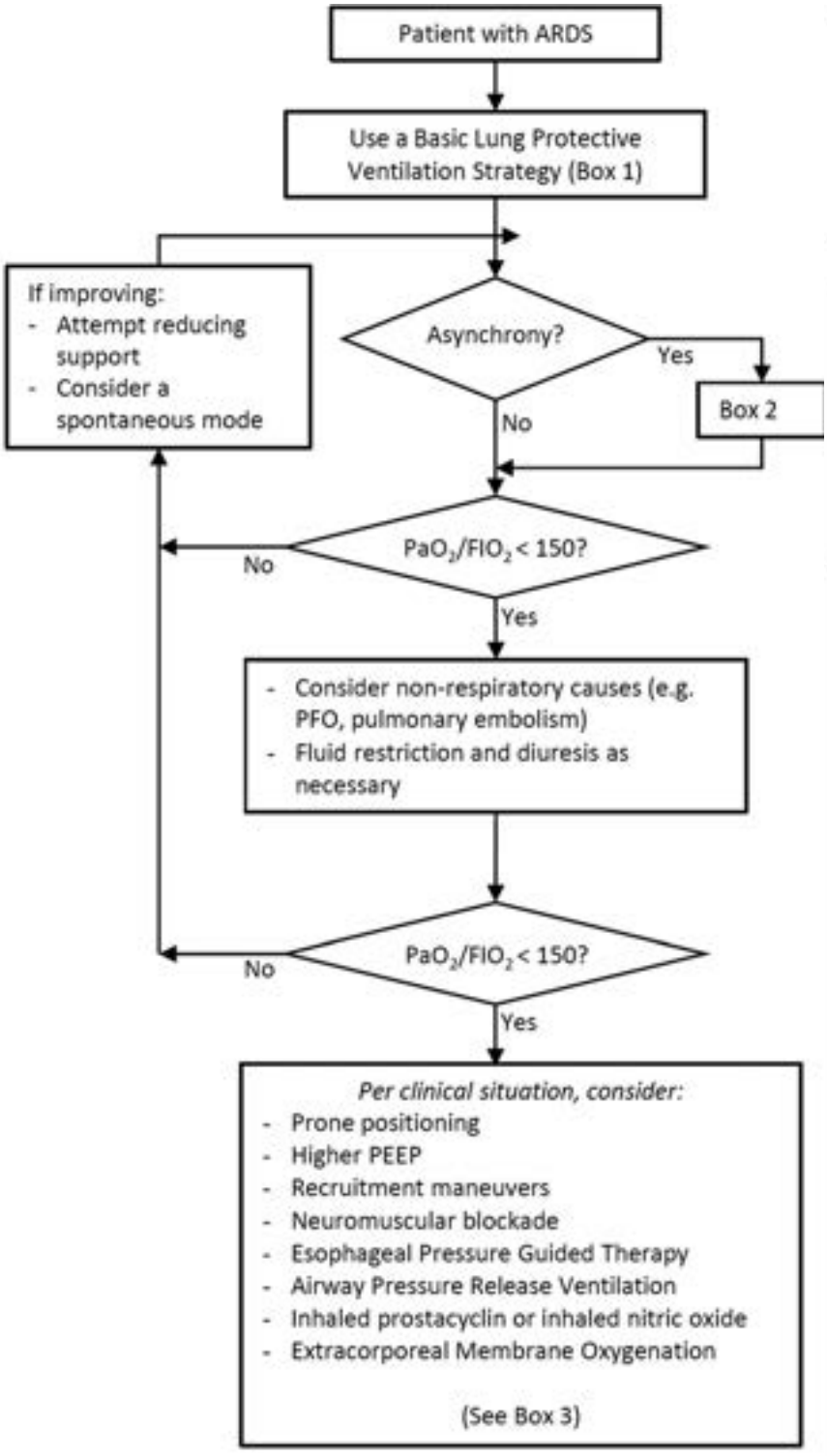
iv. Logistics:
   1. VV ECMO is standard (if patient requires VA ECMO then survivability must be re-assessed).
   2. Consult cardiothoracic surgery for input, recommendations, cannula placement.
      a. Setup takes time, consult CT surgery early to discuss options and coordinate.
      b. "**CODE ECMO**" 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.

v. UCSD ECMO / CODE ECMO protocols: https://pulse.ucsd.edu/departments/EDR/education/CVed/Pages/ECMO.aspx

vi. Good overview information: https://www.elso.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 outcomes[22]. Can be used selectively based on patient history and exam.
b. Rosuvastatin – did not improve clinical outcomes, may contribute to hepatic and renal dysfunction[23].
c. Intravenous prostaglandins
d. Anti-oxidants
e. Neutrophil elastase inhibitors
f. Ketoconazole
g. Surfactant
h. Keratinocyte growth factor



Box 1: Basic Lung Protective Ventilation

- Low tidal volume, low plateau pressure:
  a. Use VCV or PCV, targeting VT 6 mL/kg PBW
  b. Maintain Pplat ≤30 cm H_2O, reduce VT to 5 or 4 mL/kg if necessary
  c. PEEP/FiO_2 per table (see bottom of page)
- Consider maintaining driving pressure ≤12-15 cm H_2O
- If consolidation is asymmetrical, consider placing 'good lung' in dependent position

Box 2: Patient-Ventilator Asynchrony

- Consider minor ventilator adjustments (e.g., flow rate & pattern, inspiratory pause)
- Assess potential to treat with pharmacologic agents (e.g. sedation, neuromuscular blockade)
- For double-triggering, consider increasing VT 1 mL/kg (max 8 mL/kg), provided Pplat <30 cm H_2O
- For flow asynchrony, consider a variable flow pressure breath mode of ventilation (e.g., volume targeted pressure control, pressure support)

Box 3: Adjuncts to Consider

Prone Positioning

- Consider after initial 12-24 hrs of stabilization
- Use 16 hr/day Discontinue when:
  - Instability in prone position
  - Supine x 4 hr, PaO_2/FiO_2 >150 on FiO_2 ≤0.60 & PEEP ≤10

Higher PEEP

- Relative contraindications in TBI, hemorrhagic shock
- Refer to Higher PEEP/Lower FiO_2 table

Recruitment Maneuvers

- Consider for pts with clear de-recruitment, negative Ptp or PaO_2/FiO_2 <150
- Described maneuvers:
  - PCV with P_{high} 40, PI_{ow} 20-25 for 1-3 min (as tolerated)
  - PCV with delta-P of 15; increase PEEP by 5 cm H_2O to PIP of 40
  - Continuous positive pressure (30-40 cm H_2O), limited to 15-30 s

Neuromuscular Blockade

- Consider use if significant asynchrony present and concern for VILI

Esophageal Pressure (Pes) Guided Therapy

- Consider in BMI > 35 or patients with stiff chest walls
- Requires placement of esophageal pressure catheter

Airway Pressure Release Ventilation (APRV)

- Concern for P-SILI in pt with strong respiratory drive

Inhaled Nitric Oxide (iNO) – 10 ppm

- Consider in PaO_2/FiO_2 <100 and other strategies have not improved oxygenation
  - If positive response (improved oxygenation): reduce FIO2 down to 0.8, then wean iNO, or consider epoprostenol or iloprost
  - If no response, consider stopping

Extracorporeal Membrane Oxygenation (ECMO)

- Consider if (EOLIA criteria):
  - PaO_2/FiO_2 <50 x 3 hrs
  - PaO_2/FiO_2 <80 x 6 hrs
  - pH <7.25 with $PaCO_2$ >60 x6 hrs

Protocol to consider for patients with ARDS

Figure from Fawley et al, J Trauma Acute Care Surg. 2023;95(4):592-602.

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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

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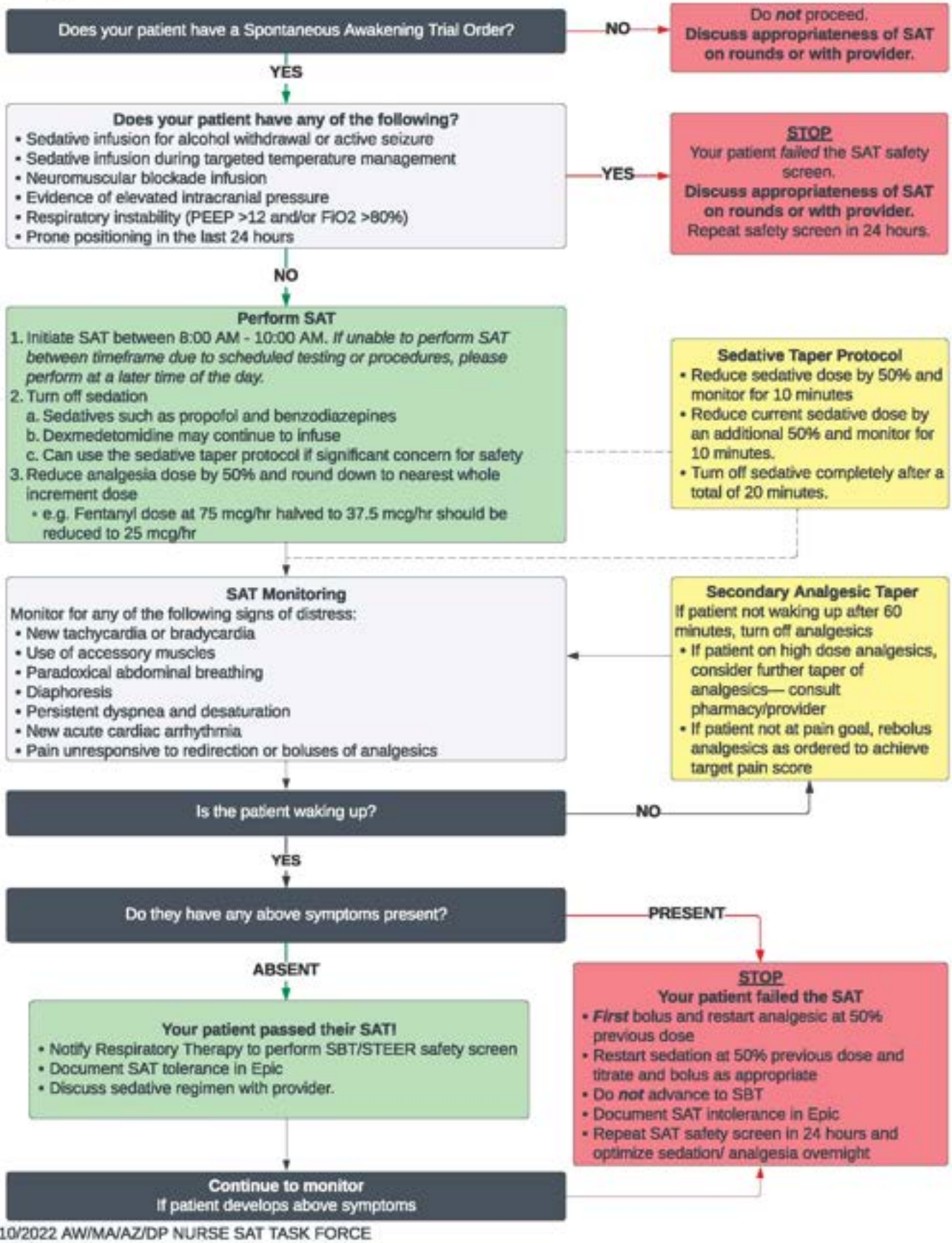
Spontaneous Awakening Trials (SAT)

- The order for an SAT should be placed at the time of placing the ventilator order, as appropriate.
- Sedation for ICU patients should target a RASS goal, most patients will ideally be at a -1 to 0.
- Some patients, i.e. those with severe traumatic brain injuries, may require deep sedation and not qualify for SATs.

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

UC San Diego Health

UC SAN DIEGO HEALTH SPONTANEOUS AWAKENING TRIAL (SAT) PROTOCOL



8/10/2022 AW/MA/AZ/DP NURSE SAT TASK FORCE

Ventilator Associated Events/Infection-related Ventilator Associated Complications

Background:

Ventilator Associated Events (VAEs) are identified by using a combination of objective criteria: deterioration in respiratory status after a period of stability or improvement on the ventilator, evidence of infection or inflammation, and laboratory evidence of respiratory infection. Patients must be mechanically ventilated for at least 4 calendar days to fulfill VAE criteria (where the day of intubation and initiation of mechanical ventilation is day 1). The earliest date of event for VAE (the date of onset of worsening oxygenation) is day 3 of mechanical ventilation.

The baseline period of stability or improvement on the ventilator is defined as the 2 calendar days immediately preceding the first day of increased daily minimum PEEP or FiO2, and must be characterized by ≥ 2 calendar days of stable or decreasing daily minimum FiO2 or PEEP values (specifically the daily minimum PEEP or FiO2 on the second day of the baseline period of stability or improvement must be equal to or less than the daily minimum PEEP or FiO2 on the first day of the baseline period of stability or improvement). The minimum daily PEEP or FiO2 used for VAE surveillance is the lowest setting during a calendar day that was maintained for > 1 hour.

Ventilator Associated Events are defined as the following changes over the baseline period:

1) Increase in FiO2 >20%
2) Increase in PEEP >3 cmH_2O

Goals:

- Reduce rapid ventilator wean that could lead to respiratory complications
- Improve rates of VAE and infection-related ventilator associated complications (IVACs)

Plan: *The following are a guide for initial ventilator settings, the ultimate decision for ventilator management will rely on the clinical judgement of the provider at the bedside.*

- Emergent or unplanned intubation - start at a PEEP of 8 cm H_2O
- Patients with BMI >50 - start at a PEEP of 10 cm H_2O
    - Weaning of PEEP and what PEEP to SPRINT at will be left at the discretion of the bedside provider
- FiO2 will start at 100%
    - FiO2 should be weaned based on pulse oximetry if an adequate wave form is present
    - FiO2 can be weaned by 20% every 30 minutes by bedside provider until down to 40% if pulse Ox ≥92% with adequate wave form.
        - If COPD or other respiratory illness, the bedside provider can choose a lower saturation goal that they feel appropriate
- Tidal volume should start at 4 to 8 mL/kg of predicted body weight (PBW)
- Ventilator settings should be titrated to appropriate plateau pressure and driving pressure
- Patients should be weaned to extubate using STEER protocol with Spontaneous Awakening and Spontaneous Breathing “sprint” Trials as appropriate.

Figure 1: Ventilator-Associated Events (VAE) Surveillance Algorithm

Patient has a baseline period of stability or improvement on the ventilator, defined by ≥ 2 calendar days of stable or decreasing daily minimum* FiO_2 or PEEP values. The baseline period is defined as the 2 calendar days immediately preceding the first day of increased daily minimum PEEP or FiO_2.

*Daily minimum defined by lowest value of FiO_2 or PEEP during a calendar day that is maintained for > 1 hour.

After a period of stability or improvement on the ventilator, the patient has at least one of the following indicators of worsening oxygenation:

1) Increase in daily minimum* FiO_2 of ≥ 0.20 (20 points) over the daily minimum FiO_2 of the first day in the baseline period, sustained for ≥ 2 calendar days.
2) Increase in daily minimum* PEEP values of ≥ 3 cmH_2O over the daily minimum PEEP of the first day in the baseline period†, sustained for ≥ 2 calendar days.

*Daily minimum defined by lowest value of FiO_2 or PEEP during a calendar day that is maintained for > 1 hour.

†Daily minimum PEEP values of 0-5 cmH_2O are considered equivalent for the purposes of VAE surveillance.

Ventilator-Associated Condition (VAC)

On or after calendar day 3 of mechanical ventilation and within 2 calendar days before or after the onset of worsening oxygenation, the patient meets both of the following criteria:

1) Temperature > 38 °C or < 36°C, **OR** white blood cell count ≥ 12,000 cells/mm^3 or ≤ 4,000 cells/mm^3.

AND

2) A new antimicrobial agent(s) (see Appendix for eligible antimicrobial agents) is started and is continued for ≥ 4 qualifying antimicrobial days (QAD).

Infection-related Ventilator-Associated Complication (IVAC)

On or after calendar day 3 of mechanical ventilation and within 2 calendar days before or after the onset of worsening oxygenation, ONE of the following criteria is met (**taking into account organism exclusions specified in the protocol**):

1) Criterion 1: Positive culture of one of the following specimens, meeting quantitative or semi-quantitative thresholds† as outlined in protocol, without requirement for purulent respiratory secretions:
   - Endotracheal aspirate, ≥ 10^5 CFU/ml or corresponding semi-quantitative result
   - Bronchoalveolar lavage, ≥ 10^4 CFU/ml or corresponding semi-quantitative result
   - Lung tissue, ≥ 10^4 CFU/g or corresponding semi-quantitative result
   - Protected specimen brush, ≥ 10^3 CFU/ml or corresponding semi-quantitative result
2) Criterion 2: Purulent respiratory secretions (defined as secretions from the lungs, bronchi, or trachea that contain ≥ 25 neutrophils and ≤ 10 squamous epithelial cells per low power field [lpf, x100])† **PLUS** organism identified from one of the following specimens (to include qualitative culture, or quantitative/semi-quantitative culture without sufficient growth to meet Criterion #1):
   - Sputum
   - Endotracheal aspirate
   - Bronchoalveolar lavage
   - Lung tissue
   - Protected specimen brush
3) Criterion 3: One of the following positive tests:
   - Organism identified from pleural fluid (where specimen was obtained during thoracentesis or within 24 hours of chest tube placement; pleural fluid specimens collected after a chest tube is repositioned or from a chest tube in place > 24 hours are not eligible for PVAP)
   - Lung histopathology, defined as: 1) abscess formation or foci of consolidation with intense neutrophil accumulation in bronchioles and alveoli; 2) evidence of lung parenchyma invasion by fungi (hyphae, pseudohyphae, or yeast forms); 3) evidence of infection with the viral pathogens listed below based on results of immunohistochemical assays, cytology, or microscopy performed on lung tissue
   - Diagnostic test for *Legionella* species
   - Diagnostic test on respiratory secretions for influenza virus, respiratory syncytial virus, adenovirus, parainfluenza virus, rhinovirus, human metapneumovirus, coronavirus

† If the laboratory reports semi-quantitative results, those results must correspond to the quantitative thresholds. Refer to Table 2 and 3.

Possible Ventilator-Associated Pneumonia (PVAP)

References:

- https://www.cdc.gov/nhsn/pdfs/pscmanual/10-vae_final.pdf
- Acute Respiratory Distress Syndrome Network; Brower RG, Matthay MA, Morris A, Schoenfeld D, Thompson BT, Wheeler A. Ventilation with lower tidal volumes as compared with traditional tidal volumes for acute lung injury and the acute respiratory distress syndrome. *N Engl J Med*. 2000 May 4;342(18):1301-1308.
- Amato MBP, Meade, MO, Slutsky AS, et al. Driving pressure and survival in the acute respiratory distress syndrome. *N Engl J Med*. 2015 Feb 19;372(8):747-755.

*****Antibiotics should be stopped at or before 72 hours if no supporting culture data to continue*****

- There are three criteria that can be used to meet the possible ventilator-associated pneumonia (PVAP) definition (Figure 1):

1. Positive culture meeting specific quantitative or semi-quantitative threshold (Table 3); January 2023 Device-associated Module VAE 10-16
2. Purulent respiratory secretions AND identification of organisms NOT meeting the quantitative or semi-quantitative thresholds specified in Table 3
3. One of the following
    a. Organisms identified from pleural fluid specimen (where specimen was obtained during thoracentesis or within 24 hours of chest tube placement; pleural fluid specimens collected after a chest tube is repositioned or from a chest tube in place > 24 hours are not eligible for PVAP)
    b. Positive lung histopathology
    c. Lower respiratory specimen cytology findings suggestive of infection
    d. Positive diagnostic test for Legionella species or selected respiratory viruses.

Table 3: Threshold values for cultured specimens used in the PVAP definition

Specimen collection/technique	Values
Lung tissue	≥ 10^4 CFU/g tissue*
Bronchoscopically (B) obtained specimens	
Bronchoalveolar lavage (B-BAL)	≥ 10^4 CFU/ml*
Protected BAL (B-PBAL)	≥ 10^4 CFU/ml*
Protected specimen brushing (B-PSB)	≥ 10^3 CFU/ml*
Nonbronchoscopically (NB) obtained (blind) specimens	
NB-BAL	≥ 10^4 CFU/ml*
NB-PSB	≥ 10^3 CFU/ml*
Endotracheal aspirate (ETA)	≥ 10^5 CFU/ml*

CFU = colony forming units, g = gram, ml = milliliter

*Or corresponding semi-quantitative result (see FAQ no. 24 at the end of this protocol)

Ventilator STEER Protocol for weaning:

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

Full policy can be found at:
UCSD Ventilator STEER Protocol

UCSD Ventilator STEER Protocol

Overview of the Process:

1. Within 24 hours of initiation of mechanical ventilation, the RCP will ask the provider to enroll the patient into the Ventilator STEER Protocol by placing the order in EPIC.

SCREEN:

2. Assessment will be done by the RCP twice daily to determine what type of trial to initiate.
3. Exclusion criteria:
    a. PEEP > 10
    b. FiO2 > .45
    c. SaO2 < 92%
    d. Hemodynamic instability
    e. HR > 140
    f. Unstable angina
    g. Increased ICP
    h. Neuromuscular blockers
    i. Sedation drip
    j. APRV with P-High ≥24
    k. A physician has requested patient not have measurements or trials completed

TEST

4. The RCP will measure the RSBI, by placing the patient on a minimum CPAP and pressure support (PS) as ordered by the physician for one minute.
5. Upon completion of the assessment, the RCP will initiate the Ventilator STEER Protocol per the protocol guidelines (see section III, B: Exercise).
6. Ongoing assessment will accompany trials to assure the efficiency of readiness for removing mechanical ventilation.
7. Throughout the Ventilator STEER Protocol, the RCP must monitor respiratory rate, respiratory pattern, spontaneous tidal volume, saturation, work of breathing, and hemodynamic response (blood pressure, cardiac rate, and rhythm).

EXERCISE, **E**VALUATE, **R**EPORT

8. Level 1A: CPAP Trial with Pressure Support of 0 or 5 x 2 Hours

    a. If the RSBI is < 100, the RCP will continue the CPAP Trial for 2 hours with the same FiO2 and PEEP and PS of 0 or 5. After the trial has been completed, the RCP should repeat the RSBI.

    b. If the patient completes the CPAP trial successfully, the RCP will contact the physician to request an order for an extubation protocol or further plans.

    c. If the physician requests to extend the sprint on current settings, the RCP will enter this sprint protocol order as stated by the MD.

    d. If the physician's request includes a change in sprint settings, a new, non-protocol sprint order must be written indicating the new settings.

        i. The STEER protocol will resume the following day unless the physician enters an order to exempt the patient from the STEER protocol.

    e. If the patient did not complete the CPAP trial successfully, the trial should be terminated and repeated in 4-6 hours. Patients who do not progress in the trials within 48 hours are classified as "Level 3/ Failure of CPAP Trial, not progressing." The physician should be notified.

9. Level 1B:

    a. The patient has completed a successful sprint, and the physician has requested to hold an extubation/trach collar for other reasons.

        i. Surgery or other procedures for example.

10. Level 2: Augmented Pressure Support Trial x 30 minutes BID

    a. If the RSBI is > 100, the RCP will contact the physician to determine either Augmented Pressure Support or SIMV/PS trials.

        i. The trial of choice at UCSan Diego Health System is the Augmented Pressure Support mode.

        ii. Once a method has been selected, it should be utilized throughout the trials for RSBIs > 100

    b. If the RSBI is > 100, the patient will be placed on a PS of 20 and then decreased by 5 until their rate is 25-35. The patient will sprint on the assessed PS.

c. If the patient completes the Augmented Pressure Support successfully, the RSBI should be repeated in 4-6 hours on minimal support (CPAP/PS 0 or 5). If the RSBI remains > 100, the pressure support used during the next sprint will be decreased by 5. If PS reaches 10, it may be decreased by increments of 2.

d. If the patient did not complete the Augmented Pressure Support successfully, the trial should be terminated, and the RSBI should be repeated in 4-6 hours. If the RSBI remains > 100, the patient should be placed on a PS of 20 and decrease by 5 until their rate is 25-35.

11. Level 3: Failure to progress in trials within 48 hours

    a. Patients who do not progress in the trials within 48 hours are classified as "Level 3/ Failure of Augmented Pressure Support Trial, not progressing." The physician should then be notified.

    b. Patients in this category may require more extensive evaluations due to their inability for readiness to be taken off mechanical ventilation. They will, however, continue to undergo assessments and, if the RSBI can be obtained, be initiated on trials unless the patient is taken out of the protocol by an order from their physician.

12. Level 4: Do not complete RSBI

    a. If at any time the patient has transitioned from a "do not complete RSBI," the RCP will notify the physician before initiating the first trial. The only exception is if the patient has undergone post-op surgery within the past 24 hours

Termination of STEER trials:

1. A trial will be terminated if one or more of the following:
    a. B/P is < 90 or > 170, the RR is > 35 for five minutes
    b. There is a change in HR of 20% or > 130/beats per minute
    c. There is a 50% reduction in the minute ventilation
    d. SaO2 < 90 or within physician-specified limits.
    e. arrhythmias are noted
        i. If the patient experiences arrhythmias during the trial, the physician/RN should be notified, and the trial should only be repeated once the physician has approved to proceed.
        ii. If the RCP notes contraindications or observes an adverse response, the physician and R.N. will be immediately informed.

REPORT:
The RCP will report back to the provider how the patient did at the end of 2 hours or if the trial was terminated early. If the patient is not ready for extubation, the patient should be placed back on their previous settings. In general, prolonged sprint trials are used only for patients requiring long term vent weaning.

Ventilator Extubation Protocol

Link to full version: Ventilator Extubation Protocol

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 with an order from the physician
2. 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
3. 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

Procedure:

1. Oxygen Therapy:
    1. The RCP will initiate the Oxygen Inpatient Protocol.
    2. The RCP will notify the physician if the oxygen requirement increase is more than 3 LPM or 10% FiO2
2. Bronchodilator Therapy:
    1. The RCP will initiate the Bronchodilator Protocol if the patient is wheezing or if clinically indicated.
3. Secretion Clearance:
    1. The RCP will initiate the secretion clearance protocol if the patient has a moderate amount of secretions post-extubation or if clinically indicated.
4. Lung Expansion:
    1. If able, the patient will perform the incentive spirometer (IS) at 30 minutes and 2 hours post-extubation
    2. If the IS achieved is less than 15 mL/kg per ideal body weight, the RCP will initiate the Lung Expansion Protocol.
    3. If unable to perform the initial IS, and atelectasis is present on the x-ray, the RCP will initiate the Lung Expansion Protocol if clinically indicated.

Additional Notes: Extubation of Trauma Patients

DO NOT EXTUBATE patients under the following circumstances without the approval and presence of a

trauma attending/fellow:

1. After 1900 hours.
2. 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.)
3. Patients status postoperative neck surgery (spine surgery cases included)
4. Patients with known spinal cord injury
5. Patients with significant chest trauma

UCSD Ventilator EXTUBATION Protocol

Early tracheostomy

The timing of tracheostomy in patients requiring prolonged ventilation is somewhat controversial. Many studies have evaluated the needs for early tracheostomy (within 7-10 days) for patients with TBI. The goal being improved ability to liberate from the ventilator decreasing ICU and hospital length of stay. This also has the potential to decrease pneumonia, costs and overall morbidity and mortality.

Patients with severe TBI frequently require mechanical ventilation in the ICU as a component of their post-injury care. If the level of consciousness remains persistently depressed and more than 7-10 days of mechanical ventilation are anticipated such that they cannot be extubated, these patients should be considered for early tracheostomy to facilitate liberation from the ventilator as well as decrease the risk of pneumonia and ventilator-induced lung injury.

- Patients with low chance of survival should not undergo early tracheostomy
- Relative contraindications include high intracranial pressure, hemodynamic instability, and severe respiratory failure requiring high levels of FiO2 (>50%) and PEEP (>10cm H2O).
- Benefits of tracheostomy include improved comfort due to reduced oropharyngeal irritation and improved pulmonary toilet
- Tracheostomy within 8 days of hospitalization is associated with shorter mechanical ventilation duration and shorter ICU and hospital stays, as well as lower risks of pneumonia, DVT, and decubitus ulcers.
- Tracheostomies are most often performed at bedside in the ICU under sedation, but can be performed open in the operating room with the trauma service at the discretion of the team if the anatomy is felt to be unfavorable or the patient is otherwise a poor candidate for a percutaneous tracheostomy.

  Tube feeds must be held at midnight prior to planned tracheostomy

- Ultimate decision for tracheostomy is at the discretion of the clinical faculty and team in communication with the patient and family.

ICU Tracheostomy checklist

- ☐ Obtain consent in chart
- ☐ Let respiratory therapist and patient's nurse know planned time
- ☐ Hold tube feeds at midnight the night prior
- ☐ Percutaneous tracheostomy kits (in skeleton key room)—kits do not include tracheostomy tubes
- ☐ Bring 2 sizes of tracheostomy tube- typically initial cannulation with size 8 (Portex brand works with current kits; not Shiley)
- ☐ Sterile gowns/gloves/caps/masks/eyewear (line bundle has all this)
- ☐ Bronchoscopy with local anesthetic order on Epic
- ☐ Bronchoscopy tower
- ☐ Sedating medications (ketamine, fentanyl/versed), paralytic (vecuronium)—must pre-order on Epic
- ☐ Patient positioning: bed flat, patient supine, neck and chest area free of leads/tubes, wide prep
- ☐ Shoulder roll to extend patient's neck
- ☐ Time out prior to beginning
- ☐ Remember to keep obturator and give to patient's nurse at conclusion of procedure

References:

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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
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4) 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.
5) 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.
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8) 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.
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11) 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.
12) 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).
13) 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.

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 tranfusion.[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.

Brain Death Criteria and Process

The purpose of this section is to provide an overview of the process and necessary procedures for determination of brain death.

Links:

The full UCSD Policy can be found at: UCSDHP 832.1 Death by Whole Brain Criteria

UCSDHP 832.1 Death by Whole Brain Criteria

Link to documentation guide: Documenting Death By Whole Brain Criteria

Links to Respiratory process for apnea test: Apnea Test for Determination of Brain Death

Definition of Brain Death:

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 Code7180 Determination of Death Act).

This is a medical and legal definition.

Process of Determination of Death by Whole Brain Criteria

- 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.
- Documentation must be completed by the ***attending***.
- 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).

- Two of the following 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:

    a. 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.

    b. 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 procedures (see below) but apnea testing may not be used as part of the criteria for establishing death by brain criteria.

    c. Core temperature must be above 36°.

    d. No neuromuscular blockade or continued presence of neuromuscular blocking agents (defined by the presence of a train of 4 twitches with maximal nerve stimulation).

    e. Systolic blood pressure must be ≥ 100 mm Hg. Vasoactive medications are allowable to maintain system blood pressure.

    f. No severe electrolyte abnormalities.

    g. No severe metabolic/acid-base disorders.

    h. No "Locked-in" syndrome.

3. For hypoxic-ischemic events, at least 24 hours must elapse before clinical determination. If certain that it is not due to hypoxic-ischemic event then several hours must pass

4. 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:

    a. <u>Cerebral Unresponsiveness</u>: Deep Coma, patient must lack all evidence of responsiveness. No eye opening, eye movement to noxious stimuli, no motor response to noxious stimuli except for spinally mediated reflexes.

    b. <u>Absence of all brain stem reflexes</u>:

        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 relex
viii. No grimacing to noxious stimuli
ix. No cough response to bronchial suctioning
x. No swallowing or yawning

c. Apnea:

i. Purpose of apnea test: To demonstrate that there are no respiratory efforts despite the stimulus of marked acidemia, indicating severe damage to the medulla.

ii. 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.

iii. Apnea Test Procedure:

1. Prerequisites Core temperature ≥ 36°C and Systolic blood pressure ≥ 100 mm Hg
2. Specific procedures and setup are detailed in the Respiratory Therapy manual.
3. Expose patient's chest and diaphragmatic area.
4. Adjust ventilation for PCO2 = 35 to 45 and obtain baseline arterial blood gas.
5. Pre-oxygenate for 10 minutes with 100% O2 to a Pa02 of ≥200 mm Hg
6. 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% O2 without ventilator pressure support while maintaining PEEP.
7. Watch for signs of respiratory effort.
8. 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 < 90mmHg 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).

iv. Results of Apnea Test:

1. *Apnea confirmed*: Respiratory movements are absent and any one or more of the following is found: $PaCO_2$ > 60 mmHg and/or $PaCO_2$ at least 20 mmHg over baseline blood gas

2. *Apnea not confirmed* - Respiratory effort is observed.

3. *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.

d. 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):

   i. 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).

   ii. Movement of the abdomen from ventricular contractions or abdominal aortic pulsations should not be confused with diaphragmatic movement during apnea test.

   iii. Sweating, blushing, tachycardia.

   iv. Absence of diabetes insipidus.

   v. Normal blood pressure without pharmacologic support; sudden increases in blood pressure or heart rate.

e. <u>Ancillary Testing Procedures</u>

   i. 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.

ii. Ancillary testing is not required for the diagnosis of death by whole-brain criteria, but may 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).

iii. Conventional Angiography, EEG and Technetium-99m Brain scan are potential ancillary tests, see the policy for additional details.

5. Documentation:

a. Must be done by an attending.

b. Use of the Epic NoteWriter prepared note is encouraged to ensure proper documentation compliant with UCSD policy and State Law. Microsoft Word - Documenting Death By Whole Brain Criteria Notes.docx (ucsd.edu)

Microsoft Word - Documenting Death By Whole Brain Criteria Notes.docx

c. Note must include

i. Etiology and irreversibility of condition

ii. Documentation of the exam including, cerebral unresponsiveness, absence of brainstem reflexes, absence of motor response to pain

iii. Apnea test results including ABG with absence of respiration with $pCO2 \geq 60$ mmHg or rise of >200mmHg.

iv. Justification for ancillary test(s) if needed and results of the tests.

v. Date and time of exam

vi. Name and title of the attending performing each exam

d. Date and Time of Death are determined by the 2nd exam.

i. Second exam should be done at an interval of ~6hours.

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) Documentation of wire removal and secondary witness must be in the Central Line note.
9) 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)
10) The CDPH hospital fine for an internally lost guidewire is $50,000 to $100,000.
11) The UCSD Central Line Blood Stream Infection rate is publicly reportable.
12) The necessity of a Central Line or PICC must be documented daily by state law.
13) Use of peripheral IVs placed with ultrasound guidance reduces need for central lines and PICCs and the CLABSI rate.

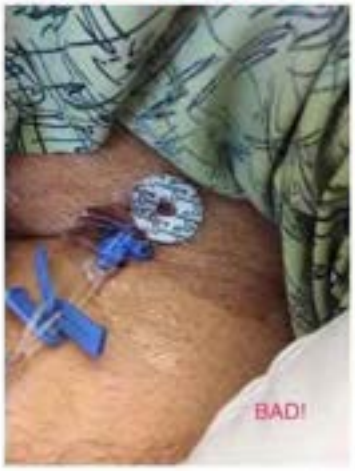
The UCSD Central Line online training course can be found at http://mycourses.ucsd.edu/

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

******When in doubt ask for help, if you are unfamiliar with a line set or think you have had a complication you must speak up.******

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.

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 Antibiograms are available on the Infection Control pages via links on the intranet homepage (go to Pulse Intranet → Departments & Services → Infection Control / Epidemiology Unit → ICC Information Reports → Quarterly Reports → choose the latest quarter → Antibiogram)

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 dosingin 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/mm^3) or leukocytosis (≥12,000 WBC/mm^3)
    - 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

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 Infections[1-5]: *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 > 38C or < 36 C, HR > 90 beats/min, RR > 20 breaths/min or PaCO2 < 32 mmHg; or WBC > 12 or < 4 or >= 10% bands

***Clostridioides difficile* Infection[6]:** *see UCSDH CDI Guideline (WD1124)*

Infectious Diarrhea[1,7,29]**:**	
Note: Avoid antibiotics in the presence of Shiga-toxin (such as Shiga-toxin producing E. coli, aka STEC). Therefore, antibiotics should be avoided for bloody diarrhea in immunocompetent adults until the infecting bacteria is identified unless the patient is septic	
Campylobacter spp.	5 days
Escherichia coli (non-STEC)	3 days
Salmonella spp.	5-7 days 14 days if immunocompromised
Shigella spp.	3 days 7 days if immunocompromised
Vibrio parahaemolyticus	1-3 days
Giardia 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-*Staph. aureus* spp.	3-5 days[2,8]	
	Persistent instability; *Staph. aureus* or *Legionella 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 *Streptococcal* 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 Ulcer[19]**:** *Manage jointly by wound, orthopedic, and ID services with antibiotics & surgical debridement*		
Soft tissue involvement *without* 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 *without* 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 >38.5ºC, 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

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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, September 2022

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.

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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 H_2 receptor antagonists (H2-antagonists) should be used FIRST for stress ulcer prophylaxis in ICU patients[7].
   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 ventilation[10]
      - Glasgow Coma Score <10 [11]
      - Burn injury>35% of body surface
      - Acute spinal cord injury[12]
      - Transplant patients in the immediate peri-operative period[13]
      - Hepatic failure[14]
      - Multiple trauma (Injury Severity Score >15)[51*]
      - 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 disease[22]
      - Documented erosive esophagitis/ hypersecretory conditions (Zollinger –Ellison syndrome)[23]
      - Treatment of *Heliobacter 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 therapy[26-30] (e.g. aspirin, clopidogrel, prasugrel, dipyridamole)
   c) IV PPI use has no know advantage over oral/enteral PPIs unless the patient in NPO.

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- 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.

UCSD Medical Center: SURGICAL INTENSIVE CARE UNIT, TRAUMA	POLICY/PROCEDURE TITLE: **NPO Guidelines for Trauma and Surgical ICU Patients**
RELATED TO: ☒ Nursing Practice Standards JCAHO ☒ Patient Care Standards ☐ QA ☐ Other ☐ Title 22	☒ ADMINISTRATIVE ☒ CLINICAL PAGE 1 OF 1 Effective date: 9/11 Revision date: 4/14, 8/2019 Unit/Department of Origin: Trauma, Anesthesia, and Nursing Critical Care Committee Revision Approval: August 2, 2019

Subject: NPO Guidelines for Trauma/Surgical ICU Patients and Critical Care Patients

POLICY STATEMENT:
In order to optimize nutrition support for critically ill and injured patients needing surgical procedures, NPO guidelines will guide the practitioner to hold feedings for a minimum amount of time to ensure patient safety.

RESPONSIBLE PARTY:
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 should use the following pre-operative NPO guidelines. The guidelines may be used for all critical care patients, per RN and MD discussion:

1. Intubated patients:
    a. Pre-operative ICU patients with a cuffed endotracheal tube or cuffed tracheostomy tube in place, NOT undergoing gastrointestinal procedures, airway procedures, or procedures in the prone position (including tracheostomy, planned extubation or airway exchanges):
        i. Gastric or post-pyloric enteral tube feedings should be continued up to the time of transport to the operating room.
    b. Those undergoing gastrointestinal procedures, airway procedures, or procedures in the prone position (including tracheostomy, planned extubation or airway exchanges):
        i. All diets and tube feeding should be stopped 6 hours prior to surgery

2. Non-Intubated patients:
    a. All pre-operative non-intubated ICU patients:
        i. All tube feeding should be stopped 6 hours prior to surgery

3. In patients where enteral feedings are held, significant effort should be made to:
    a. Adjust feeding rate to compensate for time without feeding
        i. Consult nutrition for volume-based feeding protocol

b. Hold or adjust insulin accordingly
    i. Refer to Nutrition on Hold Unexpectedly Guideline
c. Add or start D10 infusion
    i. Refer to Nutrition on Hold Unexpectedly Guideline
d. Start tube feeding as early as possible after surgery

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https://www.ncbi.nlm.nih.gov/pmc/articles/PMC5606376/
https://www.ncbi.nlm.nih.gov/pubmed/19251911

NPO Guidelines for Trauma/Surgical Critical Care - Effective April 2011

- *Approved by Anesthesiology QI committee, February 2, 2011 (Revision April 4, 2011, April 14, 2019)*
- *Trauma Multidisciplinary Committee, April 19, 2011 (Revision July 31, 2019)*
- *Critical Care Committee August 2, 2019*

2018 Nursing Guidelines of Care: Gastrointestinal

Nutrition on Hold Unexpectedly Guideline

This algorithm is a guideline. Contact physician for orders.

Patient is unexpectedly made NPO and/or nutrition is on hold or interrupted.

Patient on insulin infusion

RN will recheck blood glucose (BG), enter BG in Insulin Infusion Computer Calculator, Specify "YES" to Nutrition on Hold or Decreased, and adjust insulin infusion rate based on new IICC recommendation

Consider starting D10 at tube feed/TPN infusion rate*
(caution patients with cerebral edema or hyponatremia)

Resume q 1 hour glucose monitoring until glucose in range for 3 consecutive readings, per MCP 322.1.

If BG<70 mg/dL or 70-79 mg/dL and symptomatic,
Follow hospital hypoglycemia protocol.
•••Recheck BG in 15 minutes per protocol•••

If >2 consecutive BG<80 mg/dL, notify MD. Pharmacy may be contacted for further consultation.

Patient on subcutaneous insulin

For patient with glargine insulin order:

Continue glargine insulin. Consider reducing the dose by 20% if tight control or high risk of hypoglycemia

For patient with routine scheduled nutritional insulin (regular or lispro):

If dose of scheduled nutritional insulin given in past 1-6 hours, increase frequency of glucose monitoring q 1-2 hours until insulin action complete

Hold future nutritional insulin until nutrition resumes but continue correction insulin.

If BG<70 mg/dL or 70-79 mg/dL and symptomatic,
Follow hospital hypoglycemia protocol.
•••Recheck BG in 15-30 minutes per protocol•••

Notify MD. Consider starting D10 at tube feed/TPN infusion rate. Pharmacist may be contacted for further consultation.

Resume q 4-6 hour and prn glucose monitoring.

*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).

2018 SCCM

Clinical Practice Guidelines for the Prevention and Management of Pain, Agitation/Sedation, Delirium, Immobility, and Sleep Disruption in the Adult Patients in the ICU

"PADIS" Guideline *CCM* 2018

JS HOPKINS
EDICINE

Pain	Sedation	Delirium	Immobility	Sleep
Use an assessment-driven, protocol-based, stepwise approach		**Multicomponent, non-pharma approach** **Prevent or Tx, NOT:** - Haldol or Antitypical antipsychotic - Statin Dexmed **ONLY** in pre-extubation agitation **No** bright light single Tx	**Suggest Rehab/mobility** Pt harm is ***rare*** MV & Pressors ***not*** barriers Start/stop guidance (Table)	Protocol Consider: eye mask & ear plug **Not:** - Aromatherapy - Acupressure - Music - Propofol **No** recommend: - Melatonin - Dexmed
Multimodal analgesia (A-1) **Consider:** - Acetaminophen - Nefopam (if avble) - Ketamine (surg) - Massage - Music - Ice-pack - Breathing/relax	**Light sedation** **Protocol *or* DSI** **Use** Propofol *or* Dexmed *vs* Benzo *No RCT* on restraints			

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 outcomes[2]

~~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:		
 **500mg Ketamine vial in Pyxis** For violent/agitated delirium use 2-4 mg/kg **IM – (intramuscular)**	 **50mg/5ml Ketamine stick in Pyxis** For acute severe pain give 0.1-0.3mg IV (repeat q5min) Burn dressing changes: Intubated - 50mg IV Non-intubated - 0.3mg/kg	 **Ketamine infusion** For multimodal pain control – i.e. add-on to PCA: 0.1-0.3mg IV/hour

Three ways to use ketamine in Trauma/Critical Care patients

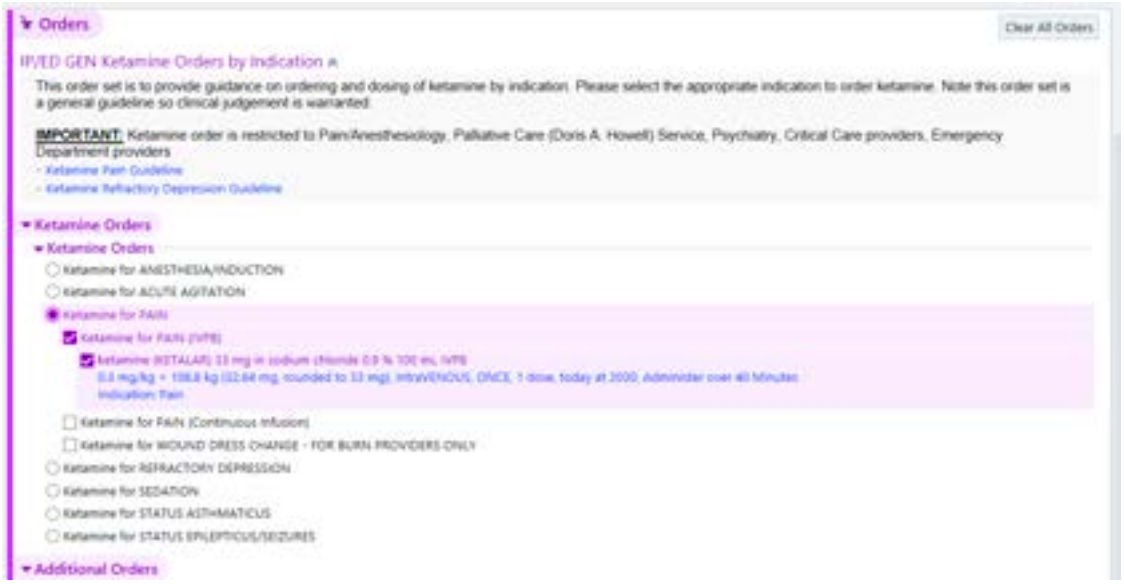
1. **Sub-dissociative dose –**
    - **Additive as secondary in multimodality pain control (ketamine drip)**
    - **Acute pain (ketamine stick – 50mg in 5ml)**
2. **Dissociative dose – extreme/violent agitation (the big 500mg vial)**

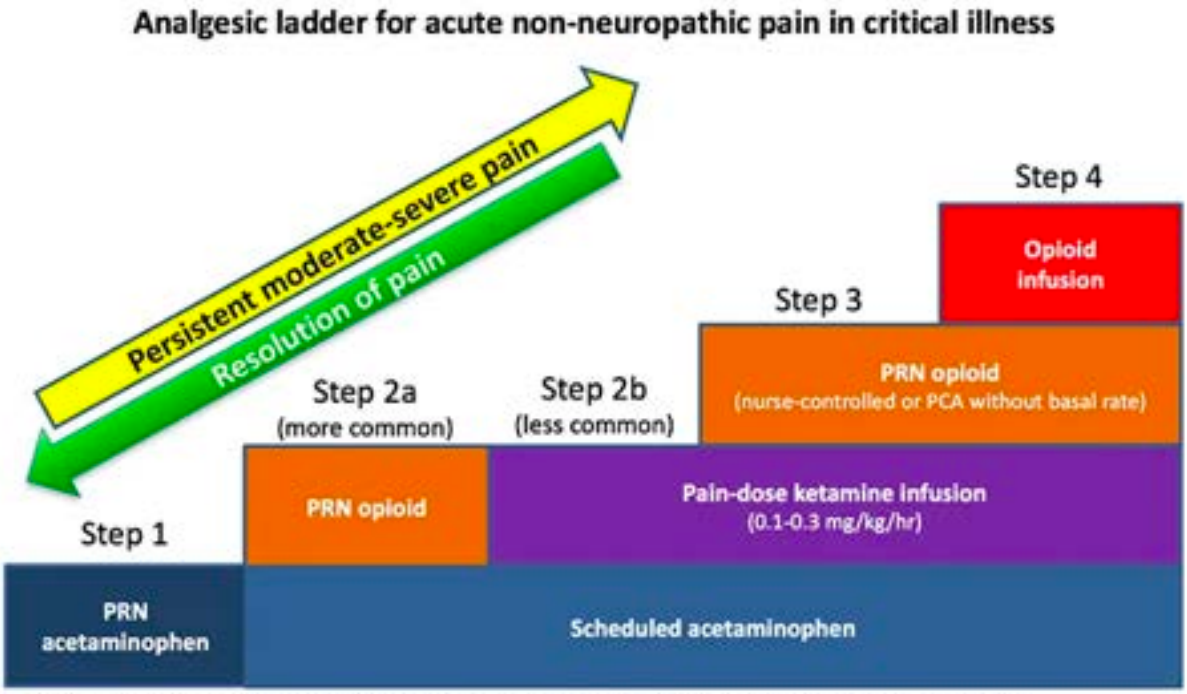
Sub-dissociative dose – multimodality pain control[6-8]

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:





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)

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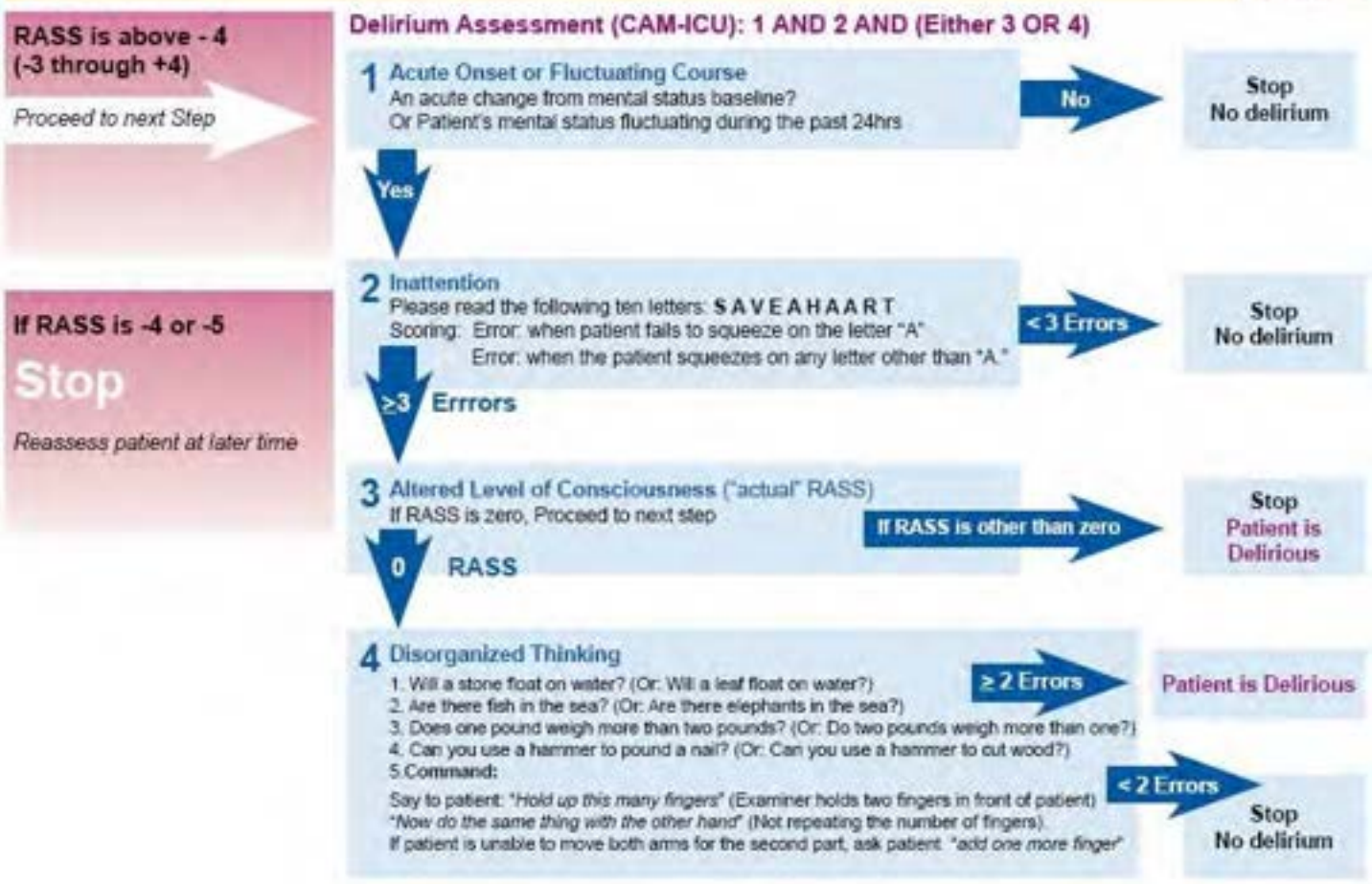
CONFUSION ASSESSMENT METHOD IN THE ICU (CAM-ICU)

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): ____

Directions: 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." Read letters from the following letter list in a normal tone:

S A V E A H A A R T

Scoring: Errors are counted when patient fails to squeeze on the letter "A" and when the patient squeezes on any letter other than "A."

2B: VISUAL (Pictures - ASE) — Record score (enter NT for not tested) — Score (out of 10): ____

Directions: Use the Picture Packets (A and B) on the next page.

FEATURE 3: Disorganized Thinking — Positive, if the combined score isles than 4 — Positive Negative

3A: Yes/No Questions

(Use either Set A or B, alternate on consecutive days if necessary):

Combined Score (3A + 3B): ____ (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 if the actual RASS score is anything other than "0" (zero) — Positive Negative

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

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, 3/12/18, 10/21/20, 5/17/23

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

		3% NaCl*
Line Access		Central line preferred due to high osmolarity For emergent situations, peripheral (large vein with good blood flow) may be utilized
Usual Dosing	**Bolus**	100-250 mL over 15-30 min
	Infusion	5-150 mL/hr (start at 5-30 mL/hr)
Who may prescribe	**Bolus**	Neurology, Neurosurgery, Neuro Critical Care, Trauma, Pulmonary Critical Care or Emergency Medicine Prescriber
	Infusion	Any prescriber
Who may administer	**Bolus**	RN or MD in the ICU/ED (RN or MD in any location in emergent situation)
	Infusion	RN or MD in ICU/ED, IMU, telemetry or Med/Surg

		23.4% NaCl^ (Use in Brain Codes Only)
Line Access		Central line only
Usual Dosing	**Bolus**	30 mL over 5 minutes (Brain Code Only)
	Infusion	Inappropriate to infuse
Who may prescribe	**Bolus**	Authorized prescriber under supervision of Neuro Critical Care attending or fellow physician.
	Infusion	Inappropriate to infuse
Who may administer	**Bolus**	Authorized prescriber under supervision of Neuro Critical Care attending or fellow physician (any location in emergent situation)
	Infusion	Inappropriate to infuse

*3% NaCl is available in 500 mL bag (3 g NaCl/100 mL = 15 g NaCl/500 mL = 513 mEq NaCl/1000 mL = 1027 mOsm/1000 mL
^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 mOsm/30 mL

Dosing and Monitoring Guidance

1. **For neurologic indications, including <u>acute</u> 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 <u>acute</u> hyponatremia (<48 hrs), rate of correction may be faster than for chronic hyponatremia

2. **For treatment of euvolemic hyponatremia of <u>chronic</u> (≥ 48 hrs) or <u>unknown</u> 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 x Weight** (in kg) x (140- patient's Na)
        **For weight > 30% of ideal body weight (IBW), use adjusted weight
        Adjusted weight = 0.5 x (ABW-IBW) + IBW up to maximum of 100 kg

   - Replacement formula for the first 24 hours:
     a. 0.6 x 10 x _____kg = 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 = ____ mEq sodium/513 x 1000 = mL/24 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 <u>chronic</u> 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***

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Disaster Planning

UC San Diego Health System Codes

Active s hooter: An armed person who is using deadly force or is actively causing death, great bodily injury, or physical damage. Location given if known.

CodeAdam: 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

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)

Ration ale:

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 thepoint 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. A~~ttending 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, overheadspeaker 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:

Treatmentof 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: Personnelwill be notified by overhead speaker systemand with the Health Systempaging systemby text paging generated via the Telecommunications Office.

Deactivation Procedure:

The Incident Commander will notify Telecommunications at thepoint 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 wi**l** 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

Ration ale:

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

Name
MR#
DOB

DISASTER TREATMENT RECORD

PRE-HOSPITAL TRIAGE TAG #	Source Date Patient Identification

DECONTAMINATION
Performed at: ☐ SCENE ☐ UCSD Medical Center
Decontamination needed: ☐ YES ☐ NO
Decontamination done: ☐ YES ☐ NO

PRIMARY ROUTING
NOTE: do not use "OR Resuscitation" during Code Triage.
☐ TRAUMA RESUS ROOM ☐ BURN UNIT ☐ OTHER (specify): ☐ MORGUE
☐ SHOCK AND HOLDING ☐ LIMITED TX CENTER
☐ E.D. ☐ LABOR & DELIVERY
Medical Examiner notified Date/Time:

CARE CLASSIFICATION
☐ IMMEDIATE ☐ DELAYED ☐ MINOR ☐ 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, WEIGHT, 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:
☐ ADMITTED ☐ TRANSFERRED ☐ DISCHARGED ☐ MORGUE

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

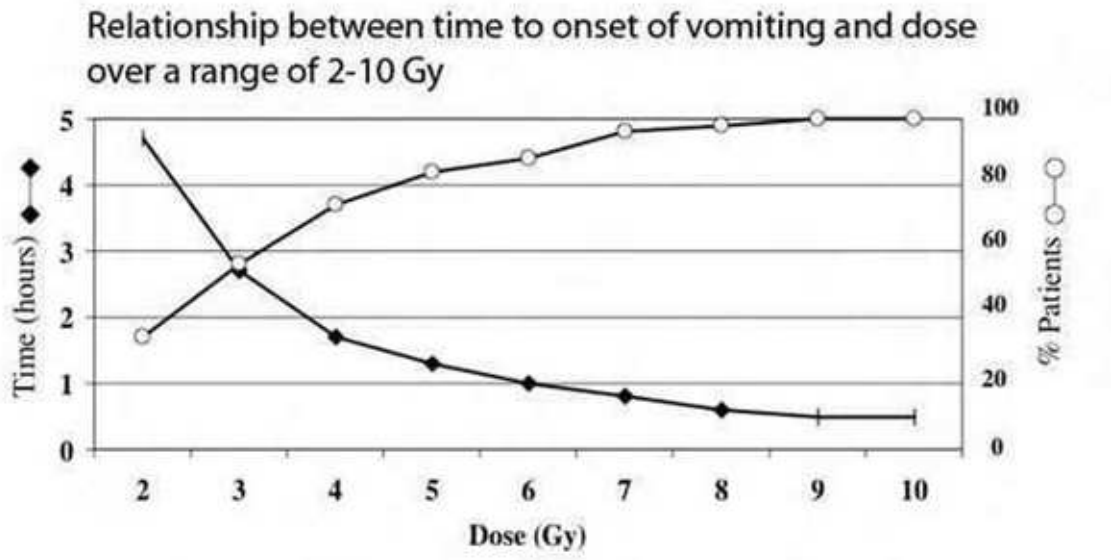
- Follow infection control practices in Table 1
- Handle equipment used according to standard infection control practices

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 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.
- 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 *No person-to-person transmission* 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 *No person-to-person transmission* 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	*Person-to-person transmission in pneumonic forms* 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 *No person-to-person transmission but laboratory personnel at risk* 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	*Person-to-person transmission* 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_2S (sewer, waste, industrial sources)
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)	Diffuse skin exposure with irritants, such as caustics, sodium hydroxides, ammonia, etc., may cause similar syndromes. Sodium hydroxide (NaOH) from trucking accidents
Pulmo-nary 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							
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://surgery.ucsd.edu/divisions/trauma-burn/training/didactic.html

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.

Jarrett E Santorelli EGS Medical Director
7/01/2021

Appendicitis

Acute appendicitis remains the most common surgical emergency in the world.[1] Despite this, the clinical presentation of appendicitis can vary greatly with various approaches in surgical technique and antibiotic management. In addition, surgeon variability in categorization of disease and antibiotic course can vary greatly.[2] Listed below is the protocol for our institutional guidance for appendicitis management.

Appendicitis

A. Expected initial course:
    1. History and physical exam
    2. Labs: CBC, BMP, +/- coags, pregnancy test in women of childbearing age
    3. Confirmatory imaging
        1. CT with IV contrast
    4. To OR within 24 hours of evaluation:
        1. Laparoscopic unless complicated operative history[3] [4]
            1. Conversion to open at discretion of clinician
    5. If concern for perforation at the base of the appendix based on imaging non-operative management can be considered at clinician discretion.
        1. Plan for 4 to 7 days of antibiotics[5]
            1. Can transition to oral antibiotics when leukocytosis normalized and patient afebrile x 24 hours.[6]
            2. Total duration of antibiotics at discretion of surgeon if patient remains febrile, has persistent leukocytosis or elevated CRP.
            3. Consider operative intervention if fails to improve on antibiotics.
        2. Consider IR consult for abdominal abscess greater than 3 cm.[7]
        3. If bacteremia on admission, will plan for longer course of antibiotics up to 14 days.
        4. Interval appendectomy to be offered approximately 6 weeks if the patient is doing well on outpatient evaluation.

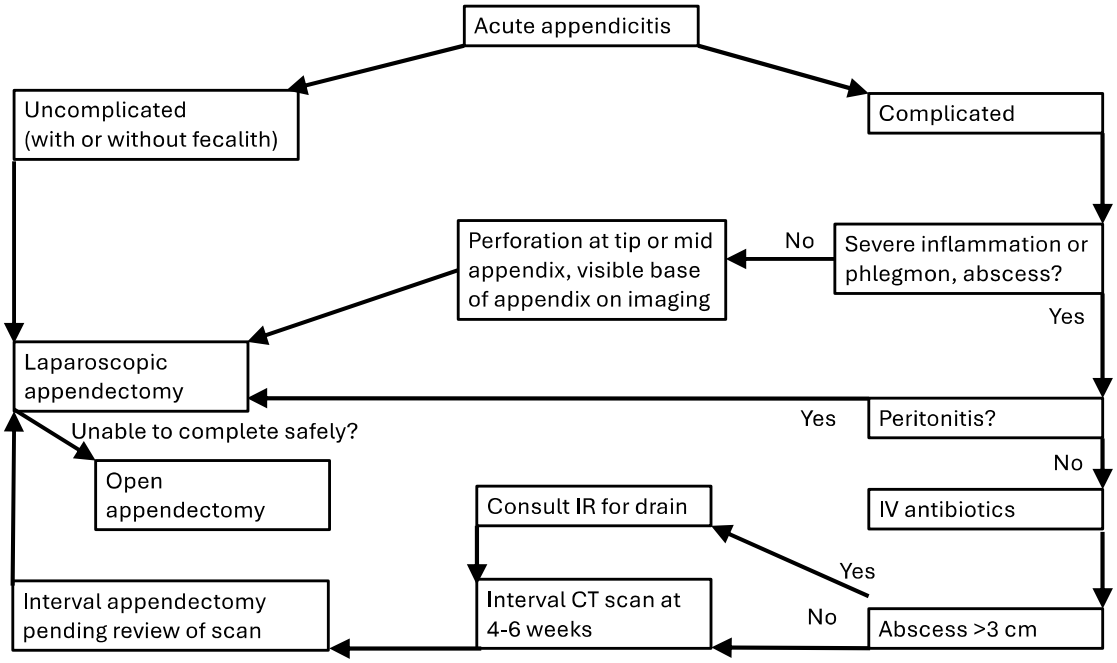
B. Goal length of stay
    1. Uncomplicated: less than 24 hours
    2. Complicated: 1-5 days

C. Antibiotic plan
    1. Short vs long course antibiotics are associated with similar outcomes[8] [9]
    2. Utilize AAST grades to guide antibiotic management
    3. Neutropenic or immunocompromised patients benefit from longer courses

AAST Grade	Description	Clinical Criteria	Imaging Criteria (CT findings)	Operative Criteria	Pathologic Criteria	Categorized	Antibiotics
I	Acutely inflamed appendix, intact	Pain, leukocytosis and right lower quadrant (RLQ) tenderness	Inflammatory changes localized to appendix +/- appendiceal dilation +/- contrast non-filling	Acutely inflamed appendix, intact	Presence of neutrophils at the base of crypts, submucosa +/- in muscular wall	Uncomplicated	Pre-operative
II	Gangrenous appendix, intact	Pain, leukocytosis and RLQ tenderness	Appendiceal wall necrosis with contrast non-enhancement +/- air in appendiceal wall	Gangrenous appendix, intact	Mucosa and muscular wall digestion; not identifiable on hematoxylin and eosin stain (H & E)	Uncomplicated	24 hours perioperative
III	Perforated appendix with local contamination	Pain, leukocytosis and RLQ tenderness	Above with local periappendiceal fluid +/- contrast extravasation	Above, with evidence of local contamination	Gross perforation or focal dissolution of muscular wall	Complicated	24 hours perioperative
IV	Perforated appendix with periappendiceal phlegmon or abscess	Pain, leukocytosis and RLQ tenderness; may have palpable mass	Regional soft tissue inflammatory changes, phlegmon or abscess	Above, with abscess or phlegmon in region of appendix	Gross perforation	Complicated	2-4 days
V	Perforated appendix with generalized peritonitis	Generalized peritonitis	Diffuse abdominal or pelvic inflammatory changes +/- free intra-peritoneal fluid or air	Above, with addition of generalized purulent contamination away from appendix	Gross perforation	Complicated	4 days

D. Discharge criteria
   1. Tolerating adequate oral intake
   2. Pain well controlled
   3. Completion of appropriate intravenous antibiotics

E. Disposition
   1. Home unless requiring home health or rehabilitation.
   2. Clinic follow up 2-4 weeks to review pathology and wound check.



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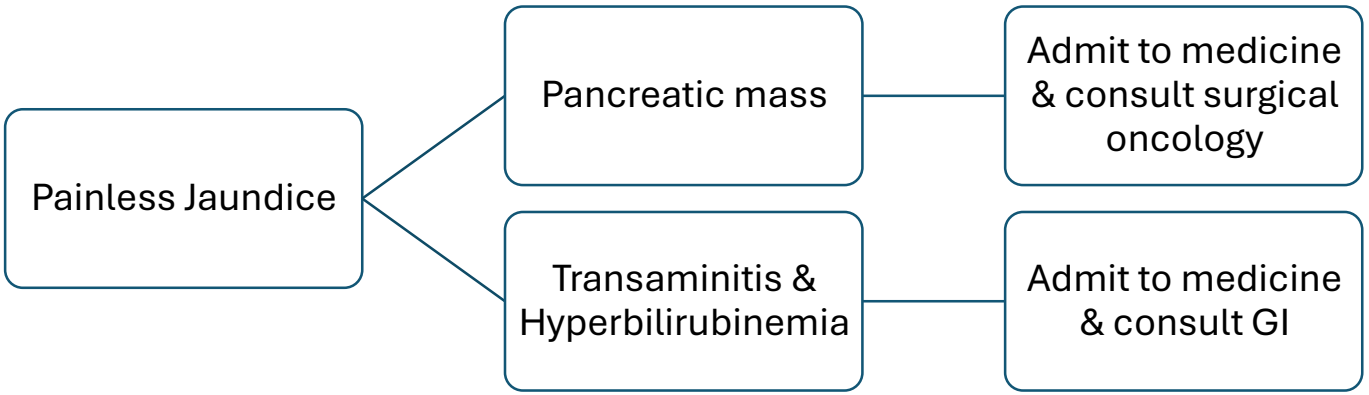
Hepatopancreatic-biliary Disease

Painless Jaundice

Labs: CBC, CMP, Dbili, coags, lipase, CA 19-9, CA-125, CEA

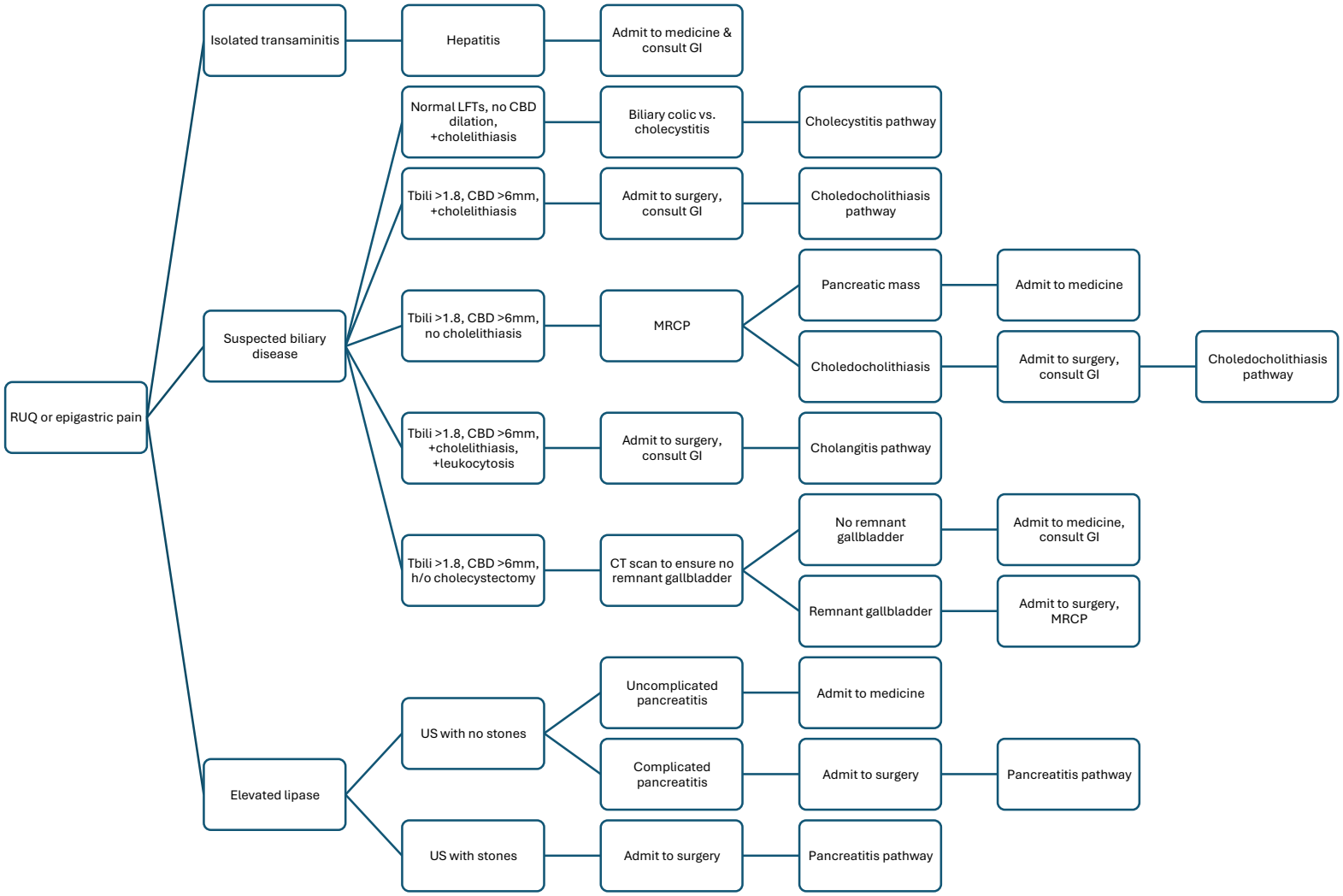
Imaging: CT A/P w/wo contrast 4 phase pancreatic protocol



RUQ or epigastric pain

Labs: CBC, CMP, Dbili, coags, lipase

Imaging: RUQ US



Cholecystitis
Labs: CBC, CMP, Dbili, lipase, coags
Imaging: RUQ US

Acute Calculous Cholecystitis:
+Murphy's Sign
Normal Tbili/Dbili, lipase
Leukocytosis
US: Stones/sludge, wall thickening, pericholecystic fluid, distended gb, normal CBD

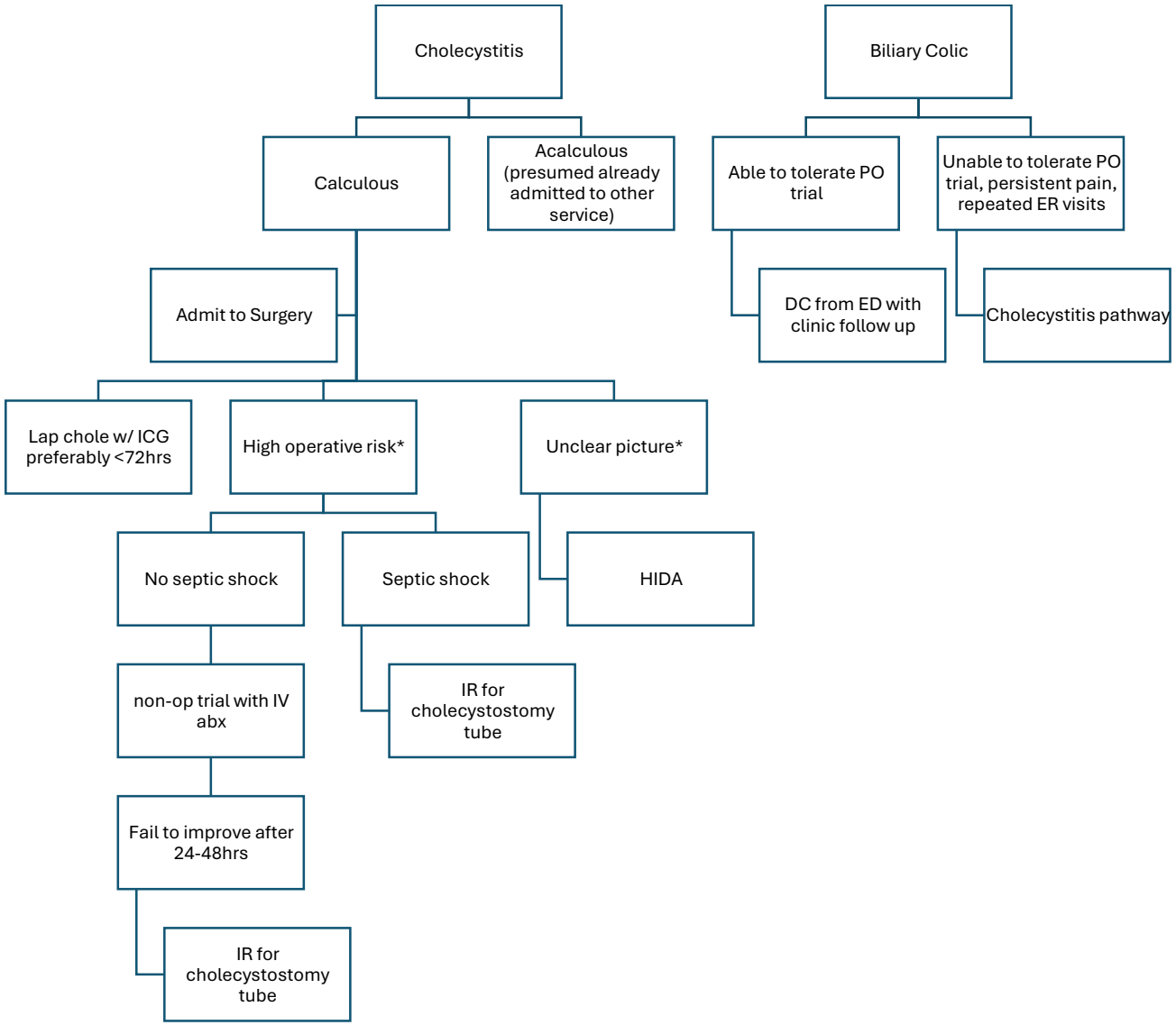
Acute Acalculous Cholecystitis:
+Murphy's Sign
Normal Tbili/Dbili, lipase
Leukocytosis
US: No stones/sludge, ± wall thickening, pericholecystic fluid, distended gb, normal CBD

Biliary Colic:
-Murphy's sign
Normal Tbili/Dbili, lipase, WBC
US: Stones/sludge, No wall thickening, no pericholecystic fluid, no CBD dilation

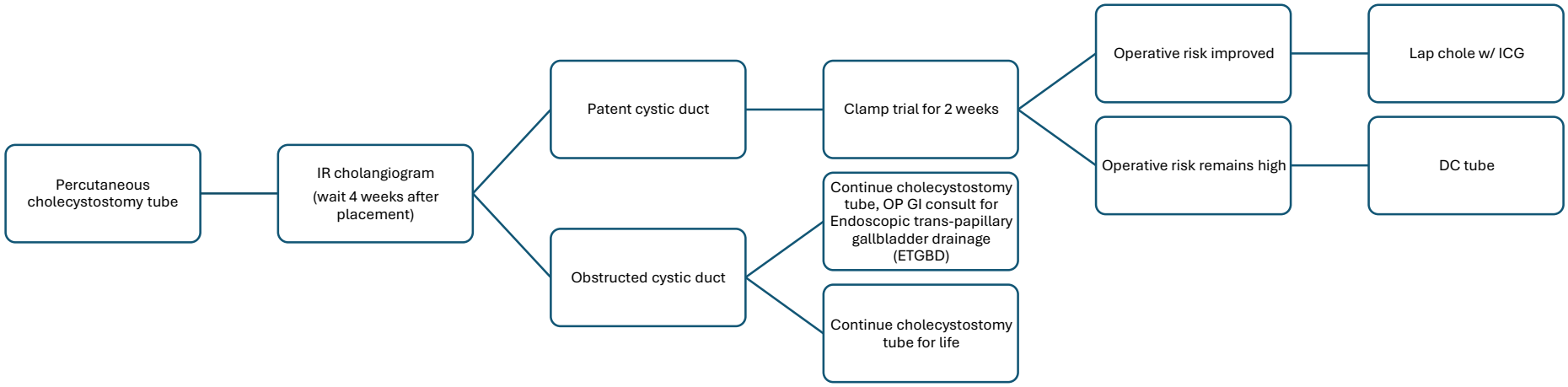
*High operative risk:
- Child's C cirrhosis
- APACHE score 7-14
- ASA >3

*Unclear clinical picture:
- Cirrhosis
- Congestive hepatopathy
- Concern etiology of symptoms from gastritis/PUD

Cholecystitis/Biliary Colic



Percutaneous Cholecystostomy Tube Pathway



AAST Grades for Acute Cholecystitis:

AAST Grade	Description	Clinical Criteria	Imaging Criteria (CT/US/HIDA findings)	Operative Criteria	Pathologic Criteria
I	Acute cholecystitis	Right upper quadrant (RUQ) or epigastric pain; Murphy's Sign; leukocytosis	Wall thickening; distention; gallstones or sludge; pericholecystic fluid; non-visualization of gallbladder (GB) on hepatobiliary iminodiacetic acid (HIDA) scan	Inflammatory changes localized to GB; wall thickening; distention; gallstones	Acute inflammatory changes in the GB wall without necrosis or pus
II	GB empyema or gangrenous cholecystitis or emphysematous cholecystitis	RUQ or epigastric pain; Murphy's Sign; leukocytosis	Above, plus air in GB lumen, wall or in the biliary tree; focal mucosal defects without frank perforation	Distended GB with pus or hydrops; necrosis or gangrene of wall; not perforated	Above, plus pus in the GB lumen; necrosis of GB wall; intramural abscess; epithelial sloughing; no perforation
III	GB perforation with local contamination	Localized peritonitis in RUQ	HIDA with focal transmural defect, extraluminal fluid collection or radiotracer but limited to RUQ	Perforated GB wall (non-iatrogenic) with bile outside the GB but limited to RUQ	Necrosis with perforation of the GB wall (non-iatrogenic)
IV	GB perforation with perichole-cystic abscess or gastrointestinal fistula	Localized peritonitis at multiple locations; abdominal distention with symptoms of bowel obstruction	Abscess in RUQ outside GB; bilio-enteric fistula; gallstone ileus	Pericholecystic abscess; bilio-enteric fistula; gallstone ileus	Necrosis with perforation of the GB wall (non-iatrogenic)
V	GB perforation with generalized peritonitis	Above, with generalized peritonitis	Free intra-peritoneal bile	Above, plus generalized peritonitis	Necrosis with perforation of the GB wall (non-iatrogenic)

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Choledocholithiasis Pathway:

Labs: CBC, CMP, Dbili, lipase, coags

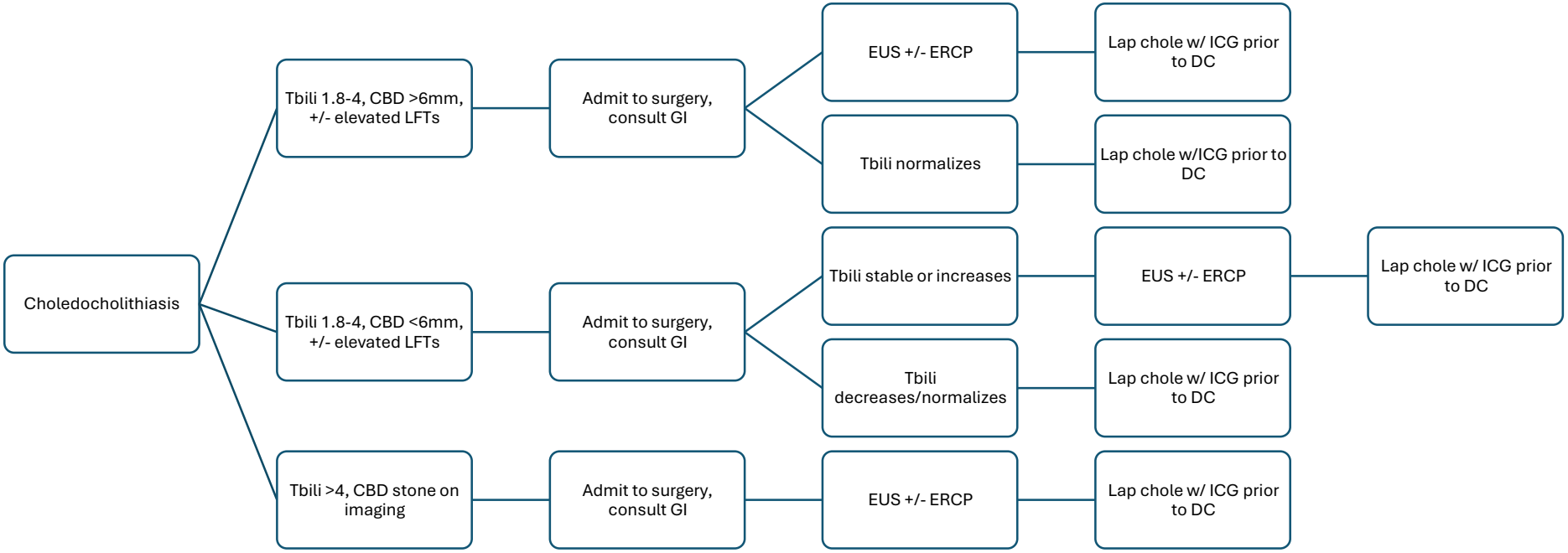
Imaging: RUQ US

Suspect Choledocholithiasis:

History: Jaundice, RUQ pain

Labs: Elevated Tbili and Dbili, ±elevated LFTs

US: gb stones/sludge, CBD stone identified, CBD >6mm



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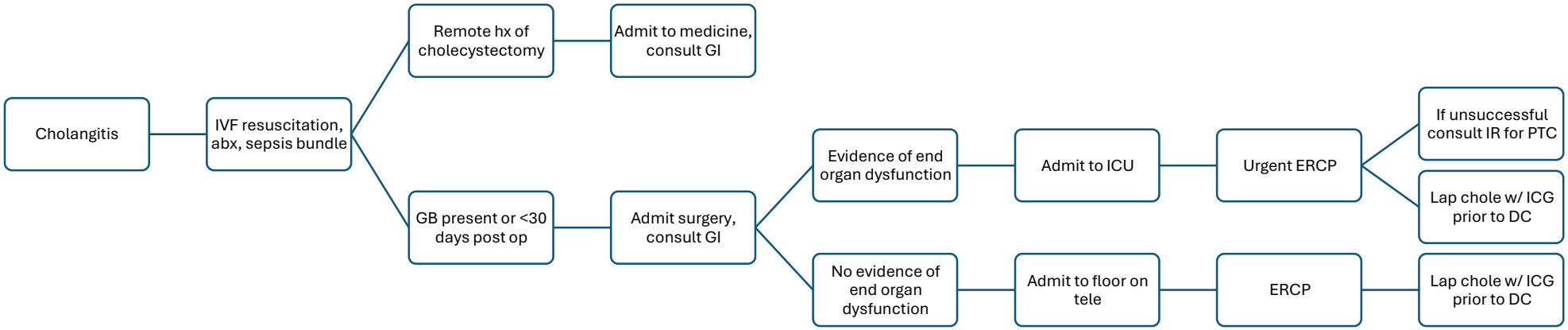
Cholangitis Pathway:

Labs: CBC, CMP, Dbili, lipase, coags, blood cultures, lactate
Imaging: RUQ US

Suspect cholangitis:

History: Reynolds' pentad- Fever, jaundice, RUQ pain, AMS, hypotension
Labs: Elevated total and direct bilirubin ± elevation of LFTs, leukocytosis
Imaging: US w/ stones/sludge, CBD >6mm, CBD stone identified



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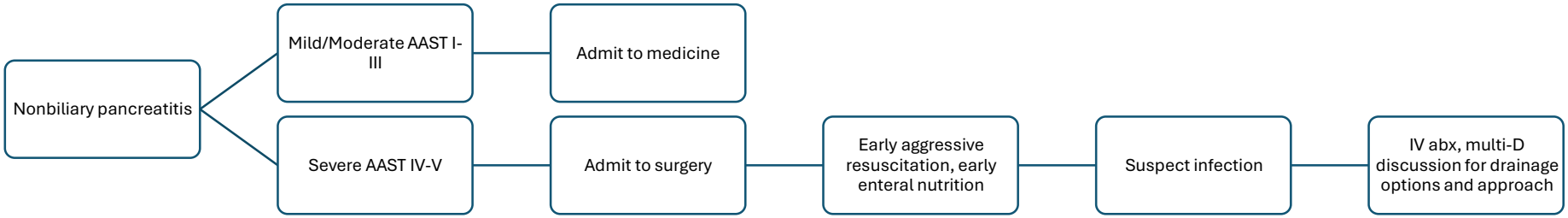
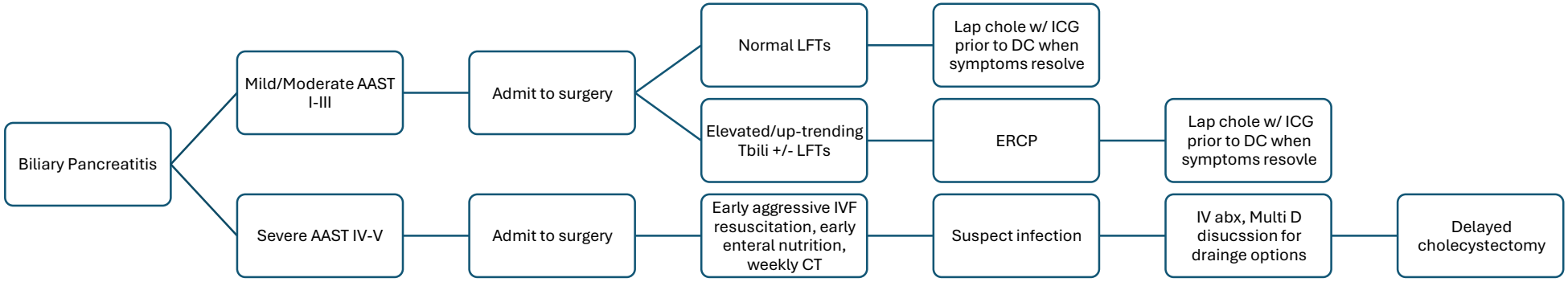
Acute Pancreatitis Pathway:

Labs: CBC, CMP, Dbili, lipase, coags, CRP, LDH

Imaging: RUQ US, CT AP w/wo contrast 4 phase pancreatic protocol





AAST Grades for Acute Pancreatitis

AAST Grade	Description	Clinical Criteria	Imaging Criteria (CT findings)	Operative Criteria	Pathologic Criteria
I	Acute edematous pancreatitis	Midepigastric abdominal pain and tenderness; elevated amylase and/or lipase	Pancreatitis without phlegmon, necrosis, peripancreatic fluid collection or abscess	Edematous pancreas	N/A
II	Pancreatic phlegmon or peripancreatic fluid collection or hemorrhage	Midepigastric abdominal pain and tenderness; elevated amylase and/or lipase	Phlegmon or peripancreatic fluid collection or hemorrhage	Pancreatic phlegmon or peripancreatic fluid collection	N/A
III	Sterile pancreatic necrosis	Midepigastric abdominal pain and tenderness; elevated amylase and/or lipase	Pancreatic necrosis without extraluminal air or abscess	Pancreatic necrosis without purulence or abscess	Gram stain and culture of necrosis negative for organisms
IV	Infected pancreatic necrosis or abscess	Severe midepigastric abdominal pain and tenderness; elevated amylase and/or lipase	Pancreatic necrosis with extraluminal air or abscess	Pancreatic necrosis with purulence or abscess	Gram stain and culture of necrosis or abscess positive for organisms
V	Extra-pancreatic extension of pancreatic necrosis involving adjacent organs, such as colonic necrosis	Severe diffuse midepigastric abdominal pain and tenderness; elevated amylase and/or lipase	Extra-pancreatic extension of necrosis involving adjacent organs, such as colonic necrosis	Involvement or necrosis of adjacent organs	Involvement or necrosis of resected adjacent organs

Mild Pancreatitis: No organ failure, no local/systemic complications.
Moderate Pancreatitis: Organ failure that resolves within 48hrs and/or systemic complications.
Severe Pancreatitis: Persistent organ failure >48hrs.

Significant Lab Values:

- CRP >150 mg/l
- HCT >44% or rising
- BUN >20 mg/dl or rising
- LDH on admission for Ranson's Criteria
- ABG at 48 hr for Ranson's Criteria

Suspected Infected Pancreatitis:

- Failure to improve after 7-10 days
- Elevated CRP
- Retroperitoneal gas on CT

Multidisciplinary Discussion:

- ACS, HPB/surgical oncology, GI, IR
- Discuss drainage options and approach for step-up/VARD/endoscopic drainage.
- Delay until 4 weeks after onset of symptoms if possible.

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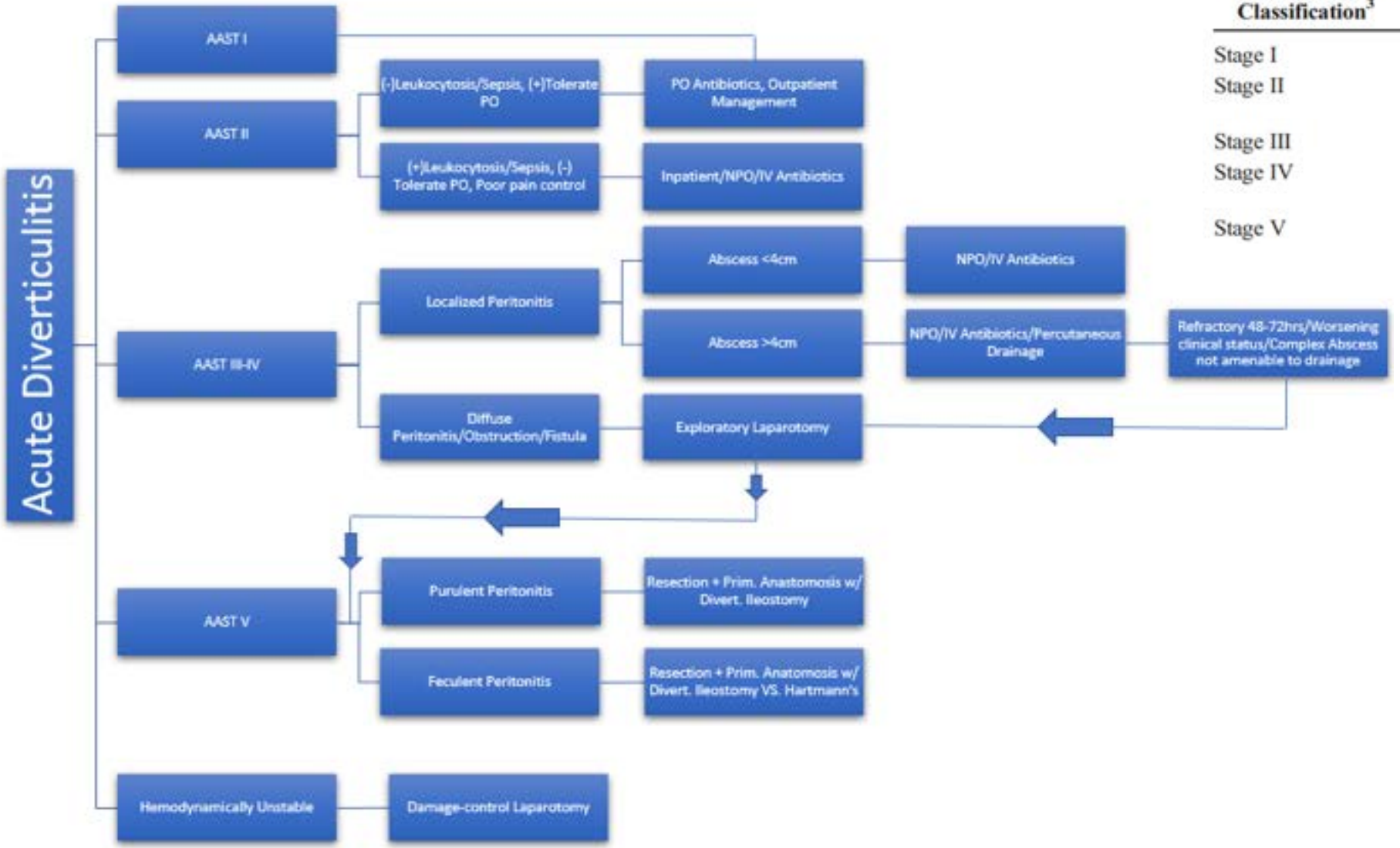
ACUTE COMPLICATED DIVERTICULITIS PROTOCOL

- **Acute Diverticulitis**: Inflammation of one or several adjacent diverticula. Categorized as **Uncomplicated** or **Complicated**.
- Complicated Diverticulitis refers to the presence of abscess, fistula, bowel obstruction, or free perforation

Hinchey Classification System	Modified Hinchey Classification System
I – Pericolic abscess/phlegmon	**Ia** – Confined Pericolic inflammation/phlegmon
II – Pelvic, Intra-abdominal, or Retroperitoneal abscess	**Ib** – Pericolic or Mesocolic abscess
III – Purulent Peritonitis	**II** – Pelvic, distant intra-abdominal, or retroperitoneal abscess
IV – Feculent Peritonitis	**III** - Purulent Peritonitis
	IV - Feculent Peritonitis

AAST Radiographic Classification[3]	
Stage I	Mesenteric stranding, colon wall thickening
Stage II	Pericolic phlegmon, foci of air (single or multiple), no abscess
Stage III	Pericolic abscess
Stage IV	Abscess or phlegmon away from the colon
Stage V	Free air and free fluid

- **Risk Factors** include: Lifestyle, Diet (Red meat and Western dietary patterns), Obesity, Smoking/Alcohol



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SMALL BOWEL OBSTRUCTION

Small bowel obstruction is a major cause of morbidity and mortality in the United States, and acute adhesive small bowel obstruction accounts for 12-16% of hospital admissions annually in the United States. The surgical management of small bowel obstruction has evolved substantially over the last decades, from primarily operative management to the majority of these being treated conservatively with nasogastric decompression, bowel rest, serial abdominal exams, and analgesia/anti-emetics with progression to surgery only if a patient develops peritonitis or fails to resolve the obstruction with conservative management. However, urgent surgery is required in certain cases; such as in the setting of leukocytosis, tachycardia or hypotension, fever, or other evidence of bowel strangulation. CT scan is a useful tool in differentiating between small bowel obstructions that require operative versus those reasonable for a trial of conservative management; as radiographic evidence of bowel ischemia, bowel perforation, closed loop obstruction, internal hernia, incarcerated external hernia, or small bowel volvulus would merit operative intervention. We aim to create a protocol to standardize our approach to management of small bowel obstruction at UCSD.

Literature has shown that in patients who are candidates for a trial of conservative management, a Gastrografin contrast study is an excellent diagnostic tool after a short period of decompression. It provides diagnostic capability in demonstrating a high rate of nonoperative failure should contrast not reach the cecum within 24h of administration, as well as therapeutic properties by its ability to draw water intraluminally to facilitate the passage of enteric contents. Thus, all patients without upfront clear surgical indications should undergo 24 hours of nasogastric tube decompression followed by a Gastrografin small bowel follow-through to guide further management.

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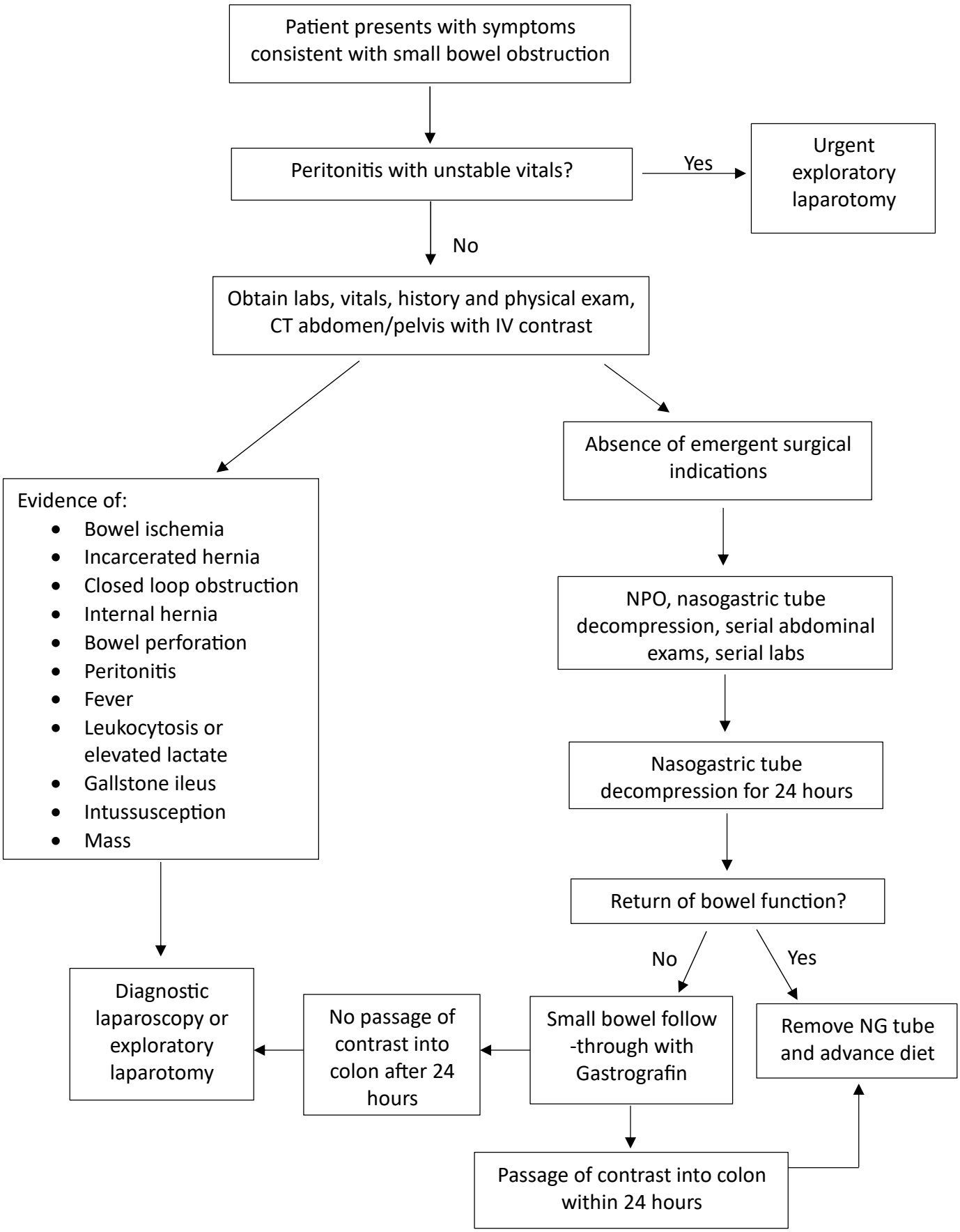
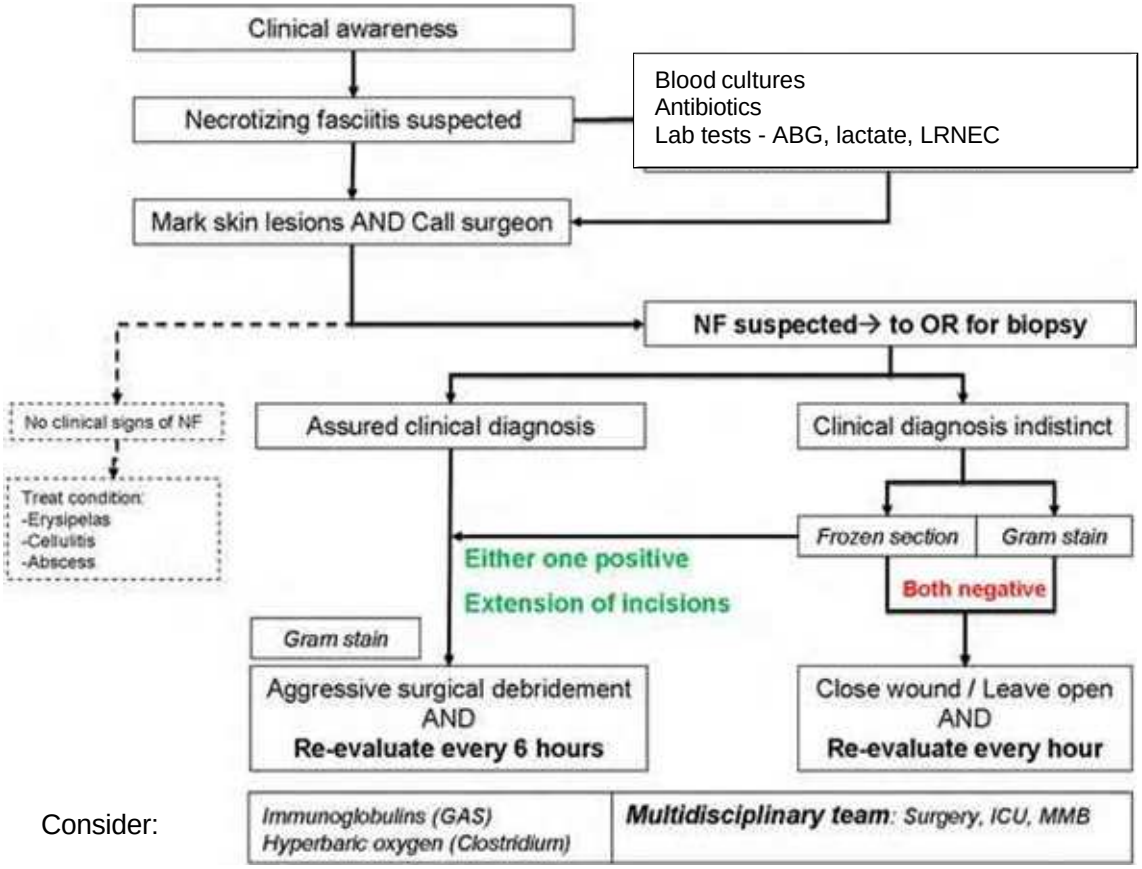
SMALL BOWEL OBSTRUCTION



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
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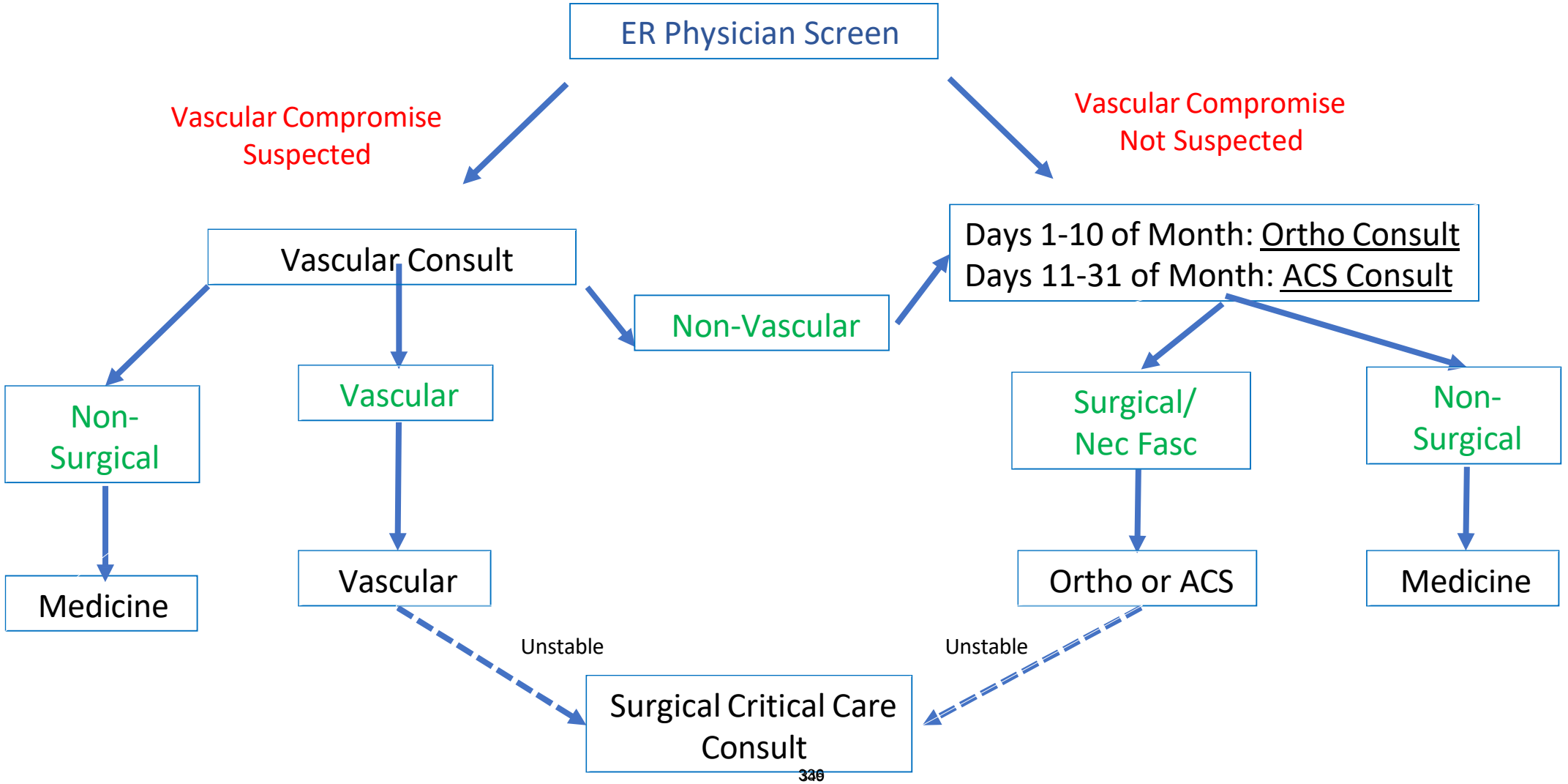
LRINEC Score

Table. Laboratory Risk Indicator for Necrotizing Fasciitis Score

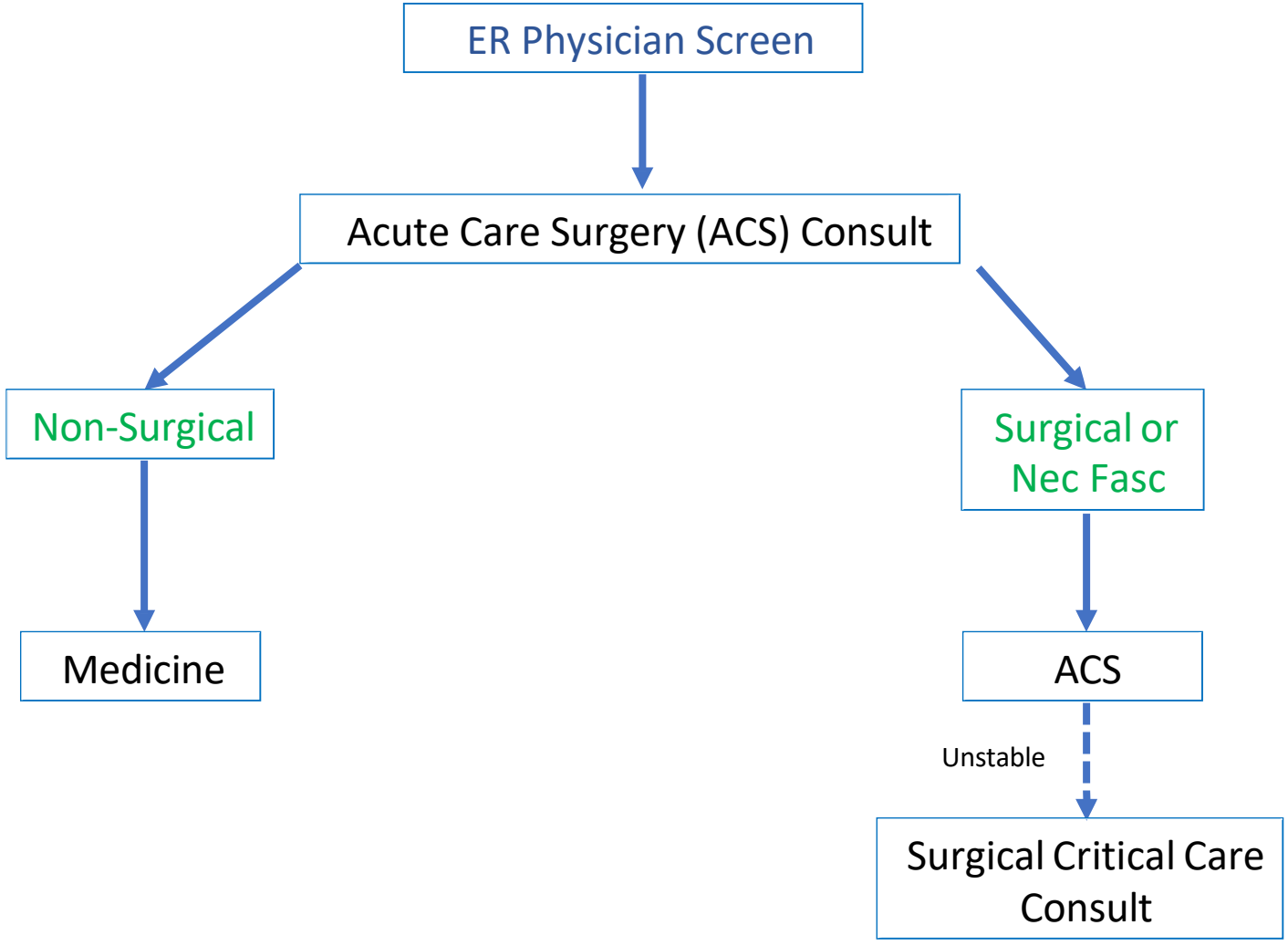
Variable	Value	Points
C-Reactive Protien (mg/L)	< 150	0
	≥ 150	4
WBC (cells/mm^3)	< 15	0
	15-25	1
	> 25	2
Hemoglobin (g/dL)	> 13.5	0
	11-13.5	1
	< 11	2
Serum sodium (mmol/L)	≥ 135	0
	< 135	2
Serum creatinine (mg/dL)	≤ 1.6	0
	> 1.6	2
Plasma glucose (mg/dL)	≤ 180	0
	> 180	2

Risk	Probability	Total Score
Low	< 50%	≤ 5
Moderate	50-75%	6-7
High	> 75%	≥ 8

Extremity Infection Algorithm- Hillcrest



Truncal Infection Algorithm- Hillcrest

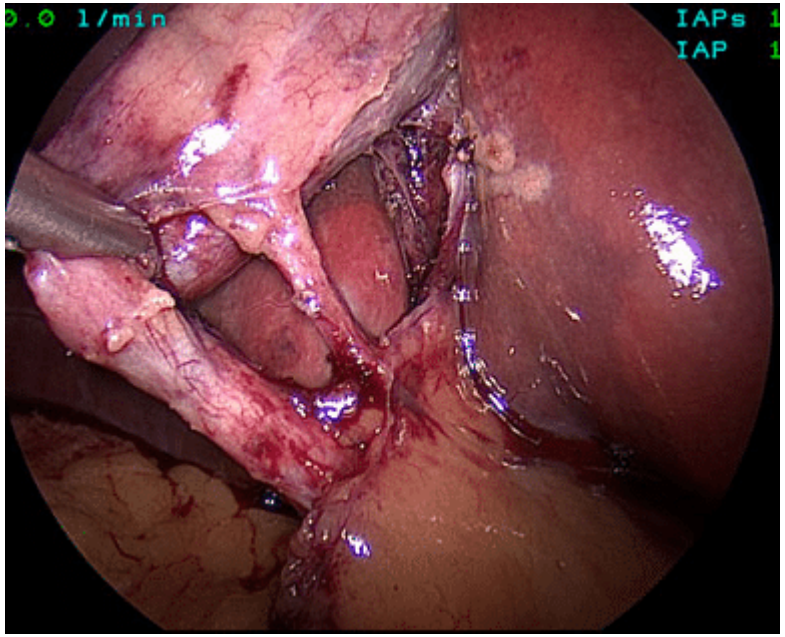


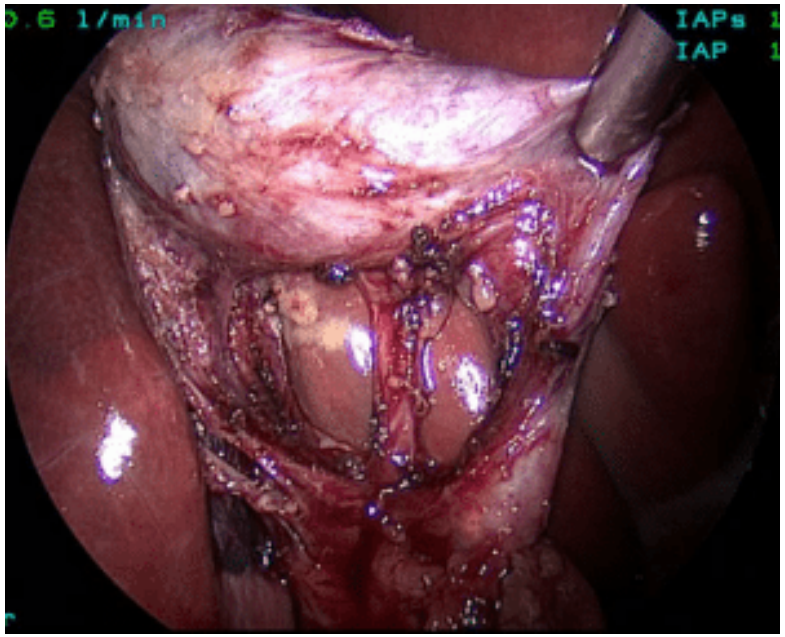
SAGES SAFE CHOLE

Use the Critical View of Safety (CVS) method of identification of the cystic duct and cystic artery during laparoscopic cholecystectomy.

•Three criteria are required to achieve the CVS:

- **The hepatocystic triangle is cleared of fat and fibrous tissue.** The hepatocystic triangle is defined as the triangle formed by the cystic duct, the common hepatic duct, and inferior edge of the liver. The common bile duct and common hepatic duct do *not* have to be exposed.
- **The lower one third of the gallbladder is separated from the liver to expose the cystic plate.** The cystic plate is also known as liver bed of the gallbladder and lies in the gallbladder fossa.
- **Two and only two structures should be seen entering the gallbladder.**





SAGES SAFE CHOLE

2. Understand the potential for aberrant anatomy in all cases.

Aberrant anatomy may include a short cystic duct, aberrant hepatic ducts, or a right hepatic artery that crosses anterior to the common bile duct.[9] These are some but not all common variants.

3. Make liberal use of cholangiography or other methods to image the biliary tree intraoperatively.

Cholangiography may be especially important in difficult cases or unclear anatomy.

Several studies have found that cholangiography reduces the incidence and extent of bile duct injury but controversy remains on this subject.[10]

4. Consider an Intra-operative Momentary Pause during laparoscopic cholecystectomy prior to clipping, cutting or transecting any ductal structures.

The Intra-operative Momentary Pause should consist of a stop point in the operation to confirm that the CVS has been achieved utilizing the Doublet View.

5. Recognize when the dissection is approaching a zone of significant risk and halt the dissection before entering the zone. Finish the operation by a safe method other than cholecystectomy if conditions around the gallbladder are too dangerous.

In situations in which there is severe inflammation in the porta hepatis and neck of the gallbladder, the CVS can be difficult to achieve. The sole fact that achieving a CVS appears not feasible is a key benefit of the method since it alerts the surgeon to possible danger of injury.

The surgical judgment that a zone of significant risk is being approached can be made when there is failure to obtain adequate exposure of the anatomy of the hepatocystic triangle or when the dissection is not progressing due to bleeding, inflammation or fibrosis.

Consider laparoscopic subtotal cholecystectomy or cholecystostomy tube placement, and/or conversion to an open procedure based on the judgment of the attending surgeon.

6. Get help from another surgeon when the dissection or conditions are difficult.

When it is practical to obtain, the advice of a second surgeon is often very helpful under conditions in which the dissection is stalled, the anatomy is unclear or under other conditions deemed “difficult” by the surgeon.

TAKE THE $1 SAFE CHOLE SAGES COURSE

- ***The Safe Cholecystectomy Didactic Modules*** *can be accessed in the OWLS catalog.*
- *Please go to www.sages.org/owls and login if you're a SAGES Member or create an account if you're a non-member and this is your first time visiting the site.*

TABLE. Morphine milligram equivalent doses for commonly prescribed opioids for pain management

Opioid	Conversion factor*
Codeine	0.15
Fentanyl transdermal (in mcg/hr)	2.4
Hydrocodone	1.0
Hydromorphone	5.0
Methadone	4.7
Morphine	**1.0**
Oxycodone	1.5
Oxymorphone	3.0
Tapentadol†	0.4
Tramadol§	0.2

Sources: CDC, Adapted from Von Korff M, Saunders K, Ray GT, et al. Clin J Pain 2008;24:521–7 and Nielsen S, Degenhardt L, Hoban B, Gisev N. Pharmacoepidemiol Drug Saf 2016;25:733–7.

Abbreviations: mcg/hr = microgram per hour; mg = milligram; MME = morphine milligram equivalent.
* Multiply the dose for each opioid by the conversion factor to determine the dose in MMEs. For example, tablets containing hydrocodone 5 mg and acetaminophen 325 mg taken four times a day would contain a total of 20 mg of hydrocodone daily, equivalent to 20 MME daily; extended-release tablets containing oxycodone 10 mg and taken twice a day would contain a total of 20 mg of oxycodone daily, equivalent to 30 MME daily. The following cautions should be noted: 1) All doses are in mg/day except for fentanyl, which is mcg/hr. 2) Equianalgesic dose conversions are only estimates and cannot account for individual variability in genetics and pharmacokinetics. 3) Do not use the calculated dose in MMEs to determine the doses to use when converting one opioid to another; when converting opioids, the new opioid is typically dosed at a substantially lower dose than the calculated MME dose to avoid overdose because of incomplete cross-tolerance and individual variability in opioid pharmacokinetics. 4) Use particular caution with methadone dose conversions because methadone has a long and variable half-life, and peak respiratory depressant effect occurs later and lasts longer than peak analgesic effect. 5) Use particular caution with transdermal fentanyl because it is dosed in mcg/hr instead of mg/day, and its absorption is affected by heat and other factors. 6) Buprenorphine products approved for the treatment of pain are not included in the table because of their partial μ-receptor agonist activity and resultant ceiling effects compared with full μ-receptor agonists. 7) These conversion factors should not be applied to dosage decisions related to the management of opioid use disorder.
† Tapentadol is a μ-receptor agonist and norepinephrine reuptake inhibitor. MMEs are based on degree of μ-receptor agonist activity; however, it is unknown whether tapentadol is associated with overdose in the same dose-dependent manner as observed with medications that are solely μ-receptor agonists.
§ Tramadol is a μ-receptor agonist and norepinephrine and serotonin reuptake inhibitor. MMEs are based on degree of μ-receptor agonist activity; however, it is unknown whether tramadol is associated with overdose in the same dose-dependent manner as observed with medications that are solely μ-receptor agonists.

Prescribing Recommendations

Procedure	Oxycodone* 5mg Tablets
Dental Extraction	0
Thyroidectomy	0 - 5
Laparoscopic Anti-re ux (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
Modi ed 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.”

Recommendations were last updated on 03/12/2018. See opioidprescribing.info for more info.

Video links

Videos can be found on https://www.youtube.com/user/UCSDTraumaBurn