



UC San Diego Division of Trauma, Surgical Critical Care, Burns and Acute Care Surgery

# HANDBOOK

Third Edition, 2017





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

# Handbook

Department of Surgery, University of California San Diego

*by Dr Raul Coimbra, UC San Diego Trauma Faculty and Fellows*

Third Edition (2017)

<http://trauma.ucsd.edu>

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## **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. Whether a trauma or a burn victim, they 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 trauma/burn patient under the direction and leadership of Raul Coimbra, MD, PhD, FACS, the Monroe E. Trout Endowed Chair of Trauma; our team is always on standby and ready to provide care to critically injured patients. In addition, we are responsible for providing surgical care to all patients with surgical emergencies at the Hillcrest campus. Our mission is to save patients 'lives and send 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, 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 sick surgical patients, but to teach the integration of care through multiple practitioners in the 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 in the San Diego Region. I would like to acknowledge all members of the Division for their hard work, dedication, and commitment to our mission.

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The Monroe E. Trout Professor of Surgery  
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Chief, Division of Trauma, Surgical Critical Care, Burns and Acute  
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# **Overview of the Trauma Service**



## Trauma Service Scheduled Meetings, Clinics, and Conferences

Day	Time	Conference	Location
Monday	0900-1000	Multidisciplinary Discharge Planning/Rehabilitation Rounds	SICU
Mondays & Thursdays	1400-1500	Trauma Multidisciplinary Rounds	SICU
Tuesday (1 <sup>st</sup> , 3 <sup>rd</sup> , 5 <sup>th</sup> )	0700-0830	Administrative Division Meeting & PI Review	SRL Classroom 130 Dickinson Street
Tuesday (1 <sup>st</sup> , 2 <sup>nd</sup> , 5 <sup>th</sup> )	1500-1700	Trauma Conference	3 <sup>rd</sup> Floor Conference Room Hillcrest Tower
Tuesday (3 <sup>rd</sup> )	1500-1700	Neurosurgery/Trauma Conference	3 <sup>rd</sup> Floor Conference Room Hillcrest Tower
Tuesday (4 <sup>th</sup> )	1500-1600	Radiology/Trauma Conference	Lasser Conference Room Main Floor, Hillcrest
Tuesday (4 <sup>th</sup> )	1600-1700	Emergency Medicine/Trauma Conference	Lasser Conference Room Main Floor, Hillcrest
Wednesday	1300-1600	White Surgery Recheck Clinic	3 <sup>rd</sup> Floor Outpatient Suite 1
Wednesday	1600-1700	Fellows Journal Club	Trauma Offices Conference Room 5
Thursday	0800-1200	White Surgery New patient Clinic	3 <sup>rd</sup> Floor Outpatient Suite 1
Thursday	1500-1600	Basic Science Research Meeting	CTF C 301
Friday (2 <sup>nd</sup> & 4 <sup>th</sup> )	0700-0800	Orthopedics/Trauma Conference	Admin Conf Room (ACR), Main Floor Hillcrest
Friday	0830-1100	Trauma Clinic	3 <sup>rd</sup> Floor Outpatient Suite 1
Friday	0900-1000	International Trauma Teleconference	Trauma Offices Conference Room 5
Friday	1300-1400	Basic Science Lab Meeting	CTF C 301

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### Frequently Used Telephone Numbers

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

## **Trauma Service Routines and Protocols Overview**

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

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

### **Documentation on the Trauma Service**

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

### **Admission Orders**

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

#### *Observation Status*

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

#### **Inpatient Status**

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

### **Types of Documentation**

#### *Resuscitation Room Orders Sheet*

(see Resuscitation Room Orders Sheet)

#### *Preoperative Notes*

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

#### ***Blood Product Transfusion Consents***

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

#### ***Emergent Operative Informed Consent***

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

#### ***Bedside Procedures***

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

#### ***Surgical Time-out***

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

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

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

#### ***Operatives Cases***

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

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

#### ***OR Resuscitations***

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

#### ***Transfer/Off-Service Notes***

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

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



- ii. during the change of rotations

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

***Discharge Summary***

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

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

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

# **The Resuscitation Room**

## Trauma Group Page & Trauma Team Activation (TTA)

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

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

## Transfers – Eligible facilities and transfer centers

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



## Trauma Center Bypass Status

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

## Operating Room Resuscitation

### a. *Criteria for OR Resus (Direct transport to OR #11)*

- i. Penetrating trauma with hypotension
- ii. Witnessed traumatic cardiac arrest
- iii. Hypotensive patients who are unresponsive to fluid challenges in the prehospital setting. (i.e. < 90mmHg systolic BP)
- iv. Major external hemorrhage - uncontrolled (i.e. amputation above knee or elbow)
- v. Direct injury to neck with serious airway compromise

b. While still enroute to the hospital, do not change patient's place of destination at the last minute. A resuscitation nurse or senior trauma physician can call an OR Resus as long as the patient is more than 5 minutes ETA. Once the decision has been made, do not change the decision. **There is often not enough time to move either the trauma team or paramedics to another destination.**

c. If trauma resuscitations are actively in progress in the trauma bay at the time a new patient meeting OR Resus criteria is enroute, it may be necessary to bring that patient to the trauma bay rather than the OR to prevent splitting the team between 2 different locations. This decision should be made at the discretion of the Trauma Fellow/Attending on-call.

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

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

Double gloving is strongly recommended for procedures.

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

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

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



Figure 1 – Example of Universal precautions for a trauma admission

# **Initial Assessment and Resuscitation**

## **Resuscitation Room Coordination**

(see MIVT Report & Responsibilities of Trauma Team Members)

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

Everyone should feel comfortable and know how to assist/perform the following at their level of responsibility:

  - i. cricothyroidotomy
  - ii. chest tube placement/removal
  - iii. central line placement
  - iv. venous cutdown technique
  - v. resuscitative thoracotomy

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

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

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

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

j. *Procedure for Obtaining Blood Sample*

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

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

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

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

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

k. *Ordering Blood*

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

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

- for emergency released, specifying the patient's name, number of units required and how rapidly they need to be delivered. The trauma fellow or attending must then sign and write their provider ID on the emergency blood request form. The Massive Transfusion Protocol is activated using the same form, but the Blood Bank must specifically be called and told "activate the massive transfusion protocol".
- iii. The Blood Bank will release up to 4 units of type O- blood and 4 units of AB- or A- FFP. A labeled blood sample should be obtained if at all possible, before administration of uncrossmatched O- blood.
  - iv. These 4 units of type O- blood and 4 units of AB- or A- FFP can be obtained by calling the Blood Bank directly at **35640/35641** and request "**Emergency Release**". The runner going to pick up blood should go to 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

## 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 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 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. The initial 4 units of RBCs may be O- along with 4 units of AB or A plasma.
10. Immediately following this, 4-6 units of RBCs, 4-6 units of plasma, and 1 apheresis platelet unit will be supplied, followed by batches of 10 RBCs, 10 plasma, and 1-2 platelets.
11. Type-specific blood will be initiated as soon as possible and depends on the availability of a second blood specimen for ABO/Rh confirmation.
12. If necessary, in order to provide sufficient blood without delay, the decision to switch blood types (eg, to O for type B; A or O for type AB) will be made by the Blood Bank.
13. In the OR, the Trauma Service should plan with Anesthesia to continue to communicate with Blood Bank to stay 10 units ahead with both RBCs and FFP.



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

## REQUEST FOR EMERGENCY BLOOD

Date: \_\_\_\_\_

Time: \_\_\_\_\_

Location: \_\_\_\_\_

Tech: \_\_\_\_\_

Patient Identification

The patient's condition warrants the increased risk to the patient that may result from the use of uncrossmatched blood.

I hereby request the Blood Bank to supply the units of blood requested below for:

\_\_\_\_\_  
Patient's Name \_\_\_\_\_  
Medical Record Number

<b>Check One Below:</b>	<b>No. of Units</b>	
.. Uncrossmatched blood - O Negative	_____	(up to 4 units)
.. Plasma AB/Type Specific	_____	(up to 4 units)
.. Uncrossmatched blood - type specific	_____	
.. Blood product _____ Untested for _____	_____	
.. Neonatal Emergency Transfusion	_____	
Blood Bank Tech: Issue the freshest O negative, CMV negative RBC. If CMV negative blood is not available, issue freshest O negative unit. Do not irradiate or aliquot. Preferably CPD, CPDA1 or AS3.		
.. OB Hemorrhage Protocol 4 units RBCs and 2 units of plasma	_____	Issue in a cooler
.. <b>Massive transfusion protocol</b>	_____	Call Blood Bank at 35640 to cancel
1 <sup>st</sup> batch: 4 units of RBCs and 4 units of plasma; 2 <sup>nd</sup> batch: 6 units of RBCs, 6 units of plasma and one unit of plt; 3 <sup>rd</sup> batch..10 units of RBCs, 10 units of plasma and 1 plt. Order cryoprecipitate as needed.		
.. Least incompatible crossmatch		
Transfuse first 50-100 mL slowly over 1/2 hour. Monitor patient closely		

<b>Blood Unit No.</b>	<b>Component</b>
_____	_____
_____	_____
_____	_____

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

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

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)**

<b>Analgesia</b> Morphine ____ mg IVP q 10 min prn pain score $\geq 4$ x ____ doses HydroMorphone ____ mg IVP q 15 min pain score $\geq 4$ x ____ doses Fentanyl ____ mcg IVP q 5 min prn pain score $> 4$ x ____ doses	<b>Sedation/agitation (RASS &gt; +1)</b> Haloperidol 5 mg IVP q 10 min x ____ doses Lorazepam ____ mg IVP q 10 min prn RASS $\geq +1$ x ____ doses Midazolam ____ mg IVP q 10 min prn RASS $> +1$ x ____ doses
<b>Rapid Sequence Intubation/ Neuromuscular Blockade</b> 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	<b>Antibiotics</b> 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
<b>IV Fluids</b> Lactated ringers IV: ____ mL/hr Normal saline IV: ____ mL/hr Other: _____	<b>Elevated ICP/Seizures</b> 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
<b>Steroids</b> Methylprednisolone 30 mg/kg in 100ml NS IV over 15 min Methylprednisolone 5.4 mg/kg/hr IV x ____ hours (24-48 hrs) Famotidine 40 mg/100 mL NS IV at 4.2 mL/hr	<b>Blood Pressure Meds</b> Hydralazine 10 mg or ____ mg IVP x1 Labetalol 10 mg or ____ mg IVP x1 Metoprolol 5 mg or ____ mg IVP x1
<b>Miscellaneous</b> Lidocaine 1% for MD use to site(s): _____ Lidocaine 1% with epinephrine 1:100,000 for MD use to site(s): _____	<b>Anti-Nausea</b> Ondansetron 4 mg IVP x1
NS= 0.9% sodium chloride IVP= IV push over 1-2 minutes Other meds: _____	<b>Vaccines</b> Tdap 0.5 mL IM x1

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

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

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

Physician Signature/PID #

Date/Time

Nurse Signature

Date/Time

## PHYSICIAN'S ORDERS

### Patient Identification

### TRAUMA RESUSCITATION

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

Blood			
Type & screen			
Type & crossmatch:	___ units PRC's	___ units FFP	___ units Platelet pheresis
Transfuse:	___ units PRC's	___ units FFP	___ units Platelet pheresis
Massive transfusion protocol			

### Imaging

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

### Procedures

Vascular Access/Lines	Sutures
___ gauge IV catheter	<b>Sutures with lidocaine 1%:</b>
Arterial line to pressure monitoring with lidocaine 1% for insertion	Site(s): _____
Central venous catheter placement w/ lidocaine 1% for insertion	Sutures with lidocaine 1% with epi 1:100,000:
<b>Other</b>	Site(s): _____
<b>Intraosseus line</b>	
Chest tube with lidocaine 1% with epi 1:100,000 to water seal and ___ cm H2O suction	Left side      Right side
Foley catheter (#16 FR silicone) to dependent drainage	_____
Gastric tube (#18 FR) to low constant suction	_____
Diagnostic peritoneal lavage	_____
12 lead ECG	_____

### Airway

Ventilator Settings	Oxygen
Mode: _____	_____ L/min nasal prong
FiO2: ___ %	_____ L/min face mask
PEEP: ___ cm/H <sub>2</sub> O	
Volume _____	
Pressure _____	
Tidal volume: ___ mL	
Inspiratory pressure _____ cm/H <sub>2</sub> O	
Respiratory Rate _____	

## E. Resuscitation Room Lab Investigations

### Standard labs:

1. Hold specimen to blood bank
2. ABG with hematocrit/hemoglobin
3. Urine Tox immunoassay
4. Blood Alcohol level (BAL)

### Head labs:

All regular labs above, plus:

1. PT/PTT/INR
2. CBC
3. TEG
4. Aspirin and Plavix assays if applicable

### Elder labs:

All regular labs above, plus:

1. PT/PTT/INR
2. CBC
3. Chem 10

### Pregnancy labs:

All regular labs above, plus:

1. PT/PTT and fibrinogen
2. CBC
3. Kleihauer-Betke
4. Type and Screen

### Burn 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
5. If electrical injury:
  - a. Cardiac markers
  - b. CPK



## 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 CDs being left lying about in trauma bay or SICU –have those disks uploaded to PACS.
- 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>

# 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%

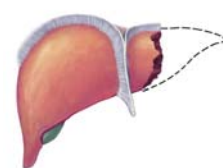


## Grade III

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%

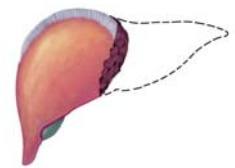


## Grade IV

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%

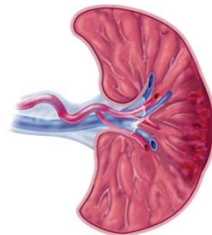
## Grade VI

Hepatic avulsion  
Incidence: rare  
OR Mortality: ~100%



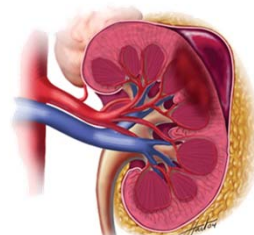
## Grade I:

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



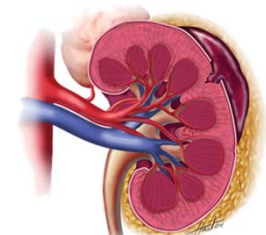
## Grade II:

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 cortex



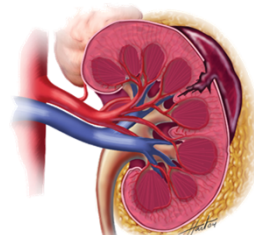
## Grade III:

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



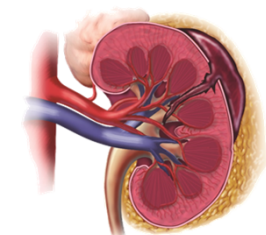
## Grade IV:

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



## Grade III:

Laceration > 1cm in depth

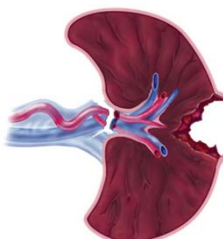


## Grade IV:

Laceration through collecting system

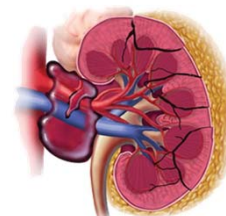
## Grade V:

Shattered spleen  
Injury of hilar vessels with completely devascularized spleen



## Grade V:

Vascular avulsion  
Shattered kidney



# UC San Diego HEALTH SYSTEM

## IMAGING REQUEST

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

DEPARTMENT/LOCATION	DATE

Patient Identification

**(Please print clearly) REQUIRED INFORMATION**

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

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

151-182 (9-08)/LHS

- |  |
|--|
| <ul style="list-style-type: none"> <li>1 Complete and attach this green paper form to any imaging that arrives with patient (disks, films) - under Exam Requested write "PLEASE ADD TO PACS"</li> <li>1 Give form and images to Xray tech in Trauma Bay to add to PACS</li> <li>1 DO NOT LEAVE DISKS OR IMAGES UNATTENDED IN TRAUMA OR SICU</li> </ul> |
|--|

## 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 $\geq 24$ 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

# **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.

If there is no ED Resident with the Trauma Team, Anesthesia can be paged by accessing the code blue page beeper for Anesthesia (x2622) and should respond *within five minutes*. If they do not respond, call the OR (36040) and then call to have the operator (36111) page the Anesthesiologist on call and page overhead.

When on service, the senior ED resident will be present with the trauma team prior to the patient's arrival and will page the ED attending for the procedure.

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

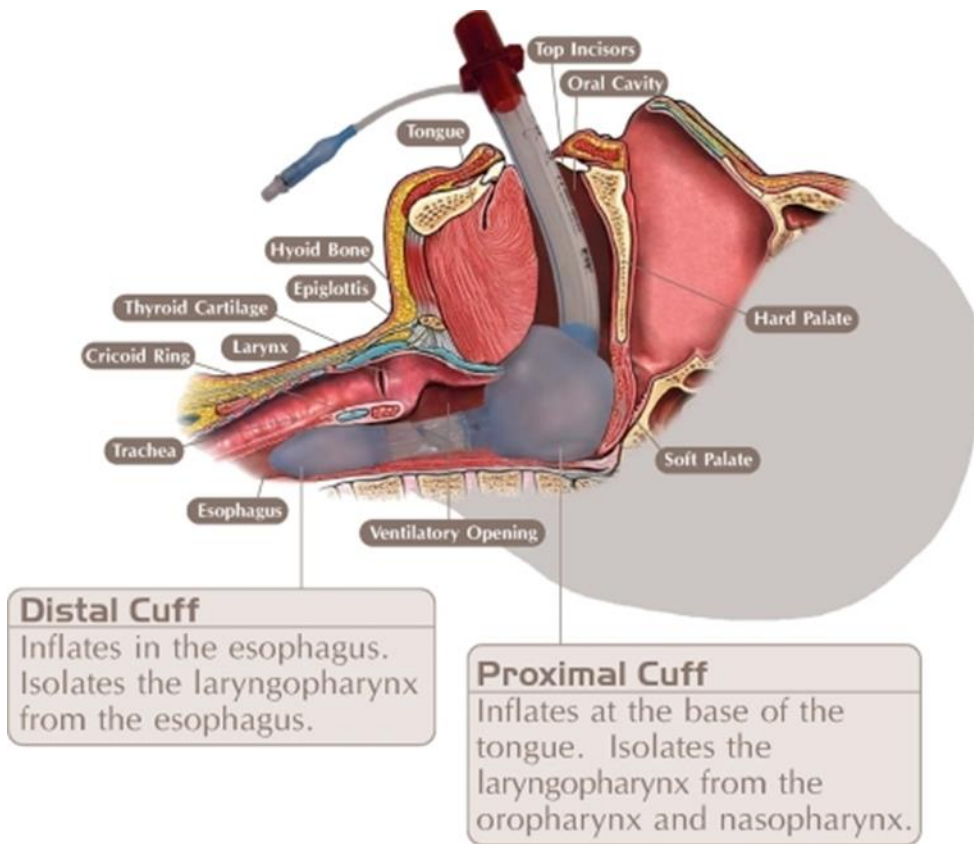
### *Procedure:*

- a. When a trauma patient arrives, Doc #1 in conjunction with the Trauma Fellow/Attending is in charge of the patient's airway including decisions for intubation and adjunctive management. Should Doc #1 ask for the patient to be intubated, **either the ED resident with ED attending backup or Anesthesia covering the code pager (x2622) will proceed.**
- b. ED residents will be scheduled for doing the resus suite intubations only when they are Doc #1 and provided a Trauma Attending is present. The ED attending will be paged stat to the resus suite to supervise the ED resident. The Trauma Attending will be at the bedside supervising patient management and decision making.
- c. If Anesthesia is to intubate, the Anesthesia code pager is paged. This code beeper is carried by the in-hospital Anesthesia resident or attending 24 hours a day. As a backup in the event that the Anesthesia code pager fails to get a response, the Anesthesia floor walker may be accessed by calling the OR front desk (x36040).
- d. *Rapid Sequence Intubation Procedure:*  
(see Rapid Sequence Intubation)
  - i. 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.
  - ii. 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.

- iii. Placement of the O2 sat monitor, EKG leads, and suction availability will be a priority for nursing.
- iv. A Trauma Attending will be at the bedside for all intubations and is in charge of the intubation procedure.
- v. 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.
- vi. In order to standardize stocked medications, the following drugs from the RSI kit will be used for intubation in the resus suite:
  - 1. Etomidate
  - 2. Succinylcholine or Rocuronium
  - 3. These are available as an RSI kit in the Pyxis.
  - 4. Propofol **MUST NOT** be used in the Trauma Bay or OR 11 due to the risk of circulatory collapse in under-resuscitated patients.
- vii. 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.)
- viii. When the intubator finds that the patient has a “difficult airway” (i.e. anterior airway or unable to have a good view due to secretions, blood, or edema, he/she should *tell the team immediately*. The resus nurse will respond by having the cricothyroidotomy set out and available.
- ix. The Trauma Attending will make the decision as to whether to do a surgical airway/cricothyroidotomy.
- x. After intubation, physical exam in conjunction with a disposable CO<sub>2</sub> detector and/or ETCO<sub>2</sub> 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.
- xi. An NG tube and Foley catheter should be placed followed by a CXR to verify ETT and NG tube placement.
- xii. Presence of a King Laryngotracheal Airway or Esophageal Obturator Airway – these are NON-definitive airways placed by EMS and indicate a potential difficult airway and high risk of aspiration (See Figure 2A and 2B). These airways should be removed only by a skilled intubator under adequate relaxation and with immediate presence of a surgeon capable of a surgical airway.

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

**Fig 2A: KING Laryngotracheal Airway**



**Fig 2B: Esophageal Obturator Airway**

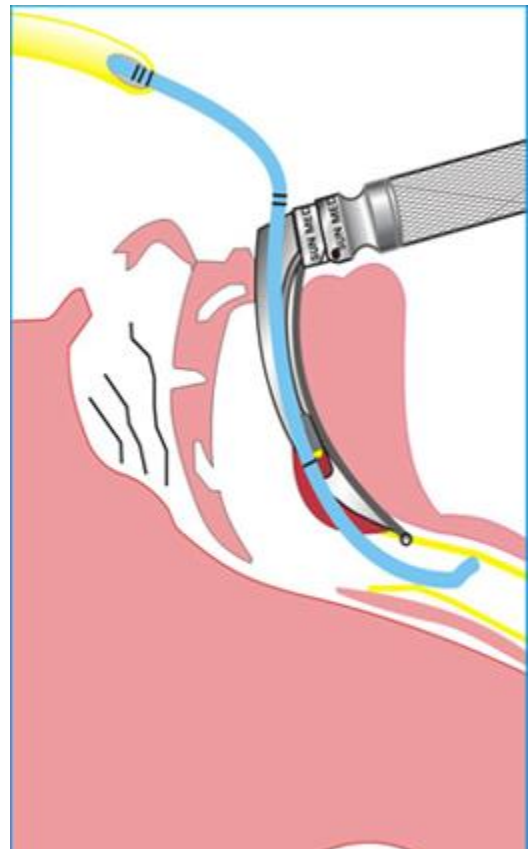
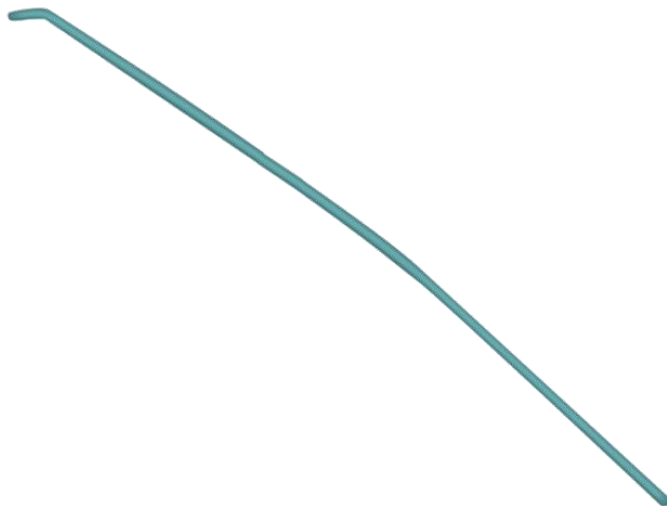




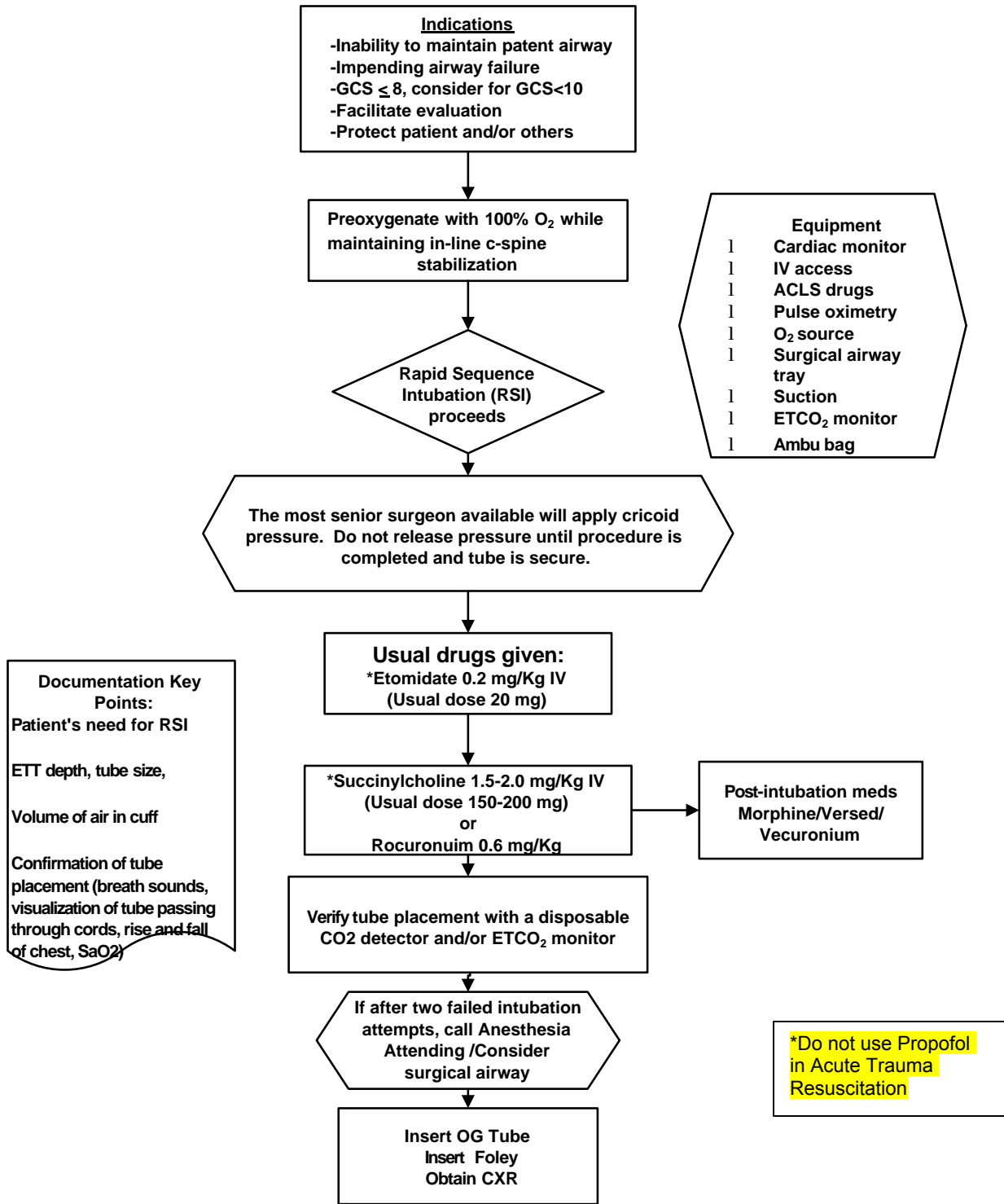
**Figure 3: CMAC Video Laryngoscopes**



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



UCSDMC DIVISION OF TRAUMA  
 RAPID SEQUENCE INTUBATION (RSI) ADULT - TRAUMA



# Head Injuries

# UCSD Clinical Guidelines for the Management of Traumatic Brain Injury

## A. Resuscitation and Basic Physiological Goals

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

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

### 1. Airway Management

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

### 2. Oxygenation/Ventilation

- i. Avoidance of hypoxia  
Efforts should be made to avoid hypoxia at all times.
  - Patients with TBI should have pulse oximetry maintained at a **SaO<sub>2</sub>  $\geq 90\%$**  and an attempt for **PaO<sub>2</sub>  $\geq 100$  mmHg**.
- ii. Ventilation  
Hyperventilation should be intensively monitored during the initial resuscitation.
  - The target **PaCO<sub>2</sub> is 35-40 mmHg**. An ETCO<sub>2</sub> monitor and serial ABGs should

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

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

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

#### i. Blood Pressure

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

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

#### ii. Euvolemia

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

#### iii. Coagulation

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

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

correct coagulopathy irrespective of need for surgical intervention.

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

#### 4. Imaging

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

### **B. Intracranial Pressure (ICP) Monitoring**

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

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

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

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

1. ICP monitoring should additionally be considered for those patients with a normal admission CT scan of the brain if two or more of the following criteria are met:
  - age > 40 y/o
  - unilateral or bilateral motor posturing
  - documented episode of hypotension (SBP <90mmHg)

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

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

### **C. Treatment of Increased Intracranial Pressure (ICP)**

(see Trauma Protocol Algorithms>Intracranial Hypertension)

Treatment for intracranial hypertension should be initiated when **ICP  $\geq 20$ mmHg.**

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

#### **Level 2**

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

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

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

### Level 3

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

## D. Adjunctive Medications and Prevention of Complications

### 1. Antiseizure Prophylaxis

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



## 2. Stress Ulcer Prophylaxis

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

## 3. Deep Venous Thrombosis (DVT) Prophylaxis

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

## 4. Early Tracheostomy

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

## 5. Nutritional Support

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

## **E. Surgical Management of TBI**

### 1. Epidural Hematomas

An epidural hematoma (EDH) of greater than 30 cm<sup>2</sup> should be surgically removed regardless of GCS. Continued non-operative management should be considered in posterior EDH of venous origin. Patients with an acute EDH, GCS <9, and anisocoria should undergo emergent EDH evacuation. EDH of less than 5 mm midline shift in patients with GCS >8 and no focal neurological deficit can be closely monitored in an ICU with serial CT scans. Judicious use of narcotics and sedatives is important as not to alter the neurologic exam. Repeat CTH should be within 4-6 if patient are to be managed non-operatively.

### 2. Acute Subdural Hematomas

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

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

### 3. Subarachnoid Hemorrhage

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

### 4. Parenchymal Lesions

Intraparenchymal hemorrhage (IPH) causing progressive neurological deterioration, medically refractory ICP elevations, or significant mass effect should be emergently evacuated. Frontal or temporal contusions with IPH  $>3.0$  cm<sup>3</sup> and  $>5$  mm shift or cistern compression in patients with GCS 6-8 should be evacuated. **Normal ICP should not preclude operative evacuation since herniation can occur without intracranial hypertension.** Repeat CTH should be within 4-6 if patient are to be managed non-operatively.

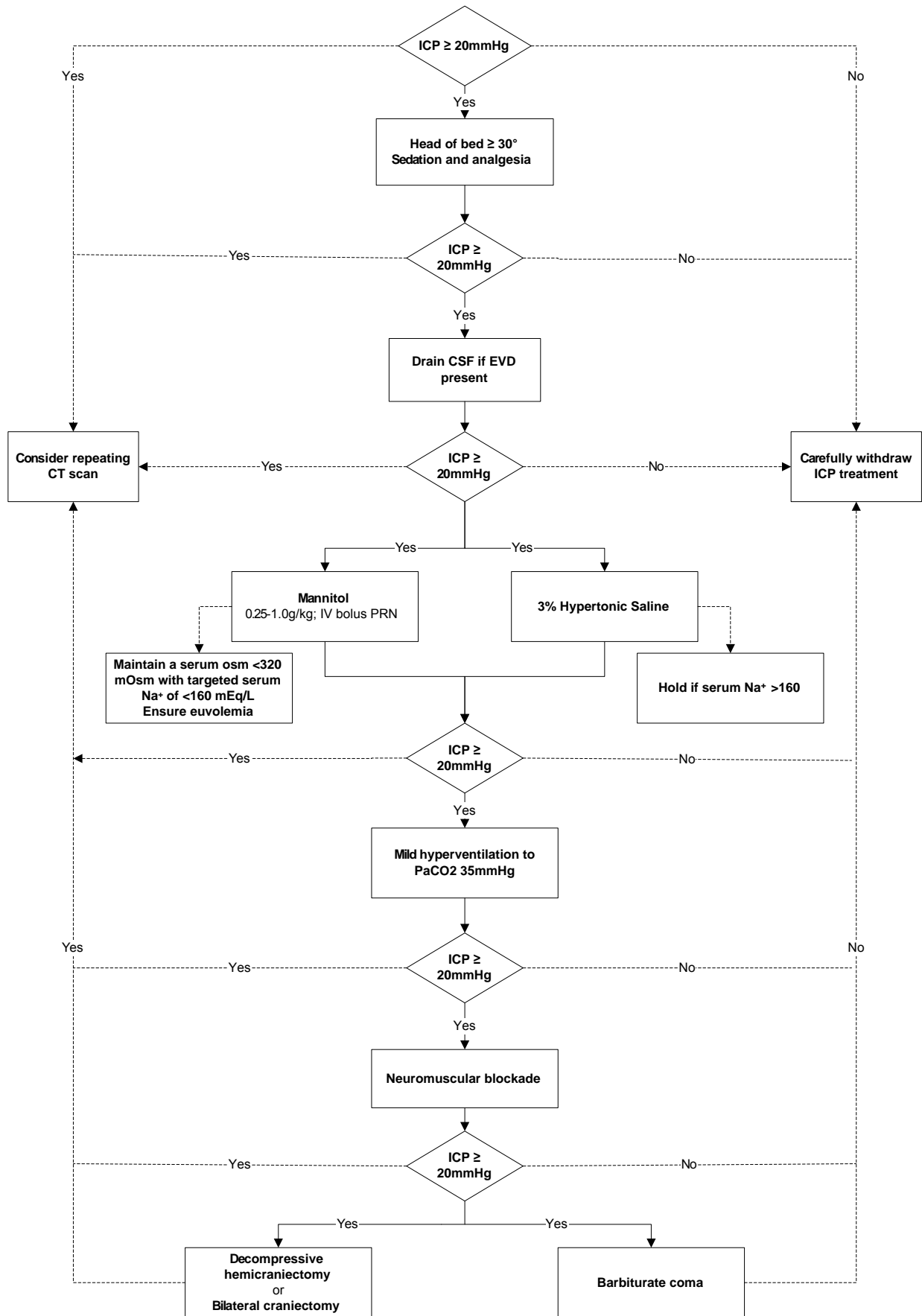
### 5. Diffuse Medically-Refractory Cerebral Edema and Elevated ICP

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

### 6. Depressed Skull Fractures

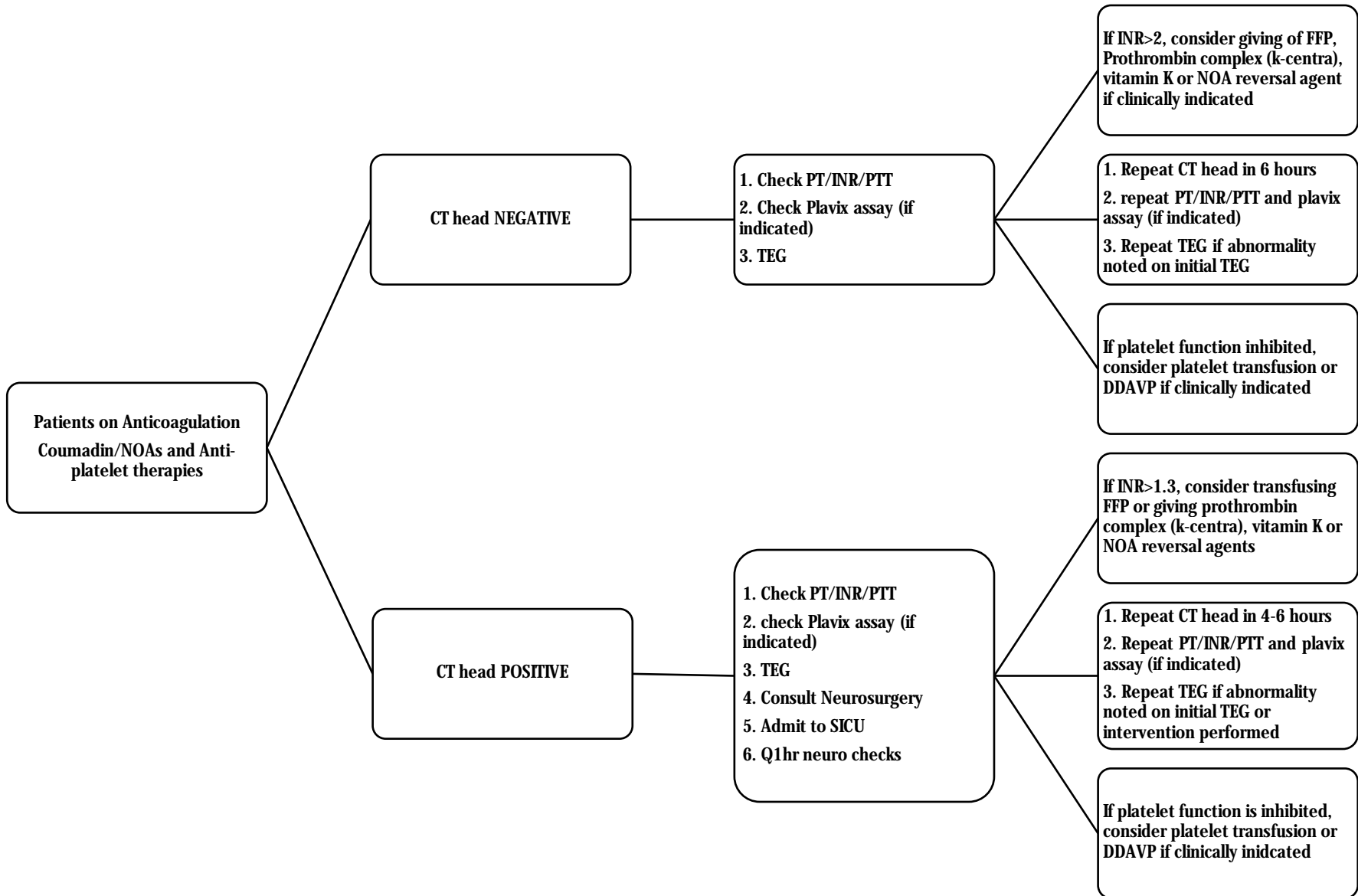
Open skull fractures depressed greater than the thickness of the inner and outer table should undergo operative management. Referable symptoms attributed to the fracture site are an **absolute indication** for operative management. Open depressed fractures that are less than 1cm depressed and have no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

# Intracranial Hypertension Management



# Reversal of Anticoagulation

# Trauma patient on anticoagulation with Closed Head Injury



**Blood Product and Factor Algorithm in Non-Hemophiliac Patients not on warfarin\***

**Does this patient have life-threatening bleeding?**

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

**Yes**

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

Check CBC/coags/fibrinogen and thromboelastograph (TEG)

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

Administer platelets

**Fibrinogen <150 mg/dL (or low angle or K on TEG)**

Administer FFP or cryoprecipitate until fibrinogen is >150 mg/dL

Consider tranexamic acid, (esp if Fibrinolysis on TEG)

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

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

Consider FFP

Consider Kcentra<sup>†</sup>

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

\*Extremely limited efficacy data exists to support Kcentra to reverse bleeding caused by rivaroxaban, apixaban, or edoxaban. At this time literature DOES NOT SUPPORT the use of Kcentra to reverse bleeding caused by dabigatran. Please use idarucizumab (Praxbind®)

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

# Interpreting Thromboelastographs (TEGs)

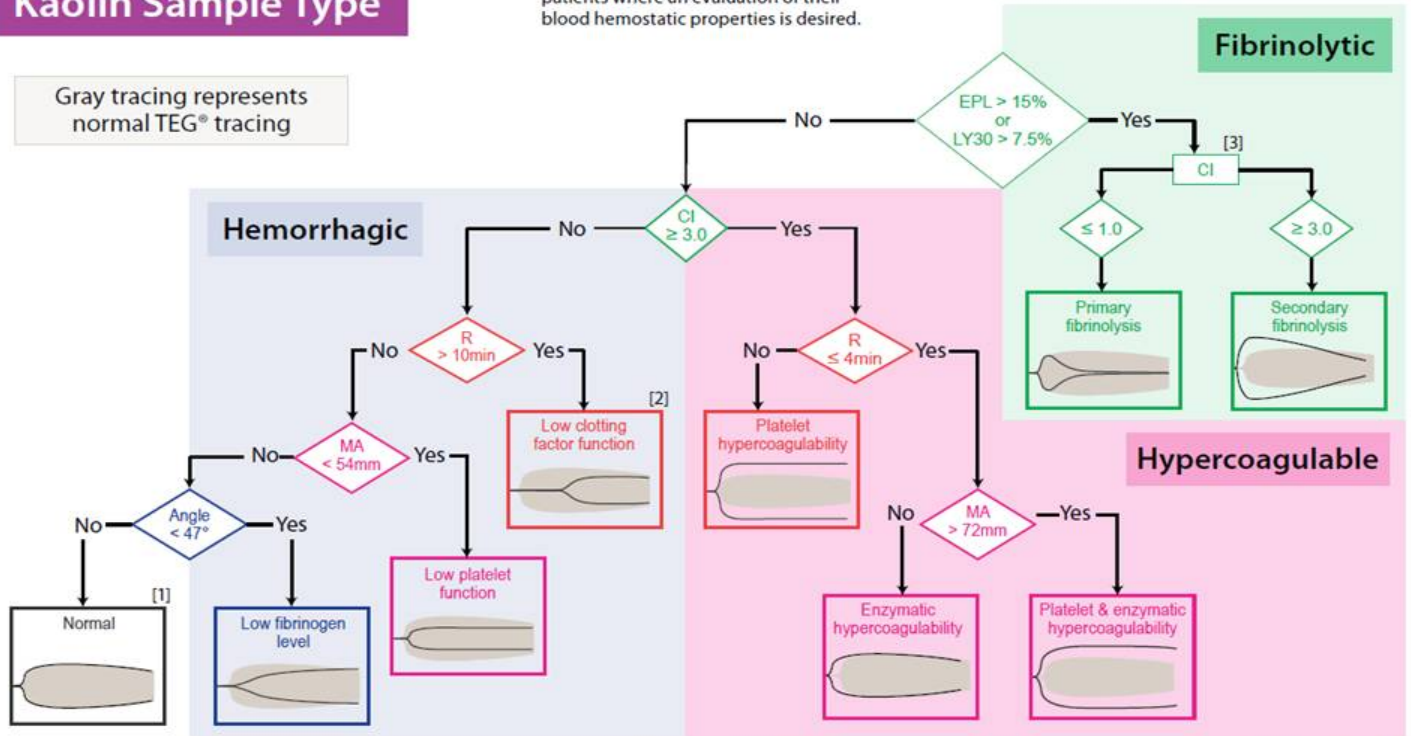
## TEG® Analysis Tree

### Kaolin Sample Type

**HAEMONETICS®**  
THE Blood Management Company

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

Gray tracing represents normal TEG® tracing

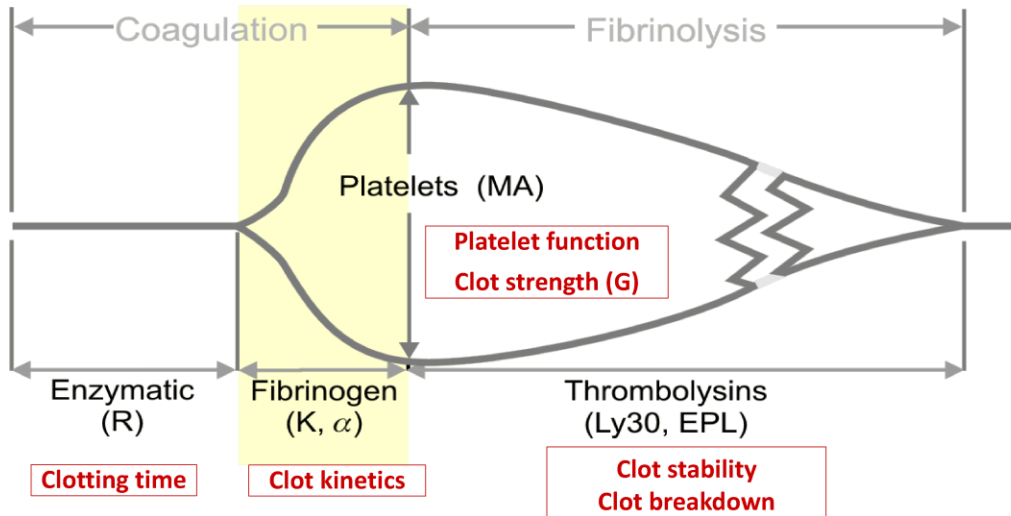


1, 2, 3 See footnotes section on other side. References for TEG analysis tree can be found at [www.haemonetics.com](http://www.haemonetics.com)

US Patent 6,787,363

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

# Thromboelastography (TEG)



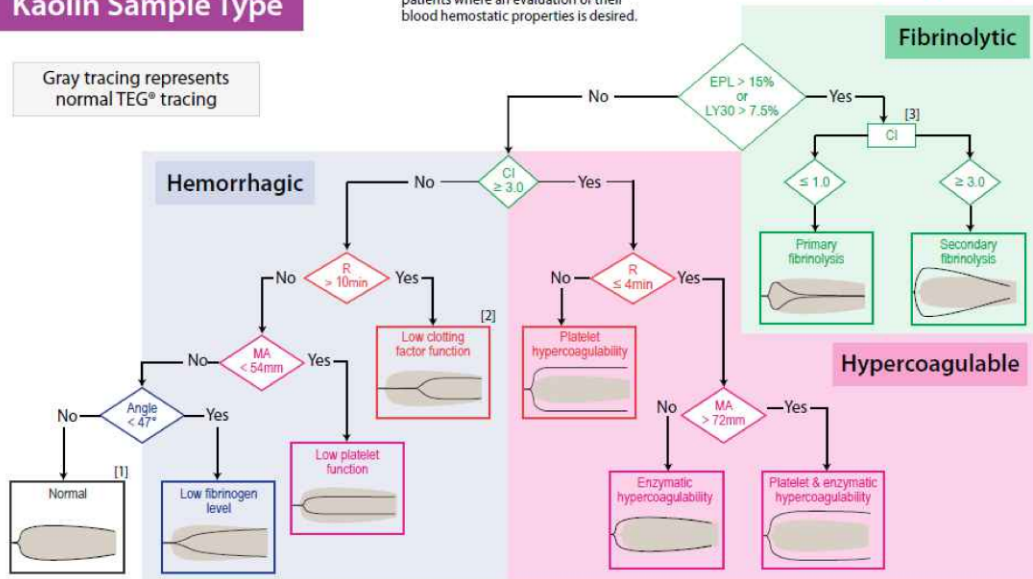
Component	Definition	Normals	Problem	Therapy
<b>R time</b> (Citrate Kaolin)	Time to start clotting	5-10 min	Coag. factors	FFP / KCentra
<b>TEG-ACT</b> (Rapid TEG)	Time to start clotting	80-140 sec	Coag. factors	FFP / KCentra
<b>K Time</b>	Time until fixed strength	1-3 min	Fibrinogen	Cryo / FFP
<b>Alpha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

## TEG® Analysis Tree

### Kaolin Sample Type

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

**HAEMONETICS®**  
THE Blood Management Company



1, 2, 3 See footnotes section on other side. References for TEG analysis tree can be found at [www.haemonetics.com](http://www.haemonetics.com)

US Patent 6,787,363



\*Check PT/INR, PTT, TEG on all ACAP patients

**Patient on anticoagulant or antiplatelet (ACAP) medication\***

**CT Head Results**

POSITIVE

**Go to Anticoagulation +CHI Algorithm**

NEGATIVE

**Other major hemorrhage?**

POSITIVE

**Reverse as per +CHI Guidelines**

NEGATIVE

**Warfarin**

**Plavix or Aspirin**

**Anti-Xa (Rivaroxaban \ Apixaban)**

**Anti-IIa (Dabigatran)**

**INR > Goal?**

**Check Plavix \ Aspirin Assay**

**Check Anti-Xa Level**

NO

YES

**Transfuse FFP until INR in goal range**

**No Reversal Needed if No Hemorrhage**

**Repeat CT Head 4-6 Hours (or sooner if mental status declines)**

**Anticoagulation-No CHI**

## Guidelines for Emergent Bleeding Reversal for Non-Hemophiliac Patients

### I. Factor Guidelines for Non-Hemophiliac Patients

An increasing number of anticoagulants have targeted reversal agents for patients in need of emergent anticoagulation reversal. Prothrombin complex concentrates, such as 4-factor PCC (factors II, VII, IX, X) (Kcentra®), are effective in reversing bleeding secondary to vitamin-K antagonists (warfarin) compared to fresh frozen plasma (FFP). Idarucizumab is available to reverse the effects of dabigatran. **Treatment may vary from these guidelines according to the discretion of the treating prescriber.**

- A. Factor products should not be given to patients who have no evidence of bleeding or do not have an urgent, invasive procedure planned.
  - 1. Per MCP 380.6, hold anticoagulation and monitor patients. <https://supplychain.ucsd.edu/Documents/formDocs/WD1104.pdf>.
- B. Kcentra® + vitamin K is FDA-indicated for life-threatening bleeding caused by **warfarin (Attachment 1)** or warfarin reversal in patients needing urgent surgical or invasive intervention.
  - 1. Kcentra is noninferior to FFP for the urgent reversal of acquired coagulation factor deficiency induced by warfarin therapy in adult patients with acute major bleeding.
  - 2. See **Attachment 1** for Kcentra® dosing for coagulopathic patients with acute major bleeding reversal secondary to warfarin.
- C. Kcentra® (±vitamin K) may be considered in patients with profuse or life-threatening bleeding **with no known history of warfarin consumption (Attachment 2)**
  - 1. The patients include:
    - § Profuse or life-threatening bleeding, or extreme risk of life-threatening bleeding, due to liver failure, intracranial hemorrhage, trauma, or critical illness
    - § Profuse or life-threatening bleeding, unresponsive or intolerant (fluid overload) to conventional therapy
  - 2. Limited efficacy data exists supporting the use of Kcentra® to reverse anticoagulation from direct thrombin inhibitors, i.e. dabigatran (Pradaxa®), or oral factor Xa-inhibitors, i.e. rivaroxaban (Xarelto®), apixaban (Eliquis®), or edoxaban (Sayvaysa®), who have life-threatening bleeding or require anticoagulation reversal for emergent invasive interventions.
- D. Idarucizumab (Praxbind®), 5 g via IV infusion, should be used to reverse life-threatening bleeding associated with dabigatran.
  - 1. Idarucizumab is a monoclonal antibody specific to dabigatran and should not be expected to work for other oral or intravenous anticoagulants.
- E. Urgent invasive procedure for coagulopathic patients with no evidence of bleeding
  - 1. For patients taking warfarin who require surgical intervention, please refer to FDA-approved Kcentra® dosing (**Attachment 1**).
  - 2. Check fibrinogen, PT/INR and thromboelastograph (TEG). See **Attachment 3** for TEG interpretation assistance.
  - 3. If fibrinogen level is low (<150 mg/dL), replace fibrinogen with cryoprecipitate or FFP, as appropriate, prior to administering Kcentra®.
  - 4. Recommended to start with a single agent first (Kcentra®, 4-factor PCC preferred).
  - 5. For non-warfarin patients, consider FFP or Kcentra® (1 box, ~500 units) once. Kcentra® may be repeated one more time if inadequate response to first dose. Inadequate response is failure of PT/INR to normalize 30 minutes after first dose.
- F. Suggested monitoring and follow-up after any Kcentra® administration
  - 1. Monitor for hypotension
  - 2. 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.
- G. **Consider hematology consult for bleeding that continues after Kcentra® or other factor product administration. Contact hematology fellow on call, Hematology attending on call.**

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

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

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

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

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

# Concussion Screening

## **Concussion Screening**

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

### **A. Key Outcomes**

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

### **B. Goal Length of Stay**

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

### **C. Proposed Hospital Course**

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

### **D. Discharge Planning**

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

— Physician Access line to make referral) follow-up

**E. Disposition**

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

**F. Post-discharge Management**

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

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

**Symptom Evaluation: To be filled out by the patient**

**How do you feel?**

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

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

\_\_\_\_\_  
(Patient’s signature)

\_\_\_\_\_  
(Date)

# CIF Concussion Return to Play (RTP) Protocol

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

**Instructions:**

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

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

**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
<b>Brain Rest</b>	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.
	<i>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.</i>		
<b>Restful Home Activity</b>	Set a regular bedtime/wake up schedule. Allow at least 8-10 hours of sleep and naps if needed. Drink lots of fluids and eat healthy foods every 3-4 hours. Limit "screen time" to less than 30 minutes a day.	No school. May begin easy tasks at home (drawing, baking, cooking). Soft music and 'books on tape' ok. Once your child can complete 60-90 minutes of light mental activity without a worsening of symptoms he/she may go to the next step.	Light physical activity, like walking. No strenuous physical activity or contact sports. No driving.
	<i>Progress to the next stage when your child starts to improve and s/he has fewer symptoms.</i>		
<b>Return to School - PARTIAL DAY</b>	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.
	<i>Progress to the next stage when your child can complete the above activities without symptoms.</i>		
<b>Return to School - FULL DAY</b>	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.
	<i>Progress to the next stage when your child has returned to full school and is able to complete all assignments/tests without symptoms.</i>		
<b>Full Recovery</b>	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**

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

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

#### Transition back to school

Alert school personnel to injury, and initiate slow reintegration

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

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

Avoid standardized testing during recovery

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

#### Graded return to play

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

Nonimpact aerobic exercise

Sport-specific exercise (nonimpact drills)

Noncontact training drills

Full contact practice

Return to normal play

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

#### Higher-risk patients

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

More than three symptoms at presentation

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

at presentation

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

neuropsychological testing,  
communication with coach and  
training staff)

Headache lasting more  
than 60 hours

Loss of consciousness for  
more than 60 seconds

Amnesia

History of concussion

Age younger than 18  
years

Comorbid conditions

Medication use  
(psychotropic drugs,  
anticoagulants)

Dangerous style of athletic  
play

High-risk sport (contact,  
collision)

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*IEP = individualized education program.*

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

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# **C-Spine Workup and Management**

## **C-Spine Workup and Management**

(see Trauma Protocols & Guidelines Cervical and Thoracolumbar Spinal Precautions; also, Trauma Protocol Algorithms>C-Spine Evaluable/Inevaluable)

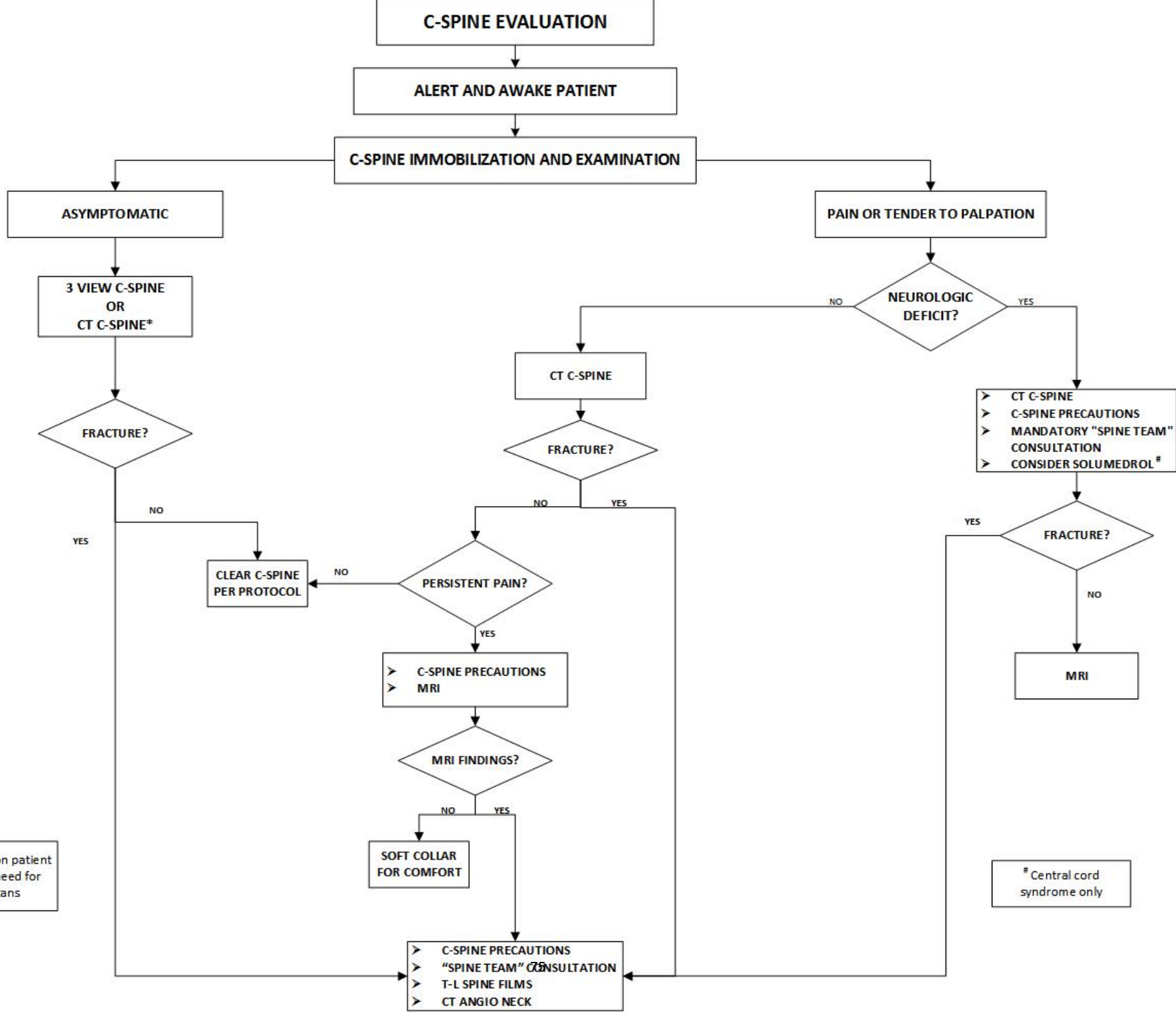
### **C-SPINE PRECAUTIONS**

- a. Who needs C-spine precautions?
  - i. All blunt trauma patients should be placed in c-spine precautions until the cervical spine can be appropriately evaluated and cleared.
  - ii. Penetrating trauma patients do not need to be placed in c-spine precautions unless there is other associated blunt trauma or they are unevaluable and blunt force cannot be excluded.
  
- b. "C-spine precautions" includes:
  - i. Bedrest (until remainder of spine can be cleared/evaluated?)
  - ii. head flat (in a neutral position)
  - iii. C-spine immobilization in a rigid cervical collar (Philadelphia collar or Miami J) at all times
  - iv. transport flat or in reverse Trendelenburg on a gurney
  
- c. In low risk patients, after T&L spines have been cleared, the Trauma Attending or Fellow may use his/her judgment and write the C-spine precautions order to include "HOB may be 30 degrees up."
  
- d. Routine c-spine clearance includes imaging with either 3-4 plain radiographic views or CT scan of the c-spine combined with a clinical exam of the c-spine.
  
- e. A CT c-spine is the preferred imaging modality for evaluation of the cervical spine if the patient is scheduled to undergo another type of CT examination.
  
- f. Patients with any spinal fracture should have a radiologic exam of the entire spine.
  
- g. "T-L spine precautions"
  - i. bed flat with reverse Trendelenburg unless contraindicated (i.e. CSF leak)
  
- h. C-spine Clearance after negative imaging tests  
Clinically clearing the C-spine involves performing a physical examination to rule out midline pain or tenderness with palpation. If the patient denies midline pain and tenderness with palpation, the anterior half of the collar may then be removed. The patient should then be given clear instructions to slowly move his/her head from side to side (without assistance) and then back to front and to stop at any time if he/she experiences any pain/discomfort.
  
- i. Any patient with:
  - i. midline cervical pain or tenderness
  - ii. a distracting injury or competing pain

- iii. intoxication (any intoxicating substance)
- iv. any head injury or impaired level of consciousness
- v. focal neurological deficit

**SHOULD NOT undergo attempted clinical exam/clearance** until sensorium is cleared (usually the next morning).

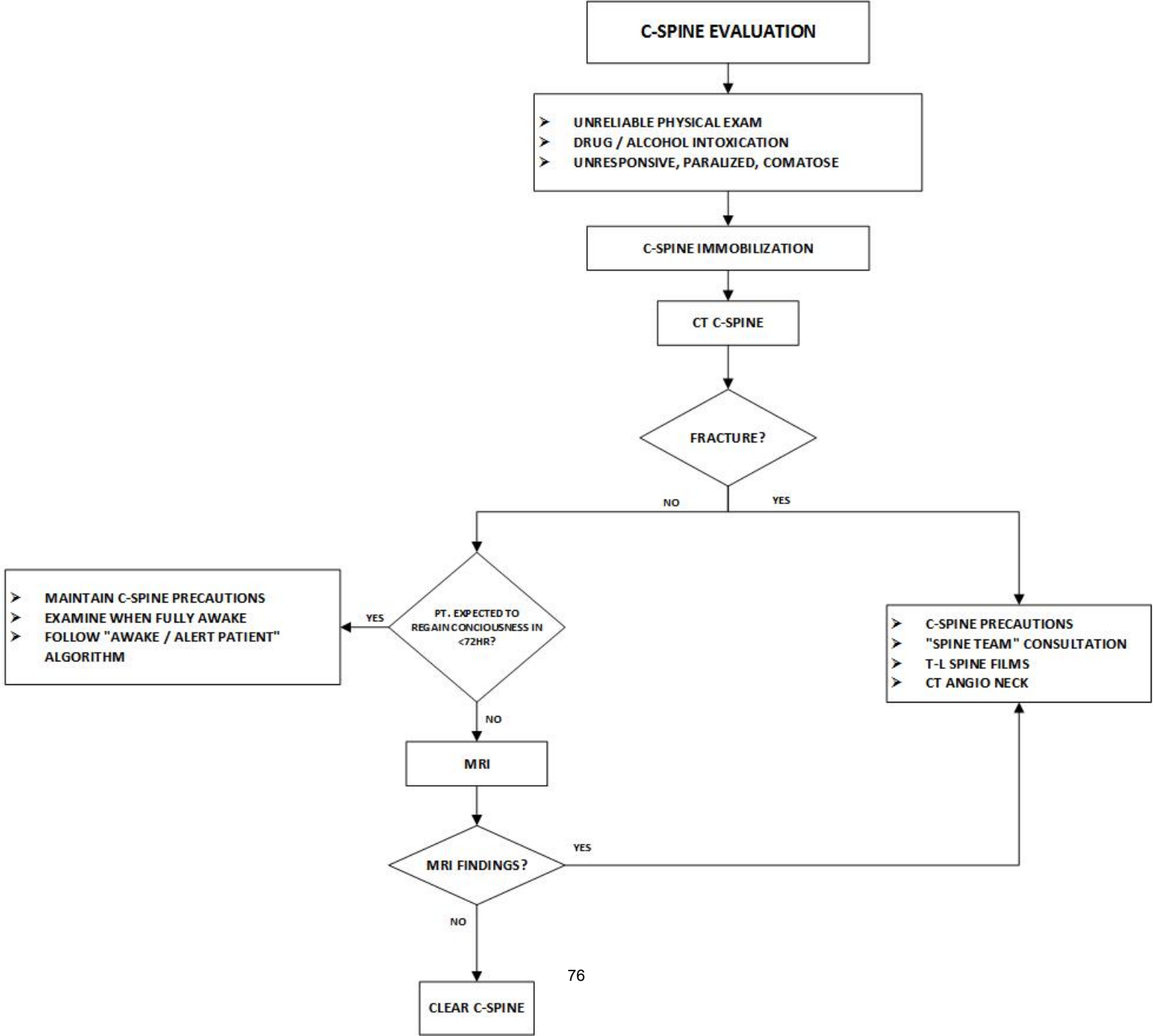
- j. Patients who are intubated for a prolonged period of time or are unable/incapable of having their C-spine cleared clinically, should undergo MRI of the C-spine within the **first 72 hours** of admission to rule out ligamentous injury. If the MRI does not demonstrate signs of ligamentous injury, the C collar may be removed.
- k. Both an order and a progress note (documenting that the patient's C-spine has been both radiographically and clinically cleared) must be written in order to clarify that the patient no longer requires C-spine precautions.
- l. Any patient with complaints of midline pain or tenderness of the C-spine should be kept in a Philadelphia collar (or changed to a soft collar) regardless of their radiographic exam results. The patient should be instructed to wear the collar for 6 weeks and follow up in Spine clinic for repeat evaluation and clearance of precautions.
- m. Occasionally, the spine surgery service (either Neurosurgery or Orthopedics) may request patient guided flexion/ extension ("flex/ex") views of the C-spine.
  - i. The correct procedure for obtaining flex/ex views of the C-spine entails that:
    - 1. a physician from the requesting service must be present in the radiology suite to supervise patient movement during the study. (Include in the order and specify service and doctor with pager #.)
    - 2. the patient should be allowed to move his/her own neck in flexion/extension exams. If the patient experiences pain or tenderness, the exam should be stopped.
    - 3. The trauma service does not order or participate in flexion/extension examinations.
- n. Patients who require a Philadelphia collar for extended periods of time are at risk for skin breakdown. These patients may have a Miami J collar placed in lieu of a Philly collar.
- o. Any patient with a C-spine injury noted on imaging should be maintained in c-spine precautions and receive a formal spine surgery consult (either neurosurgery or orthopedic spine service).
- p. Patients with suspected C-Spine injury require a CTA of the neck. See "Blunt Cerebrovascular injury"



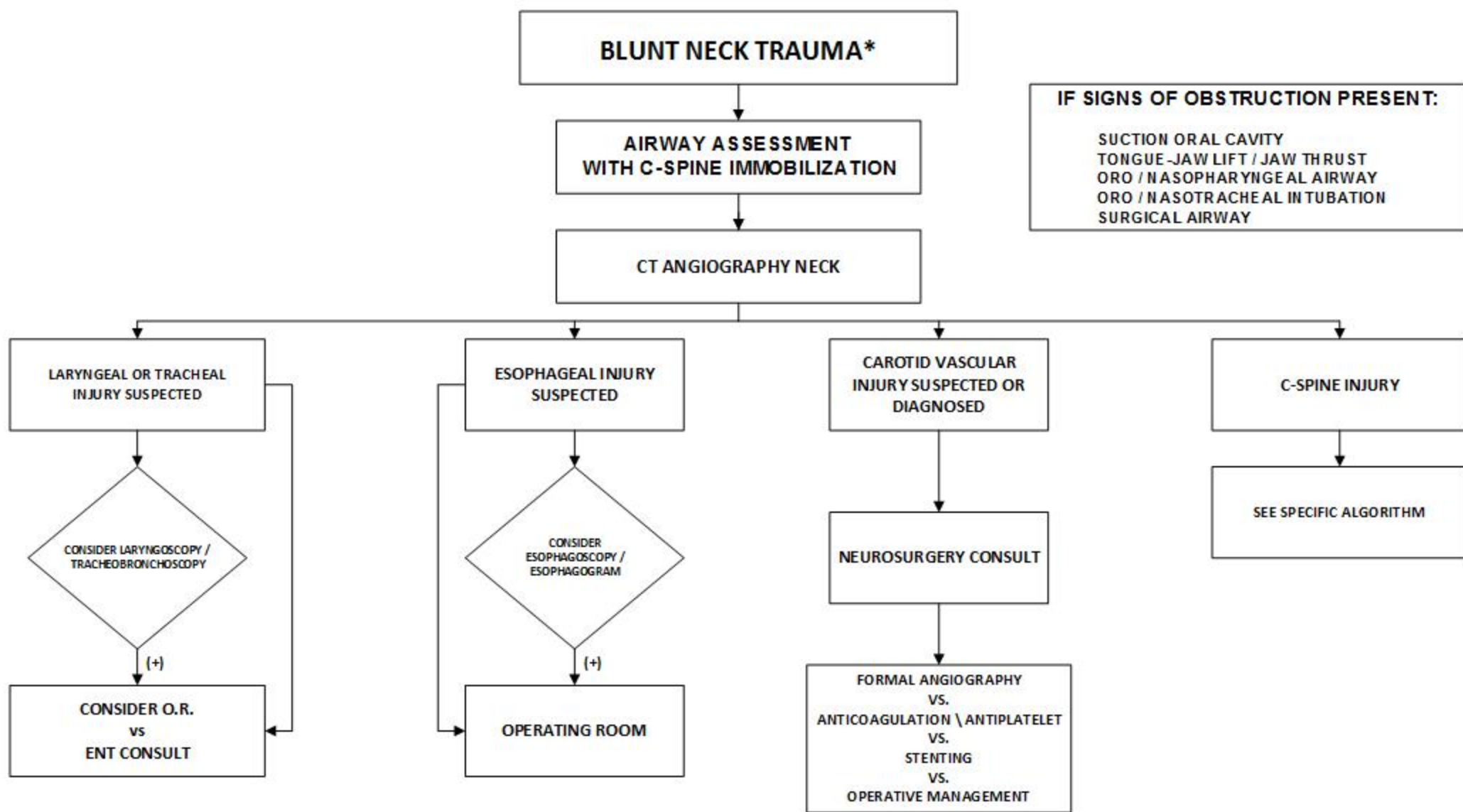
\* Dependent upon patient body habitus, need for other CT scans

# Central cord syndrome only





# Neck Trauma



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

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

## Screening Criteria

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

**Risk Factors for BCVI**

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

**Consider Screening:**  
 Hyperextension mechanism  
 TBI with thoracic injuries  
 Scalp degloving  
 Thoracic vascular injuries  
 Blunt cardiac rupture

Stop

Yes

Yes

No

Equivocal Finding or High Clinical Suspicion ‡

Arteriogram vs. MRA

**Multi-Slice CTA\***

Negative

Stop

Positive ‡

Carotid Artery Injury (common or internal)

Vertebral Artery Injury

Grade I Injury

Grade II-V Injury

Grade I Injury

Grade II-IV Injury

Grade V Injury

Antithrombotic or Antiplatelet Therapy

Antithrombotic or Antiplatelet Therapy

Endovascular Treatment

Surgically Accessible?

Yes

No

Operative or Endovascular Treatment

Endovascular Treatment

Or ‡

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

‡ Neurosurgery consult required

**Table:** Denver Grading Scale for Blunt Cerebrovascular Injuries

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

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

Grade III : pseudoaneurysm

Grade IV : vessel occlusion

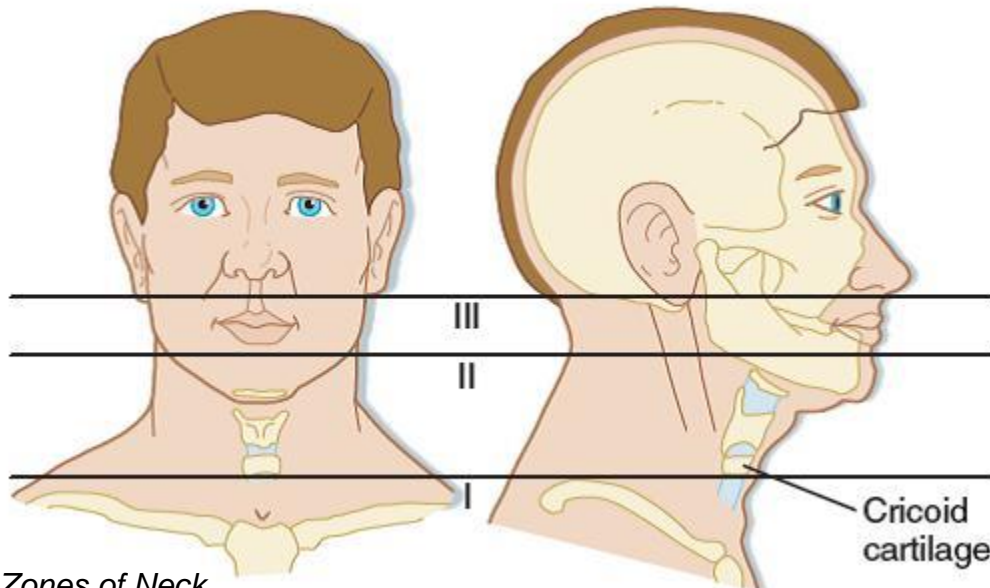
Grade V: vessel transection

# **Penetrating Neck Trauma**

## Penetrating Neck Wound- Exploration, Vascular Repair/Ligation

The neck can be divided into 3 zones

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



*Figure – Zones of Neck*

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

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

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

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

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

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

#### A. Key Outcomes

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

#### B. Goal Length of Stay

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

#### C. Proposed Hospital Course

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

#### *Hospital Day #1*

- Start clear liquid diet

#### *Hospital Day #2*

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

#### D. Disposition

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



## Penetrating Neck Wound-Esophageal Injury

### A. Key Outcomes

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

### B. Goal Length of Stay

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

### C. Proposed Hospital Course

#### *Prior to Arrival at Hospitalization Destination*

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

#### *Hospital Day #1-4*

- NPO
- Broad spectrum antibiotics
- Drainage

#### *Hospital Day #5*

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

#### *Hospital Day #6*

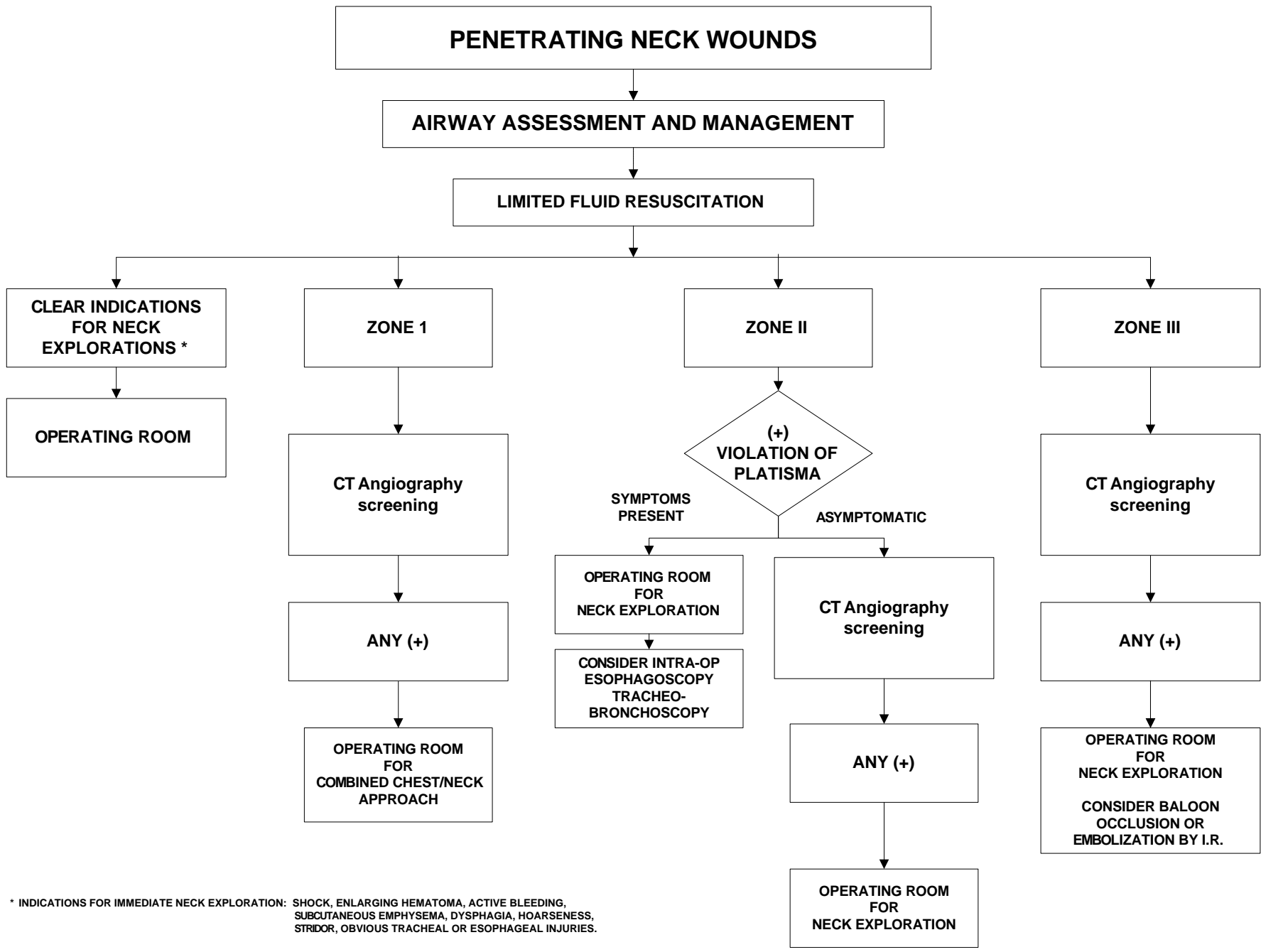
- If no evidence of esophageal leak with clear liquid diet, remove drain
- Discharge
- Patient and family education regarding wound care, diet, and activity

### D. Discharge Planning

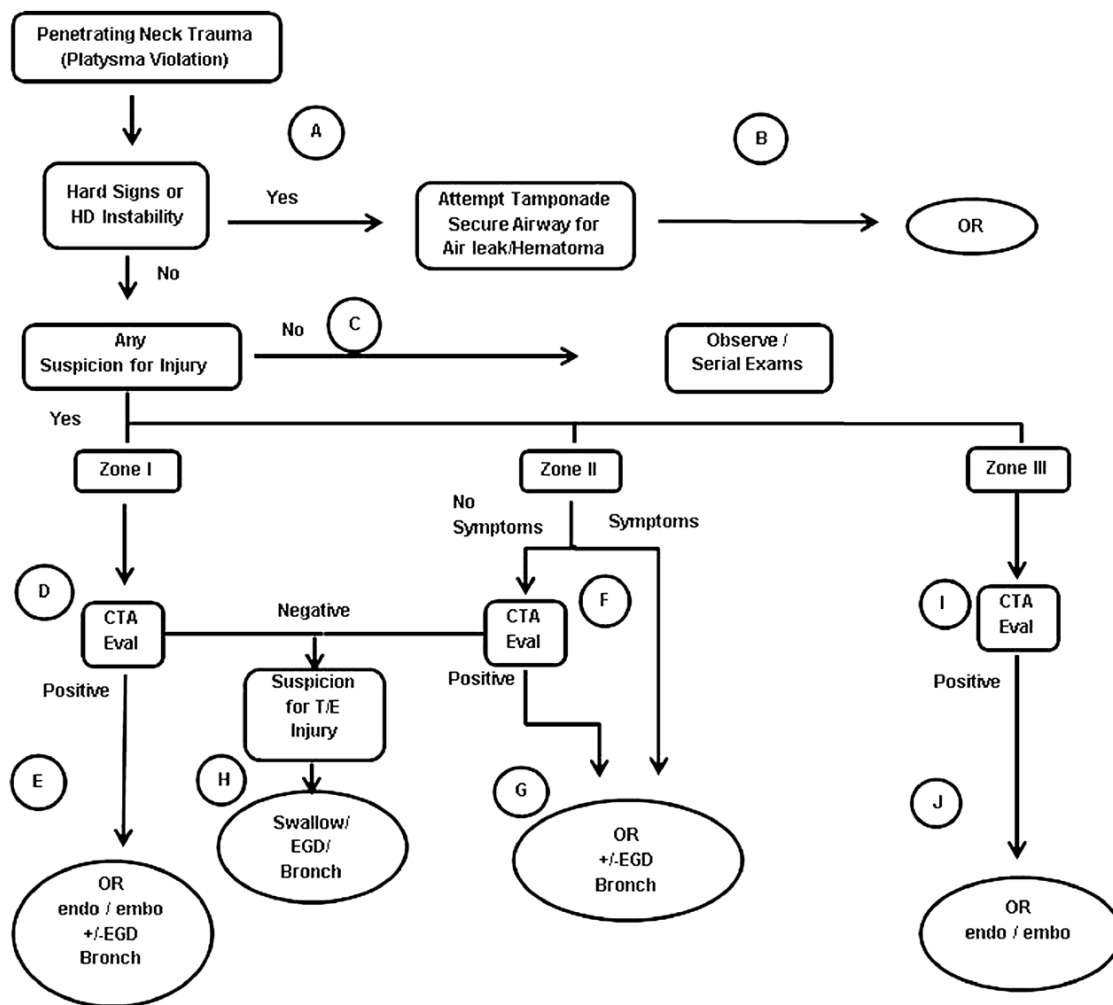
- Tolerating regular diet
- Activity as tolerated based on injuries
- Clinic follow-up as injuries dictate

### E. Disposition

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



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



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

# Facial Fractures

## Facial Fractures without Closed Head Injury

### A. Key Outcomes

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

### B. Goal Length of Stay

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

### C. Proposed Hospital Course

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

### D. Discharge Planning

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

Activity as tolerated based on injuries  
Clinic follow-up with ENT or Plastics as injuries dictate

**E. Disposition**

Home in uncomplicated cases

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

Per PT/OT recommendations

## **Facial Fractures with Mild Closed Head Injury**

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

### **A. Key Outcomes**

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

### **B. Goal Length of Stay**

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

### **C. Proposed Hospital Course**

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

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

iv. Hospital Day #1-2

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

**D. Discharge Planning**

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

Activity as tolerated based on injuries

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

**E. Disposition**

Home in uncomplicated cases

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

Per PT/OT recommendations



# Chest Trauma

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

### **A. Key Outcomes**

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

### **B. Goal Length of Stay**

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

### **C. Proposed Hospital Course**

#### *Hospital Day #1*

- Consider IMU/ICU admission for elderly patients or if other complicating factors exist
- NPO
- Chest tube to -20 cm H<sub>2</sub>O suction
- Closely monitor chest tube output and assess for air leak
- Adequate analgesia, **consider need for epidural**
- Aggressive pulmonary toilet; weaning parameters BID by RT
- OOB to chair while CT on suction
- There is insufficient evidence for routine prophylactic antibiotics for chest tubes, however consider if patient was transferred with outside tubes, has open wounds or evidence of infection.

#### *Hospital Days #2-3*

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

#### *Hospital Day #4*

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

#### **D. Discharge Planning**

Tolerating regular diet

Activity as tolerated based on injuries

Clinic follow-up as injuries dictate

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

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

#### **E. Disposition**

Care facility required for complex cases

May require home care for assistance with wounds or other therapies

Per PT/OT recommendations

#### **F. Retained Hemothorax**

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

### **RECOMMENDATIONS**

- **Level 1**

- ∅ VATS should be performed after initial chest tube thoracostomy has failed to evacuate a hemothorax.
  - ∅ VATS performed within 3-7 days 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 thoracotomy treatment (1). The incidence varies and can be as high as 20%, but in most studies is found to be 1-4% after initial tube thoracostomy for chest trauma (1,2). The most accepted complication of retained hemothorax is empyema. DuBose et al. found that the overall incidence of empyema in retained hemothorax was 27% when defined by the presence of purulent pleural fluid, pleural fluid with a pH less than 7.2, or signs of infection or proven bacterial invasion of the pleural space on Gram stain or culture. Independent risk factors for the development of empyema included presence of rib fractures, Injury Severity Score >25, and need for additional therapeutic intervention. Patients with empyema had longer intensive care unit (ICU) and hospital stays, enforcing the need for prevention of empyema and other complications of retained hemothorax (3). The literature suggests that VATS is an ideal way to evacuate blood from the pleural space and earlier rather than later intervention is beneficial in decreasing the morbidity of retained hemothorax (4,5).

## **LITERATURE REVIEW**

### **Initial Chest Tube Management**

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

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

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

### **Use of Antibiotics**

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

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

### **Diagnosis of Retained Hemothorax**

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

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

### **Role of VATS**

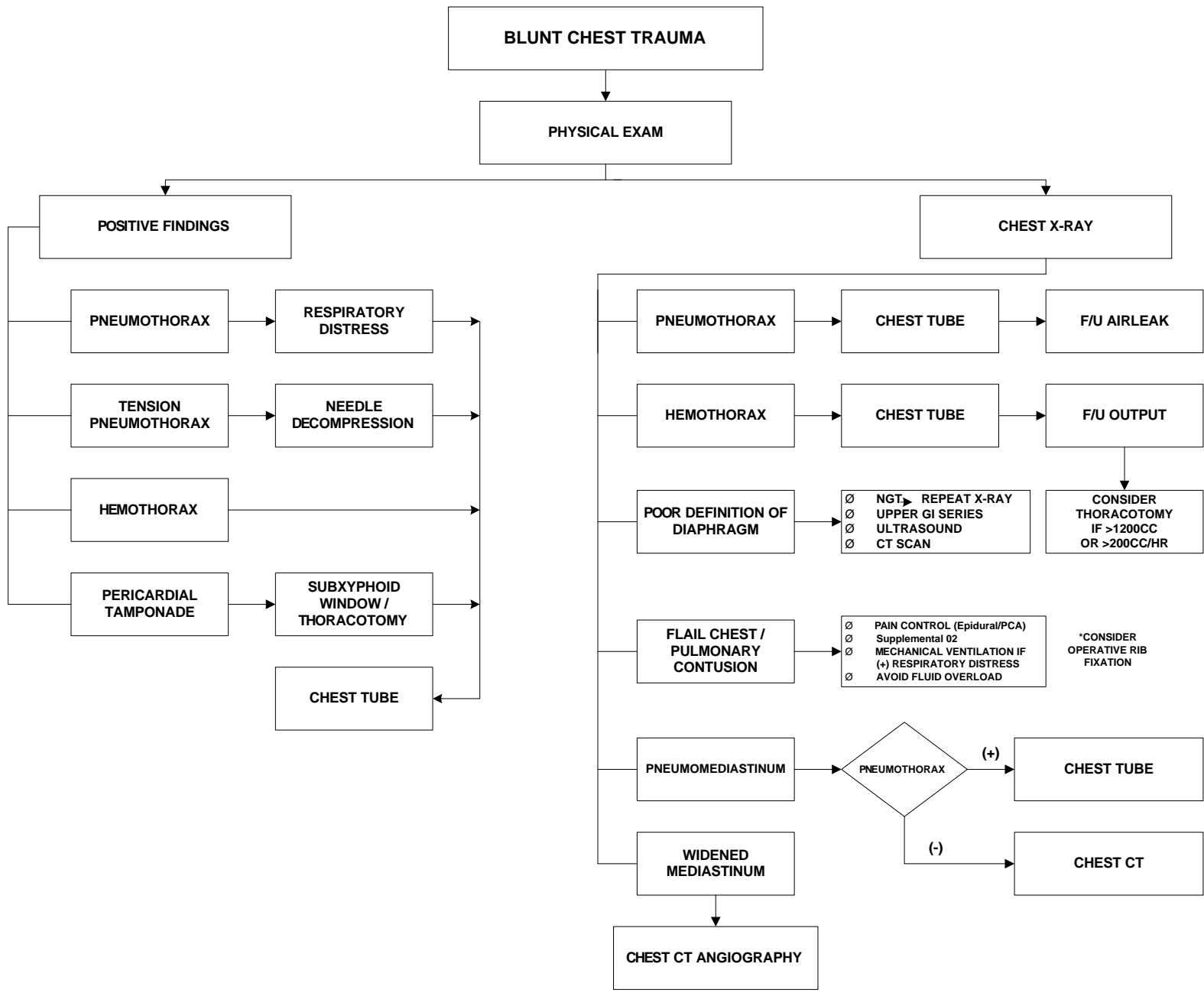
Early VATS is an alternative treatment for retained hemothorax with evidence that it is a superior intervention when compared to a second tube thoracostomy. In 1997, Meyer et al. performed a small prospective, randomized controlled trial of 39 patients comparing VATS and additional tube thoracostomy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

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

### **Role of Fibrinolytic Therapy**

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

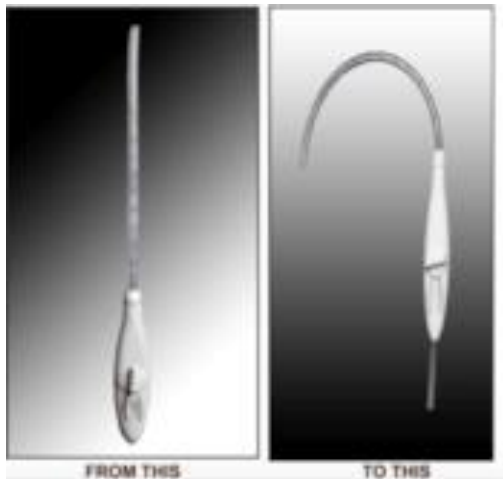
# **Blunt Chest Trauma**





## Chest Tube Insertion/Removal

- a. All chest tube insertions are to be supervised by an R3 or above.
- b. Unless being placed in a Code situation, sterile technique with a full body drape should be used for all chest tube placements
- c. Conscious sedation may be administered to awake patients under the direct supervision of a Trauma fellow or attending.
- d. Chest tube removal is a 2-person procedure requiring the presence of either an NP/PA or R3 and above.
- 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 remove
- f. For a hemothorax consider placement of the Lazarus tube (adjustable chest tube) in effort to facilitate complete evacuation of the hemothorax.



- g. For incomplete evacuation of a hemothorax, early VATS (Video Assisted Thoracoscopic Surgery) should be considered.
  - VATS is most useful in the treatment of clinically significant retained hemothorax, diagnosed at 48-72 hours after chest tube placement.
    - A CT of the chest should be obtained to make the diagnosis; the finding of  $\geq 300$ cc's of blood qualifies it as a clinically significant retained hemothorax.

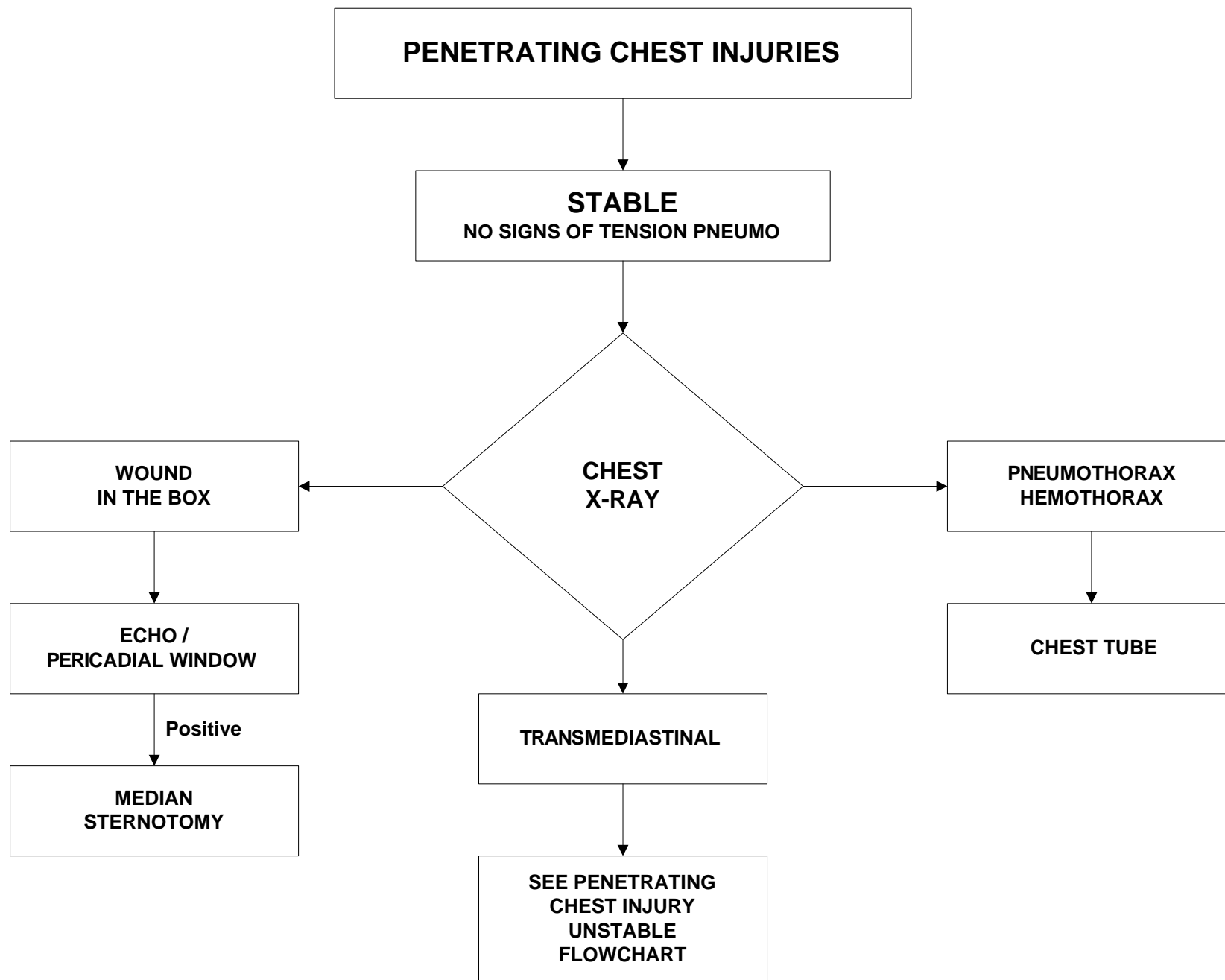
- VATS should then be performed early and aggressively (within 48-72 hours of diagnosis) to facilitate recovery and prevent additional morbidity.
- Intra-pleural thrombolytic may be used to improve drainage of subacute (6-day to 13-day duration) loculated or exudative collections, particularly patients where risks of thoracotomy are significant.
- See “Management of Hemothorax”

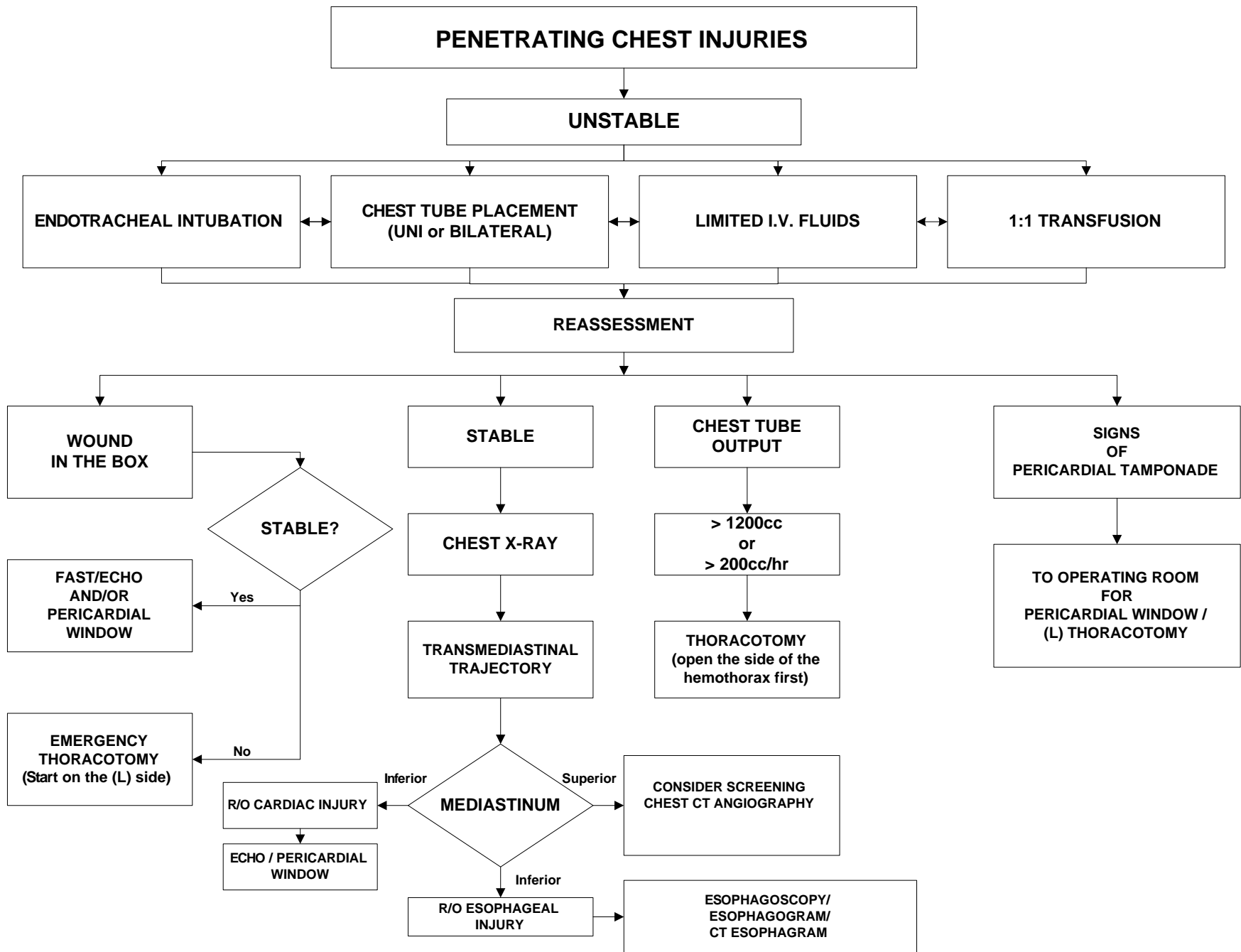
# RIB FRACTURE MANAGEMENT PROTOCOL

## Respiratory Interventions and Monitoring

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

# **Penetrating Chest Trauma**





DISCLAIMER: These guidelines were prepared by the Department of Surgical Education, Orlando Regional Medical Center. They are intended to serve as a general statement regarding appropriate patient care practices based upon the available medical literature and clinical expertise at the time of development. They should not be considered to be accepted protocol or policy, nor are intended to replace clinical judgment or dictate care of individual patients.

## RETAINED HEMOTHORAX

### SUMMARY

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

### RECOMMENDATIONS

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

### INTRODUCTION

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

### EVIDENCE DEFINITIONS

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

### LEVEL OF RECOMMENDATION DEFINITIONS

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

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

## **LITERATURE REVIEW**

### Initial Chest Tube Management

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

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### Use of Antibiotics

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

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

### Diagnosis of Retained Hemothorax

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



### Role of VATS

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

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

### Role of Fibrinolytic Therapy

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

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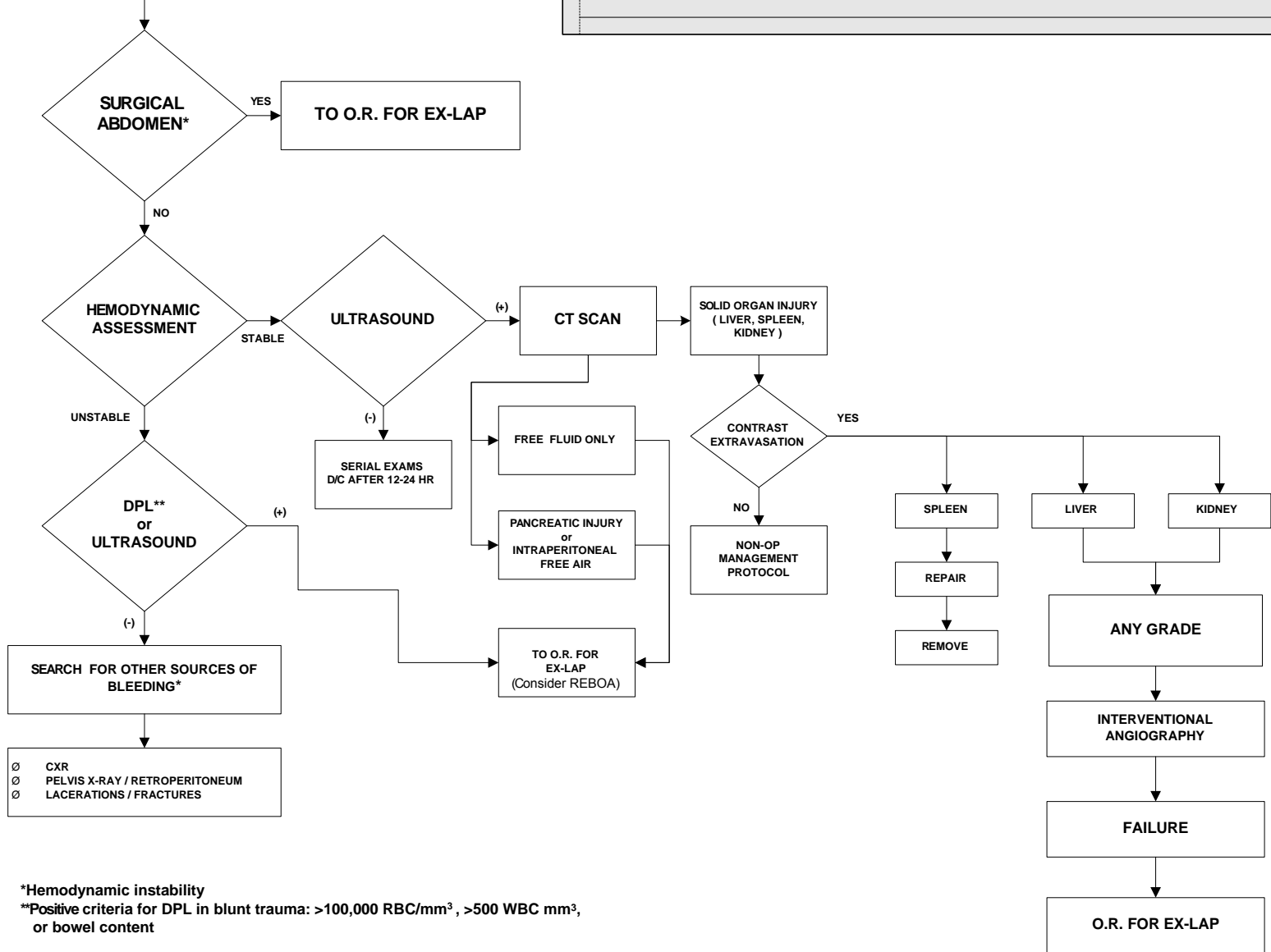
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# **Abdominal Trauma**

**BLUNT 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<sup>3</sup>, >500 WBC mm<sup>3</sup>, 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 to ICU or IMU

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

#### ii. See **Table 1 NOM of Liver Injury.**

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

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

### D. Discharge Planning

Regular diet

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

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

May require home care follow-up

### E. Disposition

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

Per PT/OT recommendations

### NOM of Liver Injury

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

## ***Operative Management of Liver Injury***

### **A. Key Outcomes**

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

### **B. Proposed Hospital Course** (see table below)

#### i. Preoperative

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

#### ii. Operative:

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

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

[DJ1]

[DJ2]

### **C. Discharge Planning**

Regular diet

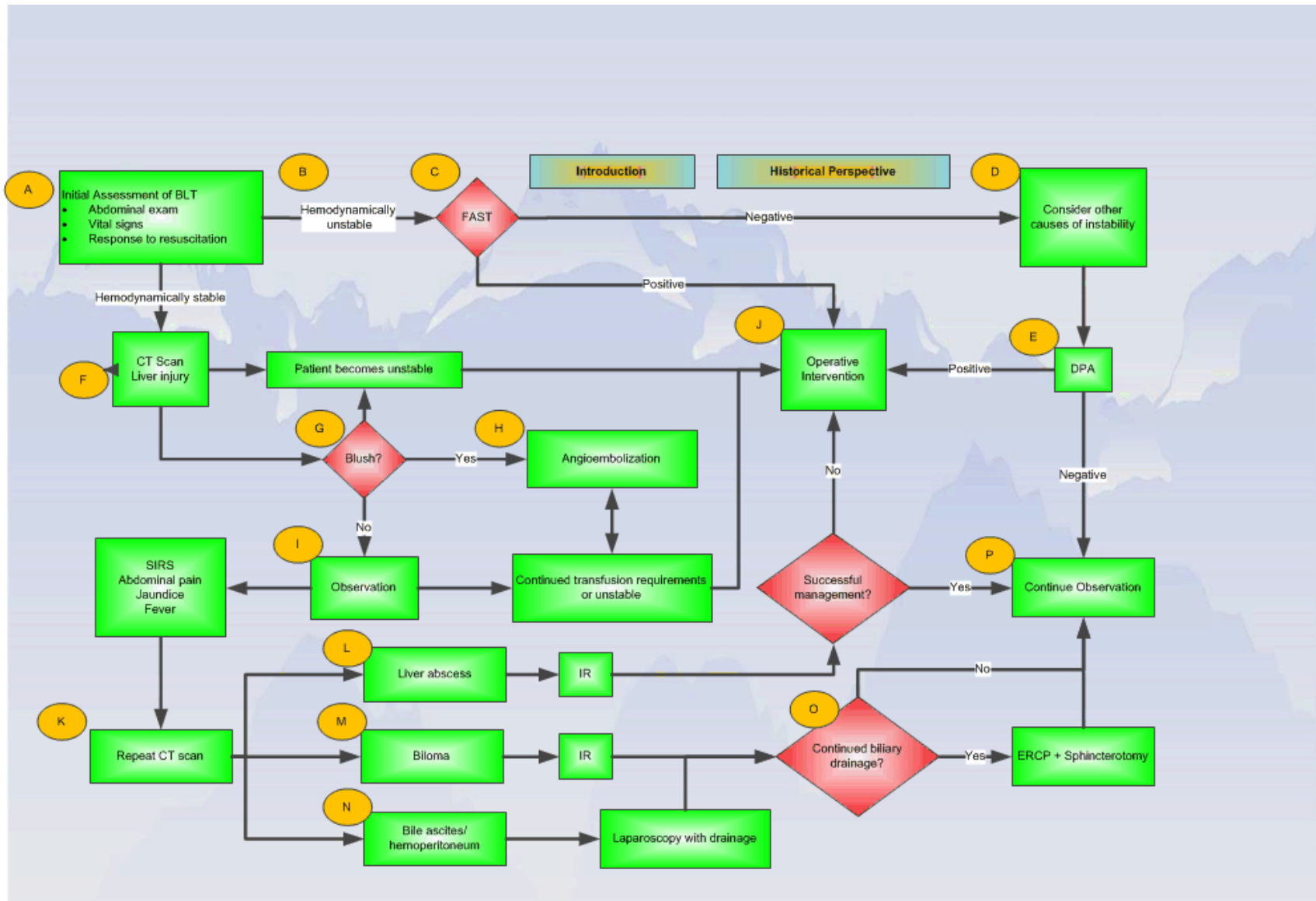
Activity as tolerated based on associated injuries. Follow-up in clinic

May require home health follow-up

### **D. Disposition**

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





# Nonoperative Management of Adult Blunt Hepatic Trauma

### **Annotation for Point A**

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

### **Annotation for Point B**

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

### **Annotation for Point C**

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

### **Annotation for Point D**

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

### Annotation for Point E

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

### Annotation for Point F

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

### Annotation for Point G

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

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

#### **Annotation for Point H**

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

#### **Annotation for Point I**

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

#### **Annotation for Point J**

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

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

#### **Annotation for Point K**

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

#### **Annotation for Point L**

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

#### **Annotation for Point M**

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

#### **Annotation for Point N**

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

#### **Annotation for Point O**

Although most peripheral biliary leaks will seal without treatment, continued high output biliary drainage may warrant adjunctive ERCP to aid in healing. Ponsky and coworkers<sup>46</sup> suggest stenting rather than sphincterotomy for more effective resolution of biliary leaks. Neither the optimal duration of leak before ERCP nor the duration of leak before operative consideration has been studied

#### **Annotation for Point P**

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

## Non-operative Management of Splenic Injury

### A. Key Outcomes

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

### B. Goal Length of Stay

**3-5 days**

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

### C. Proposed Hospital Course

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

### D. Discharge Planning

Regular diet

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

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

May require home care follow-up

### E. Disposition

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

Per PT/OT recommendations

**Table Non-operative Management of Splenic Injury Plan**

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



## Operative Management of Splenic Injury

### A. Key Outcomes

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

### B. Goal Length of Stay 5 days

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

### C. Proposed Hospital Course

#### i. Preoperative

1. ATLS protocol
2. work-up as mechanism and presentation dictate
3. CT head as indicated
4. Rule out pelvic fracture if indicated
5. FAST/ diagnostic peritoneal lavage/CT scan abdo/pelvis
6. Labs: ABG, H & H, type and cross.

#### ii. Postoperative

1. Admit to SICU/IMU
2. Daily postoperative CBC/coagulations, chemistries/LFTs as indicated
3. Arterial line as indicated
4. Possible NGT
5. Aggressive pulmonary toilet
6. Pain management

#### iii. See **Operative Management of Splenic Injury**

### D. Discharge Planning

Regular diet

Activity as tolerated based on associated injuries

Follow-up in clinic

May require home health follow-up

### E. Disposition

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

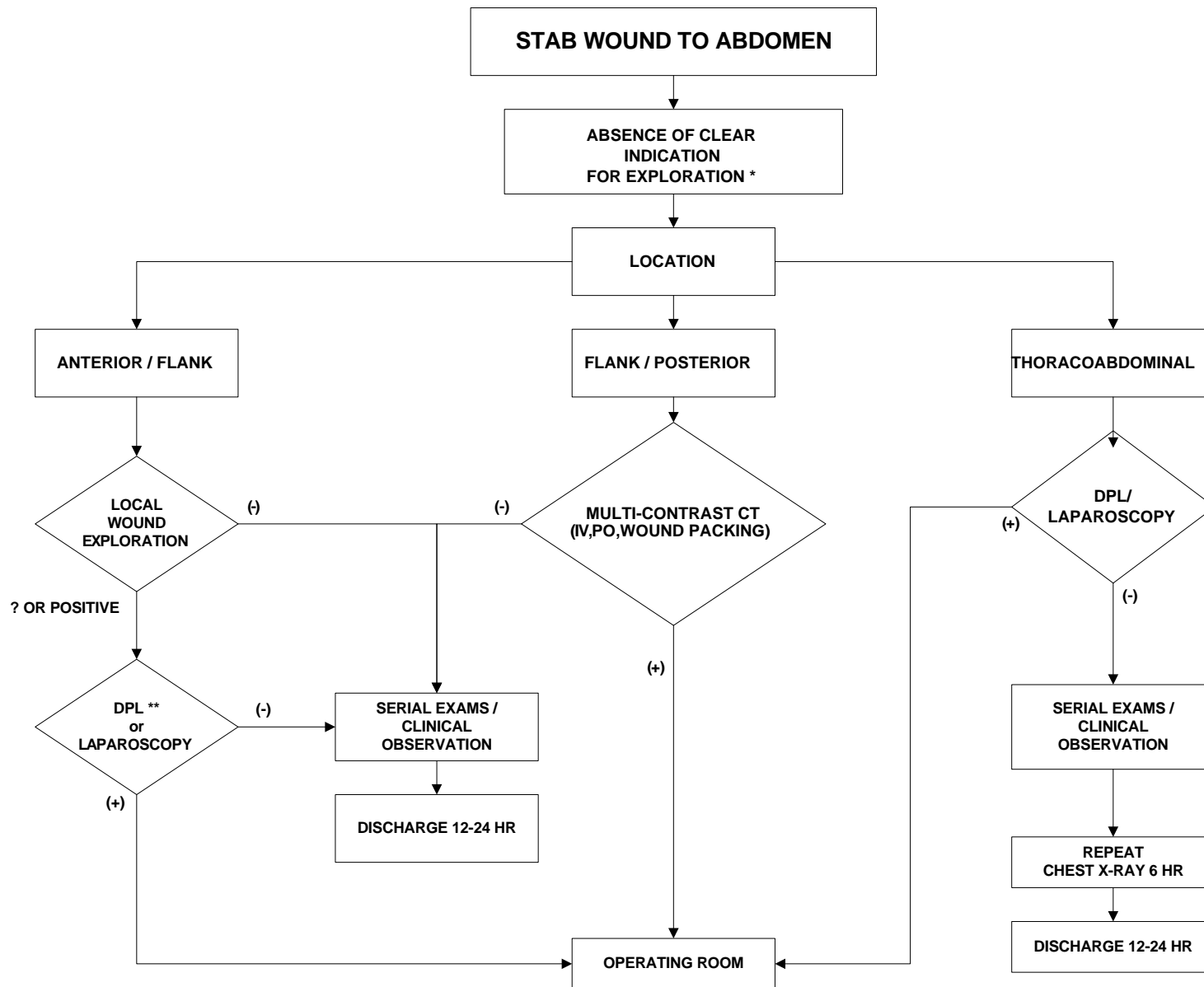
Per PT/OT recommendations

**Table Operative Management of Splenic Injury**

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

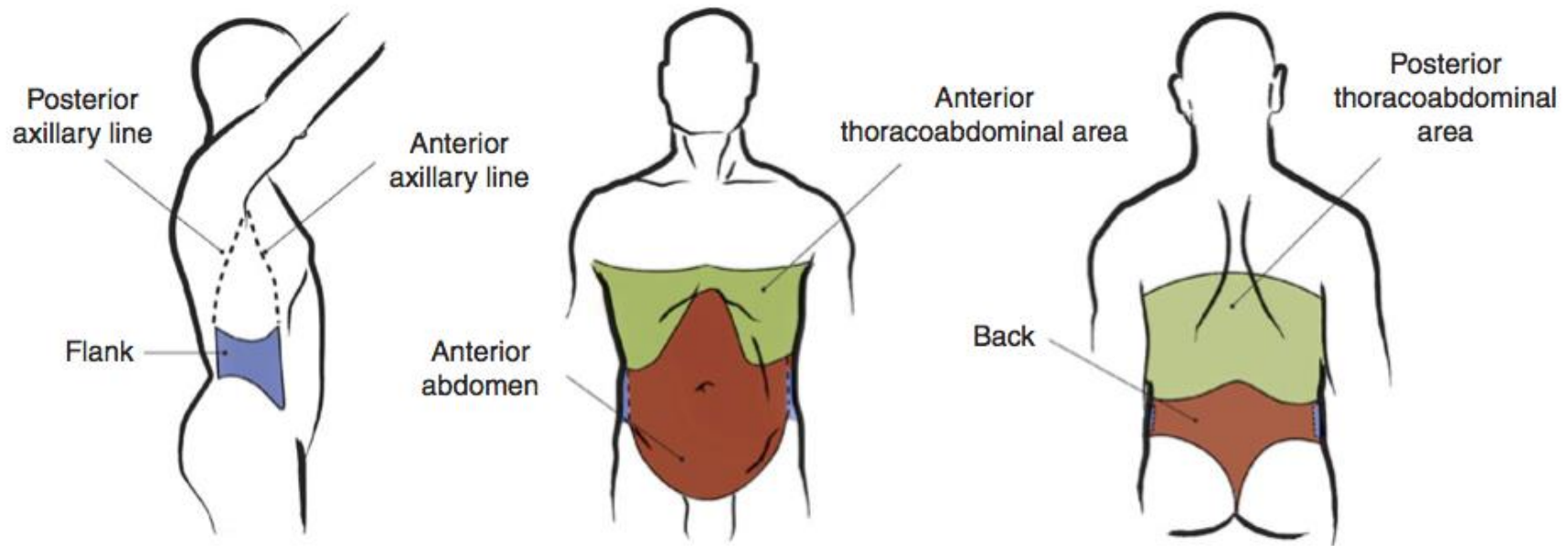
\*Four immunizations required:

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



\* Hemodynamic instability, evisceration, peritoneal signs, multiple wounds

\*\* Positivity criteria for DPL: >1000 RBC/mm<sup>3</sup>, >500 WBC/mm<sup>3</sup>,



### **\*\*\*Diaphragm Injury Evaluation**

**All thoracoabdominal stab wounds (SW), or any abdominal SW with associated pneumo or hemothorax, are presumed to have a 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 indicated, then a laparoscopic diaphragm evaluation is indicated. This may be delayed (>8-12 hrs) to allow serial exams and ensure no hollow viscus or other operative injury is present. Thoracoscopic evaluation/repair is an acceptable alternative, and is the procedure of choice if a co-existing retained hemothorax is present.**

## **Pancreatic injury**

### **A. Key Outcomes**

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

### **B. Goal Length of Stay**

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

### **Proposed Hospital Course**

#### *Prior to Arrival at Admission Destination*

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

#### *Hospital Course*

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

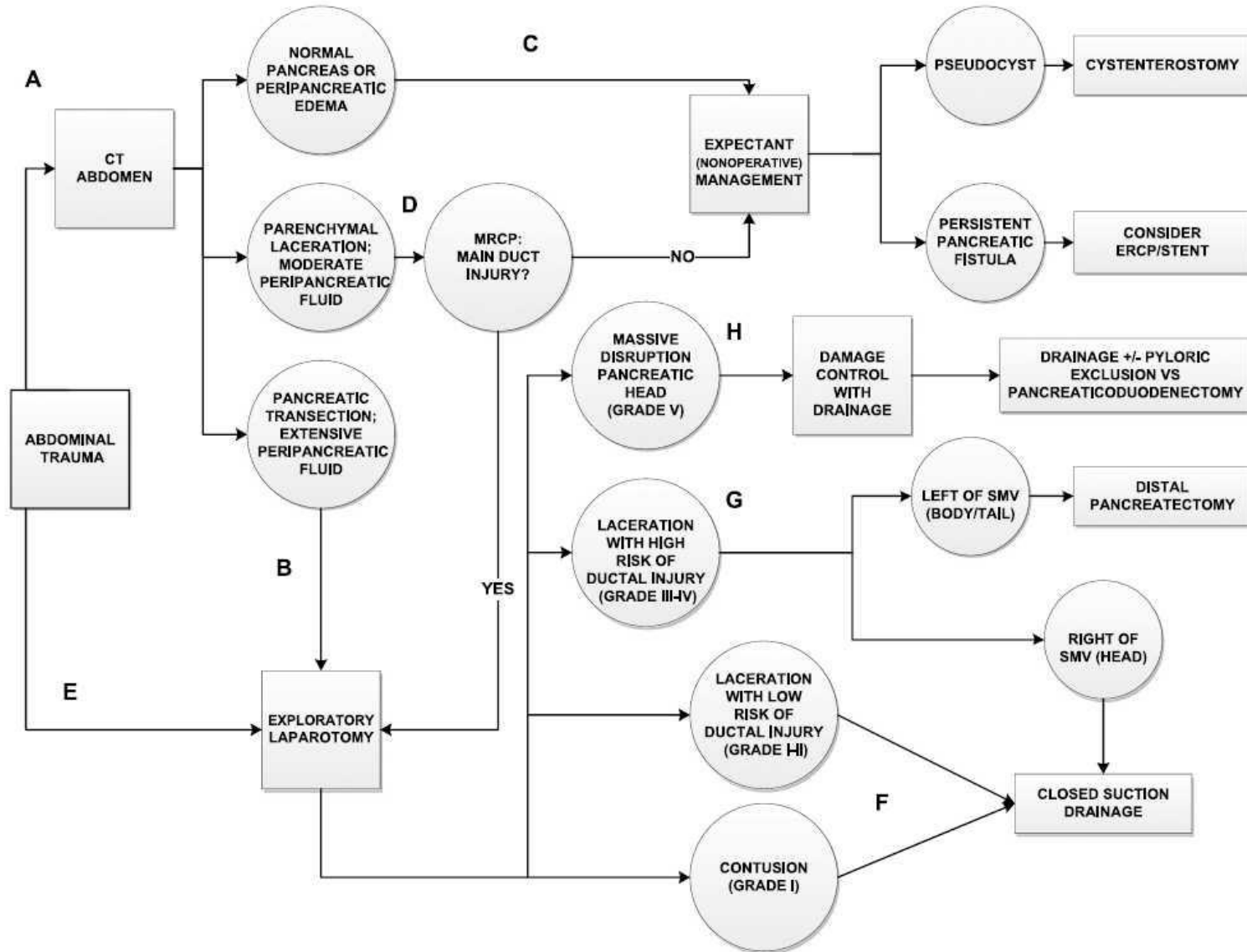
### **D. Discharge Planning**

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

### **E. Disposition**

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

# Pancreatic injury Algorithm



## **Non-operative Management of Renal Injuries**

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

### **A. Key Outcomes**

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

### **B. Goal Length of Stay**

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

### **C. Proposed Hospital Course**

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

### **D. Discharge Planning**

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

### **E. Disposition**

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

## **Operative Management of Renal Injuries**

### **A. Key Outcomes**

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

### **B. Goal Length of Stay**

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

### **C. Proposed Hospital Course**

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

### **D. Discharge Planning**

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

### **E. Disposition**

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



References:

AAST Renal Injury Grading Scale:

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

Western Trauma Association Renal Injury Algorithms:

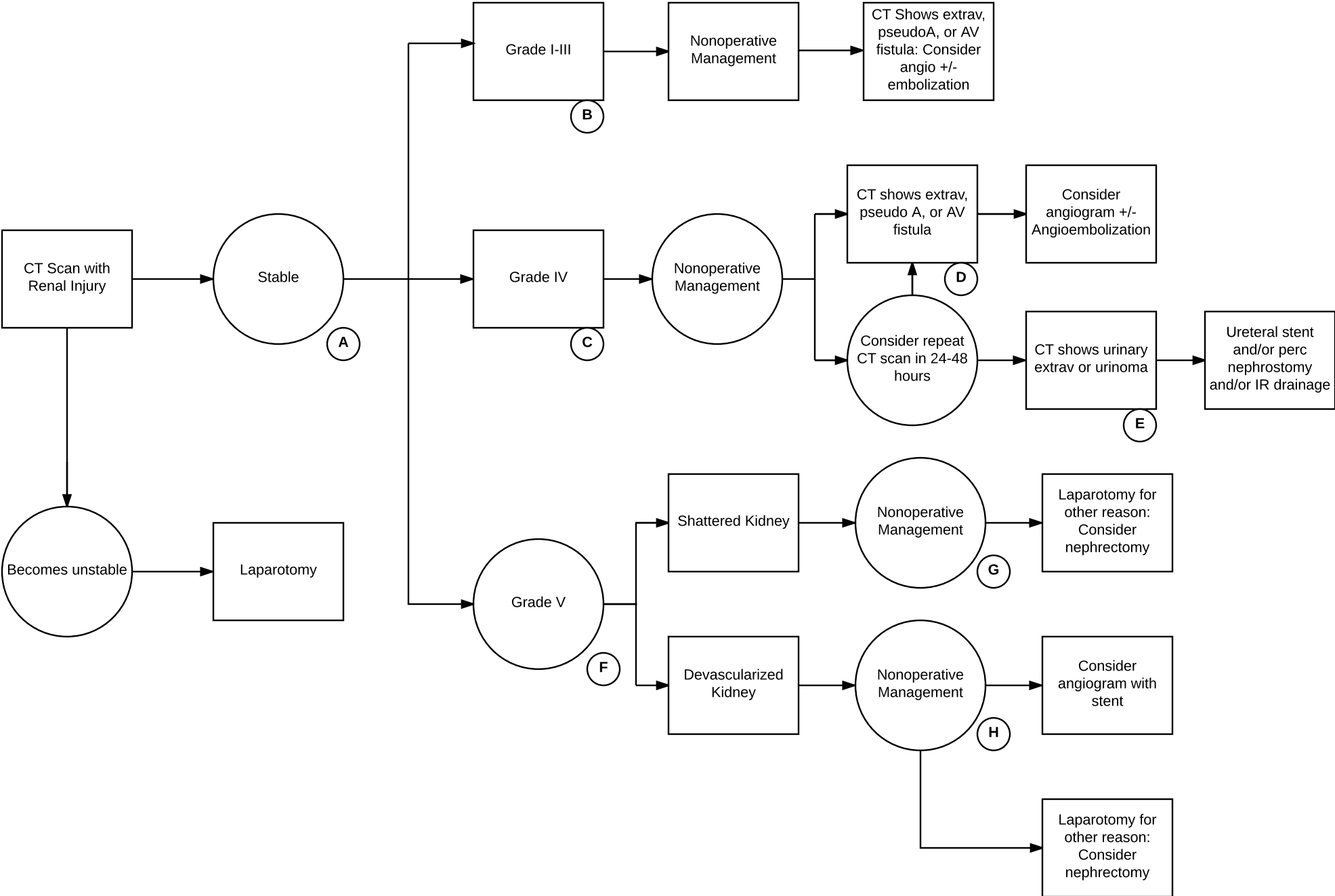
Identified on CT Scan:

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

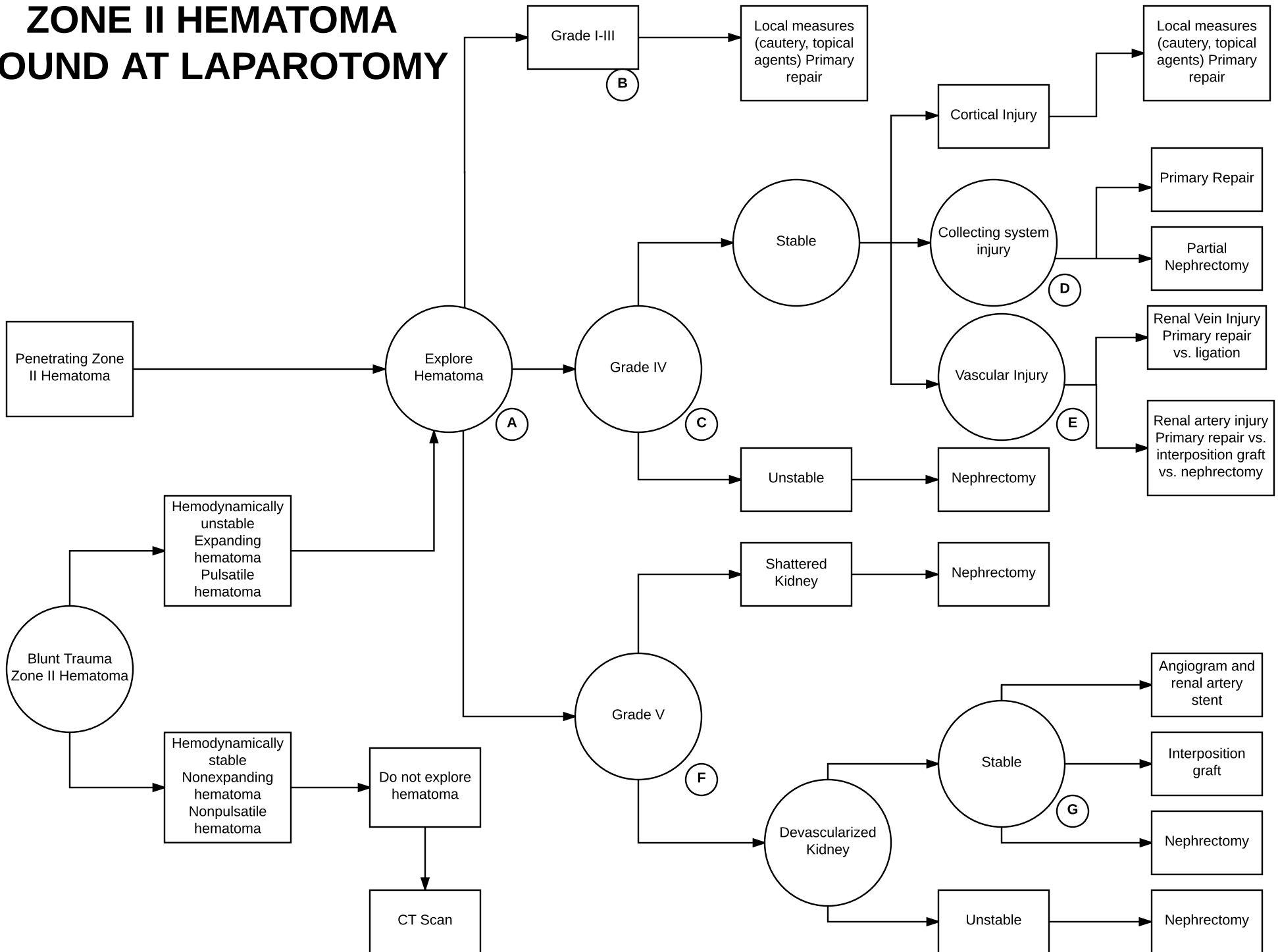
Identified at Laparotomy:

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

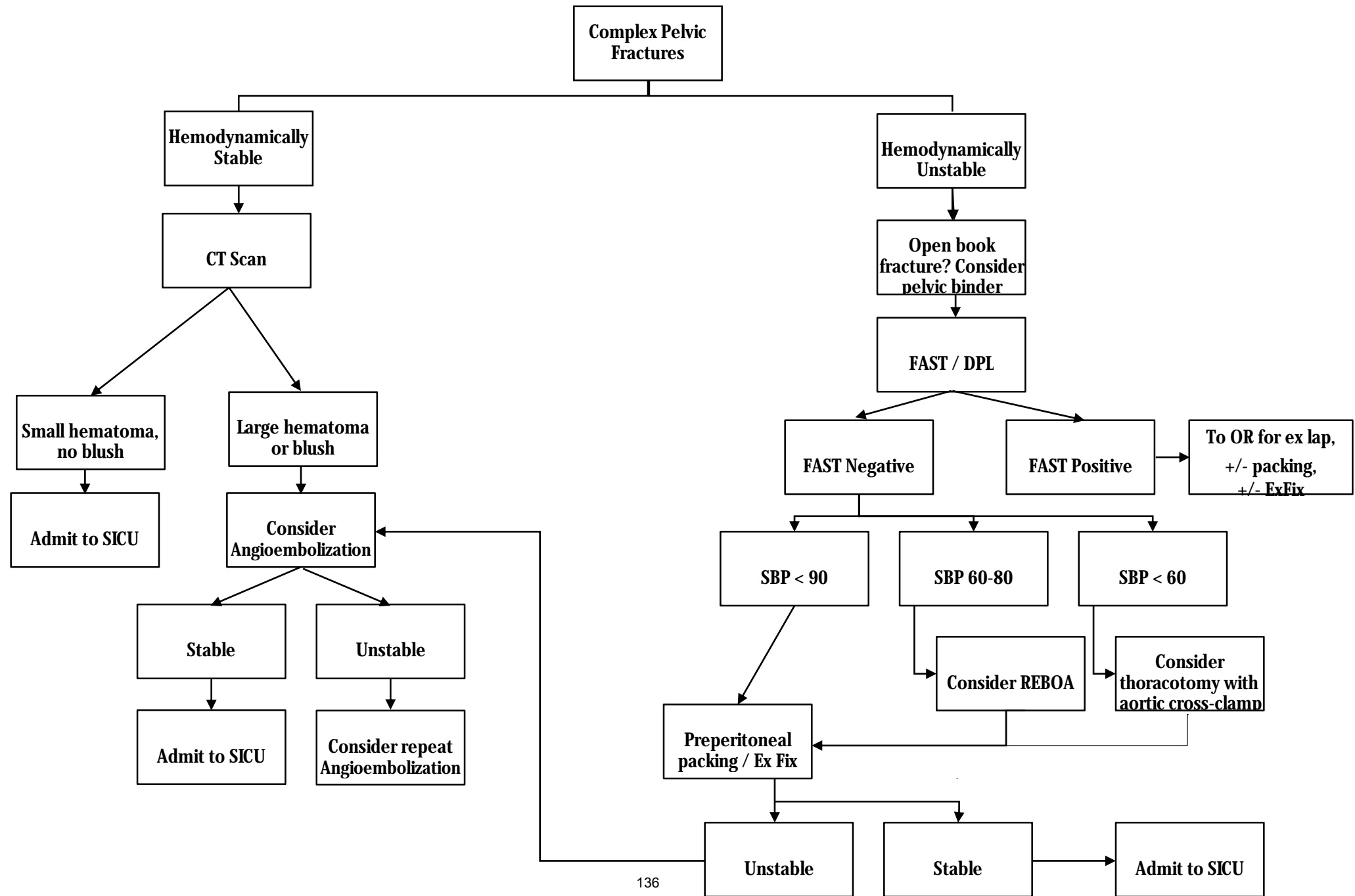
# RENAL INJURY FOUND ON CT SCAN



# ZONE II HEMATOMA FOUND AT LAPAROTOMY



# **Pelvic Fractures**



# T-PODResponder Explained



Pre-application  
of  
T-PODResponder



Post-application  
of  
T-PODResponder



Radio-density of  
T-PODResponder

[www.pyng.com](http://www.pyng.com)

## Application Procedure

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



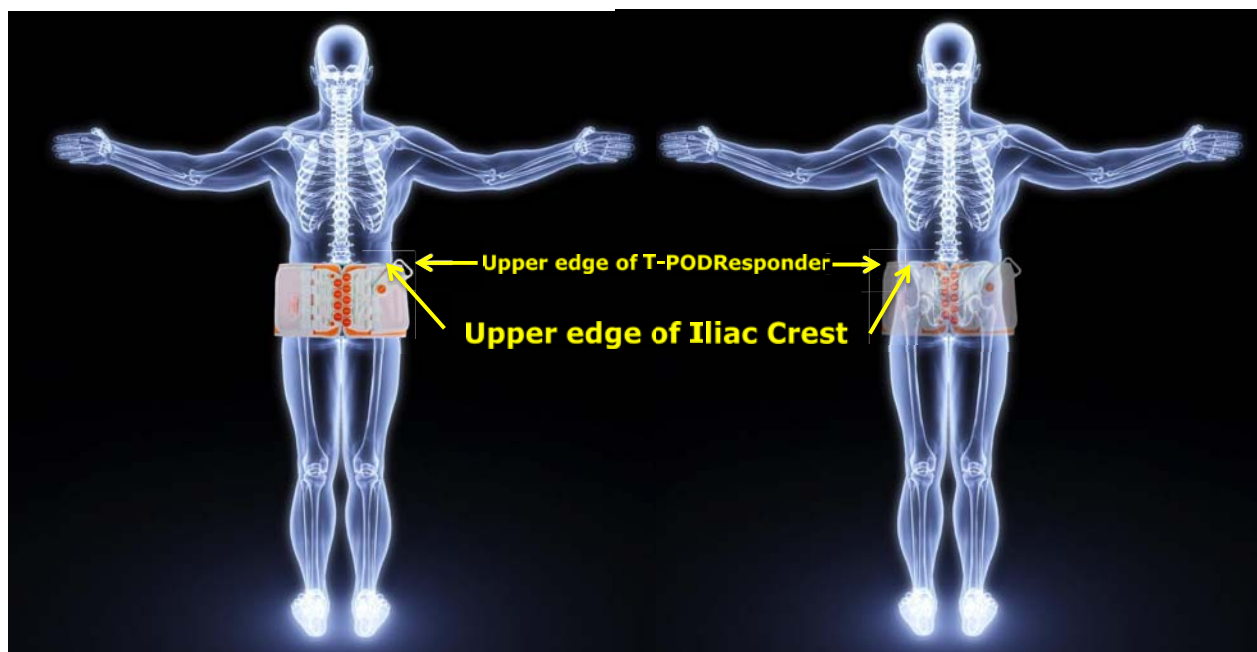
The ProSlide may be used to aid in sliding the Belt.



[www.pyng.com](http://www.pyng.com)

# Placement of T-PODResponder

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



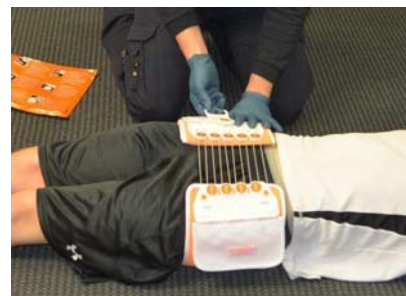
[www.pyng.com](http://www.pyng.com)

## Application Procedure

2. Trim the Belt, leaving a 6-8" (15.2-20.3cm) gap over the center of the pelvis.



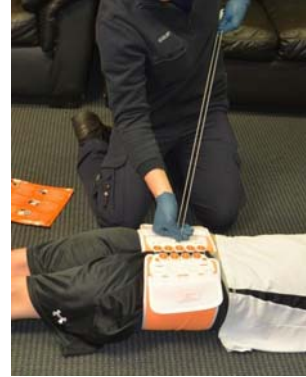
3. Apply Velcro-backed Mechanical Advantage Pulley System to each side of the trimmed Belt.



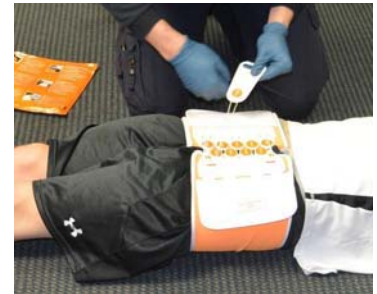
[www.pyng.com](http://www.pyng.com)

# Application Procedure

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



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



[www.pyng.com](http://www.pyng.com)

# Application Procedure

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



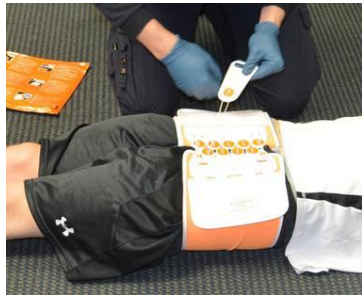
[www.pyng.com](http://www.pyng.com)



# Re-applying T-PODResponder

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

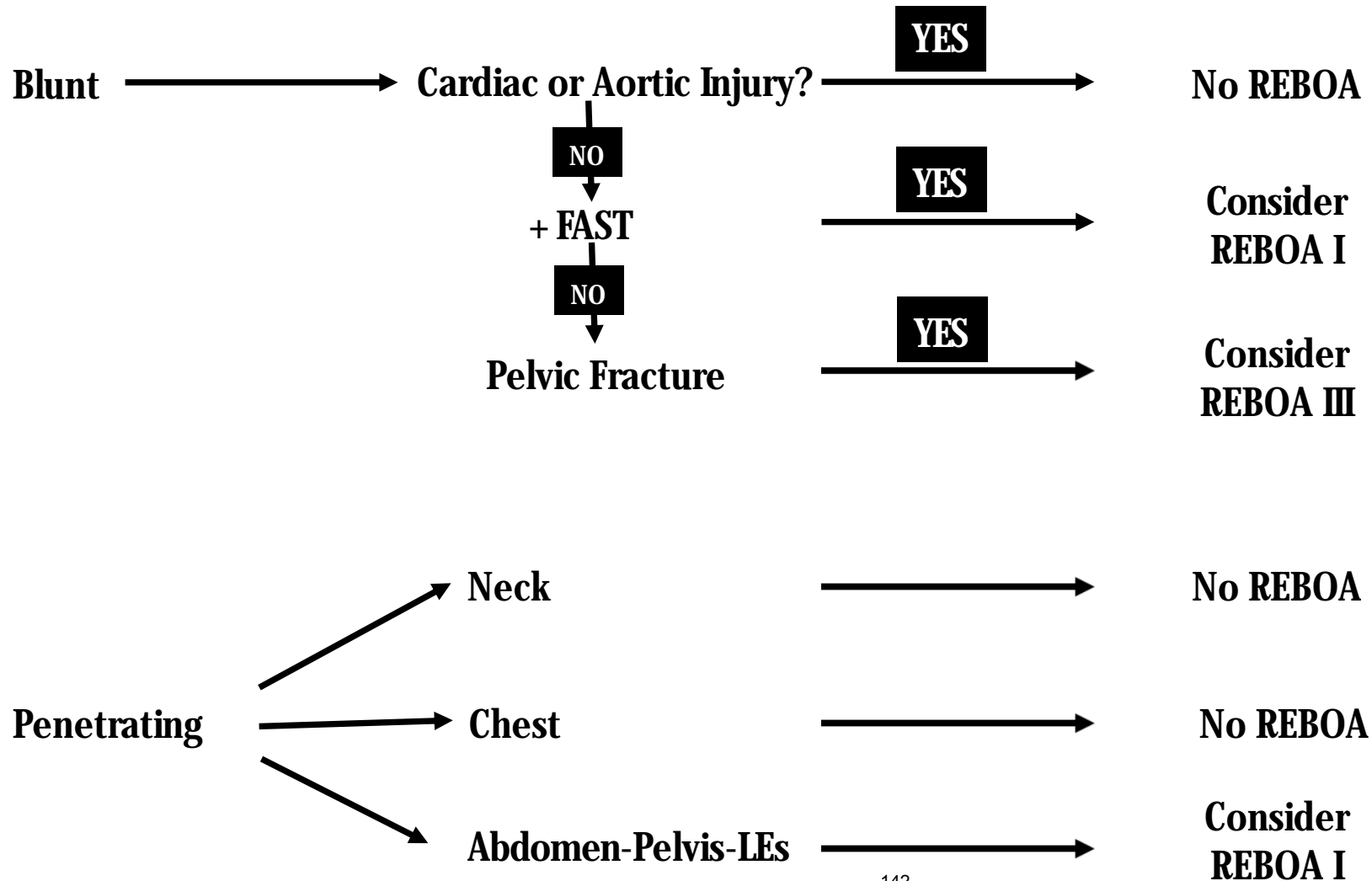
**T-PODResponder** release time should also be noted on the label.



[www.pyng.com](http://www.pyng.com)

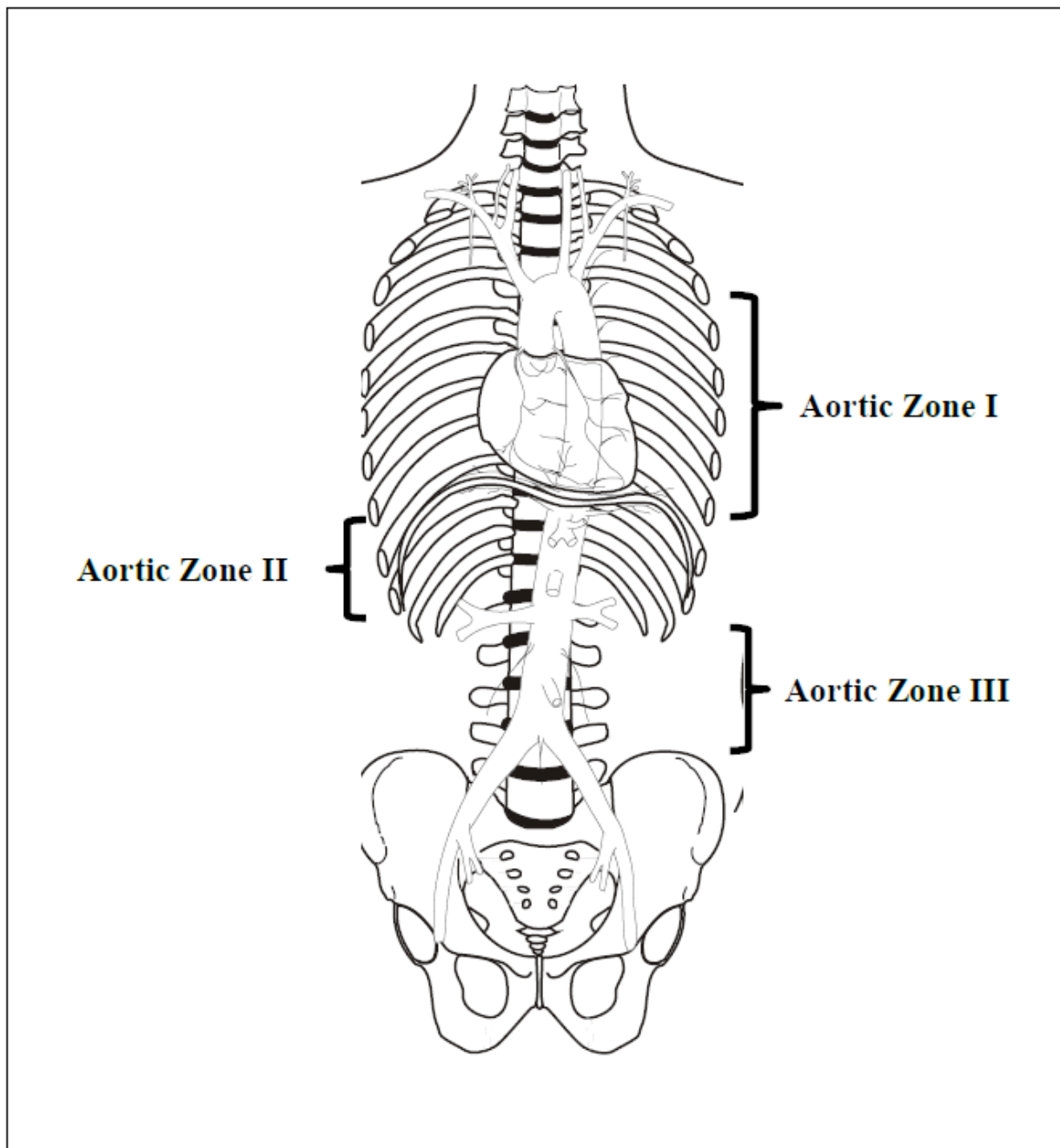
# **REBOA Protocol**

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



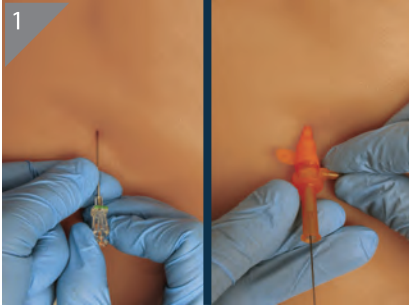
## REBOA PROTOCOL

### AORTIC ZONES

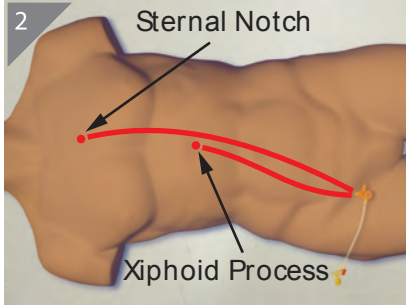


# The ER-REBOA™ Catheter Quick Reference Guide

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



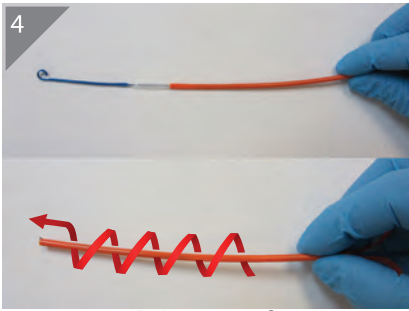
**1 Obtain access**  
Using standard techniques



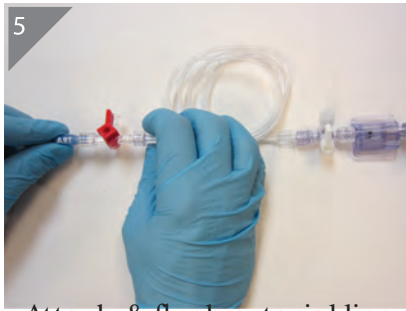
**2 Estimated placement<sup>1,2</sup>**  
Zone 1 Placement: P-tip® below the sternal notch  
Zone 3 Placement: P-tip® below the xiphoid process  
Recommend use of confirmatory imaging techniques



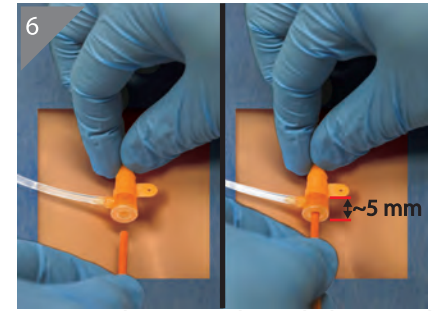
**3 Flush & deflate balloon**  
Ensure balloon is fully deflated & hold vacuum for **5 seconds**  
Close stopcock with vacuum held



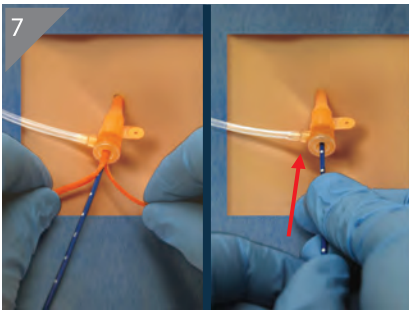
**4 Advance & twist peel-away to P-tip®**  
Ensure the balloon and P-tip® are captured



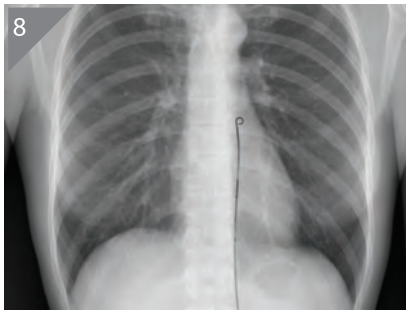
**5 Attach & flush arterial line**  
Using standard techniques ensure all air is purged from arterial line



**6 Insert peel-away sheath into valve**  
Ensure peel-away sheath has entered past the introducer sheath valve approximately 5mm



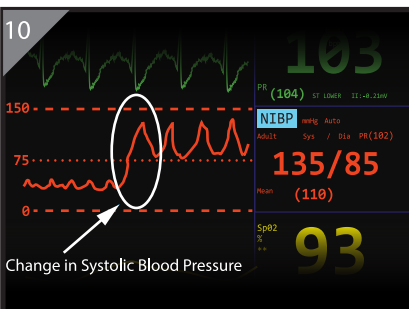
**7 Advance catheter into vessel**  
Peel-away sheath can be removed as needed to facilitate advancement



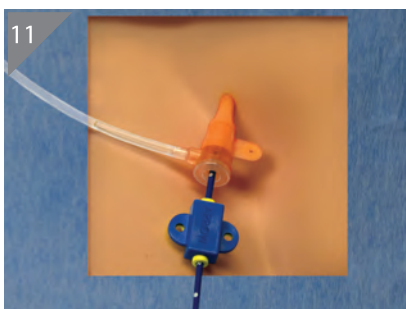
**8 Position catheter**  
If available, use of conventional x-ray or fluoroscopy is recommended to confirm position using radiopaque markers

BALLOON	INFLATION VOLUME
15mm	5cc
20mm	8cc
25mm	13cc
30mm	20cc
<b>MAX 32mm</b>	<b>MAX 24cc</b>

**9 Fill syringe with appropriate volume<sup>1</sup>**  
For zone 1 - approximate vessel diameter 20mm - young adult male  
For zone 3 - approximate vessel diameter 16mm - young adult male



**10 Monitor arterial waveform feedback**  
Look for the change in systolic blood pressure



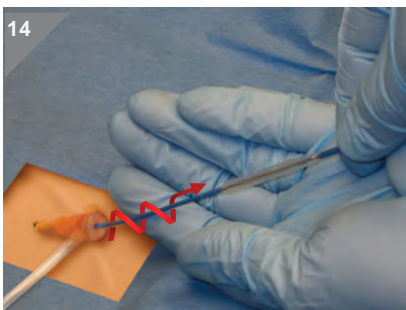
**11 Secure catheter**  
Close to the hub of the introducer sheath



**12 Provide Definitive Treatment**  
Remain vigilant of total balloon inflation time



**13 Fully Deflate balloon**  
Ensure balloon is fully deflated & hold vacuum for **5 seconds**  
Close stopcock with vacuum held



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



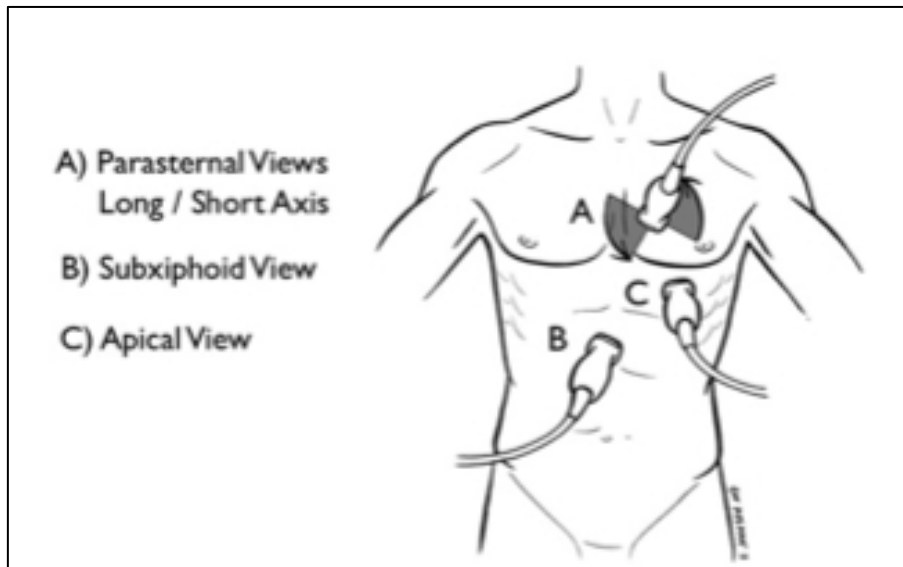
ADV-006 | Revision C

1. Stannard A, Morrison II, Sharon DJ, Elison J, Rasumussen, TE. Morphometric analysis of torso arterial anatomy with implications for resuscitative aortic occlusion. J Trauma Acute Care Surg. 2013; Vol 75:S169-S172

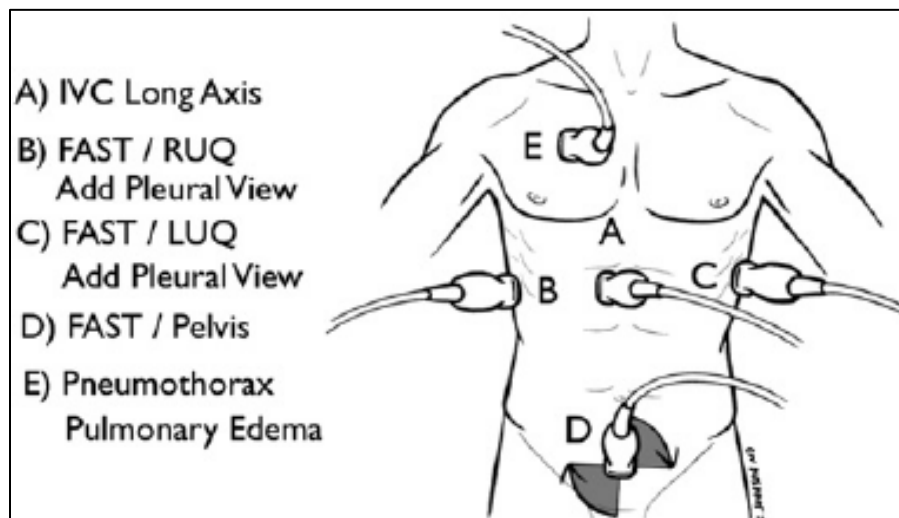
2. Morrison II, Stannard A, Midwinter MJ, Sharon DJ, Elison J, Rasumussen, TE. Prospective evaluation of the correlation between torso height and aortic anatomy in respect of a fluoroscopy free aortic balloon occlusion system. J Trauma Acute Care

# Ultrasound

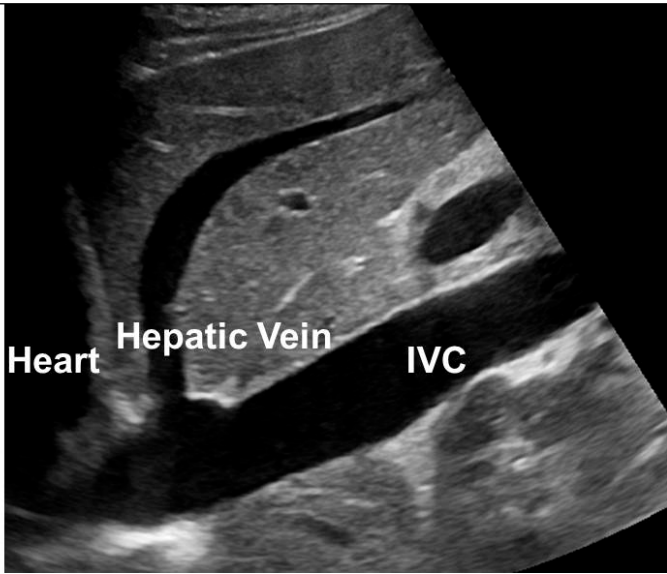
## ENHANCED FAST ULTRASOUND



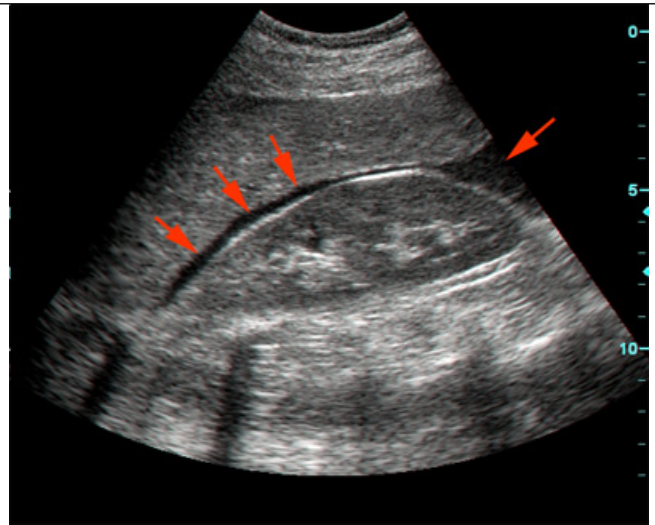
1. Cardiac VIEWS – See FATE echo



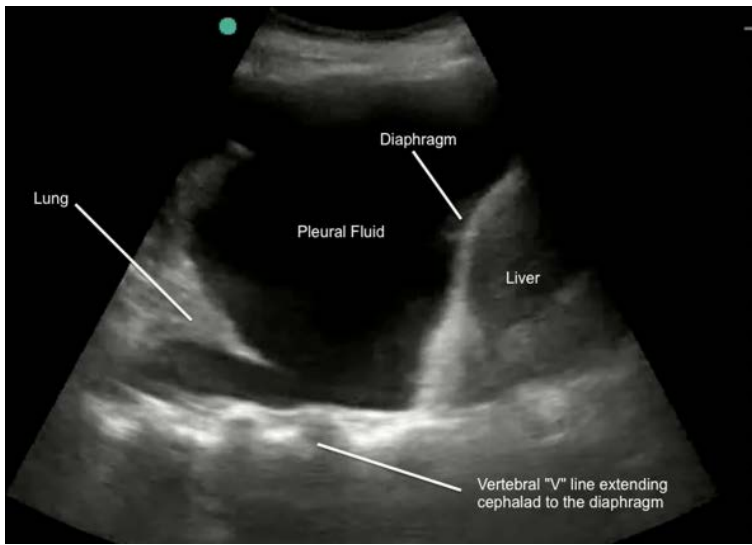
2. Abdominal and Lung Views



A: Long Axis IVC view – IVC looks full



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

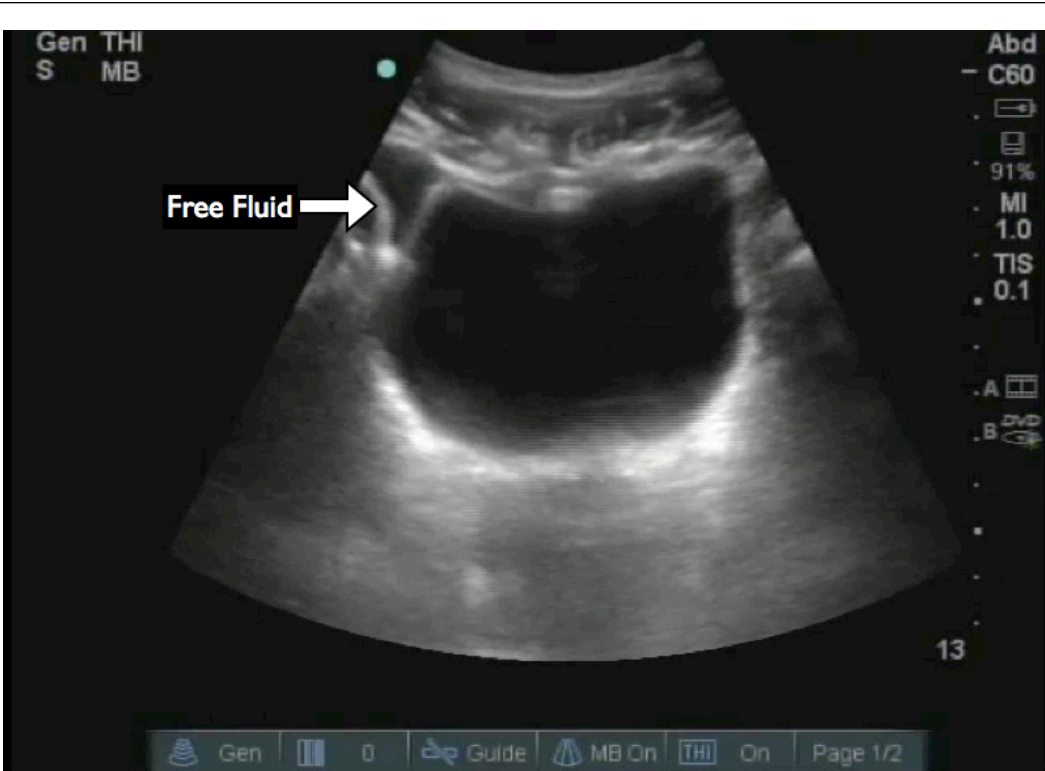


B: Right lateral chest pleural view – massive pleural fluid

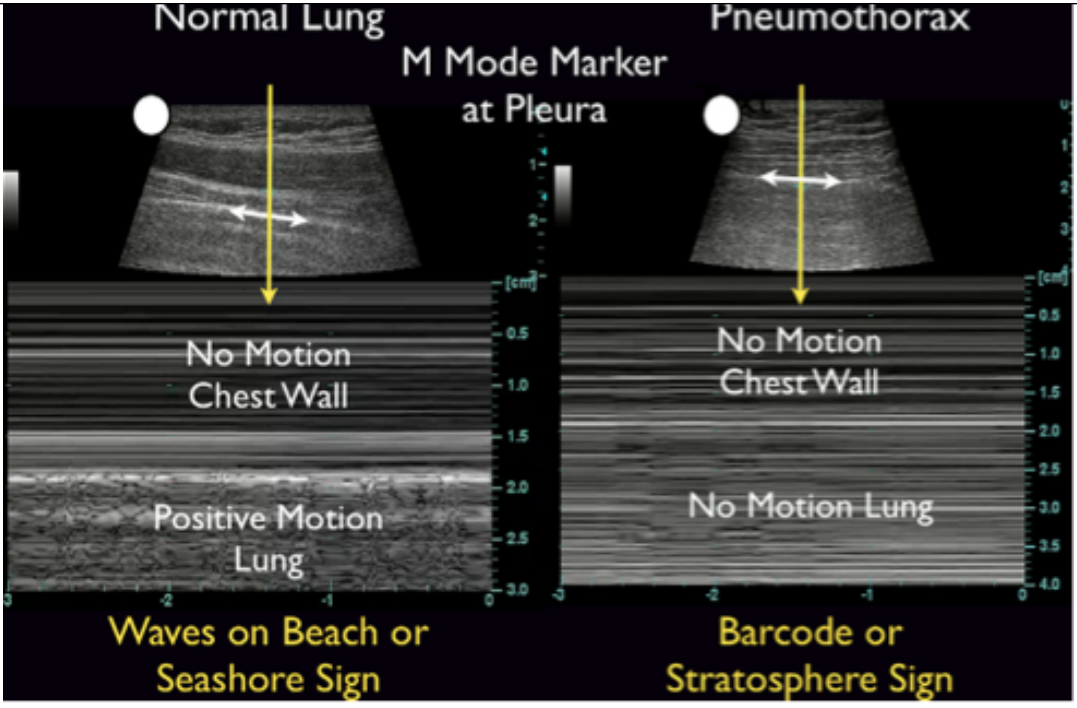
C; Splenorenal fossa – free fluid over kidney







D: Pelvis transverse with full bladder and free fluid

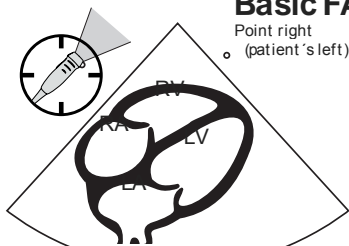


E. Normal Lung and Pneumothorax in 2D and M mode

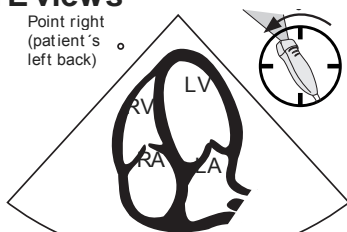
# Focus Assessed Transthoracic Echo (FATE)

Scanning through position 1-4 in the most favourable sequence

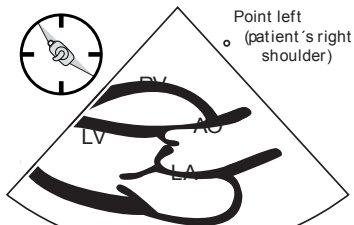
## Basic FATE views



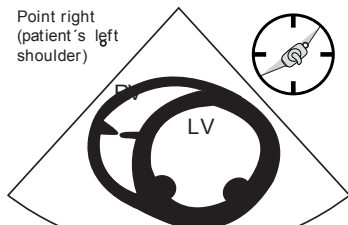
**Pos 1: Subcostal 4-chamber**



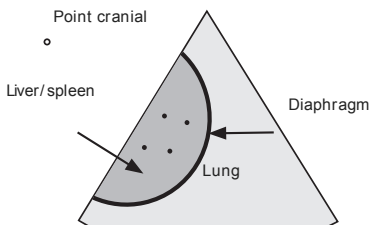
**Pos 2: Apical 4-chamber**



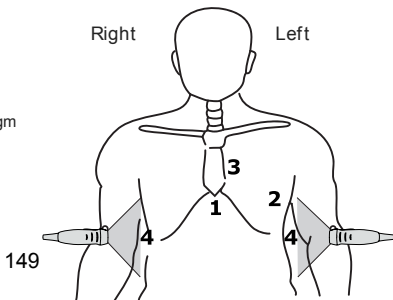
**Pos 3: Parasternal long axis**



**Pos 3: Parasternal LV short axis**



**Pos 4: Pleural scanning**



# Focus Assessed Transthoracic Echo (FATE)

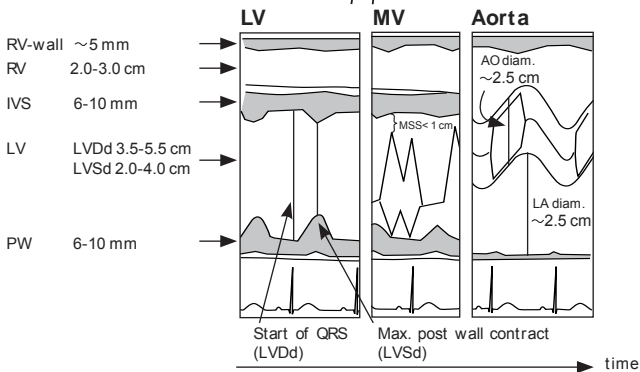
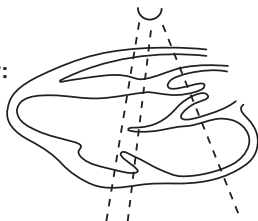
(European Journal of Anaesthesiology 2004; 21: 700-707)

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

## Dimensions and contractility:

$$FS = \frac{LVdD - LVsD}{LVdD}$$

EF ~ 2 x FS



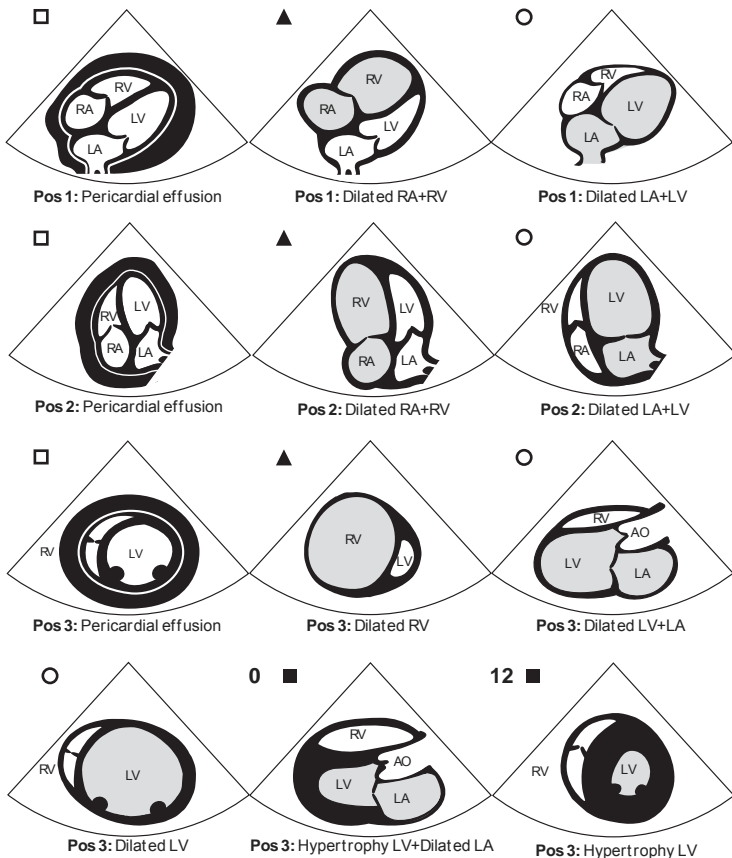
The global function of the heart is determined by the interaction between:

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

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Hemodynamic instability, perform a systematic evaluation of these determinants plus concomitant pathology: (e.g. pericardial effusion, pulmonary embolus, pleural effusion, pneumothorax, valvulopathy, dissection, defects)

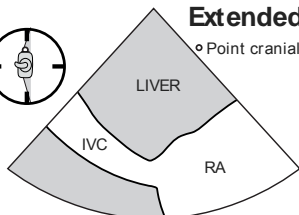
# Important pathology



## **PATHOLOGY TO BE CONSIDERED IN PARTICULAR:**

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

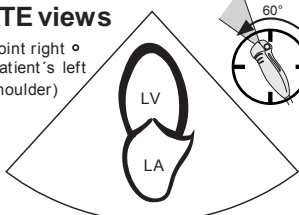
## Extended FATE views



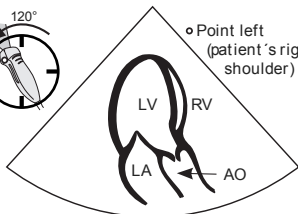
**Pos 1: Subcostal Vena Cava**

Point cranial

Point right  
(patient's left  
shoulder)



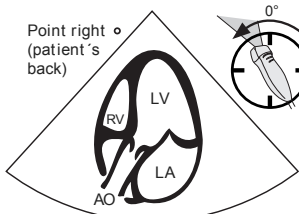
**Pos2: Apical 2 - Chamber**



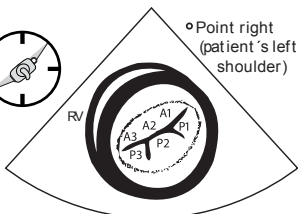
**Pos 2: Apical Long - axis**

Point left  
(patient's right  
shoulder)

Point right  
(patient's  
back)



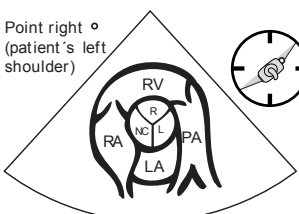
**Pos 2: Apical 5 - Chamber**



**Pos 3: Parasternal short axis mitral plane**

Point right  
(patient's left  
shoulder)

Point right  
(patient's left  
shoulder)



**Pos 3: Parasternal aorta short axis**

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

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

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

### Systolic Ventricular Function

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

Right and left ventricle Eye Balling use all views

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GE Healthcare

For additional information: [www.usabcd.org](http://www.usabcd.org)

# **Peripheral Vascular Injury & Compartment Syndrome**

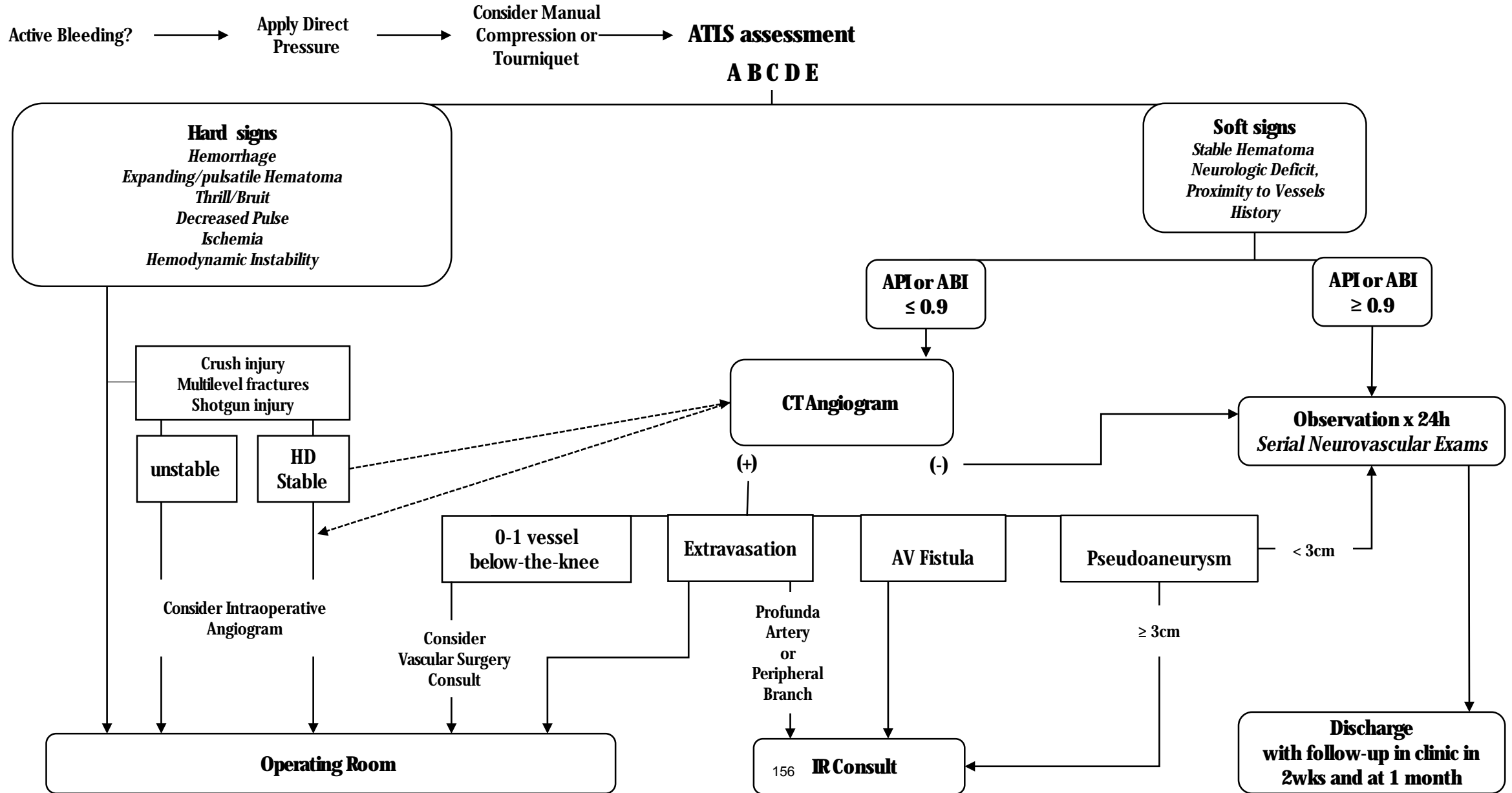
## Peripheral Vascular Injury / Compartment Syndrome

- 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.

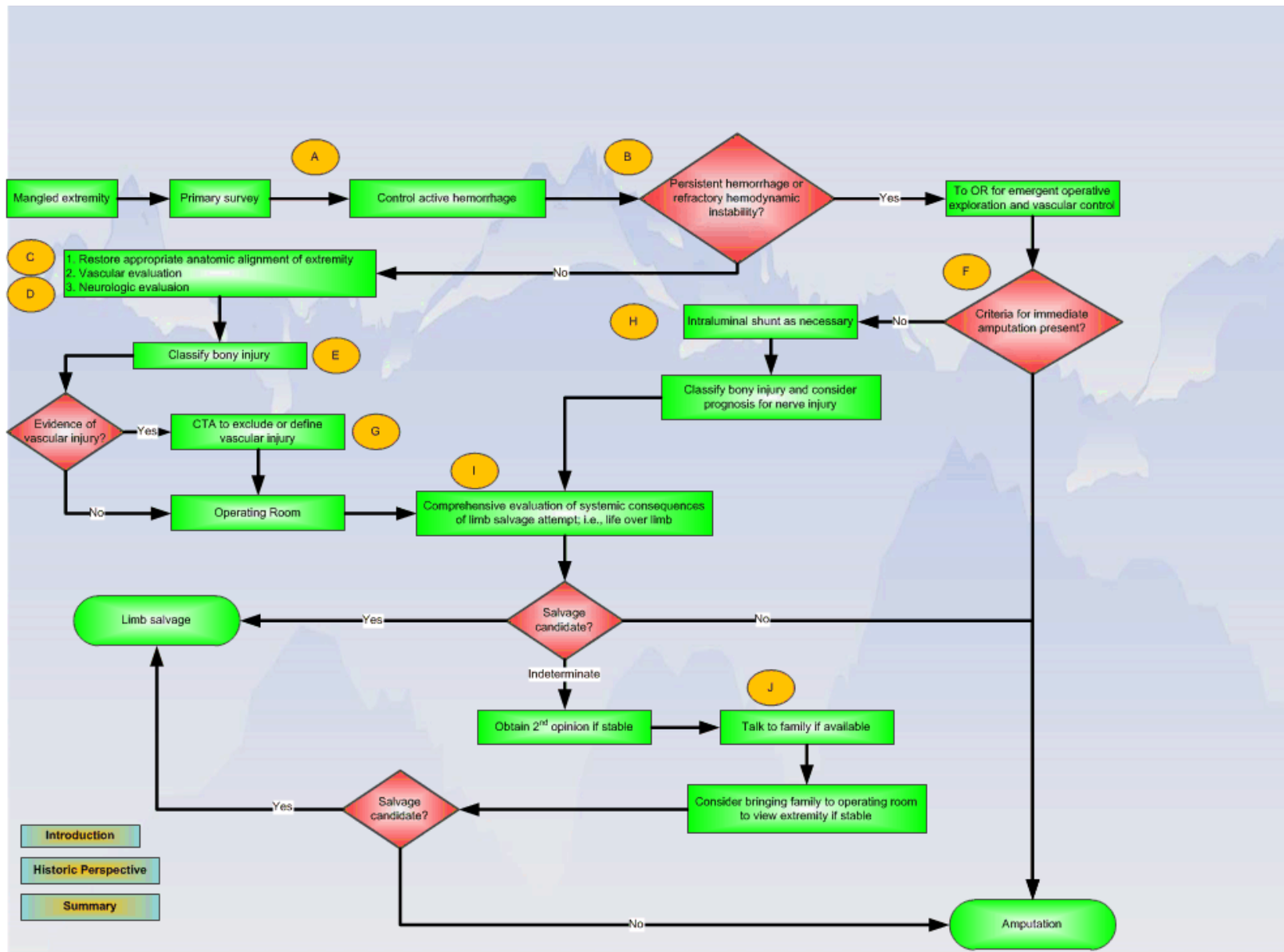
j. Patients without vascular injury but with high risk musculoskeletal injuries such as severe tibial fractures, crush injuries, and supracondylar humeral fractures in children should have routine serial examinations including measurements of compartment pressures and consideration for prophylactic fasciotomy.



# Traumatic injury of an extremity



# MANGLED EXTREMITY



- Introduction
- Historic Perspective
- Summary

Management of the Mangled Extremity

## **MANGLED EXTREMITY**

**Supporting Article:**

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

# **Consulting Services**

## **Consultation Services**

### ***Neurosurgery***

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

### ***Plastic Surgery and Head & Neck Surgery***

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

### ***Hand Surgery***

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

## ***Orthopedic Surgery***

### **General Guidelines for Traumatic Orthopedic Injuries**

#### ***a. Open Fractures***

- i. All open fractures irrespective of type require immediate irrigation and debridement (I&D). The optimal time for washout is as soon as possible and always **within 6 hours of injury**.
- ii. If the patient cannot be taken to the OR promptly due to problems with clearance by trauma surgery or neurosurgery, a preliminary I&D will be performed at the bedside to decrease the amount of gross contamination. However, this is *not an adequate procedure* and the patient will require operative debridement as soon as medical clearance is obtained.
- iii. Neurosurgery will be involved in the evaluation and management of many poly-trauma patients. It is their responsibility to communicate with the Trauma Service regarding the status of the patient's neurologic injury and provide recommendations on the timing and safety of surgical intervention. Ultimately, it is the decision of the Trauma Service regarding the timing of Orthopedic surgery and overall management.
- iv. The orthopedic resident on-call is responsible for contacting the Orthopedic Attending on-call if a patient with an open fracture is delayed for greater than six hours of if a bedside I&D is performed.
- v. Operative stabilization of open fractures is almost always required to assist with bony as well as soft tissue stabilization. This includes a variety of procedures including external fixation and internal fixation with nails or plates. Temporary fixation can be achieved in open fractures using an external fixator. This should not add a significant amount of time to the procedure. If any concern exists, the Orthopedic Attending can give a reasonable estimate regarding the duration of the procedure. Also, in the setting of hemodynamic instability that prevents transport to the operating room, external fixation may be performed in the SICU. Operative internal or external fixation should occur **within 24 hours of injury**.

#### ***b. Pelvic Fractures***

- i. Patients with significantly displaced or unstable pelvic fractures, especially the "open book" variety, are candidates for emergent external fixation.
  1. The most common method of stabilizing these injuries is an external fixator. This can be accomplished in the trauma bay if necessary but preferably in the operating room.

2. If needed, a pelvic binder should be placed to stabilize the pelvis until the patient is in the operating room. This should be accomplished quickly and should only serve as a temporary measure until definitive fixation can be achieved.
- ii. If the fracture pattern is not amenable to external fixation i.e. significant posterior injury or iliac wing fracture extension, angiography can be considered if there is evidence of bleeding.
  - iii. REBOA (Resuscitative endovascular balloon occlusion of the aorta) is available in the trauma bay and OR. This is used as a temporizing measure in patients with hemodynamic instability due to intra-abdominal hemorrhage associated with pelvic fracture. The primary utility of REBOA is as a bridge to definitive fixation, angio embolization or other surgical intervention.

*c. Skeletal Traction*

- i. All femoral shaft fractures, acetabular fractures, and vertically unstable pelvic fractures should be placed in skeletal traction.
- ii. The goal is to minimize the number of joints spanned between the fracture and traction pin. Therefore, a distal femoral traction pin is preferred for acetabular and pelvic fractures and a proximal tibial pin for femoral shaft fractures.
- iii. X-rays should be obtained of the knee to rule-out fractures prior to inserting either of these traction pins.

*d. Compartment Syndrome*

- i. 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.
- ii. The first procedure includes releasing all compartments and no effort is made to close the wound.
- iii. The patient will then return to the operating room 2 to 3 days later for delayed closure +/- split thickness skin grafting.

- iv. The threshold to perform fasciotomies in a polytrauma patient with an unreliable physical exam should be low. If you are considering performing a fasciotomy, it is probably wise to do it.

### **Orthopedic Operative Procedures on Head Injured Patients**

- a. 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.
- b. The patient who has sustained both orthopedic and neurologic injury requires a planned approach.
- c. 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*.
- d. Every effort should be made to address any issues preventing such patients from going to the operating room in a timely fashion
- e. 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.
- g. Patients with head injury should undergo a postoperative head CT to evaluate for secondary brain injury prior to returning to the SICU.
- h. 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.
- i. If the operative plans (procedure or approximate length of the surgery) change either preoperatively or intraoperatively, the Ortho Service should notify the Trauma Service Fellow or Attending.



### Guidelines for Orthopedic Operative Procedures on Head Injured Patients

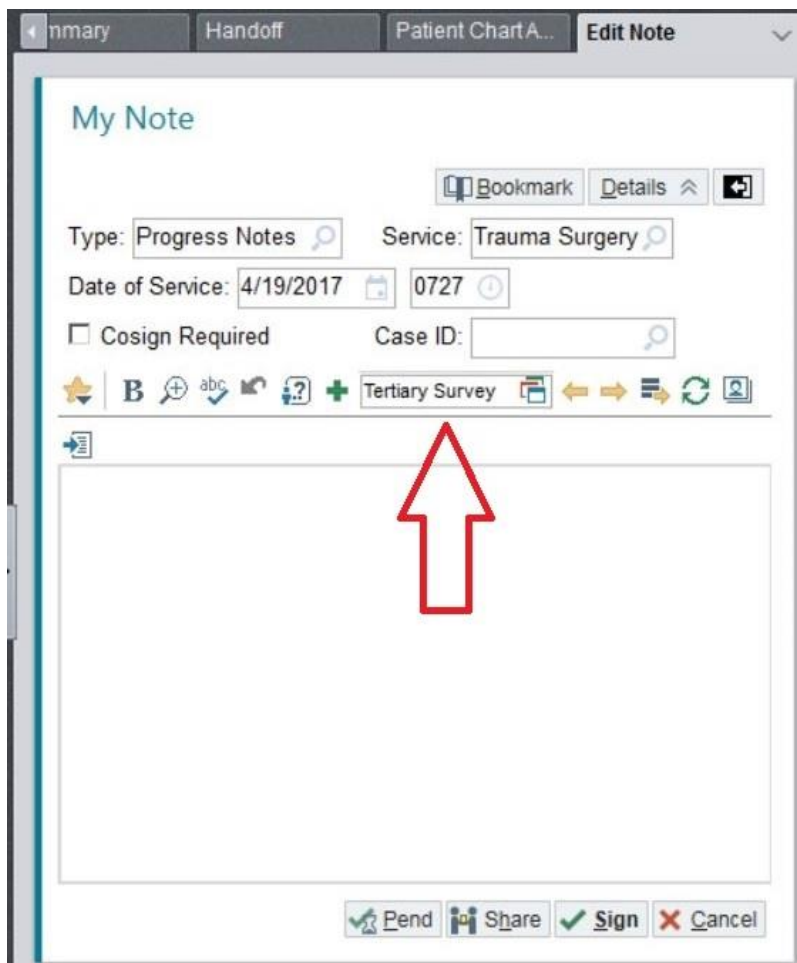
Glasgow Coma Scale	CT Results	Non-urgent Orthopedic Injuries	Urgent Orthopedic Injuries
14-15	Normal	Proceed with appropriate fixation	Proceed with appropriate fixation
11-13	Normal but persistent ABNORMAL level of consciousness	Consider repeat CT scan in 12-24h versus Proceed with appropriate fixation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

# **Service Responsibilities**

## Tertiary Survey of Trauma Patient

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

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



The screenshot displays the EPIC 'My Note' interface. At the top, there are tabs for 'Primary', 'Handoff', 'Patient Chart A...', and 'Edit Note'. Below the tabs, the 'My Note' title is visible. The interface includes several input fields: 'Type' set to 'Progress Notes', 'Service' set to 'Trauma Surgery', 'Date of Service' set to '4/19/2017', and 'Time' set to '0727'. There is also a 'Cosign Required' checkbox and a 'Case ID' field. A toolbar below these fields contains various icons, including a star, bold (B), italic (i), underline (u), strikethrough (ABC), undo, redo, help (?), a plus sign, and a 'Tertiary Survey' smart text option. A red arrow points to the 'Tertiary Survey' option. At the bottom of the interface, there are buttons for 'Pend', 'Share', 'Sign', and 'Cancel'.

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

Type:  Service:  Date of Service:

Cosign Required Case ID:

Insert SmartText

### UCSD Trauma Tertiary Survey

**Date of injury:** \*\*\*

**Mechanism of injury:** \*\*\*

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

- \*\*\*

**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 = \*\*\*

**Physical Exam**

HEENT: {HEENT NORMAL BRIEF:120983}  
Neck: {NECK BRIEF EXAM:15995}  
C-Spine: {CSPINE CLEARANCE:15996: "No pain on palpation, flexion, extension, or rotation.", "No stepoffs", "No Neurologic Injury", "No distracting injuries", "No evidence of acute osseous abnormalities on imaging", "Final interpretations of radiographs complete and reports reviewed"}  
Chest Wall/Lungs: {CHEST EXAM TRAUMA:15789}  
Cardiac: {HEART EXAM TRAUMA:15792: "regular rate and rhythm, S1, S2 normal, no murmur, click, rub or gallop"}  
Abd: {ABDOMEN EXAM TRAUMA:15794: "Abdomen soft, non-tender. BS normal. No masses, organomegaly"}  
T & L Spine: {TSPINE CLEARANCE:15998: "No pain on palpation", "No stepoffs", "No neuro deficits", "Final interpretations of radiographs complete and reports reviewed"}  
Posterior Skin: {POSTERIOR SKIN:16000}  
Wounds Present: {WOUND TYPES TRAUMA:15795}  
Wound Infection Suspected: {YES\*\*\*/NO:120090}

**Extremities**

Left Upper Extremity: {EXTREMITY EXAM:15786}  
Right Upper Extremity: {EXTREMITY EXAM:15786}  
Left Lower Extremity: {EXTREMITY EXAM:15786}  
Right Lower Extremity: {EXTREMITY EXAM:15786}

**Neurovascular**

Carotid: R {PULSE GRADE:520} L {PULSE GRADE:520}  
Radial: R {PULSE GRADE:520} L {PULSE GRADE:520}  
Posterior Tibial R {PULSE GRADE:520} L {PULSE GRADE:520}  
Dorsalis Pedis R {PULSE GRADE:520} L {PULSE GRADE:520}

**Motor/Sensory Exam:**

Motor: {MOTOR EXAM TRAUMA TERTIARY:15798}  
Sensory: {SENSORY EXAM TRAUMA TERTIARY:15799}  
Ambulation: {AMBULATION TERTIARY TRAUMA:15783}

**Imaging Review**

Available Imaging Reviewed: {YES/NO\*\*\*:120094}  
Radiologist Final Results Posted and Reviewed: {YES/NO\*\*\*:120094}  
Additional Imaging Indicated: {YES\*\*\*/NO:120090}

**Spine Clearance**

C-Spine Cleared: {YES/NO\*\*\*:120094}  
T-L Spine Cleared: {YES/NO\*\*\*:120094}

## History Review

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

{TRAUMA TERTIARY HISTORY REVIEW:15800}

## Assessment/Plan

\*\*\*

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

## Morning and evening Handoffs/iPASS

- Morning report is at 0645, 7 days a week, in the Acute Care Surgery Conference Room
- Morning report covers the following overnight events
  - 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
  - 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



<b>I</b>	Illness Severity	<ul style="list-style-type: none"> <li>• Stable, “watcher,” unstable</li> </ul>
<b>P</b>	Patient Summary	<ul style="list-style-type: none"> <li>• Summary statement</li> <li>• Events leading up to admission</li> <li>• Hospital course</li> <li>• Ongoing assessment</li> <li>• Plan</li> </ul>
<b>A</b>	Action List	<ul style="list-style-type: none"> <li>• To do list</li> <li>• Time line and ownership</li> </ul>
<b>S</b>	Situation Awareness and Contingency Planning	<ul style="list-style-type: none"> <li>• Know what’s going on</li> <li>• Plan for what might happen</li> </ul>
<b>S</b>	Synthesis by Receiver	<ul style="list-style-type: none"> <li>• Receiver summarizes what was heard</li> <li>• Asks questions</li> <li>• Restates key action/to do items</li> </ul>

## 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.

## Reporting Deaths and Complications for M&M Conference

- a. The Department of Surgery conducts a weekly Morbidity and Mortality Conference, Wednesday at 0630 at the La Jolla campus.
- b. An M&M must be submitted for ***all deaths and major complications*** per department policy. Please check in with your chief resident on how to submit an M&M.
  - i. Cases should be submitted as soon as a death or major complications are identified.
  - ii. Once submitted, a date for presentation will be assigned by the department.
  - iii. It is ***imperative*** that residents discuss and review weekly M&M with the trauma/ACS/burn attending for the case *at least 2 days prior* to M&M to ensure accuracy and completeness of data.
  - iv. **The operating resident will be responsible for the details of a concise presentation and reconstruction of the case, and will be responsible for obtaining all imaging studies (x-rays, CT scans, etc.)** If the operating resident cannot be physically present at M&M when the case is presented, he/she will designate someone to present the case and will inform the chief resident about the substitution. The chief resident will be ultimately responsible for the presentation, imaging studies, etc.
  - v. Almost all violent trauma death patients (homicide, suicide, MVC, pedestrian vs. auto, etc.) will have a Medical Examiner report. Although the final report may not arrive for several weeks, Attendings can often obtain a preliminary report by calling the Medical Examiner's office directly at **(858) 694-2895** and speaking to the appropriate ME. This should be attempted before presenting unexpected, unusual or complex death cases.
- c. Select Trauma M&M are also reviewed in a monthly "Select Case Review" as an internal process of the Division of Trauma. These will be presented by the Trauma 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. 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.

## 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

- a. Appropriate trauma patients should be scheduled for *at least one* Trauma Clinic appointment upon discharge.
- b. Criteria for clinic appointments
  - i. Patients with NO injuries DO NOT require Trauma Clinic follow-up. (Can suggest follow-up with Primary care MD)
  - ii. If the Trauma Service placed sutures/staples, follow-up in Trauma Clinic in 7-14 days for removal. Alternatively, may follow-up with Primary care MD for removal.
  - iii. If the Trauma Service is caring for wound(s), follow-up in Trauma Clinic in 1 week for a wound check.
  - iv. If patient had a chest tube inserted, follow-up in Trauma Clinic in 1 week for CXR and wound check.
  - v. If patient sustained a minor isolated system injury and no other Trauma Service issues, follow-up should be with the appropriate clinic (Ortho, Neurosurgery, Plastics, HNS). These patients DO NOT require follow-up in Trauma Clinic.
  - vi. If the patient is a Kaiser patient or on active military duty, follow-up should be with Kaiser or the Naval Medical Center San Diego (Balboa), respectively. These patients do not require follow-up in the Trauma Clinic.
  - vii. If the patient had a retrievable IVC filter placed, follow-up in Trauma Clinic in 4-6 weeks.
  - viii. Any patient that underwent an interventional procedure, including placement of a retrievable IVC filter, and all patients with any Anatomic Injury Severity score  $\geq 3$ , should have follow-up arranged in Trauma Clinic.
  - ix. Any patient that underwent a surgical procedure or operation by the trauma service should have follow-up in Trauma Clinic in 1-2 weeks.
  - x. Patients currently enrolled in clinical studies should also have follow-up arranged in the Trauma Clinic.
- c. For discharges on Monday/Tuesday→Appointment for same week Friday.
- d. For discharges on Wednesday or later→Appointment for next week Friday.
- e. Friday Trauma Clinic is run by the Trauma NP/PAs. However, Trauma residents or medical students may be required to attend if the clinic is particularly busy. Resident notes must be signed by the attending.

## **Trauma Surgery Patient Phone Call Algorithm**

### **For Clinic Appointments:**

1. **During business hours (8am-5pm) if the patient is calling to schedule a routine follow up:**

Transfer the patient to the **Call Center (619) 543-6886**. The **Call Center** will be able to give them a specific date and time for their clinic visit. All clinics are in the Medical Offices North (MON), 3<sup>rd</sup> floor of Hillcrest Hospital.

2. **To reschedule** a previously scheduled clinic appointment during business hours (8am-5pm) they should be transferred to the **Call Center (619) 543-6886**.
3. **After hours (5pm-8am)**, on weekends (Saturday/Sunday) or Holidays patients should be given the number for the call center and directed to call the Call Center [(619) 543-6886] during business hours to schedule their appointment.

**If patients are experiencing difficulties, problems, or have complaints about scheduling:** Obtain a working phone number that the patient prefers to be contacted at, first complaints can be directed to

**MON 3<sup>rd</sup> Floor** – Send Telephone Encounter to **P MON SURG GENERAL TRIAGE**. If they do not return the call in a timely fashion, or if the patient requests speaking to a physician, they should be informed that a member of the Trauma team will be paged directly and told to expect a phone call within 45min-1hour. Then page the **Trauma Floor pager (619) 290-6363** with the patient name, MRN or DOB, the patient's concern and contact phone number.

**MON SURG GENERAL TRIAGE** group includes: Kristin Bray RN, Jessica Alviar LVN, Marcelina McMillon, & Bianca Morales

### **For Prescription refills:**

The patient should be directed to **have their Pharmacy of choice fax the prescription refill request** directly to *The Division of Trauma, Surgical Critical Care, Burns and Acute Care Surgery* at (619) 543- 7202. Their prescription will be processed within 24-48hours during the business week and 48-72hrs during weekends/holidays.

### **For Clinical Questions, Concerns, or Complaints:**

1. **If this is an Emergency the patient should be directed to go to the nearest Emergency Department or contact 911 immediately.**
2. **If it is NOT an Emergency:** Obtain a working phone number that the patient

prefers to be contacted at and then send Telephone Encounter to ***P MON SURG GENERAL TRIAGE***. The patient should be informed that a member of the Trauma team will be paged directly and told to expect a phone call within 45min-1hour. Then page the ***Trauma Floor pager (619) 290-6363*** with the patient name, MRN or DOB, the patient's concern and contact phone number.

## **White Surgery/Acute Care Surgery Patient Phone Call Algorithm**

### **For Clinic Appointments:**

1. **During business hours (8am-5pm) if the patient is calling to schedule a routine follow up:** Transfer the patient to the **Call Center (619) 543-6886**. The **Call Center** will be able to give them a specific date and time for their clinic visit. All clinics are in the Medical Offices North (MON), 3<sup>rd</sup> floor of Hillcrest Hospital.
2. **To reschedule** a previously scheduled clinic appointment during business hours (8am-5pm) they should be transferred to the **Call Center (619) 543-6886**.
3. **After hours (5pm-8am)**, on weekends (Saturday/Sunday) or Holidays patients should be given the number for the call center and directed to call the Call Center [(619) 543-6886] during business hours to schedule their appointment.
4. **If patients are experiencing difficulties, problems, or have complaints about scheduling:**
  - a. **During business hours (8am-5pm):** Send Telephone Encounter to **P MON SURG GENERAL TRIAGE pool**.
  - b. **After hours:** Obtain a working phone number that the patient prefers to be contacted at. The patient should be informed that the appropriate physician will be paged directly and told to expect a phone call within 45min-1hour. Then page the **White Surgery Consult resident at (619) 290-6653** with the patient name, MRN or DOB, the patient's concern and contact phone number.

### **For Prescription refills:**

The patient should be directed to **have their Pharmacy of choice fax the prescription refill request** directly to *The Division of Trauma, Surgical Critical Care, Burns and Acute Care Surgery* at **(619) 543-7202**. Their prescription will be processed within 24-48hours during the business week and 48-72hrs during weekends/holidays.

### **For Clinical Questions, Concerns, or Complaints:**

1. **If this is an Emergency the patient should be directed to go to**

**the nearest Emergency Department or contact 911 immediately.**

**2. If it is NOT an Emergency:**

A. During Office Hours (8am-5pm Mon-Fri): Send Telephone Encounter to ***P MON SURG GENERAL TRIAGE***. They should request to speak to **Kristin Bray, RN** who can address their concerns and/or triage them to the appropriate attending physician. The patient should expect a call back/ response within 1-2 hours. If they do not get a response within this time frame, please contact the ***White Surgery Consult resident at (619) 290-6653***. The patient should be informed that the appropriate physician will be paged directly and told to expect a phone call within 45min-1hour.

B. After hours (5pm-8am) and Saturday/Sunday and Holidays: Obtain a working phonenumber that the patient prefers to be contacted at. The patient should be informed that the appropriate physician will be paged directly and told to expect a phone call within 45min- 1hour. Then page the White Surgery Consult resident at 619-290-6653. With the patient name, MRN or DOB, the patient's concern and contact phone number.

**3. For Questions about Surgery Scheduling Questions, Authorization for Surgery inquiries, Disability**

a. Transfer the call to Eloise Jones (619) 543-7200.



## **Division Policy Re Patient Calls Routed to Clinical Coordinator, Eloise Jones**

### **1) When Eloise is in the office:**

- Patient calls that come through the main division line during regular business hours from 8:00 a.m. – 4:30 p.m. are initially answered by either Mike or his back-up (an admin member of the division). The call is transferred directly to Eloise and she addresses the issue immediately.
- Patient calls that come through Eloise's direct office line are answered at all times and resolved within 24-48 hours, depending on the requests being made.
- After hours phone calls to the Division or Eloise's direct line after hours go to voicemail, these will be answered within next 1-2 business days.

### **2) When Eloise is in clinic: (Wednesdays 1-5 and Thursdays 8-12noon)**

- Patient calls that come through the main division line during regular business hours from 8:00 a.m. – 4:30 p.m. when Eloise is in clinic are **initially answered** by either Mike or his back-up (an admin member of the division). **A message is taken or if the patient prefers he/she can leave a voicemail message. Eloise will address/return the call within 24-48 hours after receiving the message.**

### **3) When Eloise is on vacation:**

- Patient calls that come through the main division line during regular business hours from 8:00 a.m. – 4:30 p.m. when Eloise is on vacation are initially fielded by Mike Josey or his back-up. The patient is informed that Eloise is out until x and asked if it is urgent or if it can wait until her return. **If it can wait, a message is taken or if the patient prefers the call is transferred to Eloise's voicemail and she addresses the issue within 24- 48 hours upon her return from vacation. If it cannot wait, the call is routed to Eloise's back-up Mike Josey. Mike addresses the patient's issue immediately either by contacting the attending physician, fellow, or NP on the service that day. This will depend on what service the patient was treated by. If the patient has a specific question such as a clinic appointment time, referral status, or what doctor he/she is scheduled to see, etc., Mike will transfer the patient to Marcie in the Surgery Clinic @3-6824. If Marcie is unavailable, the patient is transferred to the Call Center @3-6886.**

# Burns

# K. Lund & Browder Burn Area Chart

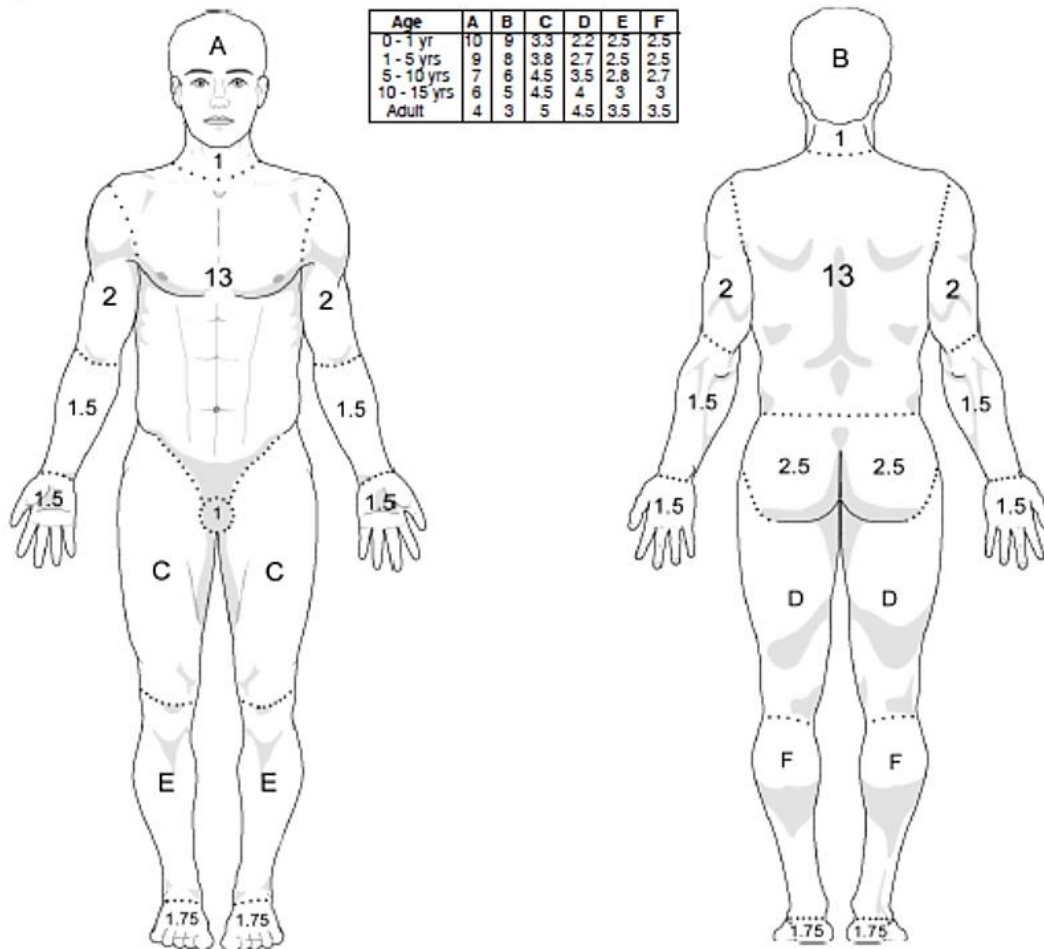
UC San Diego  
HEALTH SYSTEM

## 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

0043(12-06)

Physician Signature/PID#

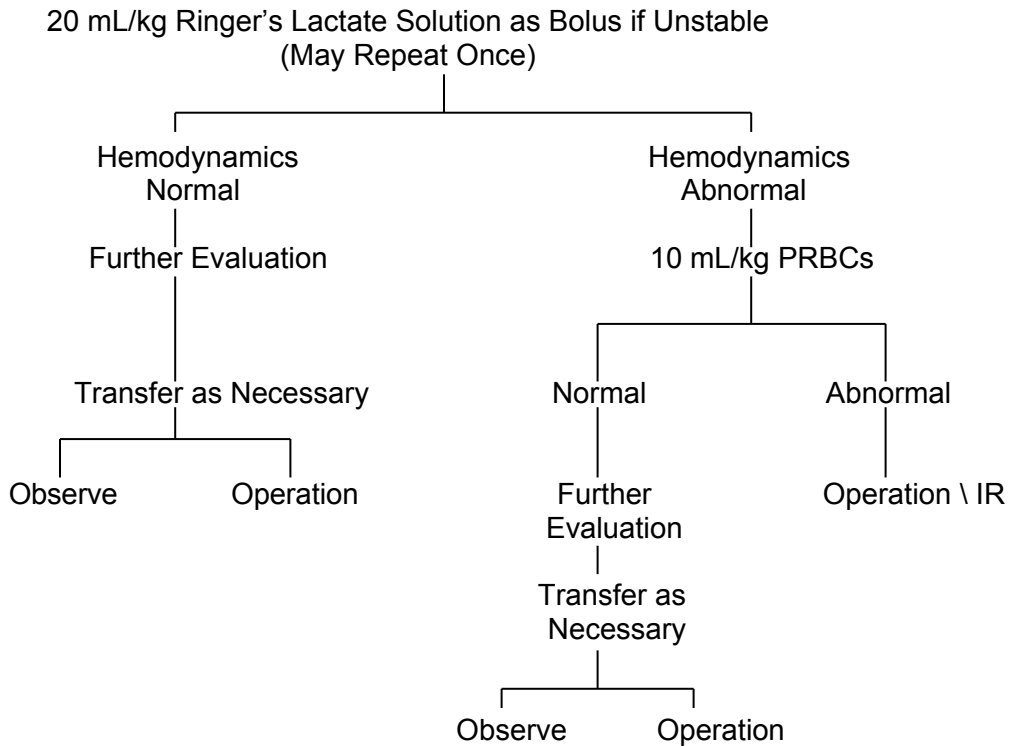
Date & Time

# **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.

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

### Transfer Considerations

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

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

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

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

## 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*. 4<sup>th</sup> ed. Chicago, Ill; American College of Surgeons; 1992, and Fleisher GR, Ludwig S. *Textbook of Pediatric Emergency Medicine*. 2<sup>nd</sup> 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*. 2<sup>nd</sup> ed. ST. Louis, Mo: Mosby Year Book; 1992.

## Drugs Used in Pediatric Advanced Life Support<sup>#</sup>

Drug	Dosage (Pediatric)	Remarks
<b>Adenosine</b>	0.1-0.2 mg/kg Maximum single dose: 12 mg	Rapid IV bolus
<b>Amiodarone</b> (SVT, VT with pulses)	5 mg/kg IV/IO <i>load</i> over 20 to 60 minutes (max 300mg)	Repeat to daily max 15 mg/kg (2.2g in adolescents)
<b>Amiodarone</b> (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)
<b>Atropine sulfate*</b>	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
<b>Calcium chloride 10%</b>	20 mg/kg IV/IO (repeat prn)	Give slowly.
<b>Calcium gluconate</b>	60 mg/kg IV/IO (repeat prn)	Give slowly.
<b>Dobutamine hydrochloride</b>	2-20 µg/kg per min	Titrate to desired effect
<b>Dopamine hydrochloride</b>	2-20 µg/kg per min	α-Adrenergic action dominates at ≥ 15-20 µg/kg per min.
<b>Epinephrine for bradycardia*</b>	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)	
<b>Epinephrine for asystolic or pulseless arrest*</b>	<b>First dose:</b> IV/IO: 0.01 mg/kg (1:10,000, 0.1 mL/kg) ET: 0.1 mg/kg (1:1000, 0.1 mL/kg) IV/IO doses as high as 0.2 mg/kg of 1:1000 may be effective. <ul style="list-style-type: none"> <li>Repeat every 3-5 min until ROSC</li> </ul>	
<b>Epinephrine infusion</b>	0.1 - 1 µg/kg per min Higher infusion dose used if asystole present	Titrate to desired effect Preferred vasopressor in pediatrics
<b>Etomidate</b>	0.2 – 0.4 mg/kg IV/IO	Infuse over 30 –60 seconds (max 20 mg) Lasts 10 – 15 minutes
<b>Lidocaine*</b>	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
<b>Lidocaine infusion</b>	20-50 µg/kg per min	Repeat bolus if infusion initiated > 15 minutes after initial bolus



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

# **Venous Thromboembolism (VTE) Prophylaxis**

## Venous Thromboembolism (VTE) Prophylaxis Protocol

### 1. Risk Stratification:

<p><b>Low Risk</b></p>	<p>Expected length of stay less than 48 hours            Patients in observation status            Patients no longer (or never) ill who are awaiting disposition            Ambulating cancer patient admitted for short stay chemo infusion            Ambulating patients <b>not</b> meeting criteria for <b>Moderate</b> or <b>High</b> risk            (Trauma patients are almost never in this group)</p>
<p><b>Moderate Risk</b></p>	<p>Moderate / major surgery with impaired mobility            Moderate / major surgery with <b>any</b> VTE risk factor            Active cancer with acute medical illness, reduced mobility, or other VTE risk factors            Medical patient with reduced mobility and acute illness            Medical patient with prior VTE or known thrombophilia</p>
<p><b>High Risk</b></p>	<p>Orthopedic joint / bone surgery in pelvis, hip, or femur            Major orthopedic trauma            Surgery for abdominal or pelvic cancer            Critically ill patients in the ICU            Acute spinal cord injury with paresis            Craniotomy surgery            Spinal surgery for cancer or spinal fusion (anterior approach)</p> <p><b>Major Trauma Victims</b> (presence of &gt;1 of following):</p> <ol style="list-style-type: none"> <li>1. likelihood of bedrest &gt;3 days, head injury, spine or pelvic fracture, lower extremity fracture</li> <li>2. laparotomy, thoracotomy, or laparoscopy</li> <li>3. co-morbid risk factors* including: history of prior DVT or PE, obesity, known sepsis, malignancy, hypercoagulable state, pregnancy</li> </ol>
<p><b>Consider IVC Filter :</b></p>	<p>Presence of &gt;1 of following:</p> <ol style="list-style-type: none"> <li>1. severe head injury with therapeutic paralysis and aggressive ICP control &gt;5-7 days</li> <li>2. spinal fracture with para- or quadriplegia</li> <li>3. unstable pelvic fracture with bedrest &gt;6 weeks</li> <li>4. multiple lower extremity fractures</li> <li>5. patients in High Risk group where usual measures cannot be employed</li> </ol>

### 2. Screening Measures for Trauma Patients

- i. *Low Risk:*  
 No routine screening

- ii. *Moderate Risk and High Risk:*  
Patient screening with venous duplex 2 times in 1<sup>st</sup> week, then weekly by the Radiology Lab. If patient needs a study prior to placing Venodynes, call Radiology Department Duplex Lab. If they are not available on weekends, call IPG technician.
- iii. *Consider IVC Filter:*  
Patients in this category but without an IVC filter will be screened as the High Risk patients but with 2 duplex studies in the first week.

#### b. Prophylactic Measures

- i. *Low Risk:*
  1. mandatory ambulation in 1<sup>st</sup> 24-36 hours
  2. in-bed mobility and lower extremity exercises
  3. NO pneumatic hose or anti-coagulation
- ii. *Moderate Risk and High Risk:*
  1. bilateral lower extremity pneumatic hose and subcutaneous low molecular weight heparin
- iii. *Consider IVC Filter:*
  1. Severe head injury
    - Head injury requiring therapeutic paralysis for > 5-7 days combined with lower extremity or pelvic fracture will receive prophylactic IVC filter placed after consensus between Neurosurgery and Trauma at the earliest time felt to be safe from the view of head injury management.
    - Isolated head injury requiring therapeutic paralysis for > 5-7 days will be considered for prophylactic IVC filter unless strong contraindications exist including young age, likelihood of future pregnancy, feasibility of anticoagulation or patient preference. IVC filter placed after consensus between Neurosurgery and Trauma as above.
    - Prophylactic anticoagulation will be used if not contraindicated.
    - Continue pneumatic compression hose in all patients unless therapeutically anticoagulated.

#### 2. Spinal cord injury

- Spinal cord injury combined with lower extremity or pelvic fractures and isolated spinal cord injuries will receive prophylactic IVC filter placed after a consensus between Neurosurgery and Trauma.
- Prophylactic anticoagulation will be used if not contraindicated.

### 3. IVC Filter candidates:

- Consider prophylactic IVC filter, retrievable or temporary (Angel Catheter).
- In general, IVC filter will be used unless strong relative contraindications exist, such as young age, likelihood of future pregnancy, feasibility of anticoagulation and patient preference.
- Prophylactic anticoagulation will be used if not contraindicated.
- Continue pneumatic compression hose.

### **Weight based lovenox dosing for VTE prophylaxis in trauma patients:**

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

### Summary of Trauma Protocol for VTE Prophylaxis

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

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

**\*VTE Risk Factors:**

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

## Venous Thromboembolism (VTE) Prophylaxis Notes

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

a. Low risk patients:

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

b. Moderate risk patients:

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

c. High risk patients:

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

d. 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.

- i. Patients with IVC filters still require Venodynes and weekly Duplex screening.

e. Mechanical VTE prophylaxis

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

f. Pharmacologic VTE prophylaxis

- i. Weight based lovenox dosing given every 12 hours is the preferred pharmacologic agent for VTE prophylaxis. (See table for appropriate weight



- based dose)
- ii. Anti-Xa levels will be checked after the 3<sup>rd</sup> or 4<sup>th</sup> dose of lovenox to ensure the patient is receiving the appropriate prophylactic dose.
  - iii. If lovenox is contraindicated (renal insufficiency, history of HIT, etc), other options for pharmacologic prophylaxis include heparin or arixtra. Please consult with the trauma attending/fellow and/or pharmacist if alternative VTE prophylaxis is being considered.
- g. Contraindications to initiating pharmacologic VTE prophylaxis upon admission:
- i. Traumatic brain injury with intracranial hemorrhage
  - ii. Solid organ injury with non-operative management
  - iii. Pelvic fractures with active extravasation
  - iv. Patients presenting in hemorrhagic shock
  - v. Significant coagulopathy
  - vi. Spinal fracture/cord injury
- h. Trauma Duplex Protocol
- i. The Trauma Routine Duplex Protocol should only be ordered for patients with High Risk or High/Consider IVC Filter. (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)
  - iv. Patients with long bone fractures expected to go to the OR for definitive fixation must undergo a screening duplex examination prior to the operation, Screening duplex is available 24/7 at Hillcrest.
  - i. When immobile patients or patients who have undergone an orthopedic surgical intervention are discharged home or transferred to nursing homes, SNF, extended care facilities, etc., the discharge summary/orders should include recommendations for DVT prophylaxis-either low molecular weight heparin (i.e. Lovenox) or unfractionated heparin or Novel Oral Anticoagulant (NOAC, i.e. rivaroxan, apixiban, dabigatran etc...).

## Weight Based Dosing of Enoxaparin/Factor Xa

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

References:

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

# UC San Diego Health

## Enoxaparin Guideline for Special Populations

Approved by P&T Committee, July, 2016

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

<b>Obesity (BMI &gt; 40 kg/m<sup>2</sup>)</b>	
<ul style="list-style-type: none"> <li>Twice daily regimen is preferred</li> <li>Peak Anti-Xa level around 3<sup>rd</sup> or 4<sup>th</sup> dose</li> </ul>	
VTE Prophylaxis	• 0.5 mg/kg SC q24h or 30% increase from standard prophylaxis dose with close Anti-Xa monitoring*
VTE Treatment	• 0.75 mg/kg q12h based on total body weight with close Anti-Xa monitoring*

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

<b>Low Total Body Weight (&lt;50kg)</b>	
<ul style="list-style-type: none"> <li>Use unfractionated heparin if possible</li> <li>Peak Anti-Xa level around 3<sup>rd</sup> or 4<sup>th</sup> dose</li> </ul>	
VTE Prophylaxis	• 0.5 mg/kg SC q12h with close Anti-Xa monitoring*
VTE Treatment	• 1 mg/kg q12h based on total body weight with close Anti-Xa monitoring*

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

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

\*Based on UCSDHS internal data

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

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

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

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

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

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

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

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

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

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# **Surgical Critical Care**

# ICU Nurse-led Rounds

## Step 1: CCRN Presents Brief Patient Data:

Presented by RN to begin rounds

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

## Step 2: FASTHUGS or ABCDEFGs:

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

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

## Step 3: Reconcile Orders:

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

## mFASTrHUGS for SICU Team Rounds:

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

- Mouthcare**    Teeth cleaning and oral moistening q4h.
  - Feeding**        Commence by day 1 in ICU, follow protocol.
  - Analgesia**      Review med record, Give pain score using visual or nonverbal scale.
  - Sedation**        Review ventilation, GCS, and reason for sedation.  
Assess and specify target RASS score. Daily wakening qAM.
  - ThromboPx**     Prescribe SCDs and/or heparin type or alternative.
  - Restraints**      Assess, reorder or discontinue restraints. Universal consent obtained.
  - Head >30°**     Head of bed up 30° or more. Get C-Spine cleared!
  - Ulcer**            Review ulcer prophylaxis.
  - Glucose & Gut**        Maintain tight glucose control per protocol.  
Last BM is specified, appropriate bowel protocol.
  - Skin care**        Braden scale: note areas of pressure breakdown, progress to healing.  
Does patient need special bed?
- Document:**    **Any Family Discussions**  
**Goals of Care ≥ 72 hours after ICU admission**  
**Daily Need for Foley**  
**Daily Location and Need for Central Line**

<b>Richmond Agitation Sedation Scale (RASS)</b>	
<b>Target RASS Value</b>	<b>RASS Description</b>
+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
<b>0 Alert and Calm</b>	
-1 Drowsy	Not fully alert, sustained awakening to voice (eyes open and contact > 10 seconds)
-2 Light Sedation	Briefly awakens to voice (eye opening and contact < 10 seconds)
-3 Moderate Sedation	Movements or eye opening to voice (but no eye contact)
-4 Deep Sedation	No response to voice; moves or eyes open to physical stimulation
-5 Unarousable	No response to voice or physical stimulation



## **Talking with SICU Families**

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

## **Guide to SICU Family Meetings**

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

Adopted from Mass. General Hospital Palliative Care Service

**Indications for Howell Service SICU consult:  
(Webpage: “Howell Service”)**

*Consider a consult if there is:*

1. Family request.
2. 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  $\geq$  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 >7 days.

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

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

## **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.

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

## 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 EtCO<sub>2</sub> >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](http://www.bapen.org.uk/pdfs/must/must_page6.pdf)
      - 2. Tibial
        - a. Men
          - i. 18–60 years Predicted height (cm)=[knee height (cm)×1.88]+71.85
          - ii. 60–90 years Predicted height (cm)=knee height (cm)×2.08]+59.01
        - b. Women
          - i. 18–60 years Predicted height (cm)=[knee height (cm)×1.87] – [age (years) ×0.06]+70.25
          - ii. 60–90 years Predicted height (cm)=[knee height (cm)×1.91] – [age (years) ×0.17]+75.0
  - b. Calculate IBW:
    - i. Women: 49 kg + 1.7 kg for each inch over 5 feet (Robinson)
    - ii. Men: 50 + 2.3 kg per inch over 5 feet (Devine)
  - c. Vt= 6mL/kg ideal weight rounded up to nearest increment of 10
  - d. Titrate respiratory rate before volume
  - e. Calculation cards located on all unit vents

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

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

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

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## **Discontinuation of Mechanical Ventilation**

### **Ventilator Steer SBT Protocol**

**(2016 RC PDP)**

#### **I : DEFINITIONS**

##### **STEER:**

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

**SBT:** Spontaneous Breathing Trial

**SAT:** Spontaneous Awakening Trial

#### **II: POLICY:**

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

### III. PROCEDURES AND RESPONSIBILITIES

#### A. Screen

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

##### STEER Screening exclusion Criteria

- Peep > 10 cmH<sub>2</sub>O
- FiO<sub>2</sub> > 0.45
- Hemodynamic Instability
- HR > 140
- Unstable Angina
- Increased ICP
- Neuromuscular blockers
- HFOV
- APRV with P-High > 24 cmH<sub>2</sub>O
- Physician has requested patient not to have measurement or trials completed (order deselected)

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

#### B. Test

##### *Brief Minimal Support SBT*

If the patient demonstrates adequate spontaneous respiratory efforts, then patient performs a brief (one minute) SBT on minimal support: PS = 0 or PS = 5 cm H<sub>2</sub>O based on physician preference. If the Rapid Shallow Breathing Index (RSBI) on the brief minimal support SBT is less than 105 and the patient does not meet any of the *Stop Criteria*, then the RCP will begin a 30-120 minute *Minimal Support SBT* (see section C. Exercise).

##### *Brief Augmented Support SBT*

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



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

### **Stop Criteria and Termination for SBT**

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

- RSBI > 105
- SpO<sub>2</sub> < 90% or within physician specified limits
- Respiratory distress defined as: Increase work of breathing, diaphoretic, RR > 35 or RR < 10
- Agitation or panic unrelieved by reassurance and adjustment of the mechanical ventilation system
- Hemodynamically unstable with significant increase or decrease of heart rate or blood pressure. (Stop SBT and do not restart without physician order.)
- New or worsening arrhythmias. (Stop SBT and do not restart without physician order.)
- RCP judgement from patient assessment.

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

## **C. Exercise**

### **Minimal Support SBT**

If the patient had completed a brief minimal support SBT during the Test phase with RSBI less than 105 and did not meet the *Stop Criteria*, then the RCP will initiate an SBT on PSV driving pressure of 0-5 cmH<sub>2</sub>O and PEEP of 0-5 cmH<sub>2</sub>O. The trial will continue for at least 30 minutes, so long as the patient's RSBI does not exceed 105 and Stop Criteria are not met. The RCP will record the RSBI at the end of 30 minutes. If the physician does not give an order to extubate or go to trach collar at that time, the RCP will continue the SBT for a total of 120 minutes unless the patient meets Stop Criteria or the physician gives an order to extubate or begin trach collar. After the trial has been completed, the RCP will record the RSBI. The therapist will then return the patient to the previous ventilator settings and notify physician.

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

## **Augmented Pressure Support**

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

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

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

Patient performed a SBT on minimal support (PS = 0 or PS = 5 cm H<sub>2</sub>O based on physician preference) for a minimum of 30 minutes without reaching stop criteria. If the SBT was up to 120 minutes, the patient did not reach stop criteria during that time either. The physician has not given an order to withhold extubation/trach collar.

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

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

#### **Level 2: Not Level 1, but improving SBT performance**

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

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

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

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

#### **E. Report:**

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

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

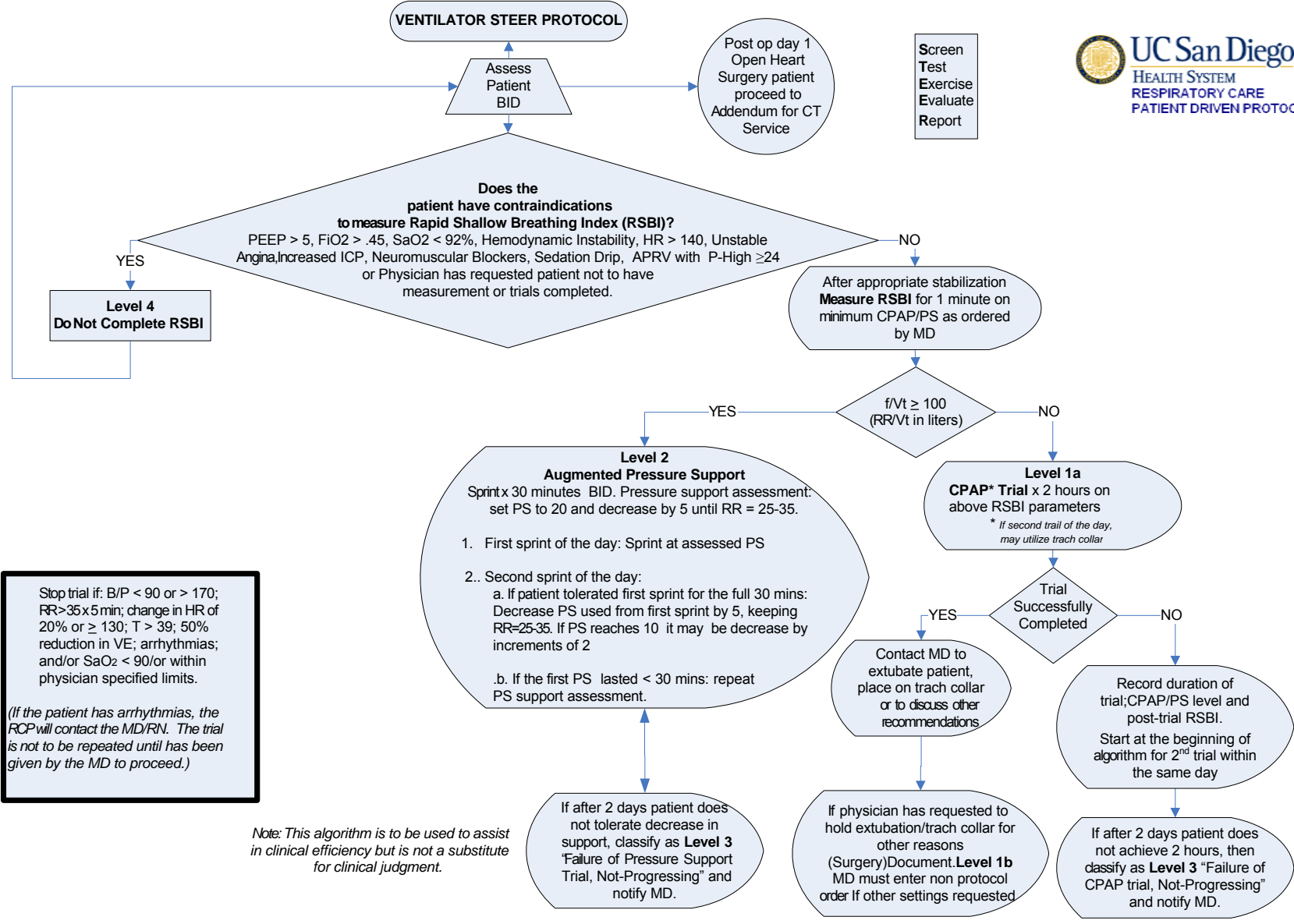
The therapist will be prepared to discuss the results (STEER level, and latest SBT results) to Respiratory Care team lead and to the Medical Director during respiratory care rounds.

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

#### **Boundaries/Interactions:**

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

**VENTILATOR STEER PROTOCOL**



Stop trial if: B/P < 90 or > 170; RR > 35 x 5 min; change in HR of 20% or ≥ 130; T > 39; 50% reduction in VE; arrhythmias; and/or SaO<sub>2</sub> < 90 or within physician specified limits.  
*(If the patient has arrhythmias, the RCP will contact the MD/RN. The trial is not to be repeated until has been given by the MD to proceed.)*

*Note: This algorithm is to be used to assist in clinical efficiency but is not a substitute for clinical judgment.*

## **Ventilator Extubation Protocol**

**(2016 RC PDP)**

### **Purpose:**

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

### **Policy:**

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

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

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

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

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

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

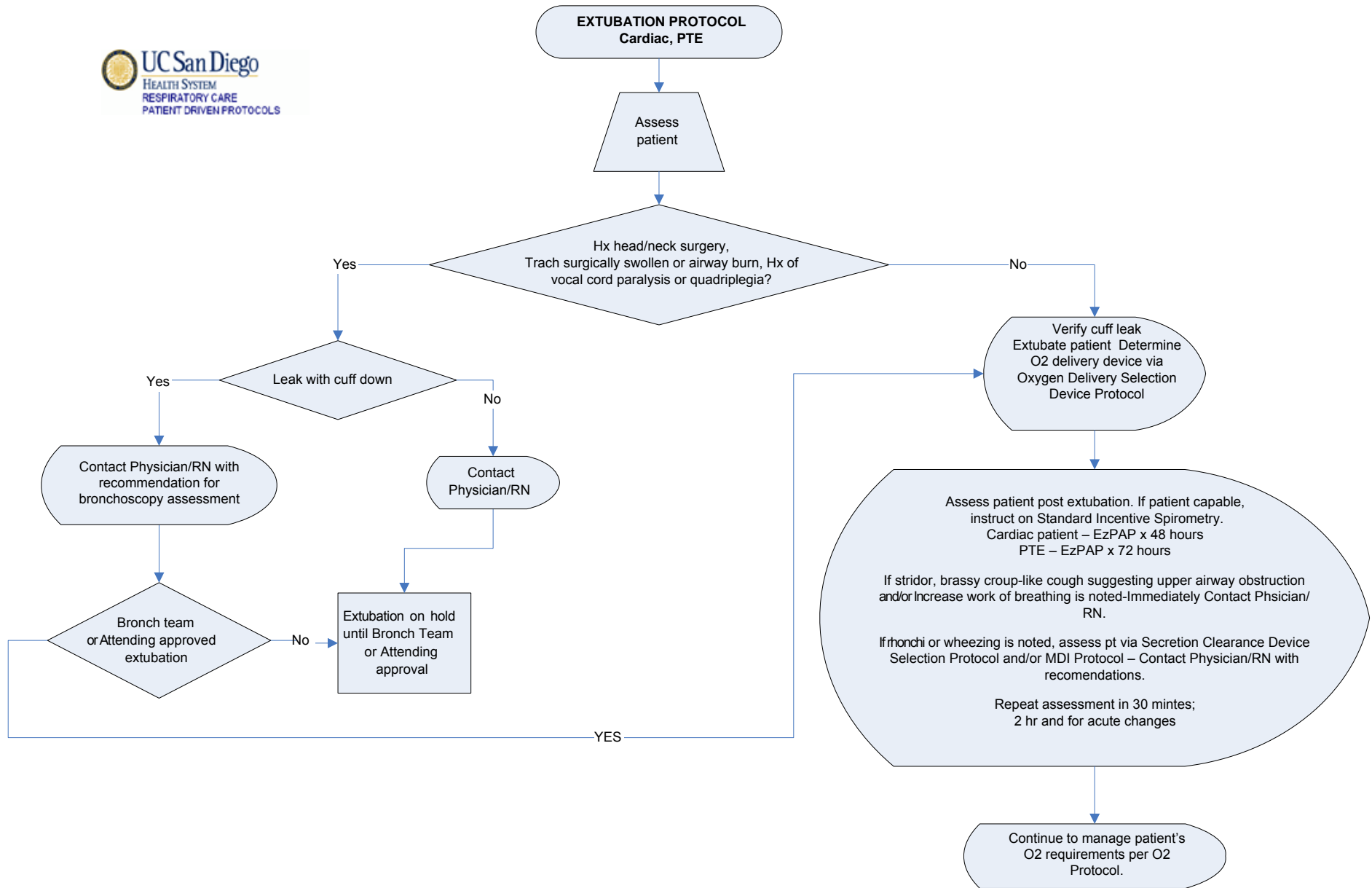
### **Protocol:**

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

3. The RCP will assess the patient post-extubation to determine if additional lung expansion therapy is required.

**Post-Extubation:**

1. Reassess patient 30 minutes post-extubation
2. Repeat assessment 2 hours post-extubation
3. Manage patient's oxygen requirements per the Respiratory Care Oxygen Protocol



*Note: This algorithm is to be used to assist in clinical efficiency but is not a substitute for clinical judgment.*

## **Additional Notes: Extubation of Trauma Patients**

- a. DO NOT EXTUBATE patients under the following circumstances without the approval and presence of a trauma attending/fellow:
  - i. after 1900 hours.
  - ii. patients with a known history of a “difficult airway” or “difficult intubation” (Includes patients who are status post anesthesia with difficult airway/intubation and/or significant soft tissue neck injury.)
  - iii. patients status postoperative neck surgery (spine surgery cases included)



DISCLAIMER: These guidelines were prepared by the Department of Surgical Education, Orlando Regional Medical Center. They are intended to serve as a general statement regarding appropriate patient care practices based upon the available medical literature and clinical expertise at the time of development. They should not be considered to be accepted protocol or policy, nor are intended to replace clinical judgment or dictate care of individual patients.

## TIMING OF TRACHEOSTOMY

### SUMMARY

The appropriate timing of tracheostomy in the patient suspected to require prolonged mechanical ventilation remains a subject of controversy. Multiple retrospective and prospective studies have been performed to evaluate this clinical question. These studies suggest that early tracheostomy (within 7-10 days of intubation), especially among patients with traumatic brain injury, is associated with significant improvements in duration of mechanical ventilation, intensive care unit and hospital length of stay, reduced ventilator-associated pneumonia, reduces hospital costs, and improves patient survival.

### RECOMMENDATIONS

- **Level 1**
  - **None**
- **Level 2**
  - **The reason for mechanical ventilation should be considered when deciding the timing of tracheostomy.**
  - **Tracheostomy should be considered in patients who require more than 7-10 days of mechanical ventilation in order to reduce the duration of mechanical ventilation and decrease intensive care unit and hospital length of stay, duration of sedation, and hospital cost.**
- **Level 3**
  - **Tracheostomy before 7 days is contraindicated in patients with a probability of survival less than 25%.**
  - **Early tracheostomy may reduce the risk of ventilator-associated pneumonia and may improve patient survival.**

### INTRODUCTION

Airway access for mechanical ventilation can be provided either by endotracheal or tracheostomy tube. During episodes of acute respiratory failure, patients are generally ventilated through an endotracheal tube. The transition to a tracheostomy tube is often considered when the need for mechanical ventilation is expected to be prolonged. The most common indications for tracheostomy are acute respiratory failure and need for prolonged mechanical ventilation and traumatic or catastrophic neurologic insult requiring airway control, mechanical ventilation or both. Upper airway obstruction is a less common indication for tracheostomy. Observational studies document that approximately 10% of mechanically ventilated patients will require tracheostomy, but there is significant variability with regard to optimal timing and patient selection.

### LITERATURE REVIEW

There have been several retrospective and prospective studies performed to examine the issues of

### EVIDENCE DEFINITIONS

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

### LEVEL OF RECOMMENDATION DEFINITIONS

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

optimal timing of tracheostomy. Arabi et al. published a retrospective study of 531 mechanically ventilated subjects in a mixed medical/surgical intensive care unit (ICU). The mean time to tracheostomy was 12 days and mean ICU length of stay (LOS) was 23.1 days. Time to tracheostomy was associated with an increased duration of mechanical ventilation, ICU LOS, and hospital LOS for each day tracheostomy was delayed. Time to tracheostomy was not associated with increased ICU or hospital mortality (1).

Beltrame et al. performed a single-center study evaluating the outcomes of bedside percutaneous dilatational tracheostomy (PDT) and surgical tracheostomy (ST). Five hundred twenty eight mechanically ventilated patients underwent tracheostomy. 161 patients received ST and 367 underwent PDT. STs were performed significantly later than PDT (12.4 days vs. 8.7,  $p < 0.05$ ). Overall ICU LOS (18.4 vs. 23.3 days,  $p < 0.05$ ) and mean duration of mechanical ventilation (14.2 vs. 20.1 days,  $p < 0.05$ ) were lower in the PDT than in the ST group (2).

Moller et al. performed a study to determine whether early tracheostomy (ET) of severely injured patients reduces duration of mechanical ventilation, the frequency of ventilator-associated pneumonia (VAP), and ICU LOS. The study was a retrospective review that included 185 surgical ICU patients with acute injuries requiring mechanical ventilation and tracheostomy. There were no differences in the rate of ARDS or lung injury between groups. ET was defined as  $\leq 7$  days, and late tracheostomy (LT) as  $> 7$  days. The incidence of VAP was significantly higher in the LT group (42.3% vs. 27.2%, respectively;  $p < 0.05$ ). They also found that APACHE II scores, hospital and ICU LOS, and the number of ventilator days were significantly higher in the LT group (3).

In 2005, a systematic review and meta-analysis included 5 randomized controlled trials (RCT) evaluating the timing of tracheostomy in 406 adult patients on ventilatory support (4-9). Early tracheostomy did not significantly alter mortality (relative risk 0.79, 95% confidence interval 0.45 to 1.39) or the risk of pneumonia (0.90, 0.66 to 1.21). Early tracheostomy did however significantly reduce the duration of mechanical ventilation (weighted mean difference 8.5 days) and ICU LOS (weighted mean difference 15.3 days) (9).

In 2008, a large retrospective analysis from Ontario compared mechanically ventilated patients who underwent early versus late tracheostomy. A total of 10,927 patients received tracheostomy during the study of which one-third ( $n=3758$ ) received early tracheostomy ( $\leq 10$  days) and two-thirds ( $n=7169$ ) received late tracheostomy ( $>10$  days). Patients in the ET group had lower unadjusted 90-day (34.8% vs. 36.9%;  $p=0.032$ ), 1 year (46.5% vs. 49.8%;  $p=0.001$ ), and study mortality (63.9% vs. 67.2%;  $p < 0.001$ ) than patients in the LT group. Multivariate analyses showed that each additional day of delay in performing tracheostomy was associated with increased mortality equivalent to an increase in 90-day mortality from 36.2% to 37.6% per week of delay (relative risk increase 3.9%) (10).

Terragni et al. conducted a multicenter prospective RCT in 12 Italian ICUs from June 2004 to June 2008. The study enrolled 600 adult patients without pneumonia who had been ventilated for 24 hours. Subjects were monitored for 48 hours and those with worsening respiratory failure and no pneumonia were then randomized to either early (after 6–8 days of laryngeal intubation,  $n=209$ ) or late tracheostomy (after 13–15 days of laryngeal intubation,  $n=210$ ) (11). The study included both medical and surgical subjects with no demographic differences. Thirty-one percent in the early group and 43% of the late group did not undergo tracheostomy due to proximity to either extubation or death. In the early group, 69% underwent tracheostomy compared with 57% in the late group. All tracheostomies were performed using bedside percutaneous techniques (Griggs technique in 72% early vs. 73% late, PercuTwist technique in 25% vs. 22%). VAP developed in 14% of early vs. 21% of late tracheostomy patients ( $p=0.07$ ). The number of ICU-free and ventilator-free days was higher in the early tracheostomy group, but the long-term outcome end point of 28-day survival (74% vs. 68%;  $p=0.25$ ) did not differ. The authors concluded that early tracheostomy (performed after 6–8 days of endotracheal intubation) did not result in significant reduction in the incidence of VAP compared with late tracheostomy (performed after 13–15 days of endotracheal intubation) and was associated with an adverse event related to the tracheostomy procedure in more than one third of subjects (11). It should be noted that both of the percutaneous insertion techniques evaluated in this study have been noted in other studies to have an increased rate of procedural complications.

Another systematic literature review and meta-analysis was performed in 2011. Seven RCTs with a total of 1,044 patients were included, 3 of which were included in the 2005 meta-analysis by Griffiths et al. (12). When compared to late tracheostomy, early tracheostomy did not significantly reduce short-term mortality (relative risk [RR], 0.86; 95% CI, 0.65-1.13), long-term mortality (RR, 0.84; 95% CI, 0.68-1.04), or incidence of ventilator-associated pneumonia (RR, 0.94; 95% CI, 0.77-1.15) in critically ill patients. The timing of the tracheostomy was not associated with a markedly reduced duration of mechanical ventilation (weighted mean difference [WMD], -3.90 days; 95% CI, -9.71-1.91) days of sedation (WMD, -7.09 days; 95% CI, -14.64-0.45), ICU LOS (WMD, -6.93 days; 95% CI, -16.50-2.63) or hospital LOS (WMD, 1.45 days; 95% CI, -5.31-8.22).

Young et al. performed the largest open multi-center RCT on timing of tracheostomy (13). This study was conducted from 2004 through 2011 in 70 general adult and 2 cardiothoracic ICUs in 72 hospitals in the United Kingdom. Nine hundred nine patients were enrolled. Inclusion criteria were mechanically ventilated subjects in adult ICUs who were identified in the first 4 days after admission as likely to require at least an additional 7 days of mechanical ventilation. Exclusion criteria included those patients receiving immediate tracheostomy or were contraindicated due to anatomical or other reasons or those with respiratory failure due to chronic neurological diseases. Patients were then randomized to either early (within 4 days after intubation, n=455) or late tracheostomy (after 10 days if still indicated, n=454). Most subjects were admitted with a medical diagnosis (79.2%), with respiratory failure as the primary admission diagnosis (n=59.5%). Interestingly, in the early group, 91.9% of subjects received tracheostomy as planned as compared to the late group where only 45.5% of subjects required tracheostomy. Many subjects in the late tracheostomy group no longer required mechanical ventilation and were successfully extubated. Ninety percent of the tracheostomies were performed by the percutaneous technique, with 88.7% performed in the ICU at the bedside, and the majority (77.3%) performed by the single tapered dilator technique. There was no difference in 30-day mortality (30.8% early vs. 31.5% late), 2-year mortality (51.0% vs. 53.7%), or median ICU stay among survivors (13.0 days vs. 13.1 days). There was also no difference in hospital stay or duration of mechanical ventilation between the two groups. However, early tracheostomy was associated with significantly decreased sedation use. The median number of days during which any sedatives were received in survivors at 30 days after randomization was 5 days in the early group and 8 in the late group ( $p < 0.001$ ), with a mean difference between groups of 2.4 days (95% CI 1.6–3.6).

Patient selection is key factor in determining timing to tracheostomy. Barquist et al. performed one of the few prospective RCTs looking at timing to tracheostomy in trauma patients (14). This was a single-center trial comparing trauma patients who received a tracheostomy within 8 days of intubation versus those whose tracheostomy was delayed until after day 28. The study was halted after the first interim analysis (after 60 patients) as there was no significant difference between groups in number of mechanical ventilator days, ICU length of stay, incidence of VAP, or hospital mortality. They concluded that tracheostomy before day 8 post-injury in trauma patients did not reduce the number of days of mechanical ventilation, frequency of pneumonia or ICU length of stay as compared with a tracheostomy strategy involving the procedure at 28 days post-injury or more.

In 2009, however, Schauer et al. performed a retrospective multi-institutional study looking back over a 5-year period (January 2001 to December 2005) (15). They analyzed the relationship between the timing of tracheostomy in trauma patients and mortality, ICU and hospital LOS, and incidence of pneumonia. This relationship was investigated in the context of expected survival based on probability of survival (Ps) greater than 25%. The study examined 685 trauma patients who received tracheostomy and stratified patients into low and high probability of survival and early (0–3 days), early intermediate (4–7 days), late intermediate (8–12 days), and late (>12 days) tracheostomy. Early tracheostomy was associated with decreased ICU stay, hospital stay, total ventilator days, and rates of pneumonia among trauma patients with a high probability of survival. There was a significantly higher mortality rate (48.9%) associated with patients with low Ps (<25%) receiving tracheostomy less than 4 days injury. This study demonstrated that early tracheostomy in patients with low Ps may not be beneficial given the high mortality rate before post injury day 4. However, in patients with high probability of survival, there is an increased benefit to early tracheostomy.

Arabi et al., in a subsequent study, also showed a benefit to early tracheostomy (16). They evaluated trauma patients who received tracheostomy over a 5-year period. Tracheostomy was considered early if it was performed by day 7 of mechanical ventilation. Multivariate analysis was performed on duration of mechanical ventilation, ICU LOS, and outcome between early and late tracheostomy patients. Six hundred fifty three trauma ICU patients were identified, of which 21% required tracheostomy. Twenty-nine patients underwent early tracheostomy and 107 received late tracheostomy. Patients with early tracheostomy were more likely to have maxillofacial injuries and to have lower Glasgow Coma Scale score. Duration of mechanical ventilation was significantly shorter with early tracheostomy (mean 9.6 versus 18.7 days;  $p<0.0001$ ). Similarly, ICU LOS was significantly shorter (10.9 vs. 21.0 days;  $p<0.0001$ ). There was no significant difference with regard to ICU LOS after tracheostomy. ICU and hospital mortality rates were similar. Late tracheostomy was found to be an independent predictor of prolonged ICU stay (>14 days).

Hyde et al. also evaluated the timing of tracheostomy and outcomes in trauma patients (17). A chart review was performed from January 2010 to June 2012. Early tracheostomy (ET) was defined as a tracheostomy performed by the fifth hospital day. ET patients were matched to late tracheostomy patients (LT, tracheostomy after day 5) using propensity scoring and compared for multiple outcomes. Cost for services was calculated using average daily billing rates at the author's institution. One hundred and six patients were included, 53 each in the ET (mean day to tracheostomy=4) and the LT (mean day to tracheostomy=10) cohorts. The average age was 47 years and 94% suffered blunt injury, with an average Injury Severity Score of 24. Patients in the ET group had significantly shorter ICU LOS (21.4 vs. 28.6 days,  $p<0.0001$ ) and significantly fewer ventilator days (16.7 vs. 21.9 days,  $p<0.0001$ ) compared to the LT group. ET patients also had significantly less VAP (34% vs. 64.2%,  $p=0.0019$ ). In the current era of increased healthcare costs, the authors concluded that early tracheostomy significantly decreased both pulmonary morbidity and critical care resource utilization translating to a cost savings of \$52,173 per patient. They concluded that for trauma patients requiring prolonged ventilator support, early tracheostomy should be performed.

Patients with traumatic brain injury (TBI) are a common population of patients requiring tracheostomy. In 2004, Boudierka et al. published a study that evaluated whether early tracheostomy (by the fifth day post-injury) reduces duration of mechanical ventilation, ICU LOS, incidence of VAP, and mortality in comparison with prolonged intubation among patients with head injury (8). Randomization was performed on the fifth day into two groups: early tracheostomy (ET group,  $n = 31$ ) and prolonged endotracheal intubation (PEI group,  $n = 31$ ). The two groups were comparable in terms of age, sex, and Simplified Acute Physiologic Score (SAPS). The mean time of mechanical ventilation was shorter in the ET group (14.5 days) vs. PEI group (17.5 days) ( $p=0.02$ ). After pneumonia was diagnosed, mechanical ventilatory time was 6 days for the ET group vs. 11.7 days for PEI group ( $p=0.01$ ). There was no difference in frequency of pneumonia or mortality between the two groups.

Rizk et al. collected data from the Pennsylvania Trauma Society Foundation statewide trauma registry from January 1990 until December 2005 (18). 3,104 patients met criteria for inclusion in the study ( $GCS \leq 8$ , documented head injury, and tracheostomy). Early tracheostomy (ET) was defined as tracheostomy performed during hospital days 1–7 and late tracheostomy (LT) as those performed >7 days after admission. Of note, patients in the ET group had higher ISS and lower GCS scores when compared to the LT group. The study showed a statistically significant decrease in ICU and hospital LOS and functional independence at discharge in the ET group when compared to the LT group. However, LT patients were more likely discharged alive (93% vs. 85%,  $p<0.0001$ ). The authors concluded that a strategy of early tracheostomy (1-7) days, particularly when performed on patients with a reasonable chance of survival, results in a better overall clinical outcome than when the tracheostomy is performed in a delayed manner.

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### **Surgical Critical Care Evidence-Based Medicine Guidelines Committee**

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## Anemia and Transfusions in Stable Trauma patients

The UC San Diego Division of Trauma, Surgical Critical Care, Burns and Acute Care Surgery follows the “Choosing Wisely” campaign, include Transfusing wisely:



**Transfusing Wisely: Save Blood—Save Lives—Know the indications for transfusion**

### **KNOW THE “4S” INDICATIONS**

**SEVEN:** Lower Hgb targets have always been equal or better in trials. If you transfuse for a Hb target, a Hgb of **7** is the trigger at UCSD.

**(IN) STABILITY:** Bleeding patients who become hemodynamically unstable can be transfused without waiting for a low Hgb. In GI Bleeding, aiming for Hb > 7 costs lives.

**SIGNIFICANT SYMPTOMS:** However, it’s best to transfuse patients, not numbers. Consider the clinical picture and whether symptoms are important, eg, angina. And use...

**SINGLE UNITS:** The adage “no one needs one unit of blood” is a myth. Each unit carries risk and must be necessary. Check Hgb between units unless starting Hb < 6.

### **KNOW THE RISKS**

**REACTIONS:** Transfusion Related Acute lung Injury (TRALI)(1 in 5-10k) is the #1 cause of transfusion related death. Hemolysis (1 in 25-50k acute, 1 per 2500 late) is #3. Anaphylaxis (1 per 50-150k), and fever (1 per 200) are also important.

**VOLUME OVERLOAD:** Transfusion-Associated Cardiac Overload (TACO) (1 per 1-10k) is the #2 killer.

**INFECTION:** VIRUSES AND PARASITES are very uncommon, <1/million, but bacterial sepsis occurs in 1/30k PRBC and 1/100k platelet transfusions. In trials, the risk of hospital-acquired infection (HAI), including pneumonia, increased to 1 in 20 after transfusion.<sup>4</sup>

### **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.

# Death by Whole Brain Criteria

(MCP 832.1 - 3/20/2014)

## ABSTRACT:

This document establishes the policy for the determination of death by whole brain criteria. This is also referred to as “brain death,” but must be understood to be no different than a diagnosis of death made by other criteria.

This policy and the implementing procedures are intended to provide a description of recommended courses of action to address a specific diagnosis/clinical condition or need of a particular patient population. While this policy represents the institution’s judgment regarding the provision of patient care services, it is not necessarily the only acceptable and appropriate approach to patient care. Patient care continues to require the exercise of judgment and individualization based on patient needs and responses.

## RELATED POLICIES:

UCSDH [MCP 360.1](#) “Organ and Tissue Donation”

UCSDH [MCP 380.1](#) “Do Not Attempt to Resuscitate”

UCSDH [MCP 381.1](#) “Limitation of Life Sustaining Treatment”

## I. DEFINITIONS

- A. Death: An individual who has sustained either (1) irreversible cessation of circulatory and respiratory functions, or (2) irreversible cessation of all functions of the entire brain, including the brain stem, is dead. (California Health & Safety Code Sections 7180)
- B. Brain Death: An individual, who has sustained irreversible cessation of all functions of the entire brain, including the brainstem, as determined by accepted medical standards, is dead.

There shall be independent confirmation of the death by two (2) physicians. (Two licensed physicians must examine the patient and declare brain death. Neither the physician making the determination of death nor the physician making the independent confirmation shall participate in the procedures for removing or transplanting organs/tissues) (California Health & Safety Code Sections 7180- 7182). Also see Policy 360.1 Organ and Tissue Donation .Both physicians must document in the medical record that the patient is brain dead. These notes must state, unequivocally, that the patient is brain dead and must include the date and time of declaration. The official time of death on the death certificate is at the declaration time by the second physician. The death certificate should be completed by the primary medical service.

- C. California Health and Safety Code Definition: The California Health and Safety Code, Section 7181 et. seq. states that an individual who has sustained “irreversible cessation of all functions of the entire brain, including the brain stem, is dead.” Brain death is a clinical diagnosis and specific clinical criteria must be satisfied in order for this diagnosis to be made. In certain circumstances, the use of confirmatory laboratory test(s) may be desirable, but the use of any of these tests is not mandatory in making the diagnosis of death by brain criteria in adults. In certain circumstances in infants and children, the use of confirmatory laboratory test(s) is recommended. The following policy does not replace the physician’s judgment in individual cases, but may be considered reasonable, current, and generally accepted brain criteria for use in the diagnosis of death.
- D. Donation after Cardiac Death (DCD) A patient for whom medical support was withdrawn, and once meeting the criteria for circulatory death may donate solid organs (See Policy 360.1 Organ and Tissue Donation).
- E. Period of Reasonable Accommodation: A reasonably brief amount of time following declaration of death, needed for next of kin or family to gather at the bedside. In determining what is reasonable, the UC San Diego Health System (UCSDH) will consider the needs of the family, but also the needs of other patients and prospective patients in need of urgent care.

## II. POLICY

**Determination of Death:** Based on current medical standards, an individual who has sustained either (A) irreversible cessation of circulatory and respiratory functions or (B) irreversible cessation of all functions of the entire brain including those of the brain stem, is dead (California Code, Health and Safety Code 7180 Determination of Death Act). A determination of death by whole brain criteria must be made in accordance with accepted medical standards. Note that the policy for death by whole brain criteria is defined separately for infants and adults below.

Death by whole brain criteria is a medical and legal definition. It does not require consent or participation by family or surrogate decision-makers. Appropriate efforts will be made to discuss the patient’s medical condition and the process of determining death by brain



criteria with family or surrogate decision-makers prior to evaluating whether or not the patient is dead.

Determination of death should be accomplished as early as practical in the patient's clinical course for the benefit of both family/surrogate decision-makers and staff.

Two licensed 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 an attending neurologist, neurosurgeon, or board-certified neurointensivist. The other physician would ideally be the patient's attending physician. At least one attending physician must participate in the process of determining death by whole brain criteria and sign the death note in the patient's chart. Other attending physicians may become involved in the determination of death at the discretion of the primary service attending of record. Neither physician making the determination of death shall participate in the procedure for organ/tissue procurement or transplantation.

The patient is declared dead at the time of the determination of death by whole brain criteria. The attending of record is responsible to notify and discuss the patient's death with the patient's family. This may not be delegated to house staff.

In the event there is any delay in reaching an attending neurologist, neurosurgeon, or board-certified neurointensivist, the chain of command should be immediately utilized, including a call or page to the Division Chief.

UCSDH will follow California law, which requires that a "reasonably brief period of accommodation" after death by whole brain criteria is provided for family or next of kin to gather at the bedside prior to discontinuation of cardiopulmonary support for the patient. No other medical intervention is required (California Health and Safety Code, Section 1254.4)

### **III. PROCEDURES AND RESPONSIBILITIES**

#### **A. Death Due To Irreversible Cessation of Cardio-Respiratory Function.**

##### **1. Responsible person(s):**

The responsible person shall be a staff physician, or a licensed resident who is functioning as surrogate for this physician.

##### **2. Procedure:**

The physician shall examine the patient to determine a lack of cardio-pulmonary function, and then certify death by entering a note in the chart.

3. Criteria:

This assessment will take place after all appropriate resuscitation efforts are completed. Absence of cardiac function will be demonstrated by the absence of pulses by palpation, and the absence of cardiac contractions by chest auscultation. Absence of respiratory function will be demonstrated by the absence of ventilation by inspection and auscultation. Additional methods of determination may be used to supplement this clinical examination, if appropriate.

4. Documentation:

The physician determining death shall enter and sign a progress note in the chart which details the date, time, and basis of determination of death, and also clearly indicates the physician responsible for this determination. A death certificate must also be completed.

B. Death due to Irreversible Cessation of All Functions of the Brain, including Brain Stem (Brain Death). (THE FOLLOWING FOUR CRITERIA MUST BE MET)

1. Before considering the use of whole brain criteria for determining whether a patient has died, the following two requirements must be met:
  - a. Establishment of irreversible and proximate cause of coma by history, examination, neuroimaging, and laboratory testing.
  - b. Reversible medical conditions that may confound the clinical assessment of coma have been excluded:
    - (1) 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.
    - (2) Arterial PO<sub>2</sub> must be above 50 mm Hg, with or without supplemental oxygen administration. If PO<sub>2</sub> is below this value, or substantially below the patient's chronic baseline oxygen status, a patient may still be declared brain dead using other surrogate laboratory procedure (see below) but apnea testing may not be used as part of the criteria for establishing death by brain criteria.
    - (3) Core temperature must be above 36°
    - (4) No neuromuscular blockade or continued presence of neuromuscular blocking agents (defined by the presence of a train of 4 twitches with maximal nerve stimulation)

- (5) Systolic blood pressure must be  $\geq 100$  mm Hg. Vasoactive medications are allowable to maintain system blood pressure
  - (6) No severe electrolyte abnormalities
  - (7) No severe metabolic/acid-base disorders
  - (8) No “Locked-in” syndrome
2. If the patient has suffered a hypoxic-ischemic event sufficient to be the cause of coma, at least 24 hours must elapse before clinical determination of death by brain criteria. If the cause of coma is known with certainty not to be hypoxia-ischemia an observation period should pass since the onset of the brain insult to exclude the possibility of recovery (in practice, usually several hours). Ancillary tests may be used to shorten the duration of the observation period.
3. Clinical Exam: once potentially confounding factors have been excluded, careful clinical examination of the patient is performed to demonstrate cerebral unresponsiveness, absence of ALL brainstem reflexes, and apnea:
- a. Cerebral Unresponsiveness
    - (1) Deep coma: Patients must lack all evidence of responsiveness. No eye opening or eye movement to noxious stimuli (e.g. nail-bed pressure and supraorbital pressure) is present. No motor response to noxious stimuli (e.g. nail-bed pressure and supraorbital pressure) except for spinally mediated reflexes is present.
  - b. Absence of all brainstem reflexes
    - (1) No decerebrate or decorticate posturing
    - (2) No pupillary response
    - (3) No gag reflex
    - (4) No corneal reflex
    - (5) No oculocephalic reflex
    - (6) No oculovestibular reflex
    - (7) No jaw reflex.

- (8) No grimacing to noxious stimuli (e.g. nail bed, supraorbital ridge, or temporomandibular joint pressure).
- (9) No cough response to bronchial suctioning.
- (10) No swallowing or yawning.

#### 4. Apnea

- a. Purpose of apnea test: To demonstrate that there are no respiratory efforts despite the stimulus of marked acidemia, indicating severe damage to the medulla.
- b. 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.
- c. Apnea test procedure
  - (1) Prerequisites Core temperature  $\geq 36^{\circ}\text{C}$  and Systolic blood pressure  $\geq 100$  mm Hg
  - (2) Specific procedures and set-up are detailed in the Respiratory Therapy manual.
  - (3) Expose patient's chest and diaphragmatic area.
  - (4) Adjust ventilation for  $\text{PCO}_2 = 35$  to  $45$  and obtain baseline arterial blood gas.
  - (5) Pre-oxygenate for 10 minutes with 100%  $\text{O}_2$  to a  $\text{PaO}_2$  of  $\geq 200$  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%  $\text{O}_2$  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) or the patient develops hemodynamic instability (SBP falls  $< 90$  torr or age appropriate normative values, or arrhythmia). If at any time

respiratory effort is observed, or the patient develops hemodynamic instability, the test should be terminated and the patient returned to assisted ventilation. (in those cases, the apnea test is therefore not confirmed).

d. Results of apnea test

- (1) Apnea confirmed: Respiratory movements are absent and any one or more of the following is found:
  - (a) PaCO<sub>2</sub> > 60 mmHg
  - (b) PaCO<sub>2</sub> 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, 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 a confirmatory laboratory procedure.

C. Clinical Manifestations compatible with the Determinations of Brain Death

1. 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):
  - a. 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).
  - b. Movement of the abdomen from ventricular contractions or abdominal aortic pulsations should not be confused with diaphragmatic movement during apnea test.
  - c. Sweating, blushing, tachycardia.

- d. Absence of diabetes insipidus.
- e. Normal blood pressure without pharmacologic support; sudden increases in blood pressure.

D. Confirmatory Laboratory Procedures

1. Death is a clinical diagnosis. A confirmatory test is not mandatory but is recommended in patients in whom the clinical examination or apnea test cannot be reliably performed. It should be emphasized that any of the suggested confirmatory tests may produce similar results in patients with catastrophic brain damage who do not (yet) fulfill the clinical criteria of death.
2. Confirmatory laboratory 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 a confirmatory test is performed, only one is required. Confirmatory laboratory 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 confirmatory test would be considered a false positive. A confirmatory test may be considered in the case of an indeterminate apnea test, or in the case where medications may confound clinical criteria (ex: high-dose barbiturates).
3. The following confirmatory test findings are listed in the order of the most sensitive test first. Consensus criteria are identified by individual tests.
  - a. Conventional angiography.
    - (1) No intracerebral filling at the level of the carotid bifurcation or circle of Willis.
    - (2) The external carotid circulation is patent, and filling of the superior longitudinal sinus may be delayed.
  - b. Electroencephalography (EEG).
    - (1) No electrical activity during at least 30 minutes of recording that adheres to the minimal technical criteria for EEG recording in suspected death as adopted by the American Electroencephalographic Society, including 16-channel EEG instruments.
    - (2) EEG may not be used as a confirmatory test if intoxication is considered.

c. Technetium-99m hexamethylpropyleneamineoxime brain scan.

(1) No uptake of isotope in brain parenchyma (“hollow skull phenomenon”)

E. Documenting that death by whole brain criteria has been diagnosed

1. A note shall be entered in the medical record at the time of determination of death by brain criteria. This note shall include:

a. Etiology and irreversibility of condition

b. Documentation of examination to include:

(1) Cerebral unresponsiveness

(2) Absence of brainstem reflexes

(3) Absence of motor response to pain

c. Results of apnea test, including arterial blood gas determinations. (Absence of respiration with  $p\text{CO}_2 \geq 60$  mmHg or rise of  $>200$ mmHg)

d. Justification for confirmatory test(s), if necessary, and result of that test(s).

e. Repeat neurologic examination. Option: the interval is arbitrary, but a 6-hour period is reasonable.

f. Time of determination of death by brain criteria.

g. Name and title of the two determining physicians.

h. Completion of the “UCSDH Post Mortem Death Information” form.

F. Special Considerations in Infants and Children

1. The criteria for the clinical diagnosis of death in infants and children are the same as adults with these exceptions regarding personnel, repeat testing, observation periods and the use of ancillary studies:

a. Personnel: Two licensed attending physicians must independently confirm the diagnosis of death by brain criteria. At least one of these physicians must be a neurologist with special qualification in child neurology, or neurosurgeon. The other physician would ideally be the patient’s attending physician.

- b. TWO EXAMINATIONS, INCLUDING APNEA TESTING WITH EACH EXAMINATION, SEPARATED BY AN OBSERVATION PERIOD, ARE REQUIRED for all infants and children up to the age of 18 years. Both examinations must be consistent with brain death.
- c. In newborns < 37 weeks gestational age, formal criteria for the determination of death by whole brain criteria have not been established.
- d. In term newborns (> 37 weeks gestational age) to 30 days of age, an observation period of 24 hours between brain death exams is recommended before determination of death by brain criteria.
- e. In infants and children (31 days to 18 years), an observation period of 12 hours between brain death exams is recommended before determination of death by brain criteria.
- f. Ancillary studies (EEG and radionuclide cerebral blood flow) are NOT required to establish brain death and are not a substitute for the neurologic examination. Ancillary studies should be used to assist in the diagnosis of brain death (i) when components of the examination or apnea testing cannot be completed safely due to the underlying medical condition of the patient; (ii) if there is uncertainty about the results of the neurologic examination; (iii) if a medication effect may be present; or (iv) to reduce the inter-examination observation period. When ancillary studies are used, a second clinical examination and apnea test should be attempted and components that can be completed must remain consistent with brain death. In this instance the observation interval may be shortened and the second neurologic examination and apnea test (or all components that are able to be completed safely) can be performed at any time thereafter. If the ancillary study is equivocal or if there is concern about the validity of the study, the patient CANNOT be pronounced dead.

G. Reasonable Period of Accommodation for Family to Gather

1. After determination of Death by whole brain criteria, when requested by a patient's family, UCSDH will allow a Reasonable Period of Accommodation (as defined in Section I above) when requested by a patient's family for next of kin or family to gather at the patient's bedside, before withdrawing cardiopulmonary support.
2. During this period, UCSDH will continue previously ordered cardiopulmonary support and compassionate nursing care. No other medical intervention will be required. However, UCSDH policy on treatment recommendations for potential organ donors should be followed until the patient's legally recognized health care decision maker, if any, or the patient's



family or next of kin, if available, has been approached by a designee of the The Organ Procurement and Transplant Network.

3. Upon request, or shortly after UCSDH physicians have determined the potential for death is imminent, UCSDH will provide the patient's legally recognized health care decision maker, if any, or the patient's family or next of kin, if available, with a written statement of this policy's provision for a Reasonable Period of Accommodation.
4. UCSDH will make reasonable efforts to accommodate those religious and cultural practices in accordance with the values and beliefs of the patient.

## **Central Venous Catheter Insertion**

- 1) Residents must receive appropriate training before placing central lines independently.
  - a) All residents must be credentialed in Central Line Insertion by their Residency Program Director to insert lines without immediate supervision.
  - b) This requires completion of:
    - i) Online Training Course, and
    - ii) Practical Training Course, and
    - iii) Supervision of insertion of 5 proctored line each at subclavian, internal jugular and femoral locations, and
    - iv) Completion of at least two years of residency (i.e. R3 or above.)
- 2) Line proctoring must be performed by an authorized senior resident, fellow or attending.
- 3) A nurse must be present for insertion of routine central lines.
- 4) Ultrasound must be used for insertion of routine central lines.
- 5) A “Timeout” must be completed for insertion of routine central lines.
- 6) The CLIP (Central Line Insertion Protocol) form must be followed and completed in EPIC for all line insertions.
- 7) The Central Line note must be completed in EPIC and must be sent to an attending for cosign.
- 8) Use of a BioPatch is a CDPH requirement. Central lines are preferably secured with a “Stat-Lock” rather than sutures to allow placement of the BioPatch. The BioPatch must be around the catheter on the skin.
  - a) Avoid “Hubbing” the line – lines inserted tightly with the hub pushing into the skin will require the nurse to cut the sutures to place the BioPatch.
  - b) Place lines in such a way that they can be dressed occlusively with a transparent dressing by the nurse. (i.e. avoid J insertions high on the neck)
- 9) The CDPH hospital fine for an internally lost guidewire is \$50,000 to \$100,000.
- 10) The UCSD Central Line Blood Stream Infection rate is publically reportable.
- 11) The necessity of a Central Line or PICC must be documented daily by state law.
- 12) Use of peripheral IVs placed with ultrasound guidance reduces need for central lines and PICCs and the CLABSI rate.

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

Non UCSD personnel can use the SICU Central Line Course at <http://surgery.ucsd.edu/som/surgery/divisions/trauma-burn/training/courses/Pages/sicu-central-line.aspx>

# DON'T HUB THE LINE!

**FAIL! HUBBED!  
NO ROOM FOR BIOPATCH**



**GOOD!  
ROOM FOR BIOPATCH ON SKIN**



**GOOD!  
STATLOCK ALLOWS ADJUSTMENT**



- There is no medical need to “hub” a CVC.
- Biopatch reduces CLABSI – but it must be placed around the CVC, on the skin.
- STATLOCKS allow sutureless placement of CVCs in many cases.

J Doucet, SICU Director, 4/17

## **Antibiotics and Antifungals for the Trauma/Surgical Intensive Care Unit Patient**

The following guidelines have been developed to assist physicians with the appropriate selection of prophylactic and empiric antibiotic therapy for common infections seen in SICU patients at UCSD. These guidelines were developed with knowledge of “nosocomial” pathogens seen in this unit.

Treatment should be directed by patient-specific parameters which include: gram stain, culture and sensitivity information (when they are known), previous infectious diseases and antibiotic courses, and other pertinent medical history, including immunosuppression and drug allergies. Duration of antibiotic treatment should be based on specific organism(s), site of infection, and clinical scenario.

The drug(s) of choice listed below are the most active, least toxic and most cost-effective agents currently on the UCSD Formulary. Dosing guidelines are for patients with “normal” renal and liver function. Many antibiotic dosages must be adjusted with altered renal function, we recommend working closely with the SICU pharmacists in these cases.

Infectious Disease consultation should be obtained for patients with unusual isolates, complicated infectious disease management problems, and those who are responding poorly to empiric therapy.

**MRSA Screening:** California State Law requires all admissions to an ICU undergo MRSA screening via a nasal swab. The only exemption is those patients already known to be MRSA positive.

### **ICU Antibiotics Rules of Thumb:**

#### *1. How sick is the patient?*

Patients with signs and symptoms of sepsis or who are immunocompromised need early, broad spectrum therapy. Delay can be fatal. Prolonged invasive ventilation and prior antibiotic use (especially of broad-spectrum agents) predispose to resistance. If you suspect sepsis you should call a “code sepsis” to ensure timely administration of antibiotics (within one hour).

#### *2. Identify the organism*

Ideally you should be treating a known organism with an appropriate dose of antibiotic to which that organism is likely to respond, based on sensitivity testing. This ideal will often not be met, at least initially. Sometimes you will obtain an organism and its sensitivity on routine microbiological surveillance and then the patient will show features of infection likely to be due to that organism. More often, you will have to rely on empiric therapy.

3. *Know the environment*

Know the patterns of resistance and the organisms prevalent in our ICU environment. This helps with antibiotic choice. The current UCSF Antibigrams are available on the Infection Control pages via links on the intranet homepage (go to Pulse Intranet à Departments & Services à Infection Control / Epidemiology Unit à ICC Information Reports à Quarterly Reports à choose the latest quarter à Antibigram)

4. *Identify the site of infection*

Positive blood cultures are simply not good enough. Identify the site of infection (i.e. respiratory tract, urinary tract, a sub-diaphragmatic collection, etc.) and address any surgically remediable pathology right away. An infection will not improve without source control.

5. *Don't overtreat*

Never treat a "fever" or a "leukocytosis" with antibiotics. Assess the patient as a whole, including their predisposition to infection and likely sites of infection. Ask whether the patient is sick enough to justify antibiotics, rather than treating laboratory values! If you are going to start 'empiric' therapy, first obtain microbiological specimens for culture. Document your reasons for starting therapy, and choose as narrow an antibiotic spectrum as possible for the clinical scenario.

When you get the results of culture and sensitivity testing, revise your treatment to narrow the spectrum as much as possible, or stop antibiotics completely if no infections are identified. With new DNA and mass-spectroscopy based testing we often receive preliminary culture results in **less than 24 hours** – antibiotics can be narrowed at this time (i.e. stopping vancomycin or transitioning to ceftriaxone if DNA testing shows no genes for methicillin resistance). An antibiotic "time out" should be performed after 48 hours of treatment to ensure that treatment is appropriate.

6. *Don't delay*

If the patient clearly needs antibiotics for treatment, give the antibiotics and do not wait for sensitivity results. The primary lesson of Rivers' EarlyGoal-Directed Therapy in Sepsis trial is to be EARLY!

7. *Don't undertreat*

Even more important than giving adequate doses of an antimicrobial is not to give an agent that has a substantial likelihood of failure. In a critically ill patient, you may not get a second chance. The wrong antibiotic can increase mortality risk greater than threefold.

8. *Know how critical illness interacts with the antibiotic*

The pharmacokinetics of antimicrobials are often substantially altered in the critically ill, especially with renal failure. Pharmacy should assist with dosing in complex patients, and can follow levels and titrate doses when appropriate.

9. *In vitro* response is not the same as *in vivo*  
 There are some agents that appear to be effective *in vitro*, but will not work *in vivo*. Always look at sensitivity results in the light of your knowledge of the microbe and the patient (and especially the site of infection!).

### Antibiotic Prophylaxis

- a. Ventriculostomy or ICP Monitor in Place
- Routine prophylaxis: cefazolin 1 g IV q8h
  - Allergy to penicillin: vancomycin 1g q12 hours, pharmacy to adjust dosing by level, especially if renal insufficiency
- b. Posttraumatic Open Fracture
- *Gustilo Grade I & II*: cefazolin 1-2g IV q8h x 24h (2gm for patients > 70 kg)
  - *Gustilo Grade III*: cefazolin 1-2gm IV q8h **and** gentamicin x 72h (or continue for 23 hours after soft tissue coverage is achieved.)

Gentamicin Dosing Regimen		
CrCl (mL/min)	Dose	Interval
≥60	5 mg/kg	q24h
30-59	5 mg/kg	q48h

- Dose is based on actual (or if patient is obese, then adjusted) body weight - **max dose 500 mg**
  - Patients in an ICU should receive **6 mg/kg**
  - Alternative therapy if patient is allergic to Penicillins or Cephalosporins:
    - Vancomycin (patient-specific dose), usual 15 mg/kg IV q12h
    - Plus or minus gentamicin (dosing as above)
- c. Penetrating Abdominal Trauma and/or Surgical Procedure
- Cefazolin 1-2g IV x1 pre-op
    - Add metronidazole 500mg IV x1 pre-op if high-risk of hollow viscus injury
  - If penicillin allergy: ciprofloxacin 400mg and metronidazole 500mg (for colon pathology) or clindamycin 600mg and ciprofloxacin 400mg
  - Continue x 24h post-surgical procedure or definitive therapy **only if** hollow viscus 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<sup>3</sup>) or leukocytosis (≥12,000 WBC/mm<sup>3</sup>)
  - Altered mental status with no other recognized cause (adults ≥70 years only)
- **PLUS TWO** of the following:
  1. Increased or purulent sputum (ask nurse\RT about suctioning)
  2. New onset or worsening cough \ dyspnea \ tachypnea
  3. Rales or bronchial breath sounds
  4. Worsening gas exchange

If yes, this is a suspect VAP case (PNU1):

1. Order Bronchoscopy + quantitative bronchoalveolar lavage (BAL) – gram stain, culture and sensitivities (C&S).
2. Start antibiotics after BAL: piperacillin / tazobactam 3.375 g IV q8h **and** vancomycin 1g IV q12h (pharmacy will adjust dose)
3. If positive C&S (PNU2), narrow antibiotics for sensitivities and continue 7 days. (14 days for *pseudomonas*.)
4. If negative C&S and WBC and fever resolve, discontinue antibiotics

f. Presumed Aspiration

Witnessed or presumed aspiration after traumatic event (i.e. loss of consciousness, vomitus in oropharynx, vomitus seen on intubation, or suspect infiltrate on initial CXR): clindamycin 600 mg IV q8h **and** ciprofloxacin 400 mg IV q12h x 72h

- If signs \ symptoms of pneumonia develop, continue treatment for 7 days, narrow to cover identified organism

g. Drowning

Drowning is unfortunately common in San Diego, and exposes patients to potential aspiration of unusual organisms, particularly if immersed in stagnant water (i.e. the river). Initial prophylaxis begins with clindamycin 600mg IV q8h **and** ciprofloxacin 400mg IV q12h x 72h as above. There should be a low threshold to obtain bronchoscopy \ BAL and widen coverage (usually adding azithromycin or transitioning to vancomycin and piperacillin\tazobactam if a patient's condition worsens.

h. Intra-abdominal abscess

After source control is achieved (via surgical or IR guided drainage), initiate treatment with piperacillin / tazobactam 3.375 g IV q 8 hours. Narrow antibiotics per culture and sensitivity data when available. Most patients should receive 5-7 days of antibiotic therapy.

## Empiric Therapy for Fungal Infections

- a. Fungal Overgrowth on Mucous Membranes  
Often seen after administration of broad-spectrum antibiotics and does not necessarily require treatment. If desired, nystatin 5-10cc oral swish & swallow/spit q6h is usually sufficient.
- b. Candidal Cystitis  
Remove or change Foley catheter. Except in neutropenic patients, Candida in the bladder rarely disseminates and does not infect the kidneys. If asymptomatic candiduria, no treatment is required other than removing or changing indwelling catheter. If neutropenic or symptomatic, treat with amphotericin bladder washes (amphotericin B 20mg in 200cc sterile water; infuse into bladder q d for 3-5 days.)
- c. Abdominal Sepsis  
Many nosocomial Candida species are resistant to fluconazole, which should not be used for empiric treatment. Significant fungal infection in abdominal sepsis following surgery is rare and usually only seen in “tertiary peritonitis” – persistent abdominal sepsis after surgery and antibiotics, usually accompanied by multiple organ failure and/or in immunocompromised states. In such patients, optimal drainage should be ensured and cultures obtained. Obtain ID consult in all cases. Options include micafungin 100 mg IV q24h or voriconazole 6 mg/kg IV q12h first day, followed by 3 mg/kg q12h. All of these patients will require long-term treatment and close follow-up with infectious disease.
- d. Disseminated Fungal Infection or Systemic Disease Suspected  
Suspect systemic disease with:
1. Positive blood cultures (<50% sensitive).
  2. Multiple deep site isolation in a patient with fevers and not doing clinically well
  3. Isolation from urine plus wound or multiple sites.
- Obtain Infectious disease consult. Treatment options include micafungin 100 mg IV q24h or voriconazole at 6 mg/kg IV q12h first day, followed by 3 mg/kg q12 h.

**Note:** An isolated positive sputum for *C. albicans* is ***not an indication*** for antifungal therapy.



# UC San Diego Health Guideline for Antibiotic Duration in Hospitalized Patients

Approved by P&T Committee December, 2015

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<sup>1</sup>:**

Initial infection	10-14 days
Recurrent infection	14 days

## **Intra-abdominal Infections<sup>1-5</sup>:** Consult Infectious Diseases Service for any **complicated** infection

General; Complicated <small>[infection extends into the peritoneal space and is associated with either abscess or peritonitis]</small>		<b>Consult ID service;</b> 4-7 days >7 days if poor response or unable to achieve source control
Biliary tract infection <small>[cholecystitis and cholangitis]</small>	Uncomplicated	No antibiotics required after obstruction is relieved
	Complicated <small>[presence of SIRS*]</small>	<b>Consult ID service;</b> 4-7 days <b>PLUS</b> biliary drain >7 days if unable to achieve source control
Diverticulitis <sup>5</sup>	Mild pain/tenderness; no SIRS*	7-14 days oral antibiotics
	Complicated <small>[presence of abscess, free air or fistula, SIRS*]</small>	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	≤4 hours if repaired <12 hours 4-7 days if repaired ≥12 hours
	Appendix; non-necrotic or gangrenous	24 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 PaCO<sub>2</sub> < 32 mmHg; or WBC > 12 or < 4 or ≥ 10% bands

## **Clostridium difficile Infection<sup>6</sup>:**

Initial episode	Mild, moderate, severe*	10-14 days
First recurrence	Mild, moderate, severe*	10-14 days
Second recurrence	Vancomycin taper or pulse regimen: 10-14 days of vancomycin 125 mg PO four days per day, then 7 days of vancomycin PO 125 mg PO twice daily, then 7 days of vancomycin 125 mg PO daily, then 2-8 weeks of vancomycin 125 mg PO every 2 to 3 days	

\*Refer to EPIC® order set for definition of severity and appropriate antibiotic selection

<b>Infectious Diarrhea<sup>1,7</sup>:</b>	
<i>Campylobacter</i> spp.	5 days
<i>Escherichia coli</i>	3 days
<i>Salmonella</i> spp.	5-7 days 14 days if immunocompromised
<i>Shigella</i> spp.	3 days 7 days if immunocompromised
<i>Vibrio parahaemolyticus</i>	1-3 days
<i>Giardia</i> spp.	7-10 days

<b>Respiratory Infections<sup>1-3,8-13</sup>:</b>		
Community-acquired pneumonia	Afebrile for 48-72 hours <b>AND</b> stable; Non- <i>staphylococcus aureus</i> spp.	3-5 days <sup>2,8,9</sup>
	Persistent instability; <i>Staphylococcus aureus</i> ; <i>Legionella</i> ; Presence of empyema, lung abscess or necrotizing pneumonia	≥ 7 days <sup>8,9</sup>
Healthcare-assoc. pneumonia; Hospital-acquired pneumonia; Ventilator-assoc. pneumonia	Good clinical response	7-8 days <sup>3,10</sup>
	<i>Pseudomonas aeruginosa</i> ; BCx POS, poor response	≥ 7-14 days <sup>10</sup>
Aspiration pneumonia <sup>10</sup>		7-10 days
Group A <i>Streptococcal</i> pharyngitis <sup>11,12</sup>		3-6 days   Azithromycin, cephalosporins
		10 days   PCN, amoxicillin
COPD exacerbation; infectious etiology <sup>13</sup> [positive for dyspnea, sputum production, and sputum purulence]		5-10 days

Abbreviations: Bcx: blood culture, POS: positive; COPD: chronic obstructive pulmonary disease; PCN: penicillin

<b>Urinary Tract Infection (UTI)<sup>1-3,14-18</sup>: Consult Infectious Diseases Service if presence of <i>bacteremia</i></b>		
Asymptomatic bacteriuria <sup>14</sup>	No antibiotic therapy recommended except in pregnancy and certain sub-populations (i.e. urologic instrumentation, immunosuppressed), then 3-7 days	
Uncomplicated cystitis in women <sup>15</sup>	3 days	Sulfamethoxazole-trimethoprim, fluoroquinolones
	5 days	Nitrofurantoin
	3-7 days	β-lactam agent
Complicated <sup>a</sup> cystitis in men and women <sup>15</sup>	10-14 days	
Pyelonephritis <sup>15</sup>	7 days	Fluoroquinolones
	10-14 days	β-lactam agent
	14 days	Sulfamethoxazole-trimethoprim
Catheter-associated (CA-UTI) <sup>16,17</sup>	Asymptomatic	If bacteriuria persists > 48 hours after catheter removal, treat for 3-7 days
	Symptomatic <sup>b</sup>	If prompt resolution of symptoms, treat for 7 days <b>PLUS</b> remove/replace catheter If delayed response, treat for 10-14 days <b>PLUS</b> remove/replace catheter
Evidence of UTI <b>AND</b> BCx POS <sup>18</sup>		<b>Consult ID Service</b> ; 14 days

Abbreviations: BCx: blood culture; POS: positive

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]**

<b>Diabetic Foot Ulcer<sup>19</sup>: Manage jointly by wound, orthopedic, and ID services with antibiotics &amp; surgical debridement</b>		
Soft tissue involvement <u>without</u> debridement	Mild [local cellulitis < 2 cm, limited to skin and subcutaneous tissue]	1-2 weeks
	Moderate [local cellulitis > 2 cm, involving deep structures; no SIRS*]	1-3 weeks
	Severe [local cellulitis + SIRS*]	2-4 weeks
Bone or joint involvement s/p amputation	No residual tissue or bone	2-5 days
	Residual soft tissue (no bone)	1-3 weeks
	Residual tissue and viable, infected bone	4-6 weeks
	Residual dead bone	> 12 weeks
Bone or joint involvement <u>without</u> amputation		> 12 weeks

\*SIRS >= 2 of the following criteria: temperature > 38C or < 36 C, HR > 90 beats/min, RR > 20 breaths/min or PaCO2 < 32 mmHg; or WBC > 12 or < 4 or >= 10% bands

<b>Skin and Soft Tissue Infections (SSTI)<sup>1-3,20</sup>:</b>		
Cellulitis	General [including impetigo, ecthyma]	5 -7 days > 5 days if inadequate response
	Orbital involvement	7 days; up to 6 weeks if evidence of bone involvement
	Recurrent [3-4 episodes per year]	4-52 weeks (prophylaxis)
Purulent SSTI [cutaneous abscesses, furuncles, carbuncles, inflamed epidermoid cysts]		Variable; dependent on presence of SIRS and clinical response
Surgical site infection (SSI)	Uncomplicated	No antibiotic therapy recommended; Incision and drainage only
	Complicated [erythema, induration > 5 cm from wound edge, temp >38.5°C, HR > 110 beats/min, WBC > 12]	Variable duration, dependent on clinical response
Deep tissue infection [Necrotizing fasciitis, Fournier Gangrene, Clostridial gas gangrene, myonecrosis]		Continue for duration of surgical debridement, clinical improvement, and afebrile x 48-72 hours
Animal bites	Prophylaxis (immunocompromised host)	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

## 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.<sup>1-3</sup> In addition, studies have shown that inappropriate use of PPIs is relatively common.<sup>4-6</sup>

### 1) Stress ulcer prophylaxis:

- a) Histamine H<sub>2</sub>receptor antagonists (H<sub>2</sub>-antagonists) should be used FIRST for stress ulcer prophylaxis in ICU patients<sup>7</sup>.
- 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)<sup>8,9</sup>
  - Patients requiring mechanical ventilation<sup>10</sup>
  - Glasgow Coma Score <10<sup>11</sup>
  - Burn injury>35% of body surface
  - Acute spinal cord injury<sup>12</sup>
  - Transplant patients in the immediate peri-operative period<sup>13</sup>
  - Hepatic failure<sup>14</sup>
  - Multiple trauma (Injury Severity Score >15)<sup>51\*</sup>
  - 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)<sup>16,17</sup>
- 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 H<sub>2</sub>-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)<sup>18,19</sup>
  - Active upper GI bleeding<sup>20,21</sup>
  - Documented peptic ulcer disease<sup>22</sup>
  - Documented erosive esophagitis/ hypersecretory conditions (Zollinger –Ellison syndrome)<sup>23</sup>
  - Treatment of *Helicobacter Pylori*<sup>24,25</sup>
- 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<sup>26-30</sup> (e.g. aspirin, clopidogrel, prasugrel, dipyridamole)
- c) IV PPI use has no know advantage over oral/enteral PPIs unless the patient in NPO.

# UC San Diego Health System Medication Use Guideline: Stress Ulcer Prophylaxis and Proton Pump Inhibitor (PPI) Use

Approved by P&T Committee January 2011, November 2013, April 2015

**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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## 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  $\geq$  7 days or with malnutrition prior to admission.

## NPO Guidelines for Patients Requiring an Operation

The Primary Registered Nurse and Physician can refer to the following guidelines for criteria to make patient NPO prior to operative procedures.

### PROCEDURE:

All surgical critical care and trauma patients will be use the following NPO guidelines.

The guidelines may be used for all critical care patients, per RN and MD discussion:

1. For patients with ~~cuffed~~ endotracheal tube or cuffed tracheostomy tube, ~~post-pyloric~~ enteral feeds should be ~~continued until time of surgery~~.
2. For patients with cuffed endotracheal tube or cuffed tracheostomy tube, ~~gastric enteral~~ feeds should be ~~held four (4) hours prior to anticipated surgery~~.
3. For patients with a cuffed endotracheal tube that will undergo tracheostomy, or any cuffed tube exchange where the tube is removed or the cuff deflated as a part of the procedure, should have gastric or post-pyloric feeds held eight (8) hours prior to anticipated procedure.
4. For patients who DO NOT have cuffed endotracheal or tracheostomy tube, feeds need be stopped eight (8) hours prior to anticipated surgery.
5. In patients where enteral feeds are held, significant effort should be placed to
  - a. adjust feeding rate to compensate
  - b. hold or adjust insulin accordingly
  - c. add or start D10 infusion –refer to Guideline for Nutrition on Hold Unexpectedly
  - d. start feeds as early as possible after surgery

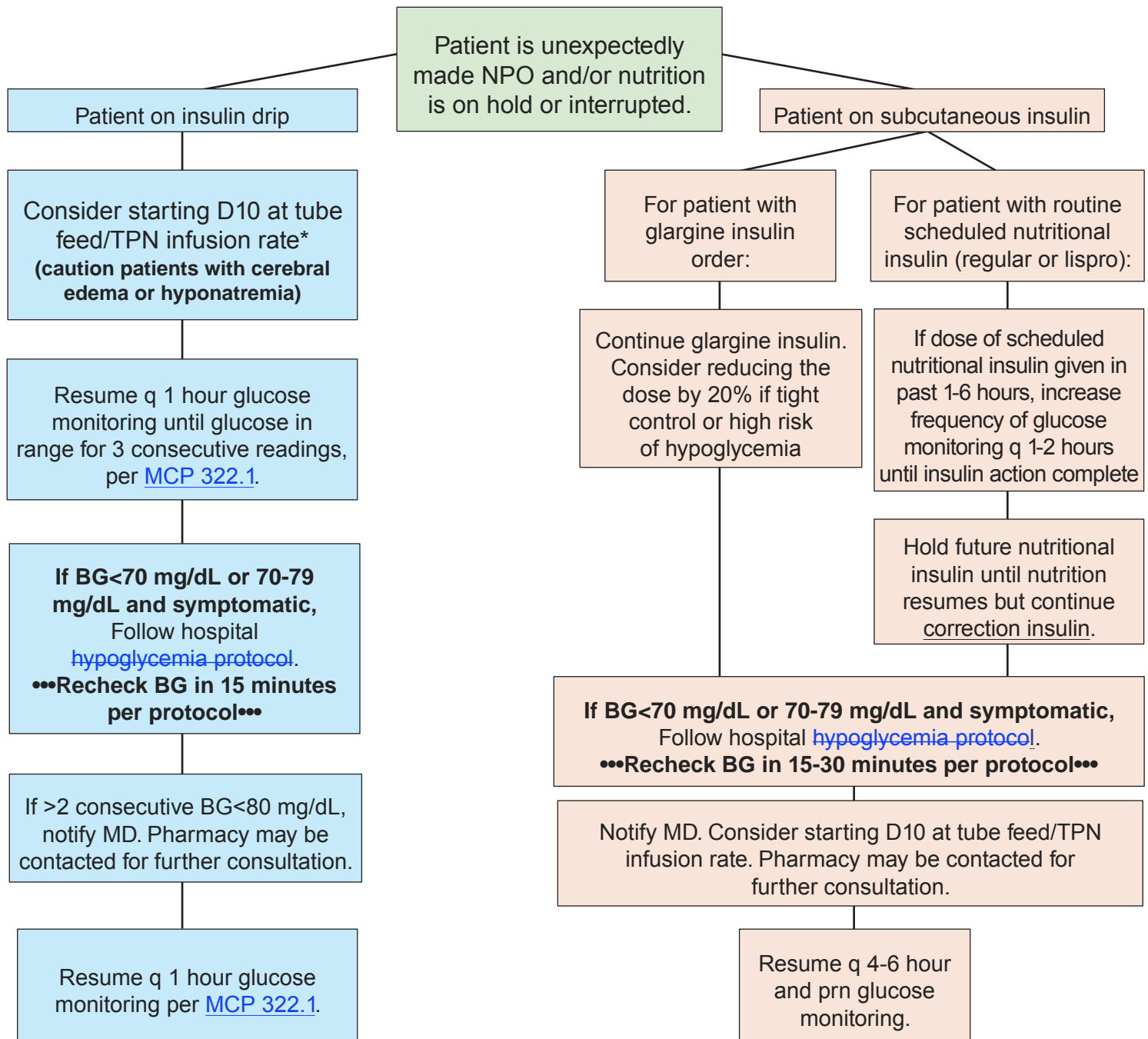
## Cortrak Post Pyloric Feeding

The CORTRAK Enteral Access system uses electromagnetic technology to enhance the safety of bedside placement of small-bore nasoenteric feeding tubes. The guidance system directs feeding tube placement by tracking the relative location of the tube as it proceeds down the alimentary tract. This visual guidance aids in avoiding placement in the pulmonary system and facilitates postpyloric placement of feeding tubes. Proper and timely placement of small-bore nasoenteric feeding tubes using the CORTRAK□□system will assist with the safety of bedside placement procedure and assist with implementation of enteral nutrition therapy for critically ill patients.

1. Critical Care RN's who have completed CORTRAK training, including placements supervised by a Super User will be authorized to insert small bore feeding tubes using the CORTRAK device in the critical care units.
2. Optimal goal is for tube tip to have placement verified in the jejunum via abdominal X-ray by radiologist. Acceptable goal is for the tip of the tube to be placed postpyloric.

3. Residuals volume assessment can continue and may indicate movement of catheter out of post pyloric placement, or other reasons for not absorbing enteral nutrition.
4. The operator must clean the unit after every patient use, per UC San Diego standard & manufacturer's instructions.
5. RESPONSIBLE PARTY - Critical Care RN's that have completed device and procedure training.
6. DOCUMENTATION – CCRN initiates LDA charting in EPIC with tube type, size, depth inserted. A note should indicate name of inserter (if other than assigned RN), patient response to insertion, unexpected outcomes and nursing interventions, medications administered, patient and family education, as appropriate.
7. Paper form: Use MD progress note, include tube size, length inserted, and anatomic landmarks associated with placement. Place a strip of the Cortrak feeding tube insertion path on the note.





**\*Alternatives:**

1. Decrease Rate of Insulin Drip - Contact pharmacy to decrease insulin drip Insulin Sensitivity Coefficient (ISC):  
 If drip > 6 units/hr → decrease ISC by 50% and adjust per insulin protocol  
 If drip < 6 units/hr → decrease ISC to 0.01 and adjust per insulin protocol
2. Stop insulin drip and start subcutaneous insulin correction scale insulin with q2-4h monitoring. Suggest administering lispro q4h or regular insulin q6h. (Patients with Type 1 Diabetes Mellitus need basal insulin at all times; do NOT use correction scale alone for Type 1 Diabetes Mellitus.)
3. Call Pharmacy for assistance

# 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 dyssynchrony, and/or ICU delirium.

- The need for the ongoing management of pain, agitation, and delirium should be reassessed often in ICU patients (1B).
- ICU patients should be awake and able to purposefully follow commands, unless a clinical indication for deeper sedation exists (1B).
- Use a multidisciplinary team approach, including: 1) provider education; 2) preprinted and/or computerized protocols and order forms; and 3) a quality ICU rounds checklist, to implement and facilitate pain, agitation, and delirium management guidelines and protocols in adult ICUs (1B).

### 1. Assess and treat Pain:

- Pain assessment should be routinely performed in all ICU patients (1B).
- Self-report is preferred over the use of behavioral pain scales in patients who are able to communicate (B).
- The BPS and CPOT\* are the most valid and reliable behavioral pain scales for use in ICU patients who cannot self-report (B).
- Vital signs should not be used alone to assess pain, but they may be used adjunctively for pain assessments (2C).
- Preemptively treat chest tube removal with either analgesic and/or non-pharmacologic therapy (1C).
- Suggest preemptively treating other types of procedural pain with either analgesic and/or non-pharmacologic therapy (2C).
- Use opioids as first-line therapy for treatment of non-neuropathic pain (1C).
- Use gabapentin or carbamazepine, in addition to opioids, for treatment of neuropathic pain (1A).
- Use thoracic epidural anesthesia/analgesia for postoperative analgesia in abdominal aortic surgery patients (1B).
- Suggest thoracic epidural analgesia for patients with traumatic rib fractures (2B).

### 2. Assess and treat Agitation:

- Depth and quality of sedation should be routinely performed in all ICU patients (1B).
- The RASS and SAS† are the most valid and reliable scales for assessing quality and depth of sedation in ICU patients (B).
- Target the lightest possible level of sedation and/or use daily sedative interruption (1B).
- Use sedation protocols and checklists to facilitate ICU sedation management (1B).
- Suggest using analgesia-first sedation for intubated and mechanically ventilated ICU patients (2B).
- Promote sleep in ICU patients by controlling light and noise, clustering patient care activities, and decreasing stimuli at night (1C).

### 3. Assess and treat Delirium:

- Delirium assessment should be routinely performed in all ICU patients (1B).
- The CAM-ICU and ICDSC delirium monitoring tools are the most valid and reliable in ICU patients (A).
- Mobilize early when feasible to reduce the incidence and duration of delirium, and to improve functional outcomes (1B).
- Avoid antipsychotics in ICU patients who are at risk for torsades de pointes.
- Avoid benzodiazepines in ICU patients with delirium unrelated to ETOH/benzodiazepine withdrawal (2B).
- Suggest using dexmedetomidine over benzodiazepines for sedation of ICU patients with delirium (2B).

\*: Behavioral Pain Scale (BPS) and the Critical-Care Pain Observation Tool (CPOT).

†: Richmond Agitation-Sedation Scale (RASS) and Sedation-Agitation Scale (SAS).

# SICU PAD Protocol - 2016



- Rule out/correct reversible causes
- Use non-pharmacologic treatment
- Optimize the environment

- Reassess goals frequently
- Titrate and taper therapy to maintain goals
- Perform awakening trial, if appropriate

## PAIN

- Is patient in pain?**
- Use pain scale to assess pain
  - Set goal for analgesia

Consider potential causes

**TARGET: Critical Care Pain Observation Tool < 3**  
**Behavioral Pain Scale < 6**

**Hemodynamically stable**

- Morphine
- HYDRomorphone
- FentaNYL

**Hemodynamically unstable**

- FentaNYL

**Renal impairment**

- FentaNYL
- HYDRomorphone

**Primary approach:**  
bolus for pain control and then infusion to sustain control

- Morphine infusion, start 1-4 mg/hr. Max 10 mg/hr
- HYDRomorphone infusion, start at 0.5-1 mg/hr. Max 5 mg/hr
- FentaNYL infusion at 25-50 mcg/hr. Max 200 mcg/hr

## AGITATION

- Is patient agitated?**
- Use scale to assess patient
  - Set goal for sedation

Consider potential causes

**TARGET: Richmond Agitation Sedation Scale (RASS): -2 to 0**

**DRUG SELECTION - Consider analgesia-first sedation**

**NON-Benzodiazepine sedation:**

- Propofol (*ventilated patients*)
- Dexmetomidine (*especially if failing SBT with agitation*)

**Alcohol withdrawal, hemodynamic instability:**

- LORazepam
- Midazolam (*caution – metabolites after 24h*)

Lighter levels of sedation are associated with improved outcomes.

Avoid benzodiazepines in mechanically ventilated adult and elderly patients unless in alcohol or benzodiazepine withdrawal or if hemodynamically unstable.

## DELIRIUM

- Is patient delirious?**
- Use scale to assess pain

Consider potential causes

**TARGET: Confusion Assessment Method for the ICU (CAM-ICU): Negative**

**Non-Pharmacologic Package for Delirium:**

- Avoid benzodiazepines for sedation
- Daily awakening trials, breathing trials
- HOB elevated
- Continually reorient patient
- Perform early mobilization
- Promote effective sleep-wake cycles
- Remove catheters and restraints early
- Ensure use of eyeglasses, hearing aids
- Minimize noise/stimulation at night
- Assess for constipation

**For Sleep Promotion:**  
Ramelteon 8mg po qhs  
254

**Symptom Relief for Delirium\*:**

**HYPOactive Delirium:** Acute, fluctuating mental status, perceptual disturbance or depressed level of consciousness, without psychomotor agitation:

1. Haloperidol po prn\*\* (Preferred)
2. RisperiDONE po prn\*\*
3. Haloperidol IM/IV prn \*\*

**HYPERactive Delirium:** Acute, fluctuating mental status with psychomotor agitation, perceptual disturbance or depressed level of consciousness.

1. Haloperidol po prn\*\* (Preferred)
2. RisperiDONE po prn\*\*
3. Scheduled Haloperidol/risperdone po/IM/IV \*\*

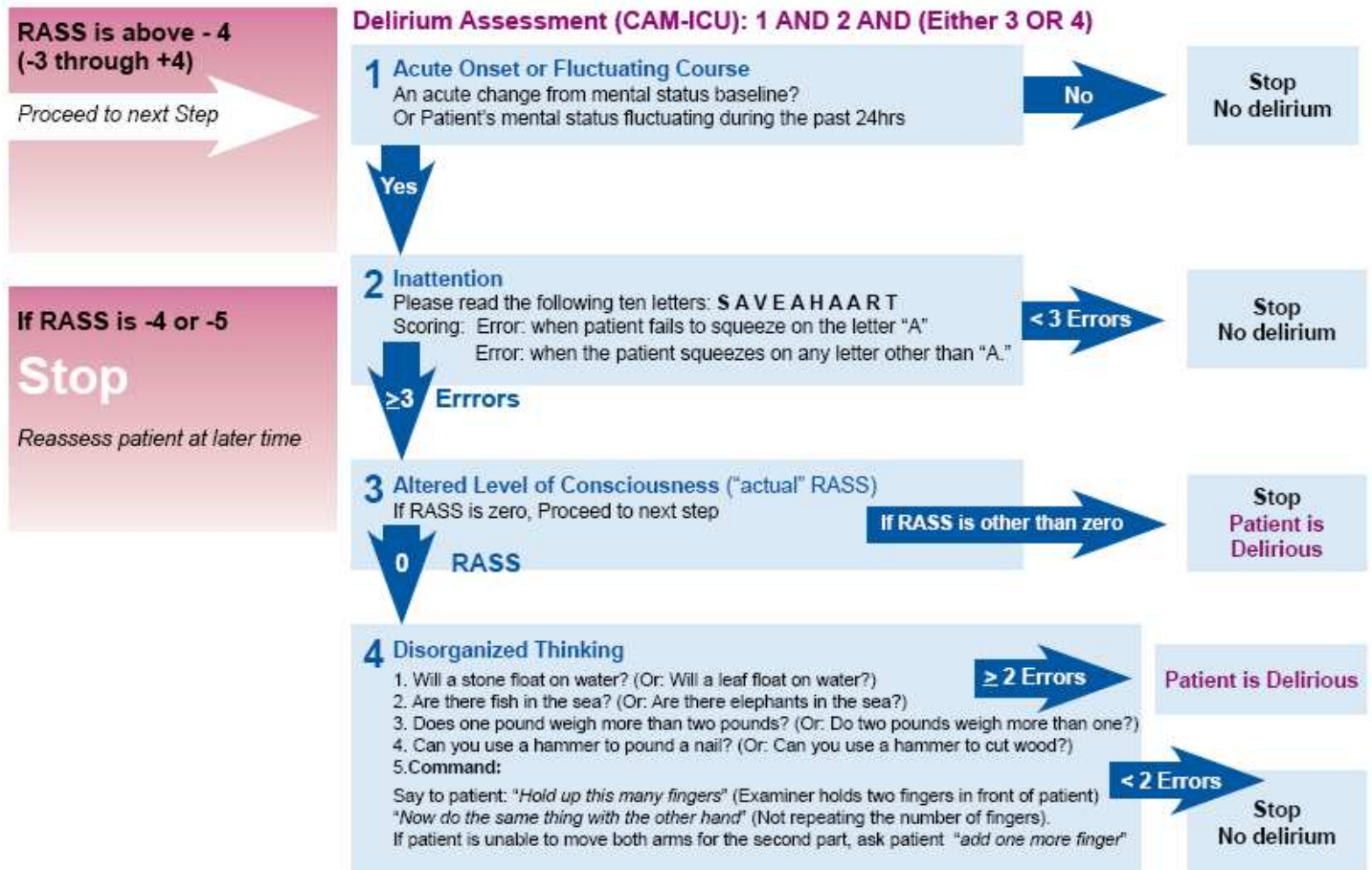
**High Risk of Extrapyramidal Symptoms:**

- QUETiaprine 25 mg po q2h prn

\*Little benefit of pharmacoprophylaxis in delirium  
\*\*Caution if QTc > 440 mSec, risk of Torsades de pointes

### 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
<p>1A: Is the patient different than his/her baseline mental status? OR</p> <p>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?</p>				
FEATURE 2: Inattention		Positive, if either score for 2A or 2B is less than 8	Positive	Negative
<p>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.</p>				
2A: AUDITORY (Letter – ASE)		Record score (enter NT for not tested)	Score (out of 10):	
<p><u>Directions:</u> Say to the patient, "I am going to read you a series of 10 letters. Whenever you hear the letter 'A' indicate by squeezing my hand." Read letters from the following letter list in a normal tone: S A V E A H A A R T</p> <p>Scoring: Errors are counted when patient fails to squeeze on the letter "A" and when the patient squeezes on any letter other than "A."</p>				
2B: VISUAL (Pictures - ASE)		Record score (enter NT for not tested)	Score (out of 10):	
<p><u>Directions:</u> Use the Picture Packets (A and B) on the next page.</p>				
FEATURE 3: Disorganized Thinking		Positive, if the combined score is less than 4	Positive	Negative
3A: Yes/ No Questions				Combined Score (3A + 3B):
(Use either Set A or B, alternate on consecutive days if necessary):				
Set A		Set B		_____ (out of 5)
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

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# UC San Diego Health System

## Guideline for IV Hypertonic Saline (3%, 23.4% sodium chloride) Use

Approved by the Pharmacy and Therapeutics Committee 09/18/2013

### Indications for Hypertonic Saline

- Treatment of increased intracranial pressure
- Treatment of cerebral edema
- Clinical signs of cerebral herniation
- Treatment of acute and chronic euvolemic hyponatremia

		23.4% NaCl <sup>^</sup>	3% NaCl <sup>*</sup>
<b>Line Access</b>		Central line only	Central line preferred due to high osmolarity  For emergent situations, peripheral (large vein with good blood flow) may be utilized
<b>Usual Dosing</b>	<b>Bolus</b>	30 mL over 3-5 min <b>(Brain Code only)</b>	100-250 mL over 15-30 min
	<b>Infusion</b>	Inappropriate to infuse	5-150 mL/hr (start at 5-30 mL/hr)
<b>Who May Prescribe</b>	<b>Bolus</b>	Authorized prescriber under supervision of an attending intensivist, critical care fellow, attending neurosurgeon, or attending neurologist	Neurology, Neurosurgery, Neuro Critical Care, Trauma, or Pulmonary Critical Care Prescriber
	<b>Infusion</b>	Inappropriate to infuse	Any prescriber
<b>Who May Administer</b>	<b>Bolus</b>	Authorized prescriber under supervision of an attending intensivist, critical care fellow, or attending neurologist in the ICU (any location in emergent situation)	RN or MD in the ICU (any location in emergent situation)
	<b>Infusion</b>	Inappropriate to infuse	RN or MD in ICU, IMU, telemetry or Med/Surg room

<sup>^</sup>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)

<sup>\*</sup>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)

### Dosing and Monitoring Guidance

- For neurologic indications, including acute hyponatremia (<48 hrs):**
  - The dose/rate of 3% sodium chloride to be decided by treating team
  - Rate of sodium correction may be higher than for chronic hyponatremia
  - Recommended monitoring serum sodium a minimum of every 6 hours
  - For acute hyponatremia (<48 hrs), rate of correction may be faster than for chronic hyponatremia
- For treatment of euvolemic hyponatremia of chronic (≥48 hrs) or unknown duration:**
  - Etiology may include SIADH, hypothyroidism, or glucocorticoid deficiency
  - Calculate the total body sodium deficit by:
    - 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



# UC San Diego Health System

## Guideline for IV Hypertonic Saline (3%, 23.4% sodium chloride) Use

Approved by the Pharmacy and Therapeutics Committee 09/18/2013

- Replacement formula for the first 24 hours:
  - a.  $0.6 \times 10 \times \text{___ kg} = \text{mEq sodium to be replaced}$
  - b. 3% sodium chloride contains 513 mEq/L sodium and 513 mEq/L chloride
  - c. Volume of 3% sodium chloride =  $\text{___ mEq sodium} / 513 \times 1000 = \text{mL} / 24 \text{ hours}$
  - d. Rate ( mL/hour) = total number of mL per 24 hours / 24 hours
- Infuse the calculated dose for first 24 hours, over 24 hours
- The order should be assessed periodically by the prescriber for continued therapy
- **For chronic hyponatremia ( $\geq 48$  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
  - 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 judgement***

# UC San Diego Health System

## Guideline for IV Hypertonic Saline (3%, 23.4% sodium chloride) Use

Approved by the Pharmacy and Therapeutics Committee 09/18/2013

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# **Disaster Planning**

## UC San Diego Health System Codes

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

**Code Adam:** Missing or abducted infant or child within the hospital.

**Code Blue:** Life-threatening cardiac or respiratory problems.

**Code Gray:** Any person in danger of injuring themselves or others intentionally or unintentionally.

**Code Orange:** Significant incident within the hospital that interrupts normal hospital functions such as major utility outages.

**Code Pink:** Maternal/infant emergency response. Newborn in distress or an unexpected delivery complication outside the Labor and Delivery area.

**Code Red:** Any fire, smoke or smoldering material.

**Code Stroke:** Onset of one or more stroke warning signs such as numbness, weakness, dizziness, headache, and confusion.

**Code Triage:** Any external event that generates multiple casualties which may exceed capacity of the Emergency Department (ED) and Trauma Center to manage. Activated by the ED attending physician and/or Administrator on Call (AOC).

**Code 10:** Bomb threat and/or Suspicious Package.

## Ten Predictable Surprises Disrupting Hospital Processes in Disasters

1. Communications breakdown creates confusion at the hospital
  - Hallmark of a Mass Casualty Incident
2. Minimally injured arrive in the first wave of patients
  - Self-transport and “home-boy” ambulance
3. “Convergers” descend on hospital
  - Media, Families, Worried Well, Poseurs and Ghouls
  - Lockdown, perimeter, direct to predetermined areas
4. Mass volunteers appear
  - Need an Emergency credentialing plan, drill.
5. Surge Capability needed
  - Need for more specialized supplies, equipment, personnel
  - “No time for Pyxis!”
6. Surge Capacity needed
  - More beds, ORs, ER, ICU space, cancel elective OR, discharge/transfers.
7. Record keeping becomes overloaded
  - Paper backup to EHR, Admissions drills, premade kits with armbands, tags.
8. Need to adopt Population Based Standard
  - Difficult decision by providers and ICS
  - Need for compassionate care for expectant
9. Caregiver needs return to the forefront
  - Need to watch each other, stress reaction, personal disaster kits, debrief, later PTSD.
10. The Hospital becomes the final victim
  - Overwhelmed, Triage Hospital, possible ruined reputation and finances.

Adapted from Potter C: Trauma System News, 7/22/2016

# Disaster Planning

MCP 801.3, Attachment D

Functional Teams-Hillcrest

3/2016

## FUNCTIONAL AREAS/TEAMS UC San Diego Health

### UC SAN DIEGO HEALTH-(UCSDH)-HILLCREST

#### Hillcrest Functional Areas / Team Listings (Key sites are underlined):

- Hospital Command Center
- Triage Area
- Labor Pool and Credentialing
- Limited Treatment Center
- Family Assistance Center (see Annex for expanded version)
- Trauma Resuscitation Room
- Acute and Delayed Treatment Areas of the Emergency Department
- Shock and Holding Area
- Media Center
- Morgue
- Victim Search Team
- Damage Assessment Team
- Hazardous Material/Radiation Incident Response Team
- Clergy, Emergency Response
- Critical Incident Stress Management Team
- Pulmonary Screening Team
- Childcare Center
- Dependent Care (Adult)
- Mass Prophylaxis Team
- Pharmacy Security and Evacuation
- CDC ChemPack
- Palliative Care (see Annex for expanded version)
-

## Hospital Command Center (Hillcrest)

Rationale:

To establish a centralized command and resource function for Code Orange and Code Triage activities.

Primary Location: Administrative Conference Room (ACR)

Secondary Location: Facilities Engineering Conference Room, 330 Dickinson

Contact Phone Number: 543-7000 (during activation); analog back-up line in the ACR (Hospital Command Center - Hillcrest) as a backup FAX that can be activated if needed. The FAX/Scanner/printer machine is located in the ACR closet and phone number is on the machine and the wall jack. The number is (619) 471-0672 (X10672)

Recorded Information: 619-543-6555

FAX Number: (619) 543-2454 (Staffing Office room 1-111 located at Nursing Administration –room 1-110); If ICC FAX line is activated (location ACR) during incident HCC to publish (619) 471-0672 (X10672)

Responsible Departments: As designated under the Hospital Incident Command System (HICS)

Primary Responsibilities:

1. Make certain the HCC has been established.
2. Make certain assignments/job action sheets have been issued.
3. Coordinate resources in response to requests from the Scene Commander.
4. Expand HCC staffing as emergency dictates.
5. Maintain accurate records of HCC decisions and resource allocations.
6. Activate functional modules as needed.
7. Deactivate code when appropriate.
8. Provide critique of HCC function following resumption of normal operations.

Suggested Team Membership:

- Administrator-on-Call (AOC)
- Director of Security
- Emergency Management personnel
- Facilities Engineering
- On Duty Nursing Supervisor
- Safety Officer
- Telecommunications
- Administrative Services and Regulatory Affairs

Activation Procedure:

Personnel will be notified by MNS, overhead speaker system, or paging system by text paging generated via the Telecommunications Office.

Deactivation Procedure:

~~The Incident Commander~~ will notify Telecommunications at the point at which HICS is to be deactivated. At conclusion of the Code, the "ALL CLEAR" status will be broadcast via MNS, overhead paging or text paging system.

Activation Authority:

~~Code Triage - E.D.~~ Attending Physician or designee and/or Administrator on Call  
Code Orange - Any employee

### Hillcrest Triage Area

Rationale:

For rapid assessment and sorting of multiple victims by injury type and severity.

Primary Location: Medical Offices North - Outpatient Center Loop

Secondary Location: Outside of the Emergency Department entrance, covered area.

Contact Phone Number: 619 543-3509 (at Triage Loop); 543-2154 ED – Nurses’ Station inside ED

FAX Number: 619 543-3122 (location ED Nurses’ Station)

Responsible Department: Emergency Department

Primary Responsibilities: Notify HCC when area/team is ready and functional.

1. Patient reception.
2. Rapid assessment and triage, tagging.
3. Initiate patient tracking.
4. Initiate transport of patients per Code Triage plan:
  - a. Shock and Holding (PACU) x36130: for patients in shock, or multi-trauma and needing operation.
  - b. Trauma Resuscitation Room x36746; X36747: for patients in shock, or multi-trauma and needing operation.
  - c. Emergency Department x36400: For primary medical problems, surgical problems not requiring operation; primary orthopedic injuries; psychiatric patients; and overflow of Shock and Holding area.
  - d. Limited Treatment Area (Cast Room) x33760: For walking wounded, minor psychiatric patients.
  - e. Burn Unit x36502
  - f. Labor and Delivery x32533
5. Record and report numbers of patients, triage category, and destination to bed assignments/patient tracking at regular intervals.

Team Membership:

- Emergency Department Attending Physician
- Emergency Medicine Resident
- Nurse
- Admissions and Registration Team

Other Personnel:

- Transport Personnel assigned by Labor Pool
- Security

Activation Procedure:

Personnel will be notified by MNS, overhead speaker system, or paging system by text paging generated via the Telecommunications Office.

Deactivation Procedure:

The Incident Commander will notify Telecommunications at the point at which HICS is to be deactivated. At conclusion of the Code, the “ALL CLEAR” status will be broadcast via the overhead paging and text paging system.

Activation Authority:

Code Triage – Automatically set up following code activation by ED Attending Physician  
Code Orange – Incident Commander

**Hillcrest  
Limited Treatment Center**

Rationale:

Treatment of minor injuries and/or medical problems not requiring hospitalization. Retrieve limited treatment disaster cart from MON Room 3-124 to augment care supplies.

Primary Location: First Floor Outpatient Center, Orthopedic Clinic (Orthopedic Technology Services Department "Cast Room")

Contact Phone Number: 619-543-2876 (Cast Room)  
619-543-6312 (Orthopedic Clinic- main line front desk; 471-0769 backline)  
FAX Number: 619-471-0738 (Ortho Clinic Fax)

Secondary Location: Third Floor Medical Offices North Room 1, Surgery Clinic  
Contact Phone Number: 543-6886 Main desk; 543-6958 Nurses' Station  
FAX Number: 543-6832

Responsible Department: Ambulatory Care Services Administration

Primary Responsibilities: Notify HCC when area/team is ready and functional.

1. Wound care, "walking wounded" injuries.
2. Minor suturing.
3. Oxygen administration.
4. Treatment of minor medical problems.
5. Treatment of minor psychiatric problems not requiring restraint.

Team Membership:

- Two treatment teams consisting of one physician, one nurse, and one recorder. One backup patient treatment team.

Code Triage: Personnel will be notified by overhead speaker system and with the Medical Center's paging system by text paging generated via the Telecommunications Office.

Deactivation Procedure:

The Incident Commander will notify Telecommunications at the point at which HICS is to be deactivated. At conclusion of the Code, the "ALL CLEAR" status will be broadcast via the overhead paging and text paging system.

Activation Authority:

Code Triage – Automatically set up following activation by ED Attending Physician  
Code Orange – Incident Commander

## Hillcrest Trauma Resuscitation Room (TRR)

Rationale:

To provide primary receiving area for patients in need of emergency surgery evaluation and operative treatment.

Primary Location: **Second Floor adjacent to SICU**

Secondary Location: To be announced by the Hospital Command Center

Contact Phone Number: 619 543-6747; X36746 Resus Room; 543-7428 SICU

FAX Number: 543-5716 (SICU)

Responsible Departments: Department of Surgery, Division of Trauma; Department of Anesthesiology

Primary Responsibilities: Notify HCC when area/team is ready and functional.

1. Resuscitate severely injured patients.
2. Perform basic diagnostic studies (lab, x-ray) on trauma patients.
3. Triage patients in order of severity of injury.
4. Make appropriate dispositions (OR, ICU, Floor).
5. Expedite transfer of patients out of TRR once workup is complete to allow new patients to be admitted.
6. Report all patient movements and transfers to the ICC.

Team Membership:

- On call trauma attending physician or fellow
- Additional trauma staff as available or on call back
- Chief, senior, and junior residents on Trauma Service
- Junior residents on other general surgery services, neurosurgery, and cardiothoracic surgery services
- Resuscitation Room nurses from SICU
- Two Trauma RNs per shift
- Trauma coordinators

Activation Procedure:

Code Triage: Personnel will be notified by overhead speaker system and with the Health System paging system by text paging generated via the Telecommunications Office.

Deactivation Procedure:

The Incident Commander will notify Telecommunications at the point at which HICS is to be deactivated. At conclusion of the Code, the "ALL CLEAR" status will be broadcast via the overhead paging and text paging system.

Activation Authority:

Code Triage – Automatically set up following code activation by Attending Physician  
Code Orange – Incident Commander



## Acute and Delayed Treatment Areas of the Emergency Department

### Rationale:

Site for management of medical cases requiring acute or delayed care until admission, transfer or discharge during an emergency situation. Patients will be triaged into ED depending on injury/illness type and severity.

Primary Location: Emergency Department and Urgent Care

Secondary Location: Surge tents when activated.

Contact Phone Number: 619 543-2154 ED – Nurses’ Station inside ED

FAX Number: 543-3122 (location ED Nurses’ Station)

Responsible Department: Emergency Department

Primary Responsibilities: Notify HCC when area/team is ready and functional.

1. Triage and either treat or send home patients already in waiting room who have minor complaints, to clear patient surge.
2. Patient management.
3. Ongoing assessment and re-triage
4. Documentation patient care in electronic record or hard copy.
5. Record and report numbers of patients, triage category, and destination to bed assignments/patient tracking at regular intervals.

### Team Membership:

- Emergency Department Physicians and Staff
- Augmented physicians and staff via labor Pool as requested

### Other Personnel:

Transport personnel assigned by Labor Pool

### Activation Procedure:

Personnel will be notified by overhead speaker system and with the Health System paging system by text paging generated via the Telecommunications Office.

### Deactivation Procedure:

The Incident Commander will notify Telecommunications at the point at which HICS is to be deactivated. At conclusion of the Code, the “ALL CLEAR” status will be broadcast via the overhead paging and text paging system.

### Activation Authority:

Code Triage – Automatically set up following

### Shock and Holding Area - Hillcrest

Rationale:

To provide secondary receiving area for patients in need of emergency surgery evaluation and operative treatment.

Primary Location: Second Floor Recovery Room (PACU)

Secondary Location: To be announced by the Incident Command Center

Contact Phone Number: 619 543-6130

FAX Number: 619 543-2586

Responsible Department: Department of Surgery, Division of Trauma, Department of Anesthesiology, and Department of Nursing

Primary Responsibilities: Notify HCC when area/team is ready and functional.

1. Resuscitate severely injured patients.
2. Perform basic diagnostic studies (lab, x-ray) on trauma patients.
3. Triage patients in order of surgical priority, for operating room time.
4. Make appropriate dispositions (OR, OR pre-op holding, ICU, Floor).
5. Hold and stabilize patients requiring surgery for whom Operating Rooms are not yet available. A pre-operative area will be set aside for this purpose. If needed, patients can be transferred to the ICU/Floor while awaiting surgery.
6. Report all patient movement and transfers to the HCC.

Team Membership:

- On call trauma attending physician
- Trauma Fellow
- Attending physicians and residents on General Surgery Services
- Surgery Attending physicians and residents
- Neurosurgery Attending physicians, chief resident and Neurosurgery residents
- All Attending physicians and residents from Plastic Surgery, ENT, and Urology Services
- Anesthesia staff and residents
- PACU nurses

Activation Procedure:

Code Triage: Personnel will be notified by overhead speaker system and with the Health System paging system by text paging generated via the Telecommunications Office.

Deactivation Procedure:

The Incident Commander will notify Telecommunications at the point at which HICS is to be deactivated. At conclusion of the Code, the "ALL CLEAR" status will be broadcast via the overhead paging and text paging system.

Activation Authority:

Code Triage – Automatically set-up following code activation by ED Physician.  
Code Orange – Incident Commander



# DISASTER TREATMENT RECORD

Name  
MR#  
DOB

PRE-HOSPITAL TRIAGE TAG #		Source		Date	
Patient Identification					
DECONTAMINATION		Decontamination needed:		Decontamination done:	
Performed at: <input type="checkbox"/> SCENE <input type="checkbox"/> UCSD Medical Center		<input type="checkbox"/> YES <input type="checkbox"/> NO		<input type="checkbox"/> YES <input type="checkbox"/> NO	
PRIMARY ROUTING					
NOTE: do not use "OR Resuscitation" during Code Triage.					
<input type="checkbox"/> TRAUMA RESUS ROOM		<input type="checkbox"/> BURN UNIT		<input type="checkbox"/> OTh ER (specify): <input type="checkbox"/> MORg UE	
<input type="checkbox"/> Shock AND h OLDING		<input type="checkbox"/> LIMITED TX CENTER		Medical Examiner notified Date/Time:	
<input type="checkbox"/> E.D.		<input type="checkbox"/> LABOR & DELIVERY			
CARE CLASSIFICATION					
<input type="checkbox"/> IMMEDIATE <input type="checkbox"/> DELAYED <input type="checkbox"/> MINOR <input type="checkbox"/> DECEASED					
PATIENT NAME (LAST, FIRST, MIDDLE INITIAL)					DATE OF BIRTH
STREET ADDRESS					SEX <input type="checkbox"/> Male <input type="checkbox"/> Female
CITY	STATE	ZIP	PHONE	RELIGION	
DESCRIPTION, FOR USE IF PATIENT UNABLE TO PROVIDE INFORMATION (HAIR, EYES, HEIGHT, w EIGHT, RACE, MARKS, BUILD, ARTICLES OF CLOTHING)			I refuse medical examination and treatment at this time.		
NEXT OF KIN			RELATIONSHIP	Date/Time	
ADDRESS					
LOCATION OF INCIDENT/ACCIDENT			NDMS CLASSIFICATION	RECEIVED FROM	
PRE-HOSPITAL TREATMENT		CHIEF COMPLAINT		ALLERGIES/ REACTIONS	
<input type="checkbox"/> Airway (type and time) _____		INITIAL HISTORY		CURRENT MEDICATIONS	
<input type="checkbox"/> Chest tube					
<input type="checkbox"/> IV (type and time) _____					
<input type="checkbox"/> Meds/narcotics (type/amt) _____					
<input type="checkbox"/> Other (specify): _____		LAST TETANUS SHOT <input type="checkbox"/> < 5 years <input type="checkbox"/> > 5 years			
PROBLEM ORIENTED INJURY LIST					
Specific or Suspected Injury	Orders	MD Initials	Date/Time Completed	RN Initials	
FINAL DISPOSITION: <input type="checkbox"/> ADMITTED <input type="checkbox"/> TRANSFERRED <input type="checkbox"/> DISCh ARg ED <input type="checkbox"/> MORg UE					
PHYSICIAN'S SIGNATURE/ PID #		DATE & TIME		NURSE'S SIGNATURE DATE & TIME	
PHYSICIAN'S SIGNATURE/ PID #		DATE & TIME		NURSE'S SIGNATURE DATE & TIME	

NOT FOR OFFICIAL USE

## 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

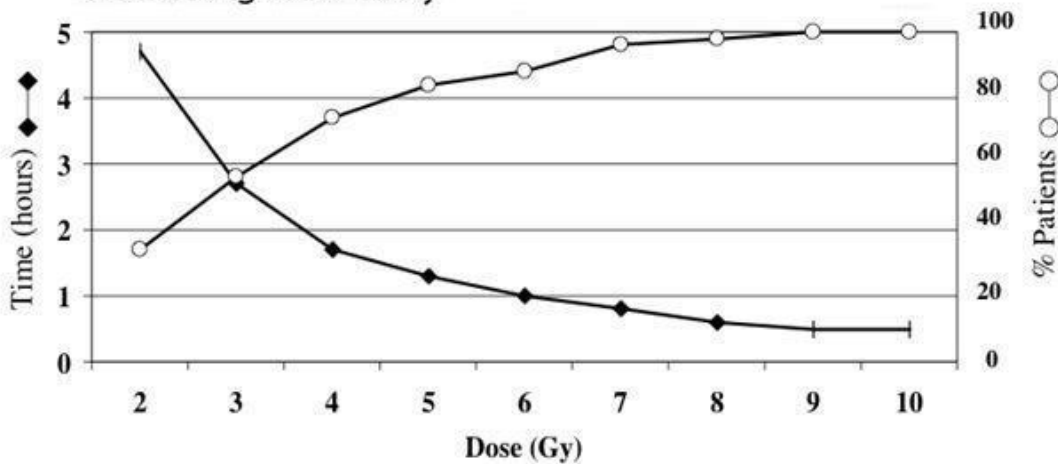
**Treatment considerations**

- 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.

Relationship between time to onset of vomiting and dose over a range of 2-10 Gy



**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 mm<sup>3</sup> suggests moderate exposure
  - absolute lymphocyte count <500 mm<sup>3</sup> 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
<b>Inhaled Anthrax</b>	2-6 days Range: 2 day to 8 weeks	Flu-like symptoms Respiratory distress	Widened mediastinum on chest X-ray (from adenopathy) Atypical pneumonia Flu-like illness followed by abrupt onset of respiratory failure	Gram stain ("boxcar" shape) Gram positive bacilli in blood culture ELISA for toxin antibodies to help confirm	Aerosol inhalation <i>No person-to-person transmission</i> Standard precautions	Mechanical ventilation Antibiotic therapy Ciprofloxacin 400 mg iv q 8-12 hr Doxycycline 200 mg iv initial, then 100 mg iv q 8-12 hr Penicillin 2 mil units iv q 2 hr -- possibly add gentamicin	Ciprofloxacin 500 mg or Doxycycline 100 mg po Q 12 h ~ 8 weeks (shorter with anthrax vaccine) Amoxicillin in pregnancy and children Vaccine if available
<b>Botulism</b>	12-72 hours Range: 2 hrs – 8 days	Difficulty swallowing or speaking (symmetrical cranial neuropathies) Symmetric descending weakness Respiratory dysfunction No sensory dysfunction No fever	Dilated or un-reactive pupils Drooping eyelids (ptosis) Double vision (diplopia) Slurred speech (dysarthria) Descending flaccid paralysis Intact mental state	Mouse bioassay in public health laboratories (5 – 7 days to conduct) ELISA for toxin	Aerosol inhalation Food ingestion <i>No person-to-person transmission</i> Standard precautions	Mechanical ventilation Parenteral nutrition  Trivalent botulinum antitoxin available from State Health Departments and CDC	Experimental vaccine has been used in laboratory workers
<b>Plague</b>	1-3 days by inhalation	Sudden onset of fever, chills, headache, myalgia <b>Pneumonic:</b> cough, chest pain, hemoptysis <b>Bubonic:</b> painful lymph nodes	<b>Pneumonic:</b> Hemoptysis; radiographic pneumonia -- patchy, cavities, confluent consolidation <b>Bubonic:</b> typically painful, enlarged lymph nodes in groin, axilla, and neck	Gram negative coccobacilli and bacilli in sputum, blood, CSF, or bubo aspirates (bipolar, closed "safety pin" shape on Wright, Wayson's stains) ELISA, DFA, PCR	<i>Person-to-person transmission in pneumonic forms</i> Droplet precautions until patient treated for at least three days	Streptomycin 30 mg/kg/day in two divided doses x 10 days Gentamicin 1-1.75 mg/kg iv/im q 8 hr Tetracycline 2-4 g per day	Asymptomatic contacts or potentially exposed Doxycycline 100 mg po q 12 h Ciprofloxacin 500 mg po q 12 h Tetracycline 250 mg po q 6 hr all x 7 days Vaccine production discontinued
<b>Tularemia "pneumonic"</b>	2-5 days Range: 1-21 days	Fever, cough, chest tightness, pleuritic pain Hemoptysis rare	Community-acquired, atypical pneumonia Radiographic: bilateral patchy pneumonia with hilar adenopathy (pleural effusions like TB) Diffuse, varied skin rash May be rapidly fatal	Gram negative bacilli in blood culture on BYCE (Legionella) cysteine- or S-H-enhanced media Serologic testing to confirm: ELISA, microhemagglutination DFA for sputum or local discharge	Inhalation of agents <i>No person-to-person transmission but laboratory personnel at risk</i> Standard precautions	Streptomycin 30 mg/kg/day im divided bid for 10-14 days Gentamicin 3-5 mg/kg/day iv in equal divided shoulders x 10-14 days Ciprofloxacin possibly effective 400 mg iv q 12 hr (change to po after clinical improvement) x 10-14 days	Ciprofloxacin 500 mg po q 12 hr Doxycycline 100 mg po q 12 hr Tetracycline 250 mg po q 6 hr All x 2 wks Experimental live vaccine
<b>Smallpox</b>	12-14 days Range: 7-17 days	High fever and myalgia; itching; abdominal pain; delirium Rash on face, extremities, hands, feet; confused with chickenpox which has less uniform rash	Maculopapular then vesicular rash -- first on extremities (face, arms, palms, soles, oral mucosa) Rash is synchronous on various segments of the body	Electron microscopy of pustule content PCR Public health lab for confirmation	<i>Person-to-person transmission</i> Airborne precautions Negative pressure Clothing and surface decontamination	Supportive care Vaccinate care givers	Vaccination (vaccine available from CDC)

**Table 2 Some Potential Chemical Terrorism Agents and Syndromes (including biologic toxins)**

Agents	Symptom Onset	Symptoms	Signs	Clinical Diagnostic Tests	Decontamination	Exposure route and treatment (adult dosages)	Differential diagnostic considerations
<b>Nerve agents</b>	Vapor: seconds Liquid: minutes to hours	<b>Moderate exposure:</b> Diffuse muscle cramping, runny nose, difficulty breathing, eye pain, dimming of vision, sweating, <b>High exposure:</b> 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) <b>Treat for signs and symptoms; lab tests only for later confirmation</b> Collect urine for later confirmation and dose estimation	Rapid disrobing  Water wash with soap and shampoo	<b>Inhalation &amp; dermal absorption</b> 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
<b>Cyanide</b>	Seconds to minutes	<b>Moderate exposure:</b> Dizziness, nausea, headache, eye irritation <b>High exposure:</b> Loss of consciousness	<b>Moderate exposure:</b> non-specific findings <b>High exposure:</b> convulsions, cessation of respiration	Cyanide (blood) or thiocyanate (blood or urine) levels in lab. <b>Treat for signs and symptoms; lab tests only for later confirmation</b>	Clothing removal	<b>Inhalation &amp; dermal absorption</b> 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 <sub>2</sub> S (sewer, waste, industrial
<b>Blister Agents</b>	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	<b>Inhalation &amp; dermal absorption</b> Thermal burn type treatment Supportive care For Lewisite and Lewisite/Mustard mixtures: British Anti-Lewisite (BAL or Dimercaprol)	sources)  Diffuse skin exposure with irritants, such as caustics, sodium hydroxides, ammonia, etc., may cause similar syndromes. Sodium hydroxide (NaOH) from trucking accidents
<b>Pulmonary agents (phosgene, etc)</b>	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	<b>Inhalation</b> Supportive care Specific treatment depends on agents	Inhalation exposures are the single most common form of industrial agent exposure (eg: HCl, Cl <sub>2</sub> , NH <sub>3</sub> )  Mucosal irritation, airways reactions, and deep lung effects depend on the specific agent, especially water-solubility
<b>Ricin (castor bean toxin)</b>	18 – 24 hours	<b>Ingestion:</b> Nausea, diarrhea, vomiting, fever, abdominal pain <b>Inhalation:</b> , 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	<b>Inhalation &amp; Ingestion</b>  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
<b>T-2 mycotoxins</b>	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	<b>Inhalation &amp; dermal contact</b>  Supportive care For ingestion: charcoal lavage Possibly high dose steroids	Pulmonary toxins (O <sub>3</sub> , NO <sub>x</sub> , phosgene, NH <sub>3</sub> ) may cause

similar syndromes though with less mucosal irritation.



**Table 3 Acute Radiation Syndrome**

		Whole body radiation from external radiation or internal absorption					
Phase or Syndrome	Feature	Subclinical range		Sublethal range		Lethal range	
		0 – 100 rad (cGy)	100 – 200 rad (cGy)	200-600 rad (cGy)	600-800 rad (cGy)	600-3000 rad (cGy)	>3000 rad (cGy)
Initial or prodromal	Nausea, vomiting	none	5-50%	50 – 100%	75-100%	90-100%	100%
	Time of onset		3-6 hrs	2-4hrs	1-2 hrs	<1 hr	<1 hr
	Duration		<24 hrs	<24 hrs	<48 hrs	<48 hrs	<48 hrs
	Lymphocyte count			< 1000 at 24 h	< 500 at 24h		
	CNS function	No impairment	No impairment	Routine task performance Cognitive impairment for 6-20 hrs	Simple and routine task performance Cognitive impairment for >24 hrs	Progressive incapacitation	
Latent	Duration	> 2 wks	7-15 days	0-7 days	0-2 days	none	
"Manifest illness" (obvious illness)	Signs and symptoms	none	Moderate leukopenia	Severe leukopenia, purpura, hemorrhage Pneumonia Hair loss after 300 rad (cGy)		Diarrhea Fever Electrolyte disturbance	Convulsions, ataxia, tremor, lethargy
	Time of onset		> 2 wks	2 days – 2 wks		2-3 days	
	Critical period		none	4-6 wks		5-14 days	1-48 hrs
	Organ system	none		Hematopoietic and respiratory (mucosal) systems		GI tract Mucosal systems	CNS
Hospitalization	%		<5%	90%	100%	100%	100%
	Duration		45-60 days	60-90 days	90+ days	2 weeks	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**

## **Appendicitis (Uncomplicated)**

### **A. Key Outcomes**

- Timely diagnosis of acute uncomplicated appendicitis
- Recognition of patients appropriate for non-operative management of appendicitis (phlegmon, perforated appendicitis with abscess)
- Prompt initiation of antibiotic therapy
- Prompt operative treatment

### **B. Goal Length of Stay**

- 24 hours

### **C. Proposed Hospital Course**

- History and physical exam
  - i. May diagnose appendicitis by H&P alone
  - ii. Obtain abdominal ultrasound or CT scan abdomen/pelvis with IV contrast if diagnosis in question or patient is at risk of complicated appendicitis
- Labs: CBC, consider BMP, coags or LFTs based upon age\comorbidities
  - i.  $\beta$ HCG in women of childbearing age
- Operating Room for laparoscopic vs open appendectomy
- Early cessation of antibiotics
  - i. Most patients require no additional post-operative antibiotics
  - ii. May provide up to 24 hours antibiotics at attending discretion

### **D. Discharge Planning**

- Regular diet
- Pain management
- Clinic follow-up in 2-4 weeks post op

### **E. Disposition**

- Home, self care

## **Appendicitis (Complicated - perforated, phlegmon, abscess)**

### **A. Key Outcomes**

- Timely diagnosis of complicated appendicitis
- Prompt initiation of antibiotic therapy
- Prompt operative treatment or consultation of Interventional Radiology if appropriate

### **B. Goal Length of Stay**

- 1-5 days
- Exceptions: unsatisfactory resolution of ileus or severe sepsis resulting in hemodynamic instability and protracted complicated hospital course

### **C. Proposed Hospital Course**

- History and physical exam
  - Identify factors concerning for complication – length of symptoms, severity of illness, etc.
- CT abdomen/pelvis with IV contrast
- Labs: CBC, BMP, coags
  - $\beta$ HCG in women of childbearing age
- Decision for operative vs interventional vs medical management
  - Perforation without phlegmon \ abscess – OR for laparoscopic vs open appendectomy
  - Phlegmon – IV antibiotics, monitor for development of drainable abscess
  - Abscess – IR consultation for percutaneous drainage
- Drain care if applicable
- Antibiotics
  - Course dependent upon level of contamination

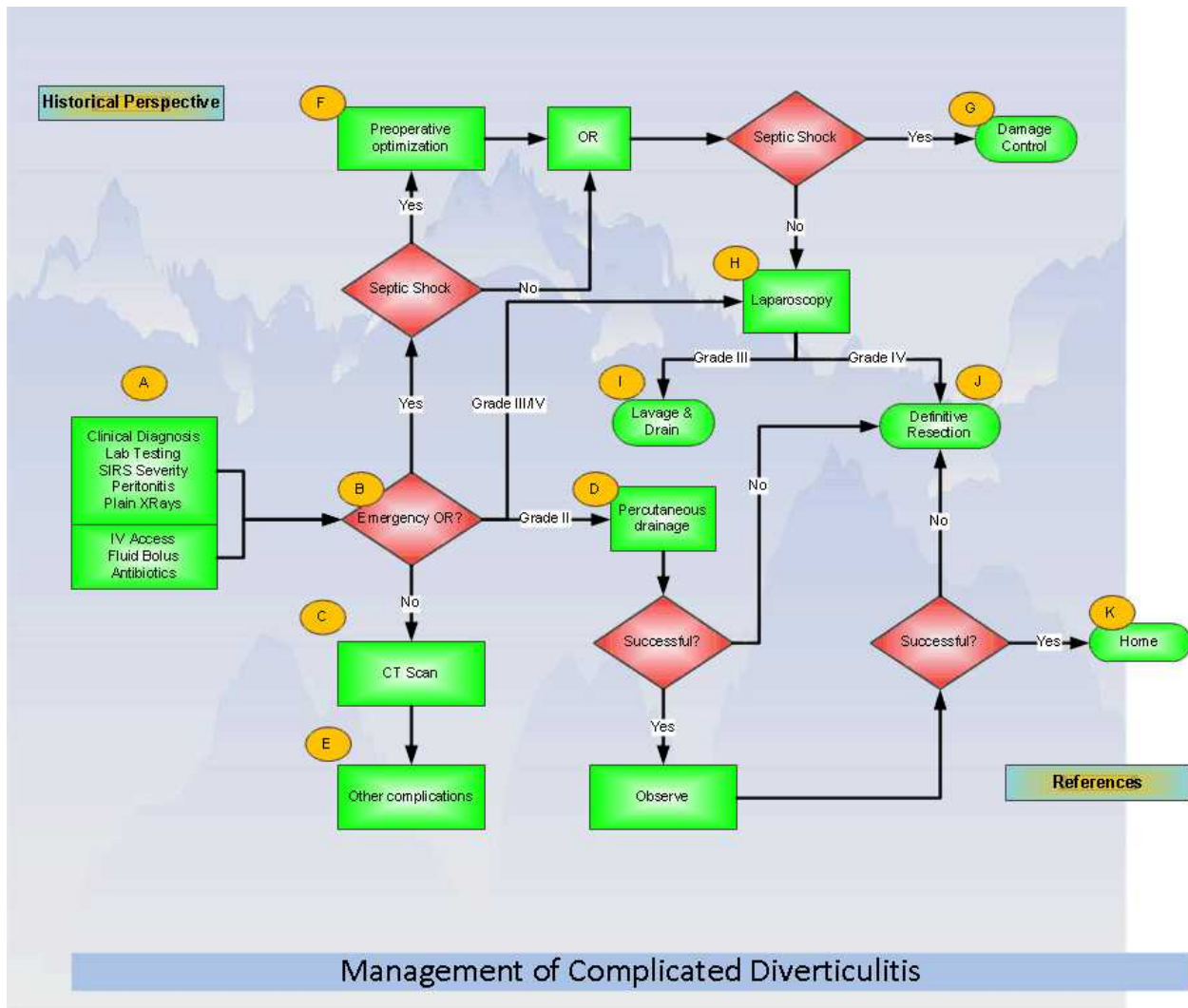
### **D. Discharge Planning**

- Regular diet or adequate caloric intake
- Pain management
- Completion of antibiotic course or plan for home antibiotics vs. SNF
- Resolution of fevers
- Resolution of ileus
- Clinic follow-up in 1-2 weeks, every month thereafter or at discretion of surgery attending
- Timing of interval appendectomy
- May require home health follow-up

### **E. Disposition**

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

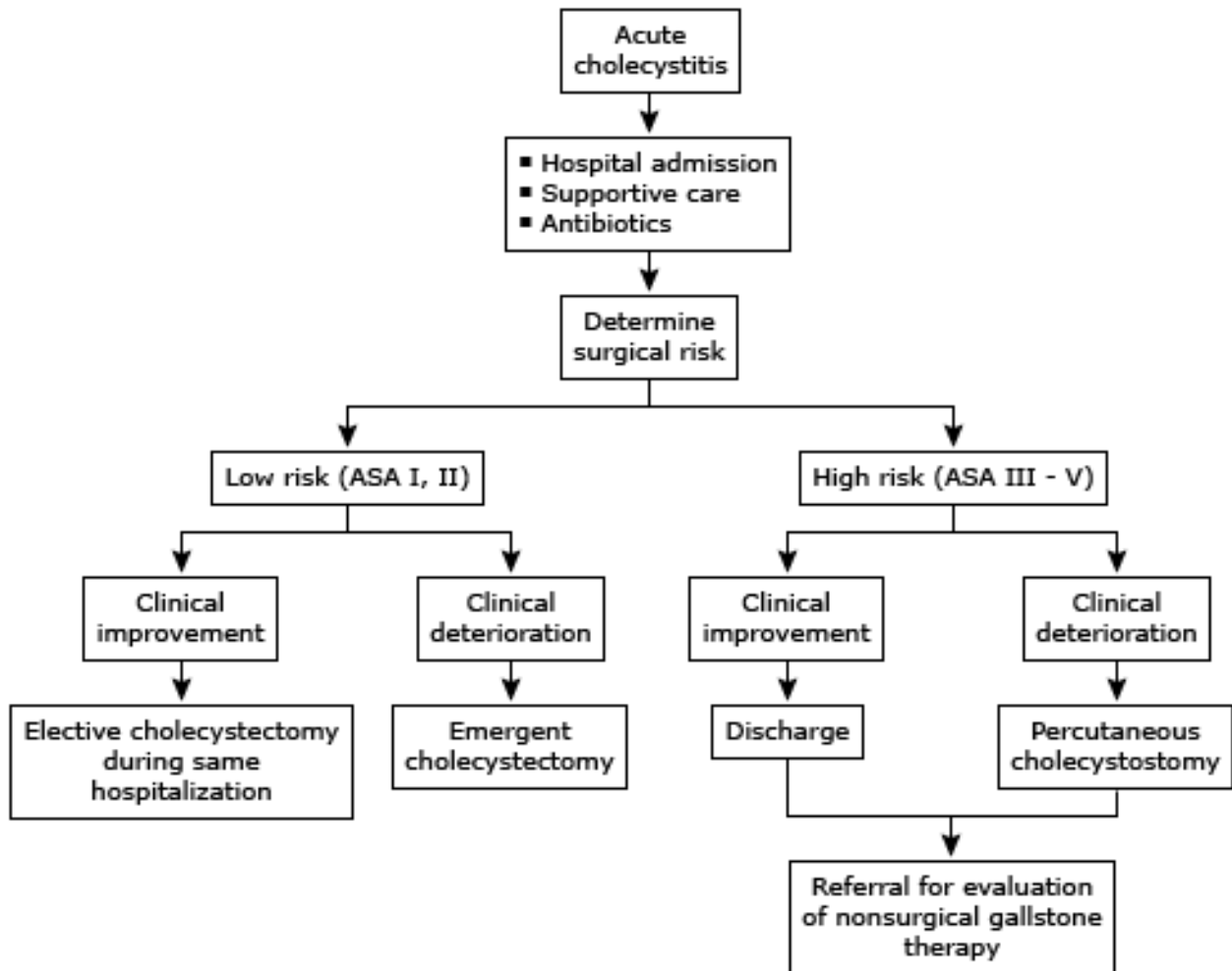
# Acute Diverticulitis



<http://westerntrauma.org/algorithms/ComplicatedDiverticulitis/NoteA.html>

Reference: Moore FA, Moore EE, Burlew CC, Coimbra R, McIntyre RC Jr, Davis JW, Sperry J, Biffi WL. Western Trauma Association critical decisions in trauma: management of complicated diverticulitis. *J Trauma Acute Care Surg.* 2012 Dec;73(6):1365-71. doi: 10.1097/TA.0b013e31827826d8. PubMed PMID: 23188229.

# Acute Calculous Cholecystitis



## LOW-RISK PATIENTS

**Timing of cholecystectomy** — Early cholecystectomy, rather than delayed cholecystectomy (>7 days after admission), is preferable for patients who require hospitalization for acute cholecystitis and who are good candidates for cholecystectomy. Evidence from large database reviews and randomized trials show that cholecystectomy performed early during the initial hospitalization may be associated with reduced perioperative morbidity and mortality in some patients, and reduces the length of hospital stay and cost. Even after 72 hours of symptoms, cholecystectomy in the same admission leads to good results [1].

## HIGH-RISK PATIENTS

Patients categorized as ASA classes III, IV, or V, have perioperative mortality rates ranging from 5 to 27 percent, and are considered high risk for cholecystectomy

For these patients, the risk of cholecystectomy likely outweighs the potential benefits, and an initial non-operative approach should be undertaken that includes antibiotic therapy and bowel rest. For those who fail to improve, gallbladder drainage should be implemented with the eventual goal of performing cholecystectomy. Once cholecystitis resolves, the patient's risk for surgery should be reassessed. Patients who have become reasonable candidates for surgery should undergo elective cholecystectomy. Medical management with interval cholecystectomy only for recurrent acute cholecystitis may be appropriate in some patients [1].

However, an initial surgical approach may be preferred in some high-risk patients (eg, gangrenous or emphysematous cholecystitis) for whom the burden of the ongoing systemic effects of cholecystitis is deemed to be greater than the risk of surgery. In a study of 483 patients undergoing cholecystectomy for acute cholecystitis, gangrenous cholecystitis was found in 24 (5 percent) [52]. Patients with gangrenous gallbladders had a much higher mortality rate than patients who had inflamed but non-gangrenous gallbladders (12.5 versus 0.9 percent). In the same study, gallbladder gangrene was associated with an older age, male sex, and a higher preoperative bilirubin level, as well as comorbid medical conditions such as diabetes, coronary artery disease, and systemic inflammatory response syndrome.

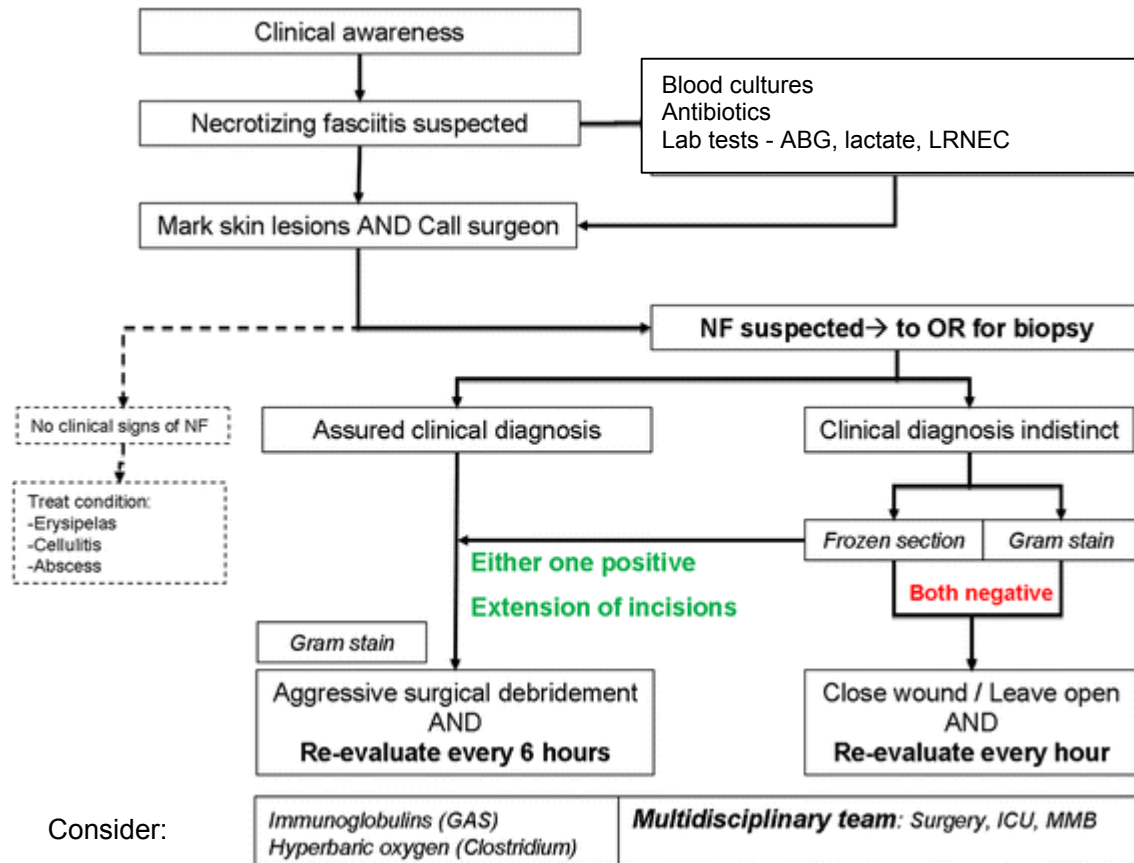
1: Roulin D, Saadi A, Di Mare L, Demartines N, Halkic N. Early Versus Delayed Cholecystectomy for Acute Cholecystitis, Are the 72 hours Still the Rule?: A Randomized Trial. *Ann Surg*. 2016 Nov;264(5):717-722. PubMed PMID: 27741006.

2: McGillicuddy EA, Schuster KM, Barre K, Suarez L, Hall MR, Kaml GJ, Davis KA, Longo WE. Non-operative management of acute cholecystitis in the elderly. *Br J Surg*. 2012 Sep;99(9):1254-61. doi: 10.1002/bjs.8836. Epub 2012 Jul 24. PubMed PMID: 22829411.

3:: Bourikian S, Anand RJ, Aboutanos M, Wolfe LG, Ferrada P. Risk factors for acute gangrenous cholecystitis in emergency general surgery patients. *Am J Surg*. 2015 Oct;210(4):730-3. doi: 10.1016/j.amjsurg.2015.05.003. Epub 2015 Jun 27. PubMed PMID: 26186803.



## Suspected necrotizing fasciitis



### Necrotizing fasciitis:

Linezolid or vancomycin  
+  
Piperacillin/tazobactam

Or

Daptomycin  
+  
Piperacillin/tazobactam  
+  
Clindamycin

### Fournier's gangrene:

*If signs and symptoms of severe sepsis are not present:*

Piperacillin/tazobactam  
+  
Clindamycin

*If signs and symptoms of severe sepsis are present*

Meropenem  
+  
Linezolid or vancomycin

Sartelli M, Malangoni MA, May AK, Viale P, Kao LS, Catena F, Ansaloni L, Moore EE, Moore FA, Peitzman AB, Coimbra R, Leppaniemi A, Kluger Y, Biffl W, Koike K, Girardis M, Ordonez CA, Tavola M, Cainzos M, Di Saverio S, Fraga GP, Gerych I, Kelly MD, Taviloglu K, Wani I, Marwah S, Bala M, Ghnnam W, Shaikh N, Chiara O, Faro MP Jr, Pereira GA Jr, Gomes CA, Cocolini F, Tranà C, Corbella D, Brambillasca P, Cui Y, Segovia Lohse HA, Khokha V, Kok KY, Hong SK, Yuan KC. World Society of Emergency Surgery (WSES) guidelines for management of skin and soft tissue infections. World J Emerg Surg. 2014 Nov 18;9(1):57. Doi: 10.1186/1749-7922-9-57. eCollection 2014. Review. PubMed PMID: 25422671; PubMed

Central PMCID: PMC4242587.

## LRINEC Score

**Table.** Laboratory Risk Indicator for Necrotizing Fasciitis Score

Variable	Value	Points
C-Reactive Protein (mg/L)	< 150	0
	≥ 150	4
WBC (cells/mm <sup>3</sup> )	< 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

# Video links

## **Video Links**

### **UCSD Trauma Burn Youtube Channel:**

<https://www.youtube.com/channel/UCRB5EunenkaDJenXQghom7w>

### **The Resuscitation Room**

Roles of Team Members: <https://youtu.be/HcR4enuaEK0>

Video Review: <https://youtu.be/tJSqLUBWxOk>

Codes in the Resuscitation Room: [https://youtu.be/JFphgFSsm\\_Q](https://youtu.be/JFphgFSsm_Q)

### **Operating Room Resuscitation**

OR Resuscitation: When, How, Why? - <https://youtu.be/9cTfSsG3v0I>

### **Surgical Procedures:**

Chest tube Insertion: <https://youtu.be/xwp57E9NJjg>

Surgical Airway – Cricothyroidotomy: <https://youtu.be/Kg14kdIycDE>

Diagnostic Peritoneal Lavage (DPL): <https://youtu.be/O9BZamRIXVA>

Resuscitative Thoracotomy: <https://youtu.be/naUT46aLIDM>

Trauma Bay Surgical Emergencies: <https://youtu.be/D7v-Z3RCoHY>

EZ-IO intraosseous needle: <https://youtu.be/jTdyOILrZLA>

### **Damage Control Surgery**

Dr Rotondo: [https://youtu.be/IyoyDU4D\\_Hk](https://youtu.be/IyoyDU4D_Hk)

Dr Coimbra: [https://youtu.be/kTsYDGi-\\_Dc](https://youtu.be/kTsYDGi-_Dc)

### **Airway**

Pediatric Airway Management: <https://youtu.be/H9D0CcQ7kS4>

### **Head:**

Management of TBI - <https://youtu.be/l8Ig9NHdmE0>

Reversal of anticoagulation: <https://youtu.be/v56OLC9PxGQ>

Stroke Codes / BCVI in the Trauma Bay: <https://youtu.be/iXbKv0AjjE>

## **Neck Trauma**

Penetrating neck trauma: <https://youtu.be/GrBneF4MYQc>

## **Chest Trauma**

Thoracic Trauma - <https://youtu.be/TWOIXp01eZY>

Penetrating Cardiac Injuries: <https://youtu.be/nR2ZdmQQVKE>

## **Abdominal Trauma**

Liver injuries: <https://youtu.be/D6PoBqKzCfM>

Splenic injuries: <https://youtu.be/cpaQzY8mtRQ>

Abdominal Vascular injuries: <https://youtu.be/cpaQzY8mtRQ>

## **Pelvic Trauma**

Pelvic Fractures – A complicated Injury: <https://youtu.be/y1kPy-lk608>

Pelvic Fractures with a focus on hemorrhage control: <https://youtu.be/Tyxk1GxKYi0>

T-POD application: [https://youtu.be/PO-gLZXxZ\\_E](https://youtu.be/PO-gLZXxZ_E)

## **REBOA**

REBOA of the aorta for major abdominal venous injury <https://youtu.be/2JlbnHvjWPU>

Best Practices for Using The ER-REBOA™ Catheter <https://youtu.be/3SAulha8Nb4>

The ER-REBOA™ Catheter & The ER-REBOA™ Catheter Convenience Kit [https://youtu.be/dx1Nxbq0K\\_Q](https://youtu.be/dx1Nxbq0K_Q)

How I do it – Joe Dubose MD part I <https://youtu.be/-U7MkU3eA7E>

How I do it – Joe Dubose MD part II <https://youtu.be/DZ5LCeT7PBk>

## **Extremity Trauma**

Short leg Bulky Jones Splint <https://youtu.be/XPxXLBriDZE>

MSK Trauma: <https://youtu.be/yvFqcnDo6uw>

### **Pediatric Trauma**

Pediatric Airway Management: <https://youtu.be/H9D0CcQ7kS4>

Pediatric Abdominal Trauma: <https://youtu.be/xopGFuhog6c>

Pediatric Trauma Transfers: [https://youtu.be/r\\_yaMzup7dk](https://youtu.be/r_yaMzup7dk)

### **Trauma in Pregnancy**

Trauma in Pregnancy: <https://youtu.be/5HztHtAC3qU>

### **FAST Ultrasound Examination**

FAST: <https://youtu.be/TCNvHfPYPBc>

FAST 2: <https://youtu.be/jfsLo35aMuU>

Ultrasound identification of Pneumothorax: <https://youtu.be/Ec2pRYOQ2II>

Limited Echo: <https://youtu.be/a0pZDeffblU>

Ultrasound for the Acute/Trauma Surgeon: <https://youtu.be/hwjmULp2fxQ>

### **Radiology**

Radiology Review: <https://youtu.be/-hV13QLeDcA>

### **Initial Management of Burns**

Part I – Prehospital Care [https://youtu.be/\\_JLeErQpFHc](https://youtu.be/_JLeErQpFHc)

Part II – Smoke Inhalation <https://youtu.be/JdC5aeodKIM>

Part III – Initial management <https://youtu.be/4Ixrz1jQKjw>

Part IV: - Resuscitation and Wound Care <https://youtu.be/4oTz0mFE7Z8>

### **Disaster & Mass Casualties**

Stop the Bleed Course: <https://youtu.be/LXQete07O5U>

Physician's Responsibilities During Disasters: [https://youtu.be/QOa\\_SqPB-sE](https://youtu.be/QOa_SqPB-sE)

Active Shooter: <https://youtu.be/iN2q9baUCGM>

Chemical & Biologic Events: <https://youtu.be/PmEAhdJRE4>

### **The Trauma System**

Trauma deaths: <https://youtu.be/jkZm65Ywy-U>

EMS System: [https://youtu.be/BBNb\\_9jDk7E](https://youtu.be/BBNb_9jDk7E)

### **Central Venous Access:**

**Part I:** <https://youtu.be/7s5f0TX5eCA>

**Part II:** <https://youtu.be/9JZNyme3h34>

**Part III:** <https://youtu.be/9JZNyme3h34>

**Part IV:** <https://youtu.be/cUq4grLFrqw>