

DEPARTMENT OF SURGERY

*Section of Pediatric Surgery*

# PEDIATRIC TRAUMA CARE GUIDELINES

2011



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## **Section 1: Introduction**

### **Preface**

The Faculty and Staff of the Trauma Program at the University of Kentucky Hospital are pleased to present the new PediatricTrauma Care Guideline 2011. This manual has been developed to provide resource material relevant to the variety of disciplines involved in the care of the multi-injured pediatric trauma patient. The UK Trauma Program strives to deliver timely and effective care to the injured patient utilizing evidence-based guidelines and pathways. This manual outlines expectations and standards of care appropriate for Level 1 Pediatric Trauma Center designation.

To further enhance trauma care internally and in our service region, the Pediatric Trauma Care Guideline will be published on-line via the Department of Surgery Website, the Trauma Program Website and the University of Kentucky CareWeb. These sites may be accessed at the web addresses listed below. New and/or updated guidelines will be posted on the website. The UK Trauma Program recommends periodic review of the site to monitor for latest revisions. The guidelines are formatted so that they may be downloaded and printed. Hardcopies are available in the Trauma Program Office (H-213) or by calling 859-323-5022. Faculty and house staff may obtain CD version by contacting Trish Cooper (3-5037) in the Trauma Program Office.

Please direct inquiries to Bari Lee Mattingly, RN, Pediatric Trauma Nurse Coordinator at 859-323-1116 or [barilee.mattingly@uky.edu](mailto:barilee.mattingly@uky.edu), or Lisa Fryman, RN, Trauma Nurse Coordinator/Program Manager at 859-257-1231 or [lisa.fryman@uky.edu](mailto:lisa.fryman@uky.edu). Specific guideline discussion may be directed to Faculty by calling 859-323-5625.

Dept of Surg, Trauma & Critical Care: [www.mc.uky.edu/surgery/General/trauma.asp](http://www.mc.uky.edu/surgery/General/trauma.asp)

Trauma Program: [www.mc.uky.edu/TraumaServices](http://www.mc.uky.edu/TraumaServices)

University of Kentucky CareWeb: [www.hosp.uky.edu/careweb](http://www.hosp.uky.edu/careweb)

## **PEDIATRIC SURGERY (TRAUMA) SERVICE**

### **ROLES OF TEAM MEMBERS:**

#### **Roles of Team Members**

#### **Pediatric Surgery Attending Physicians**

Dr. Joseph Iocono, Dr. Andrew Pulito, Dr. Sean Skinner, and Dr. John Draus, Jr. are the Pediatric Surgery Attending Physicians. They have overall responsibility for patient care and oversight of residents working on the pediatric surgery service. They will take calls from outside physicians requesting consults or referring patients to the service.

#### **Physician Assistant**

Kara Cole is our PA. Her role on the team is versatile. She will round in the mornings and some afternoons with the team, first assist when needed in the OR, help with floor questions/problems, and assist with patient phone calls. She will also help facilitate home health referrals and transfers to Rehab facilities when indicated. In the clinic she functions as a primary provider and is able to see and evaluate follow-up patients, as well as some new patients with residents and students. She is available to help the Attendings and Residents in any way needed.

#### **Chief Resident**

- The PGY 4 is our Chief and is in charge of the service. "The buck stops here..."
- Monday through Friday, the chief resident will pre-round with the team. These rounds should start early enough to provide ample time to see and examine the entire service before the first scheduled activity of the day (e.g. before general surgery conference at 6:45 on Monday, before 7:30 OR start on Tuesday, etc). Detailed service schedule is in this section.
- Chief resident has the final responsibility for the upkeep of the daily patient census and the morbidity and mortality list.
- The chief resident assigns operative case coverage for all residents.
- The chief resident is responsible for fielding parent and patient phone calls after office hours. The attendings take all UKMD's calls 24/7.
- Weekends, the chief resident will round with the attending on call.
- Pre-rounds are usually not necessary on weekends.
- It is expected that the chief resident set aside 30-60 minutes a week for an educational session with the students and residents on the service to discuss topics pertinent to patients on the service.

#### **Residents**

- Record medical history and physical exams on all new patients.
- Record daily exam and progress notes on all patients and consults.
- Be prepared to present patients on rounds. Junior residents should lead and present all patients during attending rounds on rounds on Monday and Friday.
- Follow all consults as long as they are in the hospital.
- Obtain operative permits and verify preoperative notes and orders. If unsure of the operative plan, discuss the consent with the attending before talking to the family.
- Assist in surgery. The resident who scrubs on a case is the primary surgeon.

Before entering the OR, read about the procedure and plan ahead.

- A resident must be with the patient at all times from the moment that patient enters the operating room. All patients MUST be seen in the preoperative holding area before their surgery for a final check of diagnosis before surgery.
- Maintain the patient list.
- Provide accurate diagnosis and surgery (with date).
- Educate medical students where needed.
- Review medical student's history and physical (H&P) to improve their clinical skills.

#### **Fourth year student (Als)**

- Perform ALL the duties of the intern level, supervised by either a resident or an attending.
- Record medical history and physical for the record.
- Record daily exam and progress notes on all patients and consults.
- Be prepared to present patients on rounds. Students should be ready to present 2-3 patients on attending rounds.
- Present 15 min talk on topic in pediatric surgery to the entire team during month.

#### **Third year student**

- Record medical history and physical for the record on at least 1 patient per week.
- Record daily exam and progress notes on at least 1 patient per day.
- Participate in rounds and ORs with team and read about cases.

#### **Pediatric Trauma Nurse Coordinator (PTNC)**

Bari Lee Mattingly is the Pediatric Trauma Nurse Coordinator. The PTNC is responsible for program administration, quality assurance activities, and systems problem solving. These activities are imperative to maintaining our verification as a Pediatric Level I Trauma Center. The PTNC maintains and facilitates the trauma registry for the purpose of research and quality assurance. Pediatric Trauma admission forms should be forwarded to the PTNC. The PTNC also coordinates ATLS and other education related activities. Clinically, the PTNC evaluates quality of care, especially during the initial assessment and resuscitative phase.



### **Important Phone Numbers**

Dr. Joe Iocono	(H) 271-8179	(C) 351-5724	(O) 7-5183	(P) 330-1588
Dr. Andrew Pulito	(H) 278-8691	(C) 338-6132	(O) 3-5626	(P) 330-1433
Dr. Sean Skinner	(H) 523-1557	(C) 317-3276	(O) 3-2743	(P) 330-6506
Dr. John Draus, Jr.	(H) 266-0634	(C) 559-6555	(O) 3-2109	(P) 330-1475
Kara Cole PA-C			(O) 3-1150	(P) 330-1487
Bari Lee Mattingly, RN	(H) 272-5437	(C) 533-7232	(O) 3-1116	(P) 330-4095

Pediatric Surgery Office- 323-5625 Fax- 323-5289  
MN-102, first floor in hallway behind library

### **Other Important Phone Numbers**

Pediatric Clinic.....	323-6211
Pediatric Main Floor .....	323-5741..... Fax.....323-1951
Peds Charge Nurse.....	330-6298
4 Outpatient.....	323-6822
Pediatric 4-East (Rooms 417 – 451).....	323-5881
Pediatric 4-West (Rooms 454 - 494).....	323-6820
NICU.....	323-1272
PICU.....	323-5730
PICU Resident.....	1565
PICU Sedation.....	257-5337
Pediatric Radiology	
Reading Room .....	257-6691
Ultrasound.....	323-5072
Fluoro.....	323-5076
ECHO.....	257-5129
Endo.....	323-6409
Translator.....	330-6692
Wally Bellis, (SW).....	330-7421
Stephanie Bellis (Home Health).....	330-8606
Peds Pharm.....	323-6369
Peds IV Team.....	330-7375
Peds Transport Dispatch office .....	323-6215

### **OR Numbers**

Front OR Desk.....	323-5631
OR Scheduling.....	323-6954

## ROTATION REQUIREMENTS:

### **I. Patient Care Responsibilities of Pediatric Surgery Service**

#### **A. Pediatric Trauma Patients\***

The majority of trauma patients are admitted via the Emergency Department (ED). Trauma patients can present directly from the accident scene via ground ambulance or helicopter (scene call), or as a referral from another hospital and physician. There will be some direct inter-facility transfer of injured patients from referring hospitals to the PICU or floor.

*Trauma Expect:* Pediatric trauma patients referred and accepted by the Pediatric Surgery service from another hospital (ground or air transport) are considered trauma expects. Pediatric Trauma expects can be referred for EM evaluation. Unless referred for EM evaluation, the Pediatric Surgery residents are immediately responsible for supervision of pediatric trauma expect patient care upon that patient's arrival in the ED.

*Local EMS Transports:* Patients transported by local EMS providers become the responsibility of the Pediatric Surgery residents by one of two mechanisms:

1. Pediatric trauma consult called by the ED
2. "Pediatric Trauma Alert" or "Pediatric Trauma Alert Red" called by ED.

**\*The Pediatric Trauma Alert system is discussed below under a separate heading.**

Initial assessment and evaluation of the multiply injured patient should proceed according to ATLS protocol. Resident roles and responsibilities during the initial evaluation are outlined in the attached documents. Role assignment is pre-designated depending upon experience, skill proficiency, and resident knowledge base. The Pediatric Surgery Chief resident (PGY4 or PGY5) assumes responsibility for the timely evaluation, management, and disposition of the pediatric trauma patient. This responsibility also includes the timely notification of the attending physician. The Peds Surgery Chief resident is allowed to take call from home. If a Pediatric trauma patient arrives after hours or on weekends, the in-house Trauma Surgery Chief Resident (PGY4 or PGY5) will begin evaluation and management of the patient until the Pediatric Surgery Chief resident arrives and assumes care. Patient disposition should be determined within 60 minutes of ED admission. The entire diagnostic evaluation/disposition should not exceed 120 minutes. Should it become obvious at any point during the initial evaluation that the patient will require surgical intervention, it is imperative that the OR be contacted immediately. A surgical resident will accompany hemodynamically unstable patients outside the ED for all diagnostic procedures (i.e., CT scan, angiography, etc.). Physicians are not required to accompany "stable patients". It is the responsibility of the ED nursing staff to insure that all trauma patients will be accompanied by an RN during procedures done outside the ED. There is a policy that governs the RN responsibilities for transport.

#### **1. Pediatric Trauma Alert System**

The pediatric trauma alert notification system was designed to provide rapid and efficient mobilization of personnel and resources essential for the resuscitation, evaluation, diagnosis and treatment of the multiply injured pediatric patient. The trauma alert system is divided into two levels in order to maximize the efficiency resource allocation.

### **Pediatric Trauma Alert**

A Pediatric Trauma Alert will be called based on the outlined criteria (see attached document). Patients receiving a pediatric trauma alert may be arriving via ground ambulance, air medical transport, or could be present in the ED and experience an acute deterioration in condition.

### **Pediatric Trauma Alert Red**

Our highest level of trauma alert activation is called 'Pediatric Trauma Alert Red'. This is reserved for injured patients with a pre-hospital report of hypotension following blunt injury, patients with airway compromise, and for patients who have sustained a penetrating injury to the neck, thorax and/or abdomen. The goal is to provide immediate OR access for patients that have a high likelihood of requiring emergent life-saving surgical intervention. An operating room will be held for 30 minutes after the pediatric trauma alert red has been called. The chief pediatric surgical resident is responsible for the decision to release the OR suite as soon as possible after patient arrival.

### **2. Trauma Labs**

A trauma panel is available. The labs ordered are based on the severity of the injuries. If staff has difficulty obtaining enough blood for testing, refer to the Pediatric Trauma Venipuncture Reference on page 20. Blood Alcohol and urine drug screens are mandatory for all patients age 13 or older. Blood Alcohol and Urine Drug Screens may be ordered on pediatric patients under age 13 at the discretion of the Chief Resident or Attending physician. Any questions regarding the necessity for additional lab values should be clarified with the Peds Surgery Chief Resident and communicated to the nurse. Refer to policy on trauma labs in the ED Policies/Procedures Section.

### **3. Documentation**

#### **Trauma Admit Form**

The trauma admission form is to be completed IN FULL on ALL pediatric trauma patients admitted to the Pediatric Surgery service or receiving consultation from the Pediatric Surgery service. This includes ALL ED and OPERATING ROOM MORTALITIES. The patient's Primary nurse will complete the ED Trauma Flow Sheet on all Pediatric Trauma Alert/Pediatric Trauma Alert Red patients. Critical errors and frequently missing data are as follows:

1. Injury time
2. Loss of consciousness.
3. Laboratory results including ETOH and urine drug screen results.
4. Procedures.
5. Primary diagnosis in detail (MVC is not considered an adequate medical diagnosis and will not be accepted).
6. Pediatric Surgery admitting attending physician.
7. Referring physician and referring hospital.
8. For patients transported directly from the scene, the county where the injury occurred.

The trauma admission form, upon completion, will be added to the medical record. This precludes writing an admission narrative H&P. The original goes to the patient's medical record. The yellow copy should be placed in the Trauma Coordinator's mailbox in the general surgery corridor. Any missing trauma admit forms are the responsibility of the Pediatric Surgery Chief resident on-call that day. Any trauma admission form submitted incomplete will be returned to the chief resident for

completion within 24 hours. Missing data elements will be noted for completion. THE TRAUMA ADMIT FORMS SHOULD BE COMPLETED IN LEGIBLE ENGLISH.

Documentation should not stop with the completion of the trauma admission form. Any and all significant changes in patient condition should be documented completely and legibly in the medical record.

### **Daily Census**

A daily census will be the responsibility of the peds surgery chief resident and his/her team. Updated census information should be complete for morning rounds. All patients admitted to or consulted by the service should be represented on the census. ED and OR mortalities should be listed on the weekly M&M list.

### **Procedure Documentation**

All procedures (deep lines, chest tubes, arterial lines, intubation, DPL, LP, cutdown, etc.) should have a procedure note completed in SCM in detail.

- a. The attending physician will be notified prior to performing a procedure. We realize there are emergent situations that necessitate immediate performance of procedures that would preclude prior attending physician notification.
- b. Procedure notes should be completed for all procedures regardless of whether the attending is present or absent. Procedures such as Intubation, bronchoscopy, Chest Tube placement, suture of lacerations, etc. should be documented. These procedure notes are used to provide necessary and complete documentation in the medical record for procedures performed.
- c. All procedures performed in the ED by Peds Surgery or Trauma service residents should have a note completed. There has been some confusion about procedures performed in the Emergency Department after hours and on weekends. The supervising attending physician for emergency department is the attending surgery physician that should be listed on the procedure note, unless the Pediatric Surgery and/or Trauma Surgery attending physician was present and oversaw the procedure.

A brief written note should appear in the progress notes that documents the procedure and indicates that a more detailed note will follow. For all procedures the following information must be provided:

Name:	Diagnosis:
Reg Number:	Indication:
Date/Time of Procedure:	Resident Surgeon:
Location:	Attending Surgeon:
Service: (performing the procedure)	Preparation:
Time out performed:	Sedation or Anesthetic:

### **Progress Notes and Medical Chart Documentation**

Please remember that the medical chart is a legal document. Think before you write. Do not ventilate disagreements in the medical record. The attending faculty assumes the liability for your actions and your words. Daily progress, as well as any and all acute changes in patient condition should be documented in the chart completely, accurately and legibly with the appropriate date and time.

#### **4. Trauma Admission Orders**

Computer trauma order sets are available for pediatric trauma service patients. Be sure to review these orders to ensure that they are applicable to your plan of care. REMEMBER, PATIENT ADMISSION AND/OR TRANSFER CANNOT PROCEED WITHOUT COMPLETED ORDERS. PLEASE INSURE THAT ORDERS ARE COMPLETED IN A TIMELY FASHION.

#### **B. Pediatric Surgical Emergency Patients and UKMC Inpatient Consults**

The vast majority of pediatric trauma patients are admitted via the UK Emergency Department (ED). Occasionally, there will be direct inter-facility transfer from referring hospitals to the PICU or KCH that will bypass ED evaluation. Emergency pediatric surgery patients present either as:

1. *A referral from another hospital and physician.* \*Pediatric Surgery residents, or the ESS resident if after hours, are immediately responsible for supervision of pediatric surgery referrals accepted from another hospital upon that patient's arrival in the UK ED.

2. *A consult from the ED attending.* The Pediatric Surgery service is responsible for the timely evaluation of pediatric patients when consulted by the ED. During working hours, the Peds Surgery Chief Resident is in house and should be contacted to evaluate the patient. After hours and on weekends, the ESS resident should be contacted to evaluate the patient. The Pediatric Surgery Chief Resident when in house, or the ESS resident after hours assumes ultimate responsibility for the timely evaluation, management, and disposition of all pediatric surgery emergency patients. This responsibility also includes the timely notification of the attending physician.

#### **C. Notification of Consultants**

Consultant(s) evaluation is frequently required for the complete evaluation and treatment of the multiply injured pediatric patient. Timely consultant notification and patient evaluation are necessary to minimize emergency department length of stay and to insure high quality patient care. Consultants should be notified promptly following completion of the secondary survey (<20 minutes after patient arrival) or sooner if their services are required (acute neurosurgical, face team, or orthopedic intervention). Consultants should respond to a page within 10 minutes. Consultants should be present for patient evaluation within 20 minutes of notification. Consultation should be performed by an upper level resident (PGY2 or higher) or faculty. Interns should not be notified for ED patient evaluation unless all other members of the consultant team are involved in priority patient care that precludes their presence.

## **II. ADMISSION OFFICE NOTIFICATION FOR THE PEDIATRIC SURGERY SERVICE**

The decision regarding hospital admission, level of care (PICU or floor), and admitting service can be made rapidly (<20 minutes) for the vast majority of patients. With the exception of patients taken directly to the OR, the Pediatric Surgery service will insure that the admitting process is initiated at the completion of the secondary survey or within 20 minutes of patient arrival. The Admitting Office and Pediatric Charge nurse notification should occur as soon as possible for a patient taken directly to the OR. Prompt notification of the admitting office will allow bed assignment to proceed simultaneously with ED evaluation thereby avoiding needless bed search/assignment delays. Information needed to initiate a bed search include a working diagnosis, age, sex, and type of bed needed (PICU or floor). Once a bed has been assigned and before the patient is transferred from the ED, admitting must have the patient's name and the name of the admitting service and

attending physician. Admitting office notification can be accomplished in one of two ways: 1. You may give a verbal order to the ED nurse caring for the patient; or 2. You may enter the information directly in the computer. Do not call admitting because this is time-consuming and inefficient!

### **Referring Physician Calls**

The pediatric surgery section is dependent on referrals from outside physicians and accepts referrals from a wide geographic area. It is important that we maintain a cooperative and friendly relationship with the referring physicians. Most calls from outside physicians are diverted by the hospital operator to the attending physician. If you accept a call from a referring physician, always document the name and phone number of the referring physician so that prompt follow-up can be obtained. All calls regarding patients should be evaluated with the Attending Pediatric Surgeon or the Peds Surgery Chief resident on call. As a courtesy to referring physicians, we have copies of all dictated hospital summaries sent to them.

During the initial discussion with the referring physician, the attending physician or chief resident can and should make appropriate recommendations and suggestions regarding patient care prior to transport in order to ensure optimal transfer (e.g. additional IV access, immobilization, splinting, mode of transport - ground vs air medical).

After accepting patients for transfer\*, the attending physician or chief surgical resident will notify ED triage and relay the following information on all expects:

1. Patient name/age/sex
2. Referring Physician and Hospital/ETA
3. Residents to be paged on arrival and pager number
4. Patient history/chief complaint
5. Specific diagnostics/interventions to be prepared

\*The air medical dispatcher will contact ED triage for all patients being transported by the air medical service.

Referring physicians should be treated in a polite and courteous manner. MOST REFERRING HOSPITALS DO NOT HAVE THE RESOURCES TO CARE FOR THESE PATIENTS. ALL pediatric trauma patients referred by an outside physician are to be accepted in transfer unless otherwise instructed by the Pediatric Surgery attending physician on call (NO EXCEPTIONS).

### III. Weekly Schedule for Pediatric Surgery

Monday	Tuesday	Wednesday	Thursday	Friday
AM work Rounds, time per CR	6:30 am Morning Rounds	6:00 am Morning Rounds	6:00 am Morning Rounds	AM work Rounds, time per CR
6:45 am Gen Surg Conference		6:45 am Grand Rounds	6:45 am M&M Conference	
8:00 am Peds Surgery Conference	7:30 am Major OR		7:30 am Major OR	
9:00 am Attending Rounds		8:00 am OR at CAS (2 rooms)		8:00 am Attending Rounds
				<b>9:00 am *Pediatric Surgery Clinic</b>
<b>1:00 pm *Pediatric Surgery Clinic</b>				PM work Rounds, time per CR
PM work Rounds, time per CR				

\*Pediatric Surgery Clinic is located on the second floor of the KY Clinic in the Pediatric Specialty Clinic

### IV. Patient Discharges and Service Transfers

#### A. Hospital Discharges

All discharge summaries are to be dictated by the house staff at the time of discharge. A referring physician must be specified. The hospital course may not say, "See Dictation". A detailed history of the hospital course must be documented. These sheets are faxed to the referring physician on the same day of discharge. We prefer a very succinct dictated note that corresponds to the same information provided to the referring physician on the day of discharge. The following are critical errors that are often made in patient discharges and should be considered during the discharge process:

1. Patients are not scheduled for subspecialty appointments prior to discharge (i.e. Peds Neurosurgery, Peds Orthopedics, ENT, Plastics, etc.)
2. Patients are not given adequate supplies or medication\*\*. This is poor patient care, results in unnecessary patient calls, and is unfair to the patient and their family. Please make sure

that patients are given adequate medication and supplies to make it to their first clinic appointment.

3. Appropriate labs and X-rays are not being ordered for the first clinic visit.
4. The first pediatric surgery clinic appointment should be scheduled 2-4 weeks following discharge unless otherwise specified. Not all patients require a Pediatric Surgery clinic appointment. Please check with the chief surgical resident, PA, or attending physician before scheduling a follow-up appointment.
5. The attending physician of record named on the discharge summary should be the attending physician that is on service at the time the patient is discharged. This may not necessarily be the physician that was most actively involved in the patient's care.

## **B. Service to Service Transfers**

Multiple or single system injury patients can be transferred to an appropriate subspecialty service when they are stable. Coordination of the transfer process is the primary responsibility of the Chief Pediatric Surgical resident. After transfer to another service, the Pediatric Surgery Service should function as a consultative service when appropriate.

## **V. Clinic Responsibility**

### **A. Pediatric Surgery Clinic**

- Clinic is Monday 1pm – 4pm and Friday 9am – 1pm. Clinic is located on the second floor of the Kentucky Clinic in the Pediatric Specialties clinic.
- All new patients seen in clinic who are being evaluated for a surgical procedure will need a full H&P on the proper preprinted form even if they don't end up getting an operation.
- Residents/Students will see the patients first and then present to either the attending or the PA.

## **VI. OR Scheduling**

### **Booking an Operative Case**

These patients may be inpatients, transfers from outside facilities seen in our ED or 4-outpatient area, or unexpected patients arriving by EMS or private car.

1. Obtain a H&P
2. Obtain Consent from parent of guardian
3. Call the Front OR desk at 3-5631 to schedule case
4. OR desk will require the Child's name, MRN, location, procedure, attending physician, classification, and how long NPO

### **Operation Classifications:**

The booking of emergent surgical cases is the primary responsibility of the chief surgical resident.

**Class A Emergency** (require surgery within 1 hour)

**Class B Emergency** (require surgery within 4 hours)

**Class C Emergency** (require surgery within 8 hours)



## **TEACHING CONFERENCES**

### **Pediatric Trauma and Critical Care Conference**

There is a mandatory weekly Pediatric Surgery Conference. All team members of the service are expected to attend unless precluded by patient care responsibilities. Conferences are held at 8 am on Mondays in the Hillenmeyer Room, or once a month in Pediatric Radiology.

## **LEGAL RESPONSIBILITY**

Many pediatric trauma patients become involved in custody, civil or criminal cases. Consequently, residents often receive a subpoena to testify in these cases. Under most circumstances, the responsibility to testify in court belongs to the attending faculty member that supervised the case. Please bring all subpoenas involving testimony in these cases to the immediate attention of the Chief, Division of Pediatric Surgery. All other medical practice/legal issues should be brought to the immediate attention of the Attending Physician and/ or the Chief, Division of Pediatric Surgery.

## **TRAUMA/EMERGENCY SERVICE GUIDELINES**

There are a number of guidelines that govern the treatment and care of Pediatric Trauma patients. The surgical residents are expected to be familiar with these guidelines and to adhere to them.

## **SECTION 2: ED PEDIATRIC TRAUMA PROCESS GUIDE**

### **Pediatric Trauma Admission Guide**

This manual is designed to clarify guidelines for pediatric trauma patient admissions to the University of Kentucky Hospital. A major pediatric trauma patient is any patient age  $\leq 14$  years of age with significant injury to two or more systems, or pediatric patient that has a high potential for injury to two or more systems due to mechanism of injury. Major pediatric trauma patients also include those with evidence of physiological compromise that cannot be attributed to only one organ system.

All pediatric trauma patients with injury to more than one system, or who are otherwise included under the definition of major trauma, will be admitted to the Pediatric Surgery Service for a period of no less than twenty-four (24) hours. Admission to services other than Peds Surgery does not preclude close consultation with the service on trauma patients. Any alteration in the condition of the patient will require evaluation by the Pediatric Surgery Service and any appropriate consultative service.

If after twenty-four hours the patient has a single system injury without injury to another system, transfer to the appropriate service will be instituted. The Pediatric Surgery Service may be requested to function as a consultative service on the patient after transfer of the patient to another service.

## I. Criteria for Pediatric Trauma Alert

In order to ensure that critically injured pediatric patients (  $\leq 14$  years of age) receive appropriate medical care, the Pediatric Surgical Service has developed criteria to guide medical professionals in rendering pediatric trauma care.

### A. Pediatric Trauma Alert Red

A Pediatric Trauma Alert Red will be issued if any pediatric trauma patient exhibiting any of the criteria:

- Gunshot or Penetrating wound to the neck, chest, back, or abdomen
- Confirmed age specific hypotension at any time.
- Any patient who remains hemodynamically unstable after 2 boluses of 20 ml/kg of isotonic crystalloid.
- Any pediatric trauma patient receiving/having received blood transfusion to maintain vital signs
- GCS < 8 with mechanism attributed to trauma
- Intubated patients transported directly from the scene
- Patient with respiratory compromise or obstruction
  - Includes intubated patients transferred from referring hospital with ongoing respiratory compromise
  - Does not include intubated patients from referring hospital who are stable from a respiratory standpoint
- Emergency Medicine Attending Discretion

\*HDUS (Hemodynamically Unstable)

Age	SBP
<1	<80
>1	<80-89

### B. Pediatric Trauma Alert

A Trauma Alert will be issued if a patient exhibits one or more of the following criteria:

- Pediatric trauma score <13
- Respiratory rate <10 or >30
- Glasgow Coma Score (EMV) <10
- Any intubated trauma patient
- Penetrating trauma to head
- Traumatic IC Bleed and/or skull fracture
- 2<sup>nd</sup> or 3<sup>rd</sup> degree burn > 15% BSA
- Age  $\leq 14$  with significant mechanism of injury
- Falls >15 feet
- Rollover MVC
- MVC with Ejection of the patient
- Extrication time >20 minutes
- Motor Vehicle Crash at speeds > 40 Mph
- Motorcycle or ATV crash speed >20 Mph with separation of rider
- Same vehicle occupant fatality

- Pedestrian struck by a motor vehicle at >20 mph
- Blast injury
- Two or more proximal extremity fractures and/or open fractures
- Amputation above the wrist/ankle
- Multiple system trauma requiring immediate evaluation/intervention by more than one surgical specialty
- Emergency Medicine Attending Discretion
- Pediatric Surgery Attending Discretion

## University of Kentucky Hospital Level I Trauma Center

### Pediatric Trauma Activation Criteria Age $\leq 14$ years

#### Trauma Alert Red

#### Trauma Alert

Criteria	Criteria						
<b>One or more of the following:</b> <ul style="list-style-type: none"><li>• Gunshot wounds or penetrating trauma to the neck, chest or abdomen.</li><li>• Confirmed age specific hypotension at any time.<ul style="list-style-type: none"><li>• Any pediatric trauma who remains HDUS after 2 Boluses of 20 ml/kg Isotonic Crystalloid.</li></ul></li><li>• Any pediatric patient receiving/received blood transfusion.</li><li>• GCS <math>&lt; 8</math> with mechanism attributed to trauma.</li><li>• Intubated patients transferred directly from scene.</li><li>• Patients with respiratory compromise or obstruction<ul style="list-style-type: none"><li>Includes intubated patients who are transferred from another facility with ongoing respiratory compromise.</li><li>Does not intubated patients from referring facility who are stable from a respiratory standpoint.</li></ul></li><li>• Emergency Medicine Attending discretion.</li></ul> <p>*HDUS (Hemodynamically Unstable)</p> <table><tr><th>Age</th><th>SBP</th></tr><tr><td><math>&lt; 1</math></td><td><math>&lt; 80</math></td></tr><tr><td><math>&gt; 1</math></td><td>80-89</td></tr></table> <b>Response/Resources activated:</b> <ul style="list-style-type: none"><li>• Pediatric Surgery Attending</li><li>• Pediatric Surgery Chief Resident</li><li>• Trauma Surgery Chief Resident</li><li>• Anesthesiology Attending</li><li>• ED Nurses</li><li>• ED Technicians</li><li>• ED Paramedics</li><li>• Ultrasound Technician</li><li>• Radiology Technician</li><li>• Respiratory Therapist</li><li>• CT Scan Technician</li><li>• Blood Bank confirms availability of uncross-matched blood in ED refrigerator</li><li>• Operating Room Charge Nurse</li><li>• Operating Room made available</li><li>• Chaplain</li></ul>	Age	SBP	$< 1$	$< 80$	$> 1$	80-89	<b>One or more of the following:</b> <ul style="list-style-type: none"><li>• Trauma Score <math>&lt; 13</math>.</li><li>• Respiratory Rate <math>&lt; 10</math> or <math>&gt; 30</math>.</li><li>• Glasgow Coma Score <math>&lt; 10</math>.</li><li>• Any intubated trauma patient.</li><li>• Penetrating trauma to the head.</li><li>• Traumatic ICB or Skull fracture</li><li>• <math>&gt; 15\%</math> BSA with 2<sup>ND</sup> or 3<sup>RD</sup> degree burns</li><li>• Age <math>\leq 14</math> with significant mechanism of injury.</li><li>• Falls <math>&gt; 15</math> feet.</li><li>• Rollover MVC.</li><li>• Ejection of patient.</li><li>• Extrication <math>&gt; 20</math> minutes.</li><li>• Motor vehicle crash speed changes <math>&gt; 40</math> mph.</li><li>• Motorcycle crash speed <math>&gt; 20</math> mph &amp; separation of rider.</li><li>• Same vehicle occupant fatality.</li><li>• Pedestrian struck by a motor vehicle.</li><li>• Blast Injury</li><li>• Two or more proximal extremity fractures and/or open fractures.</li><li>• Amputation above ankle or wrist.</li><li>• Multiple system trauma involving more than one surgical specialty.</li><li>• Emergency Medicine Attending discretion.</li><li>• Pediatric Surgery Attending discretion.</li></ul> <b>Response/Resources Activated:</b> <ul style="list-style-type: none"><li>• Emergency Medicine Attending</li><li>• Pediatric Surgery Chief Resident</li><li>• Pediatric Surgery Attending - <i>notified</i></li><li>• Trauma Surgery Chief Resident</li><li>• Emergency Medicine Residents</li><li>• ED Nurses</li><li>• ED Technicians</li><li>• ED Paramedics</li><li>• Radiology Technician</li><li>• Ultrasound Technician</li><li>• Respiratory Therapist</li><li>• CT Scan Technician</li><li>• Blood Bank confirms availability of uncross-matched blood in ED refrigerator</li><li>• Chaplain</li></ul>
Age	SBP						
$< 1$	$< 80$						
$> 1$	80-89						

## **II. Initiation of Pediatric Trauma Alert**

A. The Pediatric Surgery Service authorizes the following individuals to initiate a Pediatric Trauma Activation if any of the criteria are met during transport or upon arrival:

- Pre-hospital ambulance and Air Medical personnel
- Emergency Department charge nurse
- Surgical resident
- Emergency Department physician, trauma attending, or peds surgery attending may initiate a Trauma Alert at his/her discretion regardless of mandatory criteria met

B. Authorized personnel will initiate a Pediatric Trauma Alert when:

- A patient who exhibits one or more criteria is scheduled to arrive at hospital < 15 minutes.
- A patient who exhibits one or more criteria arrives without previous notification.
- A patient's condition deteriorates acutely while in the Emergency Department.

Only the Senior Trauma/Peds Surgery/EM Physician can deactivate a Pediatric Trauma Alert and dismiss Trauma Alert personnel from the Emergency Department. The Emergency Department Charge Nurse will document Trauma Alert deactivation on the nursing care record and will ensure appropriate documentation on the Trauma Alert Log completed by the clerical staff in order to prevent unwarranted patient billing.

## **III. Pediatric Trauma Alert Activation**

A. Notification:

1. When authorized personnel request a Pediatric Trauma Alert Red/Trauma Alert the ED charge nurse will:
  - Notify the ED Patient Relations Assistant (PRA) of Trauma Alert/Trauma Alert Red.
  - Document the patient's name, time, and trauma alert indicator on the Trauma/Critical Care Flow Sheet.
2. The ED PRA will call the paging operator via STAT number and instruct him/her to issue a Pediatric Trauma Alert/Trauma Alert Red supplying estimated time of arrival (ETA), and brief patient descriptors for mechanism of injury, and:
  - Notify the Blood Bank by phone (Trauma Alert Red/Trauma Alert only)
  - Document all notifications in the Trauma Alert Log and denote Trauma Alert/Trauma Alert Red.
3. When the paging operator receives instructions from the ED clerk, he/she will activate the Pediatric Trauma Alert pager system to notify Team members.

B. The Pediatric Trauma Alert Team consists of:

- Pediatric Surgery Attending (Required for Trauma Reds)
- Pediatric Surgery Chief Resident
- Trauma Surgery Chief Resident
- Anesthesiology Attending (Required for Trauma Reds)
- Emergency Department Nurse(s)
- Emergency Medicine Attending & Resident
- Emergency Department Paramedic
- Emergency Department Technician
- Respiratory Therapist
- Radiology Technologist
- Ultrasound Technologist
- CT scan Technologist
- Operating room Charge Nurse notified
- Operating room made available (Required for Trauma Reds)
- Chaplain

The Pediatric Chief Surgery Resident and intern will respond within five minutes (15 minutes if out of house). Because the Pediatric Surgery Chief Resident may take call from home, the Trauma Service Chief Resident also responds to the Pediatric Trauma Alerts to provide direction of the resuscitation until the Pediatric Surgery Chief Resident arrives, or to provide assistance to the Pediatric Surgery Chief Resident. Care of the patient and direction of the resuscitation will be assumed by the Pediatric Surgery Chief Resident upon his/her arrival.

#### **IV. Pediatric Trauma Alert Process**

##### **A. Pediatric Trauma Team Physicians**

When physicians assigned to the Trauma Team are notified that a Pediatric Trauma Activation is in effect they will:

- Report to the ED within five minutes of notification.
- Assume roles outlined in Trauma Resuscitation Roles and Responsibilities.

As the Trauma Charge Physician, the Peds Surgery Chief Resident/Trauma Chief Resident/Senior Emergency Medicine Physician will coordinate response activity. The Peds Surgery Chief Service Primary Call Resident will notify capacity command center staff of potential admission.

##### **B. Pediatric Trauma Alert Emergency Department Nurses**

When a Pediatric Trauma Alert is issued, the ED charge nurse and primary patient care nurse will:

- Designate a Trauma Nurse #1 and a Trauma Nurse #2
- Notify the Pediatric Charge Nurse of the patient's pending arrival
- Designate a Trauma Nursing Care Technician
- Designate a Emergency Department Paramedic

- Assign other personnel roles and responsibilities as designated in the Trauma Resuscitation Roles and Responsibilities
- Prepare Pediatric Trauma Resuscitation room for patient
- Document the names and arrival times of Pediatric Trauma Alert personnel

#### C. Pediatric Trauma Alert Radiology Personnel

When a Pediatric Trauma Alert is issued, the Radiology technician and Ultrasound Technician assigned to the team will respond within 5 minutes to:

- Deliver a portable Radiology machine to the Emergency Department within five minutes.
- Deliver a portable Ultrasound machine within five minutes
- Perform and process radiographs of trauma patients as quickly as possible.
- Perform and process Abdominal Ultrasound (FAST exam)
- Ensure CT Scan availability, provide oral contrast if requested
- Notify radiologist that trauma patient's radiographs are ready for evaluation

#### D. Blood Bank Personnel

Blood Bank personnel will ensure that the ED blood refrigerator in the ED is stocked with O negative and O positive PRBCs for use with unstable trauma patients.

- Prepare requested number of units of type-specific blood within 15 minutes after receipt of patient blood sample, and notify ED when blood is ready.
- Prepare requested number of units of cross-matched blood within 45 minutes after receipt of patient blood sample, and notify ED when blood is ready.
- Implement the Rapid Transfusion Guideline upon request of the Pediatric Trauma Team leader

#### E. Operating Room Personnel

When the Operating Room is notified via the pager that a Pediatric Trauma Alert has been issued, Operating Room personnel will:

- Determine Operating Room availability.
- Evaluate potential need for Operating Room Scrub and Circulating Teams.
- Evaluate potential need for Anesthesiology Team (attending and senior resident/CRNA).

**In the event of a Pediatric Trauma Alert Red**, an operating room will be designated and held for 30 minutes in anticipation of emergency operative intervention. The Attending Anesthesiologist will respond to the Emergency Department within five (5) minutes of Pediatric Trauma Alert Red notification to assist with airway management if necessary and to evaluate the patient for pending operative intervention.

#### F. Laboratory Personnel

When the laboratory is notified by the ED clerk that a Pediatric Trauma Alert has been issued, laboratory personnel will:

- Expedite analysis of all trauma labs.
- Call Emergency Department to report all panic level laboratory results. All other laboratory results will be reported to the ED via the computer.

#### G. Respiratory Therapy Personnel

When a Pediatric Trauma Alert is issued, the ED Respiratory Therapist will:

- Report to Emergency Department within five minutes of notification.
- Obtain, set up, and manage ventilator.
- Assist physicians with airway management and ventilatory support.

### V. **Pediatric Trauma Alert Quality Assurance**

- A. The Pediatric Trauma Coordinator will review all Pediatric Trauma Alert Red/Trauma Alert records for completeness of information and for details of the response efforts (trauma alert indications, arrival times of Pediatric Trauma Team members and ancillary personnel, availability of resources, timeliness of care, response to interventions).
- B. The Pediatric Trauma Coordinator will submit a quarterly report and summary of all Trauma Alerts to the Pediatric Trauma Patient Care Committee.
- C. The Pediatric Trauma Coordinator will present specific issues or concerns related to a case(s) for discussion and action planning to the Pediatric Interdepartmental Trauma Quality Assurance Committee or the Pediatric Trauma Patient Care Committee. If the committee determines that response was sub-optimal, the Chairman will notify the department director or service chief of the area that delivered sub-optimal service.
- D. All Pediatric Trauma Alert Red activations will be reviewed utilizing the following criterion:
  - Response of trauma alert members
  - Appropriateness
  - Forward progress/conduct of resuscitation
  - Time to OR
  - OR preparedness
  - Patient Outcome

All Pediatric Trauma Alert activations quality monitoring results will be forwarded to the Pediatric Trauma Director.



## **Pediatric Trauma Resuscitation Roles and Responsibilities**

**PURPOSE:** To establish guidelines for staff roles and responsibilities during trauma resuscitation of the critically injured child.

### **PROCEDURE:**

#### **Pediatric Surgery Attending/Trauma Attending/Trauma Fellow**

- A. Provides guidance and oversees trauma resuscitation.
- B. Performs and/or assist with procedures.

#### **Trauma Team Leader**

- A. Assigned to the Peds Surgery Chief Resident, Trauma Chief Resident, or Emergency Medicine Resident present or EM Attending. Pediatric Trauma Alert Red will be managed by the Pediatric Surgery Service and/or the Trauma Service with the assistance of the Emergency Medicine Service.
- B. Designated as Trauma Team Leader in charge of the Pediatric trauma resuscitation under the guidance of the Peds Surgery, Trauma, or EM Attending.
- C. Responsible for:
  - Overall patient evaluation and management.
  - Ensuring completion of primary and secondary surveys.
  - Communicating assessment findings to recording RN.
  - Determining priority of procedures and necessary tests.
  - Determining need for and timing of operative intervention when indicated and contacting the OR.
  - Determining the need for appropriate consultations.
  - Making physician assignments.
  - Dismissing ancillary personnel when services are no longer needed.
  - Deactivating Trauma Alerts when appropriate.
  - Ensuring traffic control.
- D. The Trauma Team Leader may assume or delegate the team leader role based on the needs of the patient. If the team leader role must be delegated to another person, the trauma team must be aware of this change. There must always be a clearly identified team leader that maintains responsibility for the resuscitation. The team leader role may not be delegated to first year residents.

### **Emergency Medicine MD or MD #2**

- A. Assigned to the EM resident, EM Attending, Anesthesiology Attending or Surgical Resident
- B. Responsible for:
  - Airway management and assuring cervical spine immobilization.
  - Coordinates initial assessment of airway and breathing.
  - Communicates findings to Trauma Team leader and Documenting RN

### **Primary MD or MD #3**

- A. Assigned to second-most Senior Resident, preferably second-year or higher.  
Responsible for:
- Assisting Trauma Team Leader in patient evaluation and management.
- Performs primary and secondary assessment.
- Performing necessary procedures under the direction of the Trauma Team Leader.
- Coordinating orders.

### **MD #4**

- A. Assigned to third-most Senior Resident, preferably first-year or higher.
- B. Responsible for:
  - Assisting in patient evaluation and management under the direction of MD #3.
  - Contacting CT Scan and Radiology Special Procedures, as needed, under the direction of the Trauma Team Leader.
  - Entering orders and completing Trauma H & Ps under direction of MD #3.

### **Emergency Department Charge Nurse**

- A. Pre-notifies physicians, primary patient care nurse, circulating nurses and financial counselor of impending arrival.
- B. Responsible for:
  - Delegating responsibility of checking equipment and supplies within the Pediatric Trauma Resuscitation area.
  - Assisting with traffic control.
  - Acting as family liaison as needed.
  - Disseminating pre-hospital patient report to appropriate MD's/RN's.

### **Primary Patient Care Nurse**

- A. Prepares Trauma Resuscitation area prior to patient arrival, and ensures that needed equipment/supplies are readily available.
- B. Directs nursing team members as needed and assumes overall nursing responsibility for patient to include:
  - Assists with initial assessment.
  - Monitors VS – Gives 5 minute updates.
  - Ensures patient is placed on Cardiac monitor.
  - Ensures PIVs are functional & insertion of additional IV's as needed Confirming labs are obtained and sent.
  - Obtains and sends labs.
  - Places NG tube and/or foley cath as appropriate
  - Accompanying patient outside the ED, as needed.
  - Ensuring initial notification of family and providing ongoing clinical updates.
  - Notifying Capacity Command Center of bed requirement as soon as possible.
- C. Responsible for ensuring documentation from admission to time of disposition or report to oncoming RN including:
  - Notification and response times of all medical and ancillary personnel.
  - Documentation of EMS/Air Medical report.
  - Documentation of Mechanism/time of injury & patient history.
  - Obtains Vital signs, temp, cardiac rhythm strips.
  - Ongoing assessment/re-evaluation.
  - Assists with procedures performed by physicians.

### **Circulating Nurse/EM Paramedic**

- A. Responsible for:
  - Assisting with initial assessment.
  - Obtains first manual BP pressure.
  - Assists with medication administration.
  - Assisting physicians with procedures.
  - Assisting in removal of patient clothing.
  - Inserting additional peripheral IV's and drawing labs.
  - Assisting with nursing procedures (e.g. nasogastric tubes, Foley catheters).
  - Assisting with administration of colloids/crystalloids or blood products (via fluid warmer, as needed).
  - Paramedics will not administer colloids.

### **Emergency Department Nursing Care Technician**

- A. Responsible for:
- Assisting in set-up of trauma resuscitation area.
  - Obtaining blood from Blood Bank if necessary.
  - Obtaining IV fluids and blankets from warmer.
  - Assisting in removal of patient clothing.
  - Processing lab specimens.
  - Obtaining additional supplies as directed by nurses.
  - Ensuring patient has an arm/wrist identification band.
  - Processing patient clothing/valuables.
  - Assisting with CPR, as needed.
  - Assisting with patient transport.

### **Scribe or Documenting Nurse**

- A. Responsible for:
- Documents Initial Resuscitation.
  - Assists with crowd control.
  - Assists with procedures as needed.

### **Financial Counselor(s)**

- A. Pre-notifies Radiology, Respiratory Therapy, Operating Room, Blood Bank etc. prior to patient arrival.
- B. Identifies patient from EMS run sheet, Air Medical records, and/or patient's family and updates computer when possible.
- C. Prepares lab slips, X-Ray requests, EKG requests and ID bracelets.
- D. Secures patient valuables in ED safe.

### **Respiratory Therapy**

- A. Assists with airway management.
- B. Ventilates patient.
- C. Prepares, monitors and documents all required aspects of mechanical ventilation.
- D. Assists during patient transport.

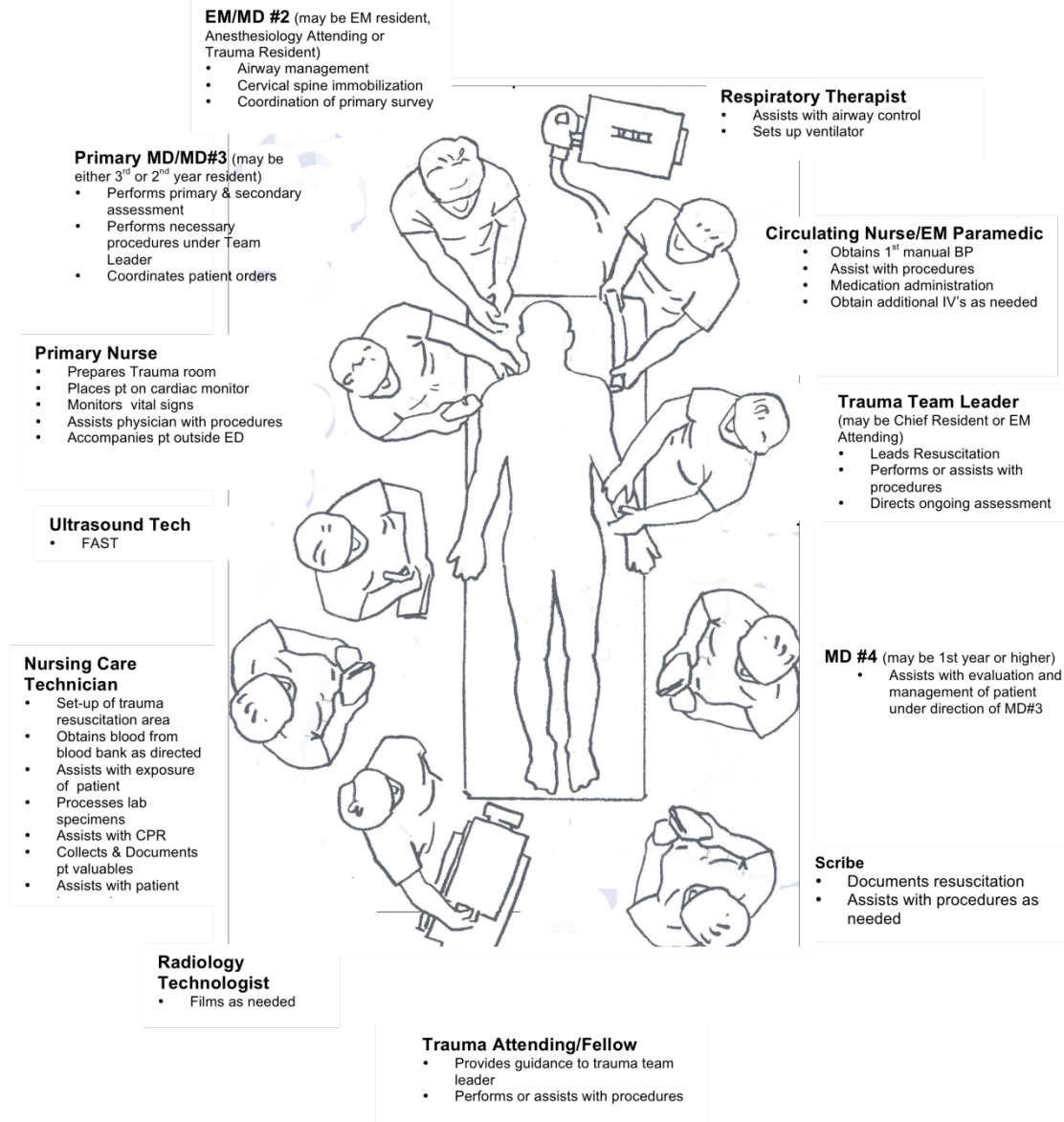
### **Radiology Technologist**

- A. Responsible for obtaining radiography studies in a timely manner as ordered.

### **Ultrasound Technologist**

- A. Performing Focus Abdominal Sonogram Test (FAST) as ordered in a timely manner.

## MULTIDISCIPLINARY TRAUMA TEAM ROLES AND RESPONSIBILITIES



# Pediatric Trauma Lab Requirements:

The pediatric trauma patients should have labs drawn as soon as possible after arrival. If possible, draw labs with PIV insertion to prevent the need for additional sticks. Below is a reference for required lab specimens. Additional labs may be ordered at the physicians discretion based on patient condition. These charts are posted in the resuscitation room.

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## Pediatric Trauma Venipuncture Reference

### Non-intubated Patients: Must draw at least 5 ml

1) **Type and Cross** – Use **Pink** topped vacutainer (adult sized) with minimum **3ml** for children > 4 months old. May send two **lavender** topped microtainers (shown below) for infants less  $\leq$  4 months of age.



2) **Venous Blood Gas** (with electrolytes) – Use Pre-packaged Heparinized ABG syringe, filled to **1 ml** line

3) **CBC** – Use **lavender** microtainer, minimum of **0.25 ml** required



4) **BMP** – Use **green** microtainer, minimum of **0.5 ml** required



**\*If you are unable to get enough blood for all tests, send what you have in the order of priority listed above**

**\*\*Above are *minimum* amounts of blood required for the ordered labs. Only if additional blood is available (e.g., if patient has deep line or a-line in place), then use larger vacutainers (adult sized) for other ordered tests.**

## Pediatric Trauma Venipuncture Reference

**Intubated Patients:** Must draw at least **7.5 ml** for ordered tests.

1) **Type and Cross** – Use **Pink** topped vacutainer (adult size) with minimum **3 ml** for children >4 months old. May use two **lavender** topped microtainers (shown below) for infants  $\leq$  4 months of age.



2) **Arterial or Venous Blood Gas** - Use Pre-packaged ABG Heparinized syringe, filled to **1 ml** line

3) **CBC** – Use **lavender** microtainer, minimum of **0.25 ml** required



4) **CMP** – Use **green** microtainer, minimum of **0.75 ml** required



5) **PT/PTT/Fibrinogen** – Use adult sized **blue** topped vacutainer, minimum **1.8 ml**

6) **Lactate** – Use **grey** microtainer, minimum of **0.25 ml** required



**\*If you are unable to get enough blood for all tests, send what you have in the following priority order:**

- 1) **Type and Cross**
- 2) **VBG with electrolytes**
- 3) **CBC**
- 4) **BMP**
- 5) **PT/PTT/Fibrinogen**
- 6) **Lactate**

## Guide for Pediatric Body CT in the Emergency Department

<b>Image acquisition:</b>	0.625 mm slices Kv: 100 (pt < 36 kg); 120 (pt > 36 kg) mA: modulates by patient weight Gantry rotation: 0.4 seconds Noise: 12
<b>Reconstruction:</b>	First series: 5mm slices at 2.5 mm intervals (std algorithm) Second series: 1.25 mm slices at 0.625 mm intervals (soft algorithm) Third series: 5mm slices at 2.5 mm intervals (lung algorithm)
<b>Contrast:</b>	IV: volume per pt weight (2-3 cc/kg) power-injected over 1 minute.
<b>Contrast timing:</b>	Nontrauma: Chest: 70 seconds Abdomen/Pelvis: 85 seconds C/A/P: 80 seconds Trauma: Chest: 55 seconds Abdomen/Pelvis: 80 seconds C/A/P: chest at 55 seconds and A/P 20-25 seconds later Delayed scanning (at discretion of radiologist): 70-120 seconds.
<b>Oral Contrast:</b>	None

### Parameters:

1. All pediatric CTs from the ED will be performed with IV contrast unless:
  - a. Known contrast allergy
  - b. Creatinine >1.5
  - c. Question is urinary tract stone (CT urogram)
  - d. Question of retroperitoneal hemorrhage (particularly in hemophilia pts)
2. Oral contrast is not routinely given to pediatric patients. Requests for oral contrast must have approval from pediatric radiologist or call resident, and may be considered in the question of pelvic cystic mass or abscess.
3. Except in the case of a CT urogram, a pediatric CT ordered without contrast should be discussed with the radiology resident or attending on call as another imaging study may be more appropriate.
4. All chest CTAs for PE should be discussed with the tier 2 resident or the peds radiology attending on call. Given the extremely high radiation dose required for this exam, the patient should have suggestive labs and risk factors for PE.
5. CTs on children less than 2 year old (except in the case of significant trauma) should be discussed with tier 2 resident or peds radiology attending. These exams tend to be poor without sedation, and another imaging study may be more appropriate.



**Special considerations for trauma:**

1. Leads should be moved to the extremities and support apparatus/lines should be moved above or below the chest, abdomen, and pelvis. These cause significant streak artifact, which can lead to equivocal interpretations as to vascular injury.
2. Trauma scans should be checked by the tier 2 resident or peds radiology attending immediately after the scan is performed to determine if delayed images are needed. The pediatric surgery attending or SAR may choose to forego the delayed imaging if the patient is unstable, but the assessment for active bleeding may be incomplete. Technologist should document in memo pad section of ISUITE if patient is removed from CT table before requested delays are performed.
3. CT technologists in the EDP have been asked to verify whether or not the chest portion of a body CT is wanted prior to performing the scan. Once the dose of IV contrast is administered, the patient cannot receive more contrast for 24 hour...so late request for the chest portion will be limited (and cannot assess vascular structures).

<b>University of Kentucky / UK HealthCare Policy and Procedure</b>	<b>Policy #ED08-75</b>
<b>Title/Description: Care of Patients in Need of Immediate Surgery When the Operating Room is at Maximum Capacity</b>	
<b>Purpose:</b> To provide criteria and procedures to manage the needs of patients who require access to the OR at times when the Operating Room is at maximum capacity.	

**POLICY:**

Patients meeting the following criteria may access the Operating Room under this policy:

- I. Acute Intracranial Bleeding - Rapidly progressing process or lesion leading to herniation or paralysis (ex: acute subdural hematoma, acute epidural hematoma, acute intracerebral hematoma, and/or acute spinal cord compression).
- II. Exsanguinating Hemorrhage:
  - A. Penetrating neck or chest trauma
  - B. Blunt neck or chest trauma
  - C. Intraabdominal bleeding (ex: penetrating or blunt trauma, ruptured abdominal viscerae, aortic, or iliac aneurysm)
- III. Potential for Acute Arterial Hemorrhage (established diagnosis)
  - A. Traumatic thoracic aortic injury
  - B. Thoracic aortic dissection or aneurysmal rupture
  - C. Leaking abdominal aorta/iliac artery aneurysm
- IV. Airway Emergencies Requiring Surgical Intervention
  - A. Traumatic disruption of airway
  - B. Airway compromise due to obstruction
  - C. Intrathoracic and/or lung hemorrhage with respiratory compromise

**PROCEDURE:**

In conjunction with the OR response, the staff in the ED will respond in the following manner:

- I. Trauma Service Responsibilities
  - A. Senior most surgeon present
    1. Responsible for determining priorities and management of patient care that necessitates immediate OR access and policy activation.
    2. Responsible for notifying OR clerk and charge nurse.
    3. Responsible for notifying ED staff.
    4. Designates trauma team roles as scrub or circulator.
  - B. Remaining surgeons
    1. Responsible for retrieving required carts: i.e. craniotomy, airway, chest, abdominal or vascular depending on need.
2. Responsible for opening room, setting up sterile field, serving as scrub and circulating personnel until OR personnel arrive.
  - C. Prior to entering OR room, all staff will apply head covering, mask, and shoe covers.

## II. Emergency Department Staff

### A. ED Charge Nurse

1. Responsible for determining need for Trauma Alert Red and for anticipating necessity for accessing the Operating Room.
2. If aware of OR maximum capacity, assess ED staff, assignments and current activities (if time allows).
3. Responsible for reassigning ED patients of primary patient care nurse if patient going to OR (may also send NA if ED staffing allows).
4. Responsible for determining availability and need for additional resources.
5. Communicates need for respiratory therapist to accompany patient to OR.
6. Responsible for ensuring that blood bank delivers blood to OR.

### B. Patient Care RN

1. Assumes nursing responsibility for the patient; delegates responsibility to others, when available, to accomplish tasks.
2. The ED nurse will prepare the patient for transport and accompany the patient immediately to the OR.

NOTE: Patients directly admitted to the OR via Air Medical Services will be accompanied by the Air Medical staff who will continue resuscitation until relieved by the ED nurse or OR personnel (i.e., Anesthesia).

3. The ED nurse will facilitate continued resuscitation in the OR until the call team arrives. The ED nurse will be responsible for the following:
  - a. Monitoring and preservation of airway patency
    1. Assisting with intubation or surgical airway as necessary
  - b. Continued volume resuscitation

1. Maintenance/titration of volume infusion rate (crystalloid and colloid)
  2. Autotransfusion

c. Ongoing hemodynamic monitoring

1. Obtaining specimens for laboratory studies
2. Administration/titration of drugs
  - d. Assisting physicians with procedures
  - e. Documentation on ED Nursing Care Record

The ED nurse will remain in the OR until released by the anesthesiologist and/or the arrival of the OR call team.

#### Quality Monitoring:

**\*\*All cases will be reviewed by the Trauma Coordinator and the Multidisciplinary Trauma Committee.**

## Optimal Logistics of Initial Trauma Evaluation

*University of Kentucky College of Medicine  
Section of Trauma and Surgical Critical Care Protocol Manual  
Jeffrey Coughenour, M.D.05/08*

### PRE-ARRIVAL

Universal precautions, assemble team, obtain trays for possible emergent procedures (Trach, thoracotomy, chest tubes, pleur-evac)  
Obtain as much information as possible from EMS report and discuss scenarios with MD/RN's present. Have a game-plan BEFORE the patient arrives



### PRIMARY SURVEY

Patient is moved to ED stretcher, primary assessment of ABCD performed  
Immediate life-threats are treated accordingly  
Exposure of the patient, manual BP by primary RN, and transfer of necessary IV lines, ventilator circuit, etc.  
**NO ONE ELSE TALKS EXCEPT THE PERSON DOING THE PRIMARY ASSESSMENT AND TEAM LEADER AS NEEDED**



### EMS REPORT AND INITIAL STUDIES

Several things happen simultaneously...  
One EMS provider gives report ONE TIME while the entire team listens  
Radiology tech performs CXR/Pelvis (as indicated)  
Ultrasound tech/MD performs FAST (as indicated)  
RN/tech continue exposure, attaching monitors, IVF, vent circuit as indicated



### SECONDARY SURVEY

Complete head to toe examination  
Logroll off LSB if not already completed  
Additional procedures once exam complete: NG/OG, foley, change from EMS extrication collar to Miami-J, add'l lines, etc  
Team leader prepares for move to next destination: OR, CT, angio



### TRANSPORT & ADDITIONAL STUDIES

Assure labs are drawn/sent  
IVF, sedation meds, respiratory therapy present?  
Is there family present that we can talk with?  
Physician dedicated to the bedside for transfer of all critically ill patients

## Documentation of Pediatric Trauma Alert/Trauma Alert Red Patients

### Purpose:

Provision of guidelines for use of the paper Trauma Care Nursing Record will allow a standardized method for use of the assessment tool resulting in more effective utilization and accuracy of the tool and the data collected. Pediatric patients that do not meet Trauma Alert/Trauma Alert Red Criteria will have documentation completed on the SCM Computerized Chart

### Rationale:

Effective and timely management of the multiple trauma pediatric patient demands a rapid, organized, systematic approach to assessment, planning, implementation and evaluation. The paper trauma nursing record provides the framework for organization of the approach and provides a documentation tool to facilitate establishment of a permanent record of comprehensive baseline and monitoring assessment data as well as facilitating the documentation of the implementation and evaluation phases of the nursing process. The nursing record organizes specific data points to assist in determination of patient status and detection of potential or actual human response to injury.

### Considerations

1. The trauma nursing record is included in the patient's permanent medical record.
2. Use of the assessment tool is initiated by the nurse when it is determined that the patient meet Pediatric Trauma Alert or Trauma Alert Red criteria. The tool must be used with all critically injured pediatric patients who require ongoing monitoring and are classified as acuity Level I or II. After completion of the initial resuscitation, when the patient condition has stabilized, the documentation can be transitioned to the SCM computer chart.
3. As assessments, interventions and/or evaluations are completed the corresponding time and information will be recorded in the appropriate area.
4. Evaluative notes will be recorded under the Nursing Evaluation section of the nursing care record.
5. The record must be signed and initialed by all nurses delivering care to the patient including the recording nurse. Assurance of adequate signatures to document care is the responsibility of the patient care nurse.
6. A mechanism for quality assurance will be implemented to audit charts for completeness. Staff will receive feedback surrounding quality assurance audit filters regarding form completion and/or documentation issues.

### Requisites

1. Black or blue ball point pen essential.
2. Trauma Nursing Record (sample of form attached).

Procedure:

1. Legibly print patient name in addressograph area.
2. Record demographic information:
  - a. Classification
  - b. Time of arrival - in military time
  - c. Date
  - d. Age
  - e. Sex
  - f. Weight - in kilograms or pounds
  - g. Mode of arrival:
    - If Air Med, specify: service.
    - If Lexington Fire Department, specify unit number: EC-1, EC-5, etc.
    - If ambulance, specify: Scott County, Jessamine County, etc.
  - h. Recording nurse: Specify by name
  - i. Patient care nurse: Specify by name
  - j. Circulating nurse names in appropriate areas.
  - k. Physician: Specify by name
  - l. Chief complaint/pre-hospital report - include as many details as are available concerning:
    1. Mechanism of injury: driver, passenger, restrained, unrestrained, ejected, roll-over, speed traveling, air bag, carseat or booster seat use, etc. Description of injury, object (if available) for penetrating trauma - caliber of gun, length or type of knife, removal of impaled objects, etc. Height of fall and surface patient landed on are important.
    2. Pre-hospital treatment: IV, intubation, immobilization, meds given and fluids infused (type and amount).
    3. Chief complaints: particularly important to help identify injuries and assess initial level of consciousness.
    4. Injury time: Actual time of MVC, fall, GSW, etc. This information is available from patient, pre-hospital personnel, referring hospital, paperwork, etc.
    5. Scene flight: Check box if patient arriving via helicopter directly from injury scene.
  - m. Past medical history - check the appropriate box and include any other conditions you identify.
3. Record information in boxes of trauma team response section.
  - a. If trauma activation is called, check the appropriate box for *Pediatric* and box for *Trauma Alert* or *Trauma Alert Red*.
  - b. For each team responder (e.g., Pediatric Surgery attending, Pediatric Surgery or trauma chief, Peds surgery or trauma resident, emergency medicine resident, anesthesia, neurosurgeon, U/S tech, RT, X-ray, etc.) complete time called and time arrived section under each responder.
  - c. Complete name section under each responder by writing in responder's first initial and last name.
4. Initial Assessment
  - a. Complete initial assessment section by documenting the primary and secondary survey findings. Document time assessment of system occurs in space provided. All sections should be completed in full. If you are unable to assess a particular area or it is not applicable document accordingly.

- b. All pediatric trauma patients must have a completed Glasgow coma scores, pupil evaluation & trauma score and on arrival and upon discharge from the ED.
- 5. After completion of the initial assessment, shade injured areas on diagram using legend at bottom of page.
- 6. Document lab draws with time, site, prep and person obtaining labs.
- 7. Vital Signs
  - a. Vital signs should have a PTA set documented. Then the frequency of the vital signs should correspond to the acuity of the patient. Vital signs will include Temp, BP, HR, RR, SpO2, GCS, and pupils.
  - b. Critical Care monitoring should be documented every hour at minimum e.g. Codman, ICP, CPP, CVP, PCWP, etc.
  - c. Intake and Output should be documented at regular intervals or as ordered by MD. This should include chest tube, NG tube, and visible external hemorrhage
  - d. Drips will be documented at regular interval for dosage and rate or when titrated.
- 8. Ventilator Settings will be completed initially and when changes occur.
  - a. ETCO2 should be continuously monitored and documented every hour at minimum for intubated pediatric trauma patients.
- 9. Intervention
  - a. Procedures - record time of procedures, size of tubes & lines placed along with sites and removal of backboard and/or changing of C-Collar in appropriate spaces. Other procedure data can be entered in the nursing evaluation section.
- 10. Resuscitation Fluids
  - 1. Record fluids patient received prior to arrival in shaded area.
  - 2. Record all fluids patient receives by using
    - a. Time
    - b. Fluid Type
    - c. Crystalloids - liter number (#)
    - d. IV site
    - e. "Y" for fluid warmer used
    - f. Colloids – document Type & unit number (#) & donor number (#) for blood products
    - g. Totals must be documented
- 11. Rhythm strip must be posted and interpreted for all pediatric patients with chest pain or a cardiac event.

12. Medications

Document all medication administration by entering time administered, name of med, dose, route, your initials and ordering MD.

13. Nursing Evaluation

Documentation of evaluation of patient response to interventions should be documented here. Nurses, EMT-Ps, and NCTs should include their initials after documenting and signature should be legible. If additional space is needed use nursing continuation record.

14. Transport

Patient transports to diagnostics should be documented in this space.

15. Discharge Information

Document D/C vital signs, admitting service, total I&Os and disposition of valuables. Transfer form should be completed if patient is transferred to another facility.

16. Notifications

All notifications should be documented by checking the box and inserting time notified in space provided.

17. Signatures

All nursing staff involved in care of the patient should sign and initial the nursing care record. All signatures should be legible.

18. Disposition

Document time report is called and last name of RN receiving report.

*Time of actual patient movement from the department should be noted as well as destination of patient. If "floor" is checked, enter room number.*

19. Place patient stickers in upper right corner of patient chart on white and yellow sheets. The white copy is to accompany the patient to the in-patient area and yellow stays in ED.



# **Transport of Pediatric Trauma Patients by UK Peds Transport Crew**

## **Information**

The pediatric surgeon on call or the Pediatric EM Attending physician will be responsible for activating the pediatric ground transport team to ensure timely inter-facility transport of trauma patients 0-5 years of age when other methods of transport are unavailable. The attending pediatric surgeon or Peds EM Attending physician will assume medical control for the duration of the transport.

## **Procedure**

1. Once a pediatric trauma patient has been accepted from another facility and it has been determined that other methods of transport are unavailable, the UK attending pediatric surgeon on call may contact the UK Emergency Communications office (323-6215) to request the pediatric transport team to transport the patient.
2. The UK Emergency Communications office will advise the physician if the transport team is available and will take patient information to relay to the transport nurses.
3. If the team is available the emergency communications tech will tone a ground transport and relay report information to the transport nurses.
4. The attending pediatric surgeon who activated the pediatric team will maintain medical control of the transport and will be available to the transport nurses through UKMDs.
5. Upon arrival at UK the patient will be admitted to the pediatric emergency department.

## **SECTION 3: ED PEDIATRIC PATIENT MANAGEMENT GUIDELINES**

### **I. Airway**

#### **Pediatric Endotracheal Intubation**

##### **INFORMATION:**

Endotracheal intubation is a means of providing an airway in a patient with an inadequate or compromised airway. Endotracheal intubation provides an airway only and patients may require assisted ventilation.

##### **INSTRUCTIONS:**

1. Insure that adequate ventilation and oxygenation are in progress.
2. Open airway by using the head tilt, chin lift method. If spinal injury is suspected use the jaw thrust method to open the airway. A towel may be placed beneath an infant's shoulders or older child's head to facilitate positioning.
3. Maintain open airway by using an oropharyngeal or nasopharyngeal airway.
3. Consider RSI (see guideline)
4. Endotracheal tube size may be chosen according to the formula:  
 $16 + \text{age in years} \div 4$   
or by the size of the child's little finger or nares;  
or by reference to the table below.
5. Have suction equipment available.
6. Hold the laryngoscope in the left hand. A Miller (straight) blade is preferred for patients <2 years of age. A Miller or Macintosh (Curved) blade may be used for patients > 2 years
7. Insert the laryngoscope in the right side of the mouth moving the tongue to the left.
8. Observe the epiglottis, then the vocal cords. Cricoid pressure may make visualizing of the vocal cords easier
9. Insert the endotracheal tube carefully watching the ETT pass through the vocal cords. Inflate cuff if applicable. (Use of a stylet may increase the chance of success)
10. Check the placement of the endotracheal tube by observing chest expansion and auscultating the chest and gastric area with a stethoscope.
11. Use E-Z cap CO<sub>2</sub> detector as an additional verification of placement.
12. Secure the endotracheal tube with tape of commercial device.
13. Insert Oral or nasal gastric tube to decompress stomach.
14. Obtain a chest film to ascertain exact placement of the ET tube.

**Endotracheal Tube and Laryngoscopes Sizes:**

Age	Weight	ET tube	Blade
< 28 weeks	<1000 g	2 to 2.5	0 Miller
28-34 weeks	1000-2000 g	2.5 - 3	0 Miller
34-38 weeks	2000 - 3000 g	3 - 3.5	0 Miller
term	> 3000 g	3.5 - 4	1 Miller
3 mo	5.5 kg	4	1 Miller
6 mo	7	4	1 Miller
1 yr	10	4.5	1 Miller
2 yr	12	4.5	1.5 Miller
3	14	5	2 Miller/Mac
4	16	5.5	2 Miller/Mac
5	18	5.5	2 Miller/Mac
6-7	20-22	6	2 Miller/Mac
8-10	25-30	6.5	2 Miller/Mac
Adult Female	60	7	
Adult Male	70	8	

**Formulas for size and depth of ETT****1. Estimation ETT size:**

$$\frac{16 + \text{age in years}}{4}$$

Use uncuffed ETT for child under 6-8 years of age. Subtract 0.5 from size of tube when using cuffed ETT

**2. ETT Depth:**

ETT depth (at gum line) should be approx = 3 X ETT size

**RSI INTUBATION**  
Julia E. Martin M.D.  
Assistant Professor  
Department of Emergency Medicine

**General information:**

Airway control is always the most important objective in the initial resuscitation and stabilization. It takes the highest priority in primary assessment. The trauma team must be prepared for any airway emergency.

RSI involves the use of neuromuscular blocking agents and sedatives to facilitate endotracheal intubation. Rapid Sequence induction technique is used to prevent regurgitation and aspiration of gastric contents. Requires preoxygenation and denitrogenation by using 100% oxygen via non-rebreather face mask to prevent apnea related hypoxia during the procedure. Once paralytic is on board, mask ventilation is not attempted at this point. During induction, a skilled assistant provides manual in-line axial stabilization of the head while a second assistant presses the cricoid cartilage to prevent gastric aspiration. Cricoid pressure is maintained until the cuff on the ET tube is inflated and tube placement is confirmed. Main disadvantage is once anesthesia has been induced there is no turning back. **The only contraindication to RSI intubation is a practitioner who is not skilled in airway management.** Indication for surgical airway is the inability to intubate the trachea. In neck trauma, intubation may be difficult or impossible and surgical airway may be required.

Short acting agents are used to allow patient to resume spontaneous respirations and to allow close monitoring of neurological status. Oral endotracheal intubation is usually the preferred method. If the head and neck are stabilized by an assistant there is almost no risk of spinal cord injury by oral tracheal intubation.

Always anticipate vomiting. Even patients, who otherwise seem relatively unresponsive, may vomit during attempted intubation without RSI. This may result in loss of airway control and aspiration of gastric contents. Struggling patients increase muscle activity making hypoxemia worse and increase ICP. As a general rule, presume all trauma patient's have just eaten. Risk for aspiration is greatest during anesthesia induction and instrumentation of the upper airway. This risk is minimized by applying cricoid pressure.

Patients with severe closed head injury are of major concern because intracranial pressure can rise precipitously during intubation. Rapid sequence induction of anesthesia and oral intubation are now recommended for patients with head injuries to minimize the rise in ICP.

Remember, rendering patient apneic, when endotracheal intubation is beyond the skill of the operator, may be rapidly fatal.

### **Indication for RSI Endotracheal Intubation of the Acute Trauma Patient:**

- Trauma patients with GCS  $\leq 8$
- Significant facial trauma with poor airway control
- Airway obstruction
- Closed head injury or hemorrhagic CVA
- Burn patients with airway involvement and inevitable airway loss
- Class 3-4 hemorrhagic shock
- Failure to maintain adequate oxygenation (PaO<sub>2</sub> < 60 despite 100% FiO<sub>2</sub>)
- Paralysis due to high spinal cord injury
- Need for positive pressure ventilation
- Blunt chest trauma with compromised ventilatory effort
- Mandibular fractures with loss of airway muscular support

### **Evaluation:**

“Talking patient” usually indicates airway is patent for the moment.

Respiratory distress associated with trauma to the upper airway is frequently made worse by blood or gastric contents in the airway and requires prompt action. These patients are often combative because of hypoxia.

When evaluating an awake patient with severe facial trauma ask them if they are getting enough air. If they cannot answer, stick out their tongues fairly easily or are hyperventilating, they should probably be intubated. In unconscious patients, it is probably best to intubate.

Tachypnea may be subtle but an early sign of airway or ventilatory compromise. Tachypnea is often also associated with pain and/or anxiety.

Signs of Airway Obstruction:

- Agitation = hypoxia
- Obtundation = suggests hypercarbia
- Cyanosis = hypoxia
- Retractions and use of accessory muscles
- Snoring, gurgling, stridor = partial obstruction at pharynx
- Hoarseness = laryngeal obstruction

### **DRUGS:**

#### **Sedatives:**

*Versed:*

- Benzodiazepine
- Rapid onset (1-2 min) and short duration (20 min)
- Amnesic
- Anticonvulsant
- Muscle relaxant
- Slight decrease in blood pressure and increase in pulse rate.
- No increase in ICP.
- Dose: 0.1 mg/kg

*Etomidate:*

Nonbarbiturate, nonnarcotic sedative-hypnotic induction agent.  
Good agent in multisystem trauma patient because it evokes minimal change in HR and CO compared to Thiopental. (ideal agent in any patient in shock including cardiogenic and septic shock)  
Decreases ICP and IOP during procedure  
Rapid onset (<1 min) and short acting (5 min)  
Vomiting, esp. with combined with a narcotic  
Dose: 0.3 mg/kg

*Thiopental:*

Ultrashort acting barbiturate sedative  
Dose: 3-5 mg/kg  
Onset 30-40 sec  
Last 10 min.  
Does not cause increase in ICP but can cause severe hypotension, therefore avoid in multi-traumatized patients.  
Can also induce bronchospasm.

*Fentanyl:*

Narcotic  
Little or no histamine release  
Rarely causes hypotension  
Consider in head-injured patients as a premedication to prevent increase in ICP (blunts pressor response)  
Rapid injection may cause chest wall rigidity.  
Dose: 3-5 mcg/kg  
Onset in 2 min with 30-40 min duration.

Paralytic Agents:

*Vecuronium:*

Nondepolarizing agent  
1/3 more potent and pancuronium and duration of action is 1/3 to 1/2 as long (25-40 min vs Pancuronium which last 2-3 hours)  
Onset 2-3 minutes  
Dose not cause the degree of tachycardia seen with pancuronium.  
No histamine release.  
Defasciculating dose: 0.01 mg/kg  
Paralytic dose: 0.1 mg/kg

*Succinylcholine:*

Depolarizing agent, which causes muscle fasciculations which can be prevented by pretreatment with a non-depolarizing neuromuscular agent.

Rapid onset (30-60sec) with short duration of action (5-7 min).

Dose:

Adult: 1.5 mg/kg

Pediatric (<10 y.o): 2.0 mg/kg

Contraindications:

Burns > 7 days old  
Extensive crush injuries > 7 days old.  
Paraplegia > 7 days old.  
Narrow-angle glaucoma  
Neuromuscular Diseases:  
    Guillain-Barre, myasthenia gravis, Multiple sclerosis,  
    muscular dystrophy, Parkinson's disease.  
Others susceptible to increased potassium:  
    Renal failure (no real evidence that RSI increases K+)  
    Rhabdomyolysis

*Rocuronium:*

Non-depolarizing agent  
Onset < 1 min.  
Duration 20-30 min.  
Dose: 0.9-1.2 mg/kg  
Expensive

Adjunctive:

*Atropine:*

Succinylcholine will cause bradycardia in infants and children therefore they should be premedicated with atropine. Also pretreat any adult who is already bradycardic.  
Children < 8 y.o.  
Dose: 0.01 mg/kg up to 0.5 mg (minimum dose of 0.1 mg)

*Lidocaine:*

Dose: 1.5 mg/kg  
Some studies recommend intravenous Lidocaine to blunt the pressor response of increased pulse, increased blood pressure, increased intracranial pressure, and increased intraocular pressure associated with intubation, its usefulness is controversial. However, because a single dose of lidocaine is unlikely to cause harm, it seems reasonable to use in the patient who has a known or suspected head injury.  
Should be administered 2-3 min prior to intubation.

**Procedure:**

The 5 P's of rapid sequence intubation:

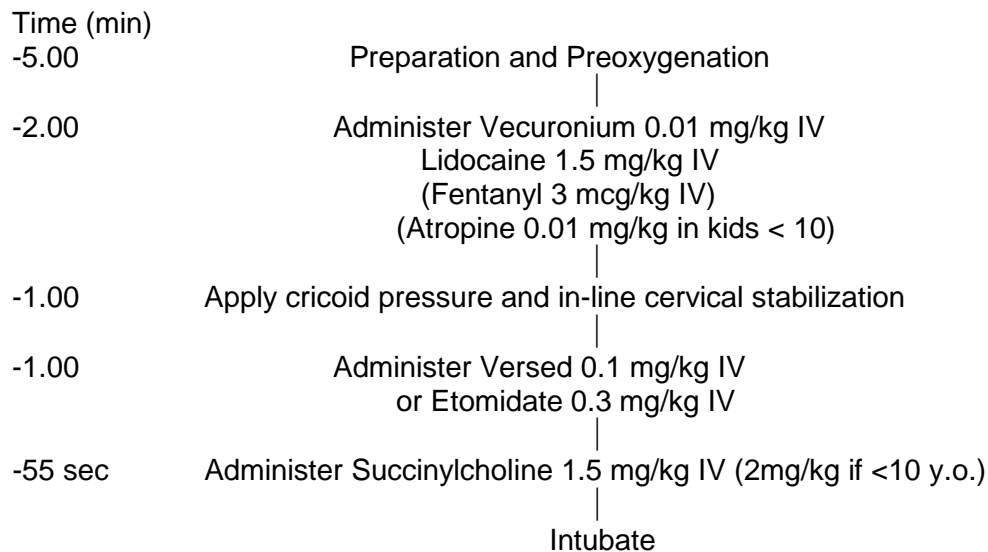
Preparation  
Preoxygenation  
Pretreatment  
Paralysis (with anesthesia)  
Placement (of the endotracheal tube)

1. Preoxygenation with 100% oxygen for 3-5 minutes via NRB mask (or 3 vital capacity breaths, avoid BVM if possible).
2. Secure IV's, ECG, pulse oximeter.
3. Prepare intubation equipment: ETT with stylet, suction, BVM, laryngoscope.
4. Premedication:

Lidocaine (head injury) 1.5 mg/Kg  
 Vecuronium (defasciculating dose) 0.01 mg/Kg  
 Versed 0.1 mg/Kg  
 Atropine (peds) 0.01 mg/Kg  
 Etomidate 0.3 mg/Kg

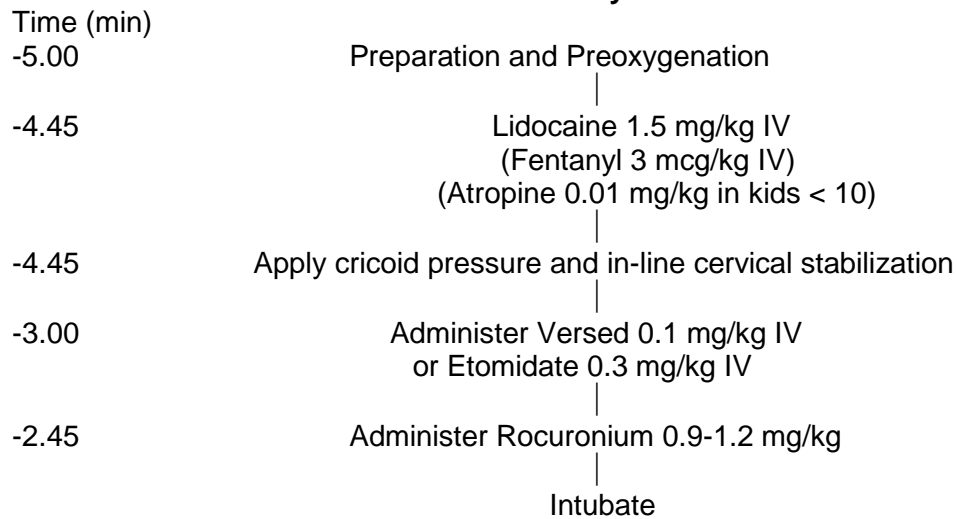
5. Perform Sellick's maneuver, maintain maneuver until after confirmation of tube placement.
6. Succinylcholine 1.5 mg/Kg (Peds: 2.0 mg/Kg)
7. Wait 30-60 sec, place ETT.
8. Confirm ETT placement by: listening for bilateral breath sounds, chest rise and fall, tube fogging, & positive ETCO<sub>2</sub>. Final confirmation by CXR.
9. Release Sellick maneuver.
10. Secure ETT.

### Basic RSI





### RSI without Succinylcholine



### References:

Wilson R, Walt A. Anesthesia for the Trauma Patient. *Management of Trauma pitfalls and Practice*, 2<sup>nd</sup> edition. Baltimore: Williams & Wilkins; 1996: 85-90,249-250.

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Tintinalli J, Ruiz E, Krome R. Advanced Airway Support. *Emergency Medicine a Comprehensive Study Guide*, 4<sup>th</sup> edition. New York: McGraw-Hill; 1996: 46-50.

Walker L. Using Rapid Sequence Induction to Facilitate Tracheal Intubation. *Emergency Medicine Reports*. 1993;15:125-131.

Hardwood-Nuss A. Trauma Airway Management. *The Clinical Practice of Emergency Medicine*, 2<sup>nd</sup> edition. Philadelphia: Lippincott-Raven; 1996: 381-382.

## **Pediatric Mechanical Ventilation**

### **Guideline**

Mechanical ventilation will be utilized to assist breathing once the airway has been established but respiration is still inadequate. Mechanical ventilation can be supplied either by mechanical ventilator or Ambu bag.

Mechanical ventilatory assistance can be provided to either the intubated or non-intubated patient. In all intubated patients, the Ambu bag or the mechanical ventilator will be the source of ventilatory assistance. In the non-intubated patient, mechanical ventilation can be provided by the bag-valve-mask.

### **Procedure**

#### **Bag-Valve-Mask**

The bag valve-mask technique may be employed to provide ventilatory assistance to patients prior to establishment of an airway, when temporary ventilatory assistance is needed or when an airway is not possible.

Instructions:

Procedure is conducted according to the Pediatric Advanced Life Support recommendations.

#### **Ambu Bag with Tracheal Intubation**

The Ambu bag can be used to provide ventilation of the intubated patient and, when used with increased FIO<sub>2</sub> can supplement oxygenation.

Instructions:

1. The Ambu bag is connected securely to the endotracheal tube and a baseline tidal breath is provided at 8 ml/kg of patient body weight.
2. Inspired FIO<sub>2</sub> should be at 1.0 until satisfactory oxygenation is proven, after which FIO<sub>2</sub> may be decreased.
3. Adequacy of ventilation should be determined by monitoring the rise and fall of the patient's chest wall, the presence of bilateral breath sounds and pulse oximetry. These parameters should be frequently reassessed to insure proper tube placement and ventilation of both lungs.

## **Mechanical Ventilation of the Intubated Pediatric Patient**

The mechanical ventilator provides several modes of ventilatory assistance to the patient. The mechanical ventilator can be of great assistance when fatigue prevents adequate ventilator assistance with the Ambu bag or when other patients' needs must be tended to.

### **Instructions:**

1. Provide adequate ventilatory assistance by use of the Ambu bag while ventilator settings are being made.
2. Inspired FIO<sub>2</sub> should be at 1.0 until satisfactory oxygenation is proven, after which FIO<sub>2</sub> should be decreased to maintain saturations of 93 to 95% unless specifically contra-indicated (i.e. pulmonary hypertension, congenital cyanotic heart disease, etc.)
3. An end tidal CO<sub>2</sub> detection device should be used
4. Set desired tidal volume. This should be 8 ml/kg of body weight.
5. Select mode of ventilatory assistance. This should be synchronized intermittent mandatory ventilations (SIMV).
6. Select ventilator rate:
  - 0 – 6 months 30-40 bpm I-time 0.5 secs
  - 6 – 12 months 25-35 bpm I-time 0.55 secs
  - 12 months – 5 years 20-30 bpm I-time 0.6 secs
  - 5 years – up 15-25 bpm I-time 0.7 secs
7. Select positive end expiratory pressure (PEEP). PEEP should be set at 5 cm of water.
8. Peak airway pressure (PAP) alarm should be set at 40 cm of water.
9. Peak airway pressures should be noted and recorded at the initiation of mechanical ventilatory support.
10. Increasing levels of peak inspiratory pressure may indicate:
  - a. Airway obstruction
  - b. Worsening pulmonary congestion
  - c. Development of tension pneumothorax
  - d. Development of hemopneumothorax with respiratory compromise
  - e. Increased patient anxiety/agitation
  - f. Pulmonary over-inflation (air trapping)

11. Signs of decompensation such as desaturation, mottling, and lack of chest rise, shall be evaluated using PALS mnemonic:
- a. **D**isplacement of the endotracheal tube
  - b. **O**bstruction of the endotracheal tube
  - c. **P**neumothorax or pneumopericardium
  - d. **E**quipment malfunction or failure

## Ventilator Reference Information

### Goals:

- Adequate oxygenation and ventilation to maintain normal blood gases without causing significant barotrauma.
- Oxygenation: Ventilator settings to maintain appropriate oxygen saturations
- Ventilation: Ventilator settings to appropriately clear carbon dioxide

### Types of ventilation

#### 1. Conventional

- SIMV: Ventilator set to give a certain number of breaths per minute, child may over breathe and extra breaths supported. Can set Rate, PEEP, pressure over PEEP. Does not set a tidal volume.
- PRVC: Ventilator set to give a certain tidal volume but limits the pressure delivered, child may over breathe and extra breaths supported. Can set Tidal volume, PEEP, and peak pressure, Rate.

#### 2. Oscillator (HFOV)

Ventilator to give high frequency and low tidal volumes, the tidal volumes are set just above the dead space so different mechanisms for gas exchange used.

### Settings

- MAP: Mean Airway Pressure (cmH<sub>2</sub>O)
- Amplitude: Variation around MAP
- Frequency: High frequency rate (0.5-5 ml/kg)

### Indications for HFOV

- Failure of conventional ventilation
- Air leak syndromes (Pneumothorax, interstitial emphysema)
- Attempt to limit barotrauma from high conventional ventilation settings

### Blood Gas Ranges

	<u>ABG</u>	<u>CBG</u>	<u>VBG</u>
pH	7.3-7.45	7.25-7.35	7.25-7.35
pCO <sub>2</sub>	35-45	40-50	40-50
pO <sub>2</sub>	50-70	35-50	35-45

### Ventilator Management

- Improve oxygenation: May increase FiO<sub>2</sub>, PIP, PEEP, iTime, MAP
- Decrease CO<sub>2</sub>: Increase rate, PIP, tidal volume, PEEP, Amplitude, lower Hz

## **Sedation for the Intubated Pediatric Patient**

### **INFORMATION:**

The goals of sedation of the intubated patient are to relieve discomfort and to increase the likelihood that the patient will not remove airway access. This concept must be balanced with the increasing responsibility of maintaining the patient en route.

### **INSTRUCTIONS:**

The major side effects of all of the drugs listed below are HYPOTENSION and DECREASED RESPIRATORY EFFORT.

Sedative agents to consider:

1. Versed - short acting benzodiazepine. May need large doses to be effective in the toddler population. Usual dose is 0.1mg/kg IV every 30 minutes prn.
2. Fentanyl - narcotic. Fentanyl is not a sedative per se; but may be useful in the control of pain associated with orotracheal intubation. Usual dose is 1-2 mcg/kg IV every 30 minutes prn.
3. Chloral hydrate - excellent hypnotic. Usual dose is 25-40 mg/kg PO/NG/PR every 6 hours prn. Produces apnea and hypotension when combined with other sedatives in high dose.
4. Propofol - anesthetic. Propofol is an excellent anesthetic that carries VERY frequent hypotensive results with its administration. There is a known correlation in the pediatric population between propofol sedation and sudden death from profound metabolic acidosis. Propofol will not be initiated by the transport team but if previously started by the referring physician it may be continued with a direct order from the transporting physician. Usual dose is 10 mg/kg/hr IV drip.
5. Neuromuscular blocking agents are not sedatives or analgesics. These agents should NOT be used until the patient's sedative needs are accounted for. The primary use for neuromuscular agents in the intubated patient is to decrease oxygen demand and to synchronize work of breathing around mechanically ventilated patients.

## Cricothyrotomy: Needle and Surgical

### INFORMATION:

Surgical airway may be utilized in providing airway access in patients in whom orotracheal intubation is impossible or contraindicated. Surgical airway should be used only after consideration of other routes for airway access. Two methods of performing surgical airway are discussed.

### INSTRUCTIONS:

#### 1. Needle Cricothyroidotomy

Needle cricothyroidotomy is the most rapid and preferred method for obtaining a surgical airway. This method allows adequate oxygenation in most instances. Patients can be supported for 30-45 minutes with needle cricothyroidotomy and jet insufflation. This method should be attempted prior to performing an incisional cricothyroidotomy.

#### Procedure

- A. Place the patient in a supine position.
- B. Palpate the cricothyroid membrane, anteriorly, between the thyroid cartilage and cricoid cartilage.
- C. Surgically prep the area using betadine swabs.
- D. Assemble a #12- or #14-gauge catheter over the needle apparatus to a 6 to 12 ml syringe.
- E. Puncture the skin midline and directly over the cricothyroid membrane (i.e., midsagittal).
- F. Direct the needle at a 45 degree angle caudally.
- G. Carefully insert the needle through the lower half of the cricothyroid membrane, aspirating as the needle is advanced.
- H. Aspiration of air signifies entry into the tracheal lumen.
- I. Withdraw the stylet while gently advancing the catheter downward into position, being careful not to perforate the posterior wall of the trachea.
- J. Attach the catheter hub to oxygen tubing, with an inline Y-connector at 15 liters/minute (50 PSI) oxygen flow. NOTE: Adequate  $\text{PaCO}_2$  removal can be maintained for only 30-45 minutes.
- K. Insufflate  $\text{O}_2$  for one second and allow four seconds for deflation.
- L. Observe lung inflations and auscultate the chest for adequate ventilation.
- M. Secure the apparatus to the neck.

## 2. Surgical Cricothyroidotomy

***Surgical Cricothyroidotomy should rarely be done in children. For children  $\leq 7$  years of age this should be airway of last resort!***

Surgical cricothyroidotomy is indicated when airway access cannot be obtained or is contraindicated via the orotracheal route. Surgical cricothyroidotomy may also be indicated when needle cricothyroidotomy proves inadequate.

### Procedure

- A. Place the patient in a supine position with the neck in a neutral position. Palpate the thyroid notch, cricothyroid interval, and the sternal notch for orientation.
- B. Surgically prep and anesthetize the area locally, if patient is conscious.
- C. Stabilize the thyroid cartilage with the left hand.
- D. Make a transverse skin incision over the lower one-half of the cricothyroid membrane. Carefully incise through the membrane, being careful to remain in the midline.
- E. Insert the scalpel handle into the incision and rotate 90 degrees to open the airway. (A tracheal spreader may be used instead of the scalpel handle.)
- F. Insert an appropriately sized (typically 6 mm), cuffed, ET tube into the cricothyroid membrane incision, directing the tube distally into the trachea.
- G. Inflate the cuff and ventilate the patient.
- H. Observe chest expansion and auscultate the chest for adequate ventilation.
- I. Secure the ET tube to the patient to prevent dislodging.
- J. Caution: Do not cut or remove cricothyroid cartilage.



## **II. Head and Face Trauma**

### **HEAD CT SCANNING OF PEDIATRIC PATIENTS**

#### Absolute Indications for Head CT Scan in Pediatric Trauma Patients:

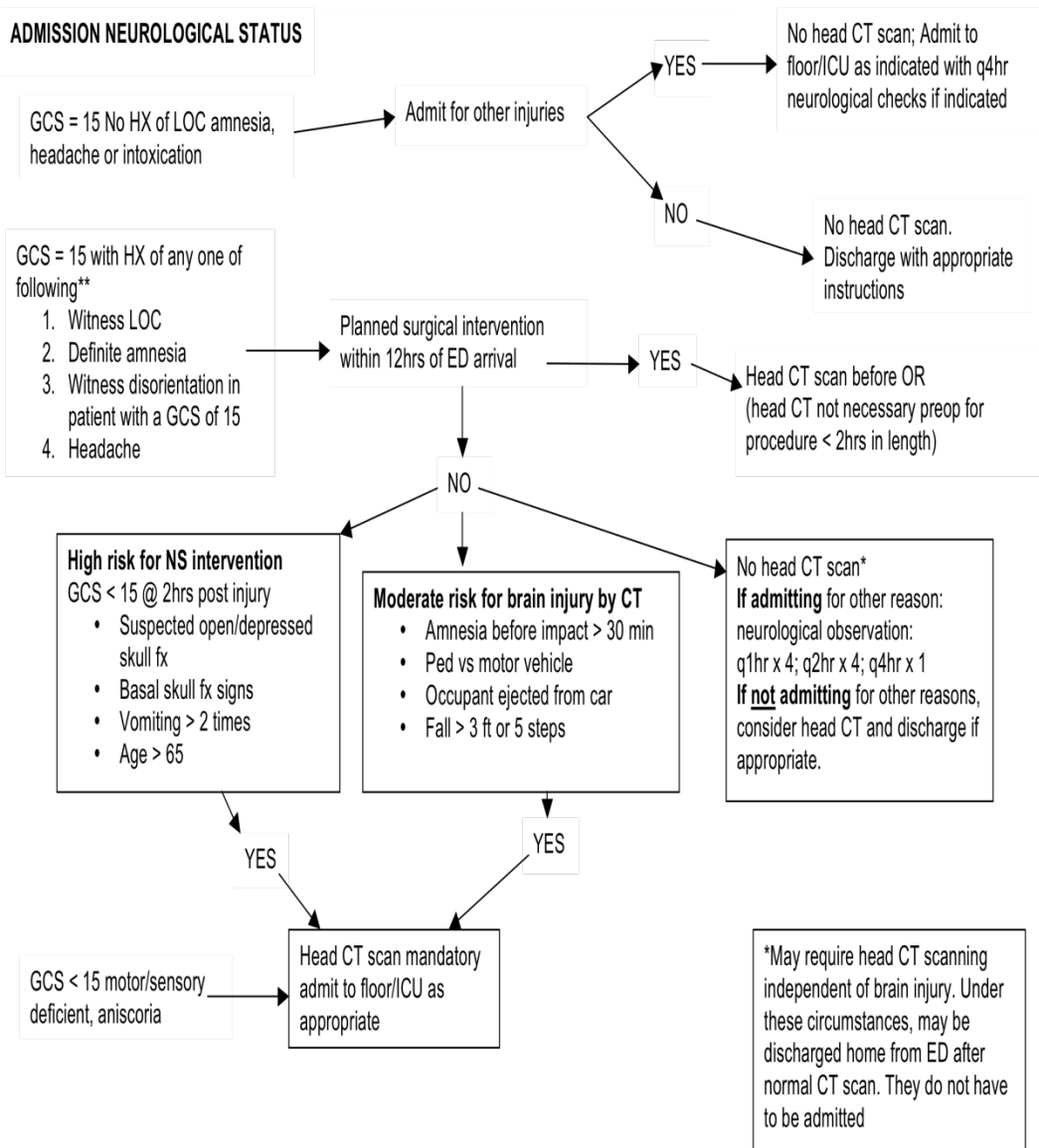
1. GCS  $\leq$  14 on two separate exams by Medical Personnel
2. Focal neurological deficit
3. Seizures after trauma
4. Persistent Vomiting
5. Extensive Facial Injury
6. Signs or suspicion of skull fracture

#### Relative Indications for Head CT Scan in Pediatric Trauma Patients

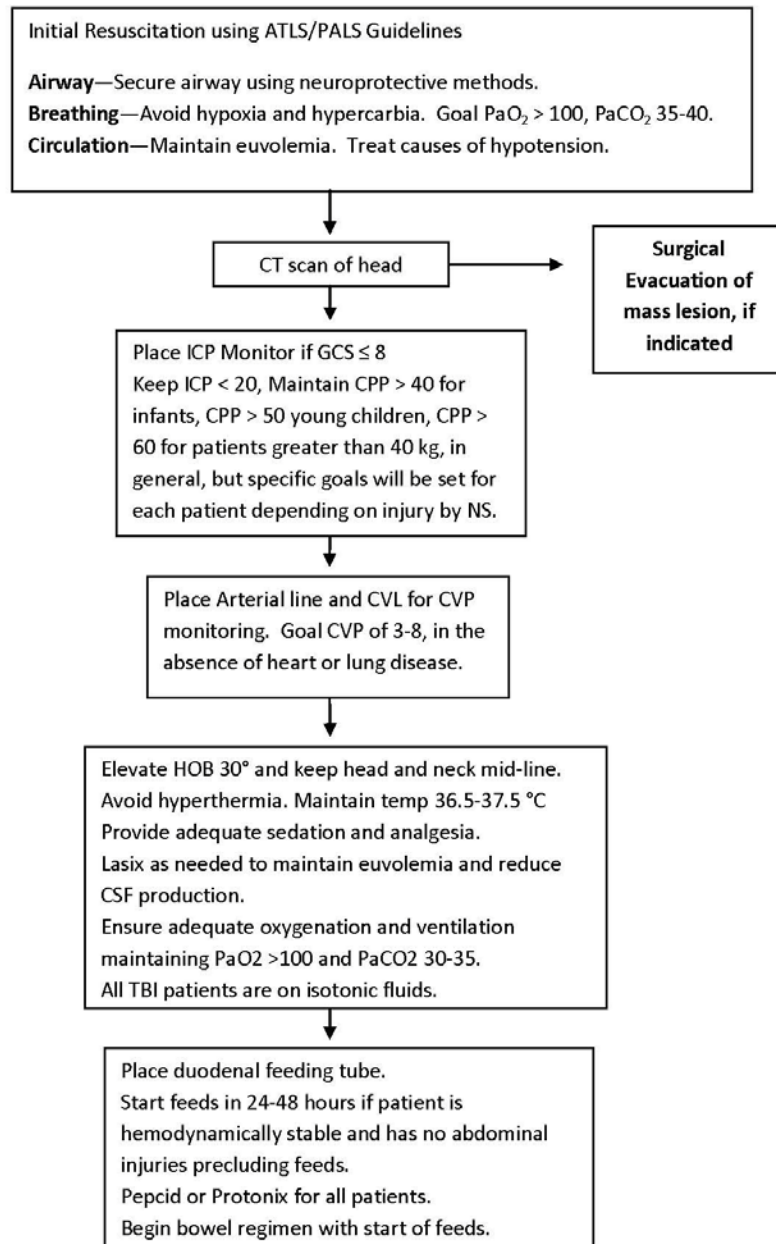
1. History of change in level of consciousness
2. Drug or alcohol intoxication
3. Suspected child abuse
4. Unreliable or inadequate details of mechanism of injury
5. Age < 2 years, unless reliable adult witnessed the event and can confirm that the mechanism of injury was minor
6. Post Concussive Annesia

## INDICATIONS FOR HEAD CT SCAN

### ADMISSION NEUROLOGICAL STATUS

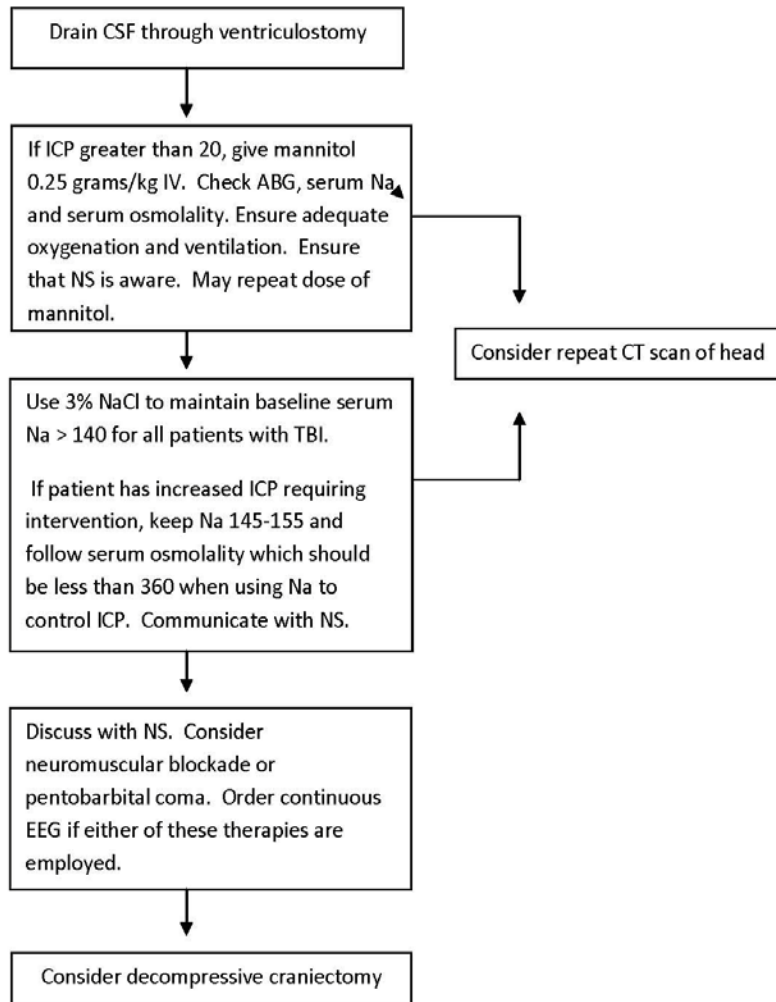


## KCH Traumatic Brain Injury Pathway



## Increased ICP Protocol

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# Pediatric Traumatic Brain Injury Clinical Practice Guidelines

Standard approaches to care include:

*Sedation/analgesia*—continuous infusion of propofol is not recommended for sedation or control of intractable intracranial hypertension in infants and children with severe TBI. In adolescent patients with adult body size and physiology, it may be used. Cases of propofol infusion syndrome have been documented in adults, and patients should be monitored accordingly.

*Fluids*—no dextrose in the IV for 48 hours unless

- a) Children < 2 years with serum glucose < 100 mg/dl
- b) Children  $\geq$  2 years with serum glucose < 70 mg/dl
- c) All infants without dextrose in fluids need glucose checks Q 1-2 hours.

*Temperature:*

- a) Tylenol for  $T > 37.5^{\circ}\text{C}$  (Tylenol 10-15 mg/kg every 4 hours prn)
- b) Cooling Blanket for  $T > 38.5^{\circ}\text{C}$
- c) Warming Blanket for  $T < 35.0^{\circ}\text{C}$

*Anti-epileptic Treatment:* Fosphenytoin 15 PE/kg IV over 30 min administered on admission and continue maintenance dose for 7 days.

*Ventilatory Parameters:*

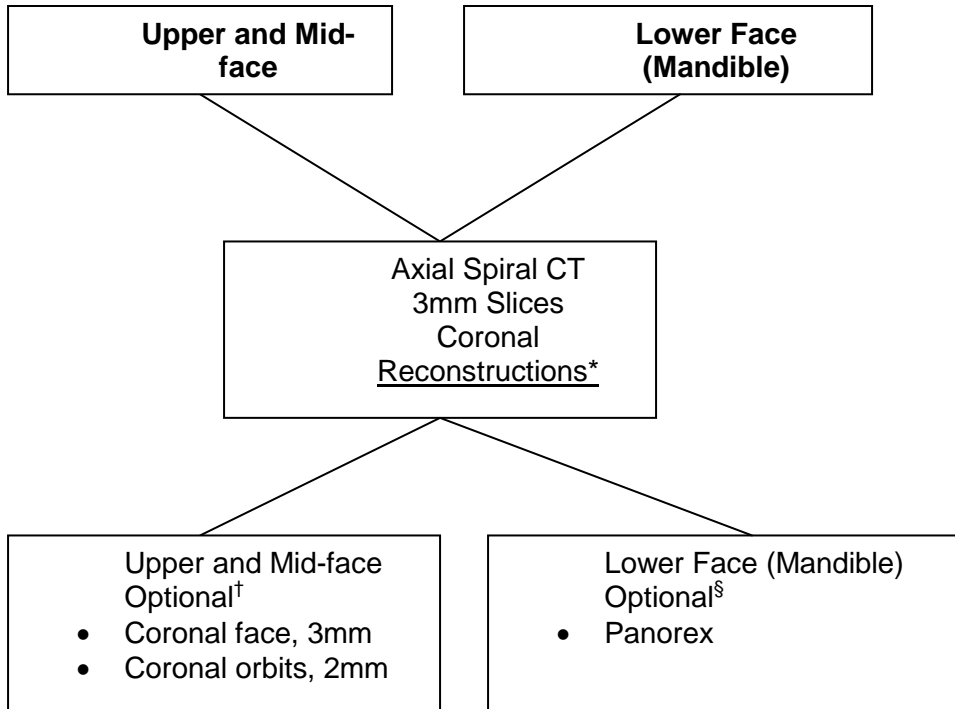
- a) If ICP < 15, keep  $\text{PaCO}_2$  of 35-40 mmHg.
- b) If ICP elevated or patient requiring hyperosmolar therapy to control ICP, keep  $\text{PaCO}_2$  of 30-35 mmHg.
- c) All patients requiring ICP monitoring must have an end-tidal  $\text{CO}_2$  monitor and be transported on ventilator with end-tidal  $\text{CO}_2$  monitoring.
- d) Hyperventilate only for signs of herniation

## FACIAL BONE FRACTURE

### EMERGENCY DEPARTMENT RADIOLOGIC ALGORITHM

#### Indications:

1. Obvious facial bone fracture or fracture suspected on physical exam.
2. Facial bone fracture detected on head CT.
3. Facial bone fracture detected on radiograph from referring facility.



\*Axial spiral CT with 3mm slices provides sufficient detail for diagnosis and treatment planning for facial fractures (forehead to mandible).

†These films are not often needed urgently and should be obtained at the request or discretion of the maxillofacial trauma consultant.

- Facial plain films are sometimes helpful for treatment planning.
- While (formal) coronal CT is usually only needed when coronal reconstructions do not provide adequate detail for surgical treatment planning, an urgent coronal CT may sometimes be needed to resolve an equivocal CT with regards to optic nerve integrity or compression.

Mandibular Panorex is a useful study in patients who can sit upright and cooperate with the exam. Thus Panorex is not often logistically obtainable in multi-trauma patients and axial CT with coronal reconstructions, which provides satisfactory detail for treatment planning, is the usual diagnostic of choice.

## **SPINE EVALUATION AND CLEARANCE**

### **Basic Principles**

#### **General**

1. Entire spine is immobilized during primary survey.
2. Radiographic clearance of the spine is not required before emergent surgical procedures. Presence of a spinal column injury is simply assumed until excluded.
3. Secondary and tertiary exams include examination of the spine for tenderness as well as testing all motor roots, sensation and reflexes.
4. Tertiary exams are performed only on alert and unimpaired patient without distracting injuries.
5. If any spine fractures are found, entire spine must be radiographed.
6. Patients with radiographic injury will have spine consultation for focused pre-operative evaluation regarding relative instability and severity of injury prior to intubation when possible.
7. Patients remain on spine precautions until spine is cleared.

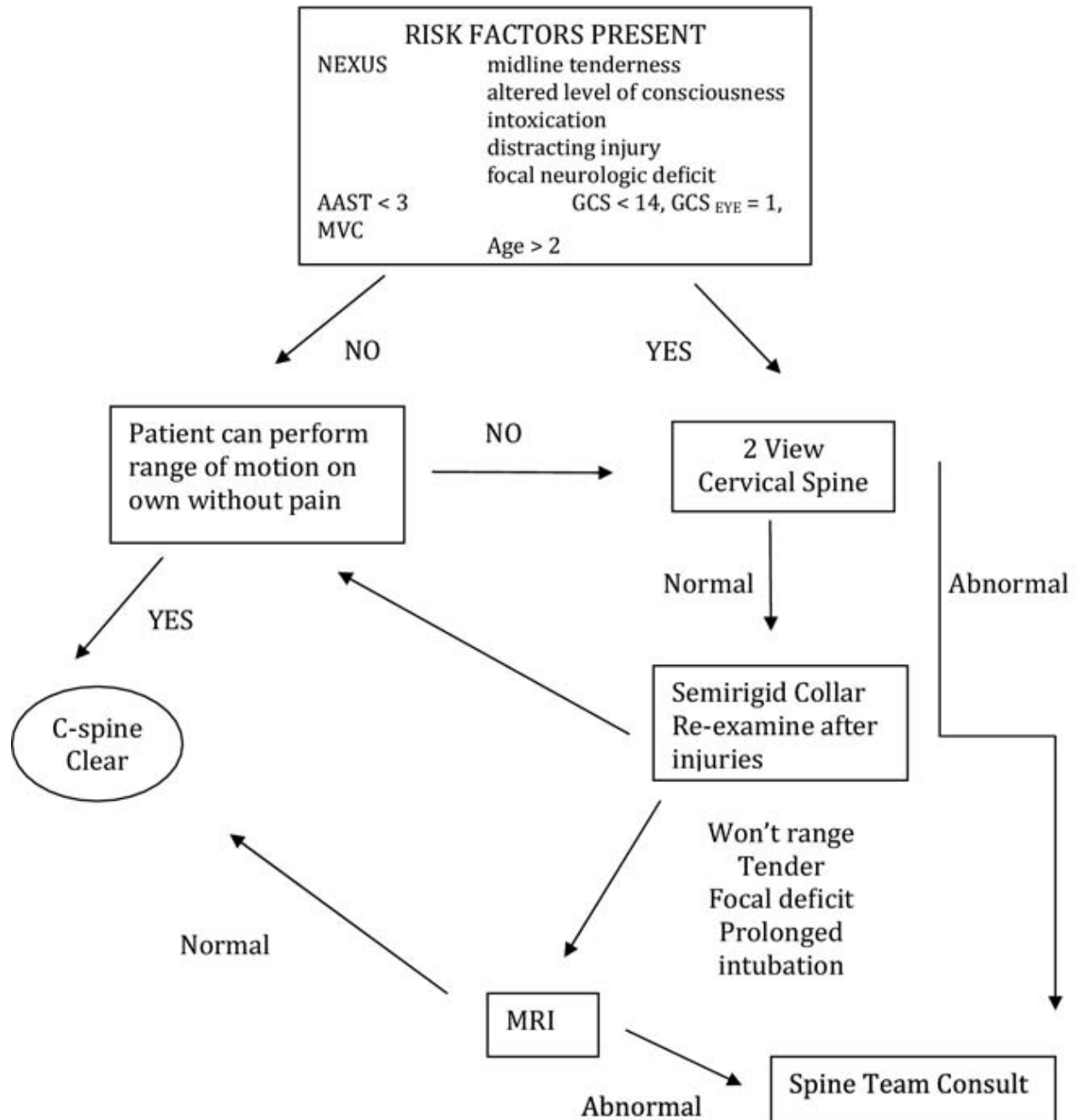
#### **Cervical**

1. C-spines are not cleared until after the tertiary exam is completed.
2. Cervical CT scan is the preferred radiographic modality when physical exam is not adequate in patients > 8 years of age. Children under age 8 should have spines and undergo clinical exam. If unable to clear spines by radiographs and clinical exam. Maintains spinal precautions and perform and MRI of the spines.
3. IF spine clearance cannot be achieved within 2 hours, rigid collars should be removed and replaced with semi-rigid pressure reducing collar.
4. Enter patients in cervical algorithm for C-Spine clearance.

#### **Thoraco-Lumbar**

1. CT scan of thoracic and lumbar spines if there are clinical findings on secondary or tertiary exams or an unreliable exam. Multi-detector CT-scan with reformatted axial collimation is superior to plain films.
2. Radiographic Thoraco-Lumbar clearance is not needed prior to OR for non spine surgery. Thoracic & Lumbar clearance may however be required for some non supine positioning in the OR, depending upon acuity and case type.
3. Tertiary exam is necessary to clear thoracic and lumbar spines.

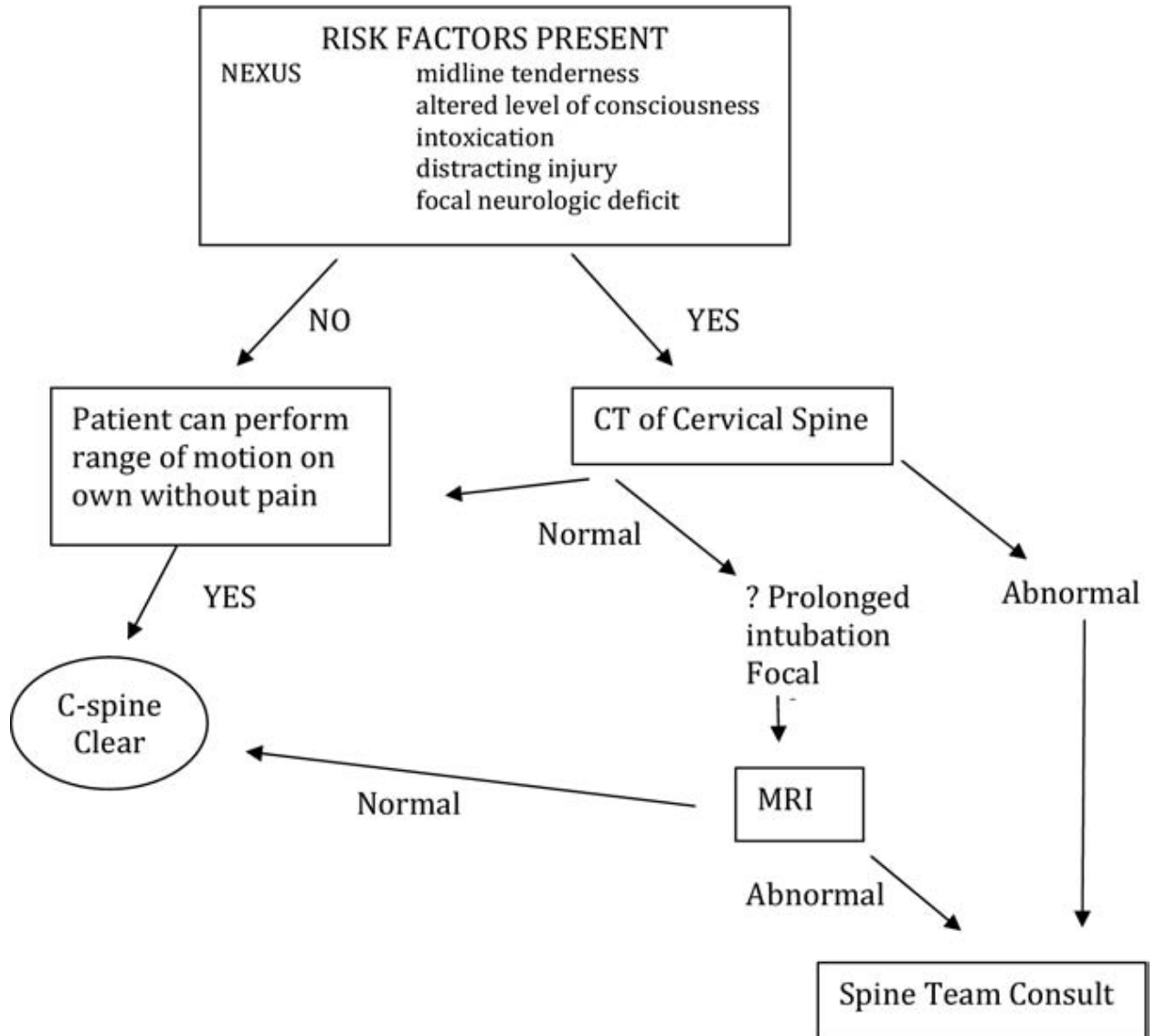
## Cervical Spine Clearance Algorithm for Infants and Children



Reference: N. Kreykes, R. Letton, University of Oklahoma, Oklahoma City, OK.  
Seminars in Pediatric Surgery, Vol 19, No 4, November 2010



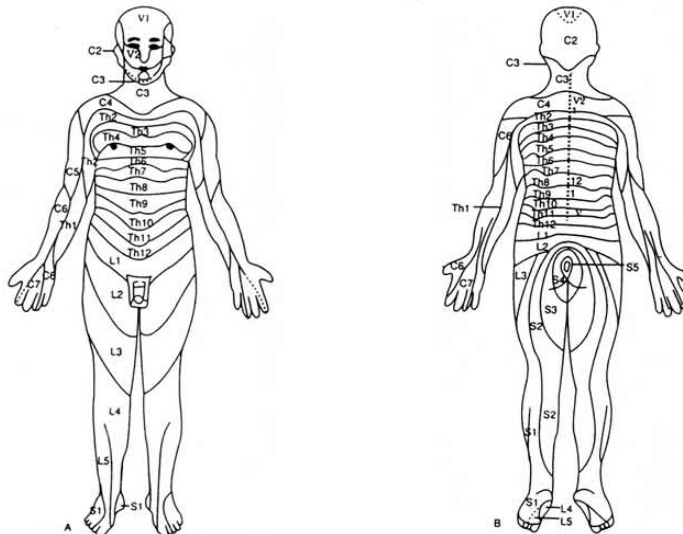
## Cervical Spine Clearance in Adolescents and Teens



Reference: N. Kreykes, R. Letton, University of Oklahoma, Oklahoma City, OK.  
Seminars in Pediatric Surgery, Vol 19, No 4, November 2010

## Initial Management of Spinal Cord Injury

1. Priorities: Airway, Breathing & Circulation
2. Maintain complete spine immobilization using:
  - a. Semi-rigid cervical collar
  - b. Modified logroll – maintaining spine in neutral position at all times
  - c. Remove patient from long board within 2 hours.
3. \*If patient is hypotensive – determine cause and treat hypovolemia with fluids and definitive surgical intervention as directed.
4. If hypotension due to Neurogenic Shock confirmed, consider inotropic agents to maintain blood pressure.  
 \*Effort must be made to reduce secondary injury.  
 \*Methylprednisolone use – insufficient evidence to support routine use
5. Patient should be removed from long spine board & placed on pressure reducing surface within 2 hours of trauma room arrival.
6. Radiographic studies to determine location of injury include:
  - a. Plain films
  - b. Spiral CT scan
  - c. MRI
7. Determine if injury is complete or incomplete and fracture is stable or unstable.
8. Fully document complete neurological exam during secondary survey & prior to OR if possible.
9. Document level of sensory and motor function using dermatomes.

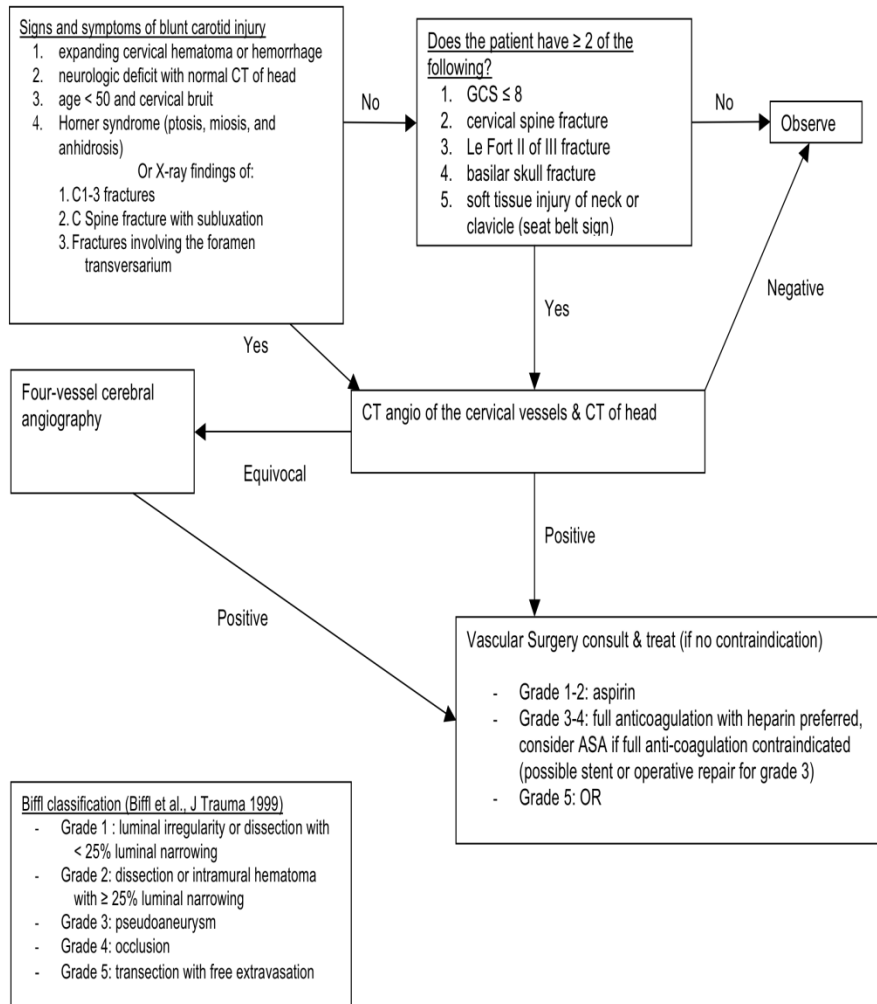


10. Obtain Spine Surgery (Orthopedic or Neurosurgery) consult.
11. Place urinary catheter to monitor urinary output & prevent bladder distension.
12. Place gastric tube to prevent gastric distension & aspiration.
13. Physical Medicine and Rehab consult on admission to begin a timely transfer to Acute Spinal Cord Injury Rehabilitation.

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## VI. Blunt and Penetrating Neck Trauma

### Blunt Cerebrovascular Injury Algorithm



## **Penetrating Neck Injury Evaluation and Treatment Algorithm**

### **University of Kentucky Hospital Trauma Center**

#### **Overview**

The neck is divided into zones:

- Zone 1-Clavicles to cricoid cartilage
- Zone 2-Cricoid to angles of the mandible
- Zone 3-Angles of the mandible to skull base

Management of patients with penetrating wounds to the neck has historically been determined by zone of injury. Because zones 1 and 3 are challenging to expose surgically, patients with injuries in zones 1 and/or 3 warrant thorough diagnostics because non-therapeutic surgery in these areas is both difficult and morbid. Zones 1 and 3 should be approached surgically only if an injury is felt to be present. However, zone 2 of the neck is easily exposed surgically. Controversy has existed as to whether patients with zone 2 injuries should undergo exhaustive diagnostics to exclude or characterize injuries in this area, or simply undergo neck exploration with limited or no preoperative evaluation of the esophagus and cervical vasculature (esophagography or esophagoscopy or both plus angiography).

Recently published studies have changed the management of penetrating neck trauma in 2 important ways. First, evidence suggests that for patients with no clinical evidence of vascular injury (shown on the algorithm as “Mandatory Criteria for Neck Exploration”) then physical examination has 100% sensitivity, thus definitively excluding vascular injury without any angiography. This is most true if the injury is to Zone 2. The second major advance in the care of these patients has been the advent of helical CT angiography as an alternative to conventional catheter-based angiography, producing equivalent results.

Furthermore, the anatomic detail provided by the neck CT may permit the clinician to exclude injury to the esophagus if the CT clearly shows a missile trajectory remote from the esophagus. However, the precise role that CT will play in excluding injury to the esophagus in these patients remains to be established. If the CT does not conclusively exclude injury to the esophagus, contrast esophagography and/or esophagoscopy (or both) should be performed.

#### **Summary**

1. CT scan of the neck including CT cervical angiography is the initial diagnostic of choice.
2. Some asymptomatic patients may avoid angiography entirely.
3. Esophageal injury must be definitively excluded, which may require esophagography or esophagoscopy or both.

References regarding the utility of CT/CTA for evaluating penetrating neck injury:

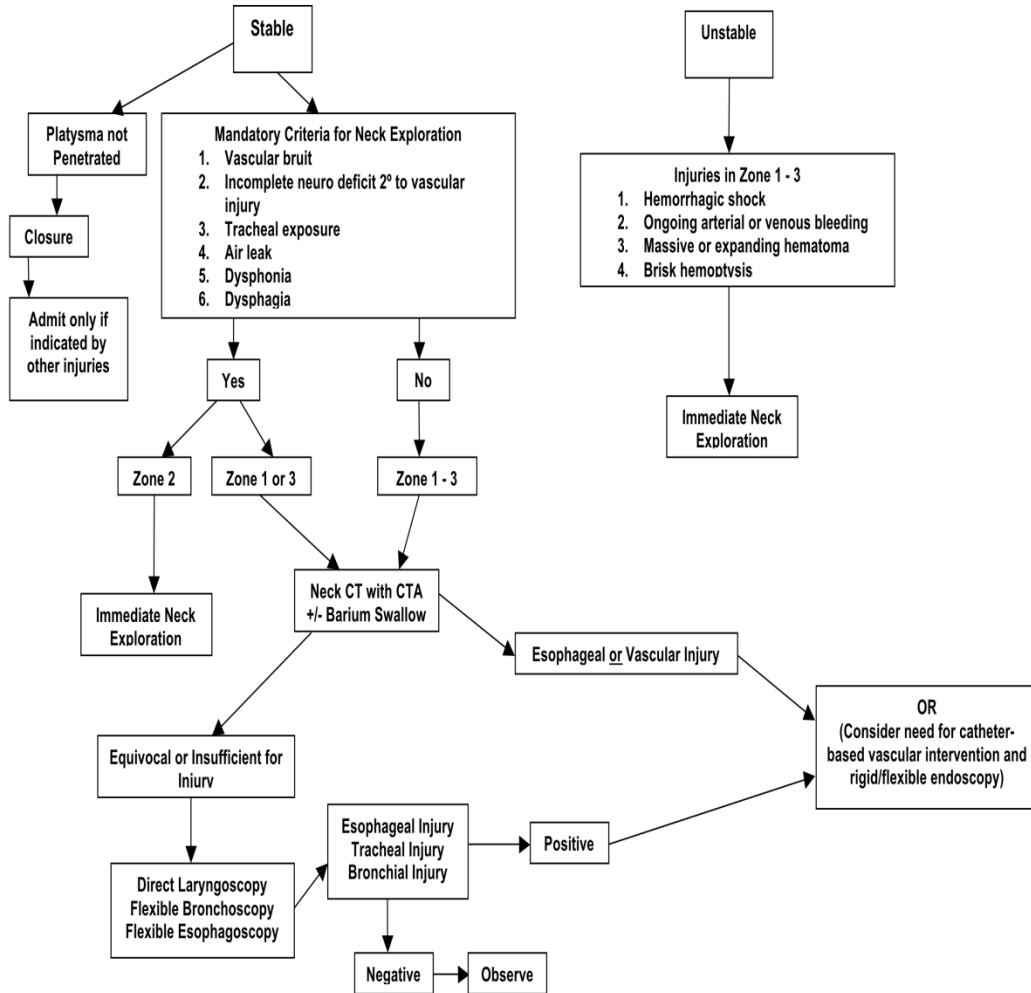
1. Gracias VH, Reilly PM, Philpott J, Klein WP, Lee SY, Singer M, Schwab CW. Computed tomography in the evaluation of penetrating neck trauma: a preliminary study. Arch Surg 2001;136: 1231-5.

2. Mazolewski PJ, Curry JD, Browder T, Fildes J. Computed tomographic scan can be used for surgical decision making in zone II penetrating neck injuries. *J Trauma* 2001;51:315-9.
3. Múnera F, Soto JA, Palacio DM, Castañeda J, Morales C, Sanabria A, Gutiérrez JE, García G. Penetrating neck injuries: helical CT angiography for initial evaluation. *Radiology* 2002; 224:366-72.
4. Ferguson E, Dennis JW, Vu JH, Frykberg ER. Redefining the role of arterial imaging in the management of penetrating zone 3 neck injuries. *Vascular*. May-jun 2005;13(3):158-63. [Medline].

References demonstrating the diagnostic accuracy of physical exam for vascular injuries in Zone II requiring intervention:

1. Nason RW, Assuras GN, Gray PR, Lipschitz J, Burns CM. Penetrating neck injuries: analysis of experience from a Canadian trauma centre. *Can J Surg* 2001;44:122-6.
2. Sriussadaporn S, Pak-Art R, Tharavej C, Sirichindakul B, Chiamananthapong S. Selective management of penetrating neck injuries based on clinical presentations is safe and practical. *Int Surg* 2001;86:90-3.
3. Azuaje RE, Jacobson LE, Glover J, Gomez GA, Rodman GH Jr, Broadie TA, Simons CJ, Bjerke HS. Reliability of physical examination as a predictor of vascular injury after penetrating neck trauma. *Am Surg* 2003;69:804-7.
4. Osborn TM, Bell RB, Qaisi W, Long WB. Computed tomographic angiography as an aid to clinical decision making in the selective management of penetrating injuries to the neck: a reduction in the need for operative exploration. *J Trauma*. Jun 2008;64(6):1466-71. [Medline].

## PENETRATING NECK ALGORITHM



8/08

## V. Pediatric Thoracic Trauma

**Thoracic trauma** is the second most common cause of death from trauma in children, with severe head injury being the most common. Anatomically and physiologically, children are different from adults. In infants and small children, the rib cage is very flexible, so significant compression can occur without associated rib fractures. Because of this, pulmonary contusion and pneumothorax are common. The flexible mediastinum of children allows for further shift with tension pneumothorax or hemothorax than in adults. Lower functional lung capacity and increased metabolic rate combined lead to more rapid decompensation when injuries are present.

Most children with chest injuries require no more than observation or tube thoracostomy. If operative intervention is required, timely, effective assessment, identification, and management of injuries is directly related to positive outcomes.

### Pediatric Chest Tube Placement

#### INFORMATION:

Chest decompression may be necessary in patients with symptoms of pneumothorax, chylothorax, or hemothorax. Any chest decompression procedure is an invasive procedure and every attempt should be made to perform the procedure under sterile conditions.

#### INSTRUCTIONS:

1. After first evacuating air with needle aspiration to stabilize clinical condition, preparations for chest tube insertion can be made. If infant is not in critical condition, prepare for chest tube insertion without needle evacuation.
2. Give morphine 0.1 - 0.2 mg/kg for pain control and sedation.
3. Place the patient in a supine position and restrain as necessary.
4. Prep the anterior and lateral chest wall with betadine.
5. Identify landmarks for chest tube placement. Chest tube should be placed at approximately the 4<sup>th</sup> intercostal space and anterior axillary line.
6. Drape the area.
7. If infant is not in extremely critical condition, infiltrate subcutaneous tissue and intercostal space with 1% Lidocaine.
8. Using a #11 scalpel blade, make an incision through skin approximately ½ -1 cm in length at point where chest tube is to be inserted.

9. Dissect through the tissue just over the rib by blunt dissection with curved hemostats. Avoid the underside of the adjacent rib; an artery and nerve run along it.
10. Using extreme care, pressure should be applied on curved hemostats to create an entry into the pleural space. The hemostats should go over the top of the rib and care should be taken to avoid entering too far into the pleural cavity. A "pop" should be felt at this time followed by a hissing sound if the pneumothorax was under tension. Do not use a trochar.
11. Open hemostats and insert chest tube into pleural space. Direct tube anteriorly and withdraw hemostat. Continue to advance tube but no further than the first black line approximately 3-5 cm.
12. Attach chest tube to Heimlich valve which should fluctuate with each breath. If tube has been placed to evacuate fluid or blood, attach to suction with a collection device such as a Pleuro-Vac.
13. Close the wound with a simple stitch using 3.0 silk suture. Tie an "air knot" 1cm above the skin stitch. Use enough throws to ensure that this knot will not slip. Tie the chest tube to the air knot, making the silk tight enough to dent the chest tube slightly. If needed, use additional stitches to approximate the edges of the wound. AVOID PURSE STRING STITCHES around the tube. They can cause an unsightly pucker type scar.
14. Apply a dressing and tape the tube to the chest.
15. Obtain chest x-ray, anterior and lateral, to establish placement of tube which should be anterior.



## **EMERGENCY DEPARTMENT RESUSCITATIVE THORACOTOMY**

### **Purpose:**

Emergency Department resuscitative thoracotomy may be necessary to salvage patients who present in extremis and may otherwise die without aggressive therapy. Emergency Department thoracotomy is not indicated in the resuscitation of all trauma patients who present in extremis. The following reference is intended to be a guide and is not intended to be all-inclusive or exclusive. Additional patients not covered by this criteria who might benefit from Emergency Department thoracotomy will be rare and case-specific. The procedure is performed in conjunction with other resuscitative efforts and should not be employed in isolation. Under certain conditions, resuscitative efforts might best be accomplished in the Operating Room. An Emergency Department resuscitative thoracotomy should only be performed by general surgery PGY-3, or higher, level residents or attendings.

### **Indications:**

- 1) Penetrating thoracic trauma that arrive pulseless, with signs of life.
- 2) Penetrating non-thoracic, non-cranial trauma that arrive pulseless, with signs of life.
- 3) Cardiac arrest in blunt chest or abdominal trauma after arrival in Emergency Department with an obtainable blood pressure.
- 4) Suspected systemic air embolism.

### **Definitions:**

- 1) Signs of life: reactive pupils, spontaneous movement, or organized ECG activity.
- 2) Aggressive fluid resuscitation: Lactated Ringers or Normal Saline IV bolus of 20 ml/kg x 2 and/or Packed RBC 10 ml/kg.

### **Procedure:**

- 1) Rapid bilateral antero-lateral Betadine or Chlorahexidine prep while thoracotomy tray opened. Thoracotomy trays are located in Trauma Bay Omni cells.
- 2) Left antero-lateral thoracotomy incision located beneath nipple in males and in inferior breast fold in females at 5<sup>th</sup> intercostal space. Incision extends from left sternal border to anterior border of latissimus dorsi and chest entered along the superior aspect of fourth or fifth rib. Care must be taken to avoid injury to heart and lung. A right antero-lateral thoracotomy may be preferred for primary right chest wounds.
- 3) Insert rib spreader with handle located toward table laterally.
- 4) Examine pericardium, if tense hemopericardium present (pericardium distended with maroon discoloration) then proceed to step 7.
- 5) If systemic air embolism is suspected or massive hemorrhage from lung parenchyma or hilum is present, then place Satinsky clamp across hilum medially.
- 6) Retract left lung with left hand. Locate aorta by running right hand medially along posterior chest wall. Aorta located along lateral aspect of

- vertebral bodies and will be postero-lateral to esophagus. Dissect around aorta inferior to pulmonary hilum and apply aortic cross-clamp.
- 7) Enter pericardium by longitudinally incising pericardium anterior and parallel to phrenic nerve. This is best accomplished by grasping pericardium with forceps and cutting with Metzenbaum scissors. Pericardial incision is carried inferiorly to diaphragmatic reflection and superiorly to level of superior pulmonary hilum. Care must be taken to avoid injury to left atrial appendage and phrenic nerve. This is best accomplished by lifting tip of scissors laterally as incision is made.
  - 8) Manually lift heart from pericardial sac. If hemopericardium present, then examine for cardiac perforation. Teflon pledgetted 3-0 prolene suture on a taper needle is present in thoracotomy suture pack for repair of cardiovascular wounds. If hemopericardium is not present, then begin open cardiac compression. Aortic cross-clamping, if not previously performed, is indicated if no hemodynamic response is noted.
  - 9) Additional exposure may be accomplished by extending thoracotomy incision across sternum into contralateral chest cavity.

Reference:

American College of Surgeons' Committee on Trauma: *Advanced Trauma Life Support*, ed.8, Chicago, 2008, The College.

Powell DW, Moore EE et al. Is emergency department resuscitative thoracotomy futile care for the critically injured patient requiring prehospital cardiopulmonary resuscitation? *J Am Coll Surg*. 2004 Aug; 199(2):211-5.

Pediatric Trauma Pathophysiology, Diagnosis, and Treatment, David Wesson, Taylor and Francis Group, New York, 2006. Pages 248-49.

## EMERGENCY DEPARTMENT TRAUMA THORACOTOMY TRAYS

### TRAY #1

<u>QUANTITY</u>		<u>INSTRUMENT</u>
1	-	Finochietto – Buford Rib Spreader (10" Spread)
1	-	Tuffier Rib Spreader
1	-	Small Rib Spreader
1	-	6 ¾" Curved Mayo Scissors
2	-	9" Metzenbaum Scissors
1	-	#10 Disposable Blade
2	-	5 ½" Tissue Forceps
2	-	9" DeBakey Forceps
2	-	8" DeBakey Needle holders
4	-	Vanderbilt Clamps
1	-	Medium Satinsky Clamp
1	-	9 ½" DeBakey Aortic Clamp
8	-	5 ¼" Towel Clamps
1	-	Liston Bone Cutter Straight
1	-	Lebsche Sternal Chisel
1	-	Hammer
4	-	Surgeons Towels
1	-	Teflon Sheet 6" x 6"
10	-	Laparotomy Pads

### SUTURE BAG

<u>QUANTITY</u>	<u>SUTURE</u>	<u>PRODUCT NUMBER</u>
2 pkgs	2-0 Silk (SH-CR) 30"	Ethicon #C01 6T
1 pkg	Cotton Umbilical Tape 30"	Ethicon #U-11 T
1 pkg	Teflon Felt Pledgets ¼"	Deknatel #K-705
1 pkg	Teflon Felt Pledgets"	Deknatel #L-705
6 pkgs	3-0 Prolene (SH) 36"	Ethicon #8522H
4 pkgs	3-0 Prolene (SH) with Teflon Pledgets	
4 pkgs	4-0 Prolene (RB-1) 36"	Ethicon #8557H
10 pkgs	2-0 Ticron (T-10) 30"	D & G #3174-51

## Blunt Cardiac Injury (BCI)

Blunt cardiac injury is rarely seen in children with multisystem trauma. Myocardial contusions are the most common lesion. Wall disruption and valvular lesions may occur. A normal ECG does not rule out blunt cardiac injury, however.

The major priority is identification of patients at risk for adverse events resulting from BCI and providing appropriate workup, monitoring and treatment. Patients with appropriate mechanism of injury and clinical evidence of cardiac dysfunction should cause high suspicion for BCI. Clinical signs of cardiac injury include chest pain, shortness of breath, muffled heart sounds, ECG changes, or abnormal ECHO. If rib fractures, flail segments, or pulmonary contusions are present on chest radiograph, there should be clinical suspicion of occult myocardial damage.

BCI results from 5 possible mechanisms: direct pre-cordial impact, crush between sternum and spine, deceleration or torsion causing a tear in the heart at a point of fixation, hydraulic effect resulting in rupture from elevated intra-abdominal and caval pressure, and blast injury.<sup>3</sup> Few clinical signs are diagnostic of BCI. Chest pain is the most common finding, but dyspnea, chest wall ecchymosis and rib fractures may also be present. Associated injuries include hemothorax, sternal fracture and great vessel injury. Clinical signs consistent with BCI include dysrhythmias, cardiac ischemia, low cardiac output and hypotension.<sup>4</sup>

Diagnostic tests include ECG, echocardiography, and enzyme analysis. Controversy exists regarding the application of these tests. Frequency of diagnosis of BCI will be proportional to the aggressiveness with which it is sought. Appropriate workup commands achieving a balance between cost-effectiveness and information acquisition with attention to the clinical value of information gained in changing patient management. Guidelines for using diagnostic tests are as follows:

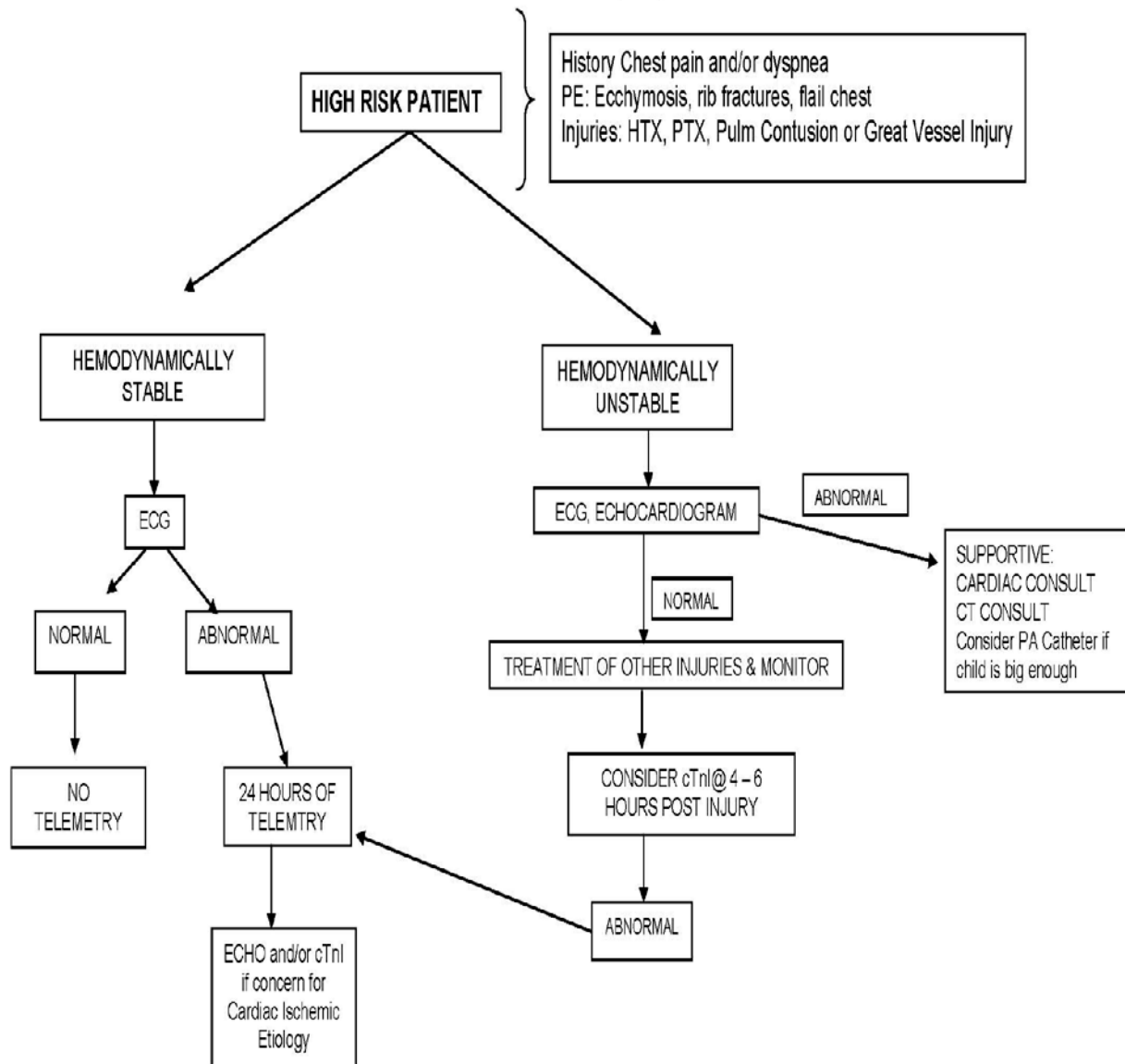
- A. Level 1 evidence supports obtaining an ECG in the emergency department for at-risk patients (described above).<sup>5</sup> Using any ECG abnormality, including sinus tachycardia, bradycardia conduction delays and PAC's/PVC's, the diagnostic sensitivity of ECG is 100%.<sup>6</sup>
- B. Echocardiography is not effective as a screening tool and does not identify patients at risk for complications.<sup>7</sup> Transthoracic (TTE) or transesophageal echocardiography (TEE) should be obtained in patients with evidence of hemodynamic instability or in whom coincident coronary ischemia is suspected.
- C. CK and CKMB fraction analysis is NOT indicated in suspected BCI because associated skeletal and visceral injury creates serum CK abnormalities that contribute to an unacceptable false-positive and negative rate.<sup>8</sup> However, a body of evidence exists suggesting some value to cardiac troponin I (cTnI) or troponin T (cTnT). That evidence is as follows:
  - i. Diagnosis of BCI should not rely solely on cTnI or cTnT. ECG should be included.
  - ii. Normal ECG and normal cTnI is 100% sensitive for BCI.<sup>9</sup>
  - iii. Abnormal ECG and abnormal cTnI is 100% specific for BCI.<sup>9</sup>
  - iv. cTnI is of little added benefit in patients with a markedly abnormal ECG (diagnosis is already made).<sup>10</sup>

- v. Though the utility of cTnI in patients with normal ECG's is limited, cTnI obtained 4-6 hours after the injury in patients with sinus tachycardia or non-specific EKG changes or in older patients may give reassurance that the likelihood of BCI-related complications is low.<sup>10</sup>

## References:

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## BLUNT CARDIAC INJURY (BCI) ALGORITHM



08/08

## **THE DIAGNOSIS OF BLUNT INJURY TO THE THORACIC AORTA**

### **What diagnostic test is best?**

### **Angiography, Transesophageal Echocardiography, or Computerized Axial Tomography**

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### **Background**

Blunt chest trauma with resulting aortic injury is a significant cause of death following high-speed motor vehicle collisions.<sup>1-3</sup> The vast majority of these patients (80%-90%) expire at the collision scene.<sup>1-3</sup> For the remaining 10%-20%, the mortality rate is high. Thirty percent expire within 6 hours and 40%-50% within 24 hours of injury.<sup>1</sup> The recent multicenter trial by the American Association for the Surgery of Trauma reported an overall mortality of 31%, with 63% of the deaths attributable to aortic rupture.<sup>4</sup> Expedient evaluation and timely surgical intervention are essential for patient survival.

### **Screening**

The goal of screening patients is to attain a zero nontherapeutic surgery rate without overlooking any significant aortic or arch vessel injury. Mechanism of injury, clinical exam, and the initial chest radiograph should reliably select patients who require further diagnostic evaluation. Chest radiographs demonstrating mediastinal hematoma have good sensitivity (93%) for aortic and arch vessel injury.<sup>5-7</sup> When combined with mechanism of injury, sensitivity rises to 98%.<sup>5</sup> More importantly the negative predictive value of a normal upright chest radiograph is almost 100%. A normal chest radiograph virtually excludes aortic and/or arch vessel injury.<sup>5-7</sup> Unfortunately, the specificity of an abnormal chest radiograph is only 10%-45%. Since most mediastinal hematoma originates from thoracic vascular structures other than the aorta, a definitive diagnostic test is required to establish the diagnosis of aortic injury. Computerized axial tomography (CT) of the chest can be used to screen patients for subsequent aortography.<sup>8-12</sup> CT is more sensitive than chest radiograph in detecting mediastinal hematoma.<sup>8,9</sup> Screening thoracic CT is cost-effective and the negative predictive value of a normal study is 100%.<sup>8-10</sup> Consequently, CT can be used to reduce the negative aortogram rate in patients with an abnormal chest radiograph.<sup>8-10</sup>

### **Diagnosis-Aortography**

Many authors advocate the liberal use of aortography based on mechanism of injury and chest radiographs.<sup>1,3,9,13</sup> Using this approach, aortography yields positive results in only 10% of patients. Although angiography remains the "gold standard", the procedure is invasive and time consuming, requires the use of intravenous contrast material and ionizing radiation, and can result in false negative or false positive results.<sup>3,9,13,14</sup> Transporting an injured patient to the angiography suite is not without risk and interrupts the patient's ongoing evaluation, resuscitation, and treatment. On the other hand, when performed properly, aortography has a sensitivity and specificity of 99%.<sup>9</sup> Complications occur in less than 1% of patients.<sup>9</sup> Aortography remains the only study that provides detailed images of the entire thoracic aorta and the arch vessels.

### **Diagnosis-Transesophageal Echocardiography**

Transesophageal echocardiography (TEE) provides high-resolution real-time axial and longitudinal images of the aorta.<sup>14-18</sup> TEE can accurately demonstrate injury to the thoracic aorta.<sup>14-18</sup> In our hands, TEE was more sensitive (100%) and specific (98%) than aortography.<sup>14,15</sup> TEE offers a number of advantages over aortography and CT scanning. The study can be performed at the bedside, eliminating transport risks. Concomitant diagnostic and therapeutic procedures can continue unhindered. TEE provides real-time images so that areas of interest can be examined repeatedly in different planes. Simultaneous evaluation of cardiac pathology and function can also be obtained. If urgent surgical intervention is indicated for other injuries, TEE can be performed in the operating room without delaying TEE or the surgical intervention. The study can be performed more rapidly than aortography making TEE ideal for the evaluation of the unstable trauma patient with a number of diagnostic and treatment priorities. Unfortunately, TEE requires the expertise of a well-trained and interested echocardiographer. Airway compromise, esophageal pathology, and unstable cervical spine fractures are contraindications to TEE. The depth and extent of injury are frequently difficult to determine particularly when atherosclerotic disease diminishes the sensitivity of the examination. In our experience, this has resulted in nontherapeutic thoracotomy.<sup>14</sup> There are blind spots related to the tracheal air column and the arch vessels simply cannot be imaged.

### **Diagnosis-Computerized Axial Tomography (CT)**

CT scanning technology is advancing rapidly. Perhaps the most promising technology for a fast, accurate, and less-invasive diagnostic test for detecting injuries to the thoracic aorta and arch vessels is the newer generation helical CT scanner.<sup>9,19-21</sup> Rather than providing indirect evidence of aortic injury (detection of mediastinal hematoma), the helical scanners can provide direct evidence of aortic injury obviating the need for confirmatory tests. Sensitivity, specificity, and accuracy depend heavily on the technical skill of CT performance and the interpretative expertise.<sup>9</sup> Confirmatory angiography or TEE must be performed for indeterminate or equivocal CT scan results. Although CT can be performed more rapidly than angiography, transport of the injured patient to CT is not without risk and interrupts the patient's ongoing evaluation, resuscitation, and treatment.

### **Summary**

Patients with suspected blunt injury to the thoracic aorta are a challenge for the trauma surgeon. Multisystem trauma, critical illness, and hemodynamic instability in this patient group result in diagnostic and treatment dilemmas. We employ a practical, evidence-based algorithm for the screening and diagnosis of injury to the thoracic aorta. Both mechanism of injury and an abnormal mediastinum on chest radiograph are required to trigger a diagnostic evaluation. Every attempt is made to obtain an "upright" AP chest radiograph to minimize distortion and magnification. However, this is not possible in all patients. Widening of the mediastinum alone is neither sensitive nor specific for mediastinal hematoma.<sup>5,6,7</sup> Instead, we employ the criteria for mediastinal hematoma (abnormal mediastinal silhouette) as defined by Mirvis and Ayella.<sup>6,7</sup> No further



diagnostic evaluation is undertaken in patients with a normal chest radiograph, unless there are compelling physical findings that suggest aortic or arch vessel injury (i.e. Pulse deficit, unequal blood pressure/pulse measurement, unexplained hemodynamic instability, unexplained neurologic deficit). Thoracic CT scan using the aortic guideline is performed.<sup>9,19</sup> A negative scan yields observation. A scan positive for aortic injury prompts surgical intervention or appropriate non-operative management. Patients with indeterminate scans undergo angiography or TEE to establish or exclude the diagnosis.

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## **BLUNT THORACIC INJURY WITH SUSPECTED INJURY TO THE THORACIC AORTA OR ARCH VESSELS**

Patients who sustain blunt thoracic trauma are at risk for injury to the heart and great vessels. Patients should be selected for additional diagnostic studies based on mechanism of injury and evidence of mediastinal hematoma on chest radiograph. Every attempt is made to obtain an "upright" AP chest radiograph to minimize distortion and magnification. However, this is not possible in all patients. Widening of the mediastinum alone is neither sensitive nor specific for mediastinal hematoma (5,6,7). Instead, we employ the criteria for mediastinal hematoma (abnormal mediastinal silhouette) as defined by Mirvis and Ayella (6,7). No further diagnostic evaluation is undertaken in patients with a normal chest radiograph, unless there are compelling physical findings that suggest aortic or arch vessel injury (i.e. Pulse deficit, unequal blood pressure/pulse measurement, unexplained hemodynamic instability, unexplained neurologic deficit).

### **MECHANISM OF INJURY (History of significant deceleration)**

1. High-speed MVC (>30-40mph)
2. Substantial vehicle deformity or associated fatalities
3. Unrestrained and/or ejection from vehicle
4. Pedestrian struck by vehicle
5. Falls > 10 feet
6. Hemodynamic instability

### **INJURY**

1. Sternal and/or scapular fracture
2. Multiple rib fractures and/or flail chest

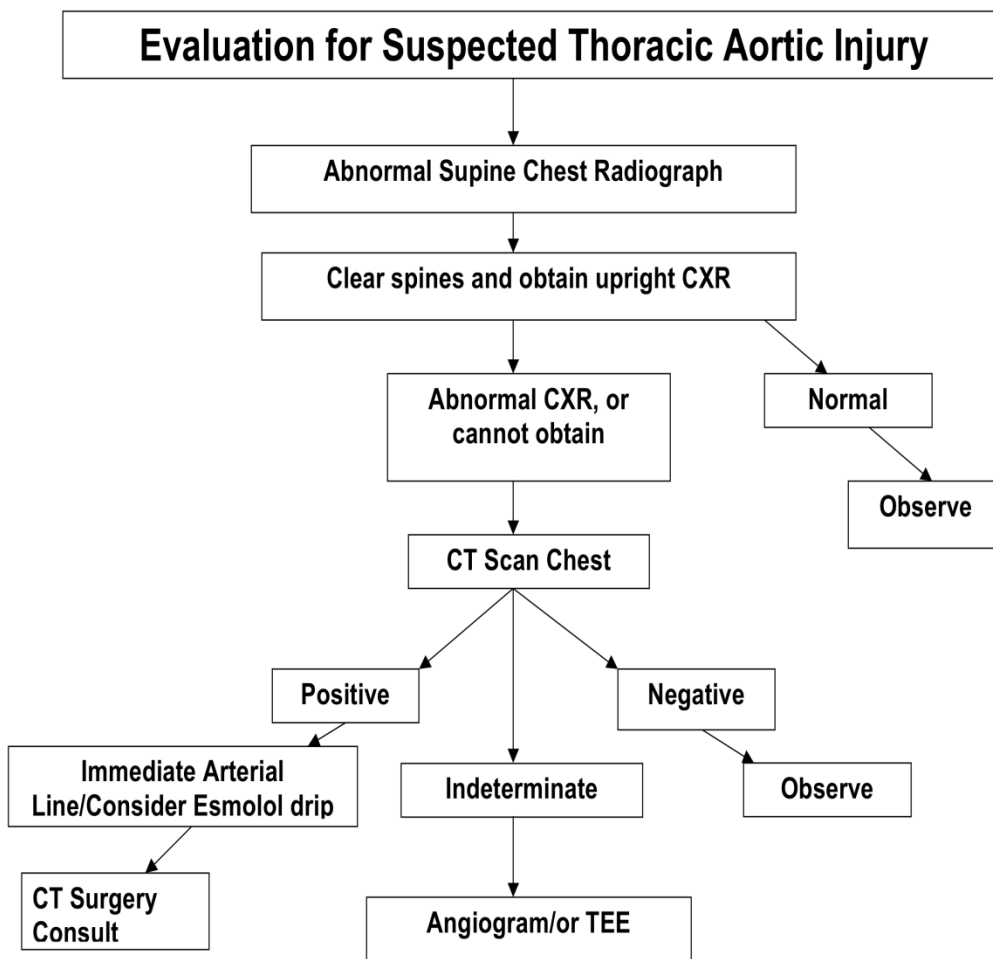
### **CHEST RADIOGRAPH (One or more of the following)**

1. Upper mediastinal widening
2. Indistinct aortic contour
3. Obscuration of the aortopulmonary window
4. Widened left paraspinal stripe
5. Deviation of the NG tube or trachea to the right
6. Depression of the left mainstem bronchus
7. Left apical cap (apical capping)

\* Isolated fractures of the first and second ribs without evidence of mediastinal hematoma do not correlate with aortic or arch vessel injury and are not an indication for further imaging.

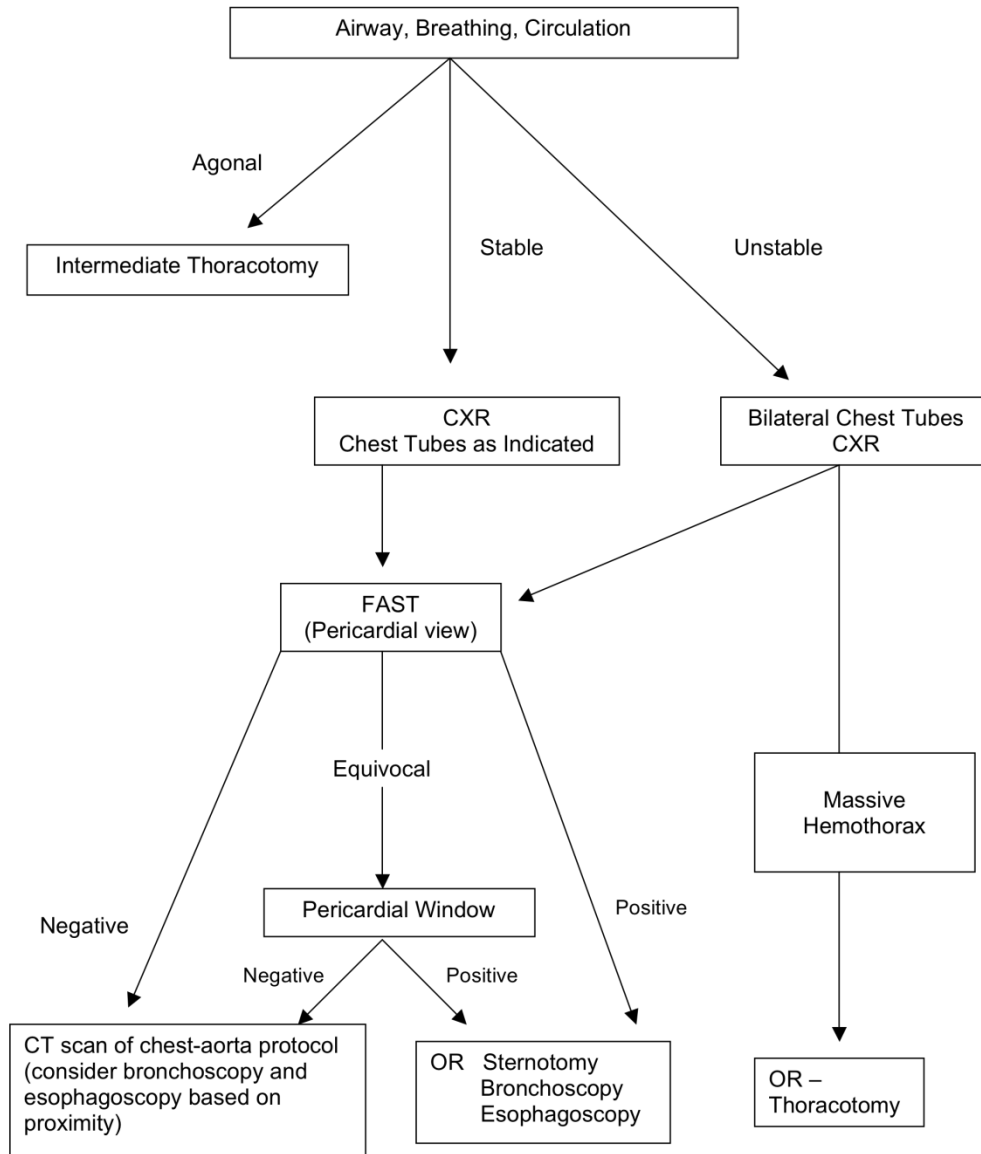
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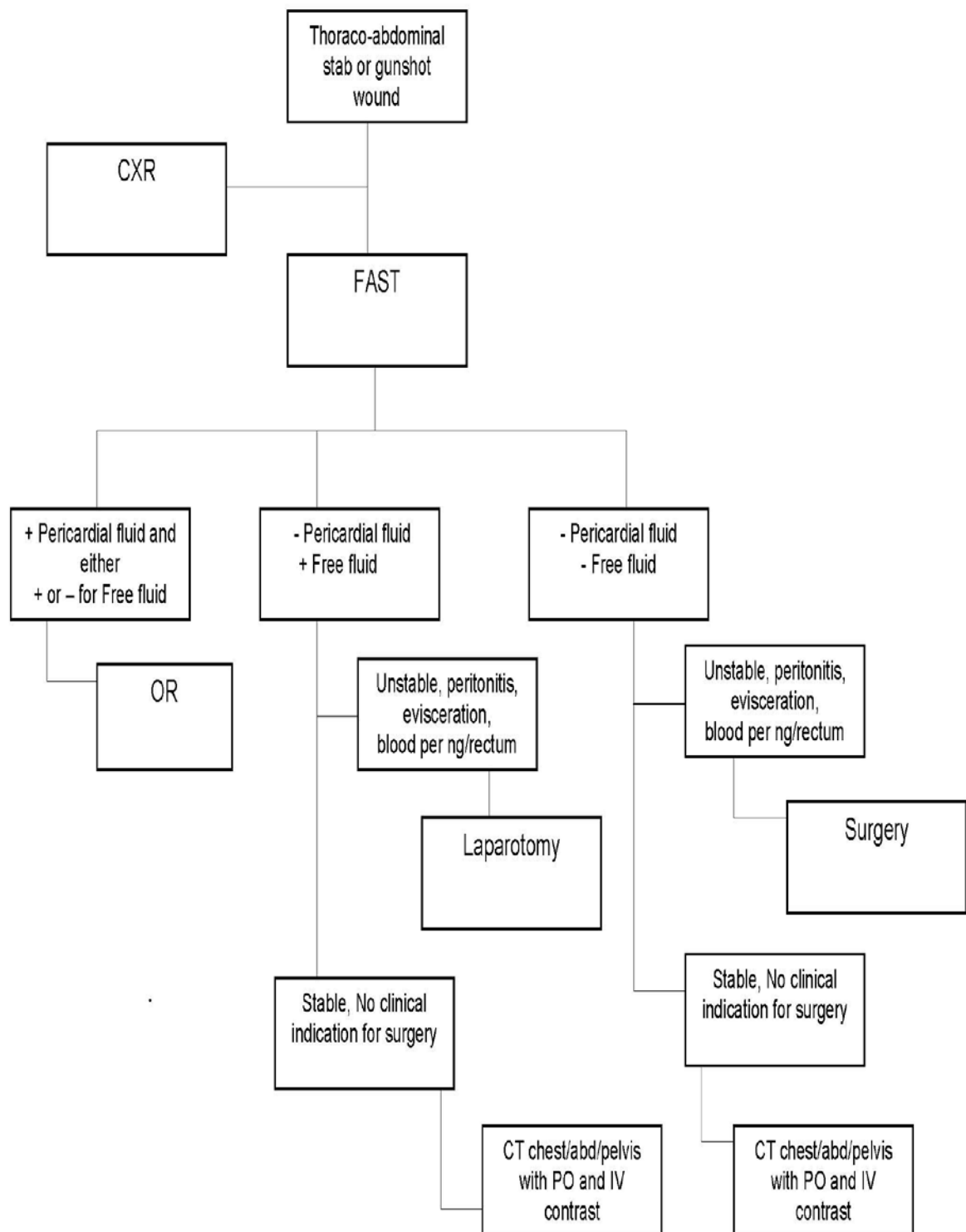
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**These injuries are rare in children**

## Penetrating Mediastinal Wounds





## **VI. Abdominal Trauma**

### **PEDIATRIC ABDOMINAL EXAM**

#### **The Role of CT scan, FAST (ultrasound), and DPL**

The treatment of children with abdominal injuries has changed significantly in the past 20 years. Pediatric surgeons have found that most abdominal injuries can be managed non-operatively. Improved awareness of anatomic patterns and physiologic responses has made it possible for most children with abdominal solid organ injury to be managed without surgical intervention. Screening capabilities of Computed tomography (CT) scanners, the focused abdominal sonograph for trauma, and less invasive percutaneous, angiographic, and endoscopic interventions allow non-surgeon members of the trauma team to play an active role in pediatric trauma care.

The goal of the abdominal evaluation of multi-system trauma patients is the safe, accurate, and timely determination of the presence or absence of intra-abdominal injury, particularly those requiring surgical intervention. Physical examination can be unreliable in polytrauma patients, particularly when the abdominal examination and/or the level of consciousness has been altered by central system trauma, distracting pain, or alcohol/drugs. CT scan and abdominal sonography (FAST) are the most frequently employed diagnostic studies used for the abdominal examination of pediatric trauma patients. Each study has advantages and disadvantages. The goal of this session is to integrate these complementary studies into a rational diagnostic algorithm for the evaluation of the abdomen.

#### **CT Scans**

Abdominopelvic CT scanning for blunt abdominal trauma has a sensitivity of 96%, a specificity of 98%, and an accuracy of 97%. CT is organ specific, allowing the identification and grading of injured organs and the quantification of intraperitoneal fluid or blood. This allows for non-operative management of stable patients, thereby reducing the rate of non-therapeutic laparotomy. Extraperitoneal injuries (thorax, retroperitoneum, and pelvis) can be identified and graded. Sensitivity and specificity depend on quality of the scan and skill of the interpreter. Contrast aspiration and allergy may occur. Bowel and pancreatic injuries may be missed. Even with the new, more rapid scanners, CT is time consuming, and transport to the scanner interrupts other diagnostic and therapeutic interventions. Consequently, CT is limited to hemodynamically stable patients. CT scan is the mainstay in the abdominal evaluation of the stable blunt trauma victim. CT now has a role to play in the evaluation of penetrating torso injury.

#### **FAST**

The use of ultrasound or FAST (Focused Assessment with Sonography in Trauma) in abdominal trauma has been employed successfully at trauma centers. FAST is noninvasive, rapid (3 to 5 minutes), and relatively inexpensive. The examination can be performed at the bedside, does not interfere with other diagnostic and therapeutic interventions, and can be repeated as needed. The primary goal of FAST is to detect free fluid in Morison's Pouch, the pelvis, peri-splenic region and the pericardium. Extraperitoneal structures can be imaged (thorax, pericardium, retroperitoneum). The relative lack of subcutaneous tissue in children, compared to an adult, makes this study easy to perform and limits the child's exposure to radiation. The technique can be easily learned and performed by the treating surgeon. Sensitivity, specificity, and accuracy of US clearly improves with experience of the examiner.

Although extremely sensitive for peritoneal fluid, US is much less sensitive for specific organ injury (liver, spleen, etc.). As is true of CT, US can miss bowel injuries. Sensitivity, specificity, and accuracy also depend on image quality and experience of the examiner.

### **DPL**

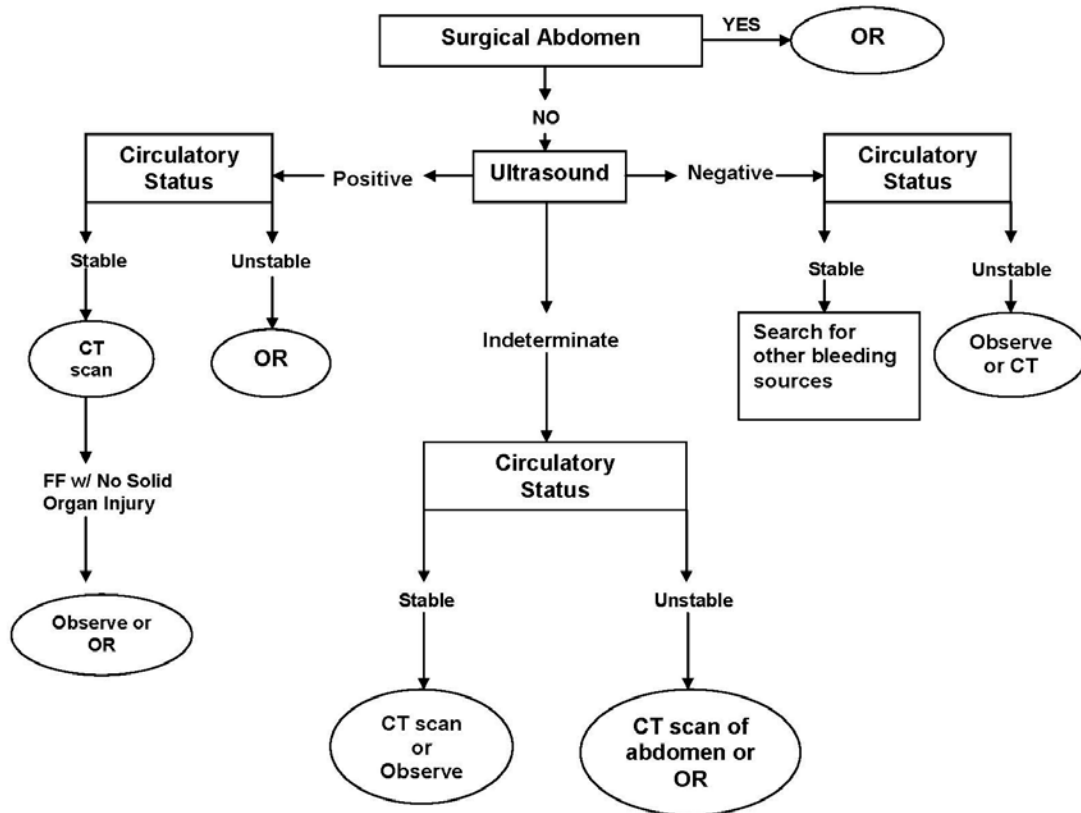
DPL (Diagnostic Peritoneal Lavage) was a mainstay in trauma evaluation for over 20 years, but this procedure is of limited use in pediatric patients. DPL is rapid (< 30 minutes) and safe (< 2% complication rate) with well-established standards for surgical intervention on the basis of cell counts or the aspiration of free blood after lavage. The procedure is invasive and can be performed at the bedside while other diagnostic and therapeutic interventions proceed. DPL cannot evaluate extraperitoneal structures (thorax, retroperitoneum, and pelvis) and must be supplemented with other diagnostic procedures. DPL is not organ specific and the presence of pelvic fractures also diminishes specificity. Therefore, a positive study may lead to a non-therapeutic laparotomy for a trivial injury. In recent years, DPL has been replaced by FAST in the unstable patient and has a limited role in the stable patient.

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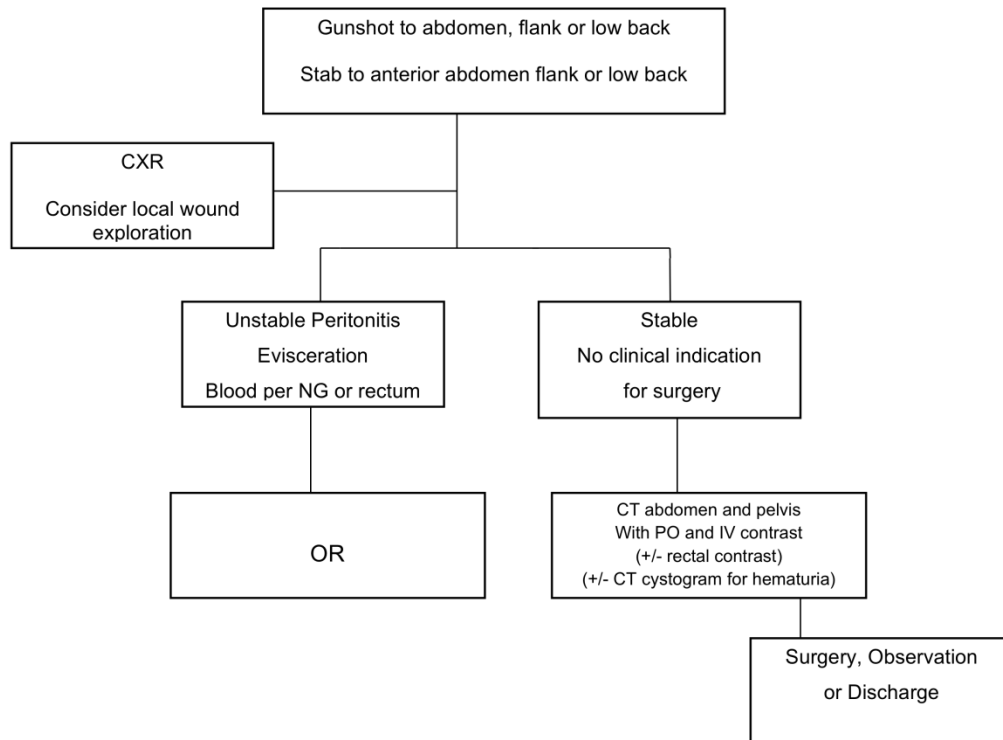
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## Pediatric Blunt Abdominal Trauma Algorithm



## Penetrating Abdominal Trauma



## Genitourinary Trauma

Trauma to the GU tract is present in approximately 10% of all injuries. The following discussion pertains to the evaluation and management of the stable patient.

Work-up of GU trauma begins with assessment of the urethra. Injuries of the female urethra are rare. Urethral injuries are usually due to blunt trauma associated with pelvic fracture or straddle-type injuries. The primary posterior site of urethral injury is the prostatomembranous junction. The primary anterior urethral injuries are most commonly caused by straddle-type injuries or perineal trauma. The location of injury is typically the bulbar urethra. Physical finding of blood at the meatus, perineal hematoma or extensive laceration, a high riding prostate, or a large hematoma found on rectal exam mandates a retrograde urethrogram prior to insertion of a Foley catheter. Management requires suprapubic urinary diversion or endoscopic assisted placement of Foley catheter.

Once urethral injury is ruled out, a Foley catheter should be inserted. It is essential to document the color of the urine, as gross hematuria mandates further workup of the GU tract. Evidence suggests the microscopic hematuria is not diagnostic for GU trauma and as such a urinalysis should not be part of the workup.

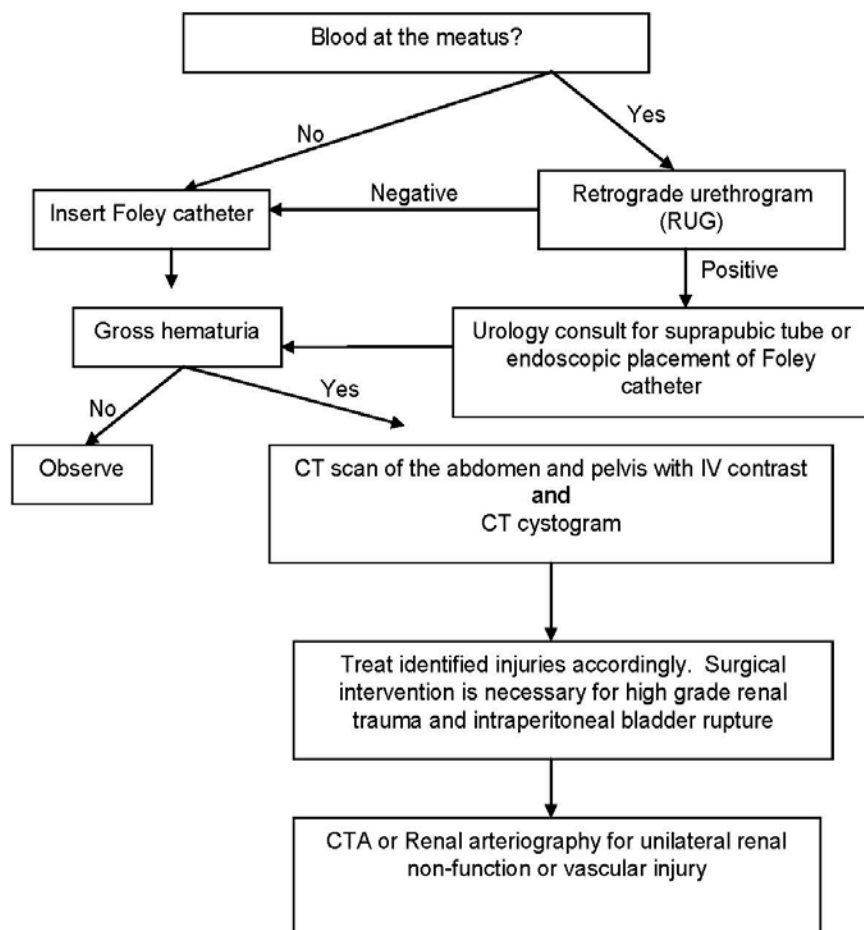
If there is gross hematuria, evaluation of the remainder of the GU tract – kidneys, ureters (in penetrating trauma), and bladder needs to be performed. This can be accomplished by various imaging techniques. However, with the advancement of the CT technology, it has evolved to become the standard of care. Therefore, for gross hematuria, a CT scan of the abdomen and pelvis to evaluate the kidneys, as well as CT cystogram should be obtained.

The kidneys are the most commonly injured organs in the GU tract. Management depends on hemodynamic stability and the grade of injury by CT scan. Most renal injuries do not require an operation in a stable patient. However, incidental intra-operative finding of perinephric hematoma should be explored if the mechanism is penetrating trauma.

A blunt ureteral injury is a case report! Most ureteral injuries are penetrating. They require surgical intervention. Basic principles of ureteral reconstruction include debridement of devitalized tissue, followed by tension-free anastomosis with absorbable suture in a spatulated fashion over a double J stent.

Bladder ruptures can result from penetrating or blunt trauma. Extraperitoneal bladder rupture is commonly associated with pelvic fracture; and intraperitoneal bladder rupture is a result of blunt lower abdominal force on a full bladder. Classic physical findings of bladder rupture include suprapubic pain, hematuria, and inability to void. A CT cystogram should be obtained. Extraperitoneal bladder rupture is generally managed with Foley catheter drainage, and intraperitoneal bladder rupture requires immediate surgical intervention.

## Genitourinary Trauma Algorithm



Revised: 5/08

## **Intra-Abdominal Hypertension and Abdominal Compartment Syndrome Assessment and Monitoring Guidelines**

The abdominal cavity can be considered a single cavity and change in the volume of contents will elevate abdominal pressures. Abdominal Compartment Syndrome (ACS) is a condition in which the increased pressure in the anatomic space results in organ dysfunction. Undetected increases in intra-abdominal pressure (IAP) can be life threatening. Identification of patients at risk is essential to prevent hemodynamic and respiratory compromise from undetected ACS. ACS is preceded by intra-abdominal hypertension (IAH) which is defined as an IAP of  $\geq 12$  mmHG. Organ dysfunction also may precede development of ACS.

Abdominal Compartment Syndrome (ACS) is defined by Intra-abdominal pressure (IAP)  $\geq 20$  mmHg (with or without an Abdominal Perfusion Pressure  $< 60$  mmHg) in a minimum of three standardized measurements taken four to six hours apart plus at least one new end-organ failure.

Experience with abdominal decompression in children is limited, but in some cases this has been shown to decrease oxygen requirements and high airway pressures, so it may be a consideration.

### **I. Etiology of Increased IAP**

#### **Acute**

- A. Intra-abdominal Hemorrhage
  - Post resuscitation visceral hemorrhage
  - Hypothermic or consumptive coagulopathic bleeding
  - Rupture of abdominal aortic or visceral artery aneurysm
  - Post traumatic intra-abdominal hemorrhage
- B. Retroperitoneal Hemorrhage
  - Blunt trauma (i.e., pelvic fracture, kidney laceration)
  - Hemorrhagic Pancreatitis
  - Ruptured abdominal aortic aneurysm
- C. Accumulation of Fluid/Visceral Swelling
  - Septic shock
  - Peritonitis (i.e., perforated viscus, postoperative abscess)
  - Paralytic ileus
  - Bowel obstruction
  - Mesenteric venous thrombosis
  - Mesenteric ischemia/reperfusion
  - Pancreatitis
- D. Other
  - Tension pneumoperitoneum
  - Intra-abdominal packing

#### **Chronic**

- A. Ascites
- B. Pregnancy
- C. Large abdominal tumor/ovarian mass

## **II. Physiologic Consequences**

### **Cardiopulmonary Effects**

**Increased IAP increases intra-thoracic pressure (ITP) which impedes venous return and causes a number of physiologic derangements.**

#### **A. Pulmonary**

- Decreased compliance (see higher peak airway pressures)
- Increased inspiratory pressure
- Hypercarbia (decreased ventilation)
- Hypovolemia (compresses SVC, decreasing preload = decreased CO)
- Respiratory Acidosis (decreased FRC and TV = decreased ventilation)
- Increased pulmonary vascular resistance (increases pulmonary shunt and increases work on heart to generate same CO)

#### **B. Cardiac**

- Decreased ventricular compliance (requires increased preload for same CO)
- Increased CVP, PWP, PAP (Falsely elevated when euvolemic!)
- Diminished venous return (compresses SVC/IVC)
- Tachycardia (decreased preload, need increased HR to keep same CO)
- Decreased cardiac output (seen when compensatory mechanisms fail)
- Increased SVR
- \* Venous stasis may increase risk of DVT/PE

### **Renal Effects**

Increased IAP compresses the inferior vena cava and renal veins. Direct extrinsic pressure on the kidney creates a circumferential constriction. The combination of direct trauma, hypoperfusion and venous backpressure can create an intra-renal compartment syndrome. As a consequence, urine output diminishes.

### **Neurological Effects**

By increasing ITP, increased IAP impedes venous outflow from the cerebral circulation.

↑ ICP

↓ CPP

### **Gastrointestinal/Hepatic/Wound Healing**

Increased abdominal pressure reduces blood flow to the abdominal viscera.

↓ celiac and portal blood flow

↓ mucosal blood flow

↓ fascial blood flow- (increases risk of wound infection and dehiscence)

↑ bacterial translocation

### **Multiple Compartment Syndrome**

↑ IAP -> ↑ ITP -> ↑CVP -> ↑ ICP -> ↓ CPP

When ICP remains elevated despite maximal medical maneuvers, give consideration to MCS which may require decompressive laparotomy and/or decompressive craniotomy.

### **Grades of Intra-abdominal Hypertension (mmHg)**

- Normal = 0 – 11
- Grade I = 12 – 15 (IAH)
- Grade II = 16 - 20
- Grade III = 21 – 25
- Grade IV = >25

**Please notify physician if IAP is > 12, or per physician's orders. Profound physiologic derangements can occur with IAH reinforcing the need to recognize and treat IAH early before ACS develops.**

**Abdominal Perfusion Pressure (APP) = MAP – IAP**

**Goal APP > 60 mmHg**

### **III. Procedure for Measuring Abdominal Pressures**

#### **A. Supplies Needed**

1. 500 ml Normal Saline
2. Transducer/pressure tubing
3. 60 ml syringe
4. 18 gauge needle
5. Providone-iodine swab
6. Alcohol Swab
7. Kelly
8. 4 x 4 gauze

#### **B. Guidelines**

1. Place patient in supine position
2. Clamp tubing of the indwelling urinary catheter distal to sampling port with Kelly clamp, using 4 x 4 gauze to protect tubing.
3. Clean sampling port with providone-iodine/alcohol
4. Attach IAP monitoring device to foley
5. Insert 18-gauge needle into sampling port of bladder drainage system.
6. Attach 60-ml syringe to 3-way stopcock and withdraw 60 ml of normal saline from the flush system.
7. Instill 60 ml of normal saline into the bladder
8. Using the proximal stopcock, level and zero the transducer at the symphysis pubis. Please mark position if you are going to be doing more intra-abdominal pressure measurements.
9. Measure abdominal pressure at end expiration (please note that the intra-abdominal pressure waveform is a relatively flat line with excursion that corresponds to respiratory cycle.
10. Record reading on flow sheet
11. Subtract NS instilled into the bladder from urine output
12. Label and date flush bag/transducer used for intra-abdominal pressure readings if repeated measurements are ordered. Please ensure that the flush bag/transducer is labeled for intra-abdominal pressure readings only.

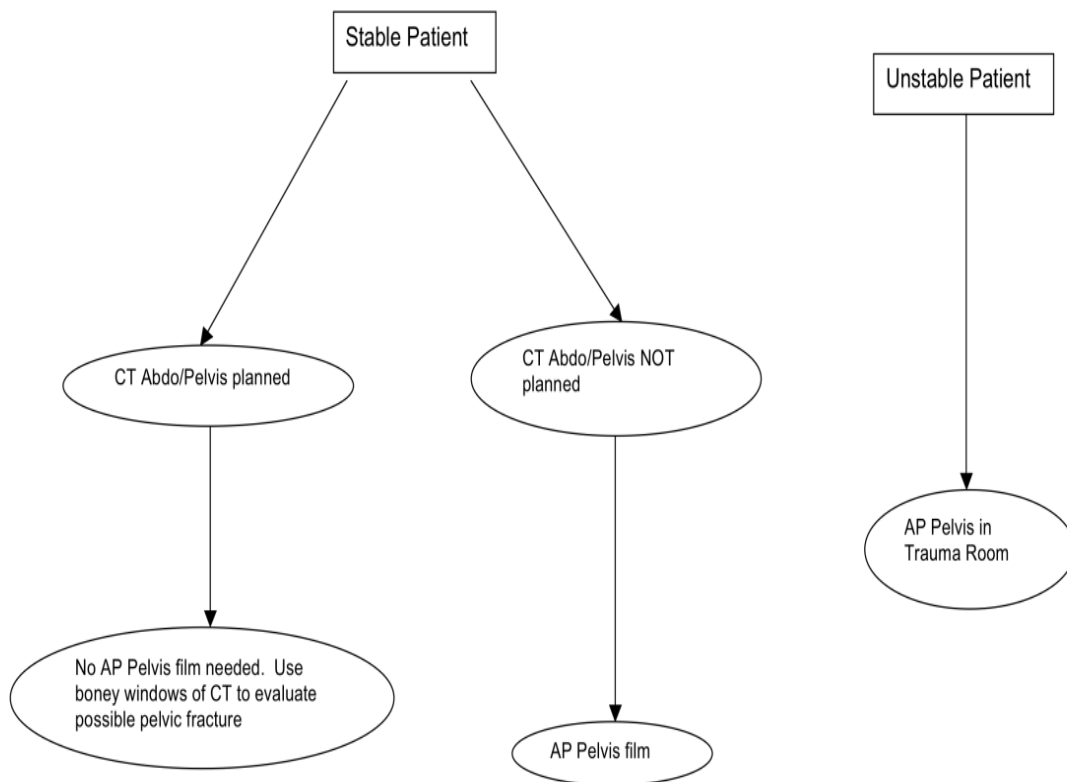
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## VII. Pelvis

### EMERGENCY DEPARTMENT RADIOLOGICAL ALGORITHM TO EVALUATE POSSIBLE PELVIC BONE FRACTURE IN BLUNT TRAUMA VICTIMS



10/08

### UK Hospital Pelvic Fracture Treatment Algorithm

Angio phone #: \_\_\_\_\_

```

graph TD
    Start[UK Hospital Pelvic Fracture Treatment Algorithm] --> Unstable[UNSTABLE PATIENT]
    Start --> Stable[STABLE PATIENT]
    Stable --> CTBony[CT BONY PELVIS, ORTHOPEDIC CONSULT]
    Unstable --> Fracture[Fracture identified on AP pelvis]
    Fracture --> Binder[BINDER*]
    Binder --> FAST[FAST]
    Binder --> Indeterminate[INDETERMINATE]
    FAST --> Positive[POSITIVE]
    FAST --> Negative[Negative]
    Positive --> Lap[LAPAROTOMY]
    Lap --> Control[CONTROL IP HEMORRHAGE;  
CONSIDER EP PACKING +/- EX-FIX  
OR C-CLAMP***  
BASED UPON HEMODYNAMICS]
    Control --> NoBleed1[NO PELVIC FRACTURE BLEEDING]
    Control --> Bleed1[PELVIC FRACTURE BLEEDING]
    NoBleed1 --> RemoveBinder1[REMOVE BINDER]
    RemoveBinder1 --> Observe1[OBSERVE;  
CT BONY PELVIS,  
ORTHOPEDIC CONSULT]
    Bleed1 --> ContinueBinder1[CONTINUE BINDER]
    ContinueBinder1 --> PelvicAngio1[PELVIC ANGIO]
    PelvicAngio1 --> Observe1
    Indeterminate --> CTorDPL[CT or DPL**]
    CTorDPL --> DPL[DPL]
    DPL --> GrossPlus[GROSS +]
    GrossPlus --> Control
    DPL --> GrossMinus[GROSS -]
    GrossMinus --> CT[CT]
    CT --> Priority[PELVIC FRACTURE HIGHEST PRIORITY LESION ON CT?]
    Priority --> Yes1[YES]
    Priority --> No1[NO! HIGHER PRIORITY IDENTIFIED.]
    Yes1 --> ContinueBinder1
    No1 --> ContinueBinder2[CONTINUE BINDER.  
O.R. BASED UPON CT]
    ContinueBinder2 --> Control
    Negative --> ConsiderLoss[CONSIDER OTHER SOURCES OF MAJOR BLOOD LOSS]
    ConsiderLoss --> None[NONE]
    ConsiderLoss --> Present[PRESENT]
    Present --> HemorrhageControl[HEMORRHAGE CONTROL]
    None --> SevereHDUS[SEVERELY HDUS?]
    SevereHDUS --> Yes2[YES]
    SevereHDUS --> No2[NO]
    Yes2 --> Control
    No2 --> CallAngio[CALL ANGIO]
    CallAngio --> Yes3[YES]
    CallAngio --> No3[NO]
    No3 --> PelvicAngio2[PELVIC ANGIO]
    No3 --> Waiting[WAITING TIME FOR ANGIO?]
    Waiting --> Yes4[YES]
    Waiting --> No4[NO]
    Yes4 --> CT
    No4 --> PelvicAngio2
    
```

\*Binder should fit snugly, not excessive. MAST could also be used for stabilization.

\*\*Decision based upon hemodynamics, other injuries and AP pelvis

\*\*\*Ex-fix/C-clamp before pelvic angio only at Ortho Trauma Attending discretion and may include EP packing

10/08

## VIII. Extremity Injuries

### Care of Extremity Fractures

#### PROCEDURE:

##### I. Assessment

- Obtain time and mechanism of injury and any associated injuries.
- Note obvious swelling, deformity, tissue integrity, dislocation, or inability to bear weight or move affected extremity. Compare to uninjured extremity.
- Assess the five P's; document quality and severity pain.
  - Pain
  - Pulses
  - Paresthesia
  - Paralysis
  - Pallor
- Assess potential for compartment syndrome.
  - Taut, firm extremity
  - Pain unrelieved by narcotics
  - Extreme pain elicited by passive stretch
  - Paresthesia
- Determine past history, including previous fracture or injury; if female – possible pregnancy status; tetanus immunization status; last meal; etc.
- Document treatment PTA – self treatment, at outlying facility, or pre-hospital personnel.

##### II. Interventions:

1. Remove jewelry and/or constrictive clothing as soon as possible.
2. RICE – rest, ice, compression, elevation.
3. Dress open wounds – give Td as indicated.
4. Splint injured site to prevent further injury or allow patient to hold extremity in position of comfort
5. Reevaluate neurovascular status after interventions provided to injured part.

##### III. Diagnostics

1. Image affected limb.
2. Consider imaging joints above and below the injury site
3. Consult orthopedics of abnormality noted on imaging or concern for compartment syndrome.
4. Consider CTA, angiogram, and/or vascular consult if vascular injury suspected

## Traumatic Peripheral Vascular Injury

Any injured extremity should be thoroughly evaluated for a possible vascular injury. The presence of obvious arterial injury from a blunt and/or penetrating mechanism rarely requires imaging and should not delay emergent operative exploration. The presence of "hard signs" strongly supports vascular injury and typically necessitates emergent repair. These "hard signs" are:

1. Bruit/Thrill
2. Active/Pulsatile hemorrhage
3. Pulsatile/Expanding hematoma
4. Signs of limb ischemia and or compartment syndrome including the 5 "P's" - pallor, paresthesias, pulse deficit, paralysis, and pain on passive extension of the compartment (pain on passive extension is the earliest and most sensitive physical finding)
5. Diminished or absent pulses with + Doppler signals (*this is not a sensitive prognostic finding, as up to 30% of patients with major vascular injuries requiring repair have normal pulses or Doppler signals distal to the injury due to collateral flow*) [1]

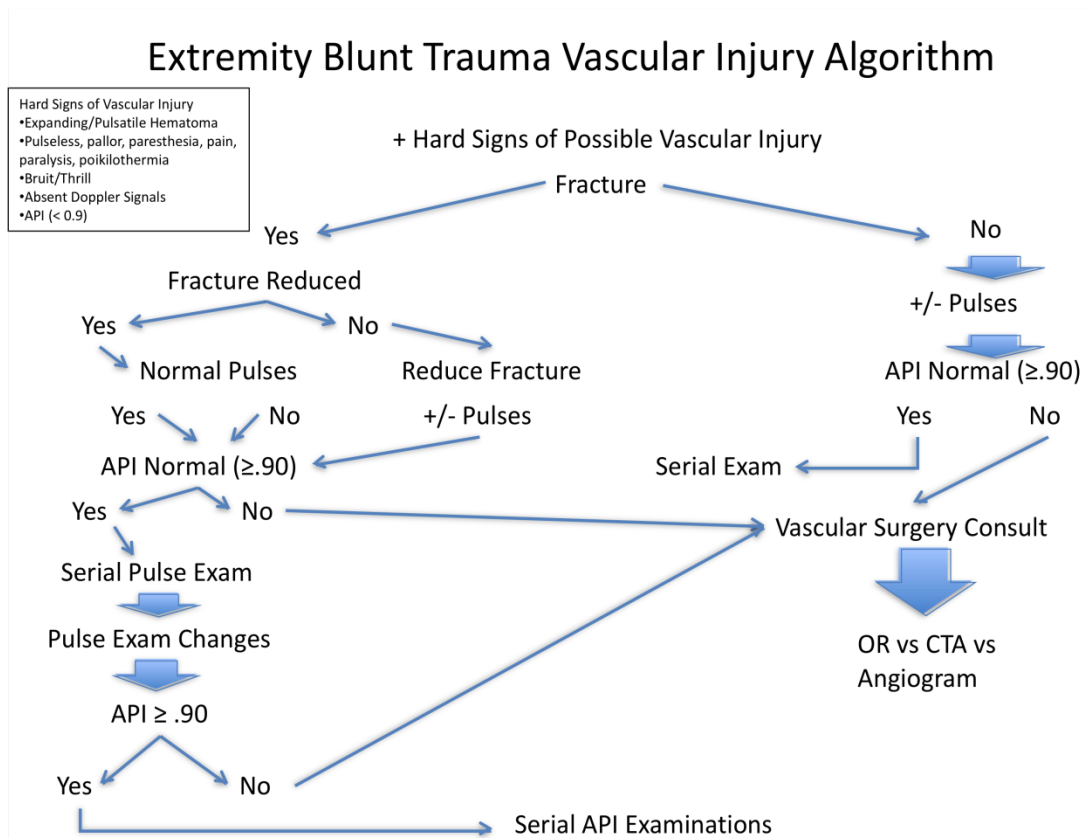
The Arterial Perfusion Index, API, is a validated tool for screening for peripheral vascular injury[2]. This is performed by placing a blood pressure cuff above the ankle or on the bicep of the limb of concern. The systolic pressure is determined with a Doppler probe at the dorsalis pedis or brachial artery. Repeat this procedure on the ipsilateral uninjured limb. The API is calculated by dividing the systolic pressure in the injured limb by the systolic pressure in the uninjured limb. An API < 0.9 has a sensitivity of 95% and specificity of 97% for a major arterial extremity injury. In a study on blunt orthopedic extremity injuries the negative predictive value is 100% for an API > 0.9 to exclude an arterial injury.[3-5]

The purpose of these algorithms is to diagnose the occult injury early before irreversible tissue ischemia is present. In patients where the "hard" signs are **NOT** present it is imperative to maintain a high suspicion of peripheral vascular injury in the injured extremity [2, 6, 7]. If "hard signs" are not present but peripheral vascular injury is suspected then expedient consultation with Vascular Surgery is indicated and the use of imaging, per Vascular Surgery, should be liberal to avoid missed injuries.

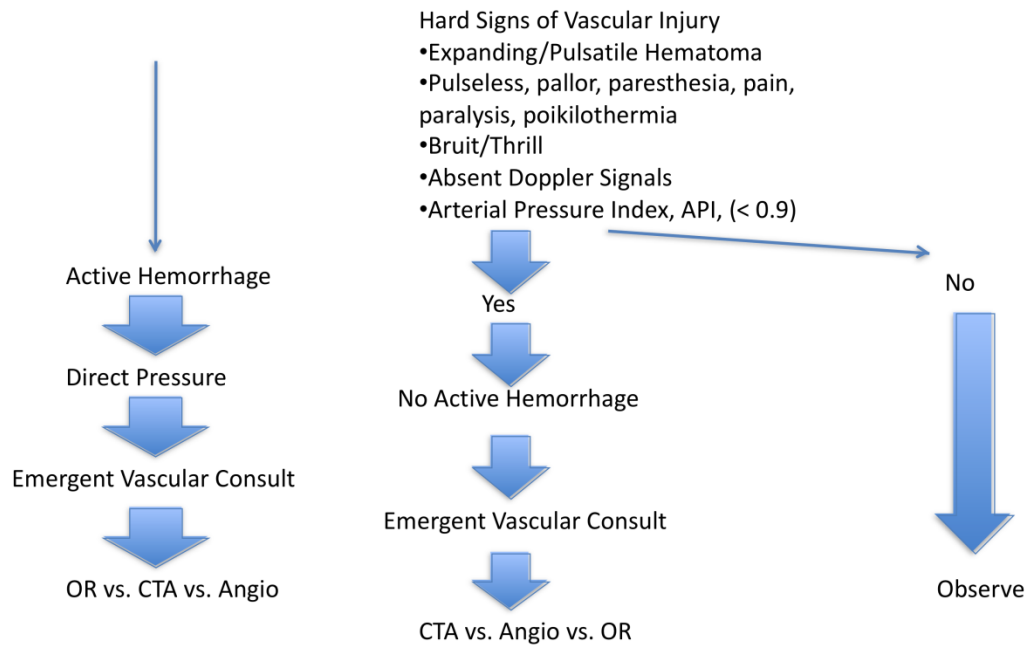
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# Penetrating Extremity Vascular Injury



## Open Long Bone Extremity Fracture Pathway

Open long bone extremity fractures are associated with significant trauma. The expedient management of these injuries ensures the best possible fracture treatment outcome. The determination of the grade of open fracture is the responsibility of the orthopedic trauma service. The extent of the grade of open fractures often requires intra-operative evaluation.

Antimicrobial Treatment for Open Fractures Depending on Grade		
Open Fracture Grade	Antibiotic Treatment	Antibiotic Treatment if PCN Allergic
Grade I	Kefzol 25 mg/kg IV q8h x 24h	Clindamycin 10 mg/kg IV q6 x 24h
Grade II	Kefzol 25 mg/kg IV q8h x 24h	Clindamycin 10 mg/kg IV q6 x 24h
Grade III	Kefzol 25 mg/kg IV q8h x 24h + Gentamicin 2.5 mg/kg/d x 48h	Clindamycin 10 mg/kg IV q6 x 48 + Gentamicin 2.5 4mg/kg/d x 48h

If patient exposed to barn or farm wound contamination then add high dose PCN x 24 hours (Grade I and II) or 48 hours in Grade III.

Open fracture management and evaluation, including antibiotics should be initiated as soon as possible from the timing of wounding, not based on arrival to ER.

If a patient gets an operation on this open fracture after completion of the above duration of antibiotics is given they should get only a perioperative dose.

Wound care for open long bone extremity fracture requires coverage of the wound with a Hibiclens or Betadine soaked gauze.

Mandatory documentation of neurovascular exam is required in all extremity injuries pre and post extremity fracture care. Frequent neurovascular examinations are required before and after fracture management to detect extremity compartment syndrome. The LAST clinical finding lost in developing compartment syndrome is the pulse. The body has evolved to perfuse cells until the very end so it makes sense that the pulse is the last clinical finding to be lost in developing compartment syndrome.

\* All open fractures must be evaluated by the Ortho Trauma Service for proper management (stabilization, wound care, further fracture grading, and definitive fracture management)

## IX. Miscellaneous

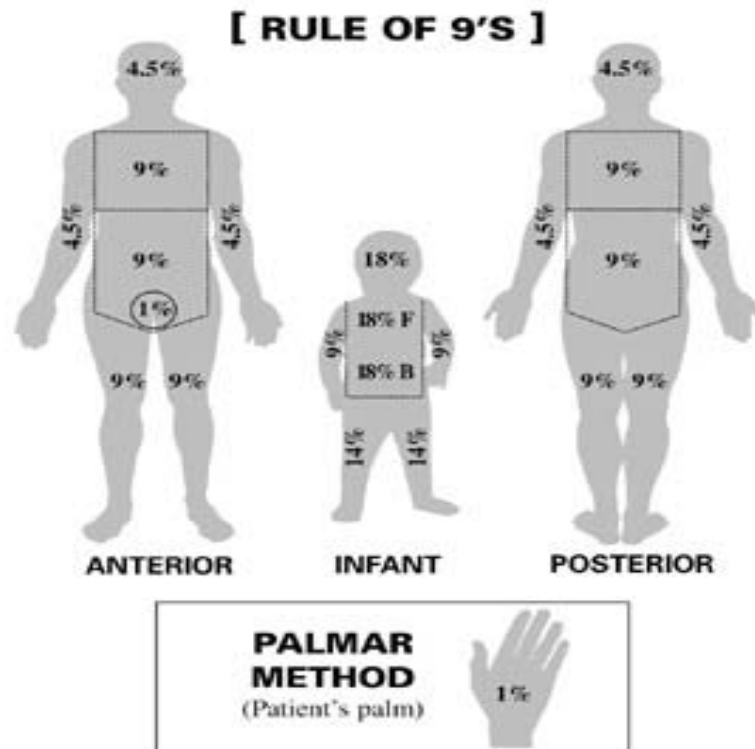
### EVALUATION OF BURN PATIENTS

#### Stabilization

1. Maintain airway - the supraglottic airway is extremely susceptible to obstruction from edema as a result of exposure to superheated air. Assess for clinical signs of inhalation injury:
  - Facial burns/singeing of the eyebrows and nasal hairs
  - Carbonaceous sputum and acute inflammatory changes in the oropharynx, raspy voice
  - History of impaired mentation and/or confinement in a burning environment
  - Assess for toxic inhalation, or carbon monoxide poisoning

#### Circulation

1. Replace volume based on Rule of Nines calculation. Follow the Parkland Formula ( $2 \text{ -cc} \times \% \text{ TBSA burned} \times \text{weight/kg} = \text{total to be administered in first 24 hours}$ . Half should be given in first 8 hours from time of burn and second half over next 16 hours) for administration of fluid. The amount of fluid given should be adjusted according to individual patient's response:
  - a. Adult UO: 0.5 – 1.0 ml/kg/hour
  - b. Child <30 KG: UO 1.0 ml of urine/KG/hour. It is necessary to administer Maintenance IV fluid containing glucose in addition to burn formula
1. Initiate two large bore IVs; overlying **burns shouldn't** prevent IV placement (upper extremities preferred)





### Assessment

A. Assess for associated injuries

B. History - time and mechanism of the injury; enclosed fire, or if toxic chemicals involved

C. Assess burn

1. **First degree:** (Sunburns): characterized by erythema, pain, and the absence of blisters – NOT COUNTED IN TBSA

2. **Second degree:** (Superficial Partial Thickness or Deep partial thickness): characterized by a red or mottled appearance with swelling and blister formation. The surface may have a weeping, wet appearance and is painfully hypersensitive

3. **Third degree:** (full thickness): skin appears dark and leathery; may also appear translucent, mottled, or waxy white; the surface is painless and generally dry, but may also be moist

D. Circumferential extremity burns:

1. Remove rings and bracelets and Assess distal circulation

2. Check pulses with a Doppler (absent pulse may indicate inadequate fluid resuscitation)

d. Observe for cyanosis, impaired capillary refill, or progressive neurological signs (i.e., paresthesia and deep tissue pain)

E. Limb Escharotomy

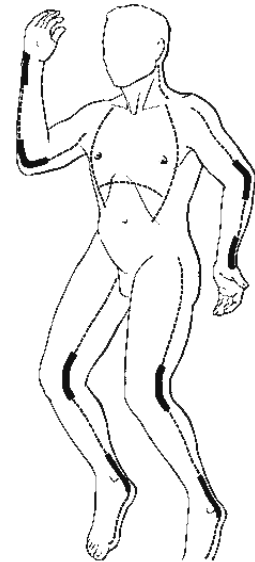
Relieve compromised distal circulation in a circumferentially burned limb by escharotomy, which can be done without anesthesia, due to the insensitive full - thickness burn

1. The incision must extend across the entire length of the eschar in the lateral and/or medial line of the limb including the fingers and joints

2. The incision should be deep enough to allow the cut edges of the eschar to separate

F. Thoracic Escharotomy:

Circumferential burns of the thorax occasionally impair respiratory excursion. Bilateral, mid-axillary escharotomy incisions should be considered



Escharotomy Incisions

### Special Burn Requirements

A. Chemical burns

1. Flush burns for at least 20 to 30 minutes; alkali burns require longer irrigation

2. Brush dry powder off before irrigation

3. Alkali burns to the eye require continuous irrigation during the first eight hours

B. Electrical burns - frequently more serious than they appear on the surface

1. Initial care as above

2. Full spinal immobilization

3. EKG monitoring

4. Urinary catheter

a. Observe for myoglobinurea (due to rhabdomyolysis)

- b. Increase IV rate fluid to ensure UO of at least 100 ml/hour
- c. Consult Medical Control for Mannitol 25 GM IVP and IV infusion with 12.5 GMs of mannitol/1000 cc NS to maintain the diuresis
- C. Explosive Injuries –
  - Any patient involved in an explosion should be considered as having a mechanism for traumatic injuries. Even if the patient states they were NOT thrown a distance. The force of a flash flame explosion is enough energy to cause concussive type of injuries.
- D. Pediatric Considerations:
  - Consult Social Service if burn injury occurred due suspected abuse, neglect, or as a result of safety hazards in the home.
  - Consider Pediatric Psych Consult for pediatric burn patients to help them cope with hospitalization, body image changes, and/or Acute Stress Disorders.

**\*\*\*\* ANY PEDIATRIC PATIENTS WITH SEVERE BURNS SHOULD BE EVALUATED  
FOR POTENTIAL BENEFIT FROM TRANSFER TO A SPECIALITY PEDIATRIC BURN  
CENTER  
(SHRINER'S PEDIATRIC BURN HOSPITAL IN CINCINNATI)**

## **Anemia Management**

Pediatric patients commonly suffer from anemia on admission to the Pediatric Intensive Care Unit (PICU). Additionally, anemia frequently develops or worsens during the course of a patient's PICU stay. Anemia can cause prolonged PICU stays, increase the costs of healthcare, and lead to other negative patient outcomes. If transfusion is required, the patient may be exposed to potential harmful effects of transfused blood products.

### **Prevention**

- Minimize phlebotomy (avoid daily lab draws, Use pediatric sized specimen tubes to limit the amount of blood required for the tests, obtain all blood needed at once, use specimen tubes that can be used for multiple labs, add tests to blood already in the lab when appropriate)
- Adequate nutritional support

### **Transfusion of PRBCs**

Patients may require 10 ml/kg of PRBCs during their initial resuscitation after trauma. This may be repeated. If the patient remains hemodynamically unstable after 2 boluses of PRBCs, institute the Massive Transfusion Guideline until hemorrhage control is achieved. See Massive Transfusion Guideline. The goal after receiving a transfusion is a Hgb  $\geq 7$  g/dL (Hct  $\geq 21$ ). If clinically indicated to monitor response and further bleeding, blood counts should be collected 30 minutes after the end of the infusion. Routine post-transfusion hematocrits are not mandatory. The most blood-economical manner of monitoring hematocrit is with blood gas panels, which require only 1cc of blood (venous or arterial).

### **Adjunctive Medications**

Consider the addition of these medications when treating anemic patients:

- **Folic acid**
- **Cyanocobalamin (vitamin B<sub>12</sub>)**
- **Ferrous sulfate**

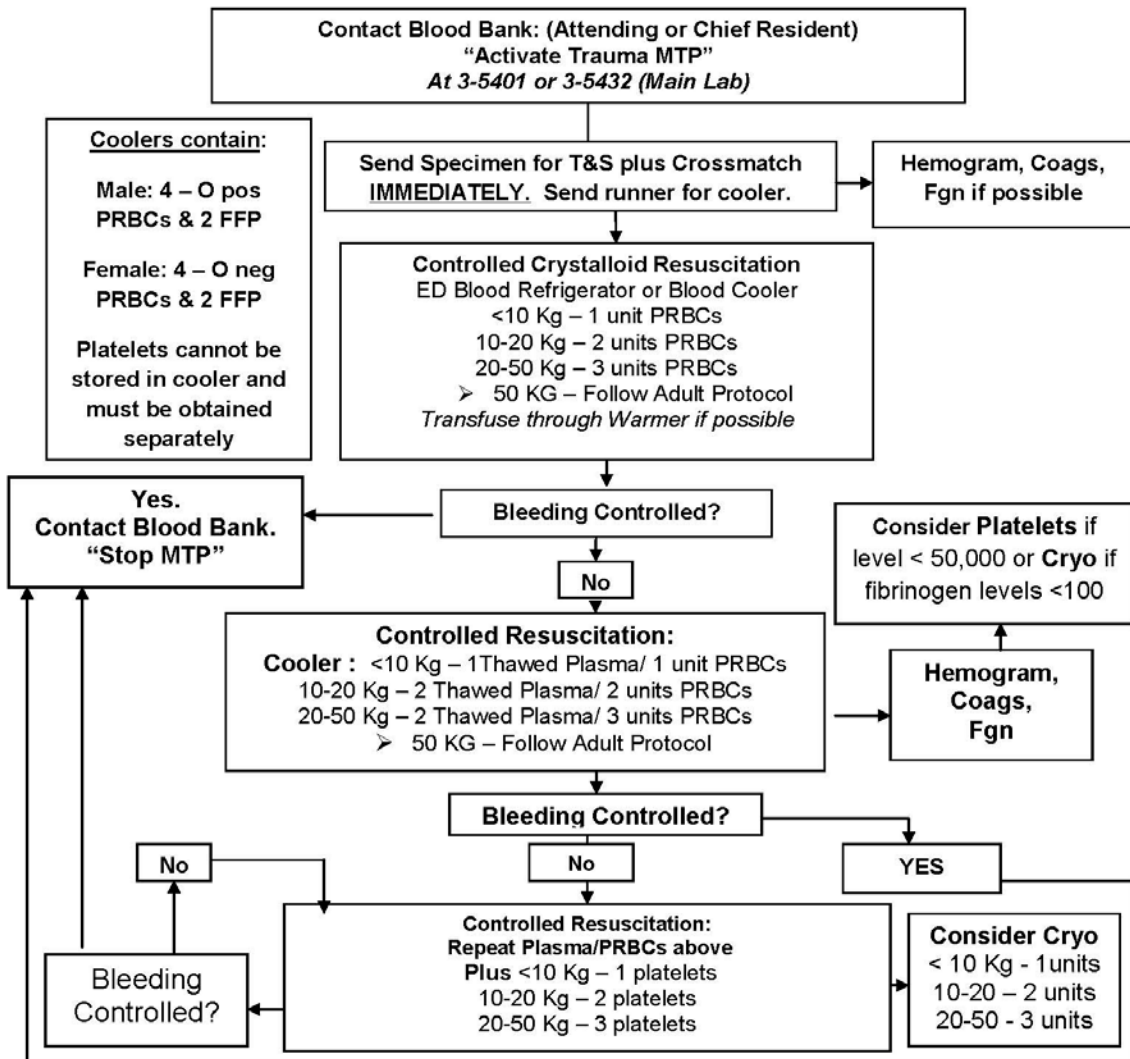
# KCH Pediatric Massive Transfusion Guideline

## Clinical Criteria

- Exsanguinating shock with associated acidosis
- Crystalloid > 40 ml/Kg or PRBC transfusion > 20 ml/Kg with continued Hemodynamic instability
- Estimated blood loss > 20-40ml/kg
- High energy chest, abdominal, pelvis trauma
- Aortic or other vascular injury
- Severe CHI in young child
- Long bone injury with multisystem injuries
- Known coagulation disorders

## Laboratory Criteria (Any Time)

Base Deficit > 8  
 INR  $\geq$  1.5  
 PT > 18 seconds  
 PTT > 60 seconds  
 Admission Hct < 21  
 pH < 7.1



### **Transfusion Notes:**

Type & Screen plus Crossmatch should be obtained ASAP and sent directly to the blood bank (not the main lab) by the tube system using destination 160.

All blood products should be administered through filters, and warmers should be used whenever possible. Give O positive PRBCs to males and O neg PRBCs to female children until ABO/Rh is obtained. Careful reporting of the blood products and volumes infused should be documented in the patient care record.

### **Volumes of Blood Products:**

- 1) **PRBCs** ≈ **360 mL** (200-220 mL RBCs, 40 mL plasma, 100-120 mL additive solution)
- 2) **THAWED PLASMA** is kept refrigerated up to 5 days and contains **250 mL** of Factors II, VII, IX, X, and fibrinogen. Factors V and VIII may be somewhat decreased.
- 3) **PLATELETS** contain ~  $3.0 \times 10^{11}$  platelets in **250 mL** (equivalent of 6 pack pooled platelets)
- 4) 1 unit of **CRYO** contains ≥ 80 IU Factor VIII, ≥ 150 mg fibrinogen, as well as significant amounts of Factor XIII and vWF in **10-15 mL**

## Section I

### I. Recognizing Child Physical Abuse

#### A. Definitions

##### 1. Child Physical Abuse

Physical abuse is non-accidental physical injury as a result of punching, beating, kicking, biting, shaking, throwing, stabbing, choking, hitting, burning, or otherwise harming a child, that is inflicted by a parent, caregiver, or other person who has responsibility for the child. Such injury is considered abuse regardless of whether the caregiver intended to hurt the child.

### II. Risk Factors for Physical Abuse:

#### A. Parent or caregiver factors:

1. Personality characteristics
2. Psychological well-being (untreated/inadequately treated mental illness)
3. History of maltreatment
4. Substance abuse
5. Attitudes and knowledge
6. Immaturity

#### B. Family Factors:

1. Non-biological parental male living in the home
2. Marital conflict/Domestic Violence
3. Lower economic status
4. High stress level/lack of social support

#### C. Child Factors

1. Age (3 and younger have the highest risk)
2. Disability (Physical/Cognitive/Emotional)
3. Prematurity
4. Long-awaited child

**Absence of risk factors is *not* the absence of risk!!!**

### III. Bruising and Other Skin Trauma:

- A. Bruising of any child under 4 months of age warrants a full child abuse work-up
  - 1. **TEN/4 rule** for body region/age raising clinical suspicion for abuse
    - a) *Any child under the age of 4 years with a bruise on the Torso (including perineum and buttocks), Ears, and Neck without corroborated story should raise level of suspicion and have low threshold to perform complete child abuse work-up for age.*
- B. Bite marks:
  - 1. Inflicted adult bite marks are very worrisome
    - a) typically indicate a more sadistic abuser
    - Measurement of diameter can be helpful
    - determination of adult vs. child can still be difficult
  - 2. Swabbing fresh bite marks can help identify perpetrator by DNA
  - 3. Photography of bite marks (and all inflicted injuries) is very important
    - a) include scale
  - 4. Most common perpetrator is TODDLER

### IV. Burns:

- A. Beware of clearly sharply demarcated edges on burns
  - 1. No splash marks should be very worrisome
  - 2. Burns can change in appearance in a matter of hours, so photo-documentation should be done IMMEDIATELY if the child is otherwise stable
- B. It is concerning if there are a predominance of second and third degree burns

### V. Abusive head trauma:

- A. Global brain injury caused by rotational forces
  - Involves shaking, impact or both
- B. Subdural hematomas, +/- retinal hemorrhage, bruising, fractures
- C. #1 cause of death in child physical abuse
- D. Often triggered by crying
- E. Not typically a one-time event
- F. Many times, these children present with NO history of trauma.
- G. Beware of vomiting without diarrhea---this is a commonly missed presentation for abusive head injury.
- H. Beware of rapid increase in head circumference.
  - 1. *Pearl: Consider head CT in any child who has crossed two major percentile lines in head circumference in a short time (a few months.)*

## **VI. Abdominal Injury:**

- A. Any abrasion or bruise on the abdominal area should prompt labs
  - 1. If labs are abnormal, then imaging should be obtained
  - 2. FAST scan/ultrasound are not good enough
    - a) *This would be a case where an injury may not be medically significant, but it could have significant forensic implications, so more detailed imaging is needed*

## **VII. Skeletal injuries:**

- A. Buckle fractures in any child under 9 months of age are of concern due to a lack of mobility and underdeveloped protective reflexes that might lead to an “accidental” mechanism such as falling on an outstretched arm
- B. Spiral fractures - can occur from seemingly innocuous trauma such as tripping while running and are not always indicative of abuse
- C. Transverse fractures - the mechanism should reflect the specific type and magnitude of forces required to cause this specific fracture morphology
- D. Metaphyseal Corner Fractures – highly suspicious for abuse. Often associated with soft tissue injury as well.



## Section II

### VII. Documentation

#### A. Questions to ask:

1. Who is/are the primary caregivers?
2. When did the caregivers first notice symptoms/bruises?
3. Does the history change with changing information given to the caregiver?
4. Do different witnesses give different accounts?
5. What did they do after they noticed these symptoms?
6. When was the child last normal?
  - a. *In young infants it can be difficult to tell*  
*(1)Tracking, cooing, smiling, eating without vomiting*
7. Have there been any accidents?
8. Are there other children at home or not living with the family?
9. Has the child had any injuries before?
10. Is there a history for SIDS or any other unexpected death of a young child?

#### B. What to Document:

1. Detailed physical examination documentation with appropriate drawings
2. Photo-documentation as soon as possible is fast-becoming the standard of care
3. Be sure the child is completely unclothed during examination and the lights are on in the room
4. Document location, size, and shape of all bruising or unusual markings
5. A careful and well documented history
  - a) Use quotes whenever possible
6. Document detailed descriptions of the mechanisms of injury or injuries with inclusion of the progression of symptoms

*b)Also make note of what the caregiver did after these events/symptoms*

**C. Photo-Documentation:**

1. Obtained informed consent is not required in open investigations of child abuse
2. Photograph injuries:
  - a) prior to treatment
  - b) from different angles (at least 2 pictures of each injury)
3. Use a ruler or measurement device to give perspective
  - a) A paper measuring tape used for measuring head circumference with a patient label attached is a great way to accomplish this
4. Include the patient's face in at least one of the pictures
  - a) *With identifiers*
5. Document the patient's name, injury location, date, photographer on/in picture (a patient label is great for this)

**IX. Work-up for Child Physical Abuse**

**A. <12 months**

1. *Skeletal survey* – Consult Orthopaedic Surgery if abnormal findings identified
2. *CT of head or MRI of brain*-Consult Neurosurgery if abnormal findings identified
3. *Dilated fundoscopic exam*
4. *CBC, PTT, PT, amylase, ALT, and UA<sup>1</sup>*
5. *Perform Abdominal/Pelvic CT with contrast and consult Peds Surgery if:*
  - a) Positive trauma labs
  - b) Bruising on abdomen/trunk
  - c) Bilious vomiting
    - (1) consider CPK if extensive bruising
    - (2) Follow-up skeletal survey performed within 2 weeks of initial skeletal survey
    - (3) Whenever possible the UA should be a bag specimen as it is looking for blood
    - (4) If the Head CT is abnormal *at all*, an MRI should be obtained

**B. 13-24 months**

1. Strongly recommend:

- a) Skeletal survey – *Consult Orthopaedic Surgery if abnormal findings identified*
- 2. Recommend:
  - a) CT of head:
    - (1) *If head/neck/ear/face bruising or swelling*
    - (2) *If signs or symptoms of neurological impairment present-Consult Neurosurgery if abnormal finding identified on Head CT*
  - b) Dilated fundoscopic exam:
    - If brain injury present*
  - c) CBC, PTT, PT, amylase, ALT, and UA<sup>1</sup>
  - d) Abdominal/Pelvic CT with contrast and Peds Surgery consult if:
    - (1) *Positive trauma labs*
    - (2) *Bruising on abdomen/trunk*
    - (3) *Bilious vomiting*
      - (a) consider CPK if extensive bruising
      - (b) Follow-up skeletal survey performed within 2 weeks of initial skeletal survey
      - (c) Whenever possible the UA should be a bag specimen as it is looking for blood
      - (d) If the Head CT is abnormal at all, an MRI should be obtained

### **C. 2-5 years:**

- 1. Consider:
  - a) Skeletal survey – *Consult Orthopaedic Surgery if abnormal findings identified*
    - (1) *If severe trauma*
    - (2) *If child is non-verbal, unresponsive, or extreme developmental delay*
  - b) CT of head:
    - (1) *If head/neck/ear/face bruising or swelling*
    - (2) *If signs or symptoms of neurological impairment present - Consult Neurosurgery if abnormal finding identified on Head CT*
  - c) Dilated fundoscopic exam:
    - If brain injury present*
  - d) CBC, PTT, PT, amylase, ALT, and UA<sup>1</sup>
  - e) Abdominal/Pelvic CT with contrast and Peds Surgery Consult if:
    - (1) *Positive trauma labs*
    - (2) *Bruising on abdomen/trunk*
    - (3) *Bilious vomiting*
      - (a) consider CPK if extensive bruising

- (b) Follow-up skeletal survey performed within 2 weeks of initial skeletal survey
- (c) Whenever possible the UA should be a bag specimen as it is looking for blood
- (d) If the Head CT is abnormal *at all*, an MRI should be obtained

## **X. Reporting**

***A. First call should always be to the social worker (in-house or on call)***

1. They can help facilitate communication with DCBS and the police

***B. In Fayette County:***

Protection and Permanency  
(859)245-5258

***C. Child Protection Hot Line***

(800)752-6200

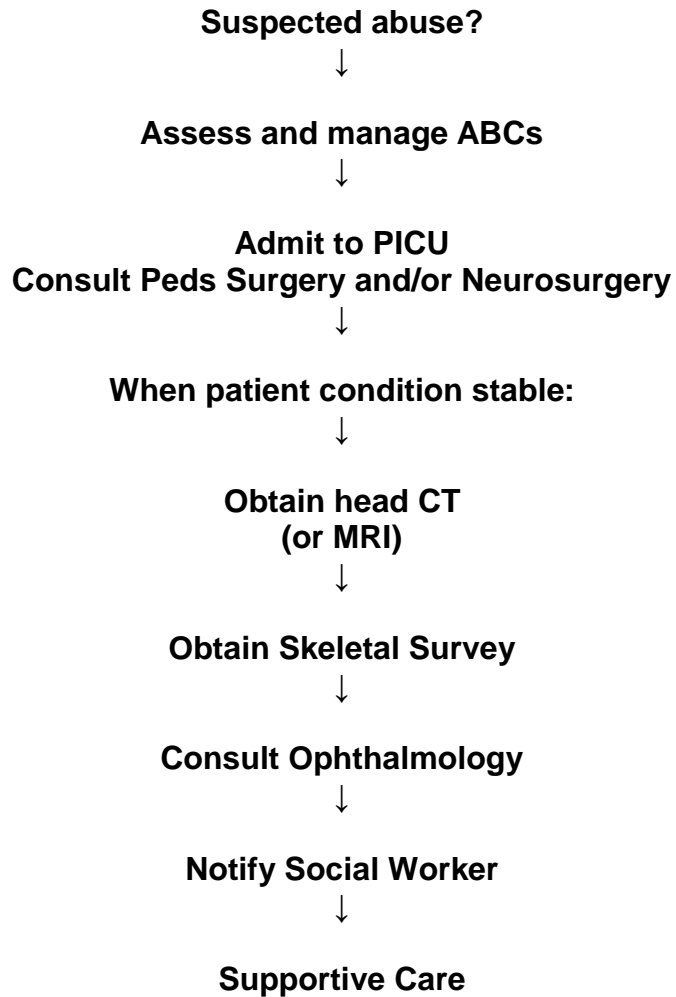
***D. If outside the county, may go to the following address:***

[https://apps.chfs.ky.gov/Office\\_Phone/index.aspx](https://apps.chfs.ky.gov/Office_Phone/index.aspx)

***If you have questions and need further assistance please feel free to call UoL Forensics Department (502)629-6000 (ask for Forensics clinician on call)***

***Remember the report must be made in the county in which the event occurred!!***

## **Altered Infant/Child**



## **FEVER MANAGEMENT WITH TYLENOL / IBUPROFEN**

### **PROCEDURE:**

#### **Medication Administration:**

- Administer Tylenol calculated at 10-15 mg/Kg po/pr administered as first-line medication intervention to treat fever  $\geq 101.5$  degrees F. If more than 3-4 hours since last dose, repeat appropriate Tylenol dose.
- If above criteria has been done < 3-4 hours, may give Ibuprofen 10 mg/Kg for fever greater  $\geq 101.5$  under following conditions:
  - No drug sensitivity to Ibuprofen or ASA
  - No history of GI ulcers or bleeding problems

#### **General:**

- If Tylenol or Ibuprofen were administer prior to arrival to the hospital, discuss the dose administered with the caregiver to ensure that appropriate dose was given.
- Consult attending M.D. for Ibuprofen administration, if child is less than 3 months old.

## **Hyperthermia Management**

### **INFORMATION:**

The patient with a temperature  $> 104^{\circ}$ ; hypotension and decreased LOC will require emergency treatment as follows:

### **INSTRUCTIONS:**

1. Assess patient's temperature if possible, otherwise assess hyperthermia by symptoms.
2. Maintain ABC's, cardiac monitoring, and seizure precautions.
3. Attempt to lower body temperature by removing clothes, pouring tepid fluid over body and allowing to evaporate or placing ice to groin and axilla if available. Monitor core temperature, if possible.
4. Cool IV fluids should be administered at a high infusion rate. High flow oxygen should also be given.
5. NG lavage with iced saline and foley irrigation with iced saline is indicated if temp  $> 106^{\circ}$
6. Notify receiving hospital of need for cooling blanket if necessary.
7. Document assessments, actions, and results.

## Hypothermia Management

### INFORMATION:

Any individual will become hypothermic given the proper circumstances, but specific groups are particularly vulnerable: infants, elderly, alcoholics, trauma victims, outdoor people, and those with CNS dysfunction.

### INSTRUCTIONS:

- 1) Mild Hypothermia  $> 90^{\circ}\text{F}$  ( $32^{\circ}\text{C}$ )
  - a) Handle patient gently
  - b) Insulate patient from cold
  - c) Warm humidified oxygen
  - d) Warm IV fluids, active external re-warming
- 2) Moderate Hypothermia  $< 90^{\circ}\text{F}$  (vital signs present)
  - a) Handle patient gently
  - b) Insulate from cold
  - c) Warm humidified oxygen
  - d) Warm IV fluids, active re-warming of truncal areas only
  - e) ***Do not administer medications until temperature  $> 90^{\circ}\text{F}$***
- 3) Severe Hypothermia (vital signs absent)
  - a) Assess pulse, respirations, and cardiac rhythm for 1-2 minutes
  - b) If no pulse or respirations and asystole, begin CPR
  - c) If VF, defib up to 3 shocks (2-4 Joules/Kg)
  - d) Check rectal core temperature
  - e) Intubate and administer warm humidified oxygen
  - f) Administer warm IV fluids
  - g) NG lavage with warm saline and foley irrigation with warm saline

NOTE: Discretion should be used when determining whether or not to transport a patient whose core temperature is  $< 90^{\circ}\text{F}$ .

## **Near Drowning Management**

### **INFORMATION:**

Injury due to submersion is usually the sole problem seen in the near-drowning victim. However, it is important to assess the near drowning victim for other associated injuries. Trauma to the head, neck, or other organs may have occurred if the patient fell or was diving into the water. A history of drug or alcohol ingestion should be sought, as well as a history of myocardial disease, hypoglycemia, loss of consciousness, seizures, or other serious illness. The patient should be assessed and treatment priorities assigned.

### **INSTRUCTIONS:**

If the patient is in arrest, he should be treated according to the Pediatric Advanced Life Support Guidelines. If the patient is not in full arrest, the patient should be managed according to the airway, breathing, and circulation pathway.

#### **1. Airway**

Airway should be secured along with control of the cervical spine and maintained as necessary according to the airway management Guideline.

#### **2. Breathing**

The patient should be evaluated and breathing managed according to the breathing management Guidelines. All patients suffering from near drowning should receive 100% oxygen. Breathing that is spontaneous (in an alert patient) should be supplemented through a non-rebreathing mask. The apneic patient should be provided with a source of mechanical ventilatory support. 100% oxygen should be continued throughout the transport period. If oxygenation remains poor, a judicious application of PEEP should be considered. Bronchospasm may occasionally occur after near drowning, and, if so, should be treated with a bronchodilator, if available. Pulmonary edema accompanying near drowning is best treated with PEEP or CPAP. If signs and symptoms of increasing intracranial pressure are present from a concurrent head injury, then controlled hyperventilation to obtain a  $p\text{CO}_2$  30-35mmHg should be employed.

#### **3. Circulation**

Impaired circulation due to cardiac problems should be treated according to PALS guidelines. If the circulation dysfunction is secondary to hypovolemia, resuscitation with crystalloid is indicated. Normally, only maintenance fluids are required. This is particularly true if the patient is comatose or cerebral edema is suspected, although it should be noted that hypothermic patients may become hypovolemic through inhibition of ADH secretion. Illness and injuries should be sought and treated according to protocol. CPR should continue until patient is normothermic.



## Pediatric Weight Based Heparin Order Set

**Patient's weight:** \_\_\_\_\_ **Kg**

Laboratory tests: \_\_\_\_\_

Discontinue any prior heparin, LMWHs, non steroidal agents, antiplatelet agents and intramuscular injections.

Heparin adjust to maintain aPTT at 50-70 seconds, that reflects an anti-Factor Xa level of 0.35 to 0.7 units in pediatric patients, and adolescents to adults maintain a PTT at 48-70 seconds that reflects an anti-Factor Xa level of 0.3 to 0.7 units

Standard concentration 1/2 NS (100 units/mL) pre-mixed heparin solution will be used unless otherwise ordered

### Infants < 1 year

Initial Bolus dose: Yes <input type="checkbox"/> 75 units/kg = _____ units IV over 10 minutes No <input type="checkbox"/>			
Initial infusion rate: Infants < 1 yr 28 units/kg/hr			
aPTT result (seconds)	IV bolus of heparin	Rate change	Repeat aPTT in
< 35	50 units/kg IV push over 10 minutes	Increase infusion rate by 10 %	4 hours
35-49	0	Increase infusion rate by 10%	4 hours
50-70	0	No change	Daily
71-80	0	Decrease infusion rate by 10 %	4 hours
81-100	0	Hold infusion for 30 min, then decrease infusion rate by 10%	4 hours
>100	0	Hold infusion for 60 min, then decrease infusion rate by 15%	4 hours

### Children > 1 year

Initial Bolus dose: Yes <input type="checkbox"/> 75 units/kg = _____ units IV over 10 minutes No <input type="checkbox"/>			
Initial infusion rate: children > 1 yr 20 units/kg/hr			
aPTT result (seconds)	IV bolus of heparin	Rate change	Repeat aPTT in
< 35	50 units/kg IV push over 10 minutes	Increase infusion rate by 10 %	4 hours
35-49	0	Increase infusion rate by 10%	4 hours
50-70	0	No change	Daily
71-80	0	Decrease infusion rate by 10%	4 hours
81-100	0	Hold infusion for 30 min, then decrease infusion rate by 10 %	4 hours
>100	0	Hold infusion for 60 min, then decrease infusion rate by 15 %	4 hours

### Older children to adult

Bolus dose: 80 units/kg IVP= _____ units (Max dose 10000 units)			
Initial infusion rate: 18 units/kg/hr; (maximum INITIAL starting infusion rate at 2250 units/hr)			
aPTT result (seconds)	IV bolus of heparin	Rate change	Repeat aPTT in
< 35	60 units/kg IV push	Increase infusion rate by 4 units/kg/hr	6 hours
35-47	40 units/kg IV push	Increase infusion rate by 2 units/kg/hr	6 hours
48-70	0	No change	Daily
71-90	0	Decrease infusion rate by 2 units/kg/hr	6 hour
> 90	0	Hold infusion for 1 hr, then decrease infusion rate by 4 units/kg/hr	6 hour

Date Ordered	Time Ordered	Nurse's Signature	Physician's Signature
Allergies & Sensitivities		<input type="checkbox"/> NKA	Patient ID
Weight	Height	Diagnosis	

**Pediatric Heparin Orders**  
**Back page**

**REVERSAL OF HEPARIN ANTICOAGULATION**

TIME SINCE LAST HEPARIN DOSE	PROTAMINE DOSE (mg per 100 units of heparin)
< 30 minutes	1 mg per 100 units of heparin
30 – 60 minutes	0.5 - 0.75 mg per 100 units of heparin
60 – 120 minutes	0.375 – 0.5 mg per 100 units of heparin
> 120 minutes	0.25 – 0.375 mg per 100 units of heparin

Maximum dose 50 mg; dilute to 10 mg/ml, and administer not to exceed 5 mg/min.

Warning: Reconsider use of heparin in patients with hypersensitivity reactions to fish, those having received protamine-containing insulin or previous protamine therapy may be at risk for hypersensitivity reaction to protamine sulfate.

- References:
1. Chest 2008;133:887S-968S.
  2. Stroke 2008;39:1-48.
  3. Heart 2004;90:808-812.
  4. Expert Rev Cardiovasc Ther 2004;2:523-534.
  5. Pediatr Clin N Am 2002;49:1257-1283.
  6. J Pediatr 1998;132:575-588.

# **Pediatric Anticoagulation Guidelines Order Set**

**Patient's weight:** \_\_\_\_\_ **Kg**

## ☐ **WARFARIN - ORAL ANTICOAGULATION**

### **Recommendations:**

- |  |  |
|--|--|
| I. Day 1: if baseline INR is 1.0 – 1.3 | 0.2 mg / kg  |
| II. Loading days 2 – 4                 |  |
| INR 1.1 – 1.3                          | Repeat initial loading dose.   |
| INR 1.4 – 1.9                          | 50% of initial loading dose.   |
| INR 2.0 – 3.0                          | 50% of initial loading dose.   |
| INR 3.1 – 3.5                          | 25% of initial loading dose.   |
| INR > 3.5                              | Hold dose until INR < 3.5, then restart at 50% of previous dose.       |
| III. Maintenance oral anticoagulation  |  |
| Dose guidelines                        |  |
| INR 1.1 – 1.4                          | Increase dose by 20%   |
| INR 1.5 – 1.9                          | Increase dose by 10%   |
| INR 2.0 – 3.0                          | No change  |
| INR 3.1 – 3.5                          | Decrease dose by 10%   |
| INR > 3.5                              | Hold dose until INR < 3.5, then restart at 20% less than previous dose |

Goal: INR = 2.0 – 3.0

**Dose: Warfarin** \_\_\_\_\_ **mg orally today at 1700:**

## ☐ **ENOXAPARIN – LOW MOLECULAR WEIGHT HEPARIN ANTICOAGULATION**

Age-dependent dose of enoxaparin, mg/kg every 12 hours, subcutaneously

Age	Initial Treatment	Initial Prophylactic
< 2 months	1.5 mg/kg/dose	0.75 mg/kg/dose
> 2 months	1 mg/kg/dose	0.5 mg/kg/dose

Treatment Maintenance Dosing:			
Anti-Factor Xa Level	Hold Next Dose	Dose Change	Repeat Anti-Xa Level
< 0.35 u/ml	no	Increase by 25%	4 hrs. after next a.m. dose
0.35 – 0.49 u/ml	no	Inc. by 10%	4 hrs. after next a.m. dose
0.5 – 1.0 u/ml	no	No change	Once a week
1.1 – 1.5 u/ml	no	Decrease by 20%	4 hrs. after next a.m. dose
1.5 – 2.0 u/ml	for 3 hours	Decrease by 30%	trough before next dose
>2.0 u/ml	until level < 0.5 u/ml	hold dose	repeat levels q12 hrs. until < 0.5 u/ml

Goals: Therapeutic range: 0.5 – 1.0 units/ml of anti-Factor Xa units.

Prophylactic range: 0.1 – 0.3 units/ml of anti-Factor Xa units.

**Dose: Enoxaparin (Lovenox):** \_\_\_\_\_ **mg subcutaneously q12h.**

Date Ordered	Time Ordered	Nurse's Signature	Physician's Signature
Allergies & Sensitivities		<input type="checkbox"/> NKA	Patient ID
Weight	Height	Diagnosis	

Form #

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### **PEDIATRIC REVERSAL OF WARFARIN -ORAL ANTICOAGULATION**

No Bleeding (Pre-Surgical)	Bleeding Not Life-Threatening	Life-Threatening
Vit. K 30 mcg/kg orally or may give IV over 30 minutes (range 0.5 – 5 mg)	Vit. K 30 mcg/kg orally or IV over 30 minutes (range 0.5 – 5 mg) and FFP 20 ml/kg	Vit. K 30 mcg/kg IV over 10-20 minutes (range 0.5 – 5 mg) and FFP 20 ml/kg or Recombinant Factor VIIa 90 mcg/kg (1-3 doses)

- References:
1. Chest 2008;133:887S-968
  4. Expert Rev Cardiovasc Ther 2004;2;4:523-534.
  7. Thrombosis Research 2006;118:85-94.

### **REVERSAL OF ENOXAPARIN- LOW MOLECULAR WEIGHT HEPARIN**

No significant bleeding → stop LWMH.

No significant bleeding + anticipated invasive procedure → hold LWMH for 12 – 24 hours (1 – 2 doses).

Significant bleeding → maximum dose of 1 mg. Protamine I.V. per 100 units (1mg) LMWH. Given over 10 minutes to avoid hypotension. (within 3-4 hours of the last dose).

Recombinant Factor VIIa. Dose range 30 mcg/kg with repeated dosing, or for severe bleeding 90 mcg/kg/dose

Comments:

Must adjust dose if renal insufficiency.

Complete reversal of anti-Factor IIa (antithrombin) but, only partial reversal of anti-Factor Xa.

Monitoring: Thrombin Clot Time (TCT).

Demonstrates complete reversal of anti-Factor IIa.

Allows minimization of Protamine dose required.

Assays of anti-Factor IIa .

- References:
1. Chest 2008;133:887S-968S.
  4. Expert Rev Cardiovasc Ther 2004;2;4:523-534.
  6. J Pediatr 1998;132:575-588.
  7. Thrombosis Research 2006;118:85-94.
  10. Andrew's Pediatric Thromboembolism and Stroke. 3<sup>rd</sup> Edition;2006:88-89.
  11. Thrombosis Research 2007;120:303-305.
  12. British Journal of Haematology 2002;116:178-186.
  13. Haemostasis 1986;16:139-146.
  14. Roger's Textbook of Pediatric Intensive Care. 4<sup>th</sup> Edition. Lippincott Williams & Wilkins. Philadelphia;2008; 1779-1798.



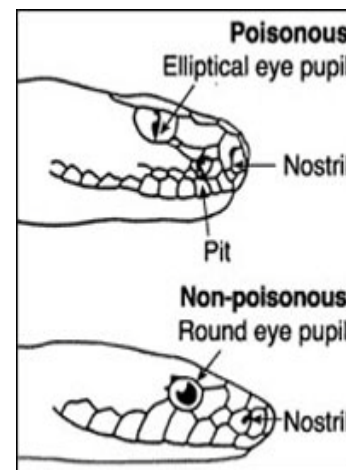
# Crotalidae Snakebite Guideline

## Description

The majority of snakebites in North America are caused by the Crotalidae family, including Copperheads and Rattlesnakes. Mortality is rare, less than 1%. The mainstay of therapy to attenuate morbidity is antivenom.

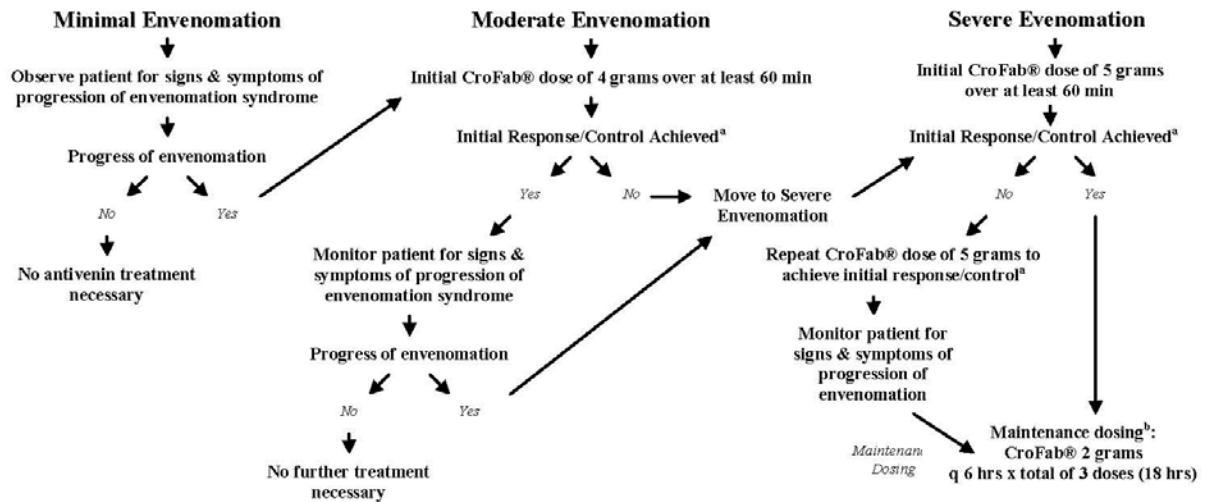
## Guideline:

1. Assess and secure airway. Apply oxygen if respiratory distress noted.
2. Assess hemodynamic status: Give 20 cc/kg NS if tachycardic or poor perfusion. Follow PALS guidelines if further resuscitation necessary.
3. Assess area of bite for fang marks, erythema, and ecchymosis. The area should be accurately measured and recorded.
4. Assess neurovascular status. Do not apply ice or tourniquets.
5. Remove jewelry and clothing. Cleanse wound area – leave unbandaged. Position or splint limb in gravity neutral position.
6. Attempt to identify snake species as well as time of envenomation. Antivenom is more effective within 6 hours of envenomation.
7. Monitor affected extremities for signs of compartment syndrome. 5 (P's) Pain out of proportion to what is expected, Paresthesia, Pallor, Paralysis, Pulselessness (pulselessness is a very late sign of compartment syndrome).
8. Initial lab work should include CBC with diff, Platelet count, PT/PTT, Fibrin Split Products (FSP). Consider CMP, Type and Cross, UA, Stool Hemocult, and ABG if in respiratory distress.
9. Administer Crofab for moderate to severe envenomations per pediatric dosing Guide.



Type of Signs or Symptoms	Severity of Envenomation		
	Minimal	Moderate	Severe
Local	Swelling, erythema, or ecchymosis confined to site of the bite	Progression of swelling, erythema, or ecchymosis beyond site of the bite	Rapid swelling, erythema, or ecchymosis involving the entire body part
Systemic	No systemic signs or symptoms	Non-life threatening signs and symptoms (N/V, mild hypotension, perioral paresthesias, myokymia)	Markedly severe signs and symptoms [hypotension (SBP < 80 mmHg), altered sensorium, tachycardia, tachypnea, and resp distress]*
Coagulation	No coagulation abnormalities or other lab abnormalities	Mild abnl coagulation profile without significant bleeding	Abnl coag profile with bleeding [↓ INR, APTT, fibrinogen; plt count <20,000 per mm <sup>3</sup> ]
Snakebite Severity Score (SSS)*	0-3	4-7	8-20

**Treatment algorithm:**



<sup>a</sup> Initial response or control: Initial control is cessation of progression of local effects, systemic effects, and coagulopathy from envenomation. Patients should be monitored up to one hour following FabAV dosing to assess initial response/control.

Clinical response: Pre-treatment signs and symptoms of envenomation were arrested or improved after treatment.

Partial response: Signs and symptoms of envenomation worsened, but at a slower rate than expected after treatment.

Non-response: Patient's condition was not favorably affected by treatment.

<sup>b</sup> Patients with documented rattlesnake envenomations should be evaluated for scheduled maintenance dosing to prevent recurrence of envenomation.

## **APPENDICES**

### **1. Common Medications**

#### **Antibiotics**

Ampicillin 50mg/kg/dose q6h IV  
Bactrim 6mg/kg/dose q12h PO  
Clindamycin 10mg/kg/dose q6h IV (PO q8h)  
Flagyl 10mg/kg/dose q8h IV/PO  
Gentamicin 2.5mg/kg/dose q8h IV\* (can give same dose PO if needed)  
Unasyn 50mg/kg/dose q6h IV  
Vancomycin 15mg/kg/dose q8h IV for non-soft tissue infections\*  
15mg/kg/dose Q6H for < 1 y.o. soft tissue infection\*  
20mg/kg/dose Q6H for > 1y.o.soft tissue infection\*  
Zosyn 75mg/kg/dose q8h IV

\*If on Vanc or Gent for >24h, order pharm consult for levels and re-dosing

#### **Antiallergic**

Benadryl 1mg/kg/dose IV / PO q6h prn

#### **Antacids/Antiemetics**

Pepcid 0.5mg/kg/dose IV q12h  
Pepcid 0.5mg/kg/day qhs or divided bid PO  
Zantac 5-10mg/kg divided bid PO only (for GERD)  
Zofran 0.1mg/kg IV q6h prn

#### **Analgesics**

Morphine 0.05-0.1mg/kg/dose IV q2h prn  
Roxicet 0.15ml/kg q4-6h IV  
Toradol 0.5 mg/kg IV max 15mg q6h for 72 hours then stop  
Tylenol 10mg/kg q4-6h prn PO/PR  
Tylenol w/Codeine Elixir (12mg/5ml)  
0.5-1mg/kg/dose q4h prn pain PO

#### **Bowel Prep**

1% Neomycin 15cc/kg per stoma/rectum (Pt will receive 3 doses pre-op; 2 the day before surgery and 1 the morning of surgery)

## **2. Emergency Medications**

Hypoglycemia.....2-4 ml/Kg D10W IV  
Hyperglycemia.....Regular Insulin 0.1u/Kg then 0.1u/Kg/hr infusion  
Hypokalemia.....KCl 0.25-1mEq/Kg IV over 1 hour  
Hyperkalemia.....IV glucose 400mg/Kg - then IV reg. insulin 0.1u/Kg  
- then CaCl 10 % 10-20mg/Kg (0.1-0.2cc/Kg) IV over 5 minutes  
Hypocalcemia.....CaCl 10% 10-20mg/Kg (0.1-0.2cc/Kg) IV over 5 minutes

## **Cardiovascular Initial Doses**

Epinephrine 1:10,000 0.01mg/Kg = 0.1 ml/Kg IV -or- Give 10x dose Via ETT  
Atropine 0.02mg /Kg IV with a minimum dose of 0.1mg  
Amiodarone 5 mg/kg IV  
Lidocaine 2% 1mg/Kg IV  
Adenosine 0.1 mg/kg (max 6 mg) rapid IV push, may repeat at 2x original dose (max 12 mg)  
Sodium Bicarbonate 1mEq /Kg IV  
Magnesium Sulfate 20-50 mg/kg IV (max Dose 2 grams)  
CaCl 10% 20mg/Kg or 0.2ml/Kg slow IV push  
Naloxone 0.1 mg/kg IV (max dose 2 gms)

Defibrillation 2-4 Joules/Kg  
Synchronized Cardioversion Dose 0.5-2 Joules/Kg

## **3. Fluids**

### **Fluid Maintenance**

<b>4/2/1 Rule</b>	Kg 0-10	100cc/Kg/day (4cc/kg/hr)
	Kg 10-20	Additional 50 cc/Kg/day (2cc/kg/hr)
	Kg >20	Additional 20 cc/Kg/day (1 cc/kg/hr)

**Fluid Bolus** 20 ml/kg of NS or LR IV/IO. May repeat bolus once, then Consider blood for trauma patients

**Blood** 10 ml/kg IV

## **4. Urine output (minimum requirements)**

Infants 2cc/kg/hr  
Children 1 cc/kg/hr  
Adults 0.5cc/kg/hr



## **SECTION 4: KENTUCKY CHILDREN'S HOSPITAL PEDIATRIC TRAUMA CARE GUIDELINES**

### **Guidelines for the Assessment of Children**

#### **INFORMATION:**

A. Respiratory assessment should include evaluation and documentation of the following:

1. Skin color
2. Respiratory rate
3. Character of respirations – include the following:
  - a. Regularity of respirations (regular, irregular, periodic, apneic)
  - b. Depth of respirations
  - c. Unlabored or labored (retractions, flaring, grunting, use of accessory muscles, etc.)
4. Cough – absence or presence and character (weak, strong, croupy, loose, productive, non-productive)
5. Secretions – amount and character (color, odor, viscosity, presence of plugs)
6. For patients in the PICU, the following should also be included:
  - a. Oxygen saturation – per pulse oximeter
  - b. Blood gases – collect as ordered and record results
  - c. If patient is intubated and/or ventilated, assessment and evaluation should also include:
    - 1) Respiratory rate – presence or absence of over-breathing the vent
    - 2) Peak airway pressure
    - 3) Air leak around ETT/NTT – presence or absence
    - 4) ETCO<sub>2</sub> – per continuous in-line monitoring
    - 5) Tube position
      - a) Check by watching chest expansion and auscultation for bilateral and equal breath sounds
      - b) Assure tube is securely taped at the proper location (teeth, gum line) and number as recorded on the patient POC at the time of intubation

B. Hemodynamic assessment should include evaluation and documentation of the following:

1. Skin temperature and color (pink, pale, mottled, cyanotic, jaundiced)
2. Capillary refill
3. Pulses – include presence or absence in all extremities and character of pulses
4. Heart rate
5. Urine output (mL/kg/hour)
6. Level of consciousness
7. Blood pressure
8. Blood gases – collect as ordered, record results and assess for metabolic acidosis
9. For patients in PICU the following should also be included:
  - a. Non-invasive BP, pulse pressure and mean arterial pressure (MAP)
  - b. If a deep line is present, monitor and record CVP q1hour or as ordered
  - c. If a Swan-Ganz catheter is present include:
    - 1) Continuous SVO<sub>2</sub> monitoring

- 2) Continuous monitoring of cardiac output
  - 3) CVP and PAP – monitor and record as ordered
  - 4) PCWP – monitor and record as ordered
- C. Hydration assessment should include evaluation and documentation of the following:
1. Systemic perfusion – include heart rate, skin temperature and color, capillary refill and peripheral pulses
  2. Mucous membranes – moist or dry
  3. Skin turgor/elasticity
  4. Tearing – presence or absence
  5. Character of fontanel (if present)
  6. Edema – presence or absence
  7. Weight changes in kg
  8. Urine output
    - a. Measure and record amount
    - b. Record character (color, clear or cloudy, presence of sediment)
    - c. Specific gravity as ordered
  9. Total intake and output
  10. Breath sounds
  11. Heart sounds
  12. Serum electrolytes – collect and record results as ordered
  13. For patients in PICU, the following should also be included:
    - a. Calculate urine output in mL/kg/hour and record with each set of vital signs
    - b. Calculate intake vs. output net value and record
    - c. If a deep line is present, monitor and record CVP q1hour or as ordered
- D. GI system assessment should include evaluation and documentation of the following:
1. Appearance of abdomen (flat, round, full, distended)
  2. Character of abdomen (soft, firm)
  3. Bowel sounds – include presence or absence and character (hypo, normal or hyperactive)
  4. Stool – frequency and amount and character (color, consistency)
  5. If patient's abdomen is distended, or patient is not stooling, measure and record abdominal circumference in cm q4hours or as ordered
- E. Neurological system assessment should include evaluation and documentation of the following:
1. Pupils – include reactivity, size and symmetry
  2. Movement of extremities
    - a. Record ability to move upper and lower extremities
    - b. Assess and record bilateral equality of strength and movement
    - c. Character of fontanel (if present)
    - d. Head circumference in cm (if patient is less than two years old)
    - e. If a ventricular drain is present:
      - 1) Measure and record the amount of drainage q4hours or as ordered
      - 2) Note color of drainage
  3. For patients in PICU:
    - a. EMV score
    - b. If an ICP monitor is present, monitor and record ICP and CPP q1hour or as ordered

## **Patient Vital Signs**

### **INFORMATION:**

A. In the Kentucky Children's Hospital, vital signs will be taken according to the following protocol unless the vital signs (VS) are ordered more frequently by the physician.

B. Vital signs will include blood pressure (except for the transitional care nursery), heart rate, respiratory rate, and temperature: exceptions are noted below.

C. All patients will have vital signs taken at least every 12 hours, and be assessed by an RN, unless otherwise ordered by a physician.

#### **D. Post-operative**

1. All post-operative/post-procedural patients, **who do not spend time in a recovery area prior to transfer to the floor**, will have vital signs done and be assessed by an RN upon arrival to the floor and then as follows:

- a. VS every 5 minutes times 3\*, if within baseline
- b. VS every 15 minutes times 4\*, if within baseline
- c. VS every 30 minutes times 2\*, if within baseline
- d. VS every 1 hour times 2\*, if within baseline
- e. VS every 4 hours for 24 hours

\*may include only blood pressure, pulse and respiratory rate

2. All post-operative/post-procedural patients, **who do spend time in a recovery area before transfer to the floor**, will have vital signs and be assessed by an RN upon arrival to the floor and then as follows:

- a. VS every one hour times 2\*, if within baseline
- b. VS every four hours for 24 hours, if within baseline
- c. VS every eight hours, per floor routine unless otherwise ordered by the physician

\*may include only blood pressure, pulse and respiratory rate

#### **E. Blood Products**

1. A patient who is receiving a blood product transfusion will have vital signs done as follows:

- a. VS immediately before starting the infusion
- b. VS 15 minutes after the infusion begins

NOTE: Registered nurse must remain with the patient for the first 15 minutes of infusion to monitor the patient for signs and symptoms of a transfusion reaction: fever, chills, dyspnea, low back pain and shock.

- c. VS every one hour until infusion complete
- d. VS at the completion of the infusion

#### **F. Patient Transfers**

1. All patients being transferred from an intensive care unit to an acute care area will be assessed by an RN on transfer and have vital signs done as follows:

- a. VS every four hours for 24 hours, if stable, then
- b. VS every eight hours, per floor routine unless otherwise directed by the physician

2. Any patient being transferred from one acute care unit to another or any acute care patient, boarding in ICU, who is being transferred to floor will be assessed by an RN on transfer and remain on routine vital signs.

#### **G. Temperature Reassessments**

1. Any patient with an elevated temperature ( $>37.6^{\circ}\text{C}$ ) will have a temperature taken every one to two hours until the temperature returns to within normal range.
2. Any patient with a subnormal temperature ( $<36.5^{\circ}\text{C}$ ) will have a temperature taken every one to two hours until the temperature returns to within normal range.

#### H. Intravenous Immune Globulin (IVIG) Infusion

1. A patient who is receiving IVIG will have vital signs done as follows:
  - a. Before administration of the medication
  - b. With all IVIG rate changes
  - c. After completion of the IVIG infusion
  - d. Fifteen minutes after the beginning of the infusion and then hourly until the infusion is complete if:
    - 1) This is the patient's first dose
    - 2) There is a dose increase since the last infusion
    - 3) It has been longer than eight weeks since the last infusion
    - 4) The ordered infusion rate is greater than 1 mL per minute
    - 5) The patient has history of a previous adverse reaction to IVIG

#### I. Amphotericin Infusion (including Amphotericin B and Liposomal Amphotericin)

1. A patient who is receiving Amphotericin will have VS done as follows:
  - a. Before administration of the medication
  - b. For first dose, every 15 minutes X 4 and then every 30 minutes during infusion
  - c. For subsequent doses, every 2 hours

## **Admission Criteria, Discharge Criteria, and Standards of Operation of the Pediatric Intensive Care Unit**

### **INFORMATION:**

A. The Pediatric Intensive Care Unit (PICU) is the designated critical care unit for newborns to 18 years old with medical or surgical problems that require frequent observation and timely interventions by nurses, physicians, and respiratory therapists, and/or invasive, specialized monitoring technology.

B. Progressive Care (Step Down Care) can also be provided within the PICU for pediatric patients who can benefit from closer supervision and monitoring technology.

#### **C. Location**

1. The PICU is located in the Kentucky Children's Hospital (KCH) on the 4<sup>th</sup> floor of the University of Kentucky Hospital.

#### **D. Physical Facilities**

1. The PICU is a 12 bed unit. Two of the bed spaces have the correct air flow for negative pressure isolation. Every bed space is equipped for bedside continuous monitoring capabilities, including: EKG, respirations, multiple vascular pressures, end tidal CO<sub>2</sub>, and pulse oximetry. Each bed space is also equipped with outlets for air, oxygen and vacuum.

2. A defibrillator and emergency cart are located within the PICU. The emergency cart within the unit contains appropriate drugs and equipment for the pediatric population as determined by the medical staff.

#### **E. Unit Director**

1. The PICU is under the administrative direction of the Director of Children's Services, and the Medical Director of the PICU (who responds directly to the Chairman of the Department of Pediatrics). The Director of the Pediatric Intensive Care Unit is a pediatrician who has received specialized training in Pediatric Critical Care Medicine.

2. It is the responsibility of the Medical Director of the PICU, the PICU Patient Care Manager, and the Director of Children's Services to determine policies, procedures, and standards for the PICU.

3. The Medical Director will maintain standards of medical care; and the Patient Care Manager will maintain standards of nursing care.

4. The PICU Director and the Manager are responsible for unit utilization, administrative issues, educational programs for the staff and approval of research projects requiring unit resources.

5. The Director of the PICU has the ultimate responsibility for setting and enforcing admission and discharge criteria.

6. The Director of the PICU or his/her designee has the responsibility to resolve any controversy which arises concerning patient flow and triage.

#### **F. Physician Responsibilities**

1. Attending Physician – The attending physician will oversee the diagnostic and therapeutic modalities, as well as write daily progress notes on every patient.

2. House Staff – Only second, third, or fourth year pediatric residents will be responsible for patient care in the PICU. A resident will be on-call and available in house on a 24-hour basis. Every PICU nurse has the responsibility to call the house officer or responsible attending physician whenever, in her/his professional judgment, the status of the patient warrants a physician's attention. The nurse will first call the PICU resident. If the response is not satisfactory, then the PICU attending should be called.

3. Emergencies and Consultations – The PICU resident and attending physician will be available for consultation upon request. Infants and children in inpatient units who demonstrate hemodynamic or respiratory instability should have a PICU consult. Consultation from sub-specialty services for patients in the PICU may be required for patient care and are obtained at the request of the attending.

#### G. Nursing Responsibilities and Requirements

1. The nursing care and unit management is under the direction of the Director of Children's Services and the PICU Patient Care Manager.
2. Method of Assignment: Each patient will be assigned to an RN who is accountable, during his/her shift, for planning, coordinating, implementing, and evaluating nursing care. All patients will have a nursing history and care plan completed within 24 hours of admission to the PICU.
3. Staffing: Staffing in the PICU will be based on the NICU/PICU Patient Acuity Profile. Using this tool, patients are profiled every four hours. The KCH DCN in collaboration with the PICU nurse adjusts staffing to meet acuity.
4. Staff Preparation Requirements: The nursing staff is composed of registered nurses who have attended formal PICU Orientation. The nurses are further prepared by special orientation to specific procedures and specialized equipment used in the PICU. Each nurse must demonstrate his/her competence to perform certain skills which the Patient Care Manager will keep on record and discuss yearly with the Unit Medical Director. Other KCH nursing staff will be given assignments based on their skills.
5. Continuing Education Requirements: The nursing staff is also required annually to demonstrate nursing skills and knowledge through completion of required annual competencies. CPR certification is required. PALS certification is required within 18 months of employment in PICU and must be maintained throughout employment in this unit.
6. Nursing Practice: All activities and procedures performed in the PICU will be in accordance with approved policies and procedures.
7. For specific practices, refer to the appropriate University of Kentucky policy and procedure manuals.

#### H. Respiratory Care Responsibilities

1. Respiratory Care Services will be responsible for the initiation and maintenance of all equipment for respiratory treatments. This service is maintained on a 24-hour basis.
2. Staffing: Staff includes registered respiratory therapists and certified respiratory therapy technicians.
3. Availability: The therapist or technician assigned to the PICU is available within the unit 24 hours a day, 7 days a week. Respiratory Therapy will carry a pager at all times.
4. Director On-Call: The Director on-call is available for technical difficulties or staffing problems. They can be contacted by beeper 24 hours a day, 7 days a week.
5. Orders: All orders for service shall be entered by a physician into SCM or written on a Physician Order Sheet. All procedures requested and ventilator changes will be recorded on the appropriate Patient Care Record.

#### I. Environmental Safety

1. The Patient Service Coordinator will be responsible for assuring a check of all equipment and facilities on a monthly basis and will complete "OSHA" and "Patient Safety" checklists. Areas requiring more frequent checks will be identified and checked appropriately.

2. Maintenance of all PICU equipment is the responsibility of Clinical Engineering. Emergency equipment is available 24 hours a day by contacting Clinical Engineering.
3. The Physical Plant Division will make monthly checks on the electrical safety system. The PICU is serviced by the emergency generator when needed.
4. All electrical equipment is inspected and approved by Clinical Engineering for safety and electrical leakage prior to utilization within the PICU.

J. Infection Control

1. Refer to KCH Policy CH03-01 Infection Control and the Hospital Blood borne Pathogens Policy.

K. Quality Improvement

1. A multidisciplinary Collaborative Practice group meets to discuss unit problems and concerns, to address QI issues and to discuss and plan for educational needs of staff. Mortality and morbidity will be discussed at the Department Faculty Meeting.
2. Children's Hospital Quality Improvement Committee meets monthly to determine needs and collect data for quality improvement activities.
3. Quality Improvement monitoring is conducted through the use of various audit tools.

L. Disaster Plan

1. Refer to Nursing Policy NU12-01 Nursing Emergency Incident Plan (Disaster Plan).

M. Safety

1. PICU patients will be transported to procedures within the Hospital with the following: EKG monitor, pulse oximeter, arterial, non-invasive blood pressure monitoring, emergency airway equipment, and appropriate O2. The RN or RT will ensure adequate supply of O2 in portable tank prior to transport. An RN and/or MD must accompany all PICU patients for procedures unless ordered otherwise.
2. An infusion pump must be used for all crystalloid IV solutions.
3. Restraints – Refer to Hospital Policy HP06-31 Use of Restraint in Acute Medical and Surgical Care.
4. All patients wear an ID band on an extremity.
5. A pediatric code cart and defibrillator are kept in the unit at all times. If used, the code cart is replaced by a fully stocked replacement cart sent from Materials Management.

N. Visitors

1. Refer to the Hospital policy HP01-17 Patient/Family-Centered Visitation Guidelines

O. Admissions and Transfers

1. Intra-facility
  - a. The physician requesting a PICU bed should contact the Children's Hospital DCN.
  - b. There MUST ALWAYS be a physician to physician contact before a patient is admitted or transferred to the PICU. Resident to resident contact is sufficient.
2. Inter-facility
  - a. If a physician from another facility wished to send a patient to PICU, that physician must contact the PICU attending for approval of the admission. The PICU attending may be contacted through the UKMD's Physician Referral Service.

- b. The PICU attending will request all necessary information from the physician, and then contact the DCN with the information needed to begin the admission process.

P. Admission Criteria for PICU Care

The criteria by which a patient is judged to be a candidate for PICU care are as follows:

1. Respiratory insufficiency or failure:
  - a. Children requiring mechanically assisted ventilation or maintenance of an artificial airway.
  - b. Children exhibiting clinical signs of impending respiratory failure, as in:
    - 1) Increased work of breathing (grunting, flaring, retracting)
    - 2) Increased O<sub>2</sub> requirements
    - 3) Wheezing
    - 4) Stridor
    - 5) Tachypnea (>80 for infants, >60 for children)
    - 6) Altered level of consciousness
  - c. Laboratory values consistent with impending respiratory failure
2. Cardiovascular:
  - a. Inadequate perfusion
  - b. Need for inotropic support
  - c. Any arrhythmia with potential for cardiovascular compromise
  - d. Hemorrhage
  - e. Post-op cardiothoracic surgery
  - f. Severe hypertension
3. Neurologic
  - a. Altered level of consciousness with potential airway compromise
  - b. Head injury or trauma
  - c. Increased intra cranial pressure
  - d. New Focal neurologic signs
  - e. Recovery from intracranial or spinal surgery
  - f. Seizures
  - g. Acute spinal cord injury
4. Metabolic Disorders
  - a. Severe acid base disturbance
  - b. Severe electrolyte imbalance
  - c. DKA requiring frequent intervention
  - d. Inborn errors of metabolism
  - e. Toxic ingestions or drug overdose
  - f. Malignant hyperthermia
5. Renal Failure
  - a. Acute renal failure
  - b. Need for CVVHD/CVVHDF
  - c. Need for emergent peritoneal dialysis
  - d. Need for emergent plasma pheresis
6. Tumor Lysis Syndrome
7. Exchange Transfusion
8. Any patient with a traumatic injury involving more than one organ system requiring monitoring.
9. Patients requiring cardiorespiratory monitoring during or after the administration of local, regional or general anesthesia.



10. Any patient with unstable vital signs or physiologic status requiring vital signs more than every two hours for over four hours.

Q. Discharge Criteria for PICU

1. Respiratory
  - a. No further need for airway support or similar care can be provided on the ward, special care facility, or home
  - b. Minimal oxygen requirements
2. Cardiovascular
  - a. Hemodynamic stability
3. Neurologic
  - a. Physiologic status requiring neurologic checks greater than or equal to every four hours
  - b. Seizure control
  - c. Absence of signs and symptoms of autonomic dysreflexia
4. Metabolic
  - a. Correction of acid-base problem
  - b. Electrolyte stability
5. Renal
  - a. No longer requiring acute renal replacement therapy

R. Discharge Responsibilities

1. Medical – When the PICU attending determines that a patient is no longer in need of ICU care and meets discharge criteria, transfer orders and a transfer note will be written as soon as feasible.
  - a. The receiving medical staff should be notified of the upcoming admission to their service and agree to take the patient.
  - b. If the discharge is to another hospital, then the resident must write the order specifying the mode of transportation. A Discharge Summary will be sent with the patient to the receiving hospital via the Transport Team. The Inter-facility Transfer Form must be filled out. The physician must document in the chart parental permission to transfer the child to another institution.
2. Nursing – The PICU nurse will update the patient's care plan, notify the unit clerk of date and time of transfer order, notify the KCH DCN and contact the unit RN to assure she is ready to accept the transfer.
  - a. The PICU nurse will transfer the patient with his/her medicine, chart, updated care plan, and necessary equipment to the receiving unit. Verbal report will be given to the receiving nurse (this may be accomplished by phone or face-to-face).
  - b. If the discharge is to another hospital, then the nurse must complete the Intra-facility Transfer Form giving explicit care information.

S. Transfer of PICU Patients When The PICU Is At Capacity

1. If the PICU is at capacity, the PICU resident has the authority to request that a service transfer a patient out of the PICU in order to provide care for another critically ill patient.
2. Possible courses of action:
  - a. If the patient meets discharge criteria, then the patient may go to the inpatient ward.
  - b. If the patient continues to require intensive care, then a decision will need to be made concerning potential transfer to another ICU.

- c. Pediatric Critical Care Medicine Service patients will receive priority to remain in the PICU.
  - d. The new admission may be denied.
3. If the matter of patient triage and flow cannot be resolved on the resident level, then the PICU attending or Director of the PICU should be notified to resolve the issue. No potential admission will be denied without first getting approval of the PICU attending.

## Guidelines for Suctioning of Children

### INFORMATION:

A. Suctioning should be performed whenever there is evidence of accumulation of secretions or whenever there is a concern for airway obstruction.

B. Suction as needed; routine suctioning should not be performed.

C. The suctioning period for each pass of the catheter should be no more than 10-15 seconds.

D. Equipment:

1. For all suctioning

a. Suction canister and tubing

b. Suction catheter – usually the largest size that fits easily through the ET tube, tracheostomy tube, or nares

c. Wall suction set as follows:

1) Infants under 1 year of age – 60 to 80 mmHg

2) Children 1 to 8 years of age – 80 to 120 mmHg

3) Children over 8 years – 120 to 150 mmHg

2. For ETT and Tracheostomy suctioning:

a. Appropriate size ambu bag (must have PEEP valve if child is on ventilator PEEP of 6 or greater)

E. Mechanically ventilated patient (ETT or Tracheostomy) or Non-ventilated patient with a tracheostomy

1. In line suctioning will be used on mechanically ventilated patients.

2. Hyperoxygenate the child to decrease the potential for arterial oxygen desaturation during suctioning.

NOTE: Lavage with NS is not routinely recommended with suctioning. However, if secretions are extremely thick, 0.5 to 2 mL of NS lavage may be instilled into the tube. In this case, the patient should be bagged again, after the instillation of the NS, before being suctioned.

3. Insert suction catheter into the tube. To prevent trauma to the trachea:

a. Child with an ETT: the catheter should only be inserted just beyond the tip of the ETT.

b. Child with a tracheostomy: the catheter should NEVER be advanced past the end of the tracheostomy tube.

4. When the catheter has been inserted to the point indicated above, apply suction intermittently, as catheter is gently rotated and withdrawn.

5. Hyper-oxygenate the patient again and assess respiratory status to determine if patient has further need of suctioning.

F. Nasotracheal Suctioning

1. Administer oxygen (blow-by) before, during, and after suctioning.

2. Apply water-soluble lubricant to catheter tip prior to insertion into nares.

3. Hold head securely and gently insert catheter into nose.

4. Advance into the nasopharynx until a cough is stimulated.

5. Apply suction intermittently, as catheter is gently rotated and withdrawn.

6. Allow child to rest and recover saturation prior to each attempt.

## **Nurse-Directed Weaning from Mechanical Ventilation**

### **INFORMATION:**

A. A physician order is always necessary before the RN may begin to wean the patient from mechanical ventilation.

1. The order may be written by the PICU attending, a PICU resident or a physician extender. The order must include ventilator rate or parameter at which to stop the wean.
2. The patient must be on SIMV Positive Pressure Support mode before initiating this guideline.

B. Weaning Guideline (see attached algorithm):

1. The RN will notify the Respiratory Therapist of the order to initiate ventilator wean per guideline. The ventilator rate will be decreased by two every four hours unless ordered otherwise.
2. The patient will be continually monitored throughout the weaning process. End tidal CO<sub>2</sub> monitoring must be utilized for all patients with an ETT size 4 and above. The nurse will reassess the patient prior to each ventilator change.
3. If the patient does not exhibit signs of respiratory distress, cardiovascular compromise, or neurologic compromise; weaning will continue per guideline until the desired end settings are reached.

C. The nurse will stop weaning and notify the MD if the following occurs:

1. The patient exhibits any signs or symptoms of respiratory distress or cardiovascular compromise.
2. The patient's respiratory rate does not exceed the SIMV rate after two consecutive rate reductions.

D. In preparation for extubation, the nurse should do the following:

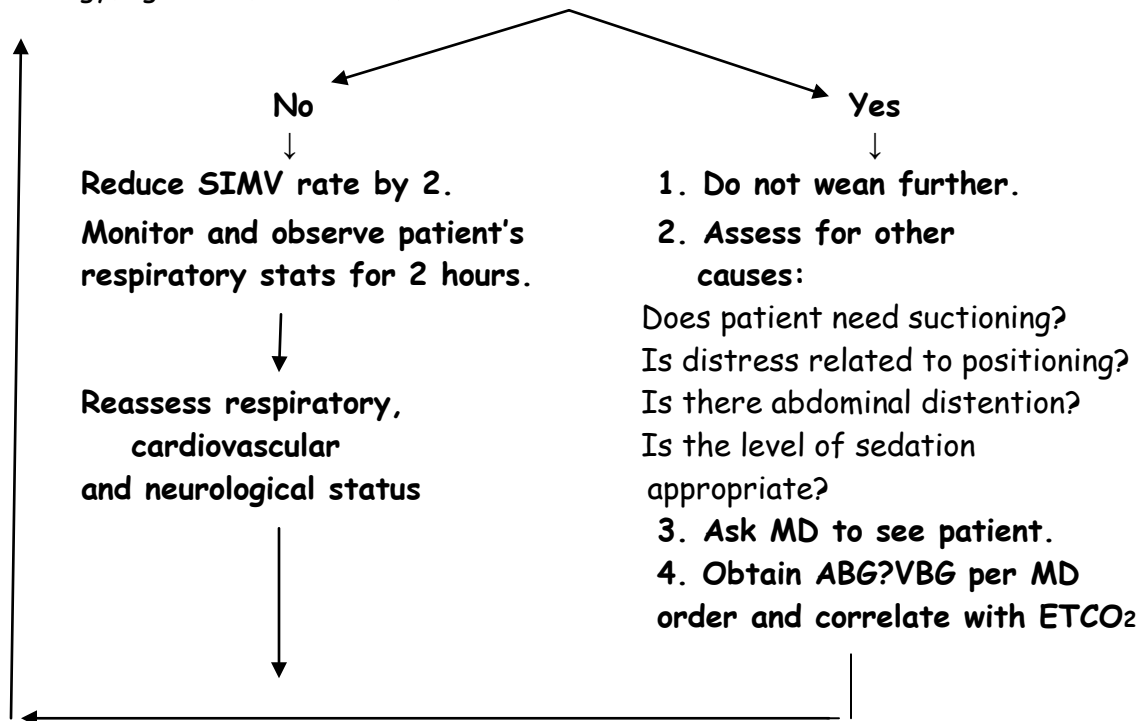
1. Make the patient NPO and initiate maintenance IVF for four hours prior to the anticipated extubation time.
2. If a nasogastric tube is present, aspirate stomach contents just prior to extubation.

E. See attached Algorithm for further guidelines.

## Weaning PICU Patients from the Ventilator

### Does the patient look distressed?

Any signs of respiratory distress (nasal flaring, tachypnea, retractions, air hunger, desaturation)? Any signs of cardiovascular compromise (hypotension, marked tachycardia, cyanosis, mottling, oliguria)? Any signs of neurological compromise (lethargy, agitation, confusion, altered level of consciousness)?



### IMPORTANT!! Four (4) hours prior to anticipated extubation time:

- Make Patient NPO
- Initiate maintenance IVF

## Nosocomial Pneumonia

The incidence of nosocomial pneumonia is high in mechanically ventilated patients. National data indicates that critically ill patient intubated for greater than 24 hours are at risk for developing pneumonia (VAP). This risk increases with every ventilator day. (Tablan et al, 1994) Morbidity and mortality associated with the development of VAP is high, adding 5-16 hospital days and increased health care cost. (Kolef, 1993, Rello et al, 2002)

Diagnosis is confirmed by sputum culture suctioned from lung. Antibiotic therapy should be initiated when VAP is suspected. When culture results are finalized, confirm that the current antibiotic therapy will treat the organism, and change therapy if needed.

VAP is suspected by:

1. Fever
2. Leukocytosis
3. Change in character and volume of sputum
4. New infiltrate on CXR
5. Increasing ventilator and/or oxygen requirement

## Post Extubation Therapy:

Breathing Exercises: The most effective method of preventing post-extubation pulmonary complications is to encourage maximal voluntary deep breathing and coughing. Incentive spirometry use or having the patient blow bubbles will augment voluntary efforts.

Aerosol Therapy: Stridor - Upper airway stridor is best treated with nebulized racemic epinephrine

Bronchoconstriction: Bronchodilators delivered via nebulized aerosol effectively reverse airway constriction.

Secretions: Thick, tenacious, inspissated secretions can be effectively treated with heated aerosol. Some patients may require the addition of a mucolytic agent [Mucomyst] delivered per hand held nebulizer. A mucolytic agent is an irritant that can cause bronchospasm and should be discontinued after 48 hours due to bronchorrhea.

Percussion and Postural Drainage: The indication for therapy is very narrow and specific.

- A. Increased secretions or infiltrate on Chest radiograph
- B. Atelectasis not responding to breathing exercises
- C. Collapse of lung, lobe or segment.

In order to achieve maximum benefit, the patient must be able to cooperate with the respiratory therapist. A large number of contraindications to this form of therapy, some of which are listed, limit its use in the critically ill patient.

- Contraindications:
- A. Unstable cardiac rate or rhythm
  - B. Congestive heart failure
  - C. Unstable neurologic status (aneurysm, increased ICP)
  - D. Abdominal distention and or obesity
  - E. Fractured ribs or flail chest
  - F. Bleeding diathesis

## Chest Tube Management

A pneumothorax occurs when the resting negative pressure in the pleural space is lost, leading to collapse of the ipsilateral lung. Pneumothoraces can occur spontaneously (primary pneumothorax) after for example, a bleb rupture; or result from trauma (secondary pneumothorax). In penetrating trauma, air can enter the pleural space from the atmosphere. In blunt trauma, air escapes the pleura after barotrauma or laceration by a fractured rib. Signs and symptoms of a pneumothorax can include: dyspnea, pleuritic chest pain, anxiety, cough, and tachypnea. Large or symptomatic pneumothoraces are treated with chest tubes (tube thoracostomies).

While in place, care of the chest tube should include:

- Chest tubes (site, tubing, drainage chamber) will be assessed every 12 hours.
- Chest tube dressings will be changed every three days and more often as needed.
- Chest tube should never be clamped (unless changing the collection chamber).
- Chest tube cannot be disconnected from suction unless specifically ordered by MD

Chest tubes are removed when the pneumo/hemothorax has been resolved and the amount of pleural effusion is decreased. Traditionally, chest tubes are removed from suction when the air leak has resolved. Chest tubes on water-seal with no air leak, Little drainage (less than 1cc/kg) in 24 hours and minimal or no residual pneumothorax on CXR are considered for removal. A chest x-ray is usually obtained 3-8 hours after placement on water-seal to identify any expansion of the pneumothorax. Sometimes, a second follow-up radiograph would be taken the next morning and if still negative, the chest tube is removed. If the initial chest x-ray on water seal shows development of or significant expansion of the pneumothorax, the chest tube is placed back on suction and/or reevaluated. An interval chest x-ray would follow.

## **PIV Insertion in Children**

### **Information:**

1. Assess the need for PIV placement.
2. Two healthcare personnel are to be present for this procedure. (Jacobson & Winslow, 2005)
3. Identify two potential sites for IV placement based on the following criteria:
  - a. Type and duration of IV therapy
  - b. Age of the patient
  - c. Developmental level

### **AGE**

### **PREFERRED SITE**

Neonate

Scalp veins are highly visible and easy to access Hand Foot Forearm (*can accommodate larger catheter*) Antecubital (*limits activity/requires armboard*)

Older Infant

Hand or Foot (*Hand site is appropriate for all ages, however, is more painful due to nerve endings are close to the skin surface*) Choose nondominant hand if sucks thumb Forearm (*can accommodate larger catheter*) Antecubital (*limits activity/requires armboard*)

Toddler

Hand (*hand site is more painful due to nerve endings are closer to skin surface/Choose nondominant hand if sucks thumb*) Forearm (*can accommodate larger catheter*) Antecubital (*limits activity/requires armboard*)

Preschool

Nondominant Hand Forearm (*can accommodate larger catheter*) Antecubital (*limits activity/requires armboard*)

### **AGE**

### **PREFERRED SITE**

Adolescent

Forearm may be preferred due to body image concerns (*less conspicuous/accommodate larger catheter*) Nondominant Hand Antecubital (*limits activity/requires armboard*)



4. The distal area of the upper extremities is optimal due to decreased risk for phlebitis. (Ingram, 2006)
5. If using antiseptic cream, clean two sites with alcohol or Chloraprep. Dry thoroughly.
6. Apply Anesthetic Cream (LMX4) to the intended sites and cover with a transparent occlusive dressing (tegaderm). (Eichenfield, Funk, Fallon-Friedlander, & Cunningham, 2002)
  - a. *Do not apply to areas of the skin that are irritated, scratched, or have cuts.*
  - b. *Follow the manufacturer's instructions for application procedure and required time.*
7. Wash Hands prior to procedure. (Ingram, 2005)
8. Make sure both nurse and patient are in a comfortable position. (Jacobson & Winslow, 2005)

*Positions that may increase feelings of comfort for the child are the following:*

  - a. *sitting on parent's lap either facing them, or facing outward with the parent hugging them during the procedure.*
  - b. *position the parent so that they are close and touching the child*
  - c. *the parent should not be responsible for restraining their child during a painful procedure.*
  - d. *children feel more relaxed and in control when they are in a sitting position. (Flint, n.d.)*
  - e. *include Child Life as needed*
9. Remove the occlusive dressing from the site prior to the needle insertion.
10. Cleanse the site with Alcohol or Chloraprep
  - a. *Allow 30 seconds for alcohol to air dry for effective removal of bacteria. (Ingram, 2006)*
  - b. *Scrub with chloraprep for 30 seconds and air dry for 30 seconds for effective removal of bacteria (www.chloraprep.com). Do not use chloraprep on infants less than 2 months of age ([www.chloraprep.com](http://www.chloraprep.com)).*
11. Choose the smallest gauge/shortest length catheter to decrease risk of mechanical phlebitis. (Ingram, 2006)
12. Make sure the skin is held taut to prevent rolling of the vein. (Trimble, 2003)
13. Two techniques exist for needle insertion
  - a. *Direct: one step insertion through skin and vein.*
  - b. *Indirect: two step insertion through skin first then into the vein (advantages are decreased bruising and decreased risk of piercing the opposite vein wall) Do not use indirect method for extremely agitated patients. (Trimble, 2003)*
14. Shorter insertion times can increase patient satisfaction with nursing care and decrease insertion pain (mean time: 32 seconds). (Jacobson & Winslow, 2005)
15. Once blood flows into the hub of the catheter, pull the needle back, retract the needle according to the manufacturer's direction and immediately place into a designated sharps container. (Ingram, 2006)
16. Flush with 0.9% NSS using a positive pulsatile flush. (Ingram, 2006)
  - a. *positive pulsatile flush: alternating stop-start technique prevents substances from adhering to the catheter lumen that could cause bacteria to grow.*
  - b. *all flush syringes must be labeled with solution, date and time*
17. Place transparent occlusive dressing over IV site to allow for visibility and prevent infection (Ingram, 2006)
18. Connect to IV tubing or heparin lock as indicated.

19. Assess the IV site for pain, redness, warmth, or swelling as this would indicate possible phlebitis, infiltration or extravasation. (Ingram, 2005)

**Recommendations for the use of Kentucky Children's IV Therapy Team:**

1. If possible, the patient's nurse, or staff nurse should attempt IV placement one time prior to requesting assistance from the Pediatric IV Team.
2. If the staff nurse is unsuccessful, the Pediatric IV Team may be contacted.
3. The patient's nurse or staff nurse is to be present to assist the Pediatric IV Team. To expedite the procedure, all supplies will be ready and all flush syringes labeled before calling the Pediatric IV Team for assistance.
4. If blood is to be collected, it is the responsibility of the patient's nurse or staff nurse to make sure the proper tubes are available for easy collection. Lab labels must be in the room when the blood is drawn to verify correct patient and comply with patient safety policies.
5. During blood collection, the patient's nurse or staff nurse is responsible for attaching the appropriate labels to the blood samples and sending the labs.
6. The Pediatric IV Team is available 8a until 8p- Monday through Friday. IF the IV Team is unavailable, and it is an emergency, contact the Transport Team or PICU
  - a. Unless it is an emergency situation, the Transport Team is unavailable for IV starts at the beginning of their shift (6:30-8:30) so they can perform equipment checks and attend their safety meeting. They are also unavailable for one hour after each transport to complete their paperwork, clean equipment and re-stock supplies.

\*If the Pediatric IV Team is unavailable, the patient's nurse is responsible for finding skilled nursing personnel to attempt the IV, or contacting the physician.

## **Intravenous Access Considerations**

There is a general hospital wide practice to “saline lock” and keep both peripheral and central venous catheters. Keeping multiple IC sites put the patient at risk for developing nosocomial site infections. Both inserting technique and indwell time influence subsequent thrombophlebitis. Many catheters are placed under less than ideal conditions and should be removed as soon as possible. In most cases, a patient will only require one functioning IV access site. Proper inspection and site care should be used to maintain function and sterility. All other IV access sites should be removed.

### **PICC lines:**

- PICC line therapy will be considered when IV initiation is difficult or impossible or when long-term IV therapy is anticipated.
- MD order is required prior to PICC line initiation. PICC line placement will be performed under sedation by the PICC nurse or by interventional radiology. Once placement is verified by fluoroscopy, the site may be used.
- TPN may be given through a PICC line.
- PICC line dressing will be changed 24 hours after PICC line insertion. Dressing will not have gauze over insertion site so that it can be assessed for infection. After initial change, PICC line dressing will be changed weekly using aseptic technique.
- PICC line should be assessed every 8 hours.
- Always use a 10 cc syringe for flushing a PICC line.
  1. If patient is receiving infusion through PICC line, flushing every 12 hours is not necessary.
- Flush with 10cc of NS and 2cc of heparin in a 10 cc syringe every 12 hours.
- After blood draw, lipid administration, blood transfusion, PICC line will be flushed with 20cc of NS.

RN is able to discontinue PICC line: pull line, measure length, assess condition (tip of catheter) and document findings

## **Intraosseous Indications and Use**

### **Information**

- A. All Pediatric Intensive Care RN's may initiate Intraosseous (IO) access after successful completion of PALS and PICU competencies.
- B. IO access is indicated in the presence of hemodynamic instability when IV access cannot be rapidly established.
- C. If no obvious peripheral access is visible IO access may be utilized immediately.

### **Procedure**

- A. Contraindications or concerns for IO access
  - Lesions, cellulites or other infections over the site
  - Fracture proximal to site
  - Previous IO access was attempted and unsuccessful
- B. Steps in initiating IO access
  - a. Equipment
    - Clean gloves
    - Antimicrobial wipes
    - EZ-IO power driver
    - EZ-IO needle set (sizes 3-39kg for pediatrics and > 40kg adult)
    - T-connector
    - Stopcock
    - Normal saline flush
  - b. Tibia bone is site of choice -Alternate sites include distal femur, iliac crest
  - c. IO needle is placed 1-3cm below tibial tuberosity
  - d. Put on gloves
  - e. Prepare the skin
  - f. Insert the needle
  - g. Remove stylette
  - h. Flush with 10ml of normal saline
  - i. Observe the site for s/s of infiltration
- C. Any medication, crystalloid or colloid may be infused
- D. Significant infiltration can cause compartment syndrome. If infiltration occurs remove IO, apply pressure, elevate extremity and notify MD
- E. To remove: Attach a sterile 5-10ml Luer lock syringe to hub of EZ IO needle. Rotate clockwise and pull out gently. Avoid excessive force.

## **University of Kentucky Trauma and Critical Care Recommendations for Central Venous Catheter Insertion**

*Adapted from the American College of Surgeons Guidelines for Central Venous Access\**

Indwelling vascular catheters are essential for patient care. All indwelling vascular catheters have associated mechanical and infection risks. Catheters should be placed when needed and the insertion should be performed properly using strict aseptic technique. Catheter maintenance should follow accepted guidelines including sterile technique for infusions, lines, and hubs. Site inspection and care are essential for preventing infection. Catheters should never remain in place for caregiver convenience and should be removed when no longer needed.

### **Placement**

1. Appropriately trained and experienced personnel identified to place CVC
2. Time out performed prior to procedure (patient ID, consent, site selection, diagnosis)
3. Choose the most appropriate site for CVC insertion based on patient's needs
4. Full sterile precautions must be performed on ALL non-emergent CVC insertions. This includes sterile hat, mask w/shield, gown and gloves. A fully body sterile sheet is applied after appropriate antisepsis.
5. Appropriate antisepsis is achieved with 2% chlorhexidine gluconate for 30 seconds and then allowed to air dry. If this is not available, it is appropriate to use iodine, iodophore or 70% ethanol, no organic solvents.
6. Choose a central venous catheter with the minimum number of lumens for your patient's needs.
7. All internal jugular and femoral lines should be placed under ultrasound guidance unless emergent line placement is required.
8. If a CVC is malfunctioning then a new one may be placed by exchange over a guidewire ONLY if there are no signs of bacteremia and/or infection
9. >3 needle sticks for access increases risk of insertion complications and consideration should be given to having a more experienced staff member proceed with the insertion and/or new stick site
10. After successful insertion a chlorhexidine impregnated sponge should be placed around the catheter at the insertion site.
11. Position of CVC must be evaluated with a STAT chest x-ray. Correct CVC should have the tip near the SVC and right atrial junction. All CXR should be evaluated for evidence of pneumothorax.
12. If line is in satisfactory position the line needs to be cleared for use in SCM. Alert the nursing staff that the line is ok to use and that the order for clearance is in SCM.
13. A procedure note is to be performed on all CVC insertion attempts, successful or not. SCM has a procedure note dedicated to CVC insertion. This is the default and expected method of procedure note completion. A brief note in the chart should indicate the patient name, date and time with reference to the complete note in SCM.

## **Maintenance**

1. The routine replacement of central lines does not prevent CRBSI and is not recommended in the absence of CRBSI
2. The CVC site should be inspected daily and PRN
3. Before manipulation of any CVC proper hand aspesis should be performed by washing with soap and water or alcohol scrub (even when gloves are worn)
4. Clean gloves should always be donned before CVC manipulation
5. If CVC lumen access is attempted via the injection ports or caps then asepsis should be applied to the ports/caps with 2% chlorhexidine gluconate or another appropriate antisepsis
6. 2% chlorhexidine gluconate, iodine, iodophore or 70% ethanol (no organic solvents) should be used for all CVC dressing care and dressing changes. All antisepsis should be allowed to air dry before manipulation/dressing changes.
7. Use a sterile, transparent dressing over catheter site with clean gloves and a no-touch technique. If the site is not dry, then apply a sterile dry gauze and change dressing when it becomes saturated. Change to a transparent sterile dressing as soon as possible.
8. Sterile dressing should be replaced q7 days unless it becomes loose.
9. There is no indication for antimicrobial prophylaxis (systemic or local) with an indwelling CVC.
10. Avoid anticoagulants for clot or CRBSI infection unless certain patient conditions mandate their use
11. Use sterile NaCl (heparin if indicated) to flush and lock to maintain patency
12. The use of needle free connectors is encouraged to prevent needle stick injuries, and aseptic technique should always be followed.

## **Catheter Related Infection and/or Complication Evaluation**

1. The occurrence of fever should not prompt CVC removal. It is expected that clinical judgment be applied. If patient demonstrates a strong suspicion of CRBSI then CVC removal is considered.
2. If CRBSI is suspected or confirmed, the CVC or introducer should be removed. The line should be cultured only if CRBSI is suspected.
3. The tip or intracutaneous segment only should be cultured.
4. If the patient demonstrates erythema or purulence at the catheter site, sepsis, + blood culture results the CVC should be reomoved.
5. If the CVC that was exchanged demonstrates quantitative cultures suggestive of CRBSI (>15 Colony Forming Units, CFUs) then the catheter should be removed and placed at a new site.
6. 2 sets of blood cultures, one from a peripheral stick, in all patients with suspected CRBSI
7. After removal of CVC in patients with CRBSI, a non-tunneled CVC may be placed at a new site after systemic antimicrobial therapy is begun
8. If after removal of CVC there is persistence of bacteremia and/or fungemia, lack of clinical improvement (after 3 days of CVC removal and appropriate antimicrobial therapy) then the clinician should seek septic foci (ie. endocarditis, septic thrombi, and mestastatic infections.
9. All institutions should have monitoring systems for outcomes, infections and complication rates. They should also have systems in place if complications exceed the standard of care to identify and correct these occurrences

10. Venous thrombosis, documented at insertion site, the CVC should be removed and placed a new site if CVC is still needed.

**Central venous, pulmonary artery, and peripheral venous lines placed outside the Intensive Care Unit**

All deep lines placed outside of the intensive care areas must be changed to a new site within 24 hours of admission to the unit. Exceptions to this policy are as follows:

1. Lines placed under aseptic conditions in the operating room, on the floor, or in another ICU where sterility of the procedure can be documented.
2. All emergent lines, placed under non-sterile conditions, placed in the ED for emergency resuscitation must be removed within 24 hours of admission to the ICU without exception.

**Pulmonary Artery Catheter Important Notes**

1. PAC should not be left in for > 10 days due to the significant risk of CRBSI
2. If the PAC is removed, under no circumstance should the introducer sheath be left in place.
3. Guide wire PAC exchanges are only indicated for PAC malfunction only. If there are extenuating circumstances then chief, fellow or attending approval is needed.

## **Arterial lines**

### **Route of Insertion**

1. The percutaneous route of arterial line placement is preferred to surgical cutdown.
  - a. Surgical cutdown for arterial cannulation should only be performed after approval by the Pediatric Surgical and/or PICU attending.

### **Site of Insertion**

1. The preferred site of arterial cannulation is the radial artery. Alternate sites of arterial cannulation are for most patients listed in descending order preference.
  - a. Femoral artery\*
  - b. Dorsalis Pedis artery\*
2. The complications associated with brachial artery and axillary artery cannulation are higher than other routes.
  - a. Brachial artery: Used uncommonly because of the high complication rates. The major complication is thromboembolic occlusion usually without ischemia.
  - b. Axillary artery: Limb threatening ischemia negligible. However, catheter infection rate is much higher than other sites and line care is difficult.

### **Insertion Procedure**

1. The site chosen for arterial cannulation should be prepped and draped to create a sterile field.
2. Sterile gloves and mask should be worn during insertion of the line.
3. The line should be sutured in place using aseptic technique.
4. At the completion of the procedure, a chlorhexidine impregnated sponge is applied to the insertion site and covered with a sterile MVP (Tegaderm © or OP-Site ©) dressing.

### **Line Changes**

1. The infection rate in percutaneously placed arterial cannulas are very low. Routine catheter removal and change to a new site is unnecessary. Arterial cannulas can remain at the original site of insertion until no longer needed.

*Exception:* Catheters should be changed to a new site when:

  - a. There is evidence of infection at the insertion site manifested as pain, redness, swelling, or purulence. Catheters should always be cultured in this situation.
  - b. There is evidence of ischemia distal to the site of insertion.
  - c. The catheter is implicated as a potential source of unexplained systemic sepsis.
2. The decision to change the arterial line to a new site or to culture the catheter tip is left to the discretion of the treating physician. It is recommended that catheter tips be submitted for culture when there is evidence of infection at the site of insertion or when the patient exhibits unexplained sepsis.



## **Guidelines for the Care of Children with Peripheral Arterial Lines (Radial, Femoral or Tibial)**

### **INFORMATION:**

#### **A. Line Maintenance: Fluids**

1. Only saline based solutions may be infused through peripheral arterial lines.
2. Heparin is added to the IV solution as follows:
  - a. For patients in the NICU, heparin concentration is two units/mL of IVF or per MD order.
  - b. For patients in the PICU, heparin concentration is one unit/mL of IVF or per MD order.

#### **B. Line Maintenance: Dressing Change**

##### **1. Supplies Needed**

- a. Tegaderm
- b. Tape
- c. Betadine, sterile water and alcohol
- d. Sterile Q-tips

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

- a. The dressing should be changed every 72 hours or if the dressing becomes loosed or soiled.
- b. Remove the old dressing and inspect the site for redness, leaking, blanching, bleeding or swelling.
- c. Document the appearance of the site in the nursing note every shift. Document the appearance of the distal extremities every two hours.
- d. Use sterile Q-tips to clean the incision site with betadine and alcohol or sterile water.
- e. Apply Biopatch Antimicrobial Dressing

NOTE: Biopatch should NOT be used for patients in the NICU, those on the Pediatric Hematology-Oncology Service, or any person with a known sensitivity to chlorhexadine.

- f. Apply sterile occlusive transparent dressing over the insertion site and/or Biopatch.
- g. Tape IV tubing securely to dressing and/or patient's skin to prevent the catheter from being dislodged.
- h. Label the dressing with date and time.

## **Pain Management in Children**

### **INFORMATION:**

A. Effective management of acute pain in children requires (Wong, Wilson, Winkelstein, Ahmann, Divito-Thomas, 2000):

1. Assessment and reassessment of pain intensity and pain relief at regular intervals.
2. Respecting child and family preferences when determining pain management strategies.
3. Understanding that children often cannot or will not report pain to their health care providers. Suspecting pain if there is a physical condition that could induce pain.
4. An organized program to evaluate the effectiveness of pain assessment and management.

B. Policies for effective management of pain (Wong, et al, 2000):

1. Use of a standard pain assessment tool and documentation in the patient record
  - a. Wong-Baker Faces for children developmentally >3 years
  - b. Visual Analog Scale for children >12 years
  - c. Or if Wong-Baker Faces is not appropriate, FLACC pain assessment for non-verbal children and children <3 years.
2. Pain assessment will be performed at regular intervals.
  - a. Pain assessment will be performed at least twice a day on every patient, including those who DO NOT have a pain diagnosis.
  - b. Intervals of at least every two hours for the first six hours after surgery.
  - c. Pain assessment will be performed with vital signs when a pain diagnosis is initiated.
  - d. Pain assessment will be performed before and within 45 minutes after a pain medication is administered.
3. Post-operative pain medication will be given around the clock for the first 24 hours (if assessment indicates) and as needed with q2-4 hour assessment of pain during the second 24 hours post-operatively.
4. Documentation will include: changes in child behavior, appearance, and activity level.
5. Documentation will indicate discussion with family about pain management and strategies to manage pain post discharge.
6. Except in the NICU, IV sticks and other invasive procedures will be preceded by topical anesthetics or other appropriate intervention to reduce pain at puncture sites.
  - a. In the NICU, nurses will administer sucrose analgesia prior to IV sticks and other invasive procedures.
7. Physical interventions such as swaddling, ice, heat, massage, or immobilization will be implemented and documented.
8. Non-pharmacological behavioral strategies (bubbles, magic wand, music, etc.) will be available, implemented and documented (Wong, et al, 2000).
9. Children will be allowed to participate in their own pain management (Wong, et al, 2000).
10. Quality improvement monitoring will assure the standard of care is maintained.

## **Patient Deterioration Guide – Acute Care**

### **INFORMATION:**

**NOTE:** \* Criteria for potential transfer to Pediatric Intensive Care Unit (PICU) \*\* Transfer to PICU after consult with Kentucky Children's Hospital Divisional Charge Nurse and PICU Attending

#### **A. Airway**

1. \* Patient requires head positioning or suctioning more than once per hour to maintain airway.
2. \*\*Patient requires intubation to maintain airway.

#### **B. Breathing**

1. Respiratory rate increased by 10 or greater from patient's baseline
2. Increased work of breathing from patient's baseline.
3. \*Oxygen concentration  $\geq 60\%$  and unable to maintain saturation  $>92\%$ .
4. \*Any sudden or progressively decreased air movement with no improvement after immediate intervention, i.e., oxygen delivery, medication.
5. \*Severe stridor with increased work of breathing.
6. \*Any cyanosis not corrected with oxygen delivery.
7. \*Continuous nebulizer treatments for  $>4$  hours with little to no improvement or with increased work of breathing despite treatment.

#### **C. Circulation**

1. Heart rate (while awake) increased for  $>30$  minutes to
  - a.  $>200$  (0-3 months)
  - b.  $>190$  (3 months-2 years)
  - c.  $>140$  (2-10 years)
  - d.  $>100$  ( $>10$  years)
2. Capillary refill  $>4$  seconds.
3. Weak peripheral pulses versus central pulses.
4. Mottling or cool extremities associated with an increase in heart rate and work of breathing that is not related to fever.
5. \*\*Any true bradycardia not corrected by immediate intervention and that continues to occur despite immediate intervention.
6. Any mental status changes, especially agitation, sudden disorientation, lethargy, or if the patient's family reports that the patient "is not acting right."
7. \*\*Any sudden mental status changes.
8. A surgical patient who has a small to moderate amount of bleeding lasting  $>15$  minutes.
9. \*\*Any hemorrhaging.
10. Seizure activity not controlled with medication.

#### **D. Pediatric Deterioration Documentation**

1. When a patient meets any of the criteria in A, the RN will:
  - a. Complete a full assessment of the patient.
  - b. Obtain a full set of vital signs and place the patient on a cardiac and oxygen saturation monitor.
  - c. Initiate oxygen by best tolerated means to maintain saturation  $>92\%$ .
  - d. Call patient's physician.
  - e. Inform the Unit Team Leader and Divisional Charge Nurse of the patient's condition.
  - f. Continue rapid ABC assessment of the patient until the patient's condition stabilizes or the patient is transferred to the PICU.
  - g. If the patient is requiring assessment and vital signs  $>30$  minutes, initiate the Pediatric Deterioration Flow Sheet.

## Logroll Guidelines

### General rules:

1. Patients are transported to UK Hospital immobilized so we must consider pre-hospital board times (don't forget referring hospital pre-transfer time as well), thus you may receive patient that has had extended length of time on a board.

*Keep suction and airway equipment readily available for patients on log roll precautions. They cannot be easily be turned to maintain their airways, so we must be prepared to maintain their airways and prevent aspiration if necessary*

2. Evaluate your patient for risk factors associated with skin breakdown such as poor nutritional status, circulatory impairment from cardiac or vascular disease, diabetes, lack of adipose tissue, etc.

3. Hardboards should be utilized in the PICU/Floor for patient transfer and obtaining films only and must be discontinued as soon as possible to prevent breakdown. **Do not keep patient on a board for any longer than necessary (2 hours is maximum time on board).**

4. Document off/on board times.

5. **Don't use slider board to transfer the patient.** Sliders are flexible devices that do not offer appropriate spine immobilization.

6. Must reassess sensory/motor function with every turn, transfer and prn.

### I. Pre-Log Roll Assessment:

#### A. Review Medical Diagnosis (Know your patient)

1. Clearance of spines per MD by radiologic evaluation
2. Level of SCI/stability of spine fractures
3. Other injuries

#### B. Review Medical Order for Activity

1. Spinal Precautions until spines clear
  - a. HOB flat or Reverse Trendelenburg (if not contraindicated)
2. Log Roll
3. Log Roll with cervical spine precautions

#### C. Determine number of staff required to perform logroll

1. Leader positioned at HOB
2. Assistants (1-2) for placement on hardboard, wound/skin assessment, linen change
3. Assistants (3-4) positioned for turning
  - a. Additional staff may be required depending on patient size and/or injuries
  - b. 1<sup>st</sup> assistant @ torso
  - c. 2<sup>nd</sup> assistant @ hips
  - d. 3<sup>rd</sup> assistant @ legs

- D. HOB flat
  - 1. maintained at all times
  - 2. Reverse Trendelenburg may be used to elevate patient head after logroll procedure completed
- E. Inspect Cervical Collar
  - 1. Correct size?
  - 2. Appropriately applied/positioned?
- F. Inspect cervical traction (if indicated)
  - 1. Are weights secure and hanging freely?

## II. **Prepare for Log Roll :**

- A. Prepare patient for log roll turn
  - 1. Explain procedure
  - 2. Instruct patient to lay still, not to assist with turn
  - 3. Ensure patient is in proper alignment prior to turn
  - 4. Raise bed to approximate waist level of all participants

## III. **Log Roll Procedure:**

- A. Leader takes position at patient's head
  - 1. Position hands on each side of patient's head
  - 2. Place thumbs at the mandible bilaterally
  - 3. Place fingers behind head at occipital ridge
  - 4. Maintain firm, gently stabilization of neck throughout procedure
- B. Leader to assess current motor and sensory function of patient
- C. Leader directs assistants to turn patient (in unison on count of "3") toward them onto patient's side
  - 1. Leader monitors alignment (nose & umbilicus) continuously
- D. Leader directs assistants on opposite side to proceed with turn
  - 1. Placement of rigid backboard
    - a. position rigid backboard for contact with patient's back
    - b. assess skin integrity while patient is on his/her side
    - c. change linen
- E. Leader directs return to supine position on count of "3"
  - 1. Patient should be gently rolled as a unit maintaining spinal alignment
- F. Continue with patient care
  - 1. Rigid backboard:
    - \*Patient should be centered on board
    - If not centered, then:
      - a. Leader maintains cervical alignment as described
      - b. Equal number of assistants on either side of patient

- c. On “1-2-3” count, patient should be repositioned to center of rigid backboard
- 2. Linen change:
  - a. Leader maintains cervical alignment as described and assess spinal alignment
  - b. Assistants move to opposite side of bed
  - c. Repeat log roll procedure in opposite direction
- G. Leader re-assesses sensory/motor function after all logroll procedures

**Transfer/Transport Guidelines :**

- H. Log Roll procedure is used at all times until spines are cleared by MD order
- I. A rigid backboard is used at all times for transfers from one surface to another until spines are cleared by MD order
  - 1. Stretcher to stretcher
  - 2. Stretcher to procedure/diagnostic table
  - 3. Stretcher to bed
  - 4. Bed to procedure/diagnostic table
  - 5. Bed to bed
- J. Slider boards must not be used to LIFT or TRANSFER patient. Slider is not a rigid surface, thus not a suitable lifting or transfer device.
  - Exception: slider may be used under hardboard (not next to patient) to reduce friction associated with movement from surface to surface.
- K. Portable Diagnostic X-rays
  - 1. Place patient on rigid backboard per log roll procedure
  - 2. Leader and assistants lift patient on rigid hardboard in unison count “1-2-3”
  - 3. Pancake x-ray board is placed between bed and patient on rigid backboard
  - 4. Count “1-2-3” in unison to lower patient/hardboard onto pancake board
  - 5. Notify radiology that patient is ready for films
  - 6. Patient remains on hardboard and pancake board until radiology approves quality of films obtained

**Patient should not remain on hardboard > 2 hours!!**

- 7. Remove patient from pancake board
  - a. Leader and assistants lift patient on rigid hardboard.
  - b. Pancake board is removed
  - c. Leader and assistants lower patient in unison (still on hardboard) to bed surface
  - d. Remove patient from rigid backboard using log roll procedure

# **General Guidelines for Trauma Patient Care**

## **1. Mobilization**

There is clear, irrefutable evidence that extended bed rest is harmful to patients. Supine position and lack of mobilization leads to reductions in pulmonary functional residual capacity, atelectasis, diminished cough, and accumulation of dependent lung water. This makes the patient more prone to pulmonary complications. Bed rest also leads to rapid loss of muscle mass leading to de-conditioning which may increase hospital length of stay, lengthen rehabilitation, or create the need for rehabilitation that would have not been otherwise needed. Patients at bed rest are more prone to pressure ulcers, bowel dysfunction, and venous thromboembolic disease.

A primary focus of patient care should be early mobilization of the patient. Weight-bearing status should be determined within 24 hours of admission to the hospital. Ambulation of the patient should be an immediate goal. If there are limitations on weight-bearing these should be identified and appropriate resources (physical therapy, equipment, etc) should be applied immediately. At the very least, patients should be out of bed and placed in a chair. This does not mean bringing the bed into a sitting position but actually getting the patients out of the bed into a chair. If traction or hemorrhage risk mandates bed rest, the patients should be nursed with the head of the bed elevated at least 30 degrees. When spine precautions are in place the patient should be placed in reverse trendelenburg.

## **2. Respiratory Function**

Respiratory therapy is essential for acutely ill and injured patients. Some of our patients have co-morbid lung disease and/or a history of tobacco use. Lung function is further compromised by bed rest, obesity, chest wall trauma, pain, surgical incisions, chest tubes, or via the use of cervical collars, back braces, and/or traction.

Apply vigorous pulmonary toilet early! Use the respiratory therapist wisely. It is far easier to prevent respiratory failure than to treat the consequences. Patients and their families require education as to their role in pulmonary toilet. Patients and families often equate pain with further damage. They need to understand that pulmonary toilet may cause pain but not harm. The simplest and best pulmonary toilet is to mobilize the patient. This requires patient effort resulting in work of breathing that maintains respiratory muscle function. Mobilization also shifts lung water, increases lung functional residual capacity, and reduces atelectasis. Mobilization should be supplemented with education on coughing and deep breathing. Incentive spirometers, blow bottles, and blowing bubbles can and should be used to supplement coughing and deep breathing. Some patients may require bronchodilators and/or chest physiotherapy. Occasionally expectorants are also required. Some children may require nasotracheal suctioning. Pain control is essential. Patients should be comfortable but not so somnolent that they can't actively participate in pulmonary toilet.

Supplemental Oxygen is expensive and unnecessary for most patients. Oxygen does not improve respiratory failure! In fact, supplemental oxygen can mask worsening respiratory function. Virtually all human beings have arterial desaturation when recumbent or sleeping. Spot pulse oximetry in these circumstances is of no clinical value and frequently results in unnecessary application of supplemental oxygen. Respiratory rate and effort combined with auscultatory findings, radiograph, and subjective patient complaints are much better determinants of respiratory failure than arterial desaturation. In the latter circumstance, supplemental oxygen should be used along with pulmonary toilet.

### **Central nervous system injury**

Patients with head and/or spinal cord injury do not have normal pulmonary toilet. These patients rely heavily on positioning, mobilization, and active pulmonary toilet to avert respiratory failure. Nasotracheal suctioning along with chest physiotherapy, bronchodilators, and breathing exercises should be used liberally in this patient group.

### **3. Tracheostomy**

Tracheostomy is frequently required for the management of airway, pulmonary toilet, and/or respiratory failure in patients with complex critical illness and/or injury. The vast majority of these are performed percutaneously although some are still placed using the older, but still reliable, open surgical technique. Regardless of placement technique, complications, daily tracheostomy tube/site care, and down sizing/decannulation are the same.

*Dislodgement:* The most common early and lethal complication of tracheostomy is tube dislodgement. In order to prevent this complication the tracheostomy tube is secured to the skin with sutures and fixed in place with a secure neck strap. Sutures often give a false sense of security and will not in and of themselves eliminate dislodgement. The most important defense against early dislodgement is a secure neck strap and strict avoidance of undue tension and/or torque on the fresh tracheostomy. It takes about four days after insertion to develop a mature tract. After four days, dislodgement rarely results airway compromise and the tube can simply be reinserted through the neck. Prior to four days, airway loss is likely and the patient may require endotracheal intubation to reestablish the airway. This is a true emergency that requires the immediate attention of the surgical house staff. The patient can be temporized with 100% oxygen delivered via bag valve mask and gentle occlusion of the tracheostomy site.

*Plugging:* The most common intermediate complication of tracheostomy is mucous plugging. This will be the most frequent problem encountered with ward patients. Secretions build up in the tracheostomy tube lumen leading to sudden occlusion and airway compromise. Virtually all of the tracheostomy tubes in use at UKMC have a removable inner cannula. The routine practice of maintaining cuff deflation and routine inspection/cleaning of the inner cannula will prevent this complication.

*Stenosis:* Tracheal stenosis is a late complication of tracheostomy. Most tracheostomies are associated with some degree of tracheal stenosis. A few patients may develop critical stenosis that compromises the airway and produces clinical symptoms. The duration of endotracheal intubation prior to tracheostomy, technique used (open > percutaneous), higher placement (between rings 1-2 vs. 2 or lower), and smaller airways (children, females) all increase the rate of clinically significant tracheal stenosis. Almost all clinically significant stenosis occur within twelve weeks of tracheostomy. The hallmark of clinically significant tracheal stenosis is respiratory distress and/or stridor and wheezing when the tracheostomy tube is plugged or removed. If plug removal or tracheostomy tube reinsertion alleviates symptoms the tube should remain in place until a diagnostic evaluation can be performed.

*Tracheal-arterial fistula:* Small amounts of bleeding may occur simply from the irritation of suctioning, site care and/or the tube itself. A rare but lethal complication of tracheostomy is tracheal-arterial fistula that occurs from erosion of the tip of the tracheostomy tube into the great vessels of the upper thorax. The hallmark of this complication is a "herald bleed" defined as a moderate to large amount of bleeding that stops spontaneously. If bleeding persists or



produces airway compromise, the endotracheal tube cuff can be inflated to tamponade bleeding and maintain the airway. Herald bleeding requires immediate investigation!

*Infection:* Tracheostomy site infection is exceedingly rare. The presence of purulent, foul-smelling secretions accompanied by an expanding zone of erythema establishes the diagnosis. Site care and appropriate antimicrobial therapy are effective in controlling this complication.

*Tracheocutaneous fistula:* This is a rare complication of tracheostomy that is defined as a persistent air leak present for more than one week after decannulation. While a small percentage of these will close after 7 days most will require a surgical intervention to achieve closure.

*Bronchorrea:* Copious secretions usually indicate a residual or recurrent pulmonary problem. Occasionally, these secretions are due to the endotracheal tube itself. The tube can and does irritate the upper airway producing excessive secretions. Decannulation is the treatment of choice. If the patient still requires a tracheostomy (coma), a drying agent such as robinol can be used.

### **Tracheostomy tube/site care**

The tracheostomy tube and site should be inspected at least once daily. The site itself should be inspected for purulence and erythema. Gentle cleansing with a small amount of soap and water followed by a dry dressing provides ample site care. The inner cannula should be removed, inspected, and cleaned as necessary to remove build up of dried secretions. The tracheostomy tape should be snug enough to prevent excess movement of the tube but not so tight as to produce skin breakdown/ulceration. The balloon should be deflated on cuffed tubes. Sutures, if present, can be removed after six days. Tracheostomy bypasses the normal humidification provided by the oro/nasopharynx so patients are prone to evaporative water loss and desiccation of the airway mucosa. Humidified air or oxygen (if required) should be used at all times to prevent the latter complications.

### **Downsizing and decannulation**

The general practice of downsizing a tracheostomy tube prior to decannulation is controversial. The stated advantages are a reduction in size of the tract to reduce tracheocutaneous fistulas and to detect tracheal stenosis prior to decannulation. After four days a well-established tract exists between the surface and the trachea. Downsizing can proceed safely at this point. Decannulation should not proceed until the patient is clinically stable. Respiratory failure should be stable or improving and suctioning requirements should be nominal (>2-4 hours). The patient should have a vigorous cough and be able to handle their secretions. There should be no residual airway issues. As a first step, the plastic tracheostomy tubes are replaced with a tube that can then be plugged. If the patient tolerates plugging (see complications: tracheal stenosis), has a good cough and minimal secretions, decannulation can proceed. The tracheostomy site should be covered with an occlusive dressing. The patient should be monitored closely over the next 24 hours for any evidence of respiratory distress. Closure of the tract usually requires 24-48 hours. Comatose patients can be downsized but should not be decannulated. This group of patients rarely has a good cough and cannot protect their airway. Consequently, they remain at risk for aspiration and/or respiratory compromise.

### **Dysphagia and aspiration following tracheostomy**

Dysphagia and/or aspiration following tracheostomy are very common. If managed correctly, this is rarely a clinical problem and oral feeding can be safely resumed without an elaborate ritual. The dysphagia team is seldom, if ever required. Most patients who require a

tracheostomy have not had oral intake for some time. This is complicated by the fact that the tracheostomy itself may interfere with swallowing. This is simply a problem of training/initiating a swallowing bolus! To initiate oral intake, cuffed tracheostomy tubes should be deflated or downsized to a smaller metal tracheostomy. *Oral intake should never begin with liquids.* The initial oral feeding challenge should be with thickened liquids and/or solids. Most importantly, the patient should be sitting upright. If the patient doesn't succeed try, try again. Give the patient good instructions and several attempts before conceding failure. Decannulation, if indicated, can also be accomplished prior to another try. Only an occasional patient will fail and require an alternative feeding access.

#### **4. Wound Care**

Simply washing a wound with soap, water, and gentle handling of tissues prevents most infections and promotes healing. Astringents (peroxide, betadine, acetic acid, alcohol, Daken's, etc.) should rarely if ever be used in a wound. Keeping wounds clean, moist, and covered allows the body to heal the wounds considerably faster. Astringents, frequent dressing care, and overzealous packing are more often responsible for delays in healing.

##### **Wound Classification**

*Clean Wounds* - These are surgical incisions that follow an elective surgical procedure that does not involve the aerodigestive tract. Examples would be neurosurgical procedures, vascular procedures, hernias, most elective orthopedic procedures.

*Clean contaminated wounds* – These are surgical incisions that follow an elective surgical procedure that crosses the aerodigestive tract. Examples would be most ENT procedures, operations on the gastrointestinal tract, or operation on the lung.

*Contaminated wounds* – These are incisions that follow an emergent surgical procedure where there is obvious or potential infection. Examples would be perforations of the GI tract, strangulated hernias, complicated soft tissue infections, open fractures.

*Dirty wounds* – This is really a matter of degree. The difference between contaminated and dirty wounds is really the degree of contamination. Complex wounds with large devitalized areas, gross fecal contamination, large amounts of purulent material, dirt, foreign bodies etc. are usually classified as dirty.

##### **Important Definition**

Dehiscence refers to separation of the wound edges. Dehiscence can further be defined as involving the skin and subcutaneous tissue (superficial) or extending to the deeper layers (fascial dehiscence). Evisceration refers to the protrusion of visceral contents through the wound. Not all dehiscence has evisceration but by definition all eviscerations have dehiscence.

##### **Wound management**

Wounds are managed in one of three ways:

1. Primary closure of the skin and subcutaneous tissues (most wounds)
2. Delayed primary closure. Wounds are left open initially. The skin is then closed primarily between day 3 and 4. Bacterial counts are lowest in the wound at this point and delayed primary closure has the greatest success.
3. Healing by secondary intention. This technique applies for most open wounds.

**Closed wounds**

Wounds that have been closed primarily will seal within 36 hours. After that point it is very unlikely that environmental contamination would compromise the wound. The general rule is to leave the surgical dressing on for 24 hours. After that point the wounds can be covered with a light dry dressing to absorb minor drainage, prevent irritation and for patient comfort. These wounds should be carefully inspected at least once a day for signs of infection (redness, swelling, excessive tenderness, purulent drainage). The subjective patient complaint of wound pain (fever may or may not be present) that increases or is out proportion to wound size is often the earliest sign of surgical wound infection.

**Open wounds**

Contaminated or dirty wounds are often packed and left open. The main clinical reason for this practice is the high incidence of wound infection if the wounds are closed. The wounds are generally packed tightly to achieve hemostasis after the initial operative procedure. Unless there is a planned return to the operating room for exam under anesthesia, further debridement, and irrigation, these dressings should be taken down and the wound examined at 24 hours. The first dressing change can be quite painful and provisions should be made for adequate analgesia prior to proceeding. Most of the pain emanates from the densely innervated wound edge and care should be taken in this area. If the dressing is adherent gentle wetting with saline will facilitate removal and reduce discomfort. "Clean wound" care rather than "sterile technique" should be the standard practice. At the first dressing change the decision can be made to initiate saline wet to dry dressing or application of a vacuum dressing. At this point a decision can also be made about washing/showering the wound with soap and water. Dressing changes need only be once or twice a day and packing of the wound should be gentle. Saline irrigation of the wound base is permissible. As mentioned previously, astringents should be avoided and every effort should be made to avoid wound dessication by irrigating the wound in between dressing changes if necessary. Regarding dressing fixation, the skin should be protected from tape adhesives by using duoderm and Montgomery straps or by application of Bandnet dressing (preferred). Absolutely every effort should be made to simplify wound care prior to discharge. Patients and families should be given clear instructions on clean wound care, showering should be encouraged. When possible, wounds can/should be dressed with tap water rather than sterile saline which is considerably more expensive and unnecessary for most wounds.

**Open wounds and evaporative water loss.**

Open wounds can and do result in significant fluid & electrolyte disturbances. Dehydration from evaporative water loss and malnutrition from protein loss are significant problems with large wounds. This can be amplified if the wound is associated with an enterocutaneous fistula. The patients should be assessed for signs of volume depletion such as excessive thirst, diminished skin turgor, and or low urine output. Keeping the wounds covered and moist reduces evaporative water loss and may reduce protein loss as well.

**Wound infection**

The earliest and most frequent sign of wound infection is excessive wound pain and tenderness. Low grade fever, wound redness, and drainage often appear later and can be easily seen with a good exam and dressing change. Wounds should be opened in the affected area to allow drainage, irrigation, and gentle packing just like in open wounds. Wound culture and antibiotics are totally unnecessary except in rare circumstances such as when patients exhibit signs of systemic illness and/or there is prosthetic material in the wound. **WARNING!** When dealing with abdominal wall wounds, drainage may indicate deep wound problems such as fascial failure and/or evisceration.

## **5. Gastrointestinal Tract**

The gastrointestinal tract plays an active role in overall host defenses, gastrointestinal stress ulceration, and systemic inflammation. The historical term attached to the clinical problem of post operative gut dysfunction was “paralytic ileus”. This has been shortened in modern medical terminology to “ileus.” The traditional clinical practice is to withhold oral intake and maintain nasogastric decompression until there was clinical evidence indicating return of bowel function (passage of flatus, bowel movement, or audible bowel sounds). This practice is outdated and not consistent with what is currently known about bowel function in illness. The stomach and small bowel function very well following illness, injury, and /or operative intervention unless there has been mesenteric ischemia or long standing obstruction. The actual root cause of the clinical entity referred to as “ileus” is delayed return of colonic function. Although ingrained in our medical terminology, “ileus” is a misnomer and the proper term to use is colonic pseudo-obstruction.

There are a number of clinical practices that either exacerbate or contribute to colonic pseudo-obstruction. Chief among these are bedrest, narcotic administration, as well as fluid & electrolyte abnormalities. Depending on the clinical circumstances, the clinician also needs to consider other contributing factors such as fecal impaction, resolving peritonitis, intra-abdominal abscess, pneumonia, wound infection, retroperitoneal hematoma, and pseudomembranous colitis. Mesenteric ischemia and early mechanical bowel obstruction, although rare, must also be considered in the differential diagnosis.

For most patients, early mobilization, judicious use of narcotics, as well as attention to fluid & electrolytes can mitigate or prevent pseudo-obstruction. Routine use of an effective bowel regimen and/or early enteral nutrition are also effective depending on the patient and clinical circumstances.

The main risk to the patient with pseudo-obstruction is colonic ischemia and/or perforation which are dependent upon the degree of colonic distention. Perforation/ischemia is much more likely when colonic/cecal diameter is enlarged. Under these circumstances, more aggressive management is warranted. For most patients, the treatment of pseudo-obstruction includes bowel rest, hydration, and correction of electrolytes is essential. Narcotics should be reduced as much as possible. Depending on the clinical situation, other treatable contributing factors need to be rectified or excluded. Nasogastric tubes are completely unnecessary for the vast majority of patients because they are not effective in reducing colonic distention. NG tubes should be withheld unless the patient is vomiting and/or has evidence of gastric distention on Xray. A combination of stool softeners and cathartics are usually effective. Cathartics are more effective when given orally but other routes of administration may be necessary depending on the clinical situation. Rectal stimulation with a suppository and/or enema may also produce results. Decompressive colonoscopy which is both diagnostic and therapeutic may be required for patients with significant colonic distention.

### **Enteral Nutrition**

Not all patients require early enteral nutrition. Well nourished patients who sustain mild to moderate injury or those undergoing elective operations tolerate several days of fasting with little or no adverse consequences. However, patients with documented pre-injury or pre-operative malnutrition as well as those patients with complex critical illness/injury clearly benefit from early enteral nutrition. In fact, infectious complications are significantly reduced in patients

who receive early enteral nutrition. Early enteral nutrition also maintains gut integrity, reduces the risk of gastrointestinal stress ulceration, and increases the rate of wound healing.

### **Access routes**

The main difficulty with early enteral nutrition is achieving and maintaining a reliable feeding access. Gastric feeding is well tolerated and most patients can be fed in the stomach. Unfortunately tolerance is an issue for some patients, monitoring may be difficult and the aspiration risk is higher than that for post-pyloric tubes. As the patient improves clinically, aspiration risk declines and the need for post-pyloric access diminishes. Three approaches are used to establish feeding access; nasoenteral feeding tube, surgical jejunostomy, and percutaneous endoscopic gastrostomy (PEG). For the vast majority of patients, a nasoenteral feeding tube is a safe, temporary access. These can be placed blindly, via endoscopy, fluoroscopy, or at the time of surgical intervention. Since these tubes frequently become dislodged they are often secured in place with a bridle. Nasoenteral feeding tubes are not a reliable long term access and should be replaced with a jejunostomy or gastrostomy tube. When a patient has significant foregut pathology, a surgical jejunostomy can be placed. This allows enteral feeding to proceed in the absence of an intact/functioning foregut. The most frequently utilized long term feeding access is the PEG. This is a safe, effective way of delivering enteral nutrition for most patients.

### **Assessing enteral feeding tolerance**

Continuous feeding is the only method used for post-pyloric nasoenteral and jejunostomy feeding tubes. The small bowel will not tolerate bolus feedings. Continuous feeding is preferred for PEG feedings but can be changed over to bolus feedings over time. Feeding intolerance manifests clinically in a variety of ways. The key to delivering effective enteral nutrition is to be aware of the clinical manifestations of feeding intolerance and to realize that signs of intolerance vary depending on the feeding access used. Tube feeding reflux, high gastric residuals, vomiting, aspiration, abdominal distention, and diarrhea are all signs of feeding intolerance.

### **Tube feeding reflux**

In patients with a post-pyloric nasoenteral tube and a nasogastric tube, the first sign of intolerance can be tube feeding reflux in the nasogastric aspirate. The first maneuver should be to confirm tube positions with a radiograph. NG tubes can migrate distally and feeding tubes can be dislodged. Tubes should be repositioned if necessary. Once tube position has been confirmed, then a downward adjustment in rate and/or the addition of a prokinetic agent may be required. If reflux is significant and accompanied by abdominal distention, the best course of action is to hold tube feedings for 12-24 hours and reassess the patient. Sudden abdominal distention and reflux in a patient previously tolerating tube feeds is a very worrisome finding that warrants further investigation.

### **Vomiting/Aspiration**

Vomiting and/or aspiration may be the first sign of feeding intolerance. In the awake patient, complaints of nausea will precede the event, so don't ignore this complaint. This manifestation is more likely in patients being fed in the stomach via PEG or nasoenteral feeding tube. Remember that post-pyloric feeding reduces but does not eliminate vomiting/aspiration risk. The most prudent course of action is to hold feedings. Depending on the clinical suspicion for aspiration, an evaluation by a physician is warranted. Vomiting will usually dislodge a nasoenteral feeding tube, so replacement and/or verification of position is warranted.

**Abdominal distention**

Frequently overlooked, abdominal distention and bloating are the earliest and most reliable signs of intolerance. All patients receiving enteral nutrition should be evaluated daily. Not all patients require an intervention but this should be noted and brought to the attention of the physicians caring for the patient. Acute and/or significant distention may indicate mesenteric ischemia or colonic pseudo-obstruction.

**Tube maintenance**

Enteral access tubes are expensive and vital to patient care. Every effort should be made to maintain patency and protect against dislodgement. See Policy CH 08-13 below

**Small bore feeding tubes**

Standard nursing guidelines for small bore feeding tubes should be rigorously followed to prevent clogging. The most effective way to maintain patency is to flush with tubes frequently with warm water and to avoid medication known to clog these tubes. Whenever tube feedings are interrupted or medications are administered, the tubes should be flushed with warm water.

**PEG**

These tubes can and do become clogged and or dislodged. One of the most important aspects of daily PEG care is to assess the tube site and determine tube depth. Nurses should pay close attention to the insertion site for redness, swelling, and/or tube feeding reflux. Following placement, PEG tubes are secured in place using a silastic bumper. These bumpers are applied loosely to maintain the PEG at the original depth of insertion which is charted in the endoscopic procedure note. Each PEG tube has a centimeter marker on the side. The general depth for most patients is between 3-6 centimeters. The depth of insertion should be recorded on the nursing assessment. If the depth marker is <3cm or > 6cm or there is tube feedings refluxing through the insertion site, feedings should be held and the physician notified immediately. Remember, a sudden change in PEG feeding tolerance accompanied by abdominal distention can indicate PEG tube migration or dislodgement.

## Duodenal Feeding Tubes in Children

### INFORMATION:

A. A nurse will not insert a nasogastric, orogastric, or duodenal tube if any of the following conditions are present:

1. Post-operative gastric, esophageal, or oropharyngeal surgery
2. Facial trauma with cribiform plate involvement
3. Basilar skull fractures
4. Documented current coagulopathy

B. The registered nurse will defer responsibility for the insertion of a nasogastric, orogastric or duodenal tube to the physician if it is determined that the insertion could jeopardize the patient's welfare.

### C. Procedure for Duodenal Tube Insertion

1. Verify Physician's order for placement of duodenal tube. If metoclopramide is ordered give 15 minutes prior to insertion.
2. Explain procedure to patient and/or family, if applicable.
3. Select appropriate tube based on patient size - available in 6fr, 8fr, 10fr.
4. Assemble following supplies: Duodenal tube Water-soluble lubricant 5ml Syringe with water (sterile water if less than 6 months of age or immunocompromised) Non-sterile gloves Tape
5. Wash hands and don gloves.
6. Flush duodenal tube with water to activate the internal lubricant for ease in removing stylette.
7. To facilitate proper insertion depth, place exit port of tube at tip of nose. Extend tube to earlobe, then to xiphoid process, then to the right costal margin at the mid-axillary line. Note centimeter marking on tube.
8. Place patient on right side if condition permits.
9. Apply lubricant to exit port, advance tube through nare until marked depth is reached.
10. Tape securely to upper lip.
11. Leave stylette in place (remove after verification by x-ray).

### D. Confirmation of Duodenal placement

1. Verification of duodenal tube position requires initial radiographic confirmation evaluated by a physician. If tube is not in the small bowel as confirmed by x-ray, then may attempt x 2. If tube continues to be in gastric position after both subsequent attempts, then document and notify physician.
2. Upon radiographic confirmation of placement in the small bowel, stylette is removed and feeding may be initiated.
- 3.. Document the placement of DT by indicating the cm marking at the nares in the nurse's note and on the patient's care plan. This documentation is required each time a feeding tube is inserted.
4. In order to detect tube displacement, the RN will determine if the tube is securely taped and in the same position as at initial placement, and document these findings each shift.
5. Once the duotube is placed in the patient and the stylette is removed, the nurse should never reinsert the stylette into the duodenal tube, since there is a possibility of perforation of the stomach or small bowel and endogenous contamination of the tube.

### E. Feeding Via Duodenal Tube

1. Verify Physician order for type of enteral formula.
2. Post-pyloric feeding tubes require continuous administration of formula. No bolus Feeds should be administered through post-pyloric tubes.

3. Administration sets (feeding bags, tubing) are to be changed every 24 hours to Diminish the possibility of pathogenic microbial contamination. Feeding bags should Not be rinsed since this can increase the chance of exogenous contamination.
  4. No more than 4 hours worth of formula should be placed in the feeding bag at one Time. Leaving formula in the bag for more than 4 hours increases the chance of Microbial growth and pathogenic contamination of the formula.
  5. Do Not Mix Blue Dye Into Formula
    - a. FD & C Blue No. 1 which has been used in enteral feeds to detect aspiration has been associated with several adverse events, including death; although a direct causal relationship has not been definitely established.
    - b. Other blue dyes, such as methylene blue and FD & C No. 2 may have similar or greater toxicity than Blue No. 1.
  6. Tube feedings that are not available as pre-mixed formulas must be prepared using aseptic technique in the Dietary Department.
- F. Prevention/Management of Tube Occlusion
1. Prior to touching the feeding tube or administration set:
    - a. Wash hands with soap and water or an alcohol-based hand rub for at least 10 seconds.
    - b. Use non-sterile, latex-free disposable gloves.
  2. If the continuous feeds are interrupted for any reason, flush feeding tube with 5-10 ml of water (sterile water should be used if patient is less than 6 months of age or patient if immunocompromised). Water instilled to flush catheter should be documented as intake.
  3. Some medications cause occlusions of duodenal feeding tubes. A nasogastric tube may be indicated for instillation of some medications.
  4. If the feeding tube becomes clogged, attempt unclogging with warm (not hot) water or carbonated beverage. Do NOT use meat tenderizer or enzyme preparations since they have been associated with tissue damage. Do NOT use undue force when attempting to unclog a feeding tube.
  5. To prevent rupture of the tube, use only a 50 ml syringe or larger to irrigate.
- G. Duotube Maintenance and Medication Administration
1. Prior to touching the duodenal tube or enteral feeding system:
    - a. Wash hands with an alcohol-based hand rub or soap and water.
    - b. Wear non-sterile, latex-free disposable gloves.
  2. To prevent rupture of the tube, vigorous pressure should not be used during flushing. Only a 50 ml or larger syringe should be used.
  3. Avoid combining multiple medications due to possible drug-drug interactions. Administer each drug separately and flush with water between each drug.
  4. When administering phenytoin enterally, hold tube feeding for one hour before and after the dose since formula alters the proper absorption of the drug.
  5. Do not enterally administer enteric-coated tablets, buccal or sublingual medication, or sustained-release medications.
  6. Some medications require the acidic medium of the stomach for proper absorption and should be administered only into the stomach, NOT into the small bowel:
    - a. Sucralfate
    - b. Antacids: Mylanta, Maalox
  7. Certain medications are more likely to clog the duodenal tube and should not be used by this route, such as Depakote sprinkles, and other medications with similar consistencies.



#### H. Strategies for Prevention of Aspiration

1. If reflux of duodenal feedings is suspected, the nurse may place a nasogastric tube to access gastric residual every 4 hours. If residual is more than two hours worth of a continuous feed, then hold feeds and notify the physician for further orders.
2. The physician should be notified of any interruption in feeding. Cessation of tube feedings should be clearly documented in the nurses notes.
3. Unless contraindicated by diagnosis, elevate the head of the bed 30-45 degrees during enteral feedings.

## **6. Nausea/Vomiting**

Pediatric trauma patients should be monitored for nausea and vomiting. Children frequently do not report nausea, or do so seconds before they vomit. Suction must always be ready. Pediatric trauma patients are at particular risk of aspiration from vomitus when spinal immobilization devices are in use. Trauma patients should have the head of the bed elevated to help reduce this risk. If spinal precautions are in place, the bed may be placed in reverse trendelenburg position. Gastric distention is also a sign of potential vomiting risk. Nasogastric or oral gastric tubes should be considered for these patients. Anti-emetics (Zofran 0.1mg/kg IV q 6 hrs PRN) may also be considered.

Any vomitus or gastric tube emesis should be observed for amount, color, type. Frequent or large amounts of emesis, bloody emesis, or increased abdominal pain after emesis should be reported to the pediatric surgery resident for further investigation. Consider potential need for volume resuscitation

#### **Nasogastric/Oral gastric Tube:**

- NG/OG tube placement will be considered if a patient has vomited multiple times, or has gastric distention and is at risk for vomiting.
- NG/OG tube drainage should be measured every 8 hours (per nursing practice guidelines).
- Assess skin around nose/mouth for breakdown every 12 hours. Clean site and re-tape if needed.
- ALWAYS VERIFY tube placement prior to instilling anything into the tube

## **7. Diarrhea**

Not all liquid stools constitute diarrhea. Diarrhea is defined as frequent loose stools and/or producing fluid/electrolyte abnormalities. The clinical objective is to identify and remove treatable causes of diarrhea. Medications are probably the most frequent cause of diarrhea. Diarrhea is probably the most frequent complication of enteral nutrition. Sometimes decreasing the rate and /or type of tube feeding will help. Oddly enough though, tube feeding is usually not the cause. Sorbitol containing medications are frequently to blame. Other drugs that produce diarrhea include prokinetic agents, oral macrolides, and cathartics. These medications should be eliminated when possible. Anti-diarrhea agents can be utilized if the problem persists.

*Clostridium difficile* colitis should be excluded or diagnosed and treated. Diarrhea may accompany a high-grade fecal impaction. Diarrhea may also be the only manifestation of intra-abdominal infection. Surgical resection of the small or large bowel (ileocecal valve in particular) may produce post-operative diarrhea. Diarrhea may follow resolution of pseudo-obstruction or surgical relief of a mechanical small bowel obstruction.

In general, treatment is defined by the cause. Medications should be changed/eliminated. Fecal impaction should be cleared. With the exception of *C. difficile* colitis, symptomatic relief can be provided with anti-diarrhea agents such as combinations of lomotil, immodium, paregoric, and narcotics. Consider volume and/or electrolyte replacement.

### *Clostridium difficile* (Pseudomembranous) Colitis

The Gram negative bacterium *Clostridium difficile* is part of the normal colonic flora in roughly 20-25% of patients. The bacteria exist in small numbers in balance with other colonic flora and do not cause any problems. Pseudomembranous colitis develops as a consequence of an overgrowth of *C. difficile* allowing for increased toxin production and mucosal damage. The major mechanism is antibiotic administration that alters/reduces colonic flora allowing room for increased growth of the drug resistant *C. difficile* bacterium. The disease can be produced by as little as one dose of antibiotics and most often follows single dose antimicrobial administration for perioperative prophylaxis. There is some data to suggest that mechanical bowel preparation/cleansing may produce the disease as well. The most frequent offending antimicrobials are cephalosporins (Rocephin), Clindamycin, ampicillin, and fluoroquinolones such as levaquin. The primary manifestation of the disease is diarrhea which may occur up to 14 days after the last antibiotic administration. Occasionally the patients will have abdominal pain and distention. Rarely they will present with or have constitutional symptoms such as fever and systemic toxicity that accompany the diarrhea and abdominal pain. The diarrhea associated with the disease is quite distinct. The frequent passage of small amounts of foul smelling liquid stools should raise clinical suspicion. The diagnosis is easily established by sending a stool specimen for toxin assay. Cultures are of no value because the bacteria are normal resident flora in many patients. First line therapy is metronidazole (flagyl) administered 7-10 days via the enteral route. Intravenous flagyl is effective for patients who will not tolerate the oral route. Vancomycin given enterally is reserved for patients who present with severe disease and/or fail on flagyl. Empiric therapy is appropriate after stool cultures have been obtained and can be stopped if the toxin assay is negative. Endoscopy to identify pseudomembranes is occasionally required to establish the diagnosis. Rarely, a patient will develop toxic megacolon and require emergent surgical intervention.

## **8. Constipation**

### **Definition**

1. Decrease in frequency of bowel movements compared to child's normal routine. Can also include the passage of hard, dry stools, with or without pain with passage.
2. Encopresis- occurs when there is a build up of stool in the colon and liquid fecal material is passed around it. Often the child will pass frequent smears of stool into underwear.

### **Causes**

There are multiple causes of constipation: low fiber diet, inadequate fluid intake, medications, surgery, sedentary lifestyle, anorectal malformations, Hirschsprung's, or idiopathic/functional.

### **Presentation**

Children can present with abdominal pain, (often mistaken for appendicitis), abdominal distension, or parents have noticed they do not have regular bowel movements or have significant straining and/or pain with bowel movements.

### **Physical Examination**

+/- generalized abdominal pain, distension

### **Radiology**

KUB- demonstrate stool in colon

### **Management**

- 1.) There are a variety of options for the management of constipation.
- 2.) Diet, Exercise, and OTC Fiber supplements should be tried first.
- 3.) Impaction removal to begin with is essential. Use Fleets enemas until return is clear.
- 4.) Once this is achieved, start with preventive measures.
- 5.) If this does not work or medical intervention necessary:

#### ***A. Enemas***

Best for children who are incontinent. Helps provide a daily cleanout to avoid accidents. They should be administered at the same time each day to "train" colon and allow child to get into a routine. Can also be used to help break up stool balls in acutely constipated children. For children btw 1-8 years or btw 35-65 lbs, they may use one pediatric phosphate enema per day. Children over 8 years old or over 65lbs may receive one adult phosphate enema daily.

#### ***B. Laxatives***

Best for continent children. Cathartic laxative- stimulates peristaltic activity. Examples include Little Tummy's, Ex-Lax, Fleets, Dulcolax, and MOM. Senokot also includes a stool softener. Osmotic laxatives- pull water into bowel causing it to stretch to trigger peristalsis. Examples include Miralax and Glycerin.

Children will often need to stay on a bowel regiment for a long time. Often times the amount of stimulant needed for bowel movements will vary in the beginning depending upon diet and activity. Encourage the family to find the best regiment that fits the child and then stay on it, even when child begins having regular bowel movements.

## **9. Total Parental Nutrition**

### Philosophy:

When starting TPN on a pediatric patient, it is begun at 1/3 of the target calories to avoid re-feeding too quickly. This method is a way to slowly obtain full caloric needs over a 3-4 day period. There are four things to consider when starting a child on TPN.

1. IV Rate
2. % Dextrose
3. % AA (protein)
4. Grams fat emulsion

### IV Rate

Glucose Concentration 1 Gram carbs = 3.4 cal

Protein Concentration 1 Gram fat = 9.0 cal

Lipid Delivery 1 Gram protein = 4.0 cal

### Maintenance IV Fluid Calculation

#### 1. 4-2-1 Rule

1st 10 kg = 100cc/kg/day or 4cc/kg/hour

2nd 10kg = 50cc/kg/day or 2cc/kg/hour

> 20kg = 20cc/kg/day or 1cc/kg/hour

\*\*If child is >40kg = Wt + 40cc = cc/hour

#### 2. Caloric Needs

Newborn	100 cal/kg/day
Toddler	80 cal/kg/day
Elem. Age	50-60 cal/kg/day
High Sch.	50 cal/kg/day
Adult	25-35 cal/kg/day

***Use the following chart to calculate TPN needs***

<b>Day</b>	<b>IV Rate</b>	<b>Dextrose conc.</b>	<b>Protein/AA Conc.</b>	<b>20% Lipid Delivery</b>
1	Maint	10	1%	1g/kg or 5cc/kg
2	Maint +1/2	12.5	2%	2g/kg or 10cc/kg
3-perip line	Maint +1/2	12.	3%	3g/kg or 15cc/kg
3-central line	Maint +1/2	15	3%	3g/kg

At day 3, calculate total non-protein cal/kg that the child is receiving:

\_\_\_\_\_cc Fat (x) 0.2 = grams of Fat (x) 9 = cal from fat

Total vol (x) % of dextrose = grams of dextrose (x) 3.4 = cal from dext.

### TPN Labs:

Labs drawn first 3 days child is on TPN, then back down to twice a week, typically on Monday and Thursday. If the child has a peripheral line, lab draws will be decreased.

## **10. Intakes and Outputs:**

- I & O's will not be measured unless specifically ordered by MD except for:
  1. I & O's will be measured when a patient is on IV therapy.
  2. I & O's will be measured after discontinuing a foley catheter until patient voids.
  3. I & O's will be measured on patients that are on tube feedings.

### **Foley Catheter:**

- RN must have MD order for foley catheter to be initiated.
- Foley catheter will be assessed for kinks and emptied every 4 hours.
- Foley catheter will be discontinued the night before discharge.
  1. Unless patient is to be discharged with foley catheter in place.
- In and Out catheterization may be carried out by RN if patient has not voided 6-8 hours after foley catheter has been discontinued. RN may repeat in and out catheterization a second time. If patient has 400cc's or more of urine out with catheterization, RN will place catheter and notify MD.
- Foley catheter care will be completed with bath every day and more often as needed.

## **11. Potential Sites of Infection**

**Pneumonia:** (The most common nosocomial infection in the ICU). Risk factors include prolonged intubation, chest trauma and ARDS. Pathogens commonly found include: gram negative enteric organisms (Hemophilus, Pseudomonas, and Enterobacter) and/or gram positive organisms (Enterococcus, other strep species and Staphylococcus aureus).

**Urinary Tract Infection:** Pathogens commonly found include: E. coli, Enterococcus, Klebsiella, Pseudomonas, Enterobacter, Proteus and Candida species.

**Wound Infection:** The wound may be erythematous with or without purulent drainage, or subcutaneous crepitus. A surgical wound infection may not be clinically apparent until 5 to 7 days post-operatively.

**Vascular Catheter Related Infection:** The risk of line infection increases with the length of time the vascular cannula has been in place.

**Sinusitis:** The risk factors include: nasogastric tube, nasotracheal tube, nasal packing, facial fractures, recumbent positions, and high dose steroids.

**Intraabdominal Infection:** The risk factors include: peritoneal contamination by GI contents, ascites, or presence of intraabdominal hematoma. If a patient develops bacteremia with Klebsiella, Enterobacter, E. coli, B fragilis, or Enterococci species, an intraabdominal source should be considered and investigated.

**Acalculous Cholecystitis:** Any critically ill patient is at risk. Contributing factors include: opiates, fasting, TPN and shock.

**Empyema:** The risk factors include: pneumothorax, hemothorax, penetrating chest trauma, unrecognized diaphragmatic perforation and pneumonia.

**Tracheitis:** Usually associated with tracheal intubation. Manifestations may include foul smelling purulent tracheal secretions.

**Fungal Infection:** This is usually seen in immunocompromised patients or in patients who have been critically ill for a prolonged period of time and have been on extended courses of broad spectrum antibiotics.

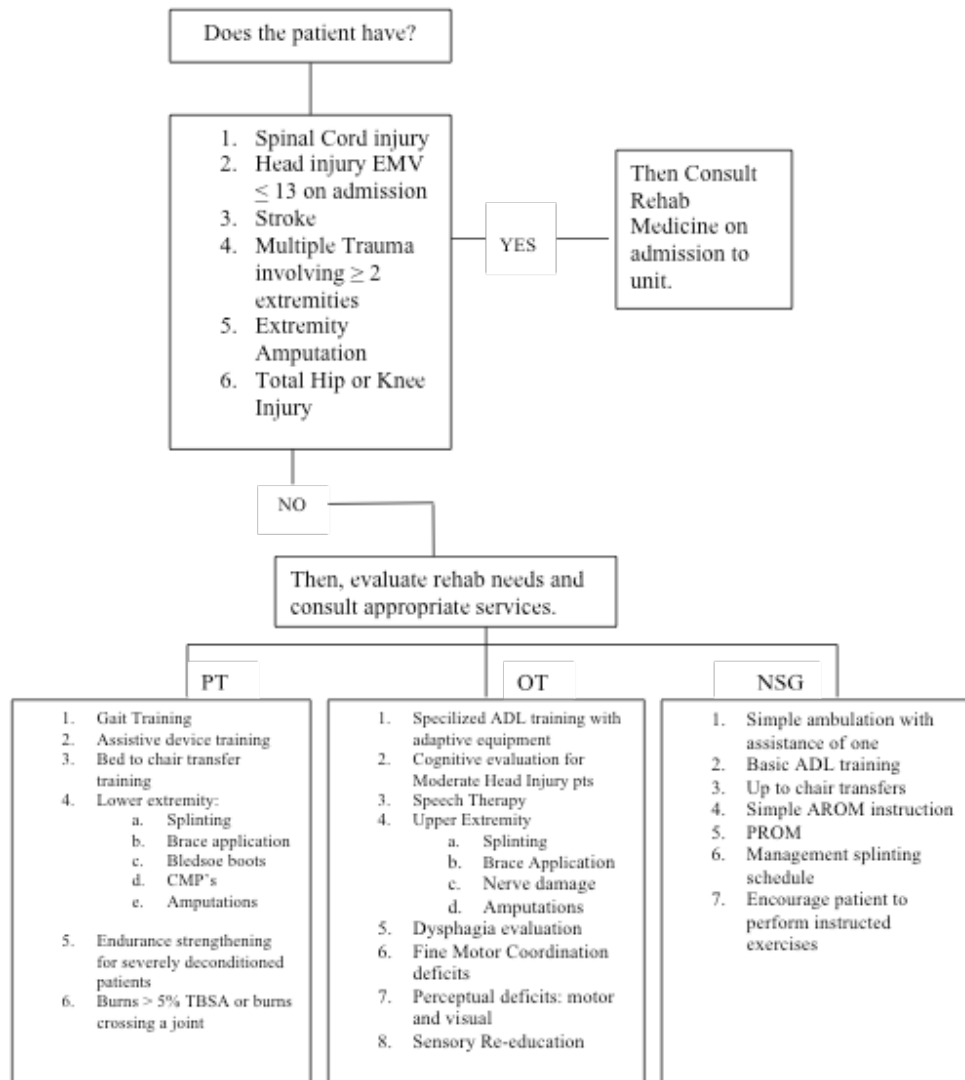
**Vascular Grafts:** Manifestations of vascular graft related infections include: wound drainage, wound infection, graft thrombosis, septic emboli and pseudoaneurysm.

**Endocarditis:** Central venous catheters can be an etiologic factor. Common pathogens include: Staphylococcus and Streptococcus.

**Mediastinitis:** Can be seen after surgical procedures performed through a median sternotomy and with injuries to the aerodigestive tract.

**Central Nervous System Infection:** The risk factors include CSF leak (following craniotomy or basilar skull fracture), craniotomy, intraventricular catheter or penetrating spinal cord injury.

**UK Trauma Service**  
**Rehabilitation Management Protocol**  
 (Needs to be initiated within 3 days)  
 10/08



## Section 6: Discharge Instructions

### D/C Home:

Please be thinking ahead of time on patient's D/C home plans. Please inform the bedside RN of D/C plans so home care instructions can be completed. If the pt. needs home health or home equipment, please contact Stephanie Bellis on UK pager 3597 for this before the day of D/C. Stephanie will contact you if written prescriptions for any of the requested Home Health/DME orders are needed. On the weekends, the weekend social worker can set up Home Health; the patients do not need to be kept over the weekend for home health needs only.

Next, complete the following:

1. Complete the UK Discharge Orders
2. Controlled substance prescriptions must be written on a separate (green) prescription pad. Record type and amount of any controlled substance prescription on the white medical record copy, of form H341, in order to have documentation of all meds given to pt. at D/C
3. Consider need for information booklet regarding Acute Stress Disorder/Post Traumatic Stress Disorder. Give to patient/family prior to discharge if needed.
4. Make sure the need for all f/u appointments have been documented and explained to the patient and family.
5. Complete the discharge sheet in the front of every chart. A referring physician must be specified. A detailed history of the hospital course must be documented. The hospital course may not say, "See Dictation". These sheets are faxed to the referring physician on the day of discharge.
6. Write "D/C to home" order in routine MD orders
7. Complete an automated D/C summary\*

\*For patients who live out-of-state, you will need to do a **STAT** D/C summary to send with the patient in case they can find a local MD to provide their follow-up care.



## **Inter-Facility Transfers:**

**Such as to: Acute Rehab, Subacute Rehab, ECF, or Hospital to Hospital**

The Pediatric Social Worker can assist you with most inter-facility transfers. If you suspect the child will need some type of placement, contact the Social Worker on pager 330-7421. Inform the patient and family that there may be rehabilitation needs and that our Social Worker and/or Rehab Services will come by to talk with them. Please never tell a patient/family we will send them to a specific place (such as Cardinal Hill). Many factors need to be looked at before a pt. can go to a facility and not all patients are candidates for CHH.

Some patients may need emergent transfer to Shriner's Pediatric Burn Hospital. In these cases, the receiving facility should be contacted directly to confirm bed availability and to contact a receiving physician. Direct physician to physician contact should be made by the referring chief resident or attending physician with the receiving physician prior to transfer of the patient. Adequate airway management, IV access, hemodynamic stability, and pain control should be established prior to transfer. The mode of transport will be decided by the referring attending physician.

Patient report should be called to the receiving facility by the patient care nurse. Copies of all pertinent paperwork, lab values, and radiology studies should be sent to the receiving facility with the patient.

## **SUBJECT: Palliative Care Guidelines for Nursing**

### **INFORMATION:**

#### **A. Physical Care**

1. Patient will have a Do Not Resuscitate (DNR) order entered into Sunrise Clinical Manager (SCM) by the Attending Physician. (HP06-17)
2. Vital Signs may be limited to respiratory rate every shift unless orders are entered into SCM for specific parameters that will result in a change in the patient's care or unless blood products are administered. If blood products are administered vital signs will be documented per blood Bank Policy (HP08-21).
3. Pain/comfort levels and response to comfort measures will be assessed and documented hourly.
4. Oxygen may be administered without use of pulse oximetry and may be titrated for the patient's comfort within the range sets by the M D (i.e. administer O2 at 2L per minute per via Nasal Cannula, may increase as necessary up to 5L per minute or O2-2L-4L per minute via nasal cannula, adjust rate as necessary to keep patient comfortable).
5. Laboratory testing will be performed only when there is an associated treatment that will enhance the patient's comfort level.
6. Documentation of output may be limited to diaper or voiding counts rather than strict measurements.
7. Patient may have diet as desired or as tolerated.

#### **B. Psychosocial Care**

1. A private room should be chosen for patient placement.
2. The patient and family may have visitors around the clock if desired.
3. Child Life, Social Services, Chaplain, or others chosen by the patient/family should be contacted for emotional support with permission from the patient/family.
4. Pet Therapy may be observed per Kentucky Children's Hospital policy CH 10-03.

## **SUBJECT: Diagnosis of Death**

### **INFORMATION**

In order to ensure appropriate patient care and abide by KRS 446.400 as it defines and applies to a patient's death, staff physicians of the University of Kentucky Hospital should follow these established guidelines in determining death.

### **Ordinary Circumstances**

In ordinary circumstances, the signs of death are:

1. Unresponsiveness,
2. Absence of pulse and heartbeat,
3. Absence of spontaneous respiratory movement and all other movement, and
4. Absence of reflexes.

### **Cerebral Death**

Cerebral death is defined as the absence of cortical and brain stem function. Certification of signs of cerebral death shall be attested to and documented by a member of the active medical staff.

### **Diagnostic Clinical Criteria of Cerebral Death**

Currently acceptable clinical criteria for determination of cerebral death in the presence of cardiac activity and relatively normal blood pressure, whether or not artificial means are used to maintain the circulation of oxygenated blood, include:

1. Absence of hypothermia (body temperature  $32^{\circ}\text{C}$ ), neuromuscular blockade, shock, significant levels of sedative and central nervous system depressants in the patient's serum (e.g., Phenobarbital, benzodiazepines), and severe metabolic disturbance (e.g., hyperosmolar coma, hepatic encephalopathy).
2. Cerebral unconsciousness and motor unresponsiveness to stimuli which are normally intensely painful. True decerebrate or decorticate posturing or seizures are inconsistent with the diagnosis of cerebral death.
3. Absence of spontaneous movements for an observation period of at least one hour, except for spinal reflex activity.
4. Absence of reflexes which involve cranial nerves. The pupils must be fixed at midpoint or larger in diameter and nonreactive to sharp changes in the intensity of incipient light. No ocular responses or eye movements to head turning or irrigation of ear with ice water.
5. Absence of corneal reflexes.
6. No gag, cough, or retching reflex in response to bronchial stimulation with suction catheter.
7. No respiratory movements when the patient is disconnected from the mechanical ventilator. Adequate testing for apnea is very important. An accepted method is ventilation with pure oxygen for a 10-minute period before withdrawal of the ventilator, followed by passive flow oxygen. A 10-minute period of apnea is sufficient to attain hypercarbia (60 Torr or greater) which adequately stimulates a respiratory effort. Testing of arterial blood gases can be used to confirm this level. Any spontaneous breathing efforts indicates that part of the brainstem is functioning and that the patient is not brain dead.

In the absence of confirmatory tests, the seven conditions described above must persist unchanged for at least six (6) hours. A confirmatory test may shorten the observation period.

### **Confirmatory Testing for Determination of Cerebral Death**

An additional confirmatory test is recommended for determination of cerebral death a) when the preceding reflexes cannot be adequately assessed and documented or b) in children under the age of five.

Currently acceptable confirmatory tests performed under a staff physician with appropriate privileges include:

1. Angiography, which reveals absence of cerebral circulation.
2. Cerebral nuclear scan, which demonstrates absence of cerebral circulation.
3. Transcranial doppler study, which demonstrates absence of cerebral circulation.

Angiography, cerebral nuclear scan, or a transcranial doppler study which demonstrates the absence of cerebral circulation is a definitive test of cerebral death. A waiting period is not required.

4. An EEG, which demonstrates isoelectric activity, provided that severe hypothermia, neuromuscular blockade, shock, significant levels of sedative or central nervous system depressants, or severe metabolic disturbance are absent. A waiting period is recommended when EEG is used a confirmatory test (See Special Circumstances below).

### **Special Circumstances**

- In cases of anoxic brain death, with demonstrated electrocerebral (EEG) silence but without radiologic, nuclear scan, or doppler demonstration of absence of cerebral circulation, a six-hour period of observation and repeat examination, excluding apnea testing, is required.
- In cases of children under the age of one year, where absence of cerebral circulation has not been demonstrated, a 72-hour period of observation and demonstrated isoelectric activity on EEG at the end of the observation period is required.
- In cases of children age one through five, where absence of cerebral circulation has not be demonstrated, a 24-hour period of observation and demonstrated isoelectric activity on EEG at the end of the observation period is required.
- In cases of gross anatomical brain injury, the period of observation for the persistence of clinical criteria for cerebral death may be reduced to one hour. Gross anatomical brain damage may be appropriately assessed by physical examination or craniotomy or by cranial MRI or CT studies, interpreted by a staff radiologist, that indicate that the brain is irreparably damaged, extruded, divided, or destroyed.

### **Pronouncing Death**

In all cases, the patient's physician will arrive within one hour to pronounce a patient dead.

Notification of death must be provided to Admitting within one hour of pronouncement of death.

**Pronouncing Death in Cases in Which Artificial Ventilation is Employed**

In cases in which artificial ventilation is employed, the fact of death and the presumptive cause of death should be determined by scientific evidence which, in the opinion of the physicians making the determination, is current, acceptable, and adequate to demonstrate irreversible cessation of cerebral and brain stem function.

The pronouncement of death in these cases will be made on the basis of the foregoing criteria by no fewer than two active medical staff physicians, one of whom may include the attending physician interpreting the confirmatory test. The time of death will be determined by the physicians who attend the patient death or, if none, by the physicians who certify the death.

When possible, the surrogate or legally responsible family member(s) will be informed before cessation of artificial ventilation.

**Organ Donation**

In the case of potential organ donors:

- All criteria of HP06-27, Organ and Tissue Procurement for Transplantation, must be met.
- Legally responsible family member or designated health care surrogate must provide witnessed informed consent for specific donation.

The two physicians determining death must not be involved in determining the suitability of the donor and must not be members of the surgical team performing the transplant.

## **Notification of Coroner and Release of Medical Information/Specimens**

### **INFORMATION and INSTRUCTIONS**

#### **Conditions That Require Notification of Coroner**

"Coroner's case" means a case in which the coroner has reasonable cause for believing that the death of a human being within their county was not natural (homicide, suicide, accident, under suspicious circumstances) or poses a threat to the public health.

According to KRS 72.020 and KRS 72.025, the attending physician, designee, or any person finding or having possession of the body of any deceased person must notify the coroner whenever the death:

- appears to be caused by homicide or violence.
- appears to be the result of suicide.
- appears to be caused by drugs or poisons in the body.
- appears to result from a motor vehicle accident in which the operator of the motor vehicle left the scene of the accident or in which the body was found in or near a roadway or railroad.
- occurs during a motor vehicle accident and an external examination of the body reveals no lethal traumatic injury.
- occurs while the person is in a state mental institution or hospital and there is no previous medical history to explain the death.
- occurs while the person is in a penal institution or otherwise in police custody, except pursuant to a death sentence.
- appears to be caused by fire or explosion.
- appears to be caused by physical abuse, including when the death of a child appears to indicate child abuse prior to the death.
- appears to be caused by drowning.
- occurs as a result of an accident.
- appears to be caused by sudden infant death syndrome.
- occurs at the work site when industrial toxics may have contributed to the cause of death or when there is no apparent cause of death.
- is sudden and unexplained.
- human skeletal remains are found.
- a person under the age of 40 dies and there is no medical history to explain the death.
- the body is to be cremated and there is no medical history to explain the death.
- the decedent is not under the care of a licensed physician and there is no medical history to explain the death.
- when post-mortem decomposition of a human corpse exists to the extent that external examination of the corpse cannot rule out injury or where the circumstances of death cannot rule out the commission of a crime.
- when the manner of death appears to be other than natural.

In recognition of an Attorney General's Opinion (OAG 62-964), University of Kentucky Hospital also requires that:

- Deaths that occur in the operating room or PACU in which the operation was necessitated by violence -- accidental or otherwise -- be reported to the coroner.

## **Notification of Coroner and Release of Medical Information/Specimens**

### **Instructions for Notifying the Coroner**

The law places responsibility for reporting to the coroner the types of death listed above with the attending physician. As a result, University of Kentucky Hospital requires that:

1. The attending physician will
  - a. determine whether each death is a coroner's case,
  - b. notify the coroner and document the notification in the appropriate section of the Notification of Death form, if death is determined to be a coroner's case,
  - c. complete and sign the Notification of Death form and submit it to Admitting within one hour of time of death.
2. The admitting clerk will verify that the coroner has been contacted when the Admitting Department receives the Notification of Death certificate on a coroner's case. (The Capacity Command Center fulfills the role of Admitting when Admitting is closed.)

*Note: If "coroner's case" is checked in the Notification of Death section and the Coroner/Medical Examiner Section has not been completed and signed, the admitting clerk will contact the coroner immediately. The coroner should be called in any case in which doubt exists as to whether the death represents a "coroner's case."*

### **Releasing Information and Specimens to the Coroner**

In accordance with KRS 72.415, University of Kentucky Hospital does not require written permission to release medical information, specimens, objects, clothing, or other evidence concerning a coroner's case to the coroner. When patient information is copied from the medical record, however, Medical Records or other Hospital personnel who prepare the information or pull the files, specimens, objects, clothing, or other evidence must document coroner receipt on form J100, Record of Possession of Medico-Legal Specimens, and file the form in the administration section of the patient's permanent medical record.

- During regular business hours, the coroner should contact Medical Records to request medical information or other requested items needed for a coroner's investigation.
- After regular business hours, the coroner should contact the Emergency Department or Admitting to obtain medical information needed for a coroner's investigation.
- The coroner should contact Clinical Lab's Special Chemistry department to obtain specimens needed for investigations (24 hours a day).

The staff member who releases medical information, specimens, objects, clothing, or other evidence to the coroner will document the release.

Disclosures of protected health information are included in HP05-37, Accounting and Tracking Disclosures of Protected Health Information per HIPAA.

## **Organ and Tissue Procurement for Transplantation**

### **INFORMATION**

Federal and state legislation requires hospitals to consider every death as a potential organ or tissue donation. These laws also require that families be given the opportunity to donate. The families should be approached with discretion and sensitivity as appropriate to the circumstances, beliefs, and desires of the family and potential donor.

As a result, it is the duty of each physician at University of Kentucky Hospital to facilitate the procurement of organs and tissue for transplantation whenever possible in cases in which the patient has died or death is imminent. Organ donor maintenance and organ recovery take place in accordance with Hospital policy and Kentucky Organ Donor Affiliates (KODA) procedures. KODA is designated as an organ procurement agency by the Health Care Financing Administration in compliance with section 372 of the Public Health Service Act.

All Hospital personnel shall make an effort to convey to the attending physician any known intent of any hospitalized patient to make a donation of all or part of the body.

*Note: The attending physician or another physician designated by the attending physician will make the declaration of death in accordance with recognized criteria*

*(see Hospital policy, Diagnosis of Death).*

### **INSTRUCTIONS**

1. Whenever a patient has died or death is imminent, the attending physician, another physician designated by the attending physician, or the nurse shall notify Kentucky Organ Donor Affiliates (KODA) immediately. Imminent deaths should be referred to KODA after determining the Glasgow coma score is equal to or less than 4 or if for a severely brain injured patient's further care is determined to be futile; and prior to discontinuing ventilation or life-sustaining treatments when the decision is made to downgrade, withhold, or withdraw care. KODA will evaluate the patient for suitability of donation. Only a KODA representative or a designated requester trained by KODA, in collaboration with the health care staff, may speak with the family about the option to donate or deny organ donation. KODA will participate in approaching the family to discuss the option to donate or deny organ donation, and will document the family's decision. KODA will also assist with family counseling. If the patient is determined to be suitable for donation the Hospital will work with KODA to maintain the potential donor while the necessary testing and placement of organs, tissues, and eyes takes place.

The local KODA telephone number is 278-3492; the 24-hour number is (800) 525-3456 or (866) 206-9250.

2. The attending physician, physician designee, or the nurse shall document on the Provisional Report of Death form that KODA has been contacted, including the name of the KODA coordinator, if the patient is suitable for donation, and the name of the family member 2 -- HP06-27, Organ and Tissue Procurement for Transplantation approached with their decision. The Provisional Report of Death form shall be filed in the patient's medical record.



3. All cardiac standstill deaths (i.e., when artificial respiration and circulation are not maintained and there is an irreversible cessation of spontaneous respiration and circulation) will be referred to KODA by the attending physician, the physician designee, or the nurse. KODA will obtain information about the deceased from the caller and determine if the patient is suitable for tissue donation. If the patient is suitable, as determined by KODA, KODA may direct the caller to contact a Hospital staff member who is trained as a designated requester to offer the family tissue donation (corneas, eyes, skin, bone, veins, and heart valves). If the family desires donation or wants more information the caller will contact KODA to speak with the family. The trained designated requester's name will be documented in the medical record or the provisional report of death.

4. When a staff member informs KODA of a potential organ/tissue/eye donor they should report the patient's name, age, reason for hospitalization, and medical/social history; they should also have the patient's medical record available in order to provide any additional information as appropriate.

5. If the patient is considered an organ/tissue/eye donor, the designated requester or KODA coordinator will obtain written consent for donation, using the Kentucky Organ Donor Affiliates/Lion's Eye Bank Authorization for Removal of Anatomical Gifts form. If the family is not present at the Hospital, KODA may obtain a recorded consent from the next-of-kin. KODA will provide the Hospital a copy of the recorded consent transcript or a written consent for the medical record. Kentucky Revised Statutes recognizes the following order of consent for authorization of donation of organs for transplantation:

**Section I of KRS 311.175**

Authorized donor designation, listed in KRS 311.175, which allows a signed donor card, authorization through the donor registry, or the first person consent.

**Section II of KRS 311.175**

- a. patient
- b. spouse
- c. adult daughter or son
- d. either parent
- e. adult brother or sister
- f. guardian at the time of the patient's death
- g. any other person authorized or under obligation to dispose of the body

If there is actual notice that the patient or a member of a prior class opposes donation, the donation shall not be accepted.

Two witnesses should confirm the next-of-kin consent by signing the witness attestation on the Kentucky Organ Donor Affiliates/Lion's Eye Bank Authorization for Removal of Anatomical Gifts form.

The original copy of the authorization form should be filed in the medical record.

6. The KODA coordinator can write all medication and patient care orders in accordance with established guidelines and protocols for the care of the donor patient.

- a. The name and title "KODA coordinator" shall be documented in the body of the order, not in the physician's signature space.
- b. Pharmacy shall dispense medications upon the written order of the KODA coordinator.
- c. All orders will be implemented by the nursing staff upon the

written order of the KODA coordinator.

d. The medication orders written by the KODA coordinator shall be countersigned by the transplant physician at the time of the organ recovery, or within 24 hours of the time the orders were written.

