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SUNY UPSTATE UNIVERSITY HOSPITAL & GOLISANO CHILDREN’S HOSPITAL
ADULT & PEDIATRIC TRAUMA MANUAL
Version 4

PURPOSE AND GOALS

Trauma care involves the entire spectrum of care from the first responder thru rehabilitation. The successful outcome of a resuscitation of a seriously injured patient is determined by the skill levels of many health care providers and their ability to function in as a team.

The Trauma Service at Upstate University Hospital, consists of both a Level I Adult and Level I Pediatric trauma program. These programs work synergistically to provide comprehensive trauma care for all ages. As the only Level I center in Central New York, our responsibility is to support the entire CNY Trauma Region. The new electronic version will allow us to provide updates regarding treatments and procedures quickly as new data becomes available. This document will be used to disseminate new information rapidly and directly to the provider.

This manual was written to accomplish the following goals:

A. Improve the delivery of resuscitation care to the trauma patient.
B. Support CNY regional hospitals, EMS providers, and trauma centers with education and provide guidelines for patient care.
C. Aid in the appropriate utilization of available resources.
D. Orient of SUNY Upstate residents and medical students to the care of the trauma patient
E. Optimize the teamwork of the resuscitation team (surgeons, emergency medicine physicians, nurses and ancillary departments).
F. Provide a “model” system of resuscitation for other regional trauma programs.

The guidelines in this manual are “suggestions” based on the current literature and expert opinion. These guidelines represent one approach to the care of the trauma patient. Individual skills, judgment and current best practices should be considered when choosing a course of treatment. The approach to each patient will vary to fit the needs of the individual patient and the available resources of the Trauma Team.

The content of this manual will be reviewed bi-annually and with any critical new treatments by the Trauma Executive Committee (TEC) of Upstate University Hospital. Updates will be communicated to thru established channels at Upstate and via the Regional Trauma Advisory Committee (RTAC) and the CNY Regional Medical Advisory Committee (REMAC).
OPERATIONAL GUIDELINES: DAILY EXPECTATIONS OF THE RESIDENTS ON THE TRAUMA SERVICE

OBJECTIVES:

1. Define the expectations of the residents assigned to the trauma team.
2. Define the daily “routine” of the trauma service.
3. Provide information to promote effective communications among the trauma team members.

GUIDELINES:

1. The responsible Attendings on the trauma service for the academic year 2013-2014 are:

   a. Dr. James Gregory
      Phone – 464-4776
      Assistant – 464-4776
      Pager - 213-0113

   b. Dr. Robert Cooney
      Phone – 464-5549
      Assistant – 464-5549
      Pager – 467-3754

   c. Dr. Moustafa Hassan
      Phone – 464-4776
      Assistant – 464-4776
      Pager – 467-1188

   d. Dr. Fahd Ali
      Phone – 464-4776
      Assistant – 464-4776
      Pager - 467-1532

   e. Dr. Joan Dolinak
      Phone – 464-4776
      Assistant – 464-4776
      Pager - 213-0245
f. Dr. Tamer Ahmed

Phone – 464-2878
Assistant – 464-4776
Pager - 213-0801


g. Dr. Andreas Meier

Phone – 464-2878
Assistant – 464-4776
Pager - 213-0801


h. Dr. Kim Wallenstein

Phone – 464-2878
Assistant – 464-4776
Pager - 213-0565


2. For the purpose of appropriate supervision, the management of all patients will be a collaborative effort between the Attendings and Residents. The Attendings are ultimately responsible for all actions of the trauma team and must be informed of all major activities occurring on the service. See protocol on “Notification of the Attending.”

3. Attending schedule (see printed schedule):
   a. A full-time Attending will be assigned to conduct daily rounds Monday through Friday. This Attending will cover all Trauma resuscitations during the hours of 0700 to 1700 Monday through Friday.
   b. Weekend daily rounding coverage will be by the surgeon on-call the night before. The covering surgeon assigned to trauma call will see admissions that occur at night or on weekends when a full-time trauma attending is not on-call.
      i. The covering surgeon must respond to the trauma room within 15 minutes of the arrival of the patient designated as a Level I trauma patient.
      ii. Level II trauma patients must be seen by an attending within 16 hours of admission to the hospital.
      iii. On Wednesday during resident education conferences, the Attending trauma surgeon on-call, an Emergency Medicine Attending, the Trauma Nurse Practitioner and ACS Nurse Practitioner will respond to all traumas. Trauma consults will be seen by the Trauma Attending or NP. The Adult and Pediatric Trauma surgeons on-call will provide back-up to each other during this time.
      iv. At rounds, on the day following admission, the full-time rounding trauma surgeon will assume primary care of patients who were seen by a covering surgeon (at night or on a weekend day). All patients admitted to the Trauma Service will be the responsibility of the rounding trauma surgeon.
4. Rounds
   a. Rounds will begin promptly at 0800 on the 8th floor in 8800 with the trauma service resident, NP and the trauma attending. Review of the patient list and all new x-rays will occur at this time.
   b. On Wednesdays, the residents are expected to pre-round on all patients. They then are expected to report to the educational program of the Department of Surgery by 0700. The Trauma Attending will then round with the NP after M&M.
   c. Rounds will start at an alternative agreed upon time on weekends. This will be agreed upon by the residents and attending prior to the weekend.
   d. All patients will have been seen and examined by a physician/physician extender prior to rounds and their “Daily Action Plans” will be established.
   e. Complicated or unstable patients should be discussed with the chief resident prior to rounds.
   f. All notes, (including those for patients in the ICU) should be written.
   g. The chief resident is the facilitator for the rounds.
   h. The critical care resident will present all patients in the ICU who are hemodynamically unstable or are still undergoing resuscitation.
   i. Presentations will consist of the following:
      i. Review of injuries and significant surgical and medical interventions since admission
      ii. Review of any changes in medical conditions or therapeutic interventions over the past 24 hours
      iii. Any changes in the ROS in the past 24 hours
      iv. Vital signs including measurements from invasive monitoring, ventilator settings, blood gases
      v. Physical exam
      vi. Current medications
      vii. Laboratory and x-ray data
      viii. Assessment and plan for each relevant body system.
   j. Notes need to be signed, dated, and timed. Medical student notes do not count as the sole note on the chart. Resident notes cannot consist solely of brief annotations or “as above” to the student note. In general, if the medical students are writing the bulk of the progress note, they should not sign them.
   k. Family members will be advised of a summary of the patient’s condition at the end of rounds.
   l. At the end of each patient visit, a plan of action and expectations should be clearly established.
   m. All pertinent x-rays will be reviewed before or after rounds.
   n. Rounds by the resident staff will be conducted in the late afternoon (weekdays) on all ICU patients. The resident team will make non-holiday weekday pre-sign out afternoon rounds on all patients to review test/study results and the events of the day.
   o. Tertiary Exam forms should be completed 24 hours after admission when all initial diagnostic studies are finalized. The senior trauma resident should ensure this is completed.
5. Sign-out
   a. Appropriate information should be conveyed to the on-call covering team every evening, including:
      i. Ongoing resuscitations in the trauma room.
      ii. The condition and clinical plan for all ICU patients.
      iii. Any studies or patients that require review while the on-call team is covering.
   b. On-call teams should convey the same information to the trauma team in the morning for all trauma activities that have occurred during the night.

6. Operative cases:
   a. A resident assigned by the senior resident on the service should cover all cases on the Trauma Service. In general, the Trauma resident will not scrub on non-trauma cases.
   b. The resident scrubbing in on the case should be familiar with the patient and the important aspects of each case, including:
      i. Disease process and pathophysiology
      ii. Operative approach and alternatives.
      iii. Potential complications.
      iv. Appropriate follow-up.
   c. The attending and resident should clarify the responsibilities for dictation before the end of the case.

7. Students
   a. Students are welcome on the trauma services.
   b. Students should be assigned specific patients to follow.
   c. Students should be assigned to all operative procedures (if available).
   d. Students are expected to present the progress of their assigned patients on daily rounds.
   e. Students will be asked to make a very short evidenced-based presentation based on a pertinent question that they have developed in the first few days on service.

8. Conferences
   a. The residents are expected to attend all required educational conferences. The on call Trauma Attending will cover during these times (see resident handbook).
   b. The senior resident will develop a list of M&M's based on their observations as well as the list given to them by the Trauma Program Managers. This list will be reviewed with the trauma director to make sure that all identified complications are educationally relevant.
   c. The chief resident will be expected to attend the monthly Trauma Multidisciplinary conference and the monthly Trauma QI conference.
9. Clinics
   a. The trauma clinic will meet at 12:30 PM on specified days (currently meeting on Thursday).
   b. All residents are expected to attend. If you have other responsibilities at the time, please notify the trauma attending. Please be prompt.
   c. Patients will be placed in rooms and the charts will be available at the front desk. If a resident has operated on a patient, then he/she should see the patient in follow-up.
   d. After seeing the patient, the resident/student should discuss the case with the attending and document the visit and plan in the medical record.

10. Documentation
    a. Please write legibly!!!
    b. Use pre-printed trauma H&P’s.
    c. Documentation of all procedures and patient encounters is expected. Any time you examine a patient or review a diagnostic exam: write or dictate a note.
    d. All procedures other than Foley’s, NGT’s, basic dressing changes and PIC’s should be dictated. If in doubt dictate.
    e. Document discharge condition, prescriptions, and follow-up at time of discharge. Please use standardized discharge sheet.
    f. If you see a patient in the ED who is subsequently discharged from the ED, you must dictate a “Consult Note.”

11. Quality Improvement
    a. If there are identified issues in trauma process or protocol, please bring them to the attention of the Trauma Medical Directors, Trauma Quality Coordinator or Trauma Program Manager as quickly as possible.
    b. Please cooperate in all quality improvement initiatives as they are developed.

12. Some hints:
    a. You represent SUNY Upstate, the Department of Surgery, the Division of Acute Care Surgery, and the Trauma Program – be courteous, and sensitive to the feelings of all with whom you come in contact. Aggressive, un-civil behavior will not be tolerated!
    b. Show interest in your work.
    c. If you have questions about patient management, ASK!!!!

If you would like feedback about your performance, please feel free to ask the trauma attendings or your more senior residents.
## Operational Guidelines: Categorization of the Trauma Patient – Trauma Code Tier System

**CM T-28 Trauma Code Criteria**


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<th>Level II Trauma Criteria:</th>
<th>Consult Criteria:</th>
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<td><strong>All Ages</strong></td>
<td>Trauma Patients with any of the following and who do not meet Level I:</td>
<td>Trauma Patients with any of the following and who do not meet Level I or Level II:</td>
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<td><strong>Airway:</strong></td>
<td>● Open or depressed Skull fracture-blunt trauma</td>
<td>● Falls over 10 feet</td>
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<td>● Intubated/assisted ventilation</td>
<td>● Suspected spine or spinal cord injury</td>
<td>● Crash speed over 20 mph</td>
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<td><strong>Breathing:</strong></td>
<td>● Bilateral femur fractures</td>
<td>● Passenger ejected from vehicle</td>
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<td>● Respiratory Arrest</td>
<td>● Pelvic fracture</td>
<td>● Vehicle roll-over</td>
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<td>● Respiratory distress(ineffective respiratory effort, stridor or grunting)</td>
<td>● Suspected airway injury from facial burns, chemical or smoke inhalation</td>
<td>● Death or severe injury of same car occupant</td>
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<td><strong>Respiratory Rate:</strong></td>
<td>● Complete/partial amputation or de-gloving above wrist or above ankle</td>
<td>● Pedestrian struck at 20 mph or greater</td>
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<tr>
<td>0 through 5 months of age: RR&lt;20</td>
<td>● Deep penetrating injuries above elbow or above knee</td>
<td>● Prolonged extrication&gt;20 min</td>
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<tr>
<td>6 months through 12 yrs of age: RR&lt;16</td>
<td>● Significant, blunt maxillofacial trauma</td>
<td>● Passenger Compartment invaded&gt;12 inches</td>
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<tr>
<td>&gt;= 13 yrs of age: RR&lt;12</td>
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<td>● Injured patient needing admission to non-surgical service</td>
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<td><strong>Circulation:</strong></td>
<td><strong>Neurological:</strong> ● GCS &lt;=12</td>
<td><strong>Anatomic Diagnosis:</strong> ● Penetrating injury to head, neck, torso, groin</td>
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<td>● Clinical signs of shock</td>
<td>● Flail Chest</td>
<td>● Open chest wound</td>
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<td>(Pale, cold; clammy; tachycardia with weak pulses; capillary refill&gt;3 sec assuming a warm environment)</td>
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<td>● Penetrating injury to head, neck, torso, groin</td>
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<td>● Patients who are receiving blood</td>
<td>● Open chest wound</td>
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<tr>
<td>0 through 5 months of age: Sys BP &lt;60</td>
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<td>● Flail Chest</td>
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<tr>
<td>6 months through 5 yrs of age: Sys BP &lt;70</td>
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<td>● Open chest wound</td>
</tr>
<tr>
<td>&gt;=6 yrs of age: Sys BP &lt;80</td>
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<td>● Flail Chest</td>
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<td></td>
<td>Pulse &lt;70</td>
<td>● Open chest wound</td>
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OPERATIONAL GUIDELINES: TRAUMA TEAM RESPONSE

CM T35 Trauma Response Team

Emergency Department Attending Physician or Trauma Attending:
- categorizes patient as Level I, II or Consult (consults with Trauma Attending if necessary)
- instructs Patient Services Clerk to send PRE-NOTIFICATION to Trauma Teams
- re-categorizes condition as necessary and notifies Trauma Team

Level I Response Times:
Team-Impmediate
Trauma Attending-15 minute

Level I Response Team:
- 1-Chief Trauma Resident (PGY 3, 4 or 5) and Adult Trauma Attending
- or Pediatric Trauma Attending (14 YEARS or Younger)
- 1-Trauma Resident (PGY 1/2)
- 1-Emergency Medicine Attending
- 2-Emergency Department RN
- 1-Emergency Department HCT
- 1-Radiology Technician
- 1-Respiratory Therapist
- 1-Chaplain or Social Worker

Level II Response Times:
Team-Impmediate
Trauma Attending-8 hours

Level II Response Team:
- Chief Trauma Resident (PGY 4 or 5) or Trauma Attending OR
- Trauma Resident (PGY 3) and Adult Trauma Attending or Pediatric Trauma Attending (14 YEARS or Younger)
- PLUS
- 1-Trauma Resident (PGY 1/2)
- 1-Emergency Medicine Attending
- 2-Emergency Department RN
- 1-Emergency Department HCT
- 1-Radiology Technician
- 1-Respiratory Therapist
- 1-Chaplain or Social Worker

Consult:
Emergency Medicine Service will call Trauma Service for admissions

Trauma Service
Or
Trauma as Consult Service

Additional Team Members and consults:
- Neurosurgeon-30 min
- Orthopedic Surgeon-30 min
- Maxillofacial-30 min
- Other Specialty Response Times refer to A 708 of the NYDOH Code.

OPERATIONAL Guidelines: Trauma Team Response for Pediatric Patients
OBJECTIVES:

1. Define the protocol for trauma team notification for pediatric trauma patients who are brought to the trauma center at SUNY, Upstate.
2. Describe the respective roles of the pediatric surgeons and the adult trauma surgeons in the resuscitation of pediatric patients.
3. Define the responsibility of the resident teams in the resuscitation of pediatric trauma patients.

DEFINITIONS:

1. Pediatric trauma patients: those patients transported to the trauma center who are 14 years old or younger and meet the trauma patient definitions.
2. Pediatric surgeons: Dr Ahmed, Dr. Meier, Dr. Wallenstein
3. Trauma resident team: Residents assigned to or covering the trauma team
4. Pediatric Surgery resident team: Residents assigned to or covering the pediatric surgery service.

GUIDELINES:

1. Pediatric trauma patients enter the trauma center system in the same fashion as all other patients
2. Scene transport – contact will be made with the Emergency Medicine (EM) attending physician or representative
3. Acute inter-hospital transport – contact will be made through the referral line to the pediatric surgeon. The pediatric trauma surgeon will notify the EM attending that a patient has been accepted
5. Hospital-to-hospital transfer – for patients who are already admitted to another hospital. Initial contact will be made with responsible pediatric trauma surgeon. Admissions will be directed to the PICU or floor after discussion between the pediatric trauma surgeon and the pediatric attending physician.
6. Trauma Codes
   a. A pediatric group page will be used to alert the trauma team and the pediatric surgeon
   b. The alpha-numeric message will include the approximate age of the patient (less than or equal to 14)
   c. Response time for the pediatric attending surgeon will be according to national guidelines (i.e. less than 15 minutes to the resuscitation room). The “Trauma Surgeon” parking spot is available for the pediatric surgeon’s use when responding to the trauma code.
d. The resuscitation will be started by the Trauma residents and directed by the Peds EM attending until the pediatric surgeon arrives. The pediatric surgeon will be the responsible attending after arrival.
e. The adult trauma surgeon is the back-up in the case of a multiple pediatric trauma codes.

7. Trauma Consults
   a. The pediatric surgeon will be contacted within 60 minutes of the initial trauma consult (or sooner if the condition dictates).
   b. Patients who require admission will be initially seen and evaluated by the Trauma team but admitted to the pediatric surgery service.

8. Direct Transfer of Inpatients:
   a. The pediatric surgeon will communicate with the referring medical team.
   b. The admission will be to the pediatric surgical service without the involvement of the Trauma team.
OPERATIONAL GUIDELINES: PREPARATION AND EQUIPMENT FOR RESUSCITATION

OBJECTIVE:

Provide guidelines describing the availability of equipment for major trauma patients in the Emergency Department.

GUIDELINES:

Prior to the arrival of the trauma patient, the following equipment must be made readily available and every member of the Trauma Team must know its location:

1. Intubation Tray:
   a. Complete set of endotracheal tubes and available stylet.
   b. Laryngoscope(s) with functional light.
   c. Magill forceps.
   d. Tracheostomy or cricothyrotomy tray with #6 Shiley tracheostomy tubes.

2. IV – two liters of warm 0.9% sodium chloride solution (NaCl) with rapid infuser/warmer. Two liters of warm NaCl readily available for Trauma II patients, spiked and hung for Trauma I patients.

3. Head of the bed:
   a. Suction with Yankauer suction tip Ambu-bag with facemask for Adult & Peds.
   b. Oxygen flow device.
   c. Cardiac and hemodynamic monitor with EKG, non-invasive blood pressure, oxygen saturation and invasive pressure monitoring modules.
   d. EKG electrodes.

4. Available at all times in the trauma room:
   a. PPE Cart
   b. Trauma Cart
   c. Broslow Cart
   d. Warm IV solutions (six liters LR, 6 liters NS).
   e. Blood warmers. ThermaCor
   f. Warm blankets.
   g. Foley catheters with Urimeter
   h. Trauma Line kit
   i. Arterial line (radial and femoral).
   j. Venous cutdown tray.
   k. Assorted chest tubes with Pleurovac
   l. DPL tray.
   m. Open thoracotomy set.
   n. T-Pod pelvic immobilizer.
   o. Surgical Airway Tray.
   p. Femoral Speed Splint
OPERATIONAL GUIDELINES: RESUSCITATION ROLE ASSIGNMENTS

OBJECTIVES:

1. Define the roles of the members of the Trauma Team during a trauma resuscitation.
2. Provide optimal patient care by defining specific responsibilities for each member of the Trauma Team.
3. Provide an appropriate educational experience for surgical and emergency medicine residents.

GUIDELINES:

For a resuscitation to be efficient, every member of the team should understand their particular responsibilities. These should be organized into tasks to be completed before the patient arrives, and during the initial assessment and evaluation of the trauma victim. When a patient with multi-system trauma arrives who requires several procedures to be done simultaneously, the assignment of roles as outlined below should be strictly followed to prevent chaos. If, after an initial evaluation, the patient is found to be stable, the junior resident (support physician: on the patient’s right) may perform necessary evaluation and procedures on the left side of the patient with the supervision of the left-sided senior resident (assessment physician). This will enhance the junior resident’s educational experience and allow the senior resident to function as a supervisor. Flexibility of roles is expected under exceptional circumstances and appropriate communication should be maintained (see Figure 1).

1. Team Leader (attending Trauma surgeon, EM attending, EM or Trauma senior/chief resident):

   The Team Leader should be designated prior to the arrival of the patient and will usually be a senior resident. Supervision will be provided by the chief surgical resident and the emergency department attending physician until the trauma attending physician arrives in the emergency department. Should the Team Leader be required to leave the bedside, the Leader must clearly transfer the responsibility to another senior team member.

   The Team Leader will direct the course of the primary survey and resuscitation and expect a response to his or her questions; all questions or information should be directed to this person. There should be no other extraneous conversation.

   a. Prior to patient arrival:
      i. Assembles the trauma team and makes specific role assignments.
      ii. The most senior surgeon calls anesthesia and/or OR personally if the patient is to go straight to the OR.
      iii. Confirms that everyone in the unit has gown, mask, cap, eye protection, and gloves.
      iv. Reviews information from ambulance radio report.

   b. Primary assessment and resuscitation:
      i. Receives verbal report directly from ambulance personnel.
      ii. Directs the “assessment physician” to perform the primary survey.
      iii. Supervises the “assessment physician” in the performance of the primary survey.
      iv. Makes the decision for intubation or cricothyrotomy.
      v. Decides on IV orders and additional venous assess.
      vi. Decides on the amount of blood and kind (O-negative, type specific, etc.) needed.
vii. Categorizes the injuries.
viii. Orders initial X-rays, determines order of priority, orders lab tests (type and cross, ABG, EKG, CT scan).
ix. Determines need for early FAST, peritoneal lavage, or thoracostomy tube.
x. Orders the emergency consults.
xi. Performs ED thoracotomy or directs/supervises the “assessment physician” in performing this procedure.
xii. Determines need for arterial monitoring line.
c. Secondary assessment and definitive care:
i. Directs and supervises the “assessment physician” in the performance of the secondary survey.
ii. Examines X-rays.
iii. Decides on the need for and priority of further X-rays.
iv. Contacts consultants as needed.
v. Decides on the disposition of the patient and discusses with consultants.
vi. Talks with family.
vii. Puts note in chart.

2. Assessment physician (senior or junior surgery or emergency medicine resident). Standing on the patient’s right.
a. Prior to patient arrival:
i. Checks equipment.
ii. PPE.
b. Primary assessment and resuscitation:
i. Generally, stands at the patient’s right arm.
ii. Performs the primary and secondary survey.
iii. Inserts the right chest tube at the direction of the Leader.
iv. May insert right-side intravenous access.
v. Performs cricothyrotomy at the direction of the Leader.
vi. Performs or assists with ED thoracotomy.
c. Secondary assessment and definitive care:
i. Performs secondary survey.
ii. Performs DPL.
iii. Monitors right femoral pulse for rate and quality.
iv. May insert right femoral line or subclavian as directed by Leader.
v. Reports findings and interventions to the Leader.

3. Airway physician (emergency medicine attending or resident, anesthesiology attending, surgery resident/attending):
a. Remains at the head of the bed.
b. Prior to patient arrival:
i. Checks contents of intubation tray, checks that laryngoscopes are in working order.
ii. Checks suction and oxygen at head of table.
c. Primary assessment and resuscitation:
i. Assesses and protects airway and neck from injury.
ii. Recommends medications for rapid sequence intubation.
iii. Intubates patient at discretion of the Team Leader.
iv. Additional responsibilities:
a) Ventilates and monitors the ventilatory status, assesses oxygenation.
b) Suctions airway.
c) Controls bleeding from head and neck wounds.
d) Inserts internal/external jugular large bore catheters as necessary.
e) Inserts nasogastric or orogastric tube as directed by the Team Leader.
f) Assists with cricothyrotomy if needed.
g) Communicates all findings to the Team Leader.

d. Secondary assessment and definitive care:
i. Monitors ventilatory status.
ii. Monitors neurologic changes as demonstrated by acute changes in pupil size or mentation.
iii. Prepares patient for possible transport (e.g., secures airway, etc.).
iv. Puts note in chart.

4. Support physician (junior resident directly responsible to Team Leader).
a. Prior to patient arrival: Checks that all anticipated equipment and supplies are available and ready
b. Primary assessment and resuscitation:
i. Generally remains at the patient’s left side, between the middle and foot end of the stretcher.
ii. Exposes the patient.
iii. Inserts left-side IV’s, including femoral line or subclavian line.
iv. Inserts left chest tube at the direction of the Leader.
v. Performs FAST
c. Secondary assessment and definitive care:
i. Obtains ABG’s.
ii. May insert Foley catheter.
iii. Inserts arterial line if needed.
iv. Ensures that H&P and orders are on chart.
v. Reports findings and interventions to the Leader.

5. Primary Nurse:
a. Generally remains at the patient’s right side (Trauma Bay 1)
b. Directs/supervises all non-physician personnel.
c. Monitors vital signs (BP, P, RR, pulse oximetry, ongoing neuro signs, etc.). Initial BP measurement obtained manually.
d. May insert right-sided IV’s.
e. Communicates with/reassures patient.
f. Communicates assessments and interventions to the Leader.
g. Accepts medical orders from the Leader.
h. Administers medications at the direction of the Leader.
i. May insert nasogastric tube, Foley, etc.
j. Delegates duties to nursing and ancillary personnel as appropriate.
k. Monitors effects of medications and treatments and communicates patient response to Leader.
l. Anticipates and sets up equipment and procedure trays.
m. Sets up blood warming equipment and administers blood.
n. Communicates problems, needs, current status to ED charge nurse.
o. Responsible for proper completion of the Trauma Flow Sheet.

6. Respiratory therapist:
a. Assists “airway physician” at the head-of-bed.
b. Assists with endotracheal intubation.
c. Performs manual bag ventilation.
d. Monitors patient respiratory status.
e. Suctions airway.
f. Provides ventilator set-ups.
g. Coordinates ventilator set-ups for other areas where patient is to move.
h. Communicates assessments and interventions to the Leader.
i. May be excused by Leader if patient is not intubated and no further respiratory interventions are needed.

7. Radiology technician:
a. Performs X-rays as directed by Leader.
b. Brings developed X-rays back to resuscitation room if needed.
c. May leave when excused by Leader (no further X-rays anticipated).
d. Facilitates timely communication with the radiologist who will interpret the trauma films.

8. Circulating Nurse (RN, LPN, HCT):
a. This person is an additional nurse.
b. May also function as a circulator in obtaining supplies and equipment.
c. Performs other duties as directed by the Primary RN.
d. In the absence of a Scribe documents assessments, tests, and interventions on the Trauma Flow Sheet. Documents Trauma Team arrival times.

9. Scribe RN
a. Document assessments, tests, and interventions on the Trauma Flow Sheet, Documents Trauma Team arrival times.
b. Directs necessary questions about findings (for purposes of good documentation) to the Leader.

10. Medical student.
a. Must remain away from the resuscitation at all times unless otherwise directed by Team Leader.
b. May assist with taking notes for the physician history and physical form. Will not complete history and physical form.
c. Will discuss case and ask questions of team members after the resuscitation is concluded.

11. If not the Team Leader, the attending physician (emergency medicine and/or trauma):
a. Will generally remain near the Leader (back from the foot of the stretcher).
b. Supervises and advises Leader.
c. When circumstances require, provide direct patient care by filling one of the above roles.

12. Social Worker / Pastoral Care
a. Assists with identifying patient.
b. Contacts patient’s family.
c. Keeps appropriate family members informed of patient's status.
d. Facilitates psychosocial care of patient, family and visitors.
e. Coordinates family visits to the bedside with the Leader and Primary Nurse.
f. Supports the grieving process.
g. May assist with patient/family interviews regarding violence, abuse, etc.

13. Others:
a. All others present must outside of the box or outside the room.
b. The Leader may ask others to leave when their presence seems inappropriate.
Figure 1
OPERATIONAL GUIDELINES: RESUSCITATION PRIORITIES FOR THE MULTIPLE OR SERIOUSLY INJURED PATIENT

OBJECTIVE:

The following protocol outlines the priorities for managing the seriously injured patient according to ATLS guidelines. This is a framework for the ongoing resuscitation, although it must be recognized that deviations will be necessary according to the patient’s status and ongoing re-evaluation.

DEFINITIONS:

1. Multiple or serious injuries: Patients who are defined as having injuries consistent with the National Trauma Triage Protocol (Upstate University Hospital’s Level I and Level II alerts), Level II
2. Advanced trauma life support guidelines: Trauma prioritization guidelines developed by the Committee of Trauma of the American College of Surgeons, which are nationally recognized as the standards for trauma care.

GUIDELINES:

The protocol below lists the priorities in the primary survey, resuscitation, and secondary survey phases of trauma management as adapted from ATLS.

1. Life support (in order of priority):
   a. Airway: guarantee patency and assure that the patient can protect his/her airway.
      i. Possible C-spine injury – maintain in-line stabilization (rigid collar and lateral immobilization):
         a) Suction secretions using Yankauer suction; remove foreign bodies; jaw thrust.
         b) Oral or nasopharyngeal airway if tolerated by patient.
         c) If necessary, orotracheal intubation with in-line stabilization and rapid sequence induction (RSI).
         d) Upper airway obstruction – cricothyrotomy.
         e) 100% oxygen.
      ii. No neck injury, stridor or evident obstruction:
         a) Position the airway using jaw thrust.
         b) Suction secretions.
         c) Oral airway, if tolerated.
         d) 100% oxygen.
         e) Mask-assisted ventilation.
         f) If no improvement, perform orotracheal intubation.
      iii. No neck injury, no stridor but apparent upper airway obstruction:
         a) As in “ii” above.
         b) If unsuccessful, cricothyrotomy.
      iv. Anterior neck injury, stridor and upper airway obstruction:
         a) Suspect laryngeal crush injury or laryngotracheal separation.
         b) Proceed to tracheostomy without prior attempt at endotracheal intubation.
      v. Head injury – intubate when Glasgow Coma Scale is less than or equal to 8.
      vi. Apneic – immediate orotracheal intubation with in-line stabilization or surgical cricothyrotomy.

b. Breathing:
i. Assess breath sounds bilaterally.
ii. Mechanical ventilation if ventilatory effort is inadequate.
   a) Bag-Valve-Mask initially.
   b) Verify ET tube position by end tidal CO₂ determination.
   c) Ventilatory support with ventilator.
iii. Tension pneumothorax:
   a) Immediate needle thoracostomy (14 or 16 gauge IV catheter in second intercostal space) or tube thoracostomy.
   b) Tube thoracostomy to follow needle thoracostomy, if performed.
   c) Chest X-ray is contraindicated prior to treatment if patient has hemodynamic compromise.
iv. Hemothorax:
   a) Thoracostomy tube after fluid resuscitation.
   b) Plan for possible autotransfusion if applicable.
v. Simple pneumothorax: Tube thoracostomy after confirmation by chest X-ray.
vi. Open pneumothorax:
   a) Cover defect with Vaseline dressing.
   b) Tube thoracostomy.

vii. Indications for thoracotomy (See Practice Guideline “Emergent Resuscitative Thoracotomy”):
   a) Immediate thoracotomy in the ED.
      i) Penetrating wound (except head) with no BP (but had signs of life at the scene < 10 minutes prior to arrival) or non-resuscitating BP (<40) in ED.
      ii) Blunt trauma with non-resuscitating BP (<40) in ED.
   b) Urgent thoracotomy in the OR.
      i) Cardiac tamponade documented by ultrasound, pericardiocentesis, or pericardial window, or strong clinical findings.
      ii) Widened mediastinum with left hemothorax or an aortogram confirming aortic transection (OR only).
      iii) Hemothorax >1200 ml initially or 800 ml total over next four hours.
      iv) Ruptured esophagus.
     v) Massive pleural air leak suggestive of ruptured bronchus after confirmation by bronchoscopy.

c. Circulation:
   i. Hemostasis – direct pressure to bleeding wounds.
   ii. Treat shock.
      a) Assess for etiology. Consider hypovolemic shock as most common cause. Neurogenic shock considered if evidence of spinal cord injury.
      b) If shock state is difficult to correct, consider source of bleeding that needs operative or angiographic intervention.
      c) Warm crystalloid solution, initially 2 liters LR), then packed cells (warmed to body temperature).
      d) Consider activating the Massive Transfusion Protocol if indicated by trauma surgeon.
      e) Head injury or lung injury – conservative, but maintain adequate fluid resuscitation to keep BP and pulse in normal range. Strive to maintain normal hemodynamics and euvolesma.
      f) Cardiac tamponade: pericardiocentesis, needle or open (especially with anterior chest penetrating injury).
         i) Shock with reduced pulse pressure unresponsive to volume.
ii) Neck vein distention or elevated CVP greater than 20 cm of water pressure.
iii) Rule-out tension pneumothorax (this is more likely than tamponade in blunt trauma).

d. Central nervous system (See Practice Guideline “Brain Injury”).
i. Assess Glasgow Coma Scale (for GCS less than 8, intubate). Consider neurosurgery consult for:
   a) GCS <12.
   b) Focal deficit.
   c) Unequal pupils not explained by local injury or peripheral nerve palsy.
ii. Continue resuscitation to maintain euvolement.
iii. Maintain oxygenation >95%.
iv. Ventilation to achieve pCO2 around 40 mmHg.
v. Medications:
   a) Sedate with morphine/fentanyl and/or lorazapam/midazolam (or other agents) to avoid agitation and protect airway.
   b) consider 3% Saline 5cc/kg or mannitol 1 gm/kg to prevent herniation secondary to brain swelling if focal neurologic findings or positive CT scan for hemorrhage.
   c) For urgent seizure consider Lorazepam 1-2 mg IV (adults) or 0.1 mg/kg (children)
   d) Consider Phenytoin 18 – 20 mg/kg (est 1,000 mg for 55 kg pt) or Keppra 1000mg prophylaxis.
v. CT scan of head, as indicated (see protocol for radiologic studies).
e. Remove all clothing.
f. Maintain normothermia.
i. Warm blankets.
ii. Overhead heating lights.
iii. Warm IV fluids.
v. Baer Hugger
g. Insert nasogastric/orogastric tube and Foley catheter, as indicated, and after rectal exam.
h. Conduct secondary survey (head-to-toe physical examination):
i. Maxillofacial: Control bleeding from scalp and face (with skin staples, suture ligatures, packing, and/or definitive wound closure).
ii. Neck:
   a) Palpate for fractures and instability.
   b) Examine for external injuries.
   c) If there is significant bruise or abrasion on side of neck, consider carotid evaluation (CT angio, or MRA)
iii. Chest:
   a) Re-evaluate breath sounds and ventilatory adequacy.
   b) Examine for external injuries.
iv. Abdomen:
   a) Quick physical assessment (distention, seatbelt injury, contusions, tenderness).
   b) Perform ultrasound FAST exam on all patients with indications of possible abdominal injury.
c) Determine need for further evaluation (if unstable, do DPL or perform laparotomy if FAST shows hemoparitoneum; if stable, do abdominal CT scan).
d) Abdominal hemorrhage – with unexplained hypotension (indicated with ultrasound FAST or positive diagnostic peritoneal lavage). Immediate laparotomy in OR.
i. If unstable pelvis, avoid unnecessary movement to minimize bleeding. Consider angiographic embolization or external fixator for associated vascular injury. Stabilize pelvis with T-pod / Sam’s sling or external fixator (by orthopedics).
j. Fracture stabilization:
i. Reduce fracture dislocation.
ii. Apply traction splint for fractured femur.
iii. Evaluate neurovascular compromise.
v. Antibiotics for open fractures.

k. Spine:
i. Assess for sensory and motor deficits.
ii. Roll patient with in-line cervical stabilization.
   Consider X-rays for any area of tenderness or step-off.

l. Coordinate radiologic examination:
i. Chest X-ray AP.
ii. AP pelvis if signs of pelvic fracture or instability or unconscious patient with mechanism suggestive of pelvic fracture.

2. After stabilization:
a. Triage – ongoing:
i. Prioritize injuries:
   a) Life-threatening.
   b) Stable but potentially life-threatening.
   c) Limb-threatening.
   d) Not life- or limb-threatening.
ii. Determine sequence: X-ray, OR, ICU. Consider Fast Track protocol. Call the ICU and write orders at this time.
iii. Specialty service should be called one at a time with respect to priority.
iv. Attending or senior surgical resident will call, OR. (see Guideline: Notifying the OR).
b. Establish contact with family, if possible.
c. Take AMPLE history.
d. Determine radiologic sequence.
e. Determine need for tetanus toxoid and antibiotic coverage.
f. Determine need for admission. Arrange for bed in appropriate unit.

3. Continued reassessment is ABSOLUTELY mandatory.
a. Vital signs: frequent determinations of vital signs, as determined by the severity of injury, should be made. It is always better to check too frequently than to be left in the dark.
b. Outputs: should be checked frequently during the resuscitation phase and then hourly when stable – urine, chest tube, nasogastric.
c. Be sensitive to trends in physical examination and vital signs - ask yourself, “Has the patient’s response to fluid infusion and early stabilization been appropriate?”
Take care of yourself. Wash your hands. Remove your gown and gloves. Take a big breath!!
To define the procedure for treatment of multiple trauma patients simultaneously admitted to the Emergency Department.

DEFINITION:

Multiple trauma patients: More than one patient arriving in the trauma resuscitation area simultaneously or sequentially over a short time span.

GUIDELINES:

1. In general, patients are admitted to the trauma room one at a time and the usual assignment of responsibilities is followed (see Guideline: Role Assignment). The trauma and EM attendings will provide supervision for all patients.

2. Assume the following responders: Trauma attending, EM attending, ED senior resident, ED junior resident, trauma junior resident, trauma intern, ED intern (intern = PG1). If not specifically assigned, the responders will help where needed.

3. When multiple patients are admitted simultaneously, the following assignments are made (acuity: Patient A > Patient B > Patient C > Patient D):
   a. Two patients:
      i. Patient A – Chief Trauma resident, junior EM resident
      ii. Patient B – Trauma or EM attending, EM senior resident.
   b. Three patients:
      i. Patient A – Chief trauma resident.
      ii. Patient B – Senior EM resident
      iii. Patient C – EM attending
   c. Four patients:
      i. Patient A – Chief trauma resident
      ii. Patient B – Trauma attending
      iii. Patient C – Senior EM resident
      iv. Patient D – EM attending

4. The Trauma and EM attendings will provide general supervision for all patients.

5. Make sure that all teams are communicating with each other to continually assess changing acuity and priorities for diagnostic studies. All important information should be relayed to the most senior physician.

6. Consider the activation of the back-up Trauma team (see Practice Guideline: Activation of the Back-Up Trauma Team) if additional trauma patients are anticipated, the EM attending should consider activation of the disaster plan according to established procedures.

OPERATIONAL GUIDELINES: ACTIVATION OF THE BACK-UP TRAUMA TEAM

OBJECTIVES:

1. To define the situation in which the back-up team should be notified.
2. To define the mechanism by which the back-up team should be activated.
GUIDELINES:

1. At all times a trauma back-up team will be available. The back-up Trauma Attending can be found on the call schedule for Surgery.

2. The back-up team should be notified under the following circumstances:
   a. The trauma team is in the OR trauma activation has occurred and no one can respond.
   b. The trauma team is occupied in multiple resuscitations.
   c. The trauma attending shall make the decision to activate the back-up team.

3. When the trauma team is available again, the back-up trauma team should be notified that they are no longer needed.

4. If patient demands exceed resources available, consider activation of the mass casualty plan.
OPERATIONAL GUIDELINES: OPERATING ROOM NOTIFICATION

OBJECTIVE:

To define a mechanism to notify the operating room of the need to transfer a patient for an immediate surgical procedure.

GUIDELINES:

1. Follow ATLS Guidelines for initial resuscitation.

2. The OR charge nurse will carry a “Trauma Code” pager.

3. The OR charge nurse will call the Chief trauma resident 15 minutes after the arrival of the patients for all Level 1 Trauma Codes to inquire about OR necessity.

4. When the need for emergent or urgent operative intervention is determined, contact the operating room representative (usually the OR charge nurse). The OR representative will call the Chief anesthesia resident on-call.

5. The following information will be conveyed:
   a. Patient name and hospital number, age
   b. Attending surgeon
   c. Type of procedure to be performed (eg., laparotomy, thoracotomy, neck exploration, etc.).
   d. The need for the cell saver (yes or no).
   e. The approximate time that the procedure should be performed (now, 5 minutes, 15 minutes, etc.).
   f. Any other information (special equipment, cell-saver, x-ray, etc.).
   g. “Warm the room”

6. The OR charge nurse will call anesthesia and notify them of the case with the following information:
   a. All of the above information
   b. IV line locations, are they working
   c. Hemodynamic stability
   d. How much fluid and blood has been given
   e. Anticipated findings at surgery (eg, big blood loss, little blood loss).
   f. Any special anesthesia equipment or procedure needed (eg. Pulmonary artery catheter, A-line, TEE, double lumen endotracheal tube, etc.)

7. Once the need for emergent operation has been made, proceed as quickly as possible to the operating room. REMEMBER – anything that can be done in the ED can also be done in the OR and more! Time to definitive care is the fundamental concept.
OPERATIONAL GUIDELINES: TEMPORARY TRAUMA CENTER CLOSURE POLICY

T13 Trauma Center Closure Policy
OPERATIONAL GUIDELINES: UNIVERSAL PRECAUTIONS (PERSONAL PROTECTIVE EQUIPMENT (PPE))

OBJECTIVE:

Define the minimum standards for Personal Protective Equipment and the situations in which they are to be applied. Refer to policy # IC D-02.

DEFINITION:

Personal Protective Equipment (PPE): The utilization of barriers to protect the health care provider from infectious disease transmission from the bodily fluids of the patient.

GUIDELINES:

1. PPEs consist of barrier protection of the health care provider to prevent transmission of infections from the patient’s bodily fluids.

2. ALL PATIENTS ARE ASSUMED TO HAVE BLOOD AND BODILY FLUID INFECTIONS THAT ARE TRANSMISSIBLE.

3. PPEs consist of:
   a. Impervious gown covering the exposed clothing and arms of the health care provider.
   b. Gloves.
   c. Goggles to provide eye protection. Corrective eyeglasses may be used if they have “lateral shields” to prevent exposure from splashes.
   d. Booties to cover footwear.

4. In addition, masks are to be worn when working on open wounds.

5. PPE will be used during every Level 1 & 2 Trauma Codes. PPE will be utilized by all members of the trauma team that is inside the box. All providers who are not wearing PPE should stay outside of the box.

6. If a needle stick or exposure to the patient’s bodily fluid occurs, see Management of Employee Exposure to Communicable Diseases

   http://www.upstate.edu/policies/documents/intra/IC_E-01.pdf
OPERATIONAL GUIDELINES: NOTIFICATION OF ATTENDING

OBJECTIVE:

Define the expectations of the residents for notifying attending of trauma patient care issues so that attending involvement and supervision is ensured.

GUIDELINES:

1. The requirements for trauma center being verified by the American College of Surgeons that it mandates that the trauma attending must be in the trauma room within 15 minutes of notification for a Trauma One. An attending must see the Trauma Two patient within 16 hours.

2. It is expected that the trauma attending be closely involved in the patient care activities of the trauma service. Frequently, residents are notified first when patient care issues occur. It is expected that residents will follow these guidelines in providing timely notification of the appropriate attending. These guidelines are not meant to be all-inclusive and there may be additional situations not listed in which the attending should be notified.

3. In general, the trauma or critical care attending responsible for rounds on a particular day should be notified for any events surrounding inpatients. For newly admitted patients, notify the on-call trauma surgeon until the patient has been transferred to the trauma team attending at rounds the following day.

4. Residents are expected to notify the trauma attending in a timely manner in the following situations:
   a. Acute change in patient condition.
   b. Any patient admitted to the intensive care unit.
   c. All patient deaths.
   d. All patients being admitted.
   e. All patients being discharged.
   f. Any time an interventional procedure is ordered or performed that has not been previously discussed. Examples include angiography, chest tube insertion, diagnostic peritoneal lavage, etc.

5. If the trauma attending is not present, then it is expected that the resident involved in a trauma code will call a report to the on-call trauma attending promptly upon competition of the diagnostic work-up of all Level Two Trauma and consult patients and prior to discharge of any patient from the ED.

6. The general rule of thumb for residents is: “It is better to call the attending a hundred times when you didn’t need to, than not to call the attending one time when you should have.”
OPERATIONAL GUIDELINE: FAST TRACK OF PATIENT FROM EMERGENCY DEPARTMENT TO INTENSIVE CARE UNIT

CM T-37 Fast Track of Trauma Patients 6l/12F
OPERATIONAL GUIDELINES: PATIENT APPROPRIATENESS FOR ADULT ICU ADMISSIONS AND DISCHARGE

OBJECTIVE:

To aid physicians and nursing staff in determining whether a patient is appropriate for Adult SICU and IMC admission and discharge. This is important for providing high quality patient care in the most appropriate clinical setting. Patient acuity and resource needs are the determining factors in defining the most appropriate clinical setting. Admitting a patient to the Adult SICU who might benefit from being in another unit is not clinically or economically appropriate. Similarly, failing to discharge a patient from the SICU who can be appropriately cared for in a less acute setting is not beneficial and potentially deprives more appropriate patients the benefit of ICU care.

GUIDELINES:

1. Patients with acute respiratory dysfunction. Requires mechanical ventilation
   a. Requires frequent pulmonary interventions or monitoring that cannot be provided on general medical floor
   b. Requires ventilation with anticipation of short-term weaning (ie., not chronically ventilator dependent)
   c. Requires short ventilator course while other factors are being mitigated (ie., awakening from alcoholic stupor)

2. Hemodynamically unstable patients
   a. Requires invasive monitoring with PA catheter
   b. Actively bleeding with need for massive resuscitation
   c. Hemodynamically unstable patient who is hypothermic
   d. Patients with expected rapid changes in pressors, inotropes, or antiarrhythmics
   e. Require maintenance or slow-wean of pressors, inotropes, or antiarrhythmics
   f. Require intensive cardiac monitoring for anticipated myocardial instability or fluid shifts.
   g. Requires arterial line

3. Patients with an acute deterioration in neurologic status.
   a. Fresh traumatic brain injury requiring ICP monitoring
   b. Traumatic brain injury requiring close observation and manipulation of therapies to treat cerebral perfusion pressure
   c. Spinal cord injury in neurogenic shock
   d. Traumatic brain injury after initial stabilization but still requiring ventilator support
   e. Neurologic dysfunction from minor brain contusion or extraneous causes
   f. Spinal cord injury requiring frequent neuro checks or mechanical ventilation
   g. Discharge of the Patient from the Intensive Care Unit: The SUNY Upstate Medical University shall transfer patients from the Intensive Care Unit to appropriate step-down units when medically stable and on order of the attending physician.
   h. In order to improve the quality of patient care and patient safety, the SICU Resident (or responsible Resident) shall write new orders for each patient being transferred. The SICU Resident (or responsible Resident) shall review all existing orders including scheduled medications, PRN medications, laboratory tests, radiological studies, diet, activity, and others prior to writing these new orders. This new set of orders to take complete precedence over the previous ICU orders.
i. Intensive Care Unit Standing Orders may not be used to transfer patients to floor status. The Resident may not give a telephone order to the nurse to “copy the existing orders” or “use the same medications”.
OBJECTIVE:
To define a standard set of laboratory studies that should be obtained for the trauma patient in an attempt to aid in diagnosis in an efficient, cost-effective manner.

DEFINITION:
Laboratory studies: An examination of the blood or other fluids to obtain information concerning physiologic derangements in the trauma patients. Additionally, other bedside studies may fall into this category including EKG, echocardiography, and ultrasound.

GUIDELINES:
1. At the Upstate Trauma Center, the trauma team has minimal “routine trauma bloods” that are drawn on all patients according to injury status. The blood studies should be individualized to the patient and the injuries that are being treated.

2. In general, full trauma labs will be obtained for Trauma Level I & II patients. If patient will go for an operative procedure, the pre-op labs will also be sent.
   a. Trauma labs (panel):
      i. ABG for critically injured patients with signs of shock / lactic acid at discretion.
      ii. CBC and BMP.
      iii. Type and screen, type and cross, if need for blood is anticipated.
      iv. Urinalysis.
      v. Urine for U-HCG for women older than 10 and younger than 55 yrs.
      vi. Coagulation studies PT/PTT on all and selected use of platelet function studies or thromobelstographic studies.

3. The following laboratory studies should be considered for the multiply injured patient:
   a. Type and cross for four to six units of packed red blood cells:
      i. A patient who has obvious source of massive blood loss.
      ii. A patient with traumatic anemia.
      iii. A patient who is hypotensive from hemorrhagic shock.
      iv. A patient who is going to the operating room for a surgical procedure that may result in major blood loss.
   b. Type and screen:
      i. A patient with marginal blood loss (e.g., from lacerations) and no anticipated further blood loss.
      ii. A patient going to the operating room for a procedure with a low likelihood of blood loss.
      iii. A patient who was hypotensive at the scene but has stabilized with moderate fluid resuscitation.
   c. Repeat CBC:
      i. All trauma patients with a significant injury with evidence of hypoperfusion or bleeding.
      ii. Follow-up on patients who had marginally low hematocrit initially or who have had slow continued blood loss (as in a chest tube).
iii. After blood transfusion.
d. Basic Metabolic Panel:
   i. All patients who may require intravenous contrast with a CT scan.
   ii. All trauma patients with preexisting morbidity suggesting an electrolyte abnormality (medications, etc).
   iii. All trauma patients to be anesthetized for general anesthesia.
   iv. Any patient with suspected renal impairment.
   v. All head injured patients.
e. Complete Metabolic Panel (or BMP plus liver function tests): Trauma patients with preexisting illness suggesting abnormalities in liver function or metabolism.
f. Clotting studies (PT/PTT/platelet count & INR):
   i. All trauma patients with suspected coagulation problems or who are taking anticoagulants.
   ii. All trauma patients requiring massive transfusions (>2 units).
   iii. All severely head injured patients (GCS <8 or with cerebral pathology on CT scan).
   iv. All patients over the age of 60.
g. Urinalysis:
   i. All trauma patients with hematuria.
   ii. All trauma patients with abdominal, flank, or pelvic trauma.
h. Serum Lactate: Patient with evidence of tissue hypoperfusion.
   i. Repeat arterial blood gas:
      i. Patients in shock or who may potentially be in shock (to assess the degree of metabolic acidosis).
      ii. Patients with severe head injury (to assess the carbon-dioxide level).
      iii. Patients with anticipated rapid weaning from the ventilator (to assess the partial pressure of oxygen).
      iv. Patients with $S_{02} <90\%$ on pulse oximetry.
   j. EKG:
      i. All patients with a serious chest trauma.
      ii. All patients with arrhythmia on cardiac monitor.
      iii. All patients with underlying cardiac disease.
      iv. All patients with sternal tenderness or fractures.
      v. All patients over age 50.
k. Serum troponin:
   i. Patients who may have had a myocardial infarction.
   ii. Suspicion of myocardial contusion is not an indication for obtaining cardiac isoenzymes or troponins.
   iii. Consider obtaining CPK for patients at risk for rhabdomyolysis.
l. Urine myoglobin (consider using serum CPK since myoglobin is expensive test):
   i. Patients with substantial crush injury
   ii. Patients with suspected rhabdomyolysis.
   iii. Dark maple syrup colored urine positive for blood and negative for RBC’s.
   iv. Urine positive for blood and negative for RBC’s in patients at risk for muscle necrosis or compartment syndrome.
m. Transthoracic or transesophageal echo:
   i. Patients with findings suggestive of myocardial contusion (myocardial dysfunction or dysrhythmia).
   ii. Patients with findings suggestive of pericardial tamponade (if time permits; otherwise perform a FAST exam).
   iii. Patients with evidence of impaired myocardial function who are not responding appropriately to fluid resuscitation.
iv. TEE - to aid in the diagnosis of thoracic aortic rupture (see widened mediastinum guidelines).
OPERATIONAL GUIDELINES: RADIOLOGIC STUDIES ON TRAUMA PATIENTS

OBJECTIVE:

To provide a guideline for the proper ordering of X-rays on multiple trauma patients.

GUIDELINES:

1. Trauma Room Radiographic studies:
   a. Radiographic studies in the Trauma room should initially focus on identification of immediate life threats.
   b. Trauma Room supine chest X-ray:
      i. In general, almost all multiply injured patients require a supine chest X-ray.
      ii. On all patients with suggestion of chest injury.
      iii. On all patients transferred from another hospital, even if intubated.
      iv. Obtain as soon as possible on intubated patients.
   c. Trauma Room AP pelvis:
      i. A pelvis film does not need to be ordered on every patient. An initial pelvis film is not necessary on a patient who will receive an abdominal/pelvis CT scan.
      ii. Obtain on all obtunded patients with a possible mechanism suggesting a pelvic injury.
      iii. If the patient is alert and cooperative, obtain portable pelvis X-ray when there are signs and symptoms of pelvic injury.
   d. Other Trauma Room films should be obtained only if the information from them is urgently needed (e.g., foreign body identification in GSW, etc.) or if the patient is unstable – remember: portable films are expensive and may be of poorer quality!

2. Other X-rays: Will be obtained in the main X-ray facility (in ED or in main radiology department). In general, spine and extremity X-rays are obtained on the basis of physical signs or symptoms.

3. Thoracic and lumbar films: Obtained for those patients with a significant mechanism of injury for blunt trauma and are unable to provide an adequate physical exam due to other injury or diminished mental status. If a CT scans of the chest and abdomen are being obtained, then reformat the CT scan to provide AP and lateral T,L,S spine views. This must be ordered at the time of ordering the CT scans. If CT scans are not performed than obtain AP and lateral T,L,S spine films.

4. Extremity arteriogram or duplex scan (for larger vessels):
   a. Any fracture with evidence of poor arterial perfusion (e.g., ankle brachial index <0.9).
   b. Posterior knee dislocations (even if spontaneously relocated) with any evidence of intimal occlusion (ABI < 0.9).
   c. Gunshot wounds where course of injury is near an artery and there are signs of bleeding, expanding hematoma or diminished distal circulation. Remember that the presence of distal pulses does not necessarily mean that an arterial injury has not occurred. Doppler occlusion pressures may be helpful (ankle brachial index <0.9 is considered significant and is an indication for an arteriogram).
   d. Wound proximity to major vessel is not by itself an indication for angiogram.

5. Thoracic arteriogram: See Guideline for evaluation of widened mediastinum.
6. Carotid evaluation (angiogram, duplex scan, or CT angiogram) Obtain on patients with lateralizing neurologic deficit unexplained by findings on head CT (ie., to evaluate for carotid occlusion/dissection). Consider evaluation of carotid for any patient with significant hematoma, echymosis, or abrasion of lateral neck. These findings can be associated with carotid dissection and should be evaluated with a duplex scan or CTA. Carotid angiogram is used to evaluate neck vasculature when non-operative management of Zone II penetrating neck injury is considered.

7. Wound clips: Use for identification of point of injury on X-rays:
   a. On all penetrating stab or gunshot wounds.
   b. Do not clip abrasions or scratches.

8. Retrograde cystogram:
   a. Should be considered for all cases of gross hematuria, penetrating abdominal trauma and pelvic fractures where bladder disruption is suspected. (NOTE: A CT Cystogram may replace this study if available)
   b. Allow 300 ml of contrast agent to flow into Foley catheter and then clamp.
   c. X-ray the pelvis.
   d. Obtain repeat x-ray after emptying bladder.
   e. Cannot accept a cystogram from the abdominal/pelvis CT scan unless contrast has been injected into the bladder, ie., a CT cystogram.

9. Retrograde urethrogram:
   a. Should be considered for all cases of gross hematuria, penetrating abdominal trauma and pelvic fractures where disruption of the urethra is suspected.
      i. Blood at the urethral meatus.
      ii. Displaced or non-palpable prostate.
      iii. Obvious perineal injury (perineal hematoma or open perineal injury or scrotal hematoma).
   b. May position patient in right anterior oblique (45°) in “bicycling” position with right hip flexed and penis placed on medial aspect of right thigh if possible. Insert small (12 Fr.) Foley catheter into the meatus for a distance of 2-3 cm. gently inject 10 – 25 ml of renograffin contrast.
   c. X-ray tube centered over pubic tubercle.
   d. If Foley catheter has been previously placed, may be performed alongside the catheter by inserting 18 gauge angiocath next to Foley.

10. CT scans:
    a. Head -- Mechanism for brain injury and
       i. GCS ≤ 14
    b. Cervical spine – mechanism for C-spine injury and
       i. Unconscious patient who is not anticipated regain consciousness within 24 hours.
       ii. C-spine tenderness
    c. Abdomen / Pelvis – Mechanism for abdominal / pelvic injury and
       i. Abdominal or pelvic pain.
       ii. Substantial mechanism for abdominal injury in the comatose or unresponsive patient.
       iii. Pelvic fracture on plain film.
       iv. Fluid in the abdomen on FAST exam in the hemodynamically stable patient.
v. If indicated consider reformatting of T,L,S spine if chest and abdominal CT scans are obtained.

d. Spine (thoracic or lumbar) – limited to area of interest.
   i. Confirm or further diagnose fractures seen on plain films or chest/abdomen/pelvis CT Scans. Evaluate severe point tenderness over midline spine.
OPERATIONAL GUIDELINES: OBTAINING CONSULTS ON TRAUMA PATIENTS

OBJECTIVES:

1. Define situations where consultation from surgical sub-specialties may aid in the care and triage of trauma patients.
2. Define the appropriate consulting service.

GUIDELINES:

1. TBI patients: Neurosurgery consult:
   a. CT scan abnormalities.
   b. GCS <12 without obvious signs of intoxication.
   c. Focal neurologic deficit.

2. Spine injury patients: Spine service (orthopedics or neurosurgery, see published schedule):
   a. Vertebral body abnormality on X-ray.
   b. Ligamentous abnormality.
   c. Neurologic deficit.
   d. Fill out an ASIA form on any patient with neurologic deficit or body fracture.

3. Facial injury: ENT
   a. Complex laceration.
   b. Facial fractures, including orbital fractures.

4. Vascular injury: Vascular surgery consult:
   a. Complex injury or injury requiring a vascular graft.

5. Orthopedic consult:
   a. For all long bone fractures or major ligamentous instability.

6. Major thoracic trauma: Thoracic Surgery
OPERATIONAL GUIDELINES: BLOOD AND BLOOD PRODUCT TRANSFUSION

OBJECTIVE:

To provide a guideline for the transfusion of blood and blood products into trauma patients.

DEFINITIONS:

1. Packed red blood cells: A blood product that contains red blood cells with most of the plasma eluted off. The average hematocrit of PRBC’s is 70%. Each unit of PRBC’s (220 ml) will raise the hematocrit by about 3%.
2. Fresh frozen plasma: A blood product that contains fresh components of plasma, including colloid proteins and clotting factors. Note that some FFP is “cryo-poor” and may have as much as 50% of the Factor VIII depleted.
3. Platelets: A blood product that contains primarily platelets suspended in a small amount of plasma. Each unit of plasma will raise the platelet count by about 10,000.
4. Cryoprecipitate: A blood product component of plasma that primarily contains Factor VIII, Factor V and fibrinogen. This is the best blood product for treatment of low fibrinogen (<150 mg/dL).
5. Transexemic acid (TXA) a non-blood product that can be used within 3 hours of a major hemorrhage to aid in clotting. Usually used as part of a massive transfusion protocol (MTP) It may be given by certain EMS providers pre-hospital under protocols.
6. PCC: (Protein Complex Concentrate) a concentrate of Factor VII and …. That can be used to rapidly reverse patient’s anticoagulated with warfarin with life threatening hemorrhage.
7. Feiba: Activted factor VIII and VII that may be useful for reversal of dagibatran.

GUIDELINES:

1. Resuscitation in the ED will be begun with NaCl solution infused through large-bore IV catheters. In hypotensive patients, blood should be given as soon as available as the primary resuscitation fluid. Generally this should be balanced resuscitation including FFP and platelets via an established MTP. Un-cross matched blood can and should be considered early. Fluid warmers should be used.

2. Upon initiating resuscitation, send blood sample to the Blood Bank for immediate type and cross. If blood requirements will be excessive, activate the Massive Transfusion Protocol for Trauma (MTP).

CM T-25 Massive Transfusion Protocol for Trauma

3. If the patient is not in shock , NaCl may be administered until type and cross-matched blood is available. However, situations will arise when O-negative or type-specific blood will be necessary.

4. O, Rho(D) negative blood is available immediately in the Trauma room refrigerator. It requires emergency release, and only two units will be released initially. Due to limited supply of O-negative blood, consider O, Rho(D) positive blood for males and sterile or post-menopausal females.
   a. Indications:
      i. To be used in severe life-threatening hemorrhage while activating the MTP.
ii. Obvious major bleeding during transport with subsequent impending cardiac arrest due to anemia (not hypovolemia).

b. Risks: about 1.3% of all patients will have a clinically significant antibody other than anti-D and 70% of these will be women. These patients are at risk for delayed hemolytic transfusion reaction.

The following guidelines apply to patients not receiving blood products via the MTP.

5. Uncross-matched, ABO, Rho(D) compatible blood: available in 10 minutes after sample received in the Blood Bank; requires signed release form.
   a. Indications:
      i. Hypotensive; hematocrit <25% prior to availability of cross-matched blood.
      ii. Hypotensive; obvious source of ongoing bleeding prior to availability of cross-matched blood.
      iii. Hypotensive with need for immediate laparotomy/thoracotomy.
      iv. Depletion of typed and crossed blood with further emergency transfusion requirement.
   b. Risks: same as above, but prevents depletion of O-negative blood supply.

6. Type and cross-matched: Four units available in 45 minutes after sample received in the Blood Bank.
   a. Indications:
      i. Usual transfusion indications.
      ii. Remember: blood loss does not stop immediately after the patient arrives in the hospital. Occult hemorrhage into contusions, hematoma and fractures will continue.
      iii. Risks: same as routine cross-match.

7. Consider cell-saver:
   a. Chest tubes with exsanguinating hemorrhage.
      i. Set up cell-saver compatible chest drainage system (see Practice Guideline: Autotransfusion).
      ii. Add 13 ml of citrate anticoagulant for every anticipated 100 ml of salvaged blood.
   b. Abdominal or chest injuries with exsanguinating bleeding.
      i. Call OR.
      ii. Make sure that operating room charge nurse is aware that cell-saver system and technician will be needed.

8. Fresh frozen plasma: available in 30-45 minutes after sample received in the Blood Bank.
   a. Absolute indications:
      i. Patient with seriously bleeding injury who is clinically anticoagulated on coumadin. (requires 4 units)
      ii. Documented coagulopathy due to dilution or DIC.
      iii. Administer 4 to 8 units as soon as it is available.
   b. Relative indications:
      i. Elevated PT/PTT.
      ii. Massive transfusion: after the sixth unit of PRBC’s and then one unit FFP for every four units of PRBC’s.


a. Absolute indication: evidence of bleeding with a platelet count <50,000.
b. Relative indications:
   i. Potential bleeding with platelet count <20,000.
   ii. Massive transfusion with non-surgical bleeding before the platelet count can be obtained.
   iii. Give 6 units of platelets after every tenth unit of PRBC’s in massive transfusion.

10. Cryoprecipitate: available in 30-45 minutes.
   a. Absolute indication: non-surgical bleeding with fibrinogen <150 mg/dL.
   b. Patients with von Willenbrand’s Disease relative indication: non-surgical bleeding after massive transfusion before a fibrinogen level can be obtained.

PROCESS FOR BLOOD AVAILABILITY AT THE University Hospital:

1. Two units of blood is kept in the Trauma room refrigerator. An emergency release form will need to be signed.

2. Blood for type and cross match will be drawn (per policy CM, B-08 [http://www.upstate.edu/policies/documents/intra/CM_B-08.pdf]) and if there is a defined need for blood, these samples will be sent to the Blood Bank for immediate processing, after orders are placed in the system.

3. Once blood is used, ED/Trauma personnel will notify Blood Bank if more than 2 units of uncrossmatched blood is needed. The request should include the type of blood needed (O-Neg or Type Specific). The physician, or their designee, requesting the uncrossmatched blood, must complete an Emergency Release Form. The Emergency Release form and patient identification number should be provided to the Blood Bank upon receipt of the blood.

4. Blood should be stored in the Trauma room refrigerator (policy LAB, B-02) until used. When used, the blood shall be administered in the usual manner, using appropriate tubing, filter and warming device as indicated.

5. Unused blood should be returned to the Blood bank as soon as possible, not longer than two hours.

6. Type Specific Blood and/or full crossmatched blood should be used as it becomes available. Close contact with the Blood Bank regarding status of blood units is essential. If the patient is transferred to another nursing unit/department with any blood components unused, notify Blood Bank so they are aware of blood locations.

7. Blood will usually be infused with 0.9% NACL but may be administered with Lactated Ringers as long as rapid flow rates are used.
PRACTICE GUIDELINES: MASSIVE TRANSFUSION PROTOCOL (MTP)

PRACTICE GUIDELINES: TRAUMATIC ARREST

OBJECTIVES:

1. To define priorities in the management of traumatic arrest.
2. To describe procedures for the management of traumatic arrest.

DEFINITION:

Traumatic arrest: A patient who is admitted to the trauma room with no pulses or spontaneous respiratory activity. This status includes pulseless electrical activity (PEA).

Signs of life: Presence of blood pressure, neurologic activity, and/or respiratory effort. Cardiac electrical activity in the absence of any other “signs of life” (PEA) will not be an indication to proceed with resuscitative thoracotomy

GUIDELINES:

1. Background
   a. Blunt trauma arrest
      i. Survival is zero.
      ii. Resuscitative thoracotomy should be not be used.
   b. Penetrating Trauma arrest
      i. Up to 30% survival depending on the circumstances and the nature of the injury
      ii. Prognosis is better at urban centers with rapid transport times
      iii. Penetrating chest injuries are associated with greatest survival
   c. General approach to the initiation of resuscitation
      i. Blunt traumatic arrest should have an intial attempt at appropriate ACLS.
      ii. Penetrating traumatic arrest
         a) Do not resuscitate if the patient has had no signs of life (consciousness, movement, blood pressure, pulse) for greater than ten minutes.
         b) Resuscitation can be terminated in the field for patients in Asystole. Please see page 69 of the Central New York EMS, Midstate EMS, North Country EMS Collaborative Protocol Handbook (2013)

2. Penetrating chest injury in traumatic arrest with hypotension or recent (less than 5 min) loss of VS deserves vigorous trauma resuscitation.

3. Penetrating abdominal injury in traumatic arrest and arrives without vital signs (survival 5.7%) and does not respond to initial resuscitation might benefit with this aggressive approach if signs of life were present within 5 minutes from arrival in the trauma room.

4. General Procedure for Traumatic arrest:
   a. Transfer patient onto trauma gurney.
   b. Continue CPR.
   c. Do a rapid primary survey.
   d. Confirm presence or absence of spontaneous cardiac and/or respiratory activity.
e. Do simultaneous orotracheal intubation and IV access.
   i. In this situation IV access may not be obtainable in peripheral veins.
   ii. Attempt simultaneous femoral venous access and/or subclavian vein IV insertion.

e. Resuscitative procedures:
   i. Bilateral Needle Thoracostomy
      1) If a large amount of air or blood is obtained out of either cannula, then
         immediately insert a 36 Fr. chest tube into that side of the chest.
      2) Alternatively, insert chest tube on both sides of the chest as initial
   
   ii. Consider Peri-Cardiocentesis
      1) If penetrating trauma
      2) If positive FAST for pericardial fluid.

g. As the above procedures are being carried out, place EKG electrodes on the patient
   and assess the cardiac rhythm.
   i. Initiate the ACLS protocol.
   ii. In the usual case, the problem will be asystole and epinephrine will be the first
   drug of choice.

h. MTP
   i. Run all blood and fluid thru the ThermaCor infusor.
   ii. The infusion rate should be between 500 and 1000 ml/minute.
   i. By this time, the resuscitation should have been ongoing for about 5 minutes.
   i. No pulse and no electrical activity, then
   ii. Terminate the resuscitation

j. Determine need for thoracotomy
   i. Indications
      a) Penetrating chest injury with signs of life within 5 minutes of now.
      Once decision is made, proceed to left anterior thoracotomy
      a) Aspirate blood from chest
      b) Examine the pericardium
         (i) If empty do nothing to pericardium
            (a) Look for bleeding from lung. If present -
               (1) Consider Satinsky clamp on the hilum
               (2) Consider Satinsky clamp on the lung
               (3) Consider mattress sutures
            (b) Look for bleeding from chest wall. If present -
               (1) Pack
               (2) Look for intercostal bleeding
               (3) Consider stick ties
         (ii) If pericardium full of blood, then make an incision longitudinally (top to bottom), anterior to the phrenic nerve
            (a) Place finger over bleeding point in myocardium
            (b) Consider skin stapler
            (c) Consider Foley catheter
            (d) Consider clamp on atrial appendage
            (e) Consider 2-0 prolene mattress sutures
         (iii) If injury appears to be in the other hemi-thorax or you need better access
            to the heart, then “clamshell” the incision across the sternum
            (a) Lebshke knife
            (b) Gigli saw
(c) Large pair of Mayo scissors
(iv) If cardiac function deteriorates, begin internal massage
(v) Place clamp on the descending aorta

c) If cardiac function deteriorates to ventricular fibrillation
   (i) Proceed with ACLS protocol
   (ii) Administer epinephrine
   (iii) Defibrillate with 20-30 joules with internal paddles
   (iv) If no effect increase to 50 joules

d) If no return of cardiac function, discontinue resuscitation.

e) If cardiac function returns
   (ii) Prepare to go to the OR as quickly as possible
   (iii) Be dignified; cover the thoracotomy with a sheet

f) If unsuccessful, close thoracotomy skin incision with large nylon running sutures. Call the medical examiner/coroner.
PRACTICE GUIDELINES: NECK IMMOBILIZATION PRIOR TO CERVICAL SPINE CLEARANCE

OBJECTIVES:

1. Define appropriate methods for cervical spine immobilization prior to clearance.
2. Define appropriate devices for cervical spine immobilization to prevent skin breakdown and decubitus formation.
3. Encourage documentation of skin changes referable to the use of cervical spine immobilization.

DEFINITIONS:

1. Cervical spine immobilization: Use of a device to stabilize the neck in a neutral position until adequate evaluation can be undertaken to determine the presence or absence of cervical spine injury.

GUIDELINES:

1. All patients who have mechanism for cervical spine injury and are being evaluated according to the C-spine clearance protocol must be treated with cervical spine immobilization, including:
   a. Head of bed elevated no greater than 30º as ordered by a physician.
   b. Limit to log roll only if suspicion of thoracic, lumbar or sacral spine injuries.
   c. Cervical immobilization collar.
2. Most patients will arrive in the trauma room with a stiff neck collar in place or a collar will be applied after arrival if necessary.
   a. Make sure the collar has been applied correctly.
   b. Check under the collar (with manual immobilization) for the presence of skin breakdown, lacerations, swelling, penetrating injuries, tracheal deviation, subcutaneous emphysema or distended neck veins.
   c. Make sure that the collar is appropriately padded around laceration or other open wounds.
3. Proceed with C-spine clearance protocol.
4. If cervical spine injury cannot be ruled out by the time the patient leaves the ED, then change the cervical collar to an appropriately-sized Philadelphia collar or padded collar.
5. If cervical spine injury cannot be ruled out clinically by 24 hours after admission, then obtain an MRI of the cervical spine or if patient awake may consider flexion/extension views.
6. If Cervical immobilization is needed for treatment switch to a padded collar (Miami J or Aspen)

PRACTICE GUIDELINES: CERVICAL SPINE CLEARANCE
OBJECTIVE:

To provide guidelines for the diagnostic evaluation of the cervical spine in patients suffering multiple injuries who are at high risk for cervical spine injuries.

DEFINITION:

1. C-Spine: Includes C1 to the upper border of T1.
2. Clearance of C-Spine: A clinical decision suggesting the absence of acute bone related, ligamentous and neurologic abnormalities of the cervical spine based on history, physical exam and/or negative radiologic studies.

GUIDELINES:

1. Patients should be considered to have a cervical spine injury if they present with any of the following conditions:
   a. A history of blow to the head or neck.
   b. Pain in the cervical spine or paraspinous muscles.
   c. Pain to palpation of the cervical spine.
   d. Traumatic brain injury and/or skull fracture.
   e. Facial injuries such as fractures, tooth loss or severe lacerations.
   f. Neurologic deficits in torso, legs or arms not explained by peripheral nerve injuries.

2. Awake patient without cervical tenderness and no distracting injury:
   a. A patient with possible C-spine injury as defined in Section 1 above (usually based on mechanism) may have their cervical spine cleared without further radiologic evaluation if all of the following conditions exist:
      i. No neck pain.
      ii. No pain to palpation of cervical spine or paraspinous area.
      iii. Patient must be awake and alert.
      iv. No intoxication with alcohol or drugs.
   EXAM:. Remove anterior collar while having patient keep their head still. Have patient flex and extend neck, turn left and right passively then against resistance (your hand). If there is pain on any movement STOP and replace collar. Patient will need additional radiographic examination (MRI)
   b. The goal is to clear the C-spine within one hour in these circumstances.

3. Awake patient with no cervical tenderness, but with associated injuries suggesting the high likelihood of a C-spine injury:
   a. If the patient has a severe acceleration-deceleration injury and has associated injuries (e.g., facial fractures) suggesting C-spine injury, then the patient should be evaluated as follows:
      i. For patients going to CT scan for any other study, obtain CT of the C-spine with reformatted images
      ii. For patients with very high clinical suspicion of fracture obtain CT of the C-spine with reformatted images
   b. If the radiologic evaluation is negative per the attending radiologist and the patient still has no pain, the C-spine can be cleared after a note is written in the chart.
   c. The goal is to clear the C-spine within four hours. If there is a significant painful “distracting” injury, then the goal is to clear the C-spine in less than 12 hours.
d. If X-rays show abnormalities, then the orthopedic or neurosurgical spine service should be consulted prior to removing the collar.

4. Awake patient with persistent tenderness:
   a. An Adult patient with possible cervical spine injury as defined in Section 1 above associated with cervical tenderness should be evaluated as follows:
      i. Obtain a dedicated CT scan of the C-spine with reformatted images.
      ii. Obtain an MRI or Flexion/Extension views of the C-spine.
   b. If both are negative and have been read by the radiologist, the C-spine may be cleared. Appropriate documentation should appear in the chart.
   c. In pediatrics, consider an MRI instead to detect ligamentous injury or laxity. If positive, consult the orthopedic or neurosurgical spine service for treatment plan.
   d. If X-rays show bony or ligamentous abnormalities or instability, then consult orthopedic or neurosurgical spine service.

5. The patient with altered mental status and possible C-spine injury as defined in Section 1 above:
   a. The patient has a head injury or severe intoxication and cannot provide a reliable clinical exam:
   b. Severe intoxication (drugs, alcohol):
      i. Obtain CT Scan of C-spine at same time a head CT scan is performed.
      ii. If X-rays show no injury by radiologist interpretation, then leave cervical collar in place until patient awakens (EtOH will metabolize at approximately 30 mg/dl per hour), and examine for cervical tenderness. If the patient has cervical tenderness, then use the protocol outlined in Section 4 above.
      iii. If the patient has no cervical tenderness, clear patient by clinical exam. (see above)
   c. If the patient has an altered mental status, without obvious intoxication (i.e., severe head injury), then:
      i. Obtain axial CT scan through C1 to T1 with lateral and AP reformatting
      ii. Obtain a cervical MRI scan when the patient can be safely transported to the scanner. (as early as possible, before day 2 is preferable)
      ii. If the above X-rays are negative, remove the collar and place appropriate documentation of cervical spine clearance in the chart.

6. If any abnormalities are found on any of the radiographs, then consult the orthopedic or neurosurgical spine service for advice on the next appropriate radiologic procedure. The cervical collar should be kept in place and spinal precautions maintained.

7. If there are any neurologic deficits attributable to a possible cervical spinal cord injury, then consult the orthopedic or neurosurgery spine service for advice on the appropriate radiologic studies. The cervical collar should remain in place and spinal precautions observed.
   a. Usually obtain a lateral C-spine X-ray in the trauma resuscitation area.
   b. Obtain a CT scan of cervical spine with reconstruction.
   c. If no bony abnormalities are seen, then obtain an MRI scan to determine spinal cord abnormalities.
8. Every effort should be made to carefully take the patient off the spine board within 2 hours of being placed on the board, even if spine has not been cleared, as these devices have been shown to cause skin damage.
PRACTICE GUIDELINES: TRAUMATIC NON-PENETRATING TETRAPLEGIA OR PARAPLEGIA

OBJECTIVES:

1. To define diagnostic approaches to non-penetrating spinal cord injuries.
2. To define early therapeutic intervention strategies for spinal cord injuries.

DEFINITIONS:

1. Traumatic tetraplegia: Any non-penetrating complete spinal cord injury associated with a spinal cord or nerve root deficit not involving the cranial nerves above and including C8, T1 roots.
2. Traumatic paraplegia: Any non-penetrating complete spinal cord injury associated with a spinal cord or nerve root deficit below and including T2.
3. Complete: Any spinal cord injury associated with a complete motor and sensory deficit below the level of the injury.
4. Incomplete: Any sensory or motor sparing below the level of injury including perianal sensation.

GUIDELINES:

1. Follow the ABC’s.
2. Perform a complete neurologic exam looking for neurologic deficit and the level of the deficit.
3. Maintain spine precautions.
4. Obtain X-rays according to the C-spine and thoracic and lumbo-sacral injury protocols.
5. If tetraplegia or paraplegia are noted, perform a bulbocavernous reflex test:
   a. Male: pull on penis while examining for an increase in rectal tone.
   b. Female: pull on Foley catheter while examining for an increase in rectal tone.
   c. If this reflex is present, then spinal shock is not occurring and injury will usually not improve.
   d. If this reflex is absent, then spinal shock (spinal neuroplexus) may be occurring and ultimate outcome of injury is masked.
   e. Document presence or absence of bulbocavernous reflex.
6. Consult the orthopedic or neurosurgery spine service immediately.
7. Neurogenic shock may occur with Cerebral or Spinal injuries down to T4-6.
   a. Place Foley and monitor urine output.
   b. Follow frequent blood pressures.
   c. If patient has SBP <90 mmHg or MAP <65 mmHg and urine output <30 ml/hr and hemorrhagic shock has been ruled out:.
      i. Administer 2000 ml IV fluid.
      ii. Start levophed or dopamine if HR <60
      iii. May consider phenylephrine starting at 30 mcg/min if HR >60
9. Quadraplegics with potential pulmonary problems:
   a. Nearly all patients with a C-5 or higher neurologic deficit will require intubation.
   b. Assess vital capacity: if less than 1000 ml (or 10 ml/kg), consider intubation.
   c. Assess ability to clear secretions: consider intubation if secretions cannot be cleared spontaneously or with quad cough maneuver.
   d. Closely monitor in ICU or step down unit for the first 24 hours, with good pulmonary toilet.
   e. If there is a question about retention of secretions or development of atelectasis in the first 24 hours, intubate – it’s only going to get worse!
10. Fill out ASIA (American Spinal Injury Association) exam form
11. Consult PM&R early to assist with planning
PRACTICE GUIDELINES: MANAGEMENT OF BLUNT CHEST INJURIES

OBJECTIVE:

To define protocols for the diagnosis and management of specific chest injuries that are commonly seen after blunt trauma.

DEFINITION:

Chest injury: Any injury to the thoracic cage and its contents, including the lungs, heart, great vessels, diaphragm, trachea-bronchial tree and esophagus.

GUIDELINES:

1. Blunt chest injuries are characterized by:
   a. Mechanism:
      i. Severe blunt force applied to the chest.
      ii. Rapid deceleration injury.
   b. Signs:
      i. Chest wall deformity
      ii. Chest wall contusion
      iii. Chest wall laceration
      iv. Severe trauma above the chest (e.g., head injury) and below the chest (e.g., abdominal or pelvic injury)
   c. Symptoms:
      i. Tachypnea
      ii. Pain
      iii. Absent breath sounds
      iv. Crepitus or subcutaneous emphysema
      v. Hemoptysis
      vi. Discordant breathing pattern
      vii. Hypotension
      viii. Distended neck veins

2. With any of the above findings, consider the possibility of the following chest injuries:
   a. Tension pneumothorax
   b. Open pneumothorax
   c. Flail chest/pulmonary contusion
   d. Massive hemothorax
   e. Cardiac tamponade
   f. Cardiac contusion
   g. Ruptured diaphragm
   h. Ruptured tracheobronchial tree
   i. Ruptured thoracic aorta
   j. Ruptured esophagus
   k. Myocardial tear
   l. Simple pneumothorax
   m. Fractured ribs

3. Maintain airway:
   a. Intubate for respiratory distress or airway obstruction.
i. Remember that current condition may deteriorate – intubate early
ii. If patient has a marginal airway, remember that unmonitored periods of time will be present – ie CT scanning
iii. Intubating outside the ED or ICU is difficult, consider intubating marginal patients prior to CT scanning

b. Beware of worsening pneumothorax as pressure is applied to the airway.

4. If time allows, obtain portable AP chest X-ray:
   a. Evaluate for possible chest injury.
   b. Confirm tube placement.
   c. In general, all transfers who have had a chest X-ray at another facility should have a repeat chest X-ray after arrival.
   d. Chest tubes should be placed prior to the chest X-ray if there is a hemodynamic compromise.

5. For severe anterior chest trauma, obtain an emergent EKG.

6. Treat injury according to the diagnostic findings:
   a. Tension pneumothorax:
      i. Physiology: air enters the pleural space and cannot exit (“flap valve” phenomenon):
         a) Respiratory compromise due to increased pleural pressure.
         b) Hemodynamic compromise due to impaired venous return.
         c) Good lung is affected by mediastinal shift into its domain
      ii. Diagnosis:
         a) Respiratory distress.
         b) Absent unilateral breath sounds.
         c) Asymmetric chest wall motion (hemithorax “stuck out”).
         d) Hypotension with distended neck veins.
         e) Shift of the trachea and the PMI.
      iii. Treatment:
         a) With hemodynamic compromise: needle thoracostomy followed by chest tube.
         b) Without hemodynamic compromise: confirm with chest X-ray and place large bore chest tube (36 Fr.).
         c) Obtain chest X-ray after chest tube has been placed.

b. Open pneumothorax:
   i. Physiology:
      a) Open defect in chest wall allows air to enter the pleural space through the defect rather than through the trachea.
      b) Mediastinum shifts as pressure gradients change across the midline.
   ii. Diagnosis: “sucking chest wound.”
   iii. Treatment:
      a) Intubate the patient and place on positive pressure ventilation.
      b) Insert large bore chest tube. Never put the tube through the wound.
      c) Cover the defect.
      d) Consider surgical closure of the defect.

   c. Flail chest/Pulmonary contusion
   i. Physiology:
      a) Blunt force to the chest.
      b) Ribs fractured in multiple places lead to unstable segment of chest wall.
      c) Pain!!!!
d) Pulmonary contusion in underlying area of lung with alveolar hemorrhage and edema resulting in focal compliance reduction and interference with gas exchange.

ii. Diagnosis:
   a) Paradoxical chest wall movement.
   b) Severe pain with breathing or with palpation in the affected area.
   c) Respiratory distress.
   d) Hemoptyisis.
   e) Chest X-ray demonstrates contusion, but it may not show up for several hours.

iii. Treatment:
   a) Flail chest:
      i) Pain control: epidural, PCA, morphine drip.
      ii) Pulmonary toilet, monitor vital capacity.
      iii) Intubate for worsening compliance and respiratory distress due to the underlying contusion or increasing pCO$_2$.
   b) Pulmonary contusion:
      i) Pulmonary toilet, monitor vital capacity (patients should be able to maintain a vital capacity of greater than 1.0 L)
      ii) Intubate for worsening compliance, respiratory distress or hypoxemia. Maintain normovolemia, do not restrict fluids but utilize fluids judiciously.

d. Massive hemothorax:
   i. Physiology:
      a) Massive bleeding into the pleural space results in hemorrhagic shock.
      b) After blunt trauma, source is usually bleeding from the chest wall.
   ii. Diagnosis:
      a) Hemorrhagic shock and hemothorax on chest X-ray.
      b) Absent breath sounds on affected side.
      c) Dull to percussion on affected side.
   iii. Treatment:
      a) Fluid resuscitation to correct hemorrhagic shock.
      b) Place large bore chest tube (36 Fr.).
      c) If initial drainage >1500 ml or drainage continues at >200 ml/hr (150 ml/hr for elderly patients) for more than two hours, then consider operative intervention.
      d) If drainage is high, may consider intubation and application of PEEP (10-20 cmH$_2$O) to tamponade chest wall bleeding.
   iv. Consider using blood salvage (autotransfuer) if available reinfusion (Note:This should be done under a protocol as you may infuse activated clotting factors. Currently we do not use this at UUH. Instead we opt for the MTP as the process is more consistent). If the patient is taken to the operating room use of a cell saver should be considered.

e. Cardiac tamponade:
   i. Physiology:
      a) Traumatic injury to the atrium, ventricle, or intrapericardial vena cava results in blood loss into the pericardial sac.
      b) As blood accumulates in pericardial sac, then end-diastolic volume is reduced, resulting in a fall of the cardiac output.
   ii. Diagnosis:
      a) Hypotension and distended neck veins without a tension pneumothorax.
      b) Distant heart sounds.
d) “Blue facies.”
e) FAST exam shows pericardial fluid ***** IMPORTANT

iii. Treatment:
   a) Start with IV fluid bolus.
   b) Pericardiocentesis, or
   c) Pericardial window. If positive, immediately go to OR for median sternotomy
      or thoracotomy depending on location of injury and anticipated findings

f. Blunt cardiac injury:
   i. Physiology:
      a) Contusion of the myocardium results in conduction defects.
      b) Contusion may result in reduced contractility.
   ii. Diagnosis:
      a) History of severe anterior chest trauma and abnormality in EKG.
         i) Unexplained tachycardia.
         ii) Right bundle branch block.
         iii) Unexplained nonspecific ST-T wave changes.
         iv) New Q-waves.
         v) New arrhythmia (atrial fib/flutter, PVC’s, multifocal PAC’s).
         vi) With high suspicion, obtain echocardiogram (preferably TEE).
         vii) Serial troponins only if trying to distinguish from myocardial infarction.
   b) Unexplained myocardial pump failure (rule out valve injury).

iii. Treatment:
   a) Monitor telemetry for 24 hours in the hospital - does not have to be in ICU if
      no other injury warrants it.
   b) Treat arrhythmias according to ACLS guidelines.
   c) If arrhythmia or EKG changes do not resolve then do an echocardiogram
   d) Treat cardiac dysfunction with inotropes. Will need PA catheter if inotropes
      are required.

g. Ruptured diaphragm:
   i. Physiology: tear in diaphragm allows abdominal contents to enter the chest,
      resulting in respiratory distress. The process is more rapid with spontaneous
      ventilation.
   ii. Diagnosis:
      a) Left:
         i) Chest X-ray shows abdominal viscera in the chest.
         ii) Place NG tube and see if it appears in the chest.
         iii) If necessary, obtain barium swallow to document the location of the
              stomach.
      b) Right:
         i) An abnormal “hump” in the lateral diaphragm suggests laceration and
            protrusion of the liver.
         ii) Confirm with CT or thoracoscopy.
         iii) Laparoscopy does not appear to be helpful since the liver often obstructs
              the view of the diaphragmatic tear, although it is worth a try
   iii. Treatment:
      a) Consider early intubation to prevent further migration of abdominal viscera
         into chest.
      b) Operative repair through the abdomen.
      c) If diagnosis is delayed (greater than two weeks), may need a thoracotomy.

h. Ruptured tracheobronchial tree:
i. Physiology: massive air leak into the pleural space after tear of the bronchial tree, usually near a point of fixation.

ii. Diagnosis:
   a) Massive pneumothorax.
   b) Continued massive air leak after placement of the chest tube.
   c) Bronchoscopic diagnosis of tear.

iii. Treatment:
   a) If massive, can try balloon occlusion of the affected bronchus.
   b) To the operating room for thoracotomy and operative closure.
   c) Avoid high pressures on the lung in the postoperative period.

i. Ruptured thoracic aorta:
   i. Physiology:
      a) Aorta ruptures at point of fixation after severe deceleration events. The point of rupture is usually just distal to the left subclavian artery or in the ascending arch.
      b) Resulting hematoma is contained by adventitia or pleura.
      c) 85% are dead at the scene.
      d) One half of the survivors will die in 24 hours.

   ii. Diagnosis:
      a) History of severe deceleration impact.
      b. Widened mediastinum (see Guideline for evaluation of the widened mediastinum).

   iii. Treatment:
      a) Avoid hypertension, using beta-blocker with vasodilator if necessary.
      b) Consult cardiothoracic surgery and prepare for operating room.

j. Ruptured esophagus:
   i. Physiology: chest crush or penetrating injury results in rupture of the esophagus.

   ii. Diagnosis:
      a) Air in the mediastinum.
      b) Sputum or intestinal contents out of the chest tube.
      c) Confirm with esophagoscopy or gastrografin swallow (preferred)

   iii. Treatment:
      Type of repair is determined by the nature of the injury and time interval to diagnosis.
      a) Simple injuries, quickly diagnosed – primary repair buttressed with pleura, intercostal muscle, or omentum
      b) Complex injury or delay in diagnosis – may try primary repair but should protect with a proximal cervical esophagostomy and G-tube.
      c) In all cases, the mediastinum should be widely drained with multiple chest tubes.

k. Simple pneumothorax:
   i. Physiology: puncture of the lung with air leak into the pleural space. The air in the space is not under excessive pressure.

   ii. Diagnosis:
      a) Absent unilateral breath sounds.
      b) Subcutaneous emphysema.
      c) Pneumothorax on chest X-ray.

   iii. Treatment: A tube thoracostomy is generally needed in pneumothoraces. The size and timing are dictated by patient stability and potential need for mechanical ventilation. Small (<15%) pneumothoraces may potentially be observed with follow-up radiographs. Larger pneumothoraces should have a tube thoracostomy.
placed on diagnosis as well as those patient undergoing general anesthesia (i.e.,
for a femur fracture.)

iv. Occult pneumothorax seen on CT scan without plain film findings can be treated
without chest tube. If the patient goes to operating room, is intubated or is
transferred by air ambulance, then a chest tube or close interval follow-up should
be considered.

I. Fractured ribs:
   i. Physiology: ribs fracture from direct force or from massive AP force.
   ii. Diagnosis:
      a) Chest wall pain.
      b) Bony crepitus.
      c) Fractured ribs on chest X-ray.
      d) Remember that the anterior costochondral cartilages can be fractured and not
         show up on chest X-ray.
   iii. Treatment:
      a) Pain control: epidural, PCA, morphine drip.
      b) Pulmonary toilet.
      c) Drain intrapleural fluid accumulation.
PRACTICE GUIDELINES: EVALUATION OF THE WIDENED MEDIASTINUM

OBJECTIVES:

1. Define the indications of pursuing an evaluation to rule out a thoracic aortic injury.
2. Suggest possible diagnostic paradigms for the evaluation of thoracic aortic injury.

DEFINITIONS:

Thoracic aortic injury: A disruption of the thoracic aorta from blunt deceleration trauma. This injury usually occurs at the ductus arteriosum which is just distal to the take-off of the left subclavian artery. Occasionally, the aorta may rupture in the ascending portion and at the take-off of the major vessels.

Widened mediastinum: Definition: A mediastinum measurement ≥8 cm or >1/3rd the transthoracic distance at the level of the aortic knob on a supine AP film.

GUIDELINES:

1. Initially assume that there is an aortic injury on every patient with a rapid deceleration mechanism of injury.

2. Evaluate and treat the ABC’s. Obtain blood pressure in both arms.

3. Obtain a chest X-ray. Examine for a widened mediastinum ≥8 cm at level of aortic knob). The following signs are confirmatory of a possible aortic injury, but in themselves, do not suggest the need for further evaluation.
   a. Pleural cap.
   b. Depressed left mainstem bronchus.
   c. Trachea or esophagus deviated to right.
   d. First and second rib fracture.
   e. Obliterated aorto-pulmonary window.

4. Assess for symptomatic upper extremity BP differences (> 10 mmHg), pseudocoarctation syndrome or infrascapular murmur. These are also suggestive of aortic injury.

5. If the possibility of aortic injury is considered at any point in the resuscitation, avoid hypertension. Extremely high blood pressures should be treated with a short acting intravenous beta-blocker (e.g., labetalol or esmolol).

6. If a widened mediastinum is found and the patient can sit up, obtain an upright chest X-ray. The sitting position will decrease the possibility of spurious widening of the mediastinum due to the gravity effects on the heart (i.e. splays it apart) and magnification from the AP projection.

7. If the mediastinum is still widened or an upright film cannot be performed, obtain a chest CT scan with cuts through the aortic arch. If the CT scan shows no periaortic mediastinal blood, then an aortic injury has been ruled out.

8. A thoracic angiogram should be obtained in the following circumstance:
a. The chest X-ray shows a widened mediastinum and a CT scan or TEE cannot be performed.

b. A chest CT scan shows blood in the mediastinum or an aortic disruption. The need for angiogram will be determined by the cardiothoracic surgeon.
PRACTICE GUIDELINES: BLUNT CARDIAC INJURY

OBJECTIVES:

1. Define the basis of the clinical diagnosis of blunt cardiac injury.
2. Define appropriate laboratory studies to diagnose blunt cardiac injury.
3. Provide guidelines for appropriate treatment of potential blunt cardiac injury.

DEFINITION:

Blunt cardiac injury: A bruise of the myocardial muscle that may result in temporary arrhythmias or loss of contractile function.

GUIDELINES:

1. Consider the possibility of blunt cardiac injury in the following situations:
   a. Severe decelerating blunt chest trauma.
   b. Multiple anterior rib fractures.
   c. Severe anterior chest pain suggesting rib fractures or chondral fractures.
   d. Fractured sternum.
   e. Seatbelt contusion across the anterior chest.
   f. Severe bilateral pulmonary contusions.

2. Follow the ABC’s and treat all chest injuries according to the diagnostic findings.

3. Obtain chest X-ray looking for any of the above findings.

4. Obtain EKG.

5. Consider EKG abnormal with the following findings:
   a. Unexplained tachycardia (rate >120).
   b. Ventricular arrhythmias – PVC’s, bigeminy.
   c. Atrial arrhythmia - multifocal PAC’s, new atrial fibrillation or flutter.
   d. Right bundle branch block.
   e. New onset Q-waves.
   f. New onset ST-T wave abnormality.

6. Admit all patients with abnormal EKG should have telemetry for at least 24 hours.

7. Obtain repeat EKG after 12 – 24 hours.

8. Consider transthoracic (or, if available, transesophageal) echocardiogram for the following:
   a. Unexplained hypotension suggestive of cardiac failure.
   b. Abnormal EKG.
   c. Persistent arrhythmias from telemetry (>24 hours).

9. Patient with blunt cardiac injury may undergo anesthesia if properly monitored.

10. CPK isoenzymes and troponin levels are not useful for predicting blunt cardiac injury.
11. If patient has persistent myocardial dysfunction:
   a. Obtain cardiology consult.
   b. Treat arrhythmias.
   c. Treat any cardiac failure.

12. Prognosis
   a. Asymptomatic Cardiac arrhythmias and dysfunction usually resolve after 24 hours
   b. If persistent, consider coronary artery injury
   c. Repeat echocardiogram and possible cardiac catheterization may be indicated.
PRACTICE GUIDELINES: PENETRATING CHEST INJURY

OBJECTIVES:

1. Define guidelines for the management of penetrating injuries to the chest.
2. Define an optimal diagnostic strategy and appropriate treatment plans for suspected injuries.

DEFINITION:

Penetrating injury to the chest: A penetrating injury of the thorax in an area bounded superiorly by the lower neck and inferiorly by the lower costal margin. See also: Thoracoabdominal injuries under “Penetrating Injuries to the Abdomen.”

GUIDELINES:

1. Any penetrating injury to the chest must be assumed to have caused internal organ damage which may involve the:
   a. Heart.
   b. Lungs.
   c. Tracheobronchial tree.
   d. Esophagus.
   e. Great vessels.
   f. Diaphragm.
   g. Spinal cord.

2. In all patients, assess the ABC’s and obtain an airway as quickly as possible, if necessary.

3. If patient has suffered cardiac arrest and has had signs of life (e.g., pulse or EKG present) at any time (< 10 minutes prior to arrival) or is in extremis with low blood pressure, proceed directly to left anterior thoracotomy while the patient is being intubated and large bore intravenous lines are being inserted. See “Emergent Thoracotomy Guidelines.”

4. In the non-arrested patient, determine whether the patient is hemodynamically stable (normal) or unstable (hypotensive or tachycardic) and whether the patient has respiratory distress.

5. If hemodynamically unstable or has respiratory distress consider:
   a. Tension pneumothorax:
      i. Absent breath sounds.
      ii. Distended neck veins.
      iii. Shift of the trachea and/or the PMI.
      iv. Insert large bore chest tube (consider needle thoracostomy to temporize).
   b. Massive hemothorax:
      i. Absent breath sounds the affected side.
      ii. Dull to percussion on affected side.
      iii. Stabilize blood pressure with vigorous fluid resuscitation.
      iv. Insert large bore chest tube.
      v. Take immediately to OR if
         a) Initial drainage is >1500 ml, or
b) Drainage continues at >200 ml/hr (>150 ml/hr for elderly patients) for 2-3 hours.

d) Consider increasing PEEP (to 10-15 cmH20) to tamponade bleeding from lung or chest wall. Discontinue if air leak increases.

c. Cardiac tamponade:
   i. Entry wound between nipples and between suprasternal notch and xyphoid.
   ii. Distended neck veins.
   iii. Distant heart sounds.
   iv. “Blue facies.”
   v. Tension pneumothorax has been treated or ruled out.
   vi. Perform FAST exam.
   vii. If FAST cannot be done or is equivocal perform needle pericardiocentesis or open subxiphoid pericardiocentesis.
   viii. If positive, go immediately to the OR for thoracotomy or median sternotomy.

6. If patient is stable and has little respiratory distress, obtain AP supine chest X-ray (mark the entry and exit sites with radio-opaque markers).

7. If X-ray shows:
   a. Pneumothorax: place large bore (≥32Fr.) chest tube.
   b. Hemothorax: resuscitate the blood volume and place large bore chest tube. Thoracotomy if drainage is higher than thresholds.

8. If the wound is below the nipples, this is considered a thoraco-abdominal wound. Refer to Practice Guideline on “Penetrating Abdominal Injury.”

9. If the injury is in Zone 1 of the neck, consider angiogram, bronchoscopy and esophagoscopy. Refer to Practice Guideline on “Penetrating Neck Injury.”

10. If the injury is between the nipples and between the clavicle and lower costal margin, consider the possibility of cardiac injury with occult cardiac tamponade:
    a. Insert CVP to determine central pressure – if it is >20 cm/H2O, consider cardiac tamponade. This can be done at the time of central line insertion. Elevate open-ended tubing (connected to the CVP catheter) above the chest and determine height of blood column as an easy way of determining CVP.
    b. Obtain echocardiogram or perform FAST exam to look for pericardial effusion.

11. If the injury suggests a trajectory through the lung parenchyma alone, obtain a chest CT scan. The bullet track should easily be seen and its relation to the pulmonary hilum and mediastinal structures should be fairly well defined. Treat subsequent hemo/pneumothorax appropriately.

12. If all X-rays are normal and there is no firm indication that the pleural space or mediastinum was penetrated, observe for 6 hours and obtain a repeat inspiratory and expiratory chest X-ray.
    a. If there is a pneumothorax or hemothorax, follow guidelines as above.
    b. If the film is normal, consider discharge from the ED.

PRACTICE GUIDELINES: MANAGEMENT OF TRANSMEDIASTINAL GUNSHOT WOUNDS
OBJECTIVE:

To provide guidelines for the diagnosis and management of a patient with a possible gunshot wound that traversed the mediastinum.

DEFINITION:

Transmediastinal gunshot wound: A penetrating injury with a trajectory that suggests penetration of any of the structures of the mediastinum, including heart, great vessels, pulmonary hilar structures or esophagus.

GUIDELINES:

1. If the patient is in cardiac arrest without “witnessed signs of life,” (>10 minutes) stop the code. Nothing you do is going to make a difference.

2. If the patient is in cardiac arrest and has had “witnessed signs of life” in the pre-hospital phase (<10 minutes), proceed to open thoracotomy:
   a. Perform emergent left anterior thoracotomy.
   b. Consider right thoracotomy if there is an entry wound on the right side of chest without an exit wound. Always remember that you can "clamshell" the thoracotomy and extend a left thoracotomy to the right and a right thoracotomy to the left.
   c. Control cardiac bleeding with finger compression, Foley balloon tamponade, sutures or skin staples.
   d. Control hilar bleeding with a hilar Satinsky clamp, top to bottom. Remember to take down the inferior pulmonary ligament, if you have to apply the clamp from below.
   e. Control retropleural bleeding with large figure-of-eight sutures.
   f. Control great vessel bleeding with Satinsky clamps, a finger, or sutures.

3. If the patient is hypotensive:
   a. Start vigorous IV resuscitation using balanced resuscitation (MTP) through large bore IV lines – remember in this case, one above and one below the diaphragm.
   b. If blood pressure improves, then go to next section – "Stable or Improving."
   c. If blood pressure remains low or pulse is high, then:
      i. Consider tension pneumothorax – follow tension pneumothorax guideline.
      ii. Consider pericardial tamponade – perform FAST exam, follow cardiac tamponade guideline.
      iii. Consider ongoing bleeding.
      iv. Obtain a chest X-ray. Mark the entry and exit sites.
   d. At this point, if there has been no improvement in blood pressure despite fluid infusion and possible chest decompression, consider going to the operating room. See protocol for Emergent OR notification. Once you have made this decision, don’t talk yourself out of it!

4. If the patient has relatively normal vital signs, i.e., BP sys >100, P <110, then proceed with rapid evaluation to determine injury.
   a. Chest X-ray: treat findings of pneumothorax or hemothorax.
   b. Subxiphoid ultrasound: if positive for effusion, then consider rapid transport to the operating room. See protocol for Emergent OR Notification. Consider left thoracotomy to gain access to heart and other potentially injured mediastinal structures.
c. If there is widening of the mediastinum or suprmediastinal enlargement, or a difference in the radial pulses, consider CTA or angiography.
d. All transmediastinal injuries treated non-operatively should undergo esophageal imaging studies (e.g., gastrograffin swallow).
e. Bronchoscopy if any hemoptysis or rapid air leak.

All patients with transmediastinal gunshot wounds, if managed non-operatively, need admission and follow-up chest X-rays.
PRACTICE GUIDELINES: BLUNT ABDOMINAL TRAUMA (ULTRASOUND CREDENTIALED RESUSCITATION TEAM)

OBJECTIVES:

1. Define the patient that might have significant intra-abdominal injury after blunt trauma.
2. Define suggested diagnostic approaches to determine intra-abdominal injury.
3. Define strategies for evaluation of patients with blunt abdominal trauma.

DEFINITIONS:

Ultrasound Credentialed: A physician will be credentialed via their own departmental and medical staff credentialing process.

FAST EXAM (Focused Abdominal Sonography in Trauma): An ultrasound examination of the abdomen that utilizes a 4-view approach for the diagnosis of blood or fluid in the abdominal cavity and pericardial fluid (this will be referred to as the FAST exam below). E-FAST is an extended exam that includes transverse views of the chest to look for pneumothorax.

GUIDELINES:

1. Treat the ABC’s first. The diagnosis of abdominal trauma is part of the secondary survey.
2. Perform physical examination of the abdomen, including rectal exam and flank exam.
   **REMEMBER A NEGATIVE EXAM DOES NOT RULE OUT INJURY WHILE A POSITIVE ONE RULES ONE IN**
3. Consider the possibility of abdominal injury in the following situation:
   a. Obvious abdominal pain with or without peritoneal findings on physical examination.
   b. Significant external findings on the abdominal wall such as deformity contusion, bleeding, laceration (seatbelt sign)
   c. Pelvic fracture.
   d. Fractures present above and below the diaphragm.
   e. Lower rib fractures.
   f. Lumbar or low thoracic spine fractures.
   g. Unexplained hemorrhage, shock or blood loss.
   h. A history of abdominal impact (e.g., deformed steering wheel, passenger compartment damage) in a patient with altered sensorium or not monitored.
      i. Drugs and alcohol impairment.
      ii. Tetraplegia, paraplegia.
      iii. Traumatic brain injury with coma.
      iv. Prolonged non-abdominal surgery requiring anesthesia.
4. Go immediately to the operating room for laparotomy in the following situation:
   a. Findings of diffuse peritoneal irritation (as in general surgery).
   b. Hemorrhagic shock with an indication that there is blood loss in the abdomen
   c. Ruptured diaphragm on chest X-ray.
   d. Obvious peritoneal penetration. (Note: Laparoscopy may be used in stable patients to r/o significant injury.)
5. If the patient has possible abdominal injury and has unstable vital signs, perform the FAST exam (see following paradigm).
   a. If positive (evidence of blood in the peritoneal cavity), go to the operating room for exploratory laparotomy
   b. If negative, consider other causes of massive hemorrhage resulting in hemodynamic instability (long bone fractures, pelvic fractures, hemothorax). (NOTE: If no other source is found rapidly then consider laparotomy as a negative FAST can be a false negative.

6. If the patient has a possibility of abdominal injury and no gross need for exploration and is stable (i.e., relatively normal) vital signs:
   a. Perform the FAST exam (may go directly to CT was well).
   b. If positive, perform abdominal CT scan.
      i. If CT scan shows solid organ injuries, then admit the patient for observation. (See guidelines for non-operative management of spleen and liver injuries.)
      ii. If CT scan shows no solid organ injuries and confirms abdominal fluid perform laparotomy to fully evaluate the bowel.

7. Consider DPL if FAST or CT unavailable.

8. If observation is chosen patients should have regular interval exams and laboratory studies (CBC). If the patient develops peritoneal signs, significant fever or increasing pain away from sites of injury, consider laparotomy/oscopy
PRACTICE GUIDELINES: PENETRATING ABDOMINAL TRAUMA

OBJECTIVE:

Define suggested diagnostic and therapeutic guidelines for penetrating abdominal wounds. Specifically, these guidelines will help determine the presence of an intra-abdominal injury that may require exploratory laparotomy or laparoscopy.

DEFINITIONS:

Penetrating abdominal injury: Any penetrating injury that could have entered the peritoneal cavity or retroperitoneum inflicting damage on the abdominal contents. In general, the entry wounds for an abdominal injury extend from the fifth intercostal space to the perineum.

Anterior penetrating abdominal injury: An entry wound on the anterior abdomen or chest that could have penetrated into the peritoneal cavity. Usually these injuries occur anterior to the posterior axillary line.

Thoraco-abdominal penetrating abdominal injury: An entry wound below the fifth intercostal space and above the costal margin. These are wounds that could have initially entered the chest and then penetrated the diaphragm to enter the abdomen. These injuries are always associated with chest pathology (i.e., hemothorax, pneumothorax).

Posterior or flank penetrating abdominal injury: An entry wound posterior to the posterior axillary line. Wounds in this area are different in that the most likely organ to be injured will be in the retroperitoneum. Additionally, the large mass of flank and back muscle will make the diagnosis of organ injury more difficult and the possibility of organ injury less frequent.

GUIDELINES:

1. Follow the ABC’s, and resuscitate patient according to findings of the primary survey.

2. Assess the abdomen looking for entry wounds, bleeding and peritoneal findings. Make sure that a good chest exam is performed, since chest injuries can be associated with penetrating abdominal injuries.

3. Determine if there are symptoms or signs suggestive of immediate need for operative intervention:
   a. Herniated abdominal contents.
   b. Massive bleeding from the wound.
   c. Obvious peritoneal signs consistent with hollow viscous injury or hemoperitoneum.
   d. Signs of hemodynamic instability associated with the abdominal injury.
   e. Signs of lower extremity ischemia suggestive of vascular injury.
   f. All gunshot wounds with path or other evidence of intraperitoneal penetration or retroperitoneal organ injury.

4. If any of the above signs are present, then take patient to the operating room immediately for exploratory laparotomy.
5. For stab wound and low velocity gunshot wounds (.22 and .25 caliber) in the right upper quadrant of the abdomen (in the area of the liver) consider using the “Right Upper Quadrant Penetrating Injury Protocol”.

6. For stab wounds, if none of the above signs are present, determine the location of the wound and classify as:
   a. Anterior.
   b. Thoracoabdominal.
   c. Posterior or flank.

7. If the stab wound is anterior:
   a. Determine if the wound enters the peritoneal cavity by visually exploring the wound. This is done by infiltrating local anesthesia, after which the wound is prepped and draped. The wound is extended if necessary to allow a visual inspection of the wound to determine its depth. The liberal use of retractors and assistants will facilitate adequate wound exploration.
   b. If the wound does not penetrate the anterior fascia, then the wound can be debrided, irrigated and closed. The patient may be discharged if no other injuries exist. If anterior fascia has been violated try and determine if there is peritoneal penetration.
   c. If the wound does penetrate the peritoneum, then laparotomy should be considered and will likely be performed at Upstate. If the patient has no evidence of peritoneal irritation, then a DPL may be performed. Prior to DPL, a Foley catheter and an NG tube should be placed. Laparotomy is indicated with gross hematuria or blood from NG tube. The threshold for a DPL in these circumstances is an RBC of 5000/mm$^3$ and WBC of 500/mm$^3$). Lavage fluid from the Foley catheter, NG tube or chest tube also mandates exploration. All patients with anterior fascia penetration who are not taken to the OR should be admitted for 24 hours of observation.
8. If the wound is thoraco-abdominal (remember there should be a chest injury – hemothorax, pneumothorax):
   a. Obtain chest X-ray with wound markers to determine the presence of chest injury and to determine the relationship of the entry wound to the diaphragm.
   b. If wound could possibly have penetrated the diaphragm, consider:
      i. CT scan of the abdomen. This study will be positive if any fluid or air is in the abdominal cavity
      ii. DPL with threshold for the RBC count of 5000/mm³.
      iii. Diagnostic laparoscopy. If laparoscopy is performed, be prepared to insert a chest tube, as the insufflation gas may cause a tension pneumothorax through a hole in the diaphragm.

9. If the wound is posterior or flank:
   a. Insert Foley catheter to determine the presence of hematuria.
   b. Obtain a TRIPLE contrast CT scan to determine injury by retroperitoneal organs. Double contrast means contrast administered IV, by mouth or by NG tube and rectum. Consideration can be given to placing a skin clip onto the wound to help localize the injury.

10. For pelvic wounds (usually GSW) that may have traversed the rectum:
    a. Perform anoscopy and sigmoidoscopy to determine the presence of a mucosal defect.
    b. Consider diversion and rectal washout if injury is found. Pre-sacral drainage should be used when contamination levels are high or there has been significant tissue destruction around the anus.

11. For “tangential” gunshot wound of abdomen
    a. Missle tract through subcutaneous tissue with no abdominal cavity entry.
       i. Entry and exit wounds clearly identified
       ii. No diffuse abdominal tenderness
    b. Obtain CT scan, mark entry and exit wounds
    c. If no evidence of abdominal cavity involvement (no fluid or air … none!!), then may observe

12. For all patients taken to OR for exploratory laparotomy:
    a. Once the decision to go the OR is made, don’t delay!!!!
    b. Make sure that there is available blood in the blood bank.
    c. Administer prophylactic antibiotics for bowel flora (piperacillin/tazobactam).
    d. Prep widely for all contingencies (chin to knees, table to table).
    e. Obtain a rapid one-shot IVP to determine the presence of bilateral kidneys if hematuria is present. Often this can be performed in the OR to avoid delay in initiating the laparotomy. Obtain KUB five minutes after injecting 1 ml per kg of renograffin or similar contrast agent. Alternatively an abdominal CT with IV contrast can be performed if patient stability and time allows.
    f. After appropriate debridement and irrigation, consider primary closure of standard gunshot wounds

PRACTICE GUIDELINES: RIGHT UPPER QUADRANT PENETRATING ABDOMINAL INJURIES
OBJECTIVES:

1. Define the type of right upper quadrant penetrating abdominal injury that might be amenable to non-operative management
2. Define diagnostic and therapeutic strategies for the non-operative management of RUQ penetrating injuries.
3. Define pitfalls and complications of this management plan

DEFINITION:

Right Upper Quadrant Penetrating Abdominal Injury – a penetrating injury in the right upper quadrant of the abdomen in which the trajectory of the penetration appears to have involved the liver as the only injured abdominal organ. Any possibility of other organ injury excludes the use of this protocol.

TRAUMA GUIDELINES:

1. For all penetrating injuries of the abdomen, follow ATLS guidelines.
   a. Two large bore IV lines. One must be above the diaphragm.
   b. Two liters of lactated Ringers.

2. Patient must have relatively normal hemodynamics. If there is any drop in blood pressure or abnormal tachycardia or acidosis associated with a penetrating injury in the RUQ, then patient must go for laparotomy.

3. Determine if this fits criteria for non-operative management
   a. Hemodynamically stable.
   b. Stab wound or low velocity gunshot wound (.22 or .25 caliber).
   c. Entry and exit (if present) wounds suggest a trajectory that traverses the liver as the only abdominal organ injured.
   d. Entry wound and x-ray showing the bullet suggest that the liver is the only abdominal organ injured.
   e. No other associated injuries or morbidity that would preclude non-operative management.
   f. Associated hemopneumothorax is OK as long as hemothorax is small (<500 ml).

4. Place chest tube if required. Use large (36 Fr) chest tube.

5. Obtain CT of the abdomen with oral and IV contrast.

6. Determine trajectory of the bullet or knife into or through liver. Consider non-operative management if:
   a. The liver is the only injured abdominal organ.
   b. The amount of blood around the liver and in the abdomen is minimal to moderate.
   c. There is no active swirl sign suggesting active bleeding. (See protocol on managing swirl sign. Consider angiography and embolization.)
   d. Go for laparotomy unless all of the above conditions are fulfilled.

7. If non-operative approach is used:
   a. Admit to ICU
b. NPO. Serial abdominal exams
d. Serial hematocrits every six hours until stable within 2%, then every 24 hours
e. Bedrest for three days.
f. Liver function studies on day 2 after injury.

8. If hemodynamically stable with unchanging hematocrit after 24-48 hours:
a. Transfer to surgical floor.
b. Advance diet
c. Mobilize on fourth day.
d. Repeat CT 48 hours after injury.
i. If there is minimal increase in fluid and bilirubin is normal, continue management and discharge when eating, having bowel movements, and afebrile.
ii. If there is increase in fluid and bilirubin is elevated
   a) Obtain radionuclide biliary imaging or MRCP
   b) If there is a bile leak, then
      (i) Percutaneous drainage of biloma
      (ii) ERCP with stents.

9. Pitfalls:
a. Biloma as above
b. Diaphragmatic hernia – should not be a problem since the liver protects the diaphragm.
c. Hemobilia
d. Major ductal injury that will result in persistent biliary fistula.
PRACTICE GUIDELINES: NON-OPERATIVE MANAGEMENT OF SPLENIC INJURIES

OBJECTIVES:

1. Define situations in which non-operative management of splenic injuries is safe and desirable.
2. Define a clinical pathway for the non-operative management of splenic injuries.

DEFINITIONS:

Spleen injury:

Grade I  Subcapsular hematoma, <10% surface area capsular tear, < 1 cm in depth
Grade II  Subcapsular hematoma, nonexpanding, 10-50% surface area Intraparenchymal hematoma, nonexpanding, <2 cm in diameter
Capsular tear, active bleeding, 1-3 cm, does not involve trabecular vessel
Grade III Subcapsular hematoma, >50% surface area or expanding Intraparenchymal hematoma, >2 cm expanding
Laceration >3 cm in depth or involving trabecular vessels
Grade IV  Ruptured intraparenchymal hematoma with active bleeding
Laceration involving segmental or hilar vessels producing major devascularization (>25% of spleen)
Grade V  Shattered spleen
Hilar vascular injury that devascularizes spleen

GUIDELINES:

1. Indications: Non-operative management of splenic injury can be considered when all of the following conditions have been met:
   a. Diagnosis of splenic injury on CT scan.
   b. Hemodynamically normal patient that has not required or has responded quickly to the resuscitation.
   c. Grade I-III splenic injury. Consider for Grade IV or V injury in children or adults if no significant hemoperitoneum is present.
   d. No other major intra-abdominal injury.
   e. Available for monitoring of abdominal exam and blood counts (ie., in a long operative procedure) except for short operative procedures.
   f. No other major sources of blood loss.
   g. No other premorbid illnesses that suggest the patient could not tolerate blood loss (e.g., severe ischemic heart disease).
   h. Willingness to take blood transfusion (e.g., not a Jehovah’s Witness).
   i. Active bleeding (swirl sign) if successful embolization

In some cases, there will be active bleeding from the spleen as defined by a blush or swirl on the CT scan or a dropping hematocrit. Consideration should be given to angiography and embolization in these patients. If this option is taken, then consider the time of the embolization as the “start time” for the following protocol.
2. Protocol:
   a. Admit all Grade II or higher splenic injuries to telemetry unit. Consider admitting all Grade IV or V splenic injuries to an ICU.
      i. Monitor hourly vital signs.
      ii. Bed rest.
      iii. NPO.
      iv. Draw serial hematocrit and hemoglobin every 6 hours until stable (within 2%) on two consecutive draws.
   b. When hematocrit is stable and there have been no adverse hemodynamic events:
      i. Transfer to regular floor or discontinue telemetry.
      ii. Advance diet.
      iii. Hematocrit and hemoglobin daily.
      iv. Bed rest for number of days corresponding to the grade of the splenic injury (e.g., Grade III = 3 days of bed rest), then may ambulate in the hospital.
      v. ALL Patients receive a SOLID ORGAN INJURY Card
   c. After discharge:
      i. No school for a week.
      ii. No physical education for approximately six weeks.
      iii. No major contact sports (e.g., football) for approximately 3 months.
      iv. Return to clinic in two weeks.
      v. Instruct to return to ED if developing worsening left upper quadrant pain, dizziness, syncope or hypotension.
   d. Failures (requires laparotomy):
      i. Children: requires >40 ml/kg of blood transfusion to maintain hematocrit >26%.
      ii. Adults: requires 2 units of blood to maintain hematocrit >26% in the absence of other injuries.
      ii. Any patient:
         1) New onset of diffuse peritoneal irritation suggestive of perforated viscus.
         2) Sudden hypotension unassociated with other bleeding sites.
      iv. If splenectomy is required, administer vaccines on the next to last hospital day:
         a) Pneumococcus vaccine (Pneumovax).
         b) Meningococcus vaccine.
         c) Hemophilus influenzae vaccine.
PRACTICE GUIDELINES: MANAGEMENT OF A SWIRL OR BLUSH ON CT SCAN

OBJECTIVES:

1. To define the CT findings of active arterial bleeding in an organ or body cavity.
2. To define potential therapeutic approaches to this finding.

DEFINITION:

On CT scan with intravascular contrast, an area of active hemorrhage will appear as an abnormal collection of intensely dense white contrast material in the area of the bleeding. Usually this appears, appears as an abnormal “blush” surrounded by otherwise normal parenchyma or as a “swirl” pattern in a cavity.

TRAUMA GUIDELINES:

1. When an abnormal area of active extravasation is diagnosed on CT scan:
   a. Continue fluid resuscitation since there is active, ongoing bleeding in the patient – avoid OVER resuscitation – a SBP of 90 is ok.
   b. Confirm the location and extent of the extravasation by reviewing the CT scan yourself.
   c. Determine how much fluid is in the body cavity or in the region of the bleeding to gain an idea of how serious the bleed is.
   d. Determine the availability and potential time to obtain angiogram and embolization.

2. Treatment options for the following locations of the extravasation:
   a. Surgery should be considered for any place in abdomen when there is associated hypotension or significant anticipated delay to angiography.
   b. Liver
      i. If there are no other injuries, consider angiography and embolization.
      ii. If there are multiple areas of extravasation in different segments of the liver consider laparotomy.
   c. Spleen
      i. Consider angiography and embolization for all children < 18,
      ii. Consider angiography and embolization in Grade I-III splenic injuries
      iii. More serious injuries should undergo laparotomy.
   d. Pelvis
      i. Consider angiography as treatment of choice in all cases.
      ii. If active bleeding has stopped at the time of the angiogram but there are cut-offs in the vessels, consider embolization of the internal iliacs.
      iii. If there is a large hematoma, but no active arterial extravasation, consider possibility of venous bleeding and embolize both internal iliac arteries.
   e. Buttock and abdominal wall
      i. Consider angiography as treatment of choice
      ii. For inferior epigastric bleeds, embolization is reasonable options.
   f. Kidney
      i. Consider angiography as treatment of choice.
      ii. Try to embolize distal vessels to preserve renal function.
   g. Mesentery or bowel – go straight to laparotomy.
3. If the patient has multiple injuries and the possibility of chest injury leading to disruption of thoracic aorta, consider performing a thoracic aortogram at the time of angiography.
PRACTICE GUIDELINES: MANAGEMENT OF LIVER INJURIES

OBJECTIVES:

1. Define situations in which non-operative management of liver injuries is safe and desirable.
2. Outline a protocol for non-operative management of liver injuries.
3. Outline a protocol for the operative management of liver injuries.

DEFINITIONS:

Fractures of the liver:

Grade I: Capsular avulsion
          Parenchymal fracture <1 cm deep

Grade II: Parenchymal fracture 1-3 cm deep
          Subcapsular hematoma <10 cm in diameter
          Peripheral penetrating wound

Grade III: Parenchymal fracture >3 cm deep
          Subcapsular hematoma >10 cm
          Central penetrating wound

Grade IV: Lobar tissue destruction
          Massive central hematoma

Grade V: Retrohepatic vena cava injury
          Extensive bilobar disruption

GUIDELINES:

1. Indications for operative and non-operative management of liver injuries:
   a. **Operative management of liver injuries should be considered when there is ongoing bleeding from the liver injury resulting in unstable vital signs or there is the possibility of other injuries.**
      i. Markedly unstable patient with rapidly expanding abdomen or increasing rigidity.
      ii. Grossly positive peritoneal lavage.
      iii. Grade V liver injury on CT scan.
      iv. A "swirl" pattern on CT scan suggestive of ongoing bleeding when angiography is not available in a timely fashion.
      v. High velocity gunshot wound to the abdomen in the RUQ.

   b. Non-operative management of active bleeding can be undertaken if:
      i. Angiography for embolization is readily available
      ii. Vital signs respond appropriately to fluid resuscitation
      iii. There are no other obvious injuries in the abdomen
      iv. The trauma team is available to monitor the patient in the angiography suite.

   c. Non-operative management of liver injuries can be undertaken in the otherwise stable patient.
      i. Liver injury diagnosed on CT scan with normalizing vital signs Grade I to IV:
         a) Injury not into hilum.
         b) Rim of blood fairly localized around liver.
      ii. FAST positive for intraperitoneal fluid & liver injury diagnosed on CT in stable patient.
2. Operative management:
   a. Transfer patient immediately to the operating room, have self-retaining retractors available (Bookwalter).
   b. Prep from chin to mid-thigh, table to table.
   c. Generous midline incision from xiphoid to below the umbilicus.
   d. Pack the RUQ with multiple lap pads. If bleeding is brisk or patient is hypotension, consider the use of the aortic occluder device!!
   e. Pack the other quadrants and check the mesentery for bleeding.
   f. Assess the bleeding from the liver.
      i. If the bleeding is brisk, clamp the porta hepatis with your finger or a non-crushing clamp (Pringle maneuver).
         a) If bleeding persists, consider hepatic vein injury or retrohepatic caval injury.
            i) Consider veno-veno bypass.
            ii) Consider resectional debridement to get to the vena cava and the branches of the hepatic veins.
            iii) Consider median sternotomy for better control
            iv) Consider packing (See Damage Control Guideline).
         b) If bleeding subsides:
            i) Control bleeding with suture ligatures.
            ii) Release Pringle maneuver and control major bleeding with suture ligatures.
            iii) Consider omental pack.
      ii. If bleeding subsides but worsens because of coagulopathy, consider packing as definitive interim procedure.
      iii. If bleeding is moderate but controllable with packs:
         a) Mobilize the liver:
            i) Divide falciform ligaments.
            ii) Divide lateral triangular ligaments.
            iii) Rotate liver medially into wound.
         b) Explore injury (but do not worsen it).
         c) Control bleeding with suture ligatures.
         d) Consider liver edge approximation with large absorbable sutures (0-chomic on liver needle).
         e) Consider omental pack.
      iii. If bleeding is controllable but then worsens because of coagulopathy, then consider packing as interim definitive procedure.
   g. When hepatic hemorrhage is controlled, explore the rest of the abdomen with particular attention to porta hepatitis, duodenum, pancreas and right colon.
   h. Drain liver if lacerations are deep and there is possibility of bile leak and fluid collection.
   i. If packs are placed, leave abdomen open with abdomen vac-pac.
   j. If packs are placed, they should be removed in 24-48 hours. Prepare for this procedure with the availability of autotransfusion, the argon beam coagulator and blood products.
   k. If packs are placed, treat with cefazolin 1 gm IV every 8 hours while packs are in place.
3. Non-operative management:
   a. Admit all Grade III-IV liver lacerations or those with significant blood around the liver (with normalizing vital signs) to telemetry unit. Admit those with large amounts of blood around the liver with hematocrit <32% to the ICU. All others can be admitted to the trauma floor.
      i. Monitor hourly vital signs until normal (e.g., pulse < 100/min) X 3.
      ii. Bed rest.
      iii. NPO.
      iv. Draw serial hematocrit and hemoglobin every 6 hours until stable (within 2 %) X 2.
   b. When hematocrit is stable and there have been no adverse hemodynamic events:
      i. Transfer to regular floor.
      ii. Advance diet.
      iii. Hematocrit and hemoglobin daily.
      iv. Liver enzymes and bilirubin on day 2 to help rule out biloma. If bilirubin elevated, consider a HIDA scan to rule out bile leak.
      i. Bed rest 2 days. Grade I and II liver fractures may ambulate immediately.
      ii. ALL Patients receive a SOLID ORGAN INJURY Card
      vi. If stable and tolerating diet:
         a) Grade I and II injuries: discharge on day 1-2.
         b) Grade III and IV injuries: discharge on day 4.
   c. After discharge:
      i. No school for a week.
      ii. No physical education for six weeks.
      iii. No major contact sports:
         a) Grade I and II: for six weeks.
         b) Grade III, IV and V: for three months.
      iv. Return to clinic in two weeks.
      v. Avoid alcoholic beverages
      vi. Instruct to return to the ED if:
         a) Worsening RUQ pain
         b) Fever
         c) Jaundice
         d) Hematemesis

4. Pitfalls:
   a. Fever and/or jaundice – consider biloma.
      i. CT scan to confirm fluid collection around liver.
      ii. Radionuclide biliary excretion exam to confirm active leak.
      iii. Percutaneous drainage.
      iv. Consider ERCP with stent placement and/or sphincterotomy.
   b. UGI bleed two to four weeks after injury – consider hemobilia.
      i. CT scan to confirm large intrahepatic injury or clot.
      ii. Angiography to confirm etiology.
      iii. Angiographic embolization of vessel.
      iv. Do not explore for hemobilia.
   c. Hypotension, drop in hematocrit seven to ten days after non-operative management of severe liver injury:
      i. Repeat bleed, usually arterial.
      ii. Admit to ICU, stabilize.
      iii. Angiography to confirm etiology.
      iv. Angiographic embolization of the vessel.
v. Attempt to avoid exploration at this time – it is a mess in there!!!!
PRACTICE GUIDELINES: DAMAGE CONTROL

OBJECTIVE:

Define the technique and expectations of “damage control” used in the operating room to temporarily control life-threatening injuries. Define the situations in which “damage control” should be helpful in stabilizing patients.

DEFINITION:

Damage control: Is an operative technique in which control of bleeding and stabilization of vital signs becomes the only priority in salvaging the patient. This usually occurs during laparotomy when there is significant bleeding in the abdomen. Attention is directed at using all available techniques for controlling bleeding, including packing. Definitive repair of bowel or visceral injuries in not attempted and temporary wound closure is used. Definitive procedures are performed after the patient has stabilized.

GUIDELINES:

1. The patient with severe abdominal injuries with suspected bleeding is brought to the OR immediately.

2. Inform the anesthesiologist of the severity of the injuries so that appropriate intravenous access can be obtained. Two large bore intravenous lines (preferably introducers) are essential.

3. Assure that blood salvage techniques are available.
   a. Make sure that the blood bank is aware of the need for large volume transfusions.
   b. Provide hypothermia protection.
   c. Warm the room.
   d. Bair Hugger.
   e. Warm IV fluids.

4. Open the abdomen and assess the injuries, pack all four quadrants and examine for mesenteric bleeding. Control bleeding first! Consider damage control in the following situation:
   a. Hypothermia, coagulopathy, non-surgical brisk bleeding.
   b. Diffuse oozing from cut or injured surfaces.
   c. Diffuse uncontrollable retroperitoneal or pelvic bleeding.
   d. Severe fracture of the liver that cannot be controlled with ligation, suture or clips.
   e. Massive bleeding from multiple sources in which it appears that definitive care of all injuries may lead to prolonged operative time or additional bleeding which could lead to hypothermia or coagulopathy.

5. Technique of damage control:
   a. Remove the packs for areas of likely bleeding first.
   b. Control all surgical bleeding as rapidly as possible. Do splenectomy rather than splenorrhaphy, nephrectomy rather than renorrhaphy. Pack areas of oozing: liver, retroperitoneum, pelvis, mesentery.
   c. Once the bleeding is controlled, examine for other injuries.
d. Once the decision for damage control has been made, proceed rapidly. The goal of this procedure is to stop the bleeding and get the patient to the ICU where the clotting factors may be replaced and physiologic disturbances such as acidosis, hypoxemia and ischemia may be definitively corrected.

6. Management of intestinal injuries:
   a. Small holes: whip stitch with a running or interrupted suture. Do not attempt definitive repair.
   b. Large defects or devitalized areas: resect the affected area with GIA stapler. Do not attempt to reanastomose.
   c. Do not create ostomies.
   d. Assess bleeding. If controlled with packing, either leave the packs in place or re-pack the area with laparotomy sponges or moist towels. Consider using a Vi-drape (two of them stuck together to avoid the adhesive edge) over the surface of the liver to facilitate pack removal.
   e. Close abdomen with temporary techniques.
      i. Continuous non-absorbable suture for fascia -- if able to close.
      ii. If unable to close facia consider “homemade” vac pac
         a.) bowel bag on bowel
         b.) green towels
         c.) JP drain x one or two
         d.) Vi-drape to skin
      iii. Comercially available Vac Dressing may be available – ask OR staff.
   f. Return to the ICU rapidly to improve cardiac output, acidosis, hypothermia, coagulopathy.
   g. Antibiotics: piperacillin/tazobactam 3.375 gm every 6 hours as appropriate for the injury. Consider anti-fungal therapy if open abdomen technique will be prolonged.
   h. Measure intra-abdominal pressure through Foley as necessary. If >30 cm H₂O, consider loosening the abdominal closure.
   i. Return to the OR for definite procedure and fascial closure when:
      i. Normothermic.
      ii. Coagulopathy resolved.
      iii. Hemodynamics are stabilized.
      iv. Usually 48-72 hours.
PRACTICE GUIDELINES: MANAGEMENT OF PENETRATING NECK INJURIES

OBJECTIVE:

Provide guidelines for the management of a penetrating injury to the neck, specifically as it relates to the need for operative exploration and the ordering of diagnostic studies.

DEFINITIONS:

Penetrating Injury: Any inflicted injury that penetrates the skin. This could be a gunshot wound, stab wound or foreign body penetration of any nature. These guidelines do not apply to penetration of the oral or pharyngeal mucosa as might be seen with medical instrumentation, etc.

Neck: The circumferential region of the body bounded by the clavicles and the base of the skull.

GUIDELINES:

1. For all penetrating injuries of the neck, first apply all of the principals of ATLS (see “Prioritization Guidelines”). Pay particular attention to airway, since this will be the most life-threatening associated condition.

2. NOTE: EARLY intubation is key. Emergency cricothyrotomy or tracheostomy may be complicated by release of contained hematoma with potentially disastrous consequences. Proceed only in extremis!

3. If the neck injury is associated with any of the following conditions, then the patient should be taken immediately to the operating room for exploration:
   a. Shock.
   b. Active hemorrhage.
   c. Expanding hematoma.
   d. Zone II penetrating injury (thru the platysma)
   e. Need for surgical airway.
   f. Obvious esophageal injury.
   g. Obvious tracheal injury.

4. For stable neck injuries, a determination should be made as to whether the platysma has been penetrated. Slash wounds can easily be examined to determine this. Usually slash wounds can be fully explored and closed in the ED if there are no major injuries. For puncture wounds that seem superficial, the wound can be anesthetized and enlarged for a direct visual observation to determine if the platysma is intact. If the platysma is intact, then close the wound if possible and discharge.

5. If the platysma has been violated, then classify the wound as:( see diagram)
   a. Zone I – below cricoid cartilage.
   b. Zone II – between cricoid and angle of the mandible.
   c. Zone III – above the angle of the mandible.
   d. An X-ray of the neck may be helpful if a bullet or foreign body is still in the neck.
6. For STABLE Zone I injuries (which are really chest injuries):
   a. Obtain a chest X-ray to determine the presence of chest injury.
      i. Obtain an angiogram or CTA, including the aortic arch and the great vessels.
      ii. Obtain an esophagram. (Gastrograffin and if no defined leak proceed to thin
           barium for better definition)
      iii. Obtain or perform bronchoscopy.
   b. Obtain CT scan to determine track of bullet
   c. If track approaches vessels or airway, then will need an angiogram and bronchoscopy
   d. Treat on the basis of the findings.

7. For a Zone II injury, use clinical findings to classify as low probability of vascular and
   aerodigestive injury or high probability of vascular and aerodigestive injury.
   a. For high probability injuries (GSW, shotgun wounds, swelling, path crossing midline):
      i. If the injury is a gunshot wound or a shotgun injury, consider a CT angiogram to
         help define extent and location of vascular injury if the patient is stable. In many
         cases this step is skipped since vascular injury is likely.
      ii. Prophylaxis with antibiotics.
      iii. Take to the operating room for neck exploration.
   b. For low probability injuries (stab wounds, minimal swelling, lateral, posterior). Obtain
      CTA scan and look for injuries to vital structures. If found and obvious then explore,
      otherwise:
      i. Obtain esophagram.
      ii. Perform laryngoscopy and bronchoscopy if indicated (e.g., air in tissues or
          subcutaneous emphysema).
      iii. Treat based on the findings.

8. For Stable Zone III injuries:
   a. Obtain angiogram.
   b. Obtain or perform direct pharyngoscopy and laryngoscopy.
   c. Treat based on findings.

9. For GSW injuries (usually Zone II) that appear to have traversed the neck lateral to the
   carotid sheath, a CT scan (with contrast) can define the bullet track. The proximity to the
   vessels and aerodigestive organs can be determined as an indicator for any additional
   studies (see above).

10. For all penetrating neck injuries that have violated oral mucosa, treat with antibiotics
    (usually penicillin, penicillin/aminoglycoside or clindamycin).
PRACTICE GUIDELINES: EMERGENCY TREATMENT OF DISLOCATIONS AND FRACTURES

OBJECTIVES:

1. Define the major orthopedic injuries that will be seen in trauma patients.
2. Provide a list of some radiographic studies that may be used to define specific injuries.
3. Enumerate immobilization and reduction techniques that can be applied in the trauma room until definitive treatment can be undertaken.
4. Provide a list of potential definitive orthopedic procedures that will be considered for each injury.

HAND:

<table>
<thead>
<tr>
<th>INJURY</th>
<th>X-RAYS</th>
<th>REDUCTION IMMOBILIZATION</th>
<th>TREATMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>DIP or PIP dislocation</td>
<td>AP/Lat finger</td>
<td>Dorsal splint in extension, or Buddy tape</td>
<td>Closed reduction</td>
</tr>
<tr>
<td>Metacarpal fracture</td>
<td>AP/Lat hand</td>
<td>Dorsal-volar splint</td>
<td>Closed reduction, wires</td>
</tr>
</tbody>
</table>

ARM:

<table>
<thead>
<tr>
<th>INJURY</th>
<th>X-RAYS</th>
<th>REDUCTION/IMMobilIZATION</th>
<th>TREATMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wrist</td>
<td>AP/Lat wrist</td>
<td>Dorsal-volar splint</td>
<td>Closed reduction</td>
</tr>
<tr>
<td>Distal radius</td>
<td>AP/Lat forearm</td>
<td>Sugar tong splint</td>
<td>Closed reduction, ORIF</td>
</tr>
<tr>
<td>Forearm, radius and/or ulna</td>
<td>AP/Lat forearm</td>
<td>Sugar tong splint</td>
<td>Closed reduction, ORIF</td>
</tr>
<tr>
<td>Radial head</td>
<td>AP/Lat elbow AP/Lat forearm</td>
<td>Posterior elbow splint</td>
<td>Closed reduction, ORIF</td>
</tr>
<tr>
<td>Olecranon</td>
<td>AP/Lat elbow AP/Lat forearm</td>
<td>Posterior elbow splint</td>
<td>ORIF</td>
</tr>
</tbody>
</table>
ARM: (continued)

<table>
<thead>
<tr>
<th>Location</th>
<th>X-Rays</th>
<th>Reduction/Immobilization</th>
<th>Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Distal humerus</td>
<td>AP/Lat elbow AP/Lat humerus</td>
<td>Posterior elbow splint <strong>Beware of vascular compromise</strong></td>
<td>ORIF</td>
</tr>
<tr>
<td>Humeral shaft</td>
<td>AP/Lat humerus</td>
<td>Coaptation splint <strong>Beware of radial nerve compromise</strong></td>
<td>Conservative ORIF</td>
</tr>
<tr>
<td>Proximal humerus (surgical and anatomic neck)</td>
<td>AP/axillary shoulder AP/Lat humerus</td>
<td>Coaptation splint Sling</td>
<td>Conservative ORIF</td>
</tr>
</tbody>
</table>

**SHOULDER:**

<table>
<thead>
<tr>
<th>INJURY</th>
<th>X-RAYS</th>
<th>REDUCTION/IMMOBILIZATION</th>
<th>TREATMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Scapula</td>
<td>AP/axillary/scapular shoulder</td>
<td>Sling</td>
<td>Conservative ORIF</td>
</tr>
<tr>
<td>Clavicle</td>
<td>AP/axillary shoulder</td>
<td>Sling</td>
<td>Conservative</td>
</tr>
</tbody>
</table>

**PELVIS:**

<table>
<thead>
<tr>
<th>INJURY</th>
<th>X-RAYS</th>
<th>REDUCTION/IMMOBILIZATION</th>
<th>TREATMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Anterior ring, pubic symphysis, rami</td>
<td>AP, inlet and outlet pelvis, CT scan</td>
<td>Initial bedrest</td>
<td>Non-operative or ORIF</td>
</tr>
<tr>
<td>Posterior ring, sacrum, SI fracture/dislocation, iliac wing</td>
<td>AP, inlet and outlet pelvis, CT scan</td>
<td>Initial bedrest. If hemodynamically unstable consider T-POD, angioembolization or external fixation</td>
<td>ORIF</td>
</tr>
<tr>
<td>Acetabulum</td>
<td>AP pelvis, Judet views, thin cut (3mm) CT scan</td>
<td>Distal femoral traction, Buck’s traction, tibial traction, or nothing</td>
<td>ORIF</td>
</tr>
</tbody>
</table>
FEMUR:

<table>
<thead>
<tr>
<th>INJURY</th>
<th>X-RAYS</th>
<th>REDUCTION/IMMOBILIZATION</th>
<th>TREATMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Femoral head</td>
<td>AP pelvis, AP/lat hip</td>
<td>Distal femoral traction, or nothing</td>
<td>ORIF</td>
</tr>
<tr>
<td>Femoral neck</td>
<td>AP pelvis, AP/lat both hips (uninjured side with templates)</td>
<td>Buck’s traction, or nothing</td>
<td>ORIF</td>
</tr>
<tr>
<td>Intratrochanteric femur</td>
<td>AP pelvis, AP/lat hip</td>
<td>Buck’s traction, or nothing</td>
<td>ORIF</td>
</tr>
<tr>
<td>Subtrochanteric femur</td>
<td>AP pelvis, AP/lat femur</td>
<td>Distal femoral traction, tibial traction</td>
<td>ORIF</td>
</tr>
<tr>
<td>Femoral shaft</td>
<td>AP/lat femur, AP/lat knee, AP pelvis</td>
<td>Hare traction splint, or Speed Splint</td>
<td>ORIF</td>
</tr>
<tr>
<td>Supracondylar femur</td>
<td>AP/lat femur, AP/lat knee, AP pelvis</td>
<td>Knee immobilizer, or tibial traction</td>
<td>ORIF</td>
</tr>
</tbody>
</table>

LOWER LEG:

<table>
<thead>
<tr>
<th>INJURY</th>
<th>X-RAYS</th>
<th>REDUCTION/IMMOBILIZATION</th>
<th>TREATMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Patella</td>
<td>AP/lat knee</td>
<td>Knee immobilizer</td>
<td>ORIF</td>
</tr>
<tr>
<td>Tibial plateau</td>
<td>AP/lat knee, CT scan (after spanning ex-fix)</td>
<td>Knee immobilizer</td>
<td>ORIF, or spanning ex-fix</td>
</tr>
<tr>
<td>Tibial shaft</td>
<td>AP/lat tibia</td>
<td>Posterior sugar tong splint</td>
<td>ORIF</td>
</tr>
</tbody>
</table>

ANKLE:

<table>
<thead>
<tr>
<th>INJURY</th>
<th>X-RAYS</th>
<th>REDUCTION/IMMOBILIZATION</th>
<th>TREATMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pilon</td>
<td>AP/lat ankle, mortise view, AP/lat tibia, or CT scan after spanning ex-fix</td>
<td>Posterior sugar tong splint, calcaneal traction</td>
<td>ORIF</td>
</tr>
<tr>
<td>Malleolus (medial, lateral, posterior)</td>
<td>AP/lat ankle, mortise view</td>
<td>Posterior sugar tong splint</td>
<td>ORIF</td>
</tr>
</tbody>
</table>
**FOOT:**

<table>
<thead>
<tr>
<th>INJURY</th>
<th>X-RAYS</th>
<th>REDUCTION/IMMOBILIZATION</th>
<th>TREATMENT</th>
</tr>
</thead>
<tbody>
<tr>
<td>Calcaneus</td>
<td>Lat foot, oblique foot, Harris heel view, thin cut CT (3mm)</td>
<td>Posterior sugar toe splint with toe plate</td>
<td>ORIF</td>
</tr>
<tr>
<td>Talus</td>
<td>Lat foot, oblique foot</td>
<td>Posterior sugar toe splint with toe plate</td>
<td>ORIF</td>
</tr>
<tr>
<td>Metatarsals and phalanx</td>
<td>AP/lat and oblique foot</td>
<td>Posterior sugar toe splint with toe plate</td>
<td>ORIF</td>
</tr>
</tbody>
</table>
PRACTICE GUIDELINES: PELVIC FRACTURES

OBJECTIVES:

1. Prevent and treat life-threatening hemorrhage.
2. Establish early pelvic stability to decrease pain and allow an upright chest posture in order to minimize pulmonary complications.
3. Diagnose and manage concomitant urologic injuries.

DEFINITIONS:

Instability: An unstable pelvis ring disruption may be rotationally or rotationally and vertically unstable.

Open fracture: Implies a soft tissue injury allowing potential contamination of the fracture and markedly increased mortality rate (30-40%). Types of soft tissue injuries include perineal lacerations, vaginal tears and rectal tears.

CLASSIFICATION:

Type A – stable:
   A1 Fractures not involving ring; avulsion injuries.
   A2 Stable, minimal displacement; iliac wing, isolated rami.
   A3 Transverse fracture of sacrum

Type B – rotationally unstable, but vertically and posteriorly stable:
   B1 External rotation instability; open-book injury.
   B2 Internal rotation instability; lateral compression injury.
   B3 Bilateral rotationally unstable injury.

Type C – rotationally, posteriorly and vertically unstable:
   C1 Unilateral injury: ileal fracture, S1 disruption, sacral fracture.
   C2 Bilateral injury: one side rotationally unstable, one side vertically unstable.
   C3 Bilateral injury: both sides completely unstable.

GUIDELINES:

1. Follow the ABC’s; pay close attention to shock and resuscitation.

2. Examine and document distal neurovascular status of limbs.

3. Examine for urethral blood or scrotal hematoma.
   a. If present, obtain urethrogram prior to Foley.
   b. If hematuria present, obtain cystogram.

4. Examine for perineal, vaginal or rectal lacerations.

5. Avoid excessive movement and transfers. Every time the fracture moves, there is more blood loss.

6. Obtain pelvic X-ray/ CTScan.
   a. If obvious fracture, consult orthopedics.
b. If anterior ring injury and pubic diastatsis >2cm, consider performing retrograde urethrogram prior to passing Foley catheter.

7. If patient is hemodynamically unstable (may interrupt this guideline if patient becomes hemodynamically normal):
   a. Continue vigorous fluid resuscitation. (Activate MTP as these patients have significant blood loss)
   b. Use T-Pod to temporarily stabilize pelvis (see protocol below). If not available, then wrap a sheet tightly around pelvis (do not twist the sheet). Avoid unnecessary movement.
   c. If remains hemodynamically unstable FAST/CT negative for intraperitoneal blood then emergently activate IR/Vascular for angio-emobilization plus Ortho for possible external fixation.
   d. If still hemodynamically unstable despite adequate fluid resuscitation and above consider salvage exploration and packing. (Note: prognosis gave at this point.)

8. If urethrogram shows urethral disruption, consult urology. Do not attempt Foley catheterization.

9. If patient has major perineal laceration involving the rectum or extending deeply, go to OR.
   a. Control bleeding.
   b. If there is significant injury of rectum, anus, or perianal skin, consider diverting colostomy.
   c. Distal segment should be washed out.
   d. Debride and pack wound. Closure may be possible on a delayed basis.

10. If patient is stable, obtain inlet and outlet views of pelvis. Consider CT scan with thin cuts of the pelvis at discretion of orthopedic consult.
PRACTICE GUIDELINES: PLACEMENT OF T-POD ON UNSTABLE PELVIC FRACTURES

OBJECTIVES:

1. Define the appropriate indications for the use of a temporary pelvic stabilizer
2. Define the appropriate use of the T-POD pelvic temporary stabilizing device.

GUIDELINES:

1. Follow ATLS guidelines while pelvis x-rays are being performed.

2. Consider the T-POD temporary pelvis stabilizing device in the following situations:
   a. Pelvis fractures with unstable vital signs. Consider permanent pelvic fixator or angiography while T-POD is being applied
   b. Open book pelvis fractures
   c. Lateral shear pelvis fractures
   d. All pelvic fractures in which a CT scan show significant pelvic hematoma.

3. Follow the directions below. When the T-pod is being placed, make sure that the breathing is not compromised and that an NG tube has been placed to avoid aspiration.

4. Remove only after more permanent stabilizing procedures have been considered or planned.

   STEP 1

   Gently slide one end of the support wrap under the small of the patient's back. Carefully slide the support wrap down until it lies flat under the pelvis.

   STEP 2

   Place the short end over the patient's abdomen and the long end over it. Cut the long end at a point that will leave a 2 inch gap between ends.
Alternatively for ease simply overlap the ends and place lacing over them. NOTE be sure there are no folds.

STEP 3
Pull the two halves of the unit apart until fully extended. When the Pulley Unit is fully extended, place the free half of the unit on the outside of the Support Binder.

STEP 4
With the pulley unit securely in place, slowly and steadily pull the handle straight out from the patient's side...keeping the handle parallel to the surface the patient is lying on. When the pulley unit is closed, fasten the handle anywhere on the support, provided on pulley mechanism.
PRACTICE GUIDELINES: APPLYING THE SPEEDSPLINT FEMORAL TRACTION DEVICE

OBJECTIVES:

1. Define the appropriate patient for the application of the Speedsplint Femoral traction device
2. Provide an operating protocol describing the steps for applying this device.

DEFINITION:

The Speedsplint femoral traction device is a lightweight self-contained traction device that is designed to apply distraction to femoral and tibial fractures. Generally, it replaces the Hare traction splint.

GUIDELINES:

1. The Speedsplint should be considered for the temporary stabilization of the following injuries:
   a. Mid-shaft or distal femur fractures, open or closed
   b. Complex knee fractures, open or closed
   c. Proximal or mid-shaft tibia fractures, open or closed.

2. Prior to application, adequate resuscitation should be ongoing. Application time is 2-3 minutes and may distract the team from other life-threatening injuries.

3. Open wounds should be examined and addressed with appropriate sterile dressings. Active bleeding should be tamponaded with compression dressings.

4. Obvious dislocations and massively open fractures should be reduced with manual traction.

5. The ankle should be examined for fracture. The Speedsplint cannot be used with ankle fracture or very distal tibia fracture.

6. One member of the team should apply and hold manual traction while the Speedsplint is applied.

7. Construct Box (this should have been previously done with the available units)
   a. Cross lateral tab (B) over contralateral tab (A).
   b. Bring bottom tab (C) up over the overlapping tabs A and B
   c. Insert tab C into the slot.
8. Construct harness assembly to foot and ankle.
   a. Pad foot circumferentially
   b. Place long strap under heel and extend downward.
   c. Take the Velcro loop around the top of foot and attach to Velcro strip.

9. Determine relative size of patient to determine whether the proximal extension of the box needs to be removed at the perforations. If the patient is short (less than 5’4”) then remove proximal part of box.

10. Place groin pads on the sides of the proximal box. Self-adhesive surface should keep them in place.

11. Place injured leg in box and push the box up to push against the groin and ischial tuberosity. The heel should lie in the area marked “heel area.”

12. Pull traction strap through slot in the end of the box and attach to Velcro pad under the box with moderate tension.

13. Loop the 2 or 3 Velcro straps around the leg to compress the sides of the box against the leg.

15. Box is radiolucent and safe for CT and MRI.

16. Beware:
   a. Ongoing occult bleeding
   b. Insufficient traction
   c. Non-reduced dislocations
   d. Foot and ankle fractures (contraindicated)
   e. Skin necrosis under foot and ankle strap
PRACTICE GUIDELINES: THORACIC AND LUMBOSACRAL SPINE INJURIES

OBJECTIVES:

1. Define patients in which evaluation of the lower spine must be undertaken.
2. Define early intervention of lower spine injuries and prevent neurologic deterioration.

DEFINITIONS:

Stable spine injury: Those injuries not associated with a neurologic deficit and not at risk for development of neurologic deficit and not prone to late collapse (e.g., transverse process fractures, spinous process fracture, minimal compression fracture).

Unstable spine injury: Any fracture pattern associated with a neurologic deficit and those that are prone to develop a neurologic deficit or those prone to late collapse (e.g., fracture subluxation and dislocation, severe burst fractures).

Screening radiologic studies: If there is a mechanism or physical finding suggesting a thoracic, lumbar, or sacral spine injury, then the appropriate screening radiologic studies are a) spine reconstructions from the chest and abdominal CT-scan if these are being done to rule out chest or abdominal injuries, OR b) plain x-rays of the T, L, and S spine. Concerning radiologic findings may be followed with “formal” CT scans of the appropriate vertebral regions.

GUIDELINES:

1. Follow ABC’s.

2. Secondary survey:
   a. Logroll patient with full C-spine immobilization to determine areas of tenderness in the thoracic and lumbosacral spine. If tenderness is present, assume the spine to be unstable.
   b. Examine for areas of increased kyphosis or spinous process step-off.
   c. Perform neurologic exam to determine any deficits suggestive of neurologic injury.
   d. Examine rectal tone (involuntary and voluntary).

3. Obtain AP and lateral thoracic X-rays for patients with pain in thoracic vertebrae or perform AP and lateral spine reconstructions from the chest and/or abdominal/pelvis CT Scans if these have been performed.

4. Obtain AP and lateral lumbosacral X-rays for patients with pain in the lumbosacral vertebrae. Keep high index of suspicion for possible lumbar fracture in patients with abdominal wall “seatbelt sign.” OR perform AP and lateral spine reconstructions from the abdominal/pelvis CT Scan if these have been performed.

5. If neurologic injury is found without bony injury, or vertebral body fractures are found obtain an MRI scan of the involved spinal level. Consider screening MRI of non-involved spinal levels. Always include at least a vertebra above and below. (Example: A C7 Body fracture will require CT & MRI of the cervical and thoracic spine)

6. Consult the spine service if bony injury or neurologic deficit is found.
7. If bony injury is found or a neurologic injury is found with concomitant bony injury, perform a complete neurological exam using the ASIA format.

8. Maintain spinal precautions until cleared by the consulting service or negative MRI’s.


10. If fracture is noted in one area of spine, complete C/T/LS spine radiographs should be obtained to assess additional fractures. Reformatting of the chest and abdominal/pelvis CT scans to examine the spine is preferable if these CT scans have been obtained.
PRACTICE GUIDELINES: OPEN FRACTURE

OBJECTIVE:

1. Define the types of open fractures and prioritize injury management based on them.

Gustilo open fracture Classification

<table>
<thead>
<tr>
<th>Grade</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Open fracture, clean wound, wound &lt;1 cm in length</td>
</tr>
<tr>
<td>II</td>
<td>Open fracture, wound &gt; 1 cm in length without extensive soft-tissue damage, flaps, avulsions</td>
</tr>
<tr>
<td>III</td>
<td>Open fracture with extensive soft-tissue laceration, damage, or loss or an open segmental fracture. This type also includes open fractures caused by farm injuries, fractures requiring vascular repair, or fractures that have been open for 8 hr prior to treatment</td>
</tr>
<tr>
<td>IIIA</td>
<td>Type III fracture with adequate periosteal coverage of the fracture bone despite the extensive soft-tissue laceration or damage</td>
</tr>
<tr>
<td>IIIB</td>
<td>Type III fracture with extensive soft-tissue loss and periosteal stripping and bone damage. Usually associated with massive contamination. Will often need further soft-tissue coverage procedure (i.e. free or rotational flap)</td>
</tr>
<tr>
<td>IIIC</td>
<td>Type III fracture associated with an arterial injury requiring repair, irrespective of degree of soft-tissue injury</td>
</tr>
</tbody>
</table>

GUIDELINES:

1. Follow ABC’s. Extremity fractures assume low priority in the multiply injured patient unless there is significant bleeding.

2. When patient is stable, examine the fracture and document distal neurovascular status of limb.

3. Remove all gross contamination using sterile saline and cover all wounds with sterile dressing soaked in saline only.

4. Grossly align limb or reduce dislocation.
   a. Splint femur fractures with Speedsplint femoral traction (see guideline)
   b. Splint other fractures with aluminum gutter or plaster, including joint above and below the fracture.

5. Radiographs in two planes, including joints above and below fracture.

6. Antibiotics: (see EAST Guidelines):
   http://www.east.org/resources/treatment-guidelines/open-fractures,-prophylactic-antibiotic-use-in-%E2%80%94-update
   a. Clean or Grade I or II wounds: cefazolin for 24hrs.
   b. Contaminated or Grade III wound: add additional Gram negative coverage (aminoglycoside NOT fluoroquinolones) for 72hrs or till flap coverage in place.
c. Soil contamination or barnyard wounds: add penicillin G 4-5 million units every 4 hours.

7. Tetanus prophylaxis if indicated.

8. Consult orthopedics.
   a. Surgical irrigation and debridement within 6 hours of injury. Early fixation according to orthopedic protocols.
   b. Repeat surgical debridements every 24-36 hours until wound clean or all devitalized tissue removed.
   c. Formal wound closure when wound is stable by whatever method necessary (delayed primary closure, STSG, rotational or free tissue transfer).
   d. For Grade IIIC injuries with pulseless distal part, perform emergent surgical intervention with intra-op angiogram if limb salvage is planned. Use of the MESS Score may help in these decisions. Scores >7 have a greater than 95% predictive value of amputation. 
    http://www.mdcalc.com/mangled-extremity-severity-score-mess-score/
PRACTICE GUIDELINES: PENETRATING INJURIES OF THE EXTREMITY

OBJECTIVES:

1. Define suggested diagnostic approaches to penetrating extremity trauma.
2. Define suggested treatment approaches to penetrating extremity trauma.

GUIDELINES:

1. Follow the ABC’s.
2. Control exsanguinating hemorrhage by direct pressure.
3. Perform rapid physical exam, noting nature of distal pulses and neurologic findings.
4. Rapidly obtain X-ray of extremity, including entry and exit wounds; use wound markers.
5. Take the patient immediately to surgery for the following findings:
   a. Exsanguinating or uncontrolled hemorrhage from the injury.
   b. Rapidly expanding hematoma.
   c. Rapidly developing compartment syndrome.
6. Obtain angiogram, duplex scan or CT angiogram for:
   a. Diminished or absent distal pulses.
   b. ABI <0.9 (for leg injury).
   c. Difference in upper extremity systolic blood pressure >20 mmHg when upper extremity injury is suspected.
   d. Continued bleeding from wounds.
   e. Major nerve injury.
   f. Bruit or thrill.
   g. Proximity to a major vessel.
7. If neurologic deficit is present:
   a. Document level of deficit.
   b. Obtain orthopedic or neurosurgical consult.
8. Penetrating injuries with an absence of vascular injury on diagnostic studies and no neurologic injury can have the wound locally treated and be discharged.
9. Administer one dose of cefazolin intravenously for stab wounds. GSW without clothing contamination do not require antibiotics. NOTE: foreign mater must be debrided. Administer tetanus IM as needed.
10. Debride wound edges and close or treat with dressings depending on clinical conditions.
11. Splint joints above and below the injury with a bulky dressing.
PRACTICE GUIDELINES: DIAGNOSIS AND TREATMENT OF COMPARTMENT SYNDROME

OBJECTIVES:

1. Define compartment syndrome and
2. Describe the signs, symptoms and use of compartment pressures to make the diagnosis.

DEFINITION:

Compartment syndrome:
1. Increased pressure in a myofascial compartment of an extremity leading to ischemia and compromise of muscle, nerves, or blood vessels within the myofascial compartment.
2. Increased pressure in the abdomen leading to respiratory and renal failure.

GUIDELINES:

1. COMPARTMENT SYNDROME IS A SURGICAL EMERGENCY THAT CAN ONLY BE TREATED WITH ADEQUATE SURGICAL DECOMPRESSION.

2. Suspect compartment syndrome associated with following injuries:
   a. Blunt extremity trauma with associated bleeding or muscle swelling. A fracture does not have to be present to have compartment syndrome.
   b. Circumferential burns
   c. Injection/infiltration injuries
   d. Revascularization after prolonged ischemia (ie., arterial repair after long cross-clamp time).
   e. An unconscious patient with a compressed limb.
   f. Massive fluid resuscitation
   g. Delay in treatment (> 4hrs)
   h. Rising intra thoracic pressures (ventilation decrease)
   i. Oliguria despite resuscitation.

3. Clinical diagnosis (Extremity):
   a. Symptoms
      1. Pain with passive stretch of the muscle groups contained within that compartment.
      2. Pain out of proportion to the injury.
      3. Paresthesia/paralysis, particularly in the distribution of the nerves within the compartment – may be the first and only finding!
   b. Signs
      1. Pallor/poor capillary refill.
      2. Lack of pulses distally – this is a late finding; don’t depend on it to make the diagnosis!
      3. Swelling with a tight tender compartment.
      4. Objective finding – Increased compartment pressure. If the diastolic pressure minus the compartment pressure < 30 mmHg, then a compartment syndrome is present and fasciotomy is indicated.
4. Clinical diagnosis (Abdomen):
   a. Symptoms
      1. Rising ventilation pressures with decreasing Tidal Volumes (Vt)
      2. Decreasing urinary output
      3. Distension of abdomen
   b. Signs
      1. Bladder pressure > 20mmHg with any of the above
      2. Bladder pressure >30mmHg at any time

5. Treatment:
   a. Extremity
      1. Flexor compartment.
      2. Extensor compartment.
      3. Mobile wad.
   b. Abdomen
      1. Paralyze patient: if pressure drops below 20mmhg then consider non-operative management with diuresis. If this is not successful or possible then proceed to emergent opening of the abdomen.
      2. Emergent opening of abdomen
      3. Placement of a temporary abdominal closure
PRACTICE GUIDELINES: MANAGEMENT OF TRAUMATIC BRAIN INJURY

OBJECTIVE:

Provide guidelines to help standardize the diagnosis and early management of traumatic brain injury.

DEFINITION:

Traumatic brain injury: An injury to the brain resulting in disorders of motor, sensory and/or cognitive function.

GUIDELINES:

1. Perform primary survey according to ATLS guidelines:
   a) Provide urgent airway for GCS ≤8 – remember that hypoxia can be devastating to the injured brain.
      i) If sedatives and paralytics are to be used, conduct a rapid but thorough neurologic exam, including:
         a) Level of consciousness.
         b) Ability to verbalize.
         c) Ability to open eyes.
         d) Ability to move all extremities to verbal command or pain.
         e) Presence of abnormal posturing.
         f) Presence of abnormal reflexes.
         g) Presence of rectal tone if unable to move lower extremities.
         h) Pupillary response.
         i) Gag reflex.
         j) Note presence of bruises, Battle’s signs, lacerations, etc.
      ii) Consider using lidocaine with intubation (IV and topical). Refer to intubation (RSI) protocol.
      iii) Maintain C-spine precautions including rigid collar.
   b) Check for chest injury, ventilate to maintain eucapnia (pCO₂ = 40 mmHg). If there is evidence of acute neurologic deterioration (ie., dilated pupil, focal motor deficit), consider mild hyperventilation to pCO₂ = 35 mmHg (ventilation rate about 20 breaths per minute).
   c) Determine hemodynamic status, resuscitate from shock with lactated ringers solution. Maintain normovolemia and normal hemodynamics.
   d) If patient not sedated, then do mini-neurologic exam as above.
   e) Expose patient, when able, to look for any non-obvious injury.

2. Resuscitate patient as above until hemodynamic and pulmonary stability is achieved.

3. Calculate the Glasgow Coma Scale.

4. Consider need for neurosurgical consult.
   f) Head CT abnormality.
   g) Any patient with GCS <12.
   h) Any patient with focal neurologic deficit.
   i) Any patient with unequal pupils secondary to brain injury.

2. Obtain a head CT scan:
a) GCS ≤14.
b) Any patient with focal neurologic deficit.
c) Any patient with loss of consciousness or amnesia to the event.

3. CT priorities:
a) CT should be abandoned if patient requires emergent operation to stop hemorrhage or immediately repair life-threatening injury. Notify neurosurgery immediately of this situation.
b) CT should be obtained, otherwise, to determine presence of space-occupying clot prior to other surgeries.

4. Sedation:
a) Uncooperative or thrashing patients should be treated with sedation.
   i) Morphine 0.1 mg/kg IV if associated with painful injury.
   ii) Midazolam 0.075 mg/kg IV for agitation or other benzodiazepine.
   iii) If intubated, Propofol 20 mcg/kg/min. Titrate to achieve adequate sedation.
   iv) If intubated, Pancuronium 0.1 mg/kg IV or vecuronium 0.1 mg/kg IV, if sedation is not satisfactory, to allow ventilatory control or cooperation with the diagnostic studies. Do not give paralyzing agent without associated pain medications or sedative.

5. Seizures:
a) Administer lorazepam 2 mg IV (adults) repeatedly until seizure breaks.
b) Prophylaxis with levetiracetam (Keppra) 1000mg
   i) Administer if seizure has occurred.
   ii) Administer if there is a high likelihood of post-traumatic seizure.
      a) Penetrating injury.
      b) Skull fracture with depression.
      c) Intraparenchymal hematoma.

6. If there are localizing findings, high suspicion of a major TBI or a GCS <12 consider ICP elevation and begin treatment:
   (1) HTS: 3% Hypertonic saline should be the first line Rx: 5ml/kg over 10 min IV up to a maximum of 500cc. Patient who suggests that an ICP monitor be placed as soon as possible. Consider starting a gtt at 30 ml/hr of HTS.
   (2) Mannitol:(Second line Rx manitol can complicate management by causing a significant osmotic diuresis and decreasing the blood pressure) A mannitol bolus of 1 gm/kg can be given for evidence of rising intracranial pressure. This should suggest that an ICP monitor be placed as soon as possible

7. Remember – a craniotomy can be performed at the same time as other operative procedure. Consider all possibilities if patient is to be taken to the OR.

8. Scalp lacerations:
a) Exsanguinating hemorrhage can arise from scalp lacerations.
b) Consider control with figure of eight sutures.
c) Consider temporary laceration closure to control bleeding.

9. Penetrating head injury
a) Obtain emergent CT scan
b) Surgical management per neurosurgery
c) Consider early ICP monitoring
d) Start antibiotics
PRACTICE GUIDELINES: ICU MANAGEMENT OF TRAUMATIC BRAIN INJURY AND CEREBRAL PERFUSION PRESSURE

OBJECTIVES:

NOTE: Upstate University Hospital Neuro-Critical Care, Trauma Surgery & Neurosurgery currently are developing a new collaborative and comprehensive management protocol. Be advised to check for revisions to the below guidelines as the new protocol rolls out.

1. Define the brain injured patient that is at risk for “secondary injury.”

PATIENTS AT RISK FOR SECONDARY BRAIN INJURY:

2. Severe diffuse swelling with ventricular effacement or obliteration.
3. Hemispheric swelling with effacement of the ventricle or midline shift.
4. Intra-cerebral hematoma with midline shift.

GUIDELINES:

1. All patients with brain injury and associated other system injuries should be admitted to the ICU under the co-management of the trauma team and the neurosurgery service.
2. If a patient is defined as being “at risk for secondary injury” by the neurosurgeons or trauma surgeons (see above) then the following protocol should be implemented:
3. Intubate patient; place on volume controlled ventilator.
   a. Maintain PaO2/FiO2 ratio > 250; maintain O2 saturation >96%.
   b. Maintain pCO2 35-40 mmHg.
4. Consider an intracranial pressure monitor/ EVD & LICOX monitor for all patients with a GCS< 8
5. Consider an intracranial pressure monitor/ EVD & LICOX monitor for all patients with a GCS> 8 with significant Intracranial hemorrhage.
6. Insert arterial line and CVL.
7. Head of bed flat unless otherwise specified.
8. Maintain sedation
   a. Propofol titrated to a RASS of 0.
   b. Narcotic gtt for continuous pain control.
9. Treat fevers of >38.5.
   a. Cooling blanket.
   b. IV Tylenol
10. Calculate cerebral perfusion pressure (CPP) as mean arterial pressure minus intracranial pressure.

11. Maintain CPP >70 torr.

12. If CPP <70 torr, then determine whether this is due to increased ICP or reduced MAP.
   a. If CPP <70 torr and ICP >25 cm H₂O, then consider measures to reduce ICP. These will be done with neurosurgery guidance.
      i. Drain ventriculostomy.
      ii. Hypertonic saline
      iii. Mannitol.
   b. If CPP <70 Torr, make sure hemodynamics are not compromised.
      i. Optimize pre-load with fluid infusion. Try to avoid boluses if possible. Avoid albumin since this may have adverse consequences with brain injury
      ii. Optimize contractility with dobutamine or dopamine
      iii. Optimize peripheral vascular resistance with neosynephrine or levophed. Make sure that CI is sufficient before starting vasopressors.
   c. Refractory intracranial hypertension
      i. Consider decompressive craniectomy
         1) Diffuse cerebral swelling on CT
         2) Within 48 hours of injury
         3) No episodes of sustained ICP > 40 mmHg
         4) GCS > 3 at some time after injury
         5) Secondary clinical deterioration
         6) Evolving cerebral herniation syndrome
      ii. Consider barbiturate coma

13. If there is any confusion with this protocol, contact neurosurgery or the trauma attending.

14. Repeat CT scans according to neurosurgery requests.

15. Start enteral/parenteral nutrition as soon as possible.
PRACTICE GUIDELINES: MANAGEMENT OF SEVERE MAXILLOFACIAL INJURIES

OBJECTIVES:

1. Define priorities in the management of facial trauma.
2. Determine short-term treatment plans for the temporary management of facial trauma.

DEFINITION:

Facial trauma: Severe fractures of the facial bones and/or lacerations of the face, nose or ear. These fractures may also include fractures of the mandible.

GUIDELINES:

1. Manage the ABC’s. Remember that fractures of the facial bones are frequently associated with severe traumatic brain injury and cervical spine fractures. Patients with facial fractures should not have the C-spine cleared until they are truly alert and oriented and can give a satisfactory exam of the neck.
   a. Airway: Avoid nasotracheal intubation. If an airway is needed, consider orotracheal intubation with in-line stabilization. Cricothyrotomy should be considered with severe mouth and mandible trauma.
   b. Breathing: Be aware of the possibility of aspirated blood. Any suggestion of aspiration would indicate the immediate need for a secured airway.
   c. Circulation: Bleeding from facial trauma can be significant and sometimes very occult. Any hypotension should indicate the need for a vigorous resuscitation.
   d. Disability: Perform a good neuro exam. In the conscious patient, anisocoria will most likely be associated with direct globe trauma or damage to the oculomotor nerve.
   e. Expose: Make sure that the back of the scalp is examined for any lacerations that might result in severe bleeding. Control obvious vigorous bleeding before proceeding.

2. Stop the bleeding!
   a. Do this as part of the primary survey.
   b. Scalp bleeding can be controlled with staples.
   c. Facial bleeding can be controlled temporarily with whip stitches of 3-0 nylon.
   d. Nasal bleeding can be controlled with packing (usually nasal or vaginal packing) or prefabricated nasal balloon tamponade devices. If this is not effective, may place 18 or 24 Fr. Foley catheters (with 30 cc balloons) in each nara. Insert the catheters deeply into the nasopharynx, inflate the balloons, and then pull back with gently pressure. Tie the catheters together at the nose with 0-silk to maintain gentle tension. Place anterior packing.
   e. With uncontrolled bleeding from the mouth, feel for a comminuted mandibular fracture. If one is found, try to align the pieces as this may control the bleeding.

3. Once the patient has stabilized, perform a good physical exam looking for:
   a. Scalp lacerations.
   b. Depressed skull fractures.
   c. Depressed frontal sinus fractures.
   d. Orbital fractures.
   e. Eye injury, loss of eye motion, foreign body in eye.
   f. Malar and zygomatic arch fractures.
g. Nasal fractures.
h. Maxillary alveolar ridge fractures.
i. Missing teeth.
j. Mandible fractures.
k. Sensory deficits.
l. Hemotympanum.
m. Malocclusion.

4. If patient is stable and is getting a head CT, consider obtaining facial cuts (2 mm). These images may be reformatted in the coronal, sagittal and other paraxial planes to obtain better views of the fractures.

5. Obtain a ENT consult.

6. If there is an eye injury, obtain an ophthalmology consult.

7. If patient has multiple lacerations, administer cefazolin 1 gm IV every 8 hours. If the patient has severe fractures into sinuses add clindamycin 600 mg q8hrs.

8. If the patient has isolated facial trauma, it may be managed definitively early in the first day or two. If there are multiple injuries, facial trauma is not a priority.
PRACTICE GUIDELINES: MANAGEMENT OF THE PEDIATRIC PATIENT

OBJECTIVE:

Define clinical guidelines for the management of the injured child by the Trauma Team.

DEFINITION:

Pediatric patient: A child who might have a different response to injury and physiology that may require an altered approach to diagnosis and treatment after major trauma. This will be individualized to the particular patient. It is impossible to identify a pediatric patient by a specific maximum age, since growth and development occur differently in different children.

GUIDELINES:

1. Follow the guidelines established by ATLS. Do not allow the age difference in the patient to divert your attention away from the ABC’s, primary survey, resuscitation, secondary survey and reassessment phase of trauma care.

2. Primary survey and resuscitation:
   a. Airway:
      i. Oral airway can be used in the unconscious patient – do not insert it upside down and rotate 180° as is done in an adult. Use a tongue blade to depress tongue & carefully place over tongue to back of pharynx.
      ii. Orotracheal intubation is preferred method of obtaining an airway:
         a) Maintain C-spine immobilization.
         b) Refer to pediatric equipment chart or Broselow tape for proper blade and tube.
         c) Position the tube 2-3 cm below the vocal cords.
         d) Auscultate both sides of the chest in the axillae.
         e) Uncuffed endotracheal tubes are typically used in children under 8 years. Cuffed tubes may be used at the discretion of the treating physician in any age, and may be preferred in situations where there is poor lung compliance, or an air leak. Uncuffed tube size (mm ID) = (age in years / 4) +4. Cuffed tube size = (mm ID) = (age in years / 4) + 3.
     iii. Cricothyrotomy should be avoided in the infant or small child.
     iv. Ventilate the child with a tidal volume of 7-10 ml/kg.
     v. Ventilatory rates should be:
        a) Infants – 40 breaths/min.
        b) Children – 20 breaths/min.
        c) Once stable and ventilator tubes can be decreased to 12-15 bpm in a child and 20 – 30 in an infant.
   b. Breathing:
      i. Chest injuries are unusual, but usually indicate significant injury because of the pliability of the chest wall.
      ii. Chest tubes are inserted similarly to adults.
      iii. The size of chest tube is in the pediatric equipment chart or on the Broselow tape.
   c. Circulation:
      i. Rapid evaluation for signs of poor tissue perfusion is performed as in an adult.
      ii. Tachycardia is the first sign of hypovolemia.
      iii. Hypotension in pediatrics is defined as SBP< the 5th percentile for age.
         a) <60 mm Hg in term neonates (0-28d)
b) <70 mm Hg in infants (1mo to 12 mo)
c) <70 mm Hg + (2 X age in years) in children 1 – 10 years
d) <90 mm Hg in children > 10 years

iv. Intravenous access: Attempt peripheral vein cannulation twice, and if unsuccessful, proceed to other access sites:
   a) Infant and child <6 yrs – intraosseous approach.
   b) Child >4 yrs – femoral vein cannulation.
   c) Child >4 yrs – central venous line via subclavian or jugular approach.
   d) Any child – cutdown:
      i) Greater saphenous vein in the ankle.
      ii) External jugular.
      iii) Median cephalic vein at the elbow.

iv) Fluid infusion:
   a) Initial bolus is 20 ml/kg with LR.
   b) If remains unstable, then re-bolus as above.
   c) If remains unstable, then administer 10 ml/kg PRBC’s.
   d) If remains unstable, then consider other forms of shock or the need for emergent operative intervention.

v). CPR in pediatrics:
   a) Two rescuers
      15:2 compressions:ventilations from newborn to puberty
      30:2 compressions:ventilations with one rescuer

d. Disability:
   i. Children tend to do better than adults with similar degrees of head injury.
   ii. Consider intubation for all children with GCS ≤8.
   iii. Maintain normo-volemia with LR solution.
   iv. Obtain urgent neurosurgical consult and head CT scan for any children with altered mental status.
   iv. Intracranial pressure monitoring should be considered early, since children have a higher likelihood of cerebral swelling without focal injury.
   v. Pediatric drug doses:
      a) Mannitol: 0.5 – 1.0 g/kg.
      b) Lorazepam 0.05 – 0.1 mg/kg IV
      c) Phenytoin 18 – 20 mg/kg, no faster than .05 mg/kg per minute.
      d) Phenobarbital 10–20 mg/kg.

e. Exposure: make sure the child is rolled with C-spine precautions to examine for all injuries. Beware of hypothermia.

3. For equipment such as NG tubes and Foley catheters, refer to pediatric equipment chart or Broselow tape.

4. For children (< 16 yrs) who appear to need the Pediatric Intensive Care Unit, call the PICU attending and resident shortly after the child arrives in the ED.
The following page shows pediatric equipment sizes from:


*Circulation*. 2005; 112:IV-167-IV-187
## PEDIATRIC EQUIPMENT SIZES

<table>
<thead>
<tr>
<th>Age/Weight Kg</th>
<th>Laryngoscope Blades</th>
<th>Endotracheal Tubes</th>
<th>Suction Catheter</th>
<th>IV Catheter</th>
<th>NG Tubes</th>
<th>Chest Tubes</th>
<th>Urinary Catheter</th>
</tr>
</thead>
<tbody>
<tr>
<td>Newborn 0-6 months 3.5 kg</td>
<td>Size 1 Straight</td>
<td>3.0-3.5 Uncuffed</td>
<td>8 Fr</td>
<td>22 Gauge</td>
<td>12 Fr</td>
<td>12-18 Fr</td>
<td>5-8 Feeding</td>
</tr>
<tr>
<td>6-12 months 7 kg</td>
<td>Size 1 Straight</td>
<td>3.5-4.5 Uncuffed</td>
<td>8-10 Fr</td>
<td>22 Gauge</td>
<td>12 Fr</td>
<td>14-20 Fr</td>
<td>8 Fr</td>
</tr>
<tr>
<td>1-3 years 10-12 kg</td>
<td>Size 1 Straight</td>
<td>4.0-4.5 Uncuffed</td>
<td>10 Fr</td>
<td>20-22 Gauge</td>
<td>12 Fr</td>
<td>14-24 Fr</td>
<td>10 Fr</td>
</tr>
<tr>
<td>4-7 years 16-18 kg</td>
<td>Size 2 Straight or Curved</td>
<td>5.0-5.5 Uncuffed</td>
<td>14 Fr</td>
<td>20 Gauge</td>
<td>10 Fr – 14 Fr</td>
<td>20-32 Fr</td>
<td>10-12 Fr</td>
</tr>
<tr>
<td>8-10 years 24-30 kg</td>
<td>Size 2-3 Straight or Curved</td>
<td>5.5-6.5 Cuffed</td>
<td>14 Fr</td>
<td>18-20 Gauge</td>
<td>14 Fr – 18 Fr</td>
<td>28-38 Fr</td>
<td>12 Fr</td>
</tr>
</tbody>
</table>
PRACTICE GUIDELINES: PREGNANT TRAUMA PATIENTS

OBJECTIVES:

1. Define guidelines to be applied to the initial evaluation of the pregnant patient who has sustained a traumatic injury.
2. Outline the process for Obstetrical care of these patients.

DEFINITIONS:

Traumatic injury: Any injury or mechanism that qualifies as a trauma activation or consult.

Pregnant: Any indication of pregnancy by examination, laboratory studies, imaging studies or history.

GUIDELINES:

1. Follow the ATLS protocols including initial assessment, resuscitation and secondary survey. (See Initial Assessment Protocol.) Remember that the mother's welfare comes first so that all of the initial assessment should be directed to the mother while keeping the fetus' welfare in mind. This includes X-rays and CT scanning.

2. Assess for pregnancy and gestational age by one or more of the following:
   a. History and last menstrual period.
   b. Beta-HCG.
   c. Prior sonogram.
   d. Discussion with primary care obstetrician.

3. Notify patient's primary obstetrician of the trauma event. If not available, call the in-house obstetrician on-call. Call neonatology consult for impending delivery.

4. If 24 weeks or greater (viable fetus) by any indicator, including physical exam, contact the OB resident on call STAT( NOTE for <24wks call the OB resident on for that service as a consult)
   a. The OB resident will assess the fetal health in the ED by appropriate monitoring.
   b. If the patient can be discharged from a Trauma standpoint then the patient will be transported to Crouse OB for monitoring per protocol.
   c. If the patient needs admission for trauma care then proceed as follows:
      (a) Admit Patient to Stepdown on 6I
      (b) OB Resident to place patient on Toco monitor
      (c) OB Resident should write basic HR call orders
      (d) OB Resident will see and evaluate the patient Q 4hrs.

5. Place patient (>20 weeks pregnant) on the left side to take uterine pressure off vena cava. If the patient cannot be positioned on her left side, manually displace the uterus to the left, off of the inferior vena cava.

7. Determine maternal Rh status. If Rh negative, then administer Rhogam 300 mcg for 2nd and 3rd trimester or 50 mcg for 1st trimester.

8. Obtain sonogram if ordered by obstetrician.

9. In case of emergency surgery, the attending trauma surgeon may proceed with obstetrical house-staff while the obstetrical attending and neonatologist are responding to the hospital.

10. Perimortem C-section may be undertaken by the obstetric consultant, the trauma attending or the assigned emergency medicine physician provided:
   a. Signs of fetal life are present
   b. Maternal demise is imminent
   c. Gestational age is estimated at greater than 24 weeks.

11. If the gestational age is less than 20 weeks, then continuous fetal monitoring is usually not necessary unless ordered by obstetrics.
PRACTICE GUIDELINES: EVALUATION OF HEMATURIA

OBJECTIVE:

Provide guidelines for the diagnosis and management of the trauma patient with hematuria.

DEFINITIONS:

Gross hematuria: Blood in the urine that can be seen as a change in the urine color.

Microhematuria: Urine that appears normal but has tested positive for blood by either a dipstick technique or by microscopic examination.

GUIDELINES:

1. Treat the patient according to ATLS guidelines.

2. Determine the presence of blood by either inserting a Foley catheter or having the patient void spontaneously.

3. If the urine has visible cells or is red or pink, then gross hematuria is present (usually >50 RBC/HPF).

4. If the urine appears normal but is "dipstick positive" for blood (1+ or greater) and has RBC's on microscopic exam (usually <50 RBC/HPF), then microhematuria is present.

5. For blunt trauma:
   a. For gross hematuria, determine whether there is a fractured pelvis and whether there is a mechanism or signs suggestive of an intra-abdominal injury.
      i. If there is a fractured pelvis, obtain an abdominal and pelvic CT scan and then consider a cystogram or CT cystogram
      ii. In all other cases, obtain abdominal and pelvic CT.
   b. For micro-hematuria, determine whether there is a mechanism or signs suggestive of an intra-abdominal injury.
      i. If there is a mechanism or signs suggestive of intra-abdominal injury, obtain an abdominal CT scan.
      ii. If there is no mechanism or signs suggestive of an intra-abdominal injury, then no further immediate diagnostic studies are necessary.
         a) If the patient is discharged, provide information about potential gross hematuria and have patient contact Trauma Team if hematuria is seen.
         b) If the patient is admitted, then obtain a urinalysis 24 hours after admission. If has >50 RBC/HPF, then obtain an abdominal CT scan.

6. For penetrating trauma:
   a. If patient is unstable, go to OR for laparotomy. Obtain intraoperative IVP if necessary. This will demonstrate presence of bilateral kidneys.
   b. If patient is stable and has gross or microhematuria, obtain a “one-shot IVP.”
7. Procedures:
   a. Cystogram (per Radiology):
      i. Place Foley catheter.
      ii. Obtain hypaque or renografin (full-strength).
      iii. Open a Toomey syringe and remove plunger. Attach barrel to the Foley catheter.
      iv. Place 300 ml of contrast (10 ml/kg in children) into bladder by gravity flow through
         the Foley catheter.
      v. Obtain pelvis film.
      vi. Drain bladder.
   b. One-shot IVP:
      i. Clamp Foley catheter if one has been placed (to obtain “free cystogram”).
      ii. Administer intravenous injection of contrast (1 ml/kg).
      iii. Obtain abdominal film at 5 minutes after completion of contrast Infusion.
PRACTICE GUIDELINES: MANAGEMENT OF KIDNEY AND BLADDER INJURIES

OBJECTIVE:

Provide guidelines for the management of renal contusions, renal fractures, renal-vascular injuries and bladder perforations.

DEFINITIONS:

Renal contusions: Defect(s) in perfusion of the kidney on CT or IVP that is consistent with a parenchymal contusion.

Renal fracture: A parenchymal defect of the kidney associated with hematoma or urinoma around the kidney.

Reno-vascular injuries: Occlusion(s) of the renal artery as evidenced by lack of perfusion to a kidney on CT, IVP or angiogram.

Bladder perforation: Extravasation of contrast from the bladder on CT, IVP or cystogram. Extraperitoneal perforations are contained in the retroperitoneal space around the bladder. Intraperitoneal perforation is associated with contrast in the peritoneal cavity that outlines bowel.

GUIDELINES:

1. Evaluation:
   a. Consider renal injury with any injury associated with hematuria (see Guideline for hematuria).
   b. Consider renal injury with penetrating abdominal injury (see Guideline for evaluation of penetrating abdominal trauma).
   c. Consider bladder injury when there is significant hematuria with a pelvic fracture or lower abdominal pain (see Guideline for cystogram).

2. Penetrating Injuries:
   a. All gunshot wounds to the kidney require exploration for the possibility of associated injuries. Obtain one-shot IVP (or, in the stable patient, a CT scan) prior to surgery or intra-operatively to determine presence of contralateral kidney.
   b. All stab wounds to the kidney require specific evaluation:
      i. If kidney is injured from anterior stab wound, exploration is required because of the possibility of associated intra-abdominal injuries.
      ii. If kidney is injured from a flank wound, CT must show that the wound is limited to the kidney with minimal blood in the perirenal space. If urine is present around the kidney, consider exploration for disrupted collecting system or ureter.

3. Blunt Injuries:
   a. Renal contusion:
      i. Diagnosed as a perfusion defect on CT or IVP.
      ii. No definitive treatment necessary.
      iii. Follow-up urinalysis every day until RBC <50/HPF.
      iv. May discharge if still has hematuria; follow-up urinalysis at clinic visit one to two weeks after discharge.
   b. Renal fracture: rarely requires surgical intervention.
i. Diagnosed on CT scan as parenchymal defect with surrounding hematoma and possible urinoma.

ii. If hemodynamically unstable, consider angiogram.
   a) If angiogram shows active arterial extravasation, consider embolization.
   b) If angiogram shows occluded main renal artery, nothing more needs to be done as long as contralateral kidney is present.
   c) If angiogram shows active extravasation and embolization cannot be accomplished, patient should be taken to surgery. Nephrectomy will probably be required. If there is venous extravasation, anticipate spontaneous resolution of bleeding as long as clotting factors are normal.

iii. If hemodynamically normal without evidence of ongoing bleeding, treat non-operatively.
   a) Obtain urology consult.
   b) Keep in monitored setting (ICU, I/O or step down bed) until hematocrit stable.
   c) Foley to remain in place until hematuria substantially clears.
   d) Bed rest for three days, then mobilize in hospital on day 4 and discharge on day 5.
   e) Serial hematocrits every 6 hours until repeated values are within 2%, then daily hematocrits for 3 days.
   f) Antibiotics unnecessary unless there is documented positive urine culture that should be treated appropriately.
   g) Expect abdominal and flank discomfort, fevers and mild ileus for 3-4 days.
   h) The presence of a urinoma does not necessarily require operative intervention.
   i) Follow-up routinely in clinic 10-14 days after discharge. Follow-up CT is unnecessary.
   j) Out of school or work 10-14 days after discharge. Avoid contact sports activities for three months.
   k) Discuss with the patient the meaning of hypertension in the follow-up period.
   l) ALL Patients receive a SOLID ORGAN INJURY Card

c. Renovascular injury:
   i. Usually discovered in patient with poor visualization of kidney on contrasted CT scan or non-visualized kidney on IVP.
   ii. Order STAT renal angiogram.
      a) If there is active extravasation, attempt embolization. If embolization is unsuccessful, perform laparotomy. Gain arterial inflow control at the aorta as first step.
      b) If there is occlusion, most likely explanation is intimal flap from partial thickness vessel disruption from traction injury.
      c) With occlusion, consider the amount of time from the injury.
         i) Less than six hours: consider revascularization although the outcome is poor.
         ii) Greater than six hours: observe. The chances of kidney survival are slim.

4. Bladder and urethral injury:
   a. Consider bladder injury in patient with the following:
      i. Gross hematuria (i.e., real bloody).
      ii. Severe displaced pelvic fracture.
      iii. Lower abdominal pain with hematuria.
      iv. Extravasation seen on CT scan of pelvis.
   b. In male, consider urethral injury with the following:
i. Displaced severe anterior pelvic fracture (i.e., open book fracture).
ii. Blood at the meatus.
iii. Perineal and scrotal hematoma.
iv. High riding or boggy prostate gland.
c. For possible urethral injury, perform a urethrogram (see Guideline: X-rays on Trauma Patients).
i. If positive, do not try and place Foley catheter. Consult urology.
ii. If negative, insert Foley catheter if indicated.
d. For possible bladder injury, insert Foley catheter and perform retrograde cystogram. If there is a bladder injury, determine whether it is extra-peritoneal or intra-peritoneal.
i. Extra-peritoneal bladder rupture: contrast flows from bladder but is confined in the extra-peritoneal space around the bladder.
   a) Consult urology.
   b) Usually treated with bladder drainage for 7-10 days.
   c) After that time, obtain cystogram and if bladder is intact, may remove catheter. Antibiotics generally not needed.
ii. Intra-peritoneal bladder rupture: contrast flows from the bladder into the peritoneal cavity. Bowel is outlined.
   a) Consult urology.
   b) Usually treated with exploratory laparotomy and bladder closure. Cystostomy in this situation is controversial.
   c) May be treated without laparotomy and repair if there are no signs of peritoneal irritation suggesting an associated injury. In this case, treatment is the same as for extraperitoneal rupture.
   d) Bladder drainage used for 7-10 days, at which time a cystogram is obtained. If bladder is intact, catheter may be removed.
PRACTICE GUIDELINES: MANAGEMENT OF THE COAGULOPATHIC TRAUMA PATIENT

OBJECTIVE:

Provide therapeutic guidance for management of trauma patients arriving with a pre-existing coagulopathy, arising from either therapeutic anticoagulation or disease.

DEFINITIONS:

Anticoagulants: Typically heparin sulfate, low molecular weight heparins (i.e., Lovenox/enoxaparin), warfarin agents (Coumadin), and anti-platelet agents (ASA, Ticlodipine, Dipyridamole)

Hereditary bleeding dyscrasias, lab abnormalities, and therapeutic goals:
- Hemophilia A (Factor VIII), isolated elevated PTT; Factor VIII half-life is 12 hr, therapeutic goal is >50% Factor VIII activity; for CNS injury, therapeutic goal is >80%
- Hemophilia B (factor IX), isolated elevated PTT; Factor IX half-life is 20-30 hr, therapeutic goal is >50% activity except for CNS injury, where therapeutic goal is >80%
- Von Willebrand’s disease (vWF, factor VIII), elevated bleeding time and PTT; half-life is 24 hr, therapeutic goal is >25% Factor activity
- Other inherited Factor deficiencies (commonly Factor V)
- Chronic liver failure (II, VII, IX, X), elevated INR

FFP: Fresh Frozen Plasma, contains 200 units of all coagulation factors, complement, and 400 mg fibrinogen per unit, and is typically used in factor II, V, VIII, IX and XI deficient states. One unit of FFP raises the average level of these factors by 2%. Typical treatment dose starts with 2-4 units; may need 10-20 units to reverse serious coagulopathies (i.e., liver failure and Coumadin toxicity). Hypocalcemia with massive transfusion should be considered and treated.

Cryoprecipitate: Plasma concentrate consisting of factor VIII and fibrinogen. One unit contains 100 units of factor VIII and 250 mg fibrinogen. One unit equals 10 ml and will increase factor VIII activity by 2%. Typical dose is 8-10 units.

Platelets: One apheresis pack (usually containing 6-8 donor units) will increase platelet one-hour count by 50,000. Counts should be repeated every 8-12 hours to address platelet consumption and need for repeat transfusion. Levels <20,000 are associated with spontaneous ICB’s and should be addressed regardless of injury. May be dosed as an apheresis pack or as a 6-8 random donor unit pack.

Vitamin K: Synthesized by intestinal flora; involved in hepatic production of factors II, VII, IX, and X. Warfarin (Coumadin) is a vitamin K antagonist. Deficiency associated with increased PTT, PT and normal bleeding time.

GUIDELINES:

1. General approach assumes blood loss will appear out of proportion to expected loss in patients with pre-existing coagulopathy.
a. Suspect underlying coagulopathy in any patient with unexplained blood loss. Review medications, family history and past medical history.
b. If indicated, begin specific therapy for early anticoagulation reversal.
c. Determine need for specific therapy using risk assessment table (see below).

2. Risk Assessment (See Treatment Table)
   a. Assessing Bleed Risk
      i. High Risk
         1. CHI, spinal cord injury, spinal fracture (increased morbidity secondary to bleeding into a confined space)
         2. Splenic/liver/renal lacerations; Grade 3, 4, or 5
         3. Unstable pelvic fractures
      ii. Moderate Risk
         1. Multiple long bone fractures
         2. Stable pelvic fractures
         3. Hemothorax
         4. Splenic/liver/renal lacerations; Grade 1 or 2
         5. Positive FAST or CT for pelvic fluid
      iii. Low Risk
         1. Extremity-only injuries (monitor for Compartment Syndrome)
         2. Blunt chest or abdominal trauma, without solid organ injury
   b. Assessing Risk of Anticoagulation Reversal
      i. High Risk
         1. Mechanical Heart Valves
         2. Acute DVT (< 1 month)
         3. Acute PE (< 1 month)
      ii. Moderate Risk
         1. Chronic DVT Rx (>1 month or < 3 months)
         2. PE Rx (> 1 month or < 3 months)
         3. Hemophilia A
      iii. Low Risk
         1. Chronic Atrial Fibrillation
         2. CVA/Stroke Prophylaxis
         3. Chronic DVT/PE (> 3 months)
         4. Von Willebrand’s disease
         5. Hemophilia B
         6. Other inherited coagulopathies

treatment Table

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<tr>
<th>Bleed Risk</th>
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<tr>
<td>Risk of Reversal</td>
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<td>High</td>
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<tr>
<td>Moderate</td>
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<tr>
<td>Low</td>
<td>Reverse</td>
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c. If patient has mechanical heart valve consider starting heparin (PTT 45 -55) 48 hours post-injury and restarting Coumadin 7 days post-injury.

d. Consider vena cava filter if DVT/PE is reason for anticoagulation; discontinue anticoagulation until 7 days post-injury.

3. Specific Therapy (Link to UUH anticoagulation guideline)
   a. Acute Reversal of Patients Receiving Coumadin
      i. FFP: give 2 units and follow INR; target INR <1.5. (For patients with traumatic brain injury with positive CT findings, consider starting with 4 units of FFP.) **If you have given 2 units and the bleeding appears to be continuing, give 2 more.** Sometimes it takes 6 to 8 units of FFP to reverse the coagulopathy in a coumadinized patient.
      ii. Vitamin K (reversal time 6-24 hours) given to prevent “re-anticoagulation;” begin immediately. Use with caution based on risk. Give IV or p.o. SQ may give hematoma.
      iii. If the patient has an intracerebral or spinal hemorrhage or life threatening hemorrhage give PCC (Prothrombin Complex Concentrate) (See UUH anticoagulation guideline)

b. Patients Receiving Heparin
   (Link to UUH anticoagulation guideline)

c. Hemophilia A
   i. If bleed risk of is High, give Factor VIII empirically to achieve therapeutic goal of >50% factor activity. If risk is Moderate or Low, check Factor levels and dose accordingly. Monitor PTT and consult hematology.
   ii. One unit/kg will raise Factor levels by 2%.
   iii. In order to obtain 50% Factor activity (assuming low patient factor levels) begin with 40 units/kg every 12 hours (especially for CNS injury, see Definition section) and obtain hematology consult. Therapeutic goal is >50% factor activity and 80% for CNS injury.

d. Von Willebrand’s Disease
   i. Bleed risk is Moderate to Low unless patient has severe von Willebrand’s Disease.
   ii. Give cryo-precipitated vWF–enriched plasma; monitor PTT and bleed time; obtain hematology consult. Goal is >25% Factor activity.

e. Hemophilia B
   i. Bleed risk is Moderate to Low, therefore replace Factor IX using serum factor levels (goal is >50% factor activity; 80% for CNS) and clinical evaluation. One unit/kg of factor IX will increase Factor activity by 1%.
   ii. For serious bleeding, start with 60 units/kg BID
   iii. Obtain hematology consult.

f. Factor V Deficiency
   i. Treat with Factor V Replacement, usually via FFP transfusion (begin with 2 units).
   ii. Obtain hematology consult.

g. Functional Platelet Defects and Thrombocytopenia (platelet count < 20,000)
i. If bleed is significant give 1 pharesis pack of platelets, follow levels and bleed times; repeat every 6-8 hours as needed.
ii. Reversing hypothermia may correct platelet dysfunction.
iii. DDAVP (Stimate) may be used as nasal spray or as intravenous dose (0.3mg/kg, infused slowly).

4. Specific Patients

a. Traumatic Brain Injury
   i. CT negative, INR 1.5-3.0; admit for observation and hold Coumadin. Check INR in 6 hours and follow guideline.
   ii. CT negative, INR >3.0; admit and give FFP until INR 1.5-3.0 (usually 4 units); repeat CT in 12 hours
   iii. CT with intracranial bleed, INR >1.5; admit to ICU and give PCC repeat INR in 1 hour and if >1.5 give additional dose of PCC or FFP. Give 2mg Vit. K IV. Repeat CT scan in 6 hours.

b. Spinal Cord Injury -- INR >1.5; give PCC repeat INR in 1 hour and if >1.5 give additional dose of PCC or FFP and recheck INR till <1.5 Give 2mg Vit. K IV.

c. Chronic Liver Failure
   i. INR>1.5; patients will be deficient in Factors II, VII, IX and X. May require BOTH cryoprecipitate and FFP.
   ii. Patients may be refractory to vitamin K secondary to hepatocyte dysfunction.

d. Severe Bleed (INR>3) or Patient Receiving LMWH Therapy
   (Link to UUH anticoagulation guideline)
   i. Give PCC repeat INR in 1 hour and if >1.5 give additional dose of PCC or FFP and recheck INR till <1.5 Give 2mg Vit K IV.
PRACTICE GUIDELINES: DEEP VENOUS THROMBOSIS PROPHYLAXIS

OBJECTIVES:

1. Define the patient at risk for deep venous thrombosis (DVT) and will benefit from appropriate prophylaxis in the surgical setting
2. Define guidelines for DVT prophylaxis that most appropriately reduce the incidence of DVT and pulmonary embolus
3. Define diagnostic and treatment protocols for DVT
4. Define surveillance protocols to detect occult DVT

DEFINITIONS:

Deep venous thrombosis (DVT) – spontaneous development of clot in the veins of the leg or pelvis

Pulmonary embolus – dislodged clot that has formed in the veins of the leg and/or pelvis that has migrated to the right heart or pulmonary arterial circulation

DVT prophylaxis – specific therapy that is used in high-risk patients to prevent the occurrence of DVT

Pulmonary embolus prophylaxis – specific treatments to prevent the migration of blood clots into the pulmonary vasculature

GUIDELINES: PATIENTS > 12 YEARS OF AGE

1. Determination of DVT risk
   a. Every patient admitted to the trauma service will undergo a DVT risk assessment by using the “Risk Factor Assessment Tool” (in table below)
   b. SCD – Sequential compression device on all patients post-op or at bedrest with no contraindications (i.e. External fixator, compartment syndrome, etc)
   c. Heparin prophylaxis
      i. Heparin 5,000 units SQ q12 hours ONLY for patients with renal failure.
2. Moderate Risk – SCD and Lovenox 40mg SQ daily
3. High Risk – SCD and Lovenox 30mg SQ BID
4. Very High Risk – SCD and Lovenox 30mg SQ BID
### Low Risk
- Minor Surgery- < 40 yo without additional risk factors

### Moderate Risk
- Major surgery (>60 min, abd or lower extremities) >40 without additional risk factors
- Minor surgery - 40-60 yo without additional risk factors
- Immobilizing plaster cast or splint

### High Risk
- Major surgery - > 40 yo without additional risk factors
- Major surgery - < 40 with additional risk factors
- Minor surgery - > 60 yo with additional risk factors
- Hip and knee replacement surgery

### Very High Risk
- Patients > 40 with any of the following:
  - Brain injury
    - Prior VTE
    - Cancer
    - Hypercoagulable state
    - Multiple risk factors
  - Multiple trauma
    - Fractured pelvis
    - Multiple lower extremity long bone injuries
    - Spinal cord injury
    - Prolonged immobilization
  - Brain injury

### Additional Risk Factors
- History of VTE
- History of prior major surgery
- Malignancy
- Inflammatory bowel disease
- Obesity
- Oral contraception

5. Indications for permanent vena cava filter – **all of the following factors**
   a. Very high risk and cannot be anticoagulated, and
   b. Age > 45yr (consider lower age if retrievable filter placed), and
   c. One of the following injury patterns
      i. Spinal cord injury
ii. GCS ≤ 8
iii. Long bone fracture with pelvic fracture
iv. Multiple long bone fractures of lower extremities

6. Consider retrievable vena cava filter for patients <45

7. Indications for venous duplex scanning
   a. Signs of DVT
      i. Unilateral swollen extremity
      ii. Unilateral painful thigh or calf not explained by injury
      iii. Swollen arm associated with indwelling central venous catheter
   b. Prophylactic screening, see above

8. Pulmonary embolus
   a. Diagnosis
      i. Clinical, unexplained by concurrent conditions (trauma, pneumonia, atelectasis)
         1. Tachypnea
         2. Chest pain, pleuritic?
         3. Hypoxemia
      ii. Imaging
         1. Contrast CT scan of chest – look for vascular filling defect
         2. V/Q scan – look for perfusion defect without matching ventilation defect
            – high probability
         3. Duplex scan – not always helpful, low priority
      iii. Treatment, no bleeding risk
         1. Lovenox 1mg/kg BID or 1.5mg/kg daily
         2. If patient has renal failure use heparin gtt protocol
      iv. Treatment, bleeding risk
         1. Vena cava filter

Adapted from the SUNY Upstate DVT Prophylaxis Protocol
PRACTICE GUIDELINES: MANAGEMENT OF SEVERELY BURNED PATIENTS

OBJECTIVES:

1. Provide triage parameters and guidelines for the management of the severely burned patient.
2. Provide guidelines to stabilize thermally-injured persons until they may be transferred to a burn unit.
3. Provide information to insure smooth transfer of the patient to the burn unit.

DEFINITIONS:

Severely burned patient: This is a patient with a severe burn injury who requires care in a burn center. The definitions are derived from the classification of burns and guidelines proposed by the American Burn Association.

- Patients with burns that involve >25% total body surface area (TBSA). This value is 20% TBSA in children <15 years old and adults >40 years old.
- Partial thickness or second degree burns exceeding 20% TBSA.
- All second- and third-degree burns involving the face, eyes, ears, hands, feet or perineum.
- Burns associated with significant fractures or other major injury.
- High-voltage electrical burns.
- Inhalation injury.
- Lesser burns in patients with significant pre-existing disease.

GUIDELINES:

1. Assess the ABC’s. Do not allow your attention to be diverted by the thermal cutaneous burn. Look for life-threatening injuries first.
   a. Airway:
      i. Assess for upper airway injury caused by the inhalation of hot air or gases. This will potentially result in rapid upper airway occlusion.
         a) Stridor.
         b) Inability to handle secretions.
         c) Inability to speak; hoarse.
         d) Burns about face and mouth.
         e) Erythema in the pharynx.
         f) If there is any question about airway occlusion, intubate the patient using the oral route under direct visualization.
      ii. Assess for smoke inhalation. This will result in lower airway occlusion or noncardiogenic pulmonary edema:
         a) All of the above signs, plus:
         b) A history of being burned in an enclosed environment.
         c) Carbonaceous sputum.
         d) Soot in the airway and around the nose and mouth.
         e) Uncontrollable coughing:
            i) Obtain chest X-ray. REMEMBER: the initial chest X-ray may be normal with severe smoke inhalation.
ii) Consider bronchoscopy, looking for erythema of the airway and soot deposition in the trachea and bronchi.

iii) If there is any question about smoke inhalation, intubate the patient and place them on positive pressure ventilation.

iii. Carbon monoxide poisoning:
   a) Immediately apply 100% O₂ via face mask then get CO level
   b) Consider carbon monoxide poisoning with any of the above findings, and
   c) Carboxyhemoglobin level >10%:
      i) 100% Mask oxygen can be used if there is no evidence of neurologic deficit.
   d) Carboxyhemoglobin level >40% or neurologic deficit:
      i) Consider hyperbaric oxygen
      ii) Consider intubation 100% O₂.

b. Breathing:
   i. Remember that the patient could have sustained a chest injury in association with the burn injury.
   ii. Assess breath sounds and obtain a chest X-ray.
   iii. Treat according to the chest injury guidelines.

c. Circulation:
   i. Assess for shock and treat accordingly.
   ii. Insert two large bore IV’s. These may be placed peripherally or centrally. It is okay to place the IV’s through eschar if it is the only access site.
   iii. Administer two liters of lactated Ringer’s solution.

d. Disability:
   iv. Assess neurologic status.
   v. If brain injury is suspected, obtain CT scan.

e. Expose: Remove all clothing and constricting bands or jewelry. Place patient on clean sheet. Sterile sheets are not required. Do not immerse burn into water or ice.

2. Obtain blood sample for laboratory.
   a. CBC, renal panel, UA, clotting studies, blood alcohol toxicology screen also (if necessary).
   b. Obtain CXR if not already done.
   c. Obtain EKG in patients over 45 or those who are having arrhythmias.
   d. Obtain arterial blood gas with carboxyhemoglobin level.

3. Insert Foley catheter and NG tube in patients with >20% TBSA burn.

4. Examine the burn when the patient is otherwise stable.
   a. Rule of nines for second- and third-degree burn only.
   b. The palm of the patient’s hand (with the fingers) is equal to 1% TBSA.
   c. Assess depth of burn:
      i. First degree: erythematous, dry, painful, blanches (e.g., sunburn).
      ii. Second degree (partial thickness): blisters, wet, erythematous, painful, blanches (e.g., blister burn).
      iii. Third degree (full thickness): dry, leathery, gray or brown, painless, does not blanch (e.g., surface of football).
      iv. Only second- and third-degree burns are considered when assessing the size of the burn.
   d. Calculate the fluid requirements:
      i. (4 ml) X (wt in kg) X (% TBSA burn) – given over first 24 hours.
ii. One-half given in first 8 hours and the rest given in second 16 hours.
iii. Maintain urine output at 0.5 ml/kg/hr in the adult (1.0 ml/kg/hr in child and 2.0 ml/kg/hr in infant <1 year).

e. Assess for constricting eschar:
   i. Usually on extremity but may be on chest or neck.
   ii. Release eschar medially and laterally as follows:
      a) Prep with betadine or Duraprep / hibiclens.
      b) Use #11 blade or Bovie.
      c) Hold between your thumb and forefinger with the blade protruding 1/4 inch.
      d) Run the blade on the medial and lateral aspect of the involved limb. For chest injuries, release the eschar on the lateral aspect of the chest at the anterior axillary line.
      e) There should be no pain and minimal bleeding.
      f) Expand the escharotomy with a clamp.
      g) Cover the site with a dry, sterile dressing.

f. Do not administer antibiotics unless there is a concomitant injury.

g. Administer intermittent boluses of morphine intravenously as needed for pain. If the patient is intubated and stable, you can be moderately liberal with the pain med.

5. Transfer to the Burn Unit at the request of the Burn Service.
PRACTICE GUIDELINES: ALCOHOL WITHDRAWAL SYNDROME

PRACTICE GUIDELINES: SUBSTANCE ABUSE TRAUMA REFERRAL

OBJECTIVES:

1. Define substance abuse as a major risk factor for many types of injury.
2. Define methods of discussing the problem with the admitted patient and making appropriate treatment referrals may prevent future substance abuse related injury.

GUIDELINES:

1. Attendings, residents, or nurse will initiate a social service/substance abuse referral on the basis of this standing protocol, which will be considered a physician order.

2. If the patient has an admission blood alcohol > .8mg/dl or any non-prescription drugs (i.e. cocaine, marijuana, Benzodiazepines on the tox screen or if the patients answers two or more of the CAGE questions affirmatively , then a chemical dependency or social service consult will be obtained.

3. If any patient younger than 21 any evidence of alcohol in his/her system at the time of admission then a social service consult will be obtained.

4. Social work staff will document any referrals in the Progress Notes section on the patient’s medical record.

5. Social work staff will maintain a current list of area referral sources for alcohol-related services.

6. Social work staff will periodically conduct in-service education for appropriate hospital staff on alcohol abuse diagnosis and referral.
PRACTICE GUIDELINES: DOMESTIC VIOLENCE

OBJECTIVE:

Identify guidelines for diagnosis, acute management and appropriate referral of domestic violence.

DEFINITIONS:

1. Domestic Violence: A pattern of coercive behaviors that involves physical abuse, sexual and/or psychological abuse against former or current intimate partners. This definition includes both male and female victims of domestic violence as well as both homosexual and heterosexual relationships.

2. Risk factors for domestic violence include:
   a. Women are at high risk. In the majority of cases of domestic violence, the victim is female and the perpetrator is male. About 20% of American women are victims of domestic violence at some point in their lives and domestic violence is thought to be the leading cause of serious injury to women between the ages of 15 and 44.
   b. Alcohol and drug abuse.
   c. Emergency Department patients have a high prevalence of domestic violence; 30% of women seen for traumatic injury and 18-24% of women seen for any reason are victims of domestic violence.

GUIDELINES:

1. The physician’s responsibility consists of:
   a. Detection of patients who are victims of domestic violence.
   b. Treatment of any acute medical problems.
   d. Referral of the patient to Social Services for further evaluation and counseling.

2. Because of its high prevalence among trauma patients, universal screening of all female patients for domestic violence is warranted. Men should be screened when they present with signs or symptoms of domestic violence.

3. Physical indicators
   a. Injury inconsistent with the explanation
   b. Delay in seeking treatment
   c. Multiple injuries in various stages of healing
   d. Contusion, abrasions, minor laceration, fractures or sprains
   e. Injuries to the head, neck, chest, breast, abdomen, pelvic organs
   f. Injuries during pregnancy, i.e., bruising/abrasions to abdomen or pelvic area
   g. Repeated or chronic injuries
   h. Musculoskeletal complaints atypical chest pain chronic headaches

4. Behavioral indicators
   a. Partner accompanies patient, insists on staying close, answers all questions directed at the patient
   b. Denial or minimizing of violence by patient or partner
c. Reluctance of partner to speak in front of partner  
d. Overly aggressive, overly attentive or overly protective partner  
e. Frequent visits with vague complaints or symptoms without evidence  

5. Screening question:  
a. “Are you currently or have you ever been in a relationship where you were physically hurt, threatened or made to feel afraid?”  

OR  

b. If the patient has a physical injury say:  
“Sometimes people come in with injuries like yours and often they are from someone hurting them. Is this what happened to you?”
PRACTICE GUIDELINES: PREVENTION OF HYPOTHERMIA

OBJECTIVE:

Define methodologies to prevent hypothermia in the trauma patient.

DEFINITIONS:

1. Hypothermia: A body temperature below normal in any victim of trauma.
2. “Clinical” hypothermia: A core temperature below 35° C in any victim of trauma and is classified as follows:
   a. Mild hypothermia: 32° to 35° C.
   b. Moderate hypothermia: 30° to 32° C.
   c. Severe hypothermia: <30° C.
3. Patients at risk for hypothermia:
   a. History of prolonged, cold environmental exposure.
   b. Massive blood and fluid loss with large fluid requirements.
   c. Severe head injury.
   d. Infants and children.
   e. Burns.
   f. Drowning victims.

GUIDELINES:

1. All victims of major trauma are considered “at risk” for hypothermia.
2. Core temperature should be obtained on all patients with major injuries:
3. The trauma room temperature should always be maintained at greater than 75° F.
4. Avoid prolonged patient exposure, i.e., cover with warm blankets. The operating room should be maintained at 85° F.
5. Warm blankets should be provided to the patient as soon as possible.
6. All fluid going into patient should be warm (available in trauma room).
7. For major transfusion requirements, use the rapid infuser/warmer that will always be kept in the trauma room. Will use Infuser as Warming device and not as rapid infuser until ordered by physician.
8. If hypothermia becomes a problem, obtain the Bair Hugger and apply over as much of the body surface as possible.
9. If the patient has severe hypothermia:
   a. Notify the trauma attending immediately.
   b. Begin aggressive passive re-warming measures.
      i. Bair Hugger (do not apply a blanket between the Bair Hugger and the patient).
      ii. Increase the temperature on the inspiratory humidifier on the ventilator.
      iii. Warm saline down the NG tube.
      iv. Consider warm peritoneal lavage.
v. Consider cardiac bypass if all else fails. Obtain a cardiac surgery consult

10. If the patient has temperature < 36°C monitor temperature every hour. If patient has temperature < 35°C monitor temperature every 30 minutes or continuously via a bladder thermistor.

11. The OR Trauma Room will be kept at 85°F.
PRACTICE GUIDELINES: USE OF ThermaCor Fluid and Blood Infuser

PRACTICE GUIDELINES: DISCHARGE CRITERIA

OBJECTIVE:

Establish minimal discharge criteria to assure safe transfer of care to home or a skilled nursing facility.

DEFINITION:

Discharge: The transfer of care from the acute care setting to home, supervised environment, skilled nursing facility, rehabilitation center or transitional care facility.

GUIDELINES:

1. For discharge to home, the following conditions must be met:
   a. Tolerating PO diet or tube feeds.
   b. Pain managed with oral medications.
   c. T <100º for 24 hours.
   d. Electrolytes normal.
   e. Hematocrit >22% (consider FeSO4); WBC not increasing.
   f. Able to ambulate with assistance that is available OR has available help if to be kept at bed rest.
   g. If needed, home health nursing has been arranged.
   h. Patient or family understands discharge plan.
   i. Method of follow-up clearly identified (clinic, primary care, specialty service). If PCP follow-up, then the PCP should be called by the resident or Trauma Program Manager. A follow-up letter will be sent.

2. For discharge to supervised environment or skilled nursing facility:
   a. Tolerating PO diet, tube feeds or TPN.
   b. Bowel activity without significant diarrhea or constipation.
   c. Pain managed with oral medications.
   d. T <100º for 24 hours.
   e. Electrolytes normal.
   f. Hematocrit >22%; WBC not increasing.
   g. If required, IV access good without phlebitis.
   h. Wounds healing.
   i. Care is within the scope of the receiving facility.
   j. Family or patient understands goal of treatment plan.

3. For transfer to rehabilitation center or transitional care facility:
   a. Tolerating PO diet, tube feeds or TPN.
   b. Bowel activity without significant diarrhea or constipation.
   c. Electrolytes within 5% of “low normal threshold,” replacement underway.
   d. Hematocrit >22%; WBC not increasing.
   e. Care is within the scope of the receiving facility.
   f. IV access good without phlebitis.
   g. Wounds healing.
   h. Antibiotic course, if needed, is well established.
   i. Family or patient understands goal of treatment plan.
4. The attending must "know" of the discharge; does not necessarily have to see the patient on day of discharge.
PRACTICE GUIDELINES: TRANSFER TO INPATIENT REHABILITATION
MINIMAL MEDICAL REQUIREMENTS AND PATIENT STABILITY

OBJECTIVE:

Define the recommended medical status of a patient that can be considered for transfer to an inpatient rehabilitation facility.

To define the optimal ongoing medical interventions that are acceptable for care in the rehabilitation.

DEFINITION:

Rehabilitation unit: An inpatient facility which provides aggressive multidisciplinary rehabilitation programs to enable patients to optimally re-enter the community after a disabling injury. At University Hospital, this unit is located on 2-North and staffed by full-time physiatrists and therapists.

GUIDELINES:

1. The following guidelines represent “suggested” standards that will help define transfer. They can be altered for the individual patient’s needs and the resources that are currently available in the rehabilitation unit

2. Cardiovascular
   a. No continuous monitoring requirement
   b. No continuous cardioactive drug drips, all cardiac drugs po or by patch
   c. Maintenance IV not required. IV fluids for line flushes only
   d. Arrhythmias controlled

3. Pulmonary
   a. Patient completely weaned from ventilator
   b. Tracheostomy is OK. Patient must be breathing spontaneously
   c. Suctioning requirement not less than every two hours
   d. Active pneumonia’s are adequately treated with established course of antimicrobials
   e. Chest tubes have been removed

4. Infection
   a. Ideal – the patient is free of active infection
   b. Infections have been diagnosed and are adequately treated with established course of antimicrobials
   c. White cell count < 12,000 or on a downward trend acceptable to PM&R staff
   d. Cutaneous infections controlled with appropriate debridement and wound care protocols
   e. MRSA acceptable if treatment or observation plan is established

5. Nutrition and feeding
   a. Optimal feeding tube is PEG or gastrostomy, should be previously placed
   b. Adequate nutritional intake provided by oral or enteric intake
   c. No requirement for supplemental IV fluid to maintain hydration
   d. Wounds are healing
6. IV access
   a. PICC line is preferred
   b. Alternative is subclavian venous access
   c. Entry site should be free of infection

7. Wounds
   a. Cutaneous wounds should be clean and free of eschar or necrotic debris
   b. Dressing change regimen should be established
      i. VAC dressing
      ii. Wet to dry dressings
      iii. Other (silver impregnated dressings, etc.)
   c. Dressing change regimen should be no more frequent than twice a day

8. Medications
   a. As much as possible, medications should be taken orally or by tube
   b. Exceptions
      i. Antibiotics
      ii. Occasional analgesics (e.g., morphine) for dressing changes

9. Follow-up
   a. The trauma team will be available to follow-up on wounds and other minor medical problems
   b. Follow-up should be required no more than once a day
   c. Return appointment to trauma clinic will be provided if needed
PRACTICE GUIDELINES: OBTAINING CONSULTS FROM PHYSICAL MEDICINE AND REHABILITATION

OBJECTIVE:

Define the type of patient and nature of injury that would benefit from inpatient rehabilitation.

NOTE: Obtain a PM&R consult as soon as you determine the potential may exist for needing rehabilitation. This can be on admission in the ICU. PM&R at UUH prefers early consultation. If in doubt consult.

GUIDELINES

1. The following patients should be considered as potential inpatient rehabilitation candidates
   a. Spinal cord injuries with permanent deficits, must be off ventilator
   b. Traumatic brain injury
      i. Residual motor deficit
      ii. Residual cognitive deficit, moderate to severe (minor deficits can be managed in concussion clinic)
      iii. Combination of deficits
   c. Orthopedic injuries
      i. Multiple extremity injuries with recoverable ambulation deficits
      ii. Severe single or multiple extremity injuries with other concurrent conditions which limit mobility
   d. Injuries resulting in de-conditioning
      i. Secondary to prolonged ICU and hospital stay
      ii. Secondary to serious injury in an elderly patient with little reserve
   e. Combinations of any of the above injuries which would benefit from intensive multidisciplinary rehabilitation programs

2. Timing of consult – not to early (when evaluation will be difficult) and not too late (when logistical planning may increase length of stay)
   a. Traumatic brain injury – can be in ICU at a time when an assessment of rate of improvement can be made
      i. After removal of intracranial pressure monitoring
      ii. After substantial weaning from the ventilator when reasonable liberation from the ventilator will occur in 24 to 48 hours
      iii. After there has been some recovery of cognitive function so that a trajectory of improvement can be plotted for planning purposes
   b. Orthopedic injuries
      i. After all fixation and operative wound management has been completed
      ii. After all infection has been controlled
      iii. At a time when an assessment of mobility can be initiated
   c. De-conditioned patients
      i. Can be done in ICU
         1. After all injuries have been treated or a treatment plan has been instituted
         2. After substantial weaning form the ventilator when reasonable liberation from the ventilator will occur in 24 to 48 hours
         3. After full nutritional goals have been achieved
ii. If not in the ICU, should already have an active PT/OT consult and plan of therapy

3. To be transferred to inpatient rehabilitation, the following conditions must apply
   a. The patient should be medically stable (see protocol for “Transfer to inpatient rehabilitation – minimal medical requirements and patient stability”)
   b. The patient should be able to tolerate at least three hours of multidisciplinary rehabilitation a day
   c. An appropriate discharge plan and destination after the rehabilitation program must be established
   d. The patient and the patient’s family must agree to the rehabilitation program and location
   e. Payment issues must be resolved

4. If patient does not qualify for rehabilitation in current condition, the PM&R team will keep the patient on the consult list and intermittently follow progress to help define appropriateness of transfer.
   a. Issues of medical condition will be communicated frequently by the trauma team to the rehabilitation team
   b. Recommendations made by the rehabilitation team will be implemented (unless contraindicated) by the trauma team
PROCEDURE GUIDELINES: EMERGENT AIRWAY MANAGEMENT AND ENDOTRACHEAL INTUBATION
PROCEDURE GUIDELINES: FOCUSED ABDOMINAL ULTRASOUND FOR TRAUMA (ULTRASOUND FAST EXAM)

OBJECTIVES:

1. Provide guidelines for the FAST exam for abdominal trauma.

DEFINITION:

FAST Exam: An ultrasound examination of the abdomen that utilizes the four-view approach for the diagnosis of blood or fluid in the abdominal cavity plus additional views of each hemithorax. E-FAST adds a fifth view in the transthoracic area to identify pneumothorax.

GUIDELINES:

1. Indications for abdominal ultrasound: (Should be used liberally)
   a. Obvious abdominal pain with or without peritoneal findings on physical examination.
   b. Significant external findings on the abdominal wall such as contusion, bleeding, laceration.
   c. Unexplained shock or blood loss.
   d. Any multiple trauma patient
   e. A patient with altered sensorium.
      i. Drugs and alcohol impairment.
      ii. Tetraplegia, paraplegia.
      iii. Traumatic brain injury with coma.
      iv. Prolonged non-abdominal surgery requiring anesthesia.

2. All ultrasound examinations are performed with the patient in the supine position.

3. The following examinations will be performed (refer to following Figure):
   a. Pericardial area:
      i. The transducer position is subxiphoid (Figure, position 1).
      ii. Identify the heart and, using blood as the standard, adjust the acoustic power, depth and gain.
      iii. The longitudinal axis (sagittal section) is used to identify the heart and examine for blood in the pericardial region.
      iv. The normal examination of the heart shows a single echogenic (white) line, representing the pericardium, which separates the cardiac chambers and the liver.
      v. The abnormal exam shows a separation of visceral and parietal pericardium by a fluid stripe.
   b. Right upper quadrant:
      i. The transducer position is in the right mid-axillary line between the 11th and 12th rib (Figure, position 2).
      ii. The transducer is oriented longitudinally to obtain a sagittal section of the liver, kidney and diaphragm.
      iii. Evaluate for fluid in Morrison’s pouch.
   c. Right thoracic cavity: (optional additional views).
i. The right hemidiaphragm and right pleural space are evaluated from the right mid-axillary line by angling the probe superiorly (Figure, position 3).

ii. The diaphragm appears as a curved white stripe that will move with respiration.

iii. Normal lung parenchyma appears as an indistinct gray area.

iv. Fluid in the pleural cavity appears as a wedge shaped anechoic area just above the diaphragm.

d. Left upper quadrant:

i. The transducer position is in the left posterior axillary line between the 10th and 11th ribs (Figure, position 4).

ii. The transducer is oriented longitudinally for a sagittal section of the left kidney and spleen.

iii. Evaluate for fluid in the splenorenal recess.

iv. Evaluate for fluid in the space between the spleen and the diaphragm.

e. Left thoracic cavity: (optional additional views).

i. The transducer position is in the left posterior axillary line with the probe angled superiorly (Figure, position 5).

ii. The diaphragm appears as a curved white stripe that will move with respiration.

iii. Normal lung parenchyma appears as indistinct gray area.

iv. Fluid in the pleural cavity appears as a wedge shaped anechoic area just above the diaphragm.

f. Pelvis:

i. The transducer is oriented for coronal sections and placed in the midline approximately 4 cm superior to the symphysis pubic (Figure, position 6).

ii. The normal examination demonstrates the full bladder as an anechoic structure.

iii. The abnormal examination will show a hematoma on the right or left side of the bladder, or posterior to the bladder. A hematoma, or free fluid, will appear as an anechoic area outside the bladder.

g. The Diagram below demonstrates the location for the FAST exam probes. Postion 3 and 5 are optional views of the chest.
PROCEDURE GUIDELINES: DIAGNOSTIC PERITONEAL LAVAGE (TAP)

OBJECTIVES:

1. Provide the indications for a diagnostic peritoneal lavage (TAP).

GUIDELINES:

1. Indications:
   a) When a FAST exam can not be performed for technical reasons and the following conditions exist:
      i. A hemodynamically unstable patient with an altered level of consciousness or para/tetraplegia with the possibility of abdominal trauma.
      ii. Suspected abdominal trauma, associated with hemodynamic instability, especially if abdominal tenderness is present.
      iii. Unexplained fall in the hematocrit or unstable patient.
   b) Rapid triage in a mass casualty situation with limited resources.

2. Contraindications:
   a) Previous midline abdominal incision.
   b) Obvious need for laparotomy.

3. Procedure Percutaneous Peritoneal tap
   a) NG and Foley catheter unless absolutely contraindicated in unstable patient.
   b) The area below the umbilicus is prepped and draped appropriately.
   c) The midline area below the umbilicus is infiltrated with 1% xylocaine with epinephrine.
   d) Use the triple lumen CVL kit
   e) Make a small nick in the skin below the umbilicus with the provided scalpel.
   f) Place the angiocath catheter from the kit on the aspirating syringe.
   g) Advance the catheter into thru the midline fascia at a 90° angle to the abdomen.
   h) Once you feel the pressure release aspirate. If you can aspirate gross blood it is POSITIVE. Remove the angiocath and proceed to the Operating room for laparotomy.
   i) If the aspiration is negative, remove the syringe and needle leaving the angiocath in place.
   j) Using the guidewire and seldinger technique gently advance the CVLcatheter into the abdominal cavity.
   k) Repeat aspiration: If still NEGATIVE: major intra-abdominal bleeding is unlikely.
   l) CAVEAT: NEGATIVE aspiration can be a false positive. If in doubt OPERATE.
PROCEDURE GUIDELINES: PERICARDIOCENTESIS

OBJECTIVES:

1. Provide indications for the performance of a pericardiocentesis and suxiphoid pericardial window.

DEFINITIONS:

Needle pericardiocentesis: A procedure in which a needle is placed into the pericardial sac to remove blood that has resulted in a pericardial tamponade.

Subxiphoid pericardial window: An emergency surgical procedure to diagnose pericardial tamponade and decompress blood from within the pericardium.

GUIDELINES:

1. Needle pericardiocentesis:
   a. Indications:
      i. Evidence of cardiac tamponade in the face of deteriorating vital signs:
         a) FAST pericardial view positive with hypotension
         b) Distended neck veins with blue facies.
         c) CVP (if measurable) >20 mmHg.
         d) Narrowed pulse pressure with other source of bleeding.
         e) No other explanation of hypotension
      ii. Consider when there is a penetrating injury to the chest between nipples.
      iii. This is not a primary diagnostic procedure (i.e., don’t do it when the vital signs are normal).
      iv. Consider ultrasound as primary diagnostic modality for pericardial tamponade.
   b. Procedure:
      i. If positive: Notify the OR immediately and begin making preparations to transfer to the OR for median sternotomy.
   c. Complications:
      i. Aspiration of ventricular blood rather than pericardial blood.
      ii. Laceration of coronary artery or vein.
      iii. Laceration of myocardium.
      iv. Hematoma.
      v. Pneumothorax.
      vi. Infection.
PROCEDURE GUIDELINES: CRICOTHYROTOMY

OBJECTIVES:

1. To provide a guideline for the indications for the need for a surgical airway.
2. To provide guidelines for the performance of a cricothyrotomy.

DEFINITION:

Cricothyrotomy: A surgical procedure to gain an airway in which a tube is placed through the cricothyrotomy membrane.

GUIDELINES:

1. Indications:
   a. An inability to get an emergent airway after an adequate attempt at endotracheal intubation.
   b. An initial approach to the airway in patients with:
      i. Severe facial trauma with distortion of the face and nose.
      ii. Upper airway obstruction.
      iii. Fracture of the larynx.

2. Equipment:
   a. 6-0 tracheostomy tube (or smaller for younger patients)
   b. Betadine,
   c. Cricothyrotomy tray.
   d. Alternative to cricothyrotomy tray:
      i. #15 scalpel.
      ii. Hemostat.
      iii. Sponges.

3. Procedure:
   a. Prep neck with betadine or Duraprep.
   b. Surgeon and assistant should stand on opposite sides of the patient’s head.
   c. Continued attempts at endotracheal intubation should continue until the surgical team is ready to make an incision.
   d. Surgeon should stabilize the thyroid cartilage with his non-dominant hand.
   e. Make a transverse or longitudinal incision over the cricothyroid membrane.
   f. Incise through membrane, being careful not to disrupt the thyroid cartilage or cricoid cartilage.
   g. Insert hemostat with the curve of the tines up into the trachea. Or your index finger through cricothyroid opening to dilate the opening to an appropriate size.
   h. If you are in the trachea now release your tracheal stabilization and grasp the hemostat with your non-dominant hand. (This assures control of the trachea at all times.)
   i. Insert an endotracheal tube (size 6 or less) or into the cricothyroid opening.(NOTE: Although a tracheostomy tube could be used it is NOT advised since it is harder to place accurately and may make a false passage)Make sure that the tube is not advanced past the carina.
   j. Inflate cuff and ventilate patient with bag-valve-mask.
   k. Confirm intratracheal position with a carbon dioxide detector and CO2 manometry.
   l. Observe chest movement and auscultate chest to determine adequate air insufflation.
m. Secure the endotracheal tube or tracheostomy tube with sutures.

4. Potential complications:
   a. Creation of false passage.
   b. Subglottic stenosis, laryngeal stenosis.
   c. Hemorrhage.
   d. Laceration of the esophagus.
   e. Laceration of the trachea.
   f. Mediastinal emphysema.
   g. Aspiration.
   h. Infection.
PROCEDURE GUIDELINES: EMERGENCY RESUSCITATIVE THORACOTOMY

OBJECTIVE:

Emergency resuscitative thoracotomy may be necessary to salvage patients who present with penetrating trauma in extremis and will otherwise die without aggressive therapy. Emergency thoracotomy is not indicated in the resuscitation of all trauma patients who present in extremis. The following protocol is intended to be a guide and is not intended to be all-inclusive or exclusive. Additional patients not covered by this protocol who might benefit from emergency 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 resuscitative thoracotomy should only be performed by PGY-3 or higher resident or attendings.

Survival for blunt trauma patients who never exhibited any signs of life is uniformly zero. Survival for penetrating trauma patients without signs of life is between 0 and 5%.

The primary causes of traumatic arrest are hypoxia, hypovolemia due to hemorrhage, tension pneumothorax, and cardiac tamponade. Hypoxic arrests respond rapidly to intubation and ventilation. Hypovolemia, tension pneumothorax and cardiac tamponade are all characterized by loss of venous return to the heart. Remember to place a needle decompress and place a right sided chest tube if there is any remote chance of a right sided PTX/HTX. If you are at the point of opening the ED thoracotomy tray, now is not the time for an x-ray.

DEFINITIONS:

Signs of life: Presence of blood pressure, neurologic activity, and/or respiratory effort. Cardiac electrical activity in the absence of any other “signs of life” (PEA) will not be an indication to proceed with resuscitative thoracotomy

Aggressive fluid resuscitation: Packed RBCs via Level one to SBP 80-90 if possible, if successful the massive transfusion protocol will likely be needed. Access ABOVE AND BELOW the diaphragm.

GUIDELINES:

1. Indications:
   a. Penetrating thoracic trauma with systolic BP <40 mmHg or pre-hospital signs of life.
   b. Penetrating non-thoracic, non-cranial trauma with systolic BP <40 mmHg unresponsive to aggressive fluid resuscitation and pre-hospital signs of life <10-15 minutes ago. PEA is not a sign of life.
   c. Cardiac arrest in blunt chest or abdominal trauma after arrival in the Emergency Department with an obtainable and documented blood pressure.

2. Procedure:
   a. Rapid bilateral antero-lateral betadine prep while thoracotomy tray opened.
   b. Left antero-lateral thoracotomy incision located beneath nipple in males and inferior breast fold in females. Incision extends from left sternal border to anterior border of latissimus dorsi. Chest entered along the superior aspect of 4th or 5th 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.
c. Additional exposure may be accomplished by extending thoracotomy incision across sternum into contralateral chest cavity.

d. Insert rib spreader with **handle located toward table laterally**.

e. Examine pericardium. If tense hemopericardium present (pericardium distended with maroon discoloration) then proceed to step “h” below.

f. If systemic air embolism is suspected or massive hemorrhage from lung parenchyma or hilum is present, then place Satinsky clamp across hilum medially or simply twist lung hilum.

g. 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.

h. 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.

i. Manually lift heart from pericardial sac. If hemopericardium is present, then examine for cardiac perforation. Tamponade perforation with finger or Foley balloon. Teflon pledgetted 3-0 prolene sutures on a taper needle are present in thoracotomy suture pack for repair of cardiovascular wounds. Consider use of skin stapler. 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.
PROCEDURE GUIDELINES: EMPIRIC ANTIBIOTICS FOR TRAUMA AND CRITICAL CARE PATIENTS

OBJECTIVE:

Define the use of “empiric antibiotics” in multiply injured and critically ill patients.

GUIDELINES:

1. The following chart shows suggested “presumptive treatment” for potential infections encountered on the trauma and critical care service.

2. Presumptive therapy should be administered for a maximum of three days.

3. Antibiotics should then, if not sooner, be reassessed according to possible source of infection, any culture results or antibiotic sensitivities.

4. Choice of antibiotic should be based on efficacy, toxicity (including resistance concerns) and cost.

5. Consult the hospital’s “Antibiogram” for current susceptibilities.