The contents of this book are intended to serve as guidelines for the care of trauma patients. They are not intended to replace clinical judgement and any questions should be referred to the trauma attending on call.

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Guidelines for the Evaluation of Thoracic and Lumbar Spine Injuries

Patients with appropriate mechanism should be placed or remain on a backboard unless GCS=15 and patient has no neurological deficit or complaints of back pain.

- Complains of back pain/Neurological deficit
  - No
  - Log roll patient examine for tenderness/deformity
    - Yes
    - Obtain appropriate CT scans for level of symptoms
      - CT scan Positive
        - Consult Spine Service or Neurosurgery
      - CT scan Negative
        - Remove Backboard
  - Yes
    - Appropriate CT scans with entire spine reconstructions

- Altered Mental Status TBI, suspected drug/alcohol intoxication
  - Yes
  - Neurological Deficit
    - Yes
      - Consult Neurosurgery
      - Remove from Backboard
    - No
      - Re exam when normal mental status and re initiate guideline

- CT scan Negative
  - Remove from backboard maintaining spinal precautions (Keep flat in bed)

Any spinal fracture requires work up of entire spine

Rev. 03/16/2010
Guidelines for Evaluation of Blunt Myocardial Injury

Significant Blunt Chest Trauma

Cardiogenic Shock Suspected

- Normal
- Abnormal

FAST
12 lead EKG
Cardiac Auscultation for rub/new murmurs

Cardiogenic Shock Suspected

Admit to ICU
Swan Ganz Catheter to confirm cardiac origin of shock
Echocardiogram
Cardiac Consult

New murmur or rub?

- Yes
- No

Echocardiogram within 24 hours

Admit for 24 hours of cardiac monitoring

Significant Arrhythmias present

- Normal
- Abnormal

Discontinue monitoring unless otherwise indicated

Cardiology Consult

1. Cardiac Enzyme testing is of no clinical value
2. Patients with Blunt myocardial injury can be safely operated upon with appropriate monitoring

Rev. 03/16/10
Pelvic Fracture Treatment Guideline

Pelvic Fracture Identified

- Patient Hemodynamically Stable
  - Yes: Evaluate for and treat other life threatening injuries and consult orthopedic surgery
  - No

- Apply external fixator or pelvic binder

- Perform DPL or FAST
  - Yes: Consult Orthopedics
  - No

- FAST / Lavage Positive
  - Patient Hemodynamically Stable
    - Yes
    - No: Exploratory Celiotomy control bleeding source in abdomen
      - Patient Hemodynamically Stable
        - Yes
        - No

- FAST / Lavage Negative
  - Patient Hemodynamically Stable
    - Yes
    - No: Abdominal CT scan/treat other injuries
      - Consider Angiogram for possible angioembolization

- Contact Attending

* RBC>100,000
  WBC>500,
  presence of bacteria,bile or amylase

Rev. 05/18/10
EVALUATION FOR BLUNT ABDOMINAL TRAUMA

Evaluation For Blunt Abdominal Trauma

- Hemodynamically stable with normal abdominal exam, normal sensorium / not intoxicated, no plans for the OR
  - Serial Physical Exams
    - Normal
      - Observe
    - Abnormal
      - Hemodynamically Unstable
        - Blunt Abdominal Trauma
          - Hemodynamically Unstable
            - Ultrasound Pelvis X-ray
              - Positive
                - Positive consider DPL Chest/Pelvis X-ray
                  - Consider for Intraperitoneal fluid
                    - Positive for Intraperitoneal fluid
                      - Observe
                    - Negative for intraperitoneal fluid
                      - Observe
              - Negative
                - Exploratory Celiotomy
                  - Discuss with Trauma Attending
                    - Positive for Intraperitoneal fluid
                      - Observe
                    - Negative for intraperitoneal fluid
                      - Observe
          - Hemodynamically Stable
            - Abdominal/Pelvic CT Scan
              - Visceral Injury
                - Observe
              - No Visceral Injury
                - Observe

Rev. 03/16/10
MANAGEMENT OF SPLEEN INJURY

Management for Spleen Injury

Blunt Splenic Injury

Hemodynamically Stable

Operating Room

CT Scan

Pseudoaneurysm or Blush

Stable Laceration

Associated Injuries
Aorta
TBI
need for anticoagulation
Need for Laparotomy

Patient has:
Spleen Laceration grade ≥ 3
TBI / SCI
Major co morbidities

Discuss with Attending
need for angioembolization

Serial Hcts
Serial Exams

Repeat CT 48/72 Hours

Psuedoaneurysm or Blush

Discharge home with
instructions to return for S/S
Bleeding

No need to repeat CT scan in 6 weeks in asymptomatic patients. Patients may resume full activity without restriction 10 weeks after injury.

Rev 05/18/10
CERVICAL SPINE EVALUATION

1. These guidelines apply to all patients presenting to the trauma center with cervical collars in place. Any patients meeting the guidelines for suspicion of cervical spine injury, should be placed in a semi-rigid collar immediately upon recognition that the patient falls into those guidelines.

2. For purpose of this guideline a radiologic study is considered normal when interpreted as such by an attending radiologist. If the attending radiologist is not available and immediate interpretation is necessary for ongoing patient care or patient discharge, the senior radiology resident will read the films.

3. Responsibility for removal of the cervical collar rests with the trauma service. The advice of radiologists and the various consultants involved in any single patient’s care will be taken into consideration. But, for patients remaining on the trauma service, the order to remove the cervical collar will be the responsibility of the trauma service.
Cervical Spine Evaluation

**Cervical Clearance Screen**
- Posterior midline cervical tenderness?
- Focal neurological deficit?
- Acute mental status change?
- Suspected intoxication/drug use?
- Pain that may distract from cervical pain?

**Cervical CT scan with reconstructions**

If no neurological deficit consult Spine Service (with deficit consult Neurosurgery)

Intubated or distracted patients (mental status change/intoxication/pain)

- Place in long term collar

**Patient Symptomatic? (tenderness without deficit)**

If patient has any neurological deficit consult Neurosurgery

- Mental Status improves
- MRI within 72 hours if patient's condition allows. If patient is unstable for MRI leave in collar

Consult Spine Service

Consult Trauma Attending

D/C collar

Cervical Spine Flexion & Extension X-rays or MRI (per trauma attending choice)

Study positive
Study negative

**An order must be written to remove c collar**
Removal of c collar must be discussed and approved by attending
Use caution, no method of c spine clearance is 100% reliable
Some risk factors for DVT include:
- Major trauma
- CHI/SCI
- Fractures of the hip/pelvis/leg
- Major surgery especially abdomen / pelvis / lower ext
- Age >40
- Prolonged Immobilization / paralysis >3 days
- Multiple Blunt Trauma
- Venous Groin Lines / major venous repair
- Prior VTE
- Obesity / CHF / Stroke /Smoking
- Hyper coagulable states
- Pregnancy

Foot pumps / SCD’s Contraindications may include established DVT, severe peripheral arterial disease, compartment syndrome, or LE cast/fixator.

Lovenox unless contraindicated. Contraindications may include hemothorax, hemorrhagic pericardial effusion, uncontrolled bleeding (stable liver and/or spleen injuries without active bleeding are not a contraindication to LMWH), major eye injury, uncorrected coagulopathy (platelet ct<50,000,INR.1.5,PTT>2Xcontrol), spinal anesthesia, history of HIT (heparin induced thrombocytopenia), or epidural catheter in place.

Renal concerns and Lovenox use
If patient has Estimated Creatinine Clearance < 30 or hourly urine output of < .5 cc /kg/hr send a Anti Factor 10A level and if >0.3 adjust Lovenox dose

Trauma Patients without Traumatic Brain or Spinal Cord Injury
Lovenox 30 mg SQ BID
Prophylaxis is continued until patient is fully ambulatory or discharged (if patient not ambulatory at discharge, has a fracture above the knee, or bilateral lower extremity fractures consult attending for consideration of possible home chemical prophylaxis for 10-14 days)

Patients with Spinal Cord Injury
Lovenox 30 mg SQ BID started 48-72 hours of injury. Consider chemical prophylaxis after discharge consult neurosurgery

EXCLUSION
1. Spinal hemorrhage (for example intramedullary or epidural hematoma
2. Unusual spinal column instability
Contact neurosurgery prior to any chemical prophylaxis

Patients with Traumatic Brain Injury
Contact neurosurgery/neurointensivist and trauma attending within 48 hours of admission to begin chemical prophylaxis
Clearly document plan in the medical record

DVT / PE Prophylaxis

All trauma patients should receive chemical and mechanical anticoagulant prophylaxis. If not possible consider IVC filter or weekly duplex screening
Urological Evaluation of Patient with Suspicion of Abdominal Trauma

Will patient need foley catheter

- Yes
  - High Riding Prostate
  - Blood at Urethral Meatus
  - Scrotal Hematoma

- No
  - Obtain Clean Catch specimen at first opportunity

Retrograde Urethrogram

- Normal
  - Place Foley / Obtain Urine Specimen

- Abnormal
  - Consult Urology for Suprapubic Catheter

Patient Hemodynamically / Neurological Stable

- Yes
  - Perform Abdominal CT with cystogram and IV contrast

- No
  - Does patient need Abdominal / Pelvic CT

Obtain 2 shot Cystogram and IVP in ED or as appropriate

Perform Abdominal CT with cystogram and IV contrast

Send Specimen to Lab

- > 50 RBC's per HPF
  - Injury Detected
    - Discuss with trauma attending
    - No further Evaluation

- No further Evaluation

Rev. 03/16/10
Did patient have signs of life at the scene?
Signs of Life:
1. Detectable BP
2. Palpable Pulse
3. Pupillary Response
4. Respiratory Effort
5. Neurological Response

Vital Signs on Arrival?

Total Time in arrest >10 minutes

Declare patient dead

Continue Resuscitation and Diagnostic Evaluation

Establish Airway
Assure Air Exchange
Initiate Volume Resuscitation
Did signs of life return?

Consider Emergent Thoracotomy: Note that survivors of this procedure in this situation are extremely rare and costs extremely high. Perform this only if it is believed that there is a reasonable possibility of successful resuscitation.
EMERGENT INTUBATION FOR TRAUMA PATIENTS

Indications for Intubation
- GCS<=8
- Expanding Neck Hematoma
- Grade III/IV Hypovolemic Shock
- Respiratory Distress not Correctable with Tube Thoracostomy
- Apnea
- Traumatic Arrest per Guideline
- Hypoxia on FIO2>50% (SaO2<90)
- Patient requiring restraint (threat to himself/others)
- Airway obst. not relieved by suction or oral/nasal airway

Airway Evaluation

Easy
- Trauma Airway/Highly Suspected C-spine Injury
  - Yes: Rapid Sequence intubation with in-line cervical stabilization and cricoid pressure
  - No: Intubate orally with cricoid pressure

Difficult
- Consult anesthesia
Penetrating Neck Injuries

Wound penetrates platysma

Yes

To OR STAT

No

Close Wound as Appropriate

Exsanguinating Hemorrhage/ Hemodynamic Instability

Yes

No

Determine Zone of Injury

Multiple Zones

Follow algorithm for Zone 1 and/or 2 Consult with Attending Surgeon

Zone I Below Cricoid Cartilage/Above Clavicle

CT Angio/Angio Bronchoscopy Esophagoscopy Contrast Swallow

Injury Detected

Yes

Treat as Appropriate

No

Admit for observation / CXR in 3 hours from injury

Zone II Above Cricoid Cartilage/Below Angle of Mandible

S/S of Major Injury (hematoma, SQ emphysema, hemoptysis, hoarseness, hematemesis)

Yes

OR

Angio Fibroptic evaluation of aerodigestive tract and Contrast Swallow vs Possible OR (Discuss with attending)

No

Zone III Above Angle of Mandible

CT Angio/Angio Laryngoscopy Pharyngoscopy Contract Swallow

Injury Detected

Discuss with Attending

Yes

Treat as Appropriate

No

Patients with evidence of SCI Radiological evaluation of the Spine should be performed as soon as patients condition allows

Injury Detected on testing or in OR

Yes

Treat as Appropriate

No

Discharge Home

Rev. 05/18/10
Penetrating Extremity Injury

OR STAT ❯ Yes ❯ Exsanguination
        ❯ No

Obtain AP/Lat X-rays

Hard Signs of Vascular Injury?
        ❯ Yes ❯ Shotgun Wound
        ❯ No ❯ ABI < 0.90

Shotgun Wound
        ❯ Yes ❯ Active Bleeding
        ❯ No ❯ Angio

Active Bleeding ❯ Yes ❯ OR
        ❯ No

Angio
Discuss results with Trauma Attending

OR

ABI < 0.90
        ❯ Yes ❯ CT Angio
        ❯ No

CT Angio
Discuss finding with trauma attending

Contact attending trauma for possible admission

Hard Signs of Vascular Injury
1. Distal Ischemia (pain / pallor / pulselessness / paralysis / parathesia)
2. Audible Bruit and/or palpable Thrill
3. Large Expanding or Pulsatile Hematoma
4. Active bleeding

Rev. 03/16/10
During initial evaluation if patient \( \geq 24 \) weeks gestation and requires procedures or X-rays FHR will be continuously monitored by the OB nurse or physician. If continuous FHR monitoring is discontinued for any reason the OB attending must be notified immediately.

Rev. 08/01/2011
**Guideline for Neonatal Resuscitation of a Delivery as a Result of Trauma**

- **Decision made to deliver fetus?**
  - No: Chief OB resident will notify Neonatal Stabilization Nurse and L&D nurse regarding decision to admit for observation.
  - Yes: Neonatal Stabilization Nurse will page Neonatal Stabilization Team and confirm O-negative PRBC availability from blood bank or ED supply.

- **NRP Resuscitation**
  - Is patient responding to resuscitation?
    - No: Obtain Hct on admission, repeat in 2 hours. Repeat transfusions / NS bolus. Obtain Hct, coagulation studies including platelets. STAT surgical evaluation. Transfuse platelets and FFP for evidence of continued bleeding or in response to abnormalities in lab profiles.
    - Yes: Continue resuscitation per NRP guidelines.

**Notes:**
1. Volume depletion secondary to blood loss might present with signs of shock but a relatively normal hematocrit. Transfusion should be considered regardless of hematocrit in any infant with suspected blood loss who does not respond to interventions.
2. In atraumatic abruptio placentae, fetal blood loss is not a common problem and it is not necessary to have O negative blood available in these circumstances.
3. In all forms of trauma, with or without direct injury to the utero-placental-fetal unit, there is a significant risk of hypoxic-ischemic injury to the fetus.
DECISION TREE FOR PREGNANT TRAUMA PATIENTS

If a pregnant trauma patient ≥ 24 weeks

meets level A criteria page OB trauma alert level A
meets level B criteria page OB trauma alert level B
meets neither level A or B trauma alert criteria page OB Injury Alert

Revised 8/1/2011
CAVEATS IN THE MANAGEMENT OF THE TRAUMATIZED PREGNANT WOMAN

1. Generally, maternal condition takes precedence over that of the fetus. There are obstetrical complications in pregnancy that jeopardize maternal health and warrant immediate treatment.

2. Maternal blood loss is often underestimated. Blood pressure typically will not decrease until at least 1500 mls of blood loss has occurred.

3. Retroperitoneal hemorrhage occurs more frequently with gestational trauma than in the presence of a nongravid uterus.

4. Bowel injuries are less frequent in gestational trauma because of the protective effect of the gravid uterus.

5. Splenic rupture is the most common cause of intraperitoneal hemorrhage found in gestational trauma. Liver and spleen trauma occur in up to 25% of severe MVA’s. Rib fractures are associated with splenic and hepatic injuries.

6. Minor injuries including minor MVC can lead to placental abruption, fetal maternal hemorrhage, and premature birth. Uterine irritability, tenderness, uterine tetany, maternal bleeding, and fetal tachycardia may be signs of those complications.

7. Vaginal bleeding, abdominal pain and uterine contractions are the cardinal warning signs of a placental abruption. However, 20% of placental abruptions may occur without external bleeding.

8. Pelvic fractures correlate with an increase frequency of placental abruption, retroperitoneal hemorrhage, urinary tract injuries, uterine rupture, and fetal head position.

9. Abdominal complaints and abnormal findings may not be present initially and diagnostic tests are not as definitive as in the non pregnant patient.

10. Tocolytic therapy must be used with discretion and sensitivity for side effects as well as potential hazards.

11. Pregnancy should not be the rationale for compromise or modification of the evaluation and treatment plan for the gravid trauma patient.

12. Diagnostic tests (radiography) and therapy should be directed primarily at the care of the mother and should not be delayed or compromised because of the pregnancy.

13. Tetanus toxoid can and should be given if otherwise indicated.

14. Magnetic resonance imaging is not recommended in the first trimester secondary to a lack of safety information.

15. When multiple diagnostic X-rays are performed consider consultation with Radiation Safety to determine fetal dose.

16. Consider keeping the pregnant patient, 20 weeks gestation, tilted left side down 15 degrees to keep the pregnant uterus off the vena cava and prevent supine hypotension syndrome.

17. The mother is the initial priority and fetal/placental disorders can cause significant maternal morbidity and mortality. It is for this reason, even more then fetal salvage, that continuous fetal heart rate monitoring and tocometry is essential during the trauma work up.

18. The greater the severity of the maternal trauma, the more likely a significant fetal insult will occur.
**HEAD CT/HEAD INJURY TRIAGE**

**Head CT / Head Injury Triage Guideline**

**Loss of Consciousness or Altered Level of Consciousness**

- **Notify Neurosurgery**
  - **Positive**
    - **CT head**
        - **Negative**
          - **Abnormal neurological symptoms i.e. headache, nausea, vomiting, diplopia and/or altered consciousness from suspected alcohol or drug use.**
          - **Admit for observation**
        - **YES**
          - **Normal Neuro Exam, GCS=15, no alcohol or drug use suspected**
            - **NO**
              - **Reliable person available to continue neuro checks at home**
                - **YES**
                  - **Home with head injury instructions given to individual responsible for observation**
                - **No**
                  - **Admit for observation**

**Rev. 05/18/10**
COMBINED ORTHOPEDIC AND CHI MANAGEMENT

CT scan shows intracranial bleed, contusion, or infarction
OR
Patient's GCS < 13

Yes
No

Open fracture?

Yes
No

Wash out at bedside and place in splint / traction and repeat CT scan in 24 hours.

Yes
No

Splint or place in traction and repeat CT scan in 24 hours.

Neurological status stable and CT better or unchanged

Yes
No

Daily bedside washout until neurologically stable

Patient may require invasive intracranial monitoring for orthopedic procedure. Discuss with neurosurgeons before proceeding to OR

Maintain in traction / splint

Neurological status stable and CT better or unchanged
OPERATIVE MANAGEMENT – AORTIC STENT GRAFTING

Policy for Operative Management of Patients Undergoing Aortic Stent Grafting for Traumatic Aortic Rupture

Background: Aortic transection due to trauma is an uncommon, but potentially rapidly lethal injury. As such, timely surgical treatment should be performed as soon as a patient is stable and other immediately life threatening problems have been stabilized.

Currently, aortic stent grafting has become the procedure of choice in many, if not most, patients with this injury. However, in the event that this procedure fails or if there is a technical complication with deployment of the graft, immediate thoracotomy is generally required. Also, in many patients, other operative procedures may be required immediately before or immediately after aortic stent graft placement.

Purpose: To develop procedures to allow application of aortic stent grafting in appropriate patients while having immediately available the resources necessary to convert to an open thoracotomy procedure in the event that this becomes necessary and to provide the resources required to perform other related and unrelated operative procedures in conjunction with placement of an aortic stent graft.

Policy:
1. If an aortic stent graft is to be placed, the CT surgery attending or fellow will simultaneously notify both the interventional radiology suite and the operating room of the intent to perform this procedure. The normal procedure for posting cases will be followed. Level 1 cases will require direct contact between the CT surgery attending or fellow and the OR charge nurse or anesthesia attending physician on call.

2. Based on the needs of the patient, the trauma attending physician and physicians from other surgery teams involved in the case will determine whether the aortic stent graft will be performed alone or in conjunction with other necessary procedures.

3. Operating room nursing staff will provide a scrub nurse in the angiography suite to provide the nursing support for the procedure. The angiography staff will serve as circulating nurse. Should equipment from the main operating room be needed, operating room staff will assure delivery of that equipment to the angiography suite.

4. CT anesthesia will be notified by the anesthesia attending of the day or the on call anesthesiologist as appropriate that an aortic stent graft is being performed. CT anesthesia will provide anesthesia support for the procedure in the angiography suite as well as in the OR should a need arise to move the patient to the operating room.

5. A “back up room” in the main OR will be set up and staffed with CT service OR nursing personnel while the patient is in the angiography suite. The room must be ready for surgery immediately. Therefore, all instrument sets and other necessary equipment must be in the room and available for immediate use so that no delay occurs once the decision is made to transport the patient to the main OR as a result of a problem with deployment of the stent graft. Instrument sets will not be opened, however, until it is clear that the patient is to be moved to the main operating room.
6. A pump team will be available in the selected back up room. A bypass machine will be available and in the operating room but will not be set up until it is determined that operative intervention will be necessary. (Assuming the set up can be accomplished within a time frame that allows its use when needed.) The CT surgery team will be responsible for assuring that the pump team has been called in.

7. In the event that other procedures will be performed prior to aortic stent graft placement, upon completion of those procedures, the patient will be transported from the operating room to the angiography suite after first assuring that the angiography team is present and prepared to initiate the procedures as well as assuring that the OR nurses who will be performing the procedure are present and the instrumentation ready for use. The patient will be accompanied to the angiography suite by anesthesia personnel for ongoing monitoring and anesthesia care during the subsequent stent grafting procedure.

8. In the event that other procedures will be performed after the stent grafting procedure, an operating room will be prepared for that subsequent procedure so that the patient can be brought from the angiography suite back to the operating room immediately upon completion of the aortic stent graft placement procedure. During transportation of the patient back to the operating room, anesthesia personnel will accompany the patient for ongoing monitoring and anesthesia care during the subsequent procedures.

07/29/10
MANGLED EXTREMITY GUIDELINE

MESS scoring will be used to guide clinical decision.

**Skeletal / soft-tissue injury**
- Low energy (stab; simple fracture; pistol gunshot wound): 1
- Medium energy (open or multiple fractures, dislocation): 2
- High energy (high speed MVC or rifle GSW): 3
- Very high energy (high speed trauma + gross contamination): 4

**Limb ischemia**
- Pulse reduced or absent but perfusion normal: 1*
- Pulseless; paresthesias, diminished capillary refill: 2
- Cool, paralyzed, insensate, numb: 3*

**Shock**
- Systolic BP always > 90 mm Hg: 0
- Hypotensive transiently: 1
- Persistent hypotension: 2

**Age (years)**
- < 30: 0
- 30-50: 1
- > 50: 2

*Score doubled for ischemia > 6 hours*

Primary amputation will be performed if score 7 or greater and agreement of two attendings (from any of the following 4 specialties: Vascular, Trauma, Plastics, Ortho) caring for the patient. For scores greater than 7 the chance for salvage is low but may be attempted if all attendings are in agreement that it should be performed.

External fixation should be performed in all patients where amputation is considered initially or in wounds with heavy contamination.

Serial debridement of the leg should be performed by the Orthopedics service in most case

07/29/10
CLINICAL GUIDELINES FOR THE MANAGEMENT OF SEVERE TRAUMATIC BRAIN INJURY (TBI): ADULTS

Clinical condition: TBI and/or Intracranial hypertension/hemiation
Target Population: Adults (age ≥ 16) with GCS < 9 or intubated < 8T plus Abnormal CT Scan [Contusion/clot/DAI/SAH]
Objectives: 1. Establish and update monitoring parameters for Severe TBI.
2. Enhance oxygen delivery to the injured brain.
3. Optimize Cerebral Perfusion Pressure (CPP) and Maintain or normalize ICP.
4. Prevent early seizures.

Goals of Therapy
1. Maintain Euvolemia
2. Maintain ICP <20 & CPP 60-70 mm Hg if ICP>20mmHg
3. Maintain Hb > 7
4. Normalize electrolytes
5. Maintain temp <38, >35
6. Maintain SaO2 > 95%

Initial Evaluation and Monitoring of Patients with TBI

Inclusion Criteria:
GCS < 9 OR < 8T
And
CT SCAN ABNORMAL
[*Contusion/Clot/DAI/SAH]

1. Insert ICP MONITOR or Ventriculostomy (preferred)
2. Insert CVC or PA catheter (as indicated)
3. Insert A-line
4. IV’s - normal saline (Avoid dextrose)
5. Ventilator Set for Pco2 : 35-40 torr
6. Load and daily dilantin for seven days
7. Correct hypovolemia, hypoxemia and inadequate cardiac output.
8. Sedation first 48 hours: propofol/fentanyl
9. Sedation >48 hours: morphine/ativan
10. Monitor temp (centigrade)
11. Head of bed ^30° or reverse Trendelenberg at 30°
12. Normalize Coags INR <= 1.4, Plts >100,000 for monitor placement, or plts >50,000 and concurrent platelet transfusion. INR<=1.5, plts >50,000 for maintenance
13. [Consider_Licox Brain Monitor (PbtO2)]
14. Foley Catheter
15. Maintain quiet room and limit visitors
15. OG tube

Back to Index
Major TBI Treatment Algorithm

If ICP > 20 for ≥ 5 min THEN apply the following in a stepwise manner until resolved:

1. Drain CSF if feasible
2. Increase sedation and/or analgesia
3. Assess temp and treat to maintain temp < 38 degree C
4. Assess CPP. If CPP < 60:
   1. Initiate fluid resuscitation: CVP > 12 to 15 or PCWP 15 to 20 or SVV < 15 or EDVI > 100
   2. Initiate or increase neosynephrine to CPP > 60 or max dose 200 mcg/min
   3. Contact critical care physician.

\[\downarrow\text{Consider Repeat Head CT scan}\]

Critical Care Resident and/or Attending: Assess for other causes of hypotension or elevated ICP (abdominal compartment syndrome, tension pneumothorax, tamponade, etc)

Initiate hyperosmolar therapy and notify on-call Neurosurgery resident
1. Hypertonic Saline if serum NA < 160 and serum osmo < 320
2. Mannitol if serum NA serum NA > 160 and serum osmo < 320
3. Consider mild hyperventilation to PaCO2 32-35

\[\downarrow\text{Repeat Head CT scan if not done above}\]

If CPP < 60 for ≥ 30 minutes despite medical therapy, Notify neurosurgery
1. Consider pentobarb coma
2. Consider craniectomy

Criteria for Discontinuing Major TBI Protocol

1. Sedation is minimal (RASS -2 to -3), paralytics off, temp control no longer problem
2. Recent CT scan shows stability or improvement
3. ICP < 20 for ≥ 24 hours & NS discontinues monitor

Note: Orders will be written by primary service caring for pt unless unavailable to come to bedside. Primary service will be notified of all orders written by other services

Date of Original TBI Clinical Guideline: 3/13/11
Approved by All of Trauma Section: 3/13/11
Approved by Neurosurgery liaison: 3/16/11

posted 5/2/11
ADULT MAJOR BLEED PROTOCOL

Patient scores > 2 on ABC score after 2L fluid bolus
Penetrating Mechanism (0=no, 1=yes)
SBP of 90 mm Hg or less (0=no, 1=yes)
HR of 120 bpm or greater (0=no, 1=yes)
Positive Fast (0=no, 1=yes)
OR
Trauma Attending Discretion

Attending surgeon notifies the charge nurse/ or designee to activate major bleed protocol
Blood Bank 2-2671 notified as following:
This is ______ we are initiating the Adult Major Bleed Protocol for TV ______
MRN ______ age ______ sex ______, When the stat pack is ready call
If patient changes location the sending area charge nurse will notify the blood bank 2-2671
To patient goes to the OR: stat pack will be delivered to OR lab and Blood Bank will call OR
charge nurse (6-6930) to obtain OR room phone number
To patient goes to the STICU: Blood Bank will call STICU Charge Nurse phone number (6-6037)

If initiated in ED send Trauma A profile draw and send to lab with crossmatch
If initiated in OR/ICU send Blood gas long panel (PO2,PCO2,ph,HCO3,TCO2,O2)
Sat,BE,Na,K,Cl,IonCa,GLu,Hb,HCT) and PT, PTT and ensure cross match previously sent
Correct hypothermia (warm blankets, Bare huggers, warm fluids)
Consider O neg blood until stat pack arrives (Available in ED/OR)

First Stat Pack
PRBC 8
FFP 8
Draw lab after each stat pack
ABG long panel / PT/ PTT

HD Unstable

Second Stat Pack
PRBC 8
FFP 8
Platelets 1

HD Unstable

Third Stat Pack
PRBC 8
FFP 8
Platelets 1

HD Unstable

>3 Stat Packs
Attending physician to determine ratio of blood products for further stat packs guided by
TEG when available

Consider
Calcium Replacement
Factor VII (if ongoing coagulopathic hemorrhage )
Draw CBC/ Fibrinogen / D-dimer
If patient has ph>7.25 temperature>33 platelets>50,000
Call Pharmacy per MUSC Factor VII Guideline

TEG guided resuscitation
ACT >110 include FFP
Angle < 60 include CRYO
MA<50 include Platelets
EPL>15% include Aminocaproic acid
(Aminocaproic acid 5 grams in 250ml over one hour)

Discontinuing MBP
MBP will continue in ED, OR and ICU until bleeding is controlled, efforts deemed futile, or correction of lab
values in normothermic patient. Final decision made by trauma attending surgeon. Charge nurse should
notify blood bank immediately 2-2671. Attending physician must sign the Transfusion Service Test and
Blood Component Request Form to authorizing the use of uncrossmatched blood

6/30/11

SECTION ONE: CLINICAL GUIDELINES
PELVIC BINDER MANAGEMENT

1. Pelvic binders should only be used in the setting of hemodynamic instability. Pelvic binders should be removed as soon as possible from a stable patient.

2. Pelvic binders should not be managed on the floor. The need for a pelvic binder is an indication for ICU admission.

3. Pelvic binders are to be adjusted and removed by physicians only, with the exception of minor adjustment for patient comfort.

4. If a pelvic binder remains in place longer than 24 hours, skin integrity must be checked and evaluated every 12 hours. The trauma service is responsible for examining skin by loosening binder daily on rounds.

8/15/11
QUICK INITIAL NEUROLOGICAL EXAM IN THE TRAUMA BAY

This is an initial emergency assessment/screening to be used in the trauma bay during a level A patient assessment where time is of the essence. This should not be used in level B or elective settings because some things may still be missed.

Pupil response, position

Face symmetry

Upper extremities: can patient lift arms off bed (antigravity or not) squeeze hands (strong, weak, absent)

Lower extremities: can patient lift leg off bed (straight leg raise), if not can they bend knees up off bed. Also check ankle plantarflexion/dorsiflexion

Can patient feel pain in arms and legs (pinch them)

Should take 20 seconds to get this and covers a lot and you should catch 90+ % of things. If the patient cooperates and follow commands, higher functions are working, including language. It also covers Cranial nerves 3, 4, 6, 7 (midbrain, pons), upper and lower C-spine and lumbar spine. Also covers spinothalamic tracts and corticospinal tracts.

If a positive finding, do a more detailed focused exam quickly (should take another 30 seconds)

Once stabilized, patient still needs a detailed neurological exam, but this quick initial exam will cover the big things.

8/15/11
ANTIBIOTIC MANAGEMENT IN PATIENTS WITH CSF LEAK: CONSENSUS STATEMENT FOR ADULTS

PART I: General Information

Title of Guideline: Antibiotic Management of patients with Cerebral Spinal Fluid (CSF) Leak

Clinical condition: CSF Leak

Target Population: Adults (age ≥ 16) with CSF Leak

Primary Setting of Care: MUSC Trauma Service

Primary Clinicians: Trauma Surgeons, Neuro-Specialists, Critical Care Nurses, Pharmacists, Respiratory Care Practitioners, Surgical and Neurosurgical Residents

Objectives: 1. Establish the role of antibiotics in patients with CSF leak

Guideline: 1. Routine prophylactic antibiotics are not indicated for patients with CSF leaks.

Team Members: Ralph Barker, MD
              Evert Eriksson, MD
              Raymond Turner IV, MD

Date of Original SCI Clinical Guideline: 7/7/11
Approved by All of Trauma Section
Approved by Neurosurgery liaison 7/18/11

Date of revision:
PART II: SPINAL CORD INJURY MANAGEMENT:

Goals of Therapy

1. Maintain Euvolemia
2. Maintain MAP 60 – 70 mmHg
3. Maintain Hb > 7
4. Normalize electrolytes
5. Maintain SaO2 > 95%

Criteria for Discontinuing Spinal Cord Injury Protocol

1. Spinal Fractures stabilized by neurosurgery
2. Discharge from ICU

Initial Evaluation and Monitoring of Patients with SCI

Inclusion Criteria:
Spinal fractures with or without neurologic findings

1. Steroids should not be given for penetrating or blunt spinal cord injury
2. Insert CVC or PA catheter (as indicated)
3. Insert A-line if concern for spinal cord compromise or evidence of spinal cord injury
4. IV’s - Isotonic fluid administration
5. Correct hypovolemia, hypoxemia and inadequate cardiac output.
6. Maintain MAP 60 – 70 mmHg
7. Reverse Trendelenberg at 30°
8. Strict Log Roll
9. Normalize Coags INR<=1.5, plts >50,000 for maintenance
10. Foley Catheter

SCI Treatment Algorithm

If MAP <60 mmHg THEN apply the following in a stepwise manner until resolved:

1. Contact Critical Care Physician
2. Critical Care Resident and/or Attending: Assess for other causes of hypotension or elevated ICP (abdominal compartment syndrome, tension pneumothorax, tamponade, etc)
3. Evaluate Neurologic function – If change in physical exam notify neurosurgery service
4. Initiate fluid resuscitation: CVP > 12 to 15 or PCWP 15 to 20 or SVV < 15 or EDVI >100

Note: Orders will be written by primary service caring for pt unless unavailable to come to bedside. Primary service will be notified of all orders written by other services
PART I: General Information

Title of Guideline: Management of Penetrating and Blunt Spinal Cord Injury
Clinical condition: Spinal Cord Injury
Target Population: Adults (age ≥ 16) with Spinal Fractures with or without neurologic finding
Primary Setting of Care: Trauma ICU
Primary Clinicians: Trauma Surgeons, Neuro-Specialists, Critical Care Nurses, Pharmacists, Respiratory Care Practitioners, Surgical and Neurosurgical Residents
Objectives: 1. Establish the role of steroids in SCI 2. Establish hemodynamic treatment parameters 3. Optimize spinal perfusion and neurologic recovery
Team Members: Ralph Barker, MD  Evert Eriksson, MD  Raymond Turner IV, MD

Date of Original SCI Clinical Guideline: 7/7/11
Approved by All of Trauma Section
Approved by Neurosurgery liaison 7/18/11

Date of revision:
PART II: SPINAL CORD INJURY MANAGEMENT:

Goals of Therapy

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Criteria for Discontinuing Spinal Cord Injury Protocol

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Initial Evaluation and Monitoring of Patients with SCI

Inclusion Criteria:
Spinal fractures with or without neurologic findings

11. Steroids should not be given for penetrating or blunt spinal cord injury
12. Insert CVC or PA catheter (as indicated)
13. Insert A-line if concern for spinal cord compromise or evidence of spinal cord injury
14. IV’s - Isotonic fluid administration
15. Correct hypovolemia, hypoxemia and inadequate cardiac output.
16. Maintain MAP 60 – 70 mmHg
17. Reverse Trendelenberg at 30°
18. Strict Log Roll
19. Normalize Coags INR<=1.5, plts >50,000 for maintenance
20. Foley Catheter

SCI Treatment Algorithm

If MAP <60 mmHg THEN apply the following in a stepwise manner until resolved:

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Note: Orders will be written by primary service caring for pt unless unavailable to come to bedside. Primary service will be notified of all orders written by other services
7/18/11

SECTION ONE: CLINICAL GUIDELINES
SECTIONS TWO: GENERAL POLICIES

GENERAL POLICIES

Transfer from another facility: (When called with a request to accept an injured patient)
In most cases referring physicians will contact the admit transfer center. The admit transfer center will contact the attending trauma surgeons.
1. Obtain patient information including injuries, name, and DOB.
2. Request that all lab work, X-rays and documentation be sent with the patient.
3. Patients transferred from another emergency room will be seen in the Emergency Department
4. Inpatient transfers will be admitted to the appropriate bed assignment. The admit transfer center will assist with obtaining a bed.
5. All physicians calling into MUSC to transfer a trauma patient will speak to the trauma attending surgeon who will assist in arranging trauma patient transport to MUSC by:
   - Accepting patients to be admitted to the trauma service
   - Providing advice to assure safe patient transfer
   - For patients with single system injury the trauma surgeon will take the referring physician phone number and contact the on call physician on the required specialty to discuss the case prior to acceptance or to have the appropriate on call physician return the referring physicians call.
6. Notify OR if patient appears to require OR intervention and notify consulting services if they will be needed during the initial evaluation and stabilization.

Admission Paperwork:
There are standardized order sheets for trauma admissions to the floor and ICU, both available on all ClinLan computers throughout the hospital. Click on the icon Clinical Order Forms and then Site Map.

To arrange helicopter transport of injured patients from another facility to MUSC
Transfer arrangements are the responsibility of the referring physician. MUSC surgeons may advise the referring physician about transport decisions, but it will remain the referring physicians responsibility to contact and arrange the transport. The emergency number for Meducare is 843 792 3311.

Rev. 5/18/10
ACTIVATING THE TRAUMA TEAM

Adult Trauma Alert Level Criteria

Age > 16

**Level A (Scene Transport)**

Physiologic Criteria:
- GCS < 9 at time of EMS report
- SBP < 90 with suspicion of shock
- Respiratory Rate < 10 or > 29 with suspicion of respiratory compromise

Anatomic Criteria:
- Penetrating injury to head, neck, torso
- Penetrating injury to extremity proximal to elbow or thigh with ongoing bleeding, expanding hematoma, and/or loss of peripheral pulses
- Flail Chest
- 2 or more long bone fractures proximal to wrist or ankle
- Crushed, degloved, or mangled extremity
- Amputation proximal to wrist or ankle
- Paralysis
- Suspected Pelvic fracture with hemodynamic instability
- Open or depressed skull fracture
- 2nd or 3rd degree Burns > 40% or with suspicion of smoke inhalation or hemodynamic compromise

**Level A (Trauma transfer from OHF)**

- Hemodynamically unstable trauma transfers
- Patient who is intubated
- Transfers with probable need of urgent surgical intervention
- Received blood transfusion prior to transfer

**Level B (Scene Transport)**

Physiologic Criteria:
- GCS > 9 and < 14 (10 to 13) at time of EMS report

Anatomic Criteria:
- Penetrating injury to extremity proximal to elbow or thigh without ongoing bleeding, expanding hematoma or loss of peripheral pulses
- 2nd or 3rd degree Burns > 20% and < 40% without smoke inhalation or hemodynamic compromise

Mechanism of Injury Criteria:
- Fall > 20 feet (One story equals approx 10 feet)
- Ejection from vehicle
- Death in same passenger compartment
- Auto/pedestrian or auto/bicycle with patient thrown, run over, or with impact > 20 MPH
- Motorcycle crash > 20 MPH

Other:
- Attending Emergency Physician concern for serious injury with none of the above present

**Level B (Trauma transfer from OHF)**

- Patient accepted for transfer by trauma service
- Request for trauma alert by accepting service

If a Level B patient’s condition deteriorates after patient arrival, an upgrade from Level B to Level A should be initiated. This should be paged as an upgrade

Rev. 02/22/10

SECTION TWO: GENERAL POLICIES
Pediatric Trauma Alert Level Criteria

Pediatric Trauma is defined as Age 15 and under 16 and older should be Adult Trauma alerts/transfers.

**Level A (Scene Transport)**
- Respiratory distress/ intubated
- Hypotension/ Shock *
- Unconscious patient (GCS 8 or less)
- Penetrating injury to head neck, or torso
- Open or Depressed Skull Fx
- Flail Chest
- Limb-threatening injury
  - Amputation proximal to wrist or ankle
  - Crushed, degloved, or mangled extremity
  - Penetrating injury proximal to elbow or knee plus diminished or absent pulse, expanding hematoma, or ongoing bleeding.
- Paralysis
- Burns 2nd or 3rd degree > 40% BSA or with suspicion of smoke inhalation or hemodynamic compromise.
- Suspected Pelvic Fx with hemodynamic instability

**Level A (Trauma transfer from OHF)**
- Hemodynamically unstable pediatric trauma transfers
- Patient who is intubated
- Transfers with probable need of urgent surgical intervention
- Received blood transfusion prior to transfer

**Level B (Scene Transport)**
- Altered mental status (GCS 9-13)
- Burns 2nd or 3rd degree 20-40% BSA
- Fall > 20 feet (One story equals approx 10 feet)
- Ejection from vehicle
- Death in same passenger compartment
- Auto/pedestrian or auto/bicycle with patient thrown, run over, or with impact >20 MPH
- Motorized off road vehicle or motor cycle crash > 20 MPH
- Attending Emergency Physician concern for serious injury

**Level B (Trauma transfer from OHF)**
- Hemodynamically stable pediatric trauma patient who is unintubated, but there is need of possible surgical intervention
- Attending Emergency Physician concern for serious injury

*Hypotension defined for children 10 years of age or younger by systolic BP < 70mmHg + (2 x age in years) and for patients older than 10 years of age
Systolic BP < 90mmHg

If a Level B patient’s condition deteriorates after patient arrival, an upgrade from Level B to Level A should be initiated. This should be paged as an upgrade.

Rev. 02/22/10
EMERGENCY BY-PASS FOR TRAUMA CARE

MUSC does not go on diversion for incoming trauma patients due to lack of bed availability. Bypass will occur only due to loss of a critical component of the trauma system.

By Protocol EMS agencies will not divert to another facility once a facility is contacted unless that other facility has agreed to accept the diversion. If no such acceptance is obtained, patients will be brought to the facility originally contacted. For this reason it is vital that, in an event that a critical MUSC resource is unavailable arrangements be made with other hospitals to accept MUSC diversion as soon as possible so that incoming EMS units can be rapidly and appropriately diverted.

The purpose of this policy is to ensure that trauma patients who would normally be transported to MUSC will be triaged to the appropriate facility, when MUSC has an internal emergency which restricts the capabilities of the Trauma Services.

1. The area hospitals and Emergency Medical Services (EMS) will be notified, via phone by the charge nurse in the Trauma Center, that MUSC cannot handle the patient load due to an in-house emergency (i.e., non-functional operating room).

2. The Emergency Service Attending will continue to provide on-line medical control for EMS en route to MUSC. In consultation with the Trauma Service, the Emergency Service Attending will negotiate disposition with other area designated Trauma Centers for those patients which exceed the capabilities of MUSC due to an internal emergency.

3. Once the problem is resolved the charge nurse will notify the area hospitals and EMS.

Rev. 6/04/10
OR PRIORITY SCALE

- **Priority 1**
  Patient extremely unstable. May require immediate surgery without further notification

- **Priority 2**
  Patient initially unstable but can be maintained with on going resuscitation,
  AND/OR Patient is unstable neurologically
  AND/OR Patient has a high likelihood of having a severe injury requiring surgical intervention after a relatively brief work-up

- **Priority 3**
  Patient stable at present. Potentially prolonged diagnostic evaluation required before any needed surgery will proceed or before need for surgery is determined

- **Priority 4**
  Patient stable. Diagnostic evaluation in progress. May require urgent but not emergent surgical procedure

- **Priority 5**
  Patient stable. Very low probability of requiring surgery.

Rev. 5/18/10
LEVEL ONE TRAUMA TEAM ROLES IN THE ADULT EMERGENCY ROOM

Purpose:
In order to provide optimal care to trauma victims, it is necessary to avoid confusion during patient resuscitations. Therefore, the following protocol will guide the roles and responsibilities of the trauma resuscitation team in order to assure that the resuscitative needs of the trauma victim are met and performed in an orderly manner. The goal is efficient, quiet, rapid resuscitation, so that patients will be delivered to definitive care in the least amount of time possible, thereby assuring the best possible outcome. Patient privacy as mandated by HIPPA will be maintained by limiting and enforcing the number of people in the trauma resuscitation area during patient evaluation. Emergency Medicine and/or Trauma Surgery Attending Physicians will be responsible for this enforcement.

Physicians and staff involved in patient evaluation and resuscitation are required to comply with their assigned roles and only their assigned roles. (Additional confirmatory physical examinations, ultrasounds examinations, etc. may be completed at the discretion of the Trauma Surgery Attending Physician or Emergency Medicine Attending Physician after completion of primary survey, resuscitation, and secondary survey including radiological evaluations and other secondary survey adjuncts.

I. Inner Core Care Providers (within the red line in resuscitation bay)

Trauma Team Leader
(Surgery attending, ED attending until surgery attending arrives, or PGY4 or more senior surgical resident. ED PGY3 can assume role of team leader under direct supervision of the trauma attending surgeon when senior surgery resident is unavailable (in the operating room for example) or agrees to trade off that role. EM PG3’s may also participate in discussions regarding patient management with trauma team leader and trauma surgery attending).
1. Identifies inner core trauma team members prior to patient arrival.
2. Obtains report from EMS.
3. Coordinates and communicates to the team the plan of care.
4. Performs, assists, or directs performance of necessary lifesaving procedures in accordance with ATLS standards.
5. Contacts appropriate consultants as needed.
6. If the attending surgeon is not present during resuscitation, team leader discusses case with attending surgeon and emergency room attending prior to patient leaving trauma resuscitation area.
7. Determines level of care needed once patient leaves ED.
8. Completes patient admission note or emergency department physician documentation if patient is discharged or expires in the Emergency Department.
9. Responsible for assuring family notification and discussing patient situation with family as soon as possible after family arrives.
10. Responsible for assuring that History and Physical, admission orders, and other necessary documentation including resident MD signature is completed and reviewed for accuracy.

MD 1
(PGY 2 or more senior surgery resident. EM PG2 or more senior residents may assume role of MD 1 if agreed to, before patient arrival, by trauma service resident (and attending) who would otherwise assume that role.)
1. Performs primary survey including GCS and reports finding to the team.
2. Assist with surgical airway if necessary.
3. Performs FAST exam at direction of team leader.
4. Assists or performs procedures at direction of team leader.

MD 2
(PGY1 or more senior surgical residents. EM PG1 or more senior residents may assume role of MD 2 if agreed to before patient arrival, by trauma service resident (and attending) who would otherwise assume that role).
1. Removes clothing and jewelry and applies warm blankets. (for lesser injured patients and/or for those without risk of spine injury, every effort should be made to preserve clothing intact unless otherwise directed by trauma team leader).
2. Performs secondary survey.
3. Assists or performs procedures at direction of team leader.
4. Responsible for closure of lacerations if team leader states appropriate.
5. Assists, at direction of team leader, in completion of History and Physical.

SECTION TWO: GENERAL POLICIES
RN 1 (Procedure)
1. Prepares trauma bay for patient arrival based on report from EMS.
2. Obtains primary peripheral IV access and draws blood work coordinating this with the performance of the primary survey at discretion of team leader.
3. Responsible to ensure that patient receives all medications.
4. Administers IV fluid and blood products and informs team leader and RN 2 of fluids infused.
5. Maintains Level I Infuser Device when in use or defer to available nurse.
6. Performs any additional nursing assessment after stabilization of patient.
7. Inserts orogastric / nasogastric tube and/or urinary catheter if requested by team leader.
8. Gives report to receiving unit and accompanies patient during transport outside the ED.

RN 2 (Recorder)
1. Responsible for making sure trauma team leader is aware of each recorded set of vital signs, fluid intake, and lab results.
2. Completes trauma resuscitation flow sheet.
3. As needs at request of RN 1, and team leader with patient care.
4. Responsible for obtaining patient valuables and recording in the nurse's note and securing them with the admission clerk or family member per hospital / emergency department policy and procedure.

Emergency Department Technician (EDT)
1. Assures that all equipment and supplies for trauma patient care are available, complete, and ready for emergent use including daily and post resuscitation check of oxygen tanks in trauma bay.
2. Starts trauma clock when patient arrives.
3. Attach patient to cardiac monitor, pulse oximetry, and BP monitor and takes temperature.
4. Obtains and sets-up procedure trays.
5. Applies patient identification band. Two identibands are needed if patient goes to the OR.
6. Assists with drawing lab specimens, obtain EKG as directed.
7. Assist team as needed to restrain patient as ordered by team leader.
8. Assist with splinting of extremities as requested by team leader.

Airway 1 (Anesthesia attending, ED attending, EM Senior resident)
1. If requested by Team Leader, performs airway assessment and management including assurance of appropriate and proper airway placement maintains cervical spine precautions until C-spine cleared by team leader. Informs nursing staff of administered medications. Once airway established and secured, leaves bedside.
2. Senior Surgery resident may assume role of ED resident in airway management if agreed to by ED attending (usually as a “trade off” when an EM resident assumes the MD 1 or MD 2 role).

Airway 2 (Anesthesia attending, ED attending, EM resident, Surgery resident)
1. Assists Airway 1 with management of airway (cricoid pressure etc). Once airway established and secured, leaves bedside.
2. Junior or Senior Surgery residents may assume role of ED resident in airway management if agreed to by ED attending (usually as a “trade off” when an EM resident assumes the MD 1 or MD 2 role).

Respiratory Therapist
1. Obtain pulse oximetry reading and respiratory rate and quality of breathing.
2. If patient not intubated, supplies oxygen to all patients by mask, unless otherwise directed by team leader.
3. Responsible for airway maintenance, i.e., suctioning, securing and periodic assessment.
4. Obtains ABG’s as indicated or ordered.
5. Assists with intubation if no physician available for Airway 2 role.
6. Assesses to assure continued proper placement of airway.
7. Attach patient to End Tidal CO2 monitor when intubated, secure ETT, and set up ventilator.
8. Insures adequate amount of oxygen and vent equipment available for transport (checks O2 tank on trauma stretcher prior to patient arrival if possible).
9. Accompanies intubated patients to O.R., I.C.U., CT scan, etc. and reconfirms airway position after patient movements completed.
Radiologic Technologist
1. Assures x-ray equipment available including adequate number of lead aprons and cassettes.
2. Assures radiation protection for other Trauma Team members while taking x-rays
3. Takes x-rays when directed by Trauma Team Leader with consideration of C-spine injury until ruled out.
4. Immediately processes films.

Charge Nurse
1. Removes patients and/or family members from Rooms 2, 2a and 3 whenever possible to more private areas to avoid unnecessary exposure to the chaos of the trauma resuscitation.
2. Assists RN 1 and/or RN II if necessary. Note: Charge nurse should not remain in trauma resuscitation area if not directly involved in patient care.

II. Outer Core Care Providers
(Must stay behind red line unless replacing an inner core trauma team member or at direction of trauma team leader)

Trauma Surgery Attending
1. Has overall responsibility and authority for trauma resuscitation and is responsible for overseeing all team members to assure compliance with standards and protocols.
2. Assures HIPPAA compliance and patient privacy is maintained.

Emergency Medicine Attending
1. Initiates trauma alert as per established trauma alert criteria. In the absence of trauma surgery attending, monitors resuscitation for appropriateness and efficiency of care, serving as primary responsible physician. Communicates with trauma attending as needed and determines need for surgery attending presence in the Emergency Department.
2. Assures HIPPAA compliance and patient privacy is maintained.

Trauma Service Physician Assistant or Nurse Practitioner
1. As requested by trauma surgery attending or team leader, provides support to other team members as needed to ensure compliance with trauma service protocols and guidelines.
2. Assists in completion and review of History and Physical and admission orders to assure consistency with trauma service patient care practices.
3. Responsible for SBIRT process.

ASB
1. Assigns patient a pre designated trauma alert packet with number and activates number with registration.
2. Notifies operator of absent trauma team member within the Resuscitation Area.
3. Page consultants at request of trauma team leader.
4. Directs all incoming calls to appropriate personnel.

Chaplain
1. Obtain patient identification and assist with notifying family members and relays information to RN 1 or RN 2.
2. Facilitates communication between family, patient, and staff.
3. Support families during visitation with patient.
4. Provide religious and spiritual support to patients, families and staff.
5. Provide grief support.
6. Collaborate with hospital supervisor, Security, and Guest Relations, to provide information for families and assists with directing them to appropriate areas within the hospital.
7. Remains in trauma admitting area only for as long as necessary to complete roles.

EMS personnel directly involved in patient transport to ED
1. Deliver patient from scene to trauma admitting area.
2. Immediately following patient delivery and movement on to gurney, move behind red line to answer additional questions or leave admitting area to complete required paperwork.
TRAUMA STUDENT, ED A-SIDE STUDENT
1. Assists with patient management and documentation as requested by and under direct supervision of trauma surgery attending, trauma team leader and/or Emergency Department attending.
2. In general any additional students beyond one trauma service student and one EM student may observe at the discretion of the trauma surgery attending (or EM attending in absence of trauma surgery attending) as long as their presence does not result in excessive overcrowding of the trauma admitting area or impair trauma team function.

TRAUMA PROGRAM MANAGER:
1. Monitors trauma team performance as per ACS guidelines
2. Identifies PI issues for later review.

SECURITY
1. Assures staff and patient safety when such concerns exist.
2. Assists with crowd control at request of attending trauma surgeon and/or attending EM physician.
3. Coordinates interactions with involved police agencies.
4. If no issues identified requiring presence in admitting area, will leave trauma admitting area and be available if needed.

HOSPITAL SUPERVISOR
1. Identifies and addresses issues in hospital function related to trauma center activities
2. Assists ATC with bed assignment
3. If no issues identified requiring presence in admitting area, will leave trauma admitting area and be available on pager if needed.

III. OB TRAUMA ALERTS:

OB ATTENDING PHYSICIAN AND NURSE (PAGED ON OB TRAUMA ALERT SYSTEM)
1. Respond to trauma bay with FHT monitor and OB Ultrasound.
2. After primary assessment and in consultation with team leader will place FHT monitor and perform US to determine fetal age/size.
3. Responsible to remain with mom and maintain FHT monitoring throughout resuscitation.
4. Accompany patient maintaining FHT monitoring to all procedures or radiology examinations within the hospital.
5. OB attending physician determines when FHT monitoring may be interrupted or terminated.

NEONATAL STABILIZATION TEAM AND PEDIATRIC EMERGENCY DEPARTMENT
1. Per Adult ED policy the One West PCT will bring the Panda Bed to the Trauma Bay area
2. Pediatric Charge RN will receive OB Trauma alert. Adult ED charge nurse notifies Pediatric ED charge nurse if impending delivery possible.
3. Pediatric charge nurse will notify pediatric attending.
4. Pediatric attending and Pediatric nurse will respond to trauma area and act as first responders in the case a neonate is born until Neonatal Stabilization Team arrives.
5. Neonatal Stabilization Nurse and NICU Charge nurse paged with the OB trauma team will respond and assess the need to page the Neonatal Stabilization Team (infant delivery possible).
6. If Neonatal Stabilization Team paged they will respond with the appropriate equipment to oversee care of the infant.
7. Pediatric Respiratory Supervisor will respond to the OB Trauma alert to assist with establishment of airway and ventilation of the infant.
8. Pediatric Surgery Attending will be notified by Neonatal Stabilization Team if necessary.

IV. EXCLUDED FROM RESUSCITATION AREA
1. Residents on services not directly involved in trauma patient care
2. Residents/students rotating in Emergency Department but not directly involved in trauma patient care
3. Hospital Volunteers
4. Nursing personnel not directly involved in trauma patient care
5. Attending Physicians not directly involved in trauma patient care
6. EMS personnel not involved in patient transport
7. Others not directly involved in acute care of patient
TRAUMA RESUSCITATION TEAM

Level One Infuser RN

Respiratory Therapist

Anesthesia or ED attending MD

MD Airway Assistant

MD 1

ED TECH

RN 1

MD 2

OB, other services:
(Moves to location of ED Tech or MD 2 as space available)

RN 2

MD Team Leader

08/04/08
DRESS CODE FOR TRAUMA ADMISSIONS

POLICIES:

1. Personnel involved in the care of trauma patients will be expected to wear the following:

   - Non-sterile gloves
   - Clean cover gown
   - Glasses or other protective eyewear
   - Lead apron (depending on expected exposure to x-rays)
   - Hats, masks, and shoe covers
TRAUMA ALERT LAB GUIDELINES

Trauma A Profile
(PT, PTT, Urinalysis, BMP, CBC, Ethanol)

Trauma A Profile: Female Childbearing Age
(PT, PTT, Urinalysis, BMP, CBC, HCG, Ethanol)

Trauma B Profile: Female Childbearing Age
(HCG)

Trauma A Profile: Pregnant
(PT, PTT, Urinalysis, BMP, CBC, HCG, Ethanol, Fetl Hgb, Fib)

Trauma B Profile: Pregnant
(PT, PTT, CBC, HCG, Fetl Hgb, Fib)

Pediatric Trauma Profile
(PT, PTT, Urinalysis, BMP, CBC, AST, ALT, Amylase)

Pediatric Trauma Profile: Female Childbearing Age
(PT, PTT, Urinalysis, BMP, CBC, HCG, AST, ALT, Amylase

UNCROSSED BLOOD IN EMERGENCY SERVICES

BACKGROUND:
A Jewett Blood Bank refrigerator is maintained in the Emergency Department and is stocked with six units of O negative blood and 6 units of O positive blood.

POLICIES:
1. The Blood Bank will monitor the chart temperature recorder. Blood Bank personnel are also responsible for checking and replacing blood prior to expiration.
2. Temperature variation triggers an alarm system connected to the Jewett refrigerator which sounds in the Emergency Department and in the Blood Bank. The Blood Bank will be responsible for correcting the problem to prevent wastage of blood.
3. The nursing staff will notify the Blood Bank when any blood is used so they may promptly replenish the expended blood.
4. When used, the attached blood tag will be labeled with the patient’s ID and the signature of two nurses involved in administrating the blood. The tag will remain with the patient’s medical record and the Uncrossmatched RBC Usage Log will be returned to the Blood Bank.
5. Prior to transfusing blood, a blood specimen will be sent to the Blood Bank for type and crossmatch of additional blood.

Revised October 1, 2009
Reviewed May 18, 2010

SECTION TWO: GENERAL POLICIES

Back to Index
BACK UP CALL SCHEDULES

Back up Call Schedules

Trauma: A back up pager is carried by one of the trauma attending surgeons at all times. The operators can page that pager to contact the back up attending.

Neurosurgery: The back up neurosurgeon is the neurosurgeon who was on-call the previous night. In addition, the chief neurosurgery resident on call can function as the back up attending until the primary on-call attending or back up attending is available.

Orthopedics: The back up orthopedic surgeon will be the orthopedic surgeon on call for spine. If that orthopedic surgeon is the same as the on call surgeon for orthopedic trauma, the pediatric orthopedic surgeon on call will serve as back up attending. In addition, the chief orthopedic surgery resident on call can function as the back up attending until the primary on-call attending or back up attending is available.

New 06/04/10
SECTION THREE: PEDIATRICS

PEDIATRIC RESUSCITATION

**PEDIATRIC RESUSCITATION GUIDELINE**

- **Airway**
  - If indicated
  - Maintain Cervical Stabilization
    - Apply 100% O2 via non-rebreather
    - 1. GCS<8 or
    - 2. Absent Gag
    - 3. PO2<50 or PCO2>50
    
- **Breathing**
  - If indicated
  - Tension Pneumothorax: Needle decompression 2nd ICS mid clavicle line followed by tube thoracostomy 4th ICS mid. Hemorthorax: Insure adequate IV access then tube thoracostomy to OR if output> 20cc/kg/hr or initial output> 20cc/kg
  - Open PTX: Seal wound vaseline gauze then tube thoracostomy Contusion/ Flail chest Intubate if PO2<50, PCO2>50/Tachypneic

- **Circulation**
  - If indicated
  - VS every 5min/ pulse oxymetry
  - 2 large IV/ Intraosseous access
  - Establish wt to nearest 10kg and bolus 20cc/kg warmed LR or NS
  - Repeat bolus X2 if necessary (reassess after each bolus) then give 10cc/kg PRBC, repeat as necessary

- **Disability**
  - If indicated
  - Neurosurgical Consult
    - Intubate and Ventilate/ normal rate
    - Insure adequate perfusion/ oxygenations
    - Head CT ASAP
    - To OR for drainage of epidural/subdural

- **Exposure**
  - If indicated
  - Tubes, X-rays, Labs, FAST
    - Place orogastric tube
    - Foley Catheter after rectal exam
    - Blood per protocol
    - C-Spine, CXR, Pelvis films
    
**Click on link to see Pediatric Intubation Guidelines**

**Click on link to Trauma Activation Guidelines**

**Click on Link to Trauma Roles Level A or B**

**Click on link for guidelines for pediatric Abdominal/Pelvis CT**

**Click on link for guidelines for clearance of pediatric c-spine**

9/8/10
PEDiatric Trauma Alert Level Criteria

Pediatric Trauma is defined as Age 15 and under
16 and older should be Adult Trauma alerts/transfers.

Level A (Scene Transport)
Respiratory distress/ intubated
Hypotension/ Shock *
Unconscious patient (GCS 8 or less)
Penetrating injury to head neck, or torso
Open or Depressed Skull Fx
Flail Chest
Limb-threatening injury
  Amputation proximal to wrist or ankle
  Crushed, degloved, or mangled extremity
  Penetrating injury proximal to elbow or knee plus diminished or absent pulse, expanding hematoma, or ongoing bleeding.
Paralysis
Burns 2nd or 3rd degree > 40% BSA or with suspicion of smoke inhalation or hemodynamic compromise.
Suspected Pelvic Fx with hemodynamic instability

Level A (Trauma transfer from OHF)
Hemodynamically unstable pediatric trauma transfers
Patient who is intubated
Transfers with probable need of urgent surgical intervention
Received blood transfusion prior to transfer

Level B (Scene Transport)
Altered mental status (GCS 9-13)
Burns 2nd or 3rd degree 20-40% BSA
Fall > 20 feet (One story equals approx 10 feet)
Ejection from vehicle
Death in same passenger compartment
Auto/pedestrian or auto/bicycle with patient thrown, run over, or with impact >20 MPH
Motorized off road vehicle or motor cycle crash > 20 MPH
Attending Emergency Physician concern for serious injury

Level B (Trauma transfer from OHF)
Hemodynamically stable pediatric trauma patient who is unintubated, but there is need of possible surgical intervention
Attending Emergency Physician concern for serious injury

*Hypotension defined for children 10 years of age or younger by systolic BP < 70mmHg + (2 x age in years) and for patients older than 10 years of age
Systolic BP < 90mmHg

If a Level B patient’s condition deteriorates after patient arrival, an upgrade from Level B to Level A should be initiated. This should be paged as an upgrade.
PEDIA TRIC TRAUMA INTUBATION ALGORITHM

--Maintain Inline Cervical Stabilization—
--Apply Cricoid Pressure as Indicated--

Pre-oxygenate*

↓

Atropine 0.02 mg/kg IV (minimum 0.1 mg/dose; maximum 1 mg/dose)**

↓

FOR HEAD INJURY ONLY: Lidocaine 1-1.5 mg/kg/dose IV***

↓

Etomidate 0.3 mg/kg/dose IV****

↓

Rocuronium 1 mg/kg/dose OR Succinylcholine 2 mg/kg/dose#

↓

Intubate

↓

Consider further sedation per Pediatric Trauma Sedation Guidelines prior to transport to CT scanner or PICU if patient is hemodynamically stable

*Preoxygenate with non-rebreather at 15 L/min O₂ flow rate. Have suction, ETCO₂ detector, in-line end-tidal monitor, alternative ETT and blade sizes, appropriate BVM sizes and LMA available.

**Suggest atropine for children less than 2 year and all patients receiving Succinylcholine; Consider atropine for all children less than 8 years old

***For head injury patients only; give 5 minutes prior to induction if time permits

****Time onset of Etomidate is 15-30 seconds; duration is 1-5 minutes

#Succinylcholine is contraindicated in crush injury, hyperkalemia, neuromuscular disorders, penetrating eye injuries, non-acute burn, or family history of malignant hyperthermia/pseudocholinesterase deficiency
MEDICATION RECOMMENDATIONS FOR PEDIATRIC TRAUMA
SEDATION/ANALGESIA/NEUROMUSCULAR BLOCKADE IN TRAUMA CENTER

A. Non-intubated Patient with stable cardiopulmonary status
1. Midazolam 0.1 mg/kg (MAX 2.5 mg) slow IVP
   - Repeat dose (after 5 minutes)
     0.1 mg/kg (max 2.5 mg)

2. Fentanyl 1 microgram/kg (MAX 50 micrograms) slow IVP
   - Repeat dose (after 3-5 minutes)
     0.5-1 microgram/kg (MAX 25 micrograms) slow IVP
   - Repeat dose (after 30 minutes)
     0.5-1 microgram/kg (MAX 25 micrograms)

B. Intubated Patient with stable cardiovascular status
1. Midazolam 0.2 mg/kg (max 5 mg) slow IVP
   - Repeat dose (after 5 minutes)
     0.1 mg/kg (MAX 2.5 mg) slow IVP
   - Repeat dose
     0.1 mg/kg (MAX 2.5 mg) slow IVP

2. Fentanyl 1-2 micrograms/kg (MAX 100 micrograms) slow IVP
   - Repeat dose q 5 minutes
     0.5-1 microgram (MAX 50 micrograms) slow IVP
   - Repeat dose
     0.5-1 mg/kg (MAX 50 micrograms) slow IVP

3. Rocuronium* 1 mg/kg IV for neuromuscular blockade
   - Repeat 0.3 mg/kg prn agitated movement
     * Prior sedative required
     ▪ Beware increased air leak with uncuffed ETT and possible ↓ tidal volume/minute ventilation
     ▪ Protect eyes

C. Intubated Patient with unstable cardiovascular status
1. Midazolam 0.05 mg/kg (MAX 2 mg)
   PLUS
2. Ketamine 1 mg/kg (MAX 50 mg)
   If > 5 minutes since last dose and uncontrolled agitation.
   - Repeat dose 0.5 mg/kg (MAX 25 mg)
   - Repeat dose 0.5 mg/kg (MAX 25 mg)
3. Rocuronium as above
Reversal Agents

1. Naloxone (Narcan) – Mix Naloxone 0.4 mg/mL with 9 mL of normal saline for a total volume of 10 mL. Dilution concentrations will be 0.04 mg/mL.
   a. Patients ≤ 20 kg: Give 0.02 mg (0.5mL) IV every three minutes until desired respiratory rate is established NOT until return of desired sensorium.
   b. Patients > 20 kg: Give 0.08 mg (2 mL) IV every three minutes until desired respiratory rate is established NOT until return of desired sensorium.

2. Flumazenil (Romazicon) – Children’s Hospital (including NNICU):
   a. Patients ≤ 20 kg: 0.01 mg/kg IV every 1-2 minutes until desired respiratory rate is established NOT until return of desired sensorium.
   b. Patients > 20 kg: 0.2 mg IV every 1-2 minutes until desired respiratory rate is established NOT until return of desired sensorium.
PEDIATRIC MASS TRANSFUSION GUIDELINES

**Unstable VS**
- *Already received 40ml/kg Crystalloid*
- *Evidence of massive hemorrhage*
- *Continued Hemodynamic Instability*

**Charge nurse Notify blood bank** 2-2671 re: Major Pediatric Bleed Protocol for patient’s weight, sex, name or TV #, MRN, when the stat pack is ready blood bank should call _____ phone #

- 40 Kg weight and under blood bank will send stat packs of 4 Units of PRBC and 4 Units of FFP. Over 40 kg weight blood bank will send stat packs of 8 units of PRBC and 8 of FFP. *(0⁻) PRBC for females*
- *(0⁺) PRBC for males*
- *FFP*
- *Platelets (pheresed) will send 1 unit of platelets with 2nd and 3rd stat packs.*

Make sure type and cross match has been sent but until this is completed the blood bank can send emergent uncross matched blood. Attending physician must sign the Transfusion Service Test and Blood Component Request Form to authorize use of uncross matched blood.

Patient location OR: stat pack delivered to OR lab and blood bank will call OR charge nurse (6-6306) to obtain OR room phone number.

Patient location PICU: blood bank will call PICU Charge Nurse at (6-6222)

Patient location Peds ED blood bank will call Peds ED charge nurse (6-6011)

Patient location One West ED: blood bank will call ED charge nurse (6-6017)

If patient changes location the sending area charge nurse will notify blood bank with patient location.

Discontinuing MBP: blood bank will continue to prepare and send stat packs until decision made by attending physician to discontinue. Charge nurse should then immediately notify blood bank.

> 3 stat packs Attending Physician to determine ratio of blood products for further stat packs to be sent. Refer to Major Pediatric Bleed Protocol for Blood Bank

**Serial Exams and Labs**

- **STABLE**
  - Giving PRBC 15ml/kg
  - UNSTABLE
    - Repeat PRBC 15ml/kg
    - FFP 15ml/kg Repeat PRBC 15ml/kg
    - Platelets 15ml/kg Repeat PRBC 15ml/kg Repeat FFP 15ml/kg
    - UNSTABLE
      - Repeat PRBC:FFP:Platelets Transfusions Ratio 3:2:2

**References:**

**Consider warming patient and fluids Correct acidosis**

**STABLE**
- **New Labs** *ISTAT for blood gas, hemoglobin, Ca++, K+
- **New labs** CBC, PT, PTT, INR, Fibrinogen, Blood gas, Lactate, Ca++

**Consider**
1. Aminocaproic acid Bolus 100mg/kg, maximum 5 grams over 30 minutes followed by 30mg/kg/hour if continued bleeding.
2. Cryoprecipitate 4ml/kg if fibrinogen <100mg/dl despite FFP 30ml/kg
3. Factor VII a 90 microgram/kg if continued bleeding for > 3 blood volume replacements.

For Ca++ < 1.0 mmol/L, Calcium gluconate 30-50mg/kg or Calcium Chloride 10-20 mg/kg

**PRBC’s 15ml/kg normally will increase hgb ~3gnd/dl.**

**PRBC’s 45ml/kg with FFP 15ml/kg and Platelets 15ml/kg constitutes ~ 1 blood volume**
PEDiatric trauma VTE guidelines

Assess patient at 36 hours following injury

Category A
- Previous VTE
- Pelvic fracture (non-ambulatory)
- Spinal cord injury
- Major vascular injury (arterial or venous)

Category B
- Intubated
- CVC any site
- Lower extremity fracture (non-ambulatory)
- Traumatic brain injury
- Family history of VTE (DVT, PE, or stroke in a sibling, parent, or grandparent, age < 50 years at time of event)

If Patient has **ONE** Category A or **TWO** Category B Risk factors, patient meets criteria for VTE prophylaxis: Proceed to Step 2.

Contraindications to Mechanical Prophylaxis Devices
- (Devices: Compression hose or wraps.
- Sequential compression devices [SCDs]
- Compartment syndrome
- Lower extremity cast/fixator
- Established DVT
- Fasciotomy or open wound
- Fracture below the knee
- (May use mechanical device in non-affected limb if only one limb has a contraindication)

Contraindications to Enoxaparin
- Clearance from appropriate surgical service not yet obtained (See Box)
- High bleeding risk determined by trauma team
- Epidural catheter in place
- Surgical procedure planned in the next 24 hours
- Hemotherax
- Hemorrhagic pericardial effusion
- Uncontrolled bleeding
- Major eye injury
- Uncorrected coagulopathy (PLT < 50,000; INR > 1.5; or PT > 2X control)
- Spinal anesthesia

Box
- Required clearances
  - From surgical service: Attending physician
  - Head or spinal cord injuries: Neurosurgery
  - Spleen and liver injuries: Pediatric surgery
  - Vascular injuries: Vascular surgery
  - Orthopedic injuries: Orthopedic surgery

Patients < 13 years of age
1. Weekly duplex venous ultrasound of bilateral lower extremities and upper extremities if a CVC is present in that location starting on post-injury day 7
2. Mechanical prophylaxis devices unless contraindicated

Patients 13 to < 16 years of age
1. If no contraindications, begin enoxaparin per Pediatric Anticoagulation MUSC Children's Hospital Order Set (click link).
   (Dose: 0.5 mg/kg/dose [maximum 30 mg] Sub Q every 12 hours. If patient has renal dysfunction a lower dose may be required—check Anti-Xa [LMWH] level 4 hours after first dose (goal 0.1-0.3 units/mL).
2. Continue enoxaparin until patient is ambulatory or is discharged (patients transferring to rehab facility may need to continue enoxaparin—document plan in medical record).
3. Hold 2 doses (24 hours) of enoxaparin prior to any surgical procedure; resume enoxaparin once approved by the operating surgeon.
4. Mechanical prophylaxis devices unless contraindicated
5. If enoxaparin is contraindicated perform weekly duplex venous ultrasound of bilateral lower extremities (and upper extremities if a CVC is present in that location) starting on post-injury day 7.

Abbreviations: CVC, central venous catheter; DVT, deep venous thrombosis; LMWH, low molecular weight heparin; PE, pulmonary embolism; PLT, platelet count; PTT, activated partial thromboplastin time; VTE, venous thromboembolism
LINK TO CHILDREN’S EMERGENCY SERVICES TRAUMA ACTIVATION ORDERS

LINK TO PICU TRAUMA ADMISSION ORDERS
EVALUATION OF PEDS PENETRATING ABDOMINAL TRAUMA

Penetrating Trauma
True Abdomen

CXR
Chest tube if appropriate

GSW

Peritoneal signs/
Hemodynamic Instability
Evisceration

Posterior or flank wound

CT Chest/Abdomen/
Pelvis with IV and
Oral Contrast

23 hour
Observation

Attending Consultation Regarding
Laparotomy
Laparoscopy
Admission for serial exams

Penetrates Anterior Fascia

Contact attending about possible
admit for observation vs. OR

Do not probe wounds
Do not explore wounds involving the rib cage

Local Exploration
Repair Wound DC

Penetrates Anterior Fascia

Peritoneal signs/
Hemodynamic Instability present

Tangential Wound
No peritoneal signs
Hemodynamics stable

Yes

OR

Peds Surg Attending Decision Regarding
Oral and IV Contrast CT or laparoscopy

Attending Consultation Regarding
Laparotomy
Laparoscopy
Admission for serial exams

No

Yes

Positive

Negative

Yes

unsure

No

Penetrates Anterior Fascia

CXR
Chest tube if appropriate

Chest / Abdominal x-ray
Chest tube if appropriate

Stab Wound

Evisceration

Hemodynamic Instability

Hemodynamic Instability

Posterior or flank wound

Contact attending about possible
admit for observation vs. OR

Yes

No

Yes

Gastrointestinal System

Revised 9/1/10
EVALUATION OF PEDS BLUNT ABDOMINAL TRAUMA

Hemodynamically stable with normal abdominal exam, normal sensorium / not intoxicated, no plans for the OR. (*See Guidelines for avoiding unnecessary abdominal CT*)

Serial Physical Exams

Normal
Abnormal

23 hour Observe (Peds Surgery Service)

Hemodynamically Unstable

Blunt Abdominal Trauma

Hemodynamically Unstable

Serial Physical Exams

("Follow Pediatric Resuscitation Guidelines")

FAST Pelvis X-ray

Positive for Intraperitoneal fluid

Discuss with Peds Surg Attending

Negative for intraperitoneal fluid

23 hour Observe (Peds Surgery Service)

Positive consider Chest / Pelvis X-ray CT if responded to resuscitation

Exploratory Celiotomy

Abdominal/Pelvic CT Scan (Oral and IV Contrast)

Visceral Injury (*See Guidelines for Peds Blunt Spleen/Liver Injury*)

No Visceral Injury

Blunt Abdominal Trauma

Abdominal/Pelvic CT Scan (iv contrast)

Hemodynamically stable but altered mental status or distracting injuries or need for general anesthesia or Abdominal Pain (handlebar/seatbelt contusion) or significantly elevated LFT's/amylase or Age <6 with worrisome mechanism (*See Guidelines for avoiding unnecessary abdominal CT*)
GUIDELINES FOR AVOIDING UNNECESSARY ABDOMINAL CT SCANS IN CHILDREN MEETING TRAUMA B ACTIVATION CRITERIA

Abdominal CT scan is NOT a mandatory part of the initial evaluation of Trauma B Pediatric patients if the following criteria are present:

A. Patient characteristic
   1. GCS 14 or higher
   2. Age 6 years or greater
   3. Systolic blood pressure normal for age
      a. 0 to 10 years of age, greater than $70 + 2 \times \text{age in years}$ mmHg
      b. 11 to 16 years of age, greater than 90 mmHg
   4. No unexplained tachycardia for age
      a. 0 to < 1 year: less than 180 beats per minute
      b. 1 to 3 years: less than 150 beats per minute
      c. 4 to 8 years: less than 135 beats per minute
      d. 9 to 16 years: less than 110 beats per minute
   5. No barriers to performing a reliable abdominal examination
   6. Normal abdominal examination (patient does not have the following exam findings)
      a. Seat belt sign
      b. Tenderness
      c. Distension

B. Initial laboratory results
   1. Aspartate aminotransferase (AST) less than 200
   2. Normal amylase
   3. Hematocrit greater than 30%
   4. Microscopic urinalysis with less than 5 RBC/hpf

References:

New 06/04/10
PEDIATRIC BLUNT SPLENIC / LIVER INJURY

Hemodynamically Stable?

Response to Resuscitation?
(20 cc/kg NS x 2 then 10-20cc/kg PRBC’s)

No or Peritonitis

Admit to PICU
Bed Rest x 24 hours
NPO
Hct Q6 hours, Coags Q12 hours

OR

Unstable or Peritonitis

Consider 10cc/kg PRBCs
PICU x 24 hours more
Hct Q6 hours, Coags Q12 hours

Stable
Hct <21

Transfer to Floor on Stable Pathway

CT Scan Findings?

Gd>=4
Hct <21
TBI/SCI or Other Major Injury

Consider Angioembolization

Gd I/II

Limited Activity/No Sports x 4 weeks
Non-Contact or Limited Contact after 4 weeks
For Contact sports need normal Abdominal US after 4 weeks

Gd III/IV

Limited Activity/No Sports x 6 weeks
Non-Contact or Limited Contact after 6 weeks
For Contact sports need normal Abdominal US after 6 weeks

Stable
Hct >=21

Ambulate
Reg. Diet
Then D/C home if stable Hct

Admit to Floor
Bed Rest x 24 hours
NPO
Hct at 6,12,24 hours

Stable
Hct <21

Consider 10cc/kg PRBCs
Bed Rest x 24 hours more
Hct Q6 hours, Coags Q12 hours
Consider Repeat CT at 48 to 72 hours post injury

References:

9/1/10
PEDIATRIC BURN POLICY / PROCEDURE MANUAL AND BURN ORDERS

https://www.musc.edu/medcenter/policy/PedsManual/C120.pdf

https://www.musc.edu/cce/ORDFRMS/pdf/picuburnadmit.pdf
### CLASSIFICATION OF SPORTS BY CONTACT

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ADMISSION TO THE PEDIATRIC TRAUMA SURGERY SERVICE

In general, Pediatric Trauma patients will be admitted to the Pediatric Surgery service. Patients with trauma isolated to a single organ system may be admitted to the specific surgical service.

List of patients who must be admitted to the Pediatric Surgery/Trauma service:
1) Level A and B traumas patients with multi-system injuries being admitted to the hospital.
2) Patients with traumatic injuries involving either the chest or the abdomen.
3) Patients with vascular injuries.
4) Patients with an isolated extremity fracture with a mechanism predictive of more extensive injuries (e.g. status post high-speed MVC or pedestrian vs. auto).
5) Patients with burns, caustic ingestions, or electrical injury.
6) Care of spinal cord injury will be coordinated between Pediatric Trauma, Neurosurgery and Pediatric Critical Care service.
7) Pediatric Trauma patients admitted to a surgical service in the PICU require mandatory consultation of the Pediatric Critical Care service.
8) Smoke inhalations without burns are to be admitted to the Pediatric Critical Care Service.

Indications for Pediatric Surgical Consultation:
1) All trauma patients with a presumed isolated injury which is moderate to severe* admitted to the PICU within 24 hours from injury should be evaluated by the Pediatric Trauma Service (e.g. direct transfer patient with a closed head injury requiring intubation and management by a Neurosurgeon should have a Peds Surgery consult to evaluate for other injuries).
2) All trauma patients with a presumed isolated injury which is moderate to severe* admitted to the floor within 24 hours from injury should be evaluated by the Pediatric Trauma Service (e.g. direct transfer patient with a closed head injury requiring observation and management by a Neurosurgeon should have a Peds Surgery consult to evaluate for other injuries even if a partial evaluation was performed at an outlying hospital).

Suspected Non-accidental Trauma (NAT):
1) All NAT patients with multiple significant injuries should be admitted to the Pediatric Trauma Service with appropriate level of care (floor or PICU).
2) If operative intervention is required or imminent, the appropriate surgical service should be consulted.
3) All NAT patients with a presumed isolated injury which is moderate to severe* admitted within 24 hours of injury should be evaluated by the Pediatric Trauma Service.
4) If NAT patient is found to have an isolated injury which is moderate to severe*, admission to appropriate surgical service is recommended.
5) If NAT patient is found to have an isolated injury which is minor**, admission to General pediatrics is acceptable.
6) All NAT patients should have consultation by Pediatric Forensic Services (VIP) and Social work (Please see guidelines for SW consultation).

*Examples of moderate to severe head injury would include skull fracture, epidural hematoma, subdural hematoma, DAI, subgaleal hematoma or head laceration with transfusion requirement, and TBI with LOC > 1hour. Example of severe extremity injury would include mangled/crushed extremity or vascular compromise.
**Examples of minor head injury would include concussion, headache or brief LOC with no significant head CT findings. Examples of minor extremity trauma would include bruising or soft tissue injury without fracture or isolated fracture without vascular injury and without a mechanism predictive of other organ system injuries.
CLEARANCE OF THE CERVICAL SPINE IN PEDIATRIC TRAUMA ALERT PATIENTS

Evaluation of the cervical spine is required for all pediatric trauma alert patients. Documentation of cervical spine clearance should be entered in the medical record for all patients at the time of clearance of the cervical spine.

The Neurosurgery service will be consulted when a patient has neurologic deficits, cervical tenderness or other symptoms suggestive of a cervical spine injury.

A pediatric trauma patient will be considered to have low probability for injury if he or she is clinically stable and meets all five of the following criteria\(^1\):

- No midline cervical tenderness
- No focal neurologic deficit
- Normal alertness
- No intoxication
- Not distracted by a painful injury

Pediatric trauma patients having low probability of injury as defined by these criteria require no further imaging or other studies. A note will be placed in the chart by the senior resident or attending responsible for this assessment.

If any of these criteria cannot be determined, radiographic clearance of the cervical spine will be obtained. In addition, radiographic clearance of the cervical spine may be pursued if the Team Leader or Attending suspects a cervical spine injury on historical or clinical grounds.

Cervical spine clearance in pediatric trauma alert patients who require cervical spine radiographs:

Pediatric Trauma Alert patients requiring C-spine clearance will remain in a cervical collar until the cervical spine is cleared.

To clear the C-spine, radiographic cervical spine evaluation must be obtained. A 3-view C-spine series will be completed to include lateral, AP, and odontoid views. Clearance of the odontoid films may not be appropriate in all patients, especially in children under age 5 without symptoms.

If plain films are not adequate to clear the C-spine, neurosurgery consultation will be obtained.

Once radiographic evaluation of the C-spine is completed and cleared for evidence of injury by a radiology attending or senior radiology resident, re-examination of the neck is performed. If patient has no pain or tenderness on documented exam, C-spine may be considered cleared and collar removed. Clinical and radiographic clearance will be documented in the chart by a senior surgical resident or Attending. The neurological exam must be documented in the chart in detail. If radiographic clearance has been documented, but if patient remains symptomatic or unexaminable, neurosurgery consultation will be obtained. If radiographic clearance cannot be obtained, patient will remain in collar and neurosurgery consultation will be obtained.

PEDIATRIC LEVEL A TRAUMA TEAM ROLES IN THE ADULT EMERGENCY ROOM

Purpose:
In order to provide optimal care to trauma victims, it is necessary to avoid confusion during patient resuscitations. Therefore, the following protocol will guide the roles and responsibilities of the trauma resuscitation team in order to assure that the resuscitative needs of the trauma victim are met and performed in an orderly manner. The goal is efficient, quiet, rapid resuscitation, so that patients will be delivered to definitive care in the least amount of time possible, thereby assuring the best possible outcome. Patient privacy as mandated by HIPPA will be maintained by limiting and enforcing the number of people in the trauma resuscitation area during patient evaluation. Emergency Medicine and/or Trauma Surgery Attending Physicians will be responsible for this enforcement.

Physicians and staff involved in patient evaluation and resuscitation are required to comply with their assigned roles and only their assigned roles. (Additional confirmatory physical examinations, ultrasounds examinations, etc. may be completed at the discretion of the Trauma Surgery Attending Physician or Emergency Medicine Attending Physician after completion of primary survey, resuscitation, and secondary survey including radiological evaluations and other secondary survey adjuncts.

I. Inner Core Care Providers (within the red line in resuscitation bay)

Trauma Team Leader
(Adult Surgery attending, or Pediatric Attending Surgeon) or Adult ED attending until surgery attending arrives, or PGY4 or more senior surgical resident. ED PGY3 can assume role of team leader under direct supervision of the trauma attending surgeon or Pediatric Attending Surgeon when senior surgery resident is unavailable (in the operating room for example) or agrees to trade off that role. EM PG3’s may also participate in discussions regarding patient management with trauma team leader and trauma surgery attending).
1. Identifies inner core trauma team members prior to patient arrival.
2. Obtains report from EMS.
3. Coordinates and communicates to the team the plan of care.
4. Performs, assists, or directs performance of necessary lifesaving procedures in accordance with
5. Contacts appropriate consultants as needed.
6. If the attending surgeon is not present during resuscitation, team leader discusses case with attending surgeon and emergency room attending prior to patient leaving trauma resuscitation area.
7. Determines level of care needed once patient leaves ED.
8. Completes patient admission note or emergency department physician documentation if patient is discharged or expires in the Emergency Department.
9. Responsible for assuring family notification and discussing patient situation with family as soon as possible after family arrives.
10. Responsible for assuring that History and Physical, admission orders, and other necessary documentation including resident MD signature is completed and reviewed for accuracy.

MD 1
(PGY 2 or more senior surgery resident. EM PG2 or more senior residents may assume role of MD 1 if agreed to, before patient arrival, by trauma service resident (and attending) who would otherwise assume that role.)
1. Performs primary survey including GCS and reports finding to the team
2. Assist with surgical airway if necessary.
3. Performs FAST exam at direction of team leader.
4. Assists or performs procedures at direction of team leader.
**MD 2**  
(PGY1 or more senior surgical residents. EM PG1 or more senior residents may assume role of MD 2 if agreed to before patient arrival, by trauma service resident (And attending) who would otherwise assume that role.)

1. Removes clothing and jewelry and applies warm blankets. (For lesser injured patients and/or for those without risk of spine injury, every effort should be made to preserve clothing intact unless otherwise directed by trauma team leader.)

2. Performs secondary survey.

3. Assists or performs procedures at direction of team leader.

4. Responsible for closure of lacerations if team leader states appropriate.

5. Assists, at direction of team leader, in completion of History and Physical.

**Pediatric RN 1 (Procedure)**

1. Prepares trauma bay for patient arrival based on report from EMS.

2. Obtains primary peripheral IV access and draws blood work coordinating this with the performance of the primary survey at discretion of team leader.

3. Responsible to ensure that patient receives all medications.

4. Administers IV fluid and blood products and informs team leader and RN 2 of fluids infused.

5. Maintains Level I Infuser Device when in use or defers to available nurse.

6. Performs any additional nursing assessment after stabilization of patient.

7. Inserts orogastric / nasogastric tube and/or urinary catheter if requested by team leader.

8. Remains with patient as Procedure RN 1 accompanying patient to CT Scan, etc.

9. Gives report to receiving unit and accompanies patient anywhere needed to be transported OR, PICU, Floor, etc.

10. If receiving unit not ready, transports patient to the Pediatric ED once patient stabilized and appropriate CT scans are completed and continues role as Procedure RN 1.

11. Responsible at the beginning of every shift to go over to the Adult Emergency Department to check the presence of any needed supplies/ equipment which may be necessary in trauma resuscitation. (Check list to be developed)

12. In the event where the PEDs ED RN assigned to Pediatric Trauma is unable to perform the role of Pediatric RN1 in a Level I Trauma because of extreme high acuity in the PED, and leaving the PED will jeopardize the care of patients in the PED, the Pediatric ED Charge RN will notify the Adult ED Charge RN at the beginning of his/ her shift, or at least prior to patient arrival to discuss and determine who will have this assigned role if needed. The RN should then report to One West for Level I Trauma alert to assist Adult RN1 with care for a brief period of time until patient stabilized, and lines secured, etc. Patient should still be transferred to the PED once stabilized if patient not going immediately to OR, PICU, or floor. Documentation of the high acuity should be completed by Charge RN, and info sent to RN Manager.

**RN 2 (Recorder)**

1. Responsible for making sure Trauma Team leader is aware of each recorded set of vital signs, fluid intake, and lab results.

2. Completes trauma resuscitation flow sheet.

3. Assists as needed at request of RN 1, and Team Leader with patient care.

4. Responsible for obtaining patient valuables and recording in the nurse's note and securing them with the admission clerk or family member per hospital / emergency department policy. and procedure.
Emergency Department Technician (EDT)
1. Assures that all equipment and supplies for trauma patient care are available, complete, and ready for emergent use including daily and post resuscitation check of oxygen tanks in trauma bay.
2. Starts trauma clock when patient arrives.
3. Attach patient to cardiac monitor, pulse oximetry, and BP monitor and takes temperature.
4. Obtains and sets-up procedure trays.
5. Applies patient identification band. Two identibands are needed if patient goes to the OR.
6. Assist with drawing lab specimens, obtain EKG as directed.
7. Assist team as needed to restrain patient as ordered by Team Leader.
8. Assist with splinting of extremities as requested by team leader.

Airway 1 (Anesthesia attending, Pediatric ED attending/ or Adult Attending, EM Senior resident, or Peds ED Fellow)
1. If requested by Team Leader, performs airway assessment and management including assurance of appropriate and proper airway placement maintains cervical spine precautions until C-spine cleared by team leader. Informs nursing staff of administered medications. Once airway established and secured, leaves bedside.
2. Senior Surgery resident may assume role of ED resident in airway management if agreed to by ED attending (usually as a “trade off” when an EM resident assumes the MD 1 or MD 2 role).
3. If Pediatric ED Attending is not able to assume Airway 1 role he/ she will contact the Adult ED Attending preferably at the beginning of his/ her shift, but at least prior to patient arrival to discuss and determine who will have this assigned role if needed. Pediatric Attending may assume this role and trade off at any time with Adult ED Attending under the direction of the Team Leader. Peds ED Attending or Adult ED Attending should request the “trading off” of roles at anytime necessary to secure the airway of a pediatric patient. Peds ED Attending will be responsible for documentation of any procedures, treatments performed or managed, or medications ordered on progress note.
4. Under direct supervision of the PEDs ED Attending, the PEDs ED Fellow may assume the role of Airway 1 or after he/she has completed the month of Anesthesia AND their month of Trauma

Airway 2 (Anesthesia attending, ED attending, EM resident, Surgery resident, or PEM Fellow)
1. Assists Airway 1 with management of airway (cricoid pressure etc). May assist at the request of Pediatric Respiratory Therapist in securing airway once airway established. Once secured leaves bedside.
2. Junior or Senior Surgery residents may assume role of ED resident in airway management if agreed to by ED attending (usually as a “trade off” when an EM resident assumes the MD 1 or MD 2 role).
3. Under direct supervision of the PEDs ED Attending, the PEDs ED Fellow may assume the role of Airway 2 with Pediatric Patients or after he/she has completed the month of Anesthesia AND their month of Trauma
**Pediatric Respiratory Therapist Supervisor or Respiratory therapist covering Peds ED**
1. Obtain pulse oximetry reading and respiratory rate and quality of breathing.
2. If patient not intubated, supplies oxygen to all patients by mask, unless otherwise directed by Team Leader.
3. Responsible for airway maintenance, i.e., suctioning, securing and periodic assessment.
4. Obtains ABG’s as indicated or ordered.
5. Assists with intubation if no physician available for Airway 2 role.
6. Assesses to assure continued proper placement of airway.
7. Attach patient to End Tidal CO2 monitor when intubated, secure ETT.
8. Insures adequate amount of oxygen and vent equipment available for transport (checks O2 tank on trauma stretcher prior to patient arrival if possible).
9. Accompanies intubated patients to O.R., I.C.U., CT scan, etc. and reconfirms airway position after patient movements completed.
10. Pediatric Respiratory Therapist may request for assistance from Supervisor to assist in the set up of Ventilator while airway is being secured.

**Radiologic Technologist**
1. Assures x-ray equipment available including adequate number of lead aprons and cassettes.
2. Assures radiation protection for other Trauma Team members while taking x-rays
3. Takes x-rays when directed by Trauma Team Leader with consideration of C-spine injury until ruled out.
4. Immediately processes films.

**Charge Nurse**
1. Removes patients and/or family members from Rooms 2, 2a and 3 whenever possible to more private areas to avoid unnecessary exposure to the chaos of the trauma resuscitation.
2. Assists RN 1 and/or RN II if necessary. *Note. Charge nurse should not remain in trauma resuscitation area if not directly involved in patient care*

**II. Outer Core Care Providers**
(Must stay behind red line unless replacing an inner core trauma team member or at direction of trauma team leader)

**Trauma Surgery Attending**
1. Has overall responsibility and authority for trauma resuscitation and is responsible for overseeing all team members to assure compliance with standards and protocols.
2. Assures HIPPAA compliance and patient privacy is maintained.

**Pediatric Surgery Attending**
1. May assume role of Team Leader and overall responsibility for management of patient following consultation with the Trauma Surgery Attending.
2. Role will replace Trauma Surgery Attending if deemed necessary.
Emergency Medicine Attending
1. Initiates trauma alert as per established trauma alert criteria. In the absence of trauma surgery attending, monitors resuscitation for appropriateness and efficiency of care, serving as primary responsible physician. Communicates with trauma attending as needed and determines need for surgery attending presence in the Emergency Department.
2. Assures HIPPAA compliance and patient privacy is maintained

Children’s Hospital Pharmacist
Physicians may consult the Pediatric Standard Concentration Information for drips located on the MUSC Children’s Emergency Department Portal.
1. Assist in the drawing up of emergency medications and preparing drips for Level A Trauma patients
2. Assist as consultant/reference to physicians for dosing of pediatric medications

ASB
1. Assigns patient a pre designated trauma alert packet with number and activates number with registration.
2. Notifies operator of absent Trauma Team member within the Resuscitation Area.
3. Page consultants at request of Trauma Team Leader.
4. Directs all incoming calls to appropriate personnel.

Chaplain
1. Obtain patient identification and assist with notifying family members and relays information to RN 1 or RN 2.
2. Facilitates communication between family, patient, and staff.
3. Support families and child interaction
4. Provide religious and spiritual support to patients, families and staff.
5. Provide grief support.
6. Collaborate with HSC’s, Security, and Guest Relations, to provide information for families and assists with directing them to appropriate areas within the hospital.
7. Remains in trauma admitting area only for as long as necessary to complete roles.

Child Life Specialist
1. Works with chaplain with any assistance they may need with family intervention
2. Supports alert child during procedures and trauma process.
3. Remains in trauma area only for as long as necessary to assess needs and complete roles.

EMS personnel directly involved in patient transport to ED
1. Deliver patient from scene to trauma admitting area.
2. Immediately following patient delivery and movement on to gurney, move behind red line to answer additional questions or leave admitting area to complete required paperwork.

Trauma Student, ED A-Side Student
1. Assists with patient management and documentation as requested by and under direct supervision of trauma surgery attending, trauma team leader and/or Emergency Department attending.
2. In general any additional students beyond one trauma service student and one EM student may observe at the discretion of the trauma surgery attending (or EM attending in absence of trauma surgery attending) as long as their presence does not result in excessive overcrowding of the trauma admitting area or impair trauma team function.
**Trauma Program Manager or Pediatric Trauma Coordinator**
1. Monitors trauma team performance as per ACS guidelines
2. Identifies PI issues for later review.

**Security**
1. Assures staff and patient safety when such concerns exist.
2. Assists with crowd control at request of attending trauma surgeon and/or attending EM physician.
3. Coordinates interactions with involved police agencies.
4. If no issues identified requiring presence in admitting area, will leave trauma admitting area and be available if needed.

**Hospital Supervisor**
1. Identifies and addresses issues in hospital function related to trauma center activities
2. Assists ATC with bed assignment
3. If no issues identified requiring presence in admitting area, will leave trauma admitting area and be available on pager if needed.

**III. OB Trauma alerts:**

**OB Attending Physician and Nurse (paged on OB trauma alert system)**
1. Respond to trauma bay with FHT monitor and OB Ultrasound.
2. After primary assessment and in consultation with team leader will place FHT monitor and perform US to determine fetal age\size.
3. Responsible to remain with mom and maintain FHT monitoring throughout resuscitation.
4. Accompany patient maintaining FHT monitoring to all procedures or radiology examinations within the hospital.
5. OB attending physician determines when FHT monitoring may be interrupted or terminated.

**Neonatal Stabilization Team and Pediatric Emergency Department**
1. Per Adult ED policy the One West PCT will bring the Panda Bed to the Trauma Bay area
2. Pediatric Charge RN will receive OB Trauma alert. Adult ED charge nurse notifies Pediatric ED charge nurse if impending delivery possible.
3. Pediatric charge nurse will notify pediatric attending.
4. Pediatric attending and Pediatric nurse will respond to trauma area and act as first responder in the case a neonate is born until Neonatal Stabilization Team arrives.
5. Neonatal Stabilization Nurse and NICU Charge nurse paged with the OB trauma team will respond and assess the need to page the Neonatal Stabilization Team (infant delivery possible).
6. If Neonatal Stabilization Team paged they will respond with the appropriate equipment to oversee care of the infant.
7. Pediatric Respiratory Supervisor will respond to the OB Trauma alert to assist with establishment of airway and ventilation of the infant.
8. Pediatric Surgery Attending will be notified by Neonatal Stabilization Team if necessary.

**IV. Excluded from resuscitation area**
1. Residents on services not directly involved in trauma patient care
2. Residents/students rotating in Emergency Department but not directly involved in trauma patient care
3. Hospital Volunteers
4. Nursing personnel not directly involved in trauma patient care
5. Attending Physicians not directly involved in trauma patient care
6. EMS personnel not involved in patient transport
7. Others not directly involved in acute care of patient

Revised 6/7/10
Clarification Of Pediatric Trauma Roles In Level A Trauma (One West)

Following a meeting of the Pediatric and Adult Emergency Medicine Group, Pediatric and Adult Trauma Surgeons, ED Nurse Managers, and Trauma Coordinators the following clarification of roles of the Emergency Medicine Attending Physicians during Level A Trauma Alerts in One West was determined on January 6th, 2010.

1. Following the determination that a pediatric patient will be a Level A Trauma Alert in One West, the Adult Emergency Department Attending will serve as the Initial Resuscitation/ Responder, serve as team leader if necessary (*see roles), and serve as the Emergency Department Physician of Record. This will include documenting the initial Emergency Medicine Trauma Note. Their involvement will continue until an official hand off of care occurs, including a conversation with the Pediatric Emergency Medicine Attending and appropriate documentation on the chart. Following this hand off of care the Pediatric Emergency Medicine Attending will assume Emergency Department Care of the patient. The timing of this hand off of official care will be determined on a case by case basis, but will be well communicated to the entire trauma team particularly the procedural RN caring for the patient.

2. The Pediatric Emergency Medicine Attending will respond to all Pediatric Trauma alerts and be available for initial assessment and stabilization of airway if necessary.

2. Any procedures or medications the Pediatric Emergency Medicine Physician Orders during the initial resuscitation will be documented in a procedural note on the chart.

3. Once patient is stabilized and CT Scan complete, patient should be moved to the Pediatric Emergency Department immediately if bed in PICU or Floor status not ready.

*Trauma Team Leader
(Adult Surgery attending, or Pediatric Attending Surgeon) or Adult ED attending until surgery attending arrives, or PGY4 or more senior surgical resident. ED PGY3 can assume role of team leader under direct supervision of the trauma attending surgeon or Pediatric Attending Surgeon when senior surgery resident is unavailable (in the operating room for example) or agrees to trade off that role. EM PG3’s may also participate in discussions regarding patient management with trauma team leader and trauma surgery attending).

Trauma Surgery Attending
1. Has overall responsibility and authority for trauma resuscitation and is responsible for overseeing all team members to assure compliance with standards and protocols.
2. Assures HIPPAA compliance and patient privacy is maintained.

Pediatric Surgery Attending
1. May assume role of Team Leader and overall responsibility for management of patient following consultation with the Trauma Surgery Attending.
2. Role will replace Trauma Surgery Attending if deemed necessary.

6/1/10
**LEVEL B TRAUMA TEAM MEMBER ROLES- PEDIATRIC TRAUMA**

**Information:**
In order to provide optimal care to trauma victims, it is necessary to avoid confusion during patient resuscitations. Therefore, the following protocol will govern the roles and responsibilities of the trauma resuscitation team in order to assure that the resuscitative needs of the trauma victim are met and performed in an orderly manner. The goal is efficient and rapid resuscitation, so that patients will be delivered to definitive care in the least amount of time possible, thereby assuring the best possible outcome.

1. **Inner Core Care Providers**
   **Trauma Team Leader**
   Pediatric Surgery service and/or Pediatric EM Attending will be the first responders for Peds Level 2 traumas sent to Pediatric Emergency Department. Pediatrics Surgical Chief Resident, Adult Trauma on call Chief Resident, PGY4 or more senior surgical resident may act as team leader. ED PGY3 assigned to the Pediatric ED can act as team leader under direct supervision of the Pediatric ED attending, trauma attending surgeon or surgical PGY4/5.

   **Major Responsibility:** Assures proper resuscitation in accordance with ATLS Standards, performs or supervises emergency procedures and directs team members. Also identifies members of the Inner Core Team and confirms their proper positions at the patient’s bedside.
   1. Obtains report from EMS
   2. Identifies team members
   3. Coordinates and communicates to the team the plan of care
   4. Orders appropriate medications per Broslow tape weight estimate
   5. Performs, assists, or directs performance of necessary lifesaving procedures
   6. Contacts appropriate consultants as needed
   7. If the attending surgeon is not present during resuscitation, team leader discusses case with attending surgeon and/or emergency room attending prior to patient leaving trauma resuscitation area
   8. Determines final disposition of patient
   9. Arranges for PICU bed or CH floor bed if necessary and notifies RN 1 of bed location.
   10. Signs emergency resuscitation record prior to patient leaving unit
   11. Completes patient admission note or emergency department physician documentation if patient is discharged or expires in the Emergency Department
   12. Responsible for assuring family notification and discussing patient situation with family as soon as possible after family arrives

   **Pediatric Emergency Medicine Attending**
   **Major responsibilities:** Initiates Trauma II alert as per established guidelines. The PEM attending will be present upon patient arrival for all Trauma II alerts and be responsible for verbally confirming which providers are assuming which role.

   Monitor resuscitation for appropriateness and efficiency of care, serving as primary responsible physician in physical absence of trauma attending from trauma resuscitation area. Communicates with trauma attending as needed and determines need for surgery attending presence in the Pediatric ED

   **MD 1**
   (PGY 2 or more senior surgery resident or PGY 2 or more senior ED resident)
   1. Performs primary survey including GCS and reports finding to the team
   2. Assist with airway if necessary
   3. Performs FAST exam at direction of team leader
   4. Assists or performs procedures at direction of team leader
MD 2
(PGY1 or more senior surgical residents. The EM resident assigned to the ED and resident currently on trauma service will both respond and they will determine who will assist at the bedside)
1. Performs secondary survey
2. Rectal exam
3. Assists or performs procedures at direction of team leader.
4. Responsible for closure of lacerations if team leader states appropriate
5. Assures proper completion of H&P. If ED resident available completes ED history and physical form.
6. Resident on trauma service completes trauma history and physical form
7. Resident on trauma service completes admission orders

RN 1 Pediatric nurse (Procedure)
1. Responsible to ensure Pediatric ED room prepared for patient arrival based on report from EMS
2. Confirms Broslow Tape Weight Estimation
3. Obtains primary peripheral IV access and draws blood work per protocol
4. Responsible to ensure that patient receives all medications. May either obtain and administer or delegate to another available nurse
5. Controls fluids (IV and blood products) and informs RN 2 of fluids infused with each new bag of blood products or crystalloids
6. Maintains Level I Infuser Device when in use or defers to available nurse
7. Performs any additional nursing assessment during and after stabilization and needed procedures are completed
8. Inserts orogastric or nasogastric tube after confirming with team leader which is appropriate
9. Inserts urinary catheter, if not contraindicated
10. Communicates clearly all fluids, blood products, medications, procedures completed to Team Leader and to RN2
11. Prior to patient arrival RN I and RN 2 will determine who will be the primary nurse. The primary nurse will give report to receiving unit and accompanying patient outside the ED.

RN 2 Pediatric Nurse (Recorder)
1. Responsible for making sure Trauma Team leader is aware of each recorded set of vital signs, fluid intake, and lab results
2. Perform documentation of the trauma resuscitation based on patient assessment and procedures performed by the trauma team.
3. Assists as needed at request of RN 1, and Team Leader with vital signs and fluids.
4. Responsible for obtaining patient valuables and recording in the nurse's note and securing them with the admission clerk or family member per hospital / emergency department policy and procedure
5. Documents arrival time of team members and patient

Pediatric Emergency Department Technician (EDT)
1. Attach patient to cardiac monitor, pulse oximetry, and BP monitor and takes temperature.
2. Places Broslow Tape for weight estimation
3. Remove clothing and jewelry and applies warm blankets.
4. Obtains and sets-up procedure trays
5. Applies patient identification band. Two identibands are needed if patient goes to the OR
6. Assists with drawing lab specimens, obtain EKG as directed
7. Assist team as needed to restrain patient as ordered by Team Leader.
8. Assist with splinting of extremities as requested by team leader
9. Assist with patient transport and applies portable monitor
10. Check Oxygen tank daily and after each trauma
**Anesthesia or PED ED Attending**
If requested by team leader performs airway assessment and management including assurance of appropriate and proper airway placement, maintains cervical spine precautions until C-spine cleared when requested by team leader. Informs nursing staff of medications given.

**Respiratory Therapist**
Maintenance of airway and proper ventilator support if directed by Team Leader.
1. Obtain pulse oximetry reading and respiratory rate
2. If patient not intubated, supplies oxygen to all patients by mask, unless otherwise directed by Team Leader
3. Responsible for airway maintenance, i.e., suctioning, securing and periodic assessment
4. Obtains ABG’s as indicated or ordered
5. Assists with intubation
6. Obtains and sets-up vent
7. Attach patient to End Tidal CO2 monitor when intubated
8. Insures adequate amount of oxygen and vent equipment available for transport (checks O2 tank on trauma stretcher prior to patient arrival if possible)
9. Accompanies intubated patients to O.R., I.C.U., CT scan, etc. and reconfirms airway position after patient movements completed

**Radiologic Technologist**
Rapidly and efficiently performs all X-rays as ordered by Trauma Team Leader, develops and immediately makes films available to Team Leader.
1. Assures x-ray equipment available including adequate number of lead aprons and cassettes
2. Assures radiation protection for other Trauma Team members while taking x-rays
3. Takes x-rays as directed by Trauma Team Leader with consideration of C-spine injury until ruled out
4. Immediately develops films

**II. Outer Core Care Providers**

**Pharmacist**
Children’s Hospital Pharmacist should respond if requested by Team Leader or RN1 or RN2 to Level II Pediatric Trauma. (Page using 2-3333)

**ASB**
Assures completion of necessary admission paperwork and handles all incoming and outgoing telephone calls
1. Assigns patient a pre designated trauma alert packet with number and activates number with registration
2. Notifies operator of absent Trauma Team member within the Resuscitation Area.
3. Page consultants at request of Trauma Team Leader (Using 2-3333 pages additional help per request)
4. Directs all incoming calls to appropriate personnel
5. Obtains admitting physicians name from trauma team leader

**Chaplain**
Help with notification of family and assist family members once they arrive at MUSC.
1. Obtain patient identification and assist with notifying family members and relays information to RN 1 or RN 2
2. Facilitates communication between family, patient, and staff.
3. Support families during visitation with patient.
4. Provide religious and spiritual support to patients, families and staff.
5. Provide grief support.
6. Collaborate with HSC’s, Security and Guest Relations, to provide information for families and assists with directing them to appropriate areas within the hospital. (Page using 2-3333)
HSC, Security, Charge Nurse and/or Guest Relations
Maintains crowd control and helps with family members support
PAINFUL PROCEDURES ON PEDIATRIC PATIENTS IN MUSC EMERGENCY DEPARTMENT

POLICIES:

This protocol will allow Pediatric Emergency Medicine, Pediatric Critical Care, Anesthesia, and Emergency Medicine attendings to provide safe and effective conscious sedation to children who must undergo painful procedures in the MUSC ED.

This protocol is for Pediatric Patients in the MUSC ED ONLY.

1. Pediatric conscious sedation may be provided only by attendings from Pediatric Emergency Medicine, Pediatric Critical Care, Anesthesiology, and Emergency Medicine. Attendings must remain in the department with the patients until they are conscious and alert.

2. Patients must remain on cardiac monitoring and pulse oximetry throughout the period of sedation. Suction will be turned on and remain available at the bedside at all times. A specific ED nurse will remain with the patient during this period and will document the patient’s status on the standard conscious sedation sheet according to the MUSC ED protocol. A period of recovery of not less than one hour will occur after administration of medications until the patient is deemed to be fully awake by the attending physician responsible.

3. This protocol will be used for procedures that will take less than 30 minutes. Appropriate procedures include but are not limited to:
   A. Small Burns
   B. Lacerations
   C. Orthopedic Procedures
   D. I & D’s
   E. Lumbar Punctures

4. This protocol is contraindicated for sedation for reasons other than painful procedures including but not limited to:
   A. Major Trauma
   B. Agitation
   C. CT Scan
   D. patients with suspected increased intracranial pressure.

5. Medications used will include:
   A. Ketamine in doses of 1 to 2 mg/kg IV or 4 mg/kg IM
   B. Addition of atropine 0.01 mg/kg or glycopyrrolate 0.005 mg/kg should be considered for anticholinergic effect.
   C. Midazolam 0.05 mg/kg may be added to prophylax against dysphoric reactions.
      These reactions are more common in older children.

IMPLEMENTED:
REVISED:
# PEDIATRIC GLASGOW COMA SCALE

## Eye opening
- Spontaneous: 4
- Opens to speech: 3
- Opens to pain: 2
- No response: 1

## Motor
- Spontaneous/to Command: 6
- Localizes to pain: 5
- Withdraws to pain: 4
- Flexion (decorticate): 3
- Extension (decerebrate): 2
- No response: 1

## Verbal
- Coos, babbles, cries appropriately/oriented: 5
- Irritable, consolable cry/confused, disoriented: 4
- Persistent cry or scream/inappropriate cry or scream: 3
- Inappropriate words: 2
- Grunts, agitated, restless/incomprehensible sounds: 2
- No response: 1
PEDIATRIC TRAUMA SOCIAL WORK CONSULTS

*Weekdays*
1) Inpatient
   - Business Hours
     - Inpatient SWs will screen admitted pts daily to identify and screen trauma and burn pts.
     - Inpatient SWs will complete appropriate assessment, intervention, and education and will document SW intervention in progress notes.
     - If regular assigned SW is out, covering SW will also screen for trauma & burn pts and provide appropriate intervention.
     - Unit RN or Secretary should page assigned SW when Trauma or Burn pt. is admitted/consult is requested.
     - SW will continue to communicate with burn RNs to identify and coordinate pts being admitted for burns
     - ED SW will communicate to inpatient SW any interactions with pts being admitted through the ED during the day.
   - After Hours
     **Follow standard inpatient procedure for contacting SW**
     - If Trauma/Burn pt. is admitted with an urgent SW need, page assigned SW.
     - If a Trauma pt. is admitted without an urgent need but consult is requested, RN/MD should leave a voice message or email for assigned SW (as posted on all Peds Units) or may wait to contact SW during business hours.

2) Emergency Department
   - Business Hours
     - Page ED SW to consult.
   - After Hours
     **Follow standard ED procedure for contacting SW**
     - If trauma pt. presents in ED with an urgent SW need, page on-call ED SW.
     - If trauma pt. presents in ED with non-urgent concerns for SW follow-up, leave a message for assigned ED SW.

*Weekends*
1) For SW consult requests without immediate SW needs:
   - RN or MD should page on-call SW during business hours when SW consults are needed for routine assessment and education.
   - RN or MD should leave a message on Department voicemail (2-9535) to request consults after hours if pt. is admitted after hours without immediate concerns.
   **NOTE:** If pt. is going to be inpatient until regular business hours (Monday) & doesn’t have immediate SW needs, on-call SW may defer consult to assigned SW.

2) For SW consult requests when immediate SW needs are indicated:
   - RN or MD should page on-call SW to assist.

02/21/11
SW INTERVENTION FOR ALCOHOL SCREENING:
1) RN or MD should contact SW for positive CRAFFT, positive Blood Alcohol level, or pt. admission of substance use in order to provide appropriate SW intervention.
2) SW will screen CRAFFT as part of SW assessment to ensure completion.
3) SW intervention will consist of pt. and family education on substance use and community resources available to them. SW will complete appropriate community referrals if pt/pt’s family agree to them.
4) SW will document SW intervention in progress notes.

02/21/11
**TRAUMA PATIENT: ALCOHOL SCREENING GUIDELINE**

Resource if questions: Melanie Stroud, RN or Debbie Kerness, LMSW  August, 2010

**STEP 1** All Pediatric Trauma Alerts Level A and B ages 12 years old and older will have a Blood Alcohol Level drawn with their Trauma Panel Labs in the Emergency Department

**STEP 2**

Screen Process

When patient stabilized registered nurses will screen admitted patients 12 years and up that are Trauma A and Trauma B patients with the CRAFFT tool located on the admission data base

Patients ineligible for further screening include the following:

- Patient is 12 years old or older with severe brain injury, high spinal cord injury or unable to participate due to extent of injury

Patients eligible for further screening/ consultation by social work for further follow-up

- Patient answers yes to any of the CRAFFT screening questions and/ or has a positive blood alcohol level.

**CRAFFT screening tool**

Have you ever ridden in a CAR driven by someone (including yourself) who was “high” or had been using alcohol or drugs?  **Yes or No**

Do you ever use alcohol or drugs to RELAX, feel better about yourself, or to fit in?  **Yes or No**

Do you ever use alcohol/ drugs while you are by yourself ALONE? **Yes or No**

Do you FORGET things you did while using alcohol or drugs?  **Yes or No**

Do your family or FRIENDS ever tell you that you should cut down on your drinking or drug use? **Yes or No**

Have you gotten in TROUBLE while you were using alcohol or drugs? **Yes or No**

*Children’s Hospital Boston, 2009, all rights reserved Reproduced with permission from the Center for Adolescent Substance Abuse Research, CeASAR Children’s Hospital Boston For more information, call 617 355-5433 mail to info@CRAFFT.org or visit www.ceasar.org*

**STEP 3**

If both blood alcohol and screening result negative result, screening process is complete.

If positive (answers yes to any of the CRAFFT questions or if Blood Alcohol screens positive) MD or RN will call for Social Work consult.

- SW will screen CRAFFT as part of SW assessment to ensure completion.
- SW will conduct psycho/social assessment to determine patient needed resources
- SW intervention will consist of patient and family education on substance use and community resources available to them.
- SW will complete appropriate community referrals if patient/patient’s family agree to them.
- SW will document SW intervention in progress notes.
- Any pertinent info social worker will communicate with multidisciplinary team.

Ehrlich, Peter, Maio, Ron, Drongowski, Robert, Wagaman, Mathew, Cunningham, Rebecca, Walton, Maureen. Alcohol Interventions for Trauma Patients are NOT just for Adults: Justification for Brief Interventions for the Injured Adolescent at a Pediatric Trauma Center. *The Journal of Trauma* 69:1, July 2010.
SECTION FOUR: INJURY SCORING/TABLES/EQUATIONS

ABBREVIATED INJURY SCALE/INJURY SEVERITY SCORE/PROBABILITY OF SURVIVAL

ABBREVIATED INJURY SCALE

Another important application of injury severity indices is to compare with varying case mix. Indices based on anatomical information are computed retrospectively. More definite diagnostic information, such as CT scan, X-ray, and surgery or autopsy findings is used.

The Abbreviated Injury Scale (AIS) was originally developed by the American Medical Association Committee on Medical Aspects of Automobile Injury to provide a common language for motor vehicle crash-related injuries. The system was developed by physicians and engineers. The severity grades are based on energy dissipation, threat to life, permanent impairment, treatment period, and incidence. The AIS provides a numerical ranking of the severity of injuries and designates one score for each injury. Unlike a physiologic severity index, the AIS will not change as the patient status improves or deteriorates. The AIS does not account for the impact of multiple organ injuries.

Since its original publication in 1971, the AIS has undergone multiple revisions, the most recent in 1990. The Abbreviated Injury Scale dictionary contains injury descriptors including those for pediatric injury and brain injury. The AIS 90 dictionary contains more than 2,000 injury descriptors in terminology compatible with current language. A scale of 1 through 6 is used to describe the severity of each injury descriptor. The levels of severity are 1) minor 2) moderate 3) serious 4) severe 5) critical and 6) maximum.

INJURY SEVERITY SCORE

The Injury Severity Score (ISS) was developed to describe the multiply injured patient. The ISS, based on the AIS injury descriptors, describe the overall severity in persons who have injured more than one body region. The sum of the squares of the highest AIS grade in each of the three most severely injured body regions is equal to the ISS. As an example, a person with a basilar skull fracture (HEAD; AIS=3), a hemothorax (CHEST; AIS=3), and a minor liver laceration (ABDOMEN =2) would have an ISS of 22 (9+9+4=22). ISS scores range from 1 to 75; with them higher the score, the more severely injured the patient. An ISS of 15 or greater is the most universally accepted definition of major trauma patient.


TRISS

Using the TRISS methodology, the probability of survival for any one patient can be estimated from the following formula

\[ P_s = \frac{1}{1 + e^{-b}} \]

where \( b = b_0 + b_1 \text{ (RTS)} + b_2 \text{ (ISS)} + b_3 \text{ (A)} \)

\( b_0 \) to \( b_3 \) are coefficients derived from Walker-Duncan regression analysis applied to data from thousands of patients analyzed in the Major Trauma Outcome Study (see Table IV). As improvements in trauma care over time result in decreased mortality, these MTOS coefficients can be expected to change. \( A \) is the symbol for age. If the patient’s age if 54 years or less, \( A \) is equal to 0. \( A \) is equal to 1 if the patient is 55 or more years of age. The constant \( e \) is equal to 2.718282 (the base of Napierian logarithms). The revised trauma score used in this calculation is a weighted score where weighted RTS = 0.9368 (GCS points) + 0.7376 (Sys BP points) + 0.7376 (Resp. Rate points)

Example: A 40-year old patient involved in blunt trauma

\[
\begin{align*}
\text{RTS} &= 6.52 \\
\text{ISS} &= 45 \\
\text{Ps} &= \frac{1}{1 + e^{-b}} \\
b &= b_0 + b_1 \text{ (RTS)} + b_2 \text{ (ISS)} + b_3 \text{ (A)} \\
b &= (-1.6465) + (0.5175)(6.52) \\
&\quad +(-0.0739)(45)+(-1.9261)(0) \\
b &= -1.6465 + 3.3741 - 3.3225 + 0 \\
b &= -1.5949 \\
\text{Ps} &= \frac{1}{1 + 2.718282^{1.5949}} \\
\text{Ps} &= \frac{1}{1 + 4.9278} \\
\text{Ps} &= 0.1687
\end{align*}
\]

Therefore this patient’s probability of survival is 0.1687 or 17%

---

**TABLE IV**

<table>
<thead>
<tr>
<th></th>
<th>( b_0 )</th>
<th>( b_1 )</th>
<th>( b_2 )</th>
<th>( b_3 )</th>
</tr>
</thead>
<tbody>
<tr>
<td>Blunt</td>
<td>-1.6465</td>
<td>0.5175</td>
<td>-0.0739</td>
<td>-1.9261</td>
</tr>
<tr>
<td>Penetrating</td>
<td>-0.8068</td>
<td>0.5442</td>
<td>-0.1159</td>
<td>-2.4782</td>
</tr>
</tbody>
</table>

Pediatric patients are scored using the coefficients for blunt trauma, irrespective of injury mode.
# Revised Trauma Score

**Systolic Blood Pressure (mmHg)**

<table>
<thead>
<tr>
<th>Blood Pressure</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>&gt; 89</td>
<td>4</td>
</tr>
<tr>
<td>76-89</td>
<td>3</td>
</tr>
<tr>
<td>50-75</td>
<td>2</td>
</tr>
<tr>
<td>1-49</td>
<td>1</td>
</tr>
<tr>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

**Respiratory Rate (spontaneous inspirations/minute)***

<table>
<thead>
<tr>
<th>Respiratory Rate</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>10-29</td>
<td>4</td>
</tr>
<tr>
<td>&gt;29</td>
<td>3</td>
</tr>
<tr>
<td>6-9</td>
<td>2</td>
</tr>
<tr>
<td>1-5</td>
<td>1</td>
</tr>
<tr>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

**Glasgow Coma Scale Score**

<table>
<thead>
<tr>
<th>Score</th>
<th>Score</th>
</tr>
</thead>
<tbody>
<tr>
<td>13-15</td>
<td>4</td>
</tr>
<tr>
<td>9-12</td>
<td>3</td>
</tr>
<tr>
<td>6-8</td>
<td>2</td>
</tr>
<tr>
<td>4-5</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>0</td>
</tr>
</tbody>
</table>

**Total Possible Points** 0-12
Glasgow Coma Scale

**Eye opening**
- Eyes open spontaneously     4
- Eyes open in response to voice    3
- Eyes open in response to pain    2
- No eye opening response     1

**Best Verbal Response**
- Oriented (e.g., to person, place, time)   5
- Confused, speaks but is disoriented       4
- Inappropriate, but comprehensible words  3
- Incomprehensible sounds but no words are spoken  2
- None               1

**Best Motor Response**
- Obeys command to move       6
- Localizes painful stimulus    5
- Withdraws from painful stimulus 4
- Flexion, abnormal decorticate posturing  3
- Extension, abnormal decerebrate posturing  2
- No movement or posturing     1

Total Possible Points              3-15

Major Head Injury       <8
Moderate Head Injury      9-12
Minor Head Injury         13-15
SENSORY EXAM DERMATONES/PERIPHERAL NERVE (ANTERIOR)

An anterior view of dermatomes (left) and cutaneous areas supplied by individual peripheral nerves (right).

Modified from MB Carpenter and J Sutin, in Human Neuroanatomy, 8th ed, Baltimore, Williams & Wilkins, 1983.)
Section Four: Injury Scoring/Tables/Equations

Sensory Exam Dermatomes/Peripheral Nerve (Posterior)

Diagram showing dermatomes and cutaneous areas supplied by individual peripheral nerves (left) and cutaneous areas supplied by individual peripheral nerves (right).

Modified from MB Carpenter and J Sutin, In Human Neuroanatomy, 8th ed, Baltimore, Williams & Wilkins, 1983.)
### MEASURED HEMODYNAMIC PARAMETERS

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Normal Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Arterial Blood Pressure (Systolic-SBP)</td>
<td>90-140 mm Hg</td>
</tr>
<tr>
<td>(Diastolic-DBP)</td>
<td>60-90 mm Hg</td>
</tr>
<tr>
<td>Right Atrial Pressure (CVP or RAP)</td>
<td>2-6 mm Hg</td>
</tr>
<tr>
<td>Right Ventricular Pressure (Systolic)</td>
<td>15-25 mm Hg</td>
</tr>
<tr>
<td>(Diastolic)</td>
<td>0-8 mm Hg</td>
</tr>
<tr>
<td>Pulmonary Artery Pressure (PAP) (Systolic-PASP)</td>
<td>15-25 mm Hg</td>
</tr>
<tr>
<td>(Diastolic-PADP)</td>
<td>8-15 mm Hg</td>
</tr>
<tr>
<td>Pulmonary Artery Wedge Pressure (PCWP) (Estimate of Left Ventricular End Diastolic Pressure)</td>
<td>6-12 mm Hg</td>
</tr>
<tr>
<td>Left Atrial Pressure (LAP)</td>
<td>6-12 mm Hg</td>
</tr>
<tr>
<td>Cardiac Output (CO)</td>
<td>4.0-8.0 L/min</td>
</tr>
<tr>
<td>Ejection Fraction (EF)</td>
<td>&gt; 60%</td>
</tr>
</tbody>
</table>

### Calculated Hemodynamic Parameters

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Equation</th>
<th>Normal Value</th>
</tr>
</thead>
</table>
| Mean Arterial Pressure (MAP)                  | \[
\text{[SBP} + (2 \times \text{DBP})]/3\]     | 70-105 mm Hg          |
| Mean Pulmonary Artery Pressure                | \[
\text{[PASP} + (2 \times \text{PADP})]/3\]   | 10-20 mm Hg           |
| Cardiac Output (CO)                           | \[
\text{HR} \times \text{SV}/1000\]            | 4.0-8.0 L/min         |
| (SV=Stroke Volume)                            |                                               |                       |
| Cardiac Index                                 | \[
\text{CO}/\text{BSA}\]                        | 2.5-4.0 L/min         |
| (BSA = Body Surface Area)                     |                                               |                       |
| Stroke Volume (SV)                            | \[
\text{CO}/\text{HR} \times 1000\]            | 60-100 ml/beat        |
| Stroke Volume Index (SVI)                     | \[
\text{Cl}/\text{HR} \times 1000\]            | 33-47 ml/m²/beat      |
| Systemic Vascular Resistance (SVR)            | \[
80 \times (\text{MAP} - \text{RAP})/\text{CO}\] | 800-1200 dynes.sec/cm^5 |
| Systemic Vascular Resistance Index (SVRI)     | \[
80 \times (\text{MAP} - \text{RAP})/\text{Cl}\] | 1970-2390 dynes.sec/cm^5/m² |
| Pulmonary Vascular Resistance (PVR)           | \[
80 \times (\text{MPAP} - \text{PAWP})/\text{CO}\] | <250 dynes.sec/cm^5 |
| Pulmonary Vascular Resistance Index (PVR)     | \[
80 \times (\text{MPAP} - \text{PAWP})/\text{Cl}\] | 255-285 dynes.sec/cm^5/m² |
| Left Ventricular Stroke Work (LVSW)           | \[
\text{SV} \times (\text{MAP} - \text{PAWP}) \times 0.0136\] | 58-104 gm-m/beat     |
| Left Ventricular Stroke Work Index (LVSWI)    | \[
\text{SVI} \times (\text{MAP} - \text{PAWP}) \times 0.0136\] | 50-62 gm-m/m²/beat   |
| Right Ventricular Stroke Work (RVSW)          | \[
\text{SV} \times (\text{MPAP} - \text{RAP}) \times 0.0136\] | 8-16 gm-m/beat       |
| Right Ventricular Stroke Work Index (RVSWI)   | \[
\text{SVI} \times (\text{MPAP} - \text{RAP}) \times 0.0136\] | 5-10 gm-m/m²/beat    |
| Coronary Artery Perfusion Pressure (CAPP)      | \[
\text{DBP} - \text{PAWP}\]                  | 60-80 mm Hg           |
| Right Ventricular End Diastolic Volume (RVEDV) | \[
\text{SV}/\text{EF}\]                       | 100-160 ml            |
| Right ventricular End Systolic Volume (RVESV)  | \[
\text{EDV} - \text{SV}\]                    | 50-100 ml             |
| Right Ventricular Ejection Fraction (RVEF)     | \[
\text{SV}/\text{EDV}\]                      | 40-60%                |
### Section Four: Injury Scoring/Tables/Equations

#### Gas Exchange Parameters (Adult)

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Equation</th>
<th>Normal Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>$P_{a}O_{2}$ (Room Air)</td>
<td></td>
<td>80-100 mm Hg</td>
</tr>
<tr>
<td>$P_{a}CO_{2}$</td>
<td></td>
<td>35-45 mm Hg</td>
</tr>
<tr>
<td>$HCO_{3}$</td>
<td></td>
<td>22-28 mEq/L</td>
</tr>
<tr>
<td>$pH$</td>
<td></td>
<td>7.38-7.42</td>
</tr>
<tr>
<td>Arterial Oxygen Saturation</td>
<td>$(S_{a}O_{2})$</td>
<td>.95-1.0 (95-100%)</td>
</tr>
<tr>
<td>Mixed Venous Oxygen Saturation</td>
<td>$(S_{v}O_{2})$</td>
<td>.60-.80 (60-80%)</td>
</tr>
<tr>
<td>Arterial Oxygen Content ($C_{a}O_{2}$)</td>
<td>$(1.38 \times Hb \times S_{a}O_{2}) + .0031 \times P_{a}O_{2}$</td>
<td>17-20 ml/dl</td>
</tr>
<tr>
<td>Mixed Venous O2 Content ($C_{v}O_{2}$)</td>
<td>$(1.38 \times Hb \times S_{v}O_{2}) + .0031 \times P_{a}O_{2}$</td>
<td>12-15 ml/dl</td>
</tr>
<tr>
<td>A-V O2 Content Difference ($C_{(a-v)}O_{2}$)</td>
<td>$C_{a}O_{2} - C_{v}O_{2}$</td>
<td>4-6 ml/dl</td>
</tr>
<tr>
<td>Oxygen Delivery (DO$_2$)</td>
<td>$C_{a}O_{2} \times CO \times 10$</td>
<td>950-1150 ml/min</td>
</tr>
<tr>
<td>Oxygen Delivery Index (DO$_2$I)</td>
<td>$C_{a}O_{2} \times CI \times 10$</td>
<td>500-600 ml/min/m$^2$</td>
</tr>
<tr>
<td>Oxygen Consumption (VO$_2$)</td>
<td>$(C_{(a-v)}O_{2}) \times CO \times 10$</td>
<td>200-250 ml/min</td>
</tr>
<tr>
<td>Oxygen Consumption Index (VO$_2$I)</td>
<td>$(C_{(a-v)}O_{2}) \times CI \times 10$</td>
<td>120-160 ml/min/m$^2$</td>
</tr>
<tr>
<td>Oxygen Extraction Ratio (O2ER)</td>
<td>$[(C_{a}O_{2}-C_{v}O_{2})/C_{a}O_{2}] \times 100$</td>
<td>22-30%</td>
</tr>
<tr>
<td>Oxygen Extraction Index (O2EI)</td>
<td>$(S_{a}O_{2}-S_{v}O_{2})/S_{a}O_{2} \times 100$</td>
<td>20-25%</td>
</tr>
</tbody>
</table>

#### Other Useful Values

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Equation</th>
<th>Normal Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Static Pulmonary Compliance</td>
<td>$V_T/(\text{Plateau Pressure-PEEP})$</td>
<td>Approx. 10 mm Hg</td>
</tr>
<tr>
<td>Dynamic Pulmonary Compliance</td>
<td>$V_T/(\text{PIP-PEEP})$</td>
<td></td>
</tr>
<tr>
<td>Intra-cranial Pressure (ICP)</td>
<td>MAP-ICP</td>
<td></td>
</tr>
<tr>
<td>Cerebral Perfusion Pressure</td>
<td>Normal</td>
<td>Approx. 80 mm Hg</td>
</tr>
<tr>
<td></td>
<td>Therapeutic Goal</td>
<td>&gt;70 mm Hg</td>
</tr>
<tr>
<td>Urine Output</td>
<td></td>
<td>.5-1 cc/kg/hr</td>
</tr>
</tbody>
</table>

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### Section Four: Injury Scoring/Tables/Equations
The Organ Injury Scaling Committee of the American Association for the Surgery of Trauma was organized in 1987 for the purpose of devising injury severity scores for individual organs to facilitate clinical investigation and outcome research. It is a classification scheme based on the anatomical disruption of an individual organ scaled 1 to 6 representing the least to most severe.

References


Pancreatic Organ Injury Scale

<table>
<thead>
<tr>
<th>Grade*</th>
<th>Injury Type</th>
<th>Injury Description **</th>
<th>ICD-9</th>
<th>AIS-85</th>
<th>AIS-90</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Hematoma</td>
<td>Minor contusion without duct injury</td>
<td>863.81-863.84</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Laceration</td>
<td>Superficial laceration without duct injury</td>
<td>863.81-863.84</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>II</td>
<td>Hematoma</td>
<td>Major contusion without duct injury or tissue loss</td>
<td>863.81-863.84</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Laceration</td>
<td>Major laceration without duct injury or tissue loss</td>
<td>863.81-863.84</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>III</td>
<td>Laceration</td>
<td>Distal transection or parenchymal injury with duct injury</td>
<td>863.92-863.94</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>IV</td>
<td>Laceration</td>
<td>Proximal* transection or parenchymal injury involving ampulla</td>
<td>863.91</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>V</td>
<td>Laceration</td>
<td>Massive disruption of pancreatic head</td>
<td>863.91</td>
<td>5</td>
<td>4</td>
</tr>
</tbody>
</table>

* Proximal pancreas is to the patient's right of the superior mesenteric vein.
* Advance one grade for multiple injuries to the same organ.
** Based on most accurate assessment at autopsy, operation, or radiologic study.
### Duodenum Organ Injury Scale

<table>
<thead>
<tr>
<th>Grade</th>
<th>Injury Description</th>
<th>ICD-9</th>
<th>AIS-85</th>
<th>AIS-90</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Hematoma</td>
<td>863.21</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Laceration</td>
<td>863.21</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td>II</td>
<td>Hematoma</td>
<td>963.21</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Laceration</td>
<td>863.31</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>III</td>
<td>Laceration</td>
<td>863.31</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Laceration</td>
<td>863.31</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>IV</td>
<td>Laceration</td>
<td>863.31</td>
<td>4</td>
<td>5</td>
</tr>
<tr>
<td>V</td>
<td>Laceration</td>
<td>863.31</td>
<td>5</td>
<td>5</td>
</tr>
</tbody>
</table>

*Advance one grade for multiple penetrating wounds to a single chamber or multiple chamber involvement.

**Based on most accurate assessment at autopsy, laparotomy, or radiologic study.

D1 = 1st portion duodenum; D2 = 2nd portion duodenum; D3 = 3rd portion duodenum; D4 = 4th portion duodenum.

### Small Bowel Organ Injury Scale

<table>
<thead>
<tr>
<th>Grade</th>
<th>Injury Description</th>
<th>ICD-9</th>
<th>AIS-85</th>
<th>AIS-90</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Hematoma</td>
<td>863.2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Laceration</td>
<td>863.2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>II</td>
<td>Laceration</td>
<td>863.3</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>III</td>
<td>Laceration</td>
<td>863.3</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>IV</td>
<td>Laceration</td>
<td>863.3</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>V</td>
<td>Laceration</td>
<td>863.3</td>
<td>4</td>
<td>4</td>
</tr>
</tbody>
</table>

*Advance one grade for multiple injuries to the same organ.

**Based on the most accurate assessment at autopsy, laparotomy, or radiologic study.

### Colon Organ Injury Scale

<table>
<thead>
<tr>
<th>Grade</th>
<th>Injury Description</th>
<th>ICD-9</th>
<th>AIS-85</th>
<th>AIS-90</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Hematoma</td>
<td>863.40-863.44</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Laceration</td>
<td>863.40-863.44</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>II</td>
<td>Laceration</td>
<td>863.50-863.54</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>III</td>
<td>Laceration</td>
<td>863.50-863.54</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>IV</td>
<td>Laceration</td>
<td>863.50-863.54</td>
<td>5</td>
<td>4</td>
</tr>
<tr>
<td>V</td>
<td>Laceration</td>
<td>863.50-863.54</td>
<td>5</td>
<td>4</td>
</tr>
</tbody>
</table>

*.41, .51 = Ascending; .42, .52 = Transverse; .43, .53 = Descending; .44, .54 = Rectum

*Advance one grade for multiple injuries to the same organ.

**Based on the most accurate assessment at autopsy, laparotomy, or radiologic study.

### Rectal Organ Injury Scale

<table>
<thead>
<tr>
<th>Grade</th>
<th>Injury Description</th>
<th>ICD-9</th>
<th>AIS-85</th>
<th>AIS-90</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Hematoma</td>
<td>863.45</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Laceration</td>
<td>863.45</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td>II</td>
<td>Laceration</td>
<td>863.55</td>
<td>4</td>
<td>3</td>
</tr>
<tr>
<td>III</td>
<td>Laceration</td>
<td>863.55</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>IV</td>
<td>Laceration</td>
<td>863.55</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>V</td>
<td>Vascular</td>
<td>863.55</td>
<td>5</td>
<td>5</td>
</tr>
</tbody>
</table>

*Advance one grade for multiple injuries to the same organ.

**Based on the most accurate assessment at autopsy, laparotomy, or radiologic study.
### Chest Wall Organ Injury Scale **

<table>
<thead>
<tr>
<th>Grade</th>
<th>Injury Type</th>
<th>Injury Description</th>
<th>ICD-9</th>
<th>AIS-85</th>
<th>AIS-90</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Contusion</td>
<td>Any size</td>
<td>911.00/922.10</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Laceration</td>
<td>Skin and subcutaneous</td>
<td>875.0</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Fracture</td>
<td>&lt;3 ribs, closed</td>
<td>807.01/807.02</td>
<td>1</td>
<td>1-2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Nondisplaced clavicle, closed</td>
<td>810.00-810.03</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Nondisplaced clavicle, closed</td>
<td>810.00-810.03</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>II</td>
<td>Laceration</td>
<td>Skin, subcutaneous and muscle</td>
<td>875.1</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>Fracture</td>
<td>&gt;3 adjacent ribs, closed</td>
<td>807.03-807.09</td>
<td>2</td>
<td>2-3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Open or displaced clavicle</td>
<td>810.10-810.13</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Nondisplaced sternum, closed</td>
<td>807.2</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Scapular body, open or closed</td>
<td>811.00-811.19</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>III</td>
<td>Laceration</td>
<td>Full thickness including pleural penetration</td>
<td>862.29</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Fracture</td>
<td>Open or displaced sternum; flail sternum</td>
<td>807.2/807.3</td>
<td>3</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Unilateral flail segment, (&lt;3 ribs)</td>
<td>807.4</td>
<td>4</td>
<td>3-4</td>
</tr>
<tr>
<td>IV</td>
<td>Laceration</td>
<td>Avulsion of chest wall tissues with underlying rib fractures</td>
<td>807.10-807.19</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Fracture</td>
<td>Unilateral flail chest (&gt;3 ribs)</td>
<td>807.4</td>
<td>4</td>
<td>3-4</td>
</tr>
<tr>
<td>V</td>
<td>Fracture</td>
<td>Bilateral flail chest; (&gt;3 ribs on both sides)</td>
<td>807.4</td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>

* Upgrade by one grade for bilateral injuries

** This scale is confined to the chest wall alone and does not reflect associated internal thoracic or abdominal injuries. Therefore, further delineation of the upper versus lower and anterior versus posterior chest wall was not considered, and a grade VI was not warranted. Specifically, thoracic crush was not used as a descriptive term; instead, the geography and extent of fractures and soft tissue injury were used to define the grade.
### Abdominal Vascular Organ Injury Scale

<table>
<thead>
<tr>
<th>Grade *</th>
<th>Injury Description</th>
<th>ICD-9</th>
<th>AIS-85</th>
<th>AIS-90</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Non-named superior mesenteric artery or superior mesenteric vein branches</td>
<td>902.20/902.39</td>
<td>NS</td>
<td>NS</td>
</tr>
<tr>
<td></td>
<td>Non-named inferior mesenteric artery or inferior mesenteric vein branches</td>
<td>902.27/902.32</td>
<td>NS</td>
<td>NS</td>
</tr>
<tr>
<td></td>
<td>Phrenic artery/vein</td>
<td>902.89</td>
<td>NS</td>
<td>NS</td>
</tr>
<tr>
<td></td>
<td>Lumbar artery/vein</td>
<td>902.89</td>
<td>NS</td>
<td>NS</td>
</tr>
<tr>
<td></td>
<td>Gonadal artery/vein</td>
<td>902.89</td>
<td>NS</td>
<td>NS</td>
</tr>
<tr>
<td></td>
<td>Ovarian artery/vein</td>
<td>902.81/902.82</td>
<td>NS</td>
<td>NS</td>
</tr>
<tr>
<td></td>
<td>Other non-named small arterial or venous structures requiring ligation</td>
<td>902.90</td>
<td>NS</td>
<td>NS</td>
</tr>
<tr>
<td>II</td>
<td>Right, left or common hepatic artery</td>
<td>902.22</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Splenic artery/vein</td>
<td>902.23/902.34</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Right or left gastric arteries</td>
<td>902.21</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Gastrroduodenal artery</td>
<td>902.24</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Inferior mesenteric artery, trunk or inferior mesenteric vein, trunk</td>
<td>902.27/902.32</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Primary named branches of mesenteric artery (i.e., ileocolic artery) or mesenteric vein</td>
<td>902.26/902.31</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Other named abdominal vessels requiring ligation/repair</td>
<td>902.89</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>III</td>
<td>Superior mesenteric vein, trunk</td>
<td>902.31</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Renal artery/vein</td>
<td>902.41/902.42</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Iliac artery/vein</td>
<td>902.53/902.54</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Hypogastric artery/vein</td>
<td>902.51/902.52</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Vena cava, infra-renal</td>
<td>902.1</td>
<td>3</td>
<td></td>
</tr>
<tr>
<td>IV</td>
<td>Superior mesenteric artery, trunk</td>
<td>902.25</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Celiac axis proper</td>
<td>902.24</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Vena cava, suprarenal and infra-hepatic</td>
<td>902.1</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Aorta, infra-renal</td>
<td>902.00</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>V</td>
<td>Portal vein</td>
<td>902.33</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Extra-parenchymal hepatic vein</td>
<td>902.11</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>liver vein</td>
<td></td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Vena cava, retrohepatic or supra-hepatic</td>
<td>902.19</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Aorta, suprarenal, subdiaphragmatic</td>
<td>902.00</td>
<td>4</td>
<td>4</td>
</tr>
</tbody>
</table>

This classification system is applicable for extraparenchymal vascular injuries. If the vessel injury is within 2 cm of the organ parenchyma, refer to the specific organ injury scale.

* Increase one grade for multiple grade III or IV injuries involving >50% vessel circumference. Downgrade one grade if <25% vessel circumference laceration for grades IV or V.

### Ureter Organ Injury Scale

<table>
<thead>
<tr>
<th>Grade *</th>
<th>Injury Description</th>
<th>ICD-9</th>
<th>AIS-85</th>
<th>AIS-90</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Hematoma Contusion or hematoma without devascularization</td>
<td>867.2/867.3</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>II</td>
<td>Laceration &lt;50% transection</td>
<td>867.2/867.3</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>III</td>
<td>Laceration &gt;50% transection</td>
<td>867.2/867.3</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>IV</td>
<td>Laceration Complete transection with 2 cm devascularization</td>
<td>867.2/867.3</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>V</td>
<td>Laceration Avulsion with &gt; 2 cm of devascularization</td>
<td>867.2/867.3</td>
<td>3</td>
<td>3</td>
</tr>
</tbody>
</table>

* Advance one grade if multiple lesions exist.
### Bladder Organ Injury Scale

<table>
<thead>
<tr>
<th>Grade</th>
<th>Injury Description</th>
<th>ICD-9</th>
<th>AIS-85</th>
<th>AIS-90</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Hematoma Contusion, intramural hematoma</td>
<td>867.0/867.1</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Laceration Partial thickness</td>
<td></td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>II</td>
<td>Laceration Extraeritoneal bladder wall laceration &lt; 2cm</td>
<td>867.0/867.1</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>III</td>
<td>Laceration Extraperitoneal (&gt;2 cm) or intraperitoneal (&lt;2 cm) bladder wall lacerations</td>
<td>867.0/867.1</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>IV</td>
<td>Laceration Intrapertoneal bladder wall laceration &gt; 2cm</td>
<td>867.0/867.1</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>V</td>
<td>Laceration Intra or extraperitoneal bladder wall laceration extending into the bladder neck or ureteral orifice (trigone)</td>
<td>863.50-863.54</td>
<td>5</td>
<td>4</td>
</tr>
</tbody>
</table>

* Advance one grade if multiple lesions exist.

### Urethra Organ Injury Scale

<table>
<thead>
<tr>
<th>Grade</th>
<th>Injury Description</th>
<th>ICD-9</th>
<th>AIS-85</th>
<th>AIS-90</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Contusion Blood at urethral meatus; urethrography normal</td>
<td>867.0/867.1</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>II</td>
<td>Stretch injury Elongation of urethra without extravasation on urethrography</td>
<td>867.0/867.1</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>III</td>
<td>Partial disruption Extravasation of urethrography contrast at injury site with contrast visualized in the bladder</td>
<td>867.0/867.1</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>IV</td>
<td>Complete disruption Extravasation of urethrography contrast at injury site without visualization in the bladder; &lt;2 cm of urethral separation</td>
<td>867.0/867.1</td>
<td>3</td>
<td>3</td>
</tr>
<tr>
<td>V</td>
<td>Complete disruption Complete transection with &gt;2 cm urethral separation, or extension into the prostate or vagina</td>
<td>867.0/867.1</td>
<td>4</td>
<td>4</td>
</tr>
</tbody>
</table>

* Advance one grade if multiple injuries exist.

### Extrahepatic Biliary Tree Injury Scale

<table>
<thead>
<tr>
<th>Grade</th>
<th>Injury Description</th>
<th>ICD-9</th>
<th>AIS-90</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Gallbladder contusion</td>
<td>868.02</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Portal triad contusion</td>
<td>868.02</td>
<td>2</td>
</tr>
<tr>
<td>II</td>
<td>Partial gallbladder avulsion from liver bed; cystic duct intact</td>
<td>868.02</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Laceration or perforation of the gallbladder</td>
<td>868.12</td>
<td>2</td>
</tr>
<tr>
<td>III</td>
<td>Complete gallbladder avulsion from liver bed</td>
<td>868.02</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Cystic duct laceration /transection</td>
<td>868.12</td>
<td>3</td>
</tr>
<tr>
<td>IV</td>
<td>Partial or complete right hepatic duct laceration</td>
<td>868.12</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Partial or complete left hepatic duct laceration</td>
<td>868.12</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Partial common hepatic duct laceration (&lt;50%)</td>
<td>868.12</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Partial common bile duct laceration (&lt;50%)</td>
<td>868.12</td>
<td>3</td>
</tr>
<tr>
<td>V</td>
<td>&gt; 50% Transection of common hepatic duct injuries</td>
<td>868.12</td>
<td>3-4</td>
</tr>
<tr>
<td></td>
<td>&gt; 50% Transection of common bile duct injuries</td>
<td>868.12</td>
<td>3-4</td>
</tr>
<tr>
<td></td>
<td>Combined right and left hepatic duct injuries</td>
<td>868.12</td>
<td>3-4</td>
</tr>
<tr>
<td></td>
<td>Intraduodenal or intrapancreatic bile duct injuries</td>
<td>868.12</td>
<td>3-4</td>
</tr>
</tbody>
</table>

* Advance one grade for multiple injuries up to grade III.

### Esophagus Injury Scale

<table>
<thead>
<tr>
<th>Grade</th>
<th>Injury Description</th>
<th>ICD-9</th>
<th>AIS-90</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Contusion/hematoma</td>
<td>862.22/.32</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Partial thickness laceration</td>
<td>862.22/.32</td>
<td>3</td>
</tr>
<tr>
<td>II</td>
<td>Laceration &lt; 50% circumference</td>
<td>862.22/.32</td>
<td>4</td>
</tr>
<tr>
<td>III</td>
<td>Laceration &gt; 50% circumference</td>
<td>862.22/.32</td>
<td>4</td>
</tr>
<tr>
<td>IV</td>
<td>Segmental loss or devascularization &lt; 2 cm</td>
<td>862.22/.32</td>
<td>5</td>
</tr>
<tr>
<td>V</td>
<td>Segmental loss or devascularization &gt; 2 cm</td>
<td>862.22/.32</td>
<td>5</td>
</tr>
</tbody>
</table>

* Advance one grade for multiple lesions up to grade III.
**Stomach Injury Scale**

<table>
<thead>
<tr>
<th>Grade*</th>
<th>Injury Description</th>
<th>ICD-9</th>
<th>AIS-90</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Contusion/hematoma</td>
<td>863.01</td>
<td>2</td>
</tr>
<tr>
<td>II</td>
<td>Partial thickness laceration</td>
<td>863.01</td>
<td>2</td>
</tr>
<tr>
<td>II</td>
<td>Laceration &lt; 2 cm in GE junction or pylorus</td>
<td>863.01</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>&lt; 5 cm in proximal 1/3 stomach</td>
<td>863.01</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>&lt; 10 cm in distal 2/3 stomach</td>
<td>863.01</td>
<td>3</td>
</tr>
<tr>
<td>III</td>
<td>Laceration &gt; 2 cm in GE junction or pylorus</td>
<td>863.01</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>&gt; 5 cm in proximal 1/3 stomach</td>
<td>863.01</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>&gt; 10 cm in distal 2/3 stomach</td>
<td>863.01</td>
<td>3</td>
</tr>
<tr>
<td>IV</td>
<td>Tissue loss or devascularization &lt; 2/3 stomach</td>
<td>863.01</td>
<td>4</td>
</tr>
<tr>
<td>V</td>
<td>Tissue loss or devascularization &gt; 2/3 stomach</td>
<td>863.01</td>
<td>4</td>
</tr>
</tbody>
</table>

* Advance one grade for multiple lesions up to grade III.

**Vulva Injury Scale**

<table>
<thead>
<tr>
<th>Grade*</th>
<th>Injury Description</th>
<th>ICD-9</th>
<th>AIS-90</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Contusion/hematoma</td>
<td>922.4</td>
<td>1</td>
</tr>
<tr>
<td>II</td>
<td>Laceration - superficial (skin only)</td>
<td>878.4</td>
<td>1</td>
</tr>
<tr>
<td>III</td>
<td>Laceration - deep (into fat/muscle)</td>
<td>878.4</td>
<td>2</td>
</tr>
<tr>
<td>IV</td>
<td>Avulsion - skin/fat/muscle</td>
<td>878.5</td>
<td>3</td>
</tr>
<tr>
<td>V</td>
<td>Injury into adjacent organs (anus/rectum/urethra/bladder)</td>
<td>878.5</td>
<td>3</td>
</tr>
</tbody>
</table>

* Advance one grade for multiple injuries up to grade III.

**Vagina Injury Scale**

<table>
<thead>
<tr>
<th>Grade*</th>
<th>Injury Description</th>
<th>ICD-9</th>
<th>AIS-90</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Contusion/hematoma</td>
<td>922.4</td>
<td>1</td>
</tr>
<tr>
<td>II</td>
<td>Laceration - superficial (mucosa only)</td>
<td>878.6</td>
<td>1</td>
</tr>
<tr>
<td>III</td>
<td>Laceration - deep in fat/muscle</td>
<td>878.6</td>
<td>2</td>
</tr>
<tr>
<td>IV</td>
<td>Laceration - complex, into cervix or peritoneum</td>
<td>878.7</td>
<td>3</td>
</tr>
<tr>
<td>V</td>
<td>Injury into adjacent organs (anus/rectum/urethra/bladder)</td>
<td>878.7</td>
<td>3</td>
</tr>
</tbody>
</table>

* Advance one grade for multiple injuries up to grade III.

**Uterus (Non-Pregnant) Injury Scale**

<table>
<thead>
<tr>
<th>Grade*</th>
<th>Injury Description</th>
<th>ICD-9</th>
<th>AIS-90</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Contusion/hematoma</td>
<td>867.4/.5</td>
<td>2</td>
</tr>
<tr>
<td>II</td>
<td>Superficial laceration (&lt;1 cm)</td>
<td>867.4/.5</td>
<td>2</td>
</tr>
<tr>
<td>III</td>
<td>Deep laceration (&gt;1 cm)</td>
<td>867.4/.5</td>
<td>3</td>
</tr>
<tr>
<td>IV</td>
<td>Laceration involving uterine artery</td>
<td>902.55</td>
<td>3</td>
</tr>
<tr>
<td>V</td>
<td>Avulsion/devascularized</td>
<td>867.4/.5</td>
<td>3</td>
</tr>
</tbody>
</table>

* Advance one grade for multiple injuries up to grade III.
### Uterus (Pregnant) Injury Scale

<table>
<thead>
<tr>
<th>Grade*</th>
<th>Injury Description</th>
<th>ICD-9</th>
<th>AIS-90</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Contusion/hematoma (without placental abruption)</td>
<td>867.4/.5</td>
<td>2</td>
</tr>
<tr>
<td>II</td>
<td>Superficial laceration (&lt;1 cm) or partial placental</td>
<td>867.4/.5</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>abruption &lt; 25%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>III</td>
<td>Deep laceration (&gt;1 cm) occurring in second trimester</td>
<td>867.4/.5</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>or placental abruption &gt; 25% but &lt; 50%</td>
<td></td>
<td></td>
</tr>
<tr>
<td>IV</td>
<td>Deep laceration (&gt;1 cm) in third trimester</td>
<td>867.4/.5</td>
<td>4</td>
</tr>
<tr>
<td>V</td>
<td>Laceration involving uterine artery</td>
<td>902.55</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Deep laceration (&gt;1 cm) with &gt; 50% placental abruption</td>
<td>867.4/.5</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Uterine rupture</td>
<td>867.4/.5</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>second trimester</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>third trimester</td>
<td>867.4/.5</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Complete placental abruption</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Advance one grade for multiple injuries up to grade III.

### Fallopian Tube Injury Scale

<table>
<thead>
<tr>
<th>Grade*</th>
<th>Injury Description</th>
<th>ICD-9</th>
<th>AIS-90</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Hematoma/contusion</td>
<td>867.6/.7</td>
<td>2</td>
</tr>
<tr>
<td>II</td>
<td>Laceration &lt; 50% circumference</td>
<td>867.6/.7</td>
<td>2</td>
</tr>
<tr>
<td>III</td>
<td>Laceration &gt; 50% circumference</td>
<td>867.6/.7</td>
<td>2</td>
</tr>
<tr>
<td>IV</td>
<td>Transection</td>
<td>867.6/.7</td>
<td>2</td>
</tr>
<tr>
<td>V</td>
<td>Vascular - devascularized segment</td>
<td>902.89</td>
<td>2</td>
</tr>
</tbody>
</table>

* Advance one grade for bilateral injuries up to grade III.

### Ovary Injury Scale

<table>
<thead>
<tr>
<th>Grade*</th>
<th>Injury Description</th>
<th>ICD-9</th>
<th>AIS-90</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Contusion/hematoma</td>
<td>867.6/.7</td>
<td>1</td>
</tr>
<tr>
<td>II</td>
<td>Superficial laceration (depth &lt; 0.5 cm)</td>
<td>867.6/.7</td>
<td>2</td>
</tr>
<tr>
<td>III</td>
<td>Deep laceration (depth &gt; 0.5 cm)</td>
<td>867.6/.7</td>
<td>3</td>
</tr>
<tr>
<td>IV</td>
<td>Partial disruption of blood supply</td>
<td>902.81</td>
<td>3</td>
</tr>
<tr>
<td>V</td>
<td>Avulsion or complete parenchymal destruction</td>
<td>902.81</td>
<td>3</td>
</tr>
</tbody>
</table>

* Advance one grade for bilateral injuries up to grade III.
### Cervical Vascular Organ Injury Scale

<table>
<thead>
<tr>
<th>Grade*</th>
<th>Injury Description</th>
<th>ICD-9</th>
<th>AIS-90</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Thyroid veins</td>
<td>900.80</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Common facial vein</td>
<td>900.80</td>
<td></td>
</tr>
<tr>
<td></td>
<td>External jugular vein</td>
<td>900.81</td>
<td>1-3</td>
</tr>
<tr>
<td></td>
<td>Non-named arterial/venous branches</td>
<td>900.90</td>
<td></td>
</tr>
<tr>
<td>II</td>
<td>External carotid arterial branches (ascending pharyngeal, superior thyroid, lingual, facial, maxillary, occipital, posterior auricular)</td>
<td>900.80</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Thyrocervical trunk or primary branches</td>
<td>900.80</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Internal jugular vein</td>
<td>900.10</td>
<td>1-3</td>
</tr>
<tr>
<td>III</td>
<td>External carotid artery</td>
<td>900.02</td>
<td>2-3</td>
</tr>
<tr>
<td></td>
<td>Subclavian vein</td>
<td>901.30</td>
<td>3-4</td>
</tr>
<tr>
<td></td>
<td>Vertebral artery</td>
<td>900.80</td>
<td>2-4</td>
</tr>
<tr>
<td>IV</td>
<td>Common carotid artery</td>
<td>900.01</td>
<td>3-5</td>
</tr>
<tr>
<td></td>
<td>Subclavian artery</td>
<td>901.10</td>
<td>3-4</td>
</tr>
<tr>
<td>V</td>
<td>Internal carotid artery (extracranial)</td>
<td>900.03</td>
<td>3-5</td>
</tr>
</tbody>
</table>

* Increase one grade for multiple grade III or IV injuries involving >50% vessel circumference. Decrease one grade for <25% vessel circumference disruption for grades IV or V.

### Peripheral Vascular Organ Injury Scale

<table>
<thead>
<tr>
<th>Grade*</th>
<th>Injury Description</th>
<th>ICD-9</th>
<th>AIS-90</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Digital artery/vein</td>
<td>903.50</td>
<td>1-3</td>
</tr>
<tr>
<td></td>
<td>Palmar artery/vein</td>
<td>903.40</td>
<td>1-3</td>
</tr>
<tr>
<td></td>
<td>Deep palmar artery/vein</td>
<td>904.60</td>
<td>1-3</td>
</tr>
<tr>
<td></td>
<td>Dorsalis pedis artery</td>
<td>904.70</td>
<td>1-3</td>
</tr>
<tr>
<td></td>
<td>Plantar artery/vein</td>
<td>904.60</td>
<td>1-3</td>
</tr>
<tr>
<td></td>
<td>Non-named arterial/venous branches</td>
<td>903.8/904.7</td>
<td>1-3</td>
</tr>
<tr>
<td>II</td>
<td>Basilic/cephalic vein</td>
<td>903.80</td>
<td>1-3</td>
</tr>
<tr>
<td></td>
<td>Saphenous vein</td>
<td>904.30</td>
<td>1-3</td>
</tr>
<tr>
<td></td>
<td>Radial artery</td>
<td>903.20</td>
<td>1-3</td>
</tr>
<tr>
<td></td>
<td>Ulnar artery</td>
<td>903.30</td>
<td>1-3</td>
</tr>
<tr>
<td>III</td>
<td>Axillary vein</td>
<td>903.02</td>
<td>2-3</td>
</tr>
<tr>
<td></td>
<td>Superficial/deep femoral vein</td>
<td>903.02</td>
<td>2-3</td>
</tr>
<tr>
<td></td>
<td>Popliteal vein</td>
<td>904.42</td>
<td>2-3</td>
</tr>
<tr>
<td></td>
<td>Brachial artery</td>
<td>903.10</td>
<td>2-3</td>
</tr>
<tr>
<td></td>
<td>Anterior tibial artery</td>
<td>904.51-904.52</td>
<td>1-3</td>
</tr>
<tr>
<td></td>
<td>Posterior tibial artery</td>
<td>904.53/904.54</td>
<td>1-3</td>
</tr>
<tr>
<td></td>
<td>Peroneal artery</td>
<td>904.70</td>
<td>1-3</td>
</tr>
<tr>
<td></td>
<td>Tibioperoneal trunk</td>
<td>904.70</td>
<td>2-3</td>
</tr>
<tr>
<td>IV</td>
<td>Superficial/deep femoral artery</td>
<td>904.1/904.7</td>
<td>3-4</td>
</tr>
<tr>
<td></td>
<td>Popliteal artery</td>
<td>904.41</td>
<td>2-3</td>
</tr>
<tr>
<td>V</td>
<td>Axillary artery</td>
<td>903.01</td>
<td>2-3</td>
</tr>
<tr>
<td></td>
<td>Common femoral artery</td>
<td>904.00</td>
<td>3-4</td>
</tr>
</tbody>
</table>

* Increase one grade for multiple grade III or IV injuries involving >50% vessel circumference. Decrease one grade for <25% vessel circumference disruption for grades IV or V.
### Adrenal Organ Injury Scale

<table>
<thead>
<tr>
<th>Grade</th>
<th>Injury Description</th>
<th>ICD-9</th>
<th>AIS-90</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Contusion</td>
<td>868.01/.11</td>
<td>1</td>
</tr>
<tr>
<td>II</td>
<td>Laceration involving only cortex (&lt;2 cm)</td>
<td>868.01/.11</td>
<td>1</td>
</tr>
<tr>
<td>III</td>
<td>Laceration extending into medulla (&gt;2 cm)</td>
<td>868.01/.11</td>
<td>2</td>
</tr>
<tr>
<td>IV</td>
<td>&gt;50% parenchymal destruction</td>
<td>868.01/.11</td>
<td>2</td>
</tr>
<tr>
<td>V</td>
<td>Total parenchymal destruction (including massive intraparenchymal hemorrhage)</td>
<td>868.01/.11</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Avulsion from blood supply</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Advance one grade for bilateral lesions up to grade V.

### Penis Injury Scale

<table>
<thead>
<tr>
<th>Grade</th>
<th>Injury Description</th>
<th>ICD-9</th>
<th>AIS-90</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Cutaneous laceration/contusion</td>
<td>911.0/922.4</td>
<td>1</td>
</tr>
<tr>
<td>II</td>
<td>Buck's fascia (cavernosum) laceration without tissue loss</td>
<td>878.10</td>
<td>1</td>
</tr>
<tr>
<td>III</td>
<td>Cutaneous avulsion</td>
<td>878.10</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Laceration through glans/meatus</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Cavernosal or urethral defect &lt; 2 cm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>IV</td>
<td>Partial penectomy</td>
<td>878.10</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Cavernosal or urethral defect &gt; 2 cm</td>
<td></td>
<td></td>
</tr>
<tr>
<td>V</td>
<td>Total penectomy</td>
<td>878.10</td>
<td>3</td>
</tr>
</tbody>
</table>

* Advance one grade for multiple injuries up to grade III.

### Testis Injury Scale

<table>
<thead>
<tr>
<th>Grade</th>
<th>Injury Description</th>
<th>ICD-9</th>
<th>AIS-90</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Contusion/Hematoma</td>
<td>911.0/922.4</td>
<td>1</td>
</tr>
<tr>
<td>II</td>
<td>Subclinical laceration of tunica albuguinea</td>
<td>922.40</td>
<td>1</td>
</tr>
<tr>
<td>III</td>
<td>Laceration of tunica albuguinea with &lt;50% parenchymal loss</td>
<td>878.20</td>
<td>2</td>
</tr>
<tr>
<td>IV</td>
<td>Major laceration of tunica albuguinea with &gt;50% parenchymal loss</td>
<td>878.30</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>V</td>
<td>Total testicular destruction or avulsion</td>
<td>878.30</td>
<td>2</td>
</tr>
</tbody>
</table>

* Advance one grade for bilateral lesions up to grade V.

### Scrotum Injury Scale

<table>
<thead>
<tr>
<th>Grade</th>
<th>Injury Description</th>
<th>ICD-9</th>
<th>AIS-90</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Contusion</td>
<td>922.40</td>
<td>1</td>
</tr>
<tr>
<td>II</td>
<td>Laceration &lt;25% of scrotal diameter</td>
<td>878.20</td>
<td>1</td>
</tr>
<tr>
<td>III</td>
<td>Laceration &gt;25% of scrotal diameter or stellate</td>
<td>878.30</td>
<td>2</td>
</tr>
<tr>
<td>IV</td>
<td>Avulsion &lt;50%</td>
<td>878.30</td>
<td>2</td>
</tr>
<tr>
<td>V</td>
<td>Avulsion &gt;50%</td>
<td>878.30</td>
<td>2</td>
</tr>
</tbody>
</table>
## Thoracic Vascular Organ Injury Scale

<table>
<thead>
<tr>
<th>Grade</th>
<th>Injury Description</th>
<th>ICD-9</th>
<th>AIS-90</th>
<th>Grade</th>
<th>Injury Description</th>
<th>ICD-9</th>
<th>AIS-90</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Intercostal artery/vein</td>
<td>901.81</td>
<td>2-3</td>
<td>IV</td>
<td>Thoracic aorta, descending</td>
<td>901.00</td>
<td>4-5</td>
</tr>
<tr>
<td></td>
<td>Internal mammary artery/vein</td>
<td>901.82</td>
<td>2-3</td>
<td></td>
<td>Inferior vena cava (intrathoracic)</td>
<td>902.10</td>
<td>3-4</td>
</tr>
<tr>
<td></td>
<td>Bronchial artery/vein</td>
<td>901.89</td>
<td>2-3</td>
<td></td>
<td>Pulmonary artery, primary intraparenchymal branch</td>
<td>901.41</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Esophageal artery/vein</td>
<td>901.90</td>
<td>2-3</td>
<td></td>
<td>Pulmonary vein, primary intraparenchymal branch</td>
<td>901.42</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Hemiazygous vein</td>
<td>901.89</td>
<td>2-3</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Unnamed artery/vein</td>
<td>901.90</td>
<td>2-3</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>II</td>
<td>Azygous vein</td>
<td>901.89</td>
<td>2-3</td>
<td>V</td>
<td>Thoracic aorta, ascending and arch</td>
<td>901.00</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Internal jugular vein</td>
<td>900.10</td>
<td>2-3</td>
<td></td>
<td>Superior vena cava</td>
<td>901.20</td>
<td>3-4</td>
</tr>
<tr>
<td></td>
<td>Subclavian vein</td>
<td>901.30</td>
<td>3-4</td>
<td></td>
<td>Pulmonary artery, main trunk</td>
<td>901.41</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Innominate vein</td>
<td>901.30</td>
<td>3-4</td>
<td></td>
<td>Pulmonary vein, main trunk</td>
<td>901.42</td>
<td>4</td>
</tr>
<tr>
<td>III</td>
<td>Carotid artery</td>
<td>900.01</td>
<td>3-5</td>
<td>VI</td>
<td>Uncontained total transection of</td>
<td>901.00</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Innominate artery</td>
<td>901.10</td>
<td>3-4</td>
<td></td>
<td>thoracic aorta or pulmonary hilum</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Subclavian artery</td>
<td>901.10</td>
<td>3-4</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Increase one grade for multiple grade III or IV injuries if >50% circumference, decrease one grade for grade IV and V injuries if <25% circumference.

** Based on most accurate assessment at autopsy, operation, or radiologic study.

## Lung Organ Injury Scale

<table>
<thead>
<tr>
<th>Grade</th>
<th>Injury Type</th>
<th>Injury Description</th>
<th>ICD-9</th>
<th>AIS-90</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Contusion</td>
<td>Unilateral, &lt;1 lobe</td>
<td>861.12/861.31</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Laceration Simple pneumothorax</td>
<td>860.0/1</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>860.4/5</td>
<td></td>
</tr>
<tr>
<td>II</td>
<td>Contusion</td>
<td>Unilateral, single lobe</td>
<td>861.20/861.30</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Laceration Simple pneumothorax</td>
<td>860.0/1</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>860.4/5</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>862.0/861.30</td>
<td></td>
</tr>
<tr>
<td>III</td>
<td>Contusion</td>
<td>Unilateral, &gt;1 lobe</td>
<td>861.20/861.30</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Laceration Persistent (&gt;72 hours), airleak from distal airway</td>
<td>860.0/1</td>
<td>3-4</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>860.4/5</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Hematoma</td>
<td>Nonexpanding intraparenchymal</td>
<td>862.0/861.30</td>
<td></td>
</tr>
<tr>
<td>IV</td>
<td>Laceration</td>
<td>Major (segmental or lobar) airway leak</td>
<td>862.21/861.31</td>
<td>4-5</td>
</tr>
<tr>
<td></td>
<td>Hematoma</td>
<td>Expanding intraparenchymal</td>
<td>901.4</td>
<td>3-5</td>
</tr>
<tr>
<td></td>
<td>Vascular</td>
<td>Primary branch intrapulmonary vessel disruption</td>
<td>901.41/901.42</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Vascular</td>
<td>Hilar vessel disruption</td>
<td>901.41/901.42</td>
<td>4</td>
</tr>
</tbody>
</table>

* Advance one grade for bilateral injuries; hemothorax is graded according to the thoracic vascular OIS.

** Based on most accurate assessment at autopsy, operation, or radiologic study.
### Cardiac Injury Organ Scale

<table>
<thead>
<tr>
<th>Grade *</th>
<th>Injury Description</th>
<th>ICD-9</th>
<th>AIS-90</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Blunt cardiac injury with minor ECG abnormality (nonspecific ST or T wave changes</td>
<td>861.01</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>premature atrial, ventricular contraction or persistent sinus tachycardia</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Blunt or penetrating percardial wound without cardia injury, cardiac tamponade or</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>cardiac herniation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>II</td>
<td>Blunt cardiac injury with heart block (right or left bundle branch, left anterior</td>
<td>861.01</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>fascicular, or atrioventricular) or ischemic changes (ST depression or T wave</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>inversion) without cardiac failure</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Penetrating tangential myocardial wound up to, but not extending through endocardium,</td>
<td>861.12</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>without tamponade</td>
<td></td>
<td></td>
</tr>
<tr>
<td>III</td>
<td>Blunt cardiac injury with sustained (&gt;5 beats/min) or multifocal ventricular</td>
<td>861.01</td>
<td>3-4</td>
</tr>
<tr>
<td></td>
<td>contractions</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Blunt or penetrating cardiac injury with septal rupture, pulmonary or tricuspid</td>
<td>861.01</td>
<td>3-4</td>
</tr>
<tr>
<td></td>
<td>valvular incompetence, papillary muscle dysfunction, or distal coronary arterial</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>occlusion without cardiac failure</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Blunt pericardial laceration with cardiac herniation</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Blunt cardiac injury with cardiac failure</td>
<td>861.01</td>
<td>3-4</td>
</tr>
<tr>
<td></td>
<td>Penetrating tangential myocardial wound up to, but not extending through endocardium,</td>
<td>861.12</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>with tamponade</td>
<td></td>
<td></td>
</tr>
<tr>
<td>IV</td>
<td>Blunt or penetrating cardiac injury with septal rupture, pulmonary or tricuspid</td>
<td>861.12</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>valvular incompetence, papillary muscle dysfunction or distal coronary arterial</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>occlusion producing cardiac failure</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Blunt or penetrating cardiac injury with aortic or mitral valve incompetence</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Blunt or penetrating cardiac injury of the right ventricle, right atrium, or left</td>
<td>861.03 / 861.13</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>atrium</td>
<td></td>
<td></td>
</tr>
<tr>
<td>V</td>
<td>Blunt or penetrating cardiac injury with proximal coronary arterial occlusion</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Blunt or penetrating left ventricular perforation</td>
<td>861.03 / 861.13</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Stellate injuries &lt;50% tissue loss of the right ventricle, right atrium or left</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>atrium</td>
<td>861.03</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Blunt avulsion of the heart; penetrating wound producing &gt;50% tissue loss of a</td>
<td>861.2</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>chamber</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

* Advance one grade for multiple penetrating wounds to a single chamber or multiple chamber involvement.

### Diaphragm Organ Injury Scale

<table>
<thead>
<tr>
<th>Grade *</th>
<th>Injury Description</th>
<th>ICD-9</th>
<th>AIS-90</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Contusion</td>
<td>862.0</td>
<td>2</td>
</tr>
<tr>
<td>II</td>
<td>Laceration &lt; 2 cm</td>
<td>862.1</td>
<td>3</td>
</tr>
<tr>
<td>III</td>
<td>Laceration 2-10 cm</td>
<td>862.1</td>
<td>3</td>
</tr>
<tr>
<td>IV</td>
<td>Laceration &gt; 10 cm with tissue loss &lt; 25 cm</td>
<td>862.1</td>
<td>3</td>
</tr>
<tr>
<td>V</td>
<td>Laceration with tissue loss &gt; 25 cm</td>
<td>862.1</td>
<td>3</td>
</tr>
</tbody>
</table>

* Advance one grade for bilateral injuries.
### Spleen Injury Scale (1994 revision)

<table>
<thead>
<tr>
<th>Grade</th>
<th>Injury</th>
<th>Description</th>
<th>ICD-9</th>
<th>AIS-90</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Hematoma</td>
<td>Subcapsular, &lt;10% surface area</td>
<td>865.01/.11</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Laceration</td>
<td>Capsular tear, &lt;1cm parenchymal depth</td>
<td>865.02/.12</td>
<td>2</td>
</tr>
<tr>
<td>II</td>
<td>Hematoma</td>
<td>Subcapsular, 10-50% surface area; intraparenchymal, &lt;5 cm in diameter</td>
<td>865.01/.11</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Laceration</td>
<td>1-3 cm parenchymal depth which does not involve a trabecular vessel</td>
<td>865.02/.12</td>
<td>2</td>
</tr>
<tr>
<td>III</td>
<td>Hematoma</td>
<td>Subcapsular, &gt;50% surface area or expanding; ruptured subcapsular or parenchymal hematoma</td>
<td>865.03/.13</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Laceration</td>
<td>Intraparenchymal hematoma &gt;5 cm or expanding</td>
<td>865.04/.14</td>
<td>3</td>
</tr>
<tr>
<td>IV</td>
<td>Laceration</td>
<td>&gt;3 cm parenchymal depth or involving trabecular vessels</td>
<td>865.04/.14</td>
<td>3</td>
</tr>
<tr>
<td>V</td>
<td>Vascular</td>
<td>Completely shattered spleen</td>
<td>865.05/.15</td>
<td>3</td>
</tr>
<tr>
<td>VI</td>
<td>Vascular</td>
<td>Hilar vascular injury which devascularizes spleen</td>
<td>865.06/.16</td>
<td>3</td>
</tr>
</tbody>
</table>

* Advance one grade for multiple injuries, up to grade III.

### Liver Injury Scale (1994 revision)

<table>
<thead>
<tr>
<th>Grade</th>
<th>Injury</th>
<th>Description</th>
<th>ICD-9</th>
<th>AIS-90</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Hematoma</td>
<td>Subcapsular, &lt;10% surface area</td>
<td>864.01/.11</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Laceration</td>
<td>Capsular tear, &lt;1cm parenchymal depth</td>
<td>864.02/.12</td>
<td>2</td>
</tr>
<tr>
<td>II</td>
<td>Hematoma</td>
<td>Subcapsular, 10-50% surface area; intraparenchymal, &lt;10 cm in diameter</td>
<td>864.01/.11</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Laceration</td>
<td>1-3 cm parenchymal depth, &lt;10 cm in length</td>
<td>864.03/.13</td>
<td>2</td>
</tr>
<tr>
<td>III</td>
<td>Hematoma</td>
<td>Subcapsular, &gt;50% surface area or expanding; ruptured subcapsular or parenchymal hematoma</td>
<td>864.04/.14</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Laceration</td>
<td>Intraparenchymal hematoma &gt;10 cm or expanding</td>
<td>864.05/.15</td>
<td>3</td>
</tr>
<tr>
<td>IV</td>
<td>Laceration</td>
<td>Parenchymal disruption involving 25-75% of hepatic lobe or &gt;3 Couinaud's segments within a single lobe</td>
<td>864.06/.16</td>
<td>4</td>
</tr>
<tr>
<td>V</td>
<td>Vascular</td>
<td>Parenchymal disruption involving &gt;75% of hepatic lobe or &gt;3 Couinaud's segments within a single lobe</td>
<td>864.07/.17</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Vascular</td>
<td>Juxtahepatic venous injuries; i.e., retrohepatic vena cava/central major hepatic veins</td>
<td>864.08/.18</td>
<td>5</td>
</tr>
<tr>
<td>VI</td>
<td>Vascular</td>
<td>Hepatic avulsion</td>
<td>864.09/.19</td>
<td>6</td>
</tr>
</tbody>
</table>

* Advance one grade for multiple injuries, up to grade III.

### Kidney Injury Scale

<table>
<thead>
<tr>
<th>Grade</th>
<th>Injury Description</th>
<th>ICD-9</th>
<th>AIS-90</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Microscopic or gross hematuria, urologic studies normal</td>
<td>866.11</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Subcapsular hematoma, nonexpanding without parenchymal laceration</td>
<td>866.11</td>
<td>2</td>
</tr>
<tr>
<td>II</td>
<td>Nonexpanding perirenal hematoma confined to renal retro-peritoneum</td>
<td>866.01/.11</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Laceration &lt; 1 cm parenchymal depth of renal cortex without urinary extravasation</td>
<td>866.02</td>
<td>2</td>
</tr>
<tr>
<td>III</td>
<td>Laceration &gt; 1 cm parenchymal depth of renal cortex without collecting system rupture or urinary extravasation</td>
<td>866.03</td>
<td>3</td>
</tr>
<tr>
<td>IV</td>
<td>Parenchymal laceration extending through the renal cortex, medulla, and collecting system</td>
<td>866.04</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Main renal artery or vein injury with contained hemorrhage</td>
<td>866.05</td>
<td>5</td>
</tr>
<tr>
<td>V</td>
<td>Completely shattered kidney</td>
<td>866.06</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Avulsion of renal hilum which devascularizes kidney</td>
<td>866.07</td>
<td>5</td>
</tr>
</tbody>
</table>
SECTION FIVE: ADULT BURNS
INJURIES REQUIRING REFERRAL TO A SPECIALIZED BURN CENTER

CRITERIA FOR ADULT BURN TRANSFER
The American Burn Association has identified the following types of burn injuries that typically require referral to a burn center:

1. Partial-thickness and full-thickness burns on greater than 10% of the BSA in patients over 50 years of age
2. Partial-thickness and full-thickness burns on greater than 20% of the BSA in adults
3. Partial-thickness and full-thickness burns involving the face, eyes, ears, hands, feet, genitalia, and perineum, as well as those that involve skin overlying major joints
4. Full-thickness burns on greater than 5% of the BSA in adults
5. Significant electrical burns, including lightning injury
6. Significant chemical burns
7. Inhalation injury
8. Burn injury in patients with preexisting illness that could complicate treatment, prolong recovery, or affect mortality
9. Any patient with a burn injury who has concomitant trauma poses and increased risk of morbidity or mortality, and may be treated initially in a trauma center until stable before being transferred to a burn center
10. Burn injury in patients who will require special social and emotional or long-term rehabilitative support

INITIAL FLUID RESUSCITATION IN ADULT BURN PATIENTS

Goals of Fluid Therapy:
► **Restore** and maintain tissue perfusion
► Provide minimum amount of fluid necessary to maintain adequate tissue perfusion

**First 24 hour Fluid Resuscitation Plan:**

Resuscitation fluid of choice:
Lactated Ringers

Volume administered during the 24 hours:
2-4 mL/kg/%TBSA burn, where % burn is based on the TBSA of 2\textsuperscript{nd} and 3\textsuperscript{rd} degree burns only

Rate administered during the first 24 hours:
In general, ½ of the projected fluid volume should be administered within the first 8 hours following injury (not admission), then the remaining half should be administered over the next 16 hours

These rate recommendations are very general guidelines. Fluid needs must be individualized based on the patient’s response and reassessed on an ongoing basis (hourly in ICU patients).

| Common Formulas for Estimating Fluid Requirements for Adult Burn Patients for the First 24 Hours Post-Burn |
|----------------------------------|--------------------------|--------------------------|
| Name of Formula                  | Fluid Used               | Formula                  |
| Parkland                         | LR                       | 4 mL/kg/%TBSA burn       |
| Modified Brooke                  | LR                       | 2 mL/kg/%TBSA burn       |

Rev 06/01/10
SECTION SIX: PHARMACOTHERAPY GUIDELINES

STRESS ULCER PROPHYLAXIS GUIDELINES

**STRESS ULCER PROPHYLAXIS GUIDELINES**

**Stress Ulcer Prophylaxis**

Is stress ulcer prophylaxis needed?
- Prophylaxis is appropriate for patients admitted to the STICU with one or more risk factors.*

<table>
<thead>
<tr>
<th>YES</th>
<th>NO</th>
</tr>
</thead>
<tbody>
<tr>
<td>Does patient have gastric or small bowel access with known or presumed absorption of feeding?</td>
<td>Continue periodic assessment</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>YES</th>
<th>NO</th>
</tr>
</thead>
<tbody>
<tr>
<td>Famotidine** 30mg via tube Q 12 hours.</td>
<td>Famotidine** 30mg IV Q 12 hours.</td>
</tr>
</tbody>
</table>

*RISK FACTORS
- Respiratory failure (mechanical ventilation anticipated > 48 hours)
- Coagulopathies (platelet count < 50,000, INR > 1.5, PTT > 3 X control)
- Head injury with GCS < 10 or inability to follow simple commands
- Thermal injury involving > 35% TBSA
- Partial hepatectomy
- Major trauma with ISS > 16
- Spinal cord injury
- History of gastric ulcer or bleeding during year prior to admission
- Presence of two of the following: sepsis, ICU stay > 1 week, occult or overt bleeding for ≥ 4 days, corticosteroid therapy (> 25mg hydrocortisone or equivalent)

**Famotidine dosage adjustment in renal impairment**
- Decrease dose to 30mg IV/ID/ via tube daily for patients with an estimated creatinine clearance ≤ 10 mL/minute

**Suspected GI Bleed:**

*Rev. 5/4/10*
PAIN MANAGEMENT GUIDELINES FOR TRAUMA PATIENTS

All patients have the right to adequate analgesia and management of their pain.

Pain Assessment:
- Pain assessment and response to therapy should be performed regularly by using a scale appropriate to the patient population and systematically documented.
- The level of pain reported by the patient must be considered the current standard for assessment of pain and response to analgesia whenever possible. Use of the numeric rating scale is recommended to assess pain.
- Patients who cannot communicate should be assessed through subjective observation of pain-related behaviors (movement, facial expression, and posturing) and physiologic indicators (HR, BP, RR) and the change in these parameters following analgesic therapy.

General Principles:
- A therapeutic plan and goal of analgesia should be established for each patient and communicated to all caregivers to ensure consistent analgesic therapy.
- Scheduled opioid doses is preferred over an “as needed” regimen to ensure consistent analgesia. A PCA device may be utilized to deliver opioids if the patient is able to understand and operate the device.

<table>
<thead>
<tr>
<th>PCA Order-Writing Guidelines</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td><strong>Loading dose</strong></td>
</tr>
<tr>
<td>Morphine</td>
</tr>
<tr>
<td>2-4 mg</td>
</tr>
<tr>
<td>Hydromorphone</td>
</tr>
<tr>
<td>0.4-0.8 mg</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Continuous infusion (basal rate)</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Morphine</td>
</tr>
<tr>
<td>0-2 mg/hour</td>
</tr>
<tr>
<td>Hydromorphone</td>
</tr>
<tr>
<td>0-0.4 mg/hour</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Incremental dose</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Morphine</td>
</tr>
<tr>
<td>0.5-2 mg</td>
</tr>
<tr>
<td>Hydromorphone</td>
</tr>
<tr>
<td>0.1-0.4 mg</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Lock out interval (delay)</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Morphine</td>
</tr>
<tr>
<td>8-15 minutes</td>
</tr>
<tr>
<td>Hydromorphone</td>
</tr>
<tr>
<td>8-15 minutes</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>1 hour limit</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>Morphine</td>
</tr>
<tr>
<td>2-15 mg</td>
</tr>
<tr>
<td>Hydromorphone</td>
</tr>
<tr>
<td>0.4-3 mg</td>
</tr>
</tbody>
</table>


Non-Opioid Analgesics:
- NSAIDS or acetaminophen may be used as adjuncts to opioids in select patients
- Ketorolac therapy should be limited to a maximum of 5 days. MUSC policy places an automatic stop date for all ketorolac orders at 48 hours. Ketorolac orders must be rewritten if therapy desired beyond 48 hours. Patients should be closely monitored for the development of renal insufficiency or gastrointestinal bleeding. Other NSAIDS (ibuprofen) may be used via the enteral route in appropriate patients.

<table>
<thead>
<tr>
<th>Non-Opioid Analgesics Commonly Used in Trauma</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Agent</strong></td>
</tr>
<tr>
<td><strong>Intermittent Dose</strong></td>
</tr>
<tr>
<td><strong>Cost/Day ($)</strong></td>
</tr>
<tr>
<td>Acetaminophen</td>
</tr>
<tr>
<td>325-650 mg PO q 4-6 hours; avoid &gt; 4 grams/day</td>
</tr>
<tr>
<td>Ibuprofen</td>
</tr>
<tr>
<td>400 mg PO q 4-6 hours</td>
</tr>
<tr>
<td>Ketorolac</td>
</tr>
<tr>
<td>For patients &lt; 50 kg or ≥ 65 y/o or estimated CrCl &lt; 30ml/minute: 15 mg IV every 6 hours</td>
</tr>
<tr>
<td>For patients ≥ 50 kg or &lt; 65 y/o or estimated CrCl &gt; 50 ml/minute: 30 mg IV every 6 hours</td>
</tr>
<tr>
<td>Maximum duration for either regimen = 5 days</td>
</tr>
</tbody>
</table>
### Oral Narcotic Analgesics Commonly Used in Trauma

<table>
<thead>
<tr>
<th>Drug</th>
<th>Regimen</th>
<th>Cost/day($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hydromorphone (Dilaudid)</td>
<td>2 mg PO q 4-6 hours PRN pain</td>
<td>0.80-1.20</td>
</tr>
<tr>
<td>Oxycodone/APAP (Percocet)</td>
<td>1-2 tablets PO q 4-6 hours PRN pain</td>
<td>0.11-1.32</td>
</tr>
<tr>
<td>MS immediate release (IR)</td>
<td>15-30 mg PO q 4-6 hours PRN breakthrough pain</td>
<td>0.25-2.58</td>
</tr>
<tr>
<td>Oxycodone</td>
<td>5-10 mg PO q 4-6 hours PRN breakthrough pain</td>
<td>0.15-1.80</td>
</tr>
<tr>
<td>Oxycontin</td>
<td>20-40 mg PO q 12 hours</td>
<td>2.88-11.52</td>
</tr>
<tr>
<td>MS Contin</td>
<td>30-60 mg PO q 8-12 hours</td>
<td>0.84-2.22</td>
</tr>
</tbody>
</table>


**CHILD-TURCOTTE HEPATIC RISK CLASSIFICATION**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>A</th>
<th>B</th>
<th>C</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bilirubin (mg/dL)</td>
<td>&lt;2</td>
<td>2-3</td>
<td>&gt;3</td>
</tr>
<tr>
<td>Albumin (g/dL)</td>
<td>&gt;3.5</td>
<td>3-3.5</td>
<td>&lt;3</td>
</tr>
<tr>
<td>Ascites</td>
<td>None</td>
<td>Treatable</td>
<td>Refractory</td>
</tr>
<tr>
<td>Encephalopathy</td>
<td>None</td>
<td>Minimal</td>
<td>Severe</td>
</tr>
<tr>
<td>Nutrition (muscle mass)</td>
<td>Normal</td>
<td>Fair</td>
<td>Poor</td>
</tr>
</tbody>
</table>

*Some clinical judgement is required in applying this classification system because patients’ laboratory and clinical status frequently overlap into more than one category.*
SPLENIC VACCINATION GUIDELINES

Indications:

All patients status post splenectomy.

All patients with less than 50% of their spleen intact and/or with absence of the major vascular supply.

Guideline:

Pneumococcal (PPV) vaccine 0.5 mL IM X 1
Haemophilus influenza vaccine 0.5 mL IM X 1
Meningococcal vaccine 0.5 mL IM X 1

Vaccinations should be administered within 48 hours of splenectomy or splenic injury, unless the patient is on a vasopressor. (Must be administered prior to discharge)

There is no evidence to support delaying vaccination because of immunosuppression following splenectomy.

All patients should be revaccinated with the pneumococcal vaccine at least every 6 years. There are no recommendations for revaccination for haemphilus or meningococcus.

The Adult Immunization Orders can be downloaded at http://www.musc.edu/cce/ORDFRMS/pdf/adultimmun.pdf or under the vaccinations link on Clinician Order Forms.

References:

2. Update on adult immunizations: Recommendations of the immunization practices advisory committee (ACIP) MMWR 1991;40:40-44.
TETANUS PROPHYLAXIS

Table 1  Wound Classification

<table>
<thead>
<tr>
<th>Clinical Features</th>
<th>Nontetanus-prone Wounds</th>
<th>Tetanus-Prone Wounds</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age of wound</td>
<td>&lt; 6 hours</td>
<td>&gt; 6 hours</td>
</tr>
<tr>
<td>Configuration</td>
<td>Linear wound, abrasion</td>
<td>Stellate wound, avulsion</td>
</tr>
<tr>
<td>Depth</td>
<td>≤ 1 cm</td>
<td>&gt; 1 cm</td>
</tr>
<tr>
<td>Mechanism of injury</td>
<td>Sharp surface (eg glass, knife)</td>
<td>Missile, crush, burn, frostbite</td>
</tr>
<tr>
<td>Signs of infection</td>
<td>Absent</td>
<td>Present</td>
</tr>
<tr>
<td>Devitalized tissue</td>
<td>Absent</td>
<td>Present</td>
</tr>
<tr>
<td>Contaminants (dirt, feces, soil, saliva, etc)</td>
<td>Absent</td>
<td>Present</td>
</tr>
<tr>
<td>Denervated, and/or ischemic tissue</td>
<td>Absent</td>
<td>Present</td>
</tr>
</tbody>
</table>

Table 2  Summary of Tetanus Prophylaxis for the Injured Patient

<table>
<thead>
<tr>
<th>History of Adsorbed Tetanus Toxoid (doses)</th>
<th>Nontetanus-Prone Wounds</th>
<th>Tetanus-Prone Wounds</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Td¹ Tig</td>
<td>Td¹ Tig</td>
</tr>
<tr>
<td>Unknown or &lt; 3</td>
<td>Yes No</td>
<td>Yes Yes</td>
</tr>
<tr>
<td>≥ 3 ²</td>
<td>No³ No</td>
<td>No⁴ No</td>
</tr>
</tbody>
</table>

Key to table 2

1. For children younger than seven years old: DTP (DT, if pertussis vaccine is contraindicated) is preferred to tetanus toxoid alone. For persons seven years old and older, Td is preferred to tetanus toxoid alone.
2. If only three doses of fluid toxoid have been received, a fourth dose of toxoid, preferably an adsorbed toxoid, should be given.
3. Yes, if more than 10 years since last dose.
4. Yes, if more than five years since last dose. (More frequent boosters are not needed and can accentuate side effects)

Td Tetanus and diphtheria toxoids adsorbed--for adult use.
TIG Tetanus immune globulin, human

Advanced Trauma Life Support, 2004
CDC web site
FLUCONAZOLE EARLY PRESUMPTIVE THERAPY (EPT)

Risk factors for fungal infection

<table>
<thead>
<tr>
<th>Risk Factor</th>
<th>Relative weight (Points)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yeast isolation</td>
<td></td>
</tr>
<tr>
<td>Blood, ≥ 1 culture</td>
<td>40</td>
</tr>
<tr>
<td>Not blood, ≥ 2 sites</td>
<td>8</td>
</tr>
<tr>
<td>Not blood, 1 site</td>
<td>6</td>
</tr>
<tr>
<td>Broad spectrum antibiotics</td>
<td></td>
</tr>
<tr>
<td>Broad spectrum antimicrobial regimen</td>
<td>10</td>
</tr>
<tr>
<td>Broad spectrum antimicrobial regimen for ≥ 7 days</td>
<td>13</td>
</tr>
<tr>
<td>Central venous catheter</td>
<td></td>
</tr>
<tr>
<td>With TPN</td>
<td>8</td>
</tr>
<tr>
<td>Alone</td>
<td>7</td>
</tr>
<tr>
<td>Gastro-intestinal surgery</td>
<td>8</td>
</tr>
<tr>
<td>Bacteremia</td>
<td>5</td>
</tr>
<tr>
<td>History of Diabetes or Hyperglycemia</td>
<td>5</td>
</tr>
<tr>
<td>Routine fever &gt; 101 on antibiotics &gt; 72 hours</td>
<td>5</td>
</tr>
<tr>
<td>Age &gt; 50</td>
<td>3</td>
</tr>
<tr>
<td>Organ failure</td>
<td>4</td>
</tr>
<tr>
<td>Concurrent supra-physiologic corticosteroids</td>
<td>3</td>
</tr>
<tr>
<td>Mechanical ventilation</td>
<td>2</td>
</tr>
<tr>
<td>Risk assessment</td>
<td></td>
</tr>
<tr>
<td>Total number of points</td>
<td>Threshold for receiving EPT ≥ 40</td>
</tr>
</tbody>
</table>

Assess patient's risk factors for developing an invasive fungal infection.

If the score is ≥ 40 points, the patient is deemed at high risk for an invasive fungal infection.
- Consider initiating fluconazole 800 mg IV/PO X 1, then 400 mg IV/PO daily. Reduce dose by 50% in patients with impaired renal function.
- Use PO route if patient has a functioning gut.

If the score < 40 points, continually reassess. If score becomes ≥ 40 consider initiating EPT.

If a patient is diagnosed with an invasive fungal infection, the MUSC Guide to Antifungal Therapy of Invasive Fungal Infections can be downloaded at [http://www.musc.edu/cce/ORDFRMS/pdf/AntifungalGuide.pdf](http://www.musc.edu/cce/ORDFRMS/pdf/AntifungalGuide.pdf).

Rev. 5/25/07
## SURGICAL ANTIMICROBIAL PROPHYLAXIS IN TRAUMA

### ABDOMINAL TRAUMA

<table>
<thead>
<tr>
<th>Regimen</th>
<th>Dose</th>
<th>Duration</th>
<th>Cost / Therapy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cefoxitin</td>
<td>1 gram</td>
<td>Pre-op, then Q8H X 24 hours</td>
<td>$23.72</td>
</tr>
<tr>
<td>IF PENICILLIN-</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ALLERGIC:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Clindamycin +</td>
<td>600 mg</td>
<td>Preop, then Q8H x 24 hours</td>
<td>$47.12</td>
</tr>
<tr>
<td>Gentamicin</td>
<td>2.5 mg/kg</td>
<td>Preop, then Q12H x 24 hours</td>
<td>$3.35</td>
</tr>
<tr>
<td>IN DRUG SHORTAGE</td>
<td></td>
<td></td>
<td>$50.47</td>
</tr>
<tr>
<td>SITUATION:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cefazolin +</td>
<td>1 gm</td>
<td>Preop, then Q6H x 24 hours</td>
<td>$20.70</td>
</tr>
<tr>
<td>Metronidazole</td>
<td>500 mg</td>
<td>Preop, then Q6H x 24 hours</td>
<td>$10.38</td>
</tr>
</tbody>
</table>

*In drug shortage situation:*

- Cefazolin + Metronidazole

### FACIAL TRAUMA

<table>
<thead>
<tr>
<th>Regimen</th>
<th>Dose</th>
<th>Duration</th>
<th>Cost / Therapy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cefazolin</td>
<td>1 gm</td>
<td>Upon admission, then Q8H until</td>
<td>$12.42/day</td>
</tr>
<tr>
<td>IF PENICILLIN-</td>
<td></td>
<td>24 hours post-op</td>
<td></td>
</tr>
<tr>
<td>ALLERGIC:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Clindamycin</td>
<td>600 mg</td>
<td>Upon admission, then Q8H until</td>
<td>$35.34/day</td>
</tr>
<tr>
<td></td>
<td></td>
<td>24 hours post-op</td>
<td></td>
</tr>
</tbody>
</table>

*Patients with either nasal packing or a bolster should continue prophylactic antibiotics until the packing is removed.

### ORTHOPEDIC TRAUMA

#### (closed fractures)

<table>
<thead>
<tr>
<th>Regimen</th>
<th>Dose</th>
<th>Duration</th>
<th>Cost / Therapy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cefazolin</td>
<td>1 gm</td>
<td>Preop, then Q8H x 24 hours</td>
<td>$16.56</td>
</tr>
<tr>
<td>IF PENICILLIN-</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ALLERGIC:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vancomycin</td>
<td>15 mg/kg</td>
<td>Preop, then Q12H x 24 hours</td>
<td>$24.00</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(based on 1 gm/dose)</td>
<td></td>
</tr>
</tbody>
</table>

#### (open fractures)

<table>
<thead>
<tr>
<th>Regimen</th>
<th>Dose</th>
<th>Duration</th>
<th>Cost / Therapy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cefazolin +/-</td>
<td>1 gm</td>
<td>Upon admission, then Q8H until</td>
<td>$12.42/day</td>
</tr>
<tr>
<td>Gentamicin&quot;</td>
<td>1 mg/kg</td>
<td>24 hours after wound closure</td>
<td>$1.34/day</td>
</tr>
<tr>
<td></td>
<td></td>
<td>If needed, start upon admission</td>
<td>$13.76/day</td>
</tr>
<tr>
<td></td>
<td></td>
<td>then Q8H x 1st 72 hrs&quot;</td>
<td></td>
</tr>
<tr>
<td>IF PENICILLIN-</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>ALLERGIC:</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vancomycin +/-</td>
<td>15 mg/kg</td>
<td>Upon admission, then Q12H until</td>
<td>$16.00/day</td>
</tr>
<tr>
<td>Gentamicin&quot;</td>
<td>1 mg/kg</td>
<td>24 hours after wound closure</td>
<td>$1.34/day</td>
</tr>
<tr>
<td></td>
<td></td>
<td>If needed, start upon admission</td>
<td>$17.34</td>
</tr>
<tr>
<td></td>
<td></td>
<td>then Q8H x 1st 72 hours only&quot;</td>
<td></td>
</tr>
</tbody>
</table>

#Gentamicin is utilized for the first 72 hours after initiation of prophylaxis, or until 24 hours after wound closure (whichever time course is shorter). Addition of gentamicin is optional for Grades I and II fractures, but suggested for Grade III fractures.

Rev. 6/7/10

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**SECTION SIX: PHARMACOTHERAPY GUIDELINES**

110
GENERAL
Infuse antibiotic(s) 30 – 60 minutes before incision is made. Studies often had anesthesiologists administer prophylactic antibiotics either during anesthesia prep or upon induction.

Redose antibiotic during surgery under either of the following circumstances:

1. Surgery is prolonged (duration > 4 hours)
   *exception = use of vancomycin (redose if surgery is longer than 6 hours)

2. Major blood loss occurs (>1500 mL)

If a patient is currently on an antibiotic for another indication but is a candidate for surgical antibiotic prophylaxis, he/she may not require preoperative antibiotics. Spectrum of activity, antibiotic half-life, and duration of surgery must be taken into consideration before this decision can accurately be made.

Rev. 5/25/07
TUBE THORACOSTOMY PROPHYLAXIS IN TRAUMA

Cefazolin 1 gram IV should be given prior to chest tube placement in non-emergent situations.

Chest tubes placed emergently should be followed by cefazolin 1 gram IV q 8 hours X 24 hours.

<table>
<thead>
<tr>
<th>Regimen</th>
<th>Dose</th>
<th>Duration</th>
<th>Cost / Therapy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cefazolin</td>
<td>1 gram</td>
<td>Prior to chest tube placement, OR</td>
<td>$ 4.14</td>
</tr>
<tr>
<td>Cefazolin</td>
<td>1 gram</td>
<td>Q8H X 24 hours post chest tube placement</td>
<td>$ 12.42</td>
</tr>
<tr>
<td>Clindamycin</td>
<td>600 mg</td>
<td>Prior to chest tube placement. OR</td>
<td>$ 11.78</td>
</tr>
<tr>
<td>Clindamycin</td>
<td>600 mg</td>
<td>Q8H X 24 hours post chest tube placement</td>
<td>$ 35.34</td>
</tr>
</tbody>
</table>

Rev. 6/7/10
# Empiric Parenteral Regimens for Nosocomial Pneumonia*

<table>
<thead>
<tr>
<th>Drug (IV)</th>
<th>Regimen</th>
<th>Cost/day ($)</th>
<th>Cost (8 day regimen)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pipercillin/Tazobactam</td>
<td>4.5 g IV q 6 hours 210 mg IV q 12 hours 1 gm IV q 8 hours</td>
<td>77.52</td>
<td>902.08</td>
</tr>
<tr>
<td>Tobramycin**</td>
<td>210 mg IV q 12 hours</td>
<td>11.24</td>
<td></td>
</tr>
<tr>
<td>Vancomycin***</td>
<td>1 gm IV q 8 hours</td>
<td>24.00</td>
<td></td>
</tr>
<tr>
<td>Cefepime</td>
<td>2 g IV q 8 hours</td>
<td>32.04</td>
<td>538.24</td>
</tr>
<tr>
<td>Tobramycin</td>
<td>210 mg IV q 12 hours</td>
<td>11.24</td>
<td></td>
</tr>
<tr>
<td>Vancomycin</td>
<td>1 gm IV q 8 hours</td>
<td>24.00</td>
<td></td>
</tr>
<tr>
<td>Doripenem</td>
<td>500 mg IV q 8 hours</td>
<td>6.93</td>
<td>337.32</td>
</tr>
<tr>
<td>Tobramycin</td>
<td>210 mg IV q 12 hours</td>
<td>11.24</td>
<td></td>
</tr>
<tr>
<td>Vancomycin</td>
<td>1 g IV q 8 hours</td>
<td>24.00</td>
<td></td>
</tr>
</tbody>
</table>

* All drugs require dosing adjustments for renal impairment
** Tobramycin dosing based on 3.0 mg/kg for 70 kg patient
*** Vancomycin dosing based on 15 mg/kg for 70 kg patient


Regimen should be streamlined once susceptibility data is available.

## Empiric Parenteral Regimens for Nosocomial Pneumonia in Patients With Penicillin/Cephalosporin Allergy*

<table>
<thead>
<tr>
<th>Drug (IV)</th>
<th>Regimen</th>
<th>Cost/day ($)</th>
<th>Cost (8 day regimen)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ciprofloxacin</td>
<td>400 mg IV q 8 hours</td>
<td>6.36</td>
<td>332.80</td>
</tr>
<tr>
<td>Tobramycin**</td>
<td>210 mg IV q 12 hours</td>
<td>11.24</td>
<td></td>
</tr>
<tr>
<td>Vancomycin***</td>
<td>1 gm IV q 8 hours</td>
<td>24.00</td>
<td></td>
</tr>
</tbody>
</table>

* All drugs require dosing adjustments for renal impairment
** Tobramycin dosing based on 3.0 mg/kg for 70 kg patient
*** Vancomycin dosing based on 15 mg/kg for 70 kg patient


Regimen should be streamlined once susceptibility data is available.

## Antimicrobial Drug Level Monitoring Costs ($)

<table>
<thead>
<tr>
<th>Drug</th>
<th>Cost Per Level (charge to patient)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gentamicin</td>
<td>$65.00</td>
</tr>
<tr>
<td>Vancomycin</td>
<td>$67.00</td>
</tr>
<tr>
<td>Amikacin</td>
<td>$78.00</td>
</tr>
<tr>
<td>Tobramycin</td>
<td>$86.00</td>
</tr>
</tbody>
</table>
### Empiric Parenteral Regimens for Intra-abdominal Infections

<table>
<thead>
<tr>
<th>Drug (IV)</th>
<th>Regimen</th>
<th>Cost/day ($10 day regimen)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moxifloxacin</td>
<td>400 mg IV daily</td>
<td>11.82</td>
</tr>
<tr>
<td>Ertapenem</td>
<td>1 gram IV daily</td>
<td>56.89</td>
</tr>
<tr>
<td>Ciprofloxacin Metronidazole</td>
<td>400 mg IV q 12 hours 500 mg IV q 6 hours</td>
<td>4.24 8.28</td>
</tr>
<tr>
<td>Ampicillin/sulbactam</td>
<td>3 grams IV q 6 hours</td>
<td>13.64</td>
</tr>
<tr>
<td>Piperacillin/tazobactam*</td>
<td>3.375 grams IV q 6 hours</td>
<td>63.04</td>
</tr>
<tr>
<td>Doripenem*</td>
<td>500 mg IV q 8 hours</td>
<td>6.93</td>
</tr>
</tbody>
</table>

*Piperacillin/tazobactam and doripenem should only be considered for empiric therapy if *P. aeruginosa* is suspected (i.e., nosocomial vs. community-acquired infection). Regimen should be tailored to susceptibility data, if available.

### Oral Step Down Regimens for Intra-abdominal Infections

<table>
<thead>
<tr>
<th>Drug (PO)</th>
<th>Regimen</th>
<th>Cost/day ($10 day regimen)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amoxicillin/clavulanate</td>
<td>875 mg PO bid</td>
<td>1.46</td>
</tr>
<tr>
<td>Moxifloxacin</td>
<td>400 mg PO daily</td>
<td>2.56</td>
</tr>
<tr>
<td>Ciprofloxacin Metronidazole</td>
<td>500-750 mg PO bid 500 mg PO qid</td>
<td>0.30-0.44 0.32</td>
</tr>
</tbody>
</table>

### Empiric Parenteral Regimens for Biliary Tract Infections

<table>
<thead>
<tr>
<th>Drug (IV)</th>
<th>Regimen</th>
<th>Cost/day ($10 day regimen)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Moxifloxacin</td>
<td>400 mg IV daily</td>
<td>11.82</td>
</tr>
<tr>
<td>Ciprofloxacin Metronidazole</td>
<td>400 mg IV q 12 hours 500 mg IV q 6 hours</td>
<td>4.24 8.28</td>
</tr>
<tr>
<td>Ampicillin/sulbactam</td>
<td>3 grams IV q 6 hours</td>
<td>13.64</td>
</tr>
<tr>
<td>Piperacillin/tazobactam*</td>
<td>3.375 grams IV q 6 hours</td>
<td>63.04</td>
</tr>
<tr>
<td>Doripenem*</td>
<td>500 mg IV q 8 hours</td>
<td>6.93</td>
</tr>
</tbody>
</table>

*Piperacillin/tazobactam and doripenem should only be considered for empiric therapy if *P. aeruginosa* is suspected (i.e., nosocomial vs. community-acquired infection). Regimen should be tailored to susceptibility data, if available.

### Oral Step Down Regimens for Biliary Tract Infections

<table>
<thead>
<tr>
<th>Drug (PO)</th>
<th>Regimen</th>
<th>Cost/day ($10 day regimen)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amoxicillin/clavulanate</td>
<td>875 mg PO bid</td>
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</tr>
<tr>
<td>Moxifloxacin</td>
<td>400 mg PO daily</td>
<td>2.56</td>
</tr>
<tr>
<td>Ciprofloxacin Metronidazole</td>
<td>500-750 mg PO bid 500 mg PO qid</td>
<td>0.30-0.44 0.32</td>
</tr>
</tbody>
</table>
Management of Urinary Tract Infections (UTIs)

### Oral Regimens for Acute Uncomplicated UTI

<table>
<thead>
<tr>
<th>Drug</th>
<th>Regimen</th>
<th>Cost/day ($)</th>
<th>Cost (3 days)</th>
</tr>
</thead>
<tbody>
<tr>
<td>TMP/SMX DS</td>
<td>1 PO bid</td>
<td>0.30</td>
<td>0.90</td>
</tr>
<tr>
<td>Ciprofloxacin</td>
<td>250 mg PO bid</td>
<td>0.26</td>
<td>0.78</td>
</tr>
<tr>
<td>Nitrofurantoin</td>
<td>100 mg PO qid</td>
<td>2.64</td>
<td>7.92</td>
</tr>
</tbody>
</table>

### Parenteral Regimens for Acute Uncomplicated Pyelonephritis

<table>
<thead>
<tr>
<th>Drug</th>
<th>Regimen</th>
<th>Cost/day ($)</th>
<th>Cost (14 days)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ciprofloxacin</td>
<td>200 mg IV q 12 hours</td>
<td>3.44</td>
<td>48.16</td>
</tr>
<tr>
<td>Cefepime</td>
<td>1 gram IV q 12 hours</td>
<td>10.70</td>
<td>149.80</td>
</tr>
<tr>
<td>Ampicillin/sulbactam</td>
<td>3 grams IV q 6 hours</td>
<td>13.64</td>
<td>190.96</td>
</tr>
<tr>
<td>Piperacillin/tazobactam</td>
<td>3.375 grams IV q 6 hours</td>
<td>63.04</td>
<td>882.56</td>
</tr>
</tbody>
</table>

### Parenteral Regimens for Complicated UTI/Catheter Infections

<table>
<thead>
<tr>
<th>Drug</th>
<th>Regimen</th>
<th>Cost/day ($)</th>
<th>Cost (14 days)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ciprofloxacin</td>
<td>400 mg IV q 12 hours</td>
<td>4.24</td>
<td>59.36</td>
</tr>
<tr>
<td>Piperacillin/tazobactam</td>
<td>3.375 grams IV q 6 hours</td>
<td>63.04</td>
<td>882.56</td>
</tr>
<tr>
<td>Doripenem</td>
<td>500 mg IV q 8 hours</td>
<td>6.93</td>
<td>97.02</td>
</tr>
</tbody>
</table>

### Empiric Parenteral Regimens for Central Venous Catheter Infections

#### Gram-Positive Organism Isolated on Gram Stain

<table>
<thead>
<tr>
<th>Drug (IV)</th>
<th>Regimen</th>
<th>Cost/day ($)</th>
<th>Cost (10 day regimen)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vancomycin</td>
<td>1 gram IV q 12 hours</td>
<td>16.00</td>
<td>160.00</td>
</tr>
</tbody>
</table>

#### Gram Negative Organism Isolated on Gram Stain

<table>
<thead>
<tr>
<th>Drug (IV)</th>
<th>Regimen</th>
<th>Cost/day ($)</th>
<th>Cost (10 day regimen)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pipercillin/Tazobactam</td>
<td>4.5 g IV q 6 hours</td>
<td>77.52</td>
<td>887.60</td>
</tr>
<tr>
<td></td>
<td>210 mg IV q 12 hours</td>
<td>11.24</td>
<td></td>
</tr>
<tr>
<td>Cefepime</td>
<td>2 g IV q 8 hours</td>
<td>32.04</td>
<td>432.80</td>
</tr>
<tr>
<td></td>
<td>210 mg IV q 12 hours</td>
<td>11.24</td>
<td></td>
</tr>
<tr>
<td>Doripenem</td>
<td>500 mg IV q 8 hours</td>
<td>6.93</td>
<td>209.42</td>
</tr>
<tr>
<td>Tobramycin</td>
<td>210 mg IV q 12 hours</td>
<td>11.24</td>
<td></td>
</tr>
</tbody>
</table>

### Parenteral Regimens for Treatment of Central Venous Catheter Infections

#### Confirmed MRSA or MRSE*

<table>
<thead>
<tr>
<th>Drug (IV)</th>
<th>Regimen</th>
<th>Cost/day ($)</th>
<th>Cost (10 day regimen)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vancomycin</td>
<td>1 gram IV q 12 hours</td>
<td>16.00</td>
<td>160.00</td>
</tr>
</tbody>
</table>

#### Confirmed MSSA

<table>
<thead>
<tr>
<th>Drug (IV)</th>
<th>Regimen</th>
<th>Cost/day ($)</th>
<th>Cost (10 day regimen)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nafcillin</td>
<td>2 grams IV q 4 hours</td>
<td>92.28</td>
<td>922.80</td>
</tr>
</tbody>
</table>

Do not treat *S. epidermidis* bacteremia with drug therapy if only 1 blood culture is positive and patient is not clinically ill.
Tailor regimen for gram-negative infection based on culture and susceptibility data when available.

---

**Rev. 6/7/10**
### Oral and Parenteral Regimens for Cellulitis

<table>
<thead>
<tr>
<th>Drug</th>
<th>Regimen</th>
<th>Cost/day ($)</th>
<th>Cost (10 day regimen)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dicloxacillin</td>
<td>500 mg PO q8h</td>
<td>1.14</td>
<td>11.40</td>
</tr>
<tr>
<td>Cefazolin</td>
<td>1 gram IV q 8 hours</td>
<td>12.42</td>
<td>124.20</td>
</tr>
<tr>
<td>Augmentin</td>
<td>875 mg PO bid</td>
<td>1.46</td>
<td>14.60</td>
</tr>
<tr>
<td>Ampicillin/sulbactam</td>
<td>3 grams IV q 6 hours</td>
<td>13.64</td>
<td>136.40</td>
</tr>
<tr>
<td>Nafcillin</td>
<td>2 grams IV q 4 hours</td>
<td>92.28</td>
<td>922.80</td>
</tr>
</tbody>
</table>

### Oral and Parenteral Regimens for C. difficile Colitis

*Using the IV formulation for oral administration. Oral capsules no longer on formulary

<table>
<thead>
<tr>
<th>Drug</th>
<th>Regimen</th>
<th>Cost/day ($)</th>
<th>Cost (10 day regimen)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Metronidazole</td>
<td>500 mg PO qid</td>
<td>0.32</td>
<td>3.20</td>
</tr>
<tr>
<td></td>
<td>500 mg IV qid</td>
<td>8.28</td>
<td>82.80</td>
</tr>
<tr>
<td>Vancomycin*</td>
<td>125-250 mg PO qid</td>
<td>2.64-5.28</td>
<td>26.40-52.80</td>
</tr>
</tbody>
</table>

### Parenteral Antifungal Regimens

<table>
<thead>
<tr>
<th>Drug (IV)</th>
<th>Regimen</th>
<th>Cost/day ($)</th>
<th>Cost (10 day regimen)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amphotericin B</td>
<td>1 mg/kg/day IV (70 mg)</td>
<td>1.98</td>
<td>19.80</td>
</tr>
<tr>
<td>Fluconazole</td>
<td>400 mg IV daily</td>
<td>6.87</td>
<td>68.70</td>
</tr>
<tr>
<td></td>
<td>800 mg IV daily</td>
<td>13.74</td>
<td>137.40</td>
</tr>
<tr>
<td>Ambisome</td>
<td>5 mg/kg/day IV (350 mg)</td>
<td>28.98</td>
<td>289.80</td>
</tr>
<tr>
<td>Caspofungin</td>
<td>50 mg IV daily</td>
<td>11.31</td>
<td>113.10</td>
</tr>
<tr>
<td>Voriconazole</td>
<td>6 mg/kg IV X 2, then 4 mg/kg q 12 hours</td>
<td>33.66 (day 1), then 22.44</td>
<td>235.62</td>
</tr>
</tbody>
</table>
MANAGEMENT OF HOSPITAL-ACQUIRED (HAP), VENTILATOR-ASSOCIATED (VAP) AND HEALTHCARE-ASSOCIATED (HCAP) PNEUMONIA IN TRAUMA PATIENTS

Hospital guidelines for HAP, VAP and HCAP were developed in 2005, based on the American Thoracic Society's (ATS) guidelines for managing these types of pneumonia. A standard medication order set for HAP, VAP and HCAP and the ATS guidelines can be downloaded at [http://www.musc.edu/cee/ORDFRMS/pdf/hapvaphcap.pdf](http://www.musc.edu/cee/ORDFRMS/pdf/hapvaphcap.pdf) and [http://ajrccm.atsjournals.org/cgi/content/full/171/4/388](http://ajrccm.atsjournals.org/cgi/content/full/171/4/388), respectively.

According to our institutional guidelines, the diagnosis of HAP, VAP, and HCAP depends upon the presence of new or progressive radiographic infiltrates as well as other clinical features (fever >101.3°F, leukocytosis or leukopenia, change in oxygenation status and purulent secretions). Pathogenic bacteria in quantity, in culture, in intubated patients, in the absence of signs and symptoms of pneumonia, is NOT diagnostic of pneumonia.

Two sets of blood cultures from separate sites and cultures of lower respiratory tract secretions should be performed in all patients with suspected HAP, VAP, and HCAP, preferably before antibiotics are administered. A sterile culture of respiratory tract secretions in the absence of a new antibiotic in the past 72 hours makes the diagnosis of bacterial pneumonia less likely. Candida in respiratory secretions is almost always colonization, not infection.

Initial empiric antimicrobial therapy should include 3 drugs to cover for multi-drug resistant pathogens. Empiric drug selection is based on our unit-specific antibiogram and should include:

- Doripenem 500 mg IV q 8 hours OR
  - Piperacillin-tazobactam 4.5 grams IV q 6 hours, PLUS
- Tobramycin 3 mg/kg IV q 12-24 hours or 7 mg/kg IV q 24 hours, PLUS
- Vancomycin 15 mg/kg IV q 8-12 hours or Linezolid 600 mg IV q 12 hours

*All drugs listed above require dosing adjustments in patients with renal insufficiency.*

Pharmacokinetic/dynamics for tobramycin and vancomycin are altered in trauma patients. Consult with Brian McKinzie, PharmD (pager 13540), to determine initial starting doses for these drugs.

Desired peak and trough levels for these drugs are:

- Tobramycin peak: 10-12 micrograms/mL; trough: < 1 micrograms/mL
- Vancomycin trough: 15-20 micrograms/mL

*Oasis may red flag drug levels in these ranges.*

Please consult with Brian McKinzie, PharmD (pager 13540) before altering doses of these drugs.

Drug levels should be obtained when the drug concentration is deemed to be at steady state. Consult with Brian McKinzie, PharmD (pager 13540) to determine optimal timing for ordering vancomycin and tobramycin levels.

Drug therapy should be narrowed after 48-72 hours, based on the results of gram stain, culture and susceptibility data, and the patient's response to therapy (respiratory rate, temperature, SaO2, WBC, etc.).

The recommended duration of therapy is 8 days unless patient has multi-drug resistant pathogens (example: *Pseudomonas*), therapy may then increase to 10-14 days depending on clinical response. Hospital guidelines for HAP, VAP and HCAP were developed in 2005, based on the American Thoracic Society's (ATS) guidelines for managing these types of pneumonia. A standard medication order set for HAP, VAP and HCAP and the ATS guidelines can be downloaded at [http://www.musc.edu/cee/ORDFRMS/pdf/hapvaphcap.pdf](http://www.musc.edu/cee/ORDFRMS/pdf/hapvaphcap.pdf) and [http://ajrccm.atsjournals.org/cgi/content/full/171/4/388](http://ajrccm.atsjournals.org/cgi/content/full/171/4/388), respectively.
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Drug therapy should be narrowed after 48-72 hours, based on the results of gram stain, culture and susceptibility data, and the patient's response to therapy (respiratory rate, temperature, SaO2, WBC, etc.).

The recommended duration of therapy is 8 days unless patient has multi-drug resistant pathogens (example: Pseudomonas), therapy may then increase to 10-14 days depending on clinical response.

New 6/7/10
MUSC GUIDELINES FOR OFF-LABEL USE OF FACTOR VII (RFVIIA) IN TRAUMA

Institutional guidelines for use of Factor VII in trauma have been established and can be downloaded at http://www.musc.edu/pharmacy_services/medusepol/Factor VII/Factor7_Trauma_Guidelines.pdf. These guidelines address criteria for use, actions to perform prior to considering Factor VII, dosing guidelines, contraindications, and monitoring parameters.

Rev. 6/4/10
PHENYTOIN (DILANTIN®) SEIZURE PROPHYLAXIS IN HEAD TRAUMA

Initiating therapy:

Phenytoin (Dilantin®) therapy should be initiated within 24 hours of injury. Initiate therapy with a loading dose of 15-20 mg/kg IV, followed by a maintenance dose of 5 mg/kg/day IV given in 2-3 divided doses.

Monitoring therapy:

Check a Dilantin® free level 24 hours after the initial loading dose. A free drug level is preferred to a total drug level because Dilantin® is highly protein bound. A total drug level cannot be accurately interpreted without considering the patient's serum albumin level (i.e., a serum albumin level must also be drawn). The 24 hour post-loading dose level is obtained to ensure that the loading dose has achieved a serum concentration in the therapeutic range (1-2 micrograms/mL). Be sure this level is drawn prior to the next scheduled dose (i.e., drawn as a trough level). If Dilantin® is dosed appropriately up front and the initial 24 hour post-loading dose level is therapeutic it is not necessary to obtain further drug levels. If the patient experiences a seizure on Dilantin® therapy, check a Dilantin® free level and adjust the regimen if needed. Consult Brian McKinzie, PharmD (pager 13540) for assistance with drug dosing.

If the initial 24 hour post-loading dose level is subtherapeutic, administer another loading dose. Use the following calculation to determine the follow-up loading dose:

\[
\text{Follow-up loading dose} = (\text{desired free concentration} - \text{actual free concentration}) \times 10 \times 0.7 \times \text{weight in Kg}
\]

Check a Dilantin® free level 24 hours after this loading dose as described above. If subtherapeutic, repeat a loading dose (calculation described above) and follow-up 24 hour post-dose free level until the patient's drug level is therapeutic.

If the initial 24 hour post-loading dose level is supratherapeutic (> 2 micrograms/mL), consult Brian McKinzie, PharmD (pager 13540).

Duration of therapy:

If the patient is seizure-free, Dilantin® may be discontinued after 7 days of therapy. If the patient has a seizure during the initial week post-injury, Dilantin® should continue for 90 days and therapy reevaluated at that time. Serum concentrations should be monitored weekly in patients continuing Dilantin® therapy beyond 7 days. Consult Brian McKinzie, PharmD (pager 13540) for further drug regimen adjustments.

PREVENTION OF CONTRAST INDUCED NEPHROPATHY

Sodium Bicarbonate

Order 150 mEq NaHCO₃ in 1 L D5W to infuse at 3 mL/kg/hour for 1 hour prior to intravenous contrast, followed by 1 mL/kg/hour for 6 hours after intravenous contrast.


Acetylcysteine

Order acetylcysteine 600 mg PO BID before and after intravenous contrast.


New 5/25/07
MANAGEMENT OF HYPERGLYCEMIA IN TRAUMA PATIENTS

Tight blood glucose (BG) control, defined as maintaining BG levels between 80-110 mg/dL, has been shown to decrease morbidity and mortality in critically ill surgical patients. Critically ill trauma patients with hyperglycemia, defined as 2 BG measurements > 110 mg/dL within a 24 hour time interval or 1 BG measurement > 140 mg/dL, will be managed with the STICU Glucose Management Protocol. This protocol can be downloaded from the STICU web site at http://www.musc.edu/medcenter/nursing/unit/STICU/ under the section on protocols and guidelines.

Standardized order forms have been developed for ordering IV insulin infusions as well as SC insulin regimens. These order forms can downloaded from the Clinician Orders Forms site.

BG control should also be maintained at normal (or close to normal) levels for trauma patients admitted to the floor service. Insulin orders should be initiated on all admissions to the trauma floor service. The target BG range is 80-140 mg/dL with BG monitoring ac and hs for patients taking an oral diet, or q 4 hours for patients who are NPO or are receiving parenteral or enteral nutrition. Correction (aspart) insulin should be ordered using the HIGH DOSE ALGORITHM (or correction scale #3 on new forms).

Patients transferred from the STICU to the floor may be receiving basal (NPH) insulin in addition to correction insulin to maintain their BG in the target range. Patients without a history of diabetes and a normal HgA1C may have their basal insulin decreased by 50% per day once stablized on the floor. Once the patient has been tapered to 10 units of basal insulin per day it can be discontinued. Patient with diabetes should be resumed on their home diabetes medication regimen as soon as it is safe to do so. Consider a DMS consult in diabetic patients who are not maintained in the target range on their home diabetes medication regimen.

A comparison chart of insulin products can be downloaded at www.musc.edu/pharmacyservices/medusepol/InsulinComparisonChart.pdf.
NUTRITION GUIDELINES FOR TRAUMA PATIENTS

Nutrition guidelines for adult patients receiving specialized nutrition support using parenteral nutrition (PN) or enteral nutrition (EN) can be downloaded at http://www.musc.edu/cce/ORDFRMS/pdf/adultpnguidelines.pdf and http://www.musc.edu/cce/ORDFRMS/pdf/enteraladultguide.pdf, respectively.

The adult PN guidelines include appropriate indications for PN, body weight calculations, methods to estimate daily calorie and protein needs, conversion factors for carbohydrate, protein and lipids, suggested laboratory tests for monitoring PN, a calculation for maximally concentrating a PN, and contents of standard multivitamin and trace elements added to PN.

The adult EN guidelines include body weight calculations, methods to estimate daily calorie and protein needs, a calculation of water requirements for patients receiving EN, the enteral formulary, and the procedure for administering Pro-Stat 64® via enteral tubes.

In general, nutrition for trauma patients is initiated at 25 kcal/kg/day and 1.5 grams/kg/day protein. Please consult with Emily Chapman, RD (pager 12255) or Brian McKinzie, PharmD (pager 13540) for nutrition issues in the STICU, and Kristi Fogg, RD (pager 12461) or Brian McKinzie, PharmD (pager 13540) for nutrition issues on the trauma floor patients.


The enteral formula commonly used in trauma patients is Promote®. Crucial® may be used in patients without sepsis for wound healing purposes and Nepro® may be used in patients with renal insufficiency. ProStat® 64 is a protein supplement that can be administered via feeding tube in addition to the protein supplied by the enteral formula. Each dose provides 15 grams of protein.

Enteral formulas may be delivered via gastric or small bowel feedings. Continuous infusion is the preferred method of delivery for both feeding routes. Enteral feedings should NOT be held secondary to high gastric residuals unless the residual is > 200 mL, regardless of the rate of the enteral infusion.

Special situations:

Permissive Underfeeding Guidelines

A permissive underfeeding protocol was developed by the Nutrition Support Team in 2005 to assist in optimizing blood glucose control in patients receiving specialized nutrition support. This protocol can be downloaded at http://www.musc.edu/cce/ORDFRMS/pdf/underfeeding.pdf.

Guidelines for Juven® Supplementation

Juven® is a therapeutic drink that contains 15.5 grams protein and 75 calories per packet. It is a combination of arginine (7 grams), glutamine (7 grams), and beta-hydroxy-beta-methylbutyrate (HMB) (1.5 grams), and may be considered for use in some specific patient populations. These guidelines can be downloaded at http://www.musc.edu/cce/ORDFRMS/pdf/juvenguidelines.pdf.
Guidelines for Use of Immune-Enhancing Enteral Formulas

Immune-enhancing enteral formulas are specialized formulas that are enhanced with glutamine, arginine, and omega 3 fatty acids. These formulas may be considered for use in some specific patient populations. These guidelines can be downloaded at http://www.musc.edu/cce/ORDFRMS/pdf/immuneenteral.pdf.

Guidelines for Glutamine Supplementation

Glutamine is a conditionally essential amino acid which has been shown to be beneficial in specific patient populations. Guidelines for Glutamine Supplementation have been established and can be downloaded at http://www.musc.edu/cce/ORDFRMS/pdf/enteralglutamineguide.pdf.

Adult Enteral Nutrition Formulary Substitution Guidelines


Methylene Blue Guidelines

Guidelines for the use of methylene blue were established in 2006 to discourage the routine use of methylene blue in tube feedings to monitor patients for aspiration. Guidelines for appropriate use of methylene blue can be downloaded from the Pharmacy Services web site at http://www.musc.edu/pharmacyservices/medusepol/methyleneblue.pdf.

Rev. 5/25/07
CONTINUOUS INFUSION GUIDELINES FOR ADULT MUSC PATIENTS

The institutional continuous infusion guidelines can be downloaded at http://www.musc.edu/pharmacieservices/medusepol/adultcontinfusion.pdf. These guidelines contain useful information regarding standard concentrations, average starting dose, dosing ranges and maximum concentrations for medication delivered by continuous infusion.

Rev. 6/4/10
PREVENTION AND MANAGEMENT OF ALCOHOL WITHDRAWAL SYNDROME IN TRAUMA PATIENTS

An Adult Alcohol Withdrawal Syndrome (AWS) Practice Guideline was developed in 2001 and is used to manage trauma patients at risk for AWS. The Adult AWS Orders and Practice Guideline can be downloaded at http://www.musc.edu/cce/ORDFRMS/pdf/ah_all_orders_awssi.pdf and http://www.musc.edu/cce/ORDFRMS/pdf/ah_all_docu_awsguidelines.pdf, respectively.

Rev. 5/25/07
TREATMENT OF DEEP VENOUS THROMBOSIS (DVT) AND PULMONARY EMBOLISM (PE)

Patients with documented DVT or PE may be treated with unfractionated heparin (UFH) IV or low molecular weight heparin (LMWH). Standardized heparin protocols have been developed for the institution. UFH must be ordered using the standardized order set, which can be downloaded at http://www.musc.edu/cce/ORDFRMS/pdf/ah_all_pedvtheparinprotocol.pdf

LMWH guidelines for treatment of proximal DVT and PE are listed below:

<table>
<thead>
<tr>
<th>Drug</th>
<th>Dose</th>
<th>Cost/day ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Enoxaparin</td>
<td>1 mg/kg bid</td>
<td>83.02 (80 mg syringe)</td>
</tr>
<tr>
<td>anti Xa</td>
<td></td>
<td>209.00</td>
</tr>
</tbody>
</table>

*LMWH cost calculated for a 70 kg patient
*anti Xa level should be drawn 4 hours after the dose

The adult anticoagulation treatment physician order set should be utilized:
http://www.musc.edu/cce/ORDFRMS/pdf/ah_all_orders_warfarinorders.pdf

<table>
<thead>
<tr>
<th>Drug/lab test</th>
<th>Dose</th>
<th>Cost/day ($)</th>
</tr>
</thead>
</table>
| UFH           | 80 units/kg loading dose  
18 units/kg/hour maintenance dose | 15.00 (per bag) |
| aPTT          | -                     | 29.00 (cost to patient per level) |

UFH cost calculated for a 70 kg patient

Treatment with UFH or LMWH should continue for at least 5 days, and warfarin should be overlapped with UFH or LMWH for at least 4-5 days. (For massive PE or severe iliofemoral thrombosis, a longer period of heparin therapy may be warranted.) Warfarin 5 mg PO should be initiated on day 1, if possible. When transitioning from UFH or LMWH to warfarin, please utilize the adult anticoagulation treatment physician order set at: http://www.musc.edu/cce/ORDFRMS/pdf/ah_all_orders_warfarinorders.pdf.

Warfarin should be continued for at least three to six months (target INR 2-3). If warfarin is contraindicated, a treatment dose of LMWH should be used for the duration of therapy.

Direct Thrombin inhibitors (DTIs)

DTIs are used for prophylaxis and/or treatment of thrombosis in patients with suspected HIT, and in patients refractory or allergic to heparin.

<table>
<thead>
<tr>
<th>Drug</th>
<th>Dose</th>
<th>Cost/day ($)</th>
<th>Clinical Pearls</th>
</tr>
</thead>
<tbody>
<tr>
<td>Argatroban</td>
<td>0.5 micrograms/kg/min*</td>
<td>591.78</td>
<td>Argatroban will falsely elevate the INR</td>
</tr>
<tr>
<td>Bivalirudin</td>
<td>0.2 mg/kg/hour**</td>
<td>857.60</td>
<td>Agent of choice for patients with hepatic insufficiency</td>
</tr>
</tbody>
</table>

*Requires dosage adjustment for hepatic insufficiency
**Requires dosage adjustment for renal insufficiency (refer to: http://www.musc.edu/cce/ORDFRMS/pdf/dtiforhpi.pdf)
### Normal Ranges

<table>
<thead>
<tr>
<th>Test</th>
<th>Normal Ranges</th>
</tr>
</thead>
<tbody>
<tr>
<td>PT</td>
<td>12.7-14.6</td>
</tr>
<tr>
<td>aPTT</td>
<td>16.9-36.4</td>
</tr>
<tr>
<td>Fibrinogen</td>
<td>224-489</td>
</tr>
<tr>
<td>Thrombin time</td>
<td>16.2-19.6</td>
</tr>
<tr>
<td>D-Dimer</td>
<td>&lt;0.43 micrograms/mL FEU</td>
</tr>
</tbody>
</table>

### Panic Values

<table>
<thead>
<tr>
<th>Test</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>INR</td>
<td>&gt;3.5</td>
</tr>
<tr>
<td>aPTT</td>
<td>&gt;150 seconds</td>
</tr>
</tbody>
</table>

### PE/DVT Heparin Protocol

Please refer to: [http://www.musc.edu/cce/ORDFRMS/pdf/ah_all_pedvtheparinprotocol.pdf](http://www.musc.edu/cce/ORDFRMS/pdf/ah_all_pedvtheparinprotocol.pdf) for desired dosing, monitoring, and adjustments based on indication.

### LMWH Monitoring (anti Xa levels)

**Desired ranges:**

- **Prophylaxis:** 0.1-0.3 anti Xa units/mL
- **Treatment:** 0.4-1 anti Xa units/mL

### Direct Thrombin Inhibitor (DTI) Protocol

**Desired aPTT Range 50-80**

- **Initial starting doses:**
  - Argatroban 0.5 microgram/kg/min;
  - Bivalirudin 0.2 mg/kg/hour

Refer to: [http://www.musc.edu/cce/ORDFRMS/pdf/dtiforhpi.pdf](http://www.musc.edu/cce/ORDFRMS/pdf/dtiforhpi.pdf) for dosing adjustments

Rev. 6/4/10
ELECTROLYTE REPLACEMENT GUIDELINES

Institutional electrolyte replacement guidelines have been developed for sodium, potassium, calcium, phosphorus and magnesium. These guidelines can be downloaded at
http://www.musc.edu/pharmacyservices/medusepol/Adult_Calcium_Guidelines.pdf
http://www.musc.edu/pharmacyservices/medusepol/AdultMagnesiumGuidelines.pdf
http://www.musc.edu/pharmacyservices/medusepol/AdultPhosphorusGuidelines.pdf
http://www.musc.edu/pharmacyservices/medusepol/ADULT%20POTASSIUM%20GUIDELINES.htm, and
http://www.musc.edu/pharmacyservices/medusepol/AdultSodiumGuidelines.pdf

Standardized orders for electrolyte replacement in the STICU can be downloaded at
http://www.musc.edu/cce/ORDFRMS/pdf/ah_ccu_cticu_ddicu_micu_nsicu_sticu_orders_electrolyteprot0.pdf

Rev. 5/22/07
COST COMPARISON: IV TO PO MEDICATION CONVERSIONS

<table>
<thead>
<tr>
<th>Drug</th>
<th>IV Dose</th>
<th>Cost/Dose ($)</th>
<th>PO Dose</th>
<th>Cost/Dose ($)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ciprofloxacin</td>
<td>400 mg</td>
<td>2.12</td>
<td>750 mg</td>
<td>0.22</td>
</tr>
<tr>
<td></td>
<td>200 mg</td>
<td>1.72</td>
<td>500 mg</td>
<td>0.15</td>
</tr>
<tr>
<td></td>
<td>250 mg</td>
<td>0.22</td>
<td>250 mg</td>
<td>0.13</td>
</tr>
<tr>
<td>Levofloxacin</td>
<td>750 mg</td>
<td>47.79</td>
<td>750 mg</td>
<td>4.83</td>
</tr>
<tr>
<td></td>
<td>500 mg</td>
<td>35.96</td>
<td>500 mg</td>
<td>2.42</td>
</tr>
<tr>
<td></td>
<td>250 mg</td>
<td>2.42</td>
<td>250 mg</td>
<td>2.42</td>
</tr>
<tr>
<td>Fluconazole</td>
<td>800 mg</td>
<td>13.74</td>
<td>800 mg suspension</td>
<td>14.40</td>
</tr>
<tr>
<td></td>
<td>400 mg</td>
<td>6.87</td>
<td>800 mg tablet</td>
<td>0.70</td>
</tr>
<tr>
<td></td>
<td>200 mg</td>
<td>3.44</td>
<td>400 mg suspension</td>
<td>7.20</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>400 mg tablet</td>
<td>0.35</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>200 mg suspension</td>
<td>3.60</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>200 mg tablet</td>
<td>0.18</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>100 mg suspension</td>
<td>1.80</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>100 mg tablet</td>
<td>0.14</td>
</tr>
<tr>
<td>Metronidazole</td>
<td>500 mg</td>
<td>2.07</td>
<td>500 mg</td>
<td>0.08</td>
</tr>
<tr>
<td>Clindamycin</td>
<td>900 mg</td>
<td>14.40</td>
<td>450 mg</td>
<td>0.85</td>
</tr>
<tr>
<td></td>
<td>600 mg</td>
<td>11.78</td>
<td>300 mg</td>
<td>0.81</td>
</tr>
<tr>
<td>Famotidine</td>
<td>20 mg</td>
<td>0.49</td>
<td>20 mg suspension</td>
<td>1.38</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>20 mg tablet</td>
<td>0.06</td>
</tr>
<tr>
<td>Ranitidine</td>
<td>50 mg</td>
<td>3.64</td>
<td>150 mg</td>
<td>0.07</td>
</tr>
<tr>
<td>Midazolam</td>
<td>1 mg</td>
<td>0.39</td>
<td>N/A</td>
<td>N/A</td>
</tr>
<tr>
<td>Lorazepam</td>
<td>1 mg</td>
<td>0.57</td>
<td>1 mg elixer</td>
<td>0.29</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>1 mg tablet</td>
<td>0.06</td>
</tr>
</tbody>
</table>

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