Munson Medical Center
Trauma/Acute Care Surgery
Service Manual

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Chapter 1

Service Organization

Munson TACS Service Philosophy

Services provided by the TACS Program partnered with Munson Healthcare and its partners provide superior quality of care and are dedicated to providing specialized, effective care to all injured patients brought to this facility.

Mission Statement

Our mission is to provide optimal quality, safe patient care, through physician driven performance evaluation and patient care improvements for the community.

Program Vision

Munson Medical Center can and should provide optimal care and resources to the injured patient in the Traverse City community and its surrounding areas through the development of a team driven model. This model will include the creation of formal transfer agreements with approved trauma centers within the state of Michigan to expedite efficient and state of the art treatment for any patient whose needs cannot be met with the available resources here at Munson Medical Center (i.e.: burns, pediatric critical care, spinal cord injuries requiring high level spinal cord rehabilitation). Munson recognizes the need for a regionalized trauma system within the state of Michigan and will participate in all efforts to move the state forward through its own center development and through participation in the activities developing public Act 440 and the State Trauma Commission. The ultimate goal of these efforts will be to assist in the reduction of preventable morbidity and mortality from trauma, the number one killer of persons aged 1-44 in Michigan and in the United States.

TACS Service Goals

Maintenance of ACS Level II trauma center verification
Community Injury prevention education
Outreach program to health facilities throughout our region that provide trauma care
Help improve trauma outcomes and prevent injury through public and professional dissemination of information and by facilitating access to the clinical and educational resources of a Trauma center.

Objectives

1. To provide assessment and initial treatment in an organized and properly directed manner, with policies and protocols consistent with the defined capabilities of the trauma service program.
2. To integrate fully with other departments of the hospital, and with the surrounding community, in all aspects of trauma care.
3. To ensure, on a basis of 24 hour a day, quality care that meets with the highest standards available
4. To provide, with the hospital staff, means of auditing and reviewing the quality of trauma patient care.

5. To ensure all staff members working within the hospital participating in trauma patient care receive adequate special training and possess the necessary skills for adequate performance of their duties.
6. To ensure that facilities for trauma patients are such to ensure effective and high quality trauma care.
7. To ensure that comprehensive medical records are kept for each patient to document appropriate and extent of trauma care.
8. To guide patient care by written policies, protocols supported by appropriate reference material and represent state of the art care.
9. To continue public education, injury prevention education, on an on going basis working with appropriate agencies.
10. To provide ongoing continuing medical education in clinical areas

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Chapter 2

Operational Guidelines

Definition of a Trauma Patient

Objectives:
To provide optimal identification of patients who require prompt assessment and intervention from the trauma service.

Definitions:
Level I trauma patient: A severely injured patient with a physiologic derangement or anatomic location of injury, who will likely need emergent surgery or lifesaving intervention.
Level II trauma patients: A hemodynamically stable moderately injured patient, or a patient whose mechanism of injury has the potential to threaten life or limb.
Trauma consultations: A patient found to have significant injury whose mechanism of injury or hemodynamic findings did not warrant initial trauma activation**.**
Trauma transfers: A traumatized patient initially evaluated at a nearby facility and found to have significant injuries that need specialized care and management that cannot be cared for at the transferring facility.

Decision Criteria:
There is automatic trauma criteria used to stratify trauma patients and is activated anytime a patient meets specific criteria. It is the responsibility of the emergency department physician to make the decision to activate the trauma team for patients who do not meet the criteria exactly but whom they feel may have injuries that require the attention of the trauma team. Collaboration with the pre-hospital personnel and the trauma surgeon may occur in the process. Decision is based on the following guidelines of physiologic signs, obvious anatomic injuries, mechanism of injury, and concurrent disease. Trauma activation guidelines are as follows:

Trauma Activations
Viewing Trauma Team Activation

Level I Trauma Activation:
LEVEL I Trauma- (15 min Trauma Surgeon Response)
ANY 1 OF THE FOLLOWING (RELATED TO TRAUMA)
(Injury occurred within last 24 hours)

□ **Airway**
- Intubated patients transferred from the scene
- Patients in need of an emergent airway
- Inhalation injury with threat of airway involvement

□ **Breathing**
- Respiratory Compromise (RR <10 or >29)

□ **Circulation**
- Hemodynamic Compromise (Systolic Blood Pressure <90)
- AGE 65 and older:
  - SBP <110
  - HR > SBP

- Birth-6 months: SBP < 60
- Infant (6-12 months): SBP < 70
- Toddler/Preschool (1-10 years): SBP < 80
- Adolescent (> 10 years): SBP < 90

□ **Deficit**
- Altered Mentation (Glasgow Coma Scale/GCS <9)

□ **Secondary Survey: Anatomic**
- GSW/Penetrating injury of head, neck, chest, abdomen, back.
- Flail chest
- Unstable pelvic fracture
- Open or depressed skull fractures
- Trauma Paralysis
- Amputation proximal to wrist or ankle, crushed, or mangled extremity.
- Limb threatening injuries

□ **Trauma Transfer:**
- Receiving blood products to maintain vital signs
- With or ongoing respiratory compromise (unstable)
- Hemodynamic compromise.
- Neurologic compromise.

□ **Emergency Department Physician discretion.**

Level II Trauma Activation:

Level II Trauma- (60 min Trauma Surgeon Response)
ANY 1 OF THE FOLLOWING (RELATED TO TRAUMA)
(Injury occurred within last 24 hours)
ANATOMIC INJURY:
□ Altered Mentation: Glasgow Coma Scale (GCS) 9-13
□ Penetrating injury of extremities unless hemodynamically unstable.
□ Burns
- Total Body Surface Area >20%
- Electrical or lightning injuries
- Full thickness circumferential burns

□ ≥2 proximal long bone fractures (humerus or femur)
□ Major degloving
□ Focal neurological abnormality resulting from trauma
MECHANISM OF INJURY
□ Motorcycle, ATV, snowmobile, watercraft, animal rider, or pedestrian:
- Rider vehicle separation
- Victim run over
- Significant impact at >20 mph

□ Motor Vehicle Crash (MVC) with:
- Ejection from vehicle
- Death of occupant in same vehicle
- High speed ≥50 mph upon impact

- Prolonged extrication > 20 minutes
- Major intrusion of passenger compartment

□ Falls > 20 feet
□ Drowning **if associated with trauma**, unless unstable (level 1)
□ Pregnancy w/abdominal trauma/abdominal pain
□ Other outside trauma transfers
□ Emergency Department physician discretion

DOWNGRADES: By ED physician only after conversation with Trauma Surgeon and/or Trauma APP

Trauma Consultation:
□ Trauma transfers without hemodynamic compromise that do not meet Level I or Level II activation criteria.
□ ED Physician discretion.
□ >2 rib fractures requiring admission or ANY # of rib fractures >65 years of age requiring admission.

Activation of the trauma team

Objective:
To assure that the patient arriving in the emergency department with a recognized threat to life or limb will receive immediate assessment and treatment.

Level I Trauma Respondents:
Trauma surgeon
E.D. physician
Trauma physician assistant or nurse practitioner
E.D. trauma nurse (primary and secondary, the secondary may be a paramedic)
Radiology technician
Respiratory therapist
Lab technician
Messenger
Pharmacist
Clerk
ED Social Worker
Registration

Alerted of level I trauma:
Radiologist
Anesthesia
ICU charge nurse
OR charge nurse
CT Technician
Blood bank: MMC NFAM Whole Blood Process

Blood Products will be delivered by blood bank in a color-coded cooler for all Level I Trauma Activations. Age must be indicated in the activation page.

- For males 15 and older, and females 50 and older:
  - **Whole Blood** will be delivered in a blue cooler
- **O negative Blood** will be delivered when whole blood is not available, and for females of childbearing age in a red cooler.

Level II Trauma Respondents:

E.D. physician
Trauma physician assistant or nurse practitioner
Trauma surgeon
E.D. trauma nurse
Radiology technician
Lab technician
ED RN (primary and secondary, secondary may be a paramedic)
Pharmacist
Clerk
ED Social Worker
Registration

Alerted to level II trauma:

CT technician

Trauma Team Roles

Viewing Trauma Team Roles

Objective:

To define the number, type, positions and responsibilities of the trauma team members in order to facilitate an orderly, complete and cooperative response to the injured patient.

Roles of Trauma Team members

The responsible parties are to know and carry out their duties as defined below. Cooperation, support, and communication among team members are essential to an effective resuscitation of the injured patient.

Emergency Room Physician
Position: Patient's head
Responsibilities: Cooperates with the ER charge nurse in defining trauma team activation level; possible need to upgrade level of activation; need for trauma surgeon consultation. Applies necessary protective gear; enforces use of protective gear by trauma team. Coordinates care of patient until trauma surgeon arrives and assumes care. Gives repot to the trauma surgeon or defers report to the trauma physician assistant or nurse practitioner. Assesses airway; secures the airway if needed; identifies need for anesthesiology consult. Performs primary and secondary surveys if needed and is the physician of record for procedures done by the trauma PA/NP in the absence of the trauma surgeon.

Attending Trauma Surgeon (team leader)
Position: Left side of patient (looking out to doorway) or foot of the bed.
Responsibilities: Arrive at the bedside within the time limits set by the trauma team activation policy; inform the scribe nurse of arrival; Applies necessary protective gear and enforces use of protective gear by other trauma team members; receives report from the emergency room physician and / or the trauma PA/NP and assumes responsibility for patient care. Directs and coordinates care among the team. Identifies consultants as needed and informs the scribe nurse to document consult time. Direct or assist trauma PA/NP with procedures; is the physician of record for procedures done by the trauma PA/NP in his/her presence. Approve release of trauma team members. Communicates status of patient to family.

Trauma PA/NP
Position: Right side of patient (looking out to doorway)

Responsibilities: Inform scribe nurse of arrival. Apply protective gear as necessary. Obtain EMS report, perform primary survey, secondary survey, and carry out interventions as needed; report findings to scribe and trauma team leader. Order necessary tests and diagnostics.

Emergency Room Nurse #1, Primary Nurse (scribe)
Position: Left side of patient next to counter and computer
Responsibilities: Document prehospital report information on the Munson Medical Center Trauma Flow Sheet. Documents arrival times of all trauma team members. Documents patient assessment data on the trauma flow sheet. Documents procedures performed, vital signs, GCS (hourly on level I trauma patients), I+O totals. Accompanies patient to all tests and procedures with a monitor until released by the trauma surgeon/designee. Communicates with patient's family; facilitates communication among team. Documents arrival times of consulting physicians, or ancillary staff (MSW, pharmacist). Eventually assumes total care of the stable patient.

Emergency Room Nurse #2 (second nurse or paramedic)
Position: Right side of patient (looking out to doorway)
Responsibilities: Applies protective gear as necessary. Assists with disrobing patient, attaches ECG monitoring leads, attaches noninvasive BP cuff, attaches pulse oximeter, ensures there are two large bore IV's, and that they are functioning, ensures proper warming techniques have been instituted as needed, assist with procedures as needed, inserts nasogastric tubes, foley catheter as needed, obtains temperature, and assists primary nurse with transport to tests/diagnostics as needed. Is released when trauma surgeon/designee, or primary nurse has deemed appropriate to do so.

Respiratory Therapist
Position: Left side of patient at head of bed pulse
Responsibilities: Applies protective gear as necessary, confirms administration of oxygen, and attaches pulse oximeter if not already done. Assists with airway management; Confirms airway placement of prehospital intubations with CO2 monitor and auscultation. Secure airway as per protocol. Assist with intubations at direction of emergency room physician, anesthesia, or trauma surgeon. Sets up mechanical ventilator as directed. Secures nasogastric tube.

Emergency Room Technician
Position: At foot of bed
Responsibilities: Applies protective gear as necessary, assists with attaching vital sign monitoring equipment, assists with acquiring necessary equipment if not readily available, assists with transport of patient to necessary tests/diagnostics, assists with sending off fluid samples to laboratory, assists with clean up of room once resuscitation is complete, as well as restocking equipment used.

Laboratory Personnel
Position: Right side of patient (or if necessary, left side)
Responsibilities: Applies protective gear as necessary, obtains trauma panel as per protocol, obtains other needed lab studies, obtains EKG when needed.

Anesthesia Services
Anesthesia Services must be available within 15 minutes of request. This response applies to all ED, OR, and inpatient requests.
The attending anesthesiologist must be present within 30 minutes of request for all operations.

Emergency Room Clerical Staff
Position: At computer located in room
Responsibilities: Reports to trauma room once activation has been initiated. Pulls up FirstNet page prior to patient's arrival. Moves patient to bed in computer if registration has not done so. Notifies staff of patient's arrival via overhead paging system. Orders all tests as instructed by

emergency room physician, trauma surgeon, or trauma PA/NP. Communicates with radiology staff to coordinate timing of CT scans or other radiological tests.

Radiology Technician
Position: As directed by trauma team members
Responsibilities: Applies protective gear as necessary, ensures that appropriate film cassettes are available and ready to use, and processes the films taken as ordered by the physician. Is released by the trauma team when no longer needed during the resuscitation phase.

Registration Clerical Staff
Position: In hallway outside trauma room
Responsibilities: Reports to trauma bay when trauma has been activated. Obtains patient information from EMS and verifies with patient if able, or with family when present. If patient is unresponsive or unable to verify information and there is no family available, the patient is registered as a “Doe” until family is available to identify patient. Applies identification band to patient, prints patient identification labels and chart, Applies labels to chart. Updates patient information once patient has been stabilized.

Trauma Advanced Practice Provider Requirements:

Must maintain certification in: BLS, ACLS, ATLS, PALS or APLS
Skill validation / competency upon hire and as needed:

- FAST exam training
- Central venous access
- Chest tube insertion
- Massive Transfusion Protocol
- Anticoagulation reversal protocol
- Arterial line
- Suturing

Transfer of the Trauma Patient to Munson Medical Center:

Purpose:
To ensure rapid transfer of injured patients in a regional Trauma system.

Definitions:
Transfers to Munson Medical Center shall be in accordance with the Munson Medical Center transfer policy. The following guidelines are recommended for patients who are transferred to Munson Medical Center as a result of traumatic injury.

Guidelines:
Responsibilities of the transferring physician:

1. To resuscitate the patient within resources available.
2. To assess the urgency of transfer.
3. To decide on the mode of transportation.
4. To decide on the level of care necessary to deal with the patient's injuries.
5. To consider the potential problems that may develop during transport.
6. To communicate directly with the receiving physician in ED and Trauma Surgeon
7. To provide a copy of records, lab and radiology studies.
8. To complete and send transfer forms with the patient. This includes the ORIGINAL EMS run report.

Responsibilities of the receiving physician:

1. To communicate directly with the transferring physician.
2. To suggest additional maneuvers to enhance the care of the patient during transport.
3. To assist the transferring physician in deciding the mode of transportation and type of personnel necessary for a safe transfer.
4. To obtain the name and phone number of the transferring physician, patient name and information pertinent to continuity of care

Transfer of the Trauma Patient from Munson Medical Center
Viewing Trauma Transfer Out Process

Purpose: To ensure access to specialized emergency care for the trauma patient when services are not available at Munson Medical Center (MMC). This is to ensure the safe and timely transfer to an appropriate accepting facility with previously agreed upon conditions.

Definition: Transfers from Munson Medical Center shall be in accordance with the Munson Medical Center transfer policy. The following guidelines are recommended for patients who are transferred from Munson Medical Center that have sustained a traumatic injury.

Consideration for transfer: Higher level of care required or unavailable resources at Munson Medical Center

Guidelines:

MMC endorses the following procedures regarding the transfer process of the injured patient:

1. The health and well-being of the patient must be the overriding concern.
2. Trauma surgeons, Emergency Department (ED) physicians, and Trauma Advanced Practice Providers (APP) should comply with applicable state and federal regulations regarding patient transfer. There must be a "medical screening exam" prior to any decision to transfer an injured patient, and this should be performed by a physician.
3. A transfer should not occur until the trauma patient has received an adequate resuscitation and has been stabilized for the transfer.
4. There must be a direct conversation from provider to provider regarding the transfer as mandated by the American College of Surgeons.
5. Prior to transfer the following guidelines should be followed at minimum:
    a. Identification of the immediate life-threatening injuries.
    b. Direct provider to provider communication which includes discussion of the patient's known injuries, current treatments, and agreement on transportation mode.
    c. It is the sending provider's responsibility to determine the mode of transportation that best suits the patient's needs and level of care;
    d. All appropriate forms must be completed and all pertinent medical information such as labs and diagnostic studies must be sent electronically if the institution has that capability or on paper/disc if needed. If results come back after the patient has left, those results should be transmitted to the receiving facility.
6. If possible, the trauma surgeon or APP should inform the patient or the next of kin of the risks and benefits of transfer. This conversation should be documented in the patient record.

Trauma Resuscitation Guidelines

General

1. Preparation of Resuscitations Suite and Personnel Prior to Patient Arrival
    a. Documentation of all personnel and their arrival time.
    b. Donning of protective gear as deemed necessary.
    c. Asses room and assure all appropriate equipment is available and functioning.
    d. Set up all equipment prior to patient's arrival as warranted i.e. Level 1, IV fluids, Bair hugger airway equipment etc.
    e. Ensure all trauma team members have been notified of activation.
    f. Assure x-ray plates are on stretcher. (Radiology tech).
    g. Team leader will review pre-assigned roles and any pertinent pre-hospital information.
2. Each team member must identify himself or herself to the scribe. They must understand their individual tasks and function within their role, unless otherwise directed by the team leader.
3. The team leader directs and coordinates diagnostic studies and interventions
4. The team leader receives key pre-hospital information after completion after completion of the primary survey.
5. Overall noise level should be minimal so that communication and control as maintained throughout the resuscitation. It is the responsibility of the team leader to assess and maintain noise control.
6. The team leader clearly announces assessment, plan and intervention for the purpose of ongoing communication and complete documentation.
7. The primary and secondary surveys are repeated frequently to ascertain any deterioration of patient condition and need for immediate intervention.
8. Initial vital signs are taken and called out to the team.
9. Protocols are based on the recommendations of the current *Advanced Trauma Life Support Manual***.**

Primary Survey Protocol

1. **A**irway maintenance with cervical spine protection: In any patient with airway compromise, a definitive airway should be placed. The decision to place an airway as based on clinical findings and includes apnea, inadequate respiratory effort, and severe head injuries, and/or GCS 8 and < Establishment of an airway is done in accordance with ATLS protocol.
2. **B**reathing and ventilation: Team leader will expose chest to evaluate any compromise of ventilation. Inspect for chest wall excursion or open chest wounds, percuss for presence of air or blood in chest, palpate for subcutaneous air or crepitus, Auscultate for symmetric breath sounds. Intervene in any acute impairment of ventilation.
3. **C**irculation with hemorrhage control:
    a. **Blood volume**: Assess skin color and palpate a central artery for quality, rate, and regularity. Absent or thready rapid pulse indicates the need for immediate resuscitation.
    b. **Bleeding**: Rapid external blood loss is managed with direct pressure. Occult blood loss in the chest or abdomen may present with hypotension and tachycardia, a fluid bolus is indicated with crystalloids. Patients with obvious open book pelvic fractures should be placed in a binder. Patients with significant abdominal injuries and hypotension (SBP <90) should undergo laparotomy as soon as possible. Blood products should be started after 1 liter of crystalloid fluids have been given with no improvements of hemodynamic status.

4. **D**isability (neurological evaluation): A rapid evaluation is conducted. This exam will include a GCS, pupillary responses, and reflexes. Frequent neurological reevaluations are important to detect any changes in mental status.
5. **E**xposure/Environmental control: As a team, completely undress patient by cutting off clothing as needed for a thorough evaluation and assessment. Cover patients with warm blankets to help prevent hypothermia. IV fluids should be warmed. Examine back of patient and remove backboard. Rectal exam is performed while patient is rolled. C-spine in line stabilization is maintained by the team member positioned at the head during log roll. Examine for any deformities, step-offs, or tenderness with palpation. A bair hugger is also available for rewarming.

This completes the **Primary Survey** and should take less than a minute, provided there are no life-saving interventions that are necessary. The concise EMS report is now reviewed.

Primary Interventions During or After Primary Survey

- Establish 2 large bore IV's for possible fluid resuscitation. (rapid, warm crystalloid fluids 0.9% Normal saline, or Lactated Ringers solution (if not contraindicated). After rapid infusion of 1 liter, trauma blood must be considered with emergent surgical intervention (O negative then type specific when available). Activate MTP.
- Continuous cardiac monitoring and pulse oximetry. Frequent vital signs and GCS are done per established guidelines.
- Focused Abdominal Ultrasound (FAST) exam to be completed.
- Placement of chest tubes. I.O. or C-lines in patients with no IV Access.
- X-rays, AP of chest and pelvis, after primary survey and interventions completed

Secondary Survey protocol (initiated after primary survey completed, resuscitative efforts are well established, and the patient demonstrates normalization of vital functions).

1. Head to Toe examination (as per ATLS protocol)
2. The lab technician draws blood, if unable to collect a sample then a femoral blood draw should be performed.
3. An NGT is placed if no major facial trauma in case of significant facial trauma an orogastric tube should be considered.
4. Foley catheter is placed, provided there is no blood at the meatus, high riding or non-palpable prostate, perineal ecchymosis, blood in the scrotum, or complex pelvic fracture with the potential for urethral/bladder injury. Foley catheters with a temperature sensor should be used on all trauma patients especially with the hypothermic patient. If genitourinary injury suspected appropriate diagnostics should be performed. NGT or orogastric tubes should now be placed in the appropriate patients.
5. The team leader collects as much history as possible: allergies, current meds, past medical history, last meal, last tetanus etc.

Frequent reevaluation of the primary and secondary surveys should be performed to assure new findings are not overlooked.

Tertiary Survey:

- Patient should have a tertiary survey within 24 hours of admission.
- Patients who have been intubated, sedated, or have a decreased LOC should receive another tertiary survey once they are extubated and their LOC is improved.

Tertiary surveys will prevent missed injuries and delays in treatment and help maintain a high standard of care.

Policy: Backboard removal
Policy Number: 38.P002
Viewing Backboard Removal

It is the intention to ensure trauma patients are promptly removed from backboards to avoid preventable trauma morbidity, such as skin breakdown, pain, etc.

Backboard spinal immobilization is a useful component of EMS care for the extrication and transfer of trauma patients. It is not a tool for hospital care. Removal of backboards early in the initial assessment of the trauma patient, while in the Emergency Department is of the greatest benefit to patients.

Procedure:
1. Remove all trauma patients from the backboard within 20 minutes of emergency department (ED) arrival unless the physician does not want the patient to be removed.
2. Remove backboard during the log roll in the secondary assessment when examining the patient's posterior surface.
3. Physicians and Advanced Practice Providers (APP) are responsible for initiating the order to remove the backboard.
4. Maintain cervical collar placement and spinal motion restriction with logrolling and use of slider boards for bed-to-bed transfers until the patient's spine has been cleared. Spinal immobilization is to remain until completion of spine clearance, unless there is a condition that is directly contraindicated, ie; moderate to severe brain injuries that require elevation to decrease intracranial pressure.
5. Document the time off backboard and ordering physician on the trauma flowsheet or within the electronic record.
6. If the head of the bed needs to be raised, reverse Trendelenburg should be used rather than raising the head of the stretcher, and no more than 30 degrees.
7. Ful spinal motion restriction with the backboard until the physician/APP exam and/or xrays/Computed Tomography (CT) are completed and cleared by the physician or APP.
8. Proceed with c-spine protocol per guidelines.

Guideline for Trauma Labs and Diagnostics

Objective: To define the standards of diagnostic tests ordered for the trauma patients in an efficient, cost effective method. The team leader can further individualize studies ordered to each patient as deemed necessary.

Trauma labs (order set for ED clerk): CBC, BMP, INR, PT/PTT, type and screen

ECGs are performed by lab technician

Also consider these labs at discretion of team leader:
ETOH
UDS
ABG
Cardiac markers
Serum or urine pregnancy test on all women of childbearing years.

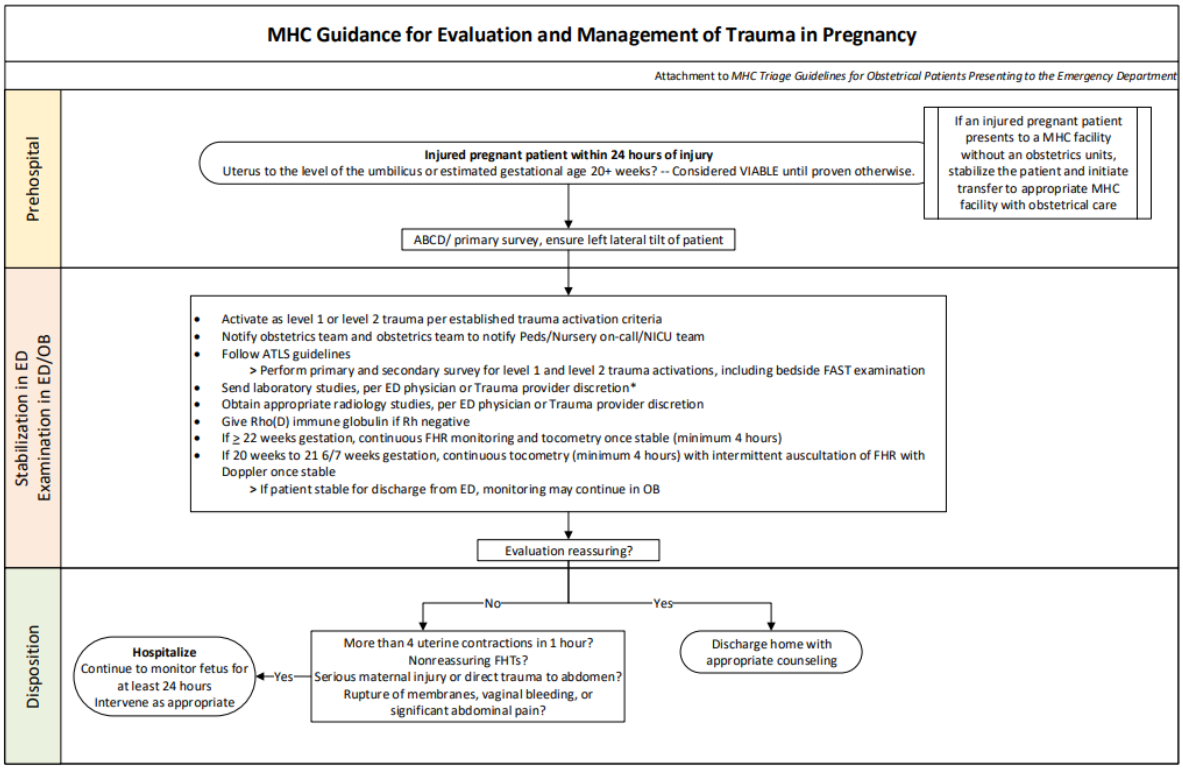
*ETOH and UDS should be ordered on all Level I traumas and at the discretion of the team leader.

Lab tests for intra-hospital trauma transfers will be determined by team leader based on date/time of injury, date/time of previous lab values, and time of patient transfer.

Trauma in Pregnancy:

Viewing Triage Guidelines for Obstetric Patients Presenting to Emergency Department Including Trauma

Pregnant Patient With	Flow of Responsibility of Care
Trauma • Pregnancy of any gestation with injury, presenting within 24 hours of injury • All pregnant trauma patients greater than or equal to 20 weeks gestation with any injury (excluding minor distal limb trauma) will be evaluated in the ED with immediate on-site OB consult – for minor trauma, patient can be evaluated in OB too *Note: Trauma classification is based on the injury to the mother*	Evaluate in ED with immediate OB consult • ED nurse to call OB unit to send an OB nurse to monitor fetus and assist with obstetrical care, (monitoring mandatory for pregnant trauma patients greater than or equal to 20 weeks) ○ Gestational age greater than or equal to 22 0/7 weeks: minimum of 4 hours of continuous fetal and uterine monitoring (tocometry) with documentation of fetal status hourly, to be started in the ED ○ Gestational age 20 weeks to 21 6/7 weeks: continuous uterine monitoring (tocometry) for minimum of 4 hours and intermittent auscultation of fetal heart tones (FHT) with Doppler: ▪ Once on arrival and before discharge home ▪ Once after incident if inpatient, then as ordered • OB nurse to notify OB Provider to ED for OB trauma



*Laboratory values: if unstable: complete blood count, coagulation profile, fibrinogen, fetal maternal hemorrhage screen, type and screen, creatinine ± arterial blood gas; if stable: complete blood count, coagulation profile, fibrinogen, fetal maternal hemorrhage screen, type and screen. ATLS, Advanced Trauma Life Support; IV, intravenous; FAST, focused abdominal sonography for trauma; CT, computed tomography; FHT, fetal heart tone.

*Refer to Policy:
MHC%20Evaluation%20and%20Management%20of%20Trauma%20in%20Pregnancy%20Algorithm%20FINAL%2001_20_2023.pdf.pdf

Radiological Studies on Trauma Patients

Viewing Medical Imaging for Trauma Patients

Objective:

To provide guidelines for the proper ordering of radiological studies on multiple trauma patients.

Trauma radiology flow:

1. Initial portable Trauma Room X-rays:
    a. Chest (supine): (must be obtained prior to traveling to CT)
        i. In general, almost all multiply injured patients require a supine chest X-ray.
        ii. On all patients with suggestion of chest injury.
        iii. On all patients transferred from another hospital, even if intubated.
        iv. Obtain as soon as possible in intubated patients.
    b. AP Pelvis: (if high level suspicion for open book pelvic fracture)
        i. Obtain on all obtunded patients with a possible mechanism suggesting a pelvic injury.
        ii. If the patient is alert and cooperative, obtain portable pelvis X-ray when there are signs and symptoms of pelvic injury.
        iii. A pelvis film does not need to be ordered on every patient.

iv. Pelvis film may be omitted if the trauma patient is stable &/or going expeditiously to the CT scanner.

2. FAST exam
    a. Viewing Focused Abdominal Sonogram for Trauma Exam Procedure
3. CT scans (patient must be hemodynamically stable prior to transport to CT)
    a. Head
    b. C-spine
    c. Facial Bones
    d. Chest
    e. Abdomen
    f. Pelvis
    g. Specific extremities if requested by consulting provider
4. Extremity x-rays

Other exams to consider:
1. Echocardiogram

2. Extremity arteriogram:
- Any fracture with evidence of poor arterial perfusion.
- Posterior knee dislocations (even if spontaneously relocated).
- Gunshot wounds where course of injury is near an artery and there are signs of bleeding, expanding hematoma or diminished distal circulation. Remember that the presence of distal pulses does not necessarily mean that an arterial injury has not occurred. Doppler occlusion pressures may be helpful.
- Wound proximity to major vessel is not by itself an indication for angiogram.

3. Carotid angiogram (four-vessel preferred): Obtain on patients with lateralizing neurologic deficit unexplained by findings on head CT. MRA or CT-angiogram may be considered instead.

4. Retrograde cystogram:
a. Should be considered for all cases of gross hematuria, penetrating abdominal trauma and pelvic fractures where bladder disruption is suspected.
b. Allow 200 ml of contrast agent to flow into Foley catheter and then clamp.
c. X-ray the pelvis (post void).

5. Retrograde urethrogram
a. Should be considered for all cases of gross hematuria, penetrating abdominal trauma and pelvic fractures where disruption of the urethra is suspected.
- Blood at the urethral meatus.
- Displaced or non-palpable prostate.
- Obvious perineal injury (perineal hematoma or open perineal injury or scrotal hematoma).

b. Position patient in right anterior oblique (45º) in “bicycling” position with right hip flexed and penis placed on medial aspect of right thigh. Insert small (12 Fr.) Foley catheter into the meatus for a distance of 2-3 cm. Inject 10-20 cc gently.
c. X-ray tube centered over pubic tubercle.
d. If Foley catheter has been previously placed, may be performed alongside the catheter by inserting 18 gauge angiocath next to Foley.

Trauma Team Documentation

Trauma flow sheet: The purpose of this form is to provide an organized, comprehensive, and standardized document which will communicate an initial patient history, assessment, resuscitation, interventions and plan of care as outlined by the trauma team.

1. All forms can be found in the ER and trauma bays.
2. Trauma flow sheet is to be completed by the trauma nurse or other delegated personnel
3. Specific information required on the trauma flow sheet
    - Mechanism of injury
    - Time of trauma activation, arrival to hospital, arrival of trauma surgeon, ED physician, PA/NP, RN and specialists
    - Time to and return from diagnostic test
    - Vital signs
    - GCS
    - Time of admission or discharge of patient
    - Disposition of patient

H&P: Should be performed at time of admission

Admission Note: Should be performed at time of admission

Admission Orders: To be completed by the trauma PA/NP or trauma surgeon.

Order sets used:

a. Admission Adult Trauma: for patients going to unmonitored beds
   B2 monitoring may be added to admission adult trauma orders

b. Admit or transfer IN stepdown ICU

c. ICU admission orders must be completed by a physician

TACS service coverage

TACS Surgeon on call and in house: 12-hour shifts
TACS advanced practice provider on call and in house: 12-hour shifts

Sign-Out
Sign out is performed at 6:45 AM and at 6:45 PM with physician and APPs finishing the previous and those starting the new shift. TPM present at morning sign-out to communicate with both teams of providers, and to have a mechanism of early identification of any issues with patient care.

On Call Responsibilities
- APP responds to level I trauma activations prior to or within 15 minutes of patient's arrival; Surgeon must respond within 15 minutes
- APP responds to level II trauma activations within 30 min of patient's arrival; Surgeon must respond within 1 hour
- Surgeon secures back-up trauma coverage when unavailable for call duties/in the OR (See back up trauma surgeon coverage)
- Respond to all trauma consultations and transfers in a reasonable time frame, usually within the hour, but no later than 2 hours.
- Primary and secondary surveys on all trauma patients.
- Ordering of all appropriate radiological and laboratory studies
- Consultation of specialty services as needed
- Facilitate all trauma transfers i.e. arrange transportation, contacting of accepting facility and physician, ensure all radiographic, laboratory studies, documentation and forms are signed and sent with patient.
- Rounds on all in-house trauma patients. Daily progress notes, orders etc. under the supervision of the on call trauma surgeon.
- Responsible for dictation of all H&P, consults, procedure notes
- Responsible for admission orders.
- Procedures i.e. laceration repairs, chest tubes, NGT, Foley catheters central lines, arterial lines and other procedures appropriate to skill level under the supervision of the on call trauma surgeon.
- Dictations for above mentioned procedures
- Sign out to oncoming surgeon and APP.

Chapter 3

Trauma Clinical Practice Guidelines

Resuscitation Priorities for the Multiple or Seriously Injured Patient

Purpose:

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

Definitions:

1. Multiple or serious injuries: Patients who are defined as having injuries consistent with the severity guidelines that would classify them as a Level I trauma activation.
2. Advanced trauma life support guidelines: Trauma prioritization guidelines developed by the Committee of Trauma of the American College of Surgeons, which are nationally recognized as the standards for trauma care.

Guidelines:

The protocol below lists the priorities in the primary survey, resuscitation, and secondary survey phases of trauma management as adapted from ATLS Version 11.

1. **Life support** (in order of priority):
    a. **Control Exsanguinating External Hemorrhage:** stop external bleeding immediately
        i. Apply Direct pressure with gauze over site of bleeding
        ii. Wound packing is for larger, deeper wounds. Pack with gauze and apply pressure.
        iii. Tourniquet application is for extremity bleeding not rapidly controlled with pressure, or when spurting arterial hemorrhage is present.
            1. Remove clothing around the injury
            2. Apply tourniquet 2-3 inches proximal to bleeding site
            3. Tighten tourniquet to overcome systolic blood pressure
            4. A pulse should not be palpable distal to the tourniquet after application
            5. Record the time of tourniquet placement
            6. If bleeding continues, apply a second tourniquet 2-3 inches proximal to the first device.
    b. **Airway:** guarantee patency and assure that the patient can protect his/her airway.
        i. Possible C-spine injury – maintain in-line stabilization (c-collar)
            1. Suction secretions using Yankauer suction; remove foreign bodies; jaw thrust.
            2. Oral or nasopharyngeal airway if tolerated by patient.
            3. If necessary, orotracheal intubation with in-line stabilization.
            4. Rule out upper airway obstruction
            5. 100% oxygen, if needed

ii. No neck injury, stridor or evident obstruction:
    1. Position the airway using jaw thrust.
    2. Suction secretions.
    3. Oral airway, if tolerated.
    4. 100% oxygen, if needed
    5. If no improvement, perform orotracheal intubation.
iii. Anterior neck injury, stridor and upper airway obstruction:
    1. Suspect laryngeal crush injury or laryngotracheal separation.
    2. Proceed to cricothyroidotomy/tracheostomy without prior attempt at endotracheal intubation.
iv. Head injury – Intubate when Glasgow Coma Scale is less than or equal to 8.
v. Apneic – immediate orotracheal intubation with in-line stabilization. Always include OG.

c. Breathing: assess breath sounds bilaterally
i. Mechanical ventilation if ventilatory effort is inadequate.
    1. Bag-Valve-Mask initially
    2. Verify ET tube position by auscultation and end tidal CO2 determination.
    3. Ventilatory support with ventilator.
ii. Tension pneumothorax:
    1. Immediate needle thoracostomy (14 or 16 gauge long IV catheter in second intercostal space) or tube thoracostomy, if stable
    2. Tube thoracostomy to follow needle thoracostomy, if performed.
    3. Chest X-ray is contraindicated prior to treatment if patient has hemodynamic compromise.
iii. Hemothorax:
    1. Thoracostomy tube after fluid resuscitation.
    2. If >1500 ml output immediately, indication for OR thoracotomy
iv. Simple pneumothorax: Tube thoracostomy after confirmation by chest x-ray
v. Open pneumothorax:
    1. Cover defect with NON-OCCLUSIVE dressing (leave 1 side open, tape 3 other sides).
    2. Tube thoracostomy.
vi. Indications for thoracotomy (See Practice Guideline “Emergency Resuscitative Thoracotomy”):
    1. Immediate thoracotomy in the ED.
        a. Penetrating wound (except head) with no BP (but had signs of life at the scene) or non-resuscitating BP (<40) in ED.
        b. Blunt trauma with non-resuscitating BP (<40) in ED.
    2. Urgent thoracotomy in the OR:
        a. Cardiac tamponade documented by ultrasound, pericardiocentesis, or pericardial window, or strong clinical findings.
        b. Widened mediastinum with left hemothorax or an aortogram confirming aortic transection (OR only).
        c. Hemothorax >1500 ml initially or 800 ml total over next four hours.
        d. Ruptured esophagus.
        e. Massive pleural air leak suggestive of ruptured bronchus after confirmation by bronchoscopy.

d. Circulation:
i. Hemostasis – direct pressure to bleeding wounds.

ii. Treat shock
    1. Assess for etiology. Consider **hypovolemic shock** as most common cause. Neurogenic shock considered if evidence of spinal cord injury.
    2. If shock state is difficult to correct, consider source of bleeding- does the patient need to go to the OR or angio?
    3. Warm crystalloid solution, initially 2 liters LR for adults (20 cc/kg children), give blood early if major blood loss is suspected, place blood on a warmer
    4. **If patient is suspected to have major blood loss and is not responding to initial resuscitation efforts, consider an MTP early.
    5. Monitor blood product ratios closely to ensure 1:1:1 transfusion rate
    6. Head injury or lung injury – conservative, but maintain adequate fluid resuscitation to keep BP and pulse in normal range. Strive to maintain normal hemodynamics and euvolemia.
    7. Cardiac tamponade: pericardiocentesis, needle or open (especially with anterior chest penetrating injury).
iii. Shock with reduced pulse pressure unresponsive to volume.
iv. Neck vein distention or elevated CVP greater than 20 cm of water pressure.
v. Rule out tension pneumothorax, since this is more likely than tamponade in blunt trauma.

e. **Central Nervous System:** (See Practice Guideline "Brain Injury and Cerebral Perfusion").
    i. Assess Glasgow Coma Scale (for GCS less than 8, intubate). Consider neurosurgery consult for:
        1. GCS <12
        2. Focal deficit
        3. Unequal pupils not explained by local injury or peripheral nerve palsy
    ii. Continue resuscitation to maintain hemodynamic stability
    iii. Maintain oxygenation >95%
    iv. "Mild" hyperventilation to achieve pCO2 around 35mmHg
    v. Medications:
        1. Sedate patient to avoid agitation and protect airway
        2. In consultation with neurosurgery, consider Mannitol 1mg/kg or Hypertonic saline to prevent herniation from brain swelling.
        3. Medicate to stop seizures
        4. Consider appropriate prophylaxis against further seizures
        5. CT scan of head, as indicated
        6. Rectal exam

f. Remove all clothing

g. Maintain normothermia
    i. Warm blankets
    ii. Overhead heating lights
    iii. Warm IV fluids, Belmont rapid infuser
    iv. Keep resuscitation room 85 degrees
    v. Bair Hugger

h. Insert nasogastric tube and Foley catheter, as indicated.

i. Conduct secondary survey (Head-to-toe physical examination):
    i. Maxillofacial: Control bleeding from scalp and face (with skin staples, suture ligatures, packing, and/or definitive wound closure).
    ii. Neck:
        1. Palpate for fractures and instability

2. Examine for external injuries

iii. Chest:
   1. Re-evaluate breath sounds and ventilatory adequacy
   2. Examine for external injuries

iv. Abdomen:
   1. Quick physical assessment (distention, seatbelt injury, contusions, tenderness).
   2. Determine need for further evaluation (if unstable, do DPL; if stable, do abdominal CT scan).
   3. Abdominal hemorrhage – distention or unexplained hypotension or positive FAST
      a. ***Immediate laparotomy in OR

j. If unstable pelvis, avoid unnecessary movement to minimize bleeding. Consider angiographic embolization, TPOD, or external fixator for associated vascular injury.

k. Fracture stabilization:
   i. Reduce fracture dislocation
   ii. Apply traction splint for fractured femur
   iii. Evaluate neurovascular compromise
   iv. Antibiotics for open fractures within 90 minutes

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

m. Coordinate radiologic examination:
   i. Technician is to use overhead X-ray machine when possible.
   ii. Chest X-ray AP.
   iii. AP pelvis if signs of pelvic fracture or instability.

n. After stabilization:
   i. Triage – ongoing
      1. Prioritize injuries as:
         a. Life-threatening
         b. Stable but potentially life-threatening
         c. Limb-threatening
         d. Not life or limb threatening
   ii. Specialty service should be called one at a time with respect to priority
   iii. Attending physician will call anesthesia, OR
   iv. Establish contact with family if possible
   v. Take AMPLE history
   vi. Determine radiologic sequence
   vii. Determine need for tetanus toxoid and antibiotic coverage
   viii. Determine need for admission. Arrange for bed in appropriate unit.

o. Continued reassessment: ABSOLUTELY mandatory
   i. Vital signs: frequency determination of vital signs, as determined by the severity of injury, should be made. It is always better to check too frequently than to be left in the dark.
   ii. Outputs: should be checked frequently during the resuscitation phase and then hourly when stable – urine, chest tube, and nasogastric.
   iii. Be sensitive to trends in physical examination and vital signs – ask yourself, “Has the patient’s response to fluid infusion and early stabilization been appropriate?”

Indications for Surgical Intervention in the Trauma Patient

Abdominal Stab Wounds/Gunshot Wounds

- Systemic hypotension secondary to intraperitoneal hemorrhage.
- Peritonitis.
- Pneumoperitoneum
- Evisceration of intraperitoneal contents.
- Retained stabbing implement.
- Abnormal diagnostic study (CT or UGI gastrografin swallow).
- Presence of gross blood per nasogastric tube, vaginal examination, or rectal examination.
- Increasing abdominal tenderness, distention during observation period.
- Fall in hematocrit 10% with no other plausible explanation during observation period.
- All close-range (entrance wound that can be covered by one hand) shotgun wounds.
- Systemic hypotension secondary to intraperitoneal hemorrhage, despite adequate resuscitation
- Positive FAST indicating penetration

Blunt Abdominal Trauma (children and adults)

- Systemic hypotension secondary to intraperitoneal hemorrhage, despite adequate resuscitation
- Peritonitis
- Pneumoperitoneum
- Retroperitoneal air
- Positive FAST for visceral injury
- Abnormal diagnostic study
- Development of increasing abdominal tenderness or distention during observation period
- Greater than 50% blood volume loss
- Failure of conservative treatment (tachycardia, decreasing Hgb, physical exam worsening)

Penetrating Lower Thoracic/Flank Trauma

("Lower Thoracic" is defined as any injury below the nipples anteriorly, below the tips of the scapulae posteriorly, and above the costal margin)
("Flank" is defined anatomically as posterior to the mid-axillary lines, between the costal margins superiorly, and between the iliac crests inferiorly)

• Evidence on physical examination or radiographic studies of abdominal penetration
• Positive FAST for penetration by meeting criteria as previously defined under abdominal gunshot/stab wounds
• Presence of >1500 ml blood in tube thoracostomy drainage (if tube thoracostomy is present)
• Retroperitoneal air
• Systemic hypotension with no other plausible cause

Penetrating Pelvic Trauma

• Evidence on physical examination or radiographic studies of peritoneal penetration
• Positive FAST for penetration
• Evidence of rectal injury
• Evidence of urinary bladder injury on cystogram
• Evidence of vaginal or uterine injury on vaginal speculum examination
• Evidence of major vascular injury on an arteriogram

Observation of Abdominal Trauma

Any patient with abdominal trauma who does not meet any of the above criteria will undergo a 24 hour period of abdominal observation to include:
• Serial abdominal examination every two to four hours; preferably done by the same provider
• Serial hemoglobin/hematocrit every six hours
• No oral intake/bedrest
• Repeat chest radiograph in eight hours if lower thoracic trauma
• If the patient has developed no new findings in a 24 hour period, he/she will be advanced in their diet and ambulation. Serial H&H's will be decreased/discontinued at the discretion of the provider.

Emergency Department Thoracotomy

Indications for an ED thoracotomy

• Any trauma patient who arrives in the Emergency Department with signs of life (pupillary reaction, respiratory effort, cardiac rhythm) but unconscious, with no obtainable blood pressure after establishment of airway access, ventilation and appropriate venous access
• Any trauma patient who has sustained penetrating trauma, has signs of life at the scene and arrives in the Emergency Department without signs of life
• Airway access, ventilation, and appropriate venous access will be established prior to thoracotomy
• Assumes a transport time of 10 minutes or less

Contraindications to ED thoracotomy

(Note that these contraindications may be superseded at the discretion of the Trauma Leader present in the Emergency Department room)

• Any trauma victim who had no signs of life at the scene, and despite EMS resuscitation efforts, has no signs of life upon arrival in the Emergency Department will be pronounced dead on arrival.
• Any blunt trauma victim who arrives in the Emergency Department without signs of life

Technique of ED Thoracotomy:

• Clean technique will be used (sterile is difficult to obtain in the ER environment/not the OR)
• A left fifth interspace anterolateral thoracotomy incision is utilized
• The incision can be extended into the right chest if there appears to be a major source of hemorrhage in the right chest.

• The pericardium is opened anteriorly in the vertical direction and any tamponade that is present will be evacuated. Watch for phrenic nerve, which courses along the lateral aspect of pericardium.
• Two-handed cardiac massage is performed anterior and posterior to heart.
• Digital pressure is used to control any source of major hemorrhage.
• The descending aorta is occluded at the diaphragm either by direct compression against the vertebral column or by placement of a non-crushing vascular clamp.
• Standard medications are used for cardiac resuscitation. Internal defibrillation can be performed using 10 - 40 joules energy.

Terminating resuscitation
• If there is no cardiac activity and no pericardial tamponade, resuscitation will continue for a maximum of 20 minutes to attempt to bring arterial pH and temperature to within a normal range.
• If a cardiac tamponade is evacuated, resuscitation will be continued until systolic blood pressure is greater than 60 mmHg. At this point, the patient will be transferred to the operating room.
• If a cardiac tamponade is evacuated, but a systolic blood pressure of 60 mmHg cannot be achieved, resuscitation efforts will be terminated after a maximum of 30 minutes.

Emergency Thoracic Surgical Intervention

Indications for the operative treatment of thoracic injuries:

• Initial tube thoracostomy output > 1,500 cc (20 cc/kg child) of blood (assuming the tube is placed within two hours of the trauma incident)
• Ongoing tube thoracostomy output of at least 250 cc blood per hour (100 cc/hr child) for four hours
• Total tube thoracostomy output of 2,000 cc of blood over the first eight hours (50% total blood volume child)
• Presence of confirmed pericardial tamponade
• Positive pericardiocentesis
• Positive echocardiogram demonstrating blood in the pericardium
• Demonstration of blood in the pericardium on a subxiphoid pericardial window
• Demonstration of a major vascular injury by arteriogram
• Demonstration of an esophageal injury by either esophagoscopy or contrast study

Emergency Peripheral Vascular Surgical Intervention

The indications for surgical intervention in peripheral vascular trauma can be broken down into “Hard Signs” and “Soft Signs:”

“Hard Signs”
• Pulsatile bleeding
• Expanding hematoma
• Palpable thrill
• Audible thrill
• Evidence of regional ischemia
• Pallor
• Paresthesia
• Paralysis
• Pain
• Pulselessness
• Poikilothermia
• Evidence of limb-threatening ischemia

“Soft Signs”
(These suggest the need for further evaluation)
• History of moderate hemorrhage
• Injury (fracture, dislocation, or penetrating wound) in proximity to a major artery
• Diminished but palpable pulse
• Peripheral nerve deficit

Additional indications for exploration:
• Demonstration of a major vascular injury by arteriogram (or duplex ultrasound)
• Evidence of compartmental hypertension
• Tense compartments to palpation
• Neurologic, venous or arterial signs of compartmental hypertension
• Elevated compartmental pressure (>30 mmHg)
• Demonstration of a major vascular injury at surgery

Indications for Surgery in Penetrating Neck Trauma

Indications for operative intervention vary by the zone of injury:

Zone I is defined as the region inferior to the clavicular heads
Zone II is defined as the region between the clavicular heads and the angles of the mandible, anterior to a perpendicular line drawn from the insertion of the sternocleidomastoid
Zone III is defined as the region superior to the angle of the mandible

Physical Exam:
Any patient with systolic hypotension that cannot be resuscitated
Any patient with exsanguinating hemorrhage
A wound that penetrates the platysma may be explored at the discretion of the attending vascular surgeon or trauma surgeon upon his examination of the patient.

All stable patients will undergo the following work-up and any evidence of injury will constitute an indication for surgery
• Arteriography
• Gastrografin swallow if superior mediastinum is crossed
• Bronchoscopy if superior mediastinum is crossed

Management and Classification of Shock

Objective:
To provide a guideline to adequately manage perfusion of the brain and major organs.

Definition:
Inadequate organ perfusion and tissue oxygenation results in cellular dysfunction and cell death.

- A patient can be in shock with or without abnormal vital signs.
- The most common cause of shock in the Trauma patient is hemorrhage/hypovolemia.
- Isolated brain injuries do not cause shock.

Guidelines:

1. The initial step in management of shock is to recognize its presence to start treatment, then determine its cause.
2. A Trauma patient in shock should be considered hypovolemic, until proven otherwise.
3. External hemorrhage should be identified and controlled by direct manual pressure on the wound.
4. Fluid resuscitation:
    a. Trauma Patients must have at least two large bore intravenous lines inserted on presentation.
    b. Trauma patients will receive warmed Lactated Ringers or Normal Saline solution as the initial resuscitation fluid.
    c. If the patient's clinical status is stable, the warmed LR / NS will be infused at a rate determined by the attending physician.
    d. If the patient has a Systolic Blood Pressure of 90 mmHg or less, he/she will receive a rapid bolus of 1000 cc warmed LR / NS. If no response, administer blood products, always assume hemorrhagic shock first
    e. The patient will be reassessed after every fluid bolus.
    f. If patient remains hemodynamically unstable:
        i. Begin transfusing blood & consider initiating an MTP
        ii. Aggressively identify the source of blood loss
        iii. Consider transfer to the operating room
    g. Central Venous Lines (if patient has thoracostomy tube, place line on same side- unless injury to area)
        i. Subclavian vein
        ii. Internal jugular vein
        iii. Femoral vein
        iv. A chest x ray must be obtained after placement of a central venous line.
5. Management of shock
    a. Rapid response (Blood loss 10-20%): Vital Signs normalize. Type and cross-match blood for the patient. Continue with evaluation.
    b. Transient response (Blood loss 20-40%): Vital signs and perfusion improve following the initial fluid bolus, but then may deteriorate as fluid infusion is slowed to maintenance. This means there is likely ongoing blood loss or inadequate resuscitation. Repeat fluid bolus and transfuse uncross-matched blood as described above. Type and cross for 6 units of packed RBC's. Evaluate for sources of blood loss. Repeat Hgb early.
    c. No response: Vital signs remain abnormal. Consider the possibility of tension PTX or cardiac tamponade. Transfuse uncross-matched blood and repeat fluid boluses.

Management of Traumatic Brain Injury

Purpose: To provide guidelines to help standardize the diagnosis and early management of traumatic brain injury.

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

- Mild traumatic brain injury: GCS 13-15
    - Initial management
        - AMPLE history and neurological exam
        - Note MOI, initial GCS, confusion, amnestic interval, seizure, H/A
            - Secondary survey including focused neurological exam
        - Diagnostics: CT scanning as determined by head CT rules (ie; PECARN for pediatric patients, Canadian CT Head rule), blood, urine ETOH and toxicology screens; consult Neurosurgeon for abnormal head CT
    - Secondary management
        - Serial examinations until GCS is 15 and memory deficits have improved
            - Perform repeat CT scan if first is abnormal or worsening neurologic function
    - Disposition: home if patient does not meet criteria for admission

- Moderate traumatic brain injury: GCS 9-12
- Severe traumatic brain injury: GCS 3-8

Guidelines:

1. Perform primary survey according to ATLS guidelines:
    a. Consider using lidocaine with intubation (IV and topical).
    b. Maintain C-spine precautions including rigid collar.
    c. Provide urgent airway for GCS ≤ 8, hypoxia can be devastating to the injured brain.
    d. If sedatives and paralytics are to be used, conduct a rapid but thorough neurologic exam, including:
        i. Level of consciousness.
        ii. Ability to verbalize.
        iii. Ability to open eyes.
        iv. Ability to move all extremities to verbal command or pain.
        v. Presence of abnormal posturing.
        vi. Presence of abnormal reflexes.
        vii. Presence of rectal tone if unable to move lower extremities.
        viii. Pupillary response.
        ix. Gag reflex.
        x. Note presence of bruises, Battle's signs, lacerations, etc.
    e. Check for chest injury, ventilate to maintain mild hypocapnia (pCO_2 = 35 to 40 mmHg).
    f. Determine hemodynamic status, resuscitate from shock with lactated ringers solution maintain euvolemia and normal hemodynamics.
    g. Expose patient, when able, to look for any non-obvious injury.

    h. If sedatives are required, please utilize fast acting medications, such as Propofol or Fentanyl, to allow the neurosurgeon and other providers to perform an adequate exam.
2. Resuscitate patient as above until hemodynamic and pulmonary stability is achieved.
3. Calculate the Glasgow Coma Scale.
4. Consider need for neurosurgical consult.
    a. Head CT abnormality.
    b. Any patient with GCS <12.
    c. Any patient with focal neurologic deficit.
    d. Any patient with unequal pupils secondary to brain injury.
5. Indications to obtain a head CT scan:
    a. GCS ≤14
    b. Any patient with focal neurologic deficit.
    c. Any patient with witnessed loss of consciousness.
    d. CT should be abandoned if patient requires emergent operation to stop hemorrhage or immediate repair life-threatening injury.
    e. Patient should be stabilized, in order to leave the trauma bay and obtain studies.
6. Sedation:
    a. Uncooperative or thrashing patients should be treated with sedation.
    b. Do not give paralyzing agent without associated pain medications or sedative.
    c. Propofol if intubated; Fentanyl if not intubated
7. Hyperventilation: mild hyperventilation may be used, trying to achieve a pCO2 of ≈35-40 mmHg.
8. Seizures:
    a. Consider seizure prophylaxis:
        i. Administer if seizure has occurred.
        ii. Administer if there is a high likelihood of post-traumatic seizure.
    b. Penetrating injury.
    c. Skull fracture with depression.
    d. Intraparenchymal hematoma.
9. Mannitol: at the discretion of the neurosurgeon, a Mannitol bolus of 1 gm/kg can be given for evidence of rising intracranial pressure.
    a. Generally utilized if Hypertonic saline is unsuccessful
10. Hypertonic saline: consider hypertonic saline bolus or infusion with target Na level.
11. Hypertonic Saline 23.4%: see guideline for administration. This is only to be used with refractory elevated intracranial pressure (ICP) not responsive to initial treatment and acute herniation syndrome.
12. Scalp lacerations:
    a. Exsanguinating hemorrhage can arise from scalp lacerations.
    b. Rainey clips are available in the trauma room and may be used to temporarily control bleeding from large scalp avulsions.

ICU Management of Traumatic Brain Injury and Cerebral Perfusion Pressure

Objective:

To define the brain injured patient at risk for "secondary injury," and to define guidelines for the prevention and management of the seriously brain injured patient.

Definition of Patients at Risk for Secondary Brain Injury:

1. Positive Head CT associated with a GCS of 8 or less.
2. Severe diffuse swelling with ventricular effacement or obliteration.
3. Hemispheric swelling with effacement of the ventricle or midline shift.
4. Intracerebral hematoma with midline shift.

Guidelines:

1. All patients with brain injury and associated other system injuries should be admitted to the ICU under the co-management of the TACS team and the neurosurgery service.
2. Intubate patient with GCS <8; place on volume-controlled ventilator. Physician orders for ventilator management and lab tests. Recommendations are as follows:
    a. Maintain pO2 >80 torr; maintain O2 saturation >96%.
    b. Maintain pCO2 35-40 mmHg.
    c. Monitor lactate levels every 12 hours until normal if the patient has had an episode of hemorrhagic shock.
3. Consider an intracranial pressure monitor or Ventriculostomy (Gold standard):
    a. May be inserted in the ED or at the bedside in the ICU.
    b. Start antibiotic for prophylaxis while catheter is in place.
4. Insert arterial line.
5. Head of bed at 30º unless otherwise specified.
6. Maintain sedation as ordered by physician.
7. Notify physician for fever of >100.5.
    a. Consider antipyretics (Tylenol-OG or rectal) for fever as ordered by physician.
    b. Consider cooling blanket.
8. Calculate cerebral perfusion pressure (CPP) as mean arterial pressure (MAP) minus intracranial pressure (ICP)
    a. Maintain CPP parameters ordered by neurosurgeon. Rec CPP is >70 torr.
    b. If CPP <70 torr, then determine whether this is due to increased ICP or reduced MAP.
    c. If CPP <70 torr and ICP >25 cm H2O, then consider measures to reduce ICP.
        i. Placement and drain ventriculostomy as ordered by neurosurgeon.
        ii. Consider Mannitol as ordered by the neurosurgeon, if 3% saline ineffective.
            a) Consider obtaining serum osmolality every 12 hours as ordered by the neurosurgeon.
            b) Maintain serum osmolality levels within parameters ordered by the neurosurgeon. Recommendation to call neurosurgeon for level >320 osm/dL.
        iii. Barbiturate coma – may be used at the discretion of neurosurgery if no other maneuvers are effective.
        vi. Make sure hemodynamics are not compromised.
9. Repeat CT scans according to neurosurgery requests.
10. Start enteral nutrition as soon as possible.

Management of the Traumatic Brain Injured Patient on Anticoagulation

Purpose:
For patients with a known or suspected head injury and with a history of current anticoagulation therapy

Before Head CT:

- Screen all patients for current AC therapy (this includes the use of aspirin, ibuprofen, etc) at triage/initial assessment with known/suspected impact to the head (falls, obvious facial trauma, actual bleeding, etc.)
- Initiate ESI Level I triage to be seen by attending immediately (ED staff responsibility)
- Attending to initiate order care set code coagulation.
- Code coagulation paged overhead in the ED, radiology technologist, and phlebotomy.
- Obtain immediate Head CT completed within 20 minutes of patient arrival- document time to CT
- Obtain Trauma lab panel to include PT/PTT INR
- Order STAT Type and screen
- Call to blood bank to thaw 2 units AB FFP and hold until further notice- to be done by Unit Clerk

Positive Head CT:

- Consult protocol for proper reversal of anticoagulant agent/power plan
- STAT Neurosurgical Consult
- STAT Trauma Service Consult
- Transfuse 2 units of type specific FFP if INR remains elevated (INR >1.2) –may also consider giving KCENTRA
- Vitamin K 10mg in 50cc NS over one hour-if AC responds to Vitamin K
- Document time of call and time of arrival of Neurosurgeon and Trauma Service
- Repeat PT/INR once FFP completed

Negative Head CT:
Admit to Trauma Service for Observation, if indicated
Obtain Neurosurgical Consult as indicated
***Obtain a repeat head CT on all patients with any changes in mental status**

Brain Injury Guidelines

Munson Healthcare Regional & Community Hospitals

Criteria	BIG 1	BIG 2	BIG 3
LOC	Yes / No	Yes / No	Yes / No
Neuro Exam	Normal	Normal	Abnormal (change in baseline)
Intoxication	No	Yes / No	Yes / No – BAL ≥80
Anticoagulants (Anticoagulants & Antiplatelets including Aspirin)	No	No	Yes / No
Skull fx	No	Non-displaced	Displaced
SDH/IPH	≤4mm	5-7mm	≥8mm and/or midline shift ≥4mm
Epidural	No	No	Yes
SAH	Trace	Localized	Scattered
IVH	No	No	Yes
Next Steps			
ED Call MHC Transfer Center	Consult TACS *	Arrange transfer to TACS at MMC**	Anticoagulant Reversal Protocol Arrange transfer to TACS at MMC** Neurosurgery Consult
ED Disposition	Admit to Local Hospitalist / Consider local general surgery consult		
Therapeutic Plan			
Repeat Head CT in 6 hrs	Yes	Yes	Yes
During Admission	Neuro checks Q2 for 6 hrs Consider PT/OT eval		
Follow-up	Case Management & PCP		

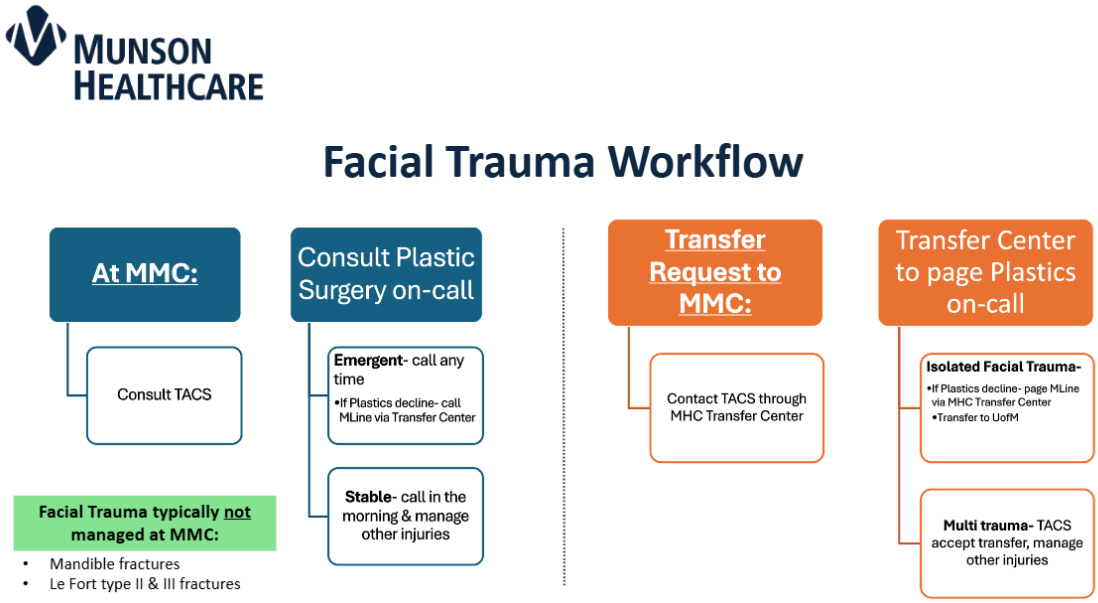
Lab results not to cause delay

*TACS may consult Neurosurgery as needed
**Many BIG patients have other traumatic injuries and/or medical comorbidities. ED Providers may use their discretion when considering disposition of these patients.

Munson Healthcare "Anticoagulation Emergency Reversal Management Guideline" found on the intranet.

https://sharepoint16.mhc.net/RX/anticoag/Documents/Anticoagulation%20Reversal%20Guidelines.pdf

Management of Severe Maxillofacial Injuries



Objective: To define priorities in the management of facial trauma and determine short-term treatment plans for the temporary management of facial trauma.

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

Guidelines:

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

2. Stop the bleeding!
    a. Do this as part of the primary survey.
    b. Scalp bleeding can be controlled with Rainey clips, Figure 8 stitches, or staples.
    c. Facial bleeding can be controlled temporarily with Figure 8 stitches of 3-0 nylon.
    d. Nasal bleeding can be controlled with packing (usually nasal or vaginal packing) but beware of basilar skull fractures.
    e. Examine for intraoral lacerations.
        i. Most of the time, intraoral lacerations can be left alone to heal by secondary Intention and good oral hygiene
3. Once the patient has stabilized, perform a good physical exam looking for:
    a. Scalp lacerations.
    b. Depressed skull fractures.
    c. Depressed frontal sinus fractures.
    d. Orbital fractures.
    e. Eye injury, loss of eye motion, foreign body in eye.
    f. Malar and zygomatic arch fractures.
    g. Unstable nasal fractures.
    h. Maxillary alveolar ridge fractures.
    i. Missing teeth.
    j. Mandible fractures.
    k. Sensory deficits.
    l. Hemotympanum.
    m. Malocclusion.
4. If patient is stable and is getting a head CT, consider obtaining Facial CT. These images may be reformatted in the coronal, sagittal and other paraxial planes to obtain better views of the fractures.
5. Obtain a plastics consult.
6. If there is an eye injury, obtain an ophthalmology consult.
7. If patient has multiple lacerations, consider antibiotics & updatetdap
8. If the patient has isolated facial trauma, it may be managed early in the first day or two. If there are multiple injuries, facial trauma is not a priority.

Management of Eye Injuries

Purpose: To define signs and symptoms suggestive of eye injuries in trauma patients, define early treatment plans for patients with eye injuries, and determine situations for ophthalmologic consultation.

Guidelines:

1. Follow the ABC's.

2. During the secondary survey obtain history of the injury as it relates to the eye:
  a. Pain (consider corneal injury).
  b. Visual acuity.
  c. Photophobia.
  d. History of thermal injury.
  e. History of corrective lens use.
  f. Previous visual acuity.
  h. Medications (e.g., pilocarpine, etc.).

3. Perform a physical exam:
  a. Eye:
    - Gross visual acuity (e.g., count fingers, read label, see light, etc).

- Pupils: shape, size, reactivity, consensual reactivity.
- Range of motion.
- Anterior chamber (clear, hyphema, cloudy).
- Conjunctiva (scleral hemorrhage, edema, etc.)
- Globe (anterior displacement, shape, symmetry).
- Retina (tears, hemorrhage, detachment).
- Papilledema.

b. Lids:

- Laceration.
- Ecchymosis.
- Edema.

c. Orbits:

- Symmetry.
- Crepitus or instability.

d. Cornea:

- Apply fluorescein after topical anesthetic.
- Examine with ultraviolet light.

4. Early treatment:

a. Chemical burns:

- Apply topical anesthetic.
- Copiously irrigate with 1000 ml or more of warm saline placed into the eye.

b. Corneal injury:

- Apply topical anesthetic.
- Apply antibiotic ointment (no steroids!).
- Apply eye patch-consult with optho before placing patch.

c. Eyelid injury:

- If superficial, suture with fine nylon.
- Make sure that eyelid approximates when finished.
- Foreign body or material on the surface of eye:
    - Irrigate the eye gently with normal saline to see if it floats away.
    - If the material is over sclera, gently try to capture it with cotton-tipped applicator.

5. Consult ophthalmology for the following injuries:

- Disrupted globe.
- Retrobulbar hematoma – EMERGENCY!!!
- Unequal pupils without central injury; ovoid or notched pupils suggesting iris injury.
- Lack of full extraocular motion, suggesting trapped eye muscle.
- Hyphema.
- Complex laceration of eyelid.
- Marked change in visual acuity.
- Foreign body that is not easily removed.

Cervical Spine Clearance

Objective:
Provide a standardized guideline for the evaluation of c-spine injuries.

Guidelines:
Patients who are alert, not intoxicated, neurologically intact, with no associated distracting injuries or midline neck pain on palpation or range of motion:

- Cervical spine radiographs are not warranted.
- Trauma leader or emergency dept. physician makes determination, documents process and removes cervical collar.

Patients who arrive in the ED awake, alert and complain of cervical pain or tenderness on exam:

- Need CT of the cervical spine
- Abnormal radiographs indicate immediate neurosurgery consultation.

Patients with abnormal mental status, distracting painful injuries, intoxicated or otherwise cannot be reliably examined:

- Will undergo CT of the c-spine.
- Remain in c-collar until a reliable examination can be performed even in presence of negative c-spine radiographs.

Patients who continue to complain of significant pain and or tenderness to the c-spine with no CT evidence of injury:

- Should remain in c-collar until flexion and extension radiographs can be obtained.
- Neurosurgery consultation may be warranted.

Neurological findings warrant neurosurgery consultation regardless of radiographic results, as these patients most likely will need an MRI

Management of Penetrating Neck Injuries

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

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

Guidelines:
1. For all penetrating injuries of the neck, first apply all of the principals of ATLS.
2. If the neck injury is associated with any of the following conditions, then the patient should be taken immediately to the operating room:

- Shock.
- Active hemorrhage.
- Expanding hematoma.
- Need for surgical airway.
- Obvious esophageal injury.
- Obvious tracheal injury.

3. For other stable neck injuries, a determination should be made as to whether the platysma has been penetrated. If platysma is intact, then close the wound if possible. Consider a neck X-ray to evaluate foreign body or SQ air.

**If the platysma has been violated, then classify the wound as:

a. Zone I- below cricoid cartilage.
b. Zone II- between cricoid and angle of the mandible.
c. Zone III- above the angle of the mandible.

5. For Zone I injuries (which are really chest injuries):
   a. Obtain a chest X-ray to determine the presence of chest injury.
   b. Consider an angiogram, including the aortic arch and the great vessels.
   c. Consider an esophagram.
   d. Consider or perform bronchoscopy.
   e. Treat on the basis of the findings.
6. For a Zone II injury, use clinical findings to classify as low probability of vascular and aerodigestive injury or high probability of vascular and aerodigestive injury.
   a. For high probability injuries (GSW, shotgun wounds, swelling, path crossing midline).
      i. If the injury is a gunshot wound or a shotgun injury, consider an angiogram.
      ii. Prophylaxis with antibiotics.
      iii. Take to the operating room for neck exploration.
   b. For low probability injuries (stab wounds, minimal swelling, lateral, posterior) or Zone III:
      i. Consider angiogram.
      ii. Consider esophagram.
      iii. Consider laryngoscopy and bronchoscopy if indicated (e.g., air in tissues or subcutaneous emphysema
      iv. Treat based on the findings.
7. For all penetrating neck injuries that have violated oral mucosa, treat with antibiotics **(**usually penicillin or penicillin/aminoglycoside).

Penetrating Chest Injury

Purpose: To define guidelines for the management of penetrating injuries to the chest. To define an optimal diagnostic strategy and appropriate treatment plans for suspected injuries.

Definitions: Penetrating injury to the chest is any penetrating injury to the thorax in an area bounded superiorly by the lower neck and inferiorly by the lower costal margin.

Guidelines:

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

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

3. If patient has suffered cardiac arrest and has had signs of life (e.g., pulse or EKG present) at any time or is *in extremis* with low blood pressure, proceed directly to left

anterior thoracotomy while the patient is being intubated and large bore intravenous lines are being inserted.

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

5. If patient is hemodynamically unstable or has respiratory distress consider:
   a. Tension pneumothorax
      i. Absent breath sounds
      ii. Distended neck veins
      iii. Shift of the trachea and/or the PMI
      iv. Insert large bore chest tube (consider needle thoracostomy to temporize).
   b. Massive hemothorax:
      i. Absent breath sounds on the affected side
      ii. Dull to percussion on affected side.
      iii. Stabilize blood pressure with vigorous fluid resuscitation
      iv. Insert large bore chest tube
      v. Take immediately to OR if
         - Initial drainage is > 1500 ml, or
         - Drainage continues at > 200 ml/hr for 4 hours.
   c. Cardiac Tamponade:
      i. Entry wound between nipples
      ii. Distended neck veins
      iii. Distant heart sounds
      iv. Cyanosis
      v. Tension pneumothorax has been treated or ruled out.
      vi. Perform needle pericardiocentesis or open subxiphoid pericardiocentesis.
      vii. If positive, go immediately to the OR for thoracotomy or median sternotomy.

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

7. If the injury is between the nipples and between the clavicle and lower costal margin, consider the possibility of cardiac injury with occult cardiac tamponade:
   a. Consider central line for monitoring.
   b. Consider cardiac tamponade.
   c. Obtain echocardiogram to look for pericardial effusion.

Blunt Chest Injuries

2025_tr_bestpracticesguidelines_chest-wall.pdf

Objectives:

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

Definitions:

A chest injury is any injury to the thoracic cage and its contents, including the lungs, heart, great vessels, tracheobronchial tree and the esophagus.

Guidelines:

1. Blunt chest injuries are characterized by:
    a. Mechanism:
        i. Severe blunt force applied to the chest.
        ii. Rapid deceleration injury.
    b. Signs:
        i. Chest wall deformity
        ii. Chest wall contusion
        iii. Chest wall laceration
        iv. Severe trauma above the chest (e.g., head injury) and below the chest (e.g., abdominal or pelvic injury)
    c. Symptoms:
        i. Tachypnea
        ii. Pain
        iii. Absent breath sounds
        iv. Crepitus or subcutaneous emphysema
        v. Hemoptysis
        vi. Discordant breathing pattern
        vii. Hypotension
        viii. Distended neck veins
2. With any of the above findings, consider the possibility of the following chest injuries:
    a. Tension pneumothorax
    b. Open pneumothorax
    c. Flail chest
    d. Pulmonary contusion
    e. Massive hemothorax
    f. Cardiac tamponade
    g. Cardiac contusion
    h. Ruptured diaphragm
    i. Ruptured tracheobronchial tree
    j. Ruptured thoracic aorta
    k. Ruptured esophagus
    l. Myocardial tear
    m. Simple pneumothorax
    n. Fractured ribs
3. Maintain airway:
    a. Intubate for respiratory distress or airway obstruction.
    b. Beware of worsening pneumothorax as pressure is applied to the airway.
    c. Consider needle decompression for tension pneumothorax
4. Obtain portable AP chest x-ray on all patients before going to CT scanner to assess for:
    a. Possible chest injury
    b. Confirm tube placement
    c. All transfers who have had a chest x-ray at another facility should have a repeat chest x-ray after arrival.
    d. Chest tubes should be placed prior to the chest x-ray and/or CT scan if there is hemodynamic compromise or any clinical evidence of a pneumothorax.
5. For severe anterior chest trauma, obtain an emergent EKG & consider echo.
6. Treat injury according to the diagnostic findings:
    a. Tension pneumothorax
        i. Physiology
            a) air enters the pleural space and cannot exit (“flap valve” phenomenon)
            b) Respiratory compromise due to increased pleural pressure.
            c) Hemodynamic compromise due to impaired venous return.
            d) Good lung is affected by mediastinal shift.
        ii. Diagnosis:
            a) Respiratory distress

b) Absent unilateral breath sounds
c) Asymmetric chest wall motion
d) Hypotension with distended neck veins
e) Shift of the trachea and the PMI

iii. Treatment:

a) With hemodynamic compromise: needle decompression followed by chest tube.
b) Chest tube insertion must occur prior to CT Scan.
c) Without hemodynamic compromise: place large bore chest tube.
d) Obtain chest x-ray or CT scan of chest after the chest tube has been placed.

b. Open pneumothorax:

i. Physiology:

a) Open defect in chest wall allows air to enter the pleural space through the defect rather than through the trachea.
b) Mediastinum shifts as pressure gradients change across the midline.

ii. Diagnosis: “sucking chest wound”

iii. Treatment:

a) Intubate the patient and place on positive pressure ventilation.
b) Insert large bore chest tube.
c) Cover wound and leave 1 side open
d) Consider surgical closure of the defect.

c. Flail chest

i. Physiology:

a) Blunt force to the chest.
b) multiple ribs fractured in two or more places lead to unstable segment of chest wall.

ii. Diagnosis:

a) Paradoxical chest wall movement.
b) Severe pain with breathing or with palpation in the affected area.
c) Respiratory distress.
d) Hemoptysis.

iii. Treatment:

a) Pain control: epidural, PCA, morphine drip.
b) Pulmonary toilet, monitor vital capacity.
c) Intubate for worsening compliance and respiratory distress due to the underlying contusion or increasing pCO2
d) Consider surgical fixation

d. Pulmonary contusion:

i. Physiology:

a) Underlying area of lung with alveolar hemorrhage and edema resulting in focal compliance reduction and interference with gas exchange

ii. Diagnosis:

a) Chest x-ray demonstrates contusion, but it may not show for several hours
b) Seen on chest CT sooner

iii. Treatment:

a) Pulmonary toilet, monitor vital capacity.
b) Intubate for worsening compliance, respiratory
c) Maintain normovolemia, do not dehydrate but utilize fluids judiciously.

e. Massive hemothorax:

i. Physiology:

a) Massive bleeding into the pleural space results in hemorrhagic shock.
b) After blunt trauma, source is usually bleeding from the chest wall.

ii. Diagnosis:

a) Hemorrhagic shock and hemothorax on chest x-ray.

b) Absent breath sounds on the affected side.
c) Dull to percussion on the affected side.

iii. Treatment:

a) Fluid resuscitation to correct hemorrhagic shock.
b) Place large bore chest tube.
c) If initial drainage > 1500 ml or drainage continues at >200 ml/hr for more that two hours, then consider operative intervention.
d) If drainage is high, may consider intubation and application of PEEP (10-20 cmH2O) to tamponade chest wall bleeding.
e) Consider auto transfusion.

f. Cardiac tamponade:

i. Physiology:

a) Hole in the atrium, ventricle, or intrapericardial vena cava results in blood loss into the pericardial sac.
b) As blood accumulates in pericardial sac, then end- diastolic volume and ventricular wall movement is reduced, resulting in a decrease of the cardiac output.

ii. Diagnosis:

a) Hypotension and distended neck veins without a tension pneumothorax.
b) Distant or muffled heart sounds.
c) Cyanosis.
d) Pulses Parodoxus.
e) Narrowed pulse pressure.

iii. Treatment:

a) IV fluid bolus.
b) Pericardiocentesis
c) Pericardial window.
d) If positive, immediately go to OR for median sternotomy or thoracotomy.

g. Cardiac Contusion:

i. Physiology:

a) Results in conduction defects.
b) Contusion may result in reduced contractility.

ii. Diagnosis:

a) History of severe anterior chest trauma and abnormality in EKG.
b) Unexplained tachycardia
c) Right bundle branch block
d) Unexplained nonspecific ST-T wave changes.
e) New Q-waves
f) New arrhythmia (atrial fib/flutter, PVC's, multifocal PAC's).
g) Unexplained myocardial pump failure (rule out valve injury).

iii. Treatment:

a) With high suspicion, obtain echocardiogram (preferably TEE).
b) Monitor telemetry for 24 hours in the hospital.
c) Treat arrhythmias.
d) Treat cardiac dysfunction
e) Obtain cardiology consult.
f) Treat any cardiac failure with inotropes and consider concurrent placement of a pulmonary artery catheter.

h. Ruptured diaphragm:

i. Physiology: tear in diaphragm allows abdominal contents to enter chest, resulting in respiratory distress. The process is more rapid with spontaneous ventilation.

ii. Diagnosis:

a) Left:
i) Chest x-ray shows abdominal visceral in the chest, therefore will assess bowel sounds in the chest.
ii) Place NG tube to see if it goes up into the chest.
iii) If necessary, obtain barium swallow to document the location of the stomach.
b) Right:
i) An abnormal “hump” in the lateral diaphragm suggests laceration and protrusion of the liver.
ii) Confirm with CT.
iii. Treatment:
a) Consider early intubation to prevent further migration of abdominal viscera into chest.
b) Operative repair through the abdomen.
c) If diagnosis is delayed, may need a thoracotomy.

i. Ruptured tracheobronchial tree:
i. Physiology: massive air leak into the pleural space after tear of the bronchial tree, usually near a point of fixation.
ii. Diagnosis:
a) Massive pneumothorax.
b) Continued massive air leak after placement of chest tube.
c) Bronchoscopy diagnosis of tear.
iii. Treatment:
a) If massive, can try balloon occlusion of the affected bronchus.
b) To the operating room for thoracotomy and operative closure.
c) Avoid high pressures on the lung.

j. Ruptured thoracic aorta:
i. Physiology:
a) Aorta ruptures at point of fixation after severe deceleration event. The point of rupture is usually just distal to the left subclavian artery or in the ascending arch.
b) Resulting hematoma is contained by adventitia or pleura.
c) 85% are dead at the scene.
d) One half of the survivors will die in 24 hours.
ii. Diagnosis:
a) History of severe deceleration impact.
b) Widened mediastinum.
iii. Treatment:
a) Avoid hypertension, using beta-blocker with vasodilator if necessary.
b) Consult cardiothoracic surgery and prepare for surgery.

k. Ruptured esophagus:
i. Physiology: chest crush or penetrating injury results in rupture of the esophagus.
ii. Diagnosis:
a) Air in the mediastinum.
b) Sputum or intestinal contents out of the chest tube.
c) Confirm with esophagoscopy or gastrografin swallow (preferred).
iii. Treatment:
a) Thoracotomy
b) Surgical repair.

l. Simple pneumothorax:
i. Physiology: puncture of the lung with air leak into the pleural space. The air in the space is not under excessive pressure.
ii. Diagnosis:
a) Absent unilateral breath sounds.

b) Subcutaneous emphysema
c) Pneumothorax on chest X-ray

iii. Treatment:

a) Large bore chest tube should be inserted in patients wit traumatic pneumothorax seen on plain chest X-ray.
b) Occult pneumothorax seen on CT scan without plain findings can be treated without chest tube. If patient goes to the operating room, is intubated or is transferred by air ambulance, then a chest tube should be in place.

m. Fractured ribs:

i. Physiology: ribs fractured from direct force.

i. Diagnosis:

a) Chest wall pain.
b) Bony crepitus.
c) Fractured ribs on chest X-ray.
d) Anterior costochondral cartilages can be fractured and not show up on chest X-ray.

iii. Treatment:

a) Pain control by epidural or PCA.
b) Pulmonary toilet.
c) Drain intrapleural fluid accumulation.

Evaluation of Widened Mediastinum

Objective:

To define the indications of pursuing an evaluation to rule out a thoracic aortic injury and to suggest possible diagnostic paradigms for the evaluation of thoracic aortic injury.

Definition:

Thoracic aortic injury is a disruption of the thoracic aorta usually as a result of a blunt deceleration trauma. This injury is usually at the ductus arteriosum just distal to the take off of the left subclavian artery. Occasionally, the aorta may rupture in the ascending portion and at the level of the major vessels. A Mediastinum measurement of > 8 cm at the level of the aortic knob on the best film that can be obtained.

Guidelines:

a. Initially assume that there is an aortic injury on every patient with a rapid deceleration mechanism of injury.
b. Evaluate and treat the ABC's.
c. Obtain blood pressure in both arms.
d. Obtain a chest x-ray & examine for a widened Mediastinum (8 cm or greater at level of aortic knob). The following signs are confirmatory of a possible aortic injury, but in themselves do not eliminate the need for further investigation:
    - Pleural cap.
    - Depressed left mainstem bronchus.
    - First and second rib fracture.
    - Trachea or esophagus deviated to right
    - First and second rib fractures
    - Obliterated aorto-pulmonary window.

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

5. If the possibility of aortic injury is considered at any point in the resuscitation, avoid hypertension. Extremely high blood pressure should be treated with a short acting intravenous beta-blocker (e.g. Labetalol).
6. Obtain a chest CT scan with IV contrast (if not contraindicated) with cuts through the aortic arch. An alternative is to obtain a transesophageal echocardiogram.
    - If the CT scan shows no periaortic mediastinal blood, than an aortic injury has been ruled out.
    - If the TEE shows no evidence of aortic disruption, then an aortic injury has been ruled out.
7. A CT angiogram is the gold standard for treatment. This should be obtained at the discretion of the trauma leader.

Chest Tube Insertion

Objective:

To outline the indications for chest tube insertion and provide a procedure guideline for chest tube insertion (thoracotomy) in the trauma patient.

Guideline:

1. Indications:
    a. Pneumothorax: when diagnosed by chest x-ray.
    b. Hemothorax: when diagnosed by chest X-ray.
    c. Hemopneumothorax: when diagnosed by chest x-ray.
    d. Subcutaneous emphysema of the chest wall in a patient who has sustained blunt chest wall trauma requiring ventilator support or general anesthesia.
    e. Severe blunt chest wall trauma in which there is a risk for development of pneumothorax.

2. Equipment:
    a. A chest tube insertion tray-will contain lidocaine & suture.
    b. A chest tube pleural vac (there are adult and pediatric containers)
    c. Chest tubes (consider large bore if hemothorax/bleeding is suspected)
    d. Medipore tape to secure tubing to pleural-vac and the patient

3. Procedure:
    1. Drape the area with four towels or sterile barriers.
    2. Prep the skin over a wide area of the chest wall.
    3. Infiltrate the skin with a local anesthetic and block the intercostal nerves with 2-5ml of anesthetic medially and laterally to the incision. Infiltrate the pleura.
    4. Make a 2.5-3 cm long incision well into the subcutaneous tissue.
    5. Insert a curved Kelly clamp and separate the tissues, so as to create a tunnel or tract in the direction in which the tube is to be inserted. Continue developing this tract all the way in to the pleura.

6. Remove the clamp and explore the tract with the gloved finger from time to time to make sure the tract is going in the right direction.
7. After the pleural cavity has been entered, insert the gloved finger to explore for adherent lung and then further enlarge the opening in the pleura by inserting a large Kelly or Peon clamp and spreading it.
8. Select the tube to be used.
9. Grasp the tip of the tube with a long Kelly (Peon) clamp to that the long axis of the clamp is almost parallel to the long axis of the tube.
10. Measure the distance that you want the tube to extend into the chest and either note or mark the proposed point of the emergence of the tube with another small clamp on the tube at this point.
11. Insert the tube into the chest using the large Kelly (Peon) clamp & your finger as a guide. Ensure you get steam inside the tubing, to confirm you are in the pleural space and not subcutaneous space.
12. Remove the large Kelly (Peon) clamp as soon as the tube has reached the desired position in the chest
13. Suture the tube to the skin with a suture.
14. Connect the tube to the underwater seal chest drainage apparatus and tape the connection between the end of the tube and the plastic connector as well as the connection between the plastic connector and the rubber tubing to the chest drainage apparatus.
15. Place xeroform gauze dressing around the tube & secure tubing with tape.
16. Obtain a portable chest x-ray to check for the position of the tube.

4. Removal of chest tubes:

a. May be removed when there has been no air leak through the tube for 24 hours after the patient has been on water-seal for 24 hours and when the drainage of fluid through the tube is less than 100 ml in 24 hours. The only exception to this rule is when the tube has been inserted for pneumothorax and the patient is on the ventilator, the tube should be left at the discretion of the surgeon

b. The tube should be removed quickly, at the peak of inspiration and valsalva, with pressure on a gauze dressing held simultaneously over the oblique tube tract right next to the tube thoracostomy incision. A portable chest x-ray is obtained after chest tube removal to make certain there has been no recurrence of pneumothorax. This can be done 4-6 hours post removal, or if the patient is on the ventilator-the following morning.

5. Patients should be instructed not to fly, scuba dive, or be in a high altitude climate for 6 weeks. If aero medical transfer to another institution is anticipated, then the chest tube should be left in place.

Blunt Abdominal Trauma

Objective:

To identify the patient that may have significant intra-abdominal injury after blunt abdominal trauma and identify appropriate diagnostic approaches to determine intra-abdominal injury

Guideline:

Assess and treat primary survey results. Abdominal trauma assessment is part of the secondary survey.

Perform physical examination of the abdomen, including flank and rectal exam.

Consider the possibility of the abdominal injury in the following situations:

- Obvious abdominal pain with or without peritoneal findings on physical examination.
- Significant external findings on the abdominal wall such as contusion, bleeding, and/or laceration.
- Pelvic fracture.
- Fractures present above and below the diaphragm.
- Lower rib fractures
- Lumbar or low thoracic spine fractures.
- Unexplained hemorrhage, shock, or blood loss.
- A history of abdominal impact (deformed steering wheel, vehicle compartment damage, intrusion) in a patient with altered LOC related to:
    i. Drug and/or alcohol use
    ii. Quadriplegia
    iii. Traumatic brain injury with coma
    iv. Prolonged non-abdominal surgery requiring anesthesia.

Go immediately to surgery for emergency laparotomy for the following:

- Findings of diffuse peritoneal irritation.
- Hemorrhagic shock with indication that blood loss is in the abdomen (distending abdomen).
- Ruptured diaphragm on chest x-ray.
- Positive FAST exam

If the patient has indications of abdominal injury and has stable vital signs:

- Consider admission for observation and serial abdominal exams
- If observation patient develops peritoneal signs, fever or prolonged ileus without a source, consider abdominal CT scan for possible perforated bowel.

Management of Blunt Injury to the Liver and Spleen

Objectives:

1. To define situations in which non-operative management of liver injuries is safe.
2. To outline a protocol for non-operative management of liver injuries.
3. To outline a protocol for the operative management of liver injuries.

Definitions:

Grading of Fractures of the Liver:

- Grade I: Subcapsular hematoma: 10 cm surface area
- Grade II: Subcapsular hematoma: 10-50% surface area
- Grade III: Subcapsular hematoma: >50% surface area or expanding
- Intraparenchymal hematoma
- Grade IV: Parenchymal disruption of 25-75% of hepatic lobe
- Grade V: Retrohepatic vena cava and/or hepatic vein injury
- Grade VI: Hepatic avulsion

Grading of Fractures of the spleen:

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

Guidelines:

1. Indications for operative management of liver/spleen injuries:
    - Considered when there is ongoing bleeding from the injury, resulting in unstable vital signs.
    - Always consider angio embolization on patients with hepatic injury or ongoing hemorrhage on unstable patient.

2. Indications for non-operative management of liver/spleen injuries:
    - No other major intra-abdominal injury.
    - Available for monitoring except for short operative procedures.
    - No other major sources of blood loss.
    - No other premorbid illnesses that suggest the patient could not tolerate blood loss (e.g., severe ischemic heart disease).

Non-operative management:

- Admit to Step Down or Intensive Care Unit.
- Monitor hourly vital signs until normal.
- Bed rest.
- NPO.
- Draw serial hematocrit and hemoglobin every 6 hours until stable

When hematocrit is stable and there have been no adverse hemodynamic events:

- Transfer to regular floor.

- Advance diet and activity
- Hematocrit and hemoglobin daily.
- If stable and tolerating diet, discharge as condition allows

After discharge:

- Return to work or school as clinical condition warrants.
- No major contact sports for 3 months.
- Return to clinic as clinical condition warrants.
- Follow up CT scan may be utilized to document healing prior to return to work or contact sports. Routine follow up CT scanning in the asymptomatic patient does not seem to be supported in the literature.
- If splenectomy is required, administer vaccines on the last hospital day:
    - Pneumococcus vaccine (Pneumovax).
    - Meningococcus vaccine.
    - Hemophilus influenzae vaccine

Instruct to return to the ED if:
a) Worsening RUQ pain.
b) Fever.
c) Jaundice.
d) Dizziness, increasing abdominal pain.
e) Bloody stool or UGI bleeding (hemobilia).
3. Complications of hepatic trauma:
a. Fever and/or jaundice – consider biloma.

Penetrating Abdominal Trauma

Objective:
To define appropriate diagnostic tests and therapeutic interventions for the diagnosis of penetrating abdominal wounds. Specifically, these guidelines will help determine the presence of an intra-abdominal injury that will require exploratory laparotomy.

Definition:
1. Penetrating abdominal injury: Any penetrating injury that could have entered the peritoneal cavity or retroperitoneum inflicting damage on the abdominal contents. In general, the entry wounds for an abdominal injury extend from the fifth intercostal space to the perineum.
2. Anterior penetrating abdominal injury: An entry wound on the anterior abdomen or chest that could have penetrated into the peritoneal cavity.
3. Thoracoabdominal penetrating abdominal injury: An entry wound below the fifth intercostal space and above the costal margin. These are wounds that could have initially entered the chest and then penetrated the diaphragm to enter the abdomen.
4. Posterior or flank penetrating abdominal injury: An entry wound posterior to the posterior axillary line. Wounds in this area are most likely to be in the retroperitoneum. Additionally, the large mass of flank and back muscle will make the diagnosis of organ injury more difficult and the possibility of organ injury less frequent.

Guidelines:
1. Follow the ABC's and resuscitate patient according to findings of the primary survey.
2. Assess the abdomen looking for entry wounds, bleeding, and peritoneal findings. Chest injuries can be associated with penetrating abdominal injuries, therefore, be sure signs and symptoms are clearly understood.

a. Determine if there are symptoms or signs suggestive of immediate need for surgical intervention.

- Herniated abdominal contents.
- Massive bleeding from the wound.
- Obvious peritoneal signs consistent with hollow viscous injury or hemoperitoneum.
- Signs of hemodynamic instability associated with the abdominal injury.
- Signs of lower extremity ischemia suggestive of vascular injury.
- All gunshot wounds with pain or other evidence of intraperitoneal penetration or retroperitoneal organ injury.

b. If any of the above signs are present, then take patient to surgery immediately for exploratory laparotomy.

c. For stab wounds, if none of the above signs are present, determine the location of the wound and classify as:

Anterior:

i. Determine if the wound enters the peritoneal cavity by visually exploring the wound. This is done by infiltrating local anesthesia, then prepping and draping the wound. The wound is extended if necessary to allow a visual inspection of the wound to determine its depth. The liberal use of retractors and assistants will facilitate wound exploration.

ii. If the wound does not penetrate the anterior fascia, then the wound can be debrided, irrigated and closed. The patient may be discharged if no other injuries exist.

iii. If the wound does penetrate the anterior fascia, the laparotomy should be considered. If the patient has no evidence of peritoneal irritation, then a Diagnostic Peritoneal Lavage (DPL) should be performed. Prior to DPL, a Foley catheter and an NG tube should be placed. Laparotomy is indicated with gross hematuria or blood from NG tube. The threshold for a DPL in these circumstances is an RBC of 5000/mm. Fluid lavaged from the Foley catheter, NG

tube or chest tube also mandates exploration. All patients with peritoneal penetration who are not taken to surgery should be admitted for 24 hours of observation.

Thoracoabdominal:

i. Obtain chest X-ray with wound markers to determine the presence of chest injury and to determine the relationship of the entry wound to the diaphragm.
ii. If wound could possibly have penetrated the diaphragm, consider DPL with threshold for the RBC count of 5000/mm.

Posterior or flank:

i. Insert Foley catheter to determine the presence of hematuria.
ii. Obtain a triple-contrast CT scan to determine injury by retroperitoneal organs. Triple contrast means contrast administered IV, by mouth or by NG tube, and per rectum. Consideration can be given to placing a contrast-soaked sponge into the wound to help localize the injury.

d. For pelvic wounds that may have traversed the rectum:

i. Perform sigmoidoscopy to determine the presence of a mucosal defect.
ii. Consider diversion, drainage and rectal washout if injury is found.

3. For all patients taken to surgery for exploratory laparotomy:

- Review risks/benefits and obtain consent.
  - If patient is unable to give consent, discuss with family
  - If no family are present and the patient is unable to give consent, then consent is based on “Surgical Necessity”
- Make sure the patient is typed and crossmatched for blood and it is immediately available.
- Administer prophylactic antibiotics for bowel flora.

Surgical Classifications at Munson Medical Center
Viewing Surgical Scheduling Regulations

A. Emergent (STAT): Life, limb, and/or sight threatening condition requiring immediate surgery and taking precedence over any other case. A reference time of 60 minutes will be used to gauge the response time of getting EMERGENT patients to the OR.

1. Trauma cases may require the OR to be ready to receive the patient within 15 minutes of receiving notification.

B. Urgent: Life, limb, and/or sight threatening case requiring surgery without undue delay.

Hemorrhage in Pelvic Fractures

Objective:

Provide guidelines for the treatment of patients who are at high-risk for hemorrhage related to pelvic fractures.

Guideline:

1. External stabilization:
   **Bed sheet tied tightly around the pelvis, a commercial pelvic binder, or external pelvic fixation device applied by an orthopedic surgeon.
   - Unstable fractures of the pelvis associated with hypotension
   - Unstable pelvic fractures who warrant laparotomy
   - Unstable fracture of the pelvis not associated with hypotension, but who do require a steady and ongoing resuscitation

2. Angiography and possible embolization:
   - Prior to proceeding to angiography in a patient with known pelvic fractures, the orthopedic service should be consulted regarding management options.
   - Patients with pelvic fractures who have signs of ongoing bleeding after non-pelvic sources of blood loss have been ruled out
   - Patients with major pelvic fracture who are found to be bleeding in the pelvis, which cannot be adequately controlled at laparotomy
   - Patients with evidence of arterial extravasation of intravenous contrast in the pelvis by CT scan

3. Laparotomy:
   - Patients with hypotension and gross blood in the abdomen or evidence of intestinal perforation warrant emergent laparotomy.
   - Urgent laparotomy is warranted for patients who demonstrate signs of continued intraabdominal bleeding after adequate resuscitation, or evidence of intestinal perforation.

Ensure you receive a pelvis plain film, during your initial treatment phase of a trauma. A missed pelvic injury can be detrimental to your resuscitation

Evaluation of Hematuria

Objective:
To provide guidelines for the diagnosis and treatment of hematuria in the trauma patient.

Definition:
1. Gross Hematuria: Blood in the urine that can be seen as a change in the urine color.

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

Guidelines:
- Treat the patient according to ATLS guidelines.
- Determine the presence of blood by either inserting a Foley catheter or having the patient void on their own.
- If the urine has visible cells or is red or pink, then gross Hematuria is present (usually >50 RBC/HPF).
- If the urine appears normal but is “dipstick positive” for blood (1+or greater) and has RBC’s on microscopic exam (usually <50 RBC/HPF), then microhematuria is present.

For gross hematuria, determine whether there is a fractured pelvis and whether there is a mechanism or signs suggestive of an intra-abdominal injury.

- If there is a fractured pelvis, obtain an abdominal and pelvic CT followed by a cystogram.
- If there is no fractured pelvis but a mechanism or signs suggestive of an intra-abdominal injury, obtain an abdominal CT scan.
- If there is no fractured pelvis and no mechanism or signs suggestive of an intra-abdominal injury, obtain a urology consult and consider intravenous pyelogram.

For micro hematuria, determine whether there is a mechanism or signs suggestive of an intra-abdominal injury.

- If there is a mechanism or signs suggestive of intra-abdominal injury, obtain an abdominal CT scan.
- If there is no mechanism or signs suggestive of intraabdominal injury, then no further immediate diagnostic studies are necessary.

Disposition: If patient is to be discharged, provide information about potential gross Hematuria and have the patient contact the trauma service if Hematuria occurs. If patient is admitted, then obtain a urinalysis 24 hours after admission. If UA has > 50 RBC/HPF, then perform IVP or Abdominal CT scan.

Management of Kidney and Bladder Injuries

Objective:
To provide a guideline for the management of renal contusions, renal fractures, renal vascular injuries and bladder perforations**.**

Definition:
1. Renal contusions: Defect(s) in perfusion of the kidney on CT that is consistent with a parenchymal contusion.
2. Renal fracture: A parenchymal defect of the kidney associated with hematoma around the kidney.
3. Renal vascular injuries: Occlusion(s) of the renal artery as evidenced by lack of perfusion to a kidney on CT, IVP or angiogram.
4. Bladder Perforation: Extravasation of contrast from the bladder on CT, IVP or cystogram. Extraperitoneal perforations are contained in the retroperitoneal space around the bladder. Intraperitoneal perforation is associated with contrast in the peritoneal cavity that outlines bowel.

Guidelines:
Evaluation:

a. Consider renal injury with any injury associated with hematuria or a penetrating abdominal injury

b. Consider bladder injury when there is significant Hematuria with a pelvic fracture or lower abdominal pain

1. Penetrating Injuries:

a. All gunshot wounds to the kidney require exploration for the possibility of associated injuries.

b. All stab wounds to the kidney require specific evaluation:

- If kidney is injured from anterior stab wound, exploration is required because of the possibility of associated intra-abdominal injuries.
- If kidney is injured from a flank wound, CT must show that the wound is limited to the kidney with minimal blood in the perirenal space. If urine is present around the kidney, consider exploration for disrupted collecting system or ureter.

2. Blunt injuries:

a. Renal contusions:

- Diagnosed as a perfusion defect on CT
- No definitive treatment necessary.
- Monitor hematuria

b. Renal fracture: rarely requires surgical intervention. Diagnosed on CT scan as parenchymal defect with surrounding hematoma.

<u>If hemodynamically unstable, consider angiogram</u>

- If angiogram shows active extravasation, consider embolization.
- If angiogram shows occluded main renal artery, nothing more needs to be done as long as contralateral kidney is present.
- If angiogram shows active extravasation and embolization cannot be accomplished, patient should be taken to surgery. Nephrectomy will probably be required.

<u>If hemodynamically stable without evidence of ongoing bleeding- treat non-operatively.</u>

- Consider urology consult.
- Keep in monitored setting until H&H stable.
- Foley to remain in place until hematuria clears.
- Bed rest until hematuria resolves.
- Antibiotics unnecessary unless there is documented positive urine culture that should be treated appropriately.
- Expect abdominal and flank discomfort, fever and mild ileus for 3-4 days.

- Follow-up in TACS clinic after discharge
- Same post-hospitalization instructions as spleen/liver injury

c. Renal vascular injury: Usually discovered in patients with poor visualization of kidney on contrasted CT. Order renal angiogram.

- If there is active extravasation, attempt embolization. If embolization unsuccessful, perform laparotomy.
- If there is occlusion, most likely explanation is intimal flap from partial thickness vessel disruption from traction injury.
- With occlusion, consider the amount of time from the injury.
    1. Less than 6 hours consider revascularization.
    2. Greater than 6 hours: observe. The chances of kidney survival are slim.

3. Bladder and urethral injuries:

a. Consider bladder injury in patients with the following:

- Gross Hematuria.
- Severe displaced pelvic fracture.
- Lower abdominal pain with hematuria.
- Extravasation seen on CT scans of the pelvis.

b. In male, consider urethral injury with the following:

- Displaced severe anterior pelvic fracture (i.e. open book fracture).
- Blood at the meatus.
- Perineal hematoma.
- High riding or boggy prostate gland.

c. For possible urethral injury, perform a urethrogram

- If positive do not try to place foley catheter. Consult urology.
- If negative insert Foley catheter if indicated.

d. For possible bladder injuries, insert foley catheter and perform retrograde cystogram. If there is a bladder injury, determine whether it is extraperitoneal or intraperitoneal.

1. Intraperitoneal bladder rupture: contrast flows from bladder but is confined in the extraperitoneal space around the bladder.

- Consult urology
- Usually treated with bladder drainage for 7-10 days.
- After that time, obtain cystogram and if bladder is intact, may remove catheter. ABX generally not needed.

2. Intraperitoneal bladder rupture: contrast flows from the bladder into the peritoneal cavity.

- Consult urology.
- Usually treated with exploratory laparotomy and bladder closure.
- May be treated without laparotomy and repair if there are no signs of peritoneal irritation suggesting an associated injury. In this case, treatment is the same as for Extraperitoneal rupture.

Open Fractures

Definition:

- Grade I: Skin opening of 1 cm or less, quite clean. Low velocity mechanism of injury.
    - Minimal muscle contusion
    - Simple transverse or short oblique fractures.
- Grade II: Laceration more than 1 cm long, with extensive soft tissue damage, flaps or oblique fractures with minimal comminution.
- Grade III: Extensive soft tissue damage including muscles, skin, and neurovascular
- structures. Often a high-velocity injury with a severe crushing component.
    - IIIA: Extensive soft tissue laceration, adequate bone coverage. Segmental fractures, gunshot injuries.
    - IIIB: Extensive soft tissue injury with periosteal stripping and bone exposure. Usually associated with massive contamination.
    - IIIC: Vascular injury requiring repair.

Guidelines:

1. Follow ABC's. Extremity fractures assume low priority in the multiply injured patient unless there is significant bleeding or impending loss of skin integrity by dislocation or displaced fracture.
2. When patient is stable, examine the fracture and document distal neurovascular status of limb.
3. Remove all gross contamination using sterile saline and cover all wounds with saline soaked dressing.
4. Grossly align limb or reduce dislocation.
    i. Splint femur fractures with Hare traction or similar splint.
    ii. Exposed, angulated bone should be pulled below the skin during reduction as much as possible.
    iii. Ortho tech ER to place splint or traction device
5. Radiographs in two planes, including joints above and below fracture.
6. Prophylactic antibiotics: Must be given within 90 minutes of arrival; See table below
7. Tetanus prophylaxis as indicated.
8. Consult orthopedics:
    i. Time to antibiotics: 75 minutes.
    ii. Time to operating room (OR) for operative debridement: 24 hours
    iii. Time to wound coverage for open fractures: as soon as possible. This will depend on the skin condition as well as need for plastics involvement related to split-thickness skin graft or need for flap.

MHC-Dept TACS-SCC - Documents - All Documents

Antibiotic Prophylaxis Regimen & Duration[1-8]

Antibiotic prophylaxis should be initiated as soon as possible following initial injury, preferably within 1 hour of presentation.

Open Fracture Classification	Preferred Regimen	Alternate Regimen for Penicillin Allergies	Duration
Type I	Patients <120 kg: Cefazolin 2 gm IVP q8hr Patients ≥120 kg: Cefazolin 3 gm load followed by 2 gm IVP q8hr	Clindamycin 900 mg IVPB q8hr **OR** Vancomycin	24 hours after wound closure
Type II			
Type III	Ceftriaxone 2 gm IVP q24hr	Clindamycin 900 mg IVPB q8hr **OR** Vancomycin **PLUS** Gentamicin*	72 hours after injury **OR** 24 hours after soft tissue coverage has been achieved
Presence of possible fecal or clostridial contamination (e.g. farm-related injuries) OR water-related injuries	Piperacillin/tazobactam 4.5 gm IVPB q8hr (First dose over 30 min)	Clindamycin 900 mg IVPB q8hr **PLUS** Gentamicin*	

Note: Fluoroquinolones offer no advantage over cephalosporin/aminoglycoside regimens and may have a detrimental effect on fracture healing and may result in higher infection rates in type III open fractures[2]

*Gentamicin 5mg/kg ABW (Use DW if ABW is >30% of IBW). Round to the nearest 20mg. Use the Dosing Nomogram below to calculate the frequency[7]

Management of Spinal Fractures

Objective:
To define patients in which evaluation of the spine must be undertaken, define early intervention of lower spine injuries, and prevent neurologic deterioration.

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

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

Guidelines:

Follow ABC's.

Secondary survey:

- Logroll patient with full C-spine immobilization to determine areas of tenderness in the thoracic and lumbosacral spine. If tenderness present, assume the spine is unstable.
- Examine for areas of increased kyphosis or spinous process step-off.
- Perform neurological exam to determine any deficits suggestive of neurological injury.
- Examine rectal tone.

- Consider obtaining x-ray films for areas of pain, during assessment. If patient is going to CT for other injuries, consider adding a CT.
- Keep high index of suspicion for possible low thoracic/lumbar fracture in patient with abdominal wall "seat-belt sign."
- If neurologic injury is found without bony injury, obtain an MRI scan of the involved spine.
- Consult neurosurgery if bone injury or Neurologic deficit is found.
- Maintain spinal precautions until cleared by the consulting service.
- Beware of ileus in patients with spinal fractures. Consider early use of NG tube / bowel program.

**If the patient needs to be sedated for imaging or their protection, consider something short acting such as Propofol or Fentanyl

Traumatic Quadriplegia or Paraplegia

Objective:
To define diagnostic approaches to spinal cord injuries. To define early therapeutic intervention strategies for spinal cord injuries.

Definition:
1. Traumatic quadriplegia: Any injury associated with a spinal cord or nerve root deficit not involving the cranial nerves above and including C8, T1 roots.
2. Traumatic paraplegia: Any injury associated with a spinal cord or nerve root deficit below and including T2.

3. Complete: Any spinal cord injury associated with a complete motor and sensory deficit below the level of the injury.
4. Incomplete: Any sensory or motor sparing below the level of injury including perianal sensation.

Guidelines:

1. Follow the ABC's & maintain high suspicion for spinal injury. Follow same steps as above.
2. If quadriplegia or paraplegia are noted, perform a bulbocavernosus reflex test:
    - Male: pull on penis while examining for an increase in rectal tone.
    - Female: pull on Foley catheter while examining for an increased rectal tone.
        - If this reflex is present, then spinal shock is not occurring and injury will usually not improve.
        - If this reflex is absent, then spinal shock may be occurring and ultimate outcome of injury is unknown.
3. Consult Neurosurgery immediately.
4. If neurosurgery requests the "steroid protocol" (call pharmacy and they can input the order):
    a. SoluMedrol 30 mg/kg, as slow IV bolus (begin as early as possible) within eight hours of injury.
    b. SoluMedrol 5.4 mg/kg, for the next 23 hours.
    c. Continue the protocol even if there is complete neurologic improvement.
5. Be sure to rule out any causes of shock.
6. Place Foley and monitor urine output.
7. Provide DVT prophylaxis
8. Request PMR services consult on admission
9. Likely ICU admission.
    - Quadriplegics with potential pulmonary problems-Nearly all patients with a C-5 or higher neuro deficit will require intubation.
    - Assess ability to clear secretions: consider intubation if secretions cannot be cleared spontaneously or with quad cough maneuver.
    - Utilize the Spinal Cord Injury subphase in the ICU admission order set.
    - Refer to Spinal Cord Injury Guideline for more detailed management.

Re-warming of Trauma Patients with Hypothermia

Objective:

To properly identify and treat trauma patients who have accidental hypothermia.

Definition:

Drop in core body temperature below 35C (95F).
Mild hypothermia ranges from >32-35C.
Moderate hypothermia ranges from >28-32C
Severe hypothermia is 28C or less.

Guidelines:

1. Patient's temperature is measured within 5 minutes of arrival (oral &/or rectal).
2. Correct hypothermia:

    - Remove all clothes and dry the patients skin surface
    - Verify that ambient room temperature in the trauma bay and any patient environment are as near 80F as possible and and all doors are kept closed.
    - Keep the patient covered with warm blankets at all times. These should be exchanged frequently to remain warm to the touch.
    - All intravenous fluids will be administered through a fluid warmer such as a high- flow Level –One infuser set at 40-42C

- Place the full body BAIR hugger blanket directly in contact with the patient's dry, intact skin and verify it is inflating with warm forced air.
- Cover the patient's head to minimize evaporative, convective and radioactive heat loss.
- Respiratory therapy will set humidified inspired gas setting at 40-42C for all intubated patients.
- Patients will maintain continuous ECG, blood pressure, during their course of hypothermia.
- ABG, blood glucose and lactate will be measured on once diagnosis is made and every 30 minutes until hypothermia resolves.
- Hypothermia patients require 2 large bore I.V.'s.

Management and Triage of Severely Burned Patients

Objective:
To provide guidelines for the management of the severely burned patient. To provide guidelines to stabilize thermally injured persons until they may be transferred to a burn unit. To provide information to insure smooth transfer of the patient to the burn unit.

Transfer Criteria
Patients with severe burn injury who should be transferred for specialized care to a burn center:
- Partial thickness burns greater than 10% total body surface area (TBSA).
- Burns involving the face, hands, feet, genitalia, perineum, or major joints.
- Third –degree burns in any age group.
- Electrical burns, including lightning injury.
- Inhalation injury.
- Chemical burns.
- Burn injury in patients with significant pre-existing disease that could complicate management, prolong recovery, or affect mortality.
- Any patient with burns and concomitant trauma (such as fractures) in which the burn injury poses the greatest risk of morbidity or mortality. In such cases, if the trauma poses the greater immediate risk, the patient may be initially stabilized in a trauma center before being transferred to a burn unit. Physician judgment will be necessary in such situations and should be in concert with the regional medical control plan and triage protocols.
- Burned children with the above parameters-as Munson does not have PICU
- Burn injury in patients who will require special social, emotional and / or long-term rehabilitative intervention.

Guidelines:
Always start with your ABC's. Don't let the obvious burns distract you-ensure life-threatening issues are addressed first.

Airway:
i. Assess for upper airway injury caused by the inhalation of hot air or gases. This will potentially result in rapid upper airway occlusion.
a) Stridor.
b) Inability to handle secretions.
c) Inability to speak; hoarse.
d) Burns to the face and mouth/soot in oropharynx
e) Erythema in the pharynx.
f) If there is any question about airway occlusion, intubate!!

ii. Assess for smoke inhalation
    a) All of the above signs, plus:
    b) A history of being burned in an enclosed environment.
    c) Carbonaceous sputum.
    d) Soot in the airway and around the nose and mouth.
    e) Uncontrollable coughing:
        i) Obtain chest X-ray. REMEMBER: the initial chest X-ray may be normal with severe smoke inhalation.
        ii) Consider bronchoscopy, looking for erythema of the airway and soot deposition in the trachea and bronchi.
        iii) If there is any question about smoke inhalation, intubate the patient and place them on positive pressure ventilation & TRANSFER.
iii. Carbon monoxide poisoning:
    a) Consider carbon monoxide poisoning with any of the above findings, and
    b) Carboxyhemoglobin level >10%:
        i) Consider intubating the patient so that 100% O2 can be given to the patient.
        ii) Consider the use of a hyperbaric chamber (these are located off site and likely not an option)

Breathing:
i. Rule out any other reasons for chest injury-in association with the burn injury.
ii. Assess breath sounds and obtain a chest X-ray.
iii. Treat according to the chest injury guidelines.

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

Disability:
i. Assess neurologic status.
ii. If brain injury is suspected, obtain CT scan.

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

Obtain blood sample for laboratory.
i. CBC, renal panel, UA, clotting studies, blood alcohol (if necessary).
ii. Obtain CXR if not already done.
iii. Obtain EKG in patients over 45 or those who are having arrhythmias.
iv. Obtain arterial blood gas with carboxyhemoglobin level.

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

Examine the burn when the patient is otherwise stable.
    a. Rule of nines for second- and third-degree burn only.
    b. The palm of the patient's hand (without the fingers) is equal to 1% TBSA.
    c. Assess depth of burn (Only second- and third- degree burns are considered when assessing the size of the burn):
        i. First degree: erythematous, dry, painful, blanches (e.g., sunburn).
        ii. Second degree (partial thickness): blisters, wet, erythematous, painful, blanches (e.g., blister burn).
        iii. Third degree (full thickness): dry, leathery, gray or brown, painless, does not blanch (e.g., surface of football).

d. Calculate the fluid requirements:
    i. (4 ml) X (wt in kg) X (% TBSA burn) – given over first 24 hours.
    ii. One-half given in first 8 hours and the rest given in second 16 hours.
    iii. Maintain urine output at 0.5 ml/kg/hr in the adult (1.0 ml/kg/hr in child and 2.0 ml/kg/hr in infant <1 year).
e. Assess for constricting eschar:
    i. Usually on extremity but may be on chest or neck.
    ii. Release eschar medially and laterally as follows:
        a) Prep with betadine.
        b) Use #11 blade.
        c) Hold between your thumb and forefinger with the blade protruding 1/4 inch.
        d) Run the blade on the medial and lateral aspect of the involved limb. For chest injuries, release the eschar on the lateral aspect of the chest at the anterior axillary line.
        e) There should be no pain and minimal bleeding.
        f) Expand the escharotomy with a clamp.
        g) Cover the site with a dry, sterile dressing.
f. Do not administer antibiotics unless there is a concomitant injury
g. Administer intermittent boluses pain medication. If the patient is intubated and stable, you can be liberal with the pain med.
h. Consult with plastic surgery.
i. If transfer is necessary, complete transfer form. Send the following with the patient:
    a. Transfer form.
    b. Medical records.
    c. Laboratory results.
    d. X-rays

Massive Transfusion Protocol for Traumatic Injuries

Viewing Massive Transfusion Protocol

Purpose:

Resuscitation, restoration of blood volume, and correction / prevention of coagulopathy in patients with major hemorrhage secondary to traumatic injuries.

Indications:

Massive blood loss and profound hemorrhagic/hypovolemic shock.
Triggers:

- Greater than 6 units packed red blood cells (PRBC) transfused within 2 hours.
- Hemodynamically unstable patient with identified or suspected coagulopathy of trauma or disseminated intravascular coagulopathy (DIC)
- Any time at the discretion of the trauma surgeon / intensivist.
- Assessment of blood consumption (ABC) score of greater than or equal to 3 (total possible score 4)
    a. Penetrating mechanism (no= 0; yes= 1)
    b. Emergency department (ED) systolic blood pressure less than 90 mmHg (no= 0; yes= 1)
    c. ED heart rate greater than 120 bpm (no= 0; yes= 1)
    d. Positive Ultrasound FAST Exam (no= 0; yes= 1)
- Trauma patient who requires more than 1 liter crystalloid to maintain systolic blood pressure greater than 90 mmHg.

Responsible Parties:

A. Team leaders: depending on area in hospital
    1. Trauma surgeon (trauma bay, operating room (OR), intensive care unit (ICU))
    2. Intensivist (in ICU when trauma surgeon unavailable).
    3. ED physician (in ED when trauma surgeon unavailable)
    4. Anesthesiologist (in OR or Post Anesthesia Care Unit (PACU))
    5. Trauma advanced practice provider (APP)
    6. Obstetrician (OB)
    7. Sound hospitalist
B. Clinical pathologist
C. Lab blood bank / laboratory personnel
D. Pharmacy
E. Nursing supervisor / charge nurse
F. Clinical team:
    1. Trauma physician assistant (PA)/nurse practitioner (NP)
    2. ED registered nurse (RN)/paramedic
    3. ICU RN
    4. OR RN
    5. ED Technician / ICU technician / OR technician
G. Vascular Access

Procedure:

Initiation of the massive transfusion protocol (MTP):

1. Trauma surgeon, intensivist, ED physician, trauma APP, anesthesiologist, Sound hospitalist, or OB initiate MTP.
    a) Staff member call switchboard to page out MTP overhead and to all responsible parties.
    b) Staff member enter order for Massive Transfusion in Cerner

i. Initiate *Lab - every 30 minutes* immediately
ii. Blood bank and lab supervisor notified (by switchboard) of MTP initiation.
iii. Nursing/house supervisor to come to area if needed.
iv. Blood bank will notify clinical pathologist of MTP initiation
v. Maintain communication with blood bank during the initiation and maintenance of MTP.
vi. Consider the use of tranexamic acid (TXA) on patients greater than 18yrs old, initial 1g dose over 10 minutes and then a second 1g dose over the next 8 hours. **MUST BE USED WITHIN 3 HOURS OF INITIAL INJURY, IDEALLY less than 1 HOUR
vii. Communicate with pharmacy the need for anticoagulation reversal agents.

c) Clinical pathologist or designee:
i. Supervises procurement of lab tests.
ii. Tracks the use and available supply of blood and blood products.
iii. Advises the clinical team on the use of blood, blood products, and procoagulants
iv. Use of products based on lab results and available reserves.

d) Lab: confirm patient identification (ID) and medical record number (MR#) (actual or John Doe)
i. Initial testing
ii. Type and cross (GTAB)
iii. STAT coagulation profile: Prothrombin time (PT), partial thromboplastin time (PTT), fibrinogen, hemoglobin (HGB), platelet count
iv. Basic metabolic panel (BMP), arterial blood gas (ABG), and lactate.
v. Massive transfusion serial lab process.
I. Repeat labs every 30 minutes until discontinued by clinical team.
II. Include complete blood count (CBC), PT/PTT, fibrinogen, lactate, BMP, and ionized calcium.

e) Blood bank:
i. Prepares and releases
I. First of five uncrossmatched PRBCs – O-negative or O-positive as indicated
II. 5 more units uncrossmatched, O-negative or O-positive PRBC as indicated (unless type specific available).
III. 5 single units of plasma
IV. 5 units platelets
ii. Delivers the first trauma pack to the location of the MTP
iii. Prepares fresh frozen plasma (FFP) to stay 5 single units ahead.
iv. Prepares platelets to stay 5 units ahead.
v. Ships components at temperatures appropriate for the product being delivered. This should prevent inappropriate temperature storage of a blood product, such as refrigeration of platelets.
vi. Prepares trauma packs (see attached schedule). Trauma packs should be ready to be delivered every 20 minutes.
vii. Updates to appropriate type-specific or crossmatched components once available.
viii. Tracks results of labs as they become available.
ix. Communicates with clinical pathologist and designated clinical team leader (usually the trauma surgeon, anesthesiologist, or intensivist depending on clinical area).
x. Access and maintenance of services:
I. Notifies blood center and requests urgent delivery as needed.
II. Communicates status of reserves to clinical pathologist.

f) ED RN/paramedic and ICU RN respond to all MTPs

g) Maternity Unit: ED Brings Belmont and Maternity provides the MTP Cart
h) ED MTP: ICU brings the Belmont only (not the MTP cart)
i) All Other Units: ICU Brings MTP Cart and Belmont. ED also brings Belmont for backup.
j) Vascular Access ensure patient has large bore IV (unless physician inserting Cordis)

Maintenance of MTP:

1. Charge nurse/Patient Care Coordinator:
    a) Checks for accuracy of specimens and verification of patient identity.
    b) Expedites transfer of patient within the institution.
    c) Expedites transfer of lab specimens in timely fashion.
    d) Communicates with and assists clinical team to maintain accuracy and timeliness.
    e) Clinical team:
        i. Draws, labels and maintains serial labs every 30 minutes during MTP or until discontinued by team leader (see heading III, below).
        ii. Transfuses shipped trauma packs at regular intervals as needed
        iii. Documents Input/Output (I/O) and medication administration record (MAR) during MTP.
        iv. Accompany the patient to the OR or ICU.
        v. Remain with the patient until the MTP is terminated.
    k) Team leader:
        i. Ensures timeliness of serial blood draws.
        ii. Ensures timeliness of transfusions.
        iii. Supervises clinical team during the maintenance of MTP.
        iv. Designates alternate team leader when appropriate (e.g.: trauma surgeon designates anesthesiologist when operating).
        v. Communicates with clinical pathologist regarding trend of lab results and transfusion needs.
    l) Laboratory goals:
        i. HGB 8-10 g/dL during the resuscitation and in the first 24 hours post stabilization. After 24 hour period of stabilization the HGB may be reduced to 7 g/dL if not actively bleeding.
        ii. Platelet count greater than 100,000 during resuscitation and in the first 24 hours post stabilization. After the 24 hour period of stabilization the goal is a platelet count greater than 50,000.
        iii. Coagulation testing goals: INR less than 2.0 and PTT less than 55 seconds. INR of 1.8 may be needed in TBI patients.
        iv. Fibrinogen greater than 150 mg/dL.
        v. Terminates MTP (See heading III)
    m) Clinical pathologist or designee:
        i. Monitors coagulation and lab results
        ii. Advises team leader and clinical team of need for other blood components or specific alterations in transfusion needs (e.g. cryoprecipitate)
        iii. Notifies team leader of critical shortages in blood supply.

Termination of MTP:

1. Determined by team leader when either of the following are achieved
    a) Achievement of endpoints of resuscitation ("stabilization").
        i. Normalization of vital signs, including temperature.
        ii. Normalization or improvement of coagulation parameters.
        iii. Termination of bleeding/exsanguination.
        iv. Failure or Futility.

b) Call 55555 for switchboard to announce termination of MTP overhead.
c) Maintenance of hematologic function:
    i. Serial hematologic assessments (CBC, PT/INR, PTT) every 6 hours for 24 hours, then twice daily (BID) or as needed.
    ii. Do not transfuse if there is no evidence of bleeding
    iii. Transfuse FFP if there is evidence of oozing until INR less than 2.0.
    iv. Transfuse platelets if platelets less than 50 k/dL.
    v. Transfuse red blood cells (RBC) to maintain HGB 8-10 g/dL in first 24 hours post stabilization; transfuse for Hgb less than 7 g/dL after 24 hours (restrictive transfusion trigger) unless evidence of new bleeding.
    vi. Transfuse cryoprecipitate if fibrinogen less than 150 g/dL.

2. Review of case and debriefing:
    a) What went well.
    b) What did not.
    c) Product wasted.

Trauma Pack	Products
1	5 u PRBCs, 5 u plasma, OPTION for cryo (5 u for fibrinogen <150, 10 u for <100)
2	5 u PRBCs, 5 u plasma, 5-pk platelets, OPTION for cryo (5 u for fibrinogen <150, 10 u for <100)
3	5 u PRBCs, 5 u plasma, OPTION for cryo (5 u for fibrinogen <150, 10 u for <100)
4	5 u PRBCs, 5 u plasma, 5-pk platelets, OPTION for cryo (5 u for fibrinogen <150, 10 u for <100)
5	5 u PRBCs, 5 u plasma, OPTION for cryo (5 u for fibrinogen <150, 10 u for <100)
6	5 u PRBCs, 5 u plasma, 5-pk platelets, OPTION for cryo (5 u for fibrinogen <150, 10 u for <100)
7	5 u PRBCs, 5 u plasma, OPTION for cryo (5 u for fibrinogen <150, 10 u for <100)
8	5 u PRBCs, 5 u plasma, 5-pk platelets, OPTION for cryo (5 u for fibrinogen <150, 10 u for <100)
9	5 u PRBCs, 5 u plasma, OPTION for cryo (5 u for fibrinogen <150, 10 u for <100)
10	5 u PRBCs, 5 u plasma, 5-pk platelets, OPTION for cryo (5 u for fibrinogen <150, 10 u for <100)

*For OB: 10 units cryoprecipitate (for fibrinogen <200) is available for order on every trauma pack.

Complications

- TRALI
- ARDS
- Hypocalcemia- the citrate in the unit of blood binds the calcium, transfusion rates at higher than one unit in 5 minutes impairs liver function leading to citrate toxicity and hypocalcemia
- Hyperkalemia
- Thrombocytopenia
- Coagulation factor depletion
- Hypothermia

Rehabilitation Services Protocol

All patients with appropriate trauma diagnosis will receive therapy evaluations which may include:

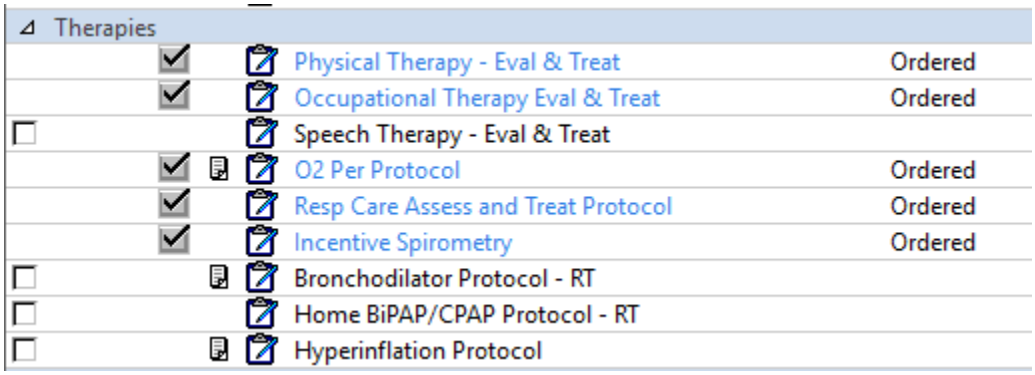
- Physical therapy,
- Occupational therapy
- Speech therapy

If patient may be considered for inpatient rehabilitation services, Physical Medicine and Rehabilitation (PM and R) will be consulted for further input.

Therapy recommendations for post-hospital disposition are taken into consideration for placement at discharge.

All therapies are available 7 days a week at Munson Medical Center.

PT, OT, and ST are available in the Trauma Core Admission order set.



Therapies

- ☐ Evaluation & Treatment - Physical Therapy
- ☐ Evaluation & Treatment - OT
- ☐ Evaluation & Treatment - PT - C/G
- ☐ Evaluation & Treatment - OT - C/G
- ☐ Evaluation & Treatment - Speech Therapy
- ☐ O2 Per Protocol
- ☐ Resp Care Assess and Treat Protocol
- ☐ Incentive Spirometry
- ☐ Bronchodilator Protocol - RT *Bronchial Hygiene*
- ☐ Flutter Valve *Acapella, Instruct per RT, Nursing/RT to follow standard of care.*
- ☐ Home BiPAP/CPAP Protocol - RT

Chapter 4

Acute Care Surgery Clinical Practice Guidelines

The Acute Abdomen

Definition: The acute abdomen may be defined generally as an intraabdominal process causing severe pain and often requiring surgical intervention. It is a condition that requires a fairly immediate judgement or decision as to management. General causes of the acute abdomen may be divided into six large categories:

- Inflammatory: The inflammatory category of causes may be divided into two subgroups: 1) bacterial, and 2) chemical. Some common examples of the bacterial causes would include acute appendicitis, diverticulitis, and some cases of pelvic inflammatory disease. An example of a chemical cause would be a perforation of a peptic ulcer, where spillage of acid gastric contents causes an intense peritoneal reaction.
- Mechanical & Neoplastic: Mechanical causes of an acute abdomen include such obstructive conditions as incarcerated hernia, post-operative adhesions, intussusception, malrotation of the gut with volvulus, congenital atresia or stenosis of the gut. The most common cause of large bowel mechanical obstruction is carcinoma of the colon (also as a Neoplastic cause).
- Vascular: Vascular entities producing an acute abdomen include mesenteric arterial thrombosis or embolism. When the blood supply is cut off, necrosis of tissue results, with gangrene of the bowel.
- Congenital: Congenital defects can produce an acute abdominal surgical emergency any time from the minute of birth (with conditions such as duodenal atresia, omphalocele or diaphragmatic hernia) to years afterward in conditions such as chronic malrotation of the intestine.
- Traumatic: Traumatic causes of an acute abdomen range from stab and gunshot wounds to blunt abdominal injuries producing such conditions as splenic rupture. History or evidence of trauma should make this diagnosis fairly obvious.

Evaluating the Acute Abdomen

- Type of onset
  sudden - rupture of viscus, mesenteric thrombosis gradual -
  cholecystitis, appendicitis
- Quality
  dull - initial epigastric pain of appendicitis
  sharp - renal or biliary colic or obstruction of gut
  aching - pelvic inflammatory disease
  pleuritic - intensified by breathing
  lancinating - acute pancreatitis
  tearing - dissecting aneurysm
- Intensity
  severe - rupture of viscus or blood in the peritoneal cavity
  moderate - RLQ appendiceal
  mild peptic ulcer, without perforation
- Temporal features
  continuous - acute pancreatitis
  pulsatile - abdominal aneurysm
  colicky - lumen obstruction, intermittent severe pain with pain-free intervals
  frequency & duration transient pain of short duration which does not recur is usually

insignificant. The longer the duration the more likely a surgical condition.

- Factors which intensify or relieve pain
  - relation to meals - peptic ulcer pain relieved by food, cholecystitis pain aggravated by fatty meal
  - posture jack-knifing - leg drawn up to decrease peritoneal irritation in suppurative appendicitis
  - motion - any movement causes intense pain in generalized peritonitis and the patient lies motionless
- Associated nausea and vomiting - reflex, or irritative non-specific vomiting occurs in many conditions. In surgical disease such as acute appendicitis, anorexia always occurs and vomiting, if it occurs, usually follows abdominal pain rather than preceding it, as in gastroenteritis. Repeated vomiting of large amounts occurs in gut obstruction, is often bile stained and may become fecal.
- Protracted vomiting
  - time - early in high GI obstruction; late in low GI obstruction
  - character of vomitus - blood - bleeding ulcer bile stained - obstruction below ampulla of Vater fecal - intestinal obstruction, mechanical or with paralytic ileus; copious amount
- Diarrhea most common with acute gastroenteritis or food poisoning, but it may occur with appendicitis or other focal inflammatory lesions of the gut
- Constipation or obstipation With complete small bowel obstruction - unrelenting constipation (obstipation) after fecal material below obstruction has been passed. Progressive constipation with carcinoma of the large bowel. Gas stoppage with decreased or absent bowel sounds - paralytic ileus

Differential Diagnosis of Abdominal Pain

Right upper quadrant	Biliary: cholecystitis, cholelithiasis, cholangitis Colonic: colitis, diverticulitis Hepatic: abscess, hepatitis, mass Pulmonary: pneumonia, embolus Renal: nephrolithiasis, pyelonephritis
Epigastric	Biliary: cholecystitis, cholelithiasis, cholangitis Cardiac: myocardial infarction, pericarditis Gastric: esophagitis, gastritis, peptic ulcer Pancreatic: mass, pancreatitis Vascular: aortic dissection, mesenteric ischemia
Left upper quadrant	Cardiac: angina, myocardial infarction, pericarditis Gastric: esophagitis, gastritis, peptic ulcer Pancreatic: mass, pancreatitis Renal: nephrolithiasis, pyelonephritis Vascular: aortic dissection, mesenteric ischemia
Periumbilical	Colonic: early appendicitis Gastric: esophagitis, gastritis, peptic ulcer, small-bowel mass or obstruction Vascular: aortic dissection, mesenteric ischemia
Right lower quadrant	Colonic: appendicitis, colitis, diverticulitis, IBD, IBS Gynecologic: ectopic pregnancy, fibroids, ovarian mass, torsion, PID Renal: nephrolithiasis, pyelonephritis
Suprapubic	Colonic: appendicitis, colitis, diverticulitis, IBD, IBS Gynecologic: ectopic pregnancy, fibroids, ovarian mass, torsion, PID Renal: cystitis, nephrolithiasis, pyelonephritis
Left lower quadrant	Colonic: colitis, diverticulitis, IBD, IBS Gynecologic: ectopic pregnancy, fibroids, ovarian mass, torsion, PID Renal: nephrolithiasis, pyelonephritis
Any location	Abdominal wall: herpes zoster, muscle strain, hernia Other: bowel obstruction, mesenteric ischemia, peritonitis, narcotic withdrawal, sickle cell crisis, porphyria, IBD, heavy metal poisoning

Cause and Pathophysiology of Acute Abdomen

Acute Appendicitis

Definition:
1. Inflammation in the appendix. The essential element causing inflammation of the wall of the appendix is invasion by bacteria. The usual organisms in the inflamed appendix are colon bacilli and streptococci, organisms commonly found in the intestinal tract.

2. Obstruction of the appendiceal lumen by fecaliths with interference of the vascular supply are important features in its pathogenesis. Obstruction of the lumen and vascular occlusion likely contribute by breaking down the resistance of the wall of the appendix to invasion by potential pathogens in the gut.

3. The earliest lesion is a superficial ulceration of the mucosa. Spread then occurs from the mucosa to the muscle layers and the serosa and the lumen may become filled with pus. Interference with circulation leads to areas of necrosis and perforation of the appendix, with spread of infection to the peritoneal cavity. If the infection becomes walled off around the appendix a localized abscess may result.

Mechanism: Initial pain is diffiuse and not well localized, with a dull pain in the epigastrum/periumbilical region. After a few hours, the pain typically shifts toward the RLQ (McBurney's point). May also have:

- Guarding
- Anorexia
- Nausea and vomiting (following the abdominal pain)
- Temperature, pulse and respiratory rate can be normal, however, later in the disease, temp may be elevated (esp with perforation).
- Mild Leukocytosis (75% of the time, patients will have elevated WBC)
- Psoas sign: elevation and extension of leg against resistance causes pain
- Rovsings sign: pain at McBurney's point when compression the LL abdomen

Studies:

- WBC may be elevated (marked elevation with perforation/abscess).
- CT of the abdomen will show thickened wall of appendix.
- Ultrasound may also show thickened wall, however, less specific.
- Physical exam!! In children (and many adults), the diagnosis of appendicitis can be clinical-Abdominal pain at McBurney's point, +/- fever, mild leukocytosis, guarding of abdomen, & anorexia.

Treatment: Laparoscopic vs open appendectomy. Antibiotics include a pre-op treatment of for non-perforated and about 5-7 days if perforated (triple coverage during hospitalization). Use something broad spectrum, which covers Gram-negatives/anaerobes. (Keflex or cipro for PCN allergy)

Diverticulitis

Definition: Inflammation that involves the descending and sigmoid colon. This is promoted by the lodging of fecal material in a diverticulum with spread of inflammation to surrounding tissue, and is accompanied by left lower quadrant pain.

Mechanism: Having a pre-existing diagnosis of diverticulosis is the biggest risk factor. Age is

second. A patient may present with the following issues:

- Steady, deep discomfort in LLQ
- Change in bowel habits
- Urinary symptoms
- Tenesmus
- Paralytic ileus
- SBO
- Low-grade fever
- Localized tenderness
- Rebound and guarding
- Left-sided pain on rectal exam
- Occult blood
- Peritoneal signs
    - Suggest perforation or abscess rupture

Studies:

- CT scan (IV and oral contrast)
    - Pericolic fat stranding
    - Diverticula
    - Thickened bowel wall
    - Peridiverticular abscess
- Leukocytosis present in only 36% of patients

Treatment

- IV Fluids (Normal Saline or D5 if not diabetic)
- Correct electrolyte abnormalities
- NPO
- Antibiotics include gentamicin AND metronidazole OR clindamycin OR levaquin/flagyl
- For outpatients (non-toxic)
    - liquid diet x 48 hours
    - cipro and flagyl
- If symptoms do not resolve or are frequently recurring, a bowel resection may be appropriate

Acute Cholecystitis

Definition: inflammation of the wall of the gall bladder, so chemical damage from the action of concentrated bile, promoted by an obstruction of the cystic duct, usually by stones. Bacterial infection with streptococci or colon bacilli may supervene.

Mechanism: In acute cholecystis the gall bladder is large and has a thick edematous wall. The mucosa shows areas of ulceration and necrosis and leukocytes are present in the wall.

a. RUQ or epigastric pain
b. Radiation to the back or shoulders
c. Dull and achy → sharp and localized
d. Pain lasting longer than 6 hours
e. N/V/anorexia
f. Fever, chills
g. Epigastric or RUQ pain
h. Murphy's sign
i. Patient appears ill
j. Peritoneal signs suggest perforation

Studies:

- CBC, LFTs, Lipase

    - Elevated alkaline phosphatase
    - Elevated lipase suggests gallstone pancreatitis
    - You may see elevated bilirubin/AST/ALT, associated with choledocolithiasis
- RUQ US
    - Thicken gallbladder wall
    - Pericholecystic fluid
    - Gallstones or sludge
    - Sonographic murphy sign
- HIDA scan (more sensitive & specific than US)-to evaluate wall thickening and if contrast passes through GB appropriately
- MRCP/ERCP-to remove any stones within the duct, if needed (Obtain GI consult)

Treatment

- Surgical consult for laparoscopic versus open cholecystectomy
- IV fluids & NPO
- Correct electrolyte abnormalities
- Analgesia
- Antibiotics (follow MMC surgical prophylaxis guidelines)
- NGT if intractable vomiting

Pancreatitis

Definition: The effects are caused by the escape of lytic pancreatic enzymes into the gland itself. These act on the parenchyma of the gland, blood vessels and fatty tissue causing edema, necrosis, hemorrhage, and suppuration of varying degree. It appears to be due to increased pancreatic secretion with partial or complete obstruction of outflow and raised intraductal pressure. It may occur suddenly with severe abdominal pain, peripheral vascular collapse or shock.

Risk Factors

- Alcohol
- Gallstones
- Drugs
    - Amiodarone, antivirals, diuretics, NSAIDs, antibiotics, more…..
- Severe hyperlipidemia
- Idiopathic

Mechanism:

1. Epigastric pain
2. Constant, boring pain
3. Radiates to back
4. Severe
5. N/V
6. bBoating
7. Low-grade fevers
8. Tachycardia, hypotension
9. Respiratory symptoms
    a. Atelectasis
    b. Pleural effusion
10. Peritonitis – a late finding
11. Ileus
12. Possible Cullen sign (Bluish discoloration around the umbilicus)
13. Grey Turner sign (Bluish discoloration of the flanks)

Studies:

- Lipase
  - Elevated more than 2 times normal
  - Sensitivity and specificity >90%
- Amylase
  - Nonspecific
  - Don't bother…
- RUQ US if etiology unknown
- CT scan
  - Insensitive in early or mild disease
  - NOT necessary to diagnose pancreatitis
  - Useful to evaluate for complications

Treatment

- NPO
- IV fluid resuscitation
  - Maintain urine output of 100 mL/hr
- NGT if severe, persistent nausea
- No antibiotics unless severe disease
  - E coli, Klebsiella, enterococci, staphylococci, pseudomonas
  - Imipenem or cipro with metronidazole
- Pain control

Bowel Obstruction

Definition: Obstruction to the passage of intestinal content is caused either by mechanical obstruction of the lumen or by paralysis of the intestinal muscles (paralytic ileus).

The development of the clinical picture is slower than in small bowel obstruction and patients do not appear as ill in comparable stages. Usually the acute episode of large bowel obstruction is superimposed on progressive change of bowel habits, with decreasing caliber of the stools and increasing constipation.

a. Adhesions (# 1 reason)
b. Strangulated/incarcerated hernia (# 2 reason)
c. Atresia
d. Intussusception
e. Volvulus
f. Ischemic necrosis/Infarction
g. Neoplastic (large bowel obstruction)

Mechanism: In general, the higher the site of an obstruction within the intestinal tract, the more severe are the associated symptoms of excessive vomiting with dehydration due to a great loss of water and electrolytes.

- Crampy, intermittent pain
  - Periumbilical or diffuse
- Inability to have BM or flatus
- N/V
- Abdominal bloating/distention
- Sensation of fullness, anorexia
- Absent, high pitched or tinkling bowel sound or "rushes"
- Abdominal tenderness: diffuse, localized, or minimal

Studies:

- CBC and electrolytes

    - Electrolyte abnormalities
    - WBC >20,000 suggests bowel necrosis, abscess or peritonitis
- Abdominal x-ray series
    - Flat, upright, and chest x-ray
    - Air-fluid levels, dilated loops of bowel
    - Lack of gas in distal bowel and rectum
- CT scan
    - Identify cause of obstruction
    - Delineate partial from complete obstruction

Treatment

- Fluid resuscitation (Normal Saline or D5 if not diabetic)
- NGT
- NPO
- Analgesia
- Surgical consult
- Hospital observation for ileus
- OR for complete obstruction
    - Peri-operative antibiotics
        - Zosyn or unasyn

Ulcer Disease

Definition: Peptic ulcers are constant in location, being found in the pyloric portion of the stomach near the lesser curvature and the first portion of the duodenum proximal to the ampulla. These chronic ulcers appear as deep, punched-out, funnel-shaped craters whose base is covered with grayish necrotic material. Certain risk factors may include:

a. H. pylori
b. NSAIDs
c. Smoking
d. Hereditary

Mechanism: The patient may have symptoms for a while, before they present to the ER. The two types of ulcer disease, gastric and duodenal can be differentiated:

Gastric:

- pain Greater with meals
- H. pylori 70%
- Blood type A
- M=F
- 1 – 3% malignant potential

Duodenal:

- pain Decreases with meals
- H. pylori 100%
- due to increased acid secretion or decreased mucosal protection
- hemorrhage > perforation
- Blood type O
- NO malignant potential
- M>F

Symptoms of PUD may include:

- Burning epigastric pain
- Sharp, dull, achy, or “empty” or “hungry” feeling
- Relieved by milk, food, or antacids
- Awakens the patient at night
- Nausea, retrosternal pain and belching are NOT related to PUD
- Atypical presentations in the elderly
- Epigastric tenderness
- Severe, generalized pain may indicate perforation with peritonitis
- Occult or gross blood per rectum or NGT if bleeding

Studies:

- Rectal exam for occult blood
- CBC
    - Anemia from chronic blood loss
- LFTs
    - Evaluate for GB, liver and pancreatic disease
- Definitive diagnosis is by EGD or upper GI barium study

Treatment:

- Empiric treatment
    - Avoid tobacco, NSAIDs, aspirin
    - PPI or H2 blocker
- Immediate referral to GI if:
    - >45 years
    - Weight loss
    - Long h/o symptoms
    - Anemia
    - Persistent anorexia or vomiting
    - Early satiety
    - GIB

Perforated Peptic Ulcer: This disease becomes surgical when the areas aren’t healing, despite medical therapy is an indication (esp to r/o cancer) or perforation occurs. Perforation may result when the ulcer continues to penetrate deeply and erodes through the wall of the duodenum into a remarkable series of dramatic changes. Spillage of gastric juice, bile, and pancreatic juice causes a marked chemical inflammation of the peritoneum comparable to a burn. Bacterial invasion may soon follow. Within a short time massive amounts of extracellular fluid may be extravasated into the area of peritoneal injury and this loss of fluid may bring about hypovolemic shock.

- Abrupt onset of severe epigastric pain followed by peritonitis
- IV, oxygen, monitor
- CBC, T&C, Lipase
- Acute abdominal x-ray series to evaluate for free air
    - Lack of free air does NOT rule out perforation
- Broad-spectrum antibiotics

Perirectal Abscess

Definition: An anal abscess is a painful condition in which a collection of pus develops near the anus. Most anal abscesses are a result of infection from small anal glands.

Mechanism: An anal abscess can have many different causes. These include:

- Infection of an anal fissure. An anal fissure is a small superficial tear in the skin of the anal canal.
- Sexually transmitted infections.
- Blocked anal glands.

Risk factors for anal abscesses include:

- Colitis
- Inflammatory bowel disease such as Crohn's disease or ulcerative colitis
- Diabetes
- Diverticulitis
- Pelvic inflammatory disease
- Being the receptive partner in anal sex
- Use of medications such as prednisone

Symptoms can be associated with superficial or deep abscesses. Superficial anal abscesses are often associated with:

- Pain, which is usually constant, throbbing, and worse when sitting down
- Skin irritation around the anus, including swelling, redness, and tenderness
- Discharge of pus
- Constipation or pain associated with bowel movements

Deeper anal abscesses may also be associated with:

- Fever
- Chills
- Malaise

Studies: Usually, a clinical evaluation is sufficient to diagnose a perirectal abscess, however, additional studies may be prudent to examine the extent of the abscess.

- Digital rectal exam
- Ultrasound
- CT

Treatment: Prompt surgical drainage is important. Superficial abscesses can be drained in the office/clinic, however larger or deep abscesses will likely require operating room evacuation.

- Pain control
- Antibiotics-may require ID consult, however, broad spectrum coverage is necessary until cultures return

- Ensuring adequate follow up and home care, as complications are common and can include: infection, anal fissure, painful scarring or return of abscess

Acute Mesenteric Ischemia

Definition: A syndrome caused by inadequate blood flow through the mesenteric vessels, resulting in ischemia and eventual gangrene of the bowel wall.

Mechanism: Insufficient blood perfusion of the small bowel and colon may result from embolic or thrombotic arterial occlusion, thrombotic venous occlusion or nonocclusive processes, such as vasospasm or low cardiac output. Injury severity is inversely proportional to the mesenteric blood flow and is influenced by the number of vessels involved, systemic blood pressure, duration of ischemia and collateral circulation. Superior mesenteric vessels are involved more frequently than the inferior vessels, with blockage of the latter often being silent because of better collateral circulation.

Intestinal ischemia can be classified according to the time course of onset and quality of symptoms, the degree to which blood flow is compromised, and the segment of bowel that is affected. Ischemia affecting the small intestine is generally referred to as mesenteric ischemia, while ischemia affecting the large intestine is referred to as colonic ischemia. The arterial supply to the intestines consists primarily of the superior mesenteric artery (SMA) and inferior mesenteric artery (IMA). The venous drainage parallels the arterial circulation and drains into the portal venous system.

Etiologies:

- Arterial embolism — Embolism to the mesenteric arteries is most frequently due to a dislodged thrombus from the left atrium, left ventricle, cardiac valves, or proximal aorta.
- Arterial thrombosis — Acute thrombosis of the mesenteric circulation usually occurs as a superimposed phenomenon in patients with a history of chronic intestinal ischemia from atherosclerotic disease. It can also occur in the setting of abdominal trauma, infection, thrombosed mesenteric aneurysm, and aortic or mesenteric dissection.
- Venous thrombosis — Mesenteric venous thrombosis can be either idiopathic (eg, hypercoagulable states) or from secondary causes (eg, malignancy or prior abdominal surgery). Increases in the resistance of mesenteric venous blood flow lead to bowel wall edema and extent of ischemia is related to the extent of venous involvement. Mesenteric venous thrombosis rarely involves the colon.
- Nonocclusive mesenteric ischemia — Nonocclusive mesenteric ischemia (NOMI) is thought to occur as a result of splanchnic hypoperfusion and vasoconstriction. Nonocclusive colonic ischemia most commonly affects the "watershed" areas of the colon that have limited collateralization, such as the splenic flexure and rectosigmoid junction

Risk Factors:

- Cardiac disease: arrhythmias, valvular disease, aneurysm, poor
- Aortic surgery or instrumentation
- Peripheral artery disease
- Hemodialysis
- Vasoconstrictive medications.
- Acquired and hereditary thrombotic conditions (Up to 75 percent of patients with mesenteric venous thrombosis have an inherited thrombotic disorder)
- Inflammation/infection

- Underlying vascular disorders
- Hypovolemia or Extreme exercise (dehydration)
- Segmental ischemia from bowel strangulation can be due to external or internal hernias, bowel volvulus, or over distention of the bowel

Exam:

- Sudden onset of Pain “out of proportion to exam;” periumbilical
- Nausea and vomiting.
- Mild to moderate amounts of rectal bleeding or bloody diarrhea if associated with colonic ischemia
- Abdominal distension with possible guarding or rebound tenderness

Studies:

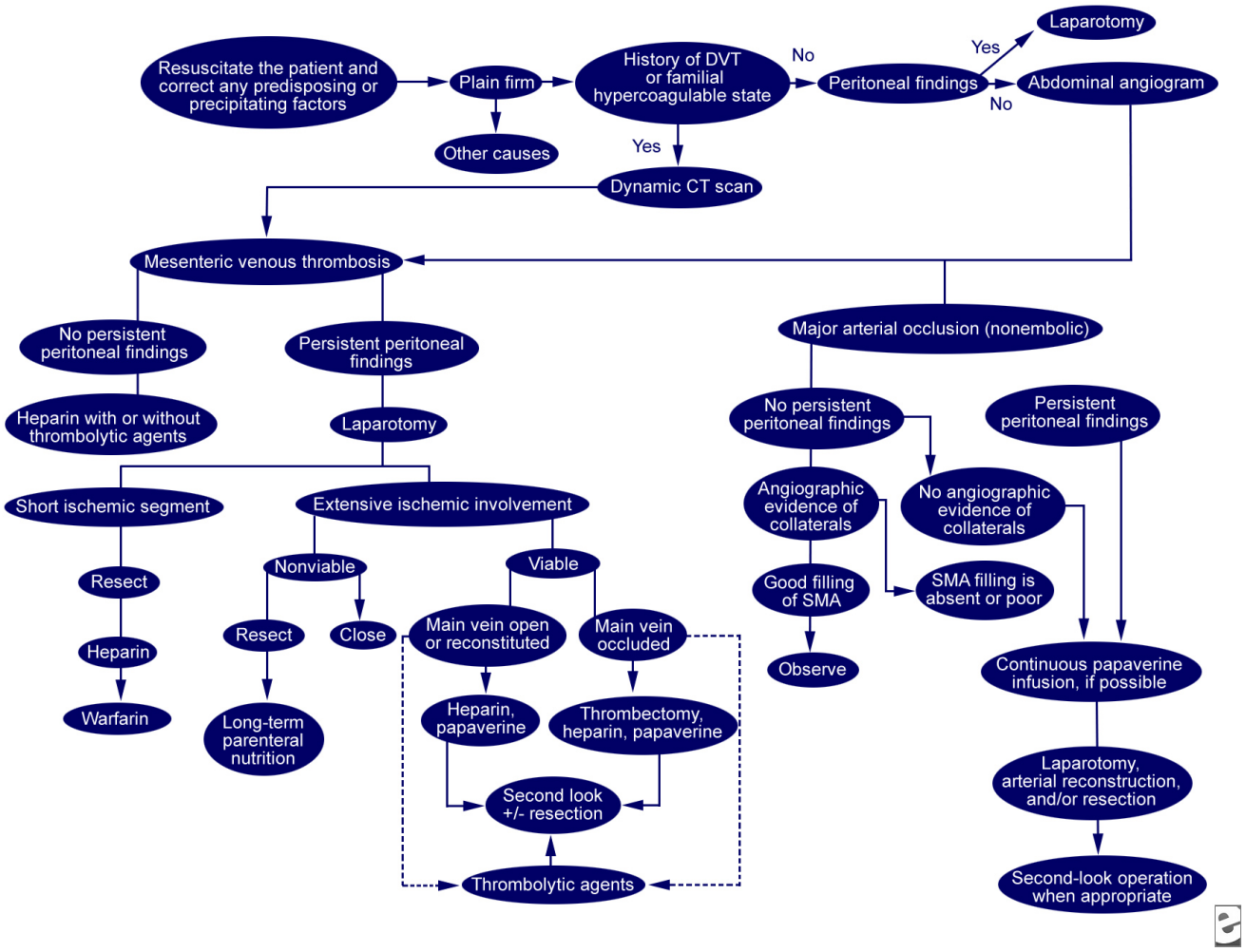
- Leukocytosis
- Elevated hematocrit (consistent with hemoconcentration)
- Metabolic acidosis
- D-Dimer (somewhat non specific-if it is negative, then that RULES OUT AMI, if positive, then that doesn’t necessarily confirm diagnosis)
- Elevated Amylase (seen in about 50% patients)
- Lactate level
- Abdominal XR-may see dilated loops of bowel, however, not fully diagnostic
- CT angio (without oral contrast)-gold standard

Treatment: The goal of treatment is to restore blood flow to the bowel as quickly as possible. Treating sepsis or shock and stabilization of the patient is also urgent. An exploratory laparotomy with embolectomy or, if needed, bypass. Vasodilator therapy is also important. Its recommend that preoperative intra-arterial papaverine (or vasodilator of choice) be started during angiography if possible, and continued for 12-24 h postoperatively if no second-look surgery is planned. This will keep the vessels dilated to aid in revascularization. Other things to remember include:

NPO

TPN/IV fluids/Nutrition

ICU!!


Resuscitate the patient and correct any predisposing or precipitating factors
Plain firm
Other causes
History of DVT or familial hypercoagulable state
No
Yes
Dynamic CT scan
Peritoneal findings
Yes
Laparotomy
No
Abdominal angiogram
Mesenteric venous thrombosis
No persistent peritoneal findings
Heparin with or without thrombolytic agents
Persistent peritoneal findings
Laparotomy
Short ischemic segment
Resect
Heparin
Warfarin
Extensive ischemic involvement
Nonviable
Resect
Long-term parenteral nutrition
Close
Viable
Main vein open or reconstituted
Heparin, papaverine
Main vein occluded
Thrombectomy, heparin, papaverine
Second look +/- resection
Thrombolytic agents
Major arterial occlusion (nonembolic)
No persistent peritoneal findings
Angiographic evidence of collaterals
Good filling of SMA
Observe
No angiographic evidence of collaterals
SMA filling is absent or poor
Persistent peritoneal findings
Continuous papaverine infusion, if possible
Laparotomy, arterial reconstruction, and/or resection
Second-look operation when appropriate

Chapter 5

MMC Surgical Critical Care for Advanced Practice Practitioners

Mission

The mission of the Munson Medical Surgical Critical Care training program is to provide APPs with education and a competency based training structure to become competent providers in academic surgical critical care and contribute to positive clinical and quality improvement outcomes.

Goals

Critical Care APPs will be an integral part of the SICU team and contribute in the following ways:

1. Provision of direct patient care
2. Provide consistency and continuity of care
3. Provide direct communication to the SICU intensivist, pulmonary intensivist, and/or admitting physician and consultants.
4. Improve compliance with guidelines, protocols, and safety practices by serving as content experts and educational resources for protocols/standards of procedure, and by direct involvement in development and implementation of quality and safety initiatives.

Surgical Critical Care Experience

APPs will help direct the management of a broad array of critically ill patients through weekly rotations in Surgical ICU. APPs are an integral part of multidisciplinary critical care teams in the unit with oversight by dedicated critical care boarded faculty. 24/7 Surgical Critical Care and Acute Care Surgery faculty and Surgical Critical Care APPs will provide continuous direction and oversight of all critically injured and ill surgical patients.

Orientation overview

Critical Care Orientation will occur during the last two months of the TACS orientation. The orientee with be in the ICU full time for the final 8 weeks of orientation. The orientee will be trained by an existing critical care APP preceptor. During orientation the employee will participate in didactic and clinical learning experiences to prepare them to function autonomously as a member of the critical care APP team. The orientee will have a designated primary preceptor but may orient with all members of the APP team based on staffing/scheduling.

Evaluations

Evaluation of the orientee is both formative and summative:

- *Formative Evaluation* – goal is to identify strengths/weakness, provide timely feedback, and focus on areas for improvement while in orientation phase.
    a. Weekly meeting with preceptor – review competency based checklist, discuss goals for upcoming week
    b. Mid Orientation Evaluation – around week 4. This is a formative evaluation during which the orientee, preceptor, collaborating physician will review orientation progress. Review competency based checklist to identify strengths/weakness, identify areas for improvement, and create additional support strategies as needed.

- *Summative Evaluation* –used to evaluate overall success in orientation and ability to progress out of orientation phase. 1. Final Orientation Evaluation is completed by the collective surgical critical care surgeons and primary preceptor.
- *Preceptor Evaluation* 1. To be completed by orientee at end of orientation
- *Program Evaluation* 2. To be completed by orientee at end of orientation

Competency Based Training

The APP will orient full time with an APP clinical preceptor. The I:\Surgical Critical Care\Munson Surgical Critical Care APP Competency Based Checklist.docx will be used to guide orientation experiences and progress. The orientee is responsible for filling out the self-assessment portion of the checklist and discussing with the APP preceptor. The checklist should be reviewed for completion weekly and during the mid and final orientation evaluations. Assessments of competency will be made through clinical experiences with preceptor observation, case-based discussion, and/or simulation.

Week-by-Week Orientation Guide:

Week 1: Non-Clinical - Obtain access to SCCM VCCR II Modules and ENLS modules Clinical - Day 1 shadow APP, day 2 manage/present 1-2 patients for AM rounds - Review critical care specific order sets and guidelines in PowerChart - Complete competency based orientation self-assessment and review with preceptor
Week 2: Non-Clinical - SCCM VCCR II Modules (recommend completing 2-3 modules/week) Clinical - By end of the week present/manage 2-3 patients for AM rounds. Assist with PM consults - Complete items in Orientation Checklist and review with preceptor
Week 3: Non-Clinical - SCCM VCCR II Modules - Request access to stroke pages and rapid AI phone application (AnnMarie will facilitate) - Complete NIH and Modified Rankin Score Training Clinical - Present/manage 3-4 patients for AM rounds. Assist with PM consults - Complete items in Orientation Checklist and review with preceptor
Week 4: Non-Clinical - SCCM VCCR II Modules - Review stroke protocol/acute stroke workflow and communication guide Clinical - Present/manage 4-5 patients for AM rounds. Assist with PM consults - Start responding to observe acute stroke calls - Complete items in Orientation Checklist and review with preceptor - Mid-Orientation Evaluation
Week 5 & 6: Non-Clinical - SCCM VCCR II Modules

Clinical - Present/manage 5-6 patients for AM rounds. Assist with PM consults - Respond to acute stroke calls with APP preceptor - Complete items in Orientation Checklist and review with preceptor
Week 7, 8: Non-Clinical - Complete SCCM VCCR II Modules Clinical - Present/manage 5-6 patients for AM rounds. Assist with PM consults - Respond to acute stroke calls with APP preceptor - Complete end-orientation, preceptor, and program evaluations

Education Methods

Self-Directed Education:
The orientee is expected to complete the following self-directed courses by the end of the orientation period. The courses will be reimbursed as part of the orientee's required education.

- The Society of Critical Care Medicine Virtual Critical Care Rounds (VCCR) II Adult. This is a series of 19 critical care specific learning modules designed for residents and fellows. Each module includes learning objectives, case studies, interactive questions, and additional learning resources.
    - Topics include: acid base disorders, AKI, arrhythmias, assessing fluid balance, basic mechanical ventilation, mechanical ventilation, cardiogenic shock, ethics in the ICU, hemorrhagic shock, ICU delirium, endocrine emergencies, infections and antimicrobial selection, management of bleeding related to anti-thrombotic therapy, neurologic emergencies, nutrition therapy and stress ulcer prophylaxis, pain/agitation/delirium, sepsis and septic shock, spinal cord emergencies, and VTE in the ICU.
    - Please document completion of the VCCR Modules and provide documentation to SCC APP clinical lead.
    - Link to SCCM VCCR II Modules

- The orientee will complete the Emergency Neurologic Life Support Course produced by the Neurocritical Care Society
    - Link to ENLS Modules

- The orientee will attend the SCCM Fundamentals of Critical Care Course either online or in person within 1 year of hire.
    - Link to FCCS Course Information

Unit Based Education

- Educational lectures by content experts in common critical care topics. Education will be scheduled bi-monthly and will include the following topics:

    - Respiratory Care (Blood Gas interpretation, respiratory mechanics, noninvasive ventilation, Mechanical ventilation, extubation, cxrs)
    - HD Monitoring/ Shock
    - Cardiovascular, Pressors
    - Renal/ Electrolytes/ Acid Base
    - Neuro/ Sedation/ Delirium
    - Infections/ DVT prophylaxis / Nutrition/ Glucose management
    - FAST, Lung exam, Abdominal, Cardiac, Vascular- DVT, Line Access

(Lecture based education topics and schedule may be variable based on need and presenter availability.)

- Education regarding ICU order sets, guidelines, and protocols to be provided by critical care APP preceptor and surgical intensivist during orientation time
    - Critical Care Admission Orders
    - Transfer Orders
    - End of life order set
    - PCA order set
    - Alcohol Withdrawal

Procedure Training

- Critical Care Procedures: APPs will gain the skills and judgment to perform invasive procedures according to institutional and service specific performance standards and guidelines. These procedures include the following but are not limited to:
    - Central lines, arterial lines
    - Assist with percutaneous tracheostomies
    - Chest tube placement
    - Assist with bedside PEG tube placement
    - Use of US in the ICU

The orientee should continue the procedure training initiated during the earlier months of TACS orientation. Document procedures in the TACS orientation checklist. The orientee may participate also participate in a skills lab as available/appropriate.

Additional Resources (optional)

- The MMC Quick Guide to ICU handbook (provided in orientation packet)
- The Pocket Guide to Neurocritical Care – Marin Darise, Asma Moheet
- Pocket Medicine, 5th edition, Mark Sabatine
- *The ICU Book, 3rd Edition*-Paul L. Marino, Kenneth M. Sutin
- *Critical Care, 3rd Edition*-Joseph M Civetta, Robert W. Taylor, Robert R. Kirby
- *Surgical Critical Care*- Joseph A. Moylan
- *Pulmonary Physiology and Pathophysiology: An Integrated, Case-Based Approach*-John West

Stroke Resources:

- The SCC APP will participate in acute stroke response. They will work with the multidisciplinary stroke team to assess the patient for candidacy for endovascular intervention and communicate with the endovascular neurosurgeon. Please see *workflow* for specific SCC APP stroke responsibilities.
- The surgical critical care folder on the TACS drive includes stroke resources such as national guidelines, evidence based workflows, MMC specific resources, and education supplements.
- Stroke Competency will be assessed via the SCC Competency Based Checklist. In addition the following items are required to review/complete to prepare for acute stroke response:

Neurocritical Care Education Checklist/References

Education Item	Method
Emergency Neurologic Life Support Certification	- Online course through the Neurocritical Care Society - (link to ENLS) - Optional Education
NIH Stroke Scale	- HealthStream Certification
Modified Rankin Score	- Modified Rankin Score Training Video - Joint Commission Quality Measures - Modified Rankin Score
Glascow Coma Scale	- Completed during TACS orientation
CT Perfusion/Rapid Software Education	- CT Perfusion Basics PowerPoint - AHA - Review of Perfusion Imaging in Acute Ischemic Stroke - Introduction to CT perfusion You Tube Video - CT Perfusion Differential Diagnosis
Introduction to AIS/Thrombectomy	- Rep Led Education to be scheduled by SCC Lead APP

Workflows

The SCC APP is expected to be present on the unit at least multiple times/day. SICU patient conditions change, and it will be imperative for you to be around to see these changes and to communicate with the SICU RN. Being available will also aid in communication with consultants.

Typical Daily ICU Workflow:

6:45-8:30: Participate in TACS team sign out. Discuss daily patient assignment with SCC physician. Review acute events overnight, vitals, labs, imaging for each patient. Perform physical assessments as indicated. Talk with the SICU RNs about pressing concerns. Prepare for rounds.

8:30-10: Formal rounds with the SICU multidisciplinary team. The APP is responsible for the system based presentation and review of relevant imaging/diagnostics. All members of the multidisciplinary team will contribute to the daily plan. Medication orders should be entered in real time (by ICU pharmacist). Remaining orders can be entered during rounds if applicable or completed immediately following rounds. Please see the Multidisciplinary Rounding Guide (in SCC drive) for guidance on patient presentations. If time allows, discussion of relevant educational topics will be discussed.

Complete orders from AM rounds. Complete physical assessments. Review vitals, new labs, and imaging, test and consultant recs.

Perform procedures, see new patients, and listen to attending lectures. Afternoon SCC consultations as appropriate.

Re- round with SCC physician. This is a brief rounding to follow up on plans made in AM rounds and identify and formulate the plan for the rest of the day/night. Identify the top concerns for each patient for overnight and discuss with ICU RN.

Follow up on orders from earlier in the day. Complete assessments and change management plans as appropriate. In addition, after 3PM the SCC APP becomes the primary responder for acute stroke calls in the ED and stroke MRT. If the SCC APP is in an emergency or procedure and cannot attend the acute stroke call they are responsible for communicating directly with the endovascular neurosurgeon. Please see Stroke folder in SCC shared folder for *Acute Stroke Workflow and Communication Guide* (below).

Stroke Workflow:

~~*Acute Stroke Workflow and Communication Guide*~~

1. Rapid assessment of ABCs
2. Establish last known well
3. Brief Medical History – specifically previous strokes, afib, smoking status, HTN, DM, hyper-coaguloable states. Assess for anticoagulant medications
4. Complete NIH stroke scale and baseline MRS → **communicate with GR if NIH >6 , clarify if there is a delta**
5. Imaging
    a. Non-contrast head CT – looking for hemorrhage.
    b. CTA – perform initial review of CTA, looking for large vessel occlusion or other pathology (ie aneurysm)
    c. CTP – looking for ischemic core relative to penumbra
6. Based on exam and imaging – establish candidacy for mechanical thrombectomy → **communicate with GR and managing team**
    a. ED/Hospitalist/Neurohospitalist to determine candidacy for tPA and administer if appropriate. This will happen concurrently with our exam assessing for intervention.
7. If there is a LVO and patient is candidate for mechanical thrombectomy:
    a. Activate neurointerventional team.
        i. Call Operator to activate *Interventional Stroke Page*
            1. Patient Name
            2. MRN
            3. Location
            4. NIH score
            5. TPA yes/no
            6. IR sedation or Anesthesia
    b. Obtain consent from family and place in paper chart
    c. Provide mechanical thrombectomy education pamphlet
    d. Assist moving patient to IR suite if necessary
8. Document using acute ischemic stroke dot phrase .aisthrombectomy (copy and paste below into your own dot phrase)

    Endovascular Neurosurgery Brief Note:

    Brief HPI: _
    Prior to admission Anticoagulants: _
    Last Known Well: _

NIH:_
baseline MRS:_
tPA administered:_
Imaging reviewed with Dr. Rajah and radiologist report reviewed: _

Plan:
- Plan for _
- interventional stroke page activated _
- medications administered in ED: _
- consent obtained _
- pre-procedure orders placed
- Acute Ischemic Stroke thrombectomy education material provided to patient and family _

Patient examined at bedside and d/w Dr. Rajah and _.

Documentation

- Daily Progress Note: SCC will document daily progress note for all patients already admitted to the SICU that have a documented SCC consult note or SCC admission note.
- SCC admission note: A SCC brief note will be completed for each patient admitted to the ICU from the TACS service. The SCC should document a brief HPI, assessment, and document any changes to the SCC plan based on the patient's status on arrival to the unit.
- SCC Consult: The SCC APP should document a consult note (and dictate it) for any SCC consultation from a primary service that is not the TACS service.
- Procedure Note: Please follow template from other TACS procedures

Please see SCC dot phrase templates in the SCC folder on the TACS drive for specific note templates

Metrics

- Metrics for the surgical critical care program are tracked via an electronic dashboard. Outcomes will be reported quarterly.

Meetings

- *SCC Team Meeting*
- *SCC M and M, Grand Rounds, etc*

Surgical Critical Care APP Competencies and Professional Behaviors

Upon completion of the Surgical Critical Care training, every APP will be able to:

Medical Knowledge

- Demonstrate advanced decision-making skill and sound medical judgment
- Demonstrate skill in performing critical care procedures
- Gather primary information through clinical exams and medical records, and to form an appropriate differential diagnosis and plan
- Safely admit and discharge patients to and from the SICU
- Resuscitate critically ill patients, using evidence-based guidelines and appropriate technology
- Manage and wean patients from mechanical ventilation utilizing various techniques and ventilator modes in collaboration with the pulmonary critical care team.
- Apply Advanced Cardiac Life Support (ACLS) protocols
- Treat all forms of shock utilizing conventional and current techniques
- Identify, treat and prevent multiple organ system failure
- Identify, treat and prevent all life-threatening electrolyte acid-base disturbances
- Identify, treat and prevent malnutrition, utilizing advanced nutritional supplement methodologies
- Perform the theory and techniques for appropriate pain management and advanced sedation strategies
- Manage pain, anxiety, delirium and agitation using a current, evidence-based approach
- Titrate inotropic and vasopressor drips based on hemodynamic monitoring
- Utilize medications safely
- Prevent and manage acute and chronic renal failure
- Manage coagulation disorders (acquired and congenital)
- Manage acute and chronic neurologic disease and injury
- Manage GI disturbances, such as GI hemorrhage, pancreatitis, diverticulitis and cholecystitis
- Recognize, treat and monitor hypertension
- Prevent and manage endocrine dysfunction related to DM, DI, adrenal and thyroid dysfunction
- Manage infectious disease, especially core ICU conditions, such as bloodstream infection and pneumonia
- Recognize, treat and monitor abdominal compartment syndrome
- Manage traumatic brain injury, including interpretation of data from invasive monitors and laboratory tests
- Manage complex surgical patients with multiple drains, monitors, and other devices

Interpersonal and Communication Skills

APPs are required to consistently communicate with patients, families and other health care professionals. The quality, quantity and attitude of communication are all important, both verbal and written. Upon completion of the Surgical Critical Care every APP will have demonstrated:

- Competence in written and verbal communication
- Fluency in appropriate medical software and communication tools

- Ability to educate the health professional team, as well as patients and patient families, regarding critical care ethical issues
- The ability to disseminate the appropriate information to patients and to their families
- Educate the health professional team, as well as patients and patient families, regarding critical care ethical issues

Professionalism

APPs must maintain the highest standards of ethical behavior, with a commitment to continuous, high-quality patient care. The professional behavior extends to all patient care interactions as well as all interactions with other health care personnel. The fellows must demonstrate sensitivity to the diversity of ages, genders, cultures and relationships.
Upon completion of the Surgical Critical Care every APP will demonstrate:

- Effective and timely contribution to the medical record
- Ability to educate patients and their families all treatment options, outcomes and patient prognosis
- Appropriate dress, grooming and behavior
- An understanding of, and commitment to, patient privacy

System-based practice

APPs must access the health system resources necessary to practice high-quality, cost-effective patient care. This includes understanding the roles of various specialists and other health care professionals in the care of their patients. APPs must fulfill their important role in the care of patients on other services that are evaluated and followed as consult patients. They should understand the ways that the timing of their care and documentation affects the function of the medical center. Upon completion of the Surgical Critical Care, the APP will:

- Demonstrate understanding of how critical care outcomes are related to a multidisciplinary system of care
- Initiate appropriate consultations with other specialists, and construct a clinical plan for complex critical care problems
- Demonstrate understanding of protocols and how they impact quality and safety
- Lead multidisciplinary rounds
- Demonstrate an ability to prioritize the recommendations of different specialties to optimize overall patient outcomes
- Have the ability to analyze, evaluate and perform critical care research
- Have the skill necessary to manage ethical and psychosocial challenges of critical care
- Initiate appropriate consultations with other specialists, and construct a clinical plan for complex critical care problems
- Utilize medications safely, and determine cost effectiveness of various therapeutic interventions
- Triage critically ill patients appropriately, understanding the needs of patients, units and the institution
- Participate in quality assurance processes, such as Mortality and Morbidity conference, performance improvement conference