General Info/Logistics for Trauma

- **Trauma Bay**
  - Consider all trauma patients as a COVID rule out
  - Document your presence
    - Scan badge outside trauma bay OR
    - Document date/time in note
  - **Leveling criteria**/Attending response times
    - Level 1 – 15min
    - Level 2 – 12hrs
    - Level 2 requiring ICU admit – 4hrs
    - Trauma Evaluation (Consult) – paged to residents only
    - **Anyone** can upgrade
  - **Level 1 specific** (criteria on signs in bay)
    - Responders in addition to ER/Trauma: Respiratory Therapy, CT tech, Anesthesia, Neurosurgery, Ortho, OR Nursing, Social Work, Pharmacy
    - Consider crowd control; keep most outside of bays to preserve PPE
    - Trauma time out before pt arrival
    - Belmont should be primed by RN
  - **Patient Arrival**
    - If pt able to say name = no ABC deficit
    - If pt able to say name = no ABC deficit
    - If pt able to say name = no ABC deficit
    - If no ABC deficit, move immediately to gurney
    - If pt able to say name = no ABC deficit
    - 2 PIV before imaging if stable
  - **OR 21** is the usual trauma room
    - Patient goes directly from ER → OR
    - If needs intubation, stop in PACU 2
      - (designated intubation room for COVID rule out patients)
  - **Determining Admission** Team
    - ≥2 system injuries → Trauma
    - Isolated injury → admit to service of system affected (often ortho/NSG)
    - >65yo +/- medically complex → trauma if injury is primary issue otherwise medicine w/subspecialty+/−trauma consult
    - No injury & requires admission (e.g., failure to thrive, syncope w/u) → Medicine or TLC

General Info/Logistics (cont.)

- All admitted patients → tertiary exam & note the next day
- No injuries/intoxicated only → consider CDU
- If a pt has any injury (anything bent, broken, bleeding), they cannot be admitted to Meriter only University Hospital
- **Initial Trauma Assessment**
  - **Primary & Secondary Survey**
    - Trauma Jr performs exam “neck down,” calls out findings as EM res performs HEENT
    - **Airway**
      - Non-definitive airways from scene: King, LMA, Combitube → convert to definitive airway (ETT, cric, trach)
      - Intubate for GCS ≤8, airway protection, need to complete evaluation, etc.
      - Intubation by anesthesia/EM (Trauma MD directs who does what look/if cric needed)
      - Intubation should be in negative pressure rooms (ER 5, 6, 7, 23) WITH DOOR CLOSED
      - If going to OR, intubate in PACU 2
    - **Breathing**
      - Trauma team places chest tube
      - Decreased breath sounds, flail chest, tension ptx, non-occult ptx, and/or hemothorax (equipment in box)
      - Can bronch in ED (follow COVID guidelines)
      - Any chest tube/bronch should be in neg pressure room (5,6,7) WITH DOOR CLOSED
    - **Circulation**
      - 2 large-bore IV; may need introducer (all line equipment in a box in trauma bay)
      - 1L crystalloid ONLY, then blood
      - **TXA**
        - Indications: penetrating torso trauma, MTP activation, ≥1u pRBC, pressors, SBP <90/HR >110, +FAST,
  - **Disability**
    - New neuro deficit or GCS <9 due to trauma = Level 1
    - C-collar all patients
    - Spine exam – log roll
    - Rectal exam if neuro deficit
  - **Environment/Exposure**
    - Fully expose patient
    - Prevent/manage hypothermia → warmed room, blankets, & fluids
    - <30°C = aggressive rewarming
  - **Secondary Survey**
    - Lacerations
  - **Initial Trauma Assessment (cont.)**
    - hemotherax, expanding hematoma, bleeding AND <3h since injury
    - 1g IV/10min bolus, followed by 1g IV over 8hr
    - If TXA gtt started pre-hospital, continue
    - Emergency release blood & FFP in ER fridge, give 1:1
    - O- for kids & women childbearing age (pink tag)
    - O+ for men & women>childbearing age (blue tag)
    - A plasma for adults; AB for kids
    - **Massive transfusion**
      - Indications: life-threatening trauma, unexpected surgical emergency, >10u transfusion requirement in 24h
      - Activate via EPIC or anyone can call blood bank w/ verbal order
      - Coolers deploy product in 1:1:1 ratios
      - Plt & cryo don’t come w/ each cooler by design; plt in every other (1 pooled plt = 6-10 units)
      - 1st + 2nd coolers issued automatically; add’tl on request
      - Unused blood from coolers in ER goes to blood bank not OR
    - **Urgent adult ECMO – pgr 1964; Thoracic staff/ECMO coordinator**
    - New neuro deficit or GCS <9 due to trauma = Level 1
    - C-collar all patients
    - Spine exam – log roll
    - Rectal exam if neuro deficit
    - Fully expose patient
    - Prevent/manage hypothermia → warmed room, blankets, & fluids
    - <30°C = aggressive rewarming
  - **Secondary Survey**
    - Lacerations

Trauma/Burn for the Non-trauma/burn Surgeon

This document is not intended to be inclusive but to provide tips/tricks/insights into the usual care of these patients. Protocol/additional information on UConnect. Go to UConnect/search trauma>adult trauma manual will come up. If you have any questions or concerns, please contact Division of Regional and Acute Care General Surgery Incident Command Officer listed in Amion. (Updated 4/3/20)
Initial Trauma Assessment (cont.)

- Fractures (open need abx w/in 1hr)
  - Orders/labs
    - Default: T/S, CBC, BMP, INR, PTT, VBG, lactate, EtOH, UA, CXR, PXR, fentanyl/zofran PRN, telemetry
    - For chest trauma
      - ABG – ≥3 rib fx, age >65, pulm contusion, pulsox ≤92% on RA, Incentive Spirometer <750mL
      - Sternal fx – EKG, trop, TTE on floor
    - Consider ABG, CK, urine tox, TEG, EKG, troponin
  - Outside hospital scans
    - Find by going into PACS not EPIC; search by patient name/DOB not MRN
    - If not read by UW Radiology (i.e., report in PACS), get overreads
    - No over-reads for: Central Wisconsin Center, Fort HC, Group HC, Madison Surgery Center, Meriter, Mile Bluff (Mauston; MBMC), Richland MC/Richland Hosp, University HS
    - No over-reads for any: fluoro, US, IR, or GI studies
    - If had CT pelvis, no need for Xray at UW
    - If had negative CXR w/o chest trauma, no need for CXR at UW
  - Adjuncts/Common Imaging for Adults
    - All blunt trauma → CXR, pelvis Xray
    - FAST while Xrays happening (only if pt is hypotensive during the COVID crisis to minimize exposure; in non-COVID crisis, FAST all for educational purposes)
    - Ground level fall on blood thinners → CT head & c-spine (usually)
    - "Pan-scan" = CT head, C spine, T/L spine, Chest, Abdomen/Pelvis w/ IV contrast
    - Dangerous mechanism = MVC >40mph, unrestrained MVC, ipsilateral compartment damage ≥1ft, >20ft fall

Initial Trauma Assessment (cont.)

- Torso imaging
  - Not indicated: isolated extremity injury, some penetrating trauma, hanging w/o other trauma
  - Indications: transient hypotension, intubated, unreliable exam (altered mental status, intoxication, distracting injury, neurological deficit)
  - CT Chest specific indications: >65 yo (not ground level fall), chest tenderness
  - CTA if concern for aortic injury (dangerous mechanism or CXR findings: wide mediastinum, lost aortic knob, 1st-3rd rib fx, clavicle/scapula fx)
  - CT Abdomen/pelvis specific indications: anticoagulated, positive physical exam (pain, bruising), gross/micro-hematuria suggestive of intra-abdominal injury
  - Spine imaging
    - CT C-spine – based on mechanism, symptoms, exam (NO lateral C-spine Xray)
    - CT T/L spine – intubated, unreliable exam, tender, >65 yo, dangerous mechanism, neuro deficit
    - L spine can be reconstructed off of abdomen & pelvis CT (T spines can't)
    - If one spine fx → complete all spines
    - Neuro deficit w/ negative CT → consider MRI
  - Adjuncts/Common Imaging for Adults (cont.)
    - Consider these images prn
      - CT maxi-face for facial trauma
      - CTA head/neck
        - R/o blunt cerebrovascular injury
        - Indications: focal neuro deficit, HEENT arterial hemorrhage, cervical bruirt <50yo, expanding neck hematoma, neuro exam inconsistent w/ head CT, new CVA on f/u head CT, hyperextension injury

Initial Trauma Assessment (cont.)

- Denver criteria: Lefort II/III; C spine fx + subluxation; C-spine VB/TP fx through foramen; ligamentous injury; basilar skull fx + carotid canal involvement; diffuse axonal injury + GCS <6; near-hanging w/ anoxic brain injury; "clothesline" injury/seatbelt sign w/ swelling, pain, or altered mental status
  - CTA lower extremity
  - CT cystogram per gross hematuriap protocol
  - Indications: gross hematuria w/ pelvis fx, some microscopic hematuria
  - Requires Foley - do NOT place Foley if concern for urethral injury
  - Plain films – painful extremities, foreign body evaluation

TBIp/Head injury

- GCS: >13 – mild; 9-12 – mod; 3-8 – severe
  - Monitoring
    - Neuro exam frequency determined by NSG → level of care (q1hr = ICU, q2hr = IMC)
  - Treatment
    - Reverse anti-coagulation if possible (PCC and vit K for Coumadin)
    - Intracranial Pressure Mgmt – per NSG
Spine/Spinal Cord Trauma (cont.)
- T/L-spine\(^P\) clearance & management
  - If non-tender & no imaging indicated (see “Initial assessment” above) → clear clinically
  - If imaging obtained, clear if no injuries on CT/MRI read [final (if admitting) or prelim (if d/c)]
- Lower thoracic & lumbar transverse process fx do not require spine cx
- Depending on injury, may need bracing by orthotics
  - Some braces need fitting prior to being custom made
  - Upright x-rays in brace & reviewed by spine team before pt can be off precautions & mobilized
- If T/L spine fx present (if not dislocated), ok for HOB to be 30\(^\circ\) even w/o brace
- Spinal Cord Injury Protocol & Management
  - Spine team may request higher MAP than 65 (often MAP ≥85 x 5d)
  - Usually achieved w/ phenyl, may need additional fluids or midodrine
- Spinal Cord Injury Protocol (cont.)
  - Respiratory management (for cord injury ≥T10)
    - Assess vital capacity, negative inspiratory force, cough, secretions
  - May need BiPAP, metaneb, bronchodilators, intubation
  - Bladder management – keep Foley if high UOP then straight cath w/ frequency based on volumes
  - Bowel management – scheduled bowel regimen, daily digital stimulation
  - Order set in HL for both bladder/bowel protocols

Blunt Chest Trauma
- Pneumo/hemothorax
  - Subcutaneous emphysema = ptx decompressed into chest
    - Treatment → place chest tube
  - Occult ptx = only seen on CT chest not CXR
    - Treatment → repeat CXR in AM (sooner if symptomatic) → if no change & asymptomatic → chest tube not needed, even if intubated
  - Chest tube size
    - Consider smaller tube (pigtail up to 24Fr) for isolated PTX
    - Up to 32Fr for hemo
- Chest tube management
  - ≥1500mL initially or >200mL/hr for 4hr → to OR
  - Initially place on -20 suction
  - Waterseal when ptx resolved & no air leak
  - Keep on waterseal 24hr
  - If no ptx, air leak, & output <150mL/24hr → remove
  - Do not push in chest tube if dislodged
  - Assess CXR daily to ensure sentinel eye is inside chest
  - If need to replace chest tube, use new incision

- Rib Fracture Management Protocol\(^P\)
  - Admission Level of Care
    - General Care: normal PaO\(_2\), normal PaCO\(_2\), no underlying lung disease
    - IMC: PaO\(_2\)/FiO\(_2\) <150, home CPAP, underlying lung disease, age >65, mild hypercarbia, poor pain control
    - ICU: contraindications to CPAP/BiPAP, card/pulm arrest, GCS <8 or AMS, aspiration, increased work of breathing, severe hypercarbia (pH <7.3, pCO\(_2\) >50)
  - Management
    - Pain Control: Tylenol QID, gabapentin 300mg TID (100mg TID if age >65 or
Blunt Chest Trauma (cont.)

- altered mental status, lidocaine patches, PCA or oral oxycodone, APS Consult for epidural/nerve catheters/ketamine, OT kinesiology taping
- Respiratory: IS, PEP, RN & RT protocols based severity (phases 1-4)
- Indications for CPAP/HFNC/BIPAP: PaO2/FiO2 <150, hypercarbia w/academia, puls ox <92%, RR >25, altered mental status
- Contraindications to CPAP/HFNC/BIPAP: CPR, some face/skull base fx’s, untreated ptx (occult ptx ok → follow CXR), upper airway obstruction, cannot protect airway/cooperate, hemodynamically unstable, upper GI bleed
- CXRs for pts w/ rib fx’s
- Repeat CXR next AM at minimum – follow occult ptx & development/size of effusion, ptx, or hemothorax
- Daily CXR if CT in place
- Retained hemothorax = consider VATS decort
- All pts = 2view CXR prior to DC
- Follow up w/ trauma APP clinic w/ repeat CXR

Blunt Liver Injury P – Normal (cont.)

- If ongoing bile drainage → ERCP/spincterotomy +/- stent
- If + for blush or pseudoaneurysm → IR

Blunt Spleenic Injury P – Normal

Hemodynamics

- Imaging in the trauma bay:
  - Rads gets delayed images – look for blush
  - If + for blush or pseudoaneurysm → IR
  - If IR planning proximal embolization → consider splenectomy
- Post-trauma bay care:
  - No splenectomy performed:
    - Trend Hbg q6hr x 24hr minimum
    - Grade 3 or greater injury → repeat CT in 3 days (or day of discharge)
    - If + for blush or pseudoaneurysm → IR
  - Splenectomy performed:
    - Do not routinely leave drain
    - Post-splenectomy vaccines prior to discharge & boosters in 8wks

Pearls of operative trauma

- Prep from neck to knees
- Keep the room hot
- Take down the falcis to pack the liver
- Pack all 4 quadrants, wait, & let anesthesia catch up

Penetrating Trauma

- Start with ABCDEs
- # holes + # bullets = even number
- Don’t forget tetanus
- Don’t chase removing bullets
- Imaging in the trauma bay:
  - Thoracic trauma: If spine injury unlikely based on GSW trajectory/mechanism (stabbing) → upright CXR
  - If CXR negative, hemodynamically normal, & injury to the “box” → consider CT chest
  - If + for abscess or biloma → IR

Miscellaneous Topics

- Note templates and .dot phrases
- Identify XXCountry patients by putting in “Unidentified Patient Name Change” order in EPIC,
  - This can only be done by attending. If not done it delays d/c.
  - Do NOT identify patients if they still need to go to the OR or if they are actively getting blood,
- Floor care
  - Round after 9:30am care team meeting
  - Most admitted patients see PT and OT, discharge plans revolve around their recs
**Miscellaneous Topics (cont.)**

- **If + LOC, speech consult**

  - **Trauma DVT prophylaxis**
    - **SCDs**
    - **Lovenox 30mg BID (adjust for obesity)**
    - **Heparin (5000u subq q8hr) if pt has:**
      - Renal failure
      - Traumatic brain injury
      - Epidural catheter in place

  - **Ortho trauma**
    - **Not all fx require ortho cx** → see guidance in trauma manual [here](#)
    - **If pulse/doppler signal not restored after splinting extremity fx** → vascular cx
    - **Open fx**
      - Washout ASAP
      - Abx (ancef if uncomplicated) w/in 1hr & continue until washout
    - **Pelvic binder across greater trochanter if hypotensive**
    - **If displaced pelvic fx, consider vaginal & procto exam**

- **Resuscitative Thoracotomy**
  - **Indications:**
    - **CPR in progress due to (1) blunt trauma w/ witnessed loss of pulse or (2) penetrating trauma to chest/abdomen w/ CPR <15mins**
    - **Consider in patients with profound refractory shock (SBP <60mmHg)**
    - **Technique:** incision across sternum to bed, place retractor w/ base toward bed, open pericardium fully, cross clamp aorta

- **Mangled Extremity**
  - **Trauma, Ortho, Vascular, Plastics all consulted**
    - “Life over limb”
    - Salvage attempt requires agreement by all
  - **Assessment**
    - **Primary survey** → control active hemorrhage (pressure, tourniquet) → if unable to, proceed to OR
Trauma/Burn for the Non-trauma/burn Surgeon

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**Burn Basics**

- **Burn degrees**
  - 1<sup>st</sup> – epidermis → redness, swelling (sunburn)
  - 2<sup>nd</sup> – partial dermis → blisters, swelling
  - 3<sup>rd</sup> – full dermis → white, leathery, no pain
  - 4<sup>th</sup> – underlying structures → no pain
- **Rule of 9’s** – palm ~ 1% body surface area

- **Common dressings:**
  - Bacitracin/Neosporin/polysporin → cuticerin → cotton gauze
  - Mepilex Ag (kept on til clinic)
  - Apply after blisters/hanging skin trimmed away & washed w/ soap & water

- **General care notes**
  - RN/resident uploads pictures to EPIC in ER if being discharged & daily if admitted
  - Dressings applied by burn RN
  - Ensure tetanus is up to date

- **Appropriate for discharge from ED**
  - Adequate pain control w/ PO pain meds ONLY (no IV)
  - Has reliable wound care at home
  - Schedule next available clinic appt before d/c

- **Admitted burn patients**
  - Due to extent of burn/need for IV pain meds
  - Order sets (small v. large; ped v. adult)

- **Admitted burn patients (cont.)**
  - **Wound care information:**
    - Premedicate w/ PO meds (oxy, Tylenol) 1hr before initial cares
    - Adults: washed daily; dressed BID
    - Peds: washed & dressed daily (face/ears BID) – unless Mepilex Ag (q5-7d)
  - If concern for compartment syndrome due to 2<sup>nd</sup>/3<sup>rd</sup> degree → escharotomy<sup>P</sup> at bedside with bovie
  - > 20% TBSA only → IV resuscitation<sup>P</sup>
    - Calculate 24 hr need
      - Adult: 2 mL/kg x %TBSA (Ringers)
      - Child <20kg: 3 mL/kg x %TBSA LR + “4/2/1 rule” MIVF D5½NS
      - Infant <10kg: 3ml/kg x %TBSA D5LR + 4/2/1 MIVF D5½NS
    - Calculate hourly starting rate by taking ½ of 24hr need divided by 8 then titrate fluid rates for UOP – change up or down in 10% increments
      - Adult (>60 kg): ½ mL/kg/hr
      - Children (1yr – 60 kg): 1mL/kg/hr
      - Infants (<1yr): 2mL/kg/hr
    - If hourly IVF reach 2X initial calculated rate – add 25% albumin gtt at 10m/hr
  - **Closed space fire** → consider inhalation injury<sup>P</sup>
    - Look at oral mucosa → if dry, red, or blistered, may need intubation for upper airway protection
    - Upper airway injury peaks within 1<sup>st</sup> few hours – early intubation to avoid airway emergency
    - Draw CO level & place on 100% O₂ ASAP
    - If CO >10%, closed space fire, & carbonaceous sputum → high likelihood of needing intubation
    - Lower airway injury peaks at 5d post injury

- **Inhalation injury**<sup>P</sup> (cont.)
  - Often have higher than expected resuscitation needs
  - Supportive care only/aggressive pulmonary toilet = no steroids or prophylactic abx. Do better extubated when able.

- **Nutrition**<sup>P</sup>
  - High protein/High calorie diet + Supplements + Protein supplements
  - >20% TBSA → PPI or H₂ blocker prophylaxis (convert from IV to PO when able)
  - >20% TBSA → DHT (gastric feeds ok until DHT team can advance postpyloric). Start tube feeds immediately.
  - Adult caloric need: 25 Kcal/kg + (40 Kcal x %TBSA)
  - Peds caloric need: 40 Kcal/kg + (40 Kcal x %TBSA)
  - Advance isocaloric tube feed toward anticipated goal as soon as able. Nutrition recommends rates, concentrations, & formulas.
  - For infants, do not advance beyond ¾ strength & 60 mL/hr until nutritionist eval

- **Electrical Burns**<sup>P</sup>
  - **Amount of potential energy delivered**
    - 110-220V (low voltage) – typical domestic wiring operates on an AC current at 120V
    - >1000V (high voltage) – typically found in industrial settings
  - **Evaluation includes EKG**
  - **Management**
    - +LOC, EKG abnormal, arrhythmia or CPR in the field → 24hr monitoring
    - Neurology & ophtho (cataract risk) consults for hi-voltage injury prior to discharge
    - Low voltage, EKG normal → discharge if wounds can be cared for
Electrical Burns

- High voltage
  - Consider deep tissue damage
  - Check myoglobinuria; if + → UOP ≥100mL/hr w/ isotonic fluids (not albumin)
  - Persistent acidosis/myoglobinuria (>8hr) → operative debridement
  - Fasciotomy if compartment syndrome develops (highest risk during 1st 48hrs)

Additional information related to Burn/Wounds
- Surgical preparation & treatment
- Frostbite injury
- Chronic wound treatments