Delivery Room and Neonatal Emergencies

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Disclosures

• I have nothing to disclose
Delivery room preparation and resuscitation

- Equipment, appropriate sizes for term and premature infants.
  - Oxygen source and blender
  - Resuscitation bag or T-piece, small masks
  - Radiant warmer
  - Suction (oral, ETT)
  - Monitoring: EKG, pulse oximetry

- If equipment used infrequently, e.g., ED, needs to be checked regularly
Maternal/obstetrical history

- Past pregnancies
- Complications of pregnancy
- Medications
- Maternal medical/surgical problems
- Gestational age
- Maternal labs
- Antepartum course: fever, meconium, bleeding
Fetal history

• Estimated fetal weight and gestational age
• Fetal anomalies (ultrasound, echocardiogram, MRI)
• Baby/fetal outcomes of previous pregnancies
Case 1

• Mother presents in advanced labor to the ED
• Reports she is 9 days past her due date
• Exam: full dilated and effaced, pushing, thick green meconium stained fluid, fetal HR decreases to 60/minute with contractions
• No time to transfer to L&D
Preparations for delivery in an ED

• Mother
  – Delivery set up
  – Team to manage the mother

• Newborn
  – Warmer
  – Resuscitation equipment for neonate
  – Separate staff to manage the baby

• L&D service in the hospital: ob and NICU staff
Case 1 continued

- Baby is born apneic, not moving, HR 60
- Positive pressure ventilation given
- Meconium clearance of airway?
Case 1 continued

- Baby resuscitated successfully, but has respiratory distress with grunting, flaring and retractions. NCPAP 5 cm started. FIO2 0.5
- IV D10 started at 80 mL/kg/day
- Blood culture drawn and ampicillin and gentamicin started
- ABG: pH 7.10, pCO2 70 pO2 40
- Pre-ductal SPO2 93, post-ductal SPO2 75
Neonatal Pulmonary Hypertension

• Pre-disposing factors:
  – Placental insufficiency and fetal hypoxemia
  – Post-dates
  – Fetal pulmonary smooth muscle hyperplasia
  – Postnatal hypoxemia, hypercarbia, acidosis

• Diseases associated with pulmonary hypertension
  – Meconium aspiration syndrome
  – Sepsis/pneumonia (group B Strep)
  – Lung hypoplasia (congenital diaphragmatic hernia)
Treatment of Pulmonary Hypertension

• Correct acidosis, hypercarbia, hypoxemia
• Maintain a normal blood pressure
• Intubate, ventilate
• Inhaled nitric oxide
• High frequency ventilation
Pulmonary hypertension with severe hypoxemia

• Timely stabilization and transfer to appropriate level of care

• Capability of transport teams
  – Conventional & high frequency ventilation
  – Nitric oxide

• If severe hypoxemia and respiratory failure despite all conventional measures may need ECMO
Case 2

• Uncomplicated pregnancy to a G1 mother who presents in labor at 40 weeks gestation
• Prolonged 2\textsuperscript{nd} stage, mom pushing for two hours
• Vacuum extraction
• Apneic at birth, HR 60/min. PPV given with improvement in HR, color and perfusion. No spontaneous breathing until 10 min of age
Case 2 continued

• Cord gases:
  – Arterial pH 6.98, pCO2 55, pO2 17, BE -20
  – Venous pH 7.05, pCO2 45, pO2 30, BE -16

• Baby’s exam: weak cry, no suck, hypotonic, obtunded

• Postnatal CBG: pH 7.01, pCO2 45, BE -24
Hypoxic ischemic encephalopathy and associated problems

• Neurologic:
  – Changing exam, which may improve or worsen
  – Risk for seizures and ongoing neurologic injury
  – Risk for long term neurodevelopmental problems

• Cardiac
  – Myocardial dysfunction

• Respiratory
  – May need O2 and/or ventilation, non-specific lung changes
  – Risk for pulmonary artery hypertension
Hypoxic ischemic encephalopathy and associated problems

- Renal
  - Renal failure, oliguria
- Hepatic
  - Elevated transaminases
- Hematologic
  - Coagulopathy, thrombocytopenia
Case 2 continued

• Passive hypothermia started
  – Turn off radiant warmer
  – Monitor rectal temp every 15 min, target 33.5 C

• Arrangements made for transfer to a referral NICU for therapeutic hypothermia

• Active cooling initiated by the transport team
  – Tecotherm
Case 2 continued

• Active whole body cooling should be initiated by 6 hours of age; earlier is better
  – Timely transport to a cooling center essential
• 72 hour of active therapeutic hypothermia
  – Whole body cooling on a blanket
  – Target temp 33.5 C rectal
  – Video EEG for 24-48 hr
  – Gradual re-warming over 4-6 hr
  – MRI at 4-7 days
Case 3

- Uncomplicated pregnancy, delivered vaginally at term, good Apgars
- Infant retracting at birth with diminished breath sounds on the left and flat abdomen.
Congenital diaphragmatic hernia: pathophysiology

- Lung hypoplasia: both lungs
- Pulmonary artery hypertension
- Mediastinal structures shifted away from defect
- Liver and/or stomach may be in the chest
Congenital diaphragmatic hernia

• Delivery room management
  – Avoid prolonged mask ventilation
  – Early intubation
  – Place NG to suction

• Stabilization
  – IV and arterial access
  – Use higher rates and low pressures

• Transfer to a surgical center with ECMO
Case 4

• Former 32 weeks gestation premature infant, who is doing well in room air and on full NG feeds.
• Develops bilious emesis and NG drainage, abdominal distention, and bloody stools
• Perfusion is poor, apnea is much worse
• Abdominal x-rays are obtained
Treatment of necrotizing enterocolitis

- NPO, NG to LIS
- Antibiotics: ampicillin, gentamicin, metronidazole
- Respiratory support
- Hemodynamic support
- Treat hematologic and coagulation abnormalities
- Referral to a surgical center for consultation
- Serial x-rays, blood gases, CBC
- Serial exams
Complications of NEC

- Respiratory compromise
- Hypotension, shock
- Thrombocytopenia
- Coagulopathy
- Hemolysis
- Sepsis
- Intestinal perforation and necrosis
Indications for surgery in NEC

- Signs of perforation and/or intestinal necrosis
  - Progressive thrombocytopenia
  - Metabolic acidosis
  - Deteriorating clinical course

- Free air on abdominal x-ray

- Worsening or unchanging pneumatosis
Complications and late outcomes of NEC

• Short gut syndrome
  – Malabsorption
  – Poor growth
  – Prolonged need for TPN

• Increased risk for neurodevelopmental delay
Changing presentation of NEC

• Late cases after discharge from NICU
• Cases associated with thickeners
• Late presentation with gastroschisis
• These infants may present to an ED with non-specific symptoms: loose stools or gastroenteritis like illness, abdominal distention
Difficult airway

- Micrognathia
- Cleft lip/palate
- Extremely premature infant
- Macroglossia
- Oral masses
- Neck masses
Pierre-Robin Sequence

• Micrognathia, cleft palate
• Upper airway obstruction from posteriorly displaced tongue
• Key measures to maintain airway:
  – Prone positioning
  – Nasal CPAP
  – Oral airway
• Timely referral and transport to surgical center with advanced airway management (ENT, Pulmonary)
Micrognathia - a small jaw with a receding chin

Tongue that is large compared to the jaw, resulting in airway obstruction
Emergencies measures to maintain airway

- Oral airway
- Nasopharyngeal airway
- Laryngeal mask
- Storz C-Mac, Glidescope
- Flexible bronchoscopy
- Don’t forget basic airway measures
  - Mild neck extension, reposition as needed
  - Good seal with appropriate size mask
  - Use CO2 detector
Extremely premature infant
Special issues for the extremely premature infant

• Immature skin:
  – Large insensible water losses
  – Skin injury with tape, anti-septics, abrasion, excoriation

• Maintenance of normal temperature
  – Hat to reduce heat loss from the scalp
  – Clear plastic wrap immediately after birth in the delivery room to reduce convective losses
Respiratory issues in extremely premature infant

• Risk of barotrauma: pulmonary interstitial emphysema and pneumothorax
  – Use of T-piece with pressure limits in the delivery room
  – Avoid high distending peak pressures

• Intubation may be very difficult
  – Small mouth and oropharynx make visualization a challenge
  – 2.5 ETT may not fit in the trachea of the smallest premies
  – Many tiny premies can be stabilized on NCPAP
Important Disclosure:

While cases are based on real events, details have been altered to protect privacy.
Topic #1: Solid Organ Injuries: Do grades matter?
Case 1: Spleen Injury

- Glasgow Coma Score: 15
- Injury Severity Score: 16
- Probability Of Survival: 99%
Case 1

- 14yo male, bike handlebars vs abdomen

- Immediate abdominal pain followed by several episodes emesis, anxious

- Took self to Community ED
  - CT demonstrated splenic injury – grade not reported
  - H&H – 11.6/35.4

- Given Zofran, morphine, TXA, Piperacillin, 1.6 L NS
  - Transferred by fixed wing to BCHO; uneventful
  - pt. ambulatory for transport
Case 1: BCHO ED

- Arrived to BCHO ~12 hours post injury
  - Ambulates to gurney
  - HR 85, BP 142/106, 98% on RA, GCS 15
  - pain 8/10

- Interventions
  - Repeat CBC - H&H- 10.5/32
  - Maintenance fluid
  - Zofran, morphine, fentanyl given

- OSH CT reviewed by trauma surgeon – Grade 4 lac
  - Impression: >12 hours since injury, hemodynamically stable, has required no colloid & relatively stable Hgb
Case 1: hospital course

- Admit to Ward
  - NPO, maintenance IVF, Zofran, strict I&Os
  - Pain control
  - bedrest, serial abdominal exams
  - Monitor hemodynamics & repeat labs in am

- HD 1: H&H 9.1/27
  - HR 76, BP 121/63, Pain 6/10
  - Pain control - initially prn morphine, changed to ATC Norco

- HD 2: no more Hb levels
  - Exam – minimally TTP on R abdomen, no guarding
  - HR 87, BP 108/62, pain 5/10
  - Out of bed
  - Diet advanced from clears to regular

- Discharged HD 4
Case 2

• 14 yo male high speed MVC, unrestrained
• Prolonged extrication; pinned under dashboard
• EMS – Trauma Activation, taken to closest TC (adult)
  • initially thought to be older than 16yrs
• Tachycardic on scene, GCS <8
Case 2
Trauma Scores for BCHO

- Glasgow Coma Score: 6t
- Injury Severity Score: 34
- Probability Of Survival: 90%
Case 2: OSH

- Intubated
- No scan
- To OR
Case 2: OSH

Interventions

- HD 1 - Initial ex-lap: splenectomy, pericardial window
  - CODED!
- HD 3 - Ex-lap: Bowel resection (patchy necrosis in cecum & transverse colon)
- HD 5 - Ex-Lap: ileocolic anastomosis, post-pyloric feeding tube
- HD 8 - Ex-lap – R ureteral stent placed, continued wound vac (fascia too tight to close)
- HD 9 - fascia closure – VAC on Sub-Q
- HD 11 - IR guided drainage of R perinephric fluid collection
Case: OSH

Injuries Listed:

- SDH/SAH,
- sternal fx and cardiac contusion,
- b/l HTX,
- Grade 4 renal lac,
- liver lac (Grade ???)
- “Large” splenic lac - splenectomy
- retroperitoneal hematoma
- Urinoma (ureteral stent placement), TMJ dislocation, b/l pubic rami fx, mult serosal colon injuries, sm and lg bowel hematomas (reseccion w ileocolonic anastomosis), L medial malleolus fx, mult metatarsal fx’s
Case 2: BCHO

HD 11/BCHO HD 1:

- Pt arrived intubated
- HD 2 – Wound Vac placed to mid abd wound
- HD 3 – Pigtail placed for pleural effusion.
  - feeds started: emesis
  - NG tube advanced to NJ.
- HD 6 – Extubated to NC, weaned to RA
- HD 9 - CT A/P showed mild thickening of the antrum and significant stool burden despite bowel regimen.
- HD 10 – Persistent emesis w feeds
  - GI contrast study revealed SMA syndrome
  - PICC placed, TPN initiated
- HD 16 – resumed NJ feeding
Case 2: BCHO

- Neuro – MRI showed mult petechial hemorrhages, Sprain of interspinous ligament (c-collar maintained).
- Pain Service consult – multimodal analgesia (clonidine, methadone, morphine, oxycodone, acetaminophen); transitioned to oral meds
- Ortho – pelvic fx stable, LLL placed in CAM boot
- Urology – Foley remained until out of bed (HD 28). Stent removed HD 46
- D/C to Rehab
  - Later: Fluid collection spontaneously began leaking from abd.
  - CT showed enterocutaneous fistula.
  - OR: ureteral stent removed, abd wound cleaned and repaired.
Education

• The AAST Grading system for solid organ injury
• The APSA clinical guidelines for Liver / Spleen injury

Can you repeat the part of the stuff where you said all about the things?
The beginning of grading

- The “Organ Injury Scaling committee” of the AAST
  - Formed in 1987
  - Charge: Devise injury scores to facilitate clinical research
  - Prior scales: no uniformity or consensus
  - 1989 report established consensus scales for Liver, Spleen and Kidney
Injury Scoring Scale

A Resource for Trauma Care Professionals

Also available in PDF: Injury Scoring Scale

<table>
<thead>
<tr>
<th>Table</th>
<th>Injury Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Cervical Vascular Injury</td>
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<tr>
<td>2</td>
<td>Chest Wall Injury</td>
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<tr>
<td>3</td>
<td>Heart Injury</td>
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<tr>
<td>4</td>
<td>Lung Injury</td>
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<td>5</td>
<td>Thoracic Vascular Injury</td>
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<td>6</td>
<td>Diaphragm Injury</td>
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<td>7</td>
<td>Splenic Injury</td>
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<tr>
<td>8</td>
<td>Liver Injury</td>
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<tr>
<td>9</td>
<td>Extraperitoneal Blunt Tree Injury</td>
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<td>10</td>
<td>Pancreas Injury</td>
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<td>11</td>
<td>Esophageal Injury</td>
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<td>12</td>
<td>Stomach Injury</td>
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<tr>
<td>13</td>
<td>Duodenal Injury</td>
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<tr>
<td>14</td>
<td>Small Bowel Injury</td>
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<tr>
<td>15</td>
<td>Colon Injury</td>
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<tr>
<td>16</td>
<td>Rectum Injury</td>
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<tr>
<td>17</td>
<td>Abdominal Vascular Injury</td>
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<tr>
<td>18</td>
<td>Adrenal Organ Injury</td>
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<tr>
<td>19</td>
<td>Kidney Injury</td>
</tr>
<tr>
<td>20</td>
<td>Ureter Injury</td>
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<tr>
<td>21</td>
<td>Bladder Injury</td>
</tr>
<tr>
<td>22</td>
<td>Urethra Injury</td>
</tr>
<tr>
<td>23</td>
<td>Uterus (non-pregnant) Injury</td>
</tr>
<tr>
<td>24</td>
<td>Uterus (pregnant) Injury</td>
</tr>
<tr>
<td>25</td>
<td>Fallopian Tube Injury</td>
</tr>
<tr>
<td>26</td>
<td>Ovary Injury</td>
</tr>
<tr>
<td>27</td>
<td>Vagina Injury</td>
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<td>28</td>
<td>Vulva Injury</td>
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<td>29</td>
<td>Testis Injury</td>
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<td>30</td>
<td>Scrotum Injury</td>
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<tr>
<td>31</td>
<td>Penis Injury</td>
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<tr>
<td>32</td>
<td>Peripheral Vascular Organ Injury</td>
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For Members

Access the member directory »
Read the newsletter »

Table 1

<table>
<thead>
<tr>
<th>Grade</th>
<th>Cervical Vascular Organ Injury Scale</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Grade</td>
</tr>
<tr>
<td></td>
<td>ICD-9</td>
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### Table 25: Fallopian tube injury scale

<table>
<thead>
<tr>
<th>Grade</th>
<th>Description of injury</th>
<th>ICD-9</th>
<th>AIS-90</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Hematoma or contusion</td>
<td>867.61.7</td>
<td>2</td>
</tr>
<tr>
<td>II</td>
<td>Laceration &lt;50% circumference</td>
<td>867.61.7</td>
<td>2</td>
</tr>
<tr>
<td>III</td>
<td>Laceration ≥50% circumference</td>
<td>867.61.7</td>
<td>2</td>
</tr>
<tr>
<td>IV</td>
<td>Transection</td>
<td>867.61.7</td>
<td>2</td>
</tr>
<tr>
<td>V</td>
<td>Vascular injury; devascularized segment</td>
<td>902.89</td>
<td>2</td>
</tr>
</tbody>
</table>

*Advance one grade for bilateral injuries up to grade III
From Moore et al. [5]; with permission

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### Table 3: Heart injury scale

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

*Advance one grade for multiple wounds to a single chamber or multiple chamber involvement.
From Moore et al. [3]; with permission.
### Table 7

**Spleen injury scale (1994 revision)**

<table>
<thead>
<tr>
<th>Grade</th>
<th>Injury type</th>
<th>Description of injury</th>
<th>ICD-9</th>
<th>AIS-90</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Hematoma</td>
<td>Subcapsular, &lt;10% surface area</td>
<td>865.01</td>
<td>2</td>
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<tr>
<td></td>
<td></td>
<td></td>
<td>865.11</td>
<td></td>
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<tr>
<td></td>
<td>Laceration</td>
<td>Capsular tear, &lt;1 cm parenchymal depth</td>
<td>865.02</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>865.12</td>
<td></td>
</tr>
<tr>
<td>II</td>
<td>Hematoma</td>
<td>Subcapsular, 10%-50% surface area; intraparenchymal, &lt;5 cm in diameter</td>
<td>865.01</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>865.11</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Laceration</td>
<td>Capsular tear, 1-3 cm parenchymal depth that does not involve a trabecular vessel</td>
<td>865.02</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>865.12</td>
<td></td>
</tr>
<tr>
<td>III</td>
<td>Hematoma</td>
<td>Subcapsular, &gt;50% surface area or expanding; ruptured subcapsular or parenchymal hematoma; intraparenchymal hematoma &gt; 5 cm or expanding</td>
<td>865.03</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Laceration</td>
<td>&gt;3 cm parenchymal depth or involving trabecular vessels</td>
<td>865.13</td>
<td></td>
</tr>
<tr>
<td>IV</td>
<td>Laceration</td>
<td>Laceration involving segmental or hilar vessels producing major devascularization (&gt;25% of spleen)</td>
<td>865.04</td>
<td>5</td>
</tr>
<tr>
<td>V</td>
<td>Laceration</td>
<td>Completely shattered spleen</td>
<td>865.14</td>
<td>5</td>
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<tr>
<td></td>
<td>Vascular</td>
<td>Hilar vascular injury with devascularizes spleen</td>
<td>865.04</td>
<td>5</td>
</tr>
</tbody>
</table>

*Advance one grade for multiple injuries up to grade III. From Moore et al. [4]; with permission.

### Table 8

**Liver injury scale (1994 revision)**

<table>
<thead>
<tr>
<th>Grade</th>
<th>Type of Injury</th>
<th>Description of Injury</th>
<th>ICD-9</th>
<th>AIS-90</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Hematoma</td>
<td>Subcapsular, &lt;10% surface area</td>
<td>964.01</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Laceration</td>
<td>Capsular tear, &lt;1 cm parenchymal depth</td>
<td>964.11</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>964.12</td>
<td></td>
</tr>
<tr>
<td>II</td>
<td>Hematoma</td>
<td>Subcapsular, 10%-50% surface area; intraparenchymal, &lt;10 cm in diameter</td>
<td>964.01</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Laceration</td>
<td>Capsular tear 1-3 cm parenchymal depth, &lt;10 cm in length</td>
<td>964.11</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>964.13</td>
<td></td>
</tr>
<tr>
<td>III</td>
<td>Hematoma</td>
<td>Subcapsular, &gt;50% surface area of ruptured subcapsular or parenchymal hematoma; intraparenchymal hematoma &gt; 10 cm or expanding</td>
<td>964.03</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Laceration</td>
<td>&gt;3 cm parenchymal depth</td>
<td>964.12</td>
<td></td>
</tr>
<tr>
<td>IV</td>
<td>Laceration</td>
<td>Parenchymal disruption involving 25% to 75% hepatic lobe or &lt;1-3 Couinaud’s segments</td>
<td>964.04</td>
<td>3</td>
</tr>
<tr>
<td>V</td>
<td>Laceration</td>
<td>Parenchymal disruption involving &gt;75% of hepatic lobe or &gt;3 Couinaud’s segments within a single lobe</td>
<td>964.14</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Vascular</td>
<td>Juxtahepatic venous injuries; i.e. retrohepatic vena cava or central major hepatic veins</td>
<td>964.35</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Vascular</td>
<td>Hepatic avulsion</td>
<td>964.36</td>
<td>6</td>
</tr>
</tbody>
</table>

*Advance one grade for multiple injuries up to grade III. From Moore et al. [4]; with permission.
Summary: Pro

- **Immediate care**
  - Defines the standards for immediate OR

- **Clinical Guidelines**
  - Impacts CPG care plans (ICU vs floor)
  - Standardizes care
  - *evidence based research*
  - Impacts follow up plans and restrictions

- **Common Language**
  - Makes communication easy across different levels of experience
  - Is the basis for benchmarking
Summary: Cons

- **Immediate care**
  - Clinical status usually guides clinical immediate decision

- **Clinical Guidelines**
  - Places patient in a category that may or may not be clinically appropriate.

- **Common Language**
  - Loses valuable descriptive verbiage that is meaningful.

- **Historical reference only**: not up to date?
Question: *Clinical Utility?*

- Historic *Liver/Spleen* Guidelines for non-operative management in children:
  - ICU for 1 day.
  - Bedrest for grade+1
  - Activity restrictions grade+2
  - Contraindicated with neurologic injury or other associated injury
  - CBC and abdominal exam every 6 hours
  - NPO for 24-48 hours

APSA Guidelines, Stylianos
2000
Liver and Spleen Injuries: Non-operative Management

- Recent Clinical Trends:
  - Decreasing length of stay and ICU stay
  - No ICU for grade 1-3
  - Begin PO when Hb is stable
  - More aggressive non-operative management
    - Observation with head injuries
    - Observation with associated injuries
  - *Grading is becoming less important*
  - No follow up CT scans

AAST Pediatric Committee Poll: Mixed response
Liver and Spleen Injuries: Non-operative Management

APSA 2019 Evidence based committee review

- Length of stay based on clinical condition, not grade
- Activity restrictions is safe at Grade +2 weeks
- Prophylactic embolization is not indicated at any grade
- Routine follow up imaging is not indicated
Bottom Line: Things you should know

- ACS verification guidelines
  - Grading is not “required” in the orange book

- Trauma registry
  - Grades define ISS
  - ISS defines the acuity level of your patients
  - Grades define categories for benchmarking
Things you should know

- ACS Site survey
  - High visibility charts:
    - Spleen, Livers, Pancreas, Deaths, MM’s
    - High acuity (High ISS and Multiple injuries)
    - Transfers
Continued: Check up on the recent versions

### TABLE 1. Spleen Organ Injury Scale—2018 Revision

<table>
<thead>
<tr>
<th>AAST Grade</th>
<th>AIS Severity</th>
<th>Imaging Criteria (CT findings)</th>
<th>Operative Criteria</th>
<th>Pathologic Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>2</td>
<td>- Subcapsular hematoma &lt;10% surface area</td>
<td>- Subcapsular hematoma &lt;10% surface area</td>
<td>- Subcapsular hematoma &lt;10% surface area</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Parenchymal laceration &lt;1 cm depth</td>
<td>- Parenchymal laceration &lt;1 cm depth</td>
<td>- Parenchymal laceration &lt;1 cm depth</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Capsular tear</td>
<td>- Capsular tear</td>
<td>- Capsular tear</td>
</tr>
<tr>
<td>II</td>
<td>2</td>
<td>- Subcapsular hematoma 10–50% surface area; intraparenchymal hematoma &lt;5 cm</td>
<td>- Subcapsular hematoma 10–50% surface area; intraparenchymal hematoma &lt;5 cm</td>
<td>- Subcapsular hematoma 10–50% surface area; intraparenchymal hematoma &lt;5 cm</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Parenchymal laceration 1–3 cm</td>
<td>- Parenchymal laceration 1–3 cm</td>
<td>- Parenchymal laceration 1–3 cm</td>
</tr>
<tr>
<td>III</td>
<td>3</td>
<td>- Subcapsular hematoma &gt;50% surface area; ruptured subcapsular or intraparenchymal hematoma ≥5 cm</td>
<td>- Subcapsular hematoma &gt;50% surface area or expanding; ruptured subcapsular or intraparenchymal hematoma ≥5 cm</td>
<td>- Subcapsular hematoma &gt;50% surface area or expanding; ruptured subcapsular or intraparenchymal hematoma ≥5 cm</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Parenchymal laceration ≥3 cm depth</td>
<td>- Parenchymal laceration ≥3 cm</td>
<td>- Parenchymal laceration ≥3 cm</td>
</tr>
<tr>
<td>IV</td>
<td>4</td>
<td>- Any injury in the presence of a splenic vascular injury or active bleeding confined within splenic capsule</td>
<td>- Parenchymal laceration involving segmental or hilar vessels producing &gt;25% devascularization</td>
<td>- Parenchymal laceration involving segmental or hilar vessels producing &gt;25% devascularization</td>
</tr>
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</tr>
<tr>
<td>V</td>
<td>5</td>
<td>- Any injury in the presence of splenic vascular injury with active bleeding extending beyond the spleen into the peritoneum</td>
<td>- Hilar vascular injury which devascularizes the spleen</td>
<td>- Hilar vascular injury which devascularizes the spleen</td>
</tr>
<tr>
<td></td>
<td></td>
<td>- Shattered spleen</td>
<td>- Shattered spleen</td>
<td>- Shattered spleen</td>
</tr>
</tbody>
</table>

2018 Revision Example: Spleen
Things you should know

**Grade or not:**
- *Institutional Consistency Matters!!!*
- Is there still bleeding?
- Is the pancreatic duct intact?
- Is there a urine leak?
- Is the organ devascularized?
- Is there air where it does not belong?
- Are there multiple organs injured?
Topic #1 Questions?
Topic #2: Challenging Children and difficult decisions
Case 3

- 5 year old male unwitnessed fall from 3rd story window
- Significant oral/facial trauma
- PMH - autistic
- EMS – Trauma Activation/Code 3 to BCHO
Case 3: Scene

- Found supine on ground underneath open 3rd story window
- Significant oral/facial trauma.
  - Multiple missing teeth, 2 inch chin lac, moveable hard palate
- Became combative with touch
- Subcutaneous emphysema in right temple noted en route

- HR 96, RR 28, BP 145/120, 99% RA
EMS – cont.

Interventions

- Suction multiple times for continued bleeding
- PIV R hand
- GCS 15??
  - (combative at baseline per mom)
- C-collar & spinal motion precautions
Crowd Vote!!!

Intubate or don’t touch?
Case 3: ED Resus

- Arrived BCHO – Trauma Partial activation
  - Awake, difficult to assess, GCS 12 (4-4-4)???
  - Notable facial trauma, L leg “deformity”
- Primary survey – airway patent
  - T 36, HR 95, RR 20, BP 110/77, 99% RA
- Secondary survey – chin lac, dental trauma
  - Labs: Hgb 10.8, INR 1.2, AST/ALT- 505/214
  - eFAST negative
- Repeat GCS 11 (2-3-6)
- Airway uncertainty: Upgraded to Full
Films

• Portable CXR
  • Pneumomediastinum, SQ emphysema of the neck

• Additional Portable plain films
  • 1 view pelvis – normal??
  • 2 view Femur – **L distal femur fx**
  • 1 view Cervical – soft tissue neck emphysema
Remove Collar?
Case 3: ED Resus

Transport Diagnostic Imaging

- **CT Head/Maxofacial** – “extensive complex fxs”
  - Le Fort III
  - b/l zygomatic arch, naso-orbital ethmoid lat & inferior orbital walls, maxillary sinus wall, sphenoid body, mandible & maxillary (alveolar), mandibular condyle & rami

- **CT Chest/Abd/Pelvis**
  - B/l sm pneumothoraces, Pneumomediastinum, R neck emphysema
  - Small b/l lower and medial lobe contusions, sm RML laceration
  - Distended stomach, (probable swallowed teeth)
  - Small amount free fluid in deep pelvis
TEG – Abnormal???
Case 3: Hospital Course

- **HD-0:** to PICU
  - Airway monitoring and pain management

- **HD-1:** to OR with Ortho & OMFS
  - Closed reduction L femur – perc pinning & application of long leg cast
  - Closed reduction b/l mandibular fxs with splint
  - Closed reduction nasal septum (Doyle splints)
  - Repair 3cm chin & lower lip lac
  - Debridement maxillary ant alveolar fs, extraction upper L canine

- Return to PICU intubated
  - Jaw – rubber band secured
  - Remained intubated secondary to extensive facial injuries
Case 3: Hospital course

- **HD-2: Extensive facial swelling**
  - Extubation question / Discussion????
  - Continuous IV drips: Precedex, fentanyl, versed
  - ATC: acetaminophen IV, Unasyn, decadron
  - PRN - fentanyl, Versed, Zofran, rocuronium
  - Although sedated, easily arousable.

- **OT/PT/Speech/Nutrition consult ordered**

- **HD-3: Extubated to RA**
  - Facial edema stable
  - Pain Mgt- transition to Tylenol/oxycodeone ATC, with morphine & Ativan prn

- **HD-4: Transfer to Ward**
  - NJ feeds, pain management

- **HD-11: Discharged to home – (NG feeds)**
Consults

- OMFS/Craniofacial
- Orthopedic Surgery
- Intensive Care
- PT/OT/Speech
- Nutrition
- Gastroenterology
- Neurosurgery
- Rehabilitation
- Social Services
- Case Management
Education and Controversy

• Debatable Issues:
  • Intubation / Extubation? Timing?
  • Partial vs Full?
  • Floor vs PICU?
  • Swallowed tooth?
  • Lung contusion / Pneumo management?
  • Fluid in pelvis management?
  • Pain management?
• New GCS for autistic Children?
• Antibiotics for facial fractures?
• Le Fort Fractures
Answers for Question #1: Intubate or Not?

COURAGE AND STUPIDITY
Hard to tell the difference at times.

Be the best “bag-Mask” provider ever!
Trauma Indications for Intubation

- Airway protection!
  - Sedation with transport
  - Depressed GCS (8)
  - Blood and secretions
- Need significant oxygen delivery (100%)
- Invasive procedures (anesthetic)
- Concern for an evolving injury

---

- Indications *not* to intubate:
  - *Everything else!*
Full vs partial Trauma?

ICU or Floor??
Indications for an ICU Admission

- To “maintain life” = O2 delivery

\[ D-O2 = (HR \times SV) + (Hb \times SaO2 \times 1.34 + (PaO2 \times 0.03)) \]

- Potential Airway concerns
- Extreme Nursing Care
- High level observation
Antibiotics for open fractures

• Standard:
  • One (1) Hour

• What does “open” mean??
  • Sinus fractures?
  • Scalp lacs?
  • Puncture wounds?
  • Bullet wounds?

Open to environment =
Air in tissue compartments???
Skull and cranio-facial abx

- **Antibiotic prophylaxis in the management of complex midface and frontal sinus trauma.**
  - “The use of additional antibiotics outside the perioperative timeframe does not reduce the rate of postoperative infections; however, such antibiotic use may be warranted in cases of severe facial trauma with multiple open fracture wounds”.

- **Controversies in Maxillofacial Trauma**
  - OMFS clinics North America, 2017
  - “A recent review of literature by Mundinger … recommendations included perioperative antibiotics within 60 minutes prior to incision…for open fractures or clean-contaminated procedures and cessation of antibiotics within 24 hours of the procedure”

- **Facing the facts on prophylactic antibiotics for facial fractures: 1 day or less.**
  - J Trauma 2018
  - “These results lead us to believe that we should limit antibiotics to 24 hours or less upon admission for facial fractures.”
Antibiotics for Pneumocephalus?

- **Prophylactic administration of ceftriaxone for the prevention of meningitis after traumatic pneumocephalus: results of a clinical trial.**
  - J Neurosurgery 2004
  - “The results of this study do not substantiate the efficacy of ceftriaxone used in the prevention of meningitis in patients with traumatic pneumocephalus after mild head injury or in any specific subgroup of these patients. Cerebrospinal fluid rhinorrhea and intracranial hemorrhage may be considered primary risk factors for the development of meningitis in patients with posttraumatic pneumocephalus and, in the absence of these symptoms, intradural location of air and air volume greater than 10 ml may be considered secondary risk factors.”
GCS-40: A new standard???

- **GCS 40 elements:**
  - Best Eye: possible 4
  - Best Verbal: possible 5
  - Best Motor: possible 6
  - New option for “Not Testable” – NT in all 3 categories

- **For Kids?**
  - For those less than 5 years of age, best verbal and best motor is usually not possible
Rene Le Fort

French Surgeon: Trauma, Pediatric, Orthopedic, Breast Cancer
1869-1951
Le Fort Classifications

- Le Fort 1: horizontal fracture or “floating Palate”
- Le Fort 2: Pyramidal Fracture, with infra-orbital rim
Le Fort Classifications

- Le Fort 3: Transverse Fracture, or “craniofacial dissociation”
  - Nasal bridge, zygomatic arch, Medial and inferior orbital wall.
Topic #2
Questions?

Pro tip.
Topic #3: “Be the Village”

- 13 yo male unhelmeted Auto vs Bicycle
- EMS – Trauma Activation, taken to closest TC
- Awake, alert in the field, GCS 15
Case: Pre-hospital

Injuries/Symptoms
- Severe avulsions/friction burns & to head, arms, legs, abd
- Deformity to bilateral lower legs
- GCS 15, HR 148 (weak pulse), RR 22

Interventions
- Trauma dressings to wounds applied
- Placed in full spinal mobilization precautions
- PIV placed x2; NS 500ml, Fentanyl 100mcg
- Taken to nearest TC
Case: Adult Trauma Center

- Arrival VS: SBP 115, GCS 14-15
  - Hemodynamically stable
  - Bilateral + pedal pulses, no tight compartments

- Given add’l pain med & ancef

- To CT
  - Head- brain negative
  - Cervical – negative
  - Abd – negative
  - Chest – 19 rib fx, L traumatic pneumatocele
Injuries

- Severe pulmonary contusions
- Left traumatic Pneumatocele
- Multiple bilat rib fractures (19)
- Open fx- dislocation R knee
- R humeral fx
- Complex pelvic fx
- Major Soft tissue injuries
Clinical Change

- Back In Trauma Bay after CT
- SBP drop from 90s- 60s
  - Intubated
  - Left chest tube placed
- Emergently to OR
  - L thoracotomy & lobectomy
- Received 18 u pRBC
- Ex-fix to R lower extremity & pelvis stabilization
13 year old, extensive skin injury, Post lung resection, Complex ortho injury, in adult trauma Center:

Now what?
Friendly Advice

- Trauma team buddy communication:
  - Should this kid be in a pediatric burn center?
Case: Hospital course

3 days post injury- transfer to BCHO

- **HD 1:**
  - Arrived intubated/sedated
  - PCIU, Trauma, Orthopaedic & Plastic Surgery
  - Intermittent hemodynamic instability: nor-epi & volume/blood
  - Ceftriaxone ppx through HD7
  - Hypoalbuminemia – 2.0: given albumin
  - CK 15,583 on arrival- ↑16,658 HD2

- **HD 2:** OR- exam and further fasciotomy
  - Immediate plan for multiple I&D and multi-staged repairs

- **HD 3:** Plt 66- platelet transfusion w bump to 127
  - Additional RBCs given as needed during OR procedures
Case: Hospital course continued

• Additional ICU issues
  • Concern for PSTD / ICU Delerium
    • Fentanyl, ketamine, precedex, ATC acetaminophen, PCA morphine
    • Versed prn anxiety & muscle spasm
    • Pain team consult- PCA morphine, oxycodone, gabapentin, acetaminophen
      o Transitioned to ketamine drip, dilaudid PCA due to inadequate pain control, methadone, toradol
      o Weaned off ketamine to scheduled methadone, gabapentin & prn Tylenol, oxycodone & IV dilaudid
      o Also received prn femoral nerve blocks 1 month post injury
  • Mobility- PT/OT/ST consulted early on: plans for Rehab
  • Mental Health team involved early
  • ID – Febrile HD 3; cx all neg.
    • Received Ancef, Vanco, Gent , Bactrim intermittently for surgical ppx
A few key moments

- HD 5: NG feeds began
- HD 6: chest tube out, lungs doing well
- HD 21: Transferred to Ward
- HD 47: Transferred to Rehab
  - all good
- Total trips to the OR: 13
~ 6 weeks later
Left thigh

~6 weeks later
Right knee/ lower leg

~ 2 weeks later

R lower leg ~ 6 weeks later
It takes a Village

- EMS!
- Adult Trauma Center
- Gen Peds Surgery
- Intensive Care
- Anesthesiology
  - Pain Team
- Plastic surgery
- Orthopaedic surgery
- ENT
- Craniofacial Surgery
- Ophthalmology
- Psychiatry/Psychology
- Infectious Disease
- Rehabilitation
- Social Services
- Nutrition
- OT/PT/ST
- Child Life
- Music therapy
- Case Management
- Palliative Care
- WOCN
- Vascular Access Team
- Nursing
Education

- Traumatic Pneumatocele
- Complex Ortho / Plastics / Burns
- “Village Dynamics”

“Be the Village”
Traumatic Pneumatocele

• “Institutional Experience”
  • Clinical problem
    - Parenchymal loss
    - Hemorrhage
    - Worsening with fluids and ventilation
  • Series of difficult cases
    - Initially stable, Decompensated, then death.
  • Protocol solution:
    - Close monitoring
    - When deterioration is noted – resect!
Ex-Fix Management

Modular variety of External Fixator
Limb Salvage

• Issues to Consider
  • Ischemic time
  • Re-vascularization options
  • Neurologic status
    - Strength
    - Sensation
  • Extent of bony injury
  • Location
    - BKA vs Trans vs AKA
Team Play

• Hospital Transfer Process
  • New: Life image
  • Direct “sign out” (doc to doc)
  • Appreciate hospital differences
    - Trauma center vs community hospital

• Gaps and Misses
  • Timing of TTS
  • Review vs. fresh eyes?
  • Radiology reviews?
Village Dynamics

- Mental Health Services
  - When???
  - How and Who??
- Sedation and Delirium
  - Recognize the effects of multiple OR trips
  - “Creative” sedation and pain management
  - Holidays, cycles, family and normalization
- Palliative care Program
Village Dynamics

• Rehab
  • Physical and occupational therapy
    - When?
    - Limitations and restrictions
    - Protect from secondary injury
  • Setting long term goals and expectations

• Team updates
  • Ultimate outcome is important!
Conclusion: Be the Village!

Questions?
Keep Calm and Carry On

The Impact of Human Performance on Treating the Critically ill and Injured Child

Philip Grieve
Objectives

“In all situations do what is right for the patient.”

• What are the non-technical challenges to this purpose?
  • The effect of stress on critical care
  • Our attitudes to errors and failures
  • Systemic challenges vs individual
Historically priority has been on chronic stress.

"The psychoanalytic approach to stress is preoccupied with illness"

- Salas et al
In all situations we do what is right for the patient:

"The prepared warrior is not only able to solve problems in a quick and commendable fashion by virtue of his life experience, but he can react appropriately through his comprehension of measures to meet any scenario... A warrior who does not think things through before hand will be ill equipped."

• Hagakure: The Secret Wisdom of the Samurai. Book I: 21
Thinking things through: Fright, Flight or Fight: two stories

- Choking child
- Seizing child

"It is the individual's perception of the demands being placed on them, and the perception of the resources they have available to cope with the demands, that dictates whether the individual feels under stress".

Flin et al 2008 Safety at the Sharp End – A Guide to Non-technical Skills
Stress

• Definition
• Impact on performance:
  • Physiology & Motor skills
  • Teamwork & Communication
  • Mistakes and mishaps - thinking bandwidth
  • Attitudes to error
A definition for acute stress and performance:

"Stress is a high-demand, high-threat situation that disrupts performance. It is time limited; stress conditions occur suddenly and often unexpectedly; quick and effective task performance is critical; and consequences of poor performance are immediate and often catastrophic."

Salas, Driskel, Hughes - Stress and Human Performance (1996)
Why do things go wrong, or not as well as the plan says they should in high demand/threat situations?

1. Ignorance
2. Uncertainty
3. Complexity
4. Equipment
5. Opposition

The Specifics of Failure: ‘Cock-up theory’
Deleterious effects of stress on performance:

- **Physiological** – HR, breathing, trembling.
- **Emotional** – fear, anxiety, frustration, motivational losses.
- **Cognitive** – narrowed attention, longer reaction times, degraded problem solving, performance rigidity, manual tasks take longer.
- **Social** – loss of team perspective, decreased pro-social behaviors such as helping.
Physiology & Performance:

The Yerkes-Dodson Law

- Optimal Stress
- Good Stress
- Bad Stress

Performance

Low

Medium

High

Stress

Heart Rate Increase

Heart Rate

beats per minute (bpm)

220

200

180

160

140

120

100

80

175 bpm:
- cognitive processing deteriorates
- loss of peripheral vision (tunnel vision)
- loss of depth perception
- loss of near vision
- auditory exclusion (tunnel hearing)

145 bpm: Complex motor skills deteriorate

115 - 145 bpm:
- optimal survival and combat performance level for:
  - complex motor skills
  - visual reaction time
  - cognitive reaction time

115 bpm: fine motor skill deteriorates

80

60-80 bpm: normal resting heart rate

Notes:
1 - This data is for hormonal induced heart rate increases resulting from sympathetic nervous system arousal. Exercise induced increases will not have the same effect.
2 - Hormonal induced performance and strength increases can achieve 100% of potential max within 10 seconds, but drop to 55% after 30 seconds, 35% after 60 seconds and 31% after 90 seconds. It takes a minimum of 3 minutes rest to recharge the system.

Effect of hormonal induced heart rate increases on heart rate and blood pressure. This can manifest with normal shock symptoms (dizziness, nausea and/or vomiting, paleness, clammy skin) and/or profound excitement.
Psychological Skills to Improve Emergency Care Providers' Performance Under Stress – Lauria et al 2017 Annals of Emergency Medicine

Beat The Stress Fool!

• BREATH
• TALK (self)
• SEE (mental rehearsal)
• FOCUS (trigger word)
Power posing: brief nonverbal displays affect neuroendocrine levels and risk tolerance.

Carney DR¹, Cuddy AJ, Yap AJ.

Abstract
Humans and other animals express power through open, expansive postures, and they express submission through closed, contractive postures. But can these postures actually cause power? The results confirmed our prediction that posing in high-power nonverbal displays (as opposed to low-power displays) would increase neuroendocrine levels associated with stress and decreased risk tolerance.
Stress and teamwork

• Communication failure is often cited as a causal factor in errors
  • Why?
• Lack of training combined with stress?
<table>
<thead>
<tr>
<th>Crew Resource Management</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Situational Awareness</strong></td>
</tr>
<tr>
<td>(How to achieve, maintain, &amp; recover)</td>
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<tr>
<td><strong>Communication</strong></td>
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<tr>
<td>(Barriers &amp; Efficiency)</td>
</tr>
<tr>
<td><strong>Task Management</strong></td>
</tr>
<tr>
<td>(Standards, Priorities, Delegation)</td>
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</table>
Improving verbal communication in critical care medicine.
Brindley and Reynolds 2011 Journal of Critical Care

• Strong verbal communication skills are key to:
  • Shared mental models
  • Coordinating tasks
  • Centralizing flow of information

• Strategies:
  • Avoid mitigating language: "meant is not said"
  • Graded assertiveness : "said is not heard"
    • 5 step advocacy
  • Step back method – the time out: "heard is not understood"
    • Primary survey - Have we missed anything?
Failure... to err is human

• If failure is inevitable why do we deny its existence?
• Organizational culture – the way we do things around here
• Organizational climate – the way it feels to work around here
Denying failure, the perils of cognitive dissonance:

• Normalization of deviance
• Loss of individual accountability
• Failure to learn the right lessons
The challenger Launch Decision.
D. Vaughan (1997)

Normalization of deviance:
– Deviance in organizations transformed into acceptable behavior.
– The influence of culture on decision makers’ world view and their interpretation of information.

Mistake, mishap and disaster are socially organized and systematically produced by social structures:
– Incremental descent into poor judgement.
– Relentless inevitability of mistakes.
The Role of Deliberate Practice in the acquisition of Expert Performance - Ericsson et al 1993

• Endurance, Grit, Resilience
• Where do these come from?
• Can you teach them?
• Can you test for them?

"Even if we practice diligently, we will still endure real-world failure from time to time. And it is often in these circumstances when failure is most threatening to our ego, when we need to learn most of all". Mathew Syed in Black Box Thinking
Deliberate practice: 'Stress Exposure Training'.


• Information/Education
  - Education on effects of stress on performance
  – knowledge of the stressors inherent in the task environment
  Recognize how stress manifests itself

• Strategies/Planning
  • Over learning to develop automated reactions in high stress environment
  • Learn physiological control
  • Cognitive control methods (OODA loop, STAR

• Training/Put it into practice
  • Gradual exposure eg Boxing - shadow, heavy bag and sparring
  • Hi fidelity vs lo fidelity
  • Training vs education
Learning from mistakes:

“Negative feelings can form major barriers towards learning. They can distort perceptions, lead to false interpretations of events, and can undermine the will to persist.”

“Reflection is purposive activity directed towards a goal.”

Boud, Keogh & Walker 1985
Dosing Errors Made by Paramedics During Pediatric Patient Simulations After Implementation of a State-Wide Pediatric Drug Dosing Reference
— Hoyle et al 2019

- 142 Simulations (four different cases)
- 58% Dual paramedic crews
- Overall 31.2% drug doses were incorrect
- Weight estimation errors responsible for 18.2% errors
"Although the state of Michigan requires paramedics to complete a pediatric medication administration practical every two years, this did not eliminate the errors we observed. One can argue that given the already rare nature of administering a drug to a child, and the difficulty EMTPs have with pediatric drug calculations, that training every two years may not be effective at decreasing errors."
• Does a high performance team practice high impact skills every two years?
• Do they leave it until the last second to decide who will do what?
• Does everybody do everything? Or are there specialized skills?
TECHNOLOGY: Reviewing the play....

• Using technology to develop a growth mindset
• To develop resilience.
• Instant feedback
Feedback to develop growth mindset to counteract the effects of stress:

"Feedback, when delayed, is considerably less effective in improving intuitive judgement." 
M. Syed - Black Box Thinking

"...a crucial component in advancing education and patient care is real time feedback in the ED. The LAC+USC ED is working diligently on creating a positive learning culture, which affords direct feedback from our physicians and nurses to the EMS crew. This feedback and education has helped EMS providers build confidence and improve patient care on the stressful pediatric seizure call."

Loza-Gomez 2019 & Wacht 2017
EFFECT OF OOH PEDIATRIC ETI ON SURVIVAL & NEUROLOGICAL OUTCOME  GAUSCHE ET AL 2000 JAMA

• 3,084 paramedics (inc. 500 students)
• Two 3 hour educational sessions (LBRT, Airway skills, ETCO2)
• Prior to study, pediatric ETI not in county scope
• 830 enrolled pts for 22 months (that’s 830 critically sick pts split between 3,084 paramedics)

• Guess what the results showed?
EARLY ON SCENE MANAGEMENT OF PEDIATRIC OOHCA CAN RESULT IN IMPROVED LIKELIHOOD FOR NEUROLOGICALLY INTACT SURVIVAL

BANERJEE ET AL RESUSCITATION 2019

Ability to pick up a child and immediately transport drives strategy historically:

- Poor outcomes become an expectation
- Study compared survival in two years prior to study 5%, with increase to 30% survival in the two years after new strategy was implemented.

Wholesale system changes to pediatric cardiac arrest:

- Marginal gains in CA
- Targeted training
- Physiologically driven procedures
- Improved drug dosing process
- Trusted encouragement from supervisors
- Targeted deployment of a cadre of ALS providers & pit crew approach

Training bias described as a limitation?
Summary: Deleterious effects of stress on performance:

- **Physiological** – HR, breathing, trembling.
- **Emotional** – fear, anxiety, frustration, motivational losses.
- **Cognitive** – narrowed attention, longer reaction times, degraded problem solving, performance rigidity, manual tasks take longer.
- **Social** – loss of team perspective, decreased pro-social behaviors such as helping.
Summary:

• Chronic stress will affect your health
• Acute Stress will affect your performance
• Learn your own stress scripts for Physiology/Cognitive/Emotional/Social
• It will affect teamwork and communication
• Beat The Stress Fool!
• Communication strategies are essential

• You can train and teach to overcome the effects with deliberate practice and a growth mindset.
Questions?

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Recommended reading:

- Saunders et al The effect of stress inoculation training on anxiety and performance 1996
- Kaufman The challenges of being prepared for pediatric emergencies
- Lauria 2017 Psychological skills to improve emergency care provider performance under stress
- Kovacs Human & Psychological factors in airway management.