Pediatric Trauma Triage:
Where are we going with this?

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Introduction

- Pediatric Trauma
  - Becoming more Common
  - Potentially tragic
  - Complex situations
- Specialty care facilities versus community resources
  - What’s in your neighborhood?
- Comfort with pediatrics
  - Range of age, development, and physical size
Low frequency
High Risk
Non-Discretionary Events

WHAT DOES THIS MEAN TO YOU?
Objectives:

- Epidemiology of pediatric trauma causes
- Anatomy and Physiology of pediatric patients compared to adults
- Pediatric Trauma Triage Criteria
- Trauma center and community resources
- Review continuum of care
Anatomy and Physiology: Pediatric compared to Adult

- NOT “just little adults”
- Physical:
- Psychological
Cardiovascular Characteristics

- Relatively healthy, compensate cardiac output by increasing heart rate, not stroke volume
- Hypotension late sign; may indicate loss of 20-25% of blood volume
- Greater body surface area in proportion to body weight
  - Require proportionally more fluid for resuscitation and maintenance
Respiratory Characteristics

- Faster respiratory rate
  - Contributes to insensible fluid loss
- Smaller airways
  - Inhalation injury causing swelling
  - Increased airway resistance
Temperature Characteristics

- Less mature thermal regulatory system
- Higher BSA to body mass ratio
- Smaller amount of subcutaneous tissue
- Thinner skin
  - Disruption of barrier can lead to sepsis/infection
- Contributory Hypothermia:
  - Environment, exposure
  - Uncovering patient for assessment
  - Cool ambient temperatures of EMS vehicles
  - Wet or moist dressings
Developmental Characteristics

- Do not comprehend cause and effect, easily distracted and impulsive
- Do not determine speed of oncoming vehicles
- Sensory features:
  - Limited ability localize sound
  - Focus on single objects
- May not always realize consequences of their actions
Structures

- Relatively large and heavy head, weaker neck muscles
  - Up to 6-8 years
- Cranium thinner, more pliable
- Rib cage more flexible
- Less protected chest and abdominal organs
Pediatric Trauma Statistics in Virginia

Pediatric Trauma by Gender

<table>
<thead>
<tr>
<th>Year</th>
<th>Female</th>
<th>Male</th>
<th>Unknown</th>
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<tbody>
<tr>
<td>2013</td>
<td>760</td>
<td>1,241</td>
<td>50</td>
</tr>
<tr>
<td>2012</td>
<td>809</td>
<td>1,393</td>
<td>71</td>
</tr>
<tr>
<td>2011</td>
<td>804</td>
<td>1,359</td>
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</table>

- Female
- Male
- Unknown
Pediatric Trauma Statistics in Virginia

Pediatric Trauma by Type and Year

<table>
<thead>
<tr>
<th>Type</th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
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<tbody>
<tr>
<td>BLUNT</td>
<td>1,751</td>
<td>1,720</td>
<td>1,499</td>
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<tr>
<td>BURN</td>
<td>240</td>
<td>209</td>
<td>201</td>
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<tr>
<td>OTHER INJURY</td>
<td>173</td>
<td>170</td>
<td>186</td>
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<tr>
<td>PENETRATING</td>
<td>165</td>
<td>174</td>
<td>165</td>
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</tbody>
</table>
Pediatric Trauma Statistics in Virginia

Pediatric Trauma by Age

- 2011
- 2012
- 2013
Pediatric Trauma Triage

- What makes an alert?
- Core elements: Field Triage Document
  - Updated in 2011 from 2006
- Multi-step process with:
  - “When in doubt, take to a trauma center”
- Not all areas have ready access to trauma center
- Critical Access Hospital
- Rural Communities
Pediatric Assessment Triangle

From Pediatric Education for Pre-Hospital Providers
Pediatric Trauma Triage

- Primary Transport: Direct to Trauma Center
- Secondary Transfer:
  - Necessary for initial stabilization
  - Airway management
  - Delay to definitive care
- Consider air transport
Trauma Center Criteria:
Step One: Physiological Vital Signs and Level of Consciousness

- Glasgow Coma Score: Less than 13
  - 15 = 4(eye) + 5(Verbal) + 6(Motor function)
- Systolic Blood Pressure: Less than 90mmHg
- Respiratory Rate: Less than 10, More than 29, or requiring ventilator support
- If all are met and not corrected:
  - Transport to trauma center
  - Alert local Center of Trauma criterias
<table>
<thead>
<tr>
<th>Response</th>
<th>Child (1-5 years)</th>
<th>Infant (&lt;1 year)</th>
<th>Score</th>
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</thead>
<tbody>
<tr>
<td>Eye Opening</td>
<td>Spontaneous</td>
<td>Spontaneous</td>
<td>4</td>
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<tr>
<td></td>
<td>To Speech</td>
<td>To Speech</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>To Pain Only</td>
<td>To Pain Only</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>No Response</td>
<td>No Response</td>
<td>1</td>
</tr>
<tr>
<td>Best Verbal Response</td>
<td>Oriented, appropriate</td>
<td>Coos and Babbles</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Confused</td>
<td>Irritable cries</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Inappropriate words</td>
<td>Cries to Pain</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Incomprehensible sounds</td>
<td>Moans to Pain</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>No Response</td>
<td>No Response</td>
<td>1</td>
</tr>
<tr>
<td>Best Motor Response</td>
<td>Obeys Command</td>
<td>Moves Spontaneously and Purposefully</td>
<td>6</td>
</tr>
<tr>
<td></td>
<td>Localizes painful Stimulus</td>
<td>Withdraws to Touch</td>
<td>5</td>
</tr>
<tr>
<td></td>
<td>Withdraws in Response to Pain</td>
<td>Withdraws in Response to Pain</td>
<td>4</td>
</tr>
<tr>
<td></td>
<td>Flexion in response to Pain</td>
<td>Abnormal Flexion to Pain</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>Extension in Response to Pain</td>
<td>Abnormal extension posture to pain</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>No Response</td>
<td>No Response</td>
<td>1</td>
</tr>
</tbody>
</table>
## Pediatric Trauma Score

Predictor of Trauma Severity, applying specific physiological signs

<table>
<thead>
<tr>
<th>Pediatric Trauma Score</th>
<th>+2</th>
<th>+1</th>
<th>-1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight</td>
<td>&gt;20kgs (44 lbs)</td>
<td>10-22kgs (22-44lbs)</td>
<td>&lt;22kgs (&lt;10lbs)</td>
</tr>
<tr>
<td>Airway</td>
<td>Patent</td>
<td>Maintainable</td>
<td>Unmaintainable</td>
</tr>
<tr>
<td>Systolic BP</td>
<td>&gt;90mmHg</td>
<td>50-90mmHg</td>
<td>&lt;50mmHg</td>
</tr>
<tr>
<td>CNS</td>
<td>Awake</td>
<td>+LOC</td>
<td>Unresponsive</td>
</tr>
<tr>
<td>Fractures</td>
<td>None</td>
<td>Closed or Suspected</td>
<td>Multiple closed or Open</td>
</tr>
<tr>
<td>Wounds</td>
<td>None</td>
<td>Minor</td>
<td>Major, Penetrating or Burns</td>
</tr>
</tbody>
</table>
Penetrating Injuries to Head, Neck, Torso, or extremities proximal to elbow or knee

Chest wall instability or deformity

Two or more proximal Long Bone fractures

Extremity that is crushed, degloved, mangled, or pulseless

Amputation proximal to wrist or ankle

Pelvis Fracture

Open or depressed skull fracture

Paralysis
Trauma Center Criteria: Decision 1

- **IF** patient presents with:
  - Physiological Signs (Step 1)
  - Anatomical Injury (Step 2)
- Transport to a Trauma Center, preferentially the highest level center available, within the defined trauma system
  - CDC 2011 Guidelines for Field Triage of Injured Patients
- First steps identify most seriously injured patients
Trauma Center Criteria:  
Step Three: Mechanism of Injury

- **Falls**
  - Adults: >20 feet
  - Children: 10 feet or 2-3 times the height of child

- **High-risk Auto Crash**
  - Intrusion, including roof, >12" occupant side, 18" any site
  - Ejection, partial or complete
  - Death in same passenger compartment
  - Vehicle telemetry data consistent with high risk of injury

- **Automobile versus Pedestrian or Bicycle**
  - Thrown, run over, or impact greater than 20mph

- **Motorcycle crash >20mph**
Mechanism of Injury

- High energy
- Blunt or penetrating
  - Vehicle Crash
  - Firearms
- Burn trauma
  - Inhalation Trauma: requires definitive inhalation management
Burns

- Over-versus-under estimation
- Increase Threshold for scald and inhalation burns
  - 1st Degree Burns do not count in fluid resuscitation
- Inhalation Injury in Children is lethal
Challenging Presentations in Trauma

- Medical presentations
  - Seizure
  - Choking
- Strange injuries
  - Straddle injuries
  - Impalements
    - Pencils, rulers (Palate puncture/oral injury)
- Eye injury
- ENT
- Non-Accidental Trauma
  - Occult TBI
- Delay in care
  - Infection
  - Poor wound or orthopedic healing
Mechanism versus Injuries in Trauma Criteria

- Mechanism Criteria: tends to create additional trauma alerts, but by calling more frequent alerts, the process is “exercised”
  - Newer vehicle design and safety features create a “safer”
  - Sometimes difficult to communicate to receiving facility;
    - Fall: from height or onto concrete surface
- Injury criteria: may overlook blunt injury in the face of compensating vital signs
  - Blood Pressure is a delayed sign of shock in pediatrics
Trauma Center Criteria: Step Four, Special Considerations

- Special Populations:
  - Older Adults
  - Pregnancy
  - Anti-coagulant therapy
  - Bleeding Disorders

- **Children:**
  - Triage preferentially to pediatric-capable centers
  - So what does that mean?
Key Treatment

- Bleeding Control
- Airway management
- Treat for shock
- Do not be afraid off getting IV access
  - In trauma, may be the only chance!!!
What makes a “Trauma Care System?”

- “Network of definitive care facilities that provide a spectrum of care for all injured patients”
- Inclusive: “All-Encompassing Approach”
  - EMS
  - Community Medical Facilities
  - Designated Trauma Center
  - Tertiary Care
- Each component with definitive role
Comprehensive Trauma Care

- Prevention
- Response
- Treatment
- Rehabilitation and Reintegration
- Research
- Advocacy
- Education
Pediatric Trauma Center Designation: All the resources of the adult trauma center PLUS

- Pediatric rehabilitation
- Child life and family support programs
- Pediatric Social Work
- Child Protective Services
- Pediatric Injury Prevention
- Community Outreach
- Education of Health Professionals and the general public in care of pediatric trauma patients.
Virginia’s Trauma System

- Designated at state level
- Tiered System
  - Level I
  - Level II
  - Level III
Case #1

- MVC: 3 patients, unrestrained and ejected in 4 vehicle crash
  - 2 children: 6 year old critical, 11 year old serious
  - 1 adult: cardiac arrest, parent of children
- Bystander CPR in progress on parent
- What do you do?
- What influences your decisions?
Case Study: Family Dynamics

- Significant crash involving members of the same family
- Fatal events:
  - Parents
  - One or more children
- Incapacity:
  - Parent unable to communicate
  - Child too young or unable to communicate
- One parent involved, the other unavailable
Scene Triage

- What does your agency need to consider?
  - Transport Resources
  - Local hospital
  - Mutual Aid
  - Definitive Care/Specialty services
- As the incident commander, what are some key decisions?
Mass Casualty Incidents

- Defined: Event where the number of patients overwhelms available resources
  - Will depend on agency and regional resources
- **Goal: Do the most Good for the most number of people**
Complications in Pediatric Mass Casualty

- Pediatric mass casualty often focal locations
  - School bus
  - Day care center
  - Park
- Parents more aware and tuned in when events occur
  - Smart phones with news alerts
  - Text messages (or not) from kids
Complications in Pediatric Mass Casualty

- Resources:
  - Pediatric Emergency Medical Specialty centers?
  - Critical patients in need of care specialty care services
  - Overwhelming local hospitals
- Consent to treat from parents
  - Implied consent and regional treatment protocols
- Keeping families together
Case #2: Commercial Bus Crash

Challenges:

- Patient Tracking
- Reunification
- Language barriers

Patient developmental age

- Different age groups behave differently

Located between regions and trauma centers
Backboards?

- Limitations of C-collars and backboards
- Current NAEMSP position paper
- How does this apply to pediatrics?
Case Study

- Car versus tree:
  - Mother, father, three year old child
- Father killed, mother injured, child unhurt other than abrasion
Case Study

- Vehicle Overturned
  - Father, two adolescent children
  - Father injured seriously and unable to communicate
  - Children ambulatory on scene
- Only one ambulance is available; next due is 25 minutes away
Case Study

- School bus crash
  - 15 special needs patients
  - Limited ability to communicate
- Minimal overt injury
- How do you handle this?
EMS Decisions impact care of pediatric trauma patients

Pediatric patients present challenges beyond the clinical
Key Points

- Be open minded, match resources to situation
- Think outside the box for transport
- Keep families together as much as possible