Description of Penetrating Trauma in Children by Age and Location: A National Trauma Database Review

Joseph Kelly, MD, Matthew Levy, DO, Jennifer Anders, MD
1Division of Pediatric Emergency Medicine, The Johns Hopkins Hospital
2Department of Emergency Medicine, The Johns Hopkins Hospital

Background

• Lessons learned from the Global War on Terror have been increasingly incorporated into civilian care through programs such as Stop The Bleed & TCCC/TECC
• School shootings and terror attacks involve kids
• There has been little description of pediatric penetrating trauma outside of conflict zones

Objectives

• Describe the injury and mortality burden of penetrating trauma in children in the US
• Identify injury locations most commonly associated with “Early Death”
• Suggest priorities for pediatric point of injury management
Methods

- Retrospective review of penetrating trauma in children 1-18yrs old in the National Trauma Database from 2011-2016
- ICD codes were queried and reviewed for age, mechanism of injury, anatomic location of injuries, and Early Death
- Injury codes for superficial injuries and spine injuries were removed from analysis

Results

142,133 Total injuries reported
941 insignificant injuries
3484 spine injuries
137,708 injuries analyzed
Results

137,708
Total injuries

31,636
(23%)
Extremity

21,322
(15%)
Head & Neck

17,715
(13%)
Thorax

Locations of penetrating trauma by age in children with Early Death

- Sum of Thorax
- Sum of Abdomen & Pelvis
- Sum of spine
- Head/neck/face
- Combined ext

Results

41,543
Total Patients

1,477
Total Early Death

66 (4.5%)
Isolated Extremity

286 (19.5%)
Isolated Head & Neck

302 (20.5%)
Isolated Thorax
Results

142,153 Total injuries
544 Injuries associated with Early Death

594 (10.7%) Extremity
1528 (28.1%) Head & Neck
2364 (43.3%) Thorax

Conclusions

• Extremity injuries are the leading location of injury and the third most commonly associated with early death
• Thorax injuries resulted in the highest mortality burden
• Our data suggest pediatric priorities should mirror the overall prehospital trauma care emphasis on addressing thorax injuries & extremity hemorrhage, including the use of tourniquets, to reduce preventable deaths

Limitations

• This review is limited by the quality and quantity of data uploaded into the NTDB
• We are unable to show causation, only correlation
Implications/Next Steps

- Next steps include identifying the optimal site for prehospital Needle Decompression

Efficacy of CAT in Children

- Recent study of 60 children 6-16 years showed 100% efficacy in arms, 93% in legs
- Our study is enrolling 1-8 year olds

Results

<table>
<thead>
<tr>
<th>Age (yrs)</th>
<th>Weight (kg)</th>
<th>Height (cm)</th>
<th>Arm circumference (cm)</th>
<th>Leg circumference (cm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.7</td>
<td>12.8-23.9</td>
<td>87.0-122.0</td>
<td>13.0-24.0</td>
<td>24.5-34.5</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Range</th>
<th>Mean</th>
<th>5% WHO age correlate (boys)</th>
<th>5% WHO age correlate (girls)</th>
</tr>
</thead>
<tbody>
<tr>
<td>2.7</td>
<td>16.3</td>
<td>4y 2m</td>
<td>N/A</td>
</tr>
<tr>
<td>12.8-23.9</td>
<td>16.7</td>
<td>4y 0m</td>
<td>4y 1m</td>
</tr>
<tr>
<td>87.0-122.0</td>
<td>103.4</td>
<td>4y 2m</td>
<td>4y 1m</td>
</tr>
<tr>
<td>13.0-24.0</td>
<td>16.3</td>
<td>4y 4m</td>
<td>4y 1m</td>
</tr>
<tr>
<td>24.5-34.5</td>
<td>27.9</td>
<td>N/A</td>
<td>N/A</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>No. Subjects</th>
<th>Arms</th>
<th>Legs</th>
<th>Success (%)</th>
<th>95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total</td>
<td>13</td>
<td>13</td>
<td>100</td>
<td>85.8-100</td>
</tr>
<tr>
<td>1-4yr</td>
<td>7</td>
<td>6</td>
<td>100</td>
<td>73.5-100</td>
</tr>
<tr>
<td>1-4yr boys</td>
<td></td>
<td></td>
<td>100</td>
<td>73.5-100</td>
</tr>
<tr>
<td>1-4yr girls</td>
<td></td>
<td></td>
<td>85.8-100</td>
<td></td>
</tr>
</tbody>
</table>