Timely Hemodynamic Resuscitation and Discharge Outcomes in Severe Traumatic Brain Injury: Preliminary Findings

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for the PEGASUS (Pediatric Guideline Adherence and Outcomes) Study

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Background

- 630,000 ED TBI visits, 60,000 hospitalizations, 6000 deaths per year in children <18 years

- Early hypotension common event associated with increased morbidity and mortality post-TBI.

- Bratton (2008)
  - showed 39% hypotension
  - 48% had attempt to treat in early period
  - Attempt to treat associated with better outcomes

- Whether or not timely treatment of hypotension during early care improve outcomes is unknown
Aim
- To examine the association between timely treatment of hypotension during early care and discharge outcomes

Hypothesis
- Timely hypotension treatment during early care is associated with better discharge outcomes.

Inclusion Criteria of PEGASUS Study
1. Age <18 years
2. Admission Glasgow Coma Scale (GCS) score < 9
3. Head Abbreviated Injury Score (AIS) ≥ 3
4. Alive with ICU tracheal intubation ≥ 48 hours
5. Trauma history
6. Abnormal admission head CT findings
Data Abstracted and Main Exposure

- Resuscitation data during early care from 234 medical records abstracted for parent PEGASUS study

- Five level 1 pediatric trauma centers (2007-2011)

- Exposure: Timely treatment of hypotension during early care
  - Hypotension = systolic blood pressure < 5th percentile for age
  - Early Care = Pre-Hospital & Emergency Department
  - Timely = Treatment within 30 minutes of hypotension episode

Outcomes

- In-hospital mortality
- Glasgow Outcome Scale (GOS) score among alive
  - Poor (vegetative & major impairment)
  - Good (minor impairment & return to baseline status)
Clinical Characteristics of 234 Children with Severe TBI by Early Hypotension

<table>
<thead>
<tr>
<th></th>
<th>Early Hypotension (N=60; 26%)</th>
<th>No Early Hypotension (N=174; 74%)</th>
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<tbody>
<tr>
<td></td>
<td>No Timely Treatment N = 5; 8%</td>
<td>Timely Treatment N = 55; 92%</td>
</tr>
<tr>
<td>Other injuries N (%)</td>
<td>5 (100)</td>
<td>46 (84)</td>
</tr>
<tr>
<td>High intracranial pressure N (%)</td>
<td>5 (100)</td>
<td>42 (76)</td>
</tr>
<tr>
<td>In-hospital death N (%)</td>
<td>3 (60)</td>
<td>11 (20)</td>
</tr>
<tr>
<td>Poor discharge GOS N (%)</td>
<td>2/2 (100)</td>
<td>32/44 (73)</td>
</tr>
</tbody>
</table>
Method of Timely Treatment of Hypotension (N = 60/234) During Early Care by Treatment Location
Timely Treatment of Hypotension During Early Care and Discharge Outcomes in 234 Children with Severe TBI

<table>
<thead>
<tr>
<th>Discharge Mortality (N= 29/234)</th>
<th>aRR (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>No timely treatment</td>
<td>Reference group</td>
</tr>
<tr>
<td>Timely treatment</td>
<td>0.46 (0.24, 0.90)</td>
</tr>
<tr>
<td>No hypotension</td>
<td>0.23 (0.06, 0.87)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Discharge Glasgow Outcome Scale Score (N= 205/234)</th>
<th>aRR (95% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>No timely treatment</td>
<td>Reference group</td>
</tr>
<tr>
<td>Timely treatment</td>
<td>0.54 (0.39, 0.76)</td>
</tr>
<tr>
<td>No hypotension</td>
<td>0.56 (0.43, 0.73)</td>
</tr>
</tbody>
</table>

*adjusted for age, gender, head abbreviated injury severity (AIS) score, motor Glasgow coma scale (GCS) score, and maximum non-head AIS score and clustering analysis within institution performed.
**Limitations**

- Retrospective data
- Few patients in the no timely treatment group
- Did not capture correction of hypotension
- Residual confounding despite adjustments
Discussion

- High burden of early hypotension
- Hypotension during early care associated with in-hospital mortality
- Timely treatment of hypotension during early care associated with better discharge survival and GOS
- Better hemodynamic stability in first 30 minutes of hypotension may help achieve better cerebral hemodynamic conditions and improve post injury outcomes.
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- NINDS

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