TRENDS IN PEDIATRIC ADJUSTED SHOCK INDEX PREDICT MORBIDITY AND MORTALITY IN CHILDREN WITH SEVERE BLUNT INJURIES

Robert J. Vandewalle MD MBA, Julia K. Peceny BS, Scott C. Dolejs MD MS, Jodi L. Hackworth MPH, Thomas M. Rouse MD

Pediatric Adjusted Shock Index (SIPA)

- First described by Acker et al. 2015 (HR/SBP)
  - 4-6 years old: 1.22
  - 7-12 years old: 1.0
  - 13-16 years old: 0.9
  - Blunt trauma
  - ISS >15
- Predicted increased injury severity


Pediatric Adjusted Shock Index (SIPA)

- Further research validated SIPA
  - Severe head injury
  - Severe liver/spleen injury
  - Need for trauma team activation/intubation/surgery
  - Need for abdominal CT after blunt injury


Trending SIPA

- Utility of following SIPA after arrival not well described
- Outcomes related to SIPA for 1st 48 hours after admission
  - Inclusion/exclusion criteria
    - 2015 Acker et al.
    - Evaluated <12 hours after injury
    - SIPA calculated every 12 hours
  - “Normal” or “elevated” (binary independent variable)

Trending SIPA

- Outcomes
  - In-Hospital Mortality
  - Intensive Care Unit (ICU) Length of Stay (LOS)/Overall LOS
  - Total days of mechanical ventilation
  - Incidence of Ventilator Associated Pneumonia (VAP)
  - Blood transfusion within 24 hours of Admission
  - Discharge to Inpatient Rehabilitation
  - Injury Severity Score (ISS)/Head Abbreviated Injury Score (Head AIS)

Trending SIPA

- Results (1/01/2010-12/31/2015)
  - 286 patients
  - 66% male
  - Mean ISS: 22
  - Elevated SIPA at arrival: 79 (27.6%)
  - Normal SIPA then elevated at 12/24h: 57 (19.9%)
Trending SIPA

- Two groups identified
  - Elevated SIPA at arrival
    - Evaluated time for SIPA to normalize
  - Normal SIPA at arrival
    - Evaluated those with later SIPA elevated/stayed normal first 48h
    - Kruskal-Wallis test for continuous outcomes
    - Chi-Squared/Fisher’s Exact Tests performed where appropriate

Trending SIPA-ISS & Head AIS

- There were no statistical differences within each group with respect to trends in SIPA and ISS/Head AIS

Trending SIPA-Elevated At Arrival

<table>
<thead>
<tr>
<th>Death</th>
<th>Survival to discharge</th>
<th>Developed VAP</th>
<th>Transfusion in first 24 hours</th>
<th>Discharge to Rehabilitation</th>
<th>Rehabilitation not Needed</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.032</td>
<td>0.152</td>
<td>0.003</td>
<td>0.082</td>
<td>0.152</td>
<td>0.010</td>
</tr>
</tbody>
</table>

Trending SIPA-Normal At Arrival

<table>
<thead>
<tr>
<th>Death</th>
<th>Survival to discharge</th>
<th>Developed VAP</th>
<th>Transfusion in first 24 hours</th>
<th>Discharge to Rehabilitation</th>
<th>Rehabilitation not Needed</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.032</td>
<td>0.152</td>
<td>0.003</td>
<td>0.082</td>
<td>0.152</td>
<td>0.010</td>
</tr>
</tbody>
</table>
Trending SIPA-Summary

<table>
<thead>
<tr>
<th>Elevated SIPA at Arrival</th>
<th>Normal SIPA at Arrival</th>
</tr>
</thead>
<tbody>
<tr>
<td>Death</td>
<td>Significant X</td>
</tr>
<tr>
<td>VAP</td>
<td>x</td>
</tr>
<tr>
<td>ICU LOS</td>
<td>X</td>
</tr>
<tr>
<td>LOS</td>
<td>X</td>
</tr>
<tr>
<td>Days on Ventilator</td>
<td>X</td>
</tr>
<tr>
<td>Transfusion in 24h</td>
<td>x</td>
</tr>
<tr>
<td>Rehab</td>
<td>X</td>
</tr>
</tbody>
</table>

Trending SIPA

- Time to normalize an elevated SIPA at arrival
  - Direct relation ICU LOS, LOS, & Days of mechanical ventilation
  - Incidence of VAP
  - Mortality?
- Elevations in SIPA after arrival
  - Particularly in the first 12h of admission: worse outcomes

Trending SIPA-Limitations

- Retrospective
  - Only correlations could be determined
  - Goal would be to determine if correcting/maintaining normal SIPA affects these outcomes
  - Sample size prohibited additional analysis
- Future
  - Extension of ISS cutoff (currently underway)
  - Multi-Institutional study for further details of utility in trending SIPA

Shock Index (SI)

- SI: Heart Rate divided by Systolic Blood Pressure
- SI >0.9 abnormal
- Well described adult blunt trauma
  - Mortality
  - Need for Massive Transfusion
  - ICU Admission
- SI does not work in pediatric population

Thank You