Scoring Systems in Pediatric Acute Pancreatitis

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Amit Grover MB BCh BAO
Co-Director, Pancreatic Disorders Program
Outline

• Prediction Models – Why we need them
• Adult Scoring Models
• Pediatric Challenges
• Pediatric Scoring Models
  – PAPS, CTSI, Lipase, PJPN, “Cinci Score”, SIRS
• Conclusion
Prediction Models

• Public Health
• Research
• Clinical Practice
  – Probability of a disease/diagnosis
  – Threshold to start treatment
  – Therapeutic decision making
Markers of Severe AP (Adults)

- The presence of organ failure
- Systemic inflammation
- Single laboratory Tests
  - HCT, BUN, Cr, Glu
- Serial laboratory tests over the first 24-48hr
  - HCT, BUN, Cr, Fluid sequestration
Predictive Models for Severe AP (Adults)

- Ranson
- Imrie
- APACHE I/II
- HAPS
- Modified Glasgow
- CTSI/Balthazar
- BISAP
- Japanese Severity Criteria
Adults ≠ Children
Challenges in Pediatrics

• Limited number of pediatric studies
• Etiologies, co-morbidities, outcomes differ between children and adults
• Definitions, and guidelines for the management of AP only recently published
• No definitive, objective severity criteria currently exist in pediatrics
What do we know?

• Overall incidence of pediatric AP increasing\textsuperscript{1,2}
• 15-20\% of patients develop “severe” disease\textsuperscript{3}
• Fatal outcomes reported in \textasciitilde10\% of patients\textsuperscript{4}

• Multiple Pediatric Scoring models have been proposed

\textsuperscript{1}Morinville 2010  
\textsuperscript{2}Bai 2011  
\textsuperscript{3}Szabo 2016  
\textsuperscript{4}Benifla 2003
PEDIATRIC SPECIFIC SCORES
**PAPS (2002)**: first validated score in children

Severe outcome was predicted by meeting ≥3 of 8 criteria based on the following parameters:

- age, weight, admission WCC, admission LDH, 48hr trough Ca, 48hr trough albumin, 48hr fluid sequestration, and 48hr rise in serum BUN

Needed to wait 48hr to calculate score

Could not be reproduced in separate studies (Lautz et al. 2011, Suzuki et al. 2008)
• **CTSI (2012):** first report examining the utility of CT imaging as predictor of severe disease in children

• Grading based on appearance of pancreas, presence of fluid collections and extent of necrosis at PRESENTATION

• 64 cases, of which 17 (26%) had severe disease
  – Reported a higher Sensitivity (81%) and NPV (90%) than PAPS, Ranson and Glasgow

• Clinical scores just as accurate of CT scores (Bollen et al, 2012)

• We want to avoid radiation exposure in children
Serum Lipase as an Early Predictor of Severity in Pediatric Acute Pancreatitis

*Michael J. Coffey, †Scott Nightingale, and ‡Chee Y. Ooi

• Aim: to identify a predictor of severe disease within 24hr of presentation.

• Retrospective analysis examining laboratory predictors of severe AP within 24hr of presentation at 2 different hospitals.

• **Serum lipase > 7xULN** within 24 hours of presentation may be a simple clinical predictor of severe AP in children.

• Lipase alone has not been demonstrated in larger adult studies, and not validated prospectively in pediatric studies.
Scoring system for the prediction of severe acute pancreatitis in children

Mitsuyoshi Suzuki, Nobutomo Saito, Nakayuki Naritaka, Satoshi Nakano, Kei Minowa, Yuka Honda, Yoshikazu Ohutsuka, Atsuyuki Yamataka and Toshiaki Shimizu

Departments of 1Pediatrics and 2Pediatric General and Urogenital Surgery, Juntendo University School of Medicine, Tokyo, Japan

• **Pediatric JPN Score (2014):** Based on the Ministry of Health, Labor and Welfare of Japan AP Score (JPN); however includes pediatric parameters (age, weight, SIRS).

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Pediatric JPN scoring system</th>
<th>JPN scoring system (2008 version)</th>
<th>Parameter</th>
<th>DeBanto score</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>BE ≤ −3 mEq</td>
<td>BE ≤ −3 mEq</td>
<td>Parameter</td>
<td>Parameter</td>
</tr>
<tr>
<td></td>
<td>or shock (Table 2 lists SBP</td>
<td>or shock (SBP ≤ 80 mmHg)</td>
<td></td>
<td>DeBanto score</td>
</tr>
<tr>
<td></td>
<td>depending on age</td>
<td></td>
<td></td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>PaO2 ≤ 60 mmHg (room air)</td>
<td>PaO2 ≤ 60 mmHg (room air)</td>
<td></td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>or pulmonary insufficiency</td>
<td>or pulmonary insufficiency (ventilation required)</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>(ventilation required)</td>
<td></td>
<td></td>
<td>Admission LDH &gt; 2000 U/L</td>
</tr>
<tr>
<td>3</td>
<td>BUN ≥ 40 mg/dL (or Cr ≥ 2 mg/dL)</td>
<td>BUN ≥ 40 mg/dL (or Cr ≥ 2 mg/dL)</td>
<td></td>
<td>1</td>
</tr>
<tr>
<td></td>
<td>or urine volume &lt; 0.5 mL/kg/h even after fluid resuscitation</td>
<td>or urine volume &lt; 400 mL/day even after fluid resuscitation</td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>4</td>
<td>LDH ≥ 2 × above upper limit (Age-adjusted value)</td>
<td>LDH ≥ 2 × above upper limit</td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>5</td>
<td>Platelet count ≤ 1 × 10^9/mm³</td>
<td>Platelet count ≤ 1 × 10^9/mm³</td>
<td></td>
<td>Age &lt; 7 years</td>
</tr>
<tr>
<td>6</td>
<td>Ca ≤ 7.5 mg/dL</td>
<td>Ca ≤ 7.5 mg/dL</td>
<td></td>
<td>Weight &lt; 23 kg</td>
</tr>
<tr>
<td>7</td>
<td>CRP ≥ 15 mg/dL</td>
<td>CRP ≥ 15 mg/dL</td>
<td></td>
<td>4</td>
</tr>
<tr>
<td>8</td>
<td>Pediatric SIRS score ≥ 3</td>
<td>SIRS score ≥ 3</td>
<td></td>
<td>5</td>
</tr>
<tr>
<td>9</td>
<td>Age &lt; 7 years and/or weight &lt; 23 kg</td>
<td>Age ≥ 70 years</td>
<td></td>
<td>6</td>
</tr>
</tbody>
</table>

Table 1 Comparison of parameters of three scoring systems


Table 6  Clinical and laboratory parameters

<table>
<thead>
<tr>
<th>Patient criteria met</th>
<th>Mild AP (n = 135)</th>
<th>Severe AP (n = 10)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean ± SE</td>
<td>Range</td>
</tr>
<tr>
<td></td>
<td>n</td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>−2.6 ± 2.7</td>
<td>8</td>
</tr>
<tr>
<td>BE ≤ −3 mEq or shock</td>
<td>0</td>
<td>135</td>
</tr>
<tr>
<td>2</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>PaO₂ ≤60 mmHg (room air) or pulmonary insufficiency</td>
<td>0</td>
<td>135</td>
</tr>
<tr>
<td>3</td>
<td>10.6 ± 0.45</td>
<td>135</td>
</tr>
<tr>
<td>BUN ≥40 mg/dL or oliguria (&lt;0.5 mL/kg/h)</td>
<td>0</td>
<td>135</td>
</tr>
<tr>
<td>4</td>
<td>1.13 ± 0.05</td>
<td>119</td>
</tr>
<tr>
<td>LDH ≥ 2 × above upper limit</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>29.9 ± 1.0</td>
<td>135</td>
</tr>
<tr>
<td>Platelet count ≤ 1 × 10^5/mm^3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>9.53 ± 0.07</td>
<td>126</td>
</tr>
<tr>
<td>Ca ≤7.5 mg/dL</td>
<td>2.36 ± 0.29</td>
<td>135</td>
</tr>
<tr>
<td>CRP ≥15 mg/dL</td>
<td>2</td>
<td>135</td>
</tr>
<tr>
<td>Pediatric SIRS score ≥ 3</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8</td>
<td>7.38 ± 0.03</td>
<td>135</td>
</tr>
<tr>
<td>Age &lt;7 years and/or weight &lt;23 kg</td>
<td>26.3 ± 1.3</td>
<td>135</td>
</tr>
</tbody>
</table>

AP, acute pancreatitis; BE, base excess; BUN, blood urea nitrogen; Ca, calcium; CRP, C-reactive protein; LDH, lactate dehydrogenase; PaO₂, partial pressure of arterial oxygen; SIRS, systemic inflammatory response syndrome.
• Retrospective analysis involving ROC analysis with derivation/validation cohorts to determine predictors of SAP.

• Similar to Coffey’s study; however, much larger sample size across multiple institutions.

• Derivation cohort involved 284 admissions of AP, (19% SAP)
  – Predictors of severe disease included WBC, Albumin, Lipase
• Validation cohort (2 add’l institutions) involved 165 cases, where SAP ranged from 8-20%.
  – Predictors of SAP: WBC and albumin
• Combined cohorts included 369 cases
  – Predictors of SAP: WBC, Albumin, Lipase (AUROC 0.76, 95% CI: 0.7, 0.83)
  – Sensitivity: 68%, Specificity: 71%
• Continuous variable analysis
  – elevated WBC, low Albumin, elevated Lipase suggestive of SAP

• No specific cut off values determined
• Retrospective in nature
• Good sample size (largest study to date)
The Utility of the Systemic Inflammatory Response Syndrome Score on Admission in Children With Acute Pancreatitis

Amit S. Grover, MB BCH BAO,* Vivek Kadiyala, MD,† Peter A. Banks, MD,† Richard J. Grand, MD,§ Darwin L. Conwell, MD,‡ and Jenifer R. Lightdale, MD, MPH§

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• Retrospective study
• 50 encounters, where AP was the admitting diagnosis, in children at BCH (2010)
  – 84% met INSPIRE Criteria for AP
  – 8 transferred to the ICU, 0 deaths
  – Median Length of Stay (LOS) 4.5 days
• 44% met SIRS criteria at presentation within the ED
  – Median LOS for patients with SIRS (8 days) > without SIRS (3 days); \( p<0.001 \)
  – 32% of those with SIRS were admitted to the ICU

• Controlling for co-morbid disease and age:
  – SIRS at admission was independently associated with increased LOS (OR 7.99, \( p<0.045 \)) and admission to ICU (OR 12.06, \( p<0.027 \))
• Other markers reported in the literature:
  – HgB
  – Elevated HCT
  – Elevated BUN
  – Lipase >7x ULN
  – BMI >90%ile
  – Age

• **None** were associated with ICU admission, nor prolonged LOS
Take home points…

• The lack of a consistent, universally accepted definition of SAP in pediatrics will continue to be a limitation to prognostic studies until a consensus agreement is reached on the best definition that can be used in practice.

• Assessment of severity at the initial medical examination plays an important role in providing adequate early treatment and transferring patients to a medical facility equipped to treat severe AP.

• Future, multicenter prospective studies will be instrumental in developing and validating a predictive model for severe pancreatitis in children.
Questions?

@pancreas_MD