306: Procalcitonin Levels: Are Lumbar Punctures a Thing of the Past? (Acute Care) (Infectious Disease Mini-Track)

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Speaker Introduction

- Chris Kyper has been a pediatric nurse practitioner for 25 years. She is certified in both primary and acute care. Ms. Kyper spent the first nine years practicing in primary care then transitioned into emergency and critical care medicine. Most of her career was spent in Pittsburgh, but currently she is practicing in Anchorage, Alaska, in the PICU at the Alaska Native Medical Center. In May, Ms. Kyper will graduate from Robert Morris University with her DNP. Her capstone project focused on the long-term outcomes of burn injured patients at the Alaska Native Medical Center.

Learning Objectives

- Define the role of procalcitonin in infection.
- Describe the epidemiology of bacteremia in the febrile infant.
- Identify current evidence-based practices for evaluating and treating the febrile infant.
- Discuss current practices among the participants and how procalcitonin is being used in their practice setting.

Background

- 500,000 febrile infants are evaluated annually
- 8-13% have a serious bacterial infection (SBI)
- SBIs have serious complications

Historical Perspective

- 1970s
- Complete sepsis work-up for all infants younger than 2 months
- Approach varied widely
1980s

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Minimum duration (in days)</th>
<th>Minimum duration (in days)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fever and physical examination</td>
<td>3</td>
<td>3</td>
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<tr>
<td>Leukopenia (less than 4000/mm³)</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Tachycardia (heart rate &gt;100/min)</td>
<td>1</td>
<td>1</td>
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<tr>
<td>Abdominal distention</td>
<td>No</td>
<td>No</td>
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Historical Perspective

1990s
- Let the experts handle it
- Only consensus was for under 28 days
- Practice varied widely
- Networks developed
- Recursive partitioning

2000s
- Why restrict the work-up?
  - Hospitalization and length of stay
  - Cost
  - Antibiotic use
  - Traumatic taps
  - Parental anxiety
  - Additional illness exposure in hospital

Why has it been difficult to develop consensus?
- Changing bacteriology
- Clinical experience influencing decision making
- Risk tolerance
- Development of better inflammatory markers

Erythrocyte Sedimentation Rate (ESR or sed rate)
- Non-specific measurement of inflammation
- Affected by both inflammatory and non-inflammatory conditions
- Relatively imprecise and non-specific test compared to other available diagnostic tests

C-reactive protein (CRP)
- Acute phase response
- Produced in the liver
- Interferon alpha inhibits CRP production from liver cells which may explain the relatively low levels of CRP found during viral infections
**Procalcitonin (PCT)**
- Level in healthy individuals is below limit of detection
- Acute phase reactant
- Elevation can be seen in 4-12 hours from onset of infection with half-life spanning anywhere from 22-35 hours
- Does not significantly rise with viral infections or non-infectious inflammations
- It's utility as a marker for bacterial meningitis has been well studied

**What is a Clinical Prediction Rule?**
- Attempt to identify best combination of medical signs, symptoms and lab studies to predict the probability of a specific disease or outcome
- Overcomes tendency towards overestimation and base rate fallacy

**Pediatric Emergency Care Applied Research Network**

**A Clinical Prediction Rule to Identify Febrile Infants 60 Days and Younger at Low Risk for Serious Bacterial Infections**
- Published in JAMA Pediatrics February 2019
- Conducted by the Febrile Infant Work Group of PECARN

**Study Objective**
- To derive and validate a prediction rule to identify febrile infants 60 days and younger at LOW RISK for SBIs.

**Design**
- Prospective, observational study
- Convenience sample
Sample
- Prediction rule was derived from a random sample of 908 infants
- The Validation of the rule was done on 913 infants (mean age 36 days)
- SBI was present in 170 of 1812 infants (9.3%)
  - 26 (1.4%) bacteremia
  - 151 (9.3%) UTI
  - 10 (0.5%) bacterial meningitis

Inclusion criteria
- Rectal temperature of at least 38°C in ED, a prior health care setting, or at home within 24 hours
- Availability of researchers at time of blood culture collection

Exclusion Criteria
- Critically ill appearing
- Received antibiotics in preceding 48 hours
- History of prematurity (<36 weeks gestation)
- Preexisting medical condition
- Indwelling catheters
- Soft tissue infections
- Patient with otitis media were not excluded

Statistical Analysis
- Binary recursive partitioning to identify a low-risk cohort
- 3 variables retained – UA, ANC, and PCT
- ANC was rounded to 4,000/μL
- PCT cutoff 0.5ng/ml which is what had been used in previous studies
- UTI definition modified to 10,000 – 50,000 cfu/ml

Validation cohort
- Sensitivity 97.7%
- Specificity 60.0%
- Negative Predictive Value (NPV) 99.6%
- One infant with bacteremia and 2 with UTI misclassified
- No infants with bacterial meningitis were missed

Significance
- 1226 infants aged 29 to 60 days, 776 (61.3%) were at low risk for the prediction rule
- 523 of the 776 (67.4%) had lumbar punctures
- The rule would have spared 523 infants a lumbar puncture
Why is PCT better?

- Takes 30 – 120 minutes to perform
- Rises earlier in bacterial infections than CRP
- Cost POC

Summary of rule

- High sensitivity
- High NPV
- Internally validated
- Does not require CSF data
- Objective
- Does not exclude infants with respiratory symptoms
- Utilizes higher threshold for PCT than previously published
- Still needs external validation
- Caution in using in infants under 29 days

Conclusion

- Currently approach to febrile infants can be variable
- Reliance on “gut instinct” and clinical judgement has not been shown to be a valid predictor
- Potential to significantly reduce the use of lumbar puncture, antibiotics, and hospitalization

Discussion

- Anyone currently using this prediction rule?
- Would you be comfortable using it after this discussion?
- Who is still not sure?
- Anyone using other prediction rules for other illnesses or diseases?

References

- Anymore.com, accessed 1/9/2020