Fever Frustration: Unraveling the mysteries and inconsistencies of fever management of infants less than 90 days

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Speaker Introduction

• Dr. Ashleigh Bowman is a certified pediatric acute care nurse practitioner who has been practicing for nearly four years in the pediatric emergency department and joined the University of South Alabama as full-time faculty in the pediatric acute care nurse practitioner track in 2019. Her practice setting is a 20-bed pediatric emergency department in Mobile, Ala., within the only children's specialty hospital in the region. This department hosts a multitude of physicians, advanced practice providers and learners across three different residencies, as well as countless students. She completed her DNP degree in 2018 and has been involved in developing clinical pathways to aid in delivering consistent, evidence-based care within the emergency department.

Disclosures

There are no conflicts of interest to declare.

Learning Objectives

• Identify best practices for clinical diagnostics of fever in infants less than 90 days in the emergency setting and the relationship with serious bacterial infections.
• Define current incidence of serious bacterial infection and epidemiology of current pathogens.
• Determine best practices for clinical management of fever, including antibiotic therapies, in infants less than 90 days.
• Describe methods and develop plans for reducing inconsistencies of fever management within their institution.

Incidence of presenting complaint in this age group

• Fever ranks as the most common reason for a visit to the emergency department (ED) in pediatric patients less than 15 years of age
• Fever is among the top 3 reasons for visits to Urgent Care and the ED for pediatric Medicaid population
• Fever in infants accounts for approximately 500,000 ED and outpatient visits annually
Lack of Standardized Approach and Guidelines

- Written protocol existed in only 36% of hospitals surveyed
- Variances in definition of febrile infant
- Variances in diagnostics/observation versus presumptive treatment in low-risk infants

Definitions

- Full septic workup
  - CBC +/- CRP/PCT
  - Blood culture
  - U/A with culture
  - Serum glucose
  - LFTs
  - CSF studies with culture
  - Stool culture (if needed)

Current Incidence of SBI

- UTI is the most common SBI
  - SBI in febrile infants <90 days is 8 to 12.5%
  - SBI in neonates is approximately 20%

Epidemiology of Current Pathogens

- Common pathogens
  - E. coli
  - GBS
  - S. viridans
  - S. aureus
  - Enterobacter
  - Enterococcus species
  - K. pneumoniae
  - Salmonella
  - N. meningitidis
  - Listeria / HSV (neonates)
History
- Method of temperature measurement
- Associated symptoms
- Detailed birth history
- Complications during newborn stay
- Family history

Physical Exam
- Difficult to arouse/console
- Bulging fontanel
- Jaundice
- Respiratory distress/abnormal lung sounds
- Murmur
- Weak pulses
- Vesicles

Risk Stratification Systems

Rochester Criteria
- <60 days
- Term birth
- No antibiotics/vaccines in last 48 hours
- Well-appearing
- WBC 5,000-15,000 / Bands<1,500
- U/A <10 WBC/hpf
- CSF not required

Boston Criteria
- 28-89 days
- No antibiotics or vaccines in the past 48 hours
- Well-appearing
- WBC <20,000
- U/A <10 WBC/hpf
- CSF <10 WBC
- No focal findings on CXR

Philadelphia Criteria
- 29-60 days
- Well-appearing
- WBC 5,000-15,000
- U/A <10 WBC/hpf
- CSF <8 WBC
- No focal finding on CXR
**PECARN Clinical Prediction Rule**

- 0-60 days
- No antibiotics in the past 48 hours
- Well-appearing/no significant medical history
- No soft tissue infection
- U/A: negative LE/nitrites, <5WBC/hpf
- ANC <4090
- PCT <1.71

**Step-by-Step Approach**

- 0-90 days
- Well-appearing/no obvious source for fever
- No leukocyturia
- PCT <0.5
- CRP <20
- ANC <10,000

**Febrile Infant <28 days**

**Case Study #1**

- HPI: 13 day old infant presents with fever (tmax 100.8 F rectally) x 6 hours to the ED. Denies treatment pre-arrival. Denies URI symptoms. Breastfeeding well with approximately 6 to 8 wet diapers/day and yellow, seedy stools with each feeding.
- Birth History: Uncomplicated vaginal delivery at 39+2 weeks, no maternal fevers, GBS status negative, 2 day NBN stay
- Exam: Infant is alert and vigorous, anterior fontanel is soft and flat, skin is warm and pink without jaundice, breath sounds are clear, regular rhythm without murmur, brachial and femoral pulses 2+ bilaterally

**Case Study #1 : Test your knowledge**

- What initial lab studies are needed?
  - A. CBC, CRP/PCT, Blood culture, HSV testing, CSF studies with culture
  - B. CBC, CRP/PCT, Urinalysis with culture, Blood culture
  - C. CBC, CRP/PCT, Chemistry panel, Blood culture, CSF studies with culture, stool studies
  - D. CBC, CRP/PCT, Chemistry panel, Urinalysis with culture, Blood culture, CSF studies with culture

**Risk Stratification for Diagnostic Decision Making**

- Ill-appearing infant
  - Full septic workup
  - Consider other differentials
- Well-appearing infant
  - Full septic workup
  - Consider HSV testing in infants <21 days
Febrile Infant 29 to 56 days

Management / Treatment
- Admission with empiric therapy
  - ampicillin plus cefotaxime or gentamicin
- cefotaxime is preferred for CSF penetration but is no longer in production
  - cefotaxime – well-appearing
  - ceftriaxone – ill-appearing
- vancomycin if ill-appearing/CSF pleocytosis/Gram +ve organisms on Gram stain
- acyclovir if HSV testing was done and/or high risk

Case Study #2
- HPI: A well-appearing 48 day old infant presents to the ED with fever (tmax 101.1F rectally) x 1 day. Mother denies any respiratory complaints. The infant continues to feed well with normal urine/stool output.
- Birth History: Uncomplicated vaginal delivery at 38+4 weeks, discharged at 48 hours of life from the NBN
- Initial work-up revealed WBC 9K, CRP 0.7, PCT 0.25. Urinalysis was unremarkable with blood and urine cultures pending.

Case Study #2 – Test your knowledge
- What is the recommended management and treatment for this patient?
  - A. A lumbar puncture is indicated for this infant and admission for empiric therapy until CSF cultures are returned.
  - B. This infant can be discharged home without empiric therapy, provided 24-hour follow-up can be arranged.
  - C. This infant should be given ceftriaxone x 1 in the ED and return within 24 hours for follow-up.
  - D. A lumbar puncture is needed to complete risk stratification.

Risk Stratification for Diagnostic Decision Making
- Ill-appearing infant
  - Full septic workup
  - Defer LP if clinically unstable
  - May defer LP if WBC is positive
- Well-appearing infant
  - CBC with diff
  - U/A with culture
  - CRP
  - PCT
  - Blood culture
  - LP is not necessarily needed

Management / Treatment
- Admission and empiric treatment for ill-appearing infants
  - Empiric treatment should consist of third-generation cephalosporin
  - ampicillin plus third-generation cephalosporin or gentamicin if meningitis is suspected
  - Add vancomycin if there is CSF pleocytosis or Gram +ve organisms on Gram stain
  - No empiric treatment indicated for low-risk infant if 24-hour follow-up can be guaranteed
  - If no follow-up can be arranged, consider hospitalization
  - Hold treatment if no CSF was obtained
Febrile Infant 57 to 89 days

Case Study #3

• HPI: A well-appearing 75 day old infant presents to the ED for evaluation of fever (tmax 101.5F rectally) x 36 hours. Mother reports wheezing and a coarse cough for the same duration. However, the infant continues to feed and urinate as normal.

• PMH/PSH: Born at 40+1 weeks via uncomplicated vaginal delivery, received routine 2 mo immunizations 10 days ago, does attend daycare

• Rapid antigen testing was positive for RSV.

Case Study #3 – Test your knowledge

• What is the recommended management and treatment of this infant?
  • A. This infant needs a urinalysis with culture to complete the work-up for fever.
  • B. No further testing is needed because the RSV bronchiolitis is a documented source for fever.
  • C. A CBC, CRP, PCT urinalysis with culture, and blood culture are needed to complete the work-up for fever.
  • D. Mother needs to be supplied with a nebulizer for home use, and the infant should be given ceftriaxone x 1 in the ED.

Risk Stratification for Diagnostic Decision Making

• Ill-appearing infant
  • Full septic workup

• Well-appearing infant
  • U/A with culture
  • For infant without respiratory symptoms:
    • CBC
    • CRP
    • PCT
    • Blood culture

Management / Treatment

• Admission and empiric treatment for ill-appearing infants
  • Empiric treatment should consist of third-generation cephalosporin
  • Add vancomycin if there is CSF pleocytosis or Gram +ve organisms Gram stain
  • No empiric treatment indicated for low-risk infant
  • 24-hour follow-up must be guaranteed

Reducing Inconsistencies in Practice
Further Diagnostic Considerations

- Rapid antigen testing for all infants with respiratory symptoms
  - Infants 29 to 60 days had a lower risk for SBI when positive
  - Neonates with RSV had same risk
- U/A with culture should be performed in infants with bronchiolitis/RSV/Flu
  - Strong consideration for blood culture, CBC/ANC, CRP/PCT

Further Diagnostic Considerations

- CBC is not accurate or reliable for prediction of IBI
- Chest x-ray not routinely recommended
- Stool studies if clinically indicated
- CSF enterovirus testing is indicated in infants <60 days who are admitted

Lack of Clinical Practice Guidelines

- Adopting a standardized approach reduces inconsistencies in practice
- Development or adoption of clinical pathways
- Use of validated prediction tools
  - MDCalc - https://www.mdcalc.com/
  - Rochester criteria
  - Step-by-Step Approach
  - PECARN Clinical Prediction Tool

In Conclusion

Key Points

- Management of febrile infants has historically been inconsistent
- There are no published clinical practice guidelines on this topic
- Clinical pathways should be developed or adopted to guide a standardized approach

Key Points

- All infants <28 days and ill-appearing infants should receive a full septic workup
- Appropriate diagnostic tests for infants 29 to 89 days is determined using risk stratification
- Management and antibiotic therapy are further guided by diagnostics and risk stratification