This evidence-based care process model (CPM) was developed by Intermountain Healthcare’s Pediatric Specialties Clinical Program in collaboration with the Intensive Medicine Clinical Program. It recommends a protocol for assessing, evaluating, and treating well-appearing infants age 1 to 90 days who present to the emergency department with a rectal temperature of 38°C or higher or with a reliable history of fever. Note that a separate document defines care for neonatal sepsis (Neonatal Early Onset Sepsis Clinical Pathway for Level I and Level II Nurseries) and that the Inpatient Management of Febrile Infants CPM complements this model.

This update reaffirms key points of the original 2008 model while adding clarification and new recommendations regarding testing.

**KEY POINTS REAFFIRMED**

- **Risk classification is crucial.** Testing and care shouldn’t be the same for all infants with fever. Low-risk infants have approximately a 1.4% occurrence of serious bacterial infection (SBI), but some high-risk infants have an occurrence of up to 21%.<sup>1,2</sup> Note that urinary tract infection (UTI) is the most common serious bacterial infection among febrile infants.

- **Lab tests (CBC and UA) are important for classifying infants as high or low risk for SBI.** Risk for SBI cannot be determined through physical examination alone. In a study of over 3,000 febrile infants, only 58% of those with bacteremia/bacterial meningitis appeared clinically ill.<sup>3</sup> Along with consideration of the infant’s age, CBC and UA results can help providers decide whether to admit or discharge to home.

- **Viral testing helps to classify infants further.** Testing for respiratory viruses should be performed throughout the year. Although RSV and influenza peak during the winter (November to April), other viruses circulate year-round. Since the incidence of enterovirus (EV) in febrile infants is particularly high in the summer (up to 50% higher in August and October), enterovirus PCR testing is recommended from June through November as well as with any finding of CSF pleocytosis.<sup>4,5,6</sup>

**NEW IN THIS UPDATE: clarification, new recommendations regarding testing**

See pages 2 and 3 of this model for more detail on the points summarized below:

- **Enterovirus PCR testing.** Note that we recommend testing seasonally (June through November) — and always with a finding of CSF pleocytosis (>18 WBC for infants 1 to 28 days of age; >9 WBC for infants 29 to 90 days).<sup>5</sup>

- **RSV-positive results.** Any infant 29 to 90 days of age with a positive RSV result and temperature ≤ 38.5°C does not require additional testing.

- **Rhinovirus-positive PCR results.** Intermountain data indicate that detection of rhinovirus alone is not significant in predicting a low risk for SBI.<sup>7</sup> Treat as viral negative.

- **HSV signs.** Neonatal HSV is rare but serious. We recommend testing and treating infants age 42 days and younger with vesicular skin lesions, abnormal CSF, or seizures. Consider testing and treating if infant has a septic appearance. Discontinue acyclovir if HSV test results are negative.

**Why Focus ON FEVER IN YOUNG INFANTS?**

Nearly 20% of emergency room visits for this age group are for evaluation of fever. While only 8% to 10% of babies will have serious bacterial infection (SBI), the consequences of a missed diagnosis are significant. Yet overtreating the 90% of infants who do not have SBI also poses risks.

What’s needed is a consistent approach that effectively evaluates risk and treats infants appropriately. This model — and the companion CPM, Inpatient Management of Febrile Infants — outlines such an approach.

**RESULTS**

- **Pilot:** Early discharge based on the recommendations in this CPM was piloted on 100 infants at Primary Children’s Medical Center and resulted in savings over $3,000 per admission and a 98% satisfaction rating from parents.<sup>8</sup>

- **System-wide implementation:** This model has helped ensure that febrile infants 1 to 90 days of age consistently receive appropriate, evidence-based care at Intermountain hospitals. Since system-wide implementation in 2008, we have seen these improvements (shown as a % of our cases):
  - Initial lab testing to determine risk status (increased from 57% to 87%)
  - Appropriate viral tests conducted (increased from 56% to 74%)

Following implementation in our EDs, there have been no missed cases of meningitis.

**GOALS**

- Ensure that appropriate labs are collected for infants age 1 to 90 days.
- Improve decision-making regarding the inpatient or outpatient management of the well-appearing febrile infant.
ALGORITHM: EMERGENCY CARE OF THE WELL-APPEARING FEBRILE INFANT 1–90 DAYS OF AGE

**INITIAL ASSESSMENT**

**Fever of ≥38°C on a single rectal temperature**

(orr a reliable history of fever)

**INFANT IS <28 DAYS OR premature (<37 weeks) with underlying medical condition?**

Gives clinical impression of possible SBI?

**HSV suspected**

Suspect HSV (vesicular skin lesions or seizure) or RSV (respiratory distress)?

**RSV suspected**

TEST specimen for RSV

**HIGH RISK for SBI**

OR **ABNORMAL CSF** (see definitions at right),

OR suspected **NEONATAL HSV**,

OR **CLINICAL IMPRESSION OF HIGH RISK**

**LIMITED TESTING** see p. 3 discussion (a)

- **Urine** (by cath):
  - UA dipstick
  - Urine culture
- **Blood**:
  - CBC with diff
  - Peripheral blood culture
- **CSF with culture**. See guidance for RSV-positive infants, page 3 discussion (a)
- **CXR** if significant respiratory signs or symptoms
- **Viral studies**:
  - Respiratory panel
  - Enterovirus PCR on blood and CSF from June to Nov — and always in patients with CSF pleocytosis
  - HSV evaluation (see sidebar, page 3) for all infants ≤42 days with vesicular skin lesions, seizure, or abnormal CSF. Testing may be indicated for an infant with a septic appearance.

**LOW RISK**

- **No treatment**
- OR **Antibiotics per dosages at left** — recommend attempt to obtain CSF before initiating IV antibiotics.

**INITIAL TREATMENT**

**ADMIT**

- • Admit locally OR • Consider consult or transfer

**DISPOSAL**

- **ADMIT**
  - • Schedule follow-up within 24 hours
  - • Provide patient/family education

- **NO FURTHER TESTING** see p. 3 discussion (a)

- • Urine (by cath):
  - UA dipstick
  - Urine culture
- **Blood**:
  - CBC with diff
  - Peripheral blood culture
- **Consider viral studies if admission is planned**

If IV antibiotics will be given, CSF should be obtained prior to antibiotic administration.

**NO FURTHER TESTING** see p. 3 discussion (a)

**ABNORMAL CSF**: 

- • Urine: any positive LE or nitrite; if microscopy positive bacteria or >10 WBC/hpf
- • WBC <5,000 or >15,000
- • Absolute band count ≥1,500

**TOTAL TESTING** see p. 3 discussion (a)

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**NO FURTHER TESTING** see p. 3 discussion (a)
DISCUSSION

(a) Laboratory studies

1. RSV-positive results. Follow these guidelines:
   - At any age, if you intend to give antibiotics, complete full diagnostic testing, including blood, urine, and CSF cultures.
   - For infants 28 days or younger with confirmed RSV, the physician may elect to test blood and urine and to observe inpatient without antibiotics. The most common cause of SBI in this group is UTI with or without bacteremia.9,10,11 Bacterial meningitis is very rare in infants with confirmed RSV.9
   - If the infant is 29 to 90 days of age and the temperature is ≤38.5°C, no additional lab testing is needed and the infant may be treated as low risk for SBI. (These infants have less than 2% risk of any SBI).3,12

2. Urinalysis results. Urinalysis should be performed for all febrile infants to determine the presence of leukocyte esterase (LE), nitrite, or bacteria; or >10WBC/hpf. The only exception is in infants 29 to 90 days of age with confirmed RSV infection and a temperature ≤38.5°C; these infants do not need UA testing. In an Intermountain study of over 5,000 febrile infants, LE was the single best test for identification of UTI in febrile infants. An LE result of trace or greater predicted UTI with a sensitivity of 87%. In addition, 98% of febrile infants with negative LE results had no UTI predicted.

3. Collecting samples for bacterial studies. Samples for all planned bacterial studies should be gathered before any antibiotic treatment is begun. Collecting CSF or blood samples after antibiotics have been started may result in false negative results.

4. Viral studies. Viral studies can help determine risk for SBI; infants with a virus (other than rhinovirus) are less likely to have SBI.
   - Testing for respiratory viruses is recommended year-round.2,6 Note that although rhinovirus is the most frequently identified virus, Intermountain data indicate that detection of rhinovirus alone is not significant in predicting a low risk for SBI. Infants with only rhinovirus detected have the same risk of SBI as viral negative infants (approximately 12%).2 Treat as a viral negative result; use clinical judgment for discharge planning.
   - Enterovirus PCR on blood and CSF is recommended from June through November and with all findings of CSF pleocytosis.4,5

5. HSV: signs, testing, treatment. HSV infection is less common than SBI, but often results in significant morbidity and mortality in this age group. Initial signs of HSV infection can occur any time between birth and approximately 6 weeks of age.13 We recommend testing for HSV when infants fulfill the criteria noted in the box at right. Infants who are evaluated for HSV should receive IV acyclovir therapy pending the results of diagnostic testing.14,15,16 Note: when obtaining lesion and surface culture samples, use a new swab for each site to eliminate the possibility of spreading infection. (Swabs may be placed in same tube for a single, multisite analysis.)

(b) Medication

Data from 1999 to 2011 from Primary Children’s Medical Center and across Intermountain show that E. coli remains the most common cause of SBI in infants 1 to 90 days of age. Antibiotics selected for treating SBI should be active against both Gram-negative and Gram-positive causes of SBI. Because ampicillin resistance occurs in over 50% of SBI pathogens, addition of a third-generation cephalosporin is recommended in all cases of suspected bacterial meningitis or abnormal CSF. Acyclovir is the treatment for suspected HSV.

Obtain guidance from a pediatric infectious disease specialist in these cases:
   - If S. aureus is suspected. None of the recommended regimens presented in the algorithm is appropriate for treatment of Staphylococcus aureus; consult a specialist to determine an alternate regimen.
   - If bacterial meningitis or HSV infection is suspected or confirmed.

HSV EVALUATION

- 42 days or younger:
  - TEST* AND TREAT if infant exhibits vesicular skin lesions, abnormal CSF, or seizures.
  - CONSIDER TESTING* AND TREATING if infant exhibits septic appearance.
- Older infants: primary HSV is rare in infants older than 42 days. Infectious disease team consult may be indicated.

*TESTING for HSV:
   - Order blood PCR, CSF PCR, culture/PCR of skin lesions, culture/PCR of surface sites (mouth and throat, eyes, umbilicus, perirectal).
   - With HSV testing, consider infant “High Risk” — begin treatment per the algorithm.

Urinary tract infection (UTI) is the most common serious bacterial infection among febrile infants.

Data from over 8,000 febrile infants seen at Primary Children’s Medical Center show that approximately 10% of all febrile infants have an SBI. Of these, UTI accounts for 80%.
CAREGIVER EDUCATION

Caregiver education is a critical part of discharge planning. Education for caregivers of febrile infants should include the following topics:

- How to give prescribed medication
- How to take their baby’s temperature
- Signs of dehydration
- Steps to take to reduce fever and prevent the spread of infection
- The importance of returning for follow-up appointments

Several fact sheet and “Let’s Talk About…” handouts are available to guide caregiver education. These are available on intermountain.net/clinicalprograms on the “Febrile Infant” topic page.

- Lumbar Puncture in a Newborn
- Fever
- Urinary tract infection
- Sepsis in babies
- How to take your child’s temperature
- How to give medicine
- Placing an IV

REFERENCES


7. Doby B, Korgenski K, Reynolds C, Byington CL. Detection of rhinovirus does not decrease the likelihood of serious bacterial infection in febrile infants younger than 90 days of age. Poster presented at: Pediatric Academic Societies’ Annual Meeting; May 1, 2011; Denver, CO.


