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C3: Pediatric Fever

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* *Drug doses are a guide only, always check a second source and follow local practice guidelines*

Take Home Points:

- Ill-appearing infants and children with fever are resuscitated as a first priority
- Infants 0-28 days old, regardless of clinical examination, are empirically treated with antibiotics and admitted for a full septic work-up
- Infants and children 29 days or older can be stratified by a clinical decision pathway or algorithm, with some low risk patients discharged home or treated for specific infection, and moderate to high risk patients empirically treated and admitted

Introduction

In this episode of C3, we discuss the approach to infants and children with fever. In general, the younger we are, the less able we are to fight infection. As a consequence, infants may be critically ill and yet show few or no clinical signs of infection except for a fever. Unfortunately, fever in young people is incredibly common, and usually it represents a self-limited viral illness. So, when it comes to identifying the life-threatening serious bacterial infections (SBI), we are literally looking for a needle in a haystack. Over the past several decades, several criteria and algorithms have been developed to help us decide which patients need admission, empiric antibiotics and a full “septic work-up” and which ones can safely be discharged home.

The 3 big studies on the work-up of fever in infants came out in the early 1990’s - the Boston criteria in 1992, the Philadelphia criteria in 1992, and the Rochester criteria in 1994. None has been shown to be superior to the other. Moreover, these major studies were performed before widespread vaccination for *Haemophilus influenzae* - so they will overstate the risk of SBI in vaccinated children. The “Step by step” algorithm is more recent (2014) and helps stratify the management of children 21 days and older.

Definitions

- Neonate = 0-28 days old
- Young infant < 90 days old
- Fever
 - Neonate – a rectal temp of 38.0° C or higher within the past 24h
 - Older than neonate – 38.3°, or 38.5°
- Adjust age for prematurity



- Chronologic age [weeks] – (40 – gestational age [weeks])
- Not applicable to workup of fever
- Serious bacterial infection (SBI) – definitions vary but these are most commonly cited:
 - Bacterial meningitis
 - Bacteremia / sepsis
 - UTI / pyelonephritis
 - Bacterial pneumonia
 - Bacterial enteritis
 - Osteomyelitis
 - Septic arthritis
 - Cellulitis
 - Abscess
- IBI = invasive bacterial infection (bacteremia, meningitis)
- Full septic workup
 - CBC
 - Blood culture
 - UA and urine culture (a catheterized urine, not a urine bag)
 - CSF – cell count, glucose, protein, and culture
 - +/- CXR based on symptoms
 - +/- stool cultures (if diarrhea)

Common Pitfalls

- Failure to recognize hypothermia (which may indicate SBI in the same way that fever does)
- Failure to perform an LP when indicated
- Failure to get a vaccination history
- Failure to consider a fever history at home
- Failure to work-up a fever because it resolved with antipyretics
- Failure to consider a second site of infection once one is found
 - Occam's razor is not necessarily true
 - Kids with one infection may have a second
 - A common example is otitis media - 4% of kids with OM will also have UTI



- Problems with blood cultures
 - Do not get a CBC if you're not going to get a blood culture
 - Only need one blood culture

Initial Evaluation

- If the child appears ill, the focus should be on resuscitation
 - A,B,C's, IV, O₂, monitor
 - Glucose
 - If low, administer dextrose:
 - Rule of 50
 - <2 months 5 cc/kg of D10
 - 2 months - 8 yrs 2 cc/kg of D25
 - 8+ years 1 cc/kg of D50
 - 20 cc/kg IV/IO crystalloid bolus – consider 10 mL/kg in neonate
 - Manage airway, consider high flow, warmed, humidified oxygen
 - Provides PEEP, helps reduce work of breathing, helps reduce need for intubation
 - Empiric antibiotics and antivirals
 - Vasopressors if BP not improving with fluids
- If the child appears well, the focus will be on risk stratification as outlined below

Critical History

- Fever
 - Highest temperature, duration
 - How measured (rectal is most accurate)
 - A tactile fever is still concerning
- Feeding
- Birth history
 - Was baby full term or in NICU or nursery vs with mom?
 - Premature children are at higher risk for SBI (and also not included in any of the studies that give us algorithms)
 - Maternal issues
 - Group B Strep (GBS) screen? Perinatal antibiotics given?
 - Herpes simplex (HSV) screen?



- C-section lower risk for HSV transmission
- Active genital herpes lesions during delivery is highest risk for HSV
 - Fever during delivery?
- Are there viral symptoms?
 - Cough, rhinorrhea

Critical Physical

- General appearance red flags
 - Lethargy
 - Do not use “lethargic” in your chart unless they are difficult to arouse and ill appearing
 - Irritability
 - Difficult to console
 - Tone
 - Decreased tone
- Undress the baby and examine from head to toe
 - Fontanelle should be soft and flat when the baby is upright and quiet
 - If bulging, think meningitis
 - If sunken, think dehydration from poor intake or third spacing from sepsis
 - Skin
 - Look in hair, esp if there was a scalp monitor during delivery
 - Jaundice can occur with sepsis and HSV
 - ENT
 - Look in mouth for lesions
 - Look in ears for otitis media
 - Look in the nose - is there rhinorrhea?
 - Lungs
 - Crackles – possibly pneumonia
 - Wheezing - possibly bronchiolitis?
- Remember that congenital heart disease can look a lot like sepsis and can cause sepsis



Empiric Antibiotic/Antiviral Treatment

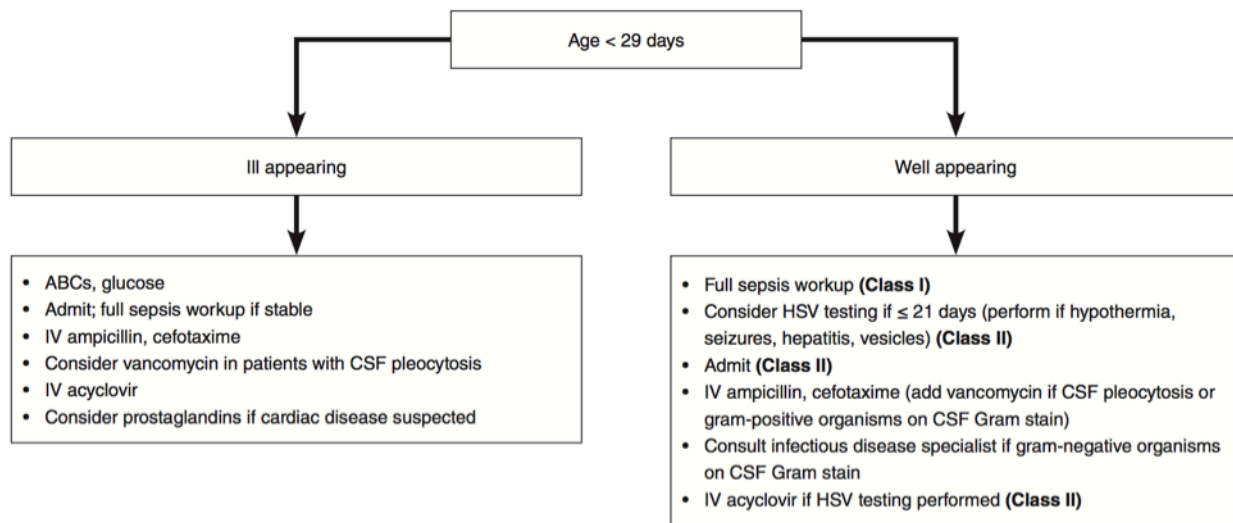
- Empiric treatment is aimed at the following likely organisms:
 - Group B strep
 - E coli and other gram negatives
 - Staph aureus
 - Strep pneumo
 - Salmonella – is there a reptile in home? (especially if signs of enteritis)
 - Listeria monocytogenes - very rare now
 - Klebsiella
 - HSV
- 0-28 days
 - Ampicillin (covers group B strep, enterococcus, listeria) and
 - Cefotaxime (covers strep, H flu, E coli) and
 - Acyclovir (covers HSV) and
 - Vancomycin (covers MRSA)
- 29-60 days
 - Ceftriaxone or cefotaxime, and
 - Ampicillin (through 6 weeks) and
 - Vancomycin and
 - Acyclovir if suspicious for HSV
- 61-90 days
 - Ceftriaxone or cefotaxime, and
 - Vancomycin

Infants (0-28 Days Old)

- 0-28 day olds cannot be trusted!
- They can be well appearing and have a terrible infection
 - Rate of SBI is up to 20%
- Well appearing – there's no such thing; doesn't exclude SBI
- From a decision making standpoint, this is the easiest patient because you empirically treat and do the full workup regardless



Clinical Pathway For Evaluation Of Febrile Young Infants (< 29 Days Old)



Abbreviations: ABCs, airway, breathing, circulation; CSF, cerebrospinal fluid; HSV, herpes simplex virus; IV, intravenous.

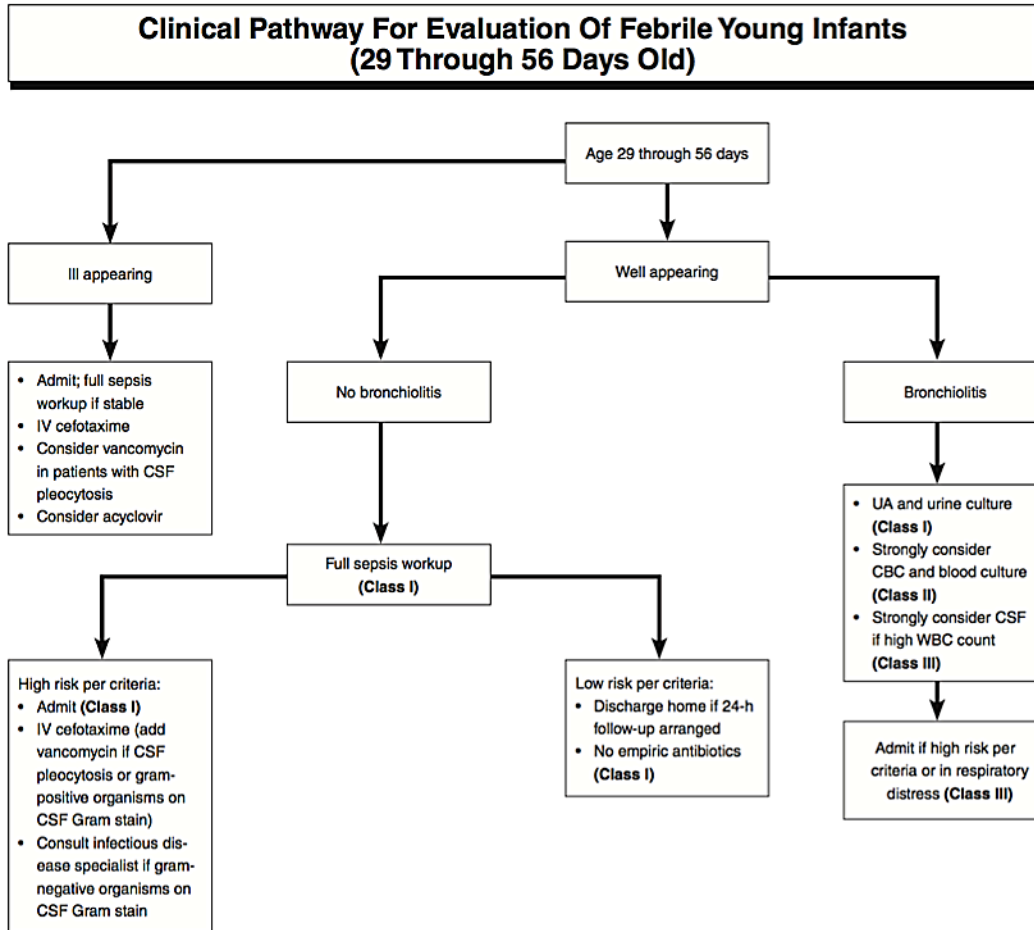
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Children 29-56 Days Old

- Why use this cut-off?
 - Philadelphia criteria used this age cut off
 - Other algorithms use a 60 day cut off. This is so similar, and if the patient is that close to an age cutoff, remember that these are somewhat arbitrary and if they are on the cusp you can error on the side of caution
- What's different for this age group?
 - This allows you to consider the possibility of bronchiolitis
 - Is it RSV season? Do they look like they have RSV?
 - Some of the respiratory viral panel pathogens can stay positive for up to 30 days, so just because the swab is positive does not mean that they don't have a different infection now
 - You should still get a urine because there is 5% chance of concomitant UTI
 - Still consider getting CBC, blood culture, and CSF - but these are not mandatory if the child fits an RSV picture perfectly
 - Can also use this approach for influenza and add oseltamivir
 - A recent article from 2017 studied this group, and is reviewed in EMA February 2018 – [ABSTRACT 19](#)
 - This retrospective cohort study looked at lumbar puncture for all febrile infants 29-56 days old
 - Of >1,100 infants, there was only a single case of meningitis and this one patient would not have been low risk by Philadelphia criteria



Algorithm



Abbreviations: CBC, complete blood count; CSF, cerebrospinal fluid; HSV, herpes simplex virus; IV, intravenous; UA, urinalysis; WBC, white blood cell. For class of evidence definitions, see page 8.

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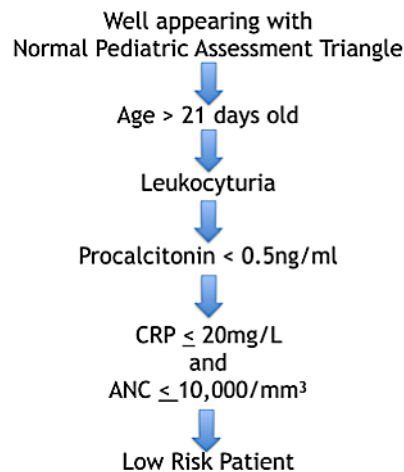
The “Step By Step” Approach

- The “Step-by-step” approach identifies low risk babies that can be discharged home without an LP or antibiotics
- Reviewed on:
 - EMRAP December 2016 – [Pediatric Pearls - Step-by-Step](#)
 - EMRAP January 2017 – [Paper Chase 3 - Step - by - Step Again](#)
- Uses appearance of child, urinalysis and biomarkers



- Issues with Step-by-Step
 - The first step is to determine if the child is ill-appearing using the Pediatric Assessment Triangle, and is subjective:
 - Appearance – tone, interactivity, consolability, gaze, cry
 - Work of breathing – abnormal noises or position, retractions, flaring
 - Circulation to skin – pallor, mottling, cyanosis
 - The 2003 ACEP guidelines (Baraff) state that febrile infants up to 28 days old should be presumed to have SBI, not the 21 days used by the Step by Step algorithm
 - The current ACEP guideline (Mace, May 2016 Pediatrics) excludes infants <28 days
 - Many EDs don't have a rapid procalcitonin available

Algorithm



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- Low risk
 - Discharge with close outpatient follow up
- Intermediate or high risk
 - Full workup, antibiotics, admission

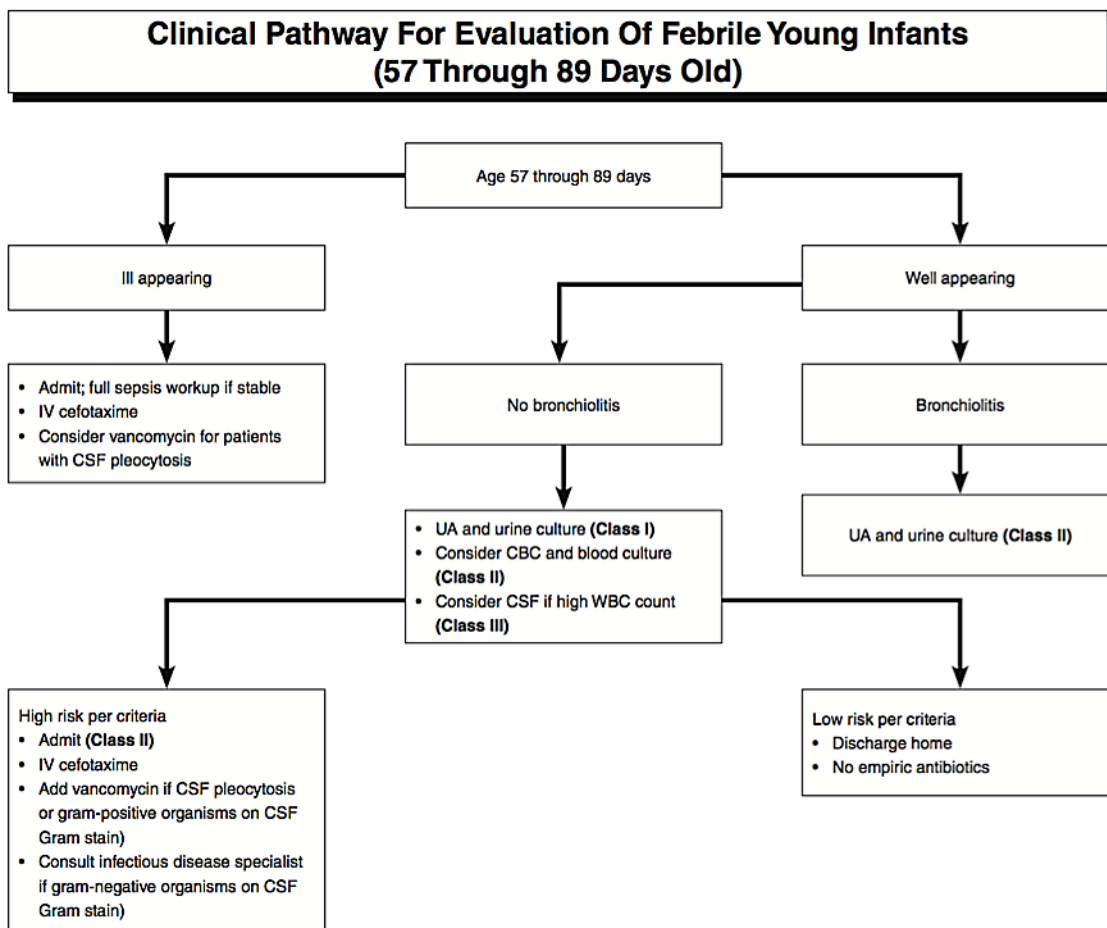
57-89 Days

- Nothing magical happens to most children at day 58 or day 61. There is still a high incidence of UTI and other SBIs should be carefully considered



- Babies get their first set of vaccines around this time and they are increasingly less susceptible to birth canal infections (eg GBS, E coli)
- They are a little bit easier to assess clinically, with a social smile typically ~6 weeks
- If you suspect bronchiolitis, still do UA and urine culture, and if that is negative you don't have to do bloodwork or CSF
- If no bronchiolitis, start with urine
 - If UTI, treat for UTI
 - If no UTI, consider doing CBC, blood culture, and LP
- If they don't cleanly fit into an RSV picture and you don't have a source you should still do the full workup

Algorithm



Abbreviations: CBC, complete blood count; CSF, cerebrospinal fluid; IV, intravenous; UA, urinalysis; WBC, white blood cell.
For class of evidence definitions, see page 8.

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3 Months To 3 Years

- If ill appearing or medically fragile, resuscitate, obtain labs, consider LP and start antibiotics
- If well appearing with source on exam, pursue workup/treatment for specific infection
- If well appearing with no source
 - May still have an occult infection
 - WBCs >15,000 is not always reliable but does raise suspicion
- What occult infections are we looking for? Mainly bacteremia, UTI, and pneumonia
 - Bacteremia
 - Pathogens – Strep pneumo (most common), H flu (less common after conjugate vaccine), Neisseria meningitidis
 - Obtain blood cultures in medically fragile patients, those with missed vaccines, ill-appearing patients, and hyperpyrexia (>41 C)
 - UTI
 - It's hard to ask a 12 month old about dysuria, or to assess frequency when they are wearing a diaper!
 - 5% of febrile well appearing 3-36 month olds with a nonfocal exam have a UTI
 - Girls and uncircumcised boys < 3 months are highest risk
 - Pneumonia
 - Consider obtaining a chest radiograph for those with cough, hypoxia, rales, high fever (39C), fever duration greater than 48 hours, or tachycardia and tachypnea out of proportion to fever
- You don't need to get a CXR if the picture fits with bronchiolitis or if they look very well
- Pneumonia is more often viral than bacterial and there is a lot of variation in the CXR reads, even among pediatric radiologists!

Individual Risk Factors: Girls	Probability of UTI	No. of Factors Present	
White race Age < 12 mo Temperature ≥ 39°C Fever ≥ 2 d Absence of another source of infection	≤1%	No more than 1	
	≤2%	No more than 2	

Individual Risk Factors: Boys	Probability of UTI	No. of Factors Present	
		Uncircumcised	Circumcised
Nonblack race Temperature ≥ 39°C Fever > 24 h Absence of another source of infection	≤1%	^a	No more than 2
	≤2%	None	No more than 3

FIGURE 2
Probability of UTI Among Febrile Infant Girls²⁸ and Infant Boys³⁰ According to Number of Findings Present. ^aProbability of UTI exceeds 1% even with no risk factors other than being uncircumcised.

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