



# Fever in Infants Under 3 Mon.

Dr. Bob Wilson Golden BC

What is the risk of serious bacterial infection in a febrile 2 month old infant ?

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- B. 10%
- C. 25%
- D. 50%
- E. 100%

# What is the most common congenital viral infection ?

- A. Herpes simplex
- B. Rubella
- C. Varicella
- D. Rabies
- E. CMV

A 3 week old infant presents with fever  $> 38$  degrees C. You will -

- A. Give acetaminophen and reassure the parents
- B. Take a blood culture and commence IM ceftriaxone as OP
- C. LP, urine and blood culture, chest x-ray, initiate ampicillin and gentamycin IV as IP
- D. Ask Dr. Blondel-Hill

I have no financial interests or  
other relationship with any  
pharmaceutical company  
I have no other conflict of  
interest to report

Unfortunately

# Learning Objectives

- Infants < 3 mon represent a special group for assessing possible causes of fever due to their intrinsic susceptibility to serious bacterial infection and particular risks of exposure
- Infants < 1 mon are the high risk group within the high risk group

# Definition

- Rectal temp  $> 38.0$
- Tympanic, temporal, axillary may be inaccurate
- ? Excessively bundled – remeasure 20 min. after unbundling

# Conditions Beyond Scope of My Talk

- Infection in VLBW infants
- Neonates in nursery



What me worry?



# Why are Infants at Risk ?

- Hold over from neonatal period
- Infections acquired in nursery but expressed later
- Increased susceptibility (poor ability to localize infection)
- Congenital infections

# How Concerned Should We Be

- Avner, Baker Emerg Med Clin NA  
2002;20: 49-67
- infants < 2 mon with documented fever
- 10% serious bacterial infection
- 3% bacteremia or bacterial meningitis



# Difficulty in “Reading” Infants

- Non specific physiologic responses  
elevations in HR and RR dependant on  
fever
- History dependant on caregivers – some  
may not be present
- Localizing signs of inflammation may not  
be present (eg meningismus)

# Fever in Infants < 3 months

- Infection
- Infection
- Infection
- Other:
  - Neurosurgical – CNS bleed, tumor
  - Abdominal – NEC, intussusception
  - Inflammatory – variants of Kawasaki's, lupus
  - Metabolic – hyperthyroidism, volume depletion, electrolyte etc
  - Drug related

# Types of Infection to Consider

- Bacterial
- Viral
- Protozoan
- Fungal (mainly VLBW infants with central lines and/or TPN)

# Congenital Infections

## Storch

- Syphilis
- Toxoplasmosis
- “Others” (influenza, varicella, et cetella)
- Rubella
- Cytomegalovirus
- Herpes Simplex

# Incidence in USA

Agent	Per 100,000 births	Annual
CMV	1000	40,000
Toxoplasmosis	100	4000
HSV	20	800
Syphilis	10	400
Rubella	<1	5



# Number of Neonates With Symptoms At Birth Is Small

Agent	Total Cases	Symptomatic
CMV	40,000	4,000
Toxoplasmosis	4,000	1,000
HSV	800	800
Syphilis	400	130

# Serious Bacterial Infections in Febrile Infants

- Bacteremia
- Meningitis
- Osteomyelitis/Suppurative Arthritis
- Skin/Soft Tissue Infection
- Urinary Tract Infection
- Gastroenteritis
- Pneumonia

# Common Bacterial Pathogens in Febrile Infants

- Gp B streptococcus
- E. coli
- Salmonella sp.
- Streptococcus pneumoniae
- Staphylococcus sp – esp MRSA
- Hemophilus influenzae type b, non typeable
- Enterococcus
- Listeria monocytogenes
- Neisseria meningitidis

# Less Common Pathogens

- TB
- Pertussis
- Chlamydia
- Syphilis
- Malaria

# History

- Pregnancy, birth wt and maturity, neonatal illness or prolonged stay in nursery ? ICN
- Change in feeding, vomiting, diarrhea, blood in stools
- Respiratory Sx : rhinorrhea, cough, distress
- Measured temp?
- Parental intuition
- Intercurrent illness in family, sibs in daycare, immunization, family coccooned?

# Physical Exam

- Rectal temp, vital signs, O2 sat
- Volume status
- CNS – interaction, fontanel, meningeal irritation
- Respiratory: URI?, flaring alae, retractions, work of breathing, lobar consolidation, wheeze, cyanosis
- Cardiac: peripheral circulation, pallor, hyperdynamic precordium

# Exam cont'd

- Abdomen: distension, tenderness, organomegally, bowel sounds
- Skin and soft tissues: rash, petechiae, purpura, jaundice, arthropathy
- Trial feed

# Infants under 1 Month

- Sepsis workup – must include LP due to late onset gp B strep meningitis  
(CBC, urine R/M, culture blood, urine, other, chest x-ray, pos. stool WBC and culture)
- Consider herpes simplex esp. if seizure or lesions
- Consider Chlamydia if pneumonia
- Consider *S. aureus* if nursery stay, family member colonized



# Infants 30-90 Days

- Ill appearing, signs of possible localizing infection or decompensation
  - sepsis workup including LP
  - anticipatory treatment
- Well appearing with possible benign explanation
  - limited workup
  - +/- anticipatory treatment
- Follow up

# Group B Strep Sepsis

Year	Early Onset < 7 days	Late Onset 7-89 days
1992	1.7/1000 births	0.3/1000 births
1997	0.7	0.3
2009	0.26	0.3

# Herpes Simplex

Dr. Sara Long's way

- Age < 21 d fever/hypothermia without focus or vesicles/oral lesions and CSF pleocytosis
- Virus culture conjunctiva, throat, rectum
- PCR CSF for herpes virus, antigen detection for bacterial pathogens (and gm stain)
- Bacterial culture CSF, blood, urine + other
- Acyclovir 60 mg/kg/d div Q8H x 21 d IV + antibiotics (amp and genta)

# Treatment of Suspected Bacteremia or Meningitis

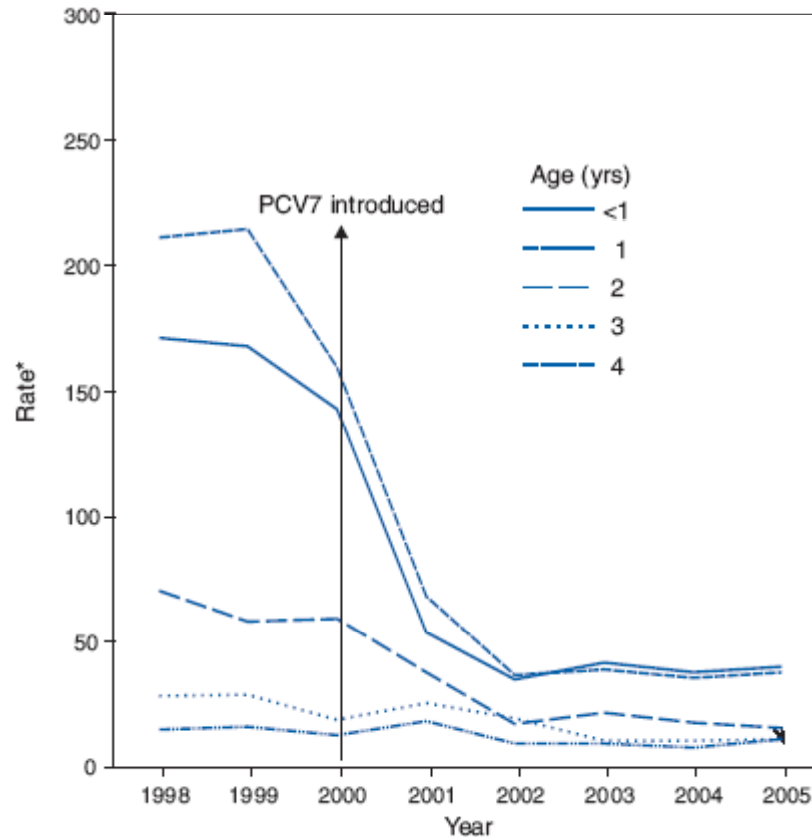
- Ampicillin 200-400 mg/kg/d IV div Q6H (max 12 gm/d) some adjustment for age and premis
- Gentamycin 2.5 mg/kg IV Q8H – alternate 6.5 mg/kg/d once daily (5 mg/kg 8-30 d) many adjustments for age and maturity adjust based on levels
- If staph or resistant *S. pneumo* suspected add vancomycin 15-20 mg/kg Q8H (age > 1 mon 10-15 mg/kg Q6-8 H) adjust in neonates
- Older than 2 mon may use ceftriaxone or cefotaxime +/- vanco (remember Ca with ceftriaxone restriction)

:

Incidence rate :  
cases per  
100,000

# Changes in Pneumococcal Disease

**FIGURE 1. Changes in incidence rate\* of invasive pneumococcal disease (IPD) among children aged <5 years before and after introduction of 7-valent pneumococcal conjugate vaccine (PCV7), by age and year — Active Bacterial Core surveillance, eight states,† 1998–2005**



# Etiology of Pneumonia in Neonates

- Gp B Strep
- Staph aureus
- Gm –ve enteric organisms
- Strep. pyogenes
- Listeria
- Chlamydia trachomatis
- CMV
- RSV

# Etiology of Pneumonia in Infants

- RSV, parainfluenza, influenza, adenovirus
- *Streptococcus pneumoniae*
- *Haemophilus influenzae* (non-typable)
- *Mycoplasma pneumoniae*
- Pertussis
- *Chlamydia* sp
- TB

# Pneumonia Treatment

McIntosh, NEJM 2002;346:429-437, Pediatr Rev  
2008;29:147

if staph aureus suspected add Clox or Vanco

Age	OP	IP – no lobar infiltrate or effusion	IP - severe
Birth – 20 d	Admit	Amp + Genta +/- Cefotaxime	Amp + Genta +/- Cefotaxime
3wk–3mon (afebrile)	Erythro or Azithro	Erythro or Azithro	N/A
3wk-3mon (febrile)	Admit	Cefotaxime	Cefotaxime or Amp (high dose)



# Protecting Infants Against Pertussis

- Immunize
- Cocoon (immunize sibs and caregivers)
- Treatment is only effective for shortening symptoms when started in catarrhal phase
- Treatment does shorten period of infectivity

# Patient 1

- 2 ½ month male infant with one day of fever to 38.0 (axilla), rhinorrhea, decreased breast feeding duration but increased frequency

# Patient 1

- No problems in pregnancy, delivery or neonatal period
- Breast feeding has progressed normally
- Intercurrent respiratory illness in mom and one older sibling

# Patient 1

- Appears well hydrated, interacts normally with parent and examiner, demonstrates ability to feed on breast
- No markers of CNS disease (not full fontanelle, meningeal irritation, lethargy or hyperirritability)
- Mild rhinorrhea and pharyngeal injection, otherwise NAD on examination

# Patient 1

- Does this patient need more evaluation
- Can we just send them home?
- What other factors might we consider?

# Rochester Criteria (variants Yale, Harvard)

- Ill or well appearing, previously healthy?
- Term ( $> 37$  wk)
- WBC  $> 20 \times 10^9/l$  , bands  $> 1.5$
- Urine bag dip/ cath – positive leuk esterase, greater than 10 WBC/hpf spun urine
- If diarrhea,  $> 5$  WBC/hpf
- Telephone, transportation, reliable, able to follow in 24 hr

## Patient 2

- 4 week old infant female with two days of reduced feeding, now fever of 38 and has vomited last two feeds

## Patient 2

- Babe is lethargic in mom's arms, fails to feed
- “looks ill”
- Normally hydrated
- Fontanelle fails to depress when held upright
- Babe emits high pitched cry with diaper change



# Patient 2

- What further investigations does this babe need?
- What treatment would you initiate?
- Admit?
- Transfer?
- Escort?

# Conclusions

- Fever in infants  $< 3$  mon represents a higher than usual risk of serious infection
- Fever in infants  $< 1$  mon is especially concerning and always warrants full work up, admission for close observation and anticipatory treatment
- The expression “a high index of suspicion” particularly applies to assessing sick infants

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