



OBJECTIVES

At the conclusion of this session, participants should be able to:


- Identify common pathogens associated with acute pediatric infections
- Analyze evidence supporting the work-up of children presenting with fever
- Select evidence-based management strategies of children with acute infection
- Describe penicillin allergy reactions and offer potential alternatives

100.4

"Although fever is a friend of the patient, infection is a foe."

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NEONATAL FEVER




VIRAL

Most Common:
Enterovirus
Influenza
Adenovirus
RSV
HSV

RSV: Respiratory Syncytial Virus
ECHO: Echo virus
E. Coli: Escherichia coli
GAS: Group A Streptococcus
Strep pneumoniae: Streptococcus pneumoniae
S. pneumoniae: Streptococcus pneumoniae
S. pneumoniae: Streptococcus pneumoniae
S. pneumoniae: Streptococcus pneumoniae






BACTERIAL

Most Common:
E. Coli
GBS
Strep pneumo

Less Common:
Staphylococcal aureus
Salmonella
Listeria



Neonatal bacterial infection DDX:
Meningitis Gastroenteritis
Bacteremia Skin/soft tissue infection
UTI Osteomyelitis
Pneumonia

↓

Prevalence of bacterial infections:
UTI 7-10% (most common)
Bacteremia 1-2%
Meningitis 0.4%

NEONATAL FEVER

**WELL-
APPEARING**

**NO OBVIOUS
SOURCE**

**38C (100.4F)
OR HIGHER**

Who is excluded from 2021 guidelines?

- Preterm <37wk
- <2wk + maternal fever, infection, and/or antimicrobial use
- High suspicion of HSV (vesicles)
- Focal bacterial infection (cellulitis, osteomyelitis)
- Clinical bronchiolitis with or without +RSV
- Infant with documented or suspected immune compromise
- Neonatal course complicated by surgery or infection
- Congenital abnormality or chromosomal abnormality
- Medically fragile infant dependent on technology or ongoing therapeutic intervention
- Infant who received immunization within last 48hr

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RSV: Respiratory Syncytial Virus
ECHO: Echo virus
E. Coli: Escherichia coli
GAS: Group A Streptococcus
Strep pneumoniae: Streptococcus pneumoniae
S. pneumoniae: Streptococcus pneumoniae
S. pneumoniae: Streptococcus pneumoniae

NEONATAL FEVER

**WELL-
APPEARING**

**NO OBVIOUS
SOURCE**

**38C (100.4F)
OR HIGHER**

Major changes in the new 2021 guidelines:

Abandon "serious bacterial infection (SBI)" and, rather, think of UTI, bacteremia, meningitis separately

New grouping infants by age:

- 8-21 days
- 22-28 days
- 29-60 days

No longer ordering LPs on everyone

- Instead, 22-60 days have LPs performed selectively

Not everyone needs to be hospitalized

Consider 24-26hr sufficient to monitor cultures

C. Culture
 P. Pathogen
 BS. Blood
 HSV. Herpes simplex virus
 RV. Respiratory Syncytial Virus
 W. WBC

8-21 days

UA, blood culture, LP, +/-inflammatory markers

Yes HSV risk

HSV studies
IV antibiotics
IV acyclovir

No HSV risk

IV antibiotics

Admit to hospital

Pathogen identified?

Yes? Treat infection

No? Watch cx +/- HSV studies x24-36hr then d/c empiric treatment

Inflammatory markers:

- ANC >4000
- CRP >20mg/L
- Procalcitonin >0.5

NOTE: 7 days or younger need full septic work-up as well as empiric antibiotic therapy

UA. Urinalysis
 LP. Lumbar puncture
 BS. Blood
 HSV. Herpes simplex virus
 RV. Respiratory Syncytial Virus
 W. WBC

NEONATAL FEVER

ACYCLOVIR

HSV Risk Factors:

- Maternal genital HSV lesions or fever 48 hours before or after delivery
- Infants with vesicles, seizures, hypothermia, mucous membrane ulcers
- CSF pleocytosis with a negative Gram stain result
- Leukopenia, thrombocytopenia, or elevated AST/ALT levels

Better to be cautious and treat if you are concerned for possible HSV!

HSV. Herpes simplex virus
 BS. Blood
 CSF. Cerebral spinal fluid
 AST. Aspartate Aminotransferase
 ALT. Alanine Aminotransferase

22-28 days

UA, blood culture, inflammatory markers

```

    graph TD
      A[UA, blood culture, inflammatory markers] --> B[Abnormal IM]
      A --> C[Normal IM]
      B --> D[Perform LP]
      D --> E{?Pleocytosis  
?Uninterpretable}
      E -- Yes --> F[Yes: antimicrobials  
Observe in hospital]
      E -- No --> G[Give IV abx x1 dose  
Okay to d/c with 24hr flu]
      C --> H[Consider LP]
      H --> I[Yes LP]
      H --> J[No LP]
      I --> K{Pleocytosis or  
traumatic}
      K -- Yes --> L[Start antimicrobials  
Observe in hospital]
      K -- No --> M[Give x1 IV abx  
May d/c home with  
24hr flu]
      J --> N[May start antimicrobials  
Observe in hospital]
    
```

Inflammatory markers:

- ANC >4000
- CRP >20mg/L
- Procalcitonin >0.5

MUST get LP if:

- Any +IM

Consider LP if:

- UA + or -
- All IM are normal
- Blood/urine cx obtained
- Infant hospitalized

All infants should be hospitalized if CSF not obtained or if uninterpretable

Can discharge home if:

- Normal IM
- Negative UA
- LP performed and normal
- Follow-up within 24hr with emergency plan

29-60 days

UA, blood culture, inflammatory markers

```

    graph TD
      A[UA, blood culture, inflammatory markers] --> B[Abnormal IM]
      A --> C[Normal IM]
      B --> D[Consider LP]
      D --> E[Abnormal CSF]
      D --> F[Normal CSF]
      D --> G[None/Un-  
interpretable  
CSF]
      E --> H[Start antimicrobials  
Observe in hospital]
      F --> I[Give IV abx x1 dose  
Okay to d/c home]
      G --> J[Consider antimicrobials  
IV or PO, okay to d/c  
home with close fu or  
observe in hospital]
      C --> K[Yes UTI]
      C --> L[No UTI]
      K --> M[Urine cx, no LP  
PO abx, d/c home,  
close fu 12-24hr]
      L --> N[No LP, no antimicrobials,  
d/c home, close fu 24-36hr]
    
```

Inflammatory markers:

- ANC >4000
- CRP >20mg/L
- Procalcitonin >0.5

Can start PO antibiotics empirically now in certain circumstances

Must start antibiotics if:

- +CSF
- +UA
- All tests are normal + infant discharged home

Consider antibiotics if:

- IM positive (all others negative)
- All tests normal
- Infant in hospital

NEONATAL FEVER

Acyclovir

IV

8-21 days (no meningitis): ampicillin + ceftazidime (or) ampicillin + gentamicin
 8-21 days (yes meningitis): ampicillin + ceftazidime

22-28 days (no meningitis): ceftriaxone 50mg/kg/dose q24hr
 22-28 days (yes meningitis): ampicillin + ceftazidime

29-60 days (no meningitis): ceftriaxone 50mg/kg/dose q24hr
 29-60 days (yes meningitis): ceftriaxone 100mg/kg/dose q24hr (or) ceftazidime + vancomycin

ORAL

29-60 days (no meningitis): cephalexin or cefixime

LUNGS

Croup **Epiglottitis** **Pertussis** **Bronchiolitis** **Pneumonia** **Viral URI**

URI: Upper respiratory infection

CROUP

Diagnosis: Clinical
Neck/chest x-ray is NOT indicated but may show steeple sign

Pathogens: parainfluenza virus, RSV, influenza, adenovirus, enterovirus

Presentation: barking cough (worse at night), hoarseness, inspiratory stridor, respiratory distress

Treatment: observation > racemic epinephrine nebulization and dexamethasone 0.6mg/kg (oral vs IM vs IV)

*Agitation and crying significantly worsen sx
May prefer sitting upright/held upright*

CXR: chest x-ray
RSV: Respiratory Syncytial Virus
Sx: symptoms
IM: intramuscular
IV: intravenous

EPIGLOTTITIS

Diagnosis: Clinical, CXR: thumb sign, laryngoscopy

Pathogens: Haemophilus influenzae type B (HIB)
"UNVACCINATED CHILD"

Presentation: fever, trouble swallowing, respiratory distress, drooling, neck hyperextension, tripod, stridor

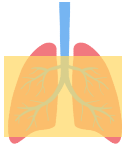
Treatment: Often requires intubation! IV ampicillin-sulbactam. Manage complications (pulmonary edema, bacteremia, pneumonia)

THANK-A-VACCINE!
RARE now thanks to Hib vaccine (2mo, 4mo, 6mo, 12mo)

CXR: chest x-ray

BRONCHIOLITIS

Diagnosis: Clinical




Pathogens: RSV, human metapneumovirus, rhinovirus, parainfluenza, influenza, bocavirus, adenovirus

Presentation: respiratory distress, tachypnea, cough, fever, decreased appetite, irritability, wheezes, rales, rhonchi, +/- hypoxemia

Treatment: Supportive care including supplemental oxygen, suctioning. Admission if O2 requirement or poor feeding

RSV: Respiratory Syncytial Virus
O2: oxygen

BRONCHIOLITIS



~~Antibiotics~~ ~~Inhaled Steroids~~

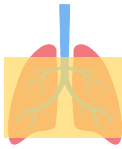
~~CXR~~ ~~Systemic Steroids~~

Albuterol?

CXR: chest xray

PNEUMONIA

Diagnosis: Uncomplicated: Clinical
Complicated: CXR > ultrasound, CT



Pathogens: S. pneumo, H. flu, M. cat

Presentation: rhinorrhea, cough, fever, tachypnea, poor PO, respiratory distress, localized rales, abdominal pain if lower lobe

Treatment: amoxicillin 90mg/kg/day divided BID x3-10 days or IV ampicillin/PCN G> IV CTX. Admit if O2 requirement, complicated PNA, poor PO (needs IV abx or dehydrated)

What about viral pneumonia?

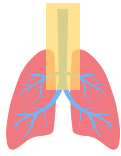
- No consolidation, exam is symmetrical
- Antibiotics are not necessary, symptomatic care only

THANK-A-VACCINE!
LESS COMMON now thanks to pneumococcal vaccine, Hib vaccine, and influenza vaccine

CXR: chest xray
S. pneumo: Streptococcus pneumoniae
H. flu: Haemophilus influenzae
M. cat: Moraxella catarrhalis
PO: poor oral intake
BID: twice a day
PCN: penicillin
CTX: ceftriaxone
O2: oxygen
PNA: pneumonia
Abx: antibiotic

PERTUSSIS

Diagnosis: Clinical, PCR or nasopharyngeal culture



Pathogens: Bordetella pertussis, Bordetella parapertussis
"UNVACCINATED CHILD"

Presentation: catarrhal (1-2wk) congestion, rhinorrhea, fever > paroxysmal (2-6wk) intense uninterrupted cough, posttussive emesis > convalescent (>2wk)


Treatment: azithromycin 1st line for treatment and PEP, alternative is trimethoprim-sulfamethoxazole if >2mo

Isn't it called whooping cough?
Not everyone "whoops" so maintain high index of suspicion even if no "whoop" is reported!


THANK-A-VACCINE!
RARE now thanks to Dtap and Tdap vaccines

PCR: Polymerase chain reaction
PEP: post-exposure prophylaxis
MC: most common


GASTROENTERITIS




VIRAL
Norovirus
Sapovirus
Rotavirus



BACTERIAL
NT Salmonella
Campylobacter
Shigella
E. Coli
Yersinia



FOODBORNE
Bacillus cereus
Clostridium perfringens
Staph aureus




PARASITE
Giardia
Cryptosporidium
Entamoeba histolytica

NT: Non-typhoidal
E. Coli: Enterohemorrhagic

GASTROENTERITIS

Diagnosis: Clinical



Pathogens: bacterial (salmonella, shigella, campylobacter, E. Coli), viral (norovirus, sapovirus), parasite (Giardia)
Rotavirus MC in world

Presentation: vomiting, diarrhea (bloody or non-bloody), +/- fever, +/- abdominal pain, +/- dehydrated

Treatment: Supportive care, oral rehydration vs IV fluids, ondansetron, NO anti-diarrheal agents

THANK-A-VACCINE!
Rotavirus is now RARE in USA (MC in world)


Salmonella
Treat only if <2mo or immunocompromised
IV ceftriaxone

E. Coli
NO antibiotics due to risk of HUS

C. diff
PO vancomycin

E. Coli: Enterohemorrhagic coli
MC: most common
HUS: hemolytic uremic syndrome
C diff: Clostridium difficile
PO: oral (by mouth)
MC: most common

MYOCARDITIS



Diagnosis: BNP, troponin, CXR, EKG, echocardiogram, cardiac MRI, blood culture, gold std: myocardial biopsy

Pathogens: Enterovirus, coxsackie virus B, parvovirus


Presentation: SOB, dyspnea, chest pain, fever, fatigue, dizziness, diaphoresis, hepatomegaly, rales, murmur, gallop, tachycardia

Treatment: Emergent cardio consult. Supportive care. If shock, start ECMO to maintain circulation and organ perfusion

3rd
leading cause sudden death in children, young adults

BNP: Brain natriuretic peptide Str. shunting
CXR: chest x-ray CSF: cerebrospinal fluid
EKG: electrocardiogram Cardio: cardiology
MRI: magnetic resonance imaging ECMO: extracorporeal membrane oxygenation

MENINGITIS



Diagnosis: CSF PCR and CSF culture


Pathogens: Viral (enterovirus), S. pneumo, N. meningitidis
Neonatal considerations: GBS, Listeria, HSV

Presentation: Fever, lethargy, irritability, poor feeding, vomiting, seizures, headache, photophobia, stiff neck

Treatment: <2mo IV ampicillin and IV cefotaxime +/- IV acyclovir (if HSV is concern), >2mo IV vancomycin + IV ceftriaxone

CSF: cerebrospinal fluid
PCR: polymerase chain reaction
S. pneumo: Streptococcus pneumoniae
N. meningitidis: Neisseria meningitidis
GBS: Group B Streptococcus
HSV: Herpes simplex virus
MR: magnetic resonance imaging
IV: intravenous

NEONATAL HSV



Diagnosis: HSV surface swabs (lesions, eye, mouth, rectal), HSV serum, CSF PCR, LFTs, platelets, PT/INR, PTT

Pathogens: HSV-1 and HSV-2

Presentation: SEM (vesicles), encephalitis (poor feeding, poor tone, seizures), disseminated (hypothermia, hyperthermia, poor feeding, vomiting, shock, DIC), **NEVER ASYMPTOMATIC**


Treatment: **DO NOT WAIT FOR TEST RESULTS.** IV acyclovir x14 days if SEM days vs x21 days if CNS or disseminated
Will need continued suppressive therapy x6mo PO acyclovir

Categories:
Skin, eyes, mouth (SEM)
Disseminated (blood)
Encephalitis (CSF)

Few infants survive without therapy and those who do generally have severe sequelae

HSV: Herpes simplex virus MR: magnetic resonance imaging Mo: months
CSF: cerebrospinal fluid PTT: Partial thromboplastin time PD: per os (by mouth)
PCR: polymerase chain reaction DIC: disseminated intravascular coagulation
LFT: liver function tests CSF: cerebrospinal fluid

URINARY TRACT INFECTION



Diagnosis: Urinalysis, urine culture (clean catch or catheter)


Pathogens: Colonic bacteria (KEEPS): **K**lebsiella, **E.** coli, **E**nterococcus, **P**seudomonas, **S**taph saprophyticus

Presentation: dysuria, urgency, frequency, abdominal pain, flank pain, fever, nausea, vomiting, poor feeding

Treatment: Empiric amoxicillin 50mg/kg/day divided BID, cephalexin, trimethoprim-sulfamethoxazole, nitrofurantoin then narrow based on culture results. IV/IM ceftriaxone if cannot tolerate PO

E. Coli: Escherichia coli
Ag: antigen
BID: two times a day
IM: intramuscular
IV: intravenous
PO: per oral intake

URINARY TRACT INFECTION



Diagnosis: Urinalysis, urine culture (clean catch or catheter)

Criteria to diagnose UTI based on UA?
+nitrite
+leuk esterase,
+WBC,
+bacteria (pyuria)

Can I use a bag specimen to dx UTI?
CANNOT DIAGNOSE UTI BASED ON BAG


Colony count on urine culture required for dx of UTI?
>50,000 CFU if urine catheter
>100,000 CFU if clean catch

What if +leuk esterase and -nitrites in an infant?
Bacteria require 4 hours for metabolism of nitrites to nitrites, so may not be detected in young infant who voids more frequently than that at baseline or in child with increased urinary frequency due to UTI

First febrile UTI (2-24mo) next steps?
Obtain renal/bladder ultrasound. If abnormal then obtain VCUG. This also applies for those with recurrent UTI

UTI: urinary tract infection
UA: urinalysis
Leuk esterase: leukocyte esterase
WBC: white blood cell
CFU: colony forming units
Dx: diagnosis
IM: intramuscular
IV: intravenous
VCUG: voiding cystourethrogram

NEONATAL CONJUNCTIVITIS



Diagnosis: Specimen swab (gram stain culture, PCR)


Pathogens: Neisseria gonorrhoea (*leading cause of blindness*), Chlamydia trachomatis (most common)

Presentation: redness, edema of eyelids, purulent eye discharge

Treatment: NG immediate IV or IM ceftriaxone
CT oral erythromycin. Prevent via ophthalmic ppx, mother tx

PCR: polymerase chain reaction
NG: Neisseria gonorrhoea
IV: intravenous
IM: intramuscular
CT: Chlamydia trachomatis
PPX: prophylaxis
tx: treatment

ACUTE OTITIS MEDIA



Diagnosis: Clinical, pneumatic otoscopy

Pathogens: Strep pneumo, H. flu, M. cat, viruses

Presentation: otalgia, fever, TM erythematous, bulging, *presence of pus, reduced mobility of TM on pneumatic otoscopy

Treatment: 1st line: amoxicillin 90mg/kg/day divided BID
 2nd line: amoxicillin-clavulanate > cefdinir
 AOM + conjunctivitis: amoxicillin-clavulanate
 Duration: 7 days >2yo, 10 days under 2yo Allergy (anaphylaxis): TMP-SMX, azithromycin

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 H. flu: Haemophilus influenzae
 M. cat: Moraxella catarrhalis
 TM: tympanic membrane
 BID: two or three times daily
 AOM: acute otitis media
 TM: tympanic membrane

AOM WATCHFUL WAITING

NON-SEVERE AOM

Age

- <6mo: Always treat
- 6mo-2yo: Unilateral (Observe + F/U), Bilateral (Treat)
- >2yo: Observe + F/U

SEVERE AOM


Age

- <6mo: Always treat
- 6mo-2yo: Treat
- >2yo: Treat

Severe: Moderate-severe otalgia at least 48hr, 102.2F or higher, otorrhea

AOM: acute otitis media
 M: months
 F/U: follow-up

STREP PHARYNGITIS



Diagnosis: Rapid strep testing, throat culture (specificity >95%, sensitivity 80-90%)

Pathogens: Group A strep (Strep pyogenes)


Presentation: Sore throat, fever, abdominal pain +/- rash (scarlet fever)

Treatment: IM benzathine penicillin G x1 dose or amoxicillin 50mg/kg/day divided BID x10 days

GAS can affect other sites of the body, including skin (impetigo), rheumatic fever, and glomerulonephritis

IM: intramuscular
 M: months
 F/U: follow-up

OSTEOMYELITIS



Diagnosis: Blood culture, MRI extremity

Pathogens: Staph aureus (MC), GBS (infant), E. Coli (infant), Kingella, GAS, Pseudomonas, Salmonella (SCD)

Presentation: pseudoparalysis (infant), fever, edema, erythema, warmth, pain, refusal to move extremity/walk

Treatment: Empiric IV antibiotic therapy based on MC pathogens at various ages, surgical washout


What about a quick x-ray?

- Can use x-ray to rule-out other causes of pain but do NOT rely on this
- X-rays can take 7-14 days to show lytic bone changes after onset of infection or even longer

Staph aureus: cefazolin or clindamycin

MRI: magnetic resonance imaging
 Staph aureus: Staphylococcus aureus
 SCD: sickle cell disease
 GBS: Group B streptococcus
 E. Coli: Escherichia coli
 GAS: Group A streptococcus
 SCD: sickle cell disease

SEPTIC ARTHRITIS



Diagnosis: Blood culture, joint aspiration WBC >50,000

Pathogens: Staph aureus (MC), GAS, S. pneumo, Kingella, Gonococcus, GBS, Neisseria meningitides

Presentation: pseudoparalysis (infant), fever, edema, erythema, warmth, pain, refusal to move extremity/walk, decreased ROM

Treatment: Empiric IV antibiotics based on MC pathogens at various ages, surgical washout. Hip is surgical emergency!


What about imaging?

- X-ray can detect widening of joint capsule, edema, and rule-out other causes of pain (fracture)
- Ultrasound can identify joint effusion, fluid collections
- MRI/CT not routinely indicated
- Imaging is not diagnostic. Joint aspiration confirms dx.

Staph aureus: cefazolin or clindamycin

WBC: White blood cells
 Staph aureus: Staphylococcus aureus
 MC: most common
 GAS: Group A streptococcus
 GBS: Group B streptococcus
 SCD: sickle cell disease
 S. pneumo: Streptococcus pneumoniae
 GBS: Group B streptococcus
 CT: computed tomography
 dx: diagnosis

CELLULITIS



Diagnosis: Clinical

Pathogens: Staph aureus (MSSA, MRSA), Strep pyogenes (GAS), rarely pseudomonas, rarely mucormycosis/fungal

Presentation: localized edema, warmth, erythema, tenderness with non-distinct margins, fever

Treatment: cephalixin x5-7 days or if worried about MRSA then clindamycin. NOTE: TMP-SMX does not cover Strep pyogenes

Staph aureus: Staphylococcus aureus
 Strep pyogenes: Streptococcus pyogenes
 MSSA: Methicillin sensitive Staphylococcus aureus
 MRSA: methicillin resistant Staphylococcus aureus
 TMP-SMX: trimethoprim-sulfamethoxazole


STAPH SCALDED SKIN

Diagnosis: Clinical

Pathogens: Staph aureus

Presentation: sudden red, painful, peeling skin of creases (neck, axillae, inguinal, gluteal), poor PO. +Nikolsky sign

Treatment: First line IV nafcillin (or IV oxacillin) + IV clindamycin (toxin reduction). IV fluids even if tolerating PO



Staph aureus: Staphylococcal aureus
 MSS: most common
 MRSA: Group A staphylococci
 S. aureus: staphylococcal aureus
 MSS: Group B staphylococci
 MRSA: per se (not treated)
 +Nikolsky sign

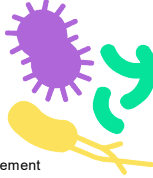
PENICILLIN ALLERGY

- Approximately 10% of USA population report *penicillin allergy*
- <1% of population have IgE-mediated reaction
- Penicillin allergy is not inheritable**
- Always document reaction when listing an allergy
- Allergy testing

PENICILLIN CROSS-REACTIVITY

	Penicillin	Oxacillin	Amoxicillin	Ampicillin	Pip/Tazo	Cephalexin	Cefazolin	Cefuroxime	Cefdinir	Ceftioxcin	Cefixime	Ceftazidime	Meropenem
Penicillin	NA												
Oxacillin		NA											
Amoxicillin			NA			CAUTION							
Ampicillin				NA	CAUTION	AVOID							
Pip/Tazo				CAUTION	NA	CAUTION							
Cephalexin	CAUTION		CAUTION	AVOID	CAUTION	NA							
Cefazolin							NA						
Cefuroxime								NA		CAUTION		CAUTION	
Cefdinir									NA				
Ceftioxcin										NA			
Cefixime											NA		
Ceftazidime												NA	
Cefepime													NA
Meropenem													NA


PEARLS



- Palatability
 - Clindamycin: solution vs capsules
 - Dexamethasone: solution vs IM/IV given as PO
- CeftriaxONE should not be given <1mo due to risk of bilirubin displacement
 - Unless concerned for gonorrhea conjunctivitis
- TMP-SMX should not be given <2mo due to risk of bilirubin displacement
- TMP-SMX does not cover Strep pyogenes
- Doxycycline should not be given <8yo (tooth development age)
 - Unless concerned for Lyme disease
- Clindamycin is excellent first line drug for SSTI but follow your local antibiogram for resistance patterns.

DO NOT USE
 FOR ANTIMETABOLITES
 DO NOT USE FOR
 DO NOT USE FOR
 DO NOT USE FOR
 DO NOT USE FOR
 DO NOT USE FOR

PEARLS



- Vancomycin is rarely first line in pediatrics
- Azithromycin is first line only for:
 - Pertussis
 - Chlamydia pneumonia
 - Mycoplasma
- Gentamicin poorly crosses blood-brain barrier
 - Clindamycin also does not cross blood-brain barrier
- High dose amoxicillin needed to cover drug resistant Strep pneumo
- Cephalosporins do not cover enterococcus
- Avoid antibiotics in gastroenteritis unless +salmonella in <3mo or immunocompromised

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