Common Pediatric Infections

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Outline

• Common pediatric infections that are frequently treated with antibiotics
  with emphasis on Pediatric ASP
  • Acute otitis media (AOM)
  • Community acquired pneumonia (CAP)
  • Pharyngitis
  • Skin and soft tissue
• Rash illnesses in pediatrics (and some adults)
• Antibiotic doses in appendix

What is Antibiotic Stewardship?

• Goal is for patients to receive appropriate antibiotic therapy
  • Right drug
  • Right dose
  • Right duration
  • Avoid antibiotics when not needed
• Avoid adverse consequences, improve outcomes

“10 days isn’t magic”

• In U.S., we treat a lot of pediatric infections for 10 days—why?
  • 10 day duration stems from
    • 1940 trials PCN for prevention of rheumatic fever in military recruits with GAS pharyngitis
  • Whereas in other countries; average duration defers
    • France-for 8 days
    • UK—5 days
    • Or in other countries until symptomatic improvement occurs
• Also more judicious about antibiotic use
  • Comment by Michael E Pichichero, Pediatric News, Jan 2016
Antibiotics

- It has been recognized for several decades that ~50% of antimicrobials that are used are inappropriate in one sense or another
  - Given when not needed
  - ~25% of patients don't have bacterial infection
  - Continued longer than needed
  - Given at wrong dose
  - "Broad-spectrum" antimicrobials given when narrower could be used
  - At least 5% of hospitalized patients experience an adverse reaction
  - Durations – not well studied! '10 day' rule

Consequences of antibiotics

- Adverse drug reactions and toxicity
- *Clostridium difficile* infections (CDI)
  - 250,000 illnesses and 14,000 deaths in US
  - 10,553 healthcare facility onset-CDI in CA in 2013
- Selection of antimicrobial-resistant pathogens
  - >2 million illnesses and 23,000 deaths in US
  - 260,000 illnesses and nearly 3,000 deaths in CA

Untreatable infections...

"Our data suggest that the advent of untreatable infections has already arrived"

Public health issue

Antibiotics are the only treatment where use in one individual patient impacts the effectiveness in another patient (true of vaccines too)

Pediatricians have something else to consider.....
Antibiotics used on farms to promote growth...

Do antibiotics also promote “growth” in children?

- Studies showing early antibiotic use...linked to obesity
  - Swedish cohort study suggested “weight-promoting effect” on boys if abx exposure at < 6 months
    - Saari, Pediatrics, April 2015
  - CHOP study found abx exposure < 5 months with broad spec abx—associated with obesity
    - Bailey, JAMA Pediatr 2014

“Less is More”

Getting away from the notion of extending antibiotics beyond clinical improvement and longer than needed “just to be sure”

Acute Otitis Media (AOM)
Case 1

In an otherwise healthy child with acute otitis media, observation without starting antibiotics is a reasonable option for which of the following patients?: (102.2)

A. 3 year-old with temperature of 102.4 F (39 C), experiencing ear severe pain and unilateral TM bulging
B. 10 month old with temperature 101.3 F (38.5) mild discomfort and mild unilateral TM bulging.
C. 10 month old with temperature 103.2 F (39.5) and mild bulging of the bilateral TMs
D. None of the above—they should all be started on antibiotics

Acute Otitis Media (AOM)

- The most frequently diagnosed illness in the US, ~5.2 million episodes/year
- The most common reason for antibiotic use in children
- 90% of 2 year-olds have had at least 1 episode
- Risk factors:
  - Young age, exposure to other young children (e.g. day care), positive family history, anatomic factors, immune function, (pacifier and bottle propping)
- Recognition that over diagnosis of AOM common
- Until recently –most children with AOM Rxed with antibiotics

AOM-Background

- AOM almost occurs in context of URI, typically between 3rd-7th day
  1. +/− symptoms (conflicting data on how much symptomatic relief abx provide first 24 hours vs. analgesic DO relieve pain within 24 hour)
  2. Complications:
     - Perforation, mastoiditis, brain abscess, epidural abscess, sinus venous thrombosis
- Treatment:
  - Antibiotics half the risk mastoiditis after AOM
  - However –NNT: 4800 patients to prevent 1 case of mastoiditis*

AOM background: pathogens

- From tympanocentesis studies of AOM
  - 69-84% bacterial pathogens found
  - +/- virus
  - Bacterial pathogens—evolving ...
    - Strep pneumonia* (mostly non PCV-7 serotypes)
    - H-flu (non-type-able)
    - Moraxella catarrhalis
  - GAS and Staph aureus < 5%, older children/severe

*PCV licensed in 2000, PCV13 in 2010
AOM and antibiotics

• AOM in many children will resolve w/o antibiotics
  • Early studies showed that (by a 2nd tympanocentesis) 2-7 days later when No Rx
  • 19% cleared S pneumonia
  • 48% cleared H flu

• Other studies have shown that 75% of children infected with M catarrhalis experienced 'cure' with Amoxicillin
  • (Amox is not active vs. Moraxella catarrhalis)
• In several European countries -- treatment only for children who don’t improve w/o antibiotics
• National guidelines for initial observations of AOM were first implemented in Netherlands, then Sweden and Scotland (later U.S, UK and Italy)

2004 AOM guidelines for diagnosis and management

• "observation option" build into guidelines – this was 1st time in North America
  • Prioritize antibiotics according to diagnostic certainty
  • Greater reliance on observation when diagnosis was uncertain

• 3 part definition for AOM
  • Acute onset of symptom
  • Presence of middle ear effusion (MEE)
  • Signs of acute middle ear inflammation
• Also included a 'uncertain diagnosis' category (without clear visualization TM)

2004 AOM guidelines (modified Table 4)

<table>
<thead>
<tr>
<th>Age</th>
<th>Definitive diagnosis of AOM</th>
<th>Uncertain diagnosis of AOM</th>
</tr>
</thead>
<tbody>
<tr>
<td>6 months-2 years</td>
<td>Antibiotics</td>
<td>Antibiotics if severe illness; observation if non-severe</td>
</tr>
<tr>
<td>&gt;2 years</td>
<td>Antibiotics if severe illness; observation if non-severe</td>
<td>Observation option</td>
</tr>
</tbody>
</table>

Observation option only if follow-up ensured
Non-severe, mild otalgia and fever ≤ 39°C within last 24 hours
Severe illness is fever ≥ 39°C or severe otalgia
Definitive diagnosis meets all 3 criteria:
- rapid onset
- signs MEE and o/u mild ear inflammation

* AAP - American Academy of Pediatrics and American Academy Family Practice, Pediatrics, 2004
Antibiotics vs. Observation

- RCT of 233 children with non-severe AOM randomized to HD amoxicillin vs. watchful waiting
- "Watchful waiting" group
  - 2/3 did not fill the prescription → fewer adverse effects
  - Took longer to improve, especially for patients < 2 yo
  - Decreased cost of care ($11.43 vs. $47.4)
- No difference in:
  - Failure/recurrence rates (day 30)
  - Outcomes according to age group
  - Office/ED visits, phone calls, or days of missed work/school
- No serious AOM-related adverse events in either group

- McCormick et al, Pediatrics 2005

2013 guidelines vs. 2004 AOM – what’s new?

- 2013 guidelines
  - Stringent diagnostic criteria
  - "Expanded" group for observation period before start antibiotic in selected cases

- Lots of pneumatic otoscopy

2013 guidelines

- Revised diagnostic criteria for AOM
  - The most important diagnosis feature for a bulging or full tympanic membrane associated with middle ear effusion

- Lieberthal AS, AOM guidelines, Pediatrics 2013

Diagnosis of AOM emphasized 2013 guidelines

- Middle ear: thickness, translucence, position relative to neutral, mobility, erythema, landmarks
- Right TM
  - A. Normal TM
  - B. TM with mild bulging
  - C. TM with moderate bulging
  - D. TM with severe bulging

Otitis media with effusion (OME)

- OME and AOM are on a continuum
- OME may occur
  - Precede and predispose to AOM
  - Occurs in setting of URI (Eustachian tube dysfunction)
  - Aftermath of AOM
  - Pain not typical but can be associated with OME
- OME does not need antibiotics
- Therefore very important OME vs AOM

Which children benefit most from antibiotics?

- A "clinically significant benefit" of immediate antibiotic therapy is observed for
  - Bilateral AOM
  - Strep pneumonia infection
  - AOM associated with otorrhea
- Children < 2 year with AOM may take longer to improve clinically than older children

- Rowens MMA. Lancet, 2006

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2013 AOM guidelines

<table>
<thead>
<tr>
<th>Age</th>
<th>Unilateral</th>
<th>Bilateral</th>
<th>Bilateral in Transient URI</th>
<th>Bilateral in URI (Eustachian tube dysfunction)</th>
</tr>
</thead>
<tbody>
<tr>
<td>6-24 mo</td>
<td>Antibiotic Therapy Without</td>
<td>Antibiotic Therapy With</td>
<td>Antibiotic Therapy or additional observation</td>
<td>Antibiotic Therapy or additional observation</td>
</tr>
<tr>
<td>2-5 y</td>
<td>Antibiotic Therapy without</td>
<td>Antibiotic Therapy</td>
<td>Antibiotic Therapy</td>
<td>Antibiotic Therapy</td>
</tr>
<tr>
<td>6-11 y</td>
<td>Antibiotic Therapy</td>
<td>Antibiotic Therapy</td>
<td>Antibiotic Therapy</td>
<td>Antibiotic Therapy</td>
</tr>
</tbody>
</table>
- Age 0-3 mo: Antibiotic therapy for bilateral AOM
- Age 11-18 y: Antibiotic therapy for unilateral AOM

Wait and watch period

- Initial observation defined as initial management of AOM limited to symptomatic relief
- With plan to start antibiotics ("rescue antibiotics") if the child’s conditions worsens at any time or does not show clinical improvement within 48-72 hours of diagnosis
  - Parents often given fax and told to fill if needed:
    - SNAP: = safety net antibiotic prescription
    - WISP: = "wait and see" prescription
  - Or parents to call/return if child fails to improve within 2-3 days
- Mechanism must be in place to ensure follow-up and initiation of abx if the child fails observation

Case 1

In an otherwise healthy child with acute otitis media, observation without starting antibiotics is a reasonable option for which of the following patients? (102.2 is AAP temp threshold)

A. 3 year-old with temperature of 102.4, experiencing severe pain and unilateral TM bulging — Rx; high fever, otalgia
B. 10 month old with temperature 101.3 F, mild discomfort and mild unilateral TM bulging
C. 10 month old with temperature 103.2 F and mild bulging of the bilateral TMs — Rx, high fever, bilateral
D. None of the above—they should all be started on antibiotics

Treatment AOM

- AAP 2013 guidelines: High dose Amoxicillin
  - S. pneumo resistance: penicillin binding proteins
  - Overcome with higher dose
  - H. flu
    - 60-80% of H. flu are susceptible to amoxicillin
    - Rarely progresses to mastoiditis or intracranial infection (i.e. not that virulent)
  - Moraxella
    - Most are beta-lactamase +
    - High rate of resolution spontaneously or on amoxicillin
- Exceptions: Amoxicillin prior 30 days, concurrent conjunctivitis (H flu) or allergy to PCN
- Some controversy whether Amox-Clav should be first line b/c of + H flu/beta-lactamase
- Recent antibiotic pressure and vaccination with the pneumococcal conjugate vaccine have resulted in the emergence of beta-lactamase-producing Haemophilus influenzae and Moraxella catarrhalis as the leading organisms causing AOM, followed by Streptococcus pneumoniae.

Duration

- < 2 years: 10 day course
- 2-5 year: 7 day course
- ≥ 6 year: 5-7 day course
- The recent guideline endorses 10 days of Rx duration for most OM but acknowledge shorter courses may be just as effective

- Is treating longer the answer?
  - Tympanocentesis data (done day 1 and day 3-5 later) showed organism dead by day 3-5, failures were resistant bug, treating long not the answer——

2013 guidelines -- other

- No role for prophylactic antibiotics for recurrent AOM
- Xylitol (birch sugar) may have some role in preventing recurrent AOM
  - Taken daily 3-5x/day throughout respiratory season — 25% reduction
  - However chewing gum and lozenges not ok < 2 year (therefore syrup)

- References:
  - Lieberthal AS, AOM guidelines, Pediatrics 2013
  - Azarpazhooh A, Cochrane Database System Rev 2011
  - Pichichero ME, Otolaryngol Head Neck Surg 2001
Recent study NEJM; AOM young children

Short course vs longer course antibiotics


Take home points AOM

- If severe pain or high fever (>102.2) – Rx
- If bilateral AOM and < 2 years - Rx
- Initial observation is appropriate for children when not severely ill or highly febrile or unilateral
- Overall management strategy
  - Analgesics
  - Parent info and education (self limited nature of most OM especially > 2yr)
  - Provisions for “rescue antibiotics”
- 1st line antibiotics either;
  - High dose Amoxicillin (AAP 2013)
  - However some experts recommend Amox clavunate

Community-Acquired PNA

Case 2

3.5 year old previously healthy, fully vaccinated child in your practice presents with high fever, increase in respiratory rate, and crackles on exam. Non-toxic on exam. CXR suggestive of lobar pneumonia.

Best treatment option is

A. Azithromycin
B. Ceftriaxone IM and f/u tomorrow
C. High dose Amoxicillin
D. Ciprofloxacin
E. Cefdinir
F. High dose Amoxicillin and Azithromycin
Community-Acquired Pneumonia (CAP)

- Fairly common
  - Leading cause of morbidity and mortality worldwide
  - Annual incidence: 5-11 cases/1000 adults, incidence in children higher 34-40 cases/1000 children
- Antibiotics commonly used
- Targeted therapy is often challenging
  - Timely identification of specific agent is limited
  - This may lead to
    - Prolonged treatment
    - Inappropriate or broad treatment

Etiologies of CAP

Broad range of pathogens:
- **Influenza, RSV, hmpv, and other viruses**
- **Streptococcus pneumoniae** – if bacterial, most common 'typical'
- **Haemophilus influenzae**
- **Moraxella catarrhalis**
- **Mycoplasma pneumonia-most common “atypical”**
- **Chlamydia pneumoniae**
- **Legionella**

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### IDSA Pediatric CAP for hospitalized patients

<table>
<thead>
<tr>
<th>First line</th>
<th>Second line</th>
</tr>
</thead>
</table>
| Fully immunized children | Amoxicillin or PCN/G
| Not fully immunized or infant/child with 'life threatening' illness | 2nd gen cephalosporin
| If 'significant consideration' of Mycoplasma/Chlamydia | Azithromycin
| Clinical, lab or imaging c/w Staph aureus | Vancomycin or Clindamycin
| A&E. Strep pneumonia no high resistance | Vancomycin or Clindamycin

Unless regional Strep pneumonia high resistance | However azithromycin resistance to Strep

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### IDSA Pediatric CAP outpatient guidelines

- Preschool aged children
  - Most viral, don't Rx
  - If suspect bacterial, Amoxicillin (high dose) 1st line (fully immunized)
- School aged children & adolescents
  - Amoxicillin (high dose) if suspect typical bacterial PNA
  - Macrolides if suspect atypical organisms (test for Mycoplasma)
IDSA recommendations for **duration** Rx pediatric CAP
• IDSA (pediatric): “10 days have been best studied although shorter courses may be just as effective”
• Caveat—if MRSA, need longer
• Antibiotics reach higher level in lungs > closed space of middle ear or sinuses
• Some centers have been using 5 day duration for CAP and same outcomes

—Bradley J, IDSA, 2011
—Pichichero M, ID newsletter, 2016

**CAP**
pediatric outpatient studies

India (7 sites)
• 3 days vs 5 days oral Amoxicillin (50-55 mg/kg/day)
• N= 2188 children enrolled, 2-10 months
• Cure rates:
  • 88.5% (3 days) vs 88.9% (5 days)

*PNA diagnosis is based on WHO definition:
cough, difficulty breathing, and increased respiratory rate

“Less is More” studies

Comment about the use of macrolides for CAP
• In pediatrics, primarily used to cover ‘atypical’ organisms such as **Mycoplasma**
• IDSA Pediatric CAP 2011 guidelines:
  • ”Macrolide antibiotics should be prescribed for treatment of children (primarily school-aged children and adolescents) evaluated...”
  • Vague recommendations in < 5 years
• **Mycoplasma** PNA thought to be uncommon in children < 5 year by some experts (controversial)
Strep pneumonia & changing epidemiology

- **2000, Prevnar 7 (PCV7) US**
  - Decrease Pneumococcal PNA
  - Several investigators noted increase parapneumonic empyemas in children due to 1, 3, 19A

- **2010, 13 valent Strep pneumo vaccine (PCV13)**
  - Includes 1,3,5,7F, 6A and 19A
  - Further decrease in invasive disease (particularly 19A and 7F)

Case 2

3.5 year old previously healthy, fully vaccinated child in your practice presents with high fever, increase in respiratory rate, and crackles on exam. Non-toxic on exam. CXR suggestive of lobar pneumonia.

Best treatment option is

A. Azithromycin
B. Ceftriaxone IM and f/u tomorrow
C. **High dose Amoxicillin // (Amoxicillin/Clavunate – other option)**
D. Ciprofloxacin
E. Cefdinir
F. High dose Amoxicillin and Azithromycin

Comment about dosing and Rx

TID vs BID, cephems vs PCNs

- Advantage of TID vs BID dosing
  - Achieving more time above the MIC

- Note that oral cephems are never superior in PK/PD for susceptible pathogens
  - In contrast IV cephems generally achieve favorable PK/PD profiles

- “As a rule the most favorable PK/PD profiles achieved with highest allowable dose given as frequently as possible to the point of continuous infusion... (Parker S, Peds Review, 2013)

- PD=pharmacodynamics, PK=pharmacokinetics

S pneumo/Intermediate, Amox vs Cefdinir

Intermediate S. pneumoniae Isolate

**Intermediate S. pneumoniae Isolate**

(MIC of 4 mcg/mL)
**CAP summary**

- For outpatient Rx CAP
  - < 5 years: most are viral but if you think bacterial, high dose Amoxicillin
  - > 5 years: high dose Amoxicillin (typical PNA) or azithromycin (atypical PNA)
- Duration?
- For outpatients who respond fairly quickly (improving, AF, less respiratory distress); 5 days reasonable
- Azithromycin, think twice for children < 5 years—
  - Most are viral
  - If need antimicrobials Amoxicillin should be first line

**Pharyngitis**

**Case 3**

- 3 year old with fever, runny nose, cough, red eyes and complains that his throat hurts when he drinks/eats
- Mother reports that older sibling may have had recent strep throat
- Exam remarkable for non-toxic boy with red eyes and cough
- Best next steps?
  - A. Rx with Amoxicillin x 10 days for probable GAS
  - B. Test and treat if positive GAS
  - C. Do not test or treat.
  - D. Rx with Amoxicillin x 20 days just to be sure

**Acute Pharyngitis**

- One of most common conditions in office practice
- 12 million visits/year (all age), 7 million pediatric visits and but overtreatment major misuse of antibiotics
- For pharyngitis in children == only 20-30% due to Group A Strep (GAS)
- GAS is the only commonly occurring pathogen for which antibiotics are “definitely indicated”
- Yet overtreatment major misuse of antibiotics
Agents of CAP

<table>
<thead>
<tr>
<th>Estimated frequency</th>
<th>Types</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Viral</strong> 50%</td>
<td>Rhinovirus Human metapneumovirus Adenovirus, Coronavirus Influenza A and B Parainfluenza Enterovirus ERV, HIV Rarely, HIV</td>
</tr>
<tr>
<td><strong>Common bacterial</strong> 15%</td>
<td>Group A Strep Group C, Group G</td>
</tr>
<tr>
<td><strong>Less common</strong> &lt;5%</td>
<td>Moraxella pneumoniae Arcanobacterium haemolyticum Fusobacterium necrophorum Chlamydia pneumoniae Neisseria meningitis Francisella tularensis</td>
</tr>
<tr>
<td><strong>Noninfectious</strong></td>
<td>Smoke GI reflux</td>
</tr>
</tbody>
</table>

Group A Strep (GAS) pharyngitis

- Highest in 5-15 year old
- Season late winter/early spring
- Antibiotics treatment for
  - Symptomatic relief
  - Reduce supplicative complications; Peritonsillar abscesses, retropharyngeal abscesses, lymphadenitis
  - Non-suppurative sequelae; acute rheumatic fever
  - Transmission to close contacts
  - However up to 30% children colonized
  - Importance of accurate diagnosis and appropriate treatment:
    - Avoid overuse of antibiotics
    - Reduce duration / severity of symptoms

Clinical: GAS vs. Viral

<table>
<thead>
<tr>
<th>GAS</th>
<th>Viral</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sudden onset of sore throat</td>
<td>Conjunctivitis</td>
</tr>
<tr>
<td>Fever</td>
<td>Cough</td>
</tr>
<tr>
<td>Nasal, sneezing, abdominal pain</td>
<td>Diverticulitis</td>
</tr>
<tr>
<td>Tonsillar/pharyngeal inflammation</td>
<td>Vesicular lesions in mouth (EV)</td>
</tr>
<tr>
<td>Patchy tonsillar/pharyngeal exudates</td>
<td>Ear pain</td>
</tr>
<tr>
<td>Peritonsillar abscesses (tender nodes)</td>
<td>Sinus discomfort</td>
</tr>
</tbody>
</table>

However...

- 2012 meta-analysis of prediction rules
  - 24,000 subjects aged 3-18 years
  - No individual finding could rule GAS in or out
  - 5 findings each increased the probability of GAS pharyngitis to > 50%
    - Scarlatiniform rash (LR 3.91; CI 2.00 – 7.62)
    - Palatal petechiae (LR 2.69, 1.92 – 3.77)
    - Pharyngeal exudate (LR, 1.85, CI, 1.58 – 2.16)
    - Vomiting (LR, 1.79; CI, 1.58 – 2.16)
    - Tender cervical nodes (LR, 1.72, CI, 1.54 – 1.90)
  - 5 clinical prediction rules studied – none gave a probability that was high enough (>85%) to rule in GAS in children

Shaikh et al, J Peds 2012
Group A Strep pharyngitis

- GAS is not a clinical diagnosis, micro tested needed for diagnosis
- IDSA recommends the use clinical scoring to decrease unnecessary testing (& treatment)
- Center Criteria developed for adults
- Modified by McIsaac to include age and expanded to all ages

Testing and Treatment

not only to decide who to treat but also who to test

McIsaac score adjusts score for pediatrics

<table>
<thead>
<tr>
<th>Clinical criterion</th>
<th>McIsaac score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fever</td>
<td>1 point</td>
</tr>
<tr>
<td>Absence cough</td>
<td>1 point</td>
</tr>
<tr>
<td>Anterior cervical adenitis</td>
<td>1 point</td>
</tr>
<tr>
<td>Tonsillar exudates</td>
<td>1 point</td>
</tr>
<tr>
<td>Age</td>
<td></td>
</tr>
<tr>
<td>2-14 years</td>
<td>1 point</td>
</tr>
<tr>
<td>&gt;14 year</td>
<td>-1 point</td>
</tr>
</tbody>
</table>

- Low risk (don’t test)
- Should be assessed for GAS; Rx only if + 4 or more
  a. American College Physicians; Rx
  b. IDSA & AHA; not necessarily Rx, test

- McIsaac W, JAMA, 2004

Testing

Important not to over-test because of high rate of Strep colonization

Don’t test:
- Test asymptomatic close contacts (unless high risk for ARF or PSGN)
- Test patients who just completed therapy (as a test of cure)
- Test patients with signs and symptoms of viral infection

Test
- Both tonsils and posterior pharynx should be swabbed
- Use RADT, DNA probe, culture depending on age
  * Negative rapid antigen tests (RADT) in children should be backed up by a culture or DNA probe
  * Backup culture not necessary in adults (pneumococcal lower, ARI as limit)
- Serology (e.g., ASO, DNaseB) not helpful during acute period

Treatment

- PCN antibiotic of choice (2-3x/day), Amoxicillin often used instead (1x/day, better taste) x 10 days
- Recent FDA approval for 5-day course; 3rd gen ceph (***)
- PCN allergic patient: 1st generation ceph (or possibly macrolides but resistance)
- High rate of resistance to macrolide
- Don’t use: Tetracyclines, Sulfonamides, or Fluoroquinolones

- GAS is the only commonly occurring pathogen for which antibiotics are “definitely indicated”
- However, European guidelines treatment symptomatic and only used for severe cases

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McIsaac W, JAMA, 2004

AAP Red Book, 2016
Pelucchi C, Clin Micro Infect, 2012
If patient not responding antibiotics......

- Should respond in 24 hours...
- Consider complications or other diagnoses
  - retropharyngeal/parapharyngeal abscess
  - Lemierre's syndrome - septic thrombophlebitis of jugular vein causing fever, neck pain, bacteremia, pneumonia

Red flag: respiratory distress, toxic appearance, stridor, drooling, unilateral neck pain

Case 3

- 3 year old with fever, runny nose, cough, red eyes and complains that his throat hurts when he drinks/eats
- Mother reports that older sibling may have had recent strep throat
- Exam remarkable for non-toxic boy with red eyes and cough
- Best next steps?
  - A. Rx with Amoxicillin x 10 days for probable GAS
  - B. Test and treat if positive GAS
  - C. Do not test or treat
  - D. Rx with Amoxicillin x 20 days just to be sure eradicated

Skin and Soft tissue (SSTI)

- Impetigo/Ecthyma
  - +/- gram stain of pus/exudates
  - To determine Staph vs Strep
  - Impetigo
    - Topical mupirocin (or metampmol) BID x 5 day
  - Oral (if lots of lesions or outbreak setting)
    - 7 days oral 1st gen cephalosporin
    - 7 days oral 1st gen cephalosporin
    - If reasons to be concerned MSSA Rx with Clindamycin or TMP-S
    - Strep infections can result in acute glomerulonephritis (+/- epidemics)

- Stevens DJ, IDSA guidelines SSTI, 2014

- Impetigo/Ecthyma; deep form of impetigo
Purulent SSTI

- Furuncles, carbuncles, epidermoid cysts
  - 1. Incision and Drainage
  - 2. +/- antibiotics
    - If +/- systemic/inflammatory response
    - Fever, increased RR or HR or abnormal WBC use antibiotics
  - Antibiotic Rx required when abscesses associated with extensive cellulitis, rapid progression, or poor response to initial drainage or specific areas of the face/hands/genital or co-morbidities
    - Stevens DL, IDSA guidelines SSTI, 2014

SSTI

- Cellulitis
  - Culture not recommended unless immunocompromised host, immersion injury or animal bite
  - If w/o systemic signs illness can cover for just Strep
  - If sick add MSSA coverage
  - If evidence of MRSA add MRSA coverage
  - X 5 days
  - Cellulitis appears to be paucibacillary disease with low bacterial yield of skin
  - Most bacteria likely eradicated from underlying dermal layers within few days of antibiotic Rx
  - Therefore, brief Rx course maybe just as effective as standard 7-10 day course
    - Stevens DL, IDSA guidelines SSTI, 2014

Case 4

8 year old boy

- 2 day history of fever & sore throat followed by
  - Rash that looked like a sunburn and now feels like sandpaper
  - Tongue with whitish coating
  - Non-toxic appearing
Case 4
Most likely diagnosis?
A. Kawasaki disease
B. Rocky Mountain Spotted Fever
C. Parvovirus B19
D. Scarlet Fever (GAS)
E. HHV-6
F. Enterovirus

Scarlet fever (Scarlatina)

• Epidemiology and Etiology
  • Due to Group A Strep (erythrogenic exotoxins produced by GAS)
  • Occurs most often in association with GAS pharyngitis
  • Can also be associated with pyoderma or infected wound
  • 120 distinct serotypes or genotypes of GAS
  • All ages, most common school aged and adolescents
  • Late fall, winter & spring

Scarlet Fever (Scarlatina)

Clinical
• Pharyngitis
• Whitish coating on tongue or posterior throat (early on) then strawberry tongue (after desquamation)
• Rash as described
• Headache, nausea/vomiting, abdominal pain
• Tender anterior cervical lymphadenopathy
• Myalgia
• Scarlet fever rash – triggered by erythrogenic exotoxins produced by GAS
• Typically not severe

Scarlet Fever rash
Rash first on the neck and part of face clear area (around mouth) and then spreads to chest and back and then remainder of body

Rash initially resembles a sunburn with tiny bumps and it may itch, blanch then becomes diffuse, fine & papular (“sandpaper”) (tissue important clue)

In body creases, the rash forms classic red streaks — Pastia’s lines (groin, underarms, antecub)
Scarlet Fever (Scarlatina)

Complications
Suppurative:
- Otitis media
- Skin infections
- Peritonsillar or retropharyngeal abscesses
- Pneumonia
- Arthritis
Nonsuppurative:
- Rheumatic fever
- Poststreptococcal glomerulonephritis
- Treatment: same as GAS pharyngitis (Penicillin V x 10 days or other option)

Case 5

- 15 year old male who presents to clinic with a history of mild fever, myalgia and headache 10 days ago
- 3 days ago: red cheeks followed by a rash that started on his trunk and moved to extremities to involve arms, buttocks and thigh
- Rash worsens after hot showers and whirlpool exposure

Case 5

Most likely diagnosis?

A. Kawasaki disease
B. Rocky Mountain Spotted Fever
C. Parvovirus B19
D. Scarlet Fever
E. HHV-6
F. Enterovirus

Parvovirus B19

Etiology & Epidemiology:
- Virus, replicates in RBC precursors
- aka Erythema infectiosum or Fifth Disease
- Transmitted by respiratory droplets and also placental
- Incubation period 4-14 days (up to 21 days)
- Peak age group 6-14 years of age
- For susceptible individuals during epidemics, the attack rate is 50% for household contacts and schoolchildren, and 30% for teachers
- Common in winter and spring
Parvovirus B 19—Classic

Clinical
- Mild prodrome
  • fever, headache, sore throat, malaise, myalgias, nausea, diarrhea, joint pain
  • Arthralgia and arthritis <10% children, common adults (especially female)
- Biphasic rash +/- joint symptoms 2-3 weeks after prodrome
  1. Slapped cheek appearance (confluent erythema over cheeks, sparing the nasal bridge and periorbital areas)
  2. Spreads from trunk to extremities, which undergo patchy clearing → lacy reticular pattern; may be itchy
- Biphasic rash +/− joint symptoms 2−3 weeks after prodrome
- 1. Slapped cheek appearance (confluent erythema over cheeks, sparing the nasal bridge and periorbital areas)
  2. Spreads from trunk to extremities, which undergo patchy clearing → lacy reticular pattern; may be itchy
- Infectious period PRIOR to onset of rash not during rash

Parvovirus B19—other

- Asymptomatic or mild URI without rash
- Atypical rashes (rubelliform, petechial, PPGSS – papulaopurpuric gloves-and-socks syndrome, with painful itchy papules, petechiae, and purpura of hands/feet, often with fever and enanthem)
- Polyarthropathy syndrome (in adults)
- Chronic erythroid hypoplasia (especially immunocompromised)
- Transient aplastic crisis lasting 7-10 days (SCD, beta-thal trait)
- Can depress all 3 cell lines (WBC, Hgb and Platelets)

Parvovirus B19—pregnancy and fetus

- IUGR, isolated pleural & pericardial effusion
- Causes non-immune hydrops in fetus (highest 2nd trimester)
  • Serious fetal condition
  • Abnormal accumulation of fluid in fetal compartments including ascites, pleural effusion, pericardial effusion, skin edema
- Risk fetal death 2-6% overall, highest 1st half of pregnancy
- Risk to pregnant woman?
  • 50% young adults immune
  • >20% of susceptible contacts become infected
  • Not all infections lead to transmission...
  • Testing can be done to determine immune status, acute infection

Case(s) 6

- 11 month old brought by parents summertime because of low grade fever and rash hands, feet and mouth. Refusing to eat/drink
- Father mentions that he also has a rash on hands/palms, itchy

Child: Father
Case 6
What is most likely diagnosis?
A. Hand foot and mouth in child but dad’s rash not related
B. Measles
C. Kawasaki disease in both child and parent
D. Hand foot and mouth in both
E. Scarlet fever
F. Mononucleosis

Hand, Foot and Mouth-enterovirus
Epidemiology and Etiology
- RNA viruses, picornaviruses belong to Polio and 'non-polio' viruses:
  - Group A coxsackieviruses
  - Group B coxsackieviruses
  - Echoviruses (now Parecho)
  - “numbered” enteroviruses (e.g. EV 68, EV 71)
- Spread via fecal-oral and respiratory route
- Most occur June-October in US
- Hand-Foot and Mouth
  - coxsackievirus A (especially A16) and EV71
- Incubation periods: 3-6 days

Clinical – enterovirus
- Fever, N/V, fatigue, irritability
- Skin lesions; start with flat discolored spots/bumps → vesicular lesions on hands, feet, lips and buttock
- Lesions on the palms, soles, and in the mouth
- Also buttocks is a common site in children
Outbreaks enterovirus

- Most outbreaks Hand, Foot and Mouth (HF&M)
  - CV A16 and EV 71—mostly SE Asia and Australia
  - (CVA 10 to a lesser extent)
  - Sporadic cases of H, F and M associated with many of the other EV

- CAV6 outbreaks have been seen in US and several other countries
  - Finland, Japan, Taiwan

Coxsackie A 6
- a relatively “new” EV

- More adults affected than other outbreaks of HF&M
- More severe and atypical rashes
  - in addition to typical H, F and M rash
  - ~50% with desquamation of palms/soles (confused with KD)
  - ~35% with onychomadesis (compared with 5% of H, F and M with non-CAV6 infection)
- Onychomadesis (shedding of nails) 1-2 months after acute illness

CAV6—what’s different?

- HFMD generally affects 11% of exposed adults but < 1% develop clinical manifestations of disease
- CVA-6 affect a broader demographic and results in more severe course compared to classic HFMD

- 4 unique characteristics
  - Widespread vesiculobullous and erosive lesions
  - “eczema coxsackium”
  - Eruption similar to Gianotti-Crosti
  - Purpuric lesion

"Eczema coxsackium" and unusual cutaneous findings in an enterovirus outbreak

- OBJECTIVE:
  - To characterize the atypical cutaneous presentations in the coxsackie A6 (CAV6) associated North American outbreaks of 2011-2012

- METHODS:
  - 33 patients with enterovirus infection and met criteria for inclusion. Categorical variables were compared using chi-square test and continuous variables were compared using the t-test. A P-value of <0.05 was considered significant

- RESULTS:
  - Rash data were available in 46 patients (39% adult, 61% pediatric) aged 1-77 years. Average age was 19 months (range 1 month-77 years). The median number of days from onset of rash to testing was 5 days (range 0-21 days). The median time of rash duration was 3 days (range 1-28 days).

- CONCLUSION:
  - Symptoms vary depending on age group. Adult's rash is less severe, and involved fewer body areas than pediatric rash, and involved more body areas than classic ECF. CAV6 has a wider spectrum of skin presentations in adults, and should be suspected in adults with rash. It is also associated with systemic complications.

- Mathes E, Pediatrics, 2013
CAV-6 rashes can be atypical

Adults with CAV-6

- 5 adults with CAV-6 positive
  - Age range: 16 – 39 year
  - 3 male
  - 3/5 oropharyngeal involvement
  - 2/5 perioral involvement
  - Lesions:
    - Purpuric macule, erythematous papules and vesicles,
    - desquamation

CAV-6 HFMD disease in adults

- Erythematous or purpuric macular lesions on the palms and soles can mimic those of secondary syphilis
- many patients were tested for syphilis

CAV-6 HFMD disease in adults

Desquamation of the plantar aspect of the right foot extending to all 5 digits. Image taken at 1 month follow-up visit.

multiple erythematous papules and eroded vesicles on the face
Case 7

3 year old Asian male presents with 6 days high fever in February
- Maculopapular rash on trunk 3 days ago, now gone
- Red lips
- Red eyes
- Swelling on hands and feet
- He has been very irritable and fever does not come down with anti-pyretics
- No recent travel, no hiking/camping, no pets at home
- Resident of San Francisco, CA
- Fully vaccinated

Labs
- WBC=16,000 (70%P), Hgb=11, Platelets=160,000
- Na=132
- ESR=95, CRP=12
- ALT=65, AST=42
- U/A – positive for LE
- EBV serology negative, GAS negative,

Case 7

What is most likely diagnosis?
A. RMSF
B. Measles
C. Kawasaki disease
D. Incomplete Kawasaki disease
E. Scarlet fever
F. Mononucleosis

Kawasaki Disease (KD): Background
- Mucocutaneous lymph node syndrome
- First described in 1967 by Dr. Tomisaku Kawasaki
- Reflect widespread inflammation of mostly medium sized muscular arteries (one of the most common vasculitides of childhood)
- Increasing incidence in Japan and US
- Considered ‘self-limiting’ but can cause coronary artery abnormalities
Kawasaki Disease (KD)

- Most commonly ages 6 months – 5 years
  - Japan: KD in 1% by 5 years of age

- Cause unknown ➔ infectious agent
- Winter/spring predominance in temperate climates
- Apparent "outbreaks" with wavelike spread, infants < 3 mo appear to be protected
- Clinical picture overlaps with several infectious diseases

Kawasaki Disease differential

Infectious Disease

- Measles
  - Other viral infections: • Varicella, adenovirus, enterovirus (e.g. Coxsackie)
  - Dengue, Chikungunya, Zika, West Nile virus
  - HIV

Non-infectious Disease

- Drug hypersensitivity reactions (e.g. DRESS)
- Stevens-Johnson syndrome
- Systemic onset JIA
- Mercury hypersensitivity reaction (acrodynia)

Etiology

Blowing in the wind...a toxin?

- Time series analysis of KD patient in 3 sites with high KD incidence (Japan, Hawaii and San Diego)
  - Seasonal increase in KD cases associated with large scale shift in Asia North Pacific wind pattern

- Seasonal analysis suggests peak of KD cases at each of 3 locations linked to a coherent seasonal shift in winds that "simultaneously exposed Japan to air masses from central Asia, and Hawaii and CA to air masses from the western North Pacific."

- Wind pattern data also suggests the "enhancement of this trans-Pacific circulation pattern is associated with unusually high KD activity in Japan and San Diego."

Mnemonic: "CRASH and Burn"

Brief nonspecific prodrome of respiratory or GI symptoms

5 days fever (high spiking, usually <14)

1. Conjunctivitis (75%) last after fever: bilateral, non-exudative, painless, limbic sparing
2. Rash-polymorphic rash (70-90%) within 5 days of fever; non-specific but NOT vesicles or bullae; perineal accentuation and early desquamation
3. Adenopathy (25-70%) (cervical): least common—but can be predominant—lymph nodes, firm, non-fluctuant, no overlying erythema, unilateral, <1.5 cm, often multiple nodes
4. Strawberry tongue (90%) (lip/oral cavity changes): often just dry, red, cracked, peeling tip; "strawberry tongue" due to swollen papillae – like in scarlet fever
5. Hands/feet (50-85%) (changes in extremities): swelling and/or redness; sometimes painful edema

Classic Kawasaki Manifestations

Neudburger et al. Kawasaki Guidelines, Pediatrics 2004
Other features of Kawasaki

Preceding respiratory illness (>50%)
Diarrhea (25-50%)
Aseptic meningitis (40%)
Gallbladder hydrops (10%)
Urethritis (>50%)
Arthralgia/arthritis (>30%)
  - 7.5-20% of patients with KD
  - Large joints-knee, ankle and hip primarily
  - Self-limited and non-deforming
Carditis-but not part of diagnostic criteria
  - Tachycardia out of proportion fever
  - Gallop sounds
  - Muffled heart tones

Kawasaki Disease Labs

No diagnostic test but characteristic lab features;
- Elevated ESR and CRP
- Leukocytosis, Left shift, lymphocyte drop early on then rise dramatically
- Elevated ferritin
- Normocytic normochromic anemia
- Urine: WBCs (urethral origin) don't cath, not PMNs so dipstick not helpful, (clean void/bag)
- ALT increase
- CSF ; mononuclear pleocytosis with normal glucose/protein
- Serum lipid profiles/elevated TGs and LDL and decreased HDL
- Low NA
- Increased platelet (after day 7)
Kawasaki Disease

**Kawasaki Disease course**
- Typically “self limited” with fever and other manifestations lasting average 12 days
- Long term complications almost all associated cardiac:
  - Acute phase myocarditis not correlated with development of aneurysms
  - Acute phase pericarditis
  - Coronary aneurysms
  - Depressed myocardial contractility and heart failure
  - Myocardial infarction
  - Arrhythmias
  - Peripheral arterial occlusion

**Kawasaki Disease: Treatment**
- Treatment decreases risk of coronary artery disease (25% no Rx vs 5% Rx)
  - IVIG
    - 2 g/kg given over 10-12 hours
    - within 10 days of fever onset (the sooner the better)
    - 10% with continued fever usually respond to 2nd dose IVIG
  - High dose aspirin
    - 80-100 mg/kg/day divided qd
    - Decrease to Low dose 3-5 mg/kg/day after 2 weeks
    - Continued for 6 weeks until ECHO rules out coronary artery problems
  - Refractory cases
    - Rituximab, Infliximab, (TNF-alpha -)

**Kawasaki Disease coronary artery aneurysms**
- 25% of patients with unRx KD vs. 5% with Rx KD will develop coronary artery aneurysms
- Coronary artery aneurysms develop primarily
  - Proximal segments
  - Bifurcations of coronary arteries
  - Often multi-vessel involvement
- Coronary aneurysms:
  - Small < 5mm
  - Moderate 5-8 mm
  - Giant > 8mm
    - Lowest regression rate
    - Highest rate of stenosis
    - Strongest associated with myocardial infarction

**Manifestations often not present simultaneously**
- 3 phases

**Clinical manifestations of Kawasaki Disease**
- Fever
- Arthritis
- Conjunctivitis
- Rash
- Oral/nasal findings
- Pharynx
- Hepatosplenomegaly
- Coronary artery involvement
- Other common symptoms: carditis, aseptic meningitis, diarrhea, gallbladder hydrops, urethritis, arthralgia/arthritis, preceding respiratory illness

**Kawasaki Disease**

- AAP Pediatric Red Book 2015.
Case 8

• 10 month old female seen in the ER with a high fever for 5 days, maculopapular rash and refusal to stand
• Also had diarrhea
Exam remarkable for
• Very irritable infant
• Temperature 103.2, HR=100
• Red eyes (but not sure if this is just from crying)
• Erythematous rash on trunk
• Slightly warm knees, pain on rotation of knee
• No red lips, no strawberry tongue, no cervical LN, no swelling hands/feet and

Case 8

• LP done and shows
  • 20 WBCs (90% L), normal glucose/protein
  • CBC: WBC=16,000 (high), HCT=29 (low), normal platelet
  • ESR=70, CRP=6
  • NA=130 (low)
  • Albumin=2.9 (low)
  • ALT=32
  • U/A normal

Case 8

Your next step should be to
• A. Tap knee
• B. Admit and start on IV antibiotics for septic knee
• C. Skin biopsy
• D. Cardiac Echo and Rx for Kawasaki Disease (KD)
• E. Send stool culture

Case--Next steps

• **Echo and Rx for Kawasaki Disease (KD)**, since she meets criteria for “Incomplete KD” (fever + red eyes/rash) and has ≥ 3 lab criteria (high WBC, anemia and Albumin)
• Infants are at higher risk of coronary artery aneurysm

• N.B. term “incomplete” KD preferable to the term “atypical” KD
Supplemental lab criteria
- WBC > 15K/mm³
- Platelets > 450K/mm³ (after 7 d)
- Anemia for age
- Albumin ≤ 3.0 g/L
- Elevated ALT
- Sterile pyuria: ≥ 10 WBC/HPF

Newburger et al, Kawasaki Guidelines, Pediatrics 2004

But not all “textbook” cases.....

What if it is day #5 of fever, only a few clinical criteria met and only a few of lab markers met......

- Continue to follow daily exam
  - Signs and symptoms of KD evolve over time
    - For example, a patient may have fever and lymphadenopathy day #3 illness but then lymphadenopathy gone and red lips appear day #5 illness
- Continue to do lab testing
  - Repeat Urinalysis: WBC can be intermittently positive
  - CBC and albumin—these tend to become more abnormal as KD progresses
  - If red eyes: consider ophthalmology consult. If uveitis is present makes KD very likely

KD and additional lab testing, day
Number (%) of patients meeting criteria

<table>
<thead>
<tr>
<th></th>
<th>% of patients</th>
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<tbody>
<tr>
<td>Day 24</td>
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<tr>
<td>Day 5</td>
<td></td>
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<tr>
<td>Day 10</td>
<td></td>
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<tr>
<td>Day 15</td>
<td></td>
</tr>
<tr>
<td>Day 24-30</td>
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</table>

Incomplete KD

- All ages, but increase in young children and older children/adults
- Term ‘incomplete’ now preferred to ‘atypical’
- “Incomplete” KD 15-36% of all KD cases
  - Risk of coronary ~ same but the abnormality may be worse in incomplete b/c delay dx and Rx
- More difficult to diagnosis
- Need to consider in differential of unexplained fever
  - Some of clinical features (only a few) Laboratory features
- Adults
  - HIV may predispose to syndrome (9 of 57 cases with KD have HIV)
  - IVIG not as beneficial? However coronary aneurysms less frequent
  - Seve E, Semin Arthritis Review 2003
  - Gerhardt-Mennecke, Medicine, 2010

Anemia and Albumin became more abnormal

Table 3

<table>
<thead>
<tr>
<th></th>
<th>% of patients</th>
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<tbody>
<tr>
<td>Day 24</td>
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<td>Day 24-30</td>
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</table>

Kawasaki Disease
Childhood vs. Adults

<table>
<thead>
<tr>
<th>Children-more common</th>
<th>Adults-more common</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Aseptic meningitis</td>
<td>• Unilateral cervical adenopathy</td>
</tr>
<tr>
<td>• Coronary artery aneurysms</td>
<td>• Arthritis/arthralgia</td>
</tr>
<tr>
<td>• Thrombocytosis</td>
<td>• Elevated ALT/AST</td>
</tr>
</tbody>
</table>

Seve P, Semin Arthritis Rheumatology, 2005

Kawasaki diagnosis – pitfalls

• Part of the diagnosis of KD includes "exclusion of other diagnosis"
• Identification of another possible agent can be helpful...but not always
  • E.g. Group A strep: a lot of overlap, up to 30% children colonized in throat so a positive doesn’t necessarily mean GAS disease
  • Not uncommon to have patient read for GAS, then rash occur due to drug reaction vs. evolving KD
• Concurrent Respiratory viruses
  • 222 patients with KD, 192 (86%) had RVP panel
  • 93 (42%) positive for virus
    • Most rhinovirus/enterovirus
    • Some had adenovirus
  • 384 patients with KD, 251 (65%) had viral done
    • 12 (3%) positive, including rhinovirus (9), adenovirus (6), Flu (5) and RSV (2)
• Authors concluded that presence of respiratory virus should not exclude diagnosis of KD
  • Turcotte A, Pediatrics, 2015
  • Jordan, J Childs, A. Ped Infect Dis J, 2010

What happens when KD missed...?
In adulthood

• 40 year old male presents with effort angina, no risk factors for CAD
  • Coronary angiogram remarkable for marked ectatic proximal LAD
  • RCA also showed marked ectasia
  • No obstructive lesions in coronary tree
  • Echo showed normal LV systolic function
  • Put on statin and antiplatelet Rx
  • Died suddenly 1 year after angiogram
  • Bhagwat A, Indian Heart Journal, 2015
What about after childhood?

- 25% of patients with unRx KD vs. 5% with Rx KD will develop coronary artery aneurysms
- Persistent aneurysms can remain silent until later in life / myocardial ischemia can develop
- Management for KD myocardial ischemia different than atherosclerotic CAD
- Presenting decades later with cardiovascular sequelae
  - Myocardial ischemia/infarction
  - CHF secondary to myocardial fibrosis
  - Claudication due to vascular insufficiency from thrombosed peripheral arteries
- 5% of young adults being evaluated for ischemia may had had KD as cause of symptoms

Daniels LB, Circ J, 2015
Daniels LB, Circulation, 2012
Burns J, J Am Cardiol, 1996

Adult onset KD and Adult recognition KD

- Unlike pediatrics no established guidelines for evaluation and treatment of patients with KD

Summary

Pediatric ASP & commonly treated infections

10 day duration probably too long for most of these conditions!
- Acute otitis media
  - Not all need antibiotics, “wait-and-see” plan
  - If antibiotics; 1st line Rx: High dose Amox or amox/clav
- Community acquired PNA
  - Children < 5 year:
    - most viral
  - If antibiotics; 1st line high dose Amox, Azithromycin not usually warranted
  - School aged and adolescents
    - If typical PNA; 1st line high dose Amox, if atypical; Azithromycin

Summary

Pediatric ASP & commonly treated infections

- Group A pharyngitis
  - Not a ‘clinical’ diagnosis
  - Only test if appropriate (2-3 modified Cantor)
  - Only treat if positive GAS and/or meets criteria
  - 5 day regimen now acceptable with 3rd gen oral
Summary Rashes

- Lots of infections associated with rashes in pediatrics
- Important to look at epidemiology (time of year, contacts), clinical and possibly lab markers to distinguish type
- Kawasaki disease should be considered in any rash illness—
  - Adult practitioners need to think about KD both in terms of acute presentation of KD as well as adults who may have had KD as child and now present with cardiac complications

Appendix

The End

GAS Rx children

<table>
<thead>
<tr>
<th>Medication</th>
<th>Dose / Duration</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Penicillin V (PO)</td>
<td>&lt; 27 kg: 400,000 U (250 mg) 2-3 times daily 10 days or 27 kg: 800,000 U (500 mg) 2-3 times daily</td>
<td></td>
</tr>
<tr>
<td></td>
<td>&gt; 27 kg: 1.2 million U (750 mg) 2-3 times daily</td>
<td></td>
</tr>
<tr>
<td>Amoxicillin (PO)</td>
<td>50 mg/kg/day once daily 10 days</td>
<td></td>
</tr>
<tr>
<td>Erythromycin (PO)</td>
<td>&lt; 27 kg: 400,000 U (250 mg) 2-3 times daily 10 days or 27 kg: 800,000 U (500 mg) 2-3 times daily</td>
<td></td>
</tr>
<tr>
<td>Cephalaxin (PO)</td>
<td>20 mg/kg/day PO 10 days</td>
<td></td>
</tr>
<tr>
<td>Clindamycin (PO)</td>
<td>20 mg/kg/day in 3 doses 10 days or 10 mg/kg twice daily for 5 days</td>
<td></td>
</tr>
<tr>
<td>Azithromycin (PO)</td>
<td>25 mg/kg/day PO daily 5 days</td>
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</tr>
</tbody>
</table>

### Doses for AOM

#### Initial/Immediate or Delayed Antibiotic Treatment

<table>
<thead>
<tr>
<th>Antibiotic</th>
<th>Dosage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Amoxicillin (Augmentin)</td>
<td>80-90 mg/kg/day in 2 doses</td>
</tr>
<tr>
<td>Amoxicillin (Augmentin)</td>
<td>80 mg/kg/day in 2 doses</td>
</tr>
<tr>
<td>Amoxicillin (Augmentin)</td>
<td>60 mg/kg/day in 2 doses</td>
</tr>
</tbody>
</table>

#### Treatment after 48-72 hours if Failing Initial Management

<table>
<thead>
<tr>
<th>Antibiotic</th>
<th>Dosage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ceftriaxone (3rd gen)</td>
<td>50 mg/kg/day in 1 dose for 1-3 days</td>
</tr>
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### AOM

#### Antibiotic dosing

- **Amoxicillin**: 80-90 mg/kg/day in 2 doses
- **Amoxicillin**: 80 mg/kg/day in 2 doses
- **Amoxicillin**: 60 mg/kg/day in 2 doses
- **Ceftriaxone**: 50 mg/kg/day in 1 dose for 1-3 days
- **Ceftriaxone**: 50 mg/kg/day in 1 dose for 1-3 days

#### Keep different susceptibility patterns in mind

- Amoxicillin slightly better against *S.pneumoniae* than cefdinir or cefuroxime
- Cefdinir, cefuroxime better against *H.flu* than amoxicillin
- *Strep* does not cover Gram-negatives (e.g. *N.flav*; *M.smithii*)

### OM Antibiotics

#### Antibiotic dosing

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definitions

- AOM - acute otitis media
- OME - otitis media with effusion (?non purulent effusion)
- MME - middle ear effusion
- NNT - number needed to treat
- Uncomplicated AOM — AOM w/o otorrhea
- Severe AOM - AOM with mod-severe otalgia OR Temp > 39
- Nonsevere AOM - AOM with mild otalgia and Temp < 39
- NNT - number needed to treat