AMERICAN COLLEGE OF EMERGENCY PHYSICIANS
SCIENTIFIC ASSEMBLY
1999

Dilemmas in Pediatric Head, Ear, Eye, Nose, and Throat (HEENT) Infections

Children commonly present to the emergency department with HEENT infections. At times, the diagnosis and management of these patients can be challenging. How do you diagnose sinusitis in a child? How do you treat the toddler with persistent otitis media? How do you deal with their frustrated parent? When do you culture and/or treat a red throat? How do you get that bead out of their nose? The lecturer will discuss solutions for these and other related dilemmas.

- Discuss the appropriate treatment for the pediatric patient with persistent or recurrent otitis media.
- Discuss the appropriate use of culture, rapid streptococcal testing, and antibiotic treatment in the child with pharyngitis.
- Discuss the options for removing a foreign body from the nose or ear of a toddler.

TU-96
Tuesday, October 12, 1999
3:00 PM - 3:55 PM
Room # N208
Las Vegas Convention Center

FACULTY

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Pediatric Head, Ear, Eye, Nose, and Throat Infections

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Pediatric Head, Eye, Ear, Nose and Throat

OTITIS MEDIA

GENERAL

- by definition, includes acute suppurative or purulent otitis media and otitis media with effusion
- accounts for 30 million oral antibiotic prescriptions each year in the U.S; ~ 60 prescriptions written / min or 1 / second
- total cost estimate $ 3-4 billion per year ** est in 1990
- between 1975 - 1990, diagnosis of otitis media increased by 224% in children < 2 years old
- by the age of 1, 2/3 of kids diagnosed with 1 AOM; by the age of 3, 4/5 of kids diagnosed with 1 AOM and 2/5 diagnosed with 3+ episodes
- myringotomy (tympanic tube placement) is the 2nd most common surgical procedure for children in the U.S.
- many parent magazines now selling otoscopes to parents directly "…the ear scope just helps you make informed decisions…" - The Right Start: Babies to Kids Westlake Village CA

ANATOMY OF THE MIDDLE EAR

- lateral border is tympanic membrane; medial border is inner ear; superior border is tegmen tympani bone, which separates middle ear from cranium; internal jugular vein lies below the middle ear cavity; posterior border is mastoid antrum
- Eustachian tube connects middle ear space to the nasopharynx; closed at rest, open during swallowing or Valsalva; functions to equilibrate middle ear and atmospheric pressures, protect middle ear from secretions from the nasopharynx, and clear middle ear of secretions into the nasopharynx

PATHOPHYSIOLOGY

- Eustachian tube straighter, shorter, less stiff and less supported in children; contributing cause of inadequate middle ear drainage and effusions in children
- Eustachian tube becomes congested during upper respiratory infections or allergies ➜ malfunction of the tube ➜ secretions in middle ear have no way out ➜ bacteria multiply
- tensor veli palatini muscle is less efficient in kids than adults so Eustachian tube opening is impaired during swallowing
- supine position in infants (along with straighter, shorter tube) allows nasopharyngeal debris to flow into middle ear; discourage use of bottle feeding when child is supine in crib

COMPLICATIONS

- Complications of otitis media include hearing loss which occurs most often with persistent effusions (even acute episodes can lose 25 dB – like "plugging ears")
- Also perforation of the TM, cholesteatoma, labrynthitis, facial paralysis
- Incidence of mastoiditis as complication of otitis media is decreased when otitis media is treated with antibiotics; Acta Otolaryngol 1954 Rudberg- incidence of mastoiditis 17% in untreated patients, and 0 – 1.5% in patients treated with penicillin, sulfonamide or combination
- CNS complications include meningitis, encephalitis, brain abscess, or lateral sinus thrombosis
- *M. catarrhalis* and *H. influenzae* have less capacity to cause invasive or suppurative complications and tend to clear spontaneously at a much higher rate than pneumococci

ETIOLOGY

- No bacteria isolated from tympanocentesis 30%
- *Streptococcus pneumoniae* 37% (~ 20% are PCN-resistant)
- *Hemophilus influenzae, most non-typable* 20% (~ 20-30% beta-lactamase producers)
- *Moraxella catarrhalis* 10% (~ 80-90% beta-lactamase producers)
- *Streptococcus pyogenes* and *Staphylococcus aureus* 3%
- Viral organisms – some studies show up to 10-20% viral etiology
  - ? role of viral organisms as precursor to bacterial pathogens
  - AOM can follow URI 7-10 days later
  - in patients who failed antibiotic treatment, studies show higher percentage of viruses
  - more difficult to eradicate bacteria when viruses also present
  - J Inf Dis 1990 Chonmaitree – 87% pts with bact cleared with ab's but only 50% cleared when bact plus virus; J Ped 1992 Chonmaitree – 51% pts with bact plus virus had persist OM, only 35% pts with bact only, or 19% pts had persist OM
  - Am J Dis Child 1991 Heikkinen – found influ A vaccine decr AOM incidence assoc with influ A by 83% and overall by 36%
  - NEJM Jan 1999 Heikkinen – aspirated ME and nasal washings of 456 kids with AOM (815 ears); used viral cxr, Ag detection, and serologic blood tests; specific viral path of resp tract found in 41%; RSV, parainfluenza, and influenza were most common; virus detected in ME fluid in 74% of kids inf by RSV; 52% para influenza, 42% influenza; bact pathogens also found in 73% of 815 ears (S.pneumo, H. flu, M.catarr); in 66 viral ears, bact also found in 43 (66%); S.pneumo found sig more often with influenza >> RSV, parainfluenza; (some argue that cause (viruses) and effect (AOM) not established by this study).

- infants < 6mo - *Chlamydia trachomatis* is a cause of OM but unlikely to be recovered in middle ear aspirations because it is an obligate intracellular pathogen
  - can have *Chlamydia* pneumonia at the same time

- *Mycoplasma pneumoniae* not frequent but should be considered in unresponsive cases or if bullous myringitis is present
  - bullous myringitis can also be seen with other more typical pathogens

- neonates < 2 wks old - OM rare in neonates but can be caused by Group B strep, *S. aureus*, gram-negative enteric bacteria
  ** EMR states S. aureus and GN enteric bacilli together are 15-20% in neonates

  ** kids < 6yo with tympanostomy tubes and acute sxs have similar orgs to other kids
  ** kids > 6yo with tympanostomy tubes have Pseudomonas aeruginosa and Staph aureus

** why resistance? Freq overuse; multiple partial courses due to poor compliance or drug discontinuation due to poor tolerance, prolong duration, inconvenience dosing, reliance on day-care employees

WHO'S AT RISK ?

- peaks between 6 and 13 months of age
- more males diagnosed in many studies
- higher incidence in American and Canadian Indians
- Caucasians affected more than African-Americans
- appears to run in families

OTHER FACTORS PREDISPOSING

- more often seen in the winter months, then autumn and spring
- cleft palates deformities will predispose to middle ear infections
- passive smoking has been associated with increased rates of otitis media

• day care attendance also increases child's risk (may be due to more upper respiratory tract infections or more fevers requiring doctor visits)
• bottle fed infants appear to have higher incidence (may be due to high negative pressure generated in the mouth while sucking can cause aspiration of fluid into middle ear)
• breast feeding appears to protect infants less 4 months old and infants with cleft palate (may be due to more vertical position when feeding, milk flowing from nipple or due to IgA or prostaglandins in breast milk)
• prolonged use of pacifiers appears to be a significant risk factor

I CAN'T SEE ANYTHING. THIS CHILD IS A MOVING TARGET !

• leave ear exam for last - most likely part of exam to piss off the child (tell child you are looking for Mickey Mouse or look in Mom's ear first)
• infants should be supine on bed with arms brought straight up to "entrap" head between arms
• older kids can be held in Mom's lap - Mom pins child's legs between her legs, one arm of Mom's wraps around child's body and 2 arms, and Mom's other hand holds child's head firmly (also useful for examining oropharynx)

• pull pinna of ear up and away in order to straighten the canal for better viewing
• in neonates, TM is more horizontal so TM may "look smaller"
  - AOM rare in kids < 2 months old
  - neonates can also retain amniotic fluid behind their tympanic membrane for several weeks after birth
• removal of cerumen best achieved by curette or irrigation; must ensure a properly immobilized child; curette with plastic (less traumatic); instill Debrox or other "cerumenolytic" for 15 min before irrigating; irrigate with warm water (cold water will cause vertigo and vomiting); "water piks" used by dentists are ideal
• if water remains in canal after irrigation, turn child's head with affected side down, gently place your finger in ear canal to cause a seal, and when released, water will come out

• warn parent about the potential for the canal to bleed slightly before attempting cleaning !
• if external canal is traumatized during cleaning, start prophylactic treatment for otitis externa

DEFINITIONS and CLINICAL FINDINGS

• Acute otitis media (AOM) = inflammation of middle ear associated with symptoms
  - also called purulent, suppurative or bacterial
  - fever, pain, ear drainage are classic findings
  - most authorities agree that more specific symptoms such as fever or pain are necessary to make diagnosis of <u>acute</u> otitis media
  - some authorities include non-specific signs and symptoms like irritability, abdominal pain, vomiting, diarrhea, or lethargy as indications of acute otitis media
  - occasionally vertigo or hearing loss can be seen

• Otitis media with effusion (OME) = fluid present in the middle ear without symptoms
  ** otitis media with "confusion" – Ped Inf Dis 1994 Bailey CM
  - no signs or symptoms usually with effusion
  - also called serous, allergic, or secretory
  - can be sequelae of acute otitis media

• Recurrent otitis media = 3 or more episodes in 6 months or 4 or more episodes in 1 year

• Persistent or chronic otitis media with effusion = usually > 2-3 months
  - tympanic membrane may be perforated and may or may not be draining

• Otitis media without an effusion = myringitis - inflammation of tympanic membrane with redness and opacification only but TM moves well
  - tympanic membrane usually moves well
  - may be seen in early AOM or in resolving AOM

TYMPANIC MEMBRANE EXAMINATION

POSITION

- should lie in neutral position; no bulging or retractions

COLOR

- usually has pale ground glass appearance
- if blue or yellow, indicates effusion
- erythematous membrane is the most confusing !!!
  - can be red due to crying, fever, canal irrigation, sneezing or viral infection
  - increased vascularity can be seen in all these conditions also (usually along length of malleolus)
  - asymmetric erythema may be early AOM (especially anterior, superior quadrant)

TRANSPARENCY

- should be able to see "landmarks"
- opacification may be an indication of an effusion or membrane thickening
- air-fluid level indicates an effusion

MOBILITY

- extremely subjective; must have good seal in canal to ensure valid "read"
- may be helpful to detect an effusion, but cannot say if effusion is acute or chronic
- can use commercial insufflators, IV extension tubing, or newborn bulb syringe into otoscope, if snug fit ensured
- if TM is already red, bulging, and distorted, avoid mobility check - PAINFUL !!

- ***classic findings include a tympanic membrane that is erythematous, opaque, and devoid of bony landmarks with an absent or splayed light reflex and abnormal mobility (as visualized by pneumatic otoscopy)***

- TM's can be "flushed" and lack a light reflex or bony landmarks secondary to crying; only reliable sign of otitis media in the crying child may be tympanic membrane mobility

ADDITIONAL TESTS

• Tympanometry - can provide information regarding TM mobility and middle ear pressure; yields same information as careful pneumatic otoscope examination
  - used to monitor resolving acute otitis or effusions

• Tympanocentesis and culture of middle ear fluid can relieve extreme pain and may be indicated in cases of intracranial involvement, AOM in the neonate or immunosuppressed child, or for impending tympanic membrane rupture

• if considering tympanocentesis, call ENT consultant; procedure - ensure good immobilization of the child, 70% alcohol instilled into canal and then removed to sterilize canal, 3.5 inch 22-gauge spinal needle bent to 30 degree angle inserted at the posterior inferior portion of the TM visualizing through the otoscope (as described in Barkin RM *Pediatric Emergency Medicine Concepts and Clinical Practice* 2nd Edition Mosby 1997

I AM CALLING IT OTITIS MEDIA. NOW WHAT ?

• Enormous pressures on physicians to make "diagnoses" when children have fevers
  - pressure from parents for prescription, want to "treat" a febrile child, need to justify the visit, etc

• Many "acute otitis media" diagnosed without the TM ever being visualized
  - many cases of antibiotics prescribed over the telephone with physician never even seeing the child; diagnosis based on Mom's observation of child at home

• One cause of partially treated meningitis can be linked to oral antibiotics being given for a presumed AOM when child actually has a more serious illness

• Studies show "spontaneous cure" from acute otitis media in 10-14 days *WITHOUT MEDS* in 14-88% of patients

** J Peds 1991 Giebink - combined 4 placebo-controlled trials and found 76% spont cure rate or demonst sig improvement without tx; "20% kids with AOM in pre-antibiotic era developed intratemp or intracranial infection"

** J Peds 1994 Rosenfeld - did meta-analysis of 30 studies, 5400 kids with AOM and found 81% spont sxs resolution and improvement in appearance of TM; Talan – ab's provide a 10-15% outcome benefit in terms of acute sxs relief (vs no ab's) in AOM; studies in U.S. are bad – cointerventions allowed 63% time, compliance checked 66%, 94% gave explicit criteria for exclusion but only 41% gave explicit criteria for inclusion; meta-analysis found modest, yet sig, efficacy of ab's over placebo or no drug; comparison of same-spectrum ab's vs extended-spectrum did not find sig diff

• Studies show only 1/3 of patients actually need antibiotics to resolve clinical signs and symptoms

• In England and other countries, patients are given symptomatic relief alone initially; if patients still have symptoms 48 hours later, may then be treated with antibiotics

** Scandinavia and Netherlands = watchful waiting; tx if still sxs after 24-72 hours or if complications develop

** Acta Otolaryngol 1983 Meistrup-Larsen "masterful inactivity" – given analgesics first, then 1-3 doses for first 8-12 hrs, then PCN 55mg/kg/d div BID for 2 days, then myringotomy +/- amox; states 2-day and 7-day PCN had equal satisf (71% vs 76%)

• If 1/3 are <u>not</u> bacterial and will presumably resolve <u>without</u> antibiotics, and 2/3 are bacterial cases and 2/3 of those will resolve <u>without</u> antibiotics ➜ 80% (7/9) of acute otitis media will spontaneously resolve

BUT

• Cannot distinguish clinically which ears are infected with potential viruses or which will self-resolve; so must over-treat 80% of ears in order to benefit 20% of ears that do require antibiotics to resolve

• Because of the high self-resolving percentages, almost any antibiotic will have high clinical cure rates; must evaluate hundreds (? thousands) of patients in order to show one antibiotic superior to another; must have placebo "arm" in the clinical trial to compare against the spontaneous cure rate

• Studies show that with antibiotics, symptoms resolve faster and infection resolves faster when compared to placebo;

*** Rosenfeld J Peds 1994, 124 (3): 355 using meta-analysis of 33 randomized trials found 10-15% outcome benefit using antibiotics over placebo; also may get parent back to work faster if child's illness resolves faster

OK, OK …BUT WHAT ANTIBIOTIC ?

- If < one month old, generally admit for intravenous antibiotics
  - Gram negative bacilli and Staph aureus also common
  - If fever or irritability present, sepsis workup and admission for IV antibiotics are necessary
- If > one month old, can be treated with outpatient antibiotics
- Must consider cost, number of times per day, taste, side effects, etc

- Assuming antibiotics have some advantage over placebo, expensive broad-spectrum antibiotics that remain in the pharmacy because the patient is unable to pay for them will not work as well as cheaper, more limited spectrum antibiotics the patient actually takes !!

• If beta-lactamase resistance and risk for resistant S.pneumo is <u>low</u>, (first line agents):
  - Amoxicillin 40–45 mg/kg/day divided TID x 10days
    - (or 125 mg TID for < 18 mo; 250 mg TID for > 24mo)
  - Trimethoprim-sulfamethoxazole 8 mg/kg/day divided BID
    - good for PCN allergic or if recently treated with Amoxicillin

- trick to dosing = 1 teaspoon BID for each 10 kg of child's weight

• Jan 1999 - Drug-resistant *Streptococcus pneumoniae* Therapeutic Working Group's recommendations –
- if not high risk for resistant-Strep pneumo, recommends regular dose Amoxicillin 40-45 mg/kg/day div TID as first line therapy
- if high risk for resistant-Strep pneumo, recommends high dose Amoxicillin 80-90 mg/kg/day div BID as first line therapy
  - less than 2 years old
  - attends day care
  - antimicrobials in last 30 days

• If beta-lactamase resistance for H.flu and M.catarrhalis is high: (must know community resistance levels)
- Trimethoprim-sulfamethoxazole
  - recent evidence that pneumococcal resistance to trimeth-sulfa may be more common than PCN resistance; not advocated if PCN resistance is high
- Erythromycin-sulfisoxazole 50 mg/kg/day of erythro component divided TID or QID
  - recent evidence that resistance to macrolides is growing; if resistant to erythro, will be resistant to azithro and clarithro; increasing dosage does not overcome resistance
  - GI side effects like diarrhea, and can interact with antihistamines
  - regular erythromycin does not achieve good clinical response or desired middle ear fluid levels
- Azithromycin 10 mg/kg on day #1, then 5 mg/kg/day on days #2-5
- Clarithromycin 15 mg/kg/day x 10 days
- Amoxicillin-clavulanate 40-50 mg/kg/day divided BID or TID
  - clavulanate added to overcome beta-lactamase production by H.flu and M.catarrhalis
  - GI side effects higher due to clavulanate
  - new Augmentin dosing BID 45 mg/kg with lower clavulanate; as effective as regular TID and almost as effective with 5 day course

• Treatment failures - otitis media that has failed previous antibiotic trial – continued ear pain, fever, and TM findings of redness, bulging, or otorrhea after 3 days of antibiotic therapy
- some authorities advocate trial of another "first line" antibiotic before moving to broader spectrum
- Jan 1999 - Drug-resistant *Streptococcus pneumoniae* Therapeutic Working Group's recommendations-
  - must now select antibiotic effect against beta-lactamase producing H.flu and M.catarrhalis and drug-resistant S.pneumo
  - Amoxicillin-clavulanate 80-90 mg/kg/day (of amox component) divided BID
    - clavulanate for beta-lactamase producers and higher dose amox for resistant S.pneumo
    - Ped Inf Dis J Oct 1998 Bottenfield showed GI sxs equal with reg dose 45 mg/kg/day and high dose 90mg/kg/day
    - can achieve higher amox dosing by 1) using newer formulation of amox-clav that has reduced amt of clavulanate, or 2) combine older amox-clav formulation with amox alone (keep clavulanate dosing at approx 10mg/kg/day
  - Cefuroxime 30-40 mg/kg/day divided BID
  - Ceftriaxone 50 mg/kg IM x 1 (approved currently by FDA for uncomplicated, PCN-susceptible AOM)
    - Ped Inf Dis J Dec 1998, Leibovitz E et al - Ceftriaxone 50 mg/kg IM x 3 days found to be effective in resistant OM; 72% S.pneumo was intermed-resist to PCN, but all susc to Ceftriaxone; bact eradication achieved in 100% H.flu, 92% S.pneumo, 50% M.catarrhalis, 100% S.pyogenes cases.

  - Cefixime 8 mg/kg/day either qd or divided BID advocated by some for treatment failures

• If patient has GI symptoms, amoxicillin-clavulanate and erythromycin-sulfisoxazole may exacerbate the symptoms
- staying as close to q 8 hour dosing for amox/clav and taking the antibiotic with meals will help reduce the risk of diarrhea

• If patient has cervical adenitis or exudative tonsillitis also, trimethoprim-sulfamethoxazole should be avoided due to the ineffectiveness toward Group A streptococcus

• If patient has purulent conjunctivitis and acute otitis media, higher incidence of *Haemophilus influenzae*

• If patient has pneumonia or sinusitis with acute otitis media, higher incidence of *Haemophilus influenzae* and *Staphylococcus aureus* producing beta-lactamase

• *Streptococcus pneumoniae* is becoming more resistant to penicillin worldwide; many isolates also be resistant to trimethoprim-sulfamethoxazole, tetracycline and erythromycin

• If patient has pneumonia and is < 6 mo old (*Chlamydia trachomatis)* or > 6 yrs old (*Mycoplasma pneumonia),* then erythromycin-sulfisoxazole is good

• Ceftriaxone IM 50 mg/kg for non-compliant, vomiting child, inability to fill meds, etc; is as effective as 10 days in recent large study; use judiciously; controversial topic due to cost, issue of resistance, etc.

HOW LONG TO TREAT ?

• Typical "ten days" of treatment of most infections based on treatment of GABHS for pharyngitis
• Studies showing 5 days of treatment for AOM comparable to 10 days of treatment
  - Ped Inf Dis J 1996 Feb - Cefuroxime BID x 5 days was equal to Amoxicillin / clavulanate TID for 10days
  - J Chemotherapy Arguedas – 3 d azithro vs 10 d clarithro – 100% azithro has satisf clin response; 95.7% clarithro had satisf clin response; rates of persist MEE equal – Talan suggests 3 days may be effective ??
  - Ped Inf Dis J 1996 Gooch – 5 d cefurox or 10 d cefurox or 10 d augmentin; 1/3 not followed; had equivilant satisf clinc response (69,70,74%) but all CI crossed zero; states clin improve/cure rate similar to other studies; 5 d cefurox did fail in pts with perf'd TM
• In many countries in Europe, standard treatment is 5 days in length; many countries will not treat the child with antibiotics unless child remains symptomatic at 48 hours
• Shorter courses (like 5 days) may be possible with these factors considered: Peds 1995 Paradise
  - older kids need shorter course than younger kids
  - summer OM appears to resolve faster
  - AOM is a spectrum - worse cases will need longer treatment
  - recurrent disease will need longer treatment
  - child's individual response to treatment may dictate length of treatment
• Complicated cases or ruptured tympanic membrane needs longer course (10 days)

ANTIBIOTIC	COST	DOSING	PRO'S & CON'S	RESISTANCE
Amoxicillin (Amoxil)	Low $ 6 (1yo, 10kg, 10days)	40-60 mg/kg/day div TID If high-risk for resist S.pneumo, use 80-90mg/kg/day div BID	Inexpensive, ** excell palatable diarrhea	weak H. flu activity * incr resist of H.flu and M.catarr and S.pneumo * can overcome resist with higher dosage
Trimethoprim-sulfamethoxazole (Septra or Bactrim) ** in 1 : 5 combo	Low $ 6 ** highly attractive due to price	8mg//kg day div BID based on trimeth	Inexpensive, Allergies ** can cause N/V ** can cause bone marrow suppress and hemolyt anemia, esp G6PD ** may incr dilantin levels ** alter dose for renal pts	weak S.pneumo activity *blocks folic acid synthesis *fairly good activity against most org's *if PCN-resistant, then likely trimeth-sulfa resistant
Azithromycin	mod $ 34	10mg/kg day #1, 5mg/kg day #2-5	Less GI effects once-a-day, ** good palatable	*good coverage of H.flu, M.catarr beta-lactam pos * overall resist to S.pneumo 5% **clin cure rate 87% = amox/clav *caution in chronic theo
Erythromycin-sulfisoxazole (Pediazole)	relatively low $ 12	40-50 mg/kg/day div TID or QID based on erythro ** bad dosing	bad taste, diarrhea ** GI side effects ** vent arryth when combo with anticholin or antihistam like terfenadine	*inconsistent against beta-lactam pos H.flu or against S.pneumo *if PCN-resist, then likely macrolide resistant
Ceftriaxone	Moderate $ 20 + nurse time	50mg/kg IM x 1 50mg/kg IM x 3 for resistant cases	painful single dose	*good for non-compliance *resistance may be overcome by dose x 3 days
Amoxicillin-Clavulanate	Relatively low $ 17 ** price recently lowered	40mg/kg/day div TID ** now 45 mg/kg BID 200 and 400/5cc ** consider high dose 80-90mg/kg/day for resistant	Diarrhea in 10% ** 16% in EMR Good palatable less clav = less GI has aspartamine must use newer formul for high dose or mix with reg amox	

Cefaclor	moderate $ 34 ** now generic	40mg/kg/day div BID or TID x 10d	possible serum sickness-like illness	weak H.flu activity *some H.flu, M.catarr beta-lactam pos resist *some S.pneumo resist
Cefixime (Suprax)	Mod – high $ 34 ++	8mg/kg/day QD	good taste, GI side effects	Weak S.pneumo activity *incr S.pneumo resist
Cefprozil (Cefzil)	Mod – high $ 46	BID	poor taste	weak H.flu activity *spectrum of in vitro is good
Cefuroxime (Ceftin)	High $ 56	30mg/kg/day div BID	bad taste ** EMR – "palatability is acceptable"	*good in vitro spectrum
Clarithromycin (Biaxin)	Moderate $ 31 ** costs more than amox, trimeth/sulfa, or azithro	15mg/kg/day div BID	metallic taste, less GI effects ** unpleasant taste and palatability ** caution with theo, terfenadine, or astemizole	weak H.flu activity * more strains of S.pneumo are suscept to Clarithro than PCN, cefix, cefaclor * excell activity against M.catarr *suff activ against H. flu (azithro > clarithro)
Loracarbef (Lorabid)	Mod - high $ 46 ** cost is high	BID	good taste ** favorable taste	* good activity
** Cefpodoxime	** Cost more than most	** QD	** Poor taste	* good in vitro coverage
Ceftibuten		9mg/kg/day qd	once-a-day	*weak S.pneumo

taste from best to worst: cefixime cefaclor amoxicillin / clavulanate erythromycin / sulfisoxazole amoxicillin trimethoprim / sulfamethoxazole

cost from best to worst: (based on 10 day treatment for 1 yr old weighing 10 kg)

- Amoxicillin and TMP-SMX were cheapest in all weight classes (5, 10, 15, 20, 25 kgs)
- Erythromycin / sulfisoxazole was third cheapest
- Azithromycin and Clarithromycin alternated between 4th and 5th depending upon weight class

OTHER TREATMENT MODALITIES

- Antihistamines
  - studies for decades have disproven their usefulness to alleviate symptoms
  - recently though, some advocating use due to increased histamine production by both bacteria and viruses demonstrated in middle ear effusions

- Steroids
  - not recommended for acute otitis media due to possible side effects and no confirmation that steroids are beneficial in AOM
  - some recommending steroids for chronic effusions

- Pain Control
  - Pain meds, such as Tylenol or Motrin, may be useful
  - topical analgesics, like Auralgen (antipyrene and benzocaine) may be useful for the first 1-2 days

- Topical antibiotics
  - usually used for perforated TM's or tympanostomy tubes or occasionally otorrhea

FOLLOW-UP

- Acute, non-complicated cases should follow-up in 4 weeks to allow tympanic membrane to heal; otherwise tendency to consider treatment "failed"
- Chronic cases, recurrent cases, younger infants, or immunocompromised patients should be followed up sooner, i.e. 2 weeks
- Pediatrics 1994 Hathaway - found parents correctly identified 97.1% of the time which children had resolved otitis media at 10-21 days after antibiotics started; might be able to do selected follow-up

PERSISTENT MIDDLE EAR EFFUSIONS:

- Generally considered when effusion is present for greater than 3 months
- Many advocate a trial of antibiotics and steroids before considering surgery
- Risk of chronic hearing loss with resultant negative effect on speech development and cognitive learning
  ** MEE assoc with sig hear loss, 25-35 dB, usually temporary; persistent effusions may result in delay of speech or language develop; < 4yo, abn speech, language develop; > 4yo, behav probs
- Myringotomy with tube placement, many times, ends up as the procedure of choice

RECURRENT OTITIS MEDIA

- Defined as 3 or more episodes in 6 months or 4 or more episodes in 1 year
- Some advocate daily prophylaxis with Amoxicillin 20mg/kg/day or sulfisoxazole 75 mg/kg/day
  ** JAMA 1993 Williams – meta-analysis of 9 studies – ab prophylaxis decr freq of new OM by 44%
- Some advocate prophylaxis only during episodes of URI
  or during winter - both advocated Am J Dis Child 1978 Biedel, Ped Inf Dis 1992 Berman
- Some advocate influenzae vaccine and pneumococcal vaccine for kids older than 2 years old
  ** Am J Dis Child 1991 Heikkinen – pneumococcal vaccine decr #OM episodes in kids with hx of recurrent OM
  ** Ped Inf Dis J 1983 Schuller – pneumo vacc decr #OM episodes in kids with recurr OM and asthma

- Kids with tympanostomy tubes
  - under 6yo, use regular ab's +/- topical
  - over 6 yo, Pseudomonas or S.aureus are not uncommon

ACUTE MASTOIDITIS

PATHOPHYSIOLOGY

- mastoid antrum is bordered by the semicircular canals, the middle cranial fossa, the temporal lobe of the brain, and the facial nerve
- mastoid air cells are well developed by age 2 years, but continue to enlarge through adolescence
- mucous membrane of the mastoid air cells is contiguous with that of the tympanic cavity

• acute clinical mastoiditis usually a complication of acute purulent otitis media
• mucous membrane becomes edematous ➜ infection can spread to periosteum of the mastoid bone leading to subperiosteal abscess ➜ air cells of mastoid can fill with pus ➜ osteitis that destroys bony network of the air cells

ETIOLOGY

• bacteriologic etiology is most commonly the same bacteria that caused the purulent otitis media - *Streptococcus pneumoniae and Haemophilus influenzae;* others include *Streptococcus epidermidis, Staphylococcus aureus, Streptococcus pyogenes, Escherichia coli, Proteus, Pseudomonas aeruginosa,* and anaerobes

SYMPTOMS and CLINICAL EXAM

• child usually usually has a history of a fever, prior otitis media and antibiotic treatment
  - Gliklich Arch Otolaryngology Head & Neck Surg 1996;122:135 - only 55% had hx of otitis media
  Relative risk factors for needing surgery - proptosis of auricle, fever, elev WBC
• ear pain, discharge, headache, malaise and upper respiratory tract congestion are common findings
• acute mastoiditis can develop without obvious middle ear findings
• in more advanced cases, erythema and swelling over the mastoid area is more likely; outward protrusion of the pinna and sagging of the posterior wall of the external auditory canal can result

COMPLICATIONS

• intracranial complications can occur like labrynthitis, encephalitis, meningitis, intracranial abscess, or cranial nerve involvement

ADDITIONAL TESTS

• leukocytosis or elevated erythrocyte sedimentation rate may occur but are not diagnostic
• blood cultures will have low yield of bacterial etiology
• tympanic cavity aspiration is moderately helpful; if perforated, tympanic cavity material should be cultured just as it passes through the tympanic membrane
• periosteal abscess aspiration or mastoid mucosa aspiration are best sources for bacterial culture

• CT scan of the temporal bone (1.5 mm cuts) are preferred to plain x-ray films; CT may show clouding of the air cells with eventual coalescence of the air cells and abscess formation; CT can also show intracranial abscess or facial nerve involvement

TREATMENT

• consultation with ENT is mandatory
• admission for IV antibiotics; Ceftriaxone 50-75 mg/kg/24hr q 12 hrs IV or penicillinase-resistant oxacillin 200 mg/kg/24hr q 4-6 hr and aminoglycoside gentamicin 5-7.5 mg/kg/24hr IV
• usually requires 2 weeks of PO antibiotics after IV administration (usually 3 days and afebrile)

• mastoidectomy indicated for mastoid osteitis (breakdown of bony septae between air cells) or subperiosteal abscess or sometimes unresponsiveness to 48 hours of IV antibiotics

PERIORBITAL (Preseptal) CELLULITIS

ANATOMY

- orbit is a fixed bony cavity - superior bordered by the frontal sinus; inferior by the maxillary sinus; medial by the ethmoid sinus separated by the thin lamina papyracea
- orbital septum is a layer of fibrous tissue extending from the orbital walls to the tarsal plate
- preseptal space lies between the orbital septum and the eyelids - area is elastic so large amount inflammation or infection can occur
- venous system of the orbit and sinuses drains into the cavernous sinus
- teeth and nasolacrimal duct can also spread infection
- contiguous structures, easy flow of the venous drainage system, and paper-thin lamina papyracea all contribute to the ease of infection spreading
- periorbital edema can occur without infection solely because pressure on sinus vessels from sinusitis impairs blood flow

PATHOPHYSIOLOGY

- Causes of periorbital swelling:
  - allergic- inflammatory -infectious
  - neoplastic - endocrine - insect bites

ETIOLOGY

- majority under 6 years old, with peak incidence at 2-4 years old

- predisposing conditions include skin or lid infection (like hordeolums, impetigo), insect bites, or trauma
- most common pathogens include *S. aureus, S. pyogenes* (Group A beta hemolytic Strep), and anaerobes

- conditions such as concurrent upper respiratory tract infection, otitis media, or pharyngitis may extend to involve periorbital areas
- typical case is child < 5 years of age, with no history of trauma or disruption of skin integrity; most common pathogens then include *S. pneumoniae, H. influenzae* type B - typical age is < 3 years old
- *H. influenzae* type B decreasing now with H.flu vaccine; Barone J Ped Ophtho Strabismus 1997 found only 2/133 cases of periorbital and orbital cellulitis due to H.flu from 1985-1995; no cases of H.flu found in Barone study after 1987

- sinusitis, especially ethmoid, can extend to periorbital areas - ?? which came first
- most common pathogens here include *H. influenzae, S. pneumoniae,* and occasional anaerobes

- other less common predisposing conditions include varicella, herpes, dental infections, adenovirus, osteomyelitis of the sinuses and nasolacrimal duct obstruction

SYMPTOMS and CLINICAL EXAM

- pain, swollen eyelid, red eye, discharge (usually unilateral, and usually left side)
- orbital cellulitis would include proptosis, ophthalmoplegia, or changes in the visual acuity !!
  - remember - preceding trauma may also give ophthalmoplegia or visual acuity changes !
- fever in only 2/3 to ¾ of patients
- lymphedema can cause contralateral eyelid swelling
- ¼ patients may have chemosis or conjunctival redness
- bluish hue to skin color associated with *H. influenzae* and *S.pneumoniae*

- if unable to test visual acuity in affected eye due to swelling, check for consensual pupillary light response in the unaffected eye

COMPLICATIONS

- potential complications include meningitis and septic joints as a result of bacterial seeding
- meningitis has been reported in children < 2 years old with no meningeal signs except irritability; CSF cell counts were normal but cultures grew either *H. influenzae* or *S. pneumoniae*
- other complications include subdural or epidural empyemas, lid abscesses or parenchymal brain abscesses

  *** Peds Emerg Care 1996 Dudin - retrospective study, 1986 -1992; stratified pts into high risk and low risk; low risk group had 1/16 pos blood cxr - H.flu; no complications in the low risk group; high risk group had 5/18 pos blood cxr or pos CSF cxr; 2 orbital abscesses, 3 intracranial infxns

ADDITIONAL TESTS

- if orbital cellulitis suspected, head / facial CT scan and ophthalmology consult needed ASAP !

- CBC not very helpful in distinguishing bacterial from a noninfectious cause of swelling

- blood cultures ????

DIFFERENTIAL DIAGNOSIS

- allergic reactions, insect bites, trauma, orbital cellultis
- periorbital edema due to dacrocystitis, conjunctivitis, or hordeolum

TREATMENT

- if ill appearing, admit for IV antibiotics!

- if < 5yrs old, with no history of trauma or insect bites, *H. influenzae* and *S. pneumoniae* are probable etiologies
  - Cefotaxime 100-200 mg/kg/24 hr div q 6 hr IV
  - Cefuroxime 75-100 mg/kg/24 hr
  - Ceftriaxone 100mg/kg/24 hr

- if > 5yrs old, or related to skin break and ill appearing, oxacillin or nafcillin 150mg/kg/24hr IV will cover *S.aureus* and group A beta-hemolytic Streptococcus

- if history of skin break and well-appearing, Ceftriaxone IM followed by cephalexin 25-50mg/kg/24 hr div QID PO may be utilized
  - these patients considered low-risk for bacteremia but some authorities recommend blood cultures prior to discharge

ORBITAL CELLULITIS

PATHOPHYSIOLOGY

- 75% of cases due to sinusitis
- orbit in close proximity to the sinuses, with common venous and lymphatic drainage systems
- inflamed sinuses build up pressure ➜ obstructs venous and lymphatic flow ➜ results in periorbital swelling ➜ orbit itself is invaded by bacteria and white cells directly from the sinuses or by venous connections

ETIOLOGY

- *Staph aureus* due to trauma, post-surgery or newborn period
- *S. pneumoniae*, group A beta-hemolytic Streptococcus, and nontypable *H.influenzae* due to dental abscess or sinus infection
- anaerobes and *B.catarrhalis* can also be due to infected sinuses or dental abscesses

- rarer causes include fungal, tuberculosis, parasites or syphilis

  *** J Peds Opthal and Strabismus 1997 - 134 kids with preseptal and orbital cellulitis; 1985-1995; 2/133 pos blood cxr for H.flu but both occurred before July 1987; No H.flu since 1987; orbital cellulitis due to sinusitis in 96%; preseptal cellulitis due to sinusitis in 81%

SYMPTOMS and CLINICAL EXAM

- onset of lid edema and erythema usually rapid onset, usually unilateral
- fever 75% of the time
- usually appears systemically ill
- eyelid can be red or purple and markedly swollen
- conjunctiva redness, chemosis
- proptosis, pain on eye movement, decreased ocular mobility or decreased visual acuity are the hallmarks of the disease !
- with expanding inflammation and pus accumulation, globe may be further displaced forward
- signs of sinusitis, like headache, rhinorrhea or boggy nasal mucosa, may be present

COMPLICATIONS

- complications include meningitis and other CNS seeding - mortality remains at 2% with neonates at 11%
- orbital and subperiosteal abscess can develop
- cavernous sinus thrombosis with abnormal CN III, IV, V, and VI - ptosis, ophthalmoplegia, pupillary rigidity, loss of accommodation, marked edema, and venous engorgement of lid and orbital areas
- less common complications include partial or total visual loss, optic atrophy or enucleation, keratitis, or osteomyelitis of the orbital bones

ADDITIONAL TESTS

- if orbital cellulitis suspected, head / facial CT scan needed ASAP !

- WBC not helpful in distinguishing periorbital from orbital cellulitis; normal WBC will not change management in definitive case of orbital cellulitis

- LP indicated for neonates with orbital cellulitis due to likelihood of hematogenous spread

TREATMENT

- all cases of orbital cellulitis or abscess must be admitted to the hospital for IV antibiotics ! Call Ophtho !!
- antibiotics should cover *H. influenzae, S. pneumoniae, S. aureus,* and anaerobes -
  - ceftriaxone 50-100 mg/kg/24 hr q 12 hr IV and clindamycin 15-40 mg/kg/24 hr q 6-8 hr IV

- if abscess seen on CT scan, surgical drainage is indicated
- if antibiotics unsuccessful, sinus drainage may be necessary
- surgical drainage also indicated for persistent fever, evidence of optic nerve compression with decreased visual acuity or color perception, worsening proptosis or globe displacement, or isolated muscle weakness

SINUSITIS

GENERAL

- U.S. adult population spends $ 2 billion annually on OTC medications and makes 16 million doctor visits each year in pursuit of symptomatic relief (Williams JAMA 1995)

ANATOMY

- paranasal sinuses are four paired structures - maxillary and ethmoid sinuses are present at or soon after birth; frontal and sphenoid are visible by xray by 7-9 years olds
- sinuses drain into the three turbinates of the lateral nasal wall - sphenoid and posterior ethmoid drain into superior; maxillary, frontal, and anterior ethmoid drain into middle
- acute sinusitis - < 30 days duration; chronic sinusitis - > 30 days duration

PATHOPHYSIOLOGY

- normal function depends upon drainage patency, function of the cilia, and nasal secretions
- predisposing problems are allergies, rhinitis, foreign bodies, cleft palate, tumors, septal deviation, enlarged adenoidal tissue, polyps, cystic fibrosis, dental infections, and immunodeficiency
- trauma and excessive swimming may also predispose
- rhinitis medicamentosa causes mucosal swelling and drainage obstruction from over-usage of nasal sprays

ETIOLOGY

- acute sinusitis - *H. influenzae type b, S. pneumoniae,* Group A streptococcus, *S. aureus, B. catarrhalis,* nontypable H. influenzae

  ** NEJM Wald 1992 - viral pathogens 10% - adenovirus, parainfluenza, influenza, rhinovirus; S.pneumo 30-40%, H.flu and M.catarr 20%, staph and anaerobes not common in acute sinusitis
- chronic sinusitis - Staphylococcus, anaerobes

SYMPTOMS and CLINICAL EXAM

- sinusitis symptoms are more severe and longer in duration than an uncomplicated upper respiratory tract infection - fever > 39 C, purulent nasal discharge, periorbital swelling usually worse in the morning, nasal discharge for > 10 days, cough usually worse at night, halitosis, and facial pain

  ** facial pain , HA rarer in kids; painless morning eye swelling
- fatigue or weight loss less common
- headache, facial pain or dental pain more common in adults than children

  ** child may not appear ill, fever is low-grade

  ** change in URI can be sign of sinusitis; fever usually at onset of most URI's, with myalgias, HA, usually disappears when resp sxs begin

- exam reveals purulent drainage, usually from the middle meatus
- boggy nasal mucosa, postnasal drip, and pharyngitis
- 8% will have tender frontal, ethmoid, or maxillary sinuses
- 76% will have poor or unequal transillumination - more limited in children because of variability of sinuses before age 8-10 years old

  ** kid in dark room; light source attached to otoscope shielded from observer; max sinus – light source is placed over the midpoint of the inf orbit rim and with patient's mouth open, doc assess the transmission of light through the hard palate; exclude light through alveolar ridge; frontal sinus – place light source below the medial border of the supraorbital ridge and eval the bilat symmetry of the blush; absence of transillumination is evidence a sinus cavity is filled with tissue or fluid
- sphenoid sinusitis may present with occipital pain only but is rare in children

COMPLICATIONS

- complications include facial cellulitis or abscess, periorbital or orbital cellulitis, osteomyelitis of the skull (Pott's puffy tumor), cavernous sinus thrombosis, meningitis, subdural empyema, epidural or parenchymal abscess

ADDITIONAL TESTS

- uncomplicated sinusitis can be treated on the basis of clinical finding alone
- sinus aspiration, rarely done, should be sent for gram stain and aerobic and anaerobic cultures

• plain sinus films are more reliable in children > 6 years old; normal sinus films are helpful but abnormal films can be difficult to interpret
• sinusitis appears as clouding, mucosal thickening or air-fluid levels within the sinuses (mucosal thickening > 4mm is a less specific but suggestive sign)
** Wald NEJM 1992 - usually AP, lat and occipitomental view; most studies showing abnormalities in many asymptomatic children fail to take into acct symptoms or signs of inflammation or failed to classify findings as major or minor; sinus xrays are markedly abn in 88% < 6yo with persistent URI;

• maxillary sinus - best seen with Water's view (occipitomental)
• frontal and ethmoid sinuses - best seen with Caldwell view (anteroposterior)
• sphenoid sinus - best seen with submentovertex view or lateral view

• for young children with suspected maxillary sinusitis, a single Water's view will usually suffice

• Comput Med Image Graphics 1997 Karantanas - compared ultrasound and plain xrays in diagnosis of sinusitis; both had sensitivity of approx 66% and specificity of 95%; authors suggest ultrasound could be utilized for kids or pregnant women to limit radiation

• CT scan described as definitive exam for acute and chronic sinusitis - recommended for cases with equivocal plain xray studies (many now recommending limited sinus CT scan as first-line exam)
** CT scan are superior to plain radiographs in the delineation of sinus abnormalities, but not necessary in kids with uncomp acute sinusitis and should be reserved for the eval of recurrent or chronic sinus infxn
** CT – Arch Otolaryngol 1988 Havas and NEJM 1994 Gwaltney - 40% of asymptomatic pts and 87% of comm-acq cold have CT abn = high sens but low spec

TREATMENT

• Antihistamines, decongestants, steroids, cromolyn sodium usage is controversial

• antibiotic therapy recommended to speed resolution of symptoms and prevent complications
** kids with sinusitis have rate of spont clin cure of 40-45% (Pediatrics Wald 1986)
** BMJ 1996 Lindbaek – found spont cure in placebo group > 50%
** JAMA 1995 Williams – 3 vs 10 days of trim/smx; found equiv rates of cure or much improved; equiv med time to clin success; trend toward more relapses with 3 days; no predictors of clin success; CT sens but not spec

• nontoxic appearance -
  • Amoxicillin 50 mg/kg/24 hr q 8 hr PO
  • Amoxicillin / clavulanic acid 50 mg/kg/24 hr q 8 hr PO
  • Cefaclor 40 mg/kg/24 hr q 8 hr PO
  • Trimethoprim-sulfamethoxazole 10 mg TMP/50 mg SMX / 24 hr q 12 hr PO

• unresponsive to therapy -
  • add *S. aureus* and anaerobic coverage - dicloxicillin 50 mg/kg/24 hr q 6 hr PO

• admission recommended for toxic appearance, evidence of sphenoid sinusitis (potential to spread), inability to take PO's, immunocompromised, unreliable follow-up

• needle or surgical drainage indicated for unresponsiveness to antibiotics, severe pain unresponsive to management, seriously ill or toxic child, severe complications, or immunocompromised child

• recurrent or refractory sinusitis - may be evaluated further by sinus lavage, surgery to create an antral window, or functional endoscopal sinus surgery

STREPTOCOCCAL PHARYNGITIS

PATHOPHYSIOLOGY

- 40 million visits to physicians/ year for pharyngitis = 1.3 visits / second
- Group A streptococcus is the most common cause of bacterial pharyngitis in children > 3yrs old
- Prevalence of Group A Strep still only 30% in children and 5% in adults as an etiology for pharyngitis for all comers
- In children < 3 yrs old, streptococcus presents as purulent rhinits
- Occurs more in the late winter or early spring
- Streptococcal infections typically involve the ring of posterior pharyngeal lymphoid tissue that consists of the tonsils and adenoids, and the surrounding lymphoid tissue (Waldeyer's ring)
  - Peyer's patches (distant lymph tissue) may also be involved
- Streptococcus is transmitted by close contact and is present in saliva and nasal secretions.

OTHER ETIOLOGIES

- Group A Streptococcus causes pharyngitis and suppurative complications, like peritonsillar abscesses, and non-suppurative complications, like rheumatic fever.
- Group B, C, and G also can cause a pharyngitis but do not cause the non-suppurative complications

- Viruses also cause pharyngitis – adenovirus, Ebstein-Barr virus, Influenza A virus, Parainfluenza virus, Herpes simplex, RSV
- *Mycoplasma pneumoniae, Chlamydia pneumoniae, Neisseria gonorrhea* all cause pharyngitis

- Idiopathic etiology probably accounts for 20-60% of pharyngitis

SYMPTOMS and CLINICAL EXAM

- Streptococcus pharyngitis
  - throat pain, dysphagia, fever, exudate on tongue and posterior pharyngeal wall, tender anterior lymph nodes
  - lack of URI symptoms or cough
  - headache, vomiting, abdominal pain, scarlitiniform rash (sandpaper-like rash)
  - excoriated nares in young infants

Amer J Dis Child 1977, 77: 514 Breese BB Criteria for Streptococcal Pharyngitis:

	YES	NO
Fever	4	2
Sore Throat	4	2
Cough	2	4
Headache	4	2
Abnormal Pharynx	4	1
Abnormal Cervical Glands	4	2

Month: Feb – April (4), Jan – Dec (3), Jun – Nov (2), July – Sept (1)
Age: 5-10yo (4), 4yo or 11-14 (3), 3yo or > 15 (2), < 2 (1)
WBC: > 20.5 (6), 13.5-20.4 (5), 10.5-13.4 (3), 8.5-10.4 (2), < 8.5 (1)

Breese tested 670 kids:
- Score < 25 ➜ 20% had this score ➜ 0-13% pos strep cxr
- Score 26-29 ➜ 22% had this score ➜ 27-37% pos strep cxr
- Score 30-31 ➜ 14% had this score ➜ 56-57% pos strep cxr
- Score >32 ➜ 44% had this score ➜ 67-100% pos strep cxr

** Breese study had 50% pos GABHS – high prevalence will influence any clinical scoring system

Clin Peds 1983 **Funamara JL –** tested Breese scoring system at Harbor/UCLA PACC

	Sens	Spec	PPV	NPV	correct dx	false pos
Breese	88%	60%	70%	83%	76%	39%
PHC	44%	71%	59%	57%	59%	29%
PACC	40	80%	40%	80%	70%	20%
PACC clin impress			44%	75%	69%	25%

** poor outcome due to lower prevalence: Breese 51%, PHC 49%, PACC 24%; also WBC at discretion of doc; need to use clinical rules exactly as stated; choose ones that are user-friendly; miss one step might affect overall results of scoring; experience of observers to score may differ; swabbing techniques may be bad

COMPLICATIONS

- Peritonsillar abscess – Bennicke Acta Med Scand 1951, 139: 253 found 9/175 untreated patients developed PTA and 1/174 PCN-treated patients developed PTA
- Retropharyngeal absess, otitis media, cervical adenitis, and sinusitis are all potential complications
- Mesenteric adenitis, meningitis, brain abscess, cavernous sinus thrombosis, septic joints, osteomyelitis, endocarditis, sepsis or septic emboli are all potential complications of hematogenous spread
- Post-streptococcus sepsis – aerobic or anaerobic bacteremia results from septic thrombophlebitis of the tonsillar vein

- Scarlet fever, acute rheumatic fever and glomerulonephritis are all non-suppurative complications of streptococcus infections

- most recent estimate is risk for ARF in untreated steptococcal phayrngitis = 0.5%
- Risk of acute rheumatic fever is pharyngitis not treated = 0.5 – 4/1000 cases = 1/400 Strep Group A cases, 1/1000 childhood pharyngitis and 1/10,000 adult pharyngitis cases
- outbreak of ARF in United States 1985-1988 – approximately 300 cases
- Half of all acute rheumatic fever patients have no history for a significant sore throat
- On the other hand, penicillin allergy risk – 1 in 150 for IM, and 1 in 4,000 for PO; risk of death by PCN allergic reaction - 1: 3 -5 million
- lower ARF incidence may be due to use of PCN, and shift from rheumatologic to non-rheumatologic strains

ADDITIONAL TESTS

- WBC may be elevated but non-specific
- Rapid streptococcus latex agglutination tests or enzyme immunoassays
  - high specificity 88% - 100% (low false positives)
  - low sensitivity 72% - 95% (higher false negatives)
  - advantage of rapid antigen tests is that test can be done in the ED; disadvantage is the high specificity but lower sensitivity of the test
  - negative rapid streptococcal test should be confirmed with a streptococcal culture

- Optical immunoassay test – extraction of a carbohydrate antigen unique to group A streptococci and then a qualitative detection of this antigen
  - reportedly 98-99% sensitive but clinical studies have found sensitivities 85-90% and loss in specificity to 95%
  - false negatives thought to possibly represent carrier states (lower CFU on culture) and false positives usually low CFU of other streptococci or no growth in culture
  - again, advantage is test can be done quickly in ED, but negatives must be followed up with a cultures

- Throat cultures require follow-up which can be difficult with an ED population
  - culture may incorrectly identify carriers as positive and give false negative result in patients who actually seroconvert

  *** Kline and Runge J Emerg Med 1994, 12: 665-680 defined “gold standard” as incr in antistrep ab (ASO titer); study?? Found 45% of neg throat cxr had rise in ASO titer

  *** need to choose a gold standard that is do-able in the ED

• Cultures or rapid strep tests of infants should be taken from their noses rather than their throats

** cost vs charges – Green Ann Emerg Med 1995 March, 25(3): 404-406 - ag test and cxr ($3 each); charges are $39 and $42; need to consider charges to self-pay patients

• In older patients, who are at less risk for airway compromise, if the examination shows minimal findings but symptoms are severe or voice changes are evident, consider soft-tissue xray of neck or CT scan to look for evidence of epiglottitis or other soft-tissue pathology

DIFFERENTIAL DIAGNOSIS

• In children < 3 yo, exudative pharyngitis more likely due to viruses
• In older children, Group A streptococcus, Ebstein-Barr virus, *Corynebacterium diphtheriae*, and adenovirus all cause exudative pharyngitis

• Group A streptococcus and EB virus both cause soft palate petechiae
• Enterovirus causes vesicle or ulcers on the posterior tonsillar pillars
• Herpes virus causes ulcers on the anterior palate with lymphadenopathy

TREATMENT

• Symptomatic relief using warm water gargling, sucking hard candy, acetaminophen or NSAIDS
• Study shows patients achieve symptom relief faster when NSAID added to regiment

ANTIBIOTICS:

J Peds 1988, 113: 1089 Middleton Penicillin vs Symptomatic Treatment

	ASA/Tyl/PCN	ASA/Tyl/Placebo	
Resolved Symptoms			
At 48 Hours			
Sore throat	94%	78%	p< 0.05
Fever	87%	76%	not sig
Odynophagia	87%	76%	not sig
Malaise	86%	94%	not sig

• ** In 1950's, Denny JAMA 1950: 142 and Wannamaker Am J Med 1951: 10 showed that PCN treatment of GABHS pharyngitis prevented primary acute rheumatic fever
- original study was with military recruits and used IM Penicillin x 3
- established 10 days as standard duration of treatment
- other studies showed PO Penicillin eradicated GABHS bacteria in pharynx just as well as IM Penicillin
- leap of faith to conclude that PO PCN will prevent GABHS

• Group A Streptococcus *STILL* susceptible to good old penicillin!
- no diminished efficacy of PCN found in over 40 years of use! Shulman Ped Inf Dis J 1994, 13: 1-7
  ** Pichichero Ped Inf Dis J 1993: 12 states need to know PCN failure rate in your community; if rate is < 10% can still use PCN as first line; in Rochester NY failure rate is 30-35%
- but studies looking at efficacy troubled by compliance not being measured, Group A Strep carriers included in trials, and serotyping of strep not done initially and later to see if case is failure or re-infection
- short course of Penicillin had more clinical failures when compared to 10 day course
  - Stromberg Scand J Inf Dis 1988, 20: 37 - 5 vs 10 days
  - Schwartz JAMA 1981: 246 - 7 vs 10 days
  - Gerber Am J Dis Child 1987: 141 - 5 vs 10 days
- 10 days still recommended for Penicillin duration !

- failure of PCN may be due to two theories:
  - beta-lactamase copathogens like H.flu, S.aureus, M.catarrhalis that inactivate PCN before it has chance to eradicate GABHS
  - PCN eradicates non-pathogen alpha-hemolytic strep better than cephs; this may predispose a pt to more susceptibility to GABHS reinfxn

- some evidence that a PCN failure and relapse with the same serotype GABHS bacteria can cause very mild or minimal symptoms; many patients may not seek additional medical care; all these failure patients are potential carriers and contagious

• Cephalosporins have been advocated as alternative to PCN
  - Pichichero Ped Inf Dis J 1993: 12 – meta-analysis of studies regard PCN vs cephs
  - many studies showing cephalosporins have lower bacterial and clinical failure rate compared to PCN
  - cost of PCN failure include lost school or work time, 2nd doctor visit, 2nd throat culture, 2nd antibiotic presecription, loss of doctor-patient confidence
  - newer cephalosporins (cefuroxime, cefixime, cefprozil, loracarbef, cefpodoxime) all show similar results
  - disadvantages include cost, broader spectrum antibiotic than necessary, and potential side effects
  - some studies showing shorter courses of cephalosporins with satisfactory bacterial eradication
    - Malitovic Ped Inf Dis J 1991: 10
    - Gehanno Med Mal Infect 1987: 2
    - Unpublished Pichichero - 5 days cefpodoxime is equivilant to 10 days PCN
  - many patients discontinue medication by day # 5-6 anyway; many symptomatically improved by day #2 anyway;

STEROIDS:

• Small studies showing varying effects of one-dose steroids for symptomatic relief; negative effects not studied
*** O'Brien JF et al Ann Emerg Med 1993 Feb; 58 pts with sorethroat – exudate, pain, and fever or nodes; given IM Dex 10mg or placebo; given PCN or erythro; no ag or cxr done; 15 cm VAS used; states analgesic use was the same (pt recall??); degree of pain relief 1.8+/-0.8 vs 1.2+/-0.9; time to onset pain relief 6.3+/-5.3 vs 12.4+/-8.5 hrs; time to pain relief – 15 +/-11.4 vs 35.4+/-17 hrs); VAS not verified; don't know % with GABHS; don't know if it inhibits eradication of the bacteria

ANTIBIOTIC	COST	DOSING	PRO'S and CON'S
Benzathine Penicillin IM		25,000 – 50,000 u/kg IM up to 1.2 million u IM	Pain, PCN allergy No PO's to worry about
Penicillin PO	Low	25 - 50mg/kg div TID max: 1000 mg BID for 10 days (250 mg = 400,000 u)	Must take meds for 10 days
Azithromycin	Intermediate	12mg/kg QD for 5 days or 500mg day #1 then 250 mg days #2-5	5 day course
Cephalexin	Low	50mg/kg/day div BID max: 250mg QID for 10days	
Cefadroxil	Intermediate	30mg/kg/day QD for 10days (max 1gram qd)	
$2^{nd}/3^{rd}$ gen ceph's	High	BID x 10days	
Clindamycin		20-30mg/kg/day div QID	Good for PCN allergic or recurrent disease
Erythromycin	Low	30-60mg/kg/day div q 6-8 hr for 10 days max: 250mg QID	GI effects Must take meds for 10 days

SHOULD I GET A CULTURE OR JUST TREAT 'EM?

- Treatment strategies:
  - treat all if epidemic of strep occurring, or patient has history of acute rheumatic fever
  - treat only those at clinical risk – patients with poor follow-up, or those with severe symptoms
  - treat those based on the rapid antigen test – need to know sensitivity of specific test, limited antibiotic use will limit antibiotic reactions
  - treat those based on positive throat culture – more expensive, limits # of antibiotic reactions, must ensure good follow-up

  *** Acad Emerg Med Seaberg 1997 Jan – if throat culture obtained and antibiotics started, 40-42% of physicians will continue to treat patients regardless of culture results

- Cost effectiveness studies conclude:
  - testing (either antigen or culture) will be of benefit because it will limit antibiotic reactions
    - recommend rapid antigen test done in the ED if follow-up is going to be a problem

    - if follow-up is going to be a problem and antigen test sensitivity is low, recommend "treating all"

(Pediatrics 1990; 85: 246 Lieu TA and J Fam Prac 1992; 34:149 Dippel DWJ)

- Kids can return to school usually after 24 hours (limited data)

PERITONSILAR ABSCESS

- most common deep space infection in the head/neck area
- usually a result of bacterial tonsillitis
- uncommon in kids < 12 years old

PATHOPHYSIOLOGY

- peritonsillar space - medial border is tonsil medially; lateral border is superior constrictor muscle; anterior and posterior borders are the anterior and posterior pillars
- infection spreads from the tonsil, through tonsillar capsule and into the peritonsillar space
- infections can spread to beyond the peritonsillar space into the peripharyngeal areas like the parotid gland

ETIOLOGY

- most PTA are polymicrobial; Group A streptococcus dominates with peptostreptococcus, peptococcus, fusobacterium, and other normal mouth flora including anaerobes
- rarely, *H. influenzae, S. pneumoniae, S. aureus*

SYMPTOMS and CLINICAL EXAM

- history of gradually worsening throat discomfort and ipsilateral pain
- trismus, dysarthria, dysphagia, odynophagia, drooling can develop
- voice is muffled, “hot potato” quality
- fever may be present

- examination may reveal a spectrum from peritonsillar cellulitis to a fluctuant abscess
- uvula is usually pushed contralaterally with swelling of the soft palate and uvula
- ipsilateral lymph nodes usually enlarged

COMPLICATIONS

- extension beyond the peritonsillar space may result in spiking fevers, neck stiffness, torticollis toward the opposite side due to sternocleidomastoid spasm, or swelling around the parotid gland
- rarer complications include airway obstruction, mediastinitis, lung abscess, thrombophlebitis and sepsis

ADDITIONAL TESTS

- CT indicated if extension from the peritonsillar space is suspected or if the patient is not responding to traditional antibiotics

TREATMENT

- aspiration or incision/drainage of the peritonsillar abscess is the definitive procedure; consult ENT
- IF ASPIRATION IS TO BE PERFORMED IN THE ED, YOU MUST HAVE A COOPERATIVE PATIENT!!
  - patient should be sitting upright, with Yankauer suction in hand
  - use nebulized 2% Lidocaine or Cetacaine spray as topical anesthetic; can use local anesthetic like 1% Lidocaine in addition

- cut distal end of plastic cap off of an 18g needle to expose only 1-2 cm of needle
- have patient breathe through mouth - "pant like a dog"; patient can pull on own tongue using gauze pad
- aspirate abscess at most fluctuant area; some advocate 3 separate needle sticks in a triangle arrangement; use 10cc syringe to aspirate - many patients with trismus cannot open their mouths enough to use a 20 or 30cc syringe
- abscess may bleed slightly even if no pus aspirated
- CAUTION !! - important arteries lie in close proximity; that is the reason to limit your ability to needle the abscess by exposing only 1-2 cm of the 18g needle

• Herzon Laryngoscope 1995, 105 (8 Pt 3 Sup 74): 1-17 - meta-analysis found 94% success rate for needle drainage of PTA; recommends this procedure first over incision/drainage
• intraoral ultrasonography has recently been demonstrated as useful in the treatment of peritonsillar abscess to differentiate cellulitis from abscess
• young children or uncooperative children should have abscess drained in the operating room under anesthesia
• some recommend conscious sedation for uncooperative or young children - personally would not recommend this !!

• Ceftriaxone 100 mg/kg/24 hr q 12 hr IV or
• Cefotaxime 150 mg/kg/24 hr q 6 hr IV
• Penicillin G 25-50mg/kg/24 hr (40,000-80,000 U/kg/24 hr) div q 4-6 hr IV
• hydration and analgesics also recommended
• admission recommended for toxic appearance, young children, cases requiring drainage in operating room, inability to take PO's, immunocompromised, unreliable follow-up
• tonsillectomy recommended for recurrent cases

• If discharged home, recheck patient within 24 hours to evaluate for toxicity or need for further drainage

CERVICAL LYMPHADENITIS

PATHOPHYSIOLOGY

• head and neck area lymph drains through lymph tissue in the neck before draining into the thoracic duct
• most prominent nodes in the neck are submandibular, submental, anterior cervical, and superficial cervical
• palpable lymph nodes, up to 2 cm, are present in 25% of normal children and 35% of neonates
• younger children most commonly have nodes in the occipital and postauricular areas; older children in the cervical and submandibular areas

• stimulation from trivial injuries or subclinical infections to more obvious primary lymphadenitis can cause cervical lymph nodes to change size or shape
• inflammation and enlargement of the nodes can be caused by the presence of simply stimulation of lymphocyte production or the presence of antigenic material

ETIOLOGY

• Primary adenitis caused predominantly by *S. aureus* and Group A Streptococcus, with a combined incidence of 60 - 85% (most of the Staphylococcus is resistant to penicillin)
• More rare etiologies of primary adenitis are mycobacteria tuberculosis, non-tuberculous mycobacteria like *M. scrofulaceum*, and anaerobes
• Other causes of primary adenitis is children are Group B streptococcus, *H. influenzae, Pseudomonas aeruginosa, Toxoplasma gondii, Yersinia pestis, Chalmydia, Mycoplasma pneumoniae, Treponema pallidum* - a good history and physicial exam may help with narrowing the etiology

• Viral causes include viral pharyngitis or tonsilliitis caused by rhinovirus, adenovirus, or enterovirus; other less common viral causes include mumps, rubella, rubeola, chicken pox, and herpes simplex

• Mucocutaneous lymph node syndrome (Kawasaki's disease) presents with fever for several days, conjunctivitis, erythematous tongue, rash, edema of the hands and feet, and eventually desquamation of the hands and feet

• Mononucleosis is caused by the Epstein-Barr virus; presentation includes tonsillitis with sometimes a gray membrane, fever, hepatosplenomegaly, weakness, and diffuse lymphadenitis; more often seen in older children or teenagers

• Cat-scratch disease develops within 10 days of exposure; begins with a erythematous, non-pruritic papule and then lymphadenitis in the area; Hanger-Rose antigenic skin test would be positive; "cat-scratch bacillus" along with noncaseasting granuloma can be seen on lymph node biopsy

SYMPTOMS and CLINICAL EXAM

• Exam should focus on finding a primary infection that may have caused regional lymphadenitis
• Tuberculous and non-tuberculous mycobacteria and cat-scratch disease typically present with "cold" lymph nodes

ADDITIONAL TESTS

• most additional tests non helpful
• Mononucleosis may see an increased number of atypical lymphocytes on peripheral blood smear and a positive "monospot"
• viral etiologies for lymphadenitis may see a predominance of lymphocytes on a blood smear
• if area is endemic for tuberculosis, or known exposure occurred or suspicious, place a 5 TU PPD skin test for tuberculosis

TREATMENT – Questions to answer:

Other head and neck disease or primary inflammatory disease? YES – treat dental infection, pharyngitis, PTA, ear infection, scalp infection or trauma, or other head/neck infections

Any evidence of primary systemic disease? YES – treat TB, Mononucleosis, Kawasaki disease, syphilis, sarcoid, or toxo

TB in the area? YES – PPD placement with controls

Unusual microbiology by history? Ask about cat scratches. Ask about exposure to atypical mycobacteria.
If YES – specific serology tests or skin tests can be used

If NO to all of the above, probably primary lymphadenitis !

(Modified from Barkin 1997 p. 735)

• Avoid needle aspiration or incision/drainage if possible
• Culture for aerobic, anaerobic, mycobacteria, and fungal pathogens should be obtained in neonatal cases, immunocompromised cases, or in cases that failed initial antibiotic therapy (CAUTION - if mycobacterium is suspected, aspiration of an inflammed lymph node may cause chronic drainage)

• Place PPD if endemic area or known TB exposure

• Oral antibiotics against *S. aureus* and *S. pyogenes* usually all that is needed if lymphadenitis determined to be a primary lymph node infection
• Dicloxacillin 25-50 mg/kg/24 hr q 6 hrs - first choice but unpalatable
• Cephalexin 25-50 mg/kg/24 hr q 6 hrs - more palatable

- amoxicillin-clavulanate acid 20-40 mg/kg/24 hr q 8 hrs - more palatable but more $$
- erythromycin 30-50 mg/kg/24 hr q 6 hrs - inexpensive but not always effective against *S.aureus*
- trimethoprim-sulfamethoxazole - good against *S.aureus* but not very effective against Group A Streptococcus
- admission for intravenous antibiotics indicated for immunocompromised, unreliable follow-up, advanced disease, toxic appearance, very young infant, unresponsive to oral antibiotics or inability to tolerate PO's

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