

Serious ENT Infections

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Serious ENT Infections

- I. Sinus Infections**
- II. Pre-septal Cellulitis vs. Orbital Cellulitis vs. Orbital Abscess**
- III. Fungal sinusitis**
- IV. Ear Infections**
- V. Pharynx, Larynx, and Epiglottitis Infections**
- VI. Head and Neck Fascial Space Infections**

Acute Sinusitis - Sensitivity/ Specificity of Symptoms and Signs

Drainage of a thick, colored nasal discharge	(72%/52%)
Cough, which may be worse at night	(70%/44%)
Sinus tenderness	(48%/65%)
Poor response to decongestants	(41%/80%)
Maxillary tenderness (Aching in upper jaw and teeth)	(18%/93%)
Fever	(16%/85%)

Other signs and symptoms can include:

- Ear pain
- Sore throat
- Reduced or abnormal sense of smell and taste
- Bad breath (halitosis)
- Fatigue and irritability
- Nausea

Acute Sinusitis -Etiology

■ <i>Streptococcus pneumoniae</i> *	20-40%
■ <i>Hemophilus influenzae</i> *	6-50%
■ Mixed anaerobic infections	0-10%
■ <i>Moraxella catarrhalis</i> *	2-4%
■ <i>Streptococcus pyogenes</i>	1-8%
■ Other streptococcal sp.	2%
■ <i>S. aureus</i> *	0-8%

Microbial etiology remains unchanged,
antimicrobial resistance patterns* have changed

Acute Bacterial Sinusitis

Treatment as Acute Otitis Media

- Spontaneous resolution >50%
- Amox/Amoxicillin Clavulanate/2nd or 3rd generation cephalosporin
- Saline nasal irrigation (NeilMed)
- ?Decongestants (?Pseudoephedrine)
- ?Mucoevacuant (Guaifenesin)

Chronic Sinusitis

At least **8** weeks (children >12 weeks) of persistent signs and symptoms or **four** (children - six weeks) of recurrent acute bacterial sinusitis, each lasting 10 days, in association with persistent changes on CT. When medical therapy is used, persistent changes on CT 4 weeks after medical therapy without intervening infection should be noted.

Chronic Sinusitis

- ENTs “Chronic Fatigue Syndrome”
- Shift to more anaerobes, saprophytes, then GNs
- Inadequate mucociliary drainage
- Obstructed drainage
- Triad: Atopic diathesis (allergic/asthma)
- Often takes triad approach to management
 - Allergy, ENT, and lastly, Infectious Diseases.

Chronic Sinusitis: Therapeutics

- Aim of Therapy:
 - Control allergies and environmental stimulants
 - Increase Flow: Saline Sinus Rinse (NeilMed)
 - Pulmicort to Sinus Rinse (experimental)
 - Drainage/Surgery
 - Antimicrobials have symptomatic improvement, but patient's often "relapse", "rebound", are not cured once antibiotics are stopped.

Nosocomial Sinusitis

- Source of FUO in ICU, nasotracheal or gastric tube patient
- After one week nasotracheal, 95% have X-ray sinusitis; <10% mechanical ventilation
- Only 40% positive culture (often polymicrobial)
 - Almost 50% is Gram-negative organisms (*Pseudomonas*, *Acinetobacter*, *E. coli*)
 - *S. aureus*; Gram-positives - 35%
 - *Candida* sp. 18%
- Remove nasotracheal tube
- Sinus aspirate for gram stain, C&S
- Empiric:
 - AP Pcn (Piperacillin/Tazobactam) or Cefepime (4th gen) or
 - Vancomycin and Ceftazidime or
 - Vancomycin and Cipro or Aminoglycosides

Complications of Sinusitis

Symptoms and Signs of Complications

Pain or swelling around your eyes

A swollen forehead

Severe headache

Confusion

Double vision or other vision changes

Stiff neck

Shortness of breath

Complications of Sinusitis

Complications directly related to anatomic location; complications more common after acute sinusitis.

- Asthma exacerbation - resolving chronic sinusitis will improve asthma flare-ups.
- Acute -> Chronic sinusitis
- Ear infections
- Loss of Smell and Taste -temporary or permanent. Lack of airflow to olfactory n.
- **Intracranial complications** - meningitis, intracranial abscess
- **Orbital complications** - mild inflammation of eyelid to orbital abscess -> blindness
- **Vascular complications** - carotid a. and cavernous sinus border sphenoid sinus; spread may lead to aneurysms or infected blood clots -> potentially fatal.
- **Osteomyelitis** - bone may be involved in chronic sinusitis -> destruction of bone with intracranial and orbital complications above.
- Ear infection - contiguous

Orbital Complications of Sinusitis

The orbital complication; may be the only presenting sign of sinusitis.

Ophthalmology service¹: “Acute orbit” only 12.4%(?) attributed to sinusitis; ethmoid predominant (facial infections, dacryocystitis, trauma +/- implants, iatrogenic, tumors).

Combined service: **>75% of orbital cellulitis** were radiologically determined to be of sinus origin, majority ethmoid sinusitis.

Pediatric admissions for sinusitis over 25yr (6770 pts): **2.3 %** had peri-orbital or orbital complications.

Younger children: ethmoid sinusitis -> orbit due to developmental dehiscences in the lamina papyracea.

Older children: involve the superior aspect of the orbit due to later-developing frontal sinuses.

History of air or water forced into sinuses (jumping feet first into water) or nasal or maxillofacial trauma predispose due to breaks in the lamina papyracea or orbital floor.

1. J Laryngol Otol 1987; 101 (suppl 12):1-18.

2. Laryngoscope 1982; 92:732-738

Chandler¹ Classification of Intraorbital Infections

Group 1: upper eyelid edema +/- erythema; venous outflow is hindered by inflammation in the orbit

Group 2: **Orbital Cellulitis**. Chemosis, restricted ocular movement, proptosis, diplopia, and possible visual loss.

Group 3: **Subperiosteal Abscess**. Can be limited due to tough periorbita.

Group 4: **Intraorbital Abscess**. Proptosis, ophthalmoplegia, pain, visual loss.

Group 5: **Cavernous sinus thrombosis**.

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¹Chandler, et al. Laryngoscope 1970; 80: 1414-1428.

Preseptal Cellulitis

- Eyelid edema, erythema, tenderness
- Visual function and motility are normal
 - *S. aureus*, streptococci
- Low threshold for CT scan to rule out orbital cellulitis
- Warm compress
- Incision and drainage of abscess when indicated
- Obtain blood and wound cultures

Orbital Cellulitis

- Infection of the soft tissues of the orbit POSTERIOR to the orbital septum
- Orbital septum violated (post-surgery, trauma, or extension of acute sinus infection); can occur after sinus surgery
- Time course can be very rapid; chemosis to visual field loss to blindness in hours. Due to increased intercellular fluid pressure -> ophthalmic vein collapse, or ophthalmic or retinal artery insufficiency due to spasm or direct thrombosis.

Orbital Cellulitis

- Streptococcus
 - Strep pneumonia, Strep pyogens (sinusitis)
- H. influenzae (sinusitis)
- Staphylococcus aureus (post-surgery)
- Less common - Gram-negatives (Pseudomonas, Klebsiella), Eikenella, enterococci
- Polymicrobial (aerobic and anaerobic) increases with age >16yo
- Fungal - Mucor and Aspergillus

Subperiosteal Abscess

- Infection limited to the potential subperiosteal space; may be rapid.
- Usually from extension through thin or dehiscent bone, pushing the orbital periosteum laterally or inferiorly.
- As long as infection is limited to periosteal plane, there should be no impairment of vision or ophthalmoplegia, nor any conjunctival signs (chemosis, vascular injection).
- A sizable abscess may give signs of intraorbital space-occupying mass with the globe displaced laterally (ethmoid sinusitis) or inferiorly (frontal sinusitis)
- The acute increase in orbital pressure and mechanical distortion may compromise the optic nerve.
- More importantly, purulent material is sequestered in a relatively avascular region, which may limit the effectiveness of antibiotic therapy and thus necessitate surgical evacuation.

Subperiosteal Abscess

■ Etiology¹:

- <9 yo: single aerobic flora (*S. pneumoniae*, *S. aureus*) or negative cultures.
- 9-14 yo: varied aerobes (Streptococci, Staphylococci, *Hemophilus influenzae*, *Moraxella*, *Eikenella*, *Klebsiella*) and few anaerobes
- >15 yo: polymicrobial: aerobes (Streptococci, Staphylococci, *Eikenella*) and anaerobes (*Bacteroides*, *Veillonella*, *Peptostreptococcus*, *Fusobacterium*)

■ Treatment:

- Surgical drainage of infected tissue and abscess
- IV antibiotics

¹Ophthalmology 1994;101:585-595.

Orbital Abscess

Collections of pus within the orbital soft tissue.

Severe exophthalmos and chemosis, with complete ophthalmoplegia, as well as venous engorgement or papilledema on funduscopy examination.

Usually secondary to orbital cellulitis.

“Orbital Apex Syndrome” - organized infection in the posterior orbit (compression of the superior orbital fissure) - unilateral ptosis, proptosis, visual loss, internal and external ophthalmoplegia (pupillary and extraocular m. palsy: CN II, III, IV, V, VI, and CN V1 (forehead) anesthesia).

Diagnosis is confirmed by CT scan.

If does not improve rapidly with antibiotics, may need surgical decompression of the orbital apex.

Orbital Cellulitis, Subperiobital Abscess, Orbital Abscess: Therapeutics

- Nafcillin 2 gms IV q 4 hours
- Ceftriaxone 2gm IV q 12h
- Metronidazole 500mh IV q 6h
 - OR:
- Ampicillin/Sulbactam 3 gm IV q 6 hours
 - If MRSA risk, then PLUS:
- Vancomycin 1gm IV q 12 hours
- *Treat to pre-empt meningitis complication*

Retro-orbital Complications

■ Cavernous Sinus Thrombosis

- The cavernous sinus, a circular venous structure surrounding the pituitary gland, drains blood from both orbits. Bilateral posterior orbital disease is highly suggestive.
 - Direct spread from sphenoid sinus.
 - Indirect spread from posterior ethmoid sinus
 - Indirect - orbital contents via valveless ophthalmic veins.
- Complete internal and external ophthalmoplegia often produced when thrombosis of the sinus causes palsy of CNs III, IV, V1, and VI and the sympathetic fibers as they travel through prior to entry into the orbit.
- Diagnosis is confirmed by CT scan or MRI; however, the.
- The distinction between infectious thrombosis and orbital infection alone is important because the treatment of cavernous sinus thrombosis may involve the addition of anticoagulation therapy to the antibiotic therapy.
- Intracranial infection or cavernous sinus thrombosis can result from any stage of orbital infections.

Invasive Fungal Sinusitis

- *Mucor* and *Aspergillus* species.
- Orbital cellulitis due to fungal infections carries a high mortality rate in patients who are immunosuppressed. Fungi can enter the orbit, most commonly *Mucor* and *Aspergillus* species.
- Mucormycosis is widespread in distribution, while aspergillosis more commonly is seen in warm humid climates.
- Host Risk Factors:
 - Diabetic Ketoacidosis
 - Hematologic malignancies
 - Chronic renal failure
 - Immunosuppressive disease (AIDS)
 - Immunosuppressants (organ and bone transplantation)

Invasive Aspergillus Sinusitis

Symptoms vary from discolored nasal discharge +/- crusting to destruction of inferior turbinates and sinuses. May be bleeding or necrosis (angioinvasion).

Usually spreads from maxillary sinus to the ethmoid and extends to the orbit and nasal cavity

Invasion of orbit, sphenoid sinus, brain - often terminal. Most/all deaths due to intracranial extension.

Once angioinvasive, may produce thromboses or mycotic aneurysms. May disseminate to the lungs, liver, and spleen.

Known to progress to middle ear and mastoids (otomastoiditis). Associated with severe ear pain.

Rhinocerebral Mucor

- Diabetic ketoacidosis (Rhizopus sp.
 - active ketone reductase system) - 70%
- Hematologic malignancies
- Leukemia/BMT¹
- Intravenous drug use
- AIDS
- Immunosuppressants (Transplant)
- Deferoxamine treatment
- Voriconazole prophylaxis¹
- Rare “Healthy”

¹JID 2004;190:641-9

Rhinocerebral Mucor -Clinical Features

- Cranial nerve deficit (blindness, ophthalmoplegia, and facial paralysis)
- Proptosis
- Facial swelling
- Palatal ulcer
- Coma and stupor
- Presenting sign with poor prognosis: Hemiplegia, facial necrosis, and nasal deformity.
- PE: Brick-red or black areas along the nasal turbinates ->Biopsy

Rhinocerebral Mucor

- Once invades tissue, organism becomes angioinvasive, predilection for the internal elastic lamina of the arteries; later invades veins and lymphatics.
- Invasion->thrombosis-> ischemic infarction and hemorrhagic necrosis.
- THRIVES in necrotic tissue and spreads by direct extension on injured vessels.
- Dx: Tissue-invasive NON-SEPTATE Hyphae (silver methenamine stain)
- Cx: direct on Sabouraud's in OR; do NOT crush specimen

Therapeutics - Invasive Fungal Sinusitis

- Candida (yeast) -nosocomial
 - Fluconazole (not *C. krusei*, +/- *C. glabrata*)
- Aspergillus (invasive)
 - Voriconazole 200 mg po BID
- Invasive Zygomycosis
 - Liposomal amphotericin B
 - ?Posaconazole
 - Hyperbaric Oxygen

I. Ear Infections

- A. Otitis Media
- B. Mastoiditis
- C. Otitis Externa
- D. Malignant Otitis Externa
- E. Otomycosis

Acute Otitis Media

Dependent on host and organism:

- *Moraxella (Branhamella) catarrhalis* (>70%)
- Non-encapsulated *H. influenza* (only in 50%)
- *S. pneumoniae* (<20% resolves spontaneously)

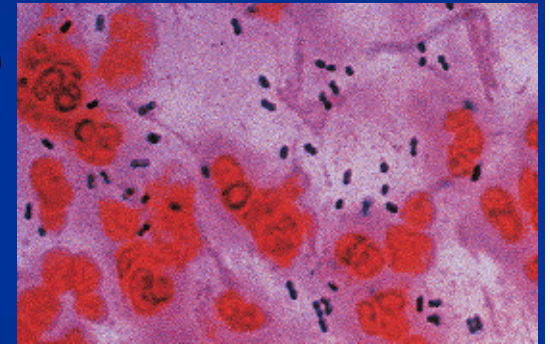
Reasons to treat:

Persists >2-3 days

Pain and prevention of hearing loss

Prevention of complications

- Mastoiditis (1:400 children)
- Resolves spontaneously in >50% of cases



Acute Otitis Media: Therapeutics

■ Uncomplicated, untreated AOM

■ Amoxicillin

- >30 *H. influenzae* and > 90% *M. catarrhalis* **Resistant*** (AAP)

- *Streptococcus pneumoniae* MEEI: 23% Pcn-resistant

28% Erythromycin-resistant

0% Azithromycin

12% TMP/SMX resistant

9% Clindamycin-resistant

15% Ofloxacin-resistant

13% Ceftriaxone-resistant

■ Amoxicillin Clavulanate

■ Complicated (age <2, prior OM, Abx <3mths)

■ Amoxicillin Clavulanate

- Ceclor (2nd Cefaclor), Vantin (3rd cefpodoxime) po or Ceftriaxone qD IM x 3 doses

Otitis Media

- Acute Otitis Media
- Acute Bullous Myringitis
- Acute Suppurative Otitis Media
 - Same Organisms; Same antimicrobials

Chronic Otitis Media

Microbial flora shifts to gram-negatives and anaerobes

S. aureus

Proteus, E. coli, Klebsiella

Pseudomonas (DM)

Anaerobes (*Prevotella, Propionomonas, Bacteroides species*)

- Treatment same as complicated AOM
 - Amoxicillin Clavulanate or 2/3rd gen cephalosporin +/- clindamycin
 - Levofloxacin/ciprofloxacin +/- clindamycin

Acute Mastoiditis

- Presence of acute or subacute OM with psoterior auricular swelling , erythema, tenderness, and a protruding ear with clouding of the ipsilateral mastoid cells on CT scan.
- Progression from AOM to infectious involvement of all pneumatized spaces of the temporal bone.
- Etiology
 - *S. pyogenes*
 - *S. pneumoniae*
 - *S. aureus*
 - *Hemophilus*
 - *S. viridans*, *Proteus*, *Enterobacter*
 - Anaerobes (*Bacteroides*)

Acute Mastoiditis: Therapeutics

- Intravenous only
 - Clindamycin and Ceftriaxone
 - Ampicillin/Sulbactam
 - Vancomycin and Ceftriaxone (if MRSA, consider Rifampin)
 - Vancomycin and Piperacillin/Tazobactam - (DM, immunocompromised host)
 - Vanco/Cipro/Clinda or Metronidazole (Pcn-allergic)

Complications of Mastoiditis

- Aural, intratemporal, or extracranial complications
 - Mastoiditis with bone destruction
 - Subperiosteal abscess
 - Petrositis with bone destruction
 - Facial paralysis
 - Labyrinthitis (serous, suppurative, or chronic)
- Intracranial complications
 - Extradural abscess or granulation tissue in extradural space
 - Lateral sinus thrombophlebitis or thrombosis
 - Subdural abscess
 - Meningitis
 - Brain abscess
 - Otitic hydrocephalus

Otitis Externa

- Acute Otitis Externa
 - *Pseudomonas aeruginosa* +/- *Staph aureus*
 - Topical only:
 - Acid/boric mixtures
 - Corticosteroids
 - Quinolone drops
 - Aminoglycoside drops

Necrotizing “Malignant” Otitis Externa

- Invasive infection of external auditory canal and the skull base. Begins at the bony-cartilage junction, through Santorini's fissures, into the mastoid bone, and along the skull base lateral to medial.

Facial Nerve -first and more often in children, glossopharyngeal, vagal, and spinal accessory n., hypoglossal n.

- *Pseudomonas aeruginosa*
- Diabetes mellitus

- Treatment

- Topical and systemic (antiPseudomonal combos)
 - Topical Ciprofloxacin or Tobramycin/ Ciprofloxacin (high dose) and Ceftazidime
 - Topical Ciprofloxacin or Tobramycin/Ceftazidime/Tobramycin
 - Topical Ciprofloxacin or Tobramycin/Piperacillin/Tazobactam and Tobramycin
 - Topical Ciprofloxacin or Tobramycin/Imipenem and Tobramycin
- Hyperbaric oxygen?

Otomycosis - Fungal Otitis Externa

Accounts for 10% of OE, higher in tropical climates.

Primary -fungi only; Intense itching

Secondary - fungal infection superimposed on bacterial; pain and complementary pruritis. Often weeks-months of antibacterial “resistant OE”

Aspergillus species (predominant)

Aspergillus niger

Aspergillus flavus

Aspergillus fumigatus

Candida species

Candida albicans, *C. parasilosis*

Others: *Phycomycetes*, *Rhizopus*, *Actinomyces*, *Penicillium*

Otomycosis: Therapeutics

- Topical (first line)
 - Clotrimazole
 - Eight plus chemicals
 - AmphoB crystals (Dr. Joe Nadol's secret)
- Systemic
 - Fluconazole (Candida)
 - *C. glabrata* (10-15% resistant)
 - *C. krusei* (95% resistant)
 - Voriconazole (Fungi or resistant Candida)-
EXPENSIVE
 - Amphotericin B systemically

Tonsillitis and Pharyngitis

■ Acute Tonsillitis

- Grp A strep, Grp C strep
- DDx-EBV
- Treatment: Pcn VK 500 mg po QID x 10 days

■ Acute Pharyngitis

- Grp A Strep- Pcn, erythromycin x 10 days
- Mycoplasma/Chlamydia (30%) - erythromycin or doxycycline x 14 days
- Others: Grp C or G strep, *Corynebacterium*, *Yersinia enterocolitis*, *Neisseria gonorrhea*, mixed anaerobic (Vincent's angina), *Treponema pallidum*.

Vincent's angina (disease)

- Trench mouth or acute necrotizing ulcerative gingivitis
- Acute pseudomembraneous involvement of pharynx and tonsils
- Poor oral hygiene
- Fusospirochetal organisms (*Fusobacterium nucleatum*, *Treponema vincetti*) and Gram-negative anaerobes (*Bacteroides*, *Prevotella intermedius*, *Prevotella melaninogenica*).

Laryngitis

- Respiratory viruses
 - Influenza, Parainfluenza, Rhinovirus, Adenovirus
 - *M. catarrhalis* (50-55%)
 - *H. influenza* (8-15%)
 - Strep (A, C), *C. pneumoniae*, *M. pneumoniae*
 - *M. hominis* and fungal (granulomatous laryngitis)

Supraglottitis (Epiglottitis)

- Decline by 95% due to Hib (children), adults also decline but 20% due to Hib
 - *S. pneumoniae*
 - *S. aureus*
 - Other streptococci
 - Non-encapsulated non-b H. influenzae
 - *H. parainfluenzae*
- Tx: Ceftriaxone or Ampicillin/Sulbactam
- Prophylaxis
 - All household contacts if children less than 4
 - Day care contacts
 - Patient
 - Rifampin x 4 doses vs. cipro 500 x 1.



Tracheitis and Thyroiditis

Tracheitis

S. aureus

Grp A strep

Hib

Thyroiditis

- *S. aureus*
- *S. pyogenes*
- *S. pneumoniae*
- Anaerobes
- Fungal (opportunistic)

Parotiditis

- Viral - Mumps
- *Staph aureus*
- *S. pneumoniae*
- *E. coli*
- *H. influenza*
- Oral anaerobes

Head and Neck Space Infections

■ Deep Neck Space Infections

- Infection of the facial spaces of the neck
- Retropharyngeal Abscess
- Submandibular Abscess
 - **Ludwig's angina** - cellulitis (not abscess of the submandibular space).
 - Never involves only one space and usually bilatera
 - Produces gangrene with serosanguinous, putrid inflammation
 - Involves connective tissue, fascia, and muscle, but not glandular structures
 - Spread by continuity and not by lymphatics
- Parapharyngeal Space Infections
- Parotid Space Infections
- Pretracheal Space Infections

Deep Neck Space Infections

- Mixed Infections -synergistic infections; beta-lactamase production is common.
- Anaerobes outnumber aerobes 2:1
- Anaerobes
 - Anaerobic Strep, *Veillonella* and *Bacteroides* sp (*Prevotella* and *Bacteroides fragilis*)
- Aerobes
 - *S. viridans* and *S. pyogenes*
 - *S. aureus*
 - *H. parainfluenzae*
 - *E. coli*
 - *Klebsiella*

Deep Neck Space Infection

Culture anaerobically

- Use gas-evacuated syringes or oxygen-free culture swabs and broth)
- Rapid transport to lab (syringe from the OR)
- Gram stain.

Surgical Drainage

Antimicrobials

Clindamycin IV or oral

Ampicillin/Sulbactam (or Piperacillin/Tazobactam)

Penicillin and Metronidazole (Metronidazole) +/- Vanco