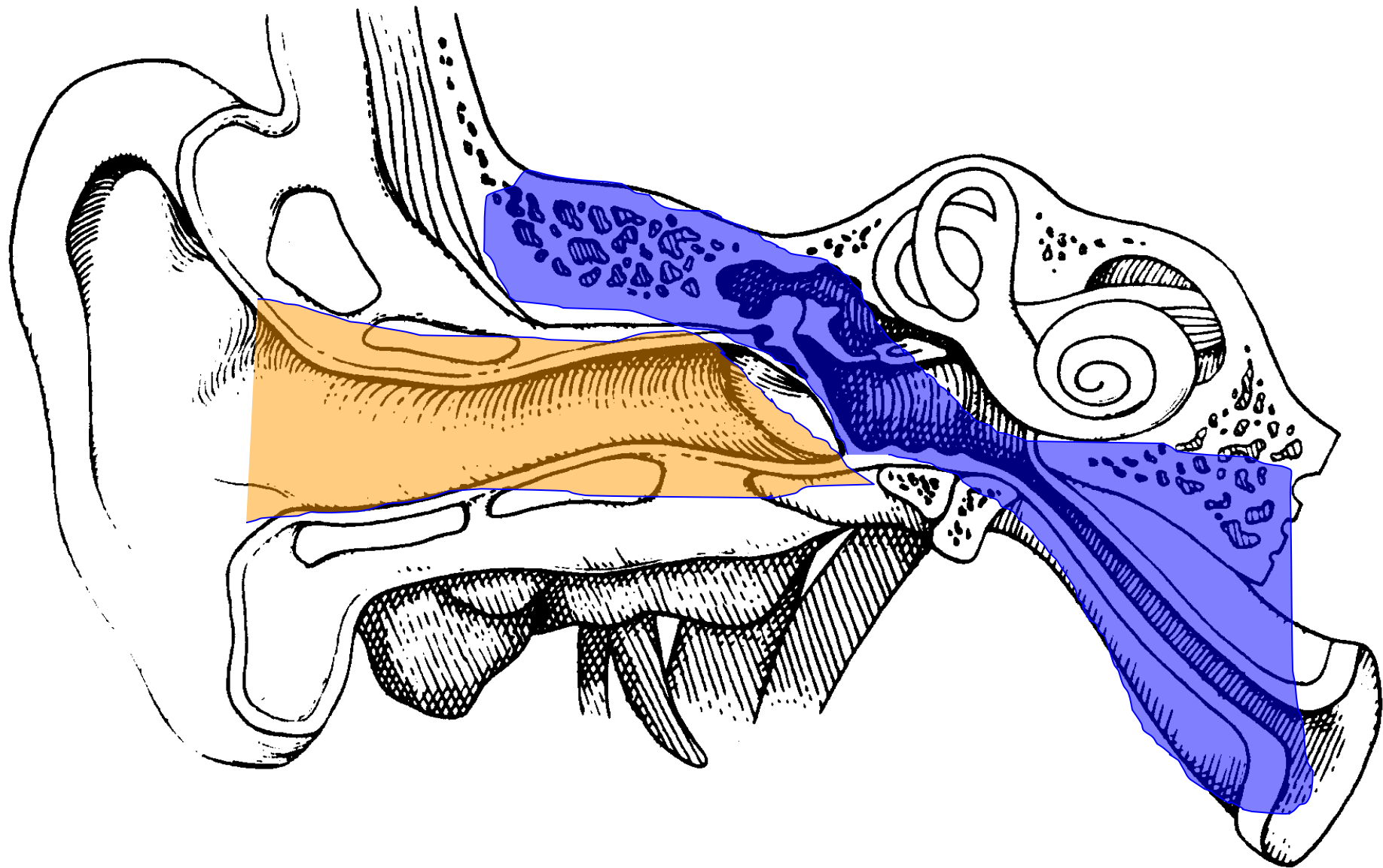


# Otitis

Patrick J. Antonelli, M.D.  
Department of Otolaryngology  
University of Florida

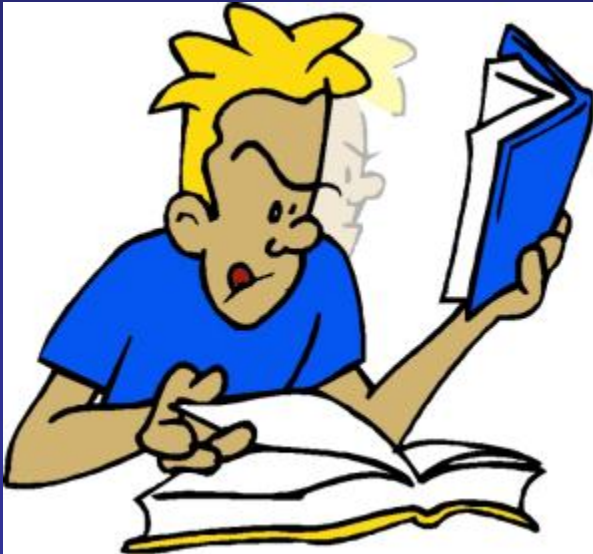


# Significance

- Affects nearly everyone at some point in life
- Hurts like hell
- Can be fatal
- Treatable
- Treatment is constantly evolving

# Caveats

- Half of the information in this lecture is wrong
- Nobody can tell you which half is wrong





# PubMed

National Library of Medicine



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 Cc:  
 Subject: Google Alert - info media

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**Cleaning Cars Cuts Ear Infection Risk in Kids**  
 (Wed)Pete Tenforde  
 News that in another trial, however, cyflol had no effect on reducing the occurrence of recurrent otitis media with effusion (OME) in children, researchers say. ...  
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**ORIGINAL ARTICLES**

**Azithromycin for Prevention of Exacerbations of COPD**  
 R.C. Anderson and Others | N Engl J Med 2011; 365:888-898

**Apixiban with Aspirin/Platelet Therapy after Acute Coronary Syndrome**  
 J.H. Alexander and Others | N Engl J Med 2011; 365:899-910 | Published Online July 24, 2011

**Origins of the E. coli Strain Causing an Outbreak of Hemolytic-Uremic Syndrome in Germany**  
 D.A. Rasko and Others | N Engl J Med 2011; 365:708-717 | Published Online July 27, 2011

**Brief Report: Open-Source Genomic Analysis of Shiga-Toxin-Producing E. coli O104:H4**  
 H. Rasko and Others | N Engl J Med 2011; 365:718-724 | Published Online July 27, 2011

**Brief Report: Chimeric Antigen Receptor–Modified T Cells in Chronic Lymphoid Leukemia**  
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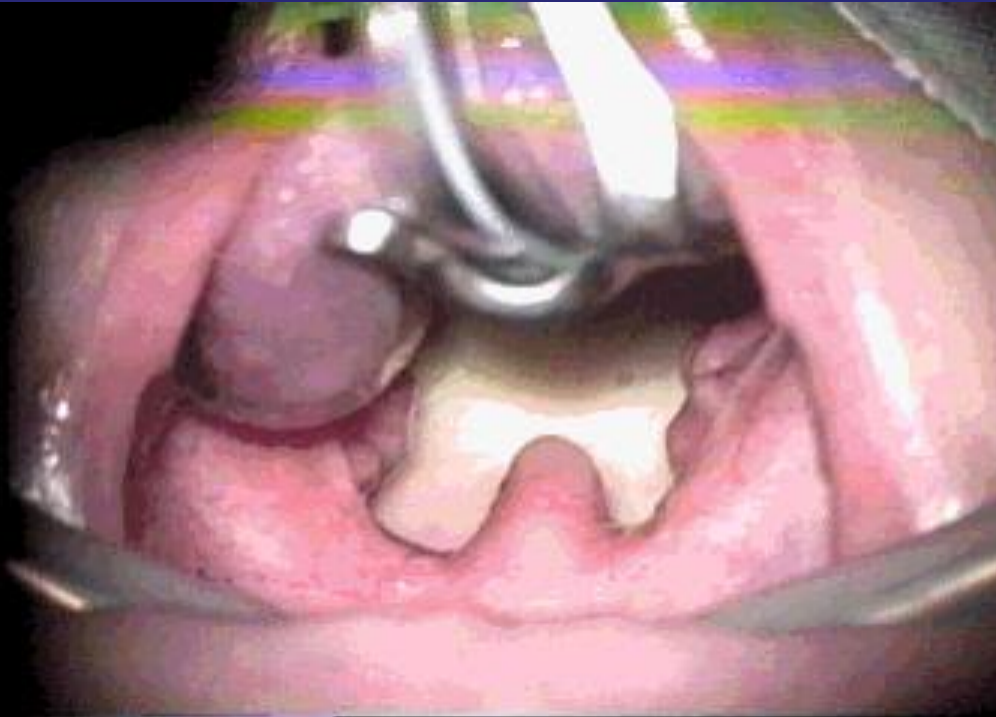
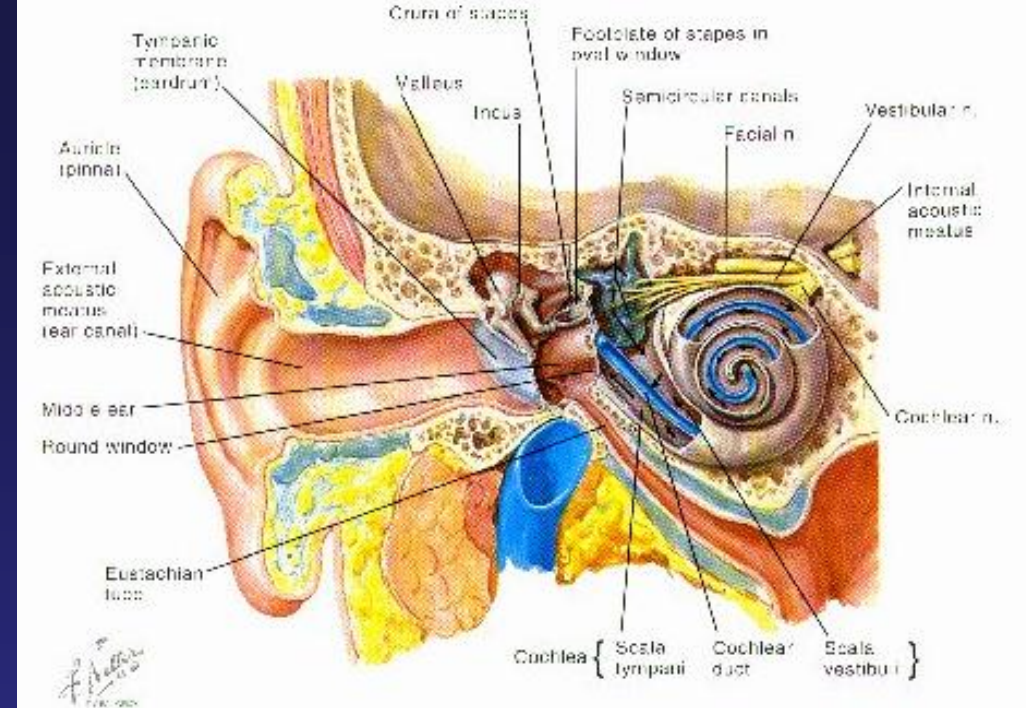
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# Pathogenesis of Otitis Media

- Eustachian tube dysfunction
  - Developmental
  - Cleft palate
  - Infectious
  - Environmental
    - Allergies
    - Smoke
- Immunologic compromise
  - Developmental
  - Immunodeficiency
  - Infectious
- Microbial challenge
  - Viral
  - Bacterial
  - Daycare!

# Adenoid Reservoir

mucopus aspirated from nasopharynx



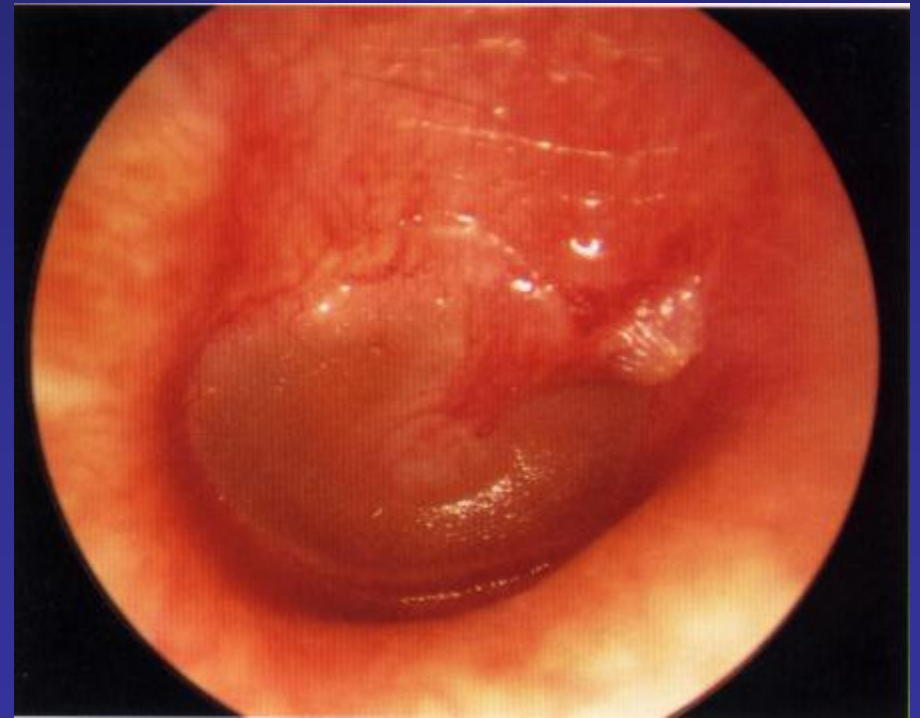
# Emerging Concepts OM Pathogenesis

- Colonization
  - Manifest by low grade inflammation
  - Polyclonal, biofilm, distributed genome
- Innate immunity vulnerable to modulation
  - By commensal bacteria (eg, H flu promotes clearance of S pneumo)
  - By viral infection (eg, suppresses macrophage development, promotes colonization)
- Density of colonization critical to development of disease



# Acute Otitis Media (AOM)

- Acute, symptomatic middle ear infection
  - Abrupt onset of ear symptoms
    - Ootalgia
    - Marked erythema, diffuse
    - Distinct TM fullness or bulging
    - Otorrhea (perforation or tube)
  - Presence of middle ear effusion
    - Stiff to insufflation
    - Type B tympanogram
    - Meniscus
  - Nonspecific not inclusive
    - fever
    - irritability
- Clinical course
  - Usually self-limited
  - Serious complications possible



# AOM Pathogens

Symptoms Persistence Complications



---

*S. pneumo*

++++

++++

++++

*H. flu -  
nontypable*

++

+++

++

*M. cat*

+

+

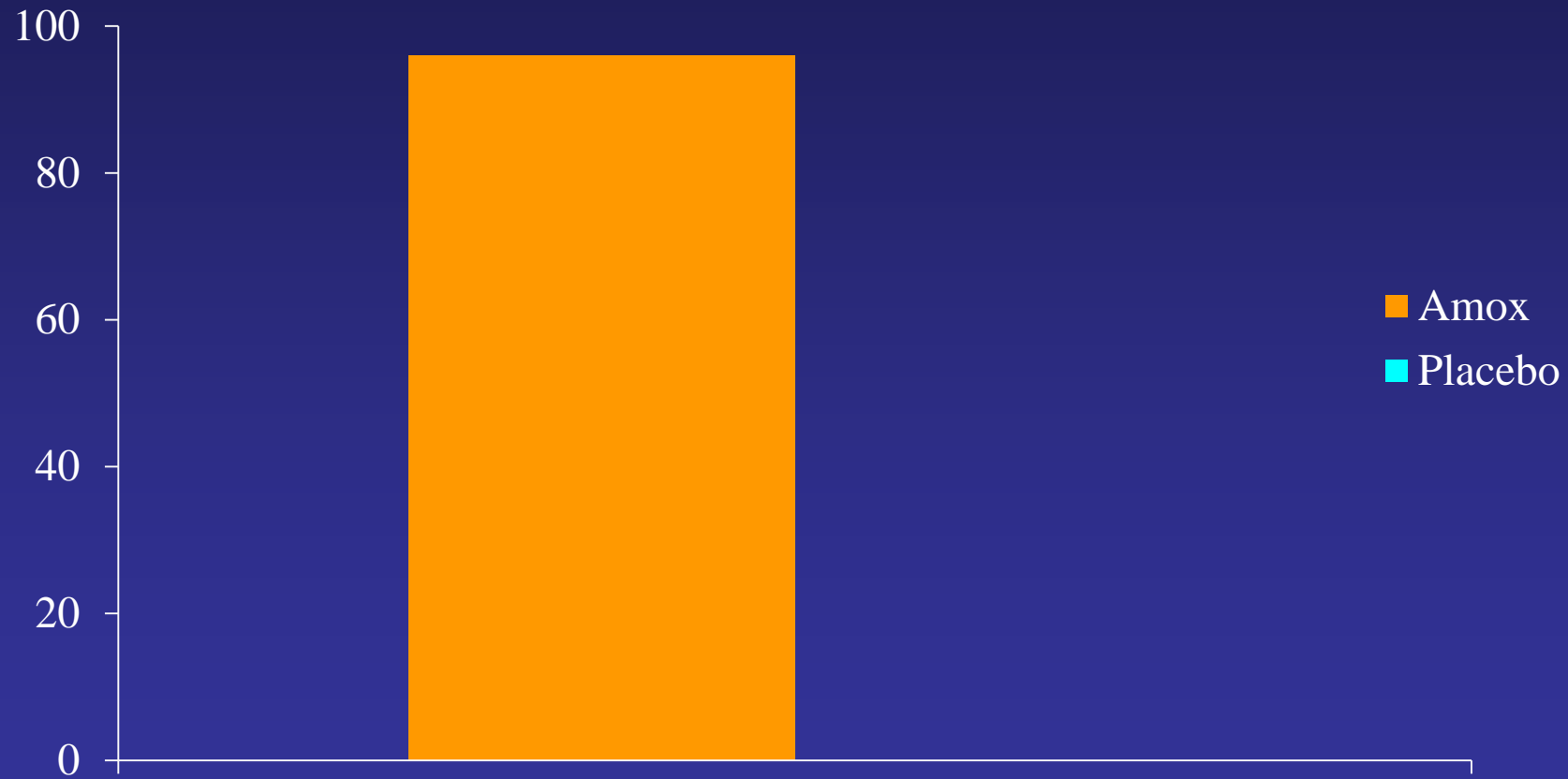
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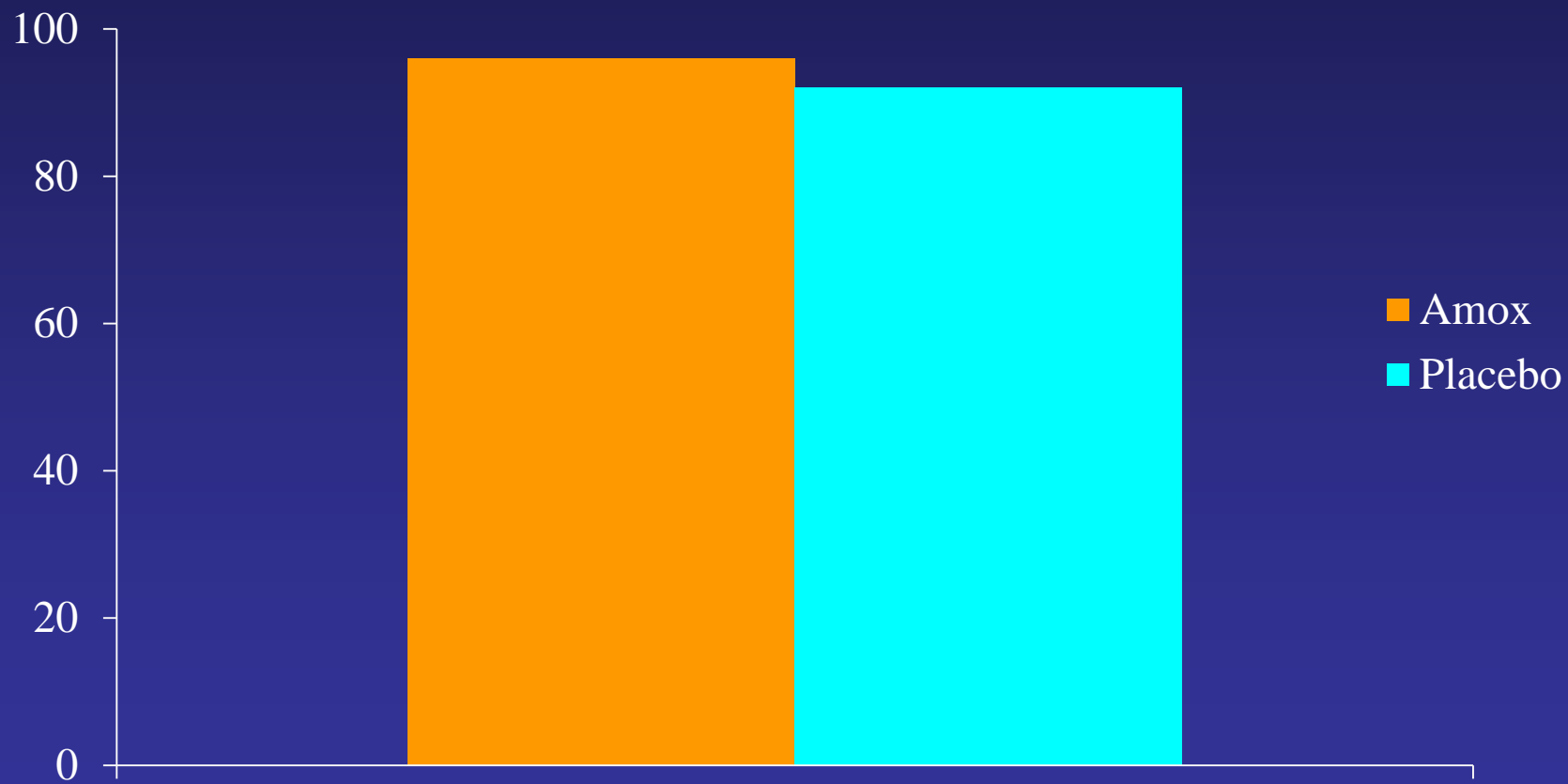
# AOM Treatment

- Observation
- Symptomatic treatment
- Systemic antibiotics
  - Standard of care
  - Effect 14% over control
  - Modest improvement in symptom control
- Empiric
  - First line
    - Amoxicillin (high dose)
    - TMP/SMX
    - AmoxHD-clavulanate
  - Second line
    - AmoxHD-clavulanate
    - Ceftriaxone
- Culture-directed
  - Tympanocentesis
  - Otorrhea

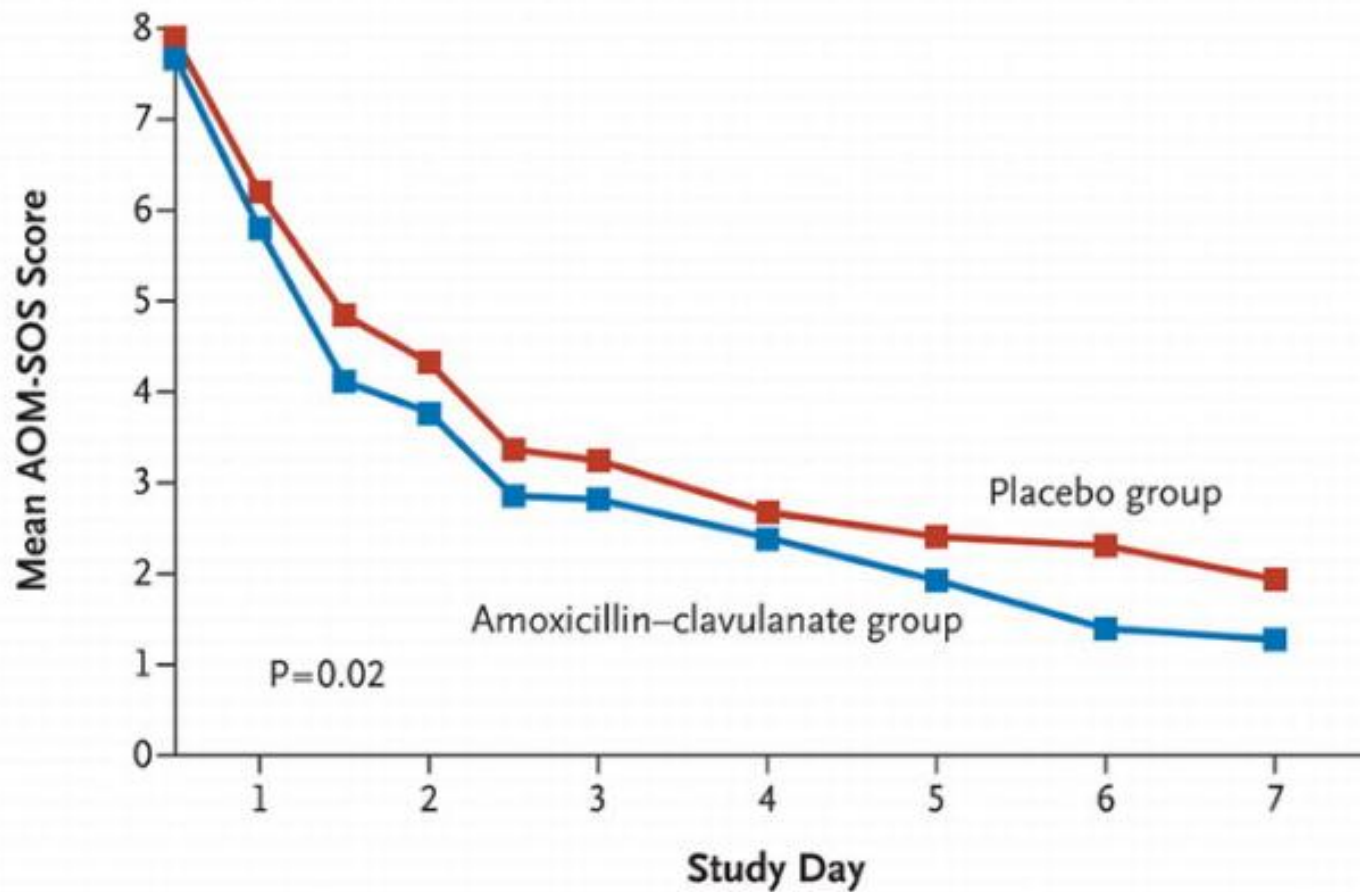
# AOM Antibiotic Efficacy



# AOM Antibiotic Efficacy

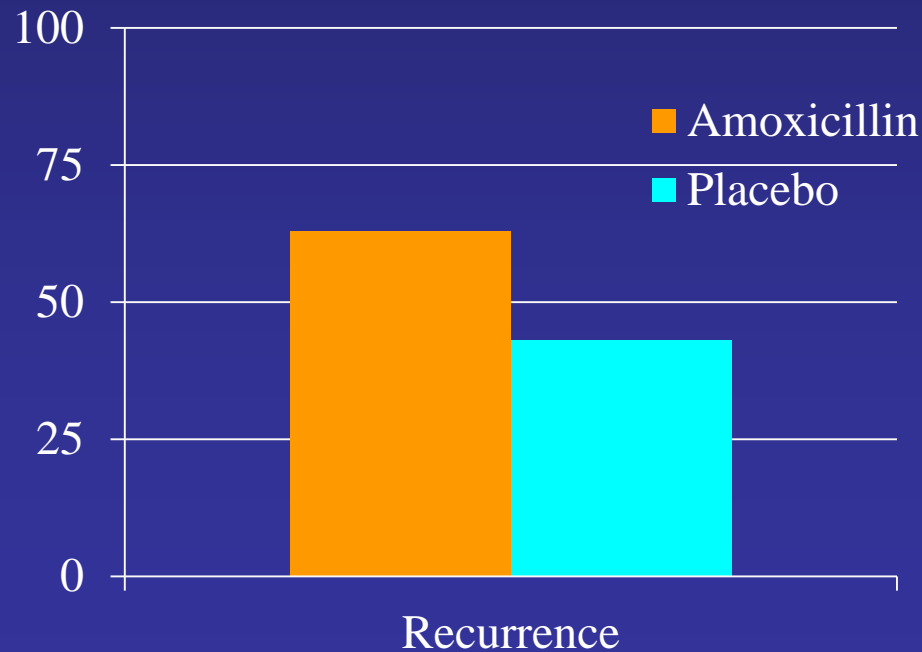


# AOM Symptom Resolution

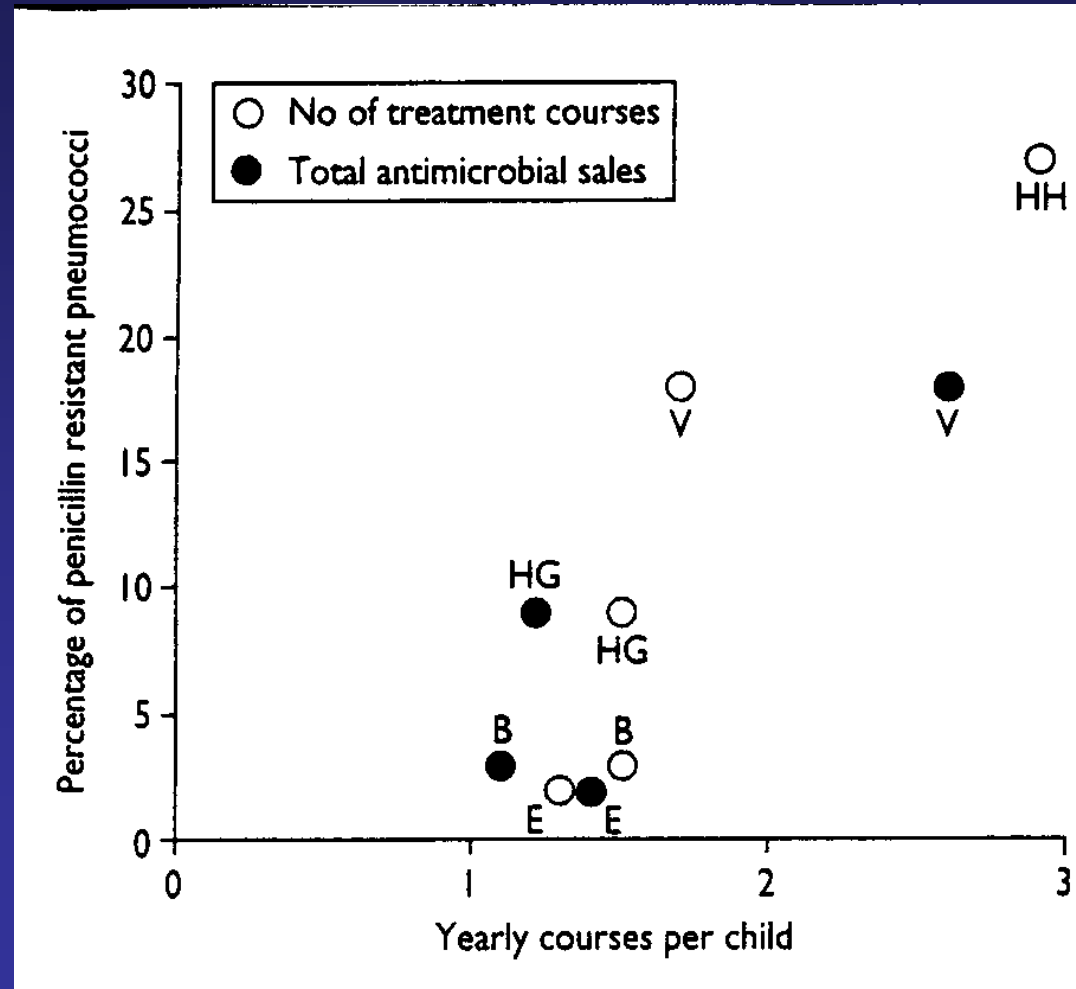


## Recurrence up to 3.5 years after antibiotic treatment of acute otitis media in very young Dutch children: survey of trial participants

Natália Bezáková, medical student,<sup>1</sup> Roger A M J Damoiseaux, general practitioner,<sup>2</sup> Arno W Hoes, professor of clinical epidemiology and general practice,<sup>1</sup> Anne G M Schilder, otorhinolaryngologist and clinical epidemiologist,<sup>3</sup> Maroeska M Rovers, clinical epidemiologist<sup>1</sup>



# Antibiotic Prescribing Patterns and Pneumococcal Resistance



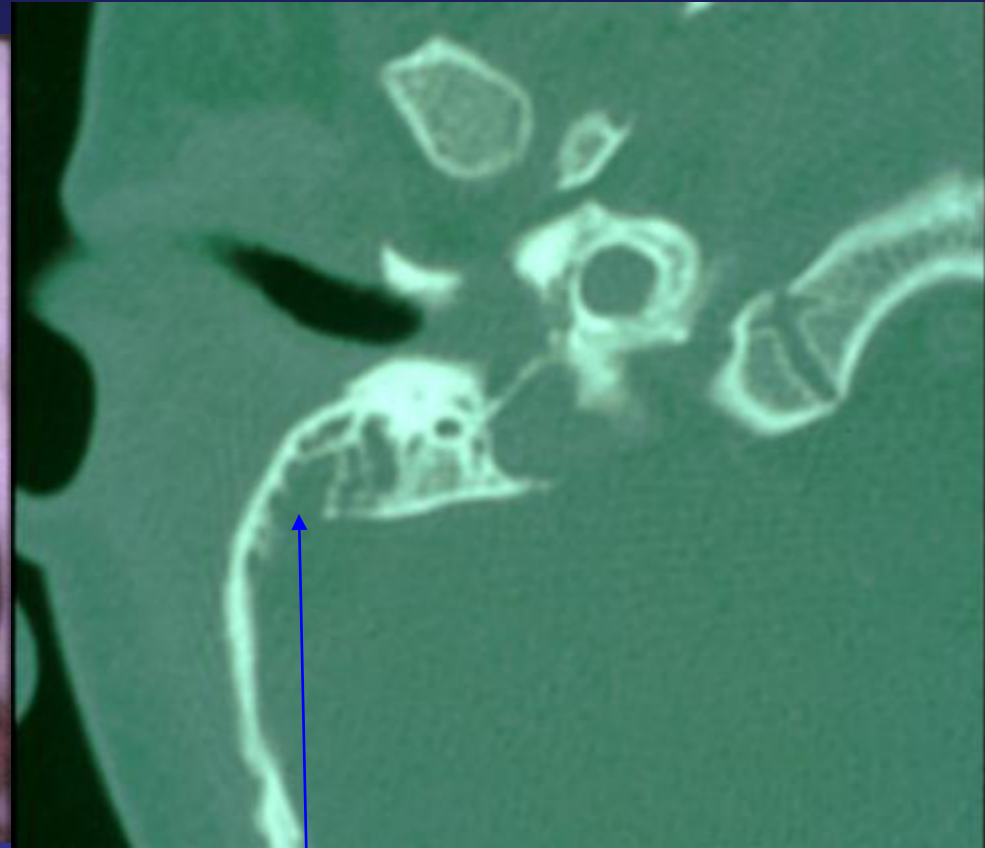
# AOM: Observation v. Early Antibiotics

	Age < 6 months	Age 6 – 24 months	Age > 24 months
Bilateral	Antibiotic	Antibiotic	Antibiotic
Acute perforation	Antibiotic	Antibiotic	Either
Unilateral	Antibiotic	Either	Observe

# Acute Mastoiditis



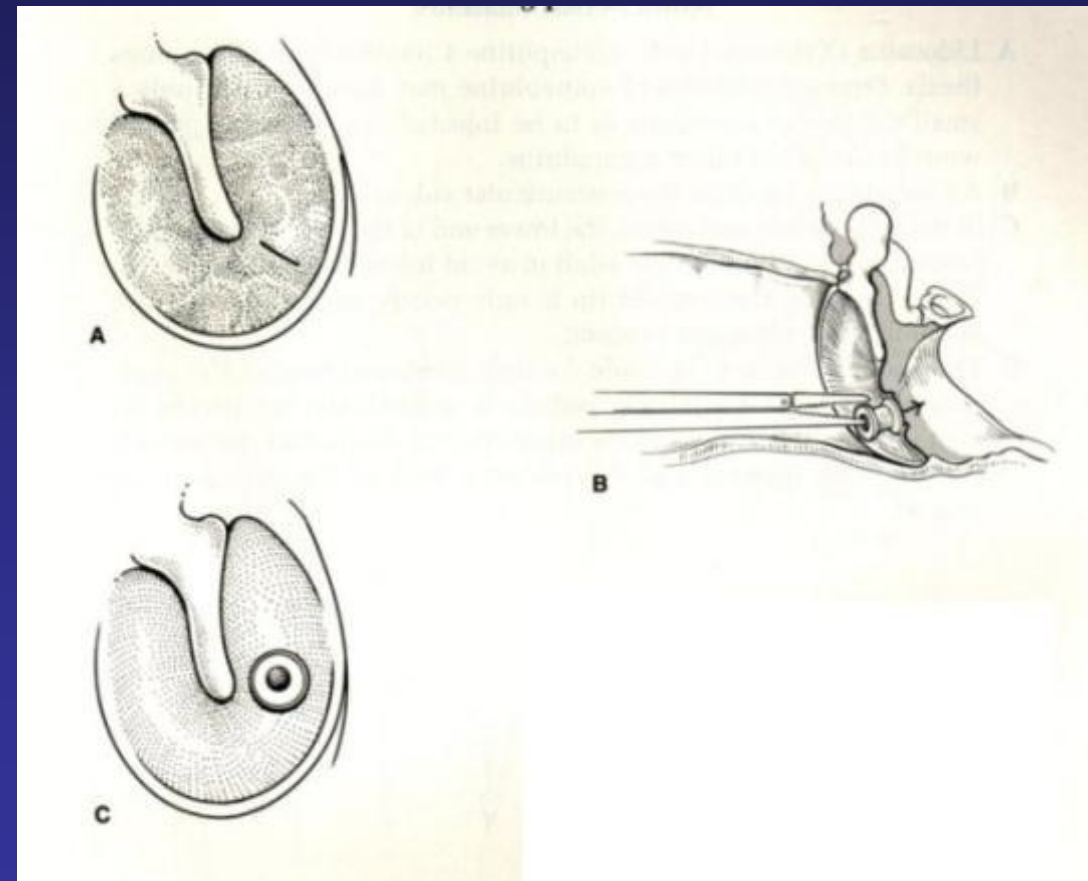
Pinna protruding



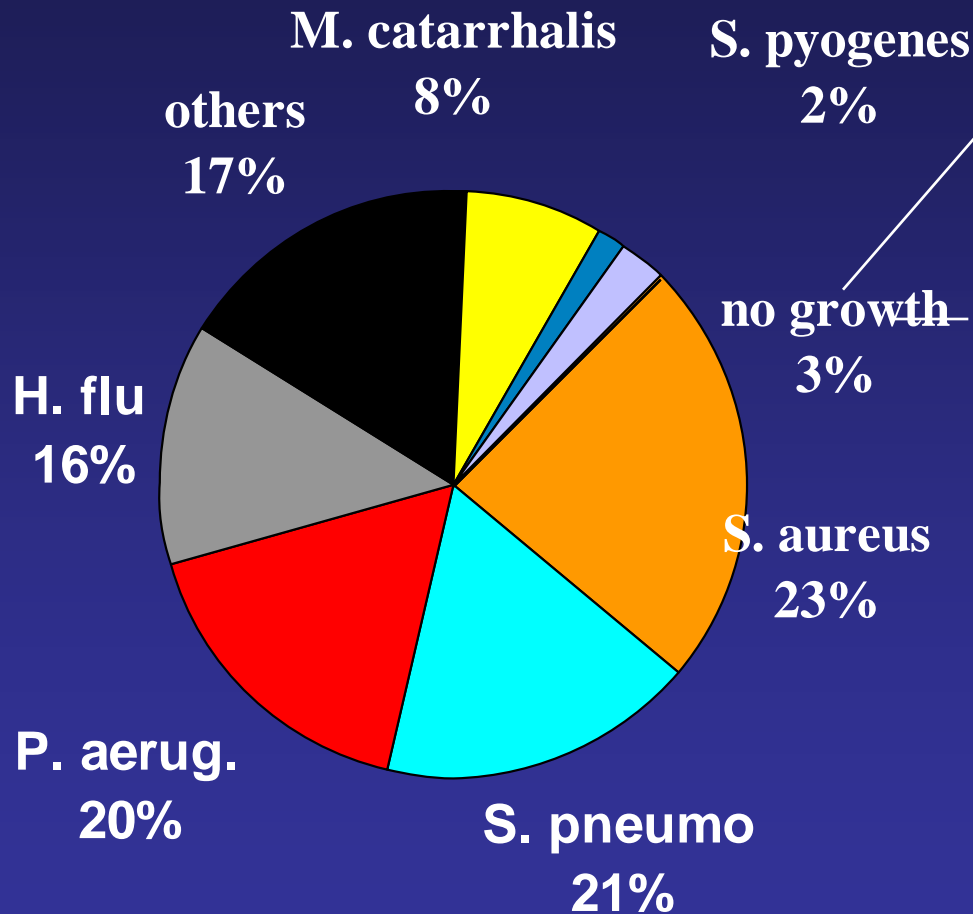
Demineralization of the sigmoid plate

# AOM Surgical Treatment

- Myringotomy
- Tympanostomy tube
- Adenoidectomy
- Mastoidectomy



# Post-Tympanostomy Otorrhea



- Very common
- Painless

# Post-Tympanostomy Otorrhea Treatment

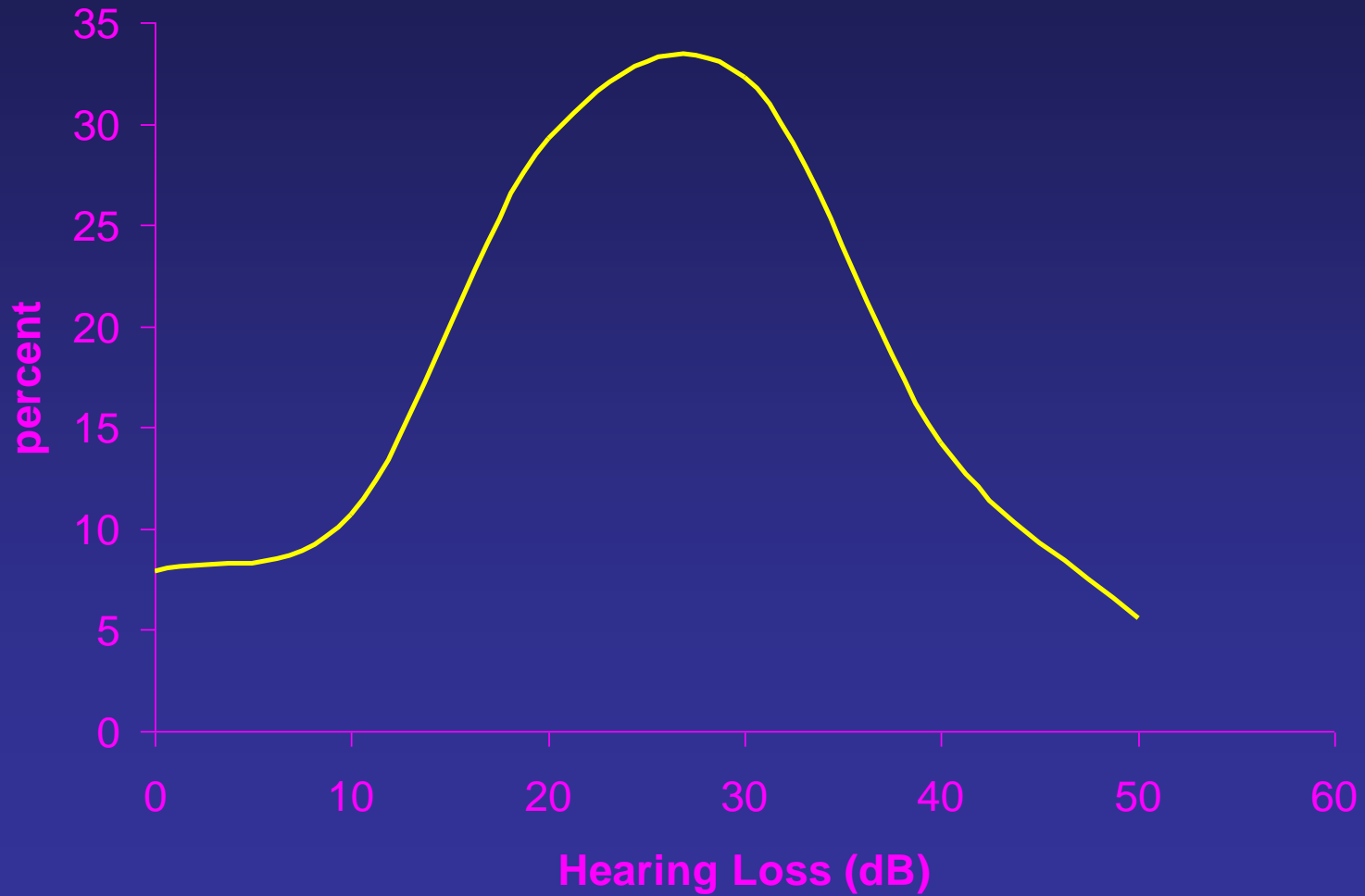
- Systemic antibiotics
  - Ineffective for some pathogens
- Otological agents
  - Preferred
  - Concentrations far exceed MICs
- Tragal pump
- Wick?

# Otitis Media with Effusion (OME)

- Non-acute middle ear inflammation
- Commonly follows AOM
- Self-limited
- Insidious symptoms & signs
  - Hearing loss primary concern



# OME Hearing Loss



# OME Pathogens

- Often “sterile” (ie, culture negative)
- Same differential as AOM
  - *Streptococcus pneumoniae*
  - *Haemophilus influenzae* (nontypable)
  - *Moraxella catarrhalis*

# Role of Bacteria in OME

- Antibiotic effect 14 - 20%
- Bacterial culture (+) 30%
- Bacterial PCR (+) 80%
  - *Streptococcus pneumoniae*, 30%
  - *Hemophilus influenzae*, 55%
  - *Moraxella catarrhalis*, 47%
  - Numerous “atypical” organisms of uncertain significance
- PCR (+) not associated with killed bacteria
- Biofilm disease?

# OME Treatment

- Medical
  - Observation
  - Antibiotics modest benefit
  - Steroids & nonsteroidals controversial
- Surgical
  - Only if persists > 3 months
  - Myringotomy
  - Tympanostomy tube
  - Adenoidectomy

# Chronic Suppurative Otitis Media (CSOM)

- Persistent middle ear infection
  - duration > 3 months
  - failure of medical management
- Tympanic membrane defect
  - perforation
  - tympanostomy tube
- Relatively asymptomatic
- May have serious complications



# CSOM Pathogens

- *Pseudomonas aeruginosa*
- *Staphylococcus*
  - *aureus*
  - *epidermidus & saprophyticus*
- Enterobacteriaceae
- Diphtheroids
- Streptococci,  $\alpha$  - hemolytic
- Anaerobes
- Biofilm



# CSOM Management

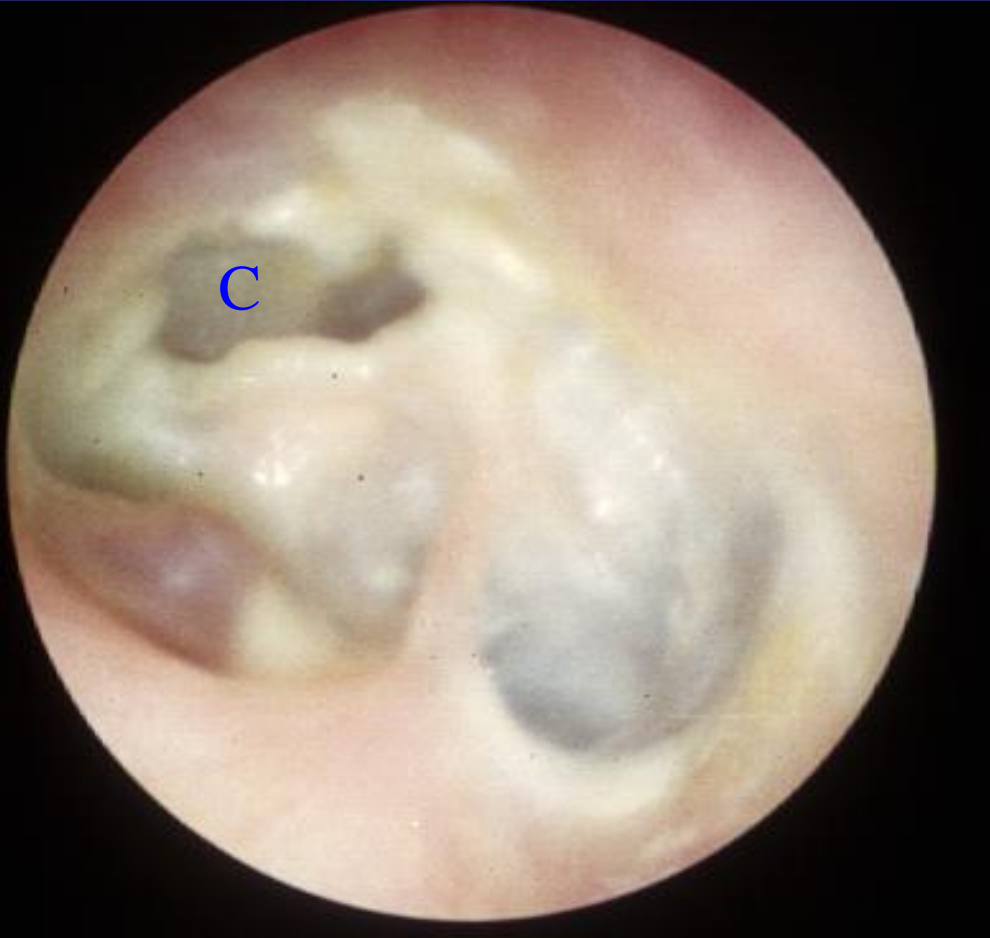
## Medical

- Parenteral antibiotics
  - ceftazidime
  - semisynthetic penicillin + aminoglycoside
  - treatment 14-21 days or 3 days after dry
- Aural toilet
  - topical antibacterial agents
  - frequent suctioning
- Dry ears 75 - 90%

## Surgical

- Standard of care
- Tympanoplasty +/- mastoidectomy
- Dry ears 90%

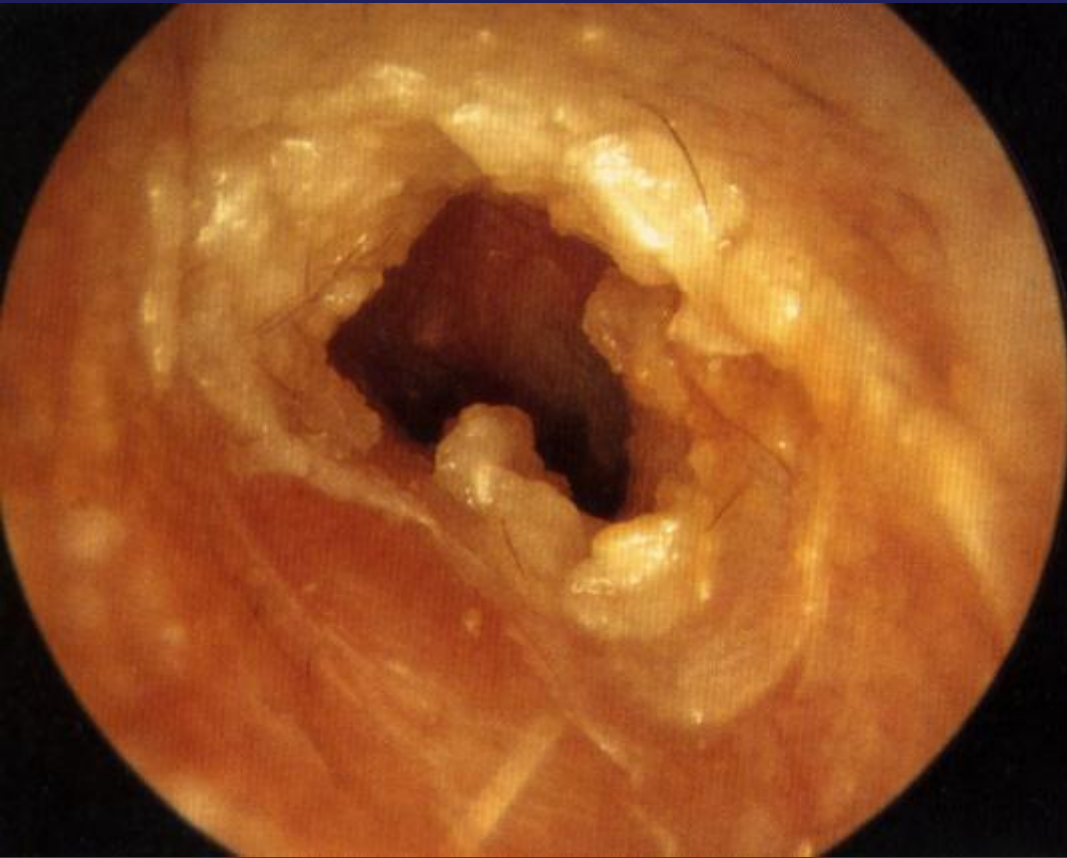
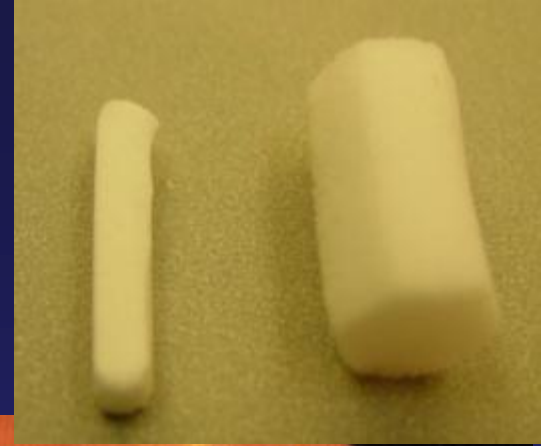
# CSOM with Cholesteatoma



# Acute OE

- “Swimmer’s ear”
- Usually self-limited
- Symptoms
  - Ootalgia
  - Otorrhea
- Findings
  - Ear canal edema
  - Otorrhea
  - Tender to pinna traction

# Acute Otitis Externa



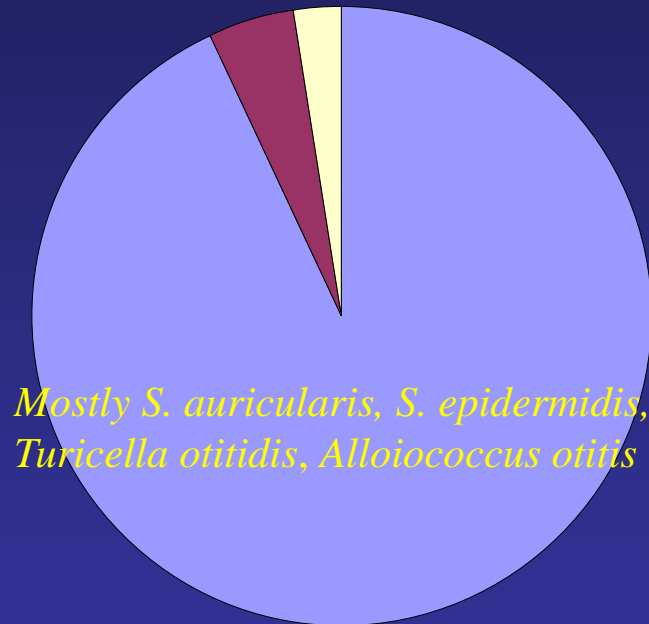
debris and swelling of ear canal, very tender!

May require wick

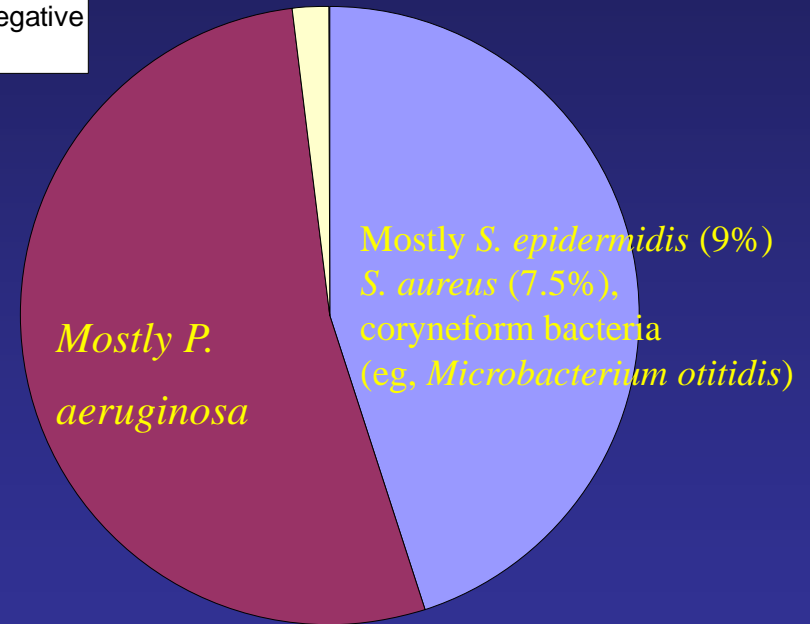
# Microbiology of the Ear Canal

## Normal v. Acute Otitis Externa

■ Gram positive  
■ Gram negative  
■ Fungal



■ Gram positive  
■ Gram negative  
■ Fungal



AOE: more *P. aerug*, *S. aureus*,  
& microbacterium sp.

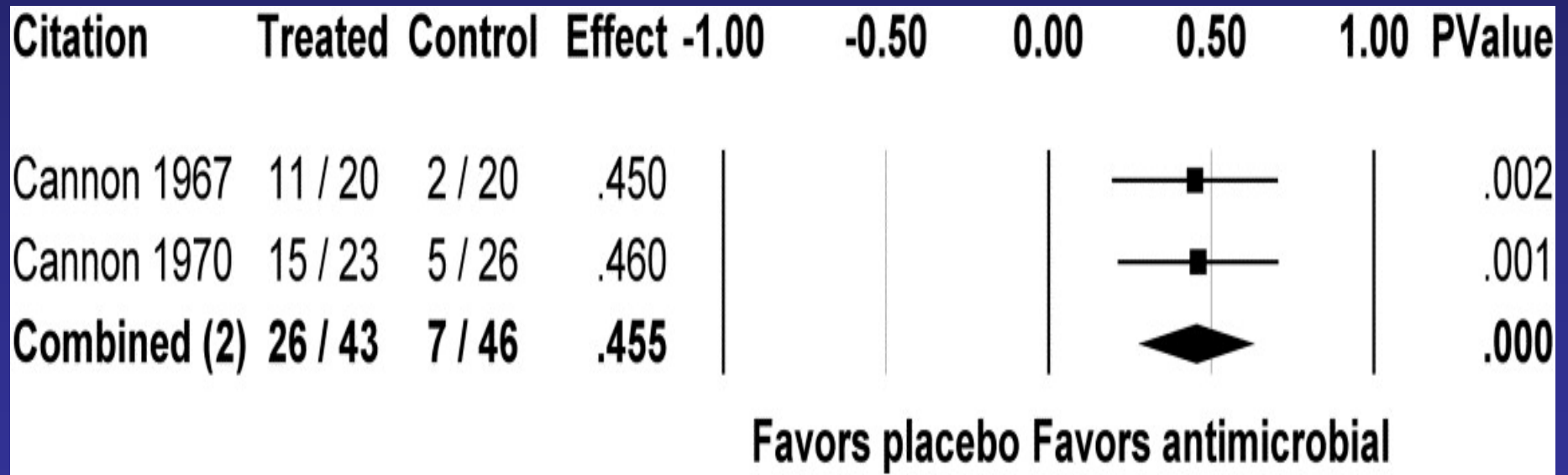
# Pathogenesis of AOE

- Water exposure
- Loss of protective barriers
  - Removal of wax
  - Irritation of EAC skin
- Accumulation of exfoliated skin debris
- Obstruction



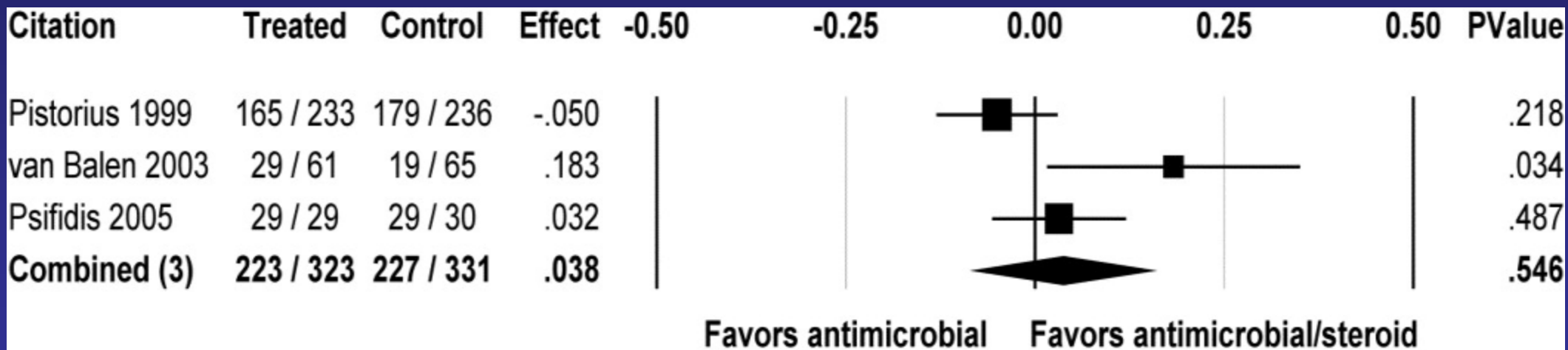
# Antibiotic v. Placebo in AOE

- NNT = 2



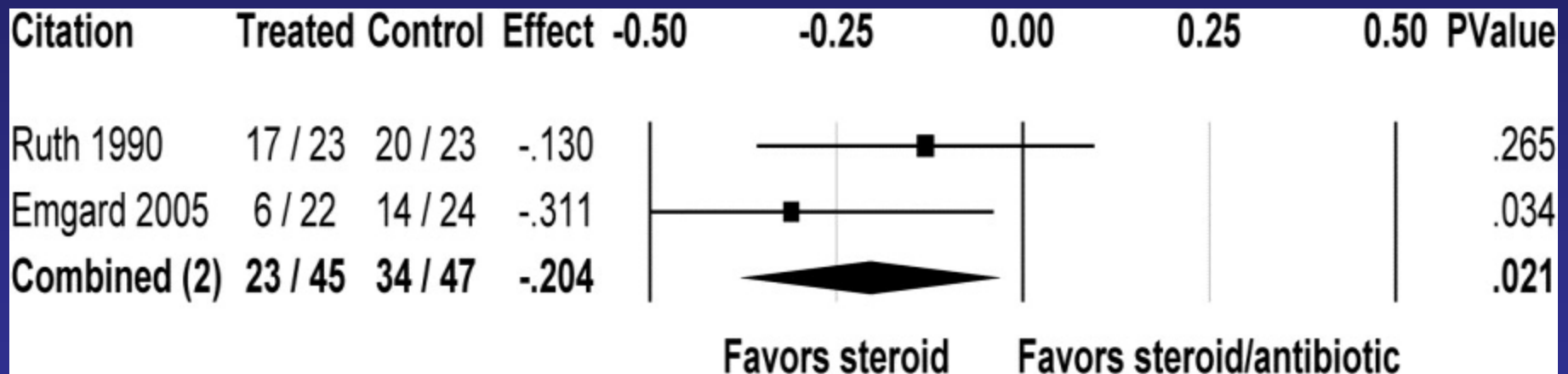
Rosenfeld et al. Otolaryngol Head Neck Surg. 2006

# Antibiotic v. Antibiotic-Steroid in AOE



Rosenfeld et al. Otolaryngol Head Neck Surg. 2006

# Steroid v. Antibiotic in AOE



Rosenfeld et al. Otolaryngol Head Neck Surg. 2006

# Necrotizing OE

- Osteomyelitis of the skull base
- High morbidity & mortality
- Risk factors
  - Diabetic
  - Immunocompromised
- Pathogens
  - *Pseudomonas aeruginosa* (most)
  - *Staphylococcus aureus*
  - *Aspergillus sp.* (rarely)
- Parenteral antibiotics critical
  - Quinolones
  - 3rd generation cephalosporin
  - Aminoglycoside + SS-PCN
  - Extended duration
    - Minimum 6 weeks
    - Normal gallium scan
- Regular cleaning
- Diabetes control
- Watch renal function\*

# Necrotizing OE

- Symptoms

- Otagia
- Otorrhea
- Hearing loss
- Fever
- Hoarseness
- Aspiration
- Dysphagia
- Facial palsy

- Signs

- Granulation tissue\*
- Otorrhea
- Canal edema
- Cranial neuropathies

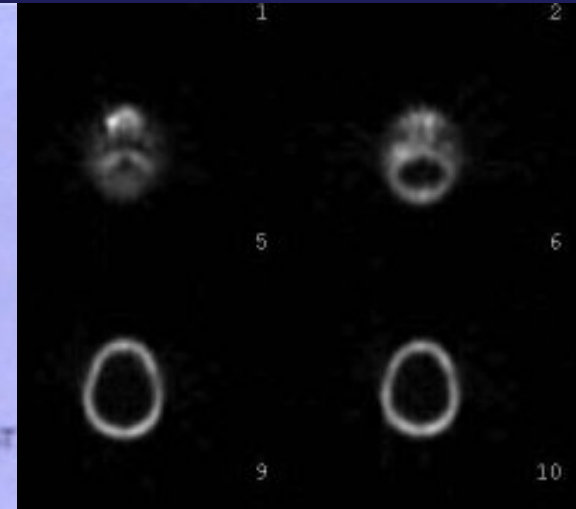
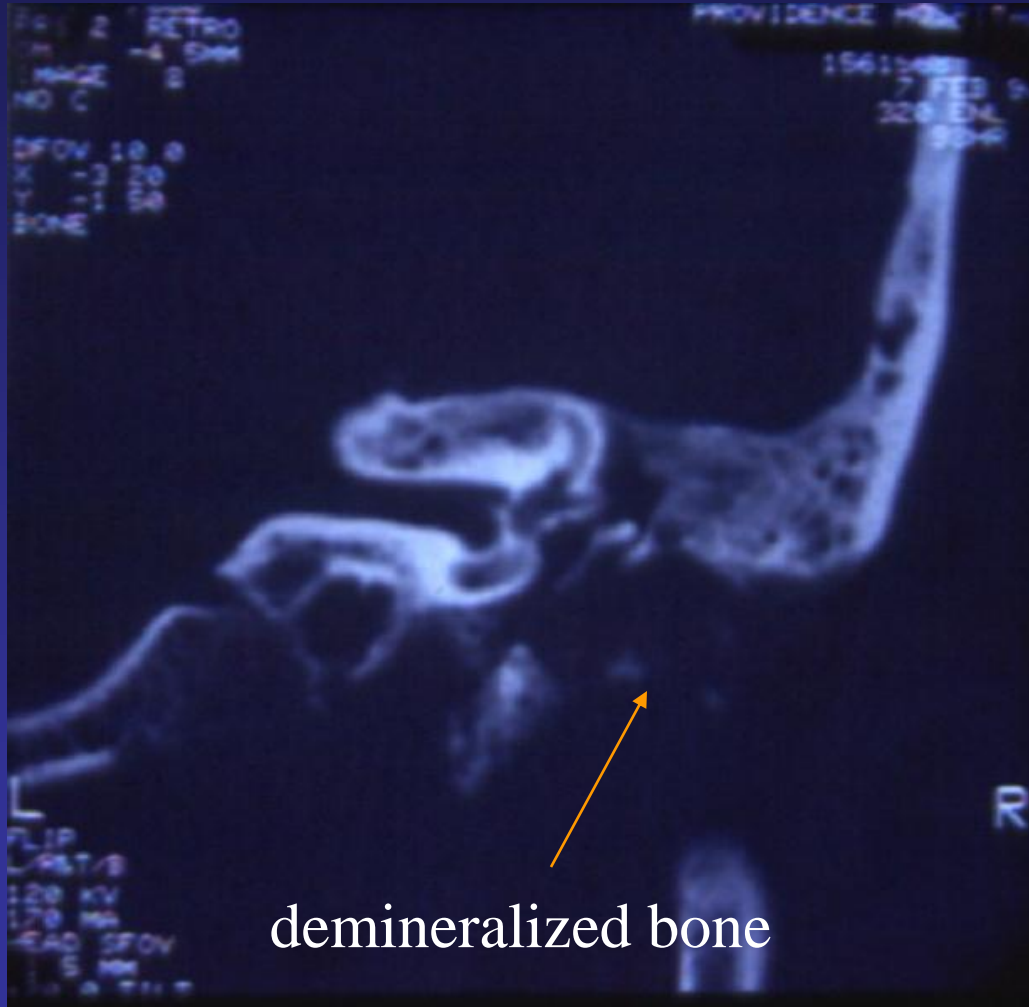


Distinguishes from routine Acute OE

# Necrotizing OE

CT

Bone Scan



# Chronic Otitis Externa

- External canal inflammation
- Symptoms: primarily pruritus
- Aggravating factors
  - Cleaning ears
  - Contamination
- Treatment: topical steroids
- Commonly leads to acute OE flares

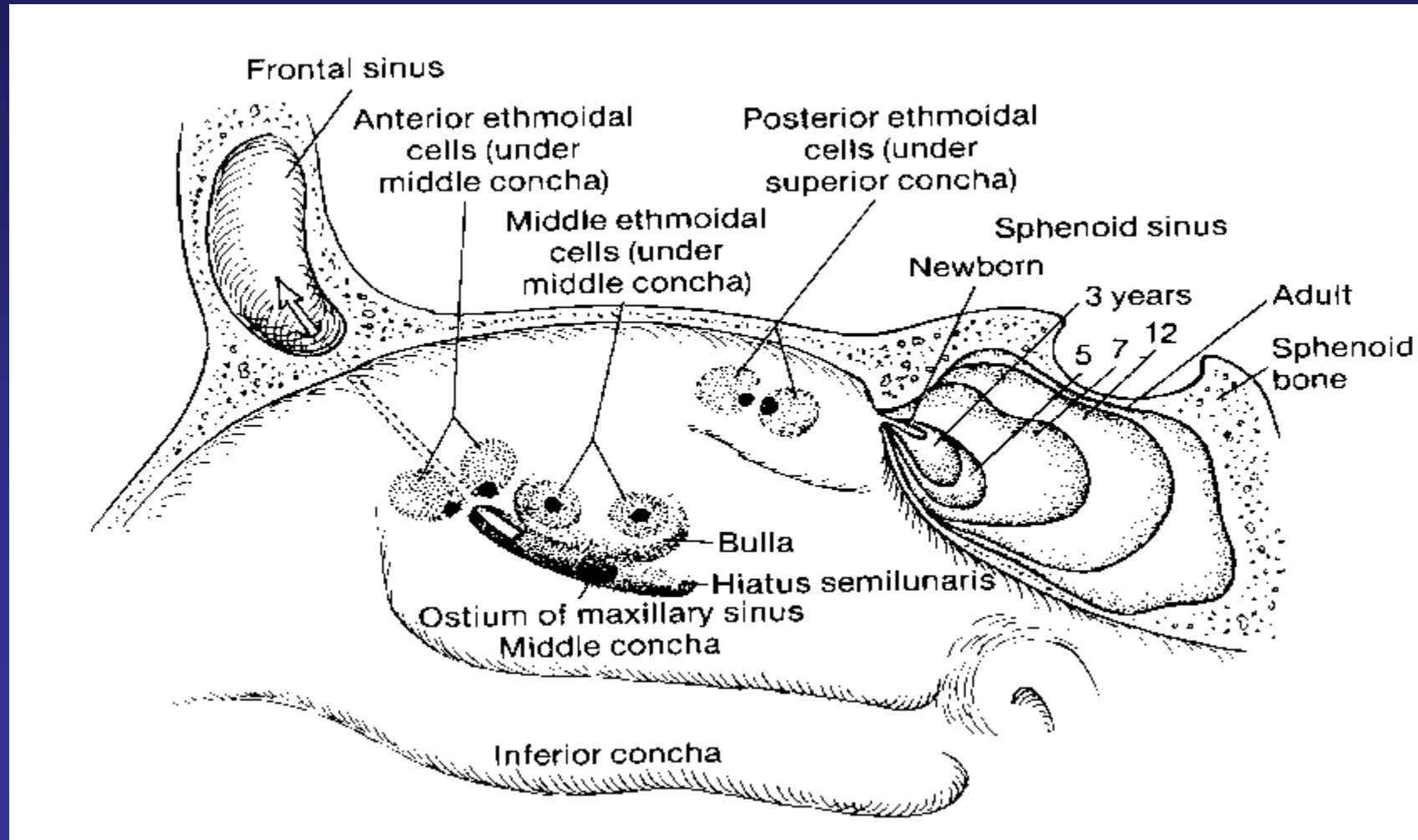


debris and swelling, nontender

# Sinusitis

(aka, Rhinosinusitis)

# Anatomy of the Sinuses



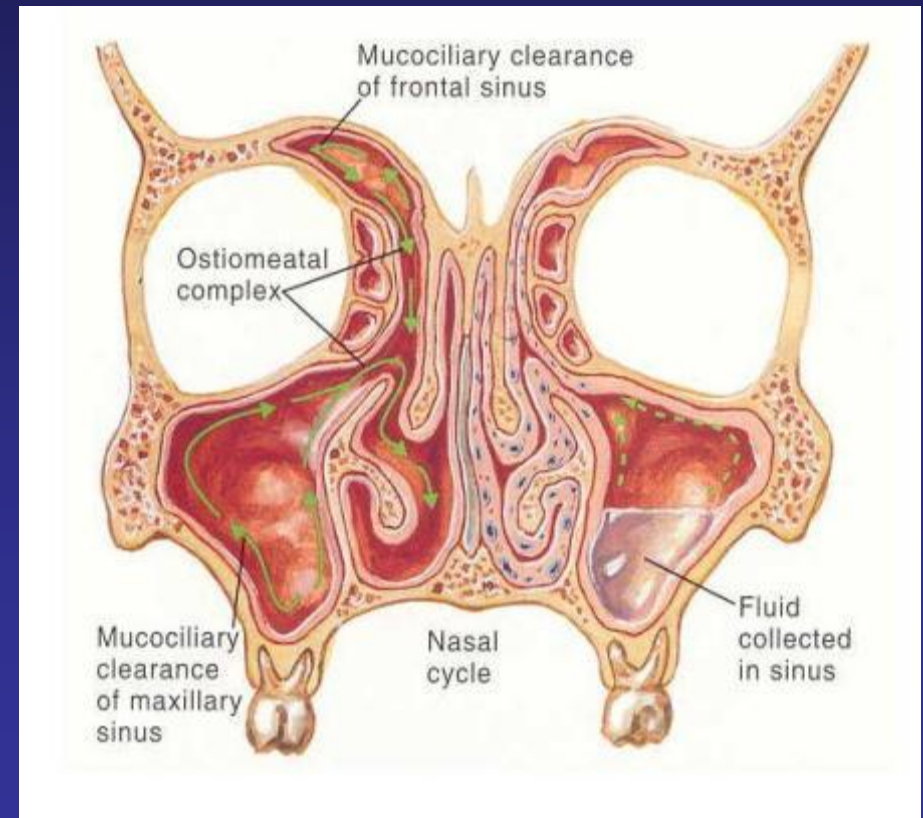
# Pathogenesis of Sinusitis

- Obstruction of sinus ostia
  - Viral
  - Atopic
  - Developmental
  - Traumatic
  - Toxic (e.g., smoke)
- Overgrowth of microbes
  - Pathogens
  - Endogenous flora
  - Biofilms



# Mucociliary Clearance

- Cilia of respiratory epithelium beat towards natural sinus ostia
  - Mucous cleared out ostium, into nasal cavity, posteriorly down pharynx
- Ciliary function affected by congenital disorders, smoking, dehydration, hypoxia, chronic infection



From Josephson, 1994

# Acute Sinusitis

- Diagnosis dependent upon
  - Clinical data
    - Fever
    - Facial pain & inflammation
    - Pus draining from sinus ostium
    - Tooth tenderness
  - Presence of sinus effusion
- Usually self-limited
- Affects both kids and adults
- Complications rare, more in young kids



# Microbiology of Acute Sinusitis

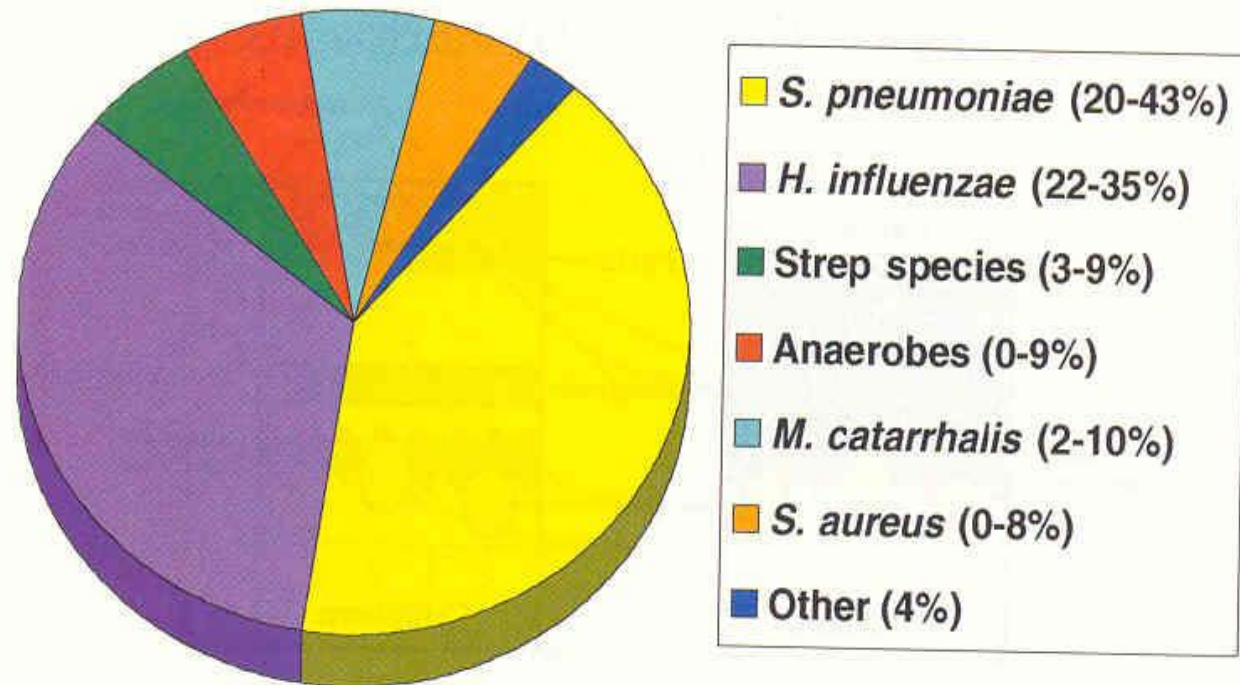


Fig 3. Ranges of prevalence of the major pathogens associated with ABRS in adults.

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# Acute Sinusitis Treatment

- Medical treatment

- Observation
- Symptomatic treatment
- Nasal decongestants
- Systemic antibiotics



- Surgical treatment

- Rarely needed
  - Mainly for complications of acute sinusitis
- Trephination vs. Sinus tap & lavage
- Endoscopic sinusotomy
- Sinusectomy (eg, ethmoidectomy)

# Purulent Rhinorrhea

- All pus in the nose is not sinusitis
  - Stasis (eg, foreign body)
- Viral looks like bacterial (kids 10 / year)
- Poor correlation between rhinorrhea and sinus aspirates
- Nasopharyngeal swab of little value
- Endoscopic culture of sinus ostium much more accurate

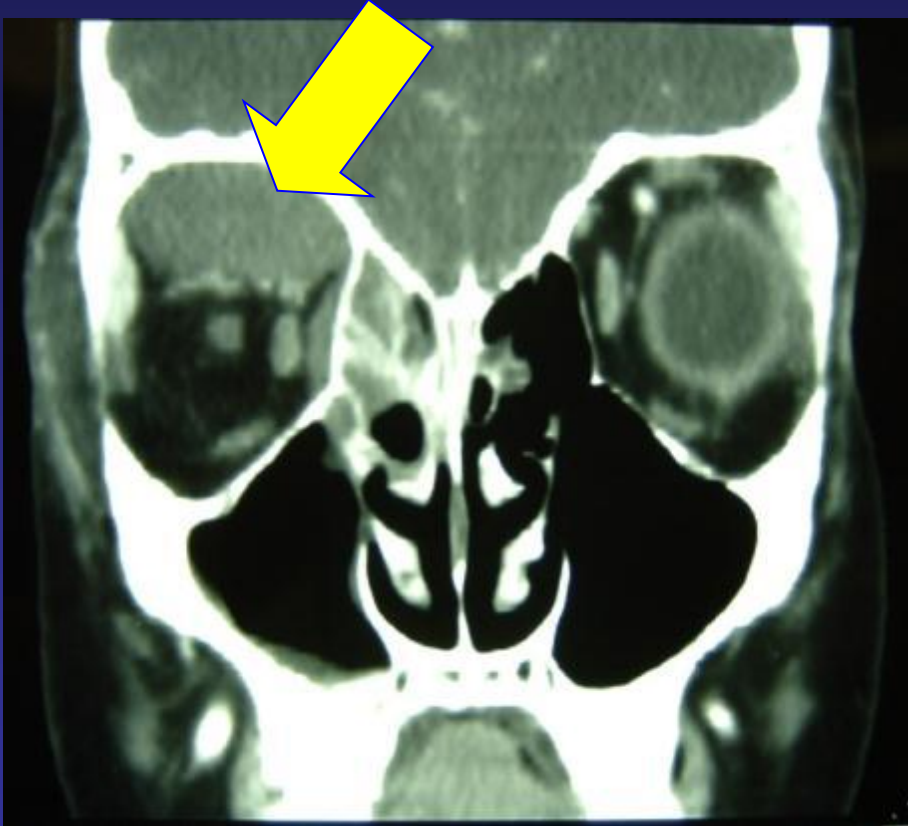
# Nasal Foreign Body Cause of Rhinorrhea



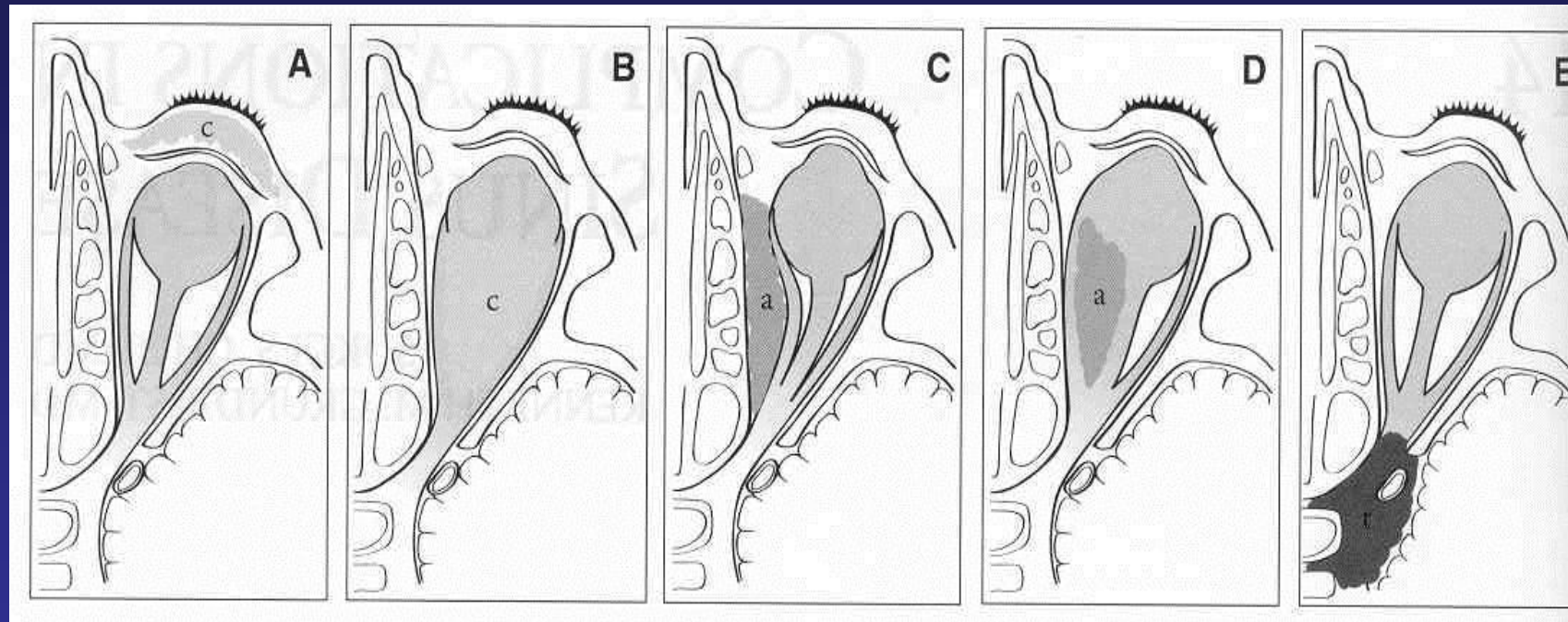
# Complications of Sinusitis

- 2 broad categories:
  - Orbital
  - Intracranial
- Presentation depends on age
  - Children more likely to get complications from acute
  - Adults more likely from chronic

# Complications of Acute Sinusitis



# Intraorbital Complications



A) Preseptal cellulitis

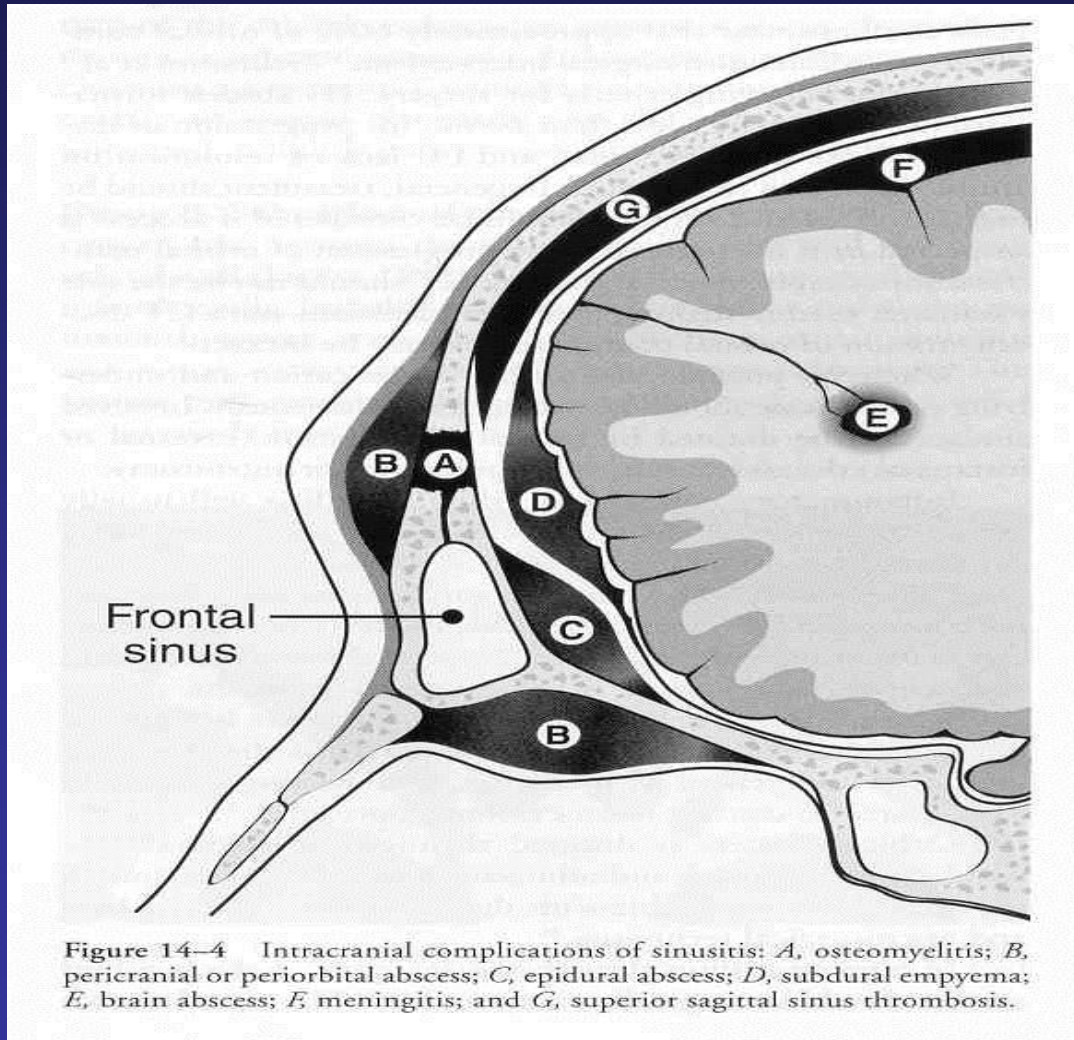
B) Orbital cellulitis

C) Subperiosteal abscess

D) Orbital abscess

E) Cavernous sinus  
thrombosis

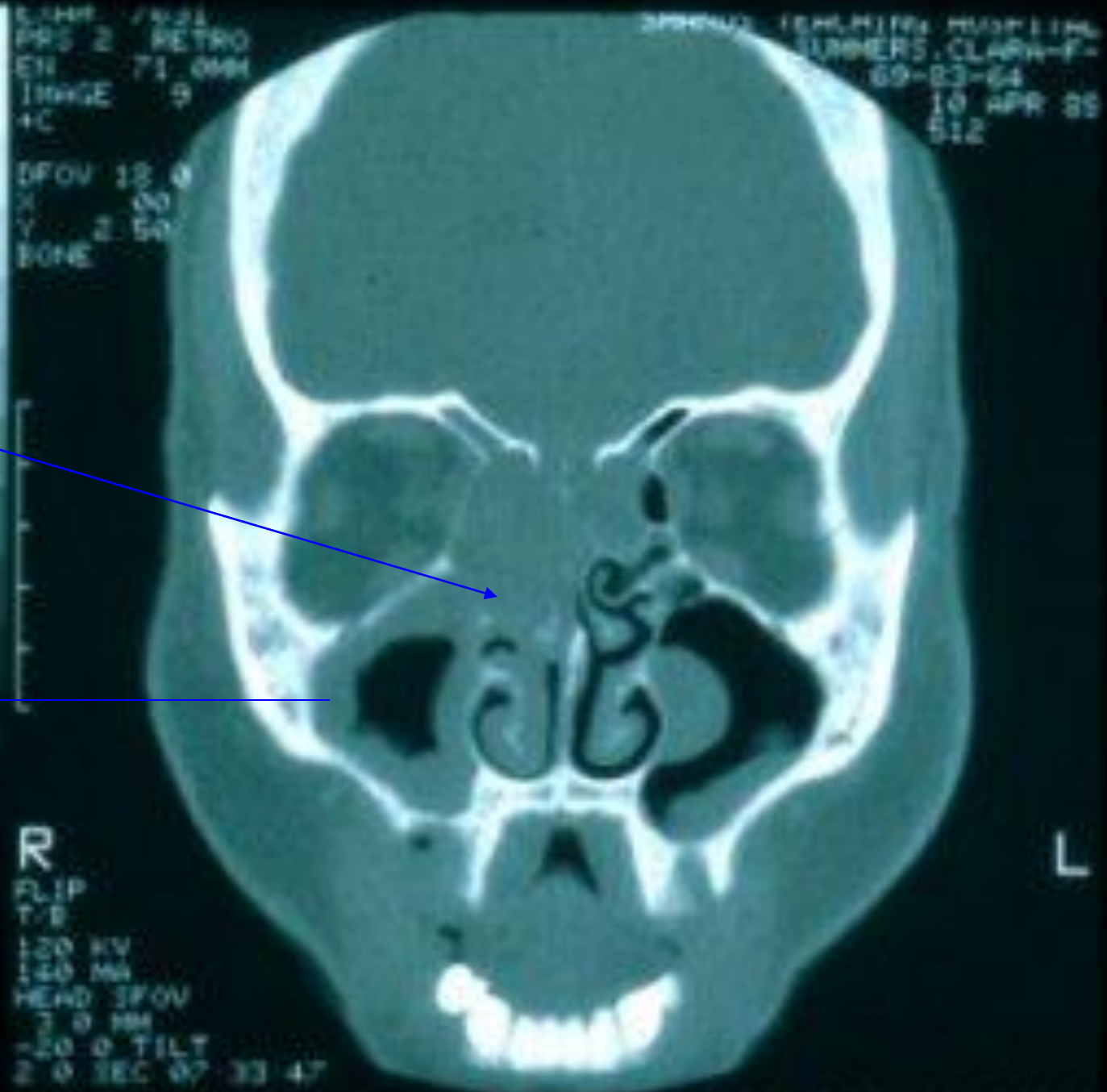
# Intracranial Complications



- A) Osteomyelitis
- B) Pericranial abscess
- C) Epidural abscess
- D) Subdural empyema
- E) Brain abscess
- F) Meningitis
- G) Sagittal sinus thrombosis

# Chronic Sinusitis

- More indolent course
- May have acute flares
- Risk factors
  - Allergies
  - Tobacco smoke
- CT imaging
- Treatment
  - Nasal steroids
  - Systemic antibiotics
    - Broad spectrum
    - prolonged
  - Surgery
    - More commonly needed
    - Endoscopic sinusotomy
    - Sinusectomy
    - Obliteration



obstruction of  
sinus ostia

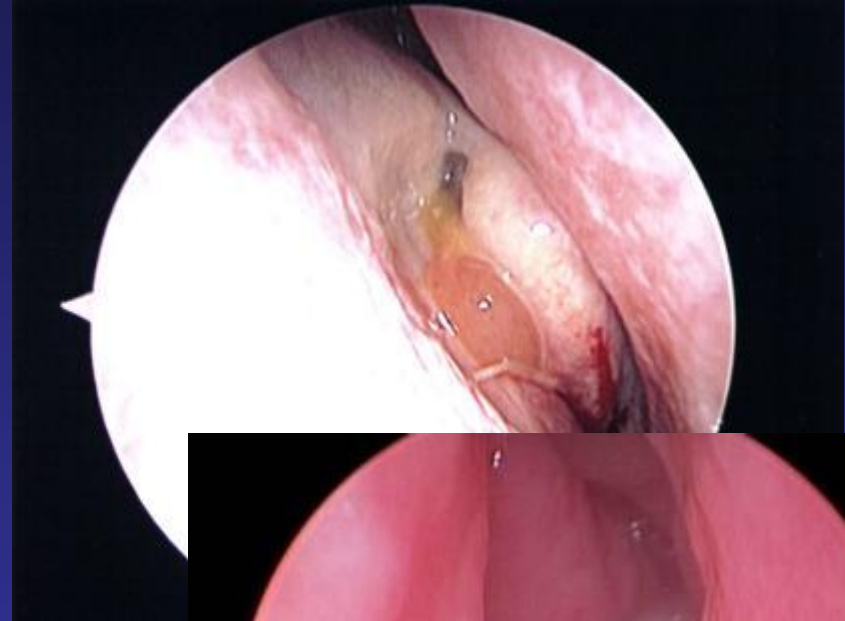
mucosal  
thickening

# Chronic Sinusitis: Pathogens

- Gram negative bacilli
- Staphylococci
- Anaerobes
- Viridans streptococci
- Fungi

# Allergic Fungal Sinusitis

- **Subset of chronic sinusitis**
- **Not immunocompromised**
- **Atopic disease**
- **Pathogens: dermatophytes**
- **Treatment**
  - **Surgical drainage**
  - **Steroids**

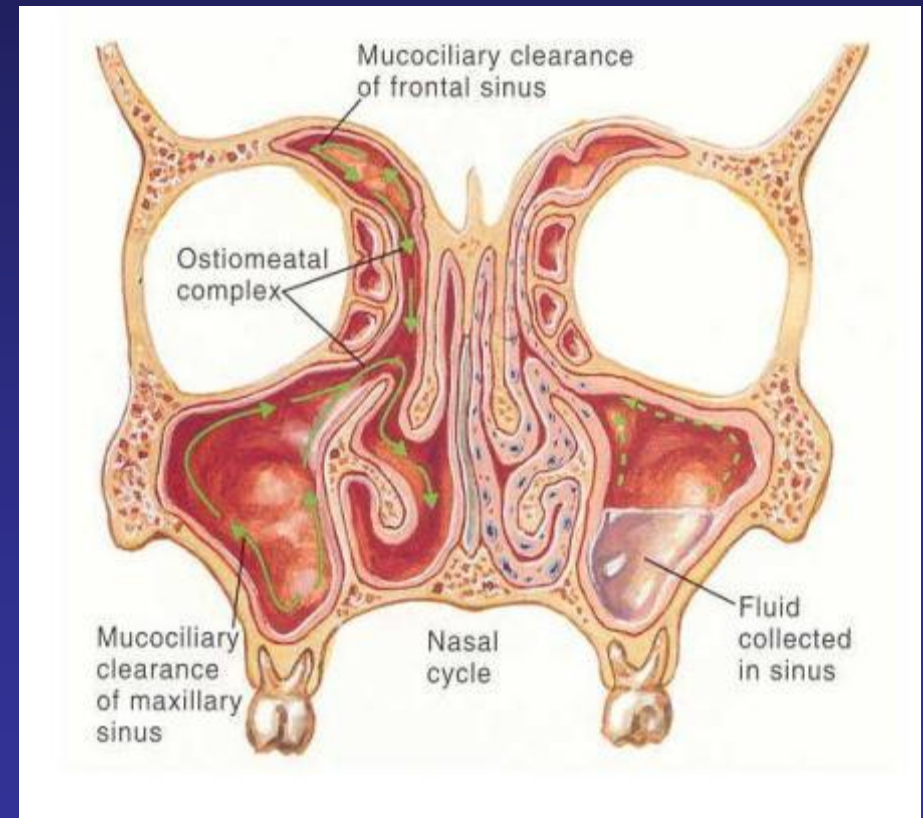


# Invasive Fungal Sinusitis

- Immunocompromised patients (DKA & neutropenic)
- High mortality due to vascular invasion
- Pathogens:
  - Rhizopus
  - Aspergillus
- Treatment
  - Surgical debridement (often radical) back to normal tissue
  - Systemic antifungal agents

# Functional Endoscopic Sinus Surgery (FESS)

- Based on principles of mucosal preservation
  - Increasing size of natural ostium
  - Helps preserve/improve sinus *function*
- Extent of surgical dissection varies by patient disease
- Chronic, low-grade osteomyelitis may exist
  - Necessitates removal of infected bone



Questions?