

A photograph of the Phoenix Children's Hospital building, featuring a prominent red hand logo on the upper left corner. The building is partially obscured by a large, semi-transparent red triangle that points towards the top right. In the foreground, several palm trees are visible, their trunks and fronds also partially covered by the red triangle. The background is a solid, vibrant blue.

# Otitis Media and Its Sequelae: A subspecialty perspective

Nathan Page, MD, FAAP  
Division of Otolaryngology  
Phoenix Children's Hospital

# Disclosures

- No financial conflicts to disclose
- Discussion of name brand product (Hummingbird) that is FDA approved for office ear tube placement age 6 months and up







# Audience Response Question:

In Arizona, acute otitis media in children is diagnosed:

- A. Too frequently
- B. Just the right amount
- C. Not frequently enough

# Audience Response Question:

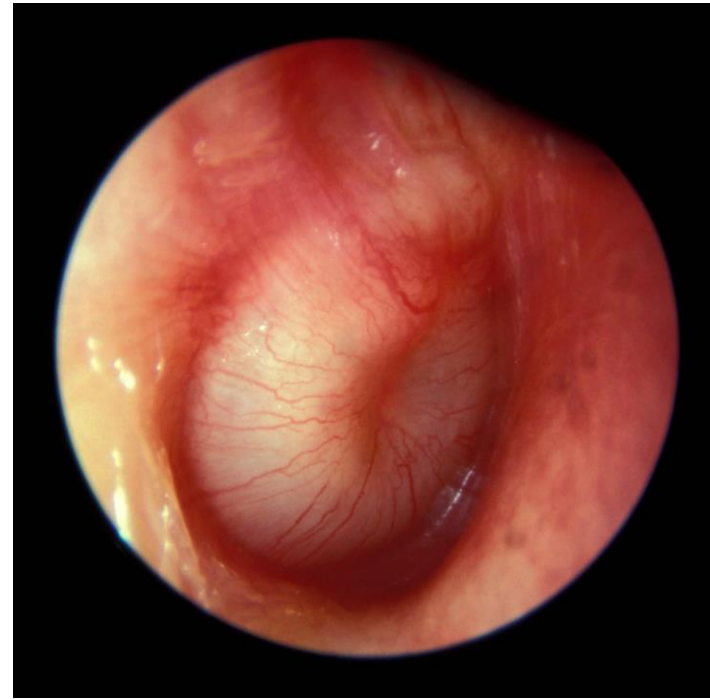
Otolaryngologists in Arizona place tympanostomy tubes:

- A. Too frequently
- B. Just the right amount
- C. Not frequently enough





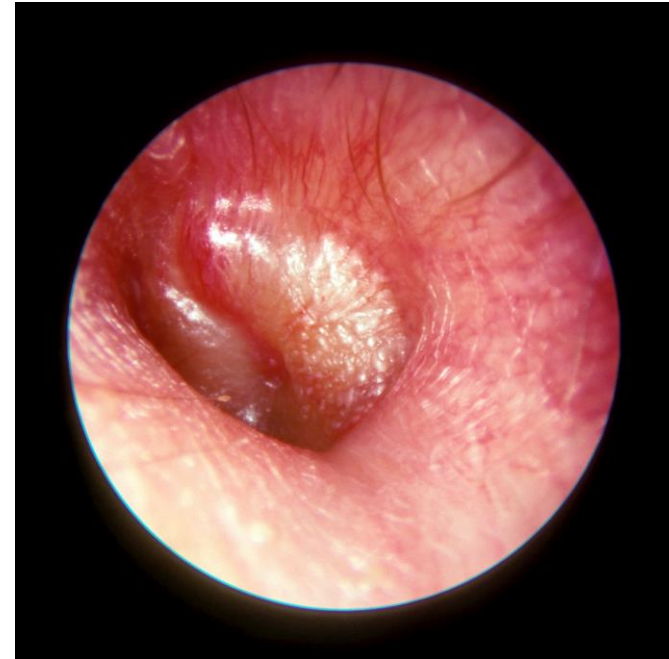
[http://me.hawkelibrary.com/albums/acute-otitis-media/Severe\\_AOM\\_BB\\_Right.jpg](http://me.hawkelibrary.com/albums/acute-otitis-media/Severe_AOM_BB_Right.jpg)



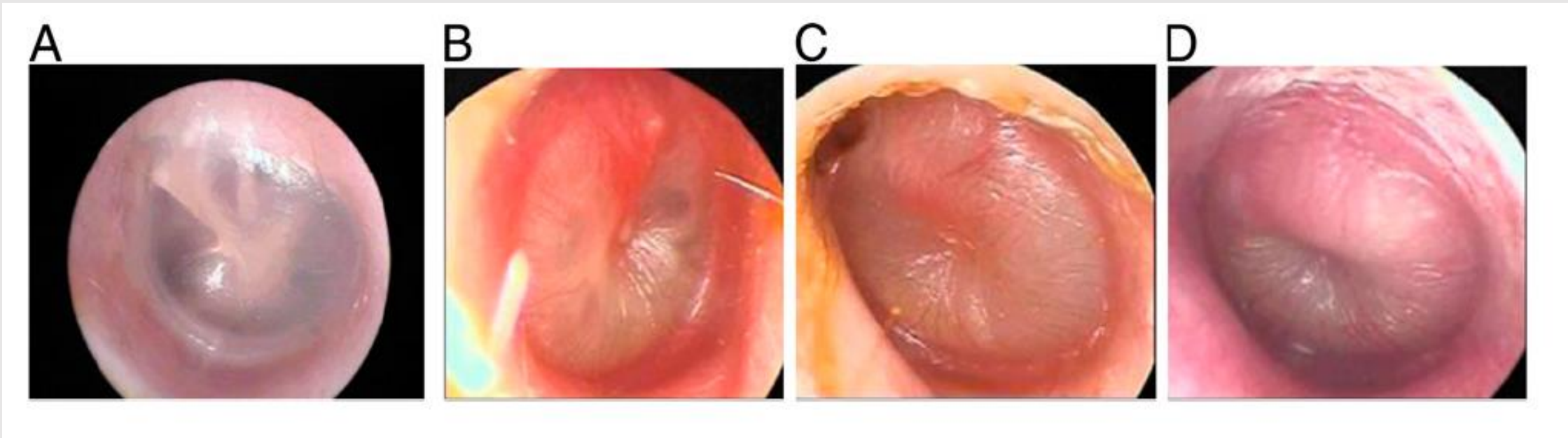
[http://otitismedia.hawkelibrary.com/albums/mastoiditis/3\\_1.jpg](http://otitismedia.hawkelibrary.com/albums/mastoiditis/3_1.jpg)



<http://o.quizlet.com/44az0SfcBHnK9wST072wRA>



# Acute Otitis Media

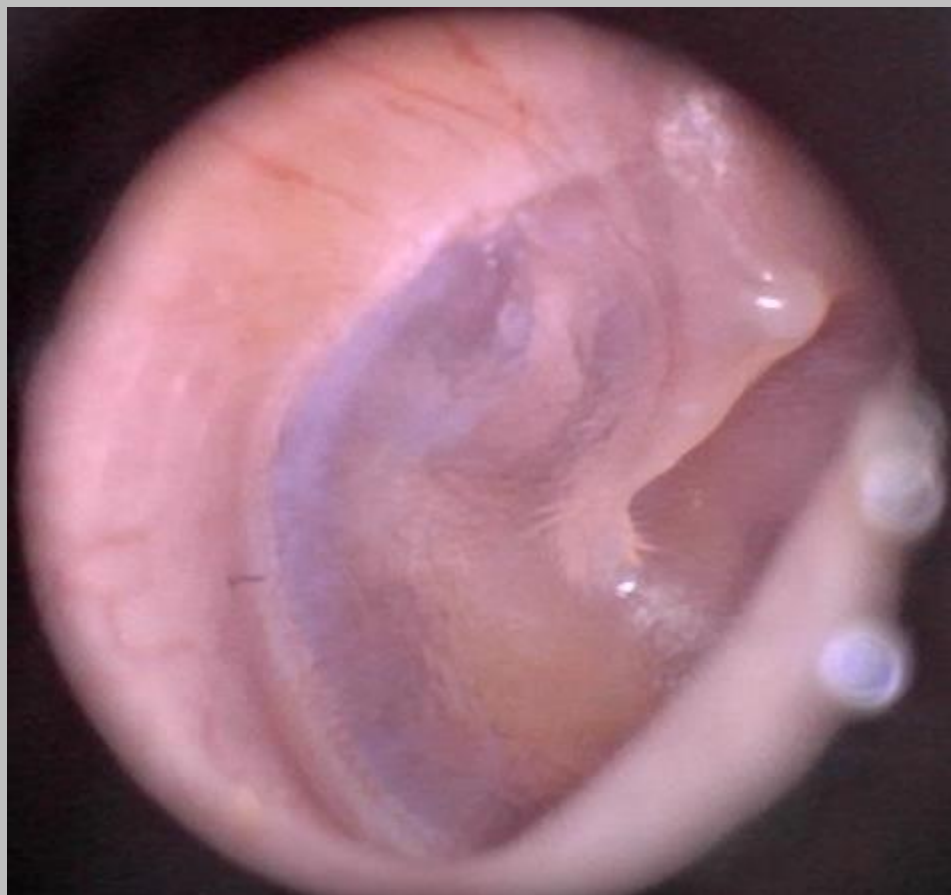




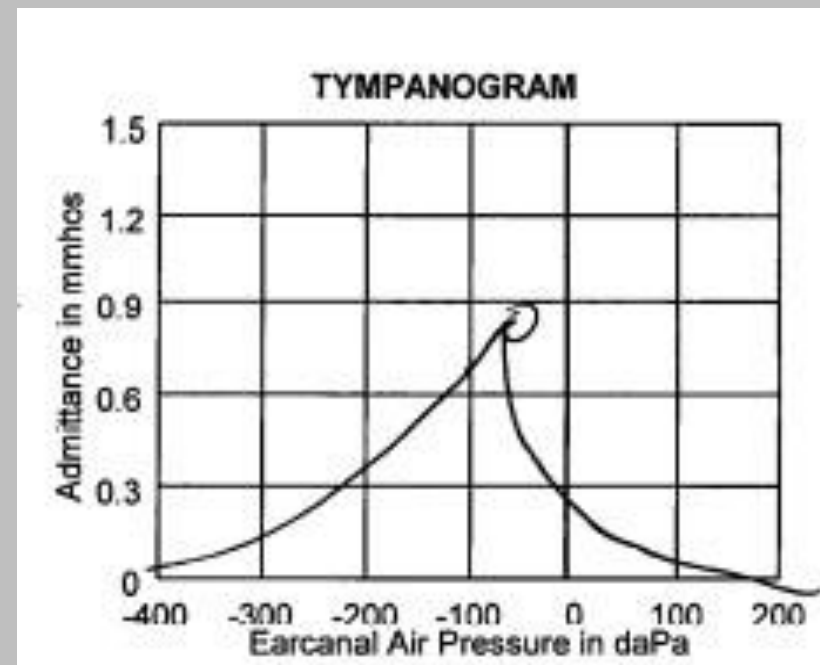
# Case presentation

- TS is a 2 yr 6 month old boy with a history of 5 ear infections in 6 months. Mom reports presenting symptoms of runny nose, irritability, poor sleep. These symptoms started again last night.
- PMHx/PSHx: None
- Social history: in daycare daily, taken to urgent care for each episode

- Examination:



- Tympanogram:







What is your treatment recommendation?

- A. Reassurance
- B. Oral antibiotics
- C. Referral to ENT
- D. More than one of the above



# 2013 AAP Guideline:

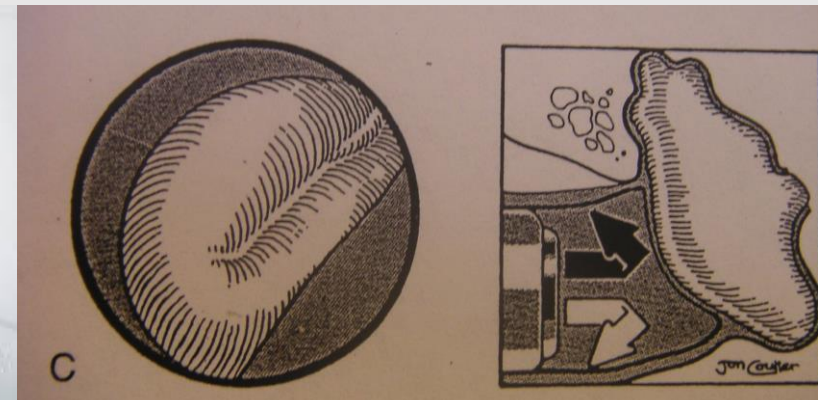
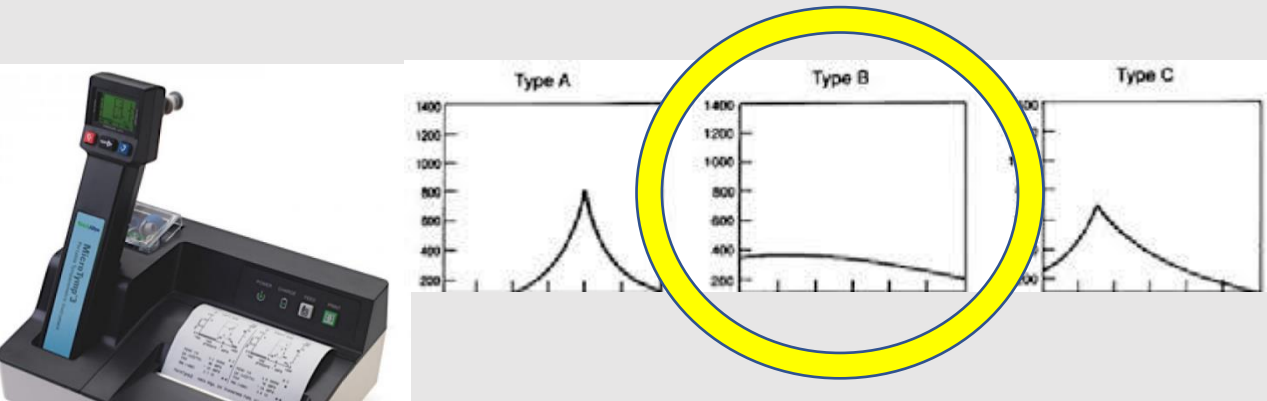
## CLINICAL PRACTICE GUIDELINE

## The Diagnosis and Management of Acute Otitis Media

The diagnosis of acute otitis media (AOM) should be made in children who present with

- moderate to severe bulging of the tympanic membrane (TM) *or*
- new onset of otorrhea not due to acute otitis externa *or*
- mild bulging of the TM *and* recent (less than 48 hours) onset of ear pain or intense erythema of the TM.

AOM should not be diagnosed in children who do not have middle ear effusion (MEE) (based on pneumatic otoscopy and/or tympanometry).



# 2015 Meta-analysis of Abx vs. Placebo

- Searched 1966 to 2015
- High quality prospective studies of Abx vs. placebo
- High income countries
- Low risk of bias
- 13 RCT
- 3401 children/3938 AOM episodes



**Cochrane  
Library**

Cochrane Database of Systematic Reviews

**Antibiotics for acute otitis media in children (Review)**

Venekamp RP, Sanders SL, Glasziou PP, Del Mar CB, Rovers MM



# 2015 Meta-analysis of Abx vs. Placebo

- **Primary Outcomes:**

1. Ear pain at various time points
2. Adverse events related to Abx

- Secondary Outcomes:

1. Abnormal tympanometry
2. TM perforations
3. Contralateral AOM
4. AOM recurrences
5. Serious complications
6. Long-term effects



**Cochrane  
Library**

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# 2015 Meta-analysis of Abx vs. Placebo

- By 24 hours, 60% of children had recovered regardless of treatment arm
- Benefits from pain reduction:
  - 24 hours—no difference
  - 2-3 days—NNTB = 20
  - 4-7 days—NNTB = 16
  - 10-12 days—NNTB = 7
- Improved tympanometry NNTB = 11
- Reduced perforations NNTB = 33
- Adverse events from meds NNTH = 14



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Library**

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# 2015 Meta-analysis of Abx vs. Placebo

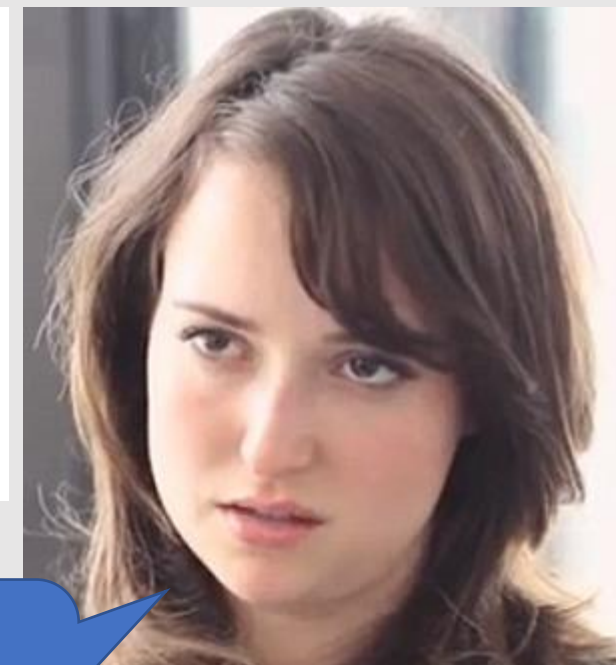
## Conclusions:

1. “In high income countries, most cases of AOM spontaneously remit without complications.” p.2
2. “We found that antibiotics were not very useful for most children with AOM” p.3
3. “Severe complications were rare and did not differ between children treated with antibiotics and those treated with placebo.” p.2
4. Quality = high; further research unlikely to change



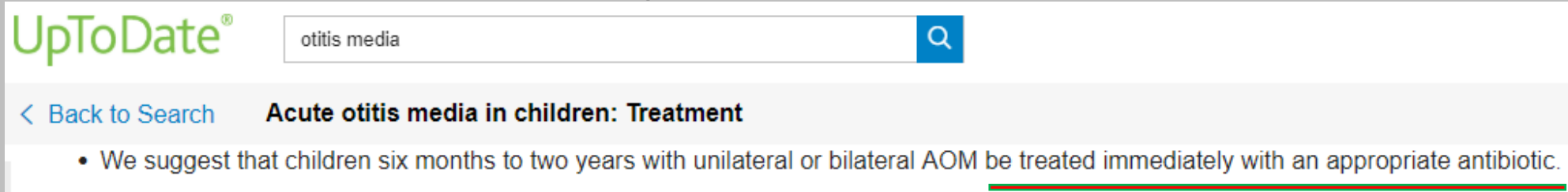


There's a 1 in 16 chance that this antibiotic will work better than placebo in reducing your daughter's ear pain in the next 7 days.



You must be kidding???

# What about *UpToDate*?

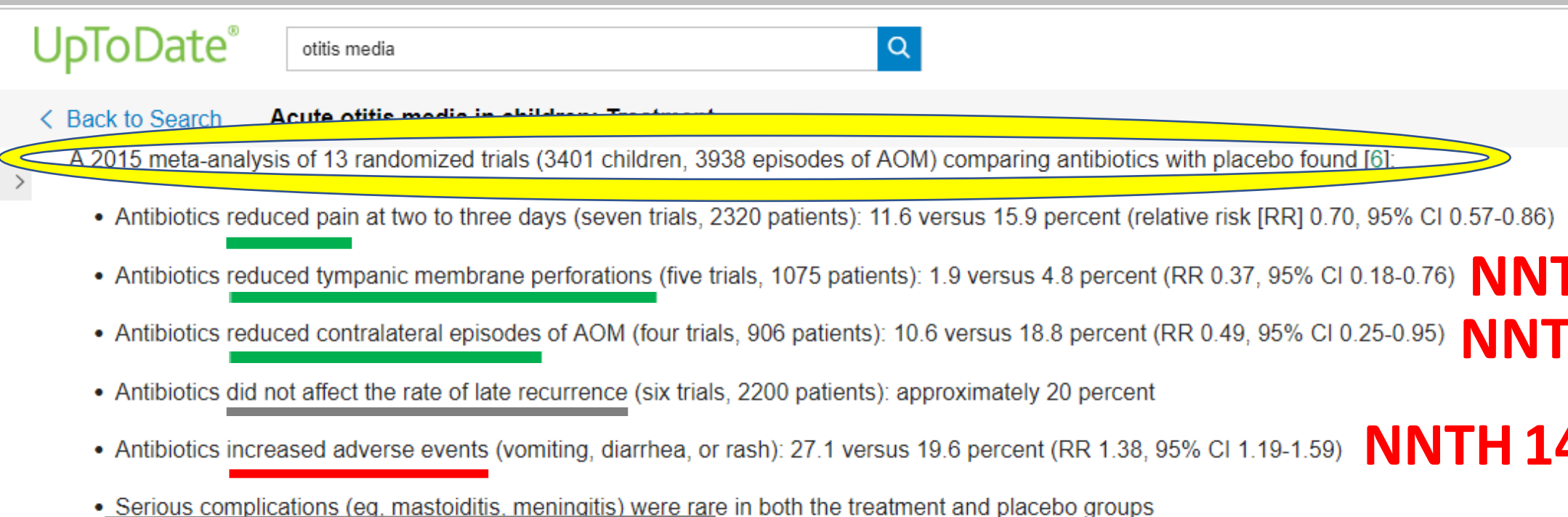


UpToDate® otitis media

< Back to Search Acute otitis media in children: Treatment

- We suggest that children six months to two years with unilateral or bilateral AOM be treated immediately with an appropriate antibiotic.

**Why? Because they work better than placebo....**



UpToDate® otitis media

< Back to Search Acute otitis media in children: Treatment

A 2015 meta-analysis of 13 randomized trials (3401 children, 3938 episodes of AOM) comparing antibiotics with placebo found [6]:

- Antibiotics reduced pain at two to three days (seven trials, 2320 patients): 11.6 versus 15.9 percent (relative risk [RR] 0.70, 95% CI 0.57-0.86)
- Antibiotics reduced tympanic membrane perforations (five trials, 1075 patients): 1.9 versus 4.8 percent (RR 0.37, 95% CI 0.18-0.76)
- Antibiotics reduced contralateral episodes of AOM (four trials, 906 patients): 10.6 versus 18.8 percent (RR 0.49, 95% CI 0.25-0.95)
- Antibiotics did not affect the rate of late recurrence (six trials, 2200 patients): approximately 20 percent
- Antibiotics increased adverse events (vomiting, diarrhea, or rash): 27.1 versus 19.6 percent (RR 1.38, 95% CI 1.19-1.59)
- Serious complications (eg, mastoiditis, meningitis) were rare in both the treatment and placebo groups

**NNTB 20**

**NNTB 33**

**NNTB 11**

**NNTB 14**

## Finland #2, Sept 2017

- 746 children, 6-35 m/o—enrollment visit
- Pneumatic Otoscopy and Tympanometry on all

**Prognostic Factors for Treatment Failure in Acute Otitis Media**

Paula A. Tähtinen, Miia K. Laine and Aino Ruohola

*Pediatrics* 2017;140;

DOI: 10.1542/peds.2017-0072 originally published online August 8, 2017;

Middle Ear Fluid (2 of 3)	Sign of Acute Inflammation	Acute Symptoms (1)
Bulging position	Distinct erythema	Ear pain
Decreased/absent mobility	Increased vascularity	Fever
Abnormal color or opacity	-over bulging/full TM	Respiratory Symptoms
Air-fluid interfaces	-over yellow TM	

- 319 Dx with AOM (387 patients excluded—no AOM):



## Finland #2, Sept 2017

- 319 children; 6-35 m/o Dx with AOM
- 161 randomized to Amox-Clav; 158 to placebo, x7d
- Endpoint: time to “treatment failure”
  - Parents think worsening—any time
  - Parents perceive no improvement by day #3
  - Perforation
  - Severe infection
  - TM not improved by day #8 (Abx completed)

# Finland #2, Sept 2017

- Rescue treatment was needed before day #8:
  - Amox-Clav = 6.8%
  - Placebo = 33.5%
- 31.7% reached treatment failure on/before day #8
  - Abx group = 19% treatment failure
  - Placebo = 45% treatment failure
- **NNT = 3.8**

# Finland #2, Sept 2017

**Prognostic Factors for Treatment Failure in Acute Otitis Media**

Paula A. Tähtinen, Miiä K. Laine and Aino Ruohola

*Pediatrics* 2017;140;

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**Table 2. Adverse Events.**

Event	Amoxicillin– Clavulanate Group (N=161)	Placebo Group (N=158)	P Value
	no. (%)		
Any adverse event	85 (52.8)	57 (36.1)	0.003
Hospitalization	0	0	
Severe infection	0	2 (1.3)	0.15
Meningitis	0	0	
Pneumococcal bacteremia	0	1 (0.6)	
Radiographically confirmed pneumonia	0	1 (0.6)	
Complications of otitis media	1 (0.6)	5 (3.2)	0.10
Mastoiditis	0	0	
Perforation	1 (0.6)	5 (3.2)	
Diarrhea	77 (47.8)	42 (26.6)	<0.001
A little	57 (35.4)	36 (22.8)	
A lot*	20 (12.4)	6 (3.8)	

# Finland #2, Sept 2017

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- Symptoms improved with Amoxicillin–clavulanate > Placebo:
  - Resolution of fever—improvement noted 6 hours after the first dose
  - Poor appetite—seen by day #2
  - Decreased activity—seen by day #2
  - Irritability—seen by day #2
- No difference between Amoxicillin–clavulanate vs. Placebo:
  - Ear pain as reported by parents or by the children
  - Ear rubbing
  - Restless sleep or Excessive crying



# Finland #2, Sept 2017

### Prognostic Factors for Treatment Failure in Acute Otitis Media

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*Pediatrics* 2017;140;

DOI: 10.1542/peds.2017-0072 originally published online August 8, 2017;

## Secondary analysis:

- “Severe Bulging”:

- 11% treatment failure with Abx
- 64% treatment failure with placebo

- **NNT = 1.9**

#### Severe bulging of the tympanic membrane

Yes	5/45 (11.1)	25/39 (64.1)
No	25/116 (21.6)	46/119 (38.7)



-53.0 (-73.5 to -32.4)	1.9
-17.1 (-28.8 to -5.4)	5.8

FINLAND  2



Finland #2, Sept 2017

Prognostic Factors for Treatment Failure in Acute Otitis Media

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## Secondary analysis—Tympanometry:

- 57/319 of “AOM” had “peaked tympanogram” Type A or C
- Of these, only 14% had treatment failure
  - 4 in Abx group failed (of 32)
  - 4 in Placebo group failed (of 25)
- **NNT = 29**

Peaked tympanogram <sup>b</sup>					
Yes	4/32 (12.5)	4/25 (16.0)		-3.5 (-21.7 to 14.7)	28.5
No	26/129 (20.2)	67/133 (50.4)		-30.2 (-41.8 to -18.6)	3.3

**Prognostic Factors for Treatment Failure in Acute Otitis Media**

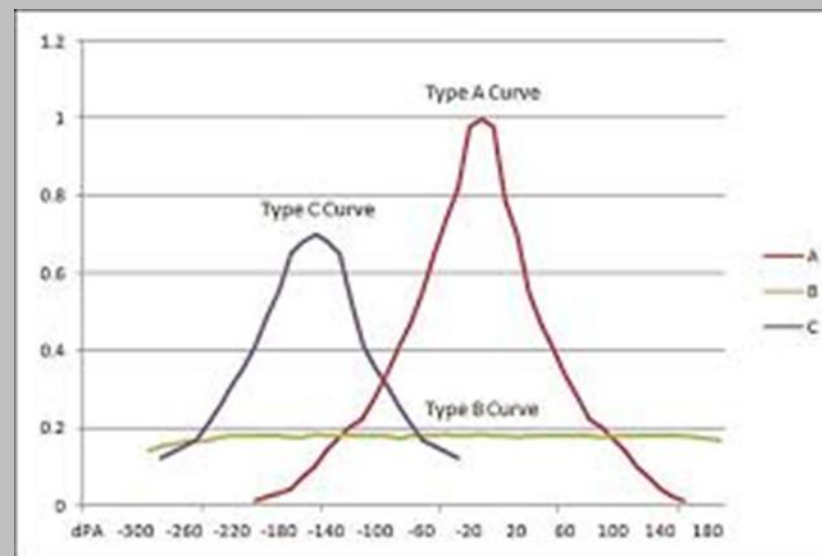
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## Finland #2, Sept 2017

- “These results are directly applicable in clinical practice; by withholding antimicrobial treatment from children with peaked tympanogram (A and C curves), the use of antimicrobial agents and the development of antimicrobial resistance could be reduced without increasing the risks for the child.”



Finland #2, Sept 2017

## Secondary analysis—Tympanometry:

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- Of these, only 14% had treatment failure
  - 4 in Abx group failed (of 32)
  - 4 in Placebo group failed (of 25)

**– NNT = 29**

Peaked tympanogram <sup>a</sup>	Abx group	Placebo group	OR (95% CI)	NNT (95% CI)
Yes	4/32 (12.5)	4/25 (16.0)	-3.5 (-21.7 to 14.7)	28.5
No	26/129 (20.2)	67/133 (50.4)	-30.2 (-41.8 to -18.6)	3.3

- The Diagnosis and Management of Acute Otitis Media (AAP 2013)
- Otitis Media with Effusion (AAO-HNS 2016)
- Tympanostomy Tubes in Children (AAO-HNS 2022)

*Clinical Practice Guidelines are “statements that include recommendations intended to optimize patient care that are informed by a systematic review of evidence and an assessment of the benefits and harms of alternative care options.” - Institute of Medicine*

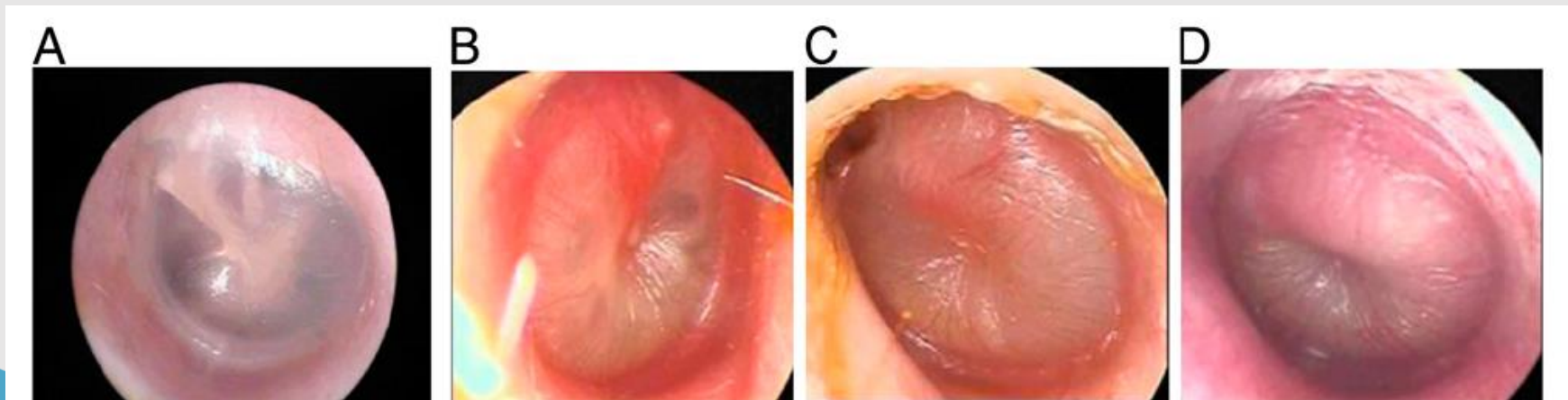




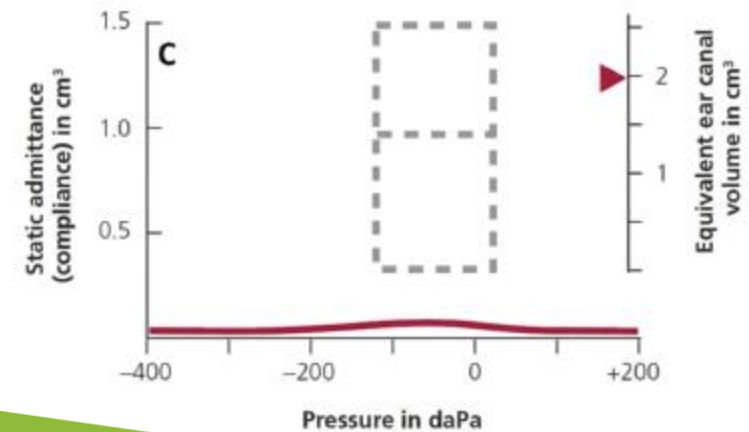
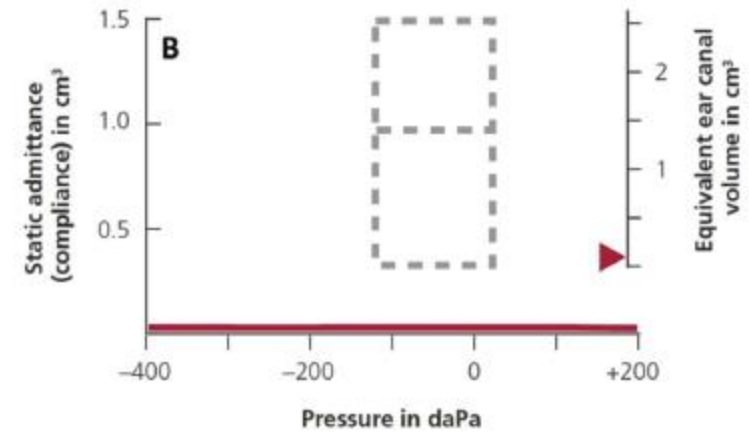
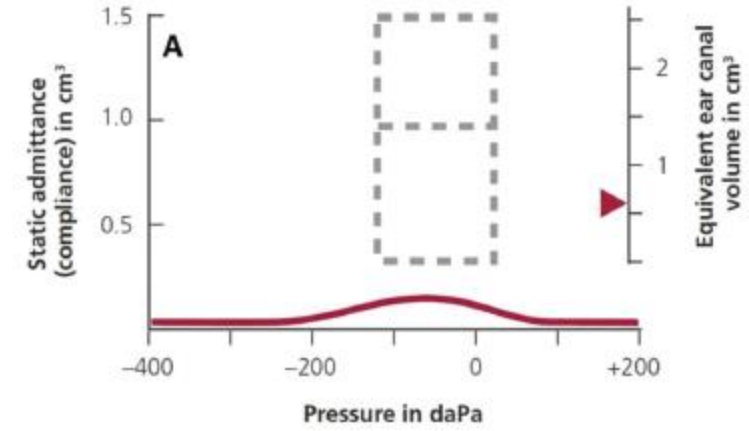
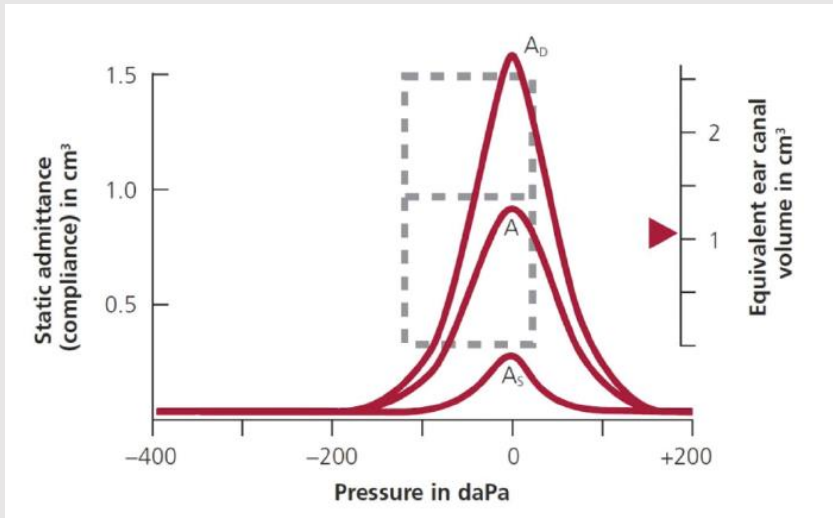
CLINICAL PRACTICE GUIDELINE

# The Diagnosis and Management of Acute Otitis Media

- Diagnose AOM in children with:
  - moderate to severe bulging of the TM OR new onset otorrhea not due to acute otitis externa
  - Mild bulging of TM AND recent (less than 48 hrs) onset of ear pain (holding, tugging, rubbing), or intense erythema of TM



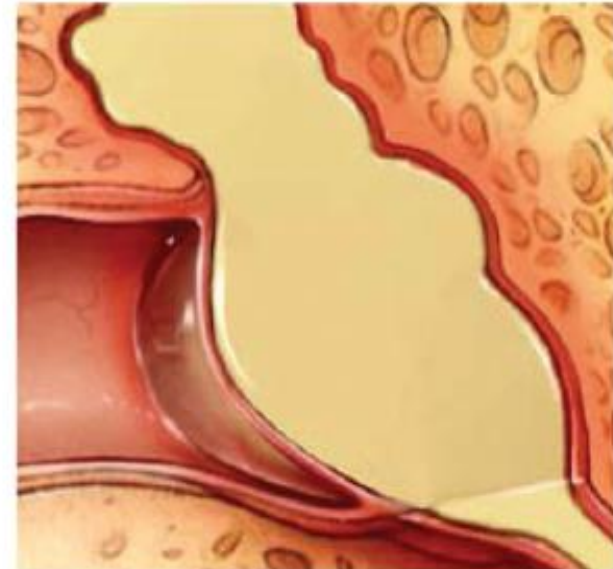
# Tympanometry



Otitis Media with Effusion (ear fluid)



Acute Otitis Media (ear infection)

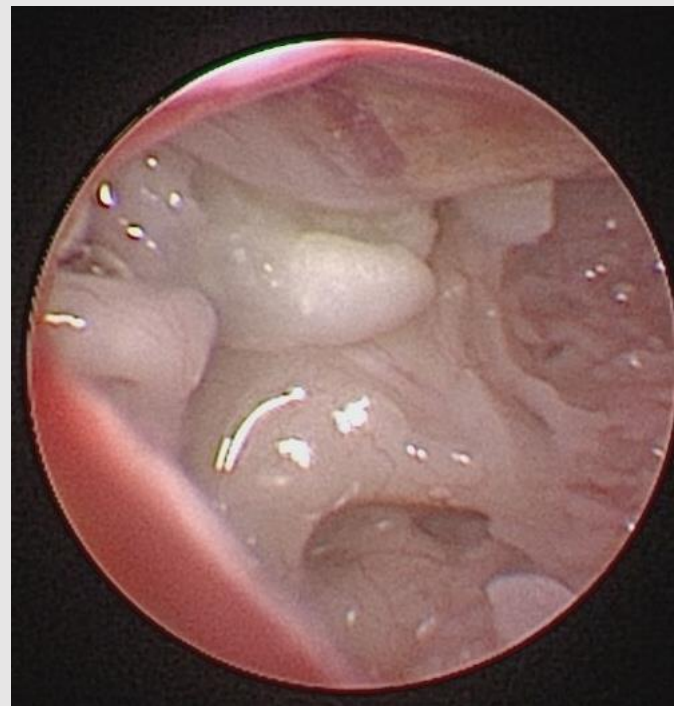




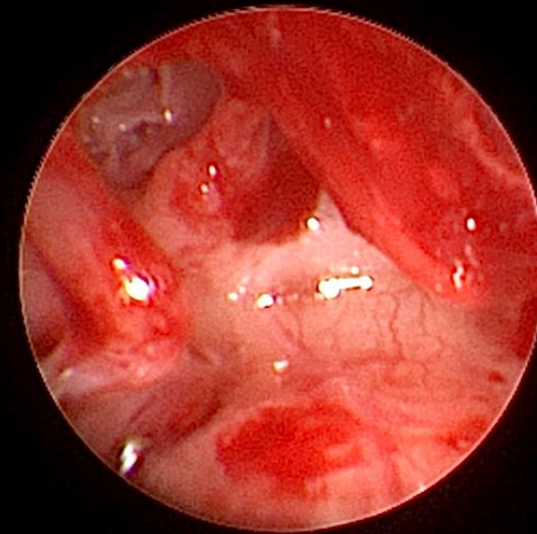
*"That surgery may have been unnecessary,  
but it went well."*



# Pediatrician Pickups







# Tympanostomy



# History

- Myringotomy has been practiced since at least 1600s
- Tubes invented in mid-19<sup>th</sup> century
- Became widespread in the mid-20<sup>th</sup> century
- Most common ambulatory surgery performed in the US – 667,000 (2006)



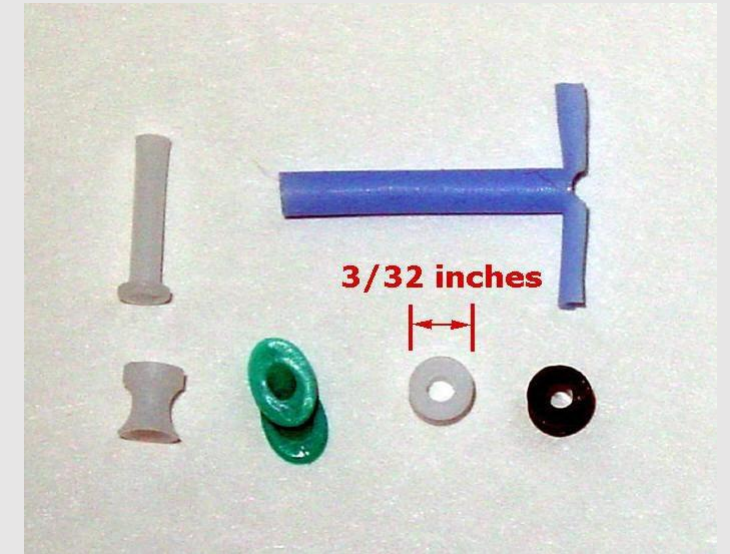
# Prevalence of tubes

- By age 3, 1 in 15 children will have tubes (6.8%)
- Children in daycare are twice as likely to have tubes
- 10% need a second set of tubes (much higher in craniofacial, Down syndrome, etc)



# Benefits of tubes

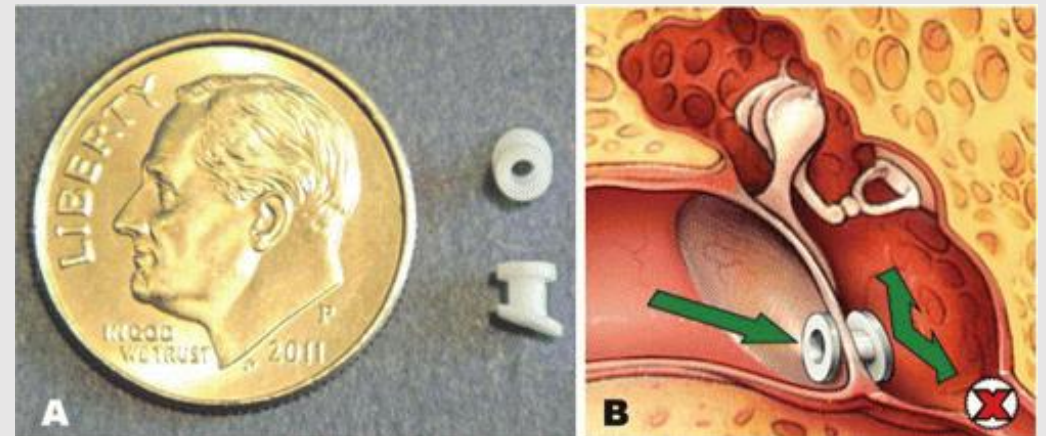
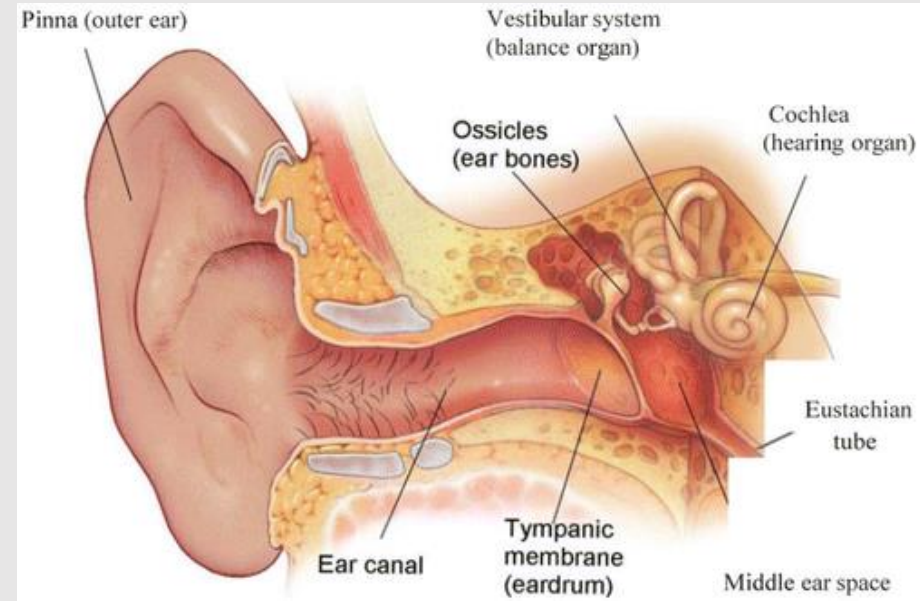
- Improves hearing
- Reduces effusion prevalence
- Reduce incidence of RAOM (~3 episodes/year)
- Reduces pain with infection
- Provides a mechanism for drainage and pressure equalization
- Allows for administration of topical antibiotic therapy
- Improves QOL





# Complications of tubes

- Common: otorrhea, tympanosclerosis, focal atrophy, shallow retraction pocket
- TM perforations, which may require repair, are seen in about 2% of children

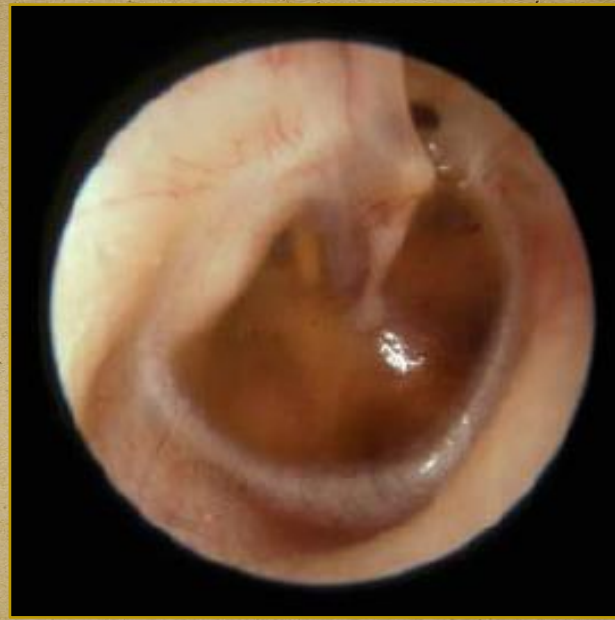




Normal TM,  
clear middle  
ear



Serous  
effusion



Tube in  
healthy ear





# Tympanostomy Tube Otorrhea Guidelines:

11. Clinicians should prescribe topical antibiotic eardrops only, without oral antibiotics, for children with uncomplicated acute tympanostomy tube otorrhea

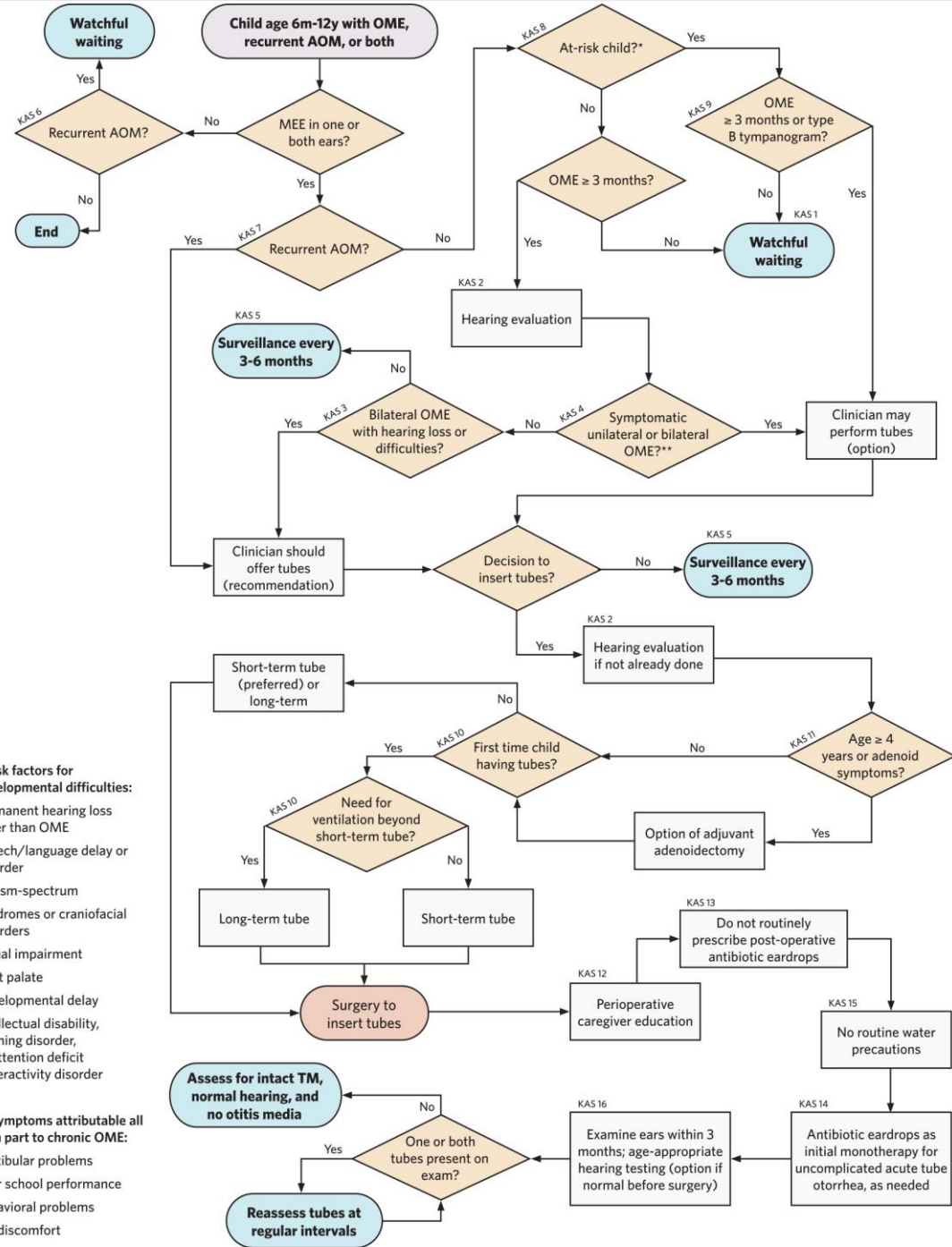
12. Clinicians should NOT encourage routine, prophylactic water precautions (use of earplugs, headbands, avoidance of water sports or swimming) for children with tympanostomy tubes

**Table 8.** Comparison of acute otitis media with and without a tympanostomy tube.<sup>a</sup>

Issue	AOM without a Tube	AOM with a Tube
Ear pain	Mild to severe	None, unless skin irritated or tube occluded
Drainage from the ear canal (otorrhea)	No, unless eardrum ruptures	Yes, unless tube obstructed
Duration of middle ear effusion after infection	Can last weeks or months	Usually resolves promptly
Needs oral antibiotics	Often	Rarely
Needs antibiotic eardrops	No benefit	Often
Risk of eardrum rupture	Yes	No, unless tube obstructed
Risk of suppurative complications	Rare	Exceedingly rare

Abbreviation: AOM, acute otitis media.

<sup>a</sup>Adapted.<sup>3</sup>



**\* Risk factors for developmental difficulties:**  
 Permanent hearing loss other than OME  
 Speech/language delay or disorder  
 Autism-spectrum  
 Syndromes or craniofacial disorders  
 Visual impairment  
 Cleft palate  
 Developmental delay  
 Intellectual disability, learning disorder, or attention deficit hyperactivity disorder

**\*\* Symptoms attributable all or in part to chronic OME:**  
 Vestibular problems  
 Poor school performance  
 Behavioral problems  
 Ear discomfort

# AAO Position Statement

## In-Office Placement of Tubes in Pediatric Patients While Awake

The position of the AAO-HNS is that tympanostomy tubes are safe and effective for managing otitis media in children who meet current guidelines for tube insertion [Rosenfeld 2013]. Although insertion of tympanostomy tubes in children is generally accomplished in the operating room under general anesthesia, insertion in the clinic in appropriately selected patients using shared decision making between clinicians and families can be appropriate.<sup>2</sup>

Adopted 7/9/19

*The AAO position statement supports in-office ear tube surgery in awake pediatric patients. This statement is not an endorsement for the use of the Hummingbird Tympanostomy Tube System but does cite the clinical data.*





Synergy <sup>UHD4</sup>







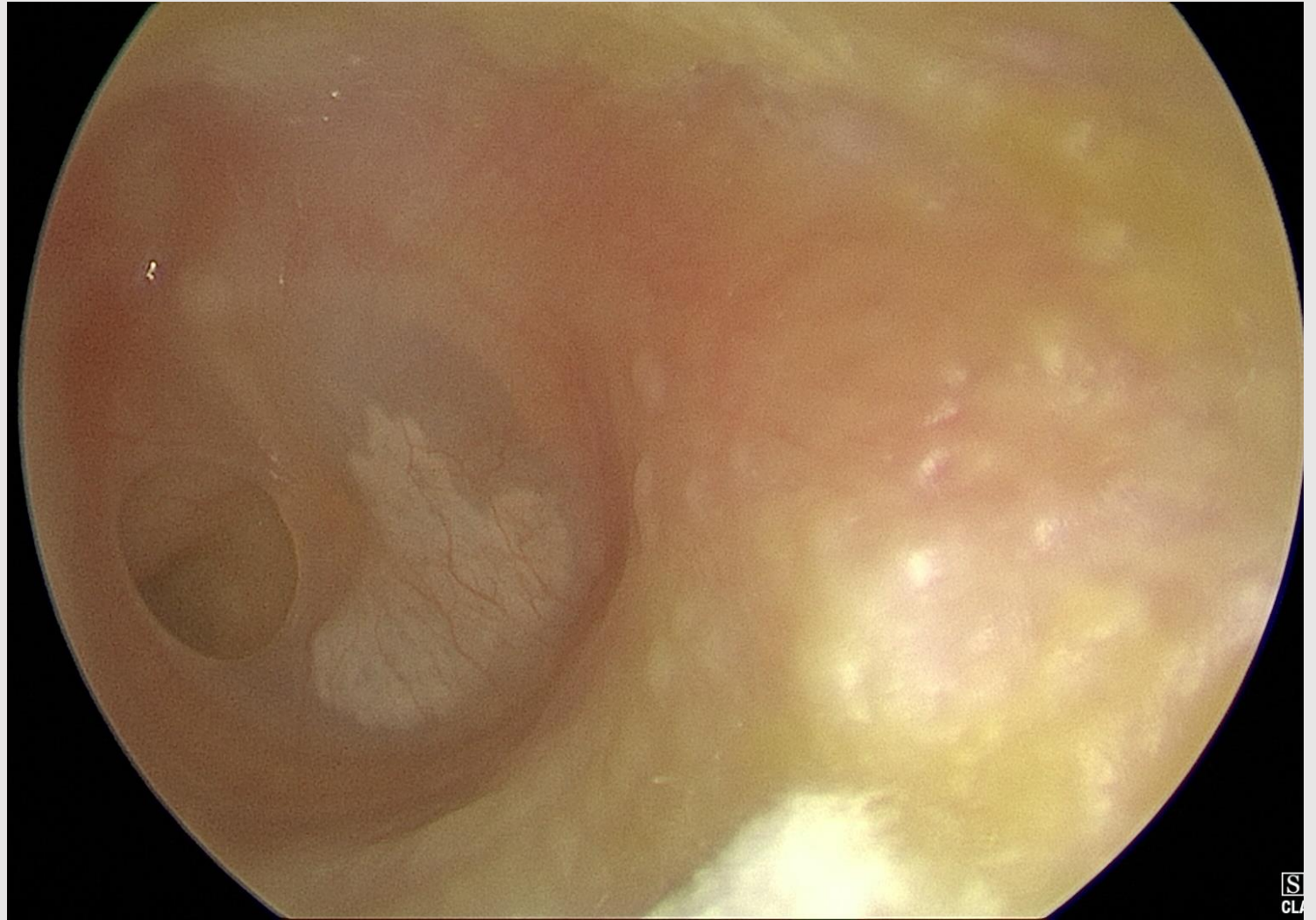


# My experience

- About 100 kids
- Age 6 months-4 years 8 months (and a few >12yo)
- Parents overall very happy
- Two kids overly anxious/irritable at follow up exam
- Currently tracking longevity of tubes
- Some tubes performed at initial office visit

# Tympanic Membrane Perforations

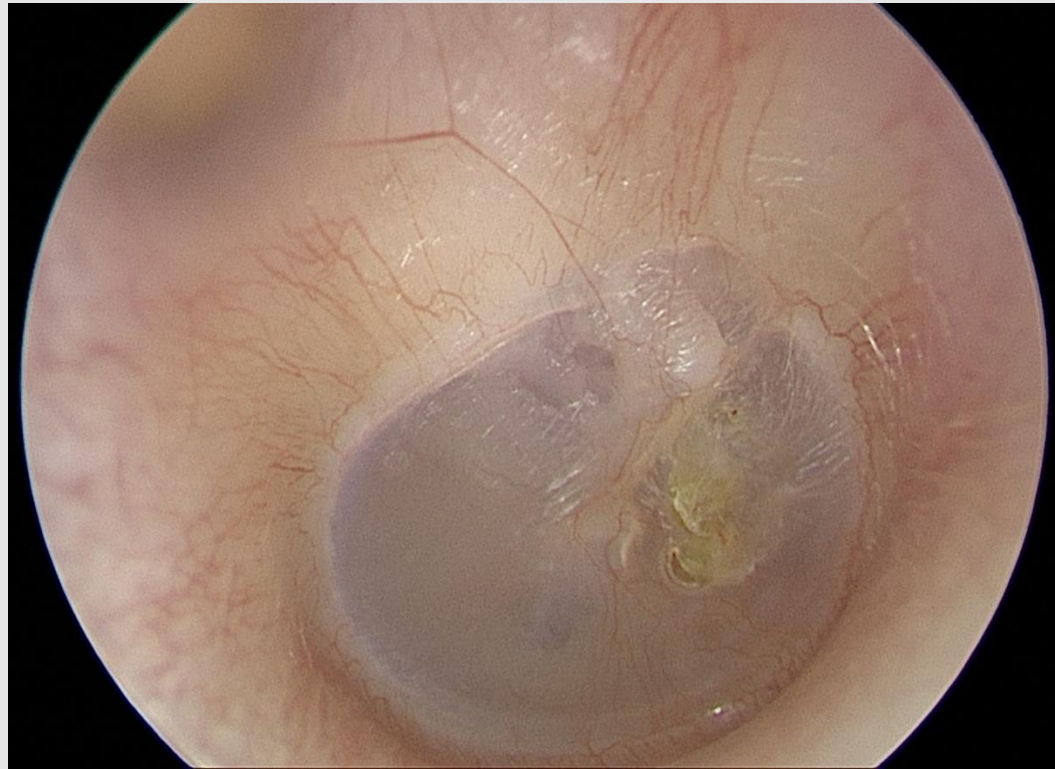
- Spontaneous
- Traumatic
- Chronic





# Tympanic Membrane Perforations

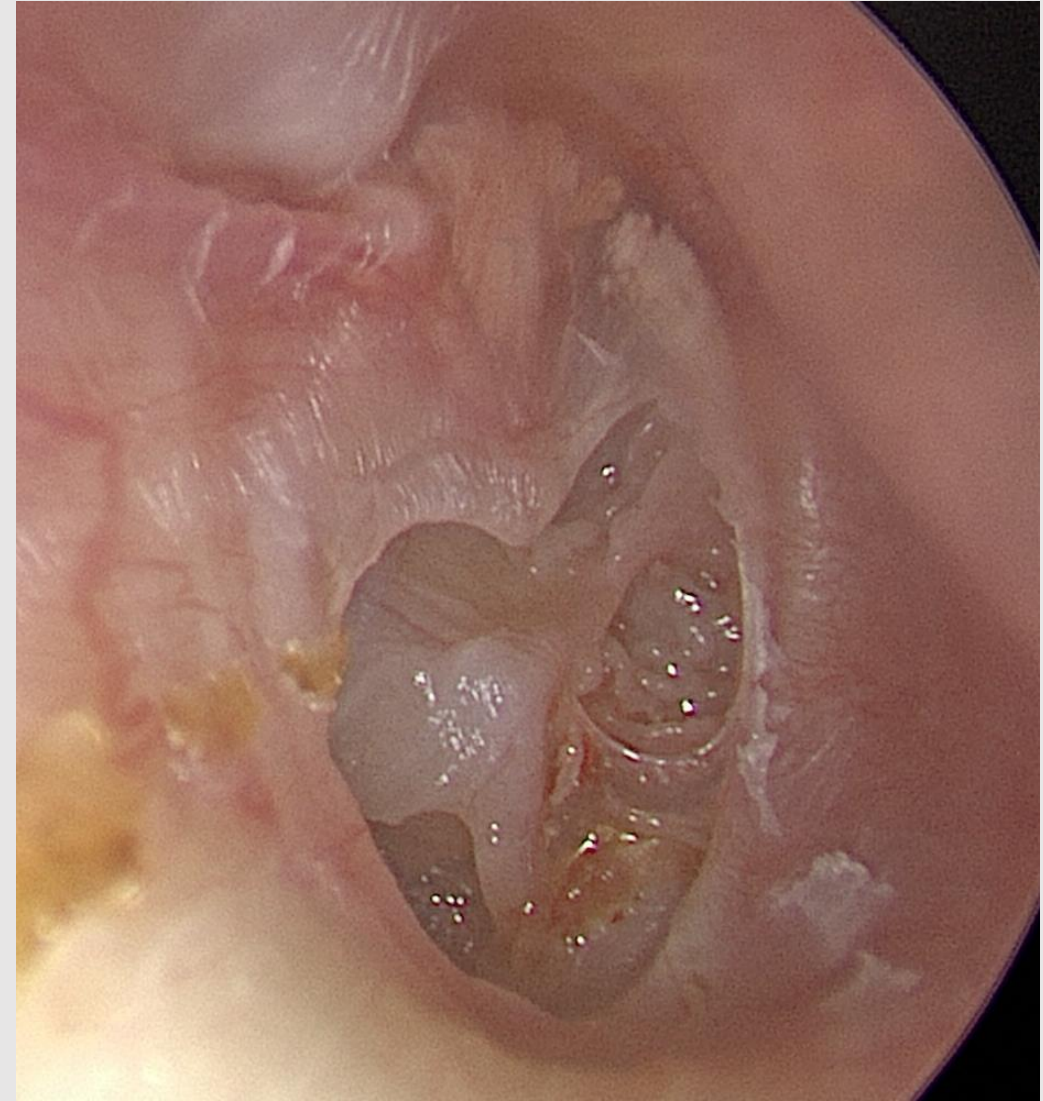
- “Spontaneous” – secondary to acute otitis media
  - Treatment typical for AOM +/- ototopical drops
  - Should close without additional treatment
  - Needs follow up to ensure healing
- 
- When should I refer?
    - If the perforation does not close after ~1 month
    - Recurrent perforations





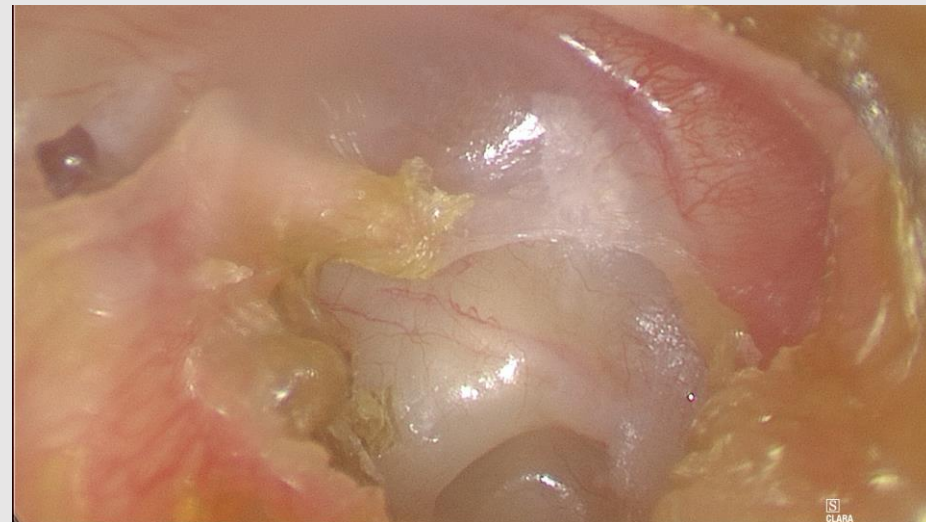
# Tympanic Membrane Perforations

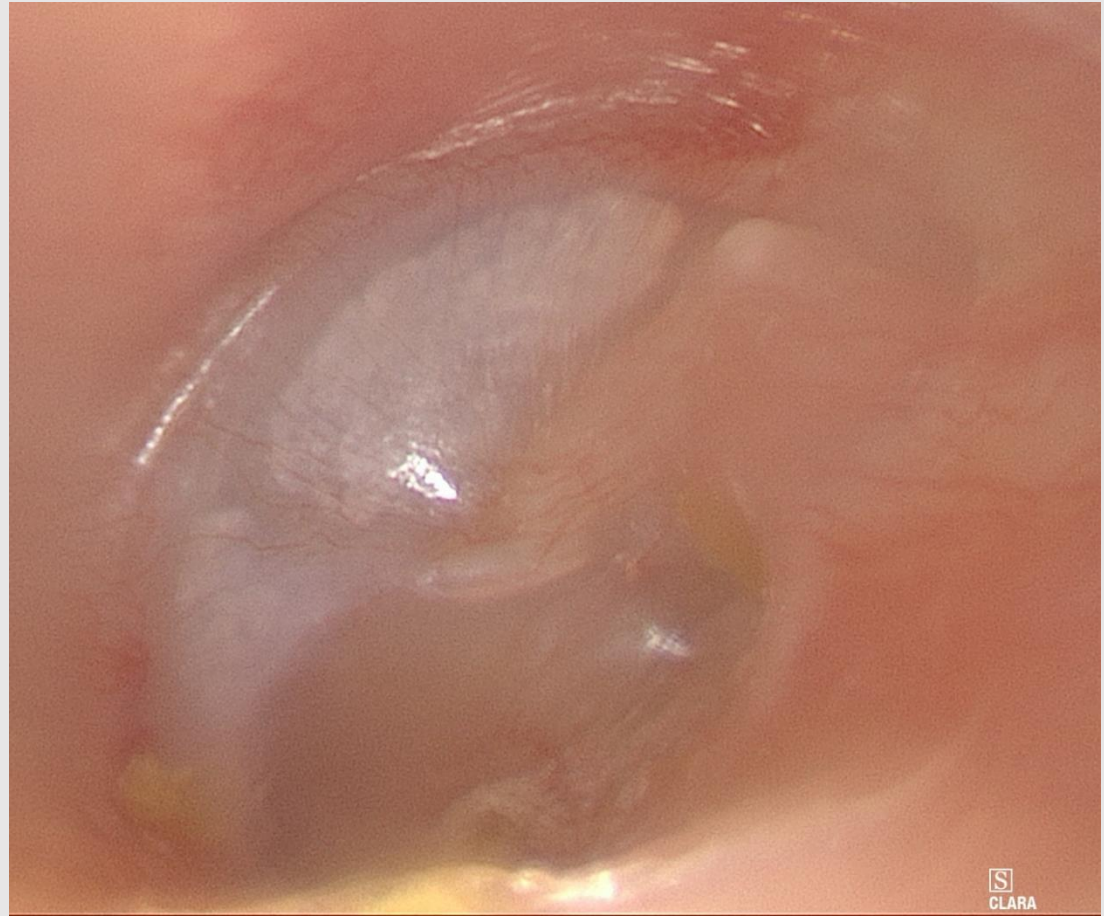
- Traumatic perforations
  - Most small to moderate perforations heal without intervention
  - No prophylactic antibiotics required
  - Otological drops are indicated if there is potential contamination of the middle ear, or when otorrhea is present
- When to refer
  - If there is concern for contamination or residual foreign body
  - Large perforation
  - Associated dizziness or hearing loss
  - Family or provider concern
  - Not emergent - best seen after 7-10 days to allow for inflammation to resolve and debris to clear.



# Tympanic Membrane Perforations - Chronic

- Please refer
- Hearing testing
- Otorrhea management
- Discussion of repair





# Acute Mastoiditis

- The most common complication of AOM
- Typically develops less than 10 days after onset of AOM
- 50% of patients <2yo
- 50-75% without antecedent AOM
- Higher rate in countries where abx are not prescribed for AOM



# Acute Mastoiditis

- Clinical Criteria

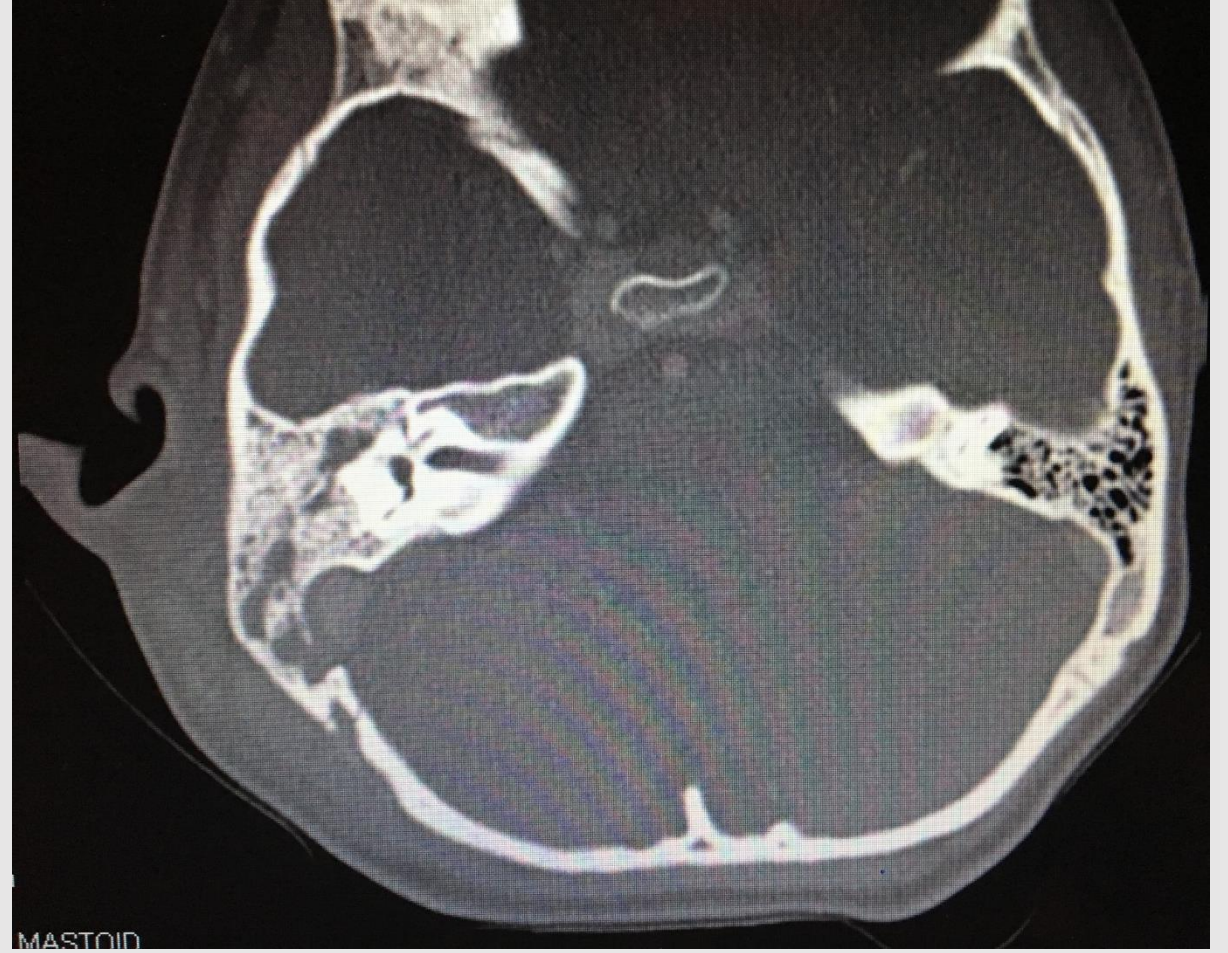
- Acute otitis media plus:

- Protrusion of the pinna – “down and out”
    - Postauricular edema/erythema
    - Tenderness to palpation

- Treatment

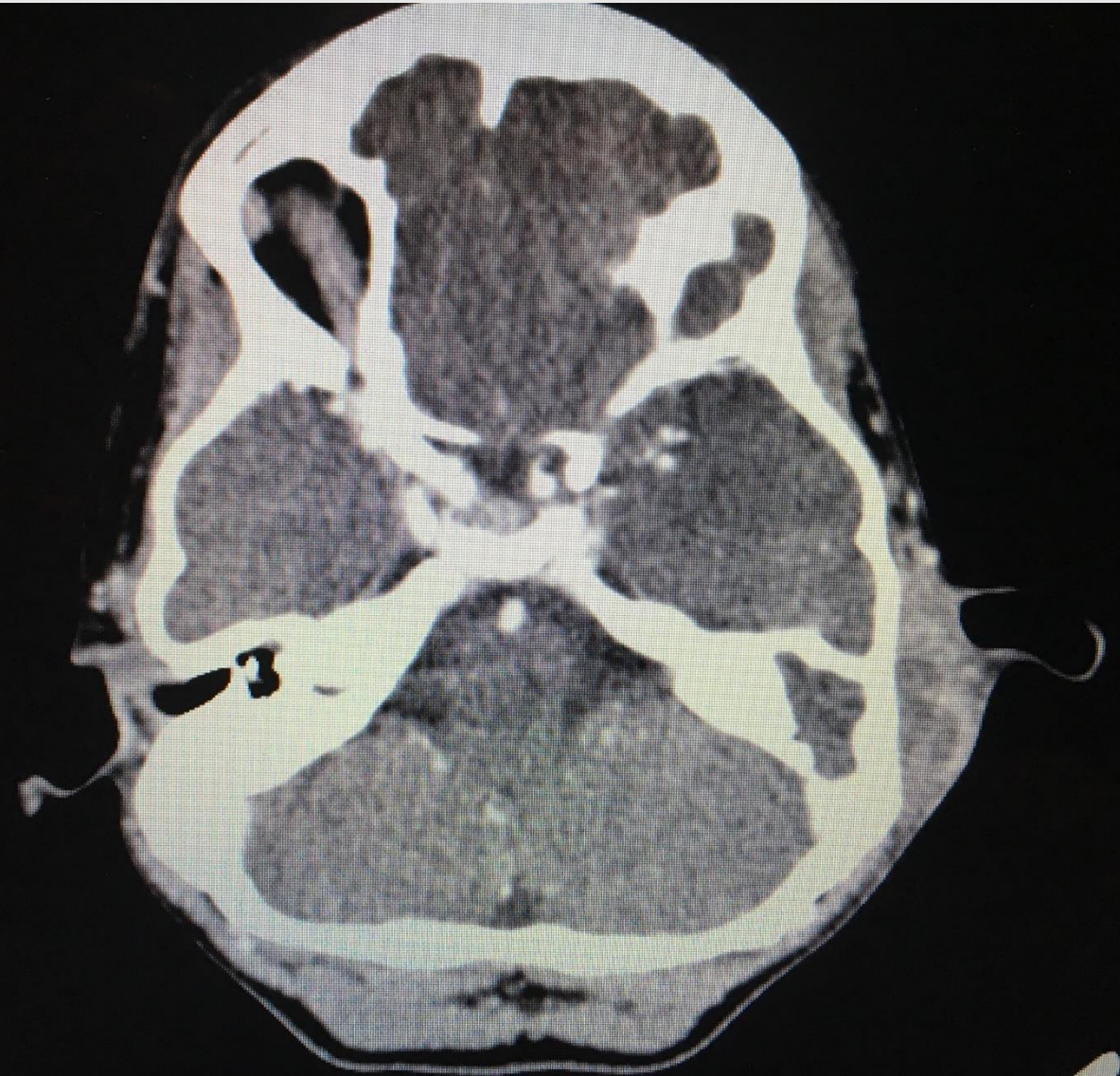
- IV abx +/- surgery



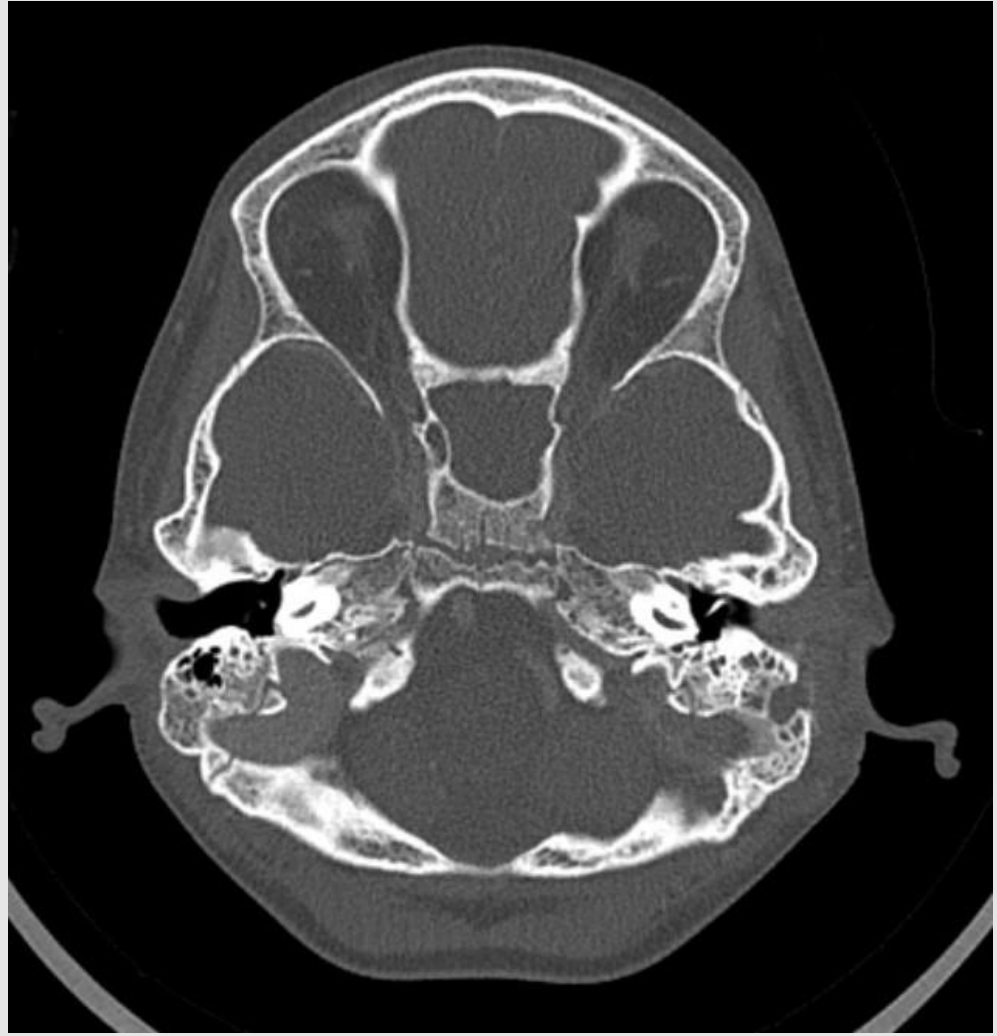
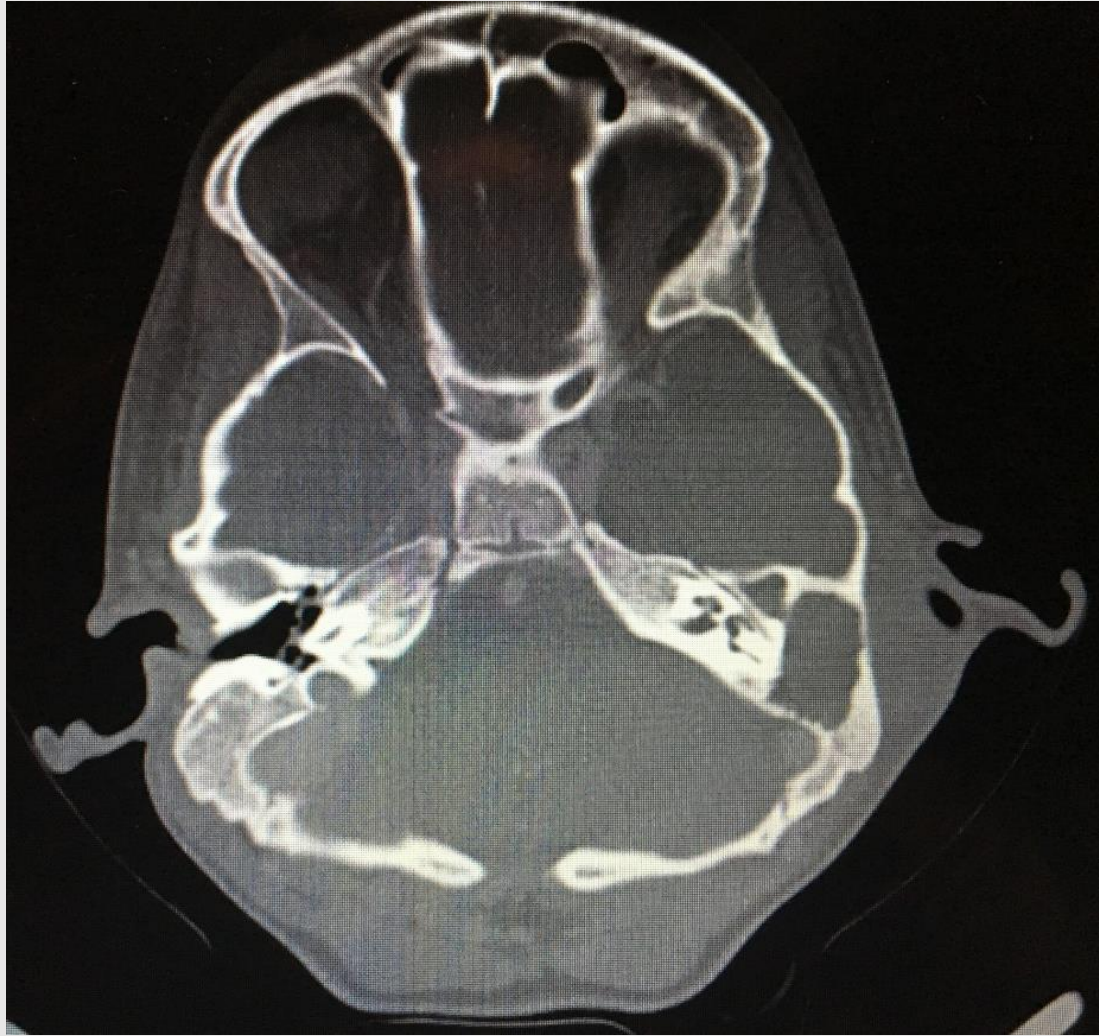




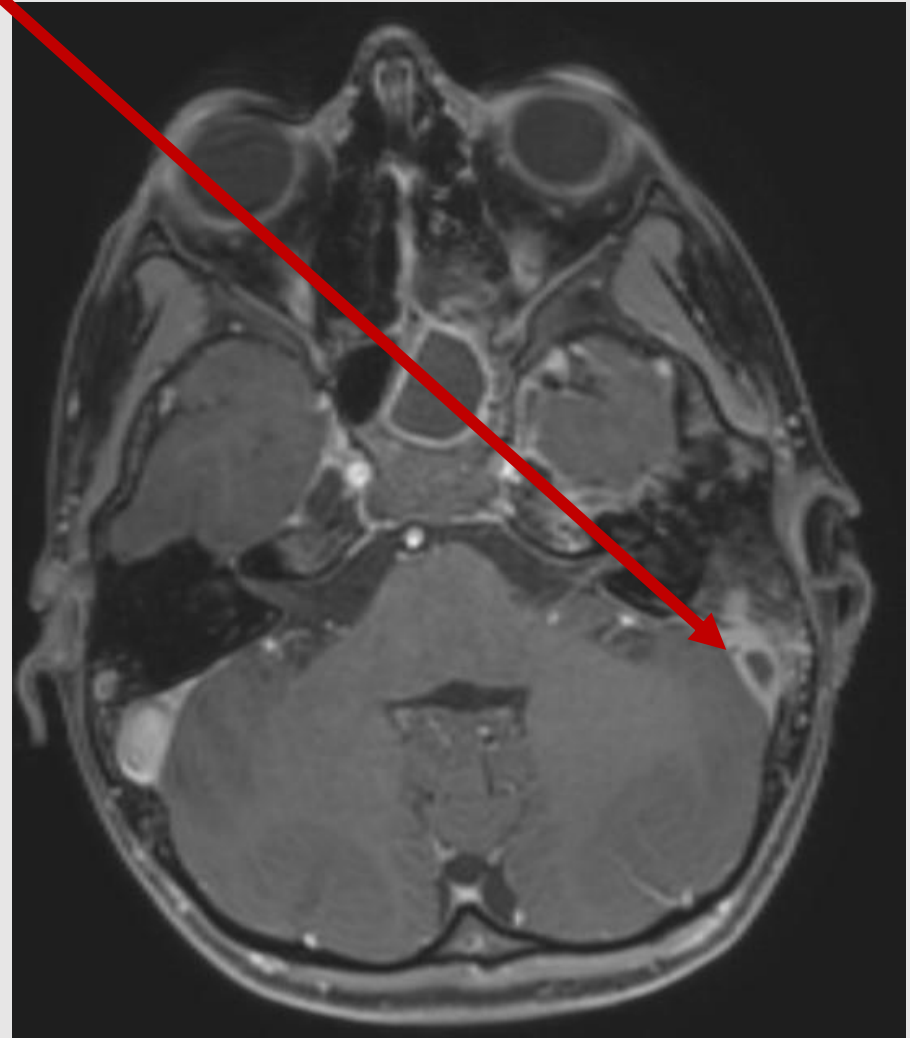
# Coalescent mastoiditis







# Sigmoid Sinus Thrombosis



# Questions?

