



New Concepts and Management in AOM

งานประชุมวิชาการประจำปี 2552 กองกุมาร รพ. พระมงกุฎเกล้า

รศ. พอ. กริธา ม่วงทอง
ภาควิชาโสต นาสิก ลาริงซ์วิทยา
วิทยาลัยแพทยศาสตร์พระมงกุฎเกล้า

- 2 ½ -yr.-old boy has mild otalgia with low grade fever (T= 38 C) in the left ear for 1 day . Otoscopic exam as shown. The next step in Mx should be
- A. Observation with analgesic
 - B. Amoxicillin 40-50 mg/kg/d plus decongestant
 - C. Amoxicillin 40-50 mg/kg/d
 - D. Amoxicillin 80-90 mg/kg/d
 - E. Amox-clavu (90/6.4) mg/kg/d



Answer A

3-yr.-old boy with history of URI for 3 days has moderate earache and fever (T 38.5° C) . PE. as show. What is the Mx of choice ?

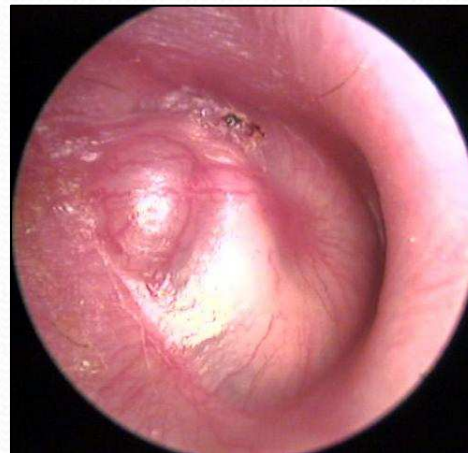
- A. Analgesic and observe
- B. Analgesic with topical antibiotic ear drop
- C. Antibiotic : amoxicillin 80-90 mg/kg
- D. Antibiotic : amoxicillin/clavulanate 45 mg/kg/day divided bid
- E. Ceftriaxone 50 mg/kg/dose IM/IV q day for 3 days



Answer C

3-yr.-old boy with history of earache and URI for 3 days developed right facial nerve palsy for 1 day despite high dose of amoxicillin-clavulanate. PE. as show. what is the Mx of choice ?

- A. Change antibiotic to cefuroxime plus clindamycin
- B. Ceftriaxone for 3 day
- C. myringotomy and PE-tube only
- D. Ceftriaxone and myringotomy without PE-tube
- E. Ceftriaxone and myringotomy with PE-tube



Answer D

Otitis media

- **AOM** : acute inflammation of middle ear
(MEE ,+ve S & S of acute inflammation)
- **OME** : otitis media with effusion (SOM,MOM)
(MEE, -ve S&S of acute inflammation)
 - Chronic OME : > 3 month
- **COM** , (CSOM)
: Chronic inflammation of middle ear
(with or w/o TM perforation)
- **R-AOM** : > 3/6 mos , > 4/yr.



AOM



SOM



MOM



C-OME



CO



CSOM

Key :Should distinguish between AOM & OME in making therapeutic decision

AOM: Costs to Society

- One of the most common diagnoses in infants and young children.
- In 1975 ,Boston Study (N = 877):
 - 93% of children had at least 1 episode of AOM by 7 yrs of age
 - 74% had at least 3 episodes by 7 yrs of age
 - 84% of 3-yr-olds had at least one episode & 46% at least 3 episodes






Teele DW, et al. J Infect Dis. 1989;83-94.
- The peak incidence occurs during the first 2 years of life
- Current or preceding URTI symptoms
- The annual cost of OM was estimated at \$4.1 billion (1992) in the U.S.*

Chonomaitree T. Pediatr Infect Dis J. 2000;19(suppl 5):S24-S3
- AOM. accounts for up to 40-50% of ATB prescribed for US children < 2 yrs of age

Zhou F, Pediatrics 2008, 121:253-260.

Advances Management of AOM

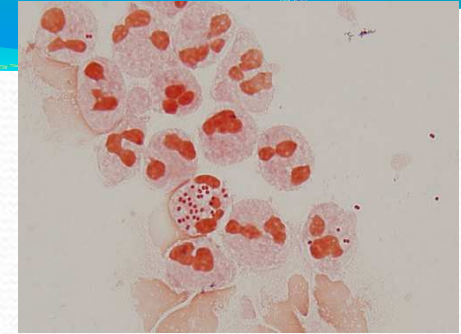
Focus on

- Knowledge of bacterial resistance 
- Advance investigation and criteria in diagnosis 
- Concept and guideline in Mx 
- Prevention of recurrent episode 
- Advent of Surgical Rx 

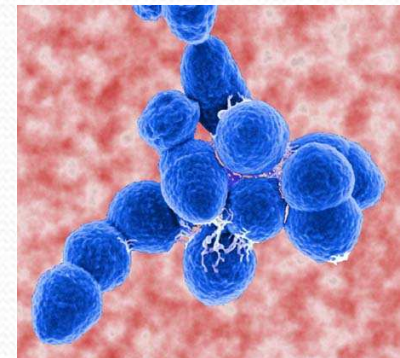


Pathogen in AOM

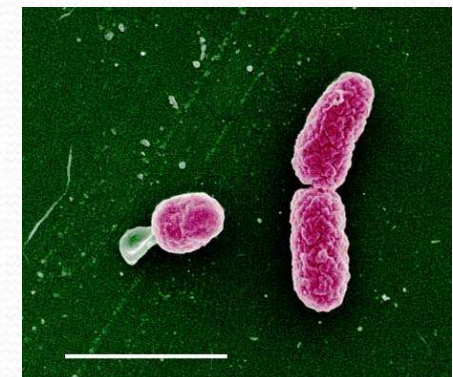
- Causative pathogen of AOM same as RTI, ABRS, CAP
 - *S. pneumoniae*, *H. influenzae*, *M. catarrhalis* (most)
 - *Stap pyogenes*, *Stap aureus*, Anaerobe
- Inappropriate ATB use → increase bact. resistance
- Heptavalent pneumococcal conjugate vaccine (PCV7)
 - decline in vaccine serotype with coincident rise in prevalence of non-vaccine serotype esp. serotype 19A (a multiply-ATB resistant)
- High prevalence of DRSP & beta-lactamase producing organisms present a clinical challenge in selection of ATB



M. catarrhalis



S. pneumoniae



H. Influenzae

Risk Factors for AOM Caused by Resistant Pathogens

- ≤ 2 years of age*
- Previous antibiotic exposure (≤ 3 months)*
 - Previous therapy with amoxicillin[†]
- Daycare attendance*

*Risk factors for infection with penicillin-nonsusceptible *S. pneumoniae*, defined as *S. pneumoniae* with penicillin MIC ≥ 0.12 $\mu\text{g/mL}$.

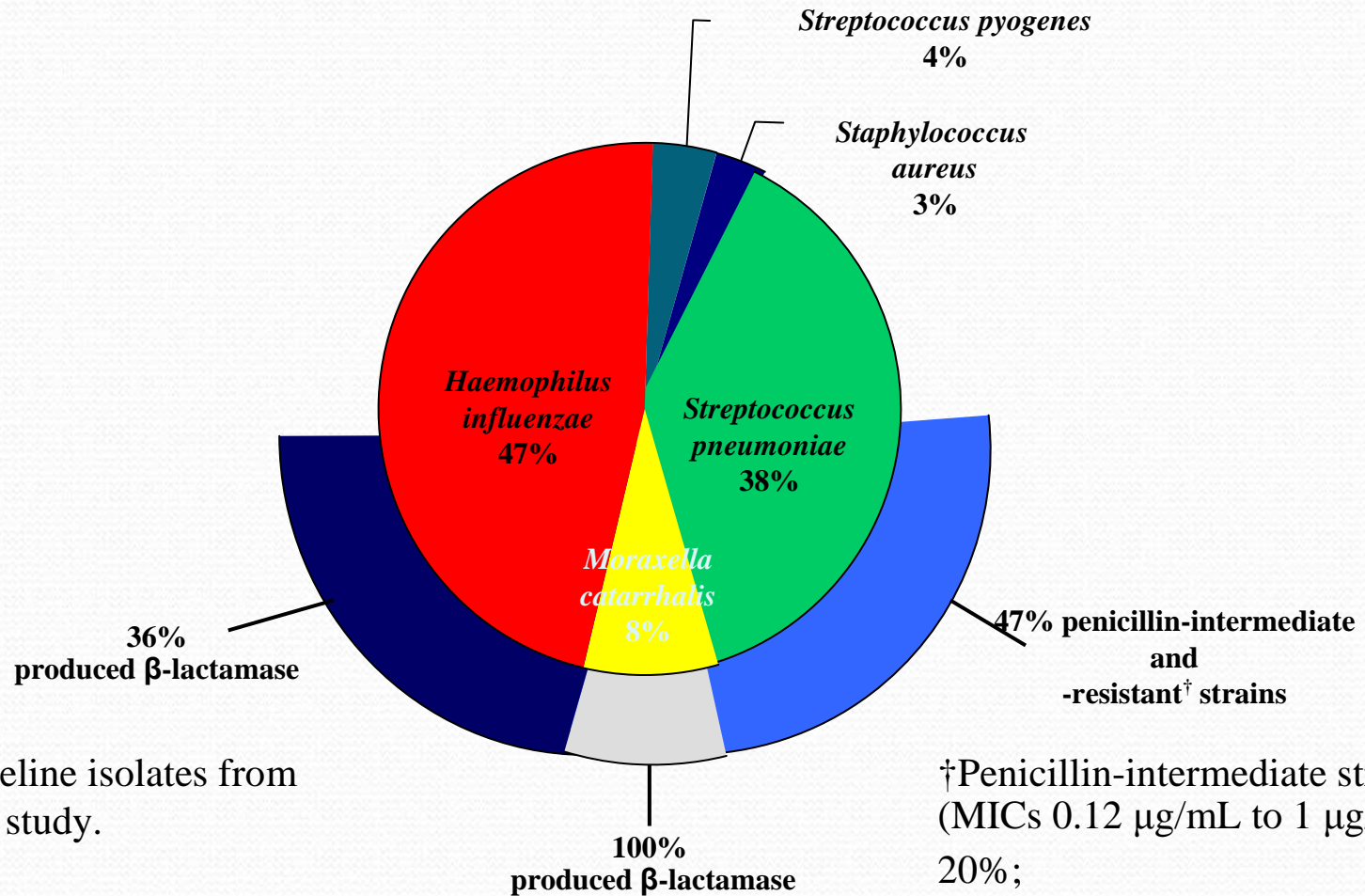
[†]Risk factor for infection with β -lactamase-positive *H. influenzae*.

Dowell SF, et al. *Pediatr Infect Dis J*. 1999;18:1-9.

Chartrand SA, et al. *Pediatr Ann*. 1998;27:86-95.

Pichichero ME, et al. *Ann Otol Rhinol Laryngol*. 2000;109:2-12.

Pathogen in AOM

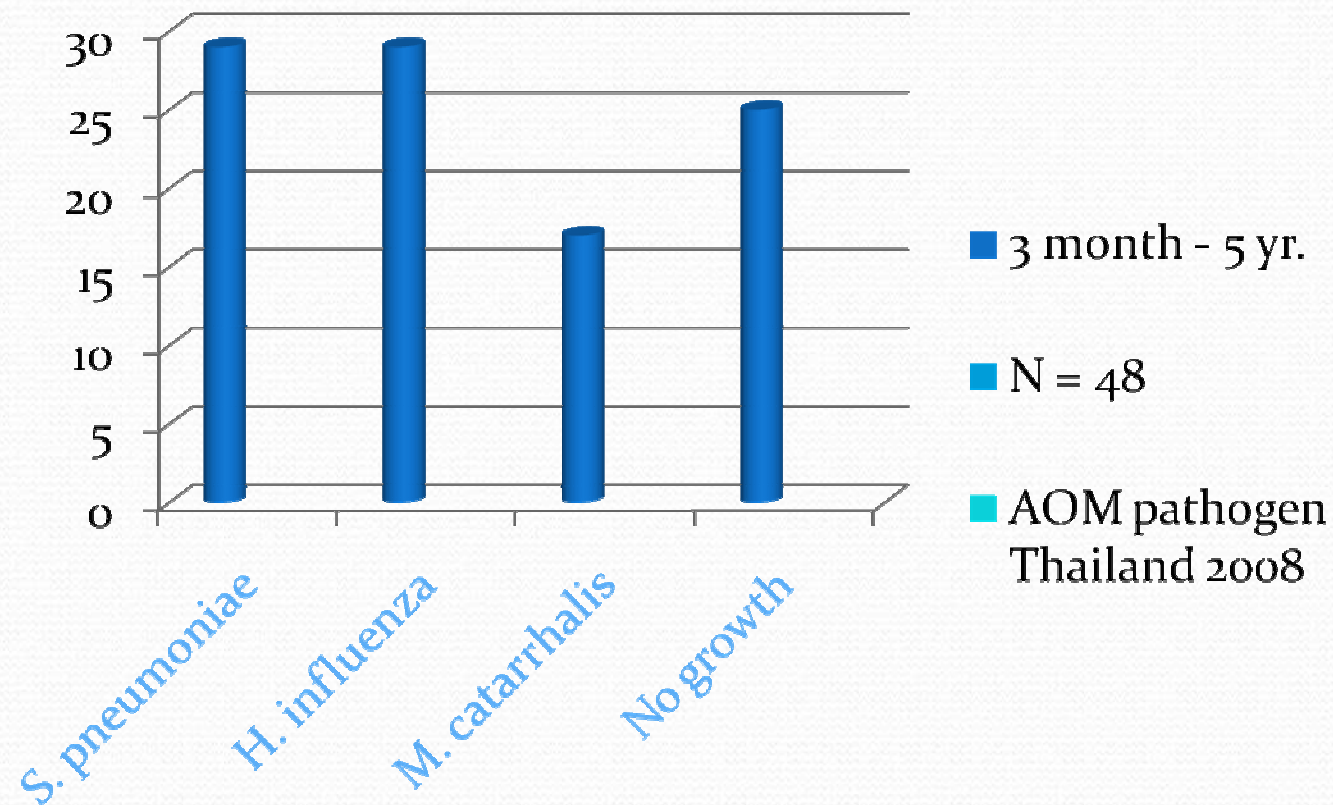


*N = 416 baseline isolates from a multicenter study.

[†]Penicillin-intermediate strains (MICs 0.12 μ g/mL to 1 μ g/mL): 20%;
penicillin-resistant strains (MICs \geq 2 μ g/mL): 27%.

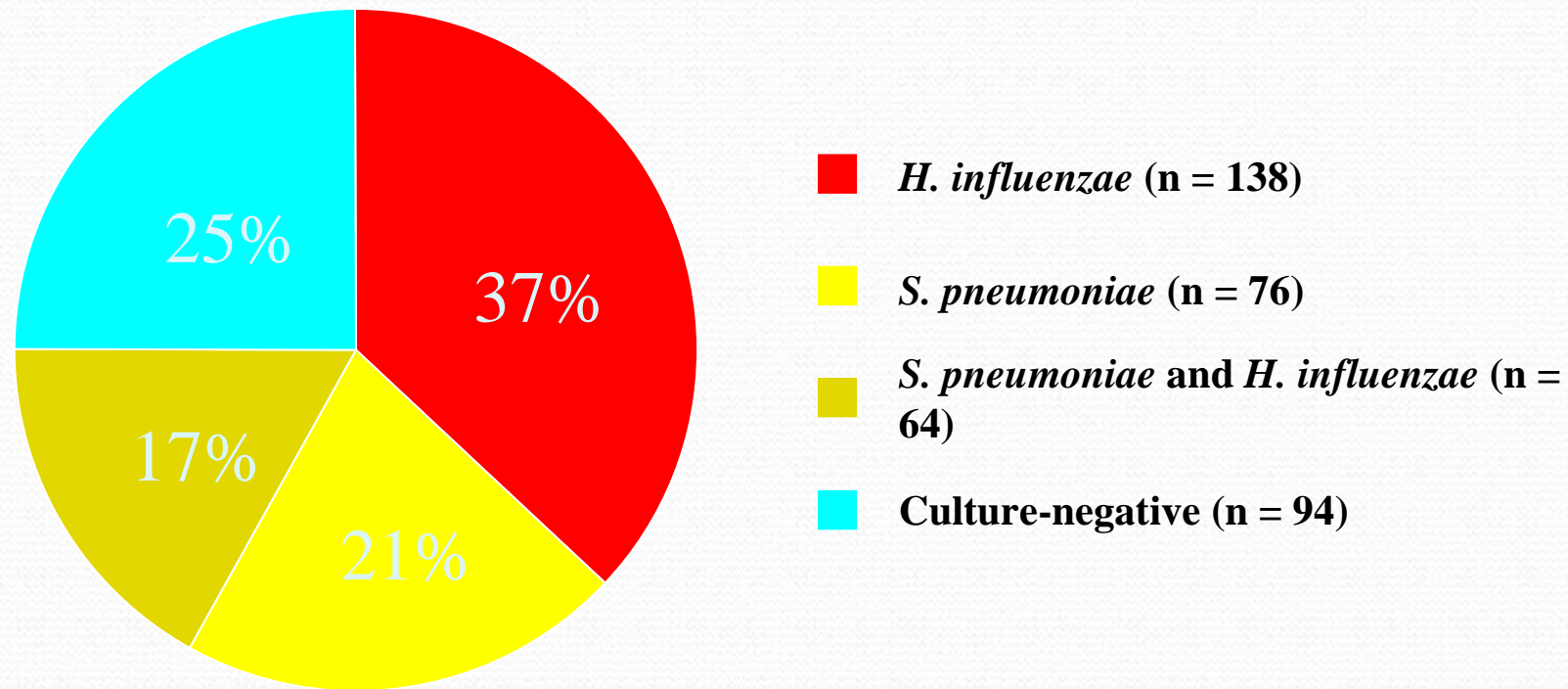
data from the pivotal clinical trial for *Augmentin ES-600*, Study 536, conducted at 25 sites in 5 countries (United States, Israel, Costa Rica, Dominican Republic and Guatemala) , 1999

Multicenter study AOM pathogen in Thailand
2008, N=48 (3 month- 5 yr.)



Mixed Infection in a 1996-2001 AOM Study

N = 372 children aged 3-36 months with AOM



Adapted from Leibovitz E, et al. *Pediatr Infect Dis J.* 2003;22:509-514.

Surveillance study for Bacterial resistance

Organism	USA (Adult)	USA children	worldwide
H. Influenza (beta-lactamase +ve)	25.1**	37.0*	17.6*
M. catarrhalis	94.1**		
S. Pneumoniae (penicilin intermediated strains)		11.8*	18.2*
S. Pneumoniae (penicillin-resistant strains)	22.5***	45.1*	25.0*

- * D Felmingham J Infect 2004;48(39-55))
- **D Hoban J Antimicrob Chemother. 2002;50(49-59
- *** SG Jenkin J Infect 2005;51(355-363)

Shift in causative pathogens in the yr. 2002 after PCV7

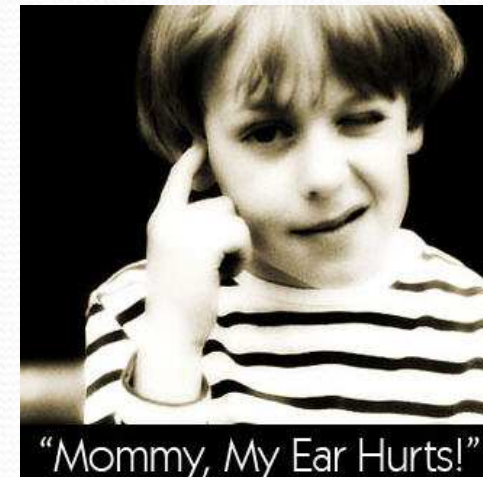
Organism	Pre -vaccine	Post -vaccine	
H. Influenza (Non typeable)	41 % (Beta-lactamase +ve = 56%)	56% (Beta-lactamase +ve = 64%)	Block (AOM)
S. pneumoniae	48%	31%	
H. Influenza (Non typeable)	43 % (Beta-lactamase +ve = 33%)	57% (Beta-lactamase +ve = 55%)	Pichichero (AOM)
H. Influenza (Non typeable)	36 % (Beta-lactamase +ve = 33%)	43% (Beta-lactamase +ve = 39%)	Brook (Max. sinus)
S. pneumoniae	46%	35%	

- * SL Block Pediatr Infect Dis 2004;23(829-833)
- **ME Pichichero Pediatr Infect Dis 2004;23(824-828)
- *** I Brook J Med Microbiol 2006;55(943-946)



Criteria diagnosis of AOM

- focus on accurate Dx to distinguish from Normal /AOM / OME
- Criteria diagnosis of AOM.
 - 1. recent , usually abrupt, onset
 - 2. presence of MEE is indicated by
 - Bulging of TM
 - Limited mobility of TM
 - Air-fluid level behind TM
 - Otorrhea
 - 3. S&S of middle ear inflammation as indicated by
 - Distinct erythema of TM
 - Distinct otalgia



Diagnostic Criteria: OME and AOM

At least two of:

1. Abnormal color of tympanic membrane (TM): white, yellow, amber, blue
2. Opacification not due to scarring
3. Decreased or absent motility

Or

Bubbles or air-fluid interfaces

Yes

Yes

Middle ear effusion (MEE)

No acute inflammation

Acute inflammation

At least one of:

1. Distinct fullness or bulging of the TM
2. Marked redness of the TM
3. New onset of ear pain

Yes

Otitis media with effusion (OME)

Acute otitis media (AOM)

Acute purulent otorrhea not due to otitis externa

Yes

Adapted from Hoberman A, et al. *Pediatr Ann.* 2000;29:609-620.

Advance investigation

- EAR Examination : Pneumatic otoscope , Microscopic ear examination , Endoscopic ear examination
- Radiodiagnosis / nasopharyngoscope
 - Lateral skull, Film mastoid , CT-temporal bone
 - Fiber -optic nasopharyngoscopy
- Tympanogram, Audiogram , Acoustic reflectometry
- Technique in tympanocentesis

What do you see ??



- Mild hyperemia of TM
 - Absent light reflex
 - Dullness in colour
 - Bulging of TM
 - Mucooid Fluid collection in middle ear space
-
- Mild degree AOM / resolving AOM / Mucooid OME ??

Otoscopy

- characteristics of TM
 - Position, mobility, colour, translucency
 - Normal: neutral position, pearly gray, translucent, briskly responding to positive and negative pressure
- Pneumatic otoscopy
 - Cuffed ear speculums for insufflation
- Pitfalls
 - Light source ,
 - Cerumen,
 - Cooperation





Tympanic Membrane Movement when apply pressure

Positive Pressure

Yes

No

*Negative
pressure*

Yes

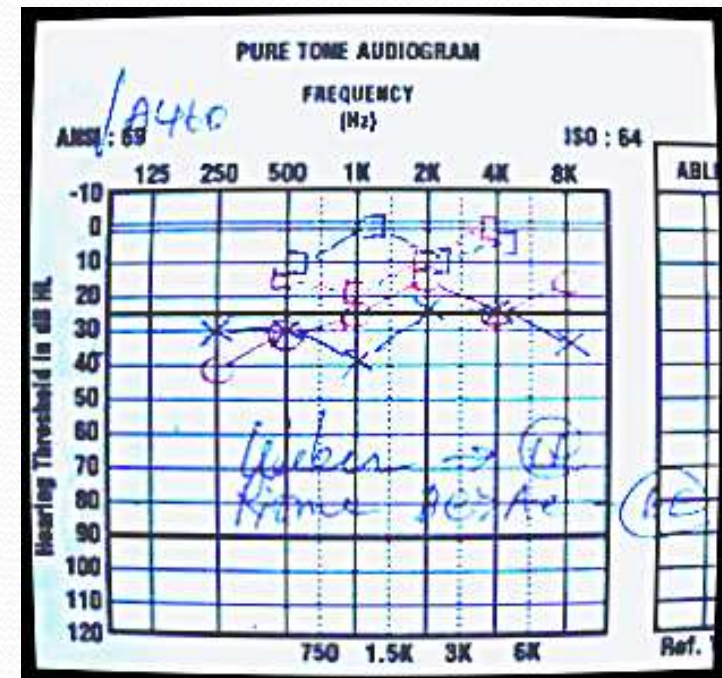
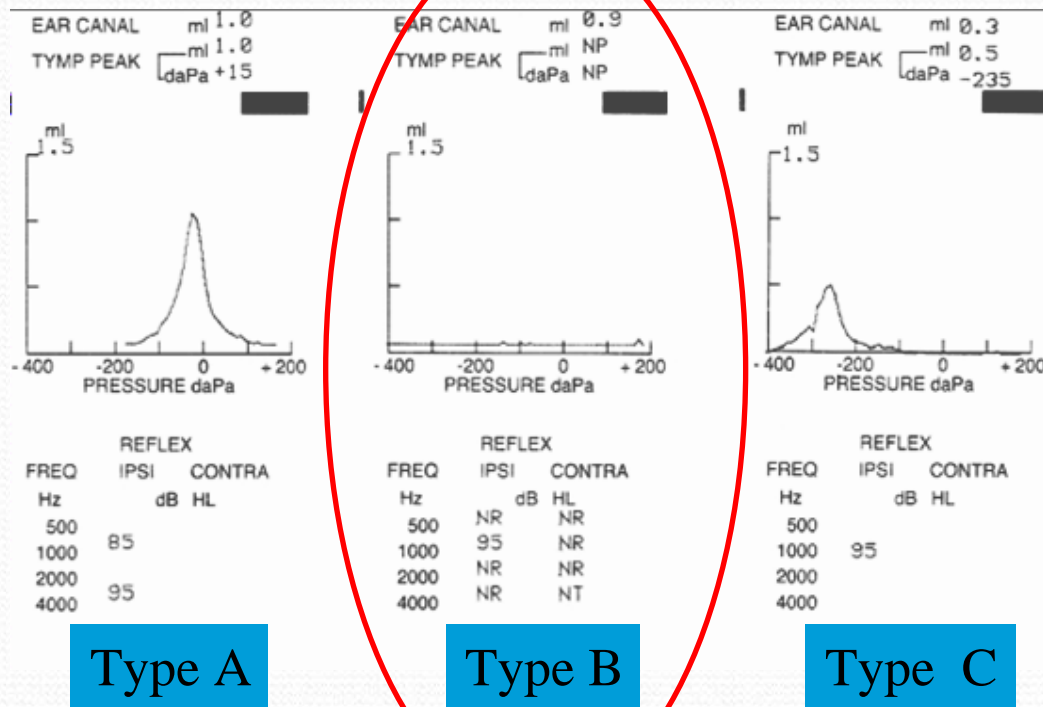
No

Normal middle-ear pressure	Negative middle-ear pressure
Positive middle-ear pressure	Middle ear effusion

Microscopic / Telescopic ear examination



Tympanogram and Audiogram

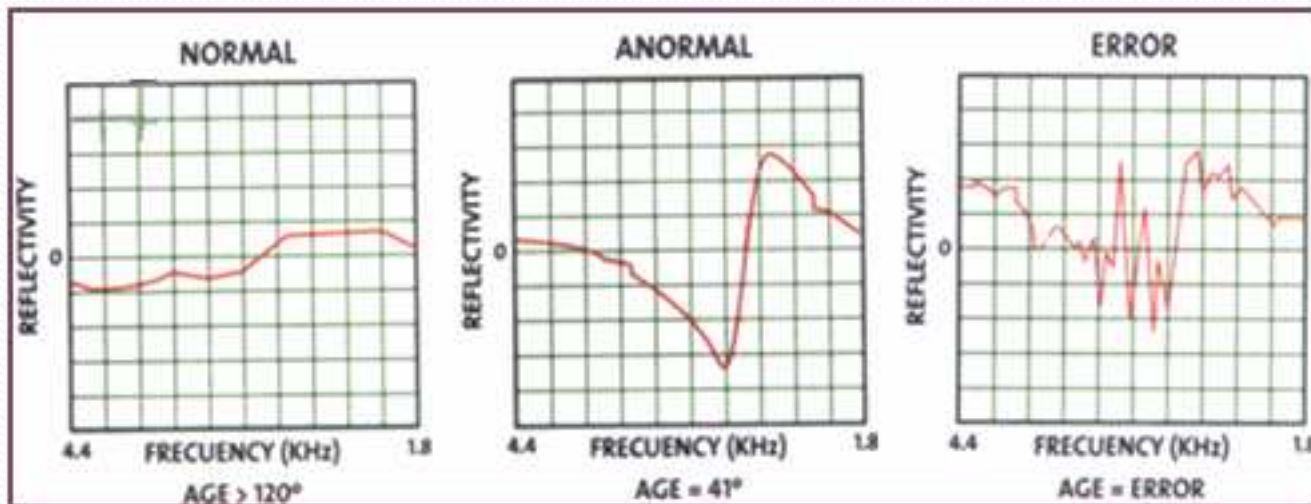


Flat Tymp(type B)
is only 81% sensitive and 74% specific for MEE

Conductive Hearing Loss: CHL
Air –Bone gap = 30 dB

Acoustic reflectometry (earCheck pro.)

- Diagnostic tool for detect MEE
- Non invasive, easy to use, not effect by cooperation
- Excellent specificity but poor sensitivity
- Good when use with tympanogram and pneumatic otoscope



Diagnostic techniques in OM

<i>Clinical feature</i>	<i>Sensitivity (%)</i>	<i>Specificity (%)</i>
Diagnostic methods		
Acoustic reflectometry ¹⁶	65 to 97	85 to 99
Pneumatic otoscopy ¹⁵	94	81
Portable tympanometry ¹⁵	89	58
Professional tympanometry ¹⁵	34 to 94	49 to 94

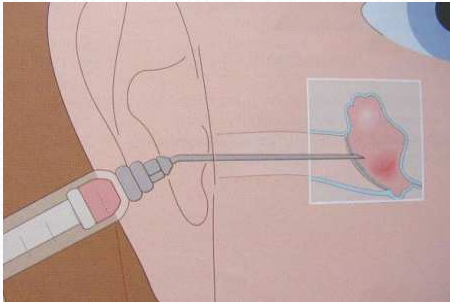
Tympanocentesis

- Gold standard for diagnosis of AOM
- Pitfalls : Cost, effort, GA ?, availability- ENT consult
- No consensus guidelines for routine use in AOM

Recommended : fail therapy

- beneficial in
 - identifying the causative pathogen.
 - relief of pressure in the middle ear cavity
 - promote drainage of the middle ear effusion

Tympanocentesis



ข้อบ่งชี้ในการทำ tympanocentesis

1. ในผู้ป่วยแก้วหูอักเสบที่มีอาการรุนแรง อาทิเช่น มีอาการปวดหูอย่างรุนแรง ไข้สูง รวมทั้งเกิดภาวะแทรกซ้อนจากภาวะแก้วหูอักเสบ
2. ในผู้ป่วยที่เริ่มมีอาการของภาวะแก้วหูอักเสบในระหว่างที่ได้รับยาปฏิชีวนะ
3. ในผู้ป่วยแก้วหูอักเสบที่ไม่ตอบสนองต่อยาปฏิชีวนะ
4. มีภาวะของ *suppurative complication* จากแก้วหูอักเสบ
5. ในทารกแรกเกิด หรือในเด็กที่มีภาวะภูมิคุ้มกันบกพร่องที่เกิดภาวะแก้วหูอักเสบ



Concept and guideline in Mx

- Recommends amoxicillin for uncomplicated AOM; switching to alternative ATB based on clinical response after 48 hr.
- Selection of 2nd line ATB when pt. has been on ATB within a month or otitis prone.
- 2nd -line agents include
 - amoxicillin/clavulanate, cefdinir, cefpodoxime, cefprozil, cefuroxime.
 - 3 injections of ceftriaxone or gatifloxacin (when approved)
- Tympanocentesis for RX / Dx

Concept and guideline in Mx

Criteria for initial ATB Rx or Observation in children with AOM.

Age	Certain diagnosis	Uncertain diagnosis
< 6 mo	Antibacterial therapy	Antibacterial therapy
6 mo-2y	Antibacterial therapy	Antibacterial therapy if severe illness; observation option* if non-severe illness
>2y	Antibacterial therapy if severe illness; observation option* if non-severe illness	Observation option*

Certain Diagnosis

- 1. rapid Onset
- 2. sign of MEE
- 3. S&S of ME inflammation

Uncertain Diagnosis

- Non severe illness
 - Mild illness , fever < 39 C
- Severe illness
 - Moderate to severe otalgia , Fever > 39 C

Modified from the New York Department of Health and the New York Region Otitis Project Committee

Antibiotic therapy at time of Dx./

Temperature > 39C and/or severe Otagia	At Dx for pt. being treated Initially with ATB or Clinically defined Rx failure at 48-72 hr. after initial Mx with observation	
	Recommended	Alternative for Penicillin Allergy
No	Amoxicillin 80-90 mg/kg/day	Non-type I : cefdinir , cefuroxime, cefpodoxime Type I azithromycin, clarithromycin
Yes	Amoxicillin-clavulanate (90 mg/kg/day of amoxicillin with 6.4 mg/kg/day of clavulanate	Ceftriaxone 1-3 days

From : Clinical Practice Guidelines of AAFA , AAP, AAO-H&N
: Pediatric Vol 113 : No.5, 2004 : 1421-1429

Antibiotic therapy

:Clinical failure 48-72 hr.

Temperature > 39C and/or severe Otagia	Clinically defined treatment failure at 48-72 hr. after initial Rx with ATB	
	Recommended	Alternative for Penicillin Allergy
No	Amoxicillin-clavulanate (90 mg/kg/day of amoxicillin with 6.4 mg/kg/day of clavulanate)	Non-type I :Ceftriaxone 3 days Type I : clidamycin
Yes	Ceftriaxone 3 days	Tympanocentesis; clindamycin

From : Clinical Practice Guidelines of AAFA , AAP, AAO-H&N
: Pediatric Vol 113 : No.5, 2004 : 1421-1429

Treatment Guidelines for AOM: CDC Drug-Resistant *Streptococcus pneumoniae* Therapeutic Working Group

	Antibiotic use in prior month	No antibiotic use in prior month
First-line therapy	<ul style="list-style-type: none"> • High-dose amoxicillin/clavulanate potassium (80-90/6.4 mg/kg/day) • High-dose amoxicillin (80-90 mg/kg/day) • Cefuroxime axetil 	<ul style="list-style-type: none"> • Amoxicillin (40 to 45 mg/kg/day) • High-dose amoxicillin (up to 80-90 mg/kg/day)
Treatment Failure at Day 3	<ul style="list-style-type: none"> • Ceftriaxone IM • Clindamycin • Tympanocentesis for culture 	<ul style="list-style-type: none"> • High-dose amoxicillin/clavulanate potassium (80-90/6.4 mg/kg/day) • Cefuroxime axetil • Ceftriaxone IM
Treatment Failure at Days 10 to 28	<ul style="list-style-type: none"> • High-dose amoxicillin/clavulanate potassium (80-90/6.4 mg/kg/day) • Cefuroxime axetil • Ceftriaxone IM • Tympanocentesis for culture 	<ul style="list-style-type: none"> • High-dose amoxicillin/clavulanate potassium (80-90/6.4 mg/kg/day) • Cefuroxime axetil • Ceftriaxone IM



Prevention of recurrent episode

Recurrent AOM

Defined as ≥ 3 episodes in the previous 6 months, or ≥ 4 in 12 months

- Risk factors for R-AOM
 - Household with smokers
 - Daycare attendance
 - History of early onset of initial episode (onset of AOM < 1 y/o)
 - History of siblings with recurrent AOM
 - Winter occurrence

Pichichero ME. *Pediatr Infect Dis J.* 2000;19:911-916.

Chartrand SA, et al. *Pediatr Ann.* 1998;27:86-95.

Klein JO. *Clin Infect Dis.* 1994;19:823-833.

Berman S, et al. *Pediatr Infect Dis J.* 1993;12:20-24.

Prevention of recurrent episode

- Prophylactic ATB
- Myringotomy with tympanostomy tube insertion
- Vaccine
 - IPD vaccines :- PVC7 (Prevnar) (**Wyeth**)(year 2000) → PVC12
 - Pneumococcal polysaccharide/ Non-typetable *H. influenzae* (protein D) conjugate vaccine (**10PhiD-CV**) (Synflorix) (**GlaxoSmithKline**)
- ▶ PREVENTION (evaluate)
 - Respiratory allergy
 - Impairment in immunological function
 - Paranasal sinusitis
 - GERD

Antibiotic prophylaxis for prevention

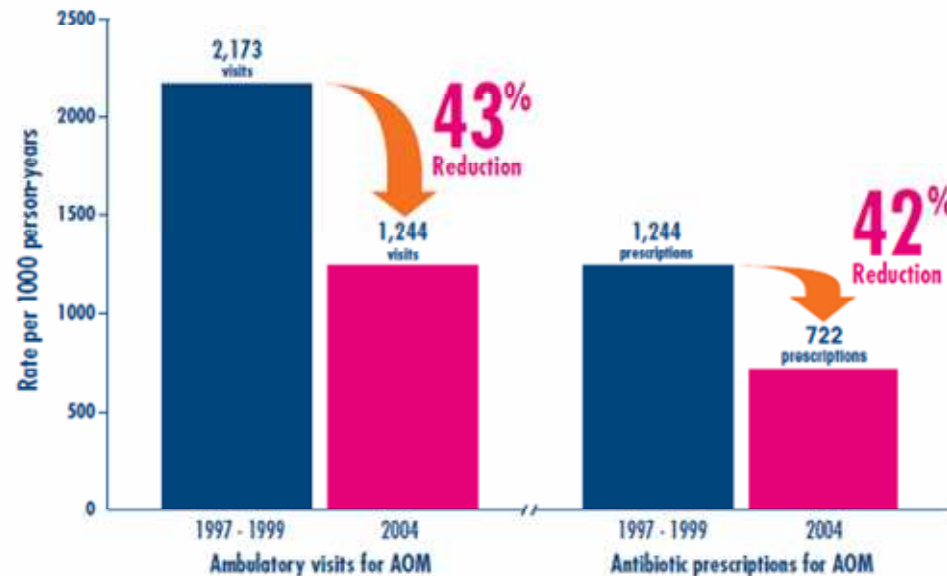
- Amoxicillin 20 mg/kg in one dose (hs) , (sulfisoxazole 60 mg/kg bid)
- Prophylaxis should continue during the URIT season
- Some evidence :– Prophylaxis with amoxicillin is more likely asso with colonization of BLPB and resistance *S. pneumoniae*
- One systematic review found that it does have an effect in preventing recurrence of AOM , 1993, 3 RCTs
 - ARR 11%, 95% CI 3-19%
 - No significant difference between antibiotics
- One RCT (1997) found no significant difference between antibiotic prophylaxis and placebo
- Disadvantage : antibiotics resistance , Not recommend nowadays

Pneumococcal Vaccine & AOM

- FDA approved
 - administered to all children < 2 yrs old
 - risk for R-AOM (day care attendance, siblings with Hx of R- AOM)
- two studies assoc. 7-valent PCV (Prevenar®) with
 - 6% (95% CI -4% to 16%) & 7% (95% CI 4% to 9%) relative reduction in risk of AOM episodes.
- 9-valent PCV in healthy toddlers was assoc. with
 - 17% (95% CI -2% to 33%) relative reduction in risk of OM episodes.
- 10-valent PCV with *H. influenzae* protein D with
 - 34% (95% CI 21% to 44%) relative reduction in risk of AOM episodes

Effectiveness of 7-valent pneumococcal conjugate vaccine in Acute Otitis Media (USA

Rates of ambulatory visits and antibiotic prescriptions for AOM in U.S. children <2 years of age²⁴



Data from 1997-2004 Market Scan databases, defined by ICD-9 codes.

What about GERD in OME/R-AOM?

- GERD may be one causative factor in the pathogenesis of OM.
- The role of GERD in OM is unclear but likely to contribute
- Logistic regression revealed that the strongest risk factor for recurrent otitis media was severe GERD (odds ratio, 4), then attendance at day-care center (odds ratio, 3), followed by allergies (odds ratio, 2.7).

What about GERD in OME/R-AOM?

- 14.4 % (22 of 152) had detectable pepsin/pepsinogen in MEF of children with OM. [Otolaryngol Head Neck Surg. 2007 Jul;137\(1\):59-64](#)
- Pepsin is detectable in ME of 20% of ped. with OM undergoing tympanostomy tube placement, compared with 1.4% of controls; [Laryngoscope. 2008 Jul;118\(7 Part 2 Suppl 116\):1-9](#)
- 187 children (40 d - 33 mons) : 31.67% with severe GERD presented episodes of R-AOM compared 12.24% in control group. [Int J Pediatr Otorhinolaryngol. 2009 Jul 28.](#)

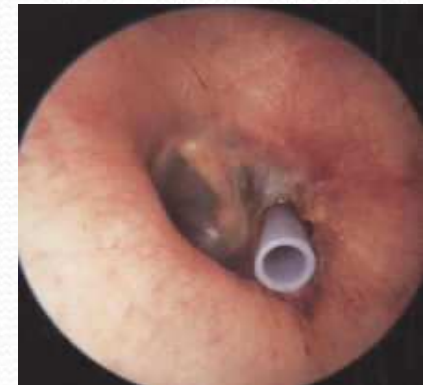
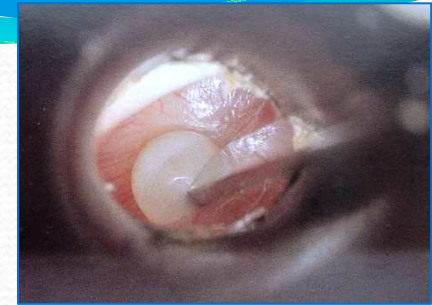


Advent of Surgical Rx

- Act as 3th -line treatment option.
- **Indication**
 - when clinically defined treatment failure at 48-72 hr. after Rx with appropriate ATB
- Role of Surgery option in AOM
 - Tympanocentesis
 - Myringotomy
- Role of Surgery option in R-AOM
 - Myringotomy with Tympanostomy tube
 - Additional Adenoidectomy
 - Tonsillectomy withheld unless other indications

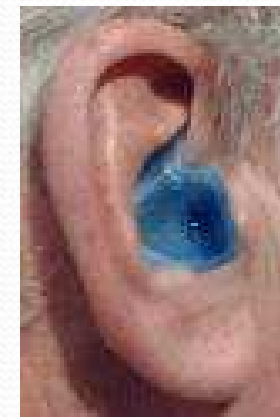
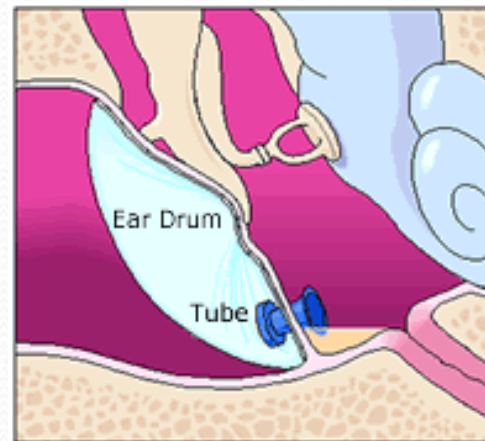
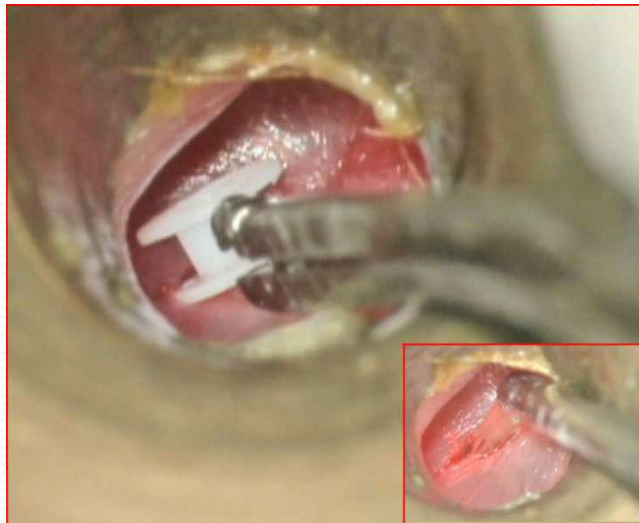
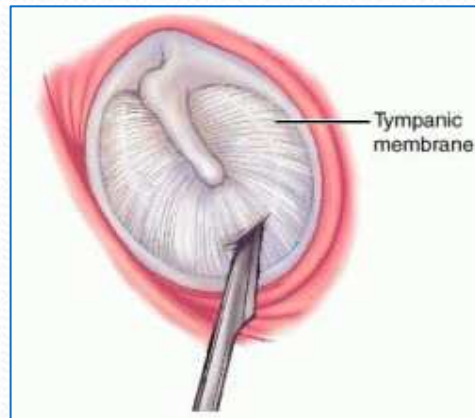
Tympanotomy with myringotomy tube

- Most common surgical procedure in children
- Potential treatment for
 - Hearing loss secondary to persisting effusions
 - Otitis media with effusion >3 months
 - Recurrent AOM
 - Chronic retraction of TM



From : Clinical Practice Guidelines of AAFA , AAP, AAO-H&N : Pediatric Vol 113 No.5 2004: 1421-1429

Insertion of myringotomy tube



Tube Choice

- Short stay (grommets)
 - Persistent perforate rates 3-5%
 - Persist 6-18 months
- Long stay (Goode T-tubes)
 - Persistent perforate rates 10 of 64 %
 - Persist 2-4 yrs
- Bioabsorbable/bacteriostatic grommets
 - New choice in future
 - Made of bacteriostatic polylactic acid
 - Similar material to resorbable miniplates



Shepard tube

A grommet is tiny,
smaller than a match
head



grommet tube



bobbin



Goode T-tube

Table 2. Clinic visits and prescriptions for antibiotics among 273 pediatric otitis media patients before and after insertion of tympanostomy tubes

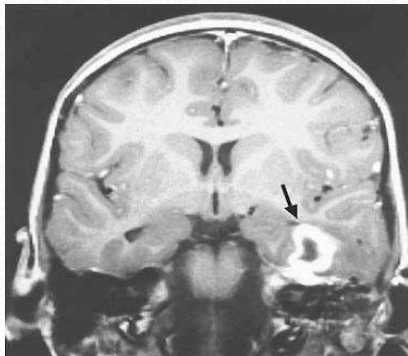
Variable	Before tube insertion	After tube insertion
No. of non-HNS clinic visits	8.4	2.4
No. of HNS clinic visits	2.2	0.4
Total no. of clinic visits	10.6	2.8
No. of routine HNS follow-up visits	N/A	2.5
No. of prescriptions for antibiotic drugs	5.8	1.9

HNS = Head and Neck Surgery Department; N/A = not applicable.



Conclusion

- Management of AOM in children still challenged for Clinician , and need cooperation among the parents, pediatrician, and otolaryngologist esp. in case of recurrent AOM. / Rx failure. to avoid serious or late complication



Brain abs.



Subperiosteum abs.



Cholesteatoma



Adhesive OM

RISK FACTORS FOR AOM Caused by Resistant Pathogens

- ≤ 2 years of age*
- Previous antibiotic exposure (≤ 3 months)*
 - Previous therapy with amoxicillin[†]
- Daycare attendance*

*Risk factors for infection with penicillin-nonsusceptible *S. pneumoniae*, defined as *S. pneumoniae* with penicillin MIC ≥ 0.12 $\mu\text{g/mL}$.

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Pichichero ME, et al. *Ann Otol Rhinol Laryngol.* 2000;109:2-12.



THANK YOU FOR YOUR ATTENTION

Answer A

- 2 wk after oral amoxicillin for AOM, 3-yr.-old boy has no pain in the ear but have 10 dB CHL. , Otoscopic exam as shown. The next step in Mx should be
- A. Observation
 - B. Consult ENT for tympanocentesis
 - C. Advice parents for myringotomy with PE-tube
 - D. Add decongestant and INCS
 - E. Change antibiotic to Amox-clavu in order to cover H. influ resistance stains



Answer D

- 2-yr-old boy has AOM 6 time/yr and normal exam. between each episode. Which of the following is the most reasonable for primary Mx ?
- A. prophylaxis ATB
 - B. adenoidectomy
 - C. Tympanostomy tube and adenoidectomy
 - D. Tympanostomy tube
 - E. Polyvalent pneumococcal vaccine

