

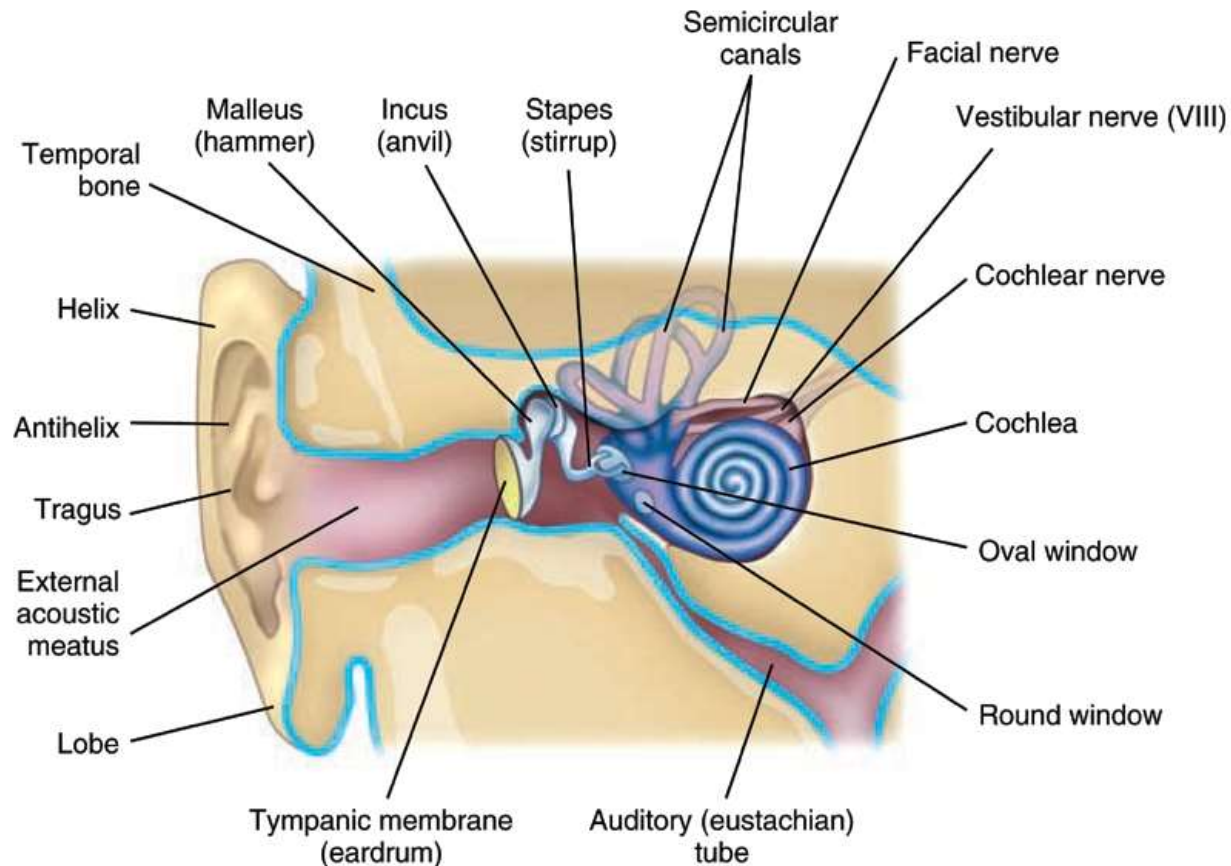
Farmakoterapi

Obat Panca Indra 2

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Fak Kedokteran-UMM 2018

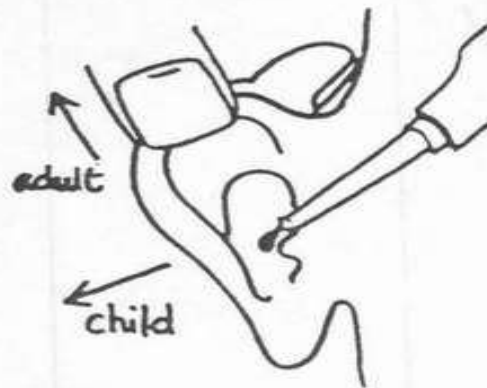
FARMAKOTERAPI PADA TELINGA



Guttae Auriculares

- = obat tetes telinga → efek lokal → melepaskan kotoran telinga (serumen), mengobati infeksi, peradangan atau rasa sakit t.u pada otitis eksterna
- Preparat u/ mengeluarkan serumen : minyak encer, minyak nabati, hydrogen peroksida (dulu), propilen glikol (pengemulsi serumen)

How to use ear drops



ADULT



CHILD



OTOTOXIC DRUG

Obat Ototoksik = obat sistemik / lokal yang mempunyai kecenderungan menyebabkan gangguan fungsi & kerusakan sel terhadap jaringan telinga dalam khususnya koklea dan vestibular (N. VII) → tinnitus, hearing loss

Obat yang Menyebabkan Hearing Loss

Salisilat : aspirin & aspirin-containing products salicylates and methyl-salicylates	Dose related, reversible
NSAID : diklofenak, ibuprofen, indometasin, naproksen, piroksikam, sulindak	Dose related, reversible
Aminoglikosida : Streptomisin, Gentamicin, Neomicin, Amikacin, Tobramicin, Kanamicin, Netilmicin	Permanent hearing loss Jk membr timpani perforasi → ototoksik Jk Aminoglikosida topikal kulit + i.v → ototoksik ↑, t.u jk ada luka di kulit / pasien sdh ada gangg ginjal Neomicin → paling toksik , shg hanya ada topikal. Diikuti dg kanamycin, gentamicin, tobramycin, amikacin and netilmicin

Obat yang Menyebabkan Hearing Loss

Eritromisin	t.u i.v dosis 2-4 gr/hr pd pasien gangg ginjal
Vankomisin	i.V pd infeksi berat
Diuretik : Furosemid, bumetadis, as etakrinat,	i.V pd GGA, udem paru CHF, krisis HT
Quinine	Spt salisilat
Misoprostol	
Opioid : Hydrocodone	
Minocycline, Capreomycin	
Polimiksin B, Amphoterasin B	

Obat yang Menyebabkan Tinnitus

Antibiotik	Aminoglikosida, Sulfonamid, Kloramfenikol,
Cardiac Medication	celiprolol, lidokain, propanolol, metoprolol, quinidine
Steroid	Prednisolon, ACTH
Antimalaria	Klorokuin, hiroklorokuin
NSAID	
Psikopharmacologic agent	Amitriptilin, Benzodiazepin, Carbamazepin, lithium
Antineoplastic agent	Bleomicin, Vinblastin
Diuretik	HCT, acetazolamid, furosemid

OTITIS EKSTERNA

- Predisposisi : kelembaban yang cukup tinggi, adanya sel – sel epithelium, dan kondisi pH yang alkali → kondisi ideal u/ pertumbuhan *Micrococci (aureus dan albus)*, *Corynebacteria*, *Pseudomonas aeruginosa*
- Preparat telinga untuk antiinfeksi, antiradang, dan analgetik :
 - Pembawa : gliserin anhidrida atau propilen glikol → kental , higroskopis → kontak obat dg jaringan telinga lebih lama, mengurangi kelembaban
 - pH= asam, 5 – 7,8 → hamb pertumb jamur & bakteri
 - Antinyeri : antipirin , anestetika local (lidokain, benzokain)
 - Antiinfeksi : kloramfenikol, kolistin sulfat, neomisin, polimiksin B sulfat dan nistatin

OTITIS MEDIA AKUT

"Common cold"
Viral infection

Mucosal congestion
Tenacious secretion
Ciliary stasis

Ostial obstruction
 $pO_2 \downarrow$, mucosal edema
transudation in sinus

INFLAMMATION
Mucosal pathology
Lactate accumulation
Impaired immune response

BACTERIAL COLONIZATION
Mucosal pathology
Edema, reduced drainage,
and immunologic defense

Bacterial multiplication
Leukocyte chemotaxis
Release of proteolytic enzymes

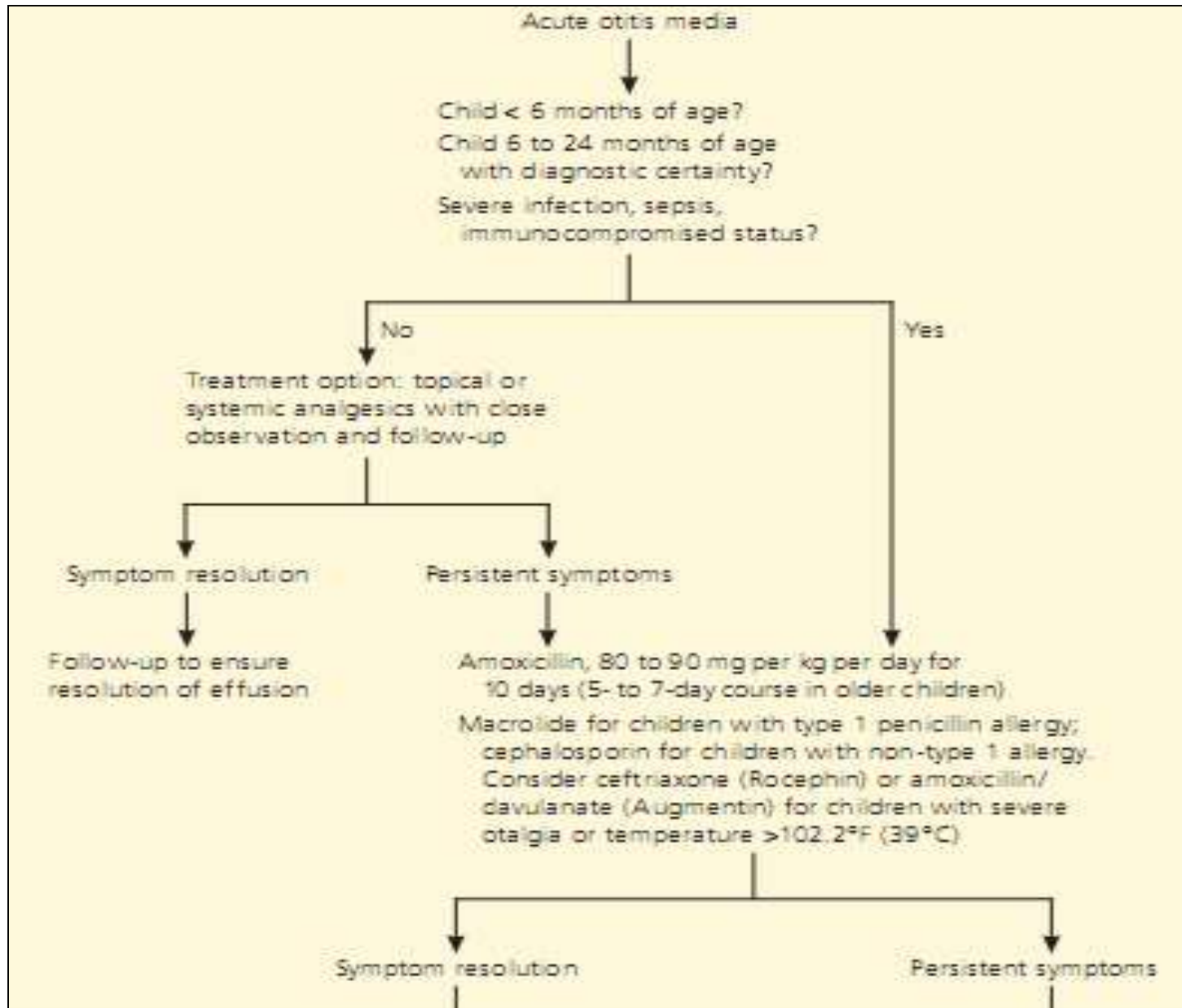
RESOLUTION

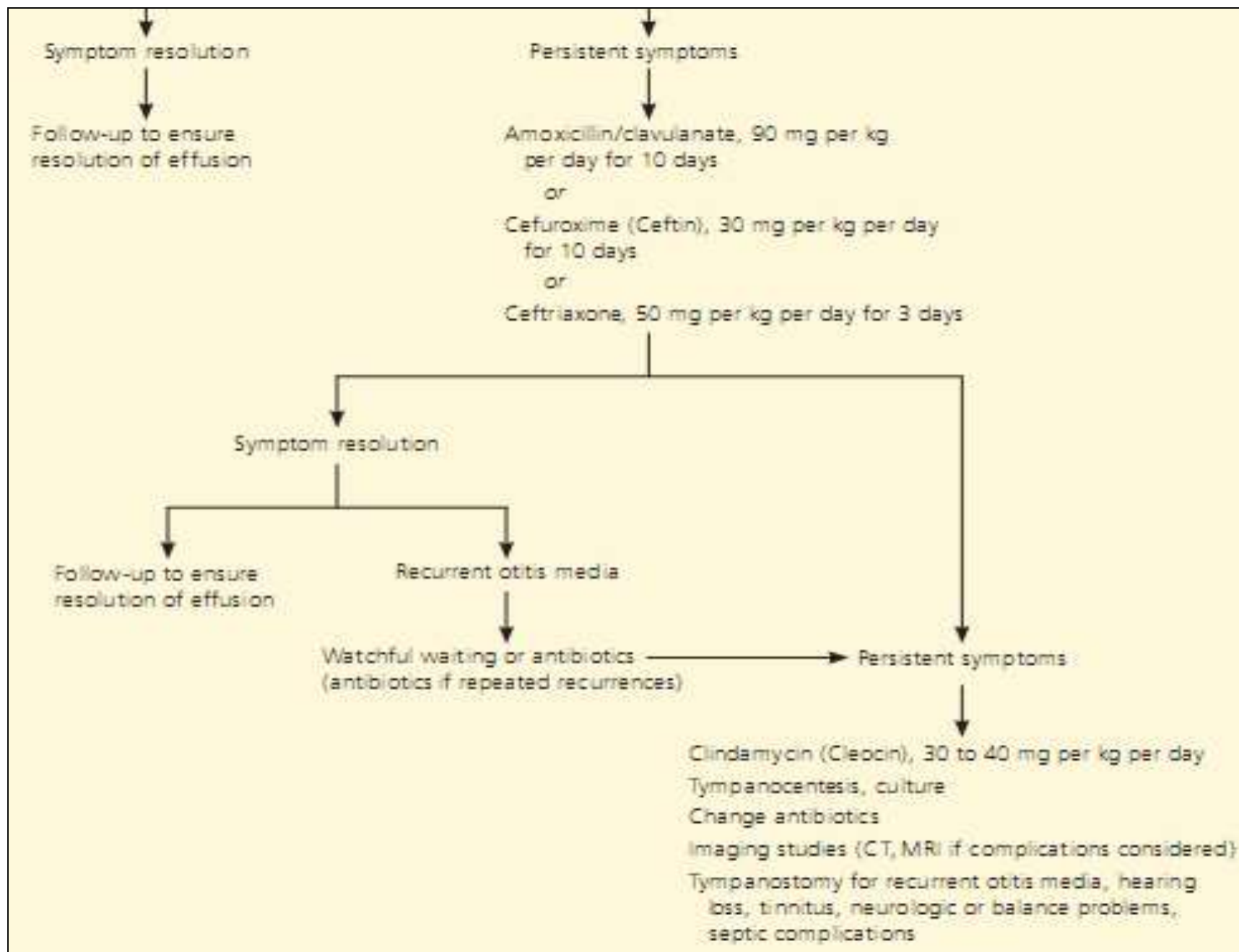
INFECTION

Metabolic acidosis
Lactate accumulation
Anoxia
Hypercapnia

Impairment of antimicrobial defense
Mucosal pathology, including ulceration,
metaplasia, ciliary damage

Treatment Algorithm for Acute Otitis Media





OTITIS MEDIA AKUT

Table 1: Initial Treatment of AOM for Children Over 6 Months of Age

Patient Type	Therapy	Dose	Comments
Otherwise healthy with mild symptoms <i>(see comments)</i>	Acetaminophen	10-15mg/kg/dose PO Q4H prn (max 75mg/kg/day)	For ages 6-24 months, observation with the use of systemic analgesics <u>without</u> the use of antibacterial agents is an option for selected children with uncomplicated AOM, based on diagnostic certainty, age, illness severity and assurance of follow-up. ^{7,8,14,16,21-23}
	Ibuprofen	5-10mg/kg/dose PO Q6-8H prn (max 40mg/kg/day)	If older than 24 months, most cases of AOM resolve and <u>do not</u> require antibiotics, as long as symptoms are manageable with systemic analgesics, the child has access to re-evaluation at 48 hours and symptoms do not persist. ^{1,13,14,16,24} If signs and symptoms of AOM persist in spite of using systemic analgesics for 48 to 72 hours, reassess and consider treatment with antibiotics. ⁶⁷
No daycare attendance and <u>no</u> antibiotics within 90 days	Amoxicillin	Standard Dose: 40-45 mg/kg/day PO div tid ≥2 years: treat for 5 days <2 years: treat for 10 days	High risk factors increase the risk of resistant <i>Streptococcus pneumoniae</i> (<i>S. pneumoniae</i>)
Daycare attendance and antibiotics within 90 days	Amoxicillin	High Dose: 80-90 mg/kg/day PO div tid ≥2 years: treat for 5 days <2 years: treat for 10 days	Amoxicillin retains the best activity of all oral B-lactam agents against <i>S. pneumoniae</i> , including penicillin intermediate resistant strains.

β-lactam allergy**	The incidence of cephalosporin cross-reactivity with penicillin allergy is less than 2%. Consider allergy testing when infection resolves to confirm penicillin allergy.		
Penicillin allergy - Non anaphylactic	Cefuroxime axetil	30mg/kg /day PO div bid ≥2 years: treat for 5 days <2 years: treat for 10 days	Due to poor taste of cefuroxime suspension, recommend tablets if possible, can be crushed and put in to a palatable fluid
	or Cefprozil	30mg/kg/day PO div bid ≥2 years: treat for 5 days <2 years: treat for 10 days	Compared to cefuroxime, liquid cefprozil has a better taste but inferior coverage of <i>Haemophilus</i> and Penicillin Intermediate resistance - <i>S. pneumoniae</i>
Penicillin allergy - Anaphylactic or - Cephalosporin allergy	Clarithromycin	15 mg/kg/day/ div bid for 10 days***	TMP/SMX and macrolides are inferior options due to high resistance rates and clinical failure rates Consider referral to otolaryngologist for tympanocentesis
	or TMP/SMX	6-12 mg TMP/kg/day PO div bid ≥2 years: treat for 5 days <2 years: treat for 10 days	
	or Azithromycin	10mg/kg/day PO on the first day and 5mg/kg/day PO for 4 days	

* Abbreviations: div = divided; TMP/SMX = trimethoprim/sulfamethoxazole

** β-lactam = Any of a class of broad-spectrum antibiotics that are structurally and pharmacologically related to the penicillins and cephalosporins.

*** 10 days of therapy with macrolides is preferred because of lower activity in this class of medication compared to the beta lactams

Pilihan Terapi OMA

<i>Agent</i>	<i>Dosage</i>	<i>Comments</i>
Antimicrobials*		
Amoxicillin	80 to 90 mg per kg per day, given orally in two divided doses	First-line drug. Safe, effective, and inexpensive
Amoxicillin/clavulanate (Augmentin)	90 mg of amoxicillin per kg per day; 6.4 mg of clavulanate per kg per day, given orally in two divided doses	Second-line drug. For patients with recurrent or persistent acute otitis media, those taking prophylactic amoxicillin, those who have used antibiotics within the previous month, and those with concurrent purulent conjunctivitis
Azithromycin (one dose; Zithromax)	30 mg per kg, given orally	For patients with penicillin allergy. One dose is as effective as longer courses
Azithromycin (three-day course; Zithromax Tri-pak)	20 mg per kg once daily, given orally	For patients with recurrent acute otitis media
Azithromycin (five-day course; Zithromax Z-pak)	5 to 10 mg per kg once daily, given orally	For patients with penicillin allergy (type 1 hypersensitivity)
Cefdinir (Omnicef)	14 mg per kg per day, given orally in one or two doses	For patients with penicillin allergy, excluding those with urticaria or anaphylaxis to penicillin (i.e., type 1 hypersensitivity)
Cefpodoxime (Vantin)	30 mg per kg once daily, given orally	For patients with penicillin allergy, excluding those with urticaria or anaphylaxis to penicillin (i.e., type 1 hypersensitivity)
Ceftriaxone (Rocephin)	50 mg per kg once daily, given intramuscularly or intravenously. One dose for initial episode of otitis media, three doses for recurrent infections	For patients with penicillin allergy, persistent or recurrent acute otitis media, or vomiting
Cefuroxime (Ceftin)	30 mg per kg per day, given orally in two divided doses	For patients with penicillin allergy, excluding those with urticaria or anaphylaxis to penicillin (i.e., type 1 hypersensitivity)
Clarithromycin (Biaxin)	15 mg per kg per day, given orally in three divided doses	For patients with penicillin allergy (type 1 hypersensitivity). May cause gastrointestinal irritation

Clindamycin (Cleocin)	30 to 40 mg per kg per day, given orally in four divided doses	For patients with penicillin allergy (type 1 hypersensitivity)
Topical agents†		
Ciprofloxacin/hydrocortisone (Cipro HC Otic)	3 drops twice daily	—
Hydrocortisone/neomycin/polymyxin B (Cortisporin Otic)	4 drops three to four times daily	—
Ofloxacin (Floxin Otic)	5 drops twice daily (10 drops in patients older than 12 years)	—
Analgesics		
Acetaminophen	1 mg per kg every six hours	—
Antipyrine/benzocaine (Auralgan)	2 to 4 drops three to four times daily	—
Ibuprofen (Motrin)	10 mg per kg every six hours	—
Narcotic agents	Variable	May cause gastrointestinal upset, respiratory depression, altered mental status, and constipation

*—These drugs should be given for 10 days, unless otherwise indicated. A five- to seven-day course is an option for patients six years and older. These agents may cause diarrhea, vomiting, abdominal pain, rash, anorexia, and dermatitis.

†—These drugs should be used for seven to 10 days in patients with chronic suppurative otitis media.

Information from references 1, 5, and 25.

FARMAKOTERAPI PADA HIDUNG

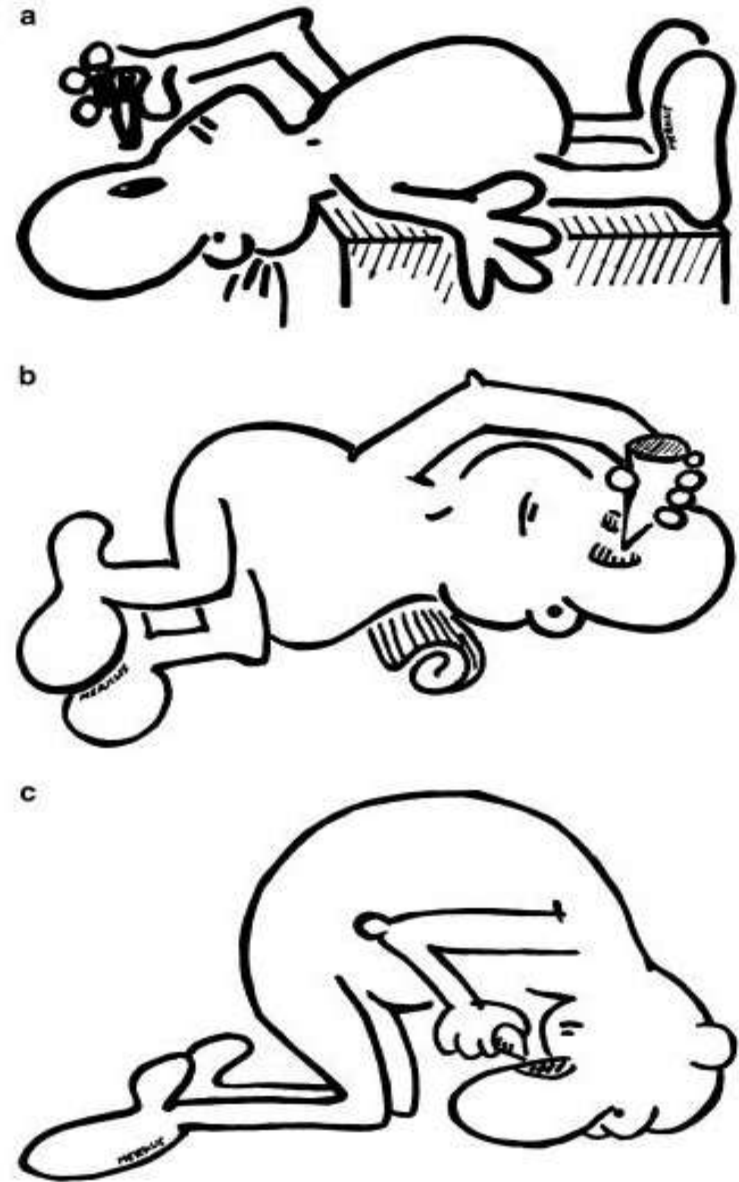
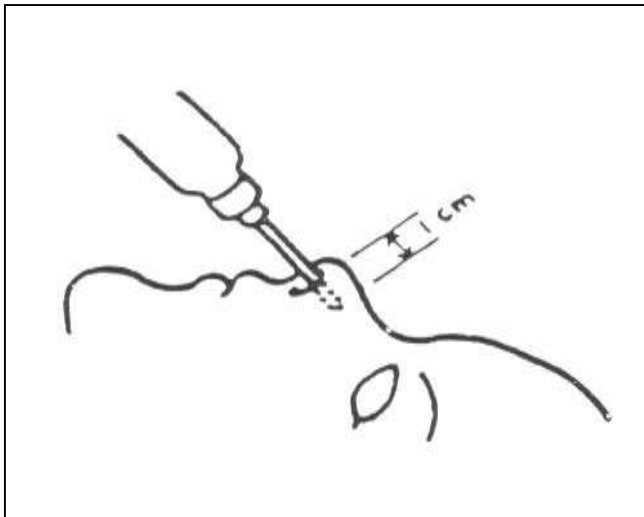
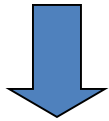


Fig. 1 Three head positions: a Lying head back (LHB, chin as highest point), b lateral head low (LHL, lying on one side), and c head down and forward (HDF, "praying to Mecca")

HOW TO USE NASAL DROPS AND NASAL SPRAYS

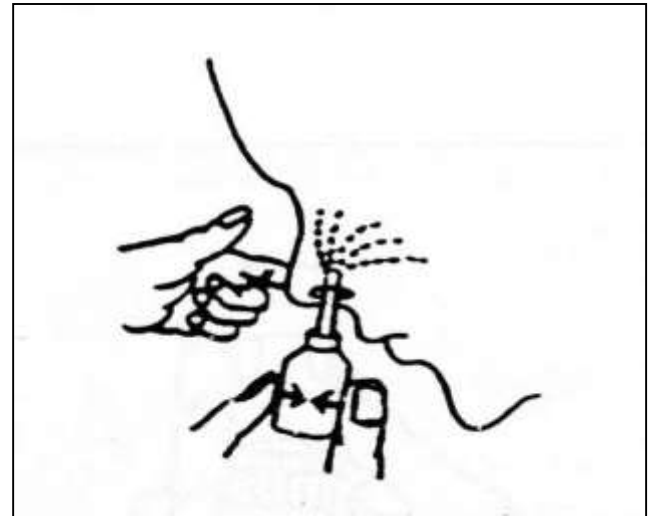
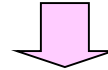
NASAL DROPS

- preferred for small children
- cover a limited surface area



NASAL SPRAY

- simple to use.
- have a fast onset of action
- cover a large surface area.



Penggunaan Tetes / Semprot Hidung

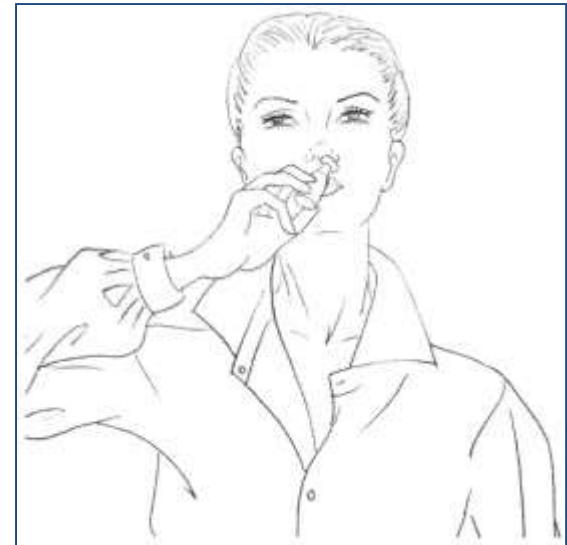


Fig 3. Technique for application of intranasal steroid spray, using the right hand to spray the left nostril.

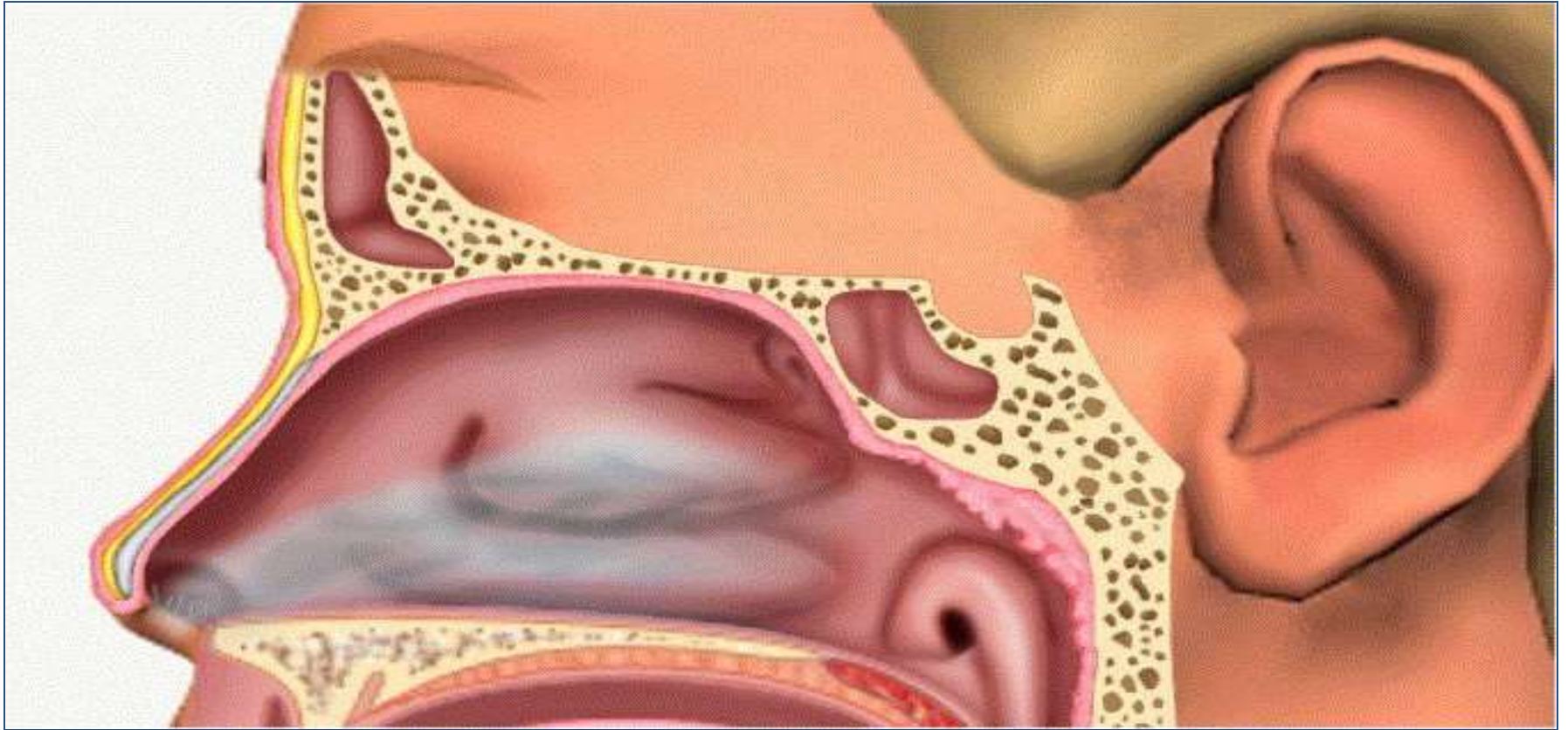


Fig 1. Sagittal view of nasal lateral wall anatomy with highlighted turbinates and nasal airflow.

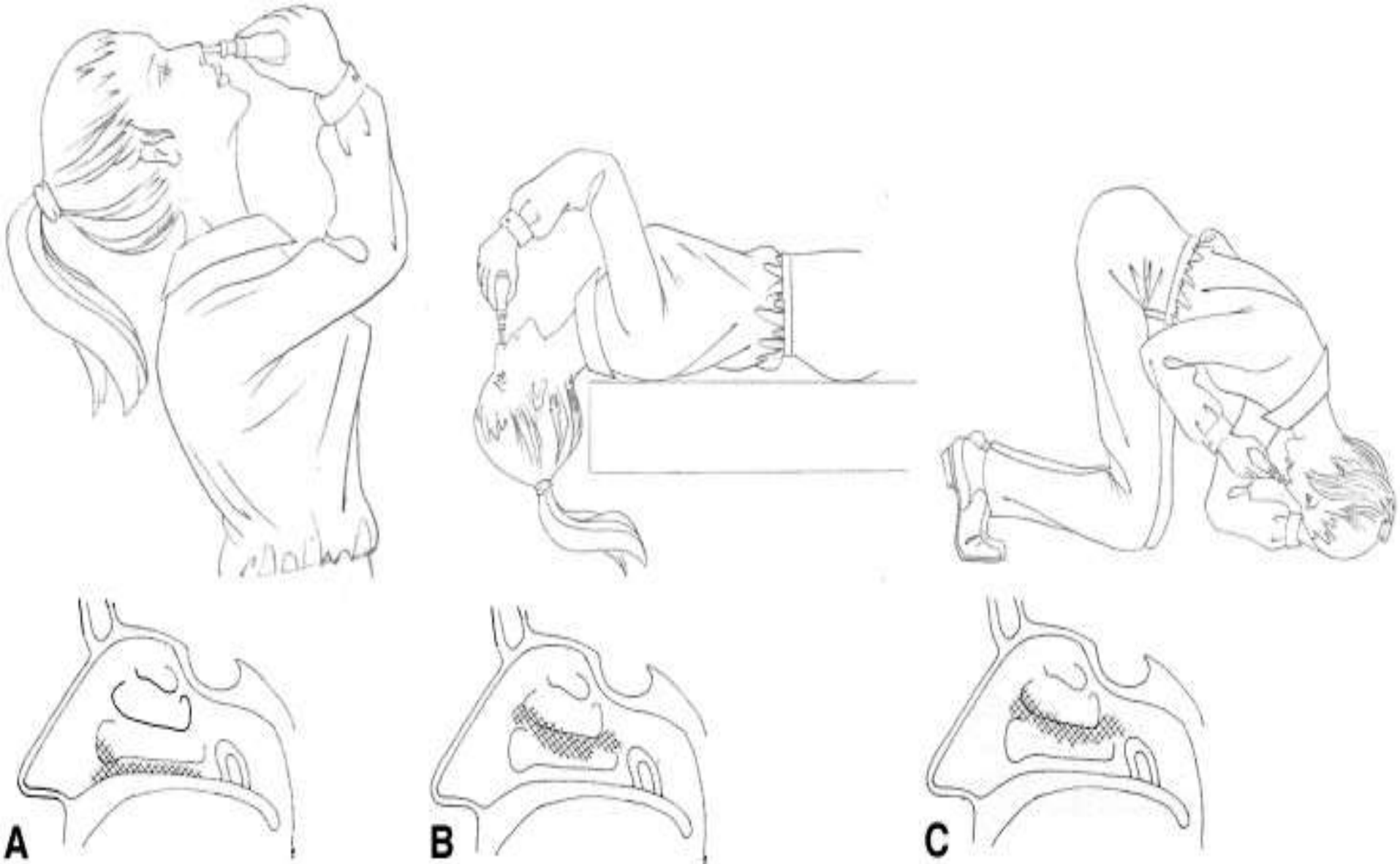


Fig 2. Distribution of blue dye (indicated by crosshatching) in the nose after instillation of topical nose drops: (A) head-tipped-back position, (B) Mygind's position, and (C) praying-to-Mecca position. Note distribution of the spray in the inferior portion of the nose in the head-tipped-back position (A). (Intranasal diagrams adapted from Kubba et al, 2000.)

Rhinnitis Allergi

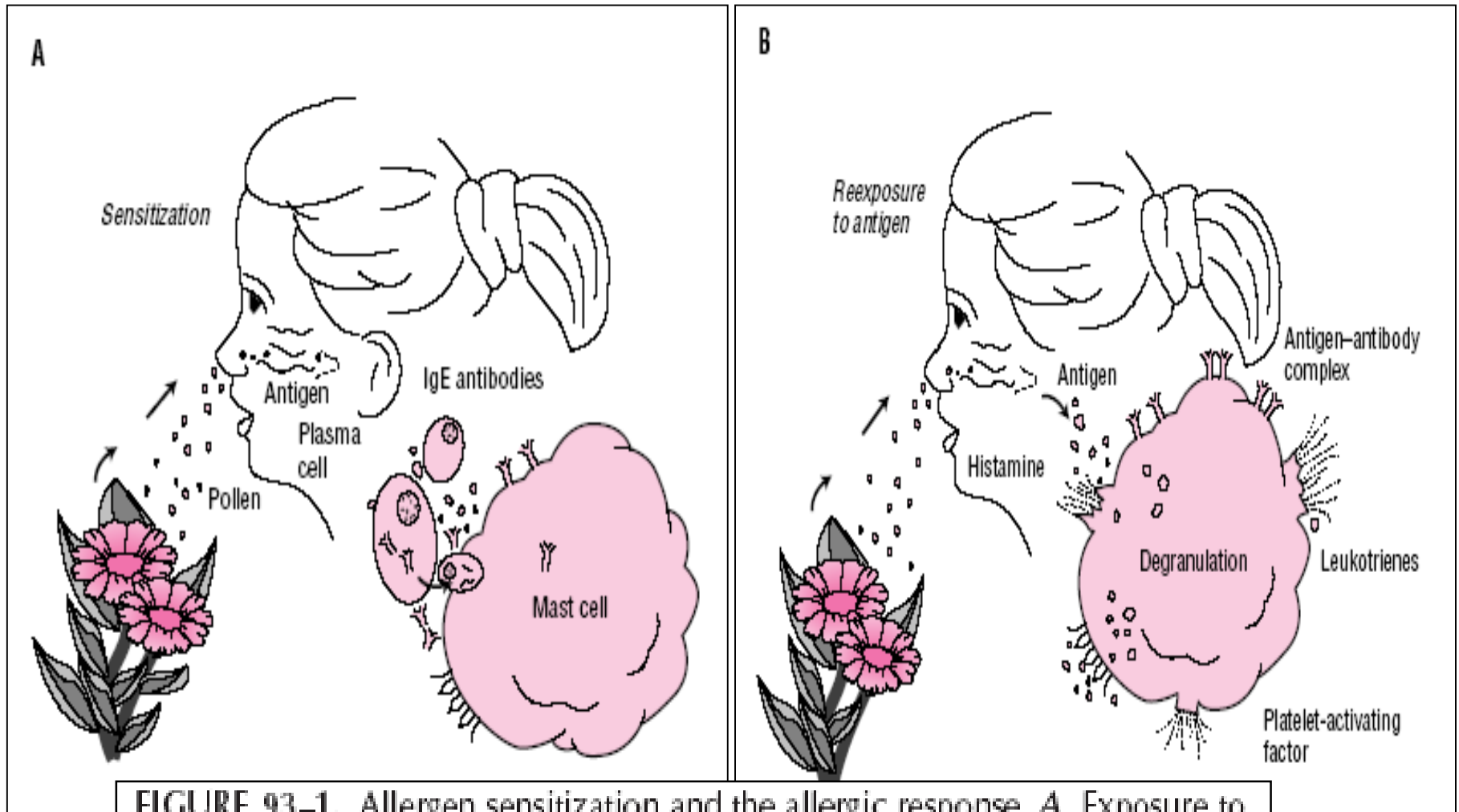


FIGURE 93-1. Allergen sensitization and the allergic response. *A.* Exposure to antigen stimulates IgE production and sensitization of mast cells with antigen-specific IgE antibodies. *B.* Subsequent exposure to the same antigen produces an allergic reaction when mast cell mediators are released.

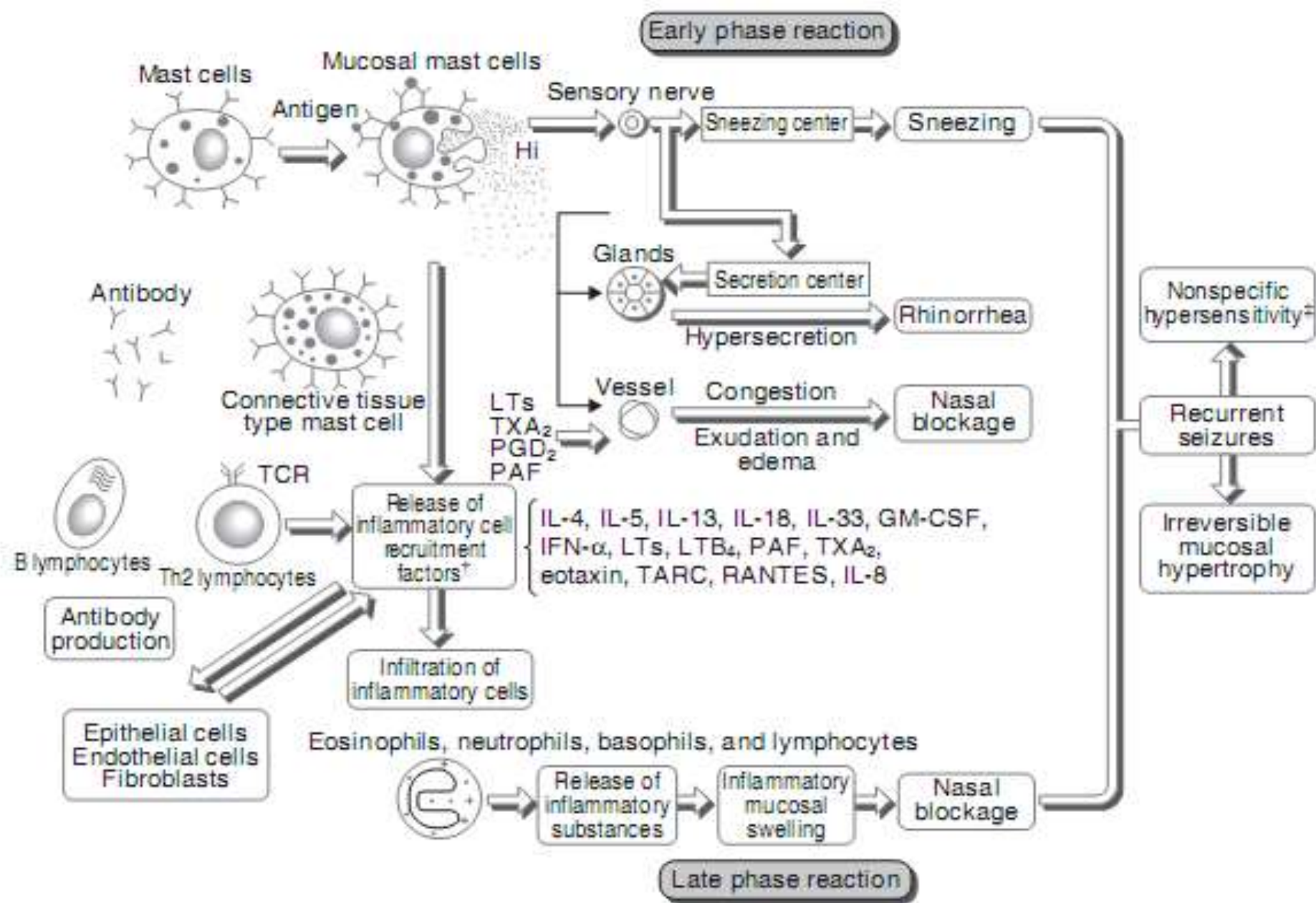


Fig. 4 Mechanism of allergic rhinitis. Hi, histamine; LT, leukotriene; TXA₂, thromboxane A₂; PGD₂, prostaglandin D₂; PAF, platelet activating factor; IL, interleukin; GM-CSF, granulocyte/macrophage colony stimulating factor; IFN- γ , Interferon- γ ; TARC, thymus and activation-regulated chemokine; RANTES, regulated upon activation non-

1. Communication with patients
2. Elimination and avoidance of antigens
 - Mites: cleaning, dehumidification, mite control blanket cover, etc.
 - Pollen: mask, glasses, etc.
3. Pharmacotherapy
 - Chemical mediator receptor antagonists (antihistamine, leukotriene receptor antagonists, anti-prostaglandin D₂/thromboxane A₂ agents) (nasal spray, oral medication)
 - Mast cell stabilizer (nasal spray, oral medication)
 - Steroids (nasal spray, oral medication)
 - Autonomic drugs (α -sympathomimetics)
 - Others
4. Specific immunotherapy (conventional or rapid procedures)
5. Operative treatment
 - Coagulation necrosis (radiofrequency electrocoagulation, laser surgery, trichloroacetic acid chemo-surgery, etc.)
 - Resection (corrective surgery of nasal cavity, extensive turbinectomy, nasal polypotomy, etc.)
 - Vidian neurectomy and posterior nasal neurectomy

Elimination and avoidance of antigens

<Elimination of house dust mites>

1. For indoor cleaning, use an exhaust circulation-type cleaner.
Clean room for 20 s/m² twice a week.
2. Avoid using textile sofa, carpet, and tatami wherever possible.
3. Put antimite covers over mattresses, beds, and pillows.
4. Keep humidity at 50% and room temperature at 20-25°C.

<Avoidance of cedar pollen>

1. Collect pollen information.
2. Stay at home during a heavy pollen dispersal period.
3. Shut windows and doors during a heavy pollen dispersal period.
4. When going out during a heavy pollen dispersal period, wear a mask and glasses.
5. When going out, avoid wearing woolen coats.
6. When going home, shake dust off from suit and hair before entering. Wash the face, gargle, and blow your nose.
7. Clean rooms frequently.

<Reduce pet (especially cat) antigens>

1. Stop keeping pets if possible.
2. Keep pets outdoors and keep them away from bedroom.
3. Clean pets and their environments.
4. Change carpet to flooring.
5. Improve ventilation, and clean rooms.

Terapi Rhinnitis alergi

1. Mast cell stabilizer

Disodium cromoglycate (Intal[®]), tranilast (Rizaben[®]), amlexanox (Sofa[®]), pemirolast potassium (Alegysa[®], Pemilaston[®])

2. Chemical mediator receptor antagonists

a. Histamine H₁ receptor antagonists (antihistamine)

<First-generation>

d-chlorpheniramine maleate (Polaramin[®]), clemastine fumarate (Tavegyl[®]), etc.

<Second-generation>

Ketotifen fumarate (Zaditen[®]), azelastine hydrochloride (Azeptin[®]), oxatomide (Celtect[®]), mequitazine (Zesulan[®], Nipolazin[®]), emedastine difumarate (Daren[®], Remicut[®]), epinastine hydrochloride (Alesion[®]), ebastine (Ebastel[®]), cetirizine hydrochloride (Zyrtec[®]), levocabastine hydrochloride (Livostin[®]), bepotastine besilate (Talion[®]), fexofenadine hydrochloride (Allegra[®]), olopatadine hydrochloride (Allelock[®]), loratadine (Claritin[®])

b. Leukotriene receptor antagonists

Pranlukast hydrate (Onon[®]), montelukast sodium (Singulair[®], Kipres[®])

c. Prostaglandin D₂/thromboxane A₂ receptor antagonists (anti-prostaglandin D₂/thromboxane A₂ agents)

Ramatroban (Baynas[®])

3. Th2 cytokine inhibitor

Suplatast tosilate (IPD[®])

4. Steroids

a. Nasal spray

Beclomethasone propionate (Aldecin[®] AQ Nasal, Rhinocort[®]), fluticasone propionate (Flunase[®]), mometasone furoate hydrate (Nasonex[®]), dexamethasone cipeccilate capsule for external use (Erizas[®])

b. Oral medication

Compounding agent of betamethasone/d-chlorpheniramine maleate (Celestamine[®])

5. Others

Nonspecific allasotherapy agents, biological preparations, and herbal medicines

Treatment of perennial allergic rhinitis

Severity	Mild	Moderate	Severe		
Disease types		Sneezing and rhinorrhea type	Nasal blockage type or combined type with nasal blockage as a chief complaint	Sneezing and rhinorrhea type	Nasal blockage type or combined type with nasal blockage as a chief complaint
Treatments	a. Second-generation antihistamine b. (Mast cell) stabilizer Choose one of (a), (b).	a. Second-generation antihistamine b. (Mast cell) stabilizer c. Th2 cytokine inhibitors d. Nasal spray steroids Choose one of (a), (b), (c), and (d). Combine (a), (b), or (c), with (d), as needed.	a. Anti-LTs agents b. Anti-PGD ₂ /TXA ₂ agents c. Nasal spray steroids Choose one of (a), (b), and (c). Combine (a) or (b) with (c) as needed.	Nasal spray steroids + Second-generation antihistamine Nasal spray steroids + Anti-LTs agents or anti-PGD ₂ /TXA ₂ agents Use vasoconstrictor nose spray for only 5-7 days at the start of treatment as needed.	Perform surgery for cases with nasal deformities of a nasal blockage type.
		Specific immunotherapy			
		Elimination and avoidance of antigens			

Note 1) Second-generation antihistamine are often used. First-generation antihistamine are inexpensive, rapidly effective, and short-acting agents, and are used as such. However, avoid their use for those with severe sleepiness, urination disorder, glaucoma, or asthma.

Note 2) Stabilizer = Mast cell stabilizer, Anti-LTs agents = Leukotriene receptor antagonists, Anti-PGD₂/TXA₂ agents = Prostaglandin D₂/Thromboxane A₂ receptor antagonists.

Note 3) For severe nasal blockage, use vasoconstrictor nose drops for ≤1 week.

Note 4) Use one or more agents depending on symptoms.

Note 5) Even if symptoms are alleviated, do not discontinue the agent immediately, but confirm stability for several months to reduce dose gradually.

Note 6) For severe cases unresponsive to the above agents, oral corticosteroids may have to be used for a short period (1-2 weeks).

Adapted from Practical Guideline for the Management of Allergic Rhinitis in Japan 2009, digest version.

Diagnosis of allergic rhinitis
(History: prick test or serum specific IgE antibody)

Avoidance of antigens

Intermittent symptoms

Persistent symptoms

Mild

Moderate
Severe

Mild

Moderate
Severe

- Oral histamine H₁ antagonists
- Nasal histamine H₁ antagonists and/or vasoconstrictors/leukotriene receptor antagonists (in random order)

- Oral histamine H₁ antagonists
- Nasal histamine H₁ antagonists and/or vasoconstrictors/nasal steroids/leukotriene receptor antagonists (in random order)

Nasal steroids

Reexamined at
2-4 weeks.

Improved

Gradually reduce the
dose and continue
administration for
1 month.

No effects

Reconsider diagnosis.
Reconfirm compliance.
Suspect infection and
others causes.

For perennial rhinitis,
revisit a hospital at
2-4 weeks.

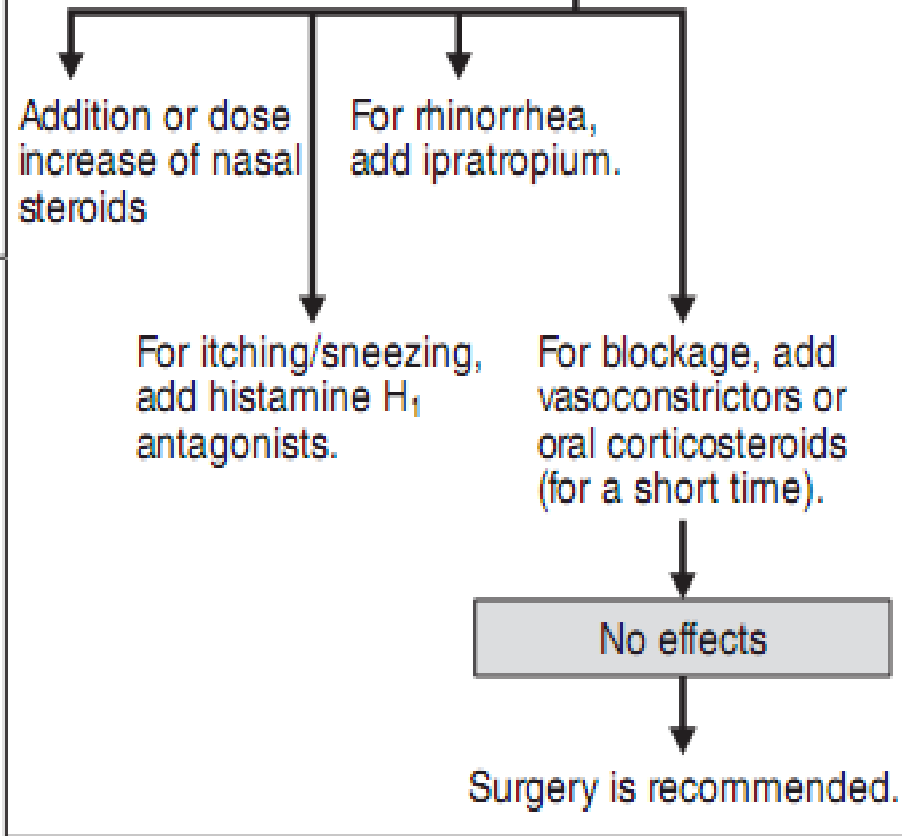
For perennial rhinitis, revisit a hospital at 2-4 weeks.



No effects: Gradually increase dose.
Improved: Continue the administration for 1 month.

Gradually reduce the dose and continue administration for 1 month.

Reconsider diagnosis. Reconfirm compliance. Suspect infection and others causes.



For conjunctivitis, add the following agents:

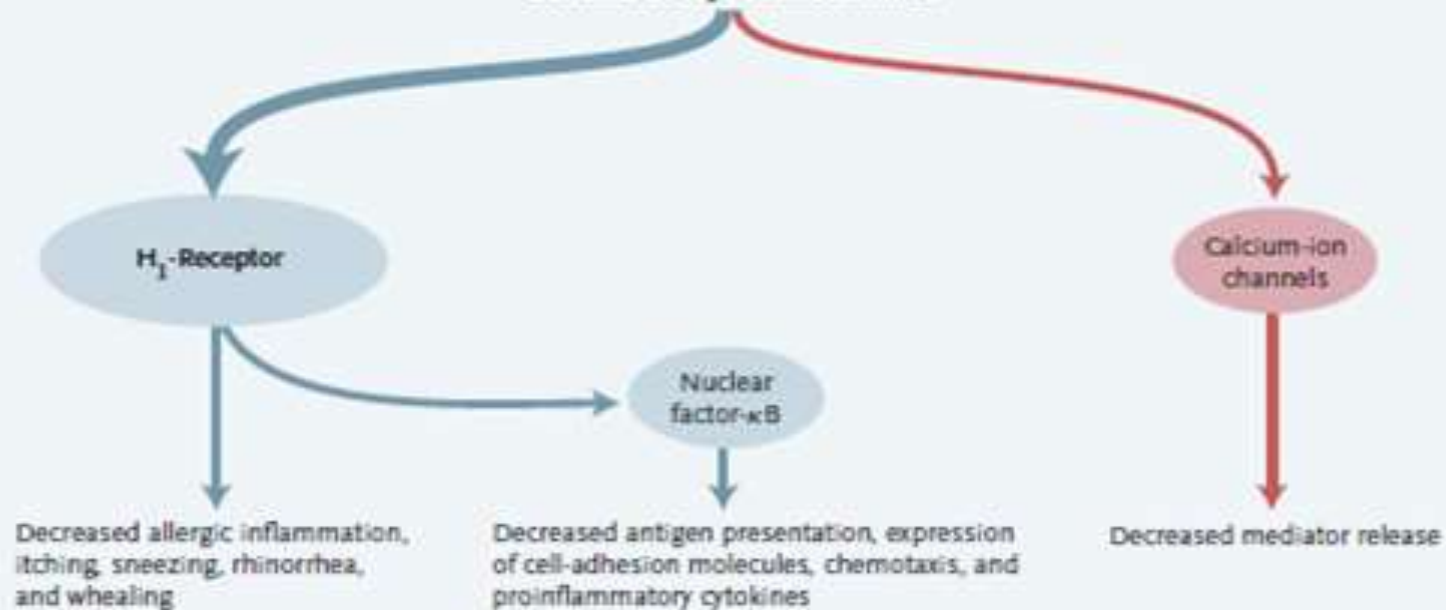
- Oral histamine H₁ antagonists, or intraocular histamine H₁ antagonists, or intraocular disodium cromoglycate (or eye irrigation with physiological saline).

Consider specific immunotherapy.

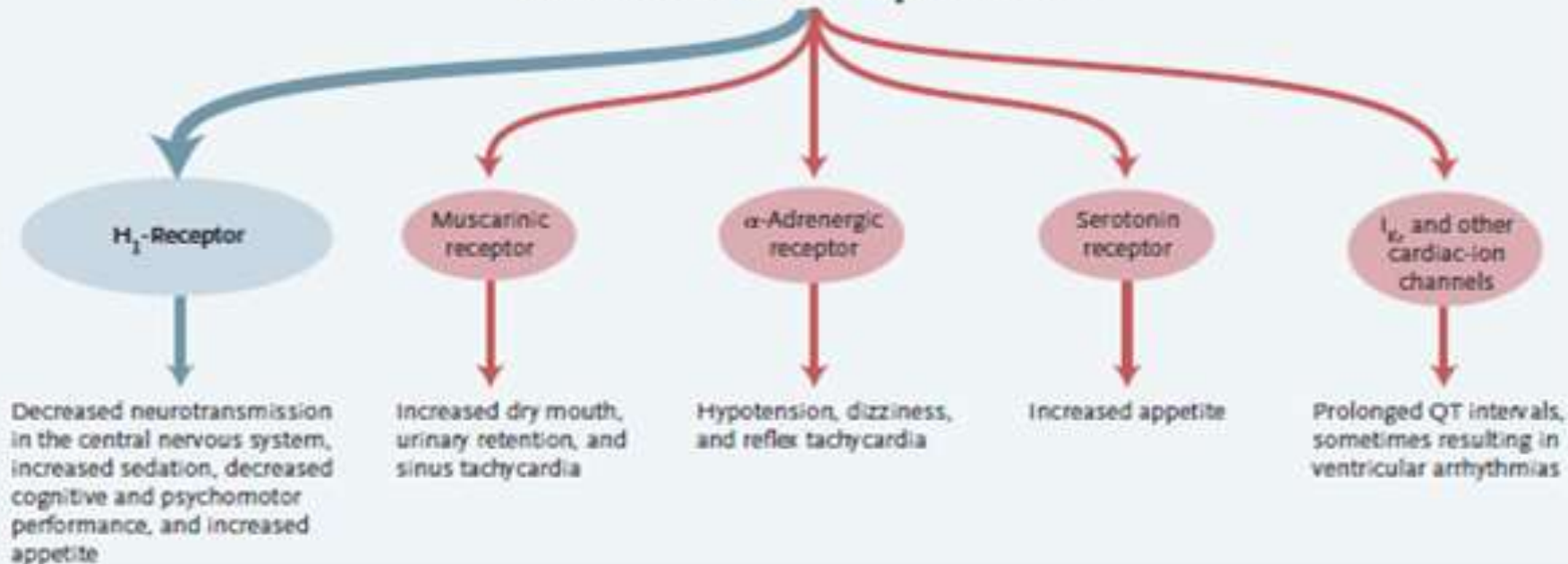
Antihistamin

Medication	Relative Sedative Effect	Relative Anticholinergic Effect
Alkylamine class, nonselective		
Brompheniramine maleate	Low	Moderate
Chlorpheniramine maleate	Low	Moderate
Dexchlorpheniramine maleate	Low	Moderate
Ethanolamine class, nonselective		
Carbinoxamine maleate	High	High
Clemastine fumarate	Moderate	High
Diphenhydramine hydrochloride	High	High
Ethylenediamine class, nonselective		
Pyrilamine maleate	Low	Low to none
Tripelennamine hydrochloride	Moderate	Low to none
Phenothiazine class, nonselective		
Promethazine hydrochloride	High	High
Piperidine class, nonselective		
Cyproheptadine hydrochloride	Low	Moderate
Phenindamine tartrate	Low to none	Moderate
Phthalazinone class, peripherally selective		
Azelastine (nasal only)	Low to none	Low to none
Piperazine class, peripherally selective		
Cetirizine	Low to moderate	Low to none
Piperidine class, peripherally selective		
Desloratadine	Low to none	Low to none
Fexofenadine	Low to none	Low to none
Loratadine	Low to none	Low to none

Benefits of H₁-Antihistamines



Potential Adverse Effects of H₁-Antihistamines



Decongestan Nasal

Medication	Duration (h)
Short-acting	
Phenylephrine hydrochloride	Up to 4
Intermediate-acting	
Naphazoline hydrochloride	4–6
Tetrahydrozoline hydrochloride	
Long-acting	
Oxymetazoline hydrochloride	Up to 12
Xylometazoline hydrochloride	

Nasal Steroid

Medication	Dosage and Interval
Beclomethasone dipropionate	>12 y: 1 inhalation (42 mcg) per nostril 2–4 times a day (maximum, 336 mcg/day) 6–12 y: 1 inhalation per nostril 3 times per day
Beclomethasone dipropionate, monohydrate	>12 y: 1–2 inhalations once daily 6–12 y: 1 inhalation per nostril (42 mcg) twice daily to start
Budesonide	>6 y: 2 sprays (64 mcg) per nostril in AM and PM or 4 sprays per nostril in AM (maximum, 256 mcg)
Flunisolide	Adults: 2 sprays (50 mcg) per nostril twice daily (maximum, 400 mcg)
Fluticasone	Children: 1 spray per nostril 3 times a day Adults: 2 sprays (100 mcg) per nostril once daily; after a few days decrease to 1 spray per nostril Children >4 y and adolescents: 1 spray per nostril once daily (maximum, 200 mcg/day)
Mometasone furoate	>12 y: 2 sprays (100 mcg) per nostril once daily
Triamcinolone acetonide	>12 y: 2 sprays (110 mcg) per nostril once daily (maximum, 440 mcg/day)

SINUSITIS

Acute bacterial sinusitis: Bacterial infection of the paranasal sinuses lasting less than 30 days in which symptoms resolve completely.

Subacute bacterial sinusitis: Bacterial infection of the paranasal sinuses lasting between 30 and 90 days in which symptoms resolve completely.

Recurrent acute bacterial sinusitis: Episodes of bacterial infection of the paranasal sinuses, each lasting less than 30 days and separated by intervals of at least 10 days during which the patient is asymptomatic.

Chronic sinusitis: Episodes of inflammation of the paranasal sinuses lasting more than 90 days. Patients have persistent residual respiratory symptoms such as cough, rhinorrhea, or nasal obstruction.

Acute bacterial sinusitis superimposed on chronic sinusitis: Patients with residual respiratory symptoms develop new respiratory symptoms. When treated with antimicrobials, these new symptoms resolve, but the underlying residual symptoms do not.¹⁴

Conventional Criteria for the Diagnosis of Sinusitis Based on the Presence of at Least 2 Major or 1 Major and \geq 2 Minor Symptoms

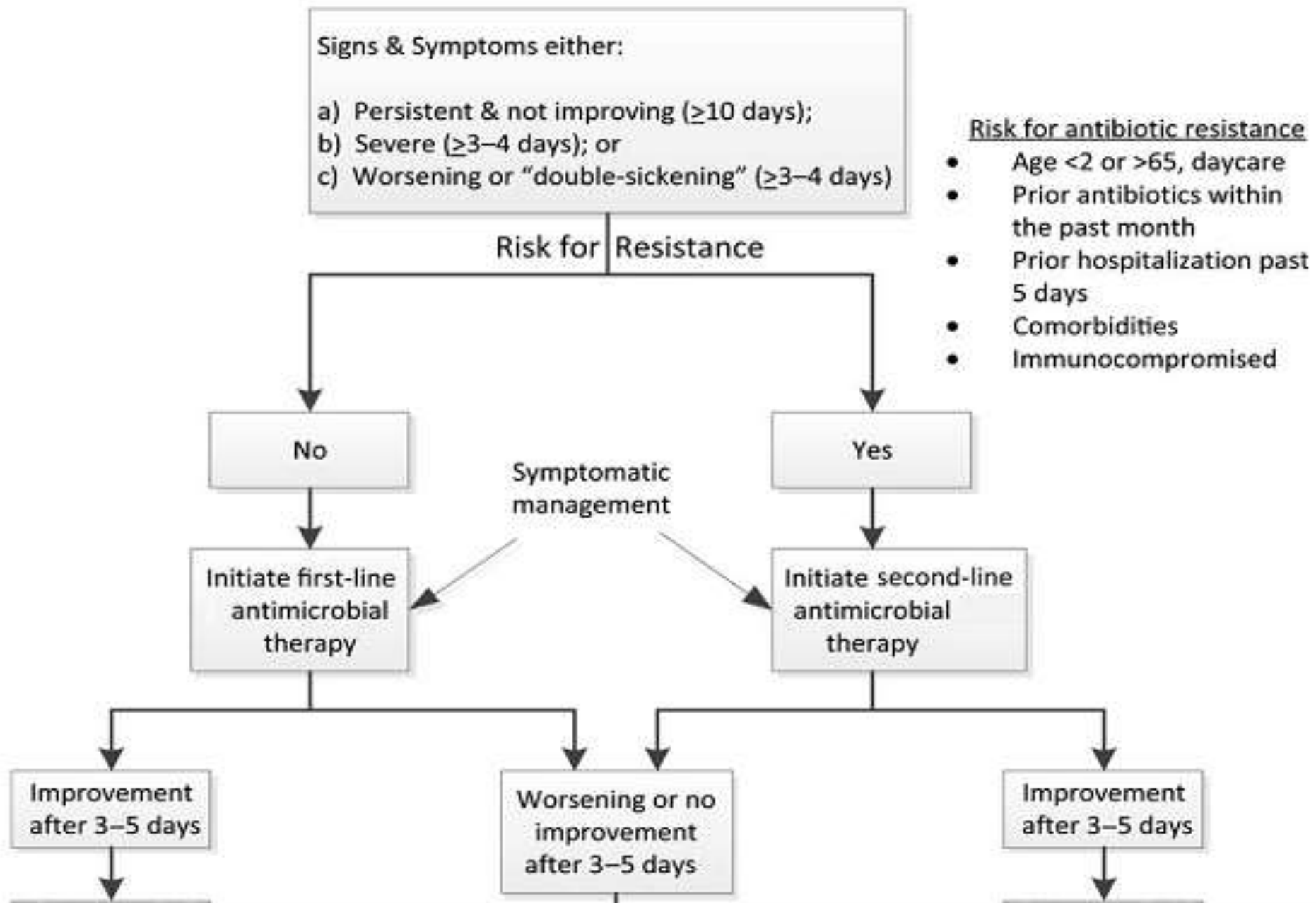
Major Symptoms	Minor Symptoms
● Purulent anterior nasal discharge	● Headache
● Purulent or discolored posterior nasal discharge	● Ear pain, pressure, or fullness
● Nasal congestion or obstruction	● Halitosis
● Facial congestion or fullness	● Dental pain
● Facial pain or pressure	● Cough
● Hyposmia or anosmia	● Fever (for subacute or chronic sinusitis)
● Fever (for acute sinusitis only)	● Fatigue

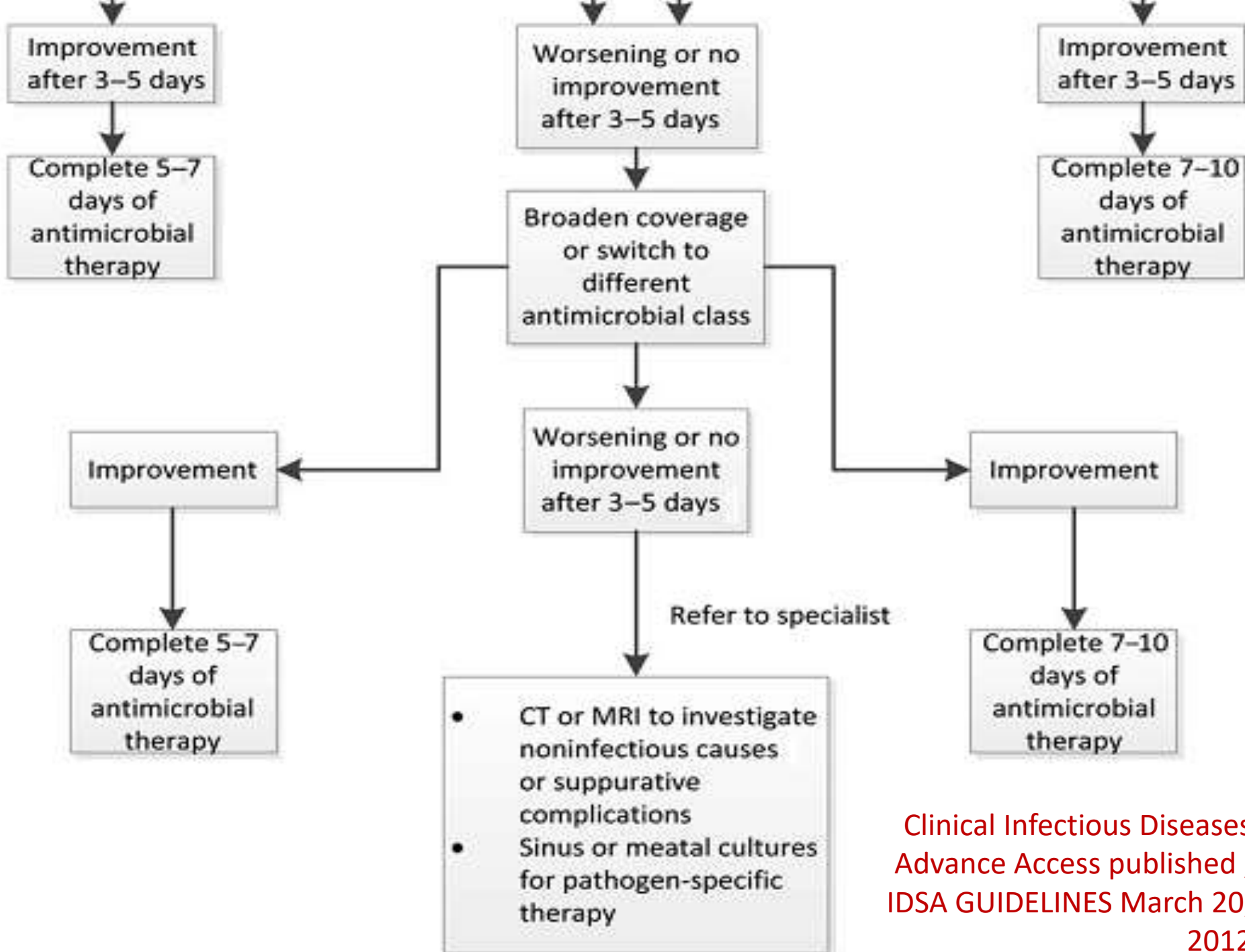
Modified from Meltzer et al [7].

Acute Bacterial Rhinosinusitis

Microbial Agent	Publications Before 2000		Publications in 2010	
	Adults ^a (%)	Children ^b (%)	Adults ^c (%)	Children ^d (%)
<i>Streptococcus pneumoniae</i>	30–43	44	38	21–33
<i>Haemophilus influenzae</i>	31–35	30	36	31–32
<i>Moraxella catarrhalis</i>	2–10	30	16	8–11
<i>Streptococcus pyogenes</i>	2–7	2	4	...
<i>Staphylococcus aureus</i>	2–3	...	13	1
Gram-negative bacilli (includes <i>Enterobacteriaceae</i> spp)	0–24	2
Anaerobes (<i>Bacteroides</i> , <i>Fusobacterium</i> , <i>Peptostreptococcus</i>) ^e	0–12	2
Respiratory viruses	3–15
No growth	40–50	30	36	29

Algorithm for the management of acute bacterial rhinosinusitis





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Antimicrobial Regimens for Acute Bacterial Rhinosinusitis in Children

Indication	First-line (Daily Dose)	Second-line (Daily Dose)
Initial empirical therapy	● Amoxicillin-clavulanate (45 mg/kg/day PO bid)	● Amoxicillin-clavulanate (90 mg/kg/day PO bid)
β-lactam allergy		
Type I hypersensitivity		● Levofloxacin (10–20 mg/kg/day PO every 12–24 h)
Non-type I hypersensitivity		● Clindamycin ^a (30–40 mg/kg/day PO tid) plus cefixime (8 mg/kg/day PO bid) or cefpodoxime (10 mg/kg/day PO bid)
Risk for antibiotic resistance or failed initial therapy		● Amoxicillin-clavulanate (90 mg/kg/day PO bid)
		● Clindamycin ^a (30–40 mg/kg/day PO tid) plus cefixime (8 mg/kg/day PO bid) or cefpodoxime (10 mg/kg/day PO bid)
		● Levofloxacin (10–20 mg/kg/day PO every 12–24 h)
Severe infection requiring hospitalization		● Ampicillin/sulbactam (200–400 mg/kg/day IV every 6 h)
		● Ceftriaxone (50 mg/kg/day IV every 12 h)
		● Cefotaxime (100–200 mg/kg/day IV every 6 h)
		● Levofloxacin (10–20 mg/kg/day IV every 12–24 h)

Abbreviations: bid, twice daily; IV, intravenously; PO, orally; qd, daily; tid, 3 times a day.

^a Resistance to clindamycin (~31%) is found frequently among *Streptococcus pneumoniae* serotype 19A isolates in different regions of the United States [94].

Antimicrobial Regimens for Acute Bacterial Rhinosinusitis in Adults

Indication	First-line (Daily Dose)	Second-line (Daily Dose)
Initial empirical therapy	<ul style="list-style-type: none"> ● Amoxicillin-clavulanate (500 mg/125 mg PO tid, or 875 mg/125 mg PO bid) 	<ul style="list-style-type: none"> ● Amoxicillin-clavulanate (2000 mg/125 mg PO bid)
β-lactam allergy		<ul style="list-style-type: none"> ● Doxycycline (100 mg PO bid or 200 mg PO qd) ● Doxycycline (100 mg PO bid or 200 mg PO qd) ● Levofloxacin (500 mg PO qd) ● Moxifloxacin (400 mg PO qd)
Risk for antibiotic resistance or failed initial therapy		<ul style="list-style-type: none"> ● Amoxicillin-clavulanate (2000 mg/125 mg PO bid) ● Levofloxacin (500 mg PO qd) ● Moxifloxacin (400 mg PO qd)
Severe infection requiring hospitalization		<ul style="list-style-type: none"> ● Ampicillin-sulbactam (1.5–3 g IV every 6 h) ● Levofloxacin (500 mg PO or IV qd) ● Moxifloxacin (400 mg PO or IV qd) ● Ceftriaxone (1–2 g IV every 12–24 h) ● Cefotaxime (2 g IV every 4–6 h)

Abbreviations: bid, twice daily; IV, intravenously; PO, orally; qd, daily; tid, 3 times a day.

Indications for Referral to a Specialist

- Severe infection (high persistent fever with temperature $>39^{\circ}\text{C}$ [$>102^{\circ}\text{F}$]; orbital edema; severe headache, visual disturbance, altered mental status, meningeal signs)
- Recalcitrant infection with failure to respond to extended courses of antimicrobial therapy
- Immunocompromised host
- Multiple medical problems that might compromise response to treatment (eg, hepatic or renal impairment, hypersensitivity to antimicrobial agents, organ transplant)
- Unusual or resistant pathogens
- Fungal sinusitis or granulomatous disease
- Nosocomial infection
- Anatomic defects causing obstruction and requiring surgical intervention
- Multiple recurrent episodes of acute bacterial rhinosinusitis (ABRS) (3–4 episodes per year) suggesting chronic sinusitis
- Chronic rhinosinusitis (with or without polyps or asthma) with recurrent ABRS exacerbations
- Evaluation of immunotherapy for allergic rhinitis

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