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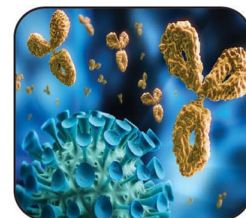
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Review of PHARMACOLOGY

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***Facts and concepts based on latest editions of
KDT, Katzung, Goodman Gilman,
Harrison and CMDT***



**Gobind Rai Garg
Sparsh Gupta**

16th Edition



JAYPEE

Review of **PHARMACOLOGY**

Sixteenth Edition

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How to Use this Book

1. FOR SECOND PROF STUDENTS:

It is preferable to begin reading this book during your second year MBBS to build your basics right from the beginning.



Read the theory of a chapter from this book and then read the textbook. You will be able to easily understand the textbook now.



Now read the theory of that chapter once again.



Now solve the MCQs from the book.



Follow this with another reading from the textbook.

- This completes your chapter with one reading and revision.
- While reading the book, either make notes or mark in the book itself for quick revision. Mark the difficult and important MCQ for further revision.
- Do this for all the chapters.
- After completing the syllabus, start revising.
- Remember minimum 4-5 readings are required as Pharmacology is a volatile subject.

2. FOR STUDENTS WHO HAVE PASSED SECOND PROF (FINAL YEAR STUDENTS, INTERNS AND POST-INTERNS):

- We do not recommend studying textbook now due to paucity of time. However, textbook should be kept as a reference material.
- Do not confuse yourself by studying many books.
- No other study material is required for entrance exams apart from this book.
- You should spend 10-15 days for Pharmacology for first reading.

Read the theory of a chapter and solve MCQs of that chapter. While solving MCQs, solve minimum 50-100 questions at a stretch and only after this compare the answers.



Re-read the theory of this chapter and now mark the important points for revision. Remember, you should mark only that much so that the next reading of book can be finished in one third of the time. Similarly, encircle or mark the important MCQ for revision.



Do same for all the chapters.



During revision, study only marked portion with encircled MCQ only. Second reading should be finished in 4-5 days.



Similarly third and fourth revision should be completed in 3 days each.



Give one last revision just before exams in a day or two.

- Remember, Pharmacology is a very important subject. You can answer nearly 35-40 questions in NEET from this book as it covers not only Pharmacology but many related subjects.

Best wishes

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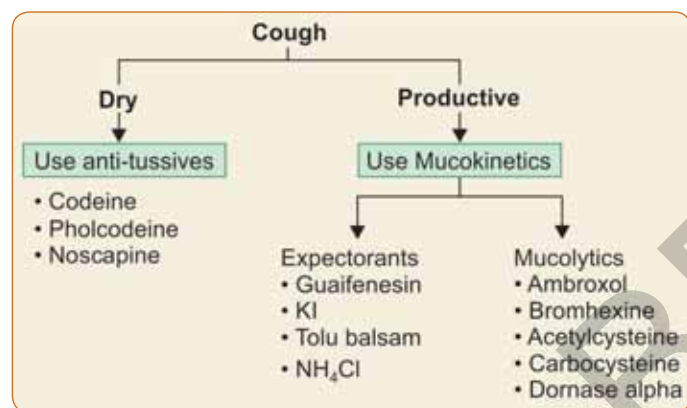
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Most Important ★★★
 Very Important ★★
 Important ★

Respiratory System

COUGH

It may be productive (with expectoration) or non productive (dry cough). Dry cough is useless and should be suppressed by using an anti-tussive agent. On the other hand, productive cough should be allowed but made easier by the use of expectorants or mucolytics.



Mucokinetics

These are the drugs which help in clearance of mucus from airways. These may be expectorants or mucolytics.

- **Expectorants:** These increase the amount and hydration of secretions. These include guaifenesin, sodium citrate, potassium citrate, potassium iodide, tolu balsam, vasaka and ammonium chloride etc.
 - **Guaifenesin** is commonly added expectorant in cough syrups
 - **Potassium iodide** acts directly (by irritating bronchial glands) as well as indirectly (by gastric irritation) to increase bronchial secretions. However, it interferes with thyroid function tests and on prolonged use, can also lead to hypothyroidism. It **may also lead to flaring up of acne** in adolescents. It should not be used in pregnancy (risk of fetal hypothyroidism) and in patients sensitive to iodine.
- **Mucolytics:** These agents dissolve thick mucus and help to relieve respiratory difficulties. Mucolytics dissolve various chemical bonds within secretions that help in lowering the viscosity of secretions. These include acetylcysteine, carbocysteine, ambroxol, bromhexine and dornase alpha etc.
 - **Dornase alpha** is an enzyme that acts as a mucolytic agent
 - **Acetylcysteine** and **carbocysteine** also help in decreasing viscosity of secretions

- **Bromhexine** causes depolymerization of mucopolysaccharides and thus results in making the mucus less viscid (mucolytic).
- **Ambroxol** (metabolite of bromhexine) is also a mucolytic drug.

Anti-tussives

These drugs suppress cough, either by acting directly in the CNS or by inhibiting cough impulses in the respiratory tract. These drugs should be used **only for dry** (non productive) cough. Anti-tussives include **codeine, pholcodeine, noscapine** and **dextromethorphan**.

BRONCHIAL ASTHMA

It is a condition of bronchial hyperreactivity associated with inflammation. IgE binds to mast cells on first exposure to antigen. On subsequent exposure, the antigen binds to this IgE (bound to mast cells) and its activation leads to degranulation of mast cells, resulting in the release of mediators. Important mediators include leukotrienes (LTs), prostaglandins (PGs), platelet activating factor (PAF), histamine and protease enzymes. These mediators can lead to bronchoconstriction (and thus acute attack of asthma) as well as inflammation leading to hyperreactivity. **The only drugs effective for the treatment of acute attack of bronchial asthma are bronchodilators** (sympathomimetics, parasympatholytics and methyl xanthines). Other drugs used in asthma include those inhibiting IgE (omalizumab), stabilizing mast cells (sodium cromoglycate), decreasing production of mediators (corticosteroids and zileuton) and those inhibiting the actions of mediators (zafirlukast, montelukast) (Fig. 10.1).



Key Points

The only drugs effective for the treatment of acute attack of bronchial asthma are bronchodilators.

1. BRONCHODILATORS (FIG. 10.2)

These are the only drugs useful in terminating acute attack of bronchial asthma. Three group of drugs may act as bronchodilators:

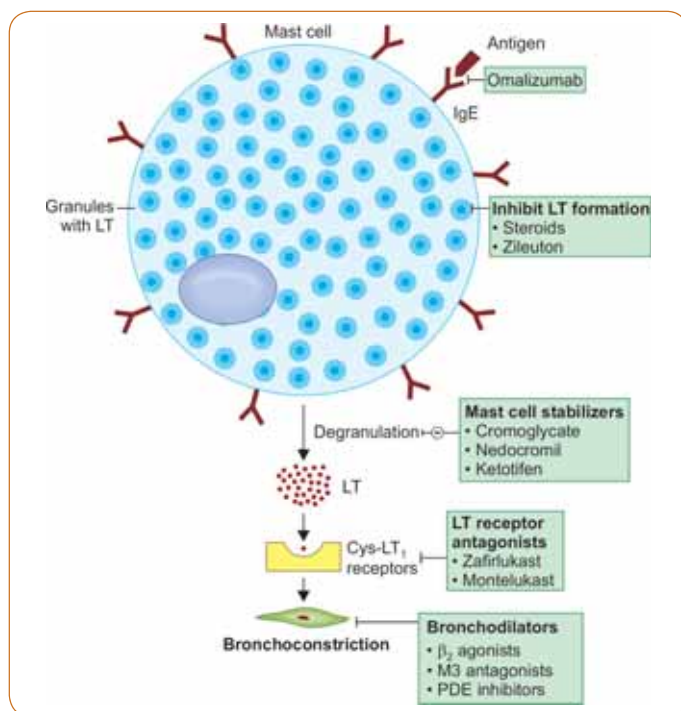
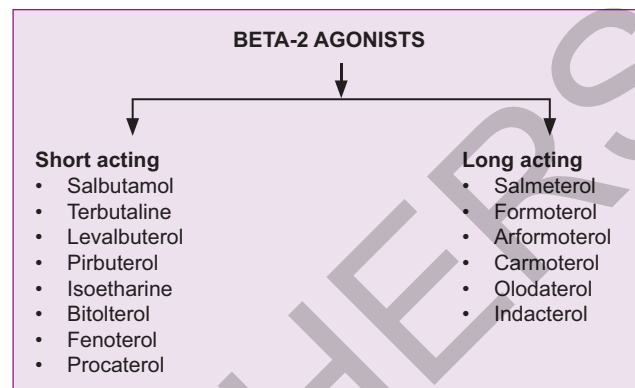


FIG. 10.1: Targets for treatment and prophylaxis of bronchial asthma.

Sympathomimetics

- Adrenergic drugs (β_2 agonists) act by:
 - Stimulating GPCRs that result in the activation of adenylyl cyclase and finally increase in cAMP, which cause smooth muscle relaxation (*bronchodilation*).
 - cAMP also *decreases the mediator release from mast cells*.
 - These drugs *also inhibit microvascular leakage and increase mucociliary transport* by increasing ciliary activity.
- By inhalational route, these are the **fastest acting drugs**. Adrenaline and isoprenaline produce bronchodilation quickly whereas ephedrine has slower onset of action. Above mentioned drugs are non selective and thus are not preferred (tachycardia and increase in the BP are their side effects). Selective β_2 agonists are preferred agents for bronchial asthma. *Salbutamol, Levalbuterol, pirbuterol, terbutaline, isoetharine, bitolterol, fenoterol and procaterol are short acting whereas salmeterol, formoterol, arformoterol, carmoterol, olodaterol and indacaterol are long acting β_2 agonists.*
- Salbutamol (albuterol), metaproterenol, pirbuterol and terbutaline** are fast acting drugs by inhalational route (*optimal particle size: 2-5 μm , deposition can be increased by holding the breath in inspiration*), so they are used for aborting an attack of acute asthma. These drugs are **not suitable for prophylaxis** because of shorter duration of action.
- Chronic use of long acting β_2 agonists may lead to tolerance due to down regulation of β_2 receptors. **Salmeterol, bambuterol (prodrug of terbutaline) and formoterol are long acting β_2 selective agonists.**
- Salmeterol** is **delayed acting**, therefore useful only for prophylaxis whereas **formoterol** is **fast acting also**, so it is useful in aborting acute attack of bronchial asthma as well as for prophylaxis.
- Bitolterol is a prodrug and is activated to form colterol by esterases in lung.*

- Muscle tremor** and tachycardia are the major side effect of β_2 agonists.
- Salbutamol causes intracellular movement of potassium from blood and result in hypokalemia



MNEMONIC

SALMETEROL and FORMOTEROL contains metro in name. Metro runs long distances, so these are long acting. Salmeterol contains S, i.e. slow acting (not for acute attack) whereas Formoterol starts with F, i.e. fast acting (so, can be used for acute attack).

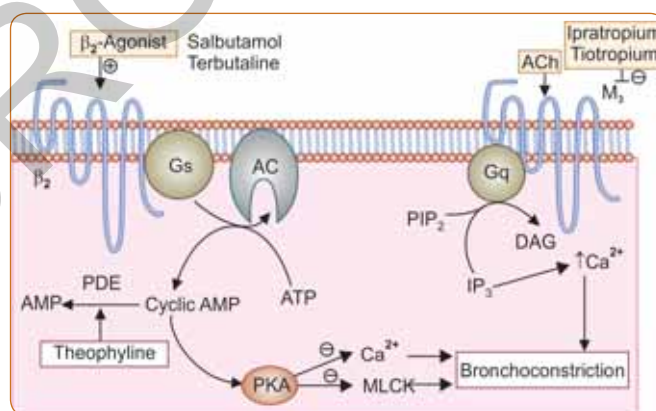


FIG. 10.2: Mechanism of action of bronchodilators.

Anticholinergics

These drugs cause dilation of mainly **large airways** (β_2 agonists cause bronchiolar dilation). These are **less efficacious and slower acting** bronchodilators than sympathomimetics. These drugs are **more effective for COPD** than bronchial asthma. **Ipratropium, tiotropium and umclidinium** are anticholinergic drugs (M_3 antagonists) that can be used only by inhalational route. **Tiotropium and umclidinium are longer acting** than ipratropium. Tiotropium is used in long-term prophylaxis of bronchial asthma (only in combination with corticosteroids) whereas umeclidinium is used for maintenance treatment of airflow obstruction in COPD. These drugs are **bronchodilators of choice in patients of bronchial asthma on β blocker therapy** (β_2 agonists will be ineffective).



Revefenacin is a new anticholinergic drug. It has recently been approved for COPD by inhalational route.

Methylxanthines

This group includes caffeine, theophylline and theobromine. Methylxanthines act by blockade of adenosine receptors (adenosine is a bronchoconstrictor) and by inhibition of enzyme phosphodiesterase (involved in the breakdown of cAMP). At high dose, these drugs can result in release of Ca^{++} from sarcoplasmic reticulum in skeletal and cardiac muscles. These drugs are CNS stimulant drugs and at toxic dose can result in tremors, delirium and convulsions. These can lead to vomiting due to gastric irritation and CTZ stimulation. **Theophylline** is a potent vasodilator (due to increase in cAMP) and can cause hypotension which leads to reflex tachycardia. Positive chronotropic and inotropic effects may be produced even at low doses due to inhibition of presynaptic adenosine receptors (heteroreceptors at sympathetic nerve endings). At toxic doses, arrhythmias can be produced. Caffeine can cause vasoconstriction of cranial vessels (so useful in migraine) whereas dilation of other blood vessels takes place with methylxanthines. Therapeutic effect of methylxanthines in bronchial asthma is due to bronchodilation, which is slow but sustained. Theophylline is given by oral route and **aminophylline** is administered by **slow IV infusion**. Kinetics of **theophylline** changes from first order to **zero order** within therapeutic dose range. It has **narrow therapeutic index**. Toxic symptoms are related to GIT, CNS and CVS as described above. Smoking and enzyme inducers (phenytoin, phenobarbitone, rifampicin etc.) decrease the plasma levels of theophylline, therefore require increase in dose. On the other hand, drugs like ciprofloxacin, erythromycin and cimetidine are powerful microsomal enzyme inhibitors, predisposing to toxicity of theophylline. **Children clear theophylline faster than adults** (require high dose) whereas clearance of theophylline is **slower in elderly, premature infants and neonates** (require less dose). Further, children are more liable to develop CNS toxicity.

Interactions of Theophylline

Dose reduction is required in	Dose should be increased in
- Elderly - Patients with CHF - Patients of pneumonia	- Smokers - Children - With enzyme inducers like rifampicin and phenobarbitone
- Hepatic insufficiency - With enzyme inhibitors like ciprofloxacin, cimetidine and erythromycin	

Apart from bronchial asthma, theophylline can also be used to **reduce** the frequency of **episodes of apnea in premature infants** because methylxanthines improve contractility and reverse fatigue of diaphragm. **Roflumilast, cilomilast and tofigilast** are **PDE-4 inhibitors** being tried for bronchial asthma.

Note

Recently, it has been found that theophylline at low doses exert anti-inflammatory action by activating a nuclear enzyme; histone deacetylase-2.

2. DRUG INHIBITING IGE ACTION

Omalizumab is a monoclonal antibody against circulating IgE and is indicated to prevent the attack of bronchial asthma in patients not responding to combination of long acting β_2 agonist and a high dose of inhalational steroid. It is administered by subcutaneous route.

3. MAST CELL STABILIZERS

Sodium cromoglycate and **nedocromil** prevent the degranulation of mast cells by trigger stimuli. These are indicated only for prophylaxis of bronchial asthma. These are given by inhalational route. **Ketotifen** has antihistaminic action apart from mast cell stabilizing property and is specially indicated for patients with multiple disorders (atopic dermatitis, perennial rhinitis, conjunctivitis, etc.).

4. DRUGS DECREASING THE ACTION OF LTS

This group includes the drugs that interfere with generation of LTs (corticosteroids and lipoxygenase inhibitors) and also that interfere with the action of LTs (leukotriene receptor antagonists).

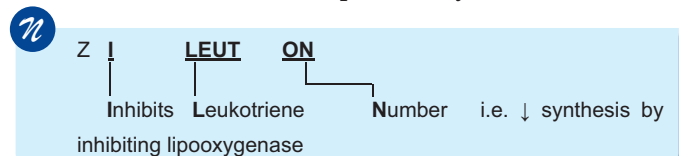
Corticosteroids

These are potent anti-inflammatory drugs and also decrease bronchial hyperreactivity and mucosal edema. Anti-inflammatory action is due to decreased recruitment of inflammatory cells as well as decreased production of PGs and LTs. Arachidonic acid (AA) is released from the membrane phospholipids with the help of enzyme phospholipase A_2 that is inhibited by corticosteroids. AA is converted to PG and TX by cyclooxygenase and to LT with the help of enzyme 5-lipoxygenase (5LOX). Thus, these mediators are not generated when corticosteroid therapy is initiated. Systemic steroids have a lot of adverse effects, therefore are reserved for resistant severe chronic asthma and in status asthmaticus. These are not bronchodilators but increase the sensitivity to β_2 agonists. **Inhaled steroids** include **beclomethasone, budesonide, mometasone, fluticasone, flunisolide** and **triamcinolone**. These have very little oral absorption and thus little systemic activity after inhalation (>90% reaches GIT after inhalational route, only 4-5% is retained in lungs). **Hoarseness of voice and oropharyngeal candidiasis** are very common adverse effects. Candidiasis can be prevented by gargling after each dose and topical nystatin (can be used for treatment also). *Systemic corticosteroids should be avoided in pregnancy but inhaled steroids are safe.* **Ciclesonide** is an inhaled corticosteroid which is metabolized by enzymes in the lungs. Thus, it has least risk of toxicity from systemic absorption when given inhalationally. It is known as soft steroid.

Intramuscular triamcinolone acetonide is a depot preparation but proximal myopathy is a major problem with this therapy.

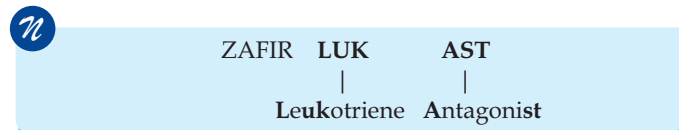
Lipoxygenase Inhibitors

Zileuton inhibits synthesis of LTB_4 (chemotactic) and LTC_4 and LTD_4 (bronchoconstrictor). Limiting features of this drug are short duration of action and **hepatotoxicity**.



LT Receptor Antagonists

Montelukast and **zafirlukast** inhibit the bronchoconstrictor action of LTs at $cys\ LT_1$ receptor. These are used as prophylactic agents for bronchial asthma. These are very safe drugs but few cases of **Churg Strauss syndrome** (vasculitis with eosinophilia) have been associated with their use.



5. MONOCLONAL ANTIBODIES AGAINST IL-4 AND IL-5

- *Mepolizumab* and *reslizumab* are monoclonal antibodies against IL-5. These act by inhibiting the recruitment of eosinophils.
- **Dupilumab** is a monoclonal antibody against IL-4.

SPECIAL TYPES OF ASTHMA

- **Exercise-Induced Asthma:** It typically begins after the end of exercise and recovers spontaneously within 30 minutes. Treatment is usually not required but can be done by SABA. Best method to prevent exercise-induced asthma is regular treatment with **inhaled corticosteroids** (Ref. Harrison 17th/1601) which reduces mast cells. Anti-leukotrienes, mast cell stabilizers and β_2 agonists can also be used for this function.
- **Aspirin Induced Asthma:** Recently, it has been found that aspirin acetylated COX-2 enzyme can convert arachidonic acid to 15-HETE (15-hydroxyeicosatetraenoic acid). In WBCs, 15-HETE is converted to epi-lipoxins (15-epi-LXA₄ or 15-epi LXB₄). These are called **aspirin-triggered lipoxins** and have powerful bronchoconstrictor action. This finding can explain induction of asthma with aspirin but not by other COX-inhibitors.
- **Brittle asthma** is very severe form of asthma resistant to inhalational beta 2 agonists. DOC for Type 1 brittle asthma is subcutaneous terbutaline and for type 2 brittle asthma, it is subcutaneous adrenaline.

Note

- LABA should not be given in the absence of ICS therapy as they do not control the underlying inflammation. Recently, FDA has issued a black box warning for this combination due to slightly increased risk of mortality from asthma attacks.
- In pregnancy; SABA, ICS and theophylline are considered safe. If oral corticosteroids are required prednisone should be used. Because, for action it needs to be converted to prednisolone and fetal liver cannot carry out this reaction. Fetus is thus protected from the systemic effects of corticosteroids.

AEROSOL DELIVERY OF DRUGS

Four classes of anti-asthma drugs (β_2 agonists, anticholinergics, sodium cromoglycate and steroids) can be administered by inhalational route. This route is aimed to decrease systemic side effects of these drugs. Two types of aerosols can be used.

- **Aerosols using drug in solution:** These include *metered dose inhaler* (MDI) and *nebulizer*.

- **MDI** use chlorofluorocarbons (less preferred due to their effect on ozone layer) or hydrofluoroalkane propellants. These deliver the drug in spray form. Disadvantage of these devices is that they *require proper co-ordination* between deep inspiration and inhaler activation which many patients (especially children and elderly) are unable to do. Use of a spacer decrease the requirement of this co-ordination
- **Nebulizers** produce a mist of drug solution generated by pressurized air. These *do not require hand-inspiration co-ordination* and are therefore preferred in children, elderly and very severe episodes of asthma.

- **Aerosols using drugs as dry powder:** These include **spinaler** and **rotahaler**. Disadvantage of these devices is that they *require high velocity inspiration* (not suitable for children,

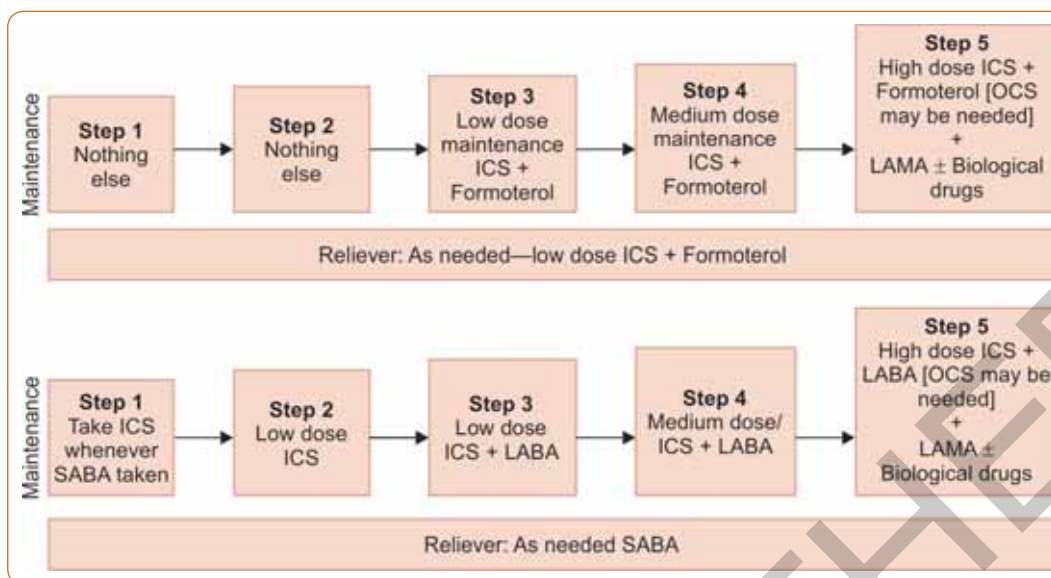
elderly and very sick patients) and these can cause *irritation of the air passage* (leading to cough and bronchoconstriction).



GLOBAL INITIATIVE OF ASTHMA (GINA)-2021 GUIDELINES

- According to GINA-2021 guidelines, short acting beta 2 agonists (SABA) alone are not recommended for treatment of asthma. Patients should receive Inhaled corticosteroids (ICS) containing controller regimen to reduce the risk of serious exacerbations and to control symptoms.
- Treatment figures for adult and adolescents have two tracks based on choice of reliever medication:
 - **Track 1:** It is *preferred approach*. The reliever is low dose ICS – Formoterol combination
 - **Track 2:** It is *alternative approach*. SABA is reliever

Presenting symptoms	Step	Track 1 (Preferred initial treatment)	Track 2 (Alternative initial treatment)
• Asthma symptoms less than twice a month • No risk factors for exacerbations	Step 1	As-needed Low dose ICS + Formoterol	Take ICS with or just after SABA (whenever needed)
Symptoms twice a month or more but less than 4-5 days a week	Step 2	As-needed Low dose ICS + Formoterol	Low dose ICS maintenance daily + As-needed SABA
Symptoms most days or waking due to asthma once a week or more	Step 3	Low dose ICS + Formoterol maintenance + As-needed low dose ICS + formoterol (MART: maintenance and reliever therapy)	Low dose ICS + LABA maintenance + As-needed SABA
Daily symptoms or waking with asthma once a week or more and low lung function	Step 4	Medium dose ICS + formoterol maintenance + As-needed low dose ICS + formoterol	Medium dose ICS + LABA maintenance + As-needed SABA
Severely uncontrolled symptoms	Step 5	High dose ICS + formoterol (OCS may be required) + Add on LAMA ± Biological drugs	High dose ICS + LABA (OCS may be needed) + Add on LAMA ± Biological agents



Note :

1. SABA is short acting β_2 agonists (like salbutamol and terbutaline) whereas LABA is long acting β_2 agonists (like salmeterol and Formoterol).
2. ICS means inhaled corticosteroids and OCS means oral corticosteroids
3. LAMA is long acting muscarinic antagonists like tiotropium
4. Biological drugs may be anti-IgE (Omalizumab), anti IL-5 (Reslizumab, Mepolizumab) and anti IL-4R (dupilumab)
5. Azithromycin may be added in Step 5 after specialist referral.

Golden Points

1. Potassium iodide acts directly (by irritating bronchial glands) as well as indirectly (by gastric irritation) to increase bronchial secretions.
2. **Umeclidinium** (anticholinergic) plus **vilanterol** (LABA) combination is recently approved for maintenance treatment of COPD.
3. Anticholinergics are more effective for COPD than bronchial asthma.
4. Anticholinergic drugs are bronchodilators of choice in patients of bronchial asthma on β blocker therapy.
5. Theophylline is a potent vasodilator and can cause hypotension which leads to reflex tachycardia.
6. Children clear theophylline faster than adults (require high dose) whereas clearance of theophylline is slower in elderly, premature infants and neonates (require less dose).
7. Roflumilast, cilomilast and tofemilast are PDE-4 inhibitors being tried for bronchial asthma.
8. Ketotifen has antihistaminic action apart from mast cell stabilizing property.
9. **Mepolizumab** is an IL-5 antagonist indicated for add-on therapy in severe asthma.
10. **Ciclesonide** is an inhaled corticosteroid which is metabolized by enzymes in the lungs. Thus, it has least risk of toxicity from systemic absorption when given inhalationally. It is known as **soft steroid**.
11. Recently MgSO_4 by intravenous and inhalational route has been tried for acute severe asthma.

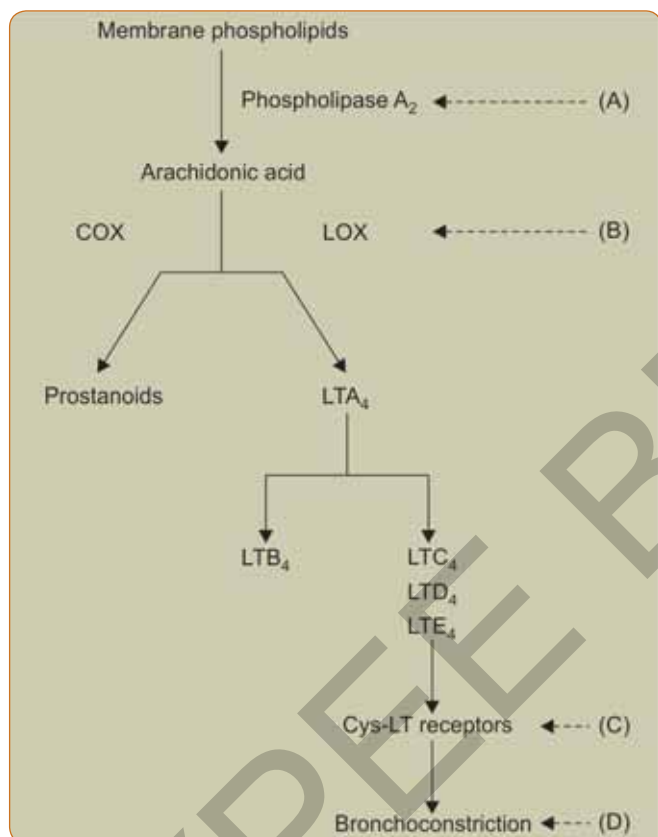
Drug of Choice

Condition	Drug of choice
• Bronchial Asthma	
– Acute attack	Low dose ICS + formoterol
– Acute attack during labour	Ipratropium
– Acute attack in patients on beta blocker therapy	Ipratropium
– Prophylaxis	Corticosteroids
• Exercise-induced asthma	
– Acute attack	Low dose ICS + formoterol
– Prophylaxis	Corticosteroids
• Aspirin-induced asthma	
– Acute attack	Low dose ICS + formoterol
– Prophylaxis	Corticosteroids
• Brittle asthma	
– Type 1	SC Terbutaline infusion
– Type 2	SC Adrenaline

Image Based Questions

1. A 20-year-old male, Chintu is being treated with zafirlukast for bronchial asthma. The most likely site of action of this drug from the below Figure can be deciphered as:

- (a) A
- (b) B
- (c) C
- (d) D



2. Which of the following drug cannot be given by the route shown in the figure?



- (a) Salbutamol
- (b) Budesonide
- (c) Cromoglycate
- (d) Montelukast

3. For which of the following type of patients, the device shown in image should be used for delivering the drug?



- a. An elderly patient presenting in emergency with exacerbation of acute attack of asthma
- b. Routine use for prophylaxis of asthma in 40 years old male with frequent travelling job
- c. A 5-year-old child with asthma
- d. Both a and c

Explanations

1. **Ans. (c) C**

(Ref: Katzung 11th/e p349)

The drug zafirlukast is a cys-LT receptor antagonist.

2. **Ans (d) Montelukast**

The anti-asthma drugs which are available by inhalational route are:

- Beta 2 agonists like salbutamol, terbutaline
- Anticholinergics like ipratropium
- Steroids like budesonide
- Mast cell stabilizer like cromoglycate

3. **Ans. (d) Both a and c**

The device shown in the figure is a nebulizer. It is used to deliver inhalational drugs (mostly bronchodilators) for:

- Acute severe asthma
- Elderly patients and patients who are unable to take deep inspiration
- Children

Multiple Choice Questions

- Theophylline causes diuresis because of:** (NEET Pattern 2020)
 - PDE4 inhibition
 - Adenosine A1 receptor antagonism
 - Beta 2 agonism
 - PDE 3 inhibition
- Which of the following antimicrobials should not be given to a chronic asthmatic patient managed on theophylline therapy?** (NEET Pattern 2020)
 - Erythromycin
 - Cefotaxime
 - Cotrimoxazole
 - Amoxicillin
- Which of the following is not an adverse effect of salbutamol?** (AIIMS May 2018)
 - Hypoglycemia
 - Hypokalemia
 - Tremors
 - Tachycardia
- A patient presented with acute exacerbation of bronchial asthma. Salbutamol inhalation did not improve the condition of the patient. So, intravenous corticosteroids and aminophylline were added and the condition improved. What is the mechanism of action of corticosteroids in this condition?** (AIIMS Nov 2017)
 - They cause bronchodilation when given with xanthines
 - They increase bronchial responsiveness to salbutamol
 - They increase the action of aminophylline on adenosine receptors
 - They increase the mucociliary clearance
- A patient of bronchial asthma was prescribed 2 puffs from a metered dose inhaler of budesonide. Which of the following should NOT be done?** (AIIMS Nov 2016)
 - Shake the inhaler well before use
 - Clean the inhaler after every use
 - Wait for 1 minute in between puffs
 - Rinse mouth after every use
- Which of the following drugs can be administered by subcutaneous route?** (AIIMS May 2013)
 - Albuterol
 - Terbutaline
 - Metaproterenol
 - Pirbuterol
- Mechanism of action of theophylline in bronchial asthma is:** (AI 2010)
 - Phosphodiesterase 4 inhibition
 - Beta2 agonism
 - Anticholinergic action
 - Inhibition of mucociliary clearance
- To prevent exercise induced bronchial asthma drug used is:** (Recent NEET Pattern Question)
 - Sodium cromoglycate
 - Ipratropium bromide
 - Terbutaline
 - Epinephrine
- Which of the following drugs has been found to be useful in acute severe asthma?** (Recent NEET Pattern Question)
 - Magnesium Sulphate
 - Anti-leukotrine
 - Cromolyn Sodium
 - Cyclosporine
- The following drug is NOT useful during acute attack of bronchial asthma:** (Recent NEET Pattern Question)
 - Salbutamol
 - Hydrocortisone
 - Cromolyn sodium
 - Theophylline
- All of the following drugs useful in bronchial asthma are bronchodilators except:** (Recent NEET Pattern Question)
 - Theophylline
 - Salmeterol
 - Beclomethasone
 - Ipratropium
- All of the following are the adverse effects seen with the use of salbutamol except:** (Recent NEET Pattern Question)
 - Tremors
 - Palpitation
 - Hypotension
 - Hypokalemia
- Which of the following is a bronchodilator?** (Recent NEET Pattern Question)
 - Corticosteroids
 - Salmeterol
 - Ketotifen
 - Sodium cromoglycate
- The drug that does not result in theophylline toxicity is:** (Recent NEET Pattern Question)
 - Ciprofloxacin
 - Amoxicillin
 - Erythromycin
 - Cimetidine
- All of the following drugs can precipitate acute attack of asthma except:** (Recent NEET Pattern Question)
 - Phenylbutazone
 - Naproxen
 - Glucocorticoids
 - Aspirin
- Ipratropium bromide used in bronchial asthma, is:** (Recent NEET Pattern Question)
 - β -Sympathomimetics
 - Methylxanthines
 - Anticholinergics
 - Mast cell stabilizers
- Which of the following is long acting sympathomimetics used in bronchial asthma?** (Recent NEET Pattern Question)
 - Salbutamol
 - Terbutaline
 - Bambuterol
 - Salmeterol
- Dextromethorphan is an:** (Recent NEET Pattern Question)
 - Antihistaminic
 - Antitussive
 - Expectorant
 - Antiallergic
- Disodium cromoglycate is used by which of the following routes?** (Recent NEET Pattern Question)
 - Inhalation
 - Oral
 - IV
 - IM
- Which is a "Soft steroid" used in bronchial asthma?** (Recent NEET Pattern Question)
 - Budesonide
 - Dexamethasone
 - Ciclesonide
 - Flunisolide

Review of PHARMACOLOGY

Salient Features

- Fully colored edition
- Plenty of eye-catching images to help aid visual memory
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- Large number of easy to grasp mnemonics
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