

Antimuscarinic bronchodilators

Inhaled antagonists of airway muscarinic receptors that widen the bronchi by removing vagal cholinergic tone rather than by stimulating relaxation, split into short-acting agents used for symptom relief and long-acting agents that anchor maintenance treatment of chronic obstructive pulmonary disease.

Online guide: <https://www.medguideglobal.com/pharmacology/respiratory-and-allergy/antimuscarinic-bronchodilators>

Content updated: 2026-08-23

Quick revision

One Liner: These agents do not stimulate airway smooth muscle to relax; they remove the parasympathetic signal that keeps it contracted, and nearly every adverse effect in the class is that same blockade turning up in tissue where it was not wanted.

1. Ipratropium is described in its label as an anticholinergic agent which, based on animal studies, appears to inhibit vagally-mediated reflexes by antagonizing the action of acetylcholine. [1]
2. Anticholinergics prevent the rise in intracellular cyclic GMP that follows the interaction of acetylcholine with the muscarinic receptor on bronchial smooth muscle. [2]
3. The long-acting members are described as producing bronchodilation through inhibition of M3 receptors at airway smooth muscle. [3][5]
4. Tiotropium has similar affinity for the muscarinic subtypes M1 to M5, so receptor-subtype selectivity is not what sets this class apart. [3]
5. Ipratropium's elimination half-life after inhalation is about two hours, and its label's maintenance schedule is four times a day. [1]
6. Tiotropium's terminal half-life in patients with COPD is approximately 25 hours, which is why the label is a once-daily maintenance one. [3]
7. Every label in the group directs that coadministration with other anticholinergic-containing medicines be avoided, because the effects add up. [1][3][5][6][7]
8. Ipratropium is a quaternary amine and is therefore not readily absorbed into the systemic circulation, which is why inhaled delivery spares most systemic antimuscarinic effects. [1]
9. Solution reaching the eyes can blur vision, cause eye pain, and precipitate or worsen narrow-angle glaucoma, so a nebuliser mouthpiece is preferred to a face mask. [2]
10. Mouth dryness was reported in 3.2% of patients given ipratropium alone, and dry mouth is among the commonest reactions in the one-year tiotropium trials. [2][3]

Overview

1. Airway smooth muscle carries a resting parasympathetic tone. Acetylcholine released from vagal endings acts on muscarinic receptors in the bronchial wall, and the ipratropium label states that anticholinergics prevent the increases in intracellular cyclic guanosine monophosphate caused by that interaction. Blocking the receptor therefore does not force the airway open; it withdraws the signal that was holding it narrowed. That distinction explains why these medicines help most where cholinergic tone is the reversible part of a fixed obstruction. [2][1]
2. The class divides on duration, not on target. Short-acting antimuscarinics, of which ipratropium is the one in general use, are given several times a day. Long-acting antimuscarinics such as tiotropium, glycopyrronium, umeclidinium and aclidinium are maintenance agents, and the NHS describes each long-acting bronchodilator dose as lasting at least twelve hours so that it is needed only once or twice a day. British practice labels the two halves SAMA and LAMA, and the abbreviations are worth learning because the choice between them is a choice about dosing interval. [10][1][3]

3. Where this class sits in disease matters as much as how it works. The inhaled antimuscarinic labels are written around chronic obstructive pulmonary disease: ipratropium, tiotropium, umeclidinium, aclidinium and revefenacin are all indicated for maintenance treatment of COPD. Only tiotropium delivered by the Respimat inhaler carries an asthma indication, and that too is maintenance rather than relief, with maximum benefit in lung function taking up to four to eight weeks. Acute relief in asthma belongs to the inhaled short-acting beta-2 agonist, which is also what the labels here name as the treatment for paradoxical bronchospasm. [4][1][5][6][7]

4. Because the receptor being blocked is present far beyond the lung, the adverse-effect list reads as a map of muscarinic receptor distribution. The eye, the bladder and the salivary glands supply the three problems that recur across every label in the group, and the reason they stay mild in practice is pharmacokinetic rather than pharmacodynamic: these are quaternary ammonium compounds delivered straight to the airway, so little of the dose reaches anywhere else. [1][3][8]

Classification and drug examples

Intro: Grouped by how long a single dose acts, because that is the property that decides whether an agent is used for symptom relief or as maintenance therapy. Several of these molecules are also marketed inside fixed-dose inhalers alongside a long-acting beta-2 agonist, and the NHS notes that some newer inhalers contain a combination of a long-acting beta-2 agonist and an antimuscarinic; those combination products are separate medicines with their own labels and are not covered here.

1. Name: Short-acting antimuscarinics (SAMA)

1. Note: Given several times a day. The NHS lists ipratropium as the antimuscarinic among short-acting bronchodilator inhalers, alongside the short-acting beta-2 agonists.

Name: Ipratropium bromide

1. Atrovent

2. Atrovent HFA

Route: Oral inhalation, by metered-dose inhaler or nebuliser

Note: Half-life of elimination about two hours after inhalation, with a label schedule of four times a day and a ceiling on inhalations in twenty-four hours. Its label states it is not indicated for the initial treatment of acute episodes of bronchospasm where rescue therapy is required. [1] [10][1]

2. Name: Long-acting antimuscarinics dosed once daily (LAMA)

2. Note: Maintenance agents whose receptor effect outlasts a day. All four are labelled for COPD maintenance and none is a rescue medicine.

1. Name: Tiotropium bromide

1. Spiriva HandiHaler

2. Spiriva Respimat

1. Route: Oral inhalation, by dry-powder capsule device or soft-mist inhaler

1. Note: Terminal half-life in COPD of approximately 25 hours, with bronchodilator effects that lasted longer than 24 hours. The label states plainly that it is not a rescue medication. [3]

2. Name: Umeclidinium

Incruse Ellipta

2. Route: Oral inhalation, dry-powder inhaler

2. Note: A long-acting muscarinic antagonist with an effective half-life of eleven hours after once-daily inhaled dosing. Contraindicated in severe hypersensitivity to milk proteins because of the lactose carrier. [5]

3. Name: Glycopyrronium bromide (inhaled)

Seebri Breezhaler

3. Route: Oral inhalation, dry-powder capsule device

3. Note: Authorised in Europe as a maintenance bronchodilator to relieve symptoms in adults with COPD. The inhaled product is a different medicine from the oral and injectable glycopyrrolate used for drooling and for drying secretions,

even though the molecule is the same. [9][8]

4. Name: Revefenacin

Yupelri

4. Route: Oral inhalation, standard jet nebuliser with a mouthpiece

4. Note: The nebulised long-acting option, for patients who cannot manage a hand-held device. It is not recommended in patients with any degree of hepatic impairment. [7] [3][5][7][9]

3. Name: Long-acting antimuscarinics dosed twice daily

3. Note: A reminder that LAMA does not automatically mean once a day; the dosing interval is a property of the individual agent and its label.

Name: Acclidinium bromide

Tudorza Pressair

Route: Oral inhalation, breath-actuated dry-powder inhaler

Note: Indicated for maintenance treatment of COPD and given morning and evening approximately twelve hours apart. Its label states it is not indicated for the initial treatment of acute episodes of bronchospasm. [6] [6]

Mechanism of action

Summary: Competitive blockade of muscarinic acetylcholine receptors in the airway wall. Removing vagally mediated cholinergic tone allows bronchial smooth muscle to relax, and for the long-acting agents the labels attribute the bronchodilation specifically to inhibition of M3 receptors at smooth muscle. Duration of receptor occupancy, not receptor subtype selectivity, is what separates the members clinically.

Target: Muscarinic acetylcholine receptors on bronchial smooth muscle, principally the M3 subtype

Cidal Static: Symptom-relieving bronchodilation; no effect on the underlying airway disease

Kill Kinetics: Effect persists while the receptor remains occupied, from a few hours to beyond twenty-four

1. Step: 1

1. Title: Vagal cholinergic tone narrows the airway

1. Detail: Acetylcholine released from vagal endings interacts with the muscarinic receptor on bronchial smooth muscle and raises intracellular cyclic guanosine monophosphate. This standing tone is the component of airway narrowing that an antimuscarinic can reverse. [2]

2. Step: 2

2. Title: Competitive occupation of the receptor blocks the signal

2. Detail: Ipratropium is an anticholinergic, or parasympatholytic, agent which appears from animal studies to inhibit vagally mediated reflexes by antagonising the action of acetylcholine, the transmitter released at nerve endings in the lung. Anticholinergics prevent the cyclic GMP increase that acetylcholine would otherwise produce. [1][2]

3. Step: 3

3. Title: M3 blockade at smooth muscle is what the long-acting labels claim

3. Detail: Tiotropium and umeclidinium are both described as exhibiting their effect through inhibition of M3 receptors at the smooth muscle, leading to bronchodilation. Revefenacin is described the same way. The tiotropium label adds that the drug has similar affinity for the subtypes M1 to M5, so the therapeutic effect is a matter of where the drug is delivered rather than which subtype it prefers. [3][5][7]

4. Step: 4

4. Title: How long the receptor stays blocked decides the clinical role

4. Detail: Ipratropium's elimination half-life after inhalation is about two hours and its schedule is four times a day. Tiotropium's terminal half-life in COPD is around twenty-five hours and its bronchodilator effect lasted longer than a day. Umeclidinium's effective half-life after once-daily inhaled dosing is eleven hours, and acclidinium is given twice daily. [1][3][5][6]

5. Step: 5

5. Title: Quaternary ammonium structure keeps the effect local

5. Detail: Ipratropium and tiotropium are quaternary compounds, poorly absorbed from the lung surface and from the gastrointestinal tract. The ipratropium label states that the bronchodilation following inhalation is primarily a local, site-specific effect and not a systemic one, which is the reason inhaled use avoids most of the antimuscarinic burden a systemic agent would carry. [2][1][3]

6. Step: 6

6. Title: The same blockade elsewhere generates the adverse effects

6. Detail: Muscarinic receptors sit in the iris and ciliary body, the bladder and the exocrine glands, so drug that escapes the airway acts there too. Glycopyrrolate given systemically is described as a competitive inhibitor of acetylcholine receptors on peripheral tissues including salivary glands, and it is licensed on that basis to reduce chronic severe drooling, which is the clearest demonstration that the class effect follows the drug wherever it reaches. [8][3]

Major clinical uses

1. Drug: Ipratropium bromide inhalation aerosol

1. Organism: Not applicable

1. Indication: Maintenance treatment of bronchospasm associated with COPD, including chronic bronchitis and emphysema

1. Line: short-acting standard

1. Note: The label restricts it to maintenance: it is not indicated for the initial treatment of acute episodes of bronchospasm where rescue therapy is required. [1]

2. Drug: Ipratropium bromide inhalation solution

2. Organism: Not applicable

2. Indication: Nebulised maintenance treatment of COPD bronchospasm, alone or with other bronchodilators

2. Line: short-acting, nebulised

2. Note: Indicated either alone or with other bronchodilators, especially beta adrenergics. Its label is candid about the limit of the evidence: use as a single agent for the relief of bronchospasm in acute COPD exacerbation has not been adequately studied. [2]

3. Drug: Tiotropium (HandiHaler)

3. Organism: Not applicable

3. Indication: Long-term once-daily maintenance treatment of COPD bronchospasm, and reduction of COPD exacerbations

3. Line: long-acting maintenance

3. Note: One of the few agents in the group with an exacerbation-reduction claim in the indication itself. The capsules are for use only with the device and are never swallowed. [3]

4. Drug: Tiotropium (Respimat)

4. Organism: Not applicable

4. Indication: Once-daily maintenance treatment of asthma in patients six years and older, in addition to COPD

4. Line: add-on maintenance in asthma

4. Note: The only asthma indication in this class among the labels reviewed here, and it is explicitly not for the relief of acute bronchospasm. Maximum benefit in lung function may take up to four to eight weeks. [4]

5. Drug: Umeclidinium

5. Organism: Not applicable

5. Indication: Once-daily maintenance treatment of patients with chronic obstructive pulmonary disease

5. Line: long-acting maintenance

5. Note: Should not be used as rescue therapy for acute episodes of bronchospasm, and should not be started while COPD is acutely deteriorating. [5]

6. Drug: Aclidinium bromide

6. Organism: Not applicable

- 6. Indication: Twice-daily maintenance treatment of patients with chronic obstructive pulmonary disease
- 6. Line: long-acting maintenance, twice daily
- 6. Note: Taken morning and evening roughly twelve hours apart, which is the practical difference from the once-daily members of the group. [6]
- 7. Drug: Revefenacin
- 7. Organism: Not applicable
- 7. Indication: Once-daily nebulised maintenance treatment of chronic obstructive pulmonary disease
- 7. Line: long-acting maintenance, nebulised
- 7. Note: Delivered through a standard jet nebuliser with a mouthpiece connected to an air compressor, which matters both for dose delivery and for keeping the drug away from the eyes. [7]

Pharmacokinetics

- 1. Drug: Ipratropium bromide
- 1. Route: Oral inhalation
- 1. Absorption: Most of the delivered dose is swallowed and reaches the gastrointestinal tract; a quaternary amine is not readily absorbed from either site
- 1. Csf Penetration: Not applicable to airway therapy; quaternary compounds cross lipid membranes poorly
- 1. Metabolism: Partial hepatic metabolism to inactive ester hydrolysis products
- 1. Elimination: Renal; about half of an intravenous dose appears unchanged in urine
- 1. Half Life: About two hours after inhalation or intravenous administration
- 1. Dose Adjust: Label frequency is four times a day with a stated ceiling on inhalations in twenty-four hours [1]
- 2. Drug: Tiotropium bromide
- 2. Route: Oral inhalation
- 2. Absorption: A synthetic, non-chiral quaternary ammonium compound with poor gastrointestinal absorption, so swallowed drug contributes little
- 2. Csf Penetration: Not applicable to airway therapy
- 2. Metabolism: Largely excreted unchanged; metabolism is a minor pathway
- 2. Elimination: Renal; 74% of an intravenous dose is excreted unchanged in urine
- 2. Half Life: Approximately 25 hours in patients with COPD
- 2. Dose Adjust: Once-daily maintenance; not a rescue medication [3]
- 3. Drug: Umeclidinium
- 3. Route: Oral inhalation
- 3. Absorption: Inhaled dry powder with a lactose carrier that contains milk proteins
- 3. Csf Penetration: Not applicable to airway therapy
- 3. Metabolism: Hepatic
- 3. Elimination: Predominantly faecal after intravenous dosing, with 58% of radiolabel in faeces and 22% in urine
- 3. Half Life: Effective half-life of eleven hours after once-daily inhaled dosing
- 3. Dose Adjust: Once-daily maintenance; not to be used more than once in twenty-four hours [5]
- 4. Drug: Revefenacin
- 4. Route: Oral inhalation by jet nebuliser
- 4. Absorption: Delivered as a unit-dose solution through a nebuliser mouthpiece
- 4. Csf Penetration: Not applicable to airway therapy
- 4. Metabolism: Hepatic, to an active metabolite
- 4. Elimination: Not established as safe where hepatic handling is impaired
- 4. Half Life: Supports once-daily administration
- 4. Dose Adjust: Not recommended in patients with any degree of hepatic impairment [7]
- 1. No dose regimens appear on this page. Selection of an inhaler, its device and its schedule, and any change to

existing treatment, rest with the treating clinician working from a current prescribing reference and the patient's inhaler technique.

2. The pharmacokinetic point examiners come back to is that these are quaternary ammonium compounds, poorly absorbed and delivered directly to the target organ. [2][3]

3. Half-life across the group ranges from roughly two hours for ipratropium to about twenty-five hours for tiotropium, and that range is the whole basis of the SAMA and LAMA division. [1][3]

Adverse effects

1. Effect: Dry mouth

1. Detail: The predictable local antimuscarinic effect of drug deposited in the mouth and throat. Mouth dryness was reported in 3.2% of patients receiving ipratropium alone in the inhalation-solution trials, and dry mouth appears among the reactions occurring in more than five per cent of patients in the one-year placebo-controlled tiotropium trials. [2][3]

2. Effect: Upper airway and non-specific symptoms

2. Detail: Nasopharyngitis, upper respiratory tract infection, cough and arthralgia were the commonest reactions with umecclidinium; headache, nasopharyngitis and cough with aclidinium; and cough, nasopharyngitis, upper respiratory tract infection, headache and back pain with revefenacin. [5][6][7]

3. Effect: Events reflecting the underlying disease

3. Detail: In the twelve-week placebo-controlled ipratropium aerosol trials the reactions reported in more than five per cent of patients were bronchitis, COPD exacerbation, dyspnoea and headache, which is a reminder that trial adverse-event tables in this population also capture the illness being treated. [1]

1. Effect: Acute narrow-angle glaucoma

1. Detail: The ipratropium solution label advises that temporary blurring of vision, precipitation or worsening of narrow-angle glaucoma or eye pain may result if the solution comes into direct contact with the eyes. The long-acting labels carry the same caution and direct prescribers and patients to watch for eye pain or discomfort, blurred vision, visual halos or coloured images in association with red eyes.

1. Action: Every label in the group directs that these signs prompt immediate contact with a doctor; the agents are used with caution where narrow-angle glaucoma is already known, and that judgement rests with the treating clinician.

[2][3][4][5]

2. Effect: Ocular contamination during delivery

2. Detail: This is a preventable harm rather than a systemic one. The aerosol label warns that spraying ipratropium into the eyes may cause eye pain or discomfort, temporary blurring of vision, mydriasis, and visual halos or coloured images in association with red eyes from conjunctival and corneal congestion. Nebulised drug carries the same risk by a different route.

2. Action: The solution label states that use of a nebuliser with mouthpiece rather than face mask may be preferable, to reduce the likelihood of the nebuliser solution reaching the eyes, and that leakage around a mask should be avoided if one is used. [1][2]

3. Effect: Urinary retention

3. Detail: The aerosol label states that ipratropium is an anticholinergic and may cause urinary retention, and advises caution in patients with prostatic hyperplasia or bladder-neck obstruction. Umeclidinium and revefenacin carry the same warning, and the tiotropium labels direct that patients be alert for difficulty passing urine or painful urination.

3. Action: Bladder outflow obstruction and prostatic hyperplasia are the two histories that matter most before one of these inhalers is started, and any change of treatment rests with the treating clinician. [1][5][7][3]

4. Effect: Paradoxical bronchospasm

4. Detail: The airway constricts instead of opening. The ipratropium aerosol label states that the product can produce paradoxical bronchospasm that can be life threatening, and the umecclidinium label uses the same phrase about a reaction which may be life threatening.

4. Action: The directions differ slightly by product and are worth reading exactly: ipratropium is stopped and other

treatments considered; umeclidinium is discontinued immediately and the episode treated at once with an inhaled short-acting bronchodilator; the tiotropium labels direct immediate treatment with an inhaled short-acting beta-2 agonist. [1][5][4][6]

5. Effect: Hypersensitivity reactions

5. Detail: The ipratropium aerosol is contraindicated in hypersensitivity to the drug or its components and in hypersensitivity to atropine or any of its derivatives, which is the practical consequence of these agents being atropine relatives. Umeclidinium is contraindicated in severe hypersensitivity to milk proteins because the inhalation powder is blended with lactose monohydrate that contains them.

5. Action: A documented atropine reaction is directly relevant to prescribing an inhaled antimuscarinic, and a severe milk-protein allergy rules out the lactose-carrier dry powders. [1][5]

1. Drug: Ipratropium bromide

1. Effect: The eye risks are most concrete here because the drug is commonly nebulised, often by mask, in patients who are breathless and cannot hold a mouthpiece well. [2]

2. Drug: Tiotropium

2. Effect: Dry mouth is prominent in the one-year trials, alongside upper respiratory tract infection, sinusitis, pharyngitis, non-specific chest pain, urinary tract infection, dyspepsia and rhinitis. [3]

3. Drug: Umeclidinium

3. Effect: Nasopharyngitis, upper respiratory tract infection, cough and arthralgia, with the milk-protein contraindication arising from the lactose carrier rather than from the drug. [5]

4. Drug: Aclidinium bromide

4. Effect: Headache, nasopharyngitis and cough at three per cent or more and more often than with placebo. [6]

5. Drug: Revefenacin

5. Effect: Not recommended in patients with any degree of hepatic impairment, which is unusual in a class whose members are otherwise largely renally handled. [7]

Contraindications, precautions and interactions

1. Ipratropium aerosol is contraindicated in hypersensitivity to ipratropium bromide or other components of the product, and in hypersensitivity to atropine or any of its derivatives. [1]

2. Umeclidinium inhalation powder is contraindicated in severe hypersensitivity to milk proteins or to any ingredient of the product. [5]

3. Revefenacin is contraindicated in patients with hypersensitivity to revefenacin or to any component of the product. [7]

1. Narrow-angle glaucoma. The whole group is used with caution where it is known, and the ipratropium solution label names precipitation or worsening of narrow-angle glaucoma among the consequences of solution reaching the eye. [2][3][5]

2. Bladder outflow obstruction. Caution is advised in prostatic hyperplasia and bladder-neck obstruction, and patients are told to seek advice for difficulty passing urine or painful urination. [1][7][4]

3. Acute symptoms. None of these agents is a reliever: tiotropium by soft-mist inhaler is not indicated for the relief of acute bronchospasm, umeclidinium is not for rescue therapy, and aclidinium is not indicated for the initial treatment of acute episodes of bronchospasm. [4][5][6]

4. Nebuliser interface. Where the drug is nebulised, a mouthpiece is preferred to a face mask to reduce the chance of solution reaching the eyes, and leakage around a mask should be avoided when one is unavoidable. [2][7]

5. Hepatic impairment is a specific limit for revefenacin, which is not recommended at any degree of impairment. [7]

1. With: Other anticholinergic-containing medicines

1. Effect: There is potential for an additive interaction, and the labels for ipratropium, tiotropium, umeclidinium, aclidinium and revefenacin all direct that such coadministration be avoided because it may increase anticholinergic adverse effects. [1][3][5][6][7]

2. With: Fixed-dose combination inhalers

2. Effect: The NHS notes that some inhalers contain a combination of a long-acting beta-2 agonist and an antimuscarinic. A combination inhaler therefore already supplies an antimuscarinic, and adding a separate one duplicates the class rather than adding a new mechanism. [10][5]
3. With: Systemic antimuscarinics used for other purposes
3. Effect: Oral or injected glycopyrrolate is used to reduce chronic severe drooling and works as a competitive inhibitor of acetylcholine receptors on peripheral tissues including salivary glands, so a patient on such a medicine is already carrying an antimuscarinic load before an inhaler is added. [8][1]
4. With: Inhaled short-acting beta-2 agonists
4. Effect: Not an adverse interaction but a deliberate pairing. Ipratropium solution is indicated alone or with other bronchodilators, especially beta adrenergics, and the tiotropium labels name an inhaled short-acting beta-2 agonist as the immediate treatment for paradoxical bronchospasm. [2][4]

Comparison tables

Title: Duration of action decides the role

Caption: Every member blocks the same receptor. What differs is how long the block lasts, how it is delivered, and which label carries which indication. Choice of agent and device belongs to the treating clinician.

1. Key: drug
1. Label: Drug
1. Is Row Header: true
2. Key: group
2. Label: Group
3. Key: schedule
3. Label: Label schedule
4. Key: delivery
4. Label: Delivery
5. Key: point
5. Label: Point to remember
1. Drug: Ipratropium bromide
1. Group: SAMA
1. Schedule: Four times a day
1. Delivery: Metered-dose aerosol or nebuliser solution
1. Point: Half-life about two hours; nebulised delivery makes eye contamination a real and avoidable hazard [1][2]
2. Drug: Tiotropium bromide
2. Group: LAMA
2. Schedule: Once daily
2. Delivery: Dry-powder capsule device or soft-mist inhaler
2. Point: Terminal half-life about 25 hours; the Respimat label adds a maintenance indication in asthma [3][4]
3. Drug: Umeclidinium
3. Group: LAMA
3. Schedule: Once daily
3. Delivery: Dry-powder inhaler with a lactose carrier
3. Point: Effective half-life of eleven hours; milk-protein hypersensitivity is a contraindication [5]
4. Drug: Glycopyrronium bromide
4. Group: LAMA
4. Schedule: Once daily in the European authorisation
4. Delivery: Dry-powder capsule device
4. Point: The same molecule is separately licensed by mouth and by injection for entirely non-respiratory purposes

[9][8]

5. Drug: Aclidinium bromide

5. Group: LAMA

5. Schedule: Twice daily, about twelve hours apart

5. Delivery: Breath-actuated dry-powder inhaler

5. Point: Proof that a long-acting antimuscarinic is not necessarily a once-daily one [6]

6. Drug: Revefenacin

6. Group: LAMA

6. Schedule: Once daily

6. Delivery: Standard jet nebuliser with a mouthpiece

6. Point: The nebulised long-acting option; not recommended at any degree of hepatic impairment [7]

High-yield exam pearls

1. Pearl: Antimuscarinic bronchodilators work by subtraction: they remove vagal cholinergic tone rather than actively relaxing smooth muscle.

1. Why: It explains why they help most where cholinergic tone is a large share of the reversible obstruction, and why they are never the fastest way out of an acute attack. [1][2]

2. Pearl: The tiotropium label states similar affinity across muscarinic subtypes M1 to M5, while attributing bronchodilation to inhibition of M3 receptors at smooth muscle.

2. Why: Students often assume a long-acting agent must be M3-selective. The label says otherwise, and the honest answer is that delivery to the airway, not subtype preference, produces the selectivity seen in practice. [3]

3. Pearl: Ipratropium's roughly two-hour half-life and four-times-daily schedule sit against tiotropium's terminal half-life of around twenty-five hours.

3. Why: This single comparison carries the whole SAMA versus LAMA distinction and is the most reliably examined fact in the class. [1][3]

4. Pearl: The eye risk is greatest when the drug is nebulised, and the label's own remedy is a mouthpiece rather than a face mask.

4. Why: It is a rare example of a serious adverse effect prevented entirely by a choice of equipment, which makes it a favourite for clinical questions. [2]

5. Pearl: Inhaled antimuscarinics are quaternary ammonium compounds, poorly absorbed from the lung and the gut, so the bronchodilation is a local, site-specific effect.

5. Why: It answers the standard question of why an inhaled antimuscarinic does not produce the confusion, tachycardia and constipation expected of a systemic one. [2][3]

6. Pearl: Across the group, labels direct that coadministration with other anticholinergic-containing medicines be avoided because the effects are additive.

6. Why: The commonest way this is breached in practice is not a second inhaler but an unnoticed systemic antimuscarinic taken for bladder symptoms or drooling. [6][8]

Common exam traps

1. Trap: Treating any inhaled bronchodilator as a reliever.

1. Correction: These are maintenance medicines. Tiotropium by soft-mist inhaler is not indicated for the relief of acute bronchospasm, umeclidinium is not rescue therapy, and the ipratropium aerosol is not indicated for the initial treatment of acute episodes of bronchospasm where rescue therapy is required. [4][5][1]

2. Trap: Assuming an antimuscarinic has no place in asthma at all.

2. Correction: Tiotropium delivered by the Respimat inhaler is indicated for long-term once-daily maintenance treatment of asthma in patients six years of age and older. It is an add-on maintenance agent, not a reliever, and maximum benefit in lung function may take four to eight weeks. [4]

3. Trap: Reading LAMA as a synonym for once-daily dosing.
3. Correction: Acclidinium is a long-acting antimuscarinic given morning and evening approximately twelve hours apart, so the dosing interval has to be learned per agent rather than inferred from the class name. [6]
4. Trap: Believing that inhaled delivery removes the antimuscarinic risks altogether.
4. Correction: It limits them but does not abolish them. Dry mouth is common, urinary retention is warned about in the labels, and drug that reaches the eye can precipitate or worsen narrow-angle glaucoma. [2][1][3]
5. Trap: Adding a second antimuscarinic without noticing the first.
5. Correction: The labels direct avoidance of coadministration with other anticholinergic-containing drugs, and the NHS points out that some combination inhalers already contain an antimuscarinic alongside a long-acting beta-2 agonist. [3][10]
6. Trap: Assuming glycopyrronium always means an inhaler.
6. Correction: The same molecule is licensed by mouth and by injection for wholly different purposes, including reducing chronic severe drooling in children with neurological conditions, where it acts on acetylcholine receptors in peripheral tissues such as the salivary glands. [8][9]

Self-test questions

1. Question: By what mechanism does ipratropium widen the airway, according to its label?
 1. It antagonises acetylcholine and inhibits vagally mediated reflexes in the lung
 2. It stimulates beta-2 adrenoceptors on bronchial smooth muscle
 3. It inhibits phosphodiesterase and raises intracellular cyclic AMP
 4. It blocks cysteinyl leukotriene receptors in the airway wall
1. Explanation: The label describes ipratropium as an anticholinergic, or parasympatholytic, agent which appears from animal studies to inhibit vagally-mediated reflexes by antagonizing the action of acetylcholine, and states that anticholinergics prevent the rise in intracellular cyclic GMP caused by acetylcholine acting on the muscarinic receptor. [1][2]
2. Question: A patient receiving nebulised ipratropium by loosely fitting face mask develops eye pain, blurred vision and a red eye. What does the label identify as the risk?
 1. Precipitation or worsening of narrow-angle glaucoma from solution reaching the eye
 2. Corneal deposits caused by systemic accumulation of the drug
 3. Retinal toxicity proportional to cumulative inhaled exposure
 4. Optic neuritis as a hypersensitivity reaction
2. Explanation: The solution label advises that temporary blurring of vision, precipitation or worsening of narrow-angle glaucoma or eye pain may result if the solution comes into direct contact with the eyes, and recommends a nebuliser with mouthpiece rather than face mask to reduce that likelihood. [2]
3. Question: Which pharmacokinetic figure best explains why tiotropium is a once-daily maintenance agent while ipratropium is not?
 1. A terminal half-life of approximately 25 hours in COPD, against about two hours for ipratropium
 2. Greater oral bioavailability of tiotropium after swallowing the inhaled fraction
 3. Higher protein binding of ipratropium in plasma
 4. Faster hepatic clearance of tiotropium by cytochrome P450 enzymes
3. Explanation: The tiotropium label gives a terminal half-life of around 25 hours in patients with COPD and bronchodilator effects lasting longer than 24 hours, while the ipratropium label gives an elimination half-life of about two hours after inhalation. [3][1]
4. Question: Which history most directly warrants caution before an inhaled antimuscarinic is started?
 1. Bladder-neck obstruction due to prostatic hyperplasia
 2. Well-controlled hypothyroidism
 3. Previous deep vein thrombosis

4. Mild iron-deficiency anaemia

4. Explanation: The ipratropium aerosol label states that the drug is an anticholinergic and may cause urinary retention, and advises caution in patients with prostatic hyperplasia or bladder-neck obstruction; the umeclidinium and revefenacin labels carry the same warning. [1][5][7]

5. Question: An inhaled antimuscarinic produces immediate wheeze and worsening breathlessness after a dose. What do the labels describe?

1. Paradoxical bronchospasm, which may be life threatening
2. An expected transient effect that settles with continued dosing
3. Tachyphylaxis at the muscarinic receptor
4. Rebound cholinergic tone from receptor upregulation

5. Explanation: The ipratropium aerosol label states that the product can produce paradoxical bronchospasm that can be life threatening, and directs that treatment be stopped and other treatments considered; the umeclidinium label directs immediate discontinuation and treatment with an inhaled short-acting bronchodilator. [1][5]

6. Question: Which statement about tiotropium and asthma is correct?

1. The soft-mist inhaler is indicated for once-daily maintenance treatment of asthma from six years of age
2. It is indicated as a reliever inhaler for acute asthma symptoms
3. It has no asthma indication in any formulation
4. It replaces inhaled corticosteroid maintenance therapy in asthma

6. Explanation: The Respimat label carries a long-term, once-daily maintenance indication in asthma for patients six years of age and older, states that the product is not indicated for the relief of acute bronchospasm, and notes that maximum benefit in lung function may take up to four to eight weeks. [4]

7. Question: Why does an inhaled antimuscarinic cause fewer systemic anticholinergic effects than an oral one?

1. It is a quaternary ammonium compound that is poorly absorbed, so the effect is local and site-specific
2. It is rapidly destroyed by esterases in plasma before reaching any receptor
3. It binds irreversibly to airway receptors and cannot dissociate into the circulation
4. It is actively pumped back into the airway lumen by efflux transporters

7. Explanation: The ipratropium label describes a quaternary amine that is not readily absorbed into the systemic circulation from the lung surface or the gastrointestinal tract, and states that the bronchodilation after inhalation is primarily a local, site-specific effect rather than a systemic one. [1][2]

Frequently asked questions

1. Question: Why are these medicines so central in COPD but secondary in asthma?

1. Answer: Because of what the labels are written for. Ipratropium, tiotropium, umeclidinium, aclidinium and revefenacin all carry maintenance indications in chronic obstructive pulmonary disease, and only tiotropium by soft-mist inhaler adds an asthma indication, which is itself maintenance rather than relief. In an acute attack the labels point to an inhaled short-acting beta-2 agonist, which is also the treatment they name for paradoxical bronchospasm. [1][3][4][6]

2. Question: What is the difference between a SAMA and a LAMA?

2. Answer: Only the duration of the receptor block. The NHS separates short-acting bronchodilator inhalers, where ipratropium is the antimuscarinic, from long-acting ones such as tiotropium, glycopyrronium and aclidinium, and notes that a long-acting dose lasts at least twelve hours so it is needed once or twice a day. The pharmacology of the receptor block is the same in both halves. [10][1]

3. Question: How can a drug that reaches the eye by accident cause glaucoma?

3. Answer: Muscarinic blockade in the eye relaxes the sphincter of the iris and dilates the pupil, which can crowd a narrow drainage angle and raise intraocular pressure. The ipratropium labels describe mydriasis, blurred vision, visual halos or coloured images with red eyes after direct ocular contact, and warn of precipitation or worsening of narrow-angle glaucoma. It is the one adverse effect in this class that a mouthpiece can prevent outright. [1][2]

4. Question: Can two antimuscarinic inhalers be used together?

4. Answer: The labels advise against it. Ipratropium, tiotropium, umeclidinium, aclidinium and revefenacin all state that coadministration with other anticholinergic-containing medicines should be avoided because of the potential for an additive interaction and an increase in anticholinergic adverse effects. The trap is a combination inhaler that already contains an antimuscarinic, or a systemic anticholinergic taken for an unrelated problem. [3][7][10]

5. Question: Why does the same drug name appear as an inhaler, a tablet and an injection?

5. Answer: Glycopyrronium bromide, also written glycopyrrolate, is the clearest example. Inhaled, it is authorised in Europe as a maintenance bronchodilator for symptom relief in adults with COPD. By mouth it is licensed to reduce chronic severe drooling in children aged three to sixteen with neurological conditions, acting as a competitive inhibitor of acetylcholine receptors in peripheral tissues including the salivary glands. Same receptor, same blockade, entirely different purpose and route. [9][8]

6. Question: Does dry mouth mean the dose is too high?

6. Answer: Not necessarily. It is the expected local consequence of an antimuscarinic deposited in the mouth and pharynx, and it was recorded in 3.2% of patients given ipratropium alone and among the commonest reactions in the one-year tiotropium trials. Persistent or troublesome dryness is worth reporting, because assessment and any change of treatment rest with the treating clinician. [2][3]

References

[1] ATROVENT HFA (ipratropium bromide HFA inhalation aerosol) - prescribing information. DailyMed, U.S. National Library of Medicine . <https://dailymed.nlm.nih.gov/dailymed/drugInfo.cfm?setid=170e98ef-5560-4068-be7d-e649068eb884>

[2] Ipratropium Bromide Inhalation Solution 0.02% - prescribing information. DailyMed, U.S. National Library of Medicine . <https://dailymed.nlm.nih.gov/dailymed/fda/fdaDrugXsl.cfm?setid=22479633-624a-4251-ad3c-1dcba5d503fb&type=display>

[3] SPIRIVA HANDIHALER (tiotropium bromide inhalation powder) - prescribing information. DailyMed, U.S. National Library of Medicine . <https://dailymed.nlm.nih.gov/dailymed/fda/fdaDrugXsl.cfm?setid=ba462261-734a-4e9f-a5c0-5c676bc56a2e>

[4] SPIRIVA RESPIMAT (tiotropium bromide inhalation spray) - prescribing information. DailyMed, U.S. National Library of Medicine . <https://dailymed.nlm.nih.gov/dailymed/fda/fdaDrugXsl.cfm?setid=7b656b14-fcaa-2741-f6f0-e0be48971c02>

[5] INCRUSE ELLIPTA (umeclidinium inhalation powder) - prescribing information. DailyMed, U.S. National Library of Medicine . <https://dailymed.nlm.nih.gov/dailymed/fda/fdaDrugXsl.cfm?setid=dbb64747-1505-49d7-9a33-99dd402e96d3>

[6] TUDORZA PRESSAIR (aclidinium bromide inhalation powder) - prescribing information. DailyMed, U.S. National Library of Medicine .

<https://dailymed.nlm.nih.gov/dailymed/fda/fdaDrugXsl.cfm?setid=6f92cceb-a63f-4470-99b6-56179d98f10f&type=display>

[7] YUPELRI (revefenacin) inhalation solution - prescribing information. DailyMed, U.S. National Library of Medicine .

<https://dailymed.nlm.nih.gov/dailymed/fda/fdaDrugXsl.cfm?type=display&setid=6dfebf04-7c90-436a-9b16-750d3c1ee0a6>

[8] GLYCOPYRROLATE oral solution - prescribing information. DailyMed, U.S. National Library of Medicine .

<https://dailymed.nlm.nih.gov/dailymed/lookup.cfm?setid=ff65c5d3-7ba9-4315-a884-199151eb45a5>

[9] Seebri Breezhaler (glycopyrronium bromide) - European public assessment report overview. European Medicines Agency . <https://www.ema.europa.eu/en/medicines/human/EPAR/seebri-breezhaler>

[10] Chronic obstructive pulmonary disease (COPD): Treatment. National Health Service (NHS.UK) .

<https://www.nhs.uk/conditions/chronic-obstructive-pulmonary-disease-copd/treatment/>

For education only. This guide does not replace professional medical advice. Do not use it to choose or change treatment.