Crown to Cortex

Pharmacology

ANS Introduction and Cholinergic Drugs

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How to read this topic

Autonomic pharmacology begins with receptor mapping. Cholinergic drugs act through muscarinic and nicotinic receptors or by inhibiting acetylcholinesterase. Exam questions often test receptor subtype effects, organophosphate poisoning, myasthenia gravis, glaucoma, urinary retention, and reversal of neuromuscular blockade.

Classify

Place the drug in the correct class before reading the clinical stem.

V

Mechanism

Convert receptor, enzyme, or pathway action into expected benefit.

V

Patient filter

Apply pregnancy, renal/hepatic disease, ECG, electrolyte, allergy, and interaction filters.

V

Exam answer

Choose the drug that fits the indication and avoids the hidden contraindication.

Classification map

Class / axis	High-yield details
Direct agonists	acetylcholine, bethanechol, carbachol, pilocarpine, cevimeline
Reversible AChE inhibitors	neostigmine, pyridostigmine, physostigmine, edrophonium, donepezil, rivastigmine
Irreversible AChE inhibitors	organophosphates such as malathion, parathion, echothiophate
Antidotes	atropine, pralidoxime, diazepam for seizures

Prototype drug map

Prototype	What to remember
Bethanechol	postoperative urinary retention and ileus; avoid asthma and PUD
Pilocarpine	glaucoma and xerostomia
Neostigmine	MG, ileus, reversal of nondepolarizing block
Physostigmine	central anticholinergic toxicity
Donepezil	Alzheimer disease symptomatic benefit

Mechanism to clinical use

1. Direct agonists

Mechanism anchor: acetylcholine, bethanechol, carbachol, pilocarpine, cevimeline. In NEET PG style questions, this becomes important when the stem asks for drug choice, mechanism of toxicity, resistance, organ-specific effect, or a contraindication. Always connect the class to the expected physiological change rather than memorizing the name alone.

Clinical conversion: ask whether the desired effect is immediate symptom relief, disease modification, prophylaxis, reversal of toxicity, or long-term prevention. The same class can be correct or wrong depending on timing, route, patient risk, and monitoring feasibility.

2. Reversible AChE inhibitors

Mechanism anchor: neostigmine, pyridostigmine, physostigmine, edrophonium, donepezil, rivastigmine. In NEET PG style questions, this becomes important when the stem asks for drug choice, mechanism of toxicity, resistance, organ-specific effect, or a contraindication. Always connect the class to the expected physiological change rather than memorizing the name alone.

Clinical conversion: ask whether the desired effect is immediate symptom relief, disease modification, prophylaxis, reversal of toxicity, or long-term prevention. The same class can be correct or wrong depending on timing, route, patient risk, and monitoring feasibility.

3. Irreversible AChE inhibitors

Mechanism anchor: organophosphates such as malathion, parathion, echothiophate. In NEET PG style questions, this becomes important when the stem asks for drug choice, mechanism of toxicity, resistance, organ-specific effect, or a contraindication. Always connect the class to the expected physiological change rather than memorizing the name alone.

Clinical conversion: ask whether the desired effect is immediate symptom relief, disease modification, prophylaxis, reversal of toxicity, or long-term prevention. The same class can be correct or wrong depending on timing, route, patient risk, and monitoring feasibility.

4. Antidotes

Mechanism anchor: atropine, pralidoxime, diazepam for seizures. In NEET PG style questions, this becomes important when the stem asks for drug choice, mechanism of toxicity, resistance, organ-specific effect, or a contraindication. Always connect the class to the expected physiological change rather than memorizing the name alone.

Clinical conversion: ask whether the desired effect is immediate symptom relief, disease modification, prophylaxis, reversal of toxicity, or long-term prevention. The same class can be correct or wrong depending on timing, route, patient risk, and monitoring feasibility.

Drug signatures

Drug / class	Mechanism cue	Use cue	Toxicity cue
Bethanechol	postoperative urinary retention and ileus	Know preferred indication	Know signature adverse effect
Pilocarpine	glaucoma and xerostomia	Know preferred indication	Know signature adverse effect
Neostigmine	MG, ileus, reversal of nondepolarizing block	Know preferred indication	Know signature adverse effect
Physostigmine	central anticholinergic toxicity	Know preferred indication	Know signature adverse effect
Donepezil	Alzheimer disease symptomatic benefit	Know preferred indication	Know signature adverse effect

Clinical edges

- OP poisoning: salivation, lacrimation, urination, diarrhea, bronchospasm, bradycardia, miosis, muscle fasciculations, seizures
- Myasthenia: pyridostigmine improves strength; cholinergic crisis worsens with excess AChE inhibition
- Eye: miosis and ciliary contraction improve outflow but can worsen vision temporarily
- NMJ reversal: combine neostigmine with glycopyrrolate/atropine to limit muscarinic toxicity
- Atropine treats muscarinic features; pralidoxime restores nicotinic function if given early.
- Physostigmine crosses the blood-brain barrier and may reverse severe central anticholinergic toxicity.
- Bethanechol is avoided in asthma and peptic ulcer disease.
- Pyridostigmine is preferred for long-term myasthenia gravis symptom control.

Adverse effects and contraindication logic

Bethanechol

Expected exam cue: postoperative urinary retention and ileus; avoid asthma and PUD. When this drug or class appears in a clinical vignette, actively look for allergy, pregnancy risk, renal or hepatic impairment, ECG abnormality, electrolyte disturbance, bleeding risk, respiratory disease, CNS depression, or interacting medicines.

How to eliminate options: reject drugs that worsen the dominant clinical danger in the stem, even if their mechanism seems suitable. This is especially important in pharmacology questions where the wrong option is often a contraindicated first-line drug.

Pilocarpine

Expected exam cue: glaucoma and xerostomia. When this drug or class appears in a clinical vignette, actively look for allergy, pregnancy risk, renal or hepatic impairment, ECG abnormality, electrolyte disturbance, bleeding risk, respiratory disease, CNS depression, or interacting medicines.

How to eliminate options: reject drugs that worsen the dominant clinical danger in the stem, even if their mechanism seems suitable. This is especially important in pharmacology questions where the wrong option is often a contraindicated first-line drug.

Neostigmine

Expected exam cue: MG, ileus, reversal of nondepolarizing block. When this drug or class appears in a clinical vignette, actively look for allergy, pregnancy risk, renal or hepatic impairment, ECG abnormality, electrolyte disturbance, bleeding risk, respiratory disease, CNS depression, or interacting medicines.

How to eliminate options: reject drugs that worsen the dominant clinical danger in the stem, even if their mechanism seems suitable. This is especially important in pharmacology questions where the wrong option is often a contraindicated first-line drug.

Physostigmine

Expected exam cue: central anticholinergic toxicity. When this drug or class appears in a clinical vignette, actively look for allergy, pregnancy risk, renal or hepatic impairment, ECG abnormality, electrolyte disturbance, bleeding risk, respiratory disease, CNS depression, or interacting medicines.

How to eliminate options: reject drugs that worsen the dominant clinical danger in the stem, even if their mechanism seems suitable. This is especially important in pharmacology questions where the wrong option is often a contraindicated first-line drug.

Donepezil

Expected exam cue: Alzheimer disease symptomatic benefit. When this drug or class appears in a clinical vignette, actively look for allergy, pregnancy risk, renal or hepatic impairment, ECG abnormality, electrolyte disturbance, bleeding risk, respiratory disease, CNS depression, or interacting medicines.

How to eliminate options: reject drugs that worsen the dominant clinical danger in the stem, even if their mechanism seems suitable. This is especially important in pharmacology questions where the wrong option is often a contraindicated first-line drug.

Exam traps

- Sweating is sympathetic but cholinergic.
- M3 on endothelium causes nitric oxide mediated vasodilation.
- Neostigmine does not cross the blood-brain barrier significantly.
- Pralidoxime is less useful after enzyme aging.
- In ANS Introduction and Cholinergic Drugs, do not memorize a class without its route, onset, elimination, and monitoring.
- Toxicity questions often hide the drug name and reveal the answer through one adverse-effect signature.
- Contraindications are tested more often than rare mechanisms.
- A drug can be first-line in one patient and dangerous in another.

Last-day revision grid

Question	Answer to recall quickly
Best prototype?	Bethanechol, Pilocarpine, Neostigmine, Physostigmine
Most tested danger?	toxicity, contraindication, interaction, and monitoring
Emergency angle?	route, onset, antidote, supportive care
Do-not-miss filter?	pregnancy, renal/hepatic failure, ECG/electrolytes, bleeding or respiratory risk

High-yield definitions

Term	Definition / exam meaning
Direct agonists	acetylcholine, bethanechol, carbachol, pilocarpine, cevimeline
Reversible AChE inhibitors	neostigmine, pyridostigmine, physostigmine, edrophonium, donepezil, rivastigmine
Irreversible AChE inhibitors	organophosphates such as malathion, parathion, echothiophate
Antidotes	atropine, pralidoxime, diazepam for seizures
Bethanechol	postoperative urinary retention and ileus; avoid asthma and PUD
Pilocarpine	glaucoma and xerostomia
Neostigmine	MG, ileus, reversal of nondepolarizing block
Physostigmine	central anticholinergic toxicity
Donepezil	Alzheimer disease symptomatic benefit
M1	CNS and gastric acid secretion.
M2	Heart: decreased SA node firing, AV conduction, and atrial contractility.

How this helps in ANS Introduction and Cholinergic Drugs: this page is meant to convert memorized pharmacology into option elimination. Read the left column first, then force yourself to say the mechanism, clinical use, toxicity, and reason another option is wrong.

Drug-by-drug comparison

Comparison	How to separate them in an exam stem	Most useful discriminator
Bethanechol vs Pilocarpine	Bethanechol is recalled by: postoperative urinary retention and ileus; avoid asthma and PUD. Pilocarpine is recalled by: glaucoma and xerostomia.	Indication, toxicity pattern, route/onset, or contraindication hidden in the stem.
Neostigmine vs Physostigmine	Neostigmine is recalled by: MG, ileus, reversal of nondepolarizing block. Physostigmine is recalled by: central anticholinergic toxicity.	Indication, toxicity pattern, route/onset, or contraindication hidden in the stem.

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Toxicity signatures

Drug / class	Toxicity pattern to actively search for	Immediate exam response
Bethanechol	Link the prototype clue to organ toxicity, laboratory change, ECG change, bleeding, CNS depression, allergy, or pregnancy risk. Cue: postoperative urinary retention and ileus; avoid asthma and PUD	Stop/avoid the drug if the stem contains the danger sign; choose antidote or safer alternative when asked.
Pilocarpine	Link the prototype clue to organ toxicity, laboratory change, ECG change, bleeding, CNS depression, allergy, or pregnancy risk. Cue: glaucoma and xerostomia	Stop/avoid the drug if the stem contains the danger sign; choose antidote or safer alternative when asked.
Neostigmine	Link the prototype clue to organ toxicity, laboratory change, ECG change, bleeding, CNS depression, allergy, or pregnancy risk. Cue: MG, ileus, reversal of nondepolarizing block	Stop/avoid the drug if the stem contains the danger sign; choose antidote or safer alternative when asked.
Physostigmine	Link the prototype clue to organ toxicity, laboratory change, ECG change, bleeding, CNS depression, allergy, or pregnancy risk. Cue: central anticholinergic toxicity	Stop/avoid the drug if the stem contains the danger sign; choose antidote or safer alternative when asked.
Donepezil	Link the prototype clue to organ toxicity, laboratory change, ECG change, bleeding, CNS depression, allergy, or pregnancy risk. Cue: Alzheimer disease symptomatic benefit	Stop/avoid the drug if the stem contains the danger sign; choose antidote or safer alternative when asked.
ANS Introduction and Cholinergic Drugs	Any severe allergy, organ failure, pregnancy risk, or dangerous interaction can override first-line status.	Do not pick a drug only because it is famous.

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Contraindication filters

Clinical filter	What it changes	Exam habit
Pregnancy/lactation	Avoid teratogenic, fetal-toxic, or neonatal-toxic drugs; prefer established safer options.	Always scan age/sex/history lines.
Renal impairment	Accumulation increases toxicity for renally cleared drugs; dose interval may need extension.	Look for creatinine, oliguria, CKD, elderly patient.
Hepatic disease	Reduced metabolism, low albumin, and bleeding risk can change drug choice.	Check jaundice, cirrhosis, INR, albumin.
ECG/electrolytes	QT prolongation, heart block, hypokalemia, and hyperkalemia decide many answers.	Never ignore ECG and potassium.
Respiratory disease	Bronchospasm or respiratory depression risk can make a familiar drug unsafe.	Asthma/COPD/sleep apnea are not decorative details.
Bleeding risk	Antiplatelets, anticoagulants, thrombolytics, NSAIDs, and marrow-toxic drugs need caution.	Check ulcer, surgery, stroke, platelets, INR.
Bethanechol	postoperative urinary retention and ileus; avoid asthma and PUD	Ask: where is this drug dangerous?
Pilocarpine	glaucoma and xerostomia	Ask: where is this drug dangerous?
Neostigmine	MG, ileus, reversal of nondepolarizing block	Ask: where is this drug dangerous?

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Drug interaction map

Interaction type	Mechanism	Common exam expression
CYP induction	Increases metabolism of substrate drugs and can cause treatment failure.	Rifampicin/carbamazepine/phenytoin reducing OCP, warfarin, antiretroviral, or steroid effect.
CYP inhibition	Raises substrate levels and toxicity.	Macrolide/azole/ritonavir/cimetidine/grapefruit toxicity stem.
Additive toxicity	Two drugs injure the same organ or pathway.	QT plus QT, bleeding plus bleeding, nephrotoxic plus nephrotoxic, CNS depressant plus CNS depressant.
Pharmacodynamic opposition	One drug blocks the desired effect of another.	NSAID reducing antihypertensive effect; beta blocker opposing beta agonist.
Bethanechol	postoperative urinary retention and ileus; avoid asthma and PUD	Check whether the vignette adds another drug that amplifies toxicity or reduces benefit.
Pilocarpine	glaucoma and xerostomia	Check whether the vignette adds another drug that amplifies toxicity or reduces benefit.
Neostigmine	MG, ileus, reversal of nondepolarizing block	Check whether the vignette adds another drug that amplifies toxicity or reduces benefit.
Physostigmine	central anticholinergic toxicity	Check whether the vignette adds another drug that amplifies toxicity or reduces benefit.

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Monitoring and dose adjustment

Monitoring target	Why it matters	What to remember
Clinical endpoint	Symptom relief or prevention outcome confirms benefit.	Pain, BP, seizure control, infection response, glucose, dyspnea, psychosis, bleeding.
Laboratory endpoint	Detects efficacy and silent toxicity.	Renal function, liver enzymes, CBC, electrolytes, coagulation, glucose, drug levels.
ECG	Many drugs alter conduction, QT, or rhythm.	QT prolongation, AV block, QRS widening, torsades risk.
Therapeutic drug monitoring	Needed when therapeutic window is narrow.	Lithium, digoxin, phenytoin, valproate, aminoglycosides, vancomycin, tacrolimus.
Bethanechol	Monitoring depends on the toxicity implied by its mechanism and elimination.	postoperative urinary retention and ileus; avoid asthma and PUD
Pilocarpine	Monitoring depends on the toxicity implied by its mechanism and elimination.	glaucoma and xerostomia
Neostigmine	Monitoring depends on the toxicity implied by its mechanism and elimination.	MG, ileus, reversal of nondepolarizing block

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Emergency decision table

Emergency scenario	First pharmacology decision	Common mistake
Shock/anaphylaxis/severe acute state	Choose route and onset before elegance of mechanism.	Choosing an oral chronic drug for an emergency.
Poisoning/toxicity	Stabilize airway, breathing, circulation, then antidote if indicated.	Giving antidote while ignoring supportive care.
Severe infection or organ-threatening disease	Start rational empirical therapy promptly, then narrow when data arrives.	Waiting for perfect information in an unstable patient.
Withdrawal or rebound	Recognize dependence physiology and taper/replace appropriately.	Abruptly stopping clonidine, beta blockers, steroids, opioids, alcohol, or benzodiazepines.
ANS Introduction and Cholinergic Drugs: Bethanechol	postoperative urinary retention and ileus; avoid asthma and PUD	Wrong route, delayed onset, or ignored contraindication.
ANS Introduction and Cholinergic Drugs: Pilocarpine	glaucoma and xerostomia	Wrong route, delayed onset, or ignored contraindication.
ANS Introduction and Cholinergic Drugs: Neostigmine	MG, ileus, reversal of nondepolarizing block	Wrong route, delayed onset, or ignored contraindication.
ANS Introduction and Cholinergic Drugs: Physostigmine	central anticholinergic toxicity	Wrong route, delayed onset, or ignored contraindication.

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INI-CET stem decoding

Stem clue	What it is trying to test	Answer strategy
Age, pregnancy, renal/liver disease	Safety filter rather than diagnosis.	Eliminate unsafe drugs first.
New symptom after drug start	Adverse-effect signature.	Name the drug from toxicity.
Drug added recently	Interaction question.	Check CYP, QT, bleeding, CNS depression, nephrotoxicity.
Emergency wording	Route/onset question.	Prefer fast, titratable, evidence-based acute therapy.
Chronic prevention wording	Outcome benefit question.	Prefer disease-modifying therapy over only symptomatic relief.
Direct agonists	acetylcholine, bethanechol, carbachol, pilocarpine, cevimeline	Place this under ANS Introduction and Cholinergic Drugs, then compare with nearby alternatives.
Reversible AChE inhibitors	neostigmine, pyridostigmine, physostigmine, edrophonium, donepezil, rivastigmine	Place this under ANS Introduction and Cholinergic Drugs, then compare with nearby alternatives.
Irreversible AChE inhibitors	organophosphates such as malathion, parathion, echothiophate	Place this under ANS Introduction and Cholinergic Drugs, then compare with nearby alternatives.
Antidotes	atropine, pralidoxime, diazepam for seizures	Place this under ANS Introduction and Cholinergic Drugs, then compare with nearby alternatives.

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Rapid pathway

Read the stem

Disease, severity, age, pregnancy, organ function, emergency status.

V

Name the class

Mechanism and prototype before option elimination.

V

Apply exclusions

Contraindications, interactions, and toxicity signatures.

V

Pick final answer

Most specific safe drug for that exact stem.