جامعة المستقبل
AL MUSTAQBAL UNIVERSITY

AL-MUSTAQBQL UNIVERSITY

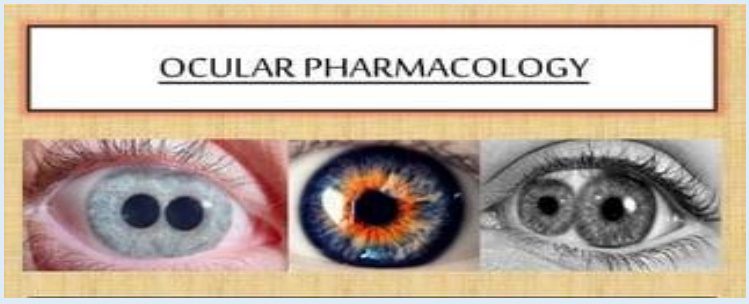
College of Health and Medical Technologies

Department Optical Technologies

Prepared by : Alaa Mohammad : MSc Optometry

Subjective { Pharmacology }

Lecture: two and three



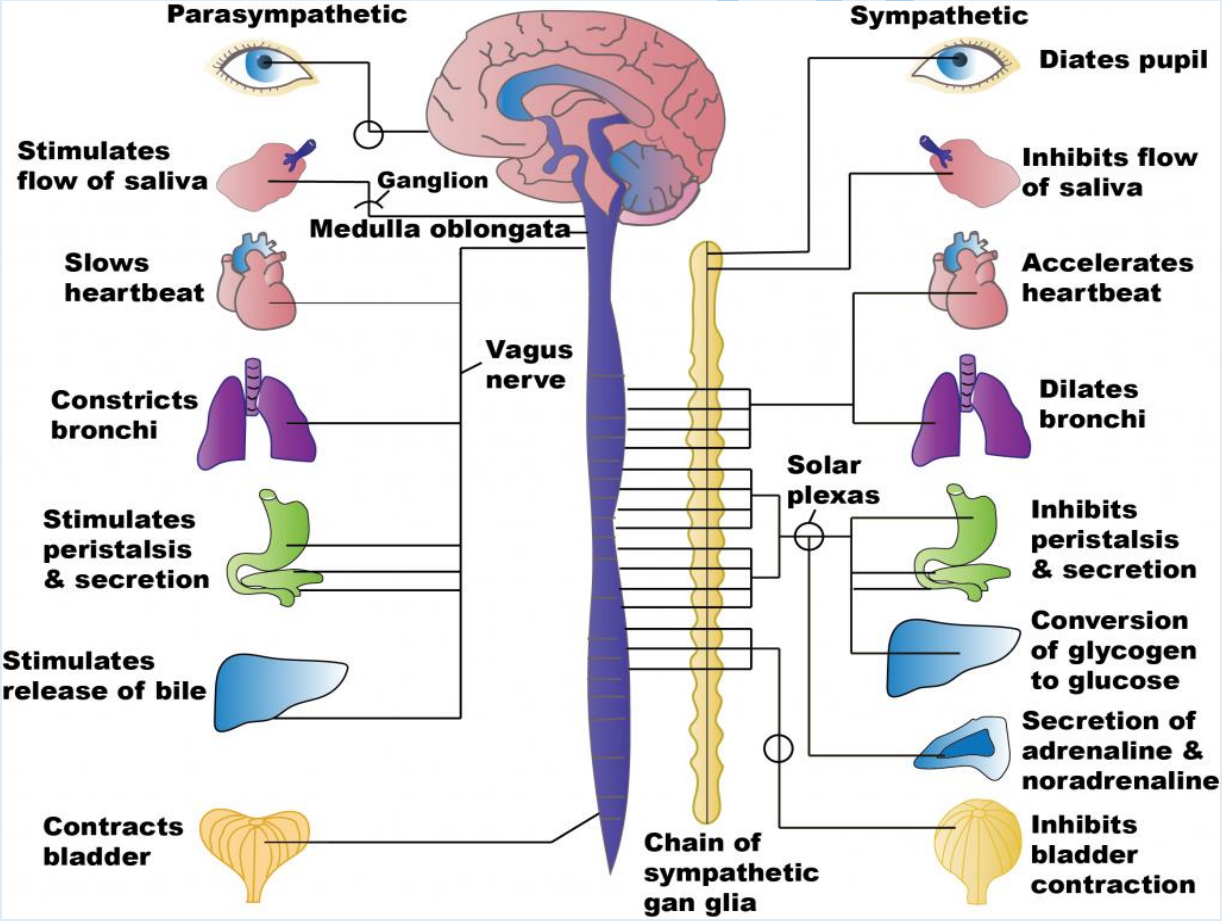
Drugs Affecting the Autonomic Nervous System

- Introduction to the Autonomic Nervous System (ANS)

-Definition: the ANS is a division of the peripheral nervous system that regulates involuntary physiological functions .

Divisions of the ANS :

1. Sympathetic Nervous system (SNS) – Fight or Flight.
2. Parasympathetic Nervous system (PNS) – Rest and Digest.



- Neurotransmitters and Receptors in the ANS.

- Neurotransmitters :

1. Acetylcholine (Ach) – use in both SNS and PNS.
2. Norepinephrine (NE) – Primary neurotransmitter for sympathetic postganglionic neurons .

-Receptors :

1. Cholinergic receptors (bind Ach).
2. Nicotinic receptors.
3. Muscarinic receptors .
4. Adrenergic receptors.
5. Alpha receptor .
6. Beta receptor .

Pharmacology Related to Drugs Used to Dilate Pupils (Mydriatics and Cycloplegics)

Introduction

Dilating the pupil (mydriasis) and paralyzing the ciliary muscle (cycloplegia) are essential procedures in optometry and ophthalmology. These effects are achieved using specific classes of drugs known as mydriatics and cycloplegics. These drugs are used for diagnostic purposes, such as fundus examination, and therapeutic purposes, such as managing uveitis. This lecture will cover the pharmacology of these drugs, their mechanisms of action, clinical uses, administration techniques, and potential side effects.

1. Mechanisms of Action

Mydriatics and cycloplegics primarily work by affecting the muscles of the iris and ciliary body, which are controlled by the autonomic nervous system. The two main classes of drugs used are:

a. Anticholinergics (Cycloplegics)

Mechanism:

These drugs block muscarinic acetylcholine receptors in the iris sphincter muscle (causing mydriasis) and the ciliary muscle (causing cycloplegia).

Examples:

Tropicamide: Short-acting, primarily used for diagnostic dilation.

Cyclopentolate: Intermediate-acting, used for both diagnostic and therapeutic purposes.

Atropine: Long-acting, used for therapeutic cycloplegia in conditions like uveitis or amblyopia management.

b. Sympathomimetics (Mydriatics)

Mechanism: These drugs stimulate alpha-adrenergic receptors in the iris dilator muscle, causing pupil dilation without affecting the ciliary muscle.

Examples:

Phenylephrine: Used for diagnostic mydriasis.

Epinephrine: Rarely used due to systemic side effects.

2. Clinical Uses

Mydriatics and cycloplegics are used in various clinical scenarios:

a. Diagnostic Uses

Fundus Examination: Dilating the pupil allows for a better view of the retina, optic nerve, and blood vessels.

Refraction: Cycloplegic drugs are used to paralyze accommodation, providing an accurate measurement of refractive error, especially in children.

b. Therapeutic Uses

Uveitis: Cycloplegics like atropine or cyclopentolate are used to reduce pain by relaxing the ciliary muscle and preventing synechiae (adhesions between the iris and lens).

Amblyopia Management: Atropine is sometimes used to penalize the stronger eye in amblyopia treatment.

Post-Surgical Management: Cycloplegics are used after intraocular surgery to reduce inflammation and pain.

3. Administration Techniques

Proper administration of mydriatics and cycloplegics is crucial for achieving the desired effects while minimizing side effects:

a. Eye Drops

- Wash hands thoroughly.
- Tilt the patient's head back and pull down the lower eyelid to create a pouch.
- Instill the prescribed number of drops into the conjunctival sac.
- Ask the patient to close their eyes gently and apply pressure to the lacrimal sac (punctal occlusion) for 1-2 minutes to reduce systemic absorption.

b. Dosage

Tropicamide: 1-2 drops of 0.5% or 1% solution, onset in 20-30 minutes, duration 4-6 hours.

Cyclopentolate: 1-2 drops of 0.5% or 1% solution, onset in 30-60 minutes, duration 6-24 hours.

Atropine: 1 drop of 0.5% or 1% solution, onset in 30-60 minutes, duration 7-14 days.

4. Side Effects

While mydriatics and cycloplegics are generally safe, they can cause local and systemic side effects:

a. Local Side Effects

Blurred Vision: Due to cycloplegia, patients may experience difficulty focusing on near objects.

Photophobia: Dilated pupils allow more light to enter the eye, causing sensitivity to light.

Increased Intraocular Pressure (IOP): In patients with narrow-angle glaucoma, dilation can precipitate angle closure.

Allergic Reactions: Some patients may develop redness, itching, or swelling.

b. Systemic Side Effects

Anticholinergic Effects: Cycloplegics like atropine and cyclopentolate can cause systemic anticholinergic effects, especially in children and elderly patients. Symptoms include:

- Dry mouth
- Flushing
- Tachycardia (increased heart rate)
- Confusion or hallucinations (rare)

Sympathomimetic Effects: Phenylephrine can cause systemic adrenergic effects, such as:

- Hypertension
- Palpitations
- Headache

5. Contraindications and Precautions

Narrow-Angle Glaucoma: Mydriatics can precipitate angle-closure glaucoma in susceptible individuals.

Allergy: Patients with known hypersensitivity to specific drugs should avoid them.

Systemic Conditions: Caution is advised in patients with cardiovascular diseases (e.g., hypertension, arrhythmias) due to the risk of systemic side effects.

Children and Elderly: These populations are more susceptible to systemic side effects, so lower concentrations or alternative drugs should be considered.

6. Patient Education

- Inform patients about the temporary nature of blurred vision and photophobia.

- Advise patients to wear sunglasses to reduce light sensitivity.

- Warn patients not to drive or operate machinery until the effects wear off.

- Educate patients about the importance of punctal occlusion to minimize systemic absorption.

Conclusion

Mydriatics and cycloplegics are indispensable tools in optometry and ophthalmology. Understanding their mechanisms of action, clinical uses, administration techniques, and potential side effects is essential for safe and effective patient care. Optometrists must carefully select the appropriate drug and dosage based on the patient's condition and medical history to achieve optimal outcomes while minimizing risks.