Autonomic Nervous System Pharmacology
Shan Nanji
ANS – Parasympathetic & Sympathetic Basics

- **Parasympathetic** - “CHOLinergic”
  - Craniosacral, cGMP
    - MUSCARINIC - Most
    - NICOTINIC: Located at _______ and _______

- **Sympathetic** - “adreNERgic”
  - Thoracolumbar, cAMP
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Parasympathetic System
- Cholinergic

- **M1** – CNS/ENS
- **M2** – Heart
- **M3** – EG MP AC BB
  - **Exocrine Gland Secretion**
  - Increases
  - **Miosis via Pupillary sphincter**
  - **Accommodation via Ciliary**
  - **Broncho**
  - **Bladder**

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CHOLinergics

- **BethanaCHOL** – Post op and neurogenic ileus and urinary retention
- **CarbeCHOL** – Glaucoma, pupillary contraction, and relief of IOP, also for Post op urinary retention
- **MethaCHOLine** – Induces bronchospasm used in

- **Pilocarpine** – Cystic Fibrosis Sweat Test; “PiloCHOLpine”
Anti-ACh-Esterases

**MOA:**
Prevent degradation of ACh increasing endogenous AcH
- More ACh (acetylCHOLine) so more CHOLinergic!

- **Edrophonium** – Dx ________________, used to differentiate it from cholinergic crisis

- **NeoSTIGmine/PyridoSTIGmine** – Rx Myasthenia Gravis (No BBB)
  - Rx – Myasthenia Gravis, Ileus, Urinary Retention, Reversal of NMJ Blockage

- **PhysoSTIGmine** – Rx for ________________ (Will cross BBB), also for glaucoma

- **Ecothiophate** – For Glaucoma

- **Donepezil** – For Alzheimer’s disease - Lipid Soluble

- **Tacrine** – Lipid Soluble – Rx – Alzheimers

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Anti-ACh – Anti-Cholinergics

**MOA:**

So, if cholinergics agonize M3…

...............an Anti-ACh will ANTAGONIZE M3.

**Antagonizing M3 will cause:**

- **Decrease** Exocrine Gland Secretions
- **Decrease** Gut Motility
- **No Miosis** so – Mydriasis
- **No Accommodation** so – loss of accommodation
- **Bronchodilation**
- **Bladder relaxation**
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- Decrease Gut Motility
- No Miosis so – Mydriasis
- No Accommodation so – loss of accommodation
- Bronchodilation
- Bladder relaxation
Anti-ACh

- **Atropine** – Mydriasis w/Cyclopegia, Management of Anti-AChE “poisoning”

- **Benztropine/Trihexyphenidyl** – Lipid Soluble (CNS Entry) for ________________, and EPS Symptoms due to antipsychotics

- **Ipratropium** – Safe to use in _______and __________

- **Glycopyrrrulate, Oxybutinin** – Reduce urgency in mild cystitis and reduce bladder spasms

- **Scopolamine** – Motion Sickness

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Alpha 1 Receptor

- ______________________
- ______________________
- **Mydriasis** via radial (dilator muscle)
Alpha 1 Receptor Pharmacology

**Alpha 1 Agonists**
- EpinephRINE/NorepinephRINE

- ____________________/__________________ – Incontinence in the elderly

- ________________ – Neurogenic shock, pupillary dilation, vasoconstriction, nasal decongestion
Alpha 1 Receptor Pharmacology

**Alpha 1 Agonists**

- **Epinephrine**
  - Causes *Decreased* Production of *Aqueous Humor*
  - *Vasoconstriction*

- **Clinical Use:**
  - Hypotension
  - Asthma
  - Anaphylaxis
  - Open Angle Glaucoma
Alpha 1 Receptor Pharmacology

Alpha 1 Agonists

- Norepinephrine
  - Clinical Use:
    - Hypotension (Decreased Renal Blood Flow)
Alpha 1 Receptor Pharmacology

**Alpha 1 Antagonists**

- ______________ – Dx Pheochromocytoma, also for patients on MAOi that ate tyramine

- ______________ – Rx Pheochromocytoma

- **Yohimbine** – Impotence

- **Prazocin** – Rx HTN but assoc. with ______________

- **Terazocin/Doxazocin** – First line for BPH, also for HTN

- **Tamsulosin**
Alpha 2 Receptor

- **Decrease** ____________________________ (makes you less “adrenergic” AKA less SYMPATHETIC and MORE Parasympathetic)

- **Decreases** ____________________________

- **Promotes** **platelet aggregation**
Alpha 2 Receptor Pharmacology

Alpha 2 Agonists

- Clonidine – __________________________, associated with rebound HTN

- Alpha-Methyl Dopa – Rx HTN, safe in pregnancy but can cause ___________________.

- Guanabenz
Alpha 2 Receptor Pharmacology

Alpha 2 Antagonists

- **Mirtazapine** – Rx ______________________, S/E – Increased appetite, Increased serum cholesterol, increased sedation
  - “mirSADzapine”
Beta 1 Receptor

- Increases Heart Rate
- Increases Contractility
- Promotes __________________ Release
- Increases __________________ Release
- Increases Lipolysis
Beta 2 Receptor

- Increases **Contractility**

- ________________ – DECREASES: TPR, Diastolic Pressure, and Afterload

- ________________ of the Uterus

- **Broncho** ________________

- Increases ________________
Trouble Remembering $\beta$ Receptors?

- So, #1 comes BEFORE #2 and
  - Letter G comes BEFORE letter I Alphabetically
    - $\beta_1 = \text{Increase Glucagon}$
    - $\beta_2 = \text{Increase Insulin}$
- Get it! Got it! Good!
  - 1 BEFORE 2 and G BEFORE I
Beta Receptor Pharmacology

Beta 1 Agonists

- ______________ (___> ___) – Congestive Heart Failure
- Isoproterenol (B1=B2) Bronchospasm, Heart block and Bradyarrhythmias
  - S/E – Flushing, Angina, Arrhythmias

Beta 2 Agonists

- Albuterol – Asthma – short half life
- ______________ – Asthma – short half life, Premature labor treatment
- Ritodrine – Premature labor treatment
- Salmeterol – Asthma – Long term treatment

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Beta Receptor Pharmacology

Beta Receptor Antagonists

- **Propanolol** – Long half life, used in TH storm – prevents peripheral T4-T3 conversion

- **Esmolol** – Short half life

- **Acebutolol, Atenolol, Pindolol** –

- **Labetalol & Carvedilol** = Has ______ Antagonistic Activity, used in HTN emergency
Beta Receptor Pharmacology

Beta Receptor Antagonists

- **Nadalol** – In liver failure; decrease variceal bleeding
- **Timolol/Butexalol** __________________ – Decreases secretion of Aqueous humor
- **Carvedilol & Metoprolol** – Decrease post MI mortality
- **Sotalol** – ___________________________ Channel Activity, will increase the QT Interval