ADHD PHARMACOLOGY

University of Hawai‘i Hilo Pre-Nursing Program
NURS 203 – General Pharmacology
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Understand what happens in “filter & gain” under normal circumstances and how that translates to ADHD

- Understand the pharmacology behind the medications used to treat ADHA

- Understand the general pharmacologic profiles of the classes of medications used to treat ADHA and the individual characteristics of medications within those classes that give them a niche in therapy
OVERVIEW

Definition of ADHD
Under normal circumstances (filter and gain)
- Risk factors for ADHD
- Types of ADHD and diagnosis
- Medications used to treat ADHD
WHAT IS ADHD?

- A persistent pattern of inattention and/or hyperactivity-impulsivity that interferes with functioning or development
ADHD

Pharmacology

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ADHD Pharmacology
HCN (Funny) Channel

Dopamine

Potassium
ADHD Pharmacology

[Diagram of a brain with a highlighted region and icons representing various stimuli and effects]
Antagonism of the alpha 2 receptor
Lead to ADHD symptoms

We overwhelmed the alpha 2 receptor
Lead to ADHD symptoms

FILTER AND GAIN – PROVEN PHARMACOLOGICALLY
ADHD – RISK FACTORS

Family history (inheritable) & psychosocial
Temperamental
- Environmental
- Course modifiers
Hyperactivity-Impulsivity

**HYPERACTIVITY:**
- Fidgets with hands or feet or squirms in seat
- Leaves seat in classroom or in other situations in which remaining seated is expected
- Runs about or climbs excessively in situations in which it is inappropriate
- Has difficulty playing or engaging in leisure activities quietly
- Is "on the go" or acts as if "driven by a motor"
- Talks excessively

**IMPULSIVITY:**
- Blurs out answers before questions have been completed
- Has difficulty awaiting turn
- Intervents or intrudes on others

Inattention

- Fails to give close attention to details, makes careless mistakes
- Difficulty sustaining attention in tasks or play
- Does not seem to listen when spoken to directly
- Does not follow through on instructions, fails to finish schoolwork, chores, or duties
- Difficulty organizing tasks and activities
- Avoids, dislikes, or is reluctant to engage in tasks that require sustained mental effort
- Loses things necessary for tasks or activities
- Easily distracted by extraneous stimuli
- Forgetful in daily activities
MEDICATIONS USED TO TREAT

Stimulants
- Dextroamphetamine
- Methamphetamine
- Lisdexamfetamine (Vyvanse)
- Dextroamphetamine + amphetamine (Adderall)
- Methylphenidate (Ritalin)
- Dexamethylphenidate (Focalin)

Alpha agonists
- Guanfacine (Intuniv)

Norepinephrine re-uptake inhibitors
- Atomoxetine (Strattera)
No outside stimulus is needed to initiate this process!
Dextroamphetamine + amphetamine - Adderall

Dosage form
- Oral (XR or IR)

Kinetics
- Absorption – well absorbed, food prolongs Tmax
- Half life – 9-14 hours depending on age
- Metabolism – Liver (CYP2D6) has active metabolites
- Time to peak – IR (3 hours), XR (7 hours)
- Excretion – urine (highly dependent on pH of urine, 30-75%) unchanged drug, metabolites (50%)

ADRs
- Hypertension, insomnia, headache, decreased appetite, dry mouth, abdominal pain, arrhythmia

Interactions
- CYP2D6 inhibitors, (bupropion & fluoxetine), MAOI (Cl), CNS stimulants
- BBW – Cardiovascular disease & abuse potential
- Pregnancy – C
- Excreted in breast milk
Dosage forms

Capsules

Kinetics
- Absorption – rapid
- Distribution – CNS penetration, CSF concentrations 80% of plasma
- **Metabolism** – In the blood, intestines, and liver (no CYP) - Prodrug
- Time to peak – about 1 hour
- Excretion – 96% in the urine mostly as metabolites

ADR
- Insomnia, decreased appetite, dry mouth, upper abdominal pain, arrhythmia

Interactions
- MAOI (CI), CNS stimulants
- Pregnancy – C
- Excreted in breast milk
Dosage forms

- Capsules & tablets (XR, chewable, IR), solution & suspension, transdermal patch

Kinetics

- Absorption – readily absorbed (different dosage forms vary slightly)
- Protein binding – low (10-33%)
- Metabolism – extensive, into inactive compounds
- Half life – 2-7 hours, depending on dosage form and age
- Time to peak – 1-11 hours, depending on dosage form and age
- Excretion – 90% in urine as metabolites and unchanged drug

ADRs

- Insomnia, headache, decreased appetite, dry mouth, CV events

Interactions

- MAOI (CI), Alcohol, CNS stimulants,
- Pregnancy – C
- Excreted in breast milk
Alpha agonists - guanfacine

Re-uptake inhibitors - Strattera

HOW THE OTHERS WORK - REVIEW
Dosage forms

- Tablet (XR, IR)

Kinetics

- Absorption – Good
- Protein bound – 70%
- Metabolism – CYP3A4
- Half life – 10-30 hours
- Time to peak – 2.6-5 hours
- Excretion - 50% in urine as unchanged drug

ADRs

- Somnolence, dizziness, headache, fatigue, dry mouth, rebound hypertension (d/c)

Interactions

- CYP3A4 inhibitors, alcohol, other hypertensive medications,
- Pregnancy – B
- Not known if excreted in breast milk
Dosage forms
Capsule

Kinetics
- Absorption – rapid
- Protein bound – 98%
- Metabolism – CYP2D6 (poor metabolizers) & 2C19
- Half life – 5 hours (parent), 6-8 (metabolite)
- Time to peak – 1-2 hours (delayed by fatty meal)
- Excretion – Urine, mostly as metabolites, 17 % in feces

ADRs
Somnolence/insomnia, headache, dry mouth, decreased appetite

Interactions
- CYP2D6 inhibitors, MAOIs (CI), mifepristone, (QTc prolongation)
- Pregnancy – C
- Not known if excreted in breast milk