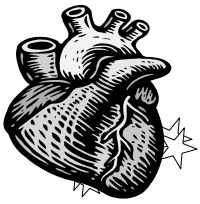
Clinical Pharmacology & Common Medications



Where to go to get drug information?

- Physician's PDR (all meds)
- Ellstad, chapter 23 (drugs and exercise testing)
- AHA books (emergency care drugs)
- ACSM Guidelines (Appendix A)
- McArdle, Katch, Katch 2001 (Table 32.20)

Classifications

1. Anti-hypertensives
2. Digitalis Glycosides
3. Anti-hyperlipidemics
4. Oral Hypoglycemics
5. Anti-coagulants
6. Anti-depressants/Anti-anxiety

Anti-hypertensives

① Alpha-adrenergic Blockers
① Beta Blockers
② Calcium Channel Blockers
③ Angiotensin Converting Enzyme Inhibitors (ACE)
⑥ Diuretics
⑦ Nitrates

Adrenergic Receptors

- **Adrenergic receptors (SNS)**
  - receptors on cell membranes that bind with catecholamines, EPI & NE
- **2 types of adrenergic receptors**
  - alpha (1 and 2)
  - beta (1 and 2)

Alpha and Beta

- **Alpha-adrenergic receptors**
  - responsive to NE and EPI equally
  - cause vc, intestinal relaxation, pupillary dilation
  - $\alpha 1$, is post-jn, $\alpha 2$ is pre-jn
- **Beta-adrenergic receptors**
  - cause ↑HR, contractility, vasodilation, bronchodilation, lipolysis
  - $\beta 1$, cardiac and lipolysis (NE and EPI equally)
  - $\beta 2$, vd and bronchodil., (more responsive to EPI)

Alpha-adrenergic Blockers

Generic Name	Trade Name
Prazosin	**Minipress**
Doxazosin	**Cardura**

Alpha-adrenergic Blockers

- **Action**
  - ↓ BP
  - Block post-synaptic α_1 receptor (binds norepi.)
  - Causes peripheral vasodilation

Alpha-adrenergic Blockers

- **Physiological effects**
  - Q no change at rest/exercise
  - BP ↓ at rest/exercise
  - EKG no changes
  - Ex. Capacity no changes

Beta Blockers

Generic Name	Trade Name
Atenolol	**Tenormin***
Metoprolol	**Lopressor, Toprol***
Propranolol	**Inderal**
Pindolol	**Visken**
Timolol	**Blocarden**

*** Selective β_1 blockers (little effect on lungs)**

Beta Blockers

- **Action**
  - Block β_1 & β_2 sites (cardio-selective β_1)
  - Negative inotropic and chronotropic effects
  - ↓ sympathetic system (Q, BP)

Beta Blockers

- **Physiological effects**
  - Q ↓ at rest/exercise
  - BP ↓ at rest/exercise
  - ECG ↓ HR at rest, ↑ ischemic threshold (delay)

Beta Blockers

- **Side Effects**
  - bradycardia, heart block, weakness, fatigue, increased cholesterol and blood sugar, insomnia
- **Exercise Response**
  - lower heart rates, hypotension, decreased cardiac contractility
  - increased capacity in patients with angina, decrease or no change in those w/o angina.

Calcium Channel Blockers

Generic Name	Trade Name
Diltiazem	**Cardizem (Type I)**
Verapamil	**Calan (Type I)**
Nifedipine	**Procardia (Type II)**
Nicardipine	**Cardene (Type II)**

Calcium Channel Blockers

- **Action (Type I)--*heart effects***
  - Used primarily for dysrhythmias (AV conduction)
  - Potent coronary vasodilators
  - Moderate peripheral vasodilators
  - Decreases BP

Calcium Channel Blockers

- **Action (Type II)--*peripheral effects***
  - No anti-dysrhythmic action
  - More potent peripheral vasodilators
  - Less potent coronary dilator
  - ↓ in contractility

Calcium Channel Blockers

- **Physiological effects**
  - Q ↑ or no change at rest/exercise
  - BP ↓ at rest/exercise
  - ECG ↓ HR (type I or type II) at rest/exercise

Calcium Channel Blockers

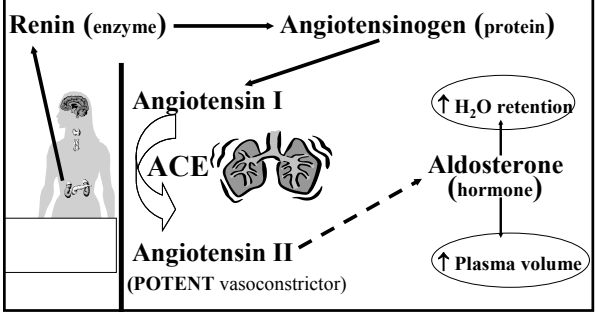
- **Side Effects**
  - Dizziness, syncope, fluid retention, headache
- **Exercise response**
  - Hypotension
  - Increased capacity in patients w/angina
  - No effect in patients w/o

ACE Inhibitors

Generic Name	Trade Name
Captopril	Capoten*
Lisinopril	Prinivil, Zestril*
Enalapril	Vasotec
Benazepril	Lotensin

***More commonly used in therapy**

Renin-Angiotensin-Aldosterone System



ACE Inhibitors

- **Action**
  - ↓ BP by ↓ TPR
  - No change in Q, HR, or GFR
  - May ↑ GFR in mild to moderate renal dysfunction
  - Inhibition of **renin-angiotensin-aldosterone** system

ACE Inhibitors

- **Physiological effects**
  - Q no change at rest/exercise
  - BP ↓ at rest/exercise
  - EKG no changes
  - Ex. Capacity ↑ in patients w/ CHF
- **Treatment is life-saver for CHF patients**

Diuretics

Generic Name	Trade Name
Hydrochlorothizide	Esidrix
Furosemide	Lasix*
Bumetanide	Bumex

***most used diuretic**

Diuretics

- **Action**
  - HCTZ
    - ↑ excretion of Na^+ and water
  - Lasix/Bumex
    - more potent
    - acts more proximal on nephron
    - indicated in CHF, pulmonary edema
    - **NOT** K^+ sparing!!!

Diuretics

- **Physiological effects**
  - Q no change at rest/exercise
  - BP ↓ at rest/exercise
  - EKG no change or PVCs

Diuretics

- **Side Effects**
  - drowsiness, dehydration, electrolyte imbalances
- **Exercise Response**
  - hypotension
  - usually no change in capacity
  - PVCs (hypomagnesemia)
  - ST depression (hypokalemia)

Nitrates

Generic Name	Trade Name
Isosorbide mononitrate	**Ismo**
Isosorbide dinitrate	**Isordil**
Nitroglycerin	**Nitrostat***

***preference for coronary artery smooth muscle**

Nitrates

- **Action & Physiological effects**
  - Predominance for venous dilation
  - Q ↓ at rest/exercise
  - BP ↓ at rest/exercise
  - EKG ↑ HR

Nitrates

- **Side Effects**
  - hypotension, headache, dizziness
- **Exercise Response**
  - hypotension
  - increase capacity in patients w/angina
  - no change in patients w/o
  - increase in patients with CHF

Digitalis Glycosides

Generic Name	Trade Name
Digoxin	**Lanoxin**

- **Action**
  - ↑ contractility, ↓ electrical conduction
  - Increases influx of Ca^{++}
  - Used in treatment of CHF
  - Used in treatment of atrial fib post-surgery

Digitalis Glycosides

- **Physiological effects**
  - Q ↑ at rest/exercise
  - BP no change or ↑ at rest/exercise
  - EKG at rest, ST-T wave changes

Digitalis Glycosides

- **Side Effects**
  - Arrhythmias, heart block, fatigue, weakness, headache, nausea, vomiting
- **Exercise Response**
  - Increased capacity, increased myocardial contractility in patient, no change others
  - ST depression

Anti-hyperlipidemics

Generic Name	Trade Name
Cholestyramine	**Questran**
Gemfibrozil	**Lopid**
Lovastatin	**Mevacor**
Simvastatin	**Zocor**
Atorvastatin	**Lipitor**
Niacin	**Nicobid**

Anti-hyperlipidemics

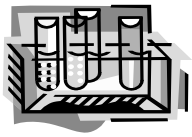
- **Action**
  - Cholestyramine
    - binds bile acids
  - Gemfibrozil
    - ↓ hepatic triglyceride (TGL) secretion
  - Statins
    - ↓ LDL, TGL, Total, ↑ HDL
  - Niacin
    - ↓ synthesis of VLDL

Anti-hyperlipidemics

- **Side Effects**
  - nausea, vomiting, diarrhea, constipation, flatulence, abdominal discomfort, glucose intolerance
- **Exercise Response**
  - Most have no effect on HR, BP, and EKG
  - Clofibrate may cause arrhythmias
  - Nicotinic Acid may ↓ BP

Oral Hypoglycemics

Generic Name	Trade Name
Glipizide	**Glucotrol**
Glyburide	**Diabeta, Micronase**



Oral Hypoglycemics

- **Action**
  - Stimulate insulin release
  - Improve binding of insulin/insulin receptor
  - Up-regulation of insulin receptors
- **Exercise considerations**
  - before exercise test: check blood glucose
  - otherwise, no effect on HR, BP or EKG

Anti-coagulants

Generic Name	Trade Name
Warfarin	Coumadin
Pentoxifylline	Trental*

***used in intermittent claudication (viscosity)**

- **Action**
  - depresses synthesis of coagulation factors (Vit. K)

Anti-coagulants

- **Side Effects**
  - easy bruising, stomach irritation, joint or abdominal pain, difficulty swallowing, unexplained swelling, uncontrolled bleeding
- **Exercise Response**
  - no effects on HR, BP, EKG
  - normal exercise capacity

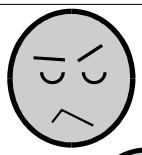
Anti-depressants/Anti-anxiety

Generic Name	Trade Name
Fluoxetine	Prozac
Sertraline	Zoloft
Paroxetine	Paxil
Alprazolam	Xanax*

***Anti-depressant**

Anti-depressants/Anti-anxiety

- **Physiological effects**
  - HR and Q ↑ at rest/exercise
  - BP ↓ at rest/exercise
  - EKG may cause "false positive"
  - Heart block and ↓ left ventricular function
  - Ex. Capacity no changes



Nicotine

- **Decreases exercise capacity and reduces anginal threshold**
- **Increases oxygen cost and metabolic rate**
- **Reduces oxyhemoglobin**
- **Increases systolic and diastolic pressure**
- **Increases symp and decreases PS drive**
- **Decreases skin blood flow and increases TPR**

Alcohol

- **May cause dehydration**
- **Reduces cardiac contractility and cardiac output**
- **Decreases exercise capacity**

Conclusions

- **Patients you will meet in a cardiac rehab clinic most likely will be taking multiple medications**
- **Many of these medications have profound influences on exercise responses and capacity**
- **As an exercise physiologist**
  - you should be aware of what meds the patient is taking
  - know side effects and how they might impact your exercise tests and prescriptions