Cardiovascular BCGP

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Acute Coronary Syndromes

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ACS

- STEMI
  - S-T Elevation
  - Biomarkers
- Non-STEMI
  - No S-T Elevation
  - Biomarkers
- Unstable Angina
  - Chest pain at rest
  - New onset, limits activity
  - Increase or worsening in symptoms
  - No Biomarkers

Symptoms of MI

- Chest pain
- Pressure
- SOB
- N/V
- Fainting
- Women can present with atypical symptoms

Causes of MI

- CAD
- Plaque Buildup
- Spasm
- Coronary artery embolism

Immediate Care

- MONA
- Aspirin
- Nitroglycerine for chest pain
- Oxygen
- Morphine

Percutaneous Coronary Intervention (PCI)

- STEMI – PCI is treatment of choice
  - Within 12-24 hours
- If cannot do PCI, fibrinolytic therapy is alternative option
  - More likely in non-US locations/extremely remote locations
- Heparin based products given in conjunction
  - Bivalirudin is an alternative option in those who can't use heparin/enoxaparin

Fibrinolytics

- Tenecteplase, alteplase, streptokinase
  - Tenecteplase – best safety profile, similar efficacy to alteplase
  - Streptokinase – cheap, less effective, less intracranial bleeding
- Considered if PCI not an option, or don't have access in 120 minutes or less
- Contraindications
  - Any significant internal bleeding
    - Intracranial hemorrhage
    - Active GI bleeding
    - Uncontrolled, unresponsive hypertension (>180/110)

NSTEMI/Unstable Angina

- Higher score, more likely to do early invasive strategies (i.e. PCI)
- Thrombosis in Myocardial Infarction (TIMI) risk score
  - Age >65
  - CAD or CAD risk factors like smoking, hypertension, hypercholesterolemia, diabetes, tobacco
  - Recent aspirin use (last 7 days)
  - Severe angina
  - Elevated cardiac marker
  - ST change >0.5

Classic Medications on Hospital Discharge

- Aspirin
- P2Y12 inhibitors (i.e. clopidogrel)
- ACE or ARB
- Beta-blocker
- Statin

Atrial Fibrillation

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Symptoms of Atrial Fibrillation

- General fatigue
- Rapid and irregular heartbeat
- Fluttering or "thumping" in the chest
- Dizziness
- Shortness of breath and anxiety
- Weakness
- Faintness or confusion
- Fatigue when exercising

Classification of AFib

- Paroxysmal (<7 days)
- Persistent (>7 days and won't go back to normal on its own)
- Permanent (continuous Afib)

Controlling Rate

- Beta-blockers
- Calcium Channel Blockers
- Digoxin

Clinical Medication Pearls

- Beta-blockers
  - Usually first line
  - Generally avoid non-selective unless compelling indication
- Calcium Channel Blockers
  - Non-dihydropyridines
  - Heart failure risk
- Digoxin toxicity
  - GI symptoms, CNS, weight loss, bradycardia
  - Renal elimination
  - Target concentration <1ng/mL vs. CHF (0.5-0.8)

Rhythm Control

- Potassium Channel Blockers
  - Amiodarone
- Sodium Channel Blockers
  - Flecainide (Tambocor®)
  - Propafenone (Rythmol®)

Amiodarone Pearls

- Extremely long half life
- Liver toxicity
- Pulmonary toxicity
- Thyroid impact
- Drug interactions
- QTc prolongation
  - Be aware of other drugs, citalopram, quinolones, ondansetron, antipsychotics

Anticoagulation

- Clot formation is one of the major risks with atrial fibrillation
- To be discussed further – see NOACs/Warfarin section
- CHADS2Vasc
  - CHF
  - Hypertension
  - Age (65-74 +1; 75 or greater +2)
  - Diabetes
  - Stroke (+2)
  - Vascular Disease history
- Score of 2 or greater; anticoagulation indicated

Valvular Heart Disease

- Anticoagulation – Mechanical Heart Valve(s) Replacement
  - Warfarin = Drug of Choice
  - Target higher INR – 2.5-3.5
- Direct oral anticoagulants
  - Not indicated for use in valvular replacement
- NOACs and Warfarin discussed in separate lectures

CHF

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CHF Characteristics

- Inability to effectively pump blood
- Elevated BNP (or pro-BNP)
- SOB, cough
- Fatigue, weakness
- Edema

Medications Frequently Used in CHF

- Diuretics
  - Loops
  - K+ sparing
  - Thiazide Like
- ACE/ARBs
- Beta-blockers
- Digoxin

Loops

- Furosemide
- Mainstay of therapy
- Fluid loss
- Risks
  - Electrolyte depletion
  - Dehydration/Kidney Failure
  - Frequent urination

Beta-blockers/ACE Inhibitors

- See Hypertension for more clinical breakdown
- Generally try to push the dose
  - Not that easy in the elderly
  - Falls
  - Weakness
  - Kidney function

Thiazide Like

- Metolazone
  - One hour before furosemide
  - Used to augment furosemide
  - Significant hyperkalemia risk when used with furosemide
  - Sometimes only need to use once or twice/week
- True thiazides (i.e. HCTZ)
  - Generally not used for CHF/fluid loss
  - Likely not as beneficial with CrCl <30

Aldosterone Antagonists

- Spironolactone, Eplerenone
- Hyperkalemia
- Gynecomastia
- 100mg spironolactone/40 mg furosemide

Additional Therapies

- Isosorbide dinitrate/hydralazine – black ancestry
  - Reduced RAAS effectiveness in blacks
- Sacubatril/valsartan
  - Still with exacerbations
  - Remember 36 hour washout period with ACE/ARB
- Ivabradine
  - Option if heart rate is still >70 and on max beta blocker

Digoxin in CHF

- Increased mortality at higher levels
- Target 0.5-0.8
- Monitor closely
  - Changing renal function
  - Symptoms of toxicity

Classic Drugs that Exacerbate CHF

- NSAIDs
  - Sodium retention
  - Also risk of Kidney damage with ACE/Diuretics on board
- CCB's
  - Increase edema
- TZD's
  - Pioglitazone
- Pregabalin

Coronary Heart Disease and Cardiovascular Risk

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Coronary Heart Disease

- Atherosclerosis, Coronary Artery Disease (CAD), Ischemic Heart Disease (IHD)
  - Plaque formation
  - Hardening of the arteries
- Can lead to;
  - Angina
  - Myocardial Infarction

Cardiovascular Risk Stratification Considerations

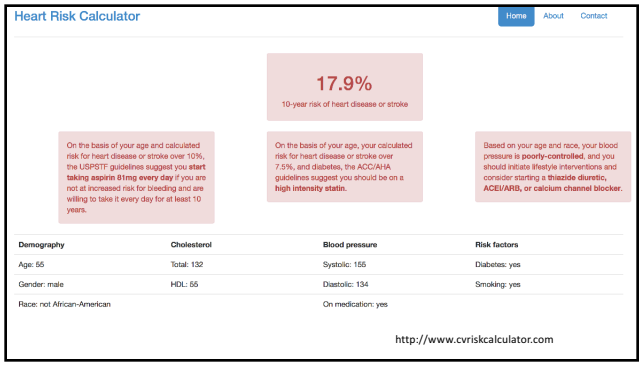
- Age
- Sex
- Family history
- Smoking
- Obesity
- Alcohol
- Hypertension
- Diabetes
- Metabolic Syndrome
- Physical activity
- Lipid levels
- Diet

ACC/AHA Risk Calculator – Primary Prevention

- Age
- Gender
- Race
- Cholesterol/HDL (doesn't use LDL in calculator, but if >190 recommend likely starting statin)
- Blood Pressure (level plus if on medication)
- Diabetes
- Smoking
- ***Provides 10 year risk as well as if aspirin is recommended

Links to Calculators

- http://www.cvriskcalculator.com
- http://www.mayoclinic.org/diseases-conditions/heart-disease/in-depth/heart-disease-risk/itt-20084942



Goal – Reduce Risk of MI/Stroke

- Platelet inhibitors
- Statins
- Smoking Cessation
- Weight loss
- Anti-angina medications
- Antihypertensives

Antiplatelet medications

- Aspirin
- ADP inhibitors commonly used with aspirin in stenting, ACS
  - Clopidogrel

Statin Consideration

- Adherence is critical
- Past history
- Some recommended to be dosed at night and some aren't
- Cost
- Life expectancy

Anti-Angina Medications

- Nitrates
  - Long acting
  - Short acting
- Beta-blockers
- CCB's

Antihypertensive Therapy

- ACE/ARB
- Beta-blocker
- CCB

Hyperlipidemia

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Hyperlipidemia Basics

- LDL is primary focus for statin medications
  - More of a shift towards risk factors, irrespective of levels
- Triglycerides – primary target >500
  - Fibrates
  - Niacin

Cardiovascular Risk Stratification Considerations

- Age
- Sex
- Family history
- Smoking
- Obesity
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- Diabetes
- Metabolic Syndrome
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High Intensity Examples

- Atherosclerotic CVD
- LDL >190
- Diabetes and CVD 10 year >7.5%
  - Age 40-75
- Age 75 – magic number to assess risk/benefits and aggressiveness of therapy

Table 1. Statin Therapy

Intensity	Definition	Dosage
Low	Daily dose lowers LDL-C by <30%, on average	Simvastatin 10 mg Pravastatin 10-20 mg Lovastatin 20 mg Fluvastatin 20-40 mg Pitavastatin 1 mg
Moderate	Daily dose lowers LDL-C by approximately 30% to <50%, on average	Atorvastatin 10-20 mg Rosuvastatin 5-10 mg Simvastatin 20-40 mg Pravastatin 40-80 mg Lovastatin 40 mg Fluvastatin XL 80 mg Fluvastatin 40 mg bid Pitavastatin 2-4 mg
High	Daily dose lowers LDL-C by approximately ≥50%, on average	Atorvastatin 40-80 mg Rosuvastatin 20-40 mg

C: cholesterol; XL: extended-release.
Source: Reference 1.

USPharmacist.com

Clinical Pearls

- Rosuvastatin/Atorvastatin for high intensity
- Generally avoid simvastatin if not on/hasn't tried others
  - CYP3A4 interactions (amlodipine, amiodarone, diltiazem, etc.)
- Rosuvastatin
  - Most potent LDL lowering, less strict on interaction with gemfibrozil
- Atorvastatin
  - Covers moderate/high intensity nicely
  - Does have some 3A4 interaction potential
- Lovastatin
  - 3A4 potential

Clinical Pearls

- If myopathy on CYP3A4 agent, try an alternative that doesn't use that pathway
  - If tried atorvastatin, avoid lovastatin, simvastatin if alternatives have not been tried
  - Look for drug interactions that might be contributing
  - Co-Q10?
- Hydrophilic may help reduce myopathy
  - Pravastatin
  - Rosuvastatin
  - Fluvastatin
- Lipid checks – recommended to assess adherence

Alternative Options – High Risk Patients

- Rechallenge with statin is recommended
- Ezetimibe
- PCSK9 inhibitors

Triglycerides

- Gemfibrozil
  - Interaction with statins (rhabodomyolysis, CPK etc.)
- Fenofibrate
  - Maybe less risk with statin interaction/myopathy
- Niacin
  - Better at increasing HDL
  - Flushing/Uric acid

Hypertension Guidelines

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AHA/ACC Hypertension Updates

- American Heart Association and American College of Cardiology
- Elevated systolic – 120-129 (do not begin pharmacotherapy, lifestyle interventions; exercise, DASH diet, etc.)
- JNC-8 cutoffs were 140/90 and 150/90 for elderly without higher risk disease states
- New updates lower threshold for pharmacotherapy in higher risk populations

Stage 1 Hypertension 130-139 or 80-89

- Lifestyle modification for low risk patients
- Medication therapy for high risk patients
  - CV event
  - Diabetes
  - CKD
  - Risk stratification
    - If greater than 10% ASCVD 10 year risk
    - http://www.cvriskcalculator.com/

Clinical Factors

- Age/life expectancy
- Falls
- Hypotension history
- Other drugs
- Medical causes of hypertension

Hypertension Medications

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ACE Inhibitors

- Common Side Effects
  - Cough
  - Kidney impairment
    - Worry about 30% changes or more
    - Diuretics/NSAIDs
  - Hypotension
  - Hyperkalemia

Clinical Pearls

- ACE inhibitors can exacerbate CKD, but can also help be renal protective
- Lisinopril most commonly used
- Classic medication cause of angioedema (extremely rare)
- In some cases, African Americans may not respond to ACE Inhibitors as well as other ethnicities
- Avoid ACE/ARB combo

Compelling Indications

- Diabetes
- Stroke
- CAD
- CKD
- CHF

Angiotensin Receptor Blockers

- Losartan
- Valsartan
- Irbesartan

ARB Clinical Pearls

- Think ACE minus the cough
  - Hyperkalemia
  - Kidney function
  - Angioedema
  - Similar compelling indications

Thiazide Diuretics

- Memorable Side Effects
  - Increase urine output
  - Frequent urination
  - Electrolyte depletion
  - Low blood pressure
  - Hyperuricemia
  - Hypercalcemia
  - Increased risk of kidney failure

Use Caution

- Gout
- Poor kidney function (CrCl <30)
- Timing near night
- Hyperglycemia

Calcium Channel Blockers

- Dihydropyridines – amlodipine, nifedipine, felodipine
- Non-dihydropyridines – verapamil, diltiazem
- Dose dependent edema
- Constipation
- Simvastatin interaction

Calcium Channel Blockers

- Compelling Indications
  - Angina
  - Atrial Fibrillation (diltiazem, verapamil)
  - CVD risk
- Caution
  - Heart failure

Beta-Blockers

- Cardioselective
  - Metoprolol
- Non-selective
  - Propranolol
- Alpha and Beta blockade
  - Carvedilol

Beta-blockers

- Compelling Indications
  - CHF
  - MI
  - Angina
  - Afib

Beta-blocker Pearls

- Asthma/Airway disease
- Pulse
- Hypoglycemia masking
- Risk of rebound hypertension
- Non-selective uses
  - Tremor
  - Esophageal varices
  - Thyroid storm
  - Migraine

Alpha-Blockers (for hypertension)

- Doxazosin
- Prazosin
- Terazosin

Alpha-Blocker Pearls

- Orthostasis
- BPH compelling indication
- Typically dosed at night
- Prazosin off label for nightmares

Hydralazine

- Multiple doses
- Contraindicated in coronary artery disease
- Lupus type syndrome
- Vasodilator – hypotension risk may be a little greater than other antihypertensives

Clonidine

- Centrally acting side effects (depression, sedation, dizziness)
- Bradycardia
- Dry mouth
- Avoid in elderly
- Lots of unique uses
  - Opioid/nicotine withdrawal
  - ADHD
  - Clozapine excessive salivation

Hypertension Pearls

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Complications/Risks

- MI
- Stroke
- Kidney
- Vision
- Heart Failure
- Aneurysm

Goals

- JNC-8
  - <150/90
  - Exception: 140/90
    - CKD
    - Diabetes
- New guideline update – see separate lecture, more aggressive goals

Drug Induced Hypertension

- NSAIDs
- Stimulants
- Corticosteroids
- Estrogen
- SNRI's
- ESA's

Medical Induced Hypertension

- Sleep apnea
- Thyroid
- Adrenal gland problems
- Illicit drug use/addiction
  - Opioid withdrawal

NOACs

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Factor 10A Inhibitors

- Gaining popularity
- Drug interactions
- Less monitoring
  - Is that good or bad?
- When might you not choose them
  - Prosthetic valves
  - Adherence issues (t ½ longer for warfarin)
  - CKD
  - Cost/insurance coverage
  - Provider comfort/preference

Rivaroxaban

- Rivaroxaban
  - Once daily
  - 3A4/P-glycoprotein interactions possible
  - <30mls/min avoid use
  - DVT – 15 mg BID for 21 days followed by 20 mg daily
  - DVT prophylaxis – 10 mg daily; up to 35 days
  - Afib – 20 mg daily
  - May have to reduce dose in elderly with CrCl between 30-50 mls/min

Apixaban

- Apixaban
  - Twice daily
  - Possible dose adjustments based upon age, creatinine, weight
  - DVT Treatment 10 mg BID for 7 days then 5 mg BID
  - Afib – 5 mg BID
  - 2 or 3; age>80, body weight <60, or creatinine >1.5; reduce dose to 2.5 BID
  - Post op prophylaxis – 2.5 BID
  - Specific dose adjustments for 3A4 and P-glycoprotein inhibitors like clarithromycin, ketoconazole, itraconazole, ritonavir

Edoxaban

- Edoxaban
  - >95 mls/min boxed warning (stroke)
  - Once daily
  - Creatinine clearance 15-50 mls/min – dose reduction)30 mg daily
  - Usual dosing = 60 mg daily
  - Reduced dose with 3A4/P-glycoprotein inhibitors (rivaroxaban)
  - Avoid in very obese/low weight extremes

Dabigatran

- Direct Thrombin Inhibitor
- GI bleed risk >75 y/o
- Reversal agent available
- Dose adjustment in CKD
- Twice daily

Peripheral Vascular Disease

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Factors That Can Contribute to PVD

- Atherosclerosis
- Hypertension
- Clot formation
- Viscosity of the blood

Peripheral Vascular Disease

- Intermittent claudication
- Ischemia
- Sharp, stabbing pain
- Pedal pulses absent
- Risk amputation

Medications

- Smoking Cessation
- Aspirin/Clopidogrel
- Statins
- Antihypertensives

Cilostazol

- Trial for 3 months
  - If no improvement discontinue
- Administer on empty stomach
- Boxed warning – don't use in heart failure
- Possibility to alter bleed risk
- 3A4 interactions

Pentoxifylline

- Possible antiplatelet activity
  - Reduces blood viscosity
  - Increase bleed risk potential
- Generally not that effective
  - Rarely see it used

Pulmonary Hypertension

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Pulmonary hypertension

- Elevated pressure in lung arteries
  - Narrowing, damage, blockage
- Can result in right side heart failure
  - SOB
  - Fatigue
  - Edema
  - Poor perfusion
  - Tachycardia

Management

- Prostanoids (i.e. epoprostenol, iloprost)
  - IV administration for acute issues (epoprostenol)
  - Potential for tolerance and rebound if abruptly discontinue
  - Bleed risks – platelet inhibition
- Endothelin Receptor Antagonists
  - Ambrisentan, bosentan
  - REMS program – pregnancy, fetal risks

PDE-5 Inhibitors

- Sildenafil, tadalafil
  - Nitrate interaction
  - Flushing
  - Headache
- CCB's
  - Last line
  - Usually well tolerated

Warfarin

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Dosing

- Usual is 5 mg once a day
- Elderly should often be lower
- Considerations for starting dose
  - Other medications
  - Age
  - Bleed risk
  - Vitamin K intake/nutrition

Warfarin Common Indications

- Atrial Fibrillation (2-3)
- DVT/PE (2-3)
- Prosthetic Mechanical Mitral Valve
  - 2.5-3.5
- Lower goals
  - High bleed risk
  - High fall risk

Warfarin - Pharmacokinetics

- Metabolized by
  - S-warfarin: CYP 2C9 (potent)
  - R-warfarin: CYP 1A2, 2C19, 3A4
- Bound to albumin
- Half-life = 36-42 hours

Warfarin – Adverse Effects

- Bleeding
- Purple Toe Syndrome
  - Don't load warfarin

Warfarin – How long does it take to work?

- Half-life of clotting factors
  - II 60 hrs (prothrombin)
  - VII 6 hrs
  - IX 24 hrs
  - X 40 hrs

  (reduction of II and X = prolongation of PT)
- Half-life of anticoagulants
  - Protein C 6 hrs
  - Protein S 72-96 hrs

Causes of INR Variation

- Adherence
- Diet
- Drug Interaction
- Changes in Disease States
  - Liver
  - CHF
  - Fever

Vitamin K

- Elevated INR and bleeding
- INR greater than 9
- Not going to work instantly
- Transfusion for acute, severe blood loss
- INR 5-9, no bleeding
  - May give vitamin K, don't have to

Endocrine BCGP

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Addison's Disease and Cushing's

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Addison's Disease

- Defined by a deficiency in cortisol (from adrenal gland)
  - Corresponding aldosterone deficiency
- Results in; - possible adrenal crisis
  - Low blood pressure
  - Hyperkalemia
  - Hyponatremia
  - Hypoglycemia
  - Skin darkening

Management

- Exogenous steroids
  - Prednisone/hydrocortisone
  - Lifelong therapy likely unless identifiable/treatable reason for deficiency
- Mineralocorticoid replacement
  - Fludrocortisone
    - Helps with hyponatremia
      - May also see additional salt intake requirements
    - Side note – often used in the management of severe hypotension due to dialysis

Adrenal Crisis

- Acute, severe, symptomatic adrenal gland failure
  - Hypotension
  - Loss of consciousness
  - Hyperkalemia, hyponatremia
  - N/V
- IV glucocorticoid (hydrocortisone)
- Fluid replacement
- Sodium monitoring
- Dextrose – to treat hypoglycemia

Cushing's

- Opposite of Addison's
  - Excessive corticosteroid (cortisol)
  - Caused by oversupply of exogenous
- Weight gain
- Hyperglycemia
- Moon face/buffalo hump – fat distribution changes
- Acne
- HTN
- Osteoporosis

Treatment – Cushing's

- Remove exogenous steroids
  - SLOWLY!!!
- Abrupt discontinuation of long term steroids
  - Adrenal insufficiency
- Treat underlying cause if not due to excessive supplementation of steroid
  - I.e. cancer
  - Surgery, radiation
- Cabergoline – may help normalize production of cortisol
  - Low success rate
  - Dopamine agonist
    - May see used for elevated prolactin levels
    - Psych/GI adverse effects

Diabetes: Compelling Indications, Complications, and Goals

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Diabetes Monitoring

- A1C
- Blood sugars
- Kidney, eye, feet
- Goals
  - 6.5-8
  - Trend toward less strict control as we age/life expectancy declines and keen sense of hypoglycemia risks

Complications

- Cardiovascular Disease
- Neuropathy
- Nephropathy
- Retinopathy
- Gastroparesis
- Amputation risk
  - Infection risk

Statin Use

- Recommended for majority of patient with diabetes
- Many patients at high risk
- Drug Interactions
- Factors to discontinue?
  - Tolerability
  - End of life

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High	Daily dose lowers LDL-C by approximately ≥50%, on average	Atorvastatin 40-80 mg Rosuvastatin 20-40 mg

Courtesy: uspharmacist.com

Hypertension

- ACE OR ARB
  - Renal protection
- CCB
- Thiazide

Aspirin

- Most likely, but
  - Consider risk with other medications (i.e. Warfarin, NSAIDs, etc.)
  - Past history
  - Bleeding
  - Risk calculators (See CHD lecture)

Diabetic Neuropathy

- Gabapentin/pregabalin
- SNRI's
- Topical Lidoderm
- TCA's

Gastroparesis

- Cause of GI nausea/upset in diabetes patients
- Metoclopramide
  - Parkinson's disease risk
- Erythromycin
  - Drug interaction risk
- Be careful with anticholinergics
  - Exacerbate gastroparesis

Changes That Can Impact Diabetes

- Steroids
- Beta-blockers
- Infections
- Dementia
- Medications that suppress or stimulate appetite

Treatment of Hypoglycemia

- Glucagon
  - Alertness compromised
- Sugar replacement
  - Aspiration
  - Choking

Type 2 Diabetes; The Medications

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Metformin

- First line
- Kidney function
  - Target 45 mls/min
- GI side effects
- Weight neutral to weight loss
- Low risk hypoglycemia
- B12

Sulfonylurea's

- Glipizide, glimepiride, glyburide
- Hypoglycemia
- Weight gain
- Chlorpropamide (rarely used) SIADH risk

DPP-4 Inhibitors

- Sitagliptan, linagliptan etc.
- Well tolerated
- Increases incretin
  - Post-prandial
  - Promotes fullness
- Weight neutral
- $$$
- Generally low hypoglycemia when used alone

TZD's

- Reduces insulin resistance in peripheral
- Weight Gain
- Edema
- CHF risk

SGLT-2 Inhibitors

- Glucose loss through the urine
- Low hypoglycemia when used alone
- UTI/genital infections
- Lower BP (mildly)
- Hyperkalemia
- Kidney function
- $$$

GLP-1 Agonists

- Incretin
  - Post-prandial
- GI SE's
- Injection
- $$$
- Thyroid tumor risk

Insulin

- Sliding Scale
  - Short term use
- Long Acting
  - Targets fasting
- Rapid Acting
  - Targets post-prandial
- Diet Changes

Estrogen Replacement

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Estrogen Risks

- Clots
- CHD
- Breast Cancer
- Endometrial Cancer

Benefits of Estrogen

- Osteoporosis
- Colorectal Cancer
- Improve menopausal symptoms

Goals of Estrogen Therapy

- Treat symptoms
- Limit length of use
- Minimum Effective Dose
- Avoid use
- Discontinue

Alternatives for Menopausal Symptoms

- SSRI
  - Paroxetine
    Fluoxetine
- SNRI
  - Venlafaxine
- Gabapentin
- Clonidine
- Topical Estrogen (vaginal atrophy/dryness)

Hyperparathyroidism

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Hyperparathyroidism types

- Primary
  - Surgery
- Secondary
  - Most commonly due to CKD complications

CKD Induced Hyperparathyroidism

- Vitamin D is converted to active form by the kidney
  - In CKD this process is reduced
  - Possible resulting hypocalcemia
- Hypocalcemia signals PTH release
- Phosphorus elevations can signal PTH release as well

Management

- Depends upon calcium level
- If low calcium level
  - Utilize active vitamin D (calcitriol)
- If low calcium and high phosphorus
  - Utilize calcium based phosphate binder
- If hypercalcemia
  - Avoid medications that can increase calcium
  - Cinacalcet

Cinacalcet

- Mimics calcium, but doesn't contribute to hypercalcemia
- Risk of hypocalcemia and elevations in phosphorus
- Monitor levels closely upon initiation of therapy

Osteoporosis Prevention

- Bisphosphonates
- Reduce calcium loss from bones
- Adverse effects/risk
  - Oral – GI ulceration
  - Burdensome administration procedure
  - Osteonecrosis

Obesity

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Obesity

- BMI >30
- Complications
  - Diabetes
  - Cardiovascular risk
  - Pain/physical complications
  - Sleep Apnea
  - GERD

Options for Treatment

- Diet changes/calorie reduction
- Exercise
- Medications
  - OTC/Herbals
- Surgery

Orlistat

- Blocks fat absorption in GI tract
- Relatively safe
- Problematic oily diarrhea if patient has significant fat intake in diet
- May decrease fat soluble vitamin absorption
  - ADEK
  - Supplement with multivitamin may be necessary

Lorcaserin

- Serotonin activity
- Reduces appetite
- $$$
- GI side effects
- Avoid if poor kidney function CrCl <30

Phentermine

- Stimulant
  - Acts via norepinephrine effects
  - Warnings/precautions regarding patient with cardiac complications/risk
    - Hypertension
    - Atrial fibrillation
  - Insomnia
- Controlled substance
  - Caution/avoid if history of addiction/drug abuse

Topiramate

- Seizure medication/migraines
- Cognitive slowing
- Combination product with phentermine

Bupropion

- Stimulating type antidepressant
- Avoid in seizures
- Smoking cessation benefit

Diabetes Medications

- GLP-1's
  - Liraglutide – higher 3 mg dosing
  - Exenatide
- Metformin

Avoiding Weight+ Medications

- Antidepressants
  - Mirtazapine
  - TCA's
  - Paroxetine
- Sulfonylureas
- Pioglitazone
- Depakote
- Antipsychotics

Thyroid Disorders

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Hypothyroidism - Diagnosis

- Usually elevated TSH and low T4
- Symptoms
  - Lethargy
  - Cold
  - Weight Gain
  - Constipation
  - Hair loss/Skin Dryness
  - Lack of energy

Levothyroxine

- Usual starting dose 25-50 mcg/day
- Binding interactions
  - Consistency with administration
- Follow up – 6 weeks to 3 months

Drugs That Can Impact Thyroid Function

- Amiodarone
  - Hyperthyroid or Hypothyroid
- Lithium

Levothyroxine Interactions

- Enzyme Inducers
  - Phenobarbital
  - Carbamazepine
- Binding interactions
  - Calcium
  - Cholestyramine
  - Sucralfate
  - Iron

Hyperthyroidism

- Methimazole
- PTU
  - Liver toxicity
- Risk
  - Weight Loss
  - Tachycardia
  - Insomnia
  - Nervousness
  - Osteoporosis

Thyroid Storm

- Symptoms
  - Tachycardia
  - Anxiety
  - Agitation
  - Psychosis
  - Elevated temp
- Treatment
  - Beta-blocker
    - Helps with tachycardia/anxiety
  - Antithyroid medication
    - I.e. PTU/Methimazole

Geriatric Syndromes

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Delirium

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Definition

- Delirium – "an ***acutely*** disturbed state of mind that occurs in fever, intoxication, and other disorders and is characterized by restlessness, illusions, and incoherence of thought and speech"

Causes

- Medical
  - Infection
  - Pain
  - Electrolyte imbalances
- Prescription Drugs
- Drugs of abuse
  - Opioids
  - Alcohol
  - Methamphetamines
  - LSD

Drug Causes

- Anything that acts on the CNS
- Classic Examples
  - Benzo's
  - Opioids
  - Anticholinergics
  - Antispasmotics
  - Z-drugs
  - Sinemet
  - Drug levels (Digoxin, phenytoin, lithium)
  - Drug interactions

1st Line Therapy

- Identify and solve existing problem
- Redirect Patient
- Enlist patient in an activity
- Offer snacks and beverages to patient.
- Go to the bathroom

When Drugs Are Necessary

- Haldol
  - Most experience
  - Higher incidence of AE's
- Newer AP's
  - Risperidone
  - Quetiapine
    - Less EPS
    - Less experience

Treatment of Delirium - Avoid

- Benzo's
  - Can aggravate
- Opioid
  - Pain can be cause of delirium
  - Use non-opioid if possible to treat delirium suspected to be caused by pain

Dementia

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Major Types of Dementia

- Alzheimer's
- Vascular
- Lewy Body

MMSE

- *Higher = Better
  - 24-30 Normal
  - 20-23 Mild
  - 10-19 Moderate
  - <10 Severe

Medications

- Acetylcholinesterase Inhibitors
  - Donepezil, Rivastigmine, Galantamine, Tacrine
- NMDA Receptor Antagonists
  - Memantine
- *Do NOT Reverse Dementia

NMDA Antagonists - Memantine

- Moderate to Severe
- XR and Immediate release
- 28 mg to 20 mg conversion
- CrCl
- Usually well tolerated
  - CNS Changes

Acetylcholinesterase Inhibitors

- All oral except rivastigmine patch option
  - Less GI ($$)
- Tacrine – liver toxicity
- GI (NVD)
- Weight Loss
- Low risk of bradycardia (think about Atropine)
- Mild-moderate

The One Million Dollar Question

- When to DC?
- Questions to think about
  - Adverse Effects?
  - Function Left?
  - Family opinions?
  - What would the patient think?
  - Another problem identified?
- Risk of DC?
  - Deterioration
  - Increase in behaviors

Behaviors

- Wandering
- Restless
- Agitation
- Physical Aggression
  - Hit, bite, kick
- Hallucinations
- Delusions

Behavior Identification

- Contributing factors
  - Individual person
  - Time of day
- Rule Out Causes
  - Pain
  - Infection
  - Medication changes

Solutions

- Non-drug approaches
- Solve underlying problem
- Creativity
- Make sure problem is distressing to patient before treating
- Medications last resort
  - Drugs don't often "treat" behaviors effectively

Common Psych Medications Tried

- Antipsychotics
- Benzodiazepines
- Mood Stabilizers
- Antidepressants

Failure to Thrive

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Failure to Thrive

- Weight Loss
- Malnutrition
- Poor intake
- Inactivity
- "Frail"

Failure to Thrive - Associations

- Cancer
- Stroke
- GI Surgery
- Depression
- Frequent UTI's/pneumonia
- Respiratory failure

Medication Associations

- Anticholinergics
- Opioids
- Diuretics
- More than 4 Rx's
- Antipsychotics
- Benzo's

Falls

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Why do we Care About Falls?

- Mortality
- Injury
  - Fracture
  - Head injury
- Bleeding risk
- Fear of falling

Risk Factors

- Cognition
- Balance
- Dizziness
- Orthostatic BP
- Anemia
- Medications
- Stroke

Body Systems

- Muscle weakness/pain
- Accumulation of medications and risk of toxicity due to reduced metabolism and clearance
- Visual changes
- Disease
  - Parkinson's
  - MS
- Stiffening vessels, less responsive to body's adaptations (i.e. orthostasis)
- Loss of feeling (PVD or neuropathy)

Common Medications Implicated with Falls

- Psych medications
  - Benzodiazepines
  - Antipsychotics
  - TCA's
  - Antidepressants
- Blood pressure medications
- Parkinson's medications
  - Dopamine agonists
  - Carbidopa/levodopa

Environmental Considerations

- Steps
- Walking areas
  - Clutter
- Footwear

Vertigo

- Difficult diagnosis to make for physicians
- Medications
  - Meclizine
  - Antiemetic
  - Anxiety

Dizziness Follow Up

- Timing of Falls
  - Medication changes
- Vitals
- Diagnosis

Orthostasis

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Orthostasis

- Drop in blood pressure with position changes
  - 20mm Hg drop in blood pressure
- Dizziness, syncope, fainting
- Fall risk

Causes of Orthostasis

- Medications
- Dialysis
- Medical
  - Parkinson's
  - Dehydration

Medication Causes of Orthostasis

- Antihypertensives (all)
  - Central acting alpha-2 agonists
  - Alpha blockers
- Carbidopa/levodopa
- PDE-4 inhibitors

Treatment of orthostasis

- Remove offending medication
- Fludrocortisone
  - GI upset
  - Edema
  - Adrenal suppression
  - Immunosuppression
- Midodrine
  - Raise BP
  - Exacerbate BPH

Physiological Changes in the Elderly

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GI Tract

- Decreased GI Motility
- Decreased Gastric Acid Secretion
- Higher PH

Distribution

- Increase in body fat
  - Increased volume of distribution for lipophilic drugs
    - Example Diazepam
- Reduction in Muscle
  - Fall risk
  - Lower creatinine (doesn't necessarily mean improved renal function)
    - Creatinine clearance equation includes age

Kidney

- Reduced elimination of medications
- Remember muscle mass decreases
  - If creatinine stays the same, it doesn't mean kidney function does change
- Increased half-life of kidney cleared meds
  - Digoxin
  - Allopurinol

Liver Changes

- Decrease in metabolic activity
  - CYP enzyme system
- Reduced hepatic blood flow
- Changes are complex
- Need to reduce doses, but no standard

Albumin

- Protein in the blood
- Drugs frequently bind to it
- Less found in the elderly/malnourished
- Higher free fraction of certain medications
  - Phenytoin
  - Warfarin

Infection Risk

- Reduced immune response
  - Example: fever
- Skin thinning
- Urinary changes
- Natural flora
- Immunosuppressant medications
- Nutrition
- Antibiotic use

Gastrointestinal Disorders

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Cirrhosis

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Cirrhosis – Major Complications

- Edema
- Ascites
- Esophageal Varices
- Hepatic encephalopathy

Common Medications

- Spironolactone
- Loop diuretics
- Propranolol
- Lactulose

Edema/Ascites

- Diuretic Combo
  - Furosemide 40mg
  - Spironolactone 100mg
- Close electrolyte monitoring
- Gynecomastia

Hepatic Encephalopathy

- Accumulation of toxins due to poor liver function
  - Toxins impact the brain
    - Cognitive symptoms (i.e. confusion, lethargy)
- Ammonia (NH_3)
- Lactulose
- Neomycin, rifaximin

Portal Hypertension

- Increased pressure in portal venous system
- Veins can swell and increase due to this increased pressure
  - Leading to rupture and possible bleed
    - Esophageal varices
- Non-selective beta-blocker used to treat
  - Propranolol

Crohn's and Ulcerative Colitis

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Symptoms

- Diarrhea
- Cramping
- Pain
- Possible blood

Crohn's Versus Ulcerative Colitis

- Major Difference
  - Crohn's located "patches" throughout intestinal system
    - Can impact all the way through the intestine
  - Ulcerative colitis – continuous area in the colon and typically just the inner lining

Crohn's Major Options

- 5-Asa Compounds
  - Sulfasalazine
    - GI/rash
    - Rare – Elevated LFT's, neutropenia, thrombocytopenia
  - Mesalamine
    - Diarrhea, nausea
  - Maybe not so great if large small intestine component
- Corticosteroids
  - Budesonide (Entocort EC)
  - Used for short term active disease/maintenance over 3-6 month period
    - Long term not recommended
  - Much less systemic absorption than alternative steroids

Crohn's Major Options

- Antibiotics
  - Metronidazole
  - Ciprofloxacin
- Immunosuppressive
  - I.e. Azathioprine
- Biologics
  - I.e. Infliximab, adalimumab

Ulcerative Colitis Major Options

- 5-Asa based compounds
  - Sulfasalazine
  - Mesalamine
- Steroids

Symptom Management

- Antidiarrheal
  - Loperamide
  - Cholestyramine
  - Colestipol

Diarrhea and Constipation

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Changes in Regularity

- Diet
- Exercise
- Fluid intake
- Drugs
- Disease

Medical Causes of Diarrhea

- C. Diff
- Viral
- Rare bacteria (giardia etc.)
- IBS

Medical Causes of Constipation

- Hypothyroid
- IBS
- Parkinson's
- MS
- Colon Cancer

Medications that Cause Diarrhea

- Metformin
- Acetylcholinesterase Inhibitors
- Antibiotics
- PPI's
- GLP-1
- Colchicine
- Laxatives

Medications that Cause Constipation

- Opioids
- Anticholinergics
- CCB's
- Bile Acid Sequestran
- Calcium/Iron

Diarrhea Treatment

- Identify Cause
  - Medical?
  - Drug?
- Loperamide
- Diphenoxylate/atropine
- Bile acid sequestrans

Constipation Treatment

- Non-drug (fluid, fiber, exercise)
  - Ideal management
- Docusate (prevention)
  - Usually very well tolerated
- Stimulants
  - Cramping, pain can be bothersome for some patients
- PEG
  - Requires volume intake, rare chance for electrolyte changes

Constipation Treatment

- Lubiprostone
  - Expensive
- Lactulose
  - Excessively sweet taste, used in elevated ammonia levels
- Enemas
  - Caution with fleets type products and patients with poor kidney function
  - Used for quick results
- Mineral Oil
  - **Avoid
  - Pneumonitis, reduce absorption of fat soluble vitamins

Dysphagia

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Dysphagia

- Difficulty swallowing
- Regurgitation
- Cough/Gag
- Choking/vomiting
- Weight loss

Causes of Dysphagia

- Weakening of esophageal muscles
- Narrowing (stricture) of esophagus
- GERD
- Foreign Body

Neurological Disorders Causing Dysphagia

- Neuro Disorders
  - Parkinson's
  - MS
- Aspiration pneumonia risk

Management

- Treat GERD
- Liquid diet
- Feeding Tube
- Alternative dosage forms/crushing medications

GERD, PUD, and Dyspepsia

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GI Risk Considerations

- GI Diagnosis
  - PUD (Don't forget about H. Pylori)
  - GERD
  - Heartburn
  - Barrett's
- Length of medication use
- Reason for initiation

Proton Pump Inhibitors

- Incredibly common medication
- Often used for prophylaxis
- Often never reassessed
- Sometimes necessary long term

PPI Risks

- Fracture
- C. Diff
- Low Magnesium
- Pneumonia
- B12

PPI Drug Interactions

- Cefuroxime (concentrations reduced) – all PPI's
- Reduced iron absorption
- Rifampin/St. John's Wort – can reduce concentrations
- Omeprazole (2C19)
  - Clopidogrel (reduced concentrations)
  - Cilostazol (increased concentrations)
  - Citalopram/escitalopram

H2 blockers

- Kidney disease
  - Dose adjustments
- Confusion/CNS effects with accumulation
- Cimetidine – bad idea
  - Numerous 3A4 drug interactions

Antacids

- Calcium containing products
  - Constipation
  - Binding interactions
  - Work quickly
  - Don't last long
  - Rare accumulation of calcium if frequent use
    - Combination with HCTZ

Step Down Versus Step Up

- Step Down
  - Reducing PPI to less potent acid blocker
  - H2 Blocker
- Step Up
  - Start with antacid and/or H2 blocker
  - Step up to PPI if inadequate control

Classic Medication Causes of GI Issues

- Steroids
- Bisphosphonates
- Digoxin toxicity
- NSAIDs
- Metformin
- Acetylcholinesterase inhibitors
- GLP-1
- Antibiotics

Irritable Bowel Syndrome (IBS)

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IBS versus IBD

- Irritable Bowel Syndrome
  - Similar symptoms
    - Diarrhea
    - Cramping
    - Pain
    - Constipation
- Irritable Bowel Disease
  - Marked by inflammation/damage
  - I.e. Crohn's or UC

Treatment of IBS

- Antidiarrheal (if diarrhea)
- Constipation
  - Fiber/fluids
  - Osmotics (i.e. PEG)
- Spasms/pain
  - Anticholinergics
  - Dicyclomine, hyoscyamine

Awareness of Medication Adverse Effects

- Diarrhea
  - Metformin
  - Acetylcholinesterase inhibitors
  - Colchicine
  - SSRI's (sertraline)
- Constipation
  - TCA's
  - Opioids

Malabsorption, Malnutrition and Nutritional Deficiencies

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Malabsorption Disorders

- Lack of absorption of essential nutrients
- Cause
  - GI damage, alteration to GI tract
  - Surgery, Celiac disease, Crohn's
- Symptoms
  - Diarrhea
  - Weight loss
  - Poor growth (kids)
  - Anemia
  - Fatigue

Contributors to Malnutrition

- Cancer
- Dental Issues
- Restricted diets
- Finances
- Depression
- Taste/smell alterations
- Socially eating
- Alcoholism

Weight Loss – Medication Causes

- Digoxin
- Stimulants
- Acetylcholinesterase Inhibitors
- Diuretics
- *Be aware of timing of medication changes

Malnutrition Concerns

- Weight Loss
- Vitamin Deficiency
  - I.e. B12, thiamine, folic acid, etc.
- Low Albumin
  - Phenytoin
- Frailty

Replacement of Essential Nutrients

- B12
- Vitamins A, D, E, K
- Iron
- Thiamine
- Folic acid
- Electrolyte replenishment
  - Magnesium
  - Potassium
  - Calcium

Vitamin B12

- Deficiency
  - Can cause cognitive impairment/dementia if severe enough
  - Metformin, PPI's – possible contributors
  - Pernicious Anemia
    - Lack of intrinsic factor
    - GI absorption compromised
    - B12 injections
- Folic acid, iron, B12
  - See anemia

Thiamine

- Supplementation common for alcoholics
- Deficiency
  - Wernicke's encephalopathy
  - Acute delirium
  - Amnesia

Vitamin D

- Treatment of deficiency
  - Vitamin D 50,000 units weekly X 8 weeks
- Maintenance
  - Vitamin D 50,000 units/month
  - Vitamin D 1,000-2,000 units/day
- Target levels >30 (some may argue a little higher)
- Medication contributors
  - Anticonvulsants (phenytoin, phenobarbital, carbamazepine)
  - Leuprolide

Nausea and Vomiting

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Causes of Nausea and Vomiting

- Chemo
- Gastroparesis
- Motion Sickness
- Drugs
- Infection
- Severe Pain
- Migraine
- Pregnancy

Challenges

- Huge diagnostic differential
- Polypharmacy
- Easy to treat symptoms and hard to identify cause

Medications for Nausea/Vomiting

- Ondansetron
  - Serotonin activity (5-HT3)
    - Rare issues, but look out for other serotonergic meds
  - Be cautious with other QTC Prolonging agents

Dopamine Antagonists

- Meclizine
- Prochlorperazine
- Metoclopramide
  - May have serotonin activity as well
- *Movement disorders

Corticosteroids

- Dexamethasone
  - Chemo
  - Risks
    - GI Upset
    - OP, Cushing's, insomnia, etc.

Classic Medication Causes of Nausea/Vomiting

- Antibiotics
- Acetylcholinesterase inhibitors
- GLP-1
- Digoxin toxicity
- Opioids
- Metformin
- NSAIDs
- Iron
- Antidepressants
- Alcohol

Pancreatitis

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Pancreatitis

- Symptoms
  - GI pain (possibly radiating)
    - Upper abdomen
  - N/V
  - Fever
- Major roles - pancreas
  - Digestive enzymes
  - Insulin
- Elevation
  - Amylase
  - Lipase

Causes of Pancreatitis

- Gall stones
- Alcohol
- Infection
- High Triglycerides
- Medications

Medication Causes (Acute)

- Azathioprine
- Thiazides
- VPA
- Sulfasalazine
- Bactrim
- Tetracycline
- GLP-1 agonists
- DPP-4 inhibitors

Treatment

- Treat the cause
  - Gallstone removal
  - Hypertriglycerides (500 or greater)
    - Fibrates
    - Niacin
    - Fish Oil
  - Digestive enzymes
  - ETOH treatment

Hematology

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Anemia

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Signs/Symptoms of Anemia

- Fatigue
- Low Hemoglobin/Hematocrit
  - Elderly often can feel normal despite levels below normal
  - WHO (men<14, women <12.3)
- Dizziness/Falls
- Skin pallor
- Weak
- Confusion

Classic Causes of Anemia

- Blood loss
- Iron
- B12
- Folic Acid
- Chronic Disease (esp. CKD)
- Chemotherapy

B12 Deficiency Causes

- PPI
- Metformin
- ETOH
- Intrinsic Factor – pernicious
  - Common in the elderly

Drug Causes – Folic Acid Deficiency

- Methotrexate
- Trimethoprim
- Phenytoin

Treatment of Anemia

- Transfusion
- ESA (i.e. darbepoetin)
  - Discussed further in upcoming slide
- B12
- Iron
- Folic Acid
- No treatment (if asymptomatic)

Megaloblastic Versus Microcytic

- B12/FA
  - Megaloblastic
  - MCV>100
    - Homocysteine
    - MMA
- Iron
  - Microcytic
  - MCV <80
  - Ferritin
- *Elderly often present with mixed type of anemias and normal MCV

Pernicious Anemia

- Lack of intrinsic factor
- Poor oral B12 absorption
- B12 toxicity rare
- B12 shots

ESA Pearls

- Kidney produces erythropoietin
  - Using to avoid transfusions
  - Boxed warning in CKD on Hg >11
  - Risk of CV Event/Hypertension/Blood Clot
- Hold orders based on hemoglobin
- Iron shortage causes failure
  - Ferritin <100 – add supplementation
- Consideration for starting if hemoglobin <10
  - Reduce dose if >1 point increase in hemoglobin in less than 2 weeks

Blood Disorders and HIT

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Factor V Leiden

- Mutation in gene
- Thrombophilia (clot formation likely)
- Anticoagulation (warfarin chronic, heparin type product for acute treatment)

Von Willebrand Disease

- Von Willebrand Factor
  - Required for platelet aggregation
  - Bleed risk increased
- Treatment
  - DDAVP (desmopressin)
  - Stimulates release of VW factor

Thrombocytopenia

- Low platelets
- Increased bleed risk
- Symptoms
  - Bruising
  - Bleeding
  - Anemia

When to Worry - Thrombocytopenia

- 150-450k = normal
- <150k = “thrombocytopenia”
- Trends are important
- <50k severe

Medication Causes of Thrombocytopenia

- Aspirin
  - (NSAIDs)
- Clopidogrel
- Heparin
- Seizure medications
- Sulfonamides
- PCN antibiotics
- Chemo

Heparin Induced Thrombocytopenia

- HIT – Heparin induced thrombocytopenia
  - Type 1 – occurs within hours to a couple of days
    - Direct effects on platelet aggregation (non-immune response)
  - Type 2 – What most people think when they hear "HIT"
    - 4-10 days after initiating, immune response
    - May see skin reaction at injection site, fever, chills, SOB after administration
  - Drop in platelets >50%
- Alternative anticoagulation
  - Argatroban, bivalirudin (PCI), fondaparinux, warfarin

DVT/PE

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Risk Factors for DVT/PE

- Patient history
- Hypercoagulable Disorders
- Immobility
- Atrial Fibrillation
- Medications
- Smoking
- Cancer

Medications – Increased Risk of DVT/PE

- Estrogen
- Megesterol
- SERM

Important Considerations DVT/PE Treatment

- Drug Selection
  - LMWH
  - Heparin
  - NOACs
  - Warfarin

Considerations in Selection

- Low-molecular weight heparin
  - Immediate action (unlike warfarin)
    - Often used for bridging
  - Injection
  - 1mg/kg BID or 1.5 mg/kg daily
  - Obesity – higher doses
- Contraindications
  - Heparin induced thrombocytopenia
  - Derived from pork products
  - Avoid in dialysis
- Warfarin/NOACs – See separate presentations

Length of Therapy

- First Episode (usually 3-6 months)
- Known Cause
- Risk Factors

Infectious Disease

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Bacterial Prostatitis

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Symptoms

- Pain
- Inflammation
- Change in urine consistency
  - Blood
  - Frequent urination
- Often not bacterial infection

Bacterial

- Simply remember standard UTI medications
- Length of therapy is different (next slide)
- Targeted bugs
  - Gram (-)
  - Enterobacteriaceae
    - I.e. E. coli

Chronic Bacterial Prostatitis

- 4-6 weeks treatment
  - Possibly up to twelve
- Bug Coverage
  - Quinolones (i.e. ciprofloxacin, levofloxacin)
  - TMP/Sulfa
  - Doxycycline

Adjunct Symptom Management

- Pain relief
  - NSAIDs
  - Acetaminophen
- Urinary flow
  - Alpha blockers

Common Drug Resistant Bacteria

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MRSA

- Methicillin Resistant Staphylococcus Aureus
  - Community acquired
    - Resistant to Penicillins, cephalosporins
    - Oral options: Doxycycline, Clindamycin, Sulfa/tmp
  - Inpatient medications
    - Vancomycin
    - Linezolid
    - Daptomycin (non-pneumonia)

Other Gram Positives

- Strep Pneumo.
  - Gram Positive
    - Resistance to penicillins, cephalosporins
    - Alternatives: Levofloxacin or moxifloxacin (avoid ciprofloxacin), clindamycin, vancomycin (IV only)
- Vancomycin Resistant Enterococcus (VRE)
  - Linezolid, daptomycin alternatives

Pseudomonas Aeruginosa

- Gram negative
  - Resistant to 1st, 2nd, 3rd generation cephalosporin's (exception ceftazidime), non antipseudomonal penicillins
  - Common Treatment
    - Quinolones (oral)
    - Pip/tazo
    - Meropenem
    - Colistin
    - Polymixin B

Extended Spectrum Beta Lactamases

- Klebsiella
  - Resistance to 2nd/3rd generation cephalosporins
  - Alternatives:
    - Imipenem
    - Colistin
- E Coli.
  - Resistance to sulfa/tmp, cephalosporins, quinolones
  - Nitrofurantoin, penems

Fungal Infections

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Tinea pedis

- Athlete's foot
  - Itching, burning, redness between toes, on feet
  - Warm moist environment
- Treatment
  - Topicals
    - Fungal infections can take a while to heal (up to 6 weeks)
    - Clotrimazole, miconazole, ketoconazole (imidazoles)
    - Terbinafine (allylamines)
  - Orals
    - Don't use for mild cases
    - Itra/fluconazole
      - Drug interactions! (3A4)
    - Terbinafine

Tinea cruris

- Jock itch
  - Warm/moist environments
    - Keep areas cool and dry as much as possible
    - May see higher incident in summertime/warm climate temps
- Topical agents, similar to Tinea pedis
  - Clotrimazole
  - Terbinafine
  - Miconazole

Ringworm

- Tinea family
  - Topical agents
    - Terbinafine
    - Ciclopirox
  - Orals
    - Systemic azoles
    - Terbinafine

Azole Clinical Pearls

- Adverse effects
  - Common – GI
  - Rare but serious – Liver function
    - More concerning with longer term/higher dose or those at risk for liver concerns
  - CYP3A4 inhibition
    - Warfarin, seizure medications, etc.
  - Possible QTc prolongation risk – highest risk in those on other agents
    - I.e. Amiodarone (+ 3A4 interaction)

Thrush

- Candida albicans
  - White gunk, pain, inflammation, difficulty swallowing
  - Immunosuppression from meds increases risk
    - Chemo, steroids (including inhaled)
  - Treatment
    - Clotrimazole troche
    - Nystatin topical (swish/swallow or swish/spit)
    - Systemic fluconazole for non-responders, adherence concerns, more severe disease
    - Ampho B – life threatening

Yeast Infection

- Candida albicans
  - Itching, burning, cottage cheese type discharge
  - May be exacerbated/caused by changes in normal flora
    - Recent antibiotics
  - Topical azoles
    - Clotrimazole, miconazole, etc.
  - Systemic
    - Fluconazole

PCP – Pneumocystis Pneumonia

- Pneumonia
- Sulfamethoxazole/TMP
  - Longer length of treatment usually necessary compared to UTI or antibacterial use (i.e. a few weeks)

GI Infections

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Infections

- 2 Classic Infections you need to know
  - Clostridium Difficile (C. Diff)
  - Helicobacter Pylori (H. Pylori)

C. Diff

- Watery diarrhea
- Cramping
- Pain
- Blood (severe)
- Spores can last for weeks to months
  - Horrible for healthcare facilities

Medication Risks

- Antibiotics
  - Minimize duration
  - Minimize spectrum
- PPI's
  - Assess diagnosis for use
  - Risk/Benefit

Treatment

- Metronidazole
- Vancomycin
  - Oral ok
- Fidaxomicin

H. Pylori

- Major cause of GI ulcers
- Able to tolerate acid environment of stomach
- Symptoms
  - N/V
  - Abdominal pain
  - Weight loss
  - Burping

Treatment

- Typically 10-14 days
- Different regimens (see next slide for combo's)
  - Amoxicillin
  - Clarithromycin
  - Metronidazole
  - Bismuth
  - Tetracycline

Treatment

- Bismuth, metronidazole, tetracycline, PPI
- Amoxicillin, clarithromycin, PPI
- Clarithromycin, metronidazole, PPI
- Regimen considerations
  - Resistance
  - Previous treatments
  - Penicillin allergy

Clinical Pearls - Antibiotics

- Clarithromycin
  - Drug interactions via 3A4
  - QTc prolongation
- Metronidazole
  - Avoid alcohol
  - Neuropathy (more likely with long term use)
- Tetracycline
  - Binding interactions
  - Sun sensitivity

HIV/AIDS

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HIV/AIDS Pearls

- Drug resistance
  - Frequent mutations
  - Adherence CRITICAL
- Immune Deficiency
- Rare, opportunistic infections
- Monitoring
  - CD4 counts

Opportunistic Infections

- PCP (Pneumocystis pneumonia)
  - Sulfa/TMP
  - Glucocorticoids
- Kaposi Sarcoma
  - Chemo or radiation
- Mycobacterium Avian Complex (MAC)
  - Macrolide
  - Ethambutol
  - Rifampin

CD4 Count

- CD4 Count
  - 500-1500 is normal
  - Following trend
  - Lower = higher risk for infection
- If less than 200
  - PCP prophylaxis
- If less than 50
  - MAC prophylaxis

Medications for HIV/AIDS

- NRTI (Nucleoside)
  - Abacavir, Emtricitabine, Lamivudine
  - Adverse Effects: Fat redistribution (lipodystrophy –i.e. buffalo hump), lactic acidosis, fatty liver
- NRTI (Nucleotide)
  - Tenofovir
  - Adverse Effects: lactic acidosis, fatty liver, may increase cholesterol and decrease bone mineral density

Protease Inhibitors

- Atazanavir, Darunavir, Fosamprenavir, Lopinavir/Ritonavir
  - Lipodystrophy (buffalo hump)
  - CYP3A4 interactions
  - Rash
  - Hyperglycemia
  - (Ritonavir is a booster – increases concentrations of lopinavir)

NNRTI's

- Efavirenz
  - Rash
  - CNS changes
    - Mood/Depression
  - Liver

Integrase Inhibitors

- Raltegravir, dolutegravir, elvitegravir
  - GI
  - Myopathy/elevations in LFT, CPK
  - Immune reaction
  - Skin reactions

Influenza

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Influenza Pearls

- Very contagious
- Institutionalized patient at high risk of transmission
- Vaccination
- Prophylaxis in an outbreak
- Mutations
- Elderly/young at higher risk for complications
  - Secondary pneumonia

Medications

- Antiviral – Neuraminidase Inhibitor
  - Prevents replication
- Oseltamivir
  - Drug of choice for treatment and prevention
  - Sooner the better with treatment (less than 48 hours)
  - Expensive
  - Watch kidney function/dose adjustments
  - Lower dose for prophylaxis (75 BID vs. QD)
  - GI, psych changes as most common AE's

Ophthalmic Infections

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Symptoms

- Redness
- Itching
- Discharge
- Foreign Body Sensation

Bugs

- Staphylococcus
- Streptococcus
  - Classic gunky, yellow, mucous like discharge
- Viral infections
  - Watery discharge

Common Antibiotics

- Erythromycin
- Ofloxacin
- Ciprofloxacin
- Trimethoprim/polymixin

Shingles

- Reactivation of "Chicken Pox"
- Risk of vision loss
- Acute retinal necrosis
- Treatment
  - Acyclovir
  - Steroids

Eye Drop Administration Pearls

- Don't touch tip to eye
- Avoid contact lenses
- Recommendation 5 minutes between drops
- Drops before ointment
- For more info
  - http://www.cc.nih.gov/ccc/patient_education/pepubs/eyedrops.pdf

Osteomyelitis

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Osteomyelitis

- Infection of the bone
- Redness/swelling/pain at site
- Fever
- Long length of treatment (weeks)

Risk Factors

- Diabetes
- Immunosuppressed
  - Chemo
  - Corticosteroids
  - Biologics
- Illicit drug use
  - I.e. dirty needles
- Recent trauma or surgery

Procedures

- Debridement
- Improving blood flow
- Amputation

Bacteria

- Cultures Important!
- Most common: Staphylococcus
  - Need to be aware of MRSA (vancomycin, linezolid)
  - MSSA (Penicillins)
- Gram negatives possible
  - Quinolones
- Tough infections to treat
  - Likely at least 4-6 weeks on initial infection
  - Recurrent infections might require life long prophylaxis

Effective antibiotics

- Penicillin(s) - MSSA
- Clindamycin
- Sulfamethoxazole/trimethoprim
- Rifampin (used to prevent reinfection, prosthetic)
- Vancomycin (empiric gram positive)
- Linezolid
  - MRSA/VRE
- Quinolones (gram negative)

Pneumonia

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Common Bugs

- Strep. Pneumoniae
- H. Flu
- Staph Aureus
- M. Cat
- Atypical
  - Legionella
  - Mycoplasma

Risk Calculator for Hospitalization

- CURB-65
  - Confusion
  - Urea>20
  - Respirations >20/min
  - BP <90 or diastolic <60
  - Age >65

Vaccination

- Polysaccaride-23 Vaccine
- Conjugate-13 Vaccine
- Influenza

Healthcare Associated

- Hospitalization
- Long term care
- Bugs to be fearful of
  - MRSA
  - Pseudomonas
  - Resistant gram negatives

Community Acquired Treatment

- Macrolide
- Macrolide +/- beta lactam
- Doxycycline
- Respiratory fluoroquinolone

Risk Factors – Resistant Pathogens

- Previous antibiotic use
- Hospitalization
- Immunosuppressive deficiency
- Spreading in the community

Coverage for MDR Organisms

- Pseudomonas
  - Ceftazidime
  - Pip/Tazo
  - Cefepime
  - Penem (excluding ertapenem)
- MRSA
  - Vancomycin
  - Linezolid
- If concern for MDR Gram negatives
  - May add respiratory quinolone
  - Or aminoglycoside

Outpatient MDR Organisms

- MRSA
  - Bactrim
  - Clindamycin
  - Linezolid
- Pseudomonas
  - Quinolones

Skin and Soft Tissue Infections

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Important Bugs

- Staphylococcus
- Streptococcus
- Pseudomonas

Cellulitis

- Beta-hemolytic Streptococcus
- MSSA
  - Drugs
    - Cephalexin
    - Penicillin
    - Clindamycin

Pseudomonas and MRSA Empiric

- Pseudomonas
  - Quinolones
- MRSA
  - Clindamycin
  - Sulfa/TMP
  - Tetracycline
- Inpatient, higher risk patients
  - Vancomycin
  - Daptomycin
  - Linezolid

Animal/Insect Bites

- Pasteurella multocida (dog/cat bites)
  - Amox/clav
  - Doxycycline
- Lymes (Borrelia burgdorferi)
  - Doxycycline
  - Amoxicillin

Tuberculosis

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Tuberculosis

- Latent
  - No symptoms
  - Not contagious
- Active
  - Cough
  - Fever
  - Fatigue
  - Weight loss
  - Contagious
- Difficult to treat - https://www.cdc.gov/tb/topic/treatment/guidelinehighlights.htm

Immunosuppression and TB

- Most immune systems will suppress the infection
  - TB goes from latent to active in immunosuppressed
- HIV/AIDS
- Chemo
- Transplant
- Biologics

Drugs

- Isoniazid
  - Boxed warning for liver toxicity
    - Look out for high risk patients (i.e. other hx liver disease, alcoholics, etc.)
  - Possibility for neuropathy
    - Pyridoxine supplementation may be helpful
- Rifampin
  - Enzyme inducer
    - Look out for high risk meds (anticoagulants, amiodarone, seizure medications, etc.)
- Ethambutol
  - Hepatotoxic
  - Eye exams – optic neuritis, potential blindness
- Pyrazinamide
  - Exacerbate gout
  - LFT monitoring

Urinary Tract Infections

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Definition

- UTIs in women are defined as at least 100,000 colony-forming units (CFU)/ml in a pure culture of voided clean catch urine
- In men, the presence of just 1,000 CFU/ml indicates a UTI

UTIs

- Asymptomatic bacteriuria: >10^5 bacteria in the urine without symptoms
- Recurrent UTIs: culture confirmed UTIs with a frequency of >3 in 1 year or >2 in 6 months.
  - Relapse occurs within 2 weeks of treatment and is caused by the same pathogen
  - Reinfection occurs >4 weeks after an earlier UTI and usually involves a different pathogen
- Catheter-Associated UTIs

Common Pathogens

- E. coli (70-80%)
- Proteus mirabilis
- Staphylococcus saprophyticus
- Klebsiella pneumoniae

Antibiotics

- Common treatment regimens include:
  - Trimethoprim/Sulfamethoxazole
  - Nitrofurantoin monohydrate/macrocrystals
  - Ciprofloxacin and other fluoroquinolones
  - Third-generation cephalosporins

Treatment Regimens for Uncomplicated UTIs

- TMP-SMX 160/800mg BID for 3-7 days
- Trimethoprim 100 mg BID for 3-7 days
- Ciprofloxacin 250 mg BID for 3 days
- Levofloxacin 250 mg QD for 3 days
- Nitrofurantoin 100 mg BID for 7 days
- Fosfomycin 3 grams x 1 dose
- Cefpodoxime 100 mg BID for 3 days

Complicated

- Structural abnormality
  - Surgery
  - Urinary retention
  - Males
- Renal insufficiency
- Transplant
- Immunosuppression
- Diabetes

Treatment of Complicated UTIs

- Usually a 7-14 day treatment for mild cases
- Avoid Nitrofurantoin and Fosfomycin if suspected pyelonephritis
- Symptomatic cases require hospitalization and IV antibiotics
- Fluoroquinolones
  - Ciprofloxacin 500mg BID for 7 to 14 days
  - Levofloxacin 250 mg for 10 days or 750mg QD for 5 days
  - Can be used outpatient

Inpatient

- Extended-spectrum beta lactams:
  - Ceftriaxone 1-2 grams IV/IM q24h or in divided doses twice a day
  - Ceftazidime 500mg IV/IM q8-12h
- Aminoglycosides
  - Ototoxicity
  - Nephrotoxicity
- If ESBL
  - Carbapenems

Trimethoprim-Sulfamethoxazole (TMP-SMX)

- Considered 1st-line for uncomplicated UTIs
- Good activity against many pathogens (except *Enterococcus* species)
- Growing resisitance to *E.coli* (20%)
- Common side effects: GI upset and rash
- Crystalluria may occur- take with a full glass of water
- Contraindicated in patients with sulfonamide allergies
- Syrup available

Fluoroquinolones (ciprofloxacin and levofloxacin)

- Effective against gram (-) organisms, but only fair coverage against gram (+)
- Administer (oral) at least 2 to 4 hours before or 6 hours after antacids or other products containing calcium, iron, or zinc.
- Common side effects: N/V/D
- Rare side effect: tendonitis
- Avoid excessive exposure to sunlight
- Reduce the dose by half if CrCl< 30 ml/min
- Caution: may increase effects of warfarin/QTc prolongation

Nitrofurantoin (Macrobid)

- Provides good antibacterial coverage
- Common side effects: N/V/D
- Take with food- increases serum concentrations
- Avoid alcohol
- Avoid in suspected pyelonephritis
- May discolor urine brown
- Rare lung fibrosis
- Contraindicated in patients with CrCl < 60ml/min
  - Some evidence now that it may be ok in CrCl 30-60 mls/min

Fosfomycin

- Studies showed equally effective to nitrofurantoin and TMP-SMX
- Can be given as a single dose
- Expensive- not generally used
- Avoid in suspected pyelonephritis

Pharmacologic Prophylaxis

- Regimens
  - Bactrim/Septra double strength 3x/week or single strength QD
  - Trimethoprim 100 mg QD
  - Macrobid (nitrofurantoin) 100mg QD

Non-Pharmacologic Prophylaxis

- Cranberry juice
- 300 ml/day of standard juice or 60 ml/day of concentrated juice
- 400 mg QD of cranberry extract
- Common side effect: calcium oxalate kidney stones

Vaccines

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Adult Vaccines

- Pneumococcal
  - PCV13
  - PPSV23
- Influenza
- Zoster Live Vaccine, (Recombinant – Shingrix)
- Tetanus, diphtheria, pertussis

Zoster Vaccine Recombinant, Adjuvanted

- 2 doses (0 months and 2-6 months later)
- Non-living
- Patients Age 50 and older
- Revaccination of patients previously vaccinated with Zoster Live Vaccine recommended
- Injection site reaction, fever (higher rate than Zoster Live Vaccine)
- Before reconstitution
  - Fridge
  - After reconstitution use right away (or fridge for up to 6 hours)

Zoster Pearls

- Same virus as chicken pox
- Live vaccine
  - Immunosuppressed
- Storage in freezer (fridge for 72 hours)
- Age 60-69 best benefit
  - Indicated at age 50

Pneumococcal (Strep Pneumoniae)

- PCV13
  - Give age >65 once
  - Aim for one year between PCV13 and PPSV23
  - Do not co-administer
- PPSV23
  - Give twice if given before age 65
  - Give 5 years apart if given twice

Influenza

- Annually
- Inactivated injection
- High dose available
  - Somewhat more expensive
  - CDC not recommending high dose yet
    - Many target 65 and older
  - Some clinicians will target high risk patients
    - I.e. COPD/Asthma
  - Probably more effective
    - http://www.cdc.gov/flu/protect/vaccine/qa_fluzone.htm

Tdap/Td

- Tetanus, Diphtheria, Pertussis (whooping cough)
- Revaccination
  - Every 10 years (one time dose of Tdap)
  - Td for all other doses
- Inactivated
  - Immunosuppressed patients ok

Kidney/Urology

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Acute and Chronic Kidney Disease

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Signs of Kidney Failure

- Rise in serum creatinine
  - Generally 30%
- Rise in Blood urea nitrogen
  - Both are removed by the kidney
  - In renal disease, both accumulate
- Hyperkalemia/cardiac changes

Cockcroft-Gault Formula for Estimating Creatinine Clearance

$$\text{CrCl (mL/min)} = \frac{(140\text{-age}) \times \text{Lean Body Weight (kg)}}{\text{Serum Creatinine (mg/dL)} \times 72} \quad (\times 0.85 \text{ if female})$$

MDRD

- Serum Creatinine
- Age
- Female
- African descent
- Normalized by body surface area (no weight in calculation)

$$GFR\ (mL/min/1.73\ m^2) = 175 \times (S_{cr})^{-1.154} \times (Age)^{-0.203} \times (0.742 \text{ if female}) \times (1.212 \text{ if African American})$$

Acute Renal Failure

- Prerenal
  - Inadequate perfusion
- Post renal
  - Blockage (stones, BPH)
- Intrinsic
  - Infection
  - Toxic agents
  - May be marked by elevated protein in the urine

Acute Kidney (Injury) Disease - Prerenal

- Common causes
  - Reduced blood flow to kidney
  - Caused by
    - Dehydration
    - Significant acute blood loss
    - Severe N/V/D
- Medications
  - ACE/ARB
  - NSAIDs
  - Diuretics

Classic Medication Causes - Intrinsic

- Aminoglycosides
- Cisplatin
- Amphotericin B

Treatment of ARF

- Supportive care
- Prerenal
  - Volume replacement with dehydration
- Intrinsic
  - Remove offending agent
  - Inflammation
    - Steroids
- Post renal
  - Remove blockage

Stages of Chronic Kidney Disease of all Types

Stage	Qualitative Description	Renal Function (mL/min/1.73 m²)
1	Kidney damage-normal GFR	≥90
2	Kidney damage-mild ↓ GFR	60-89
3	Moderate ↓ GFR	30-59
4	Severe ↓ GFR	15-29
5	End-stage renal disease	<15 (or dialysis)

Source: http://guidelines.diabetes.ca/

Problem: Dosing Medications

- Many drugs are dosed by CrCl
- Lab reports GFR
- Keep an eye on changes in kidney function
  - Inaccuracy of equations in changing renal function
  - Drugs can accumulate
  - Cause toxicity

Incredible # of Medications Dose Adjusted

- Chronic medications
  - Use common sense
  - Check levels (i.e. digoxin)
  - Start low go slow
  - Should you change dose if no side effects
    - Gabapentin
    - Ranitidine
    - Allopurinol

Collateral Damage - CKD

- Fracture risk
  - Vitamin D deficiency
- Anemia
  - Kidney = source of EPO
- Fluid retention
- CVD
- Hyperkalemia

Preventing Kidney Problems

- Diabetes
  - Blood sugar control
  - ACE inhibitors
- Hypertension management
- Smoking cessation
- Obesity management

BPH

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BPH Characteristics

- Enlargement of the prostate
- Impairs urination
  - Frequency
  - Incomplete bladder emptying
  - Low flow
  - Incontinence

BPH Treatment

- Alpha Blockers
- 5-Alpha Reductase Inhibitors
- Surgery (TURP)

Alpha-Blockers

- Tamsulosin
  - Not used for hypertension
  - Works quickly
- Non-selective agents
  - Terazosin
  - Doxazosin
- Risks
  - Orthostasis
  - Floppy iris syndrome (cataract extraction)

5-Alpha Reductase Inhibitors

- Finasteride, Dutasteride
- Takes weeks/months to begin to work
- Actually shrink prostate
- Decreased libido
- Pregnancy risk

Drugs That Exacerbate Frequency

- Diuretics
- Caffeine
- ETOH

Drugs That Exacerbate Retention

- Anticholinergics
- Alpha agonists (Midodrine)
- Pseudoephedrine

Dialysis Complications

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Electrolyte Complications

- Hyperkalemia
- Hyponatremia
- Hypocalcemia
- Hypermagnesia

Complications

- Infection risk
  - Access site
  - Think about potential causes/source
    - Skin (gram +)
- Bleeding
  - May already be anemic
    - EPO production lacking
  - Many on antiplatelet/anticoagulant therapy
- Hypotension

Management/Monitoring

- Electrolytes
  - Replace as appropriate
  - EKG if significant deviations from normal
- Hypotension
  - Fluid bolus for acute management
    - Saline
    - Lactated ringers can elevate potassium
  - Hold/alter antihypertensives

Medication

- Hypotension Associated with Dialysis
  - Medication NOT first line
  - Reassess goal weight
  - Holding BP meds
- Midodrine
  - Alpha agonist
  - Exacerbate BPH
  - Raise BP
- Dose given 15-30 minutes before dialysis

Electrolyte Abnormalities

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Symptoms/Signs of Hyponatremia

- Fatigue
- Cramps
- Confusion
- Dizziness
- Seizures (rare, usually with acute changes)
- Normal Sodium 135-145 mEq/L

Causes of Hyponatremia

- Diuretics
- SIADH
  - Oversecretion of ADH
  - Water retention
  - Dilutes Na+
  - Resulting Hyponatremia
- Heart Failure
- Cirrhosis
- Polydipsia

Causes of SIADH

- CNS changes
  - Trauma
  - Stroke
- Cancer
- Drugs
  - Carbamazepine/oxcarbazepine
  - SSRI's
  - Chlorpropamide

Correcting Hyponatremia - Chronic

- If chronic, asymptomatic – correct slowly and/or monitor
  - Typically done outpatient
- Correct identifiable problem
- Remove offending medication(s)
- Medication management
  - Sodium chloride tablets
  - Demeclocycline
    - Tetracycline derivative
    - GI side effects, binding interactions, sun sensitivity

Hypernatremia

- Correct imbalances by 8-10 mEq/d
  - May be slightly more aggressive if acute hypernatremia
- Use isotonic saline if patient has fluid losses
- Free water if fluid status is stable
- Diuretics
  - Can help eliminate sodium
- Desmopressin (DDAVP)
  - Hyponatremia boxed warning

Hypokalemia

- Signs/symptoms
  - Muscle cramps
  - Weakness, fatigue
  - Arrhythmias
  - Normal 3.5-5.1 mEq/L
- Acute management
  - Replace potassium
  - EKG monitoring
  - Reduce diuretics
- Chronic
  - Reduce diuretics
  - Replacement
  - Increase/add medications that can increase K+ (ACE, ARB, Aldosterone Antagonist)

Hyperkalemia

- Acute – EKG changes or >6.5
- IV calcium and insulin
  - Dextrose to avoid hypoglycemia
- If acidosis and hyperkalemia, consider bicarb
- Diuretic therapy
- Sodium polystyrene sulfonate (SPS)
- Discontinue offending agent(s)
  - ACE, ARB, Aldosterone antagonist
- Dialysis
- Beta-agonist
  - Albuterol – can cause intracellular shift of potassium

Hypomagnesia

- Normal 1.5-2.2
- Symptoms
  - Muscle weakness, cramping, EKG changes, seizures
- Causes
  - Alcoholics
  - Diarrhea/vomiting
  - Drugs
    - Diuretics
    - PPI's

Hypocalcemia

- Normal total calcium (9-10.2 mg/dL)
- Abnormal albumin can erroneously report total calcium
  - 1 gram change albumin is approximately 0.8 change in calcium level
- Symptoms
  - Neuromuscular, tingling, cramps, Arrhythmias
- Drug causes
  - Loops
  - Bisphosphonates
  - Cinacalcet
  - Estrogen

Nephrolithiasis

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Nephrolithiasis

- Kidney stones
  - Severe side/back pain
  - Change in urination
    - Blood, urine consistency, flow
  - Severe pain causing N/V

Causes/Risks

- Excessive Calcium intake
  - Key component of stones
- Dehydration
- Hyperparathyroidism
- Obesity
- Genetic

Potential Medication Contributors

- Theophylline
- Acetazolamide
- Glucocorticoids
- Antacids (calcium)
  - Excess vitamin D
- Vitamin C

Acute Management

- Surgery, shock waves
- Pushing fluids
- Pain management
  - Simple analgesics
  - Opioids
- Alpha blockers (ok to use in females)
- Uric acid based stones
  - Allopurinol
  - Febuxostat

Sexual Dysfunction

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Psych

- SSRI's
- TCA's
- MAOI's
- Better options
  - Bupropion
  - Mirtazapine
- Antipsychotics (typicals maybe a little worse as well as risperidone)
- Lithium

Cardiac Medications

- Beta-blockers
- Thiazide Diuretics
  - Alternatives for HTN – ACE/ARB/CCB
- Clonidine, methyldopa

Other Medications

- Finasteride
- Dutasteride
- Antihistamines (drugs with anticholinergic effects)

Use of PDE-5 Inhibitors

- SE's
  - Dizzy, drop in blood pressure
  - Headache
  - Visual changes
  - Flushing
- Nitrate Interaction

Urinary Incontinence

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Definitions

- Incontinence
  - Go when you don't want to (can't control)
  - Weakness or loss of voluntary control of urinary sphincter
- Frequency
  - Feeling of having to go all the time
- Retention
  - "retaining" – incomplete emptying of the bladder
    - Most common cause (males) - BPH

Types of urinary incontinence

- Stress
  - Physical exertion (i.e. sneeze, cough)
- Urge
  - Over Active Bladder (OAB)
  - Feel the need to go, but maybe don't make it in time
  - Immobility
  - MS, Parkinson's, Diabetes
- Overflow
  - Blockage (BPH)
  - May dribble urine
- Functional
  - Patient who has dementia

Drugs – Clinical Pearls

- Anticholinergics
  - Confusion
  - Dry eyes, mouth
  - Constipation, slows GI motility
  - Retention
- Beta agonist (mirabegron)
  - Tachycardia
  - HTN
- 5-alpha reductase inhibitors
  - Sexual dysfunction
  - Fatigue
- Alpha agonists
  - Hypertension
- Diuretic timing/sleep
  - Urinary frequency
- Alpha blockers
  - Hypotension

Stress Incontinence Treatment

- Kegel Exercises
- Alpha agonists
  - Midodrine
  - Pseudoephedrine
- Anticholinergics tried, but may not be that effective
  - Could be mixed incontinence if beneficial

Urge Incontinence

- Treatment
  - Anticholinergics
  - Beta agonist (mirabegron) – selective for Beta-3
  - Estrogen (topical)

Overflow

- Medication Treatment
  - Alpha-blockers
  - 5 alpha reductase inhibitors (BPH)

Miscellaneous

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Dermatologic Disorders

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Dermatitis

- Contact, Atopic (Eczema)
  - Inflamed skin
  - Redness
  - Itchy
- Treatment
  - Topical Steroids
  - Calcineurin Inhibitors (i.e. tacrolimus)

Common Steroids

- Determinants of potency
  - Drug
  - Percentage
- Table
  - https://www.psoriasis.org/about-psoriasis/treatments/topicals/steroids/potency-chart

Medication Causes of Skin Disorders

- Rash
  - Antibiotics
    - Sulfa
    - Penicillins
    - Macrolides
- SJS risk
  - Antiepileptic (i.e. carbamazepine, lamotrigine)
  - Allopurinol
  - Penicillins
- **Timing, Timing, Timing

Yeast Infection

- Candida albicans
- Risks
  - Diabetes
  - Antibiotics
  - Immunosupression
- Treatment
  - Topical nystatin, clotrimazole
  - Systemic, fluconazole

Pressure Ulcer

- Staging:
  - 1 – red, no breaks in skin, potentially pain
  - 2 – skin broken open
  - 3 – deeper into the skin, fat potentially showing
  - 4 – deepest, possible visual presence of bone, tendon, or muscle
- Risk of osteomyelitis or sepsis with deeper stages (3 or 4 typically)

Dry Skin

- Xerosis
  - Common in the elderly
  - Cracks/Infection risk
  - Itching
- Common treatment
  - Moisturizers

Psoriasis

- Inflammation
- Excessive growth in the epidermis
  - Raised, rough skin
  - Scaly appearance
- Most common location
  - Elbows
  - Knees
  - Scalp
- Can result in pain in the joints (psoriatic arthritis)

Management

- Localized areas
  - Topical corticosteroids
    - Triamcinolone, betamethasone, etc.
  - Vitamin D analogs calcipotriene, calcitriol
  - Calcineurin inhibitors
    - Can increase risk of skin cancer
  - Coal tar
    - Messy

Management

- Moderate to Severe Disease
  - Systemic retinoids (acitretin)
    - Birth defect in females
  - Methotrexate
    - LFT, CBC
    - Similar dosing to RA – 10-25 mg per week
    - Folic acid
  - Cyclosporine
    - Immunosuppressive
    - HTN, nephrotoxicity, infection/malignancy risk
    - Tons of drug interactions
  - Biologics (etanercept, infliximab, etc.)
    - Risk of malignancy, infection
    - Injection/infusion
    - Expensive

Oncology

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Breast Cancer

- Facts
  - Approximately 1/8 women will be diagnosed in lifetime
  - Most common cancer worldwide
- Recent reduction
  - Possibly due to stronger avoidance of hormone replacement therapy

Leukemia

- Bone marrow
- Dysfunctional or abnormal blood cells
- Labs can differentiate
  - WBC (abnormal high/low)
  - Hgb/hct (anemia, RBC's)
  - Platelets

Prostate Cancer

- Symptoms of prostate dysfunction
  - Urinary troubles
- Prostate Specific Antigen (PSA)
  - Quick increases can signal more aggressive cancer
- Prostate cancer
  - Often very slow growth
- Drugs
  - Bicalutamide
  - Leuprolide

Skin Cancer

- 1 in 5 Americans will develop skin cancer
- Much more common than other cancers
- 5.4 million cases annually
- Melanoma
  - Life threatening

Chemotherapy in the Elderly

- Mouth Sores
- Nausea/Vomiting
  - Weight loss
- Fatigue
- Blood disorders
  - Low WBC
  - Low Platelets
  - Anemia
- Pain
- Neuropathy

Medications for Organ Transplantation

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Calcineurin Inhibitors

- Cyclosporine, tacrolimus
  - Adherence is very critical
  - Change in dosage forms can result in changes in levels/bioavailability
- Monitoring
  - Immunosuppression/infection/cancer
  - Hypertension
  - Hyperglycemia
  - Hyperkalemia
  - GI side effects

Calcineurin Inhibitors

- Trough concentrations drawn
  - Goals can vary based upon:
  - Infection risk
  - Adverse effects
  - Risk of rejection
  - Time from transplant
  - 100-400 target levels
- Consistent timing of administration recommended
- CYP3A4 drug interactions
  - Monitor levels closely with changes

Corticosteroids

- Infection
- Cushing's
- Hyperglycemia
- Osteoporosis
- GI Risk

Mycophenolate

- Adverse effects
  - GI
  - Hypertension
  - Edema
  - Immunosuppressive effects
- Administer on empty stomach

Signs of Rejection

- Loss of function of organ – examples:
  - Jaundice (liver)
  - Worsening renal function
- Patient feeling poorly
  - Flu like symptoms
- Pain/swelling
  - Location of organ
- Acute rejection
  - Week to 3 months; chronic >3 months
- Review for adherence/interaction/adverse effect potential

Steven Johnson's Syndrome

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SJS

- Severe skin reaction
  - Pain
  - Redness
  - Hives
  - Blisters/necrosis
- Complications
  - Sepsis
  - Cellulitis
  - Respiratory involvement
  - Skin damage

At Risk Patients

- Immunosuppressed
  - HIV
- Previous history of SJS
- HLA-B 1502 Gene
  - Chinese
  - Indian
  - Southeast Asia

Medication Related Causes

- Allopurinol
- Lamotrigine
- Carbamazepine
  - HLA-B*1502 gene may place at higher risk
- Barbituates
- Phenytoin
- Sulfa
- PCN's
- NSAIDs
- Acetaminophen

Management

- Stop offending agent
- Simple analgesics for pain
- Monitor/treat as appropriate
  - Sepsis
  - Cellulitis
- Corticosteroids to reduce inflammation, pain as necessary
- Wound care as needed

Systemic Lupus Erythematosus

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Systemic Lupus Erythematosus - The Disease

- Autoimmune disease "Lupus"
- Generalized Symptoms
  - Fatigue
  - Joint Pain
  - Selling
  - "Butterfly rash" – cheeks/nose
  - Anemia
  - Clotting disorder
  - Can be associated with Raynaud's
    - Fingers turning blue/white when cold

Risks/Complications

- MI/Stroke
- Renal failure
- Inflammation of lung/heart
- Blood clots/vasculitis
- Osteoporosis

Autoimmune Nature

- DMARDs
  - Hydroxychloroquine
  - MTX
- Rashes
  - Corticosteroid creams
- Inflammation and Pain
  - NSAIDs
  - Acetaminophen
- Immunosuppression/inflammation
  - Steroids
  - Azathioprine, cyclophosphamide
- Treatment guided by severity of disease

Drug Induced Lupus/Exacerbate Lupus

- Sulfamethoxazole or other sulfa containing drugs
- Hydralazine
- Procainamide

Neurology

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Fibromyalgia

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Fibromyalgia

- Pain
  - Often non-specific, non-localized
- Fatigue
- Non-inflammatory
- Insomnia
- Mental cloudiness
  - Fibro Fog
- Laboratory negative

Medication Induced Symptoms - Differential

- Hypothyroid
  - Amiodarone
  - Lithium
- Lupus
  - Hydralazine
- Skeletal Muscle Pain/Myopathy
  - Statins

Fibromyalgia Treatment

- Initial – Non-drug interventions
  - Exercise program
  - Sleep hygiene
  - Patient education about disease
  - Cognitive Behavioral Therapy
- Second Line
  - Medication Management

Fibromyalgia Treatment

- TCA's
- SNRI's
- Anticonvulsants

Fibromyalgia Treatment

- Selection considerations
  - Cost
  - Adverse effect profile
    - Sedation
  - Agents tried in past
  - Adherence
- FDA approval
  - Duloxetine
  - Milnacipran
  - Pregabalin

TCA's

- Amitriptyline, nortriptyline
  - Anticholinergic
    - Dry eyes
    - Dry mouth
    - Constipation
    - Urinary retention
    - Sedation
    - QTc prolongation
    - Sexual dysfunction
    - Weight gain
  - Can be useful in insomnia management
  - Younger populations will tolerate better
  - Inexpensive

SNRI's

- Duloxetine, milnacipran, venlafaxine
  - Duloxetine better studied than venlafaxine
  - If venlafaxine used, consider trying to get to higher doses
  - SE's
    - GI
    - Norepinephrine effects at higher doses especially
      - HTN, Tachycardia
    - Sexual dysfunction
    - Tends to be less sedating than TCA's
  - Milnacipran $$$

Anticonvulsants

- Gabapentin, pregabalin
  - Sedating
  - Dizziness
  - Edema/fluid/weight gain
  - Accumulation in kidney disease
  - Dosed multiple times per day, could use at night for sedative effects if daytime symptoms are manageable

Other Options

- Simple analgesics
  - NSAIDs
  - Acetaminophen
- Opioids
  - Avoid

Headache

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Types of Headache

- Tension
- Migraine
- Cluster
- Medication Overuse/Rebound

Management of Tension Headache

- Non-pharmacologic
  - Reduce stress
  - Avoid triggers
  - Rest
- Pharmacologic
  - Acetaminophen
  - NSAIDs
  - Combination with Caffeine
  - Triptans
  - Opioids

Medication Overuse/Rebound

- Often precipitated by initial onset of headache
- Repeated use of medication over time to relieve headache
- Drug Causes
  - NSAIDs
  - Acetaminophen
  - Triptans
  - Opioids

Migraine Treatment

- Triptans
  - SE's – dizziness, dopey, GI, Serotonin risks (rare)
- NSAIDs/APAP in Combo
- Dihydroergotamine
- Antiemetics
  - Prochlorperazine
  - Metoclopramide
- Dexamethasone

Migraine Prophylaxis

- Propranolol
  - Sedating, pulse monitoring
- Valproic Acid
  - Lab monitoring (CBC, LFTs), hepatic issues, weight gain
- Topiramate
  - Cognitive slowing
- Tricyclic antidepressants
  - Highly anticholinergic
- SNRI's
- CCB's

Cluster Headaches

- Acute
  - Oxygen
  - Triptans
- Prophylaxis
  - Verapamil

Insomnia

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Insomnia Concerns

- Troubles
  - Getting to sleep
  - Staying asleep
- Quality of Life
  - Motivation
  - Ability to perform at work/school

Non-Drug Interventions

- 1st Line Therapy
- Sleep Hygiene
  - Regular schedule
  - Snacks/warm milk
  - Avoiding Caffeine near bedtime
  - Minimize stimulation before bed
  - Exercise earlier in the day
  - Pain
  - Avoiding other stimulants

Pharmacotherapy

- Z-drugs
- Anticholinergics
- Melatonin
- Trazodone
- Benzo's
- Ramelteon
- Mirtazapine
- Suvorexant

Z-Drugs

- Fall risk
- Confusion
- Risk of dependence
- Abnormal sleep behaviors
- Zolpidem, eszopiclone
  - Dose restriction on zolpidem – limit to 5 mg, risk of next day impairment at 10 mg
  - Max 5 mg for females

Anticholinergics

- Diphenhydramine, doxylamine, TCA's
- Retention
- Dry eyes
- Dry mouth
- Constipation
- Fall risk
- Confusion (interacts with dementia meds)

Trazodone and Mirtazapine

- Trazodone
  - Usually higher doses required for antidepressant effect
  - Orthostasis
  - Dry mouth
- Mirtazapine
  - Low dose
  - Weight gain

Melatonin

- OTC
- Tends to regulate the sleep cycle
- Some patients use as needed

Antipsychotics for Sleep

- Can be sedating
- Always avoid unless compelling indication
  - Hallucinations unresolved by other methods
  - Schizophrenia

Multiple Sclerosis

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Multiple Sclerosis

- Immune dysregulation – attacks nervous system
- Unique sensations
  - Fatigue
  - Weakness
  - Tingling
  - Balance problems
- Vision problems

Interferon

- Beta-interferons
- Disease modifying
- Adverse drug reactions
  - Injection site reaction (High percentages – 50%+)
    - Flu-like symptoms
    - Fever
    - Pain
  - Pretreatment with acetaminophen/ibuprofen
  - Neutropenia
  - Lots of other unique reported side effects; thyroid, hepatotoxic, SLE, etc.

MS Complications

- MS Flares
  - Corticosteroids
- Spasms/pain
  - Baclofen
  - Tizanidine
  - NSAIDs
  - Acetaminophen

Bladder/Bowel Issues

- Spasms/Incontinence
  - Anticholinergics
- Constipation
  - Stool softeners
  - Stimulants

Other Associated Risks

- Mood disorders
  - Depression
- Epilepsy

Neuropathy

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Neuropathy

- Painful
- Burning
- Tingling
- Needles/pinprick type pain
- Diabetes
  - Control blood sugars
  - Lower A1C
- Falls risk with loss of sensation

Treatment

- Gabapentin/Pregabalin
  - Sedation
  - Renally cleared
  - Cost concern with pregabalin
  - Edema/weight gain
    - Dose dependent
  - Gabapentin requires transporter in gut
    - Dose dependent absorption
  - 300 gabapentin – approx. 50 mg pregabalin
  - Multiple daily doses

Treatment

- SNRI's
  - Duloxetine with most evidence
  - Likely need higher doses of venlafaxine
  - Antidepressant effect can be nice
  - HTN possible at higher doses

Treatment

- TCA's
  - Generally avoid in elderly
  - Really nice inexpensive option
  - Highly anticholinergic
    - Retention, constipation, dry eyes, dry mouth, CNS effects
  - Nortriptyline possibly better tolerated in elderly

Topical Agents

- Capsaicin
  - Regular, frequent use
  - PRN generally not effective
- Lidoderm patch
  - Needs to be small areas
  - Expensive (limits use)
  - On/off 12 hours

Parkinson's Disorder

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Parkinson's Symptoms

- Tremor
- Rigidity
- Akinesia
- Postural instability
- Can be challenging to diagnose
  - Trial Sinemet

Drugs for Parkinson's

- Sinemet
- Dopamine Agonists
- MAOI's
- COMT's
- Anticholinergics

Sinemet

- Gold Standard
- Frequent dosing
  - CR product available
- GI
- Psych AE's
  - Psychosis
- Orthostasis
- Drug/Food interaction – protein
- Unusual obsessive behaviors
  - I.e. gambling, eating

Dopamine Agonists

- Ropinirole, pramipexole
- RLS treatment
- Orthostasis
- Edema
- Unusual obsessive behaviors
  - I.e. gambling, eating

COMT's

- COMT's
  - Preserve levodopa
  - Need to be dosed with Sinemet
  - May need to reduce dose of Sinemet
  - Entacapone, tolcapone
    - Tolcapone – liver toxicity

MAOI's

- Selegiline
  - Reduce Sinemet dosing – 10-30%
  - Serotonin interaction concern
  - Tyramine interaction potential
    - Hypertensive crisis
  - Increases Sinemet effects so may see side effect profile similar to Sinemet

Anticholinergics

- Rarely used due to adverse effect profile
  - Constipation
  - Dry eyes
  - Confusion/CNS changes
  - Dry mouth
  - Urinary retention
- Trihexyphenidyl
- Benztropine

Drug Induced

- Antipsychotics
  - Typicals – the worst
  - Quetiapine – the best
- Metoclopramide
  - Used for GI problems, but DA blocking activity

Seizures

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Causes of Seizures

- CVD
- Dementia
- Trauma
- Cancer
- Withdrawal
  - Benzo's
  - Barbiturates
  - ETOH

Medications that Increase Seizure Risk

- Bupropion
- Tramadol
- Cancer medications
- Hypoglycemia
- Antipsychotics
- Stimulants

Common Seizure Medications

- Phenytoin
- Levetiracetam
- Carbamazepine
- Lamotrigine
- Valproic Acid
- Topiramate

Phenytoin

- Complex Kinetics
  - Dose depending increase in concentration
  - Small doses can lead to disproportionately large increases in drug levels
- Free versus total levels
  - 1-2, 10-20
- Vitamin D deficiency
- General toxicity symptoms similar to alcohol
  - Vertical nystagmus
- Enzyme inducer
- Gingival Hyperplasia

Carbamazepine

- Enzyme inducer
- Hyponatremia
- Bipolar and trigeminal neuralgia
- Bone loss
- Levels
  - 4-12
- Cousin *oxcarbazepine

Levetiracetam

- Watch kidney function
- Drug levels not routinely done
- Adjust dose based upon SE's/seizures
- Less drug interactions
- SE's; sedation, confusion, GI, behavioral changes, increase in BP

Lamotrigine

- Very slow dose titration
- Interaction with Valproic acid and enzyme induces
  - Quicker titration with enzyme inducers like phenytoin
  - Slower titration with VPA
- Drug induced rash (SJS)
  - Life threatening

Topiramate

- Cognitive slowing
- Weight loss
- Migraine indication
- Metabolic acidosis
- Kidney stone formation

Valproic Acid

- Weight gain
- GI
- Hair loss
- Rare (ammonia elevations, LFTs, thrombocytopenia)
- Migraine, Bipolar indications, might also see off label for aggressive type behaviors versus use of antipsychotics

Stroke and TIA's

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Types of Stroke

- Hemorrhagic
- TIA
- Ischemic
  - Local (Atherosclerotic)
  - Heart (Atrial Fibrillation)

Classic Signs

- Face drooping
- One sided arm weakness
- Slurred Speech
- Confusion
- Vision changes
- Fall

Acute Ischemic Stroke Management

- Reperfusion
  - tPA
- Quicker the better for tPA administration
  - Best outcomes 90 minutes or less
    - Good evidence of benefit in 3 hours or less
  - 3-6 hours range, less evidence

Exclusion Criteria - tPA

- History of intracranial bleeding
- Active bleed/hemorrhage (last 21 days)
- BP > 185/110
- Recent head trauma/surgery (3 months)
- INR >1.7, heparin, or other anticoagulant (including DOACs)
- Platelets < 100,000
- Glucose < 50
- Endocarditis

Classic Risk Factors

- Hypertension
- Smoking
- Atrial Fibrillation
- Diabetes
- Hyperlipidemia
- Age
- Genetics

Prevention of Stroke

- Manage modifiable risk factors
  - Hypertension
  - Smoking
  - Weight loss
  - Diabetes
  - Statins

Options for Long Term Management of Stroke

- Atherosclerotic
  - Aggrenox (Aspirin/Dipyridamole)
  - Clopidogrel
    - Ticlopidine - neutropenia
  - Aspirin
- Cardioembolic (Atrial Fibrillation)
  - Warfarin
  - DOACs
  - Aspirin

Tremor

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Essential Tremor

- Rhythmic, consistent movement of body part
  - Often hands
- Consistent frequency
- Severity can vary
- Interfere with life activities

Treatment

- Propranolol
  - Pulse
  - BP
  - Selectivity for beta receptors
- Primidone
  - Phenobarbital is metabolite
  - Sedation
  - Confusion
  - Fall risk

Drug Induced Tremor

- Lithium
- Beta-agonists
- Theophylline
- Hyperthyroidism (or over supplementation)
- VPA
- Stimulants

Vertigo and Dizziness

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Potential Causes

- Benign Paroxysmal Positional Vertigo
- Inner ear disorders
  - Infection
  - Inflammation
  - Motion Sickness
- Meniere's Disease
- Migraines
- Drugs

Rare, but Serious Causes

- Stroke
- TIA's
- MS
- CNS Tumor/cancer

Treatment – Underlying Cause

- Bacterial Ear Infection
  - Antibiotics
- Meniere's
  - Salt restriction/Diuretics
  - Corticosteroids
- Migraines
  - Typical treatment

Treatment - Symptomatic

- Meclizine, dimenhydrinate
  - H1 antagonist as primary mechanism
  - Sedation, dry mouth
- Glycopyrrolate, scopolamine
  - Anticholinergics
- Benzodiazepines
  - Short term
- Dopamine blockers
  - Promethazine
  - Prochlorperazine

Drug Induced Dizziness

- Antihypertensives
- Antiepileptics
  - Gabapentin, pregabalin, carbamazepine, phenytoin, etc.
- Opioids
- Psych Medications
  - Antipsychotics
  - Antidepressants
  - Benzodiazepines
- ***Timing, interactions, metabolic changes (renal/liver function)

Pain/Musculoskeletal

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Gout

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Signs/Symptoms

- Uric Acid Elevation
  - Approximately 3-7 mg/dL (normal)
- Pain
- Redness
- Swelling
- Usually singular joint

Classic Risk Factors

- Obese
- Alcohol (excessive)
- Meats/Seafood
- Drugs

Classic Drugs That Increase Uric Acid

- Diuretics (thiazides)
- Niacin
- Cyclosporine

Acute Treatment Options

- NSAIDs
  - GI, CHF, Kidney
- Steroids
  - Hyperglycemia, GI, Insomnia
- Colchicine
  - Diarrhea
  - 3A4 inhibitors may increase concentrations

Chronic Management

- Xanthine Oxidase Inhibitors
  - Allopurinol
  - Febuxostat
- Colchicine
  - Diarrhea, GI adverse effects
  - Dose adjusted with poor kidney function
- Probenecid
  - Rarely used
  - May raise penicillin anbx concentrations
  - Promotes excretion of uric acid through kidney (avoid in CrCl <30)

Osteoarthritis

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Osteoarthritis Symptoms

- Pain after longer periods of use
- Stiffness after resting
- Potential change in the shape of ends of fingers (DIP)
- Not much inflammation (differentiator from RA)

Pain Impact

- Quality of life
- Sleep
- Function/ability
- Work/Volunteerism
- Appetite
- Exercise
- Mood

Treatment for OA

- Trial of hot/cold
- Massage
- Acetaminophen
- NSAIDs
- Opioids
- Steroid injections
- Topicals

Acetaminophen

- 4 gram max
- Lots of variation in dose
- Short half life
- Safest agent especially in elderly
- Combo products

NSAIDs – Risk

- GI
- CKD
- CHF
- HTN
- Cardiovascular risk boxed warning

NSAID Pearls

- Ibuprofen
  - OTC
  - Short ½ life
- Naproxen
  - OTC
  - Longer ½ life
  - Maybe cardiovascular risk is less/neutral
- Ketorolac
  - 5 days or less (boxed warning)
- Indomethacin
  - Higher GI risk

COX-2 Inhibitor

- Celecoxib
  - Same issues as NSAIDs
  - Exception: GI bleed is less
    - Remember that elderly patients are usually on antiplatelet/anticoagulant therapy
    - Risk similar if on baby aspirin

Common Opioids

- Tramadol
- Tylenol #3
- Morphine
- Oxycodone
- Fentanyl
- Hydrocodone
- Methadone

Important Approximate Conversions

- Morphine (oral) 30 mg
- Oxycodone 20 mg
- Tramadol 300 mg
- Fentanyl (patch) 12 mcg
- Hydrocodone 30 mg

Opioid Adverse Effects

- GI
- Constipation
- Sedation
- Cough suppression
- CNS
- Itching
- Tolerance/Dependence/Addiction risk

Opioid Pearls

- Oxycodone
  - In combo with APAP or alone
  - Very commonly used
- Hydrocodone
  - Combo with APAP

Opioid Pearls

- Tramadol
  - Seizure
  - Serotonin
- Morphine
  - Kidney disease
  - Gold standard
  - Hospice
- Codeine
  - Prodrug (2D6)
  - Acetaminophen

Opioid Pearls

- Fentanyl patch
  - Very potent
  - Disposal concerns
  - Slow onset/offset
  - Potential absorption issues
  - Convenient
- Methadone
  - QTC
  - Conversion sucks
  - Sometime seen in hospice

Topical Medications

- Good option for elderly if only a few locations of pain
- Capsaicin
  - Avoid prn use
  - Substance P
- IcyHot, BenGay etc.
- Lidoderm patch
  - $$$

Steroids

- Acute inflammation
- Injection to site of pain
  - Still has systemic effects

Glucosamine/Chondroitin

- Potential option for OA
- Takes time to work
- Be sure dose is adequate – target 1,500 mg
- If beneficial continue…if not, DC

Osteoporosis

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WHO Classification

- Normal; T-score greater than or equal to -1.0
- Osteopenia; -1.0 to -2.5
- Osteoporosis; -2.5 or below

Risk Factors

- Female
- Age
- Low BMI
- T-score
- Steroid use
- Smoking
- ETOH
- Hyperthyroidism (chronic)
- Prior Fracture
- RA

Treatment

- Bisphosphonates
- Denosumab
- Calcitonin
- SERM (Raloxifene)
- Teriparatide
- Estrogen

Bisphosphonates

- Bone resorption inhibitors
- Administration Procedure
  - Before other meds/food
  - Glass of water
  - Remain upright
  - Try to avoid esophageal ulceration
- Osteonecrosis
  - Extremely rare, most occurrences surrounding oral surgery
- IV (zoledronic acid, ibandronate)
- Reassess use after 5 years

Denosumab

- SubQ injection every 6 months
- Hypocalcemia risk; monitor phosphorus and magnesium as well
- Rare osteonecrosis risk
- $$$

Calcitonin

- Nasal spray used most often
  - Rhinitis and nose bleed
- Potential compression fracture benefit
- Storage/Admin pearls
  - Store upright
  - Prime 5 times before use
  - Discard after 30 doses or 35 days

Raloxifene

- Breast cancer indication
- DVT/Cardiovascular disease warning
- Side effects
  - Hot flashes
  - Edema

Teriparatide

- Builds Bone (osteoblasts)
- SubQ – once daily
- $$$
- Warning – osteosarcoma in rats
  - Use longer than 2 years is not recommended

Other Considerations

- Vitamin D
- Calcium
- Exercise, strength building, weight bearing
- Fall risk

Classic Medication Contribution

- Steroids
- Anticonvulsants
- Thyroid supplements
- PPI's
- TZD's

Rheumatoid Arthritis

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Rheumatoid Arthritis

- Inflammation
- Painful
- Joint Swelling (big difference with OA)
- Typically symmetrical
- CRP, RF, ESR, ANA

RA Versus OA

- RA
  - Onset middle age/anytime in life
  - Quick onset – Weeks to months
  - Inflammation/Swelling
  - Both sides of the body affected
  - Stiffness can last much longer throughout the day
  - Whole body symptoms possible (fatigue, feeling sick)

DMARDs

- Methotrexate
  - Once weekly up to 20-30 mg
  - LFT's, CBC, immune system suppression, Folic acid
- Sulfasalazine
  - GI upset, rash, CBC, LFT's
- Hydroxychloroquine
  - CBC, LFT's, eye exams
- Leflunomide
  - LFT's, CBC, diarrhea, skin reactions, hair loss

DMARDs - Biologics

- Etanercept (once weekly), adalimumab (every 2 weeks), infliximab (infusion), etc.
- Injection site reaction
- Infection risk

Flare Medications

- Steroids
  - Minimize dose
  - Minimize duration
    - Osteoporosis, GI, Diabetes, Insomnia, Weight gain, HTN
- NSAIDs
  - GI, Kidney, HTN, CHF

Shingles

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Shingles

- Caused by Varicella Zoster virus
  - Chicken pox
  - Reactivation
- Painful skin rash/reaction
  - Inflammation of nerve
  - Blisters

Treatment

- Vaccination (prevention)
  - Best efficacy in the 60's
  - Indicated for age 50 or greater
  - ACIP now recommends Shingrix (over Zostavax)
    - Shingrix (two doses + cost a little more)
    - More effective
- Antiviral treatment
  - Get started ASAP
  - Acyclovir
  - Valacyclovir

Antivirals

- Acyclovir dosed 5 times/day
- GI SE's
- CNS toxicity rare, but possible
  - More likely with poor kidney function
- Potential for renal issues if other kidney toxic medications or dehydration

Pain Management

- Gabapentin
- Pregabalin
- TCA's
- Topical
  - Capsaicin
  - Lidocaine

Psych

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Anxiety

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Association of Anxiety

- PTSD
- Substance Abuse
- OCD

Assessment

- GAD-7
  - 7 questions
  - Example: Feeling afraid something awful might happen
  - Scored from 0-3 for each question
    - Not at all
    - Several days
    - More than half the days
    - Nearly every day
  - Higher the score the worse
  - Obviously might not work in our dementia type patients

Acute Treatment

- Identify underlying cause
  - Pain
  - Infection
  - Hyperthyroid
  - Situational
  - Medications
    - Stimulants
    - Alpha/beta agonists

Medications

- SSRI's
- Benzo's
- Buspirone
- Other antidepressants
- Antipsychotics (usually with comorbidities)

SSRI's

- Won't work quickly
- Preferred for long term maintenance over benzo's
- Selection based upon adverse effects

Benzodiazepines

- Falls
- Sedation
- Confusion
- Paradoxical effect (exacerbates anxiety, especially in association with delirium)
- Disinhibition
- Generally avoid if possible

Benzodiazepines

- Work quickly
- Controlled substance
- Avoid long acting if using as needed
- LOT in elderly
  - Less likely to accumulate
  - Inactive metabolites

Buspirone

- Usually well tolerated
- Takes time to work
  - Similar to SSRI's
- Not a controlled substance
- Pretty safe option in elderly

Anticholinergics

- Hydroxyzine
  - Non-controlled option
  - Works quickly
  - Beneficial for itching
- AE's in elderly problematic
  - Constipation
  - Confusion
  - Retention
  - Falls
  - Dry eyes, mouth

Bipolar Disorder/Schizophrenia

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Acute Mania Treatment

- Antipsychotics
- Valproic Acid
- Lithium

Lithium

- Target Concentration
  - Acute 0.8-1.2
  - Maintenance 0.6-1.0
- AE's
  - GI
  - Tremor
  - Slurred Speech
  - TSH
  - Kidney function
- Drug Interactions
  - NSAIDs
  - Thiazides
  - ACE Inhibitors

Bipolar Depression

- Lamotrigine
- SSRI's
  - Can induce mania
  - Often used with mood stabilizer (i.e. Lithium, VPA, Carbamazepine)

Schizophrenia

- Elderly Adults
  - Likely tried numerous agents
  - May be able to or have to decrease doses
- Metabolic Syndrome
- TD risk
- More concern with sedation, EPS, fall risk as life expectancy and physical ability declines

Antipsychotics

- Typical
  - Haloperidol
- Atypicals
  - Ripseridone
  - Quetiapine
  - Aripiprazole
  - Clozapine
  - Olanzapine
  - Ziprasidone

Side Effect Profile, Clinical Considerations

- Sedation
- Weight Gain
- EPS
- Prolactin
- Anticholinergic
- Agranulocytosis
- QTC prolongation

Antipsychotic Pearls

- Weight gain/metabolic syndrome
  - Olanzapine, clozapine
  - Aripiprazole, ziprasidone better
- QTc
  - Ziprasidone, typicals (i.e. haloperidol) tend to be worst
- EPS
  - Typicals, risperidone
  - Quetiapine tends to be best
- Prolactin elevation
  - Risperidone

Depression

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Depression – Kind of a Big Deal

- Suicide
- Circumstances
  - Finances
  - Job Loss
  - Living alone
  - Aging
  - Loss of Family/Friends

Common Diseases That Increase Risk of Depression or Depressive Symptoms

- MS
- Parkinson's
- Dementia
- Cancer
- Hypothyroid
- Nutritional factors
  - B12

Antidepressant Pearls

- Take time to work
- Selection
  - Adverse effects
  - Compelling indications
- Monitoring
  - PHQ-9
  - Higher number/worse depression
  - Not perfect

Common SSRI's

- Sertraline
- Escitalopram
- Citalopram
- Fluoxetine
- Paroxetine
- Fluvoxamine

SSRI Clinical Pearls

- Citalopram
  - QTc prolongation, limit dose in elderly to 20 mg daily; omeprazole interaction
- Fluvoxamine
  - Generally avoid, multiple 3A4 drug interactions
- Fluoxetine
  - A little more activating
- Sertraline
  - Loose stools/serotonergic
- Paroxetine
  - Generally avoid in elderly, mildly anticholinergic
  - 2D6 interactions
  - Tends to be more sedating/weight gain
- Controversial effect on platelets and bleeding

Common SNRI's

- Duloxetine
- Venlafaxine
  - Pain relief at higher doses
  - Challenging to taper down/off

Trazodone/Nefazodone

- Nefazodone – rare use, hepatotoxic
- Trazodone
  - Low doses insomnia
  - Orthostasis
  - Dry mouth
  - Sedation

Mirtazapine

- Weight gain
- Less sexual dysfunction
- Sedation
  - Lower doses

Bupropion

- Smoking cessation
- Activating
- Caution - Seizure disorder
- Less sexual dysfunction

TCA's – lots of them!

- Nortriptyline, Desipramine, Amitriptyline, Imipramine
- Anticholinergic
- Risk in overdose
- Nortriptyline – possibly better tolerated in elderly
- QTc prolongation
- Good for corresponding pain syndrome
  - Fibromyalgia
  - Neuropathy
- Generally avoided in elderly

Less Common Antidepressants

- Serotonin modulators and stimulators
  - i.e. vilazodone
- MAOI's
- Antipsychotic augmentation
- OTC's
  - St. John's Wort

Substance Abuse

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Most Common Substance Abuse

- Alcohol
- Tobacco
- Methamphetamine
- Prescription Drugs
  - Opioids
  - Benzo's

Signs of Alcohol Abuse

- Higher tolerance
- Blackouts
- Concerns from friends/family
- Legal or financial issues
- Liver disease

Alcohol Addiction

- Loss of control
- Lack of other interests
- Withdrawal symptoms
  - Sweating, shaking, anxiety, DT's
- Guilt
- Worry
- Change in relationships

Alcohol Treatment

- Withdrawal seizures/DT's
  - Benzodiazepine
- Craving/Pleasure reduction
  - Naltrexone
  - Acamprosate
- Negative feedback
  - Disulfiram

Smoking Cessation

- Nicotine replacement
- Varenicline
  - Vivid dreams, CNS adverse effects
  - $$$
- Bupropion
- TCA's
- Counseling

Methamphetamine

- Stimulant
  - Psychosis
  - Agitation
  - HTN
  - Tachycardia
- Medications for management of addiction
  - None have good evidence
  - Counseling

Prescription Drug Misuse

- Using for legitimate reason, but not under supervision of a healthcare provider
- Medication hoarding
- Opioids, Benzo's

Signs of Opioid Overdose

- Respiratory depression
  - Snoring like noise
- Unconsciousness
- Pinpoint pupils
- No bowel sounds
- Response to naloxone

Signs of Opioid Withdrawal

- Withdrawal when stopping use
  - Nausea
  - Sweating
  - Anxiety
  - Insomnia
  - Chills
  - Irritability

Drugs to Treat Opioid Addiction

- Withdrawal
  - Clonidine
  - Diphenhydramine
  - Trazodone
  - Simple analgesics
- Buprenorphine/naloxone
- Methadone
- Naltrexone

Benzodiazepine

- Withdrawal
  - Anxiety
  - Irritability
  - Tremor
  - Confusion
  - Nausea
  - *Seizures
  - Psychosis
- Reversal agent
  - Flumazenil

Respiratory

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Allergic Rhinitis

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Allergic Rhinitis

- Make sure not from acute illness
- Reassess treatment throughout the year
  - Patients may be able to reduce medication burden

Treatment

- Nasal Steroid
  - i.e. Fluticasone
  - May take some time for max effect
- Antihistamine nasal spray
  - I.e. Azelastine
- Many patients will know what works best for them

Antihistamines

- 1st Generation
  - i.e. diphenhydramine
  - Avoid, highly anticholinergic
- 2nd Generation
  - Loratadine
  - Cetirizine

Other Therapies

- Oxymetazoline
  - Nasal
  - Use only short term (3-5 days)
    - Rebound congestion risk
- Pseudoephedrine/phenylephrine
  - Avoid if possible
  - Raise blood pressure
    - Assess recent BP and ensure controlled and not high risk patient
  - BPH
  - Insomnia risk

Other Therapies

- Montelukast
  - If allergies and asthma coexist
- Cromolyn
  - Generally safe
  - Likely less effective than steroids, antihistamines

Asthma

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Asthma Versus COPD

- Reactive
- Younger onset
- Reversible
- Triggers
- Wheeze
- Inflammation

Drug Selection

- SABA
- Steroids (inhaled)
- Dose escalation
- Addition of LABA
- Montelukast

Factors in Classification

- Frequency of exacerbations requiring oral steroids
- SABA use
- Interference with activity
- Nighttime awakenings
- FEV
  - Target 80% of predicted or better

Steps in Asthma Treatment

- Intermittent – SABA
- Mild Persistent – SABA + Low dose inhaled corticosteroid
- Moderate Persistent – SABA + Medium dose inhaled corticosteroid
- Severe Persistent – SABA + ICS + LABA and/or montelukast
- Last options for severe asthma
  - Oral corticosteroids (chronic)
  - Inhaled Anticholinergics
  - Theophylline
  - Cromolyn

Rule of 2 in Asthma

- < or equal to 2 times/week – use of albuterol
- < or equal to 2 nighttime awakenings/mo
- > 2 refills per year on rescue
- ER visits/hospitalizations
- https://www.nhlbi.nih.gov/files/docs/guidelines/asthma_qrg.pdf

Nebulizers

- Elderly
  - Physical and cognitive problems
- Albuterol
- Ipratropium
  - Combination with albuterol
- LABA
- Budesonide

Adverse Effects

- Beta agonists
  - Tachycardia, tremor, anxiety
- Steroids
  - Thrush
- Anticholinergics (not commonly used in asthma)
  - Dry mouth
- Theophylline
  - Tachycardia, anxiety, tremor
  - Interactions via CYP1A2 (inhibitors increase concentrations)
    - Caffeine, tizanidine, mirtazapine, ropinerole
    - Smoking cessation will increase concentrations (smoking 1A2 inducer)

COPD

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GOLD Classification

- 1 – mild (FEV >80% of predicted)
- 2 – moderate (FEV 50-80)
- 3 – Severe (FEV 30-50)
- 4 – Very Severe (FEV <30)
- http://goldcopd.org/wp-content/uploads/2016/12/wms-GOLD-2017-Pocket-Guide.pdf

General Medication Flow

- SABA/Short Acting Anticholinergic
  - Or Combo
- Long Acting Anticholinergic
- Long Acting Beta Agonist (LABA)
- Inhaled corticosteroids
- Roflumilast
- Theophylline

Adverse Effects Beta Agonists, Anticholinergics

- Beta Agonists (i.e. albuterol, salmeterol)
  - Tachycardia
  - Tremor
- Anticholinergic (i.e. ipratropium, tiotropium)
  - Dry mouth

Inhaled Corticosteroids

- Reduces Exacerbations
- Not used as monotherapy in COPD
- Systemic Corticosteroids
  - Avoid long term if possible
  - OP, GERD, HPA suppression, Diabetes

Roflumilast

- Reduces exacerbations
- $$
- SE risks
  - Weight loss, GI
  - Psychiatric concerns

Other Alternatives

- Theophylline
  - Drug levels
  - Drug interactions
    - Quinolones, macrolides
    - Sympathomimetics
  - Systemic effects
- Azithromycin

Classic Medication Causes of Respiratory Issues

- Amiodarone
- Nitrofurantoin
- Beta-blockers
  - Can blunt response to medications (beta-agonists)

Other Considerations

- Oxygen
- Vaccination
- Smoking
- Alpha-1 antitrypsin deficiency (AATD) screening

Sinusitis

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Sinusitis

- Nasal discharge plus obstruction
- Facial pain, headache, pressure sensation
- Most common cause is viral
- Signs that may point bacterial
  - Persistent symptoms >10 days and no improvement
  - Fever >102
  - Purulent discharge, facial pain for extended period of time – 3 or more days
  - Continued symptoms after initial improvement

Treatment

- Bacterial
  - Amox/clav
    - N/V/D
  - Doxycycline (PCN allergic patients)
    - Binding interaction
    - Sun sensitivity
    - Avoid in pregnancy
  - Respiratory quinolones (levofloxacin, moxifloxacin)
    - Generally avoid if possible
    - QTc prolongation, tendon rupture, CNS effects, renal dosing
  - Macrolides
    - Commonly prescribed, generally now discouraged due to resistance

Supportive Care

- Simple analgesics
  - NSAIDs, acetaminophen
- Nasal steroids
  - Fluticasone, mometasone, etc.
- Nasal saline
- Decongestants
  - Pseudoephedrine (be a little careful depending upon patient population)
- Antihistamines
  - Second generation

Sleep Apnea

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Sleep Apnea

- Patient stops breathing during sleep
  - Reduced respiration
- Gasping/choking/snoring sounds
- Drop in oxygen sats
- Waking up
  - Patients don't feel rested
  - Daytime sleepiness
- ***Important cause of resistant hypertension

Typical Management

- No drugs
- CPAP
- Change in sleeping position
- Smoking Cessation
- Weight Loss
- Alcohol Cessation

Medications – Daytime Sleepiness

- Despite adequate CPAP/management of sleep apnea
- Modafinil/armodafinil
  - Stimulant
  - Aids in wakefulness in partial responders to CPAP/other therapies
  - Monitor BP/HR
  - Be a little careful in patient with psychiatric history (psychosis, mania)

Sleep Apnea - Risky Medications

- Opioids
- Benzodiazepine
- Barbituates
- Alcohol

Smoking Cessation

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Indications for Pharmacotherapy

- All smokers
- Exceptions
  - Medical contraindications
  - "light smokers" – less than 10/day
    - Reduce doses if pharmacotherapy is used

Smoking Cessation

- First line in combination with cognitive therapy
  - Bupropion SR
  - Varenicline
  - Nicotine
    - Inhaler
    - Gum
    - Nasal spray
    - Patch
- Pharmacotherapy ranked in no-specific order
- Patient preference, contraindications, adverse reactions, previous trials, co-morbidities are primary selection factors

Bupropion SR

- Usual target 150 mg BID
- Can help reduce risk of weight gain with cessation
- Insomnia, agitation, increases seizure risk
- Antidepressant advantage
- Initiate at least a week or two before start date

Varenicline

- Partial agonist
  - Helps ease withdrawal
  - Blocks reward
- Possible change in psychiatric status
- Vivid dreams, insomnia, GI
- Usually start 1-2 weeks prior to quit date

Nicotine Replacement

- 21 mg/day for >10 cigs/day
- 14 mg/day for <10 cigs/day
- Patch irritation, insomnia, dreams
  - Patients may take off at bedtime especially if side effects problematic
- Not “as needed” for immediate craving
  - Often used in combo with “prn nicotine replacement”

Nicotine Replacement – Short Acting

- Gum
  - 2 mg <25 cigs/day; 4 mg >25 cigs/day
  - Max 24 pieces per day
  - GI, jaw pain, taste
- Lozenge
  - Max 20/day
  - GI, mouth irritation, taste
- Inhaler
  - Max 16/day
  - Mouth/throat irritation
- Nasal spray
  - 80 spray/day max
  - Irritation

Weight Gain

- Encourage lifestyle changes/exercise etc.
- Bupropion and NRT (maybe more so gum)
  - Can help delay weight gain
  - Won’t prevent

Second Line Agents

- Clonidine
  - Sedation
  - Dry mouth
  - Hypotension
- Nortriptyline
  - Anticholinergic AE's
  - Weight gain
- Likely avoid in elderly for smoking cessation

Social Issues, Clinical Literature/Statistics and Other Geriatric Considerations

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Activities of Daily Living and Instrumental Activities of Daily Living

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Activities of Daily living (ADL's)

- Feeding
- Dressing
- Grooming
- Toileting
- *necessary for survival

Instrumental Activites of daily living (IADL's)

- Financial management
- Following directions/medication management
- Meal preparation and planning
- *not necessarily required for survival, but necessary to be able to function independently in society

Disease Progression

- IADL's will typically become more challenging before ADL's
- Inability to perform IADL's can lead patients to be very vulnerable to financial elder abuse
- ADL's will typically become more challenging with nearing end stage of the disease process
- IADL and ADL will help determine level of care needed
  - Home care
  - Assisted living
  - Nursing home care

Advance Directives

Advance Directives

- Patient wishes for their healthcare
- Will outline certain situations and how much and what type of care the individual will want
- Written document
- Designates an "agent"

Medical Requests

- Must be reasonable medical practice
- Usually preference regarding common things are spelled out
  - Types and extent of medical treatment desired
  - CPR
  - Ventilation
  - Tube feedings
  - Medication use
  - Hydration

Advance Directive

- Agent – person who carries out wishes of patient
  - MUST FOLLOW THEIR DESIRES
- In the event of an unforeseen scenario
  - Agent must follow wishes to the best of their ability as to what the patient would want
- Agent
  - Needs to be 18 years old
- Not mandatory to have advance directives

Biostatistics

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Hypothesis Testing

- Ho – null hypothesis
  - No difference between groups
  - Example: comparing new drug to placebo
    - People studying new drug will want p-value less than 0.05
  - If the p-value is low (<0.05), null hypothesis must go
- Ha – alternative hypothesis
  - Ha is accepted when the null hypothesis is rejected

P-Value

- Also referred to as alpha (α)
- Represents the probability that your study is wrong
- The lower the p-value, the less likely your study is incorrect
  - <0.05 (5%) is set by convention as a statistically significant study
- Type 1 error
  - Detecting a difference when one doesn't actually exist

Beta

- Beta (β) represents the probability of type 2 error
  - Type 2 error is the inability to detect a difference and one actually exists
  - Underpowered studies
    - Inadequate sample size
- Power = 1-Beta
  - Target power is 80% or greater (0.8)
  - Target Beta is 0.2

Variables

- Independent
  - What the researches set as variables
  - Drugs, doses, etc.
- Dependent
  - They depend upon the independent variables
  - Drop in blood sugar, blood pressure, etc.
- Control variable
  - No intervention is made
  - Comparison group

Types of Variables

- Nominal "name"
  - Placing patients in groups/categories
  - Those with MS, those without
- Ordinal
  - Order
  - No specific distance between variables
  - Subjective scales/surveys are included in this group
    - Staging of pressure ulcer
    - Pain scale
    - Rating a speaker
  - Ordinal and Nominal are also called discrete variables (only take on a limited # of values within a range

Types of Variables

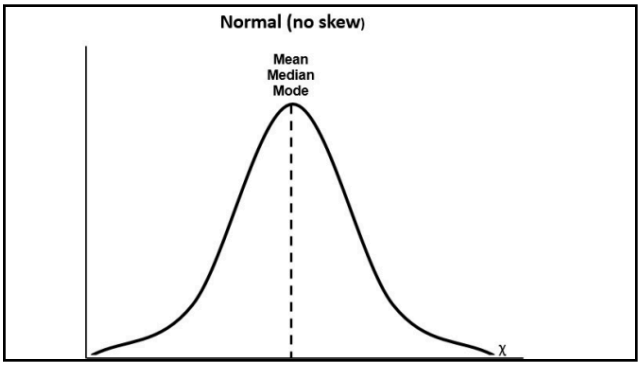
- Continuous (can have fraction of numbers)
  - Ratio
    - Has an absolute zero
    - Example: height
  - Interval
    - Similar to ratio
    - No absolute zero
    - Fahrenheit/Celsius temperature scale

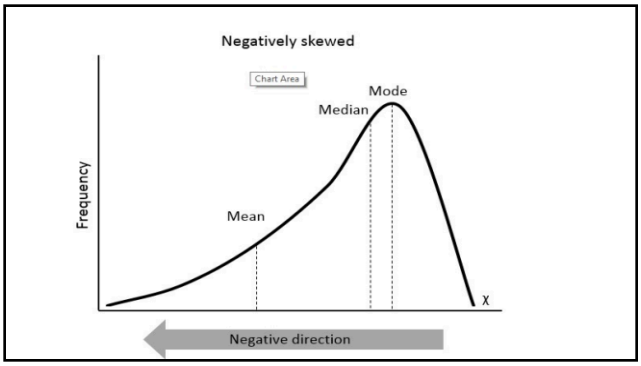
Confidence Intervals

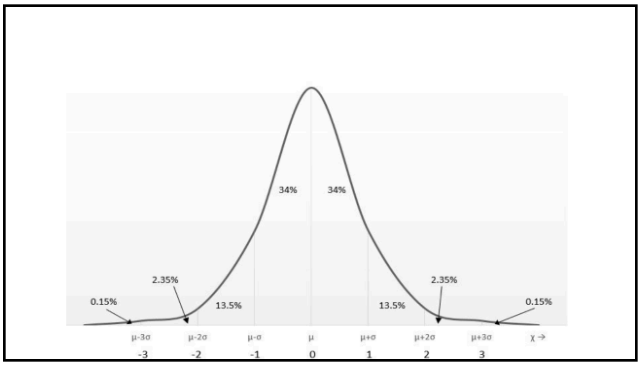
- Range of values that you believe the true value lies between
  - Traditionally set at 95%
  - I.e. you are 95% confident that the values lie between two values
- If you are looking for a change, does your confidence interval contain "0"
  - Change in blood sugar on prednisone; 95% CI = 4-25
- If you are looking for a deviation from normal comparing two confidence intervals (groups), do they overlap?
  - Comparing two different dosages
  - Drop in systolic blood pressure (2.3-6.8) vs. (4.5-8.1)

Normal Distribution – Continuous Variables

- Also termed parametric data
- Mean = Median = Mode
- Mean – average
- Median – middle number
- Mode - # (or value) that occurs most often
  - Bell Curve
- ***Do NOT use for ordinal data
  - Ordinal, nominal are considered nonparametric data







Statistical Testing – Paired/Unpaired Groups

- Paired
  - Data measured from same subject
  - Before and after treatment
    - Washout period when using drugs
- Unpaired
  - Two different groups being compared
  - Assume a normal distribution in the population
    - No before and after comparison for an individual research participant

Statistical Testing

- Ordinal
  - Sign test
  - Wilcoxon test
    - Used for two paired samples
  - Unpaired Samples (two)
    - Mann-Whitney
  - Three or more unpaired samples
    - Kruskal-Wallis test
  - Spearman correlation
    - Correlation for two paired samples

Statistical Testing - Continuous

- Continuous (t-test or sometimes called Student's t-test)
  - Paired t-test
    - Two paired continuous groups
  - Unpaired t-test
    - Two unpaired continuous groups
- ANOVA (analysis of variance)
  - Three or more samples
- Pearson correltation

Nominal Data

- Chi-squared χ^2
  - Unpaired samples
- Paired samples
  - Sign test
- Correlation comparison
  - Contingency coeffecients

	Dataset		
	Nominal	**Continuous**	**Ordinal**
Example of Variable	Separation of patients into Afib and non-Afib groups	Readings of blood pressure from several patients	Pain Scale
Is mean (average), standard deviation applicable?	No	Yes	No
Example of appropriate Statistical Test (dependent upon samples)	χ^2 (chi-squared)	One-sample t test	Sign test or Wilcoxon test
Compare two paired samples	Sign test	Paired t test	Sign test or Wilcoxon test
Compare two unpaired samples	χ^2 square Fisher's exact test	Unpaired t test	Mann-Whitney test
Compare three or more unmatched samples	χ^2 test	One-way ANOVA	Kruskal-Wallis test
Quantify association between two paired samples (correlation)	Contingency coefficients	Pearson correlation	Spearman correlation

Absolute Risk

- Simply take the difference between the raw %
  - 60% of smokers develop lung cancer
  - 20% of non-smokers develop cancer
- Absolute risk reduction
  - Not smoking is 40% (0.4) absolute risk reduction

Number Needed to Treat

- NNT
  - Good comparison of agents/pharmacoeconomics
  - Also good to compare risks (adverse effects) versus benefits of medication therapy
- Lower NNT = more effective treatment
  - How many people will get benefit
- NNT = 1/ARR
  - Difference between groups is 5% MI rate versus 10% MI rate
  - ARR = 0.05
  - NNT = 1/0.05 = 20

Number Needed to Harm

- Similar to NNT
- Demonstrates tolerability/risk of ADR's in medication studies
- Higher NNH is better
  - Less likely that an adverse effect will happen
- Risk of renal failure is 1% in placebo group and 2% in treatment group
  - NNH = 1/Absolute risk
  - NNH – 1/0.01 = 100 patients treated, 1 patient will have renal failure from the medication

Odds Ratio

- Most often presented as 95% CI
- CI containing 1 will not be considered statistically significant
  - 0.7-1.31
- Range less than 1
  - Demonstrates that outcome is less likely to happen
- Range greater than 1
  - I.e. 1.23 – 1.61
  - Demonstrates that outcome is more likely to happen

Hazard Ratio

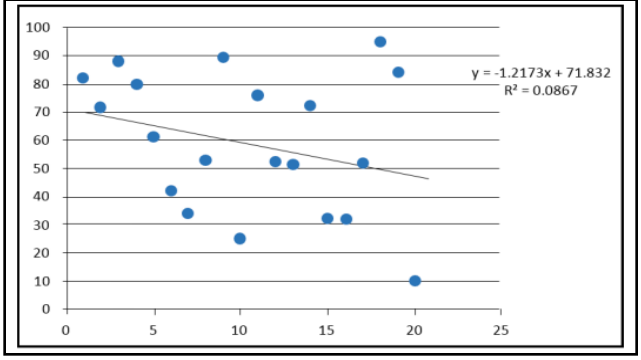
- Often related to adverse events
  - CI less than 1 and doesn't contain 1
  - Protective effect
- Adverse effects more likely
  - CI that doesn't contain 1 and is greater than 1

Correlation

- Association
- Negative
  - Variables go in opposite direction
- Positive
  - Variables go in the same direction
- Correlation does not mean causation***
  - Patients with COPD develop lung cancer

Correlation Coefficient

- Correlation coefficient = r
  - Value ranging from -1 to 1
- R-squared
  - Lies between 0-1
  - Tells us how accurately we can predict where values fall
  - 0 = no correlation
  - 1 = perfect predictability of the model



Bias in Studies

- Selection
  - Study participant groups differ
- Observation
  - Investigator "seeing" something or exaggerating the response
- Recall
  - Memory recall
- Misclassification
  - Incorrect incorrect classification of a study participant
  - Misdiagnosis

Confounding Variables

- A variable that is impacting your study results
  - Known or unknown
- Confounding Variable
  - Lead to incorrect assumptions/association
  - Kind of similar to correlation does not mean causation

Clinical Literature

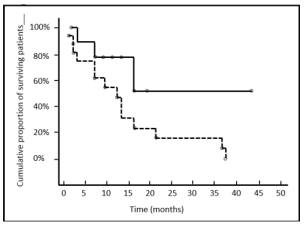
- Primary
  - Clinical trial/study
- Secondary
  - Review article breaking down a particular topic
- Tertiary
  - Large compilation of information
  - Textbook

Study Design Strength

- Randomized Controlled Trials
  - Direct comparison under controlled environment to identify
  - Gold Standard
- Meta-Analysis
  - Comparison of similar studies to draw conclusions
- Cohort
  - Following a group of patients over time on a drug/with a disease etc. and monitor some effect (done prospectively)
- Case Control series
  - Look back at information to identify trends/associations
- Cross Section Surveys
  - Snap-shot in time
- Case Studies
- Expert opinion

Kaplan Meier

- Estimation of survival over time



Caregiver Stress and Burnout

Caregiver Education

- Understand what the patient is going through
- Expectations
  - Based upon disease progression
- Caregiver support
- Burnout

Caregiver Burnout

- Significant Stress
- Insomnia
- Frustration/anger
- Anxiety
- Guilt
- Risk for abuse

Ways to Improve/Minimize Burnout

- Accept help/recommend help
- Identify realistic goals
  - Identify things that the caregiver can actually do
- Support groups
- Take breaks and continue to do activities that bring the caregiver enjoyment

Elder Abuse

Elder abuse

- Neglect
  - Social isolation
  - Ignoring needs
  - Most common
- Physical abuse
  - Includes over medicating
  - Blunt trauma/injuries
  - Restraints

Elder abuse

- Financial scheming
  - Often done by family or caregivers
    - They often rationalize
  - Outside schemes possible
- Verbal (threats, intimidation)
  - Fear
  - Scared to speak with others
  - Isolating

What to do if suspect elder abuse

- Call 911 if IMMEDIATE risk of harm
- Contact social services
  - Adult protective services
  - May have different name depending upon state/country/region
- If concerned in a long term care facility or assisted living
  - Contact ombudsman
- Healthcare professionals are generally considered mandated reports
  - Report if you suspect that abuse is happening

Geriatric Teaching

Identifying Problems

- Care Centers (LTC/AL)
  - Report problems to nurse leadership, education leaders
- Tons of opportunities
  - Look for trends
  - Survey results
  - Community needs
  - Tabulate data if able, necessary
- Work with nursing, administration, providers, or community

Setting Up education

- What are your objectives
- Audience
- How to show improvement, retention of knowledge

Common Topics

- Medication errors
- Medication administration
- Psych/Dementia
- Infection/antibiotics
- Major disease states
  - Diabetes
  - Parkinson's

Hospice Care

Hospice

- Life expectancy less than 6 months
  - Determined by usual progression of disease
  - Physician/hospice may work together to make determination
- Possible indicators that hospice care may be warranted
  - Clear disease progression (NYHA stage 4)
  - Frequent healthcare visits (particularly ER, hospitalization)
  - Weight loss
  - CHF, COPD, Dementia, Parkinson's, Renal failure, cancer, AIDS, ALS, liver disease

Medications to Discontinue

- Statins
- Osteoporosis medications
- Herbals/supplements/vitamins
- Dementia medications
- Look at goals
  - A1C
  - Blood pressure

Careful with abrupt discontinuation

- Beta-blockers
- Clonidine
- Seizure meds
- Long term corticosteroids
- Benzo's
- Opioids – likely not going to discontinue

Patient/Team/Family Decisions

- Listen to patient/family
  - What do they want?
  - Ask open ended questions?
- Listen to nursing/caregivers
- Relax goals, minimize meds, simplify life
- Administration challenges
  - Oral intake

Long Term Care Players

Structure

- Administration
- Nurse leadership (Director of Nursing – DON or DNS)
  - Nurse managers/unit managers
- Medical Director (in smaller facilities may not be that engaged)

Administration

- Pays your wages
- Important to stay on their good side
- Demonstrate your value
- Attend meetings
- Offer solutions and education
- Concern with medical director (possibly will address this with director of nursing)

Director of Nursing

- Likely going to be the place you go first when a problem is identified
  - Exceptions
    - Immediate clinical concern that needs an order change
    - Elder abuse
    - Concern with the director of nursing

Medical Director

- The leader of the provider team
- Ultimately makes clinical decisions for the patients/residents within the facility
  - Which influenza vaccine to give
  - How to handle our high fall rate
- Go to person if having challenges with another provider