Pharmacology I, II, III

2006 Edition
Pregnancy & Lactation

- FDA assigned categories
  - A  Controlled studies show no risk
  - B  No evidence of risk in humans
  - C  Risk cannot be ruled out
  - D  Positive evidence of risk
  - X  Contraindicated in pregnancy
Blood Pressure Control/Shock

Key Concepts!

- CO = SV X HR
- BP = CO X PVR
- BP = SV X HR X PVR

Most treatment of cardiac problems involve an attempt to change one or more of the factors that control BP – SV, HR, PVR.
Cardiac Pharmacology
Tropic Agents

- Chronotropic = rate
- Ionotropic = force
- Dromotropic = rate of nerve impulse conduction (electrical conduction)
Epinephrine

- Pregnancy class  C
- Sympathetic agonist
- Potent alpha/beta stimulator
  - Positive chronotrope
  - Positive ionotrope
  - Positive dromotrope
  - Increases PVR
  - Increases BP
  - Increases automaticity
Epinephrine

**Indications**
- Cardiac arrest
- Severe anaphylaxis
- Severe reactive airway disease

**Contraindications**
- Arrhythmias

**Precautions**
- Cardiac disease, diabetes, hypertension
Epinephrine

- Protect from light
- Can be deactivated by alkalines

Side Effects
- Nausea vomiting
- anxiety
- Headache, tremors
- Ischemia
- Arrhythmias
Epinephrine

- **Dosage (IV)**
  - Cardiac arrest - 1.0mg q 3-5min
    - Children - 0.01mg/kg (0.1ml/kg)
  - Severe anaphylaxis/asthma
    - 0.3-0.5mg IV
    - Children 0.01mg/kg

- **How supplied**
  - 1 mg/ml ampules
  - 1 mg in 10 ml syringes
  - 30 mg/30ml vials
Calculate!

Your 32 YO patient in anaphylaxis requires 0.3mg Epi 1:1000 IM. You have a vial containing 1mg Epi in 1ml.

1. How many ml of Epi will you administer to this patient?
2. What sides effects can you expect?
Vasopressin

- Pregnancy class  C
- Mechanism of action
  - In high dose acts as a peripheral smooth muscle vasoconstrictor
  - During CPR vasopressin increases cerebral blood flow, vital organ blood flow and O2 delivery
  - Has almost no Beta adrenergic activity
- Indications
  - As an alternative to epinephrine in VF
**Vasopressin**

- **Contraindications**
  - None in arrest

- **Precautions**
  - Responsive patients with CAD

- **Dose**
  - 40 units IV

- **How supplied**
  - 20 units/ml vials
Vasopressin

- Adverse reactions
  - Dizziness
  - Pounding sensation in head
  - AMI
  - Chest pain
  - Abdominal cramps
  - N/V
  - Sweating
Norepinephrine (Levophed)

- Sympathetic agonist
- More prominent alpha effect
  - Potent vasoconstrictor
  - Constricts renal and mesentery
- Indicated for:
  - Hypotension refractory to other sympathomimetics
  - Neurogenic shock
- Contraindication
  - Hypovolemia ➔ Treat with fluids first
Norepinephrine

- Side effects
  - Myocardial ischemia
- Interactions
  - Deactivated by “alkalines” – for example?
  - Use with Beta-blockers can result in significant hypertension
- Dosage
  - 0.5 - 30 micrograms/minute
  - 4mg diluted in 250cc NS
Isoproterenol (Isuprel)

- Pregnancy class C
- Mechanism of action
  - Sympathetic agonist
  - Pure Beta agent
- Indications
  - Bradycardias refractory to atropine, epinephrine and TCP
  - High degree heart blocks refractory to TCP
  - Severe status asthmaticus
  - Rarely used since the advent of external pacemakers
Isoproterenol (Isuprel)

- **Precautions**
  - Myocardial ischemia
  - Arrhythmias
  - Pediatrics

- **Dosage**
  - 2 to 10 micrograms/minute
  - 1mg in 250cc NS
    - concentration yield 4mcg/ml

- **How supplied**
  - 20ug/ml
Dopamine (Intropin)

- Pregnancy class: C
- Mechanism of action
  - Sympathetic Agonist
  - Acts on alpha, beta and dopaminergic receptors
  - Effect is dose dependent
  - Most frequently used vasopressive agent ("pressor")
Dopamine

**Indications**
- Hemodynamically significant hypotension, usually associated with cardiogenic shock
- Symptomatic bradycardia
- Increase urine output/mesenteric perfusion in shock not responsive to fluid

**Contraindications**
- Tachyarrhythmias
- Pheochromocytoma
Dopamine

- **Precautions**
  - Hypovolemia (fluid first!)
  - Can worsen ischemia, and occlusive vascular disease

- **Side effects**
  - Nervousness, headache, dysrhythmias, palpitations, chest pain, dyspnea, nausea, vomiting, dilated pupils, hypotension, tissue necrosis at IV site
Dopamine

- **Dosage**
  - Standard dose is 400mg in 250cc NS, run at 2.5 to 20mcg/kg/min titrated to effect

- **How supplied**
  - 40mg/ml
Dopamine – Interesting Drug

- Different dose range produces different effects:
  - 2-5 mcg/kg/min: Renal Dose
  - 5-20 mcg/kg/min:
    - Positive chronotrope/inotrope/dromotrope
    - Slight alpha agonist (increases PVR)
  - >20 mcg/kg/min: Pure alpha agonist
Calculate!

Medical Control has ordered that you give your 154 pound (lb.) patient in Cardiogenic Shock 10mcg/kg/min of Dopamine (to attempt to raise the blood pressure). You will place 400mg of Dopamine into a 250ml bag of Normal Saline. Assuming that you use a microdrip set, what is the number of drops/minute that you will administer?
**Dobutamine (Dobutrex)**

- Pregnancy class: B
- **Mechanism of action**
  - Sympathetic Agonist
  - Acts primarily on Beta 1 receptors
  - Increases the force of systolic contraction, with little increase in rate
- **Indications**
  - Short term management of CHF when an increase in output, *without an increase in rate*, is desired.
  - Hypotension when vasodilators cannot be used
Dobutamine

- Contraindications
  - Should not be used as the sole agent in hypovolemia. In cardiogenic shock, dopamine is preferred.

- Precautions
  - Atrial fibrillation – treat with digoxin first
  - Hypovolemia – use fluid first

- Dosage
  - 2-20ug/kg/min
Dobutamine

- Adverse reactions
  - Dizziness, headache, chest pain, arrhythmias, shortness of breath, N/V
Atropine

- Pregnancy class: C
- Anticholinergic
  - Parasympatholytic (blocker)
  - Blocks acetylcholine receptors
  - Inhibits parasympathetic tone
- Indications
  - Symptomatic bradycardias
  - Dead People (Asystole & EMD/PEA with HR<60)
  - Reversible bronchospasm in COPD
    - Which drugs, for example?
Atropine

- **Precautions**
  - patients with hypertension, certain types of Glaucoma
  - may worsen a lower degree block such as third degree or Mobitz II

- **Side Effects**
  - blurred vision, tachycardia, dilated pupils, dry mouth, confusion, palpitations, nausea and vomiting, nervousness
Atropine

Dosage:

- **Symptomatic** Bradycardia - 0.5mg iv q 3-5 minutes for a maximum dose of 0.04mg/kg
- Asystole: - 1.0mg iv q 3-5 minutes for a maximum of 0.04mg/kg
  - Except in case of ET administration

How supplied

- Vials, ampules, and prefilled syringes in 1.0 mg concentrations
Calculate!

You are ordered to administer 0.5mg of Atropine to a patient with a HR=42 showing S/S of Bradycardia. Atropine comes in a “bristoject” containing 1mg in 10ml.

1. What are S/S of bradycardia?
2. How many ml will you administer?
3. Why not give Atropine for a slow HR even with no S/S of bradycardia?
Propanolol (Inderal)

- Pregnancy class  C
- Mechanism of action
  - **Non-selective** Beta Blocker
    - Blocks both B1 & B2
  - Negative chronotrope
  - Negative Inotrope
  - Reduces BP
  - Reduces cardiac O2 demand
Propanolol (Inderal)

- Indications
  - V-Tach refractory to lidocaine and Bretylium
  - Recurrent V-Fib
    - Now most patients would get an “implanted AICD”
  - Certain Supraventricular Tachycardias
  - Hypertension
  - Angina
  - Decrease heart rate
  - Essential Tremors
**Propanolol (Inderal)**

- **Contraindications**
  - Bradycardia
  - Asthma
  - COPD
  - CHF
  - Depressed cardiac function
  - Cardiogenic shock, heart blocks
  - During pregnancy, may result in apnea, hypoglycemia, bradycardias, low APGAR scores
Propanolol (Inderal)

- Interactions
  - Verapmil
  - Antihypertensives

- Dosage
  - 1 to 3 mgs *slowly* over 2-5 minutes
  - Total dose not to exceed 0.1mg/kg
  - No faster than 1mg/minute

- How supplied
  - 1mg/ml
Propanolol (Inderal)

- Side effects
  - Weakness, depression, fatigue, bradycardia, CHF, Impotence (all beta blockers)
  - Bronchospasm, wheezing, hypoglycemia, N/V
Sotalol HCL
(Sotacar, Betapace)

- Non selective Beta Blocker
- Indicated for the prophylactic treatment of documented v-tach/v-fib
  - Most patients would get an AICD
- May have a pro-arrhythmic effect
Metoprolol (Lopressor)

- Pregnancy class C
- Mechanism of action
  - Selective beta blocker
  - Selective for beta1
  - Reduces heart rate, systolic blood pressure and cardiac output
  - Inhibits tachycardias
Metoprolol (Lopressor)

- Indications
  - Pts with suspected MI or unstable angina who are hemodynamically stable
  - Hypertensive urgency/emergency
  - “Second line” for SVT
  - Used with thrombolysis to decrease nonfatal infarction and recurrent ischemia
Metoprolol (Lopressor)

- Contraindications
  - Heart rate less than 45
  - BP less than 100 systolic
  - CHF
  - Heart blocks
  - Asthma or Bronchospasm
  - Cardiogenic shock
  - Pregnancy
Metoprolol (Lopressor)

- Precautions
  - Coronary insufficiency
  - DM

- Dosage
  - Initial dose of 5 milligrams slow iv followed by a second 5mg bolus 2 minutes after
  - Followed by a third 5mg bolus 2 minutes after the second

- How supplied
  - 1mg/ml
Labetalol

- Pregnancy class  C
- Mechanism of action
  - **Non-selective** Beta Blocker
  - Also acts as an alpha blocker
    - Inhibits vasoconstriction
    - Produces vasodilatation
Labetalol

**Indications**

- **Hypertensive urgency or emergency**
  - What is a hypertensive emergency?
  - Used to be in REMAC protocol
  - Protocol for hypertensive emergency no longer exists
    - Why?
  - Second line for SVT
  - To reduce workload on myocardium in setting of an MI

**Contraindications**

- bronchial asthma
- CHF
- bradycardia
- cardiogenic shock
- Heart blocks
Labetalol

- **Precautions**
  - Patients with diminished renal function
  - CHF in cardiac insufficiency
  - DM

- **Side effects**
  - Fatigue, depression, bradycardia, CHF, bronchospasm, blurred vision, N/V, impotence

- **How supplied**
  - 5mg/ml
Labetalol

Dosage

- **IV Push**
  - 20mgs slow IV push over 2 minutes
  - Repeated at 20mg intervals for desired effect or a max of 300mgs

- **Infusion**
  - 2 mgs/min
  - 200mgs in 250NS
    - equals 0.8mg/ml
Nitroglycerine

- Pregnancy class  C
- Mechanism of action
  - Potent smooth muscle relaxant
  - Decreases myocardial oxygen demand
  - Causes vasodilation
    - reduces preload
  - Dilates coronary arteries
  - Onset of action 2 minutes with duration up to 30 minutes
Nitroglycerine

- **Indications**
  - Ischemic chest pain associated with angina or MI
  - Acute pulmonary edema

- **Contraindications**
  - Hypotension
  - hypovolemia
  - Increased ICP
  - Patients taking Viagra, Levitra, Ciala – and perhaps “natural medications” for this condition
Nitroglycerine

Precautions

- Tolerance
- Syncope (take lying down)
- Headache due to cerebral vasodilatation
- Use in pregnancy can affect fetal blood flow
- Remove transdermal prior to defibrillation/cardioversion
  - Why?
Nitroglycerine

- Side effects
  - headache, dizziness, weakness, tachycardia, Hypotension, nausea/vomiting, dry mouth

- Interactions
  - Can cause severe hypotension in the presence of recent alcohol ingestion
  - Severe orthostasis when used in conjunction with Beta Blockers and some other antihypertensives
Nitroglycerine

Dosage

- One tablet 0.4mg (1/150th gr.) sublingual
- One metered spray (0.4mg)
- Repeated every 3 to 5 minutes as required
- 1/2 to 1 1/2 inches paste
Nitroglycerine (Paste)

- 2% solution of NTG in a special absorbent paste
- Absorbed transdermally into the systemic circulation
- Longer duration of action
- Retrievable
Adenosine (Adenocard)

- Pregnancy class C
- Mechanism of action
  - Decreases conduction through the AV node
  - Interrupts AV re-entry pathways and can “break” an SVT
- Indications
  - PSVT including WPW
- Contraindications
  - 2nd and 3rd degree block
    - How would you know if the patient has a 2nd or 3rd degree block?
  - Sick-Sinus Syndrome
Adenosine (Adenocard)

- **Precautions**
  - Brief periods of heart block may occur
  - 50-60% develop transient dysrhythmias
- **Route and dosage**
  - 6mg rapid IVP followed with a 30cc flush
  - If no change, 12mg followed PRN by 12mg
- **How supplied**
  - 6mg/2ml vial
Adenosine (Adenocard)

- **Precautions and Side Effects:**
  - Significantly increases sphincter tone of the **Paramedic**
  - Facial flushing, headache, shortness of breath, chest tightness, bronchoconstriction, nausea, metallic taste, “ill feeling”

- **Interactions**
  - Aminophylline, Theophylline decrease the effectiveness need larger doses
  - Dipyridamole (Persantine) potentiates – needs smaller dose
    - What is Dipyridamole used for?
Verapamil

- Pregnancy class  C
- Mechanism of action
  - Calcium channel blocker
  - Slows conduction through the AV node
  - Relaxes smooth muscle
  - Coronary vasodilation
- Indications
  - PSVT *refractory* to adenosine
  - Rapid ventricular response in A-fib
  - Prevention or relief of angina
**Verapamil**

- **Contraindications:**
  - Hypotension
  - Cardiogenic shock
  - WPW
  - CHF

- **Precautions**
  - Sick sinus syndrome
  - **Blood pressure must be continuously monitored**
  - Calcium chloride should be available
Verapamil

- Side effects
  - Nausea, vomiting, dizziness, headache, bradycardia, hypotension, sinus arrest, pulmonary edema Asystole (oops!)

- Interactions
  - Patients receiving IV Beta Blockers
  - Nitrates
  - Quinidines
Verapamil

Dosage
- 2.5-5.0mg slow iv push over 2 minutes
- Repeat of 5-10mg iv push in 15-30 minutes
- Maximum dose is 30mg
- **Have Calcium Chloride close by!**

How supplied
- 2.5mg/ml
Diltiazem (Cardizem)

- Pregnancy class: C

- Mechanism of action
  - Inhibits transport of calcium into myocardial and smooth muscle cells
  - Decreases nodal conduction

- Indications
  - Rapid a-fib and flutter
  - Angina
  - PSVT refractory to adenosine
Diltiazem (Cardizem)

- **Contraindications**
  - Hypotension
  - APE
  - WPW
  - AV blocks
  - Acute MI

- **Precautions**
  - Hypotension, patients with liver and renal dysfunction
  - CHF
Diltiazem (Cardizem)

- **Side Effects**
  - Dizziness, weakness, arrhythmias, CHF, bradycardias, hypotension, Stevens-Johnson Syndrome

- **Dosage**
  - (0.25mg/kg) over 2 minutes, may be repeated at 0.35mg/kg in 15 minutes
  - Maintenance infusion of 5-15mg/hour
  - **Have Calcium Chloride close by!**

- **How supplied**
  - Lyo-ject syringe containing 25mg to be mixed
Your 132 lb patient has AFIB with a rapid ventricular response and SOB. MC orders a bolus of 0.25mg/kg Diltiazam slow IV.

How many ml will you administer?
Amiodarone (Cordarone)

- The “new” wonder drug
- It is however, old
- One study
  - great conversion
  - not so great survival to discharge
- Currently considered the first-line drug for ventricular arrhythmias
Amiodarone (Cordarone)

- Pregnancy class C
- Mechanism of action
  - Prolongs action potential and refractory period of all myocardial cells
  - Results in – slowing of sinus rate, increased PR and QT intervals
  - Inhibits alpha and beta stimulation
- Indications:
  - V-Tach/V-Fib
  - Polymorphic V-Tach and wide complex tachycardias of unknown etiology
  - Hemodynamically stable VT refractory to cardioversion
  - Second line drug for SVT and AFIB
Amiodarone (Cordarone)

- Contraindications
  - Sick sinus
  - Bradycardia
  - AV Blocks
  - Cardiogenic shock

- Precautions
  - Patients with CHF
  - Renal or hepatic dysfunction
  - Thyroid disease
Amiodarone (Cordarone)

- Side effects
  - Hypotension, dizziness, fatigue, ataxia, prolonged QT interval, hepatitis, cirrhosis, photosensitivity, blue discoloration of skin, visual disturbances

- Dosage:
  - Loading dose of 300mg IVP
  - Repeat 150mg to max of 2.2G
Phenytoin (Dilantin)

- Pregnancy class: D
- Mechanism of action:
  - Depresses spontaneous depolarization of the ventricular tissues and AV conduction
- Indications:
  - Life-threatening arrhythmias resulting from digitalis toxicity or tricyclic antidepressant overdose
  - Also a very popular ant-seizure drug
Phenytoin (Dilantin)

- Contraindications:
  - Bradycardia, heart block
  - Intolerance of alcohol
  - Adams-Stokes syndrome

- Precautions
  - Patients with inadequate cardiac or respiratory function
  - In pregnancy, fetal hydantoin syndrome or hemorrhage may result
  - Administration should not exceed 50mgs/min
  - Signs of CNS depression and hypotension may occur
Phenytoin (Dilantin)

- **Side Effects**
  - Drowsiness, dizziness, poor muscle coordination, headache, hypotension, arrhythmia, n/v, hypocalcemia

- **Interactions**
  - Do not mix with D5W or any dextrose solution

- **Dosage**
  - 100mgs over 5 minutes to a maximum of 1,000 mgs, until the arrhythmia stops or CNS depression occurs

- **How supplied**
  - 50mg/ml in 2 and 5 ml ampules
Magnesium Sulfate (Cardiac)

- Pregnancy class  C
- Mechanism of action
  - Essential for muscle contraction, nerve transmission and some enzyme systems
  - Resolves magnesium deficiency associated with arrhythmias
- Indications
  - Severe refractory v-fib/v-tach
  - Post MI prophylaxis
  - Torsade de pointes
  - Pre-term labor
  - Seizures related to eclampsia
Magnesium Sulfate (Cardiac)

- Contraindications
  - Shock
  - Severe persistent HTN
  - Heart block
  - Known dialysis patients
  - Hypocalcaemia

- Precautions
  - Rapid administration can cause arrest
Magnesium Sulfate (Cardiac)

**Dosage**

- **V-fib**
  - 1-2 Grams diluted in 10cc NS slow IV push over 2 minutes
  - 1-2 Grams in 100cc of NS IVPB over 1-2 minutes

- **Post MI**
  - 1-2 Grams diluted in 100cc of NS over 5 - 30 Minutes

- **Seizures**
  - 1-2 Grams in 100cc of NS IVPB over 1-2 minutes
Magnesium Sulfate (Cardiac)

- Adverse reactions
  - Drowsiness, respiratory depression, bradycardia, hypotension, hypothermia

- How supplied
  - 100mg/ml
Magnesium Sulfate (Ob/Gyn)

- Pregnancy class A
- Mechanism of action
  - Controls seizures by blocking release of Ach at myoneural junction
  - Decreases sensitivity of motor end plate to Ach
  - Decreases excitability of motor membrane
- Indications
  - Preeclampsia and eclampsia
- Contraindications
  - Do not administer during 2 hour period prior to delivery
Magnesium Sulfate (Ob/Gyn)

- Precautions
  - Renal failure

- Dosage and route
  - 2 gs diluted in 50-100 cc normal saline over 10-20 minutes

- How supplied
  - 10% solution

- Adverse reactions
  - Respiratory depression, arrhythmias, hypotension, sweating, N/V
Oxytocin

- Pregnancy class: X
- Mechanism of action:
  - Stimulates uterine muscle contraction and contraction of uterine blood vessels
- Indications:
  - Postpartum hemorrhage
- Contraindications:
  - Hypersensitivity
Oxytocin

- Precautions
  - Do not administer until fetus and placenta delivered

- Route and dosage
  - 20munits/min (prepare by adding 20 units to 1l of normal saline) IV

- How supplied
  - 10 units/ml
Oxytocin

- Adverse reactions
  - Hypotension, painful uterine contractions, hyponatremia, water intoxication
Sodium Bicarbonate

- Pregnancy class: C
- Mechanism of action:
  - Buffers acid build up caused by severe hypoxia
  - Helps correct metabolic acidosis in conjunction with adequate ventilation
- Indications:
  - Possibly to correct metabolic acidosis in cardiac arrest and used after all more appropriate treatment (defibrillation, CPR, intubation, epinephrine, and treatment for hyperkalemia) has been exhausted
Sodium Bicarbonate

- Contraindications
  - None

- Precautions
  - Can result in metabolic alkalosis or sodium overload

- Dosage
  - 1meq/kg IV bolus

- How supplied
  - 7.5% in 50 cc prefilled syringes (44meq)
Sodium Bicarbonate

- Adverse reactions
  - Fluid retention
  - Hypokalemia, hypocalcemia, metabolic alkalosis
  - tissue necrosis at IV site
**Digoxin (Lanoxin)**

- Rapid acting
- One of the oldest medication known to humans
- Increases the force of cardiac contraction
- Increases stroke volume and cardiac output
- Decreases conduction through the AV node
Digoxin (Lanoxin)

- **Indications**
  - Congestive heart failure
  - Supraventricular Tachyarrhythmias
    - Especially a-flutter/a-fib

- **Side Effects:**
  - Nausea, vomiting, fatigue, drowsiness, yellow vision, hallucinations, arrhythmias, heart blocks, hypotension
Digoxin (Lanoxin)

- Interactions
  - Calcium channel blockers increase serum dig levels
  - Administration concurrently with Beta Blockers will cause severe bradycardia
  - Diuretics can cause potassium depletion, which can lead to dig toxicity
Albuterol
(Proventil, Ventolin)

- Pregnancy class: C
- Sympathetic agonist (Bronchodilator)
- Mechanism of action
  - Selective Beta 2 agonist
- Indication:
  - Bronchospasm
- Contraindications
  - Patients who are lactating
  - So, what do you do for a lactating patient having an asthma attack?
- Side effects
  - Palpitations, anxiety, dizziness, headache, HTN
Albuterol (Proventil, Ventolin)

- How supplied
  - Metered inhaler containing three hundred 0.09 mg/inhaled sprays
  - Single patient vials containing 0.5ml in 2.5ml of NS

- Dosage:
  - Two puffs q 4h
  - Nebulizer q 20 minutes
Intal (Cromolyn Sodium)

- Pregnancy class: B

- Mechanism of action
  - Prevents release of histamine

- Indications
  - Adjunct in management of bronchial asthma
  - Meant for long-term management of asthma – NOT for an acute attack

- Contraindications
  - Status asthmaticus

- Precautions
  - Lactating patients
Intal (Cromolyn Sodium)

- How supplied
  - MDI 0.8 mg/inh

- Side effects
  - bronchospasm, cough, dizziness, headache, drowsiness, nausea
Decadron
(Dexamethasone)

- **Mechanism of action**
  - long-acting steroid that suppresses inflammation and normal immune response

- **Indications**
  - severe allergic reactions

- **Contraindications**
  - none

- **Precautions**
  - pregnant patients, where risk is outweighed, also patients with hypertension and CHF
Decadron (Dexamethasone)

- **Dosage**
  - Adult – 4 mg/dose iv bolus

- **How supplied**
  - 24 mg/ml in 5 or 10 ml ampules

- **Side effects**
  - headache, restlessness, depression, vertigo, hypertension, CHF, abdominal distention, nausea and vomiting
Diphenhydramine (Benadryl)

- Pregnancy class  B
- Mechanism of action
  - Competes with histamine for H<sub>1</sub> receptor sites
  - Blocks effect of histamine causing vasodilatation, tachycardia, and hypotension
- Indications
  - Allergic symptoms
- Contraindications
  - Acute asthma – produces “dry lungs”
Diphenhydramine (Benadryl)

- **Precautions**
  - Cardiac disease and hypertension

- **Dosage**
  - adults – 25-50 mg/dose IV or IM
  - pediatrics – 2-5 mg/kg dose IV or IM

- **How supplied**
  - 10 mg/ml
Diphenhydramine (Benadryl)

- Adverse reactions
  - Drowsiness, dizziness, headache, wheezing, chest tightness, palpitations, blurred vision, dry mouth, nausea and vomiting
Terbutaline (Brethine)

- Pregnancy class  B
- Mechanism of action
  - Beta 2 selective sympathomimetic resulting in:
    - Relaxation of uterine smooth muscles
    - Relaxation of vascular smooth muscles
    - Brochodilation
- Indications:
  - Bronchial asthma and bronchospasm
  - Premature labor
Terbutaline (Brethine)

- **Contraindications**
  - Hypersensitivity

- **Precautions**
  - Safety in lactation not established
  - Cautious use in the elderly and patients with CAD, HTN, hyperthyroidism, DM and glaucoma

- **Dosage:** 0.25mg SQ, repeated in 15 to 30 minutes prn

- **How supplied**
  - 1mg/ml
Terbutaline (Brethine)

- Side effects
  - palpitations, anxiety, dizziness, tremors, nervousness, angina, arrhythmias, hyperglycemia, N/V
Metaproterenol (Alupent)

- Sympathetic agonist
  - Beta 2 selective (?)
- Indications: Bronchospasm
- Contraindications: Tachycardia or cardiac dysrhythmias
  - Side effects: Similar to other Beta agents
- Dosage: Metered dose inhaler, Hand held nebulizer
Methylprednisolone (Solu-Medrol)

- Synthetic steroid with potent anti-inflammatory properties
- Intermediate acting, half life of about 3 to 4 hours
- Indications:
  - Asthma/COPD
  - Anaphylaxis
  - Sometimes used in high doses (1 gram) for spinal cord injuries
Methylprednisolone

- **Dosage:**
  - 125 to 250 mgs. IV

- **Side Effects**
  - fluid retention, CHF, HTN
  - Vertigo, headache, nausea
Furosemide (Lasix)

- Pregnancy class  C
- Mechanism of action
  - Inhibits reabsorption of sodium and chloride in kidneys resulting in loss of water, Na, Cl, K, Mg, and Ca
  - Causes venous-dilation and decreases pre-load within first 5 minutes
  - Within 5 - 20 minutes, the diuretic effect takes place
  - referred to as a “loop diuretic”
Furosemide (Lasix)

- **Indications:**
  - Management of edema secondary to CHF

- **Contraindications**
  - Hypovolemia, hypotension, hypokalemia

- **Precautions:**
  - Dehydration, electrolyte depletion
  - **Hypotension**
  - Renal Failure

- **Side effects:**
  - Headache, dizziness, K depletion, hypotension, metabolic alkalosis, diarrhea, arrhythmias
Furosemide (Lasix)

Dosage:
- 0.5-1.0mg/kg IVP (slow 1-2 minutes)
- Two times the daily maintenance dose in an emergent situation
- Dose range 20-200mg

How supplied
- 10mg/ml vials, bristojects
Bumetanide (Bumex)

- Potent Loop Diuretic
  - 40 times the potency of Lasix
- Indicated for CHF & APE
- Usage in pregnancy contraindicated
- Useful in furosemide allergy
- Dosage
  - 0.5 to 1.0 mgs over 1 to 2 minutes
Lidocaine

- Pregnancy class B
- Mechanism of action
  - Shortens refractory period
  - Increases the fibrillation threshold
  - Suppresses automaticity in the ventricles
- Indications
  - Ventricular tachycardia (pulse or pulseless)
  - Ventricular fibrillation
  - PVC’S
  - No longer the first-line drug
Lidocaine

- Contraindications
  - Second degree and third degree blocks
  - Ventricular escape beats in the presence of bradycardias
  - Stokes-Adams syndrome
  - WPW

- Precautions
  - CNS depression
  - 70 years of age, CHF, liver disease, bradycardia
Lidocaine

- Side effects
  - Seizures, confusion, coma, death
  - Hypotension, bradycardia, N/V

- Dosage
  - 1.0-1.5mg/kg IVP
  - Can be repeated q 3-5 at half the initial dose
  - Max is 3.0mg/kg

- Lidocaine bolus should always be followed with a 1-4mg/min drip reduced to 0.5-2mg/min drip when bolus dose is halved
Lidocaine

- How supplied
  - 10mg/ml
  - premixed solution for infusion
  - 40mg/ml vials
Calculate!

Your patient in VTACH is allergic to Amioderone. You have given your patient 1mg/kg Lidocaine IV bolus. MC orders a Lidocaine drip of 2mg/min. You will place 1 gram of Lidocaine into a 250ml bag of NS. You are to use a microdrip set.

What is the drip rate for this patient?
Lidocaine

- Dosing should be adjusted for those over 70, and in patients with liver disease, heart failure, or known conduction disturbances.
Procainamide (Pronestyl)

- Pregnancy class  C
- Mechanism of action
  - Prolongs refractory period of atria, bundles and ventricles
  - Slows intraventricular conduction to a lesser degree than Lidocaine
  - Cardiac excitability decreased
  - Ectopy and arrhythmias suppressed
Procainamide (Pronestyl)

- **Indications**
  - Persistent cardiac arrest due to v-fib that is refractory to lidocaine
  - PVC’s refractory to lidocaine
  - V-tach refractory to lidocaine
  - PSVT refractory to Adenosine and vagal maneuvers
  - A-Fib with a rapid rate in WPW
  - Sounds like a great drug!
Procainamide (Pronestyl)

- Contraindications
  - Patients with severe conduction system disturbances
  - AV blocks
  - Torsade des pointes
Procainamide (Pronestyl)

- Precautions
  - PVC’s in conjunction with a bradycardia
  - Hypotension
  - Pts having an MI
  - Digitalis toxicity
  - Renal failure, hepatic failure, CHF

- Side effects
  - Drowsiness, seizures, confusion, heart blocks, respiratory depression, ventricular arrhythmias, n/v
Procainamide (Pronestyl)

Dosage

- 20-30mgs/min IV infusion This is discontinued if any of the following occur:
  - Arrhythmia is suppressed
  - Hypotension ensues
  - QRS complex is widened by 50% of its original width
  - A total of 17mg/kg of the medication has been administered
  - Maintenance infusion is 1 to 4 mgs/min

How supplied

- 100mg/ml in 10 ml vials
Aspirin (acetylsalicylic acid)

- Pregnancy class  C
- Mechanism of action
  - Blocks formation of Thromboxane A2, which causes platelets to aggregate and arteries to constrict
- Indications:
  - Acute MI
  - Ischemic chest pain
Aspirin (acetylsalicylic acid)

- **Contraindications**
  - Bleeding disorder, thrombocytopenia
  - Avoid during pregnancy

- **Precautions**
  - GI Bleeding or ulcer disease
    - Reflux (GERD) is NOT a contraindication
  - Patients with history of asthma
  - Children to prevent Reye’s syndrome
  - ASA and NSAID allergies

- **Dosage:**
  - 160-325mg
Aspirin (acetylsalicylic acid)

- How supplied
  - 81mg
- Adverse effects
  - GI bleeding, anemia, increased bleeding time, tinnitus, bronchospasm
Morphine Sulfate

- Pregnancy class  C
- Mechanism of action
  - Narcotic Analgesic (Class II)
    - Opioid receptor stimulator
    - Alters response to pain
  - CNS Depressant
  - Outstanding hemodynamic properties
    - Increases venous capacitance (pooling)
    - Decreases pre-load
    - Decreases myocardial O2 demand
Morphine Sulfate

- **Indications**
  - Analgesia associated with MI
  - Pulmonary edema
  - Isolated extremity injury

- **Contraindication:**
  - Hypotension
  - Head injury
  - Respiratory depression not associated with APE
  - Undiagnosed abdominal pain
Morphine Sulfate

- **Precaution:**
  - Patients with COPD

- **Dosage:**
  - 1-5mg IVP maximum 15mg

- **How supplied**
  - 10mg/ml vial, prefilled, or ampule
Morphine Sulfate

- Side effects
  - Confusion, sedation, headache, hypotension, respiratory depression, dry eyes, blurred vision, nausea/vomiting
50% Dextrose in Water (D50)

- Pregnancy class: C
- Mechanism of action
  - Increases circulating blood sugar levels
  - Acts briefly as an osmotic diuretic
- Indications
  - Patients in coma due to hypoglycemia
  - Coma of unknown etiology
  - Altered sensorium in pts with finger stick below 45mg
50% Dextrose in Water (D50)

- Contraindications
  - Intracranial hemorrhage

- Precautions
  - Patients with DM
  - Patients sensitive to carbohydrate agents

- Route and dosage
  - 25g slow IV bolus
  - 0.5-1.0 mg/kg (pediatrics)
50% Dextrose in Water (D50)

- Adverse reactions
  - Neurologic symptoms in the alcoholic
  - Can aggravate hypertension and CHF
  - Tissue necrosis at injection site
- How supplied
  - 50% solution
- Use a large proximal vein if at all possible
Glucagon

- Pregnancy class  B
- Mechanism of action
  - Increases level of circulating blood sugars by stimulating release of glycogen from liver
  - Causes rise in glucose levels, smooth muscle relaxation, positive inotrope and chronotrope
- Indications
  - Hypoglycemia with no IV access
- Contraindications
  - allergy
Glucagon

- Precautions
  - Pheochromocytoma
- Route and dosage
  - 1.0 mg IV or IM
- How supplied
  - 1.0 mg (powder to be mixed)
- Adverse reactions
  - Dizziness, tachycardia, hypertension, N/V
Insulin

- Pregnancy class: B
- Mechanism of action:
  - Lowers blood glucose levels
  - Promotes conversion of glucose to glycogen
- Indications:
  - Patients with diabetic ketoacidosis
- Contraindications:
  - Patients sensitive to its preparation
Insulin

- Precautions
  - Dosage effects can vary greatly depending on diet, exercise, stress and work patterns
  - Children!
- Route and dosage
  - 2-10 units loading dose
- How supplied
  - 100 unit/ml vial
- Adverse reactions
  - Itching, swelling, hypoglycemia, allergic reactions
Thiamine (Vitamin B1)

- Pregnancy class A
- Mechanism of action
  - Converts pyruvic acid to acetyl co-enzyme A (Kreb's cycle)
  - Needed for glucose metabolism
- Adverse reactions
  - Rapid administration can cause vasodilation and hypotension
  - Excessive administration can cause dyspnea or respiratory failure
Thiamine (Vitamin B1)

- Precautions
  - Thiamine deficiency can in the alcohol dependant patient cause:
    - Wernicke’s encephalopathy
      - Unsteady gait, eye muscle weakness, psychosis
        - Acute and reversible
    - Korsakoff’s psychosis
      - Memory disorder with disorientation, illusions, hallucinations, painful extremities and may have bilateral foot drop
        - Irreversible
Thiamine (Vitamin B1)

- **Indications**
  - Coma of unknown etiology
  - Coma caused by alcohol
  - Delirium tremens

- **Contraindications**
  - None

- **Dosage:**
  - Before administering $D_{50W}$
    - 100mg IVP or IM
Benzodiazepines

- Sedatives, anti-anxiety agents
- Muscle relaxants, anticonvulsants
- Act in the cerebral cortex
- Act in the limbic, thalamic and hypothalamic components of the CNS. (We think)
- Safe, addiction and dependence minimal
Diazepam (Valium)

- Pregnancy class  D
  - Anticonvulsant, anti-anxiety agent, sedative, skeletal muscle relaxant
- Mechanism of action
  - CNS depressant
  - Decreases seizures by enhanced presynaptic inhibition
- Indications
  - Seizures
  - Status epilepticus
  - Procedural premedication
  - Skeletal muscle relaxation
Diazepam (Valium)

- **Contraindications**
  - Hypersensitivity to benzos or propylene glycol
  - Preexisting CNS depression
  - Acute narrow angle glaucoma
  - Pregnancy and lactation

- **Precautions**
  - History of psychosis or drug addiction
  - Elderly
  - Patients with hepatic dysfunction
Diazepam (Valium)

Dosage
- 5 to 10 mgs slow IVP
- 0.1mg/kg (pediatrics)
- Can also be given rectally 0.5mg/kg

How supplied
- 5mg/ml

Adverse reactions
- Respiratory depression, dizziness, headache, hypotension, blurred vision
Lorazepam (Ativan)

- Pregnancy class: D
  - Anticonvulsant, sedative, and hypnotic

Mechanism of action
- Decreases seizure activity caused by enhanced presynaptic inhibition

Indications
- Generalized motor seizures and status
Lorazepam (Ativan)

- **Contraindications**
  - Preexisting CNS depression
  - Acute narrow angle glaucoma
  - Pregnancy and lactation

- **Precautions**
  - History of psychosis or drug addiction
  - Elderly
  - Patients with hepatic dysfunction
  - Pediatrics
Lorazepam (Ativan)

- Dosage
  - 0.05mg/kg (maximum dose 4 mg) slow IV (2mg/min)

- How supplied
  - 2mg/ml

- Adverse reactions
  - Respiratory depression, dizziness, headache, hypotension, blurred vision
Midazolam (Versed)

- Benzodiazepine
  - short acting sedative and hypnotic
  - 3 - 4 times more potent than Valium (diazepam)
  - Strong amnesic properties
  - No effect on pain
Midazolam (Versed)

- **Indications**
  - Premedication in cardioversion, RSI, or other painful procedures

- **Contraindications**
  - narrow angle glaucoma
  - hypoperfusion

- **Precautions**
  - potent respiratory depressant
  - Have Flumazenil available (see slide)
### Midazolam (Versed)

- **Dosage** - 1 to 2.5mg
  - slow iv push
Etomidate

- Pregnancy Class: D
- Mechanism of action: Produces rapid sedation with minimal cardiovascular effects.
- Not a “benzo”
- Indications: Rapid sedation for intubation
- Contraindications: Hypersensitivity to the drug
Etomidate

- Precautions
  - Marked hypotension
  - Severe asthma
  - Severe cardiovascular disease
  - Pt. taking Verapamil
    - May cause prolonged apnea or respiratory depression

- Dose: 0.1 – 0.3mg/kg
Etomidate

Adverse effects:
- Myoclonic muscle movements
- Apnea
- Hyperventilation or hypoventilation
- Laryngospasm
- Hypertension or hypotension
- Tachycardia or Bradycardia
- Nausea/Vomiting
Flumazenil (Romazicon)

- Pregnancy class  C
- Mechanism of action
  - Benzodiazepine antagonist
  - Inhibits actions in the CNS
  - Reverses effects, especially respiratory
- Indications
  - Benzodiazepine overdose
- Contraindications
  - Patients receiving benzos for life threatening medical disorders (status, increased ICP, TCA overdose)
Flumazenil (Romazicon)

- **Precautions**
  - Can result in seizures due to withdrawal

- **Dose**
  - 0.2mg IVP over 30 seconds
  - Maximum dose 1.0mg

- **How supplied**
  - 0.1mg/ml

- **Adverse effects**
  - Seizures, dizziness, confusion, arrhythmias, hiccups, abnormal hearing, shivering
Narcan (Naloxone)

- Pregnancy class  B
- Mechanism of action
  - Blocks or reverses action of narcotic analgesics
- Indications
  - Symptomatic narcotic overdose
- Contraindications
  - Hypersensitivity
- Precautions
  - CAD, physical dependence, head injury, history of seizures, neonates of narcotic addicted mothers
Narcan (Naloxone)

- **Route and dosage**
  - 2.0 mg IV or IM or ET
  - 0.01mg/kg in pediatrics

- **How supplied**
  - 1mg/ml

- **Adverse reactions**
  - Hypertension, hypotension, v-tach, N/V
Syrup of Ipecac

- Pregnancy class: C
- Mechanism of action:
  - Gastric mucosal irritant
- Indications:
  - To empty stomach after oral poisoning or drug overdose
- Contraindications:
  - Corrosives and petroleum distillates
  - Patients with altered sensorium
Syrup of Ipecac

- Precautions
  - Pregnancy and lactation
  - Children less than one

- Dosage
  - 15-30 ml PO followed by 240ml water

- How supplied
  - 30ml bottles
Syrup of Ipecac

- Adverse effects
  - Sedation, myocarditis with overdose, arrhythmias, diarrhea