Personal Drugs

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First Diagnosis: Pulmonary Hypertension in Adults

A 34 year old female presented to the cardiology office with worsening dyspnea while running over the last six months. She also complains of fatigue. Her HR is 78bpm, and BP is 115/74. Upon clinical examination of her heart sounds, a loud S2 was heard. The chest x-ray obtained prior to her visit showed cardiomegaly and prominent pulmonary arteries. The ECG revealed sinus rhythm with right ventricular hypertrophy (RVH) and right axis deviation. An echo performed in the office showed septal flattening and an enlarged right atrium and ventricle. With suspected idiopathic pulmonary hypertension (IPAH), she was sent for a right heart catheterization. The results revealed a mean pulmonary artery pressure (mPA) of 35 mm Hg, peripheral vascular resistance (PVR) of 300 dynes, and a pulmonary wedge pressure (PAWP) of 6 mm Hg. During the catheterization, she had a positive response to a vasodilitory nitric oxide test dose (mPA of 22). Upon completion of diagnostic and clinical workup, her suspected diagnosis of IPAH was confirmed.

I. Definition of Diagnosis

Pulmonary hypertension is defined as remodeling of small pulmonary arteries and vascular proliferation causing progressive pulmonary vascular resistance leading to right sided heart failure. An imbalance of vasodilation and vasoconstriction occurs as an increase of endothelin and thromboxane is released and a decrease of production of prostacyclin and nitrous oxide (McLaughlin et al., 2009).

Hemodynamically pulmonary hypertension is defined as mean pulmonary pressures greater than or equal to 25 mm Hg at rest without evidence of elevated pulmonary artery wedge pressures (PAWP < 15 mm Hg). Increased PVR greater than 240 dynes x S x cm–5 in

combination is also indicative of pulmonary hypertension (McLaughlin et al., 2009; Sitbun et al., 2005).

II. Therapeutic Objective

Pulmonary hypertension has a high mortality rate and the prognosis for this disease depends on functional classification of the illness defined by the World Health Organization and the New York Heart Association. Functional classifications of pulmonary hypertension are based on responsiveness to vasodilation during the cardiac catheterization initial test dose and other contributory factors (co-morbidities, degree of heart failure, etc.). Ultimately, the goals of treatment are to improve quality of life, symptomology (exercise induced dyspnea), and overall survival (McLaughlin et al., 2009).

III. Effective Drug Groups

Drug Classification	Efficacy	Safety	Suitability
Prostanoids (epoprostenol, iloprost) (LexiComp, 2013)	*Pharmacodynamics:* Epoprostenol is a prostacyclin which is a potent vasodilator of the vasculature and an endogenous inhibitor of platelet aggregation. Iloprost dilates systemic and pulmonary arterial vasculature with mild platelet aggregation. *Pharmacokinetics:* Metabolism: epoprostenol-rapidly hydrolyzed, forms two active metabolites with minimal activity and 14 inactive metabolites. Iloprost-mainly hepatic via	*Side effects:* Common: during dose initiation and escalation; flushing, headache, nausea/vomiting, hypotension, anxiety, agitation, chest pain, dizziness, abdominal pain, bradycardia, musculoskeletal pain, dyspnea, back pain, diaphoresis, dyspepsia, hypoesthesia, tachycardia. During chronic administration; thrombocytopenia, diaphoresis, flu-like symptoms, jaw pain, pulmonary edema,	*Contraindications*: patients who develop pulmonary edema during initial infusion, chronic use in heart failure patients with severe left ventricular failure. Pregnancy category: B. No well-defined studies done in pregnant women. Disease-related precautions: use with caution in patients with risk factors of bleeding Drug-drug interactions: may increase levels/effects of anticoagulants, anti-hypertensives,

	beta oxidation. Distribution: Vd 0.7-0.8 L/kg for iloprost. Excretion: primarily in urine, small amount in feces (LexiComp, 2013)	infection at the injection site, and rebound pulmonary hypertension with abrupt discontinuation or lowered dose of medication. Pulmonary edema. Rare: anemia, fatigue, hepatic failure, splenomegaly, hyperthyroidism, pallor, pancytopenia, pulmonary embolism, thrombocytopenia Monitor: baseline heart rate, blood pressure, and respirations. Monitor pulmonary function and exercise tolerance. (LexiComp, 2013)	antiplatelet agents (LexiComp, 2013)
Endothelin receptor antagonists (ambridsentan, bosentan) Ambridsentan 10mg (30): $5,992.00 Bosentan 250mg (40): $2,981.00 (LexiComp, 2013)	*Pharmacodynamics:* Endothelin antagonist *Pharmacokinetics:* Distribution: Vd: 18L Metabolism: hepatic via CYP2C9 and 3A4 to three primary metabolites Excretion: mainly in feces, small amount in urine. (LexiComp, 2013)	*Side effects:* Common: anemia, abnormal LFT's, headaches, peripheral edema, nasal congestion, palpitations, flushing, constipation, abdominal pain Rare: angioedema, heart failure, hypersensitivity, rash, and malaise Monitor: obtain baseline bilirubin, hemoglobin, hematocrit, and serum transaminase prior to therapy and monthly after initiation. Monitor for signs of	*Contraindications:* Pregnancy, idiopathic pulmonary fibrosis Pregnancy risk factor: X. Teratogenic. Prior to initiating this drug in females who are of child bearing age, a pregnancy test must be obtained and two forms of birth control must be used while on this medication until one month after medication is discontinued Hazardous agent: special handling required Drug to drug interactions: Cyclosporine may

		hepatic impairment. (LexiComp, 2013)	increase levels of drug Dietary considerations: Avoid grapefruit juice (LexiComp, 2013)
Phosphodiesterase-5 Enzyme Inhibitors (sildenafil, tadalafil) Sildenafil (Revatio) 20mg (30): $555.98 Tadalafil (Adcirca) 20mg (60): $1348.95 (LexiComp, 2013)	*Pharmacodynamics*- Inhibits phoshodiesterase-5 in pulmonary vasculature smooth muscle where PDE-5 is responsible for the degradation of cyclic guanosine monophosphate. Increased levels of this cause pulmonary vasculature relaxation and vasodilation in the pulmonary bed. *Pharmacokinetics*- Absorption: rapid. Slows with a high fat meal. Distribution: Vd: 105L. Metabolism: Hepatic via CYP34A and CYP2C9; forms N-desmethyl metabolite (active). Bioavailability:40% Excretion: 80% through feces; 13% through urine (LexiComp, 2013)	*Side effects:* Common: Headache, dyspepsia, flushing, insomnia, dizziness, erythema, rash, diarrhea, gastritis, increased LFT's, myalgia, paresthesias, blurred vision, epistaxis, exacerbation of dyspnea, nasal congestion, rhinitis, sinusitis Life threatening: anaphylaxis, pulmonary edema, amnesia, anemia, angina pectoris, AV block, cardiac arrest, cardiomyopathy, cataract, cerebral thrombosis, cerebrovascular hemorrhage, hypotension, leukopenia, ICH, MI, orthostatic hypotension, pulmonary hemorrhage, seizure, SAH, ventricular arrhythmias Rare: gout, hearing loss, heart failure, migraine, palpitations, syncope, tachycardia, vertigo Monitor: monitor heart rate and blood	*Contraindications:* Concomitant use with nitrate preparations Pregnancy risk factor: B. No adequate studies in pregnant women are performed. Use in caution with breast-feeding mothers. Cardiovascular considerations: avoid combination with other nitrates, may cause severe hypotension, MI, or even death. Avoid use in patients with heart failure, on multiple anti-hypertensive medications. Drug-drug interactions: avoid with other drugs that inhibit CYP3A4, such as protease inhibitors, certain macrolide antibiotics, imidazole, voriconazole, fluconazole, ketoconazole, all organic nitrates Dietary considerations: Avoid grapefruit juice (may increase serum levels) Ethanol- avoid and limit use (may cause hypotension with substantial consumption)

		pressure when used with blood pressure lowering agents. (LexiComp, 2013)	(LexiComp, 2013)
Calcium Channel Blockers (nifedipine, amlodipine, diltiazem, verapamil, felodipine, isradipine, nicardipine, nisoldipine) Nifedipine: 20mg (90): $165.99 Amlodipine: 10mg (90): $23.99 (LexiComp, 2013)	*Pharmacodynamics:* inhibits calcium from entering slow channels of vascular smooth muscle and myocardium during depolarization, producing coronary vasodilation and relaxation of the vascular smooth muscle; reduces peripheral vascular resistance and increases myocardial oxygen delivery. Negative inotrope *Pharmacokinetics:* Metabolism: hepatic via CYP3A4 to inactive metabolites Bioavailability: increased with significant hepatic disease. 40-77% with capsule, 65-89% with sustained release Excretion: mainly in urine, small amount in feces (LexiComp, 2013)	*Side effects:* Common: flushing, peripheral edema, dizziness, headache, nausea, heartburn, palpitations, transient hypotension, CHF, nervousness, mood changes, sleep disturbances, balance difficulties, dermatitis, pruritus, urticarial, diarrhea, constipation, muscle cramps, joint stiffness, blurred vision, cough, nasal congestion, dyspnea Life threatening: angioedema, ventricular arrhythmias, acute MI, severe hypotension, cerebral ischemia Rare: agranulocytosis, allergic hepatitis, alopecia, anemia, angina, aplastic anemia, arrhythmias, epistaxis, GERD, facial edema, leukopenia, migraine, tachycardia, thrombocytopenia Monitor: pulse, blood pressure and peripheral edema. (LexiComp, 2013)	*Contraindications:* Hypersensitivity, concomitant use with strong CYP3A4 inducers (rifampin), cardiogenic shock, acute MI Pregnancy risk factor: C. Crosses the placenta. Also not encouraged to use with breast feeding mothers as it enters breast milk. Disease related precautions: aortic stenosis (may reduce coronary perfusion pressure), heart failure (may cause worsening of symptoms), hepatic impairment (clearance is reduced), hypertrophic cardiomyopathy with outflow tract obstruction (may worsen symptoms with reduction of afterload), and gastrointestinal strictures Drug to drug interactions: conivaptan, pimozide. May increase levels of antihypertensives, digoxin, Dilantin, neuromuscular blocking agents, nitroprusside, quinidine, rituximab,

			and tacrolimus. Antifungal agents, cimetidine, cyclosporine, CYP3A4 inhibitors, macrolide antibiotics, magnesium salts, MAO inhibitors, phosphodiesterase 5 inhibitors, and protease inhibitors may increase levels/effects of this drug. St Johns wort may decrease levels. Dietary Considerations: avoid grapefruit juice. Take on an empty stomach with extended release. Ethanol- alcohol may increase levels/effects of this drug (LexiComp, 2013)

IV. Effective Drug Classification: Calcium Channel Blockers

Drug Name	Efficacy	Safety	Suitability	Cost
Nifedipine (adalat, Procardia, nifediac) (LexiComp, 2013)	*Pharmacodynamics:* Inhibits calcium from entering select voltage sensitive areas of smooth muscle vasculature and myocardium during depolarization causing coronary vasodilation and decreased peripheral vascular resistance (LexiComp, 2013). *Pharmacokinetics:* Onset of action:	*Drug interaction:* conivaptan, grapefruit juice, pimozide Increased effect/toxicity: amifostine, antihypertensives, aripiprazole, beta blockers, CYP1A2 substrates, difoxin, fosphenytoin, hypotensive agents,	*Patient education:* Take on an empty stomach. Teach orthostatic precautions. Avoid alcohol use and grapefruit juice. Alcohol may potentiate hypotensive effects. Encourage reporting symptoms of heart failure (peripheral edema, dyspnea, chest pain or	Nifedipine capsules: 10mg (90): $80.99 20mg (90): $165.99 Procardia capsules: 10mg (90): $115.38 Adalat tablet, 24-hour: 30mg (30): $54.99 60mg (30): $83.99 90mg (30):

	Immediate release- 20 minutes Protein binding: 92-98% Metabolism: hepatic via CYP3A4 to inactive metabolites Bioavailability: capsule- 40-77%; sustained release: 65-89%; increased in significant hepatic disease Half-life elimination: healthy adults- two to five hours; cirrhosis- seven hours; elderly- seven hours Excretion: 60-80% in urine (LexiComp, 2013)	lomitapide, magnesium salts, neuromuscular blocking agents, nitroprusside, phenytoin, pimozide, quinidine, rituximab, tacrolimus, vincristine. Drugs that increase levels/effects of nifedipine: alcohol, alpha-1-blockers, antifungal agents, cimetidine, cisapride, conivaptan, cyclosporine, CYP3A4 inhibitors, dasatinib, diazoxide, fluconazole, fluoxetine, herbs, ivacaftor, macrolide antibiotics, MAO inhibitors, mifepristone, pentoxifylline, phosphodiesterase 5 inhibitors, prostacyclin analogues, protease inhibitors, quinidine Drugs that decrease levels/effects: barbituates, calcium salts,	palpatations), rash, severe headache, or severe constipation. Encourage patient to notify if becomes pregnant. Nifedipine crosses the placenta. Use in pregnancy only when absolutely necessary and when the benefits outweigh the potential hazard to the fetus. Monitor: heart rate, blood pressure, signs and symptoms of heart failure, peripheral edema, and constipation when starting, adjusting dose, or discontinuing. *Contraindications:* do not give to patients in cardiogenic shock or with an acute MI. (LexiComp, 2013)	$98.62 Afeditab CR tablet, 24-hour: 30mg (30): $46.52 60mg (30): $63.86 Nifediac CC tablet, 24-hour: 60mg (30) $49.99 90mg (30): $61.99 Nifedipine tablet, 24-hour: 30mg (100): $94.99 60mg (90): $129.96 Nifedipine CR Osmotic tablet, 24-hour: 30mg (30): $37.99 60mg (30): $59.99 90mg (30): $75.99 Procardia XL tablet, 24-hour: 30mg (30): $79.79 60mg (30): $135.99 90mg (30): $145.86 (LexiComp, 2013)

		carbamazepine, CYP3A4 inducers, deferasirox, herbs, melatonin, methylphenidate, nafcillin, rifamycin, tocilizumab, yohimbine, St. John's wort Food: take on an empty stomach. Food may decrease serum levels and the rate of absorption. Avoid grapefruit juice and caffeine. (LexiComp, 2013)		
Amlodipine (Norvasc) (LexiComp, 2013)	*Pharmacodynamics:* Acts directly on vascular smooth muscle to produce peripheral arterial vasodilation reducing peripheral vascular resistance and blood pressure. *Pharmacokinetics:* Peak plasma level: 6-12 hours Duration: 24 hours Absorption: well absorbed orally Distribution: Vd: 21 L/kg Protein binding: 93-98% Metabolism: >90% hepatic to inactive metabolites Bioavailability: 64-90%	*Drug interactions:* avoid conviaptan and pimozide. Amlodipine may increase levels/effect of: amisfostine, antihypertensives, aripiprazole, beta blockers, CYP1A2 substrates, fosphenytoin, hypotensive agents, lomitapide, magnesium salts, neuromuscular-blocking agents, nitroprusside, phenytoin, pimozide, quinidine,	*Patient education:* Report pregnancy immediately. Pregnancy risk factor: C, use only in pregnancy when absolutely necessary and benefits outweigh potential fetal hazards. Doses > 10mg increase side effects (ankle edema especially in women). May cause drowsiness, if so take at bedtime. Monitor: heart rate, blood pressure, peripheral edema. Assess for	Amlodipine Besylate: 2.5mg (90): $19.99 5mg (90): $22.99 10mg (90): 23.99 Norvasc: 2.5mg (30): $80.99 5mg (30): $80.99 10mg (30): $107.99 (LexiComp, 2013)

	Half-life elimination: terminal: 30-50 hours; increased with hepatic dysfunction Excretion: urine (LexiComp, 2013)	rituximab, simvastatin, tacrolimus May decrease the levels/effects of: clopidogrel; quinidine Drugs that may decrease levels/effects of amlodipine: barbituates, calcium salts, carbamazepine, CYP3A4 inducers, deferasirox, herbs, melatonin, methylphenidate, nafcillin, tocilizumab, yohimbine, St.John's wort. Food: grapefruit juice may modestly increase levels. (LexiComp, 2013)	therapeutic effectiveness with repeat echo and blood pressure. *Contraindications*: Hypersensitivity. Use in extreme caution with aortic stenosis; may reduce coronary perfusion pressures. Use with caution in hepatic impairment; may require lower dose. (LexiComp, 2013)	
Diltiazem (Cardizem, cartia, dilacor, tiazac) (LexiComp, 2013)	*Pharmacodynamics:* Inhibits calcium ion from entering select voltage-sensitive areas of smooth muscle vasculature and myocardium, producing coronary vasodilation; increases myocardial oxygen in patients with vasospastic angina. *Pharmacokinetics:* Onset of action: Immediate release oral: 30-60 minutes	*Drug interactions:* Avoid concomitant use with bosutinib, conivaptan, dantrolene, lomitapide, pimozide, tolvaptan Diltiazem may increase levels/effects of: alfentanil, amifostine, amiodarone, antihypertensives,	*Patient education:* Avoid ethanol; may increase risk of hypotension. Take on an empty stomach; food may elevate serum levels. Avoid St.John's wort; may decrease serum levels. Monitor: liver function tests, blood pressure, ECG, and heart rate.	Diltiazem capsule, 12-hour: 60mg (60): $62.99 90mg (60): $71.99 120mg (60): $92.87 Cardizem capsule, 24-hour: 120mg (30): $114.44 180mg (30): $145.08

	Absorption: >90% for immediate release tablets and ~93% for extended release Distribution: Vd: 3-13 L/kg Protein binding: 70-80% Metabolism: Hepatic, extensive first pass effect. Half-life elimination: immediate release tablet: 3-4.5 hours, may be prolonged with renal impairment; 6-9 hours for extended release tablet; 5-10 hours for extended release capsules Peak serum concentrations: Immediate release: 2-4 hours; extended release tablet: 11-18 hours; extended release capsules: 10-14 hours Excretion: urine (LexiComp, 2013)	aprepitant, aripiprazole, atorvastatin, avanfil, benzodiazepines, beta blockers, bosutinib, budesonide, buspirone, carbamazepine, cardiac glycosides, colchicine, corticosteroids, cyclosporine, CYP3A4 substrates, dronedarone, eletriptan, eplernone, everolimus, fingolimod, fosphenytoin, halofantrine, hypotensive agents, lithium, lomitapide, lovastatin, lurasidone, magnesium salts, midodrine, neuromuscular-blocking agents, nitroprusside, phenytoin, quinidine, ranolazine, red yeast rice, rituximab, salicylates, salmeterol, saxagliptin, simvastatin, tacrolimus, vilazodone, zuclopenthixol	*Contraindications:* Pregnancy risk factor: C. Avoid use in pregnancy, teratogenic. Hypersensitivity, sick sinus syndrome (except with a functional pacemaker), second or third degree AV block (except with a functional pacemaker), cardiogenic shock, ventricular tachycardia. Caution with renal insufficiency (LexiComp, 2013)	240mg (30): $199.92 300mg (30): $249.89 360mg (30): $300.00 Dilacor XR capsule, 24-hour: 120mg (30): $77.99 180mg (30): $98.89 240 mg (30): $113.21 (LexiComp, 2013)

		Drugs that may increase levels/effects of diltiazem: alpha-1 blockers, anilidopiperidine opioids, antifungal agents, aprepitant, atorvastatin, cimetidine, clonidine, conivaptan, cyclosporine, CYP3A4 inhibitors, dantrolene, diazoxide, grapefruit juice, herbs, lovastatin, macrolide antibiotics, MAO inhibitors, magnesium salts, phosphodiesterase 5 inhibitors, prostacyclin analogues, protease inhibitors, simvastatin Diltiazem may decrease levels/effects of: clopidogrel; ifosfamide (LexiComp, 2013)		
Verapamil (Calan, isoptin, verelan) (LexiComp, 2013)	*Pharmacodynamics:* Inhibits calcium ion from entering select voltage-sensitive areas of smooth muscle vasculature and myocardium, producing coronary	*Drug interactions:* Avoid concomitant use with bosutinib, conivaptan, dantrolene, disopyramide,	*Patient education:* Inform prescriber if becomes pregnant. Pregnancy risk factor: C. Verapamil crosses the placenta and	Verapamil capsule, 24-hour: 100mg (100): $189.98 120mg (30): $29.99 180mg (30):

	vasodilation; increases myocardial oxygen in patients with vasospastic angina. Slows automaticity and conduction of AV node. *Pharmacokinetics:* Onset of action: peak effect in 1-2 hours for immediate release. Duration: immediate release tablets: 6-8 hours. Absorption: well absorbed Distribution: Vd: 3.89 L/kg Protein binding: 90% Metabolism: Hepatic. Extensive first pass effect via multiple CYP isoenzymes; primary metabolite is norverapamil Bioavailability: 20-35% Half-life elimination: 3-7 hours; hepatic impairment: 14-16 hours Excretion: mainly in urine, small amount in feces. (LexiComp, 2013)	dofetilide, lomitapide, pimozide, tolvaptan, topotecan, vincristine. Verapamil may increase levels/effects of: alcohol, aliskiren amifostine, amiodarone, antihypertensives, aripiprazole, atorvastatin, avanfil, benzodiazepines, beta blockers, bosutinib, budesonide, buspirone, carbamazepine, cardiac glycosides, colchicine, corticosteroids, cyclosporine, CYP3A4 substrates, dronedarone, eletriptan, eplernone, everolimus, fingolimod, fosphenytoin, halofantrine, hypotensive agents, lithium, lomitapide, lovastatin, lurasidone, magnesium salts, midodrine, neuromuscular-blocking agents, nitroprusside,	may cause adverse fetal effects. Avoid grapefruit juice, alcohol, and caffeine. Maintain good oral hygiene to avoid gum disease with this medication. Report chest pain, palpatations, irregular heartbeat, unusual cough, dyspnea, edema of the feet/ankles. Monitor: liver function tests, blood pressure, heart rate, ECG, especially with renal or hepatic impairment *Contraindications:* Hypersensitivity to verapamil; severe left ventricular dysfunction; hypotension; cardiogenic shock; sick sinus syndrome (except with functioning pacemaker), second or third degree heart block (except with functioning pacemaker). (LexiComp, 2013)	$26.99 200mg (30): $72.99 240mg (30): $25.99 300mg (30): $105.99 360mg (30): $61.99 Verelan capsule, 24-hour: 100mg (30): $123.99 200mg (30): $139.98 300mg (30): $207.99 Covera HS tablet, 24-hour: 180mg (30): $75.99 240mg (30): $102.89 Verapamil HCL tablet: 40mg (90): $24.99 80mg (90): $16.99 120mg (90): $17.99 (LexiComp, 2013)

		phenytoin, quinidine, ranolazine, red yeast rice, rituximab, salicylates, salmeterol, saxagliptin, simvastatin, tacrolimus, vilazodone, zuclopenthixol Drugs that may increase levels/effects of verapamil: alpha-1 blockers, anilidopiperidine opioids, antifungal agents, aprepitant, atorvastatin, cimetidine, clonidine, conivaptan, cyclosporine, CYP3A4 inhibitors, dantrolene, diazoxide, grapefruit juice, herbs, lovastatin, macrolide antibiotics, MAO inhibitors, magnesium salts, phosphodiesterase 5 inhibitors, prostacyclin analogues, protease inhibitors, quinidine, telithromycin, St.John's wort Verapamil may		

		decrease levels/effects of: clopidogrel; ifosfamide (LexiComp, 2013)		
Felodipine (LexiComp, 2013)	*Pharmacodynamics:* Inhibits calcium ion from entering select voltage-sensitive areas of smooth muscle vasculature and myocardium, producing coronary vasodilation; increases myocardial oxygen in patients with vasospastic angina. *Pharmacokinetics:* Onset of action: 2-5 hours Absorption: 100%, 20% due to first pass effect Protein binding: >99% Metabolism: Hepatic; CYP3A4 substrate and extensive first pass effect. Half-life elimination: Immediate release: 11-16 hours Excretion: Urine 70%, feces 10%	*Drug interactions:* Avoid concomitant use with conivaptan, 15traconazole, pimozide. Felodipine may increase effect/toxicity of: amifostine, antihypertensives, aripiprazole, beta blockers, CYP2C8 substrates, fosphenytoin, hypotensive agents, lomitapide, magnesium salts, neuromuscular blocking agents, nitroprusside, phenytoin, pimozide, rituximab, tacrolimus Levels/effects of felodipine may be increased by: Alpha 1-blockers, antifungal agents, cimetidine, conivaptan, cyclosporine, CYP3A4 inhibitors, dasatinib,	*Patient education:* Take on empty stomach. Avoid concurrent alcohol use. May cause headache, constipation, or swelling of ankles. Report chest pain, palpitations, irregular heartbeat, persistent headache, severe constipation, peripheral edema, weight gain, and dyspnea. Monitor: heart rate and blood pressure. Use caution in heart failure patients. When discontinuing, taper dose gradually. *Contraindications:* Hypersensitivity. Use in extreme caution with aortic stenosis (can cause decreased coronary perfusion pressure). Use with caution with heart failure, hypertrophic	Felodipine tablet, 24-hour: 2.5mg (30): $42.99 5mg (30): $49.99 10mg (100): $192.41 (LexiComp, 2013)

		diazoxide, fluconazole, grapefruit juice, herbs, Itraconazole, ivacaftor, macrolide antibiotics, MAO inhibitors, mifespristone, pentoxifyline, phosphodiesterase 5 inhibitors, protease inhibitors. Felodipine may decrease levels/effects of: clopidogrel Drugs that may decrease levels/effects of felodipine: barbituates, calcium salts, carbamazepine, CYP inducers, deferasirox, herbs, melatonin, methylphenidate, nafcillin, rifamycin derivatives, yohimbine. (LexiComp, 2013)	cardiomyopathy and hepatic impairment. Pregnancy risk factor: C. May prolong labor. (LexiComp, 2013)	
Isradipine (DynaCirc CR) (LexiComp, 2013)	*Pharmacodynamics:* Inhibits calcium ion from entering select voltage-sensitive areas of smooth muscle vasculature and myocardium, producing coronary vasodilation; increases	*Drug interactions:* Avoid concomitant use with conivaptan and pimozide. Isradipine may increase effect/toxicity of: amifostine,	*Patient education:* Take with or without food. Food may delay absorption of medication, but does not affect the bioavailability. Monitor: heart	Isradipine capsules: 2.5mg (30): $79.99 DynaCirc CR tablet, 24-hour: 5mg (30): $83.99 10mg (30):

	myocardial oxygen in patients with vasospastic angina. *Pharmacokinetics:* Onset of action: immediate release: 2-3 hours Duration: Immediate release: >12 hours Absorption: 90-95% Distribution: Vd: 3 L/kg Protein binding: 95% Metabolism: Hepatic, CYP3A4 substrate, extensive first pass effect, forms inactive metabolites Bioavailability: 15-24% Half-life elimination: Terminal: 8 hous Time to serum peak: 1-1.5 hours Excretion: 60% urine, 25-30% feces (LexiComp, 2013)	antihypertensives, aripiprazole, beta blockers, CYP2C8 substrates, fosphenytoin, hypotensive agents, lomitapide, magnesium salts, neuromuscular blocking agents, nitroprusside, phenytoin, pimozide, rituximab, tacrolimus Levels/effects of isradipine may be increased by: Alpha 1-blockers, antifungal agents, cimetidine, conivaptan, cyclosporine, CYP3A4 inhibitors, dasatinib, diazoxide, fluconazole, grapefruit juice, herbs, Itraconazole, ivacaftor, macrolide antibiotics, MAO inhibitors, mifespristone, pentoxifyline, phosphodiesterase 5 inhibitors, protease inhibitors, quinidine. Isradipine may decrease	rate, blood pressure, and QT interval (may prolong QT interval). Monitor renal panel and liver function tests. Taper dose slowly with discontinuation. *Contraindications:* Hypersensitivity, hypotension. Pregnancy risk factor: C. Crosses the placenta. Use with caution in heart failure, hepatic impairment, idiopathic hypertrophic sub aortic stenosis. (LexiComp, 2013)	$129.99 (LexiComp, 2013)

		levels/effects of: clopidogrel and quinidine Drugs that may decrease levels/effects of isradipine: barbituates, calcium salts, carbamazepine, CYP inducers, deferasirox, herbs, melatonin, methylphenidate, nafcillin, rifamycin derivatives, yohimbine, St.John's wort. (LexiComp, 2013)		
Nicardipine (Cardene) (LexiComp, 2013)	*Pharmacodynamics:* Inhibits calcium ion from entering select voltage-sensitive areas of smooth muscle vasculature and myocardium, producing coronary vasodilation; increases myocardial oxygen in patients with vasospastic angina. *Pharmacokinetics:* Onset of action: 0.5-2 hours Duration: Immediate release capsules: <8 hours, sustained release: 8-12 hours Absorption: 100% Protein binding: >95% Metabolism:	*Drug interactions:* Avoid concomitant use with alfuzosin, apixaban, axitinib, bosutinib, cabozantinib, conivaptan, crizotinib, dronedarone, eplerenone, everolimus, fluticasone lovastatin, lurasidone, nilotinib, nisoldipine pimozide, ranolazine, red yeast rice, regorafenib, salmeterol, silodosin,	*Patient education:* Avoid alcohol ingestion, may cause CNS depression. Take on empty stomach, food may decrease peak effect. Avoid grapefruit juice. Orthostatic precautions. Monitor: heart rate and blood pressure. Use caution in heart failure patients. *Contraindications:* Hypersensitivity, advance aortic stenosis. Caution with use in heart failure, hepatic impairment, renal	Cardene SR capsule, 12-hour: 30mg (60): $105.99 45mg (60): $169.98 60mg (60): $199.99 Nicardipine HCL capsules: 20mg (90): $45.99 30mg (90): $60.99 (LexiComp, 2013)

	Hepatic, CYP3A4 substrates, extensive first pass effect Bioavailability: 35% Time to serum peak: immediate release: 30-120 minutes; sustained release: 60-240 minutes Excretion: Urine 49-60%; feces 43% (LexiComp, 2013)	simvastatin, thioridazine, vincristine Nicardipine may increase effect/toxicity of: alfuzosin, almotriptan, alosetron amifostine, antihypertensives, aripiprazole, avanafil beta blockers, colchicine, citalopram, corticosteroids, CYP2C19, CYP2C9, CYP3A4 and CYP2D6 substrates, fentanyl, fosphenytoin, hypotensive agents, lomitapide, magnesium salts, neuromuscular blocking agents, nitroprusside, phenytoin, pimozide, rituximab, tacrolimus Levels/effects of nicardipine may be increased by: Alpha 1-blockers, antifungal agents, cimetidine, conivaptan, cyclosporine, CYP3A4 inhibitors, dasatinib,	impairment and hypertrophic cardiomyopathy. Pregnancy risk factor: C. This has been used in pregnancy for severe hypertension and pre-term labor. Nicardipine crosses the placenta and may change fetal heart rate, blood pressure, and has caused neonatal acidosis. (LexiComp, 2013)	

		diazoxide, fluconazole, grapefruit juice, herbs, Itraconazole, ivacaftor, macrolide antibiotics, MAO inhibitors, mifespristone, pentoxifyline, phosphodiesterase 5 inhibitors, protease inhibitors. <u>Nicardipine may decrease levels/effects of:</u> clopidogrel, codeine, ifosfamide, prasugrel, quinidine, tamoxifen, ticagrelor, tramadol. <u>Drugs that may decrease levels/effects of nicardipine:</u> barbituates, calcium salts, carbamazepine, CYP inducers, deferasirox, herbs, melatonin, methylphenidate, nafcillin, rifamycin derivatives, yohimbine, St. John's wort. (LexiComp, 2013)		
Nisoldipine (Sular)	*Pharmacodynamics:* Impedes the	*Drug interactions:*	*Patient education:* Avoid high lipid	Nisoldipine tablet, 24-

(LexiComp, 2013)	movement of calcium ions into smooth muscle vasculature and myocardium. Less likely to suppress cardiac contractility and is a more potent vasodilator than other calcium channel blockers. *Pharmacokinetics:* Duration: >24 hours Absorption: well absorbed. High-lipid meals increase peak concentrations and decrease AUC. Protein binding: >99% Metabolism: Extensively hepatic, first pass effect. Bioavailability: 5% Half-life elimination: 9-18 hours Time to peak: 4-14 hours Excretion: Urine 60-80% (LexiComp, 2013)	Avoid concomitant use with CYP3A4 inducers and inhibitors, grapefruit juice, and pimozide. Nisoldipine may increase effect/toxicity of: amifostine, antihypertensives, aripiprazole, beta blockers, CYP2C8 substrates, fosphenytoin, hypotensive agents, lomitapide, magnesium salts, neuromuscular blocking agents, nitroprusside, phenytoin, pimozide, rituximab, tacrolimus Levels/effects of nisoldipine may be increased by: Alpha 1-blockers, antifungal agents, cimetidine, conivaptan, cyclosporine, CYP3A4 inhibitors, dasatinib, diazoxide, fluconazole, grapefruit juice, herbs, Itraconazole, ivacaftor, macrolide	foods, may significantly increase peak concentrations. Avoid grapefruit juice as it increases the bioavailability. Take on an empty stomach 1 hour prior or 2 hours after meals. Report chest pain, dyspnea, edema, rash or severe constipation. Monitor: heart rate and blood pressure. Use caution in heart failure patients. *Contraindications:* Hypersensitivity. Use caution in severe aortic stenosis, heart failure, hypertrophic cardiomyopathy, and hepatic impairment. (LexiComp, 2013)	hour: 8.5mg (30): $156.98 17mg (30): $189.98 20mg (30): $200.00 25.5mg (30): $218.00 30mg (30): $219.00 40mg (30): $220.48 Sular tablet, 24-hour: 8.5mg (100): $658.92 17mg (100): $1000.01 25.5mg (100): $939.54 34mg (100): $905.00 (LexiComp, 2013)

		antibiotics, MAO inhibitors, mifespristone, pentoxifyline, phosphodiesterase 5 inhibitors, protease inhibitors. Nisoldipine may decrease levels/effects of: clopidogrel Drugs that may decrease levels/effects of nisoldipine: barbituates, calcium salts, carbamazepine, CYP inducers, deferasirox, herbs, melatonin, methylphenidate, nafcillin, rifamycin derivatives, yohimbine, and St. John's wort. (LexiComp, 2013)		

V. Drug of Choice: Nifedipine

According to the American College of Chest Physicians (ACCP) evidence based clinical guidelines algorithm, calcium channel blockers are the first line of treatment in IPAH who have a positive response to the vasodilator nitric oxide test during cardiac catheterization (Badesch, Abman, Simonneau, Rubin, & McLaughlin, 2007). The likelihood of a sustained response to calcium channel blockers is improved with a positive response to the vasodilitory test (McLaughlin et al., 2009). Calcium channel blockers cause vasodilation of the vascular smooth

muscle and reduce PVR thus decreasing pulmonary arterial pressures. Treatment with calcium channel blockers are less expensive than alternative treatments indicated for pulmonary hypertension. After initial dosing, follow up is necessary to see if the patient has responded to therapy. Based on her response (exercise tolerance/dyspnea), will determine whether another medication will need to be added or discontinued all together and modified per the treatment algorithm. Although a small percentage of individuals continue on calcium channel blockers alone, benefit of long term calcium channel blocker treatment in patients as functional class I or II has shown decrease mortality with proven response to treatment (McLaughlin et al., 2009).

Nifedipine is the drug of choice based on the selectivity of the drug. Nifedipine, amlodipine, and diltiazem are the recommended calcium channel blockers to use for treatement of IPAH. The recommended dose for amlodipine is 20mg daily which is considered a high dose and has the potential to cause ankle edema especially in women (Sitbun et al., 2005). Diltiazem has a potential negative inotropic effect thus causing a decrease in heart rate. This could be cumbersome with a patient who enjoys running perhaps limiting her exercise tolerance. Therefore, nifedipine was chosen as the drug of choice. Nifedipine 10mg by mouth three times daily is recommended as the initial dose for IPAH (Sitbun et al., 2005). Increased titration of nifedipine to 20mg by mouth three times daily is suggested if the patient has not experienced significant side effects such as hypotension, and bradycardia. Follow up includes a six minute walk test after three and six months of treatment and a right heart catheterization after three months and one year of treatment to determine response to therapy (Sitbun et al., 2005). A retrospective study showed a limited number of patients who were classified as chronic responders to calcium channel blockers thus encouraging the need for strict follow up to determine the safety and efficacy of these drugs as treatment for IPAH and potential for

additional therapy (Sitbun et al., 2005). An advanced practice nurse (APN) with a current certificate to prescribe (CTP) can prescribe a calcium channel blocker (Ohio Board of Nursing, 2013).

Second Diagnosis: Necrotizing Fasciitis Associated With Group A Beta Hemolytic Streptococcus

A 64 year old male presents to the emergency department (ED) with complaints of severe left elbow pain that started two days ago. His left elbow has a small blister with non-blanchable erythema noted to extend up his tricep muscle. He mentioned that he had a fever of 102.2˚F this morning prompting him to come in. The patient's only past medical history is type II diabetes. When asking him if he injured his elbow recently, the patient responded that he had scratched it on his fence a couple of days ago. An x-ray revealed subcutaneous gas extending from his elbow into his tricep and bicep muscles. After emergent surgical debridement, he was sent to the intensive care unit for monitoring. Blood and tissue cultures revealed group A beta hemolytic streptococcus confirming the diagnosis of necrotizing fasciitis.

I. Definition of Diagnosis

Necrotizing fasciitis is a virulent soft tissue infection that may extend deep into the fascia and even muscle (Anaya & Dellinger, 2007). Often necrotizing fasciitis begins as a blister or bullae. Symptomology is usually associated with pain, tense edema, ecchymosis, non-blanchable erythema, subcutaneous gas noted on an x-ray, and crepitus of affected site. Findings such as tachycardia, fever, hypotension, and shock warrant immediate treatment. Diabetes, immunosuppression, trauma, and recent surgery are some of the risk factors associated with necrotizing fasciitis. The infectious disease society published a laboratory risk indicator of six variables to help differentiate the diagnosis of necrotizing fasciitis versus non-necrotizing

fasciitis infections. These variable lab values include; creatinine, white blood count, blood glucose, C - reactive protein, hemoglobin, and serum sodium levels (Anaya & Dellinger, 2007). Elevated laboratory values are scored using a point system. A higher score is more indicative of necrotizing fasciitis, but should not be used alone for diagnosis.

II. Therapeutic Objective

The goal of treatment with necrotizing fasciitis is: prompt diagnosis, early treatment to preserve as much skin and fascia as possible, and prevent further spread (May, 2009). The importance of source control through antimicrobial therapy, surgical intervention, supportive care and monitoring is essential for survival with this type of infection. Necrotizing fasciitis has a tendency to spread rapidly and mortality is high. The patient may also need resuscitation efforts for the sepsis that may ensue (Stevens et al., 2005).

III. Effective Drug Groups

Drug Classification	Efficacy	Safety	Suitability
Penicillins (natural penicillin G, aminopenicillins, amoxicillin, ampicillin, azlocillin, carbenicillin, carboxypenicillins, cloxacillin, dicloxacillin, mezlocillin, nafcillin, oxacillin, penicillin G, penicillin V, piperacillin, ticarcillin) Ampicillin 250mg (30): $12.99	*Pharmacodynamics:* inhibits bacterial cell wall synthesis and biosynthesis by impeding the final transpeptidation step of peptidoglycan synthesis. Lysis of bacteria ensues due to the cell wall autolysis of enzymes. Beta-lactam antibiotic. Gram positive and gram negative coverage. *Pharmacokinetics:* <u>Absorption:</u> 50% orally <u>Distribution:</u> bile, tissue fluids, and	*Side effects:* rash, fever, nausea, vomiting, anaphylaxis, hypersensitivity reactions, penicillin encephalopathy, pseudomembranous or C. difficile toxin related colitis, agranulocytosis, anemia, leukopenia, thrombocytopenia purpura, oral candidiasis <u>Rare:</u> Interstitial nephritis <u>Monitor:</u> observe for signs and symptoms	*Contraindications:* Hypersensitivity to any penicillin formulation. *Caution with use in:* renal impairment (may need dose adjustment), avoid use with infectious mononucleosis (high risk for developing a rash). (LexiComp, 2013)

Amoxicillin 500mg (100): $49.99 Dicloxacillin Sodium 250mg (30): $18.99 (LexiComp, 2013)	blisters; CSF penetration occurs with inflamed meninges only Protein binding: 15-25% Half-life elimination: 1-1.8 hours in adults; ESRD: 7-20 hours Time to peak concentration: oral within 1-2 hours Excretion: mostly in urine within 24 hours (LexiComp, 2013)	of anaphylaxis during initial intravenous infusion. Evaluate any appearance of a rash and determine if it is a hypersensitivity reaction. (LexiComp, 2013)	
Lincosamides Clindamycin (Cleocin) Clindamycin solution 600mg/4ml (4): $13.99 Cleocin solution 75mg/5ml (100): $78.70 Lincomycin (Lincocin) (LexiComp, 2013)	*Pharmacodynamics:* Lincosamides reversibly fixes themselves to 50S ribosomal subunits, inhibiting bacterial protein synthesis. Depending on the drug concentration, infection site, and organism it acts as either bacteriostatic or bactericidal. Active against most anaerobes and aerobic gram-positive bacteria. *Pharmacokinetics:* Absorption: oral: 90% is rapidly absorbed in the gut. Distribution: high concentrations in bone and urine with no significant amounts in CSF. Metabolism: forms the metabolite	*Side effects:* Common: pseudomembranous colitis, nausea, vomiting, abdominal cramping, leukocytosis, hypersensitivity reactions, superinfections. Rare: neutropenia, thrombocytopenia, Stevens-Johnson syndrome, erythema multiform Monitor: liver function panel (may need to give ½ of dose with hepatic impairment), renal panel, and CBC (LexiComp, 2013)	*Contraindications:* Hypersensitivity reactions to any formulation of lincosamides. Stop medication if C. difficile-associated diarrhea and pseudomembranous colitis occurs. *Use with caution in:* Hepatic impairment and gastrointestinal disease. Prolonged use may cause pseudomembranous colitis which can lead to toxic megacolon. Not appropriate to use for treatment of meningitis as it does not penetrate into the CSF. (LexiComp, 2013)

	clindamycin HCL converted from clindamycin phosphate Time to peak concentration: oral: within 60 minutes; IM: 1-3 hours Excretion: mainly in urine as active drug and metabolites, small amount in feces. (LexiComp, 2013)		
Glycopeptides (Vancomycin, Telavancin) Vancomycin 125mg (20): $686.99 250mg (20): $1194.63 (LexiComp, 2013)	*Pharmacodynamics:* Blocks glycopeptide polymerization inhibiting bacterial cell wall synthesis *Pharmacokinetics:* Absorption: poor orally Distribution: Vd: 0.4-1L/kg. Does not penetrate CSF unless meninges are inflamed Protein binding: 50% Half-life elimination: 5-11 hours, prolonged with renal impairment Time to serum peak concentration: immediate after completion of IV infusion Excretion: mainly in urine with IV, primarily in feces with oral formulation (LexiComp, 2013)	*Side effects:* Common: hypotension, red man syndrome with rapid infusion of medication, chills, drug fever, phlebitis, and neutropenia Rare: drug rash, Stevens-Johnson syndrome, ototoxicity, renal failure, thrombocytopenia, and vasculitis Monitor: CBC, renal function, and serum trough levels	*Contraindications:* Hypersensitivity to glycopeptides Disease-related precautions: renal impairment (dosing adjustment may be required) Drug to drug interactions: avoid concomitant use with aminoglycosides, colistimethate, gallium nitrate, and neuromuscular blockade agents (LexiComp, 2013)
Oxazolidinone (Linezolid) Zyvox 600mg (20): $1989.19 (LexiComp, 2013)	*Pharmacodynamics:* Binds to bacterial 23S ribosomal RNA of 50S subunit inhibiting bacterial protein synthesis.	*Side effects:* Common: headache, diarrhea, dizziness, rash, nausea, vomiting, constipation,	*Contraindications:* Hypersensitivity to linezolid or component of formulation, concurrent use of

	Bacteriostatic against enterococci, staphylococci, and bactericidal against most strains of streptococci. *Pharmacokinetics:* Absorption: rapid and extensive Distribution: Vd: 40-50L Protein binding: 31% Metabolism: hepatic via oxidation of morpholine ring Bioavailability: 100% orally Half-life elimination: 4-5 hours Time to serum peak concentration: 1-2 hours Excretion: mainly in urine, some in feces (LexiComp, 2013)	increased amylase, thrombocytopenia, leukopenia, neutropenia, and increased liver enzymes Rare: anaphylaxis, anemia, angioedema, C. difficile, increased creatinine, hypoglycemia, seizures, and Stevens-Johnson syndrome Monitor: CBC weekly in immunocompromised, and high risk for bleeding individuals, and if therapy is greater than 2 weeks. (LexiComp, 2013)	MAOIs, uncontrolled hypertension, pheochromocytoma, thyrotoxicosis, sympathomimetic, vasopresive agents, dopaminergic agents, tricyclic antidepressants, meperidine, buspirone, and patients with carcinoid syndrome Disease-related precautions: use caution with carcinoid syndrome, diabetes mellitus, hypertension, hyperthyroidism, pheochromocytoma, and seizure disorder Drug to drug interactions: Avoid concomitant use with alpha/beta agonists, alpha-1 and 2 agonists, amphetamines, antidepressants, SSRIs, cyclobenzaprine, methylene blue and tryptophan (LexiComp, 2013)
Streptogramin (Synercid) (LexiComp, 2013)	*Pharmacodynamics:* Binds to different sites on 50S bacterial ribosomal subunit inhibiting bacterial protein synthesis *Pharmacokinetics:* Distribution: 0.45L/kg Metabolism: active metabolites via nonenzymatic	*Side effects:* Common: hyperbilirubinemia, local pain at injection site, local edema, infusion site reaction, myalgia, rash, pruritus, nausea, vomiting, diarrhea, and thrombophlebitis Rare: increased CPK	*Contraindications:* Hypersensitivity to quinupristin, dalfopristin, virginiamycin, pristinamycin or any other component Drug to drug interactions: Avoid concurrent use with cisapride (may

	reactions Half-life elimination: 0.85 hour for quinupristin and 0.7 hour for dalfopristin Excretion: mainly in feces, some in urine (LexiComp, 2013)	levels, allergic reaction, anaphylaxis, angina, gout, dyspnea, hepatitis, mesenteric artery occlusion, pancreatitis, thrombocytopenia, pseudomembranous colitis, and shock Monitor: culture and sensitivity. Infusion site for reactions. Report of arthralgia, rash, headache, opportunistic infection, pseudomembranous colitis, dyspnea, hyperbilirubinemia, dyspnea, and ataxia. (LexiComp, 2013)	prolong QT interval), and drugs metabolized by CYP3A4. (LexiComp, 2013)
Cyclic Lipopeptide (Daptomycin) Daptomycin (Cubicin) 500mg vial: $152.00 (LexiComp, 2013)	*Pharmacodynamics:* Binds to cell membrane components of susceptible organisms and causes rapid depolarization, inhibiting synthesis of DNA, RNA, and protein inside the cells. Bactericidal. *Pharmacokinetics:* Protein binding: 90-93% Half-life elimination: 8-9 hours Excretion: mainly in urine, some in feces (LexiComp, 2013)	*Side effects:* Common: diarrhea, nausea, vomiting, constipation, and anemia Rare: chest pain, hypotension, hypertension, headache, fever, dizziness, rash, pruritus, erythema, hypokalemia, increased liver enzymes, injection site reaction, increased CPK, arthralgia, bacteremia, sepsis, anaphylaxis, dysrhythmias, C. difficile, Stevens-Johnson syndrome, and thrombocytopenia Monitor: signs and symptoms of	*Contraindications:* Hypersensitivity to daptomycin or any other component. Use for pneumonia as this medication does not penetrate the lung. Disease-related precautions: renal impairment (dosage may need adjustment with creatine clearance < 30ml/minute) Drug to drug interactions: HMG-CoA reductase inhibitors may increase levels of daptomycin and potentially cause rhabdomyolysis. (LexiComp, 2013)

		infection. Monitor CPK levels weekly. Monitor for muscle cramps and weakness. (LexiComp, 2013)	

IV. Effective Drug Classification: Lincosamides Combined With Penicillins

Drug Name	Efficacy	Safety	Suitability	Cost
Clindamycin (Cleocin) (LexiComp, 2013)	*Pharmacodynamics:* reversibly fixes themselves to 50S ribosomal subunits, inhibiting bacterial protein synthesis. Depending on the drug concentration, infection site, and organism it acts as either bacteriostatic or bactericidal. Active against most anaerobes and aerobic gram-positive bacteria. *Pharmacokinetics:* Absorption: oral: 90% is rapidly absorbed in the gut. Distribution: high concentrations in bone and urine with no significant amounts in CSF. Vd: 2 L/kg Metabolism: forms the metabolite clindamycin HCL converted from clindamycin phosphate Time to peak concentration: oral: within 60 minutes;	*Drug interactions:* avoid concomitant use with erythromycin Clindamycin may increase levels/effects of: Neuromuscular blocking agents Clindamycin may decrease the levels of: erythromycin, sodium picosulfate, BCG, typhoid vaccine Drugs that may decrease clindamycin levels: St. John's wort (LexiComp, 2013)	*Patient education:* Report pain, burning, edema, or erythema at injection site with intravenous formulation. Avoid taking with food with oral formulation as it may delay peak concentrations. Take with a full glass of water with oral formulation. Monitor: liver function panel (may need to give ½ of dose with hepatic impairment), renal panel, and CBC. Monitor for diarrhea; if excessive may be pseudomembranous colitis and will need to discontinue medication. (LexiComp, 2013)	Clindamycin phosphate solution 600mg/4ml (4): $13.99 Cleocin solution 75mg/5ml (100): $78.70 Cleocin capsules 150mg (30): $127.04 Clindamycin capsules 150 mg (30): $24.99 300mg (30): $79.99 (LexiComp, 2013)

	IM: 1-3 hours Excretion: mainly in urine 10%. 4% active drug and metabolites in feces. (LexiComp, 2013)			
Lincomycin (Lincocin) (LexiComp, 2013)	*Pharmacodynamics:* binds to 50S subunit inhibiting bacterial protein synthesis and the process of peptide chain initiation *Pharmacokinetics:* Metabolism: hepatic Serum half-life elimination: 5 hours; can be prolonged with renal or hepatic impairment Serum peak concentration: 1 hour for intramuscular Excretion: 2-30% in urine (LexiComp, 2013)	*Drug interactions:* avoid concomitant use wit erythromycin and BCG Lincomycin may increase levels of: neuromuscular blockers (cisatracurium, vecuronium) Lincomycin may decrease levels of: erythromycin, BCG, sodium picosulfate, typhoid vaccine Lincomycin levels may be decreased by: kaolin (LexiComp, 2013)	*Patient education:* encourage patient to report feeling light headed or throat swelling during infusion. Report any changes in bowel frequency. Monitor: bowel frequency changes, hepatic panel, renal panel, and CBC Administration: give intravenous infusion over an hour to prevent hypotension and possibly cardiac arrest (rare) (LexiComp, 2013)	Lincocin 300mg/ml (10ml): $123.47 (LexiComp, 2013)
Penicillin G (Pfizerpen) (LexiComp, 2013)	*Pharmacodynamics:* Bactericidal. Causes cell wall death through interference of bacterial cell wall synthesis. *Pharmacokinetics:* Distribution: poor distribution across blood brain barrier Protein binding: 65% Metabolism: hepatic	*Drug interactions:* May increase levels/effects of: methotrexate and vitamin K antagonists Penicillin G levels may be increased by: probenecid May decrease levels of:	*Patient education:* Instruct patient to report erythema, edema, burning, or pain at the infusion site and signs of opportunistic infection. Maintain adequate hydration. Monitor: electrolytes, hepatic and renal function periodically.	Penicillin G 10MMU: $6.84 (LexiComp, 2013)

	Half-life elimination: 30-50 minutes Time to serum peak concentration: 1 hour for IV Excretion: mainly in urine (LexiComp, 2013)	mycopheolate, sodium picosulfate, and typhoid vaccine Drugs that may decrease levels of penicillin G: fusidic acid and tetracycline derivatives (LexiComp, 2013)	Monitor for signs and symptoms of anaphylaxis with first dose. (LexiComp, 2013)	
Ampicillin (LexiComp, 2013)	*Pharmacodynamics:* Binds to penicillin binding proteins inhibiting bacterial cell wall biosynthesis. Cell wall autolytic enzymes lyse bacteria. *Pharmacokinetics:* Absorption: 50% Distribution: bile, blister and tissue fluids, does not penetrate meninges unless inflamed. Protein binding: 15-25% Half-life elimination: 1-1.8 hours Time to serum peak concentration: 1-2 hours with oral Excretion: mainly in urine (LexiComp, 2013)	*Drug interactions:* May increase levels of: methotrexate, and vitamin K antagonists Drugs that may increase ampicillin levels: allopurinol, and probenecid May decrease levels of: mycophenolate, sodium picosulfate, and typhoid vaccine Drugs that may decrease levels of ampicillin: chloroquine, fusidic acid, lanthanum, and tetracycline derivatives (LexiComp, 2013)	*Patient education:* Maintain adequate hydration. May cause diarrhea, nausea or vomiting. Report rash, facial, tongue, mouth or throat edema, persistent diarrhea, and chest tightness immediately. Monitor: renal and hepatic panel, and CBC periodically with treatment. Observe for anaphylaxis signs and symptoms during first dose. (LexiComp, 2013)	Ampicillin 250mg (30): $12.99 500mg (100): $34.99 (LexiComp, 2013)

V. Drug of Choice: Clindamycin and Penicillin G

Clindamycin is recommended as the drug of choice for beta hemolytic group A streptococcus bacteria because of the inhibitory effects of endotoxins and M protein produced with this bacterium (Sarani, Strong, Pascual, & Schwab, 2009). Also, clindamycin has good anaerobic coverage. The Infectious Disease Society of America (IDSA) guidelines recommend clindamycin and penicillin together to treat beta hemolytic group A streptococcus due to the increasing resistance of macrolides with this type of bacteria (Stevens et al., 2005). Alternative antibiotics are indicated with a penicillin allergy. Clindamycin has shown to have greater toxin suppression and reduction of cytokine production versus penicillin in animal studies (Anaya & Dellinger, 2007).

Clindamycin and penicillin G are safe and effective medications for this patient. The cost of clindamycin is inexpensive at $13.99 for 600mg/4ml solution. IDSA guidelines recommend clindamycin 600-900mg intravenously every eight hours and penicillin G 2-4 MU every six hours to treat necrotizing fasciitis caused by beta hemolytic group A streptococcus (Stevens et al., 2005). Baseline complete blood count (CBC), renal panel, liver function panel, and lactic acid levels are important to obtain prior to initiating therapy to determine improvement of illness. These laboratory values will need to be monitored frequently during the immediate course of this infection to help guide treatment. Early surgical debridement of the infected tissue is of extreme importance along with antibiotic treatment to potentially halt further spread. Multiple surgical debridements are expected throughout the course of this infection (Anaya & Dellinger, 2007). Additional supportive therapy most likely will be required during the acute phase of the infection. Monitor patient for signs and symptoms of allergic reactions during initial antibiotic

infusions. An APN with a CTP can prescribe clindamycin and penicillin G (Ohio Board of Nursing, 2013).

Third Diagnosis: Pain Associated with Chronic Pancreatitis

A 68 year old male presents to the ED with complaints of persistent abdominal pain, nausea and vomiting. The pain is described as constant, dull that improves with leaning forward and is worse after meals. Abdomen slightly distended, but soft. Normoactive bowel sounds are heard. Normal percussion throughout abdomen. He is guards with light and deep palpation. Extreme tenderness noted throughout all four quadrants. Vital signs: HR: 122bpm, respirations: 32bpm, BP: 168/92, O2Sat: 97% on room air, and temperature: 99.1˚F. Patient denies any significant medical history besides depression. He states he is a recent widow and has been drinking heavily over the last six months. The patient reports a fifteen pound weight loss over the last month and difficulty keeping food down. A computed tomography (CT) scan revealed multiple stones in the pancreatic duct. The diagnosis was confirmed to be chronic pancreatitis.

I. Definition of Diagnosis

Progressive pancreatic damage resulting in significant impairment of exocrine and endocrine function defines chronic pancreatitis (Witt, Apte, Keim, & Wilson, 2007). Pain is often associated with nerve injury and circulating inflammatory mediators. Ductal obstruction is thought to be the primary cause of pain with chronic pancreatitis (Chauhan & Forsmark, 2010). Increased pressure in the duct stimulated by pancreatic secretion after eating can create intractable pain for some individuals with this condition. Intense abdominal pain is felt and may be described as continuous, dull, stabbing, or burning like pain. Hypersensitivity and sensitization in regards to painful stimuli (noxious and non-noxious) frequently occurs with chronic pancreatitis. Seldom pain is adequately controlled completely in this population.

Diagnosis of chronic pancreatitis is confirmed through symptomology and diagnostic tests. Diagnostic tests include; abdominal ultrasound, CT, and endoscopic retrograde cholangiopancreatography; rarely diagnosed with an abdominal film (Witt, Apte, Keim, & Wilson, 2007).

II. Therapeutic Objective

The goal of treatment in chronic pancreatitis is adequate pain control that is tolerable for the patient to function and perform activities of daily living (Chauhan & Forsmark, 2010). The initial action is confirming the diagnosis of chronic pancreatitis to ensure appropriate treatment indicated. Next, is to determine potential causes of pancreatitis (pseudocyst, ductal obstruction, excessive alcohol ingestion, biliary obstruction, etc.) (Witt, Apte, Keim, & Wilson, 2007). Once diagnosis and potential causes are established, a treatment plan can be devised. Pain management modalities for this disease are complex and may require a multidisciplinary approach. Also, encouraging abstinence from alcohol may help slow down the progression of the disease (Chauhan & Forsmark, 2010).

III. Effective Drug Groups

Drug Classification	Efficacy	Safety	Suitability
Opioid Analgesics Full Agonists (Morphine, fentanyl, oxycodone, hydrocodone, hydromorphone, meperidine, codeine, methadone, oxymorphone, levorphanol) Oxycodone 5mg (20): $22.76	*Pharmacodynamics:* Produce analgesia effects through binding to specific receptor sites located in the brain and spinal cord. *Pharmacokinetics:* Absorption: oral analgesics all have a first-pass effect and are well absorbed. Distribution: bind to plasma proteins with	*Side effects:* Common: analgesia, euphoria, respiratory depression, cough suppression, dizziness, sedation, miosis, truncal rigidity, nausea, vomiting, hyperthermia, constipation, bradycardia, pruritus, biliary colic, depressed renal	*Contraindications:* Hypersensitivity, bowel obstruction, and paralytic ileus. Disease-related precautions: Use caution with head trauma, biliary tract impairment, hepatic impairment, renal impairment, history of drug abuse, respiratory disease, urinary stricture,

Morphine Sulfate 15mg (20): $12.99 Methadone HCL 5mg (20): $11.99 Meperidine HCL 50mg (20): $19.99 (LexiComp, 2013)	varying affinity. Metabolism: converted to polar metabolites. Hepatic oxidation occurs with phenylpiperidine opioids. Oxycodone and codeine is metabolized by the P450 isoenzyme in the liver. Excretion: mainly in urine (Schumacher & Basbaum, 2012)	function Rare: anaphylaxis, angioedema, bronchospasm, hypotension, gastric bleeding, palpitations, tinnitus, stevens-johnson syndrome. Monitor: pain relief, blood pressure, respiratory and mental status. (Schumacher & Basbaum, 2012)	seizures Drug to drug interactions: use caution with amphetamines, CYP3A4 inhibitors and inducers, methadone, other CNS depressants. (LexiComp, 2013)
Tricyclic Antidepressants (amitriptyline, clomipramine, doxepin, imipramine, trimipramine) Amitriptyline 10mg (30): $11.99 Clomipramine 25mg (60): $38.99 Doxepin HCL 10mg (90): $28.99 (LexiComp, 2013)	*Pharmacodynamics:* Synaptic concentrations of serotonin and norepinephrine are increased in the central nervous system through inhibition of reuptake. *Pharmacokinetics:* Onset of action: 4-6 weeks Metabolism: hepatic, may be impaired in the elderly Half-life elimination: 9-27 hours Time to serum peak concentration: 4 hours Excretion: mainly in urine, some in feces (LexiComp, 2013)	*Side effects:* Common: anticholinergic effects, sedation, orthostatic hypotension, ECG changes, MI, heart block, syncope, hypertension, coma, hallucinations, rash, photosensitivity, IADH secretion, weight gain, nausea, vomiting, diarrhea, stomatitis, bone marrow suppression, eosinophilia, numbness, paresthesia, weakness, tremors, tinnitus, diaphoresis, and withdrawal reactions. Rare: neuroleptic malignant syndrome, serotonin syndrome Monitor: pulse, blood pressure during initial therapy, mental status, suicide ideation, and ECG in elderly and	*Contraindications:* Hypersensitivity to drug or any component of the formulation, use of MAO inhibitors within 14 days of initiation of therapy, MI recovery phase. Disease-related precautions: use caution in cardiovascular disease, diabetes, hepatic impairment, mania/hypomania, renal impairment, seizure disorder (may lower seizure threshold), and thyroid dysfunction. Avoid use in elderly. Drug to drug interactions: cisapride, anticholinergic and neuroleptic agents, and sedatives. -do not abruptly discontinue inpatients receiving high doses for prolonged periods.

		cardiac disease (LexiComp, 2013)	(LexiComp, 2013)
Antiepileptic Agents (carbamazepine, gabapentin, divalproex, oxcarbazepine, valproic acid, vigabatrin, tiagabine) Gabapentin 100mg (90): $43.99 Carbamazepine 100mg (30): $65.99 Valproic Acid 250mg (30): $19.99 (LexiComp, 2013)	*Pharmacodynamics:* Anticonvulsant, anticholenergice, antineuralgic, antidiuretic, muscle relaxant, antimanic, antidepressive, and antiarrhythmic properties. Releases ADH and promotes reabsorption of water. *Pharmacokinetics:* Absorption: slow Protein binding: 75-95% Metabolism: Hepatic via CYP3A4 Bioavailability: 85% Half-life elimination: variable Time to serum peak concentration: unpredictable Excretion: mainly in urine, some in feces (LexiComp, 2013)	*Side effects:* Common: hypertension, arrhythmias, coronary artery disease, AV block, edema, heart failure, syncope, hypotension, dizziness, somnolence, ataxia, headache, vertigo, depression, amnesia, neuroleptic malignant syndrome, slurred speech, pruritus, rash, photosensitivity, stevens-johnson syndrome, hypocalcemia, SIADH, hyponatremia, nausea, vomiting, constipation, xerostomia, diarrhea, urinary retention, agranulocytosis, leukocytosis, leukopenia, tremor, paresthesia, blurred vision, and nystagmus Rare: aseptic meningitis, hirsutism, paralysis, suicidal ideation, tinnitus Monitor: CBC with differential, lipid panel, liver function tests, renal panel, ophthalmic exams, and for excessive sedation (LexiComp, 2013)	*Contraindications:* Hypersensitivity to medication or tricyclic antidepressants, concomitant use with MAO inhibitors or within 14 days of use, concurrent uses with nefazadone, delavirdine, or other non-nucleoside reverse transcriptase inhibitors Disease-related precautions: cardiovascular disease (may cause ECG abnormalities), hepatic impairment, and renal impairment Drug to drug interactions: concurrent use with strong CYP3A4 inducers or inhibitors has a high risk for interactions. Concomitant use with nefazodone. Sedatives may have potentiated effects with concomitant use. (LexiComp, 2013)
Non-Steroidal Anti-	*Pharmacodynamics:*	*Side effects:*	*Contraindications:*

inflammatory Agents (Diclofenac, etodolac, fenoprofen, ibuprofen, ketorolac, mecolfenamate, meloxicam, nabumetone, naproxen, oxaprozin, piroxicam, sulindac, tolmetin) Diclofenac 50mg (60): $39.99 Ibuprofen 400mg (30): $11.99 Ketorolac 10mg (30): $24.99 (LexiComp, 2013)	Inhibits COX-1 & 2 enzymes reversibly, causing decreased formation of prostaglandins. Has analgesic, antipyretic, and anti-inflammatory properties. *Pharmacokinetics:* Onset of action: 30-60 minutes for analgesic effect. < 7 days for anti-inflammatory effect. Absorption: rapid Protein binding: 90-99% Metabolism: Hepatic Half-life elimination: 2-4 hours Time to serum peak concentration: 1-2 hours Excretion: mainly in urine, some in feces. (LexiComp, 2013)	Common: rash, edema, heartburn, epigastric pain, abdominal cramps, suppressed appetite, constipation, diarrhea, dyspepsia, vomiting, and tinnitus. Rare: acute renal failure, agranulocytosis, anaphylaxis, aplastic anemia, azotemia, duodenal ulcer, gastric ulcer, epistaxis, GI bleed, hemorrhage, or ulceration, hypertension, inhibition of platelet aggregation, stevens-johnson syndrome, thrombocytopenia, melena, and neutropenia. Monitor: CBC, renal panel, periodic liver function tests. Observe for bruising, bleeding and gastrointestinal effects. (LexiComp, 2013)	Hypersensitivity to medication and other NSAIDS, perioperative pain in CABG patients. Disease-related precautions: aseptic meningitis (may increase risk in systemic lupus erythematosus), asthma (aspirin-sensitive asthma), hepatic impairment, renal impairment, hypertension (may cause new onset or worsening). Avoid chronic use in the elderly. Drug to drug interactions: avoid concomitant use with floctafenine, ketorolac, omacetaxine. (LexiComp, 2013)
Acetaminophen (Tylenol) Tylenol 650mg (50): $17.99 Acetaminophen 500mg (700): $38.99 (LexiComp, 2013)	*Pharmacodynamics:* inhibits synthesis of prostaglandins in the CNS and blocks pain impulses peripherally. Also inhibits hypothalamic heat regulating center causing antipyresis. *Pharmacokinetics:* Onset of action: < 1 hour	*Side effects:* Common: rash, anemia, blood dyscrasias, increased bilirubin, alkaline phosphatase, and ammonia levels, Rare: nephrotoxicity with overdose, hepatic failure with overdose, hypersensitivity reactions,	*Contraindications:* Hypersensitivity, severe hepatic impairment or hepatic disease. Disease-related precautions: G6PD deficiency (hemolysis can occur), hepatic impairment, hypovolemia, renal impairment (consider

	Duration: 4-6 hours Absorption: absorbed primarily in the small intestine Distribution: 1 L/kg Protein binding: 10-25% with therapeutic concentrations. 8-43% with toxic concentrations Metabolism: primarily hepatic. Oral formulation is subject to first pass effect. Half-life elimination: prolonged in toxic doses. Adults: 2 hours, may be prolonged in renal insufficiency 2-5 hours Time to serum peak concentration: 10-60 minutes for immediate release Excretion: mainly in urine (LexiComp, 2013)	anaphylaxis. Monitor: pain relief, and liver function tests (LexiComp, 2013)	dosage adjustments). Caution with use in excessive alcohol ingestion. Drug to drug interactions: avoid concomitant use with pimozide. (LexiComp, 2013)
Non-Steroidal Anti-inflammatory Agents COX-2 Selective (Celebrex) Celebrex 50mg (30): $49.99 100mg (30): $90.99 (LexiComp, 2013)	*Pharmacodynamics:* Inhibits prostaglandin synthesis through decreasing activity of COX-2 enzyme causing decreased inflammation, analgesic effects, and antipyretic effects. *Pharmacokinetics:* Distribution: Vd: 400L Protein binding: 97% to albumin Metabolism: Hepatic via CYP2C9 Bioavailability: unknown	*Side effects:* Common: peripheral edema, dizziness, headache, fever, rash, diarrhea, abdominal pain, nausea, vomiting, flatulence, arthralgia, cough, and sinusitis. Rare: angina, edema, hypertension, MI, palpitations, anxiety, depression, fatigue, migraine, somnolence, photosensitivity, pruritus, hypokalemia, anorexia,	*Contraindications:* Hypersensitivity, sulfonamide, aspirin, or other NSAID allergy, perioperative pain in CABG surgery (risk of MI and stroke post-surgery). Disease-related precautions: caution in use with asthma (aspirin-sensitive asthma), corticosteroid-dependent diseases, CYP450 deficiencies, hepatic impairment, renal impairment

	Half-life elimination: 11 hours Time to serum peak concentration: 3 hours Excretion: mainly in feces, some in urine. (LexiComp, 2013)	constipation, esophagitis, dysphagia, gastritis, dysuria, anemia, thrombocytopenia, increased liver enzymes, acute renal failure, agranulocytosis, anaphylaxis, stevens-johnson syndrome, and vasculitis Monitor: CBC, renal panel, liver function panel, inflammation, blood pressure, and pain relief. (LexiComp, 2013)	Drug to drug interactions: Avoid concomitant use with ketorolac, omacetaxine, floctafenine, and thioridazine. (LexiComp, 2013)
Opioid Analgesics Full Agonist/Reuptake Inhibitors (Tramadol, tapentadol) (LexiComp, 2013)	*Pharmacodynamics:* Binds to μ-opiate receptors inhibiting ascending pain pathways and altering pain response and perception. Inhibits serotonin and norepinephrine reuptake which also modifies ascending pain pathway. *Pharmacokinetics:* Onset of action: 1 hour Duration: 9 hours Absorption: Rapid and complete Metabolism: Hepatic via glucuronidation Half-life elimination: 6-8 hours Time to serum peak concentration: 2 hours Exertion: mainly in urine (LexiComp, 2013)	*Side effects:* Common: dizziness, drowsiness, somnolence, headache, flushing, pruritus, constipation, nausea, vomiting, and weakness Rare: orthostatic hypotension, peripheral edema, vasodilation, agitation, anxiety, depression, restlessness, seizures, dermatitis, lethargy, hyperglycemia, diarrhea, arthralgia, blurred vision, dyspnea, withdrawal syndrome, shivering, allergic reaction, anaphylaxis, anemia, angioedema, bradycardia, peripheral edema, pulmonary edema,	*Contraindications:* Hypersensitivity to tramadol or any component, and opioids. Alcohol, hypnotics, opioid, or centrally-acting analgesic intoxication. Bronchial asthma, hypercapnia or significant respiratory depression. Disease-related precautions: abdominal conditions (may obscure diagnosis), drug abuse, ethanol use, head trauma, hepatic and renal impairment, and suicide risk. Drug to drug interactions: Avoid concomitant use with azelastine, carbamazepine, conivaptan, and

		and thrombocytopenia Monitor: Monitor: pain relief, pulse, respirations, blood pressure, signs of tolerance, abuse and suicidal ideation (LexiComp, 2013)	paraldehyde (LexiComp, 2013)
Salicylates (Aspirin) Aspirin 325mg (100): $11.99 (LexiComp, 2013)	*Pharmacodynamics:* Inhibits COX 1 and 2 enzymes via acetylation resulting in decreased prostaglandin production. Also inhibits platelet aggregation by inhibiting prostaglandin formation and thromboxane A2. Has anti-inflammatory, analgesic, and antipyretic properties *Pharmacokinetics:* Duration: 4-6 hours Absorption: Rapid Metabolism: Esterases in the GI mucosa, RBCs, synovial fluid, and blood hydrolyze to salicylate. Occurs mainly via hepatic conjunction. Pathways are saturable. Bioavailability: 50-75% Half-life elimination: dose dependent Time to serum peak concentration: 1-2 hours Excretion: mainly in urine (LexiComp, 2013)	*Side effects:* Common: bleeding, GI ulceration, dyspepsia, rash, thrombocytopenia, hemolytic anemia, and iron deficiency anemia. Rare: hemorrhage, Reye's syndrome, anaphylaxis, angioedema, dysrhythmias, coma, cerebral edema, tachycardia, and disseminated intravascular coagulation. Monitor: CBC, signs and symptoms of bleeding or bleeding disorders. (LexiComp, 2013)	*Contraindications:* Hypersensitivity to salicylates or other NSAIDS, asthma, rhinitis, and bleeding disorders (factor VII & IX). Disease-related precautions: caution with use in bleeding disorders, dehydration, ethanol use, GI disease, hepatic and renal impairment. Drug to drug interactions: Avoid concomitant use with alteplase, and COX-2 inhibitors/NSAIDS (LexiComp, 2013)

IV. Effective Drug Classification: Opioid Analgesics Full Agonist/Reuptake Inhibitors

Drug Name	Efficacy	Safety	Suitability	Cost
Tramadol (ConZip, Rybix, Ryzolt, Ultram) (LexiComp, 2013)	*Pharmacodynamics:* Binds to μ-opiate receptors inhibiting ascending pain pathways and altering pain response and perception. Inhibits serotonin and norepinephrine reuptake which also modifies ascending pain pathway. *Pharmacokinetics:* Onset of action: 1 hour Duration: 9 hours Absorption: Rapid and complete with immediate release and delayed with extended release formulation. Distribution: Vd: 2.5-3L/kg Protein binding: 20% Metabolism: Hepatic via glucuronidation, demethylation, and sulfation Bioavailability: 75% for immediate release, 85% for extended release Half-life elimination: 6-8 hours Time to serum peak	*Drug interactions:* Avoid concomitant use with azelastine, carbamazepine, conivaptan, and paraldehyde May increase levels/effects of: alvimopan, alcohol, azelastine, carbamazepine, desmopressin, CNS depressants, MAO inhibitors, metyrosine, metoclopramide, paraldehyde, pramipexole, ropinirole, SSRIs, serotonin modulators, thiazide diuretics, and vitamin K antagonists Drugs that may increase levels/effects of tramadol: amphetamines, antipsychotic agents, CYP3A4 inhibitors (strong), conivaptan, dasatinib, hydroxyzine, magnesium	*Patient education:* Physical and or psychological dependence can occur. Do not use alcohol or over the counter medications without consulting with the prescriber. Dizziness, drowsiness, headache, dry mouth, blurred vision, nausea, vomiting, constipation, and insomnia are symptoms that may occur while taking this medication. Report if any of these symptoms become severe or unresolved. Report rash, seizures, respiratory difficulty, muscle weakness, tremors, chest pain or palpitations. Monitor: pain relief, pulse,	Ryzolt 200mg (30): $213.98 Tramadol HCL 100mg (30): $109.99 200mg (30): $145.99 Ultram ER 100mg (30): $144.99 200mg (30): $224.99 300mg (30): $298.00 Tramadol HCL 50mg (30): $16.99 Ultram 50mg (30): $62.99 (LexiComp, 2013)

	concentration: 2 hours for immediate release, 10-12 hours for extended release Exertion: 30% in urine (LexiComp, 2013)	sulfate, ivacaftor, SSRIs, succinylcholine, and tricyclic antidepressants May decrease levels of: carbamazepine, and pegvisomant Levels/effects of tramadol may be decreased by: ammonium chloride, antiemetics, carbamazepine, CYP2D6 inhibitors and CYP3A4 inducers, deferasirox, and mixed agonist/antagonist opioids. (LexiComp, 2013)	respirations, blood pressure, signs of tolerance, abuse and suicidal ideation (LexiComp, 2013)	
Tapentadol (Nucynta) (LexiComp, 2013)	*Pharmacodynamics:* Binds to μ-opiate receptors inhibiting ascending pain pathways and altering pain response and perception. Inhibits serotonin and norepinephrine reuptake which also modifies ascending pain pathway. *Pharmacokinetics:* Absorption: rapid Distribution: Vd: 442-638 L Protein binding: 20% Metabolism:	*Drug interactions:* Avoid concomitant use with alcohol, azelastine, MAO inhibitors, and paraldehyde. May increase levels/effects of: azelastine, alvimopan, CNS depressants, MAO inhibitors, desmopressin, metoclopramide, metyrosine, paraldehyde, ropinirole, rotigotine, SSRIs,	*Patient education:* Do not use alcohol or other over the counter prescriptions without consultation with prescriber. May cause physical or psychological dependence. Hydrate adequately. Report dizziness, shortness of breath, change in mental status,	Tapentadol 50mg (30): $60.00 (LexiComp, 2013)

	Extensive first-pass metabolism. Metabolized via phase 2 glucuronidation to glucuronides and minimally through phase 1 oxidative metabolism. Lesser degree of metabolism through CYP2C9, CYP2C19, and CYP2D6 Bioavailability: 32% Half-life elimination: 4 hours for immediate release and 5-6 hours for long acting formulations. Time to serum peak concentration: 1.25 hours for immediate release and 3-6 hours for long acting Excretion: 99% in urine (LexiComp, 2013)	serotonin modulators, thiazide diuretics, and zolpidem Tapentadol may be increased by: alcohol, amphetamines, antipsychotic agents, hydroxyzine, magnesium sulfate, sodium oxybate, succinylcholine May decrease the levels/effects of: pegvisomant Drugs that may decrease levels/effects of tapentadol: ammonium choloride, antiemetics, mixed agonist/antagonist opioids, and peginterferon alfa-2b (LexiComp, 2013)	and skin rash. Report severe symptoms or ones that become unresolved. Do not stop medication suddenly. Monitor: pulse, blood pressure, and respirations. Signs of misuse, abuse or addiction. (LexiComp, 2013)	

V. Drug of Choice: Tramadol

Pain with chronic pancreatitis can be difficult to treat and control with conventional analgesic therapy. Tramadol's unique neuropathic and nociceptive properties make this a suitable drug for treatment of pain with chronic pancreatitis (Chauhan & Forsmark, 2010). Careful consideration should be taken with choosing pain medications for chronic pancreatitis due to vulnerability of dependence and tolerance with chronic pain. Studies have shown tramadol to

have a lower potential of tolerance, dependence and gastrointestinal motility impact (Duehmke, Hollingshead, & Cornblath, 2006).

An APN with a CTP can prescribe tramadol according to the Ohio Board of Nursing formulary, but can only write for a seven day maximum in a hospital setting (Ohio Board of Nursing, 2013). Gastroenterology research guidelines suggest use of tramadol as an effective first line treatment for pain in chronic pancreatitis (Chauhan & Forsmark, 2010). Administration of Tramadol 50mg by mouth every four to six hours as needed for pain is recommended (The Medical Letter, 2013). Maximum dose is 400mg per day. A five day supply of thirty tablets if taken every four hours will cost $16.99 (LexiComp, 2013). Starting with a lower dose initially is ideal to decrease potential adverse effects of respiratory depression, drowsiness, dizziness and other untoward effects. Important teaching aspects regarding consultation with a healthcare provider prior to taking any additional pain medication or certain over the counter medications is crucial to prevent drug interactions and potentially serious side effects. Also, it is essential to explain the importance of eliminating alcohol ingestion while on this medication and for pancreatitis treatment (Chauhan & Forsmark, 2010). This patient will be instructed to seek immediate medical assistance if he experiences extreme drowsiness, dizziness, respiratory difficulty, and any possible allergic reactions. Initial follow up should be within a week to determine pain relief and effectiveness of medication. If the patient reports no relief of pain after a couple of weeks of adjusting medication, adjunctive therapy such as tricyclic antidepressants or anticonvulsant agents that work synergistically with opioids is advocated (Chauhan & Forsmark, 2010). Encouraging a low fat diet and increasing frequency of meals may help with pain, nausea and vomiting. During the process of managing pain with a chronic condition, building rapport and trust is critical to provide exceptional care.

Fourth Diagnosis: Dyslipidemia in a Post Myocardial Infarction Patient

A 48 year old male was admitted to the coronary care intensive care unit post myocardial infarction. Vital signs: HR: 72bpm, Respirations: 22bpm, BP: 145/90 mmHg, and O2Sat: 94% on 4L/O2 per nasal cannula. His lipid profile revealed triglyceride (TG) level of 274 mg/dl, high-density lipoprotein (HDL) of 30mg/dl and low-density lipoprotein (LDL-C) of 190 mg/dl. The patient has a medical history of hypertension. His family history included his father dying from a myocardial infarction at age 42. Upon completion of a thorough assessment, the patient was diagnosed with dyslipidemia.

I. Definition of Diagnosis

Cholesterol forms in the inner media and intima of the coronary arteries causing inflammation from endothelial dysfunction. Accumulation of cholesterol transpires leading to formation of atherosclerotic plaques. Overtime this can potentially lead to obstruction of flow causing acute coronary syndrome (Blaha, Ketlogetswe, Nudmele, Gluckman, & Blumenthal, 2011). High cholesterol levels play a major contributory role with coronary artery disease (CAD). Diagnosis is confirmed with a high LDL-C (>100 mg/dl), low HDL (<40 mg/dl), and a high TG level (>200 mg/dl) (Blaha, Ketlogetswe, Nudmele, Gluckman, & Blumenthal, 2011).

II. Therapeutic Objective

The goal of treatment is through secondary prevention measures of cardiovascular disease (CVD) by lowering lipid and triglyceride levels. High LDL-C and TG levels can increase risk for further progression of CVD (Smith et al., 2011). An emphasis on lowering the LDL-C < 70 mg/dl and total cholesterol level is essential to prevent CVD progression for this patient and is a class I recommendation from the American Heart Association (Smith et al., 2011).

III. Effective Drug Groups

Drug Classification	Efficacy	Safety	Suitability
HMG-CoA Reductase Inhibitors (atorvastatin, fluvastatin, lovastatin, pitavastatin, pravastatin, rosuvastatin, simvastatin) (LexiComp, 2013)	*Pharmacodynamics:* Inhibits 3-hydroxyl-3-methylglutaryl-coenzyme A reductase. This halts the rate limiting step in cholesterol biosynthesis *Pharmacokinetics:* Onset of action: 3 days for LDL reduction Absorption: 30% Protein binding: >95% Metabolism: extensive first pass effect, hepatic Bioavailability: Increased with extended release tablets Half-life elimination: 1-1.7 hours Time to serum peak concentration: 2-4 hours for immediate release, 12-14 hours for extended release Excretion: mainly in feces, some in urine (LexiComp, 2013)	*Side effects:* Common: increased CPK levels, headache, flatulence, constipation, abdominal pain, diarrhea, nausea, myalgia, rash Rare: arthralgia, hyperglycemia, confusion, insomnia, leg pain, memory disturbance, amnesia, memory impairment, pruritus, vomiting, paresthesia (LexiComp, 2013)	*Contraindications:* Hypersensitivity to drug, unexplained elevations in transaminases, active hepatic disease, and concomitant use of strong CYP3A4 inhibitors Disease-related precautions: diabetes mellitus (increase in HbA1C has been reported). Use caution with hepatic impairment, excessive alcohol ingestion, and renal impairment (increased risk for myopathy). Caution in prescribing use with elderly patients (may have renal impairment) Drug to drug interactions: concomitant use with fibric acid derivatives or niacin at doses >1g/day increases risk for rhabdomyolysis and acute tubular necrosis leading to acute renal failure (LexiComp, 2013)
Bile-Acid Sequestrants (cholestyramine resin, colesevelam, colestipol) Cholestyramine 4g (60): $122.99	*Pharmacodynamics:* In the intestine formation of a nonabsorbable complex with bile acids release chloride ions and inhibits enterohepatic reuptake of intestinal	*Side effects:* Common: anxiety, drowsiness, fatigue, anorexia, nausea, vomiting, flatulence, steatorrhea, taste disturbance, diarrhea, constipation, dental caries, ulcer, weight	*Contraindications:* Hypersensitivity to medication and complete biliary obstruction Precaution with chronic use may lead to bleeding problems. Also may exacerbate

Questran 4g (60): $215.96 Welchol 3.75g (30): $265.98 Colestid 5g (500): $158.55 (LexiComp, 2013)	bile salts and increases release of bile salt bound low density lipoprotein cholesterol via feces *Pharmacokinetics:* Absorption: none Peak effect: 21 days Excretion: feces (LexiComp, 2013)	gain/loss, liver function abnormalities, anemia, arthritis, diuresis, tinnitus Rare: night blindness, intestinal obstruction, anaphylaxis (LexiComp, 2013)	constipation. Disease-related precautions: use caution with renal impairment and patients with fat soluble vitamin deficiency (take vitamins >4 hours prior) Drug to drug interactions: may decrease absorption of other oral medications, do not take simultaneously with other meds. (LexiComp, 2013)
Fibric Acid Derivatives (gemfibrozil, fenofibrate) Fenofibrate capsules 67mg (30): $29.99 Fenofibrate tablets 54mg (90): $69.99 Tricor 48mg (30): $62.99 Gemfibrozil 600mg (60): $22.99 (LexiComp, 2013)	*Pharmacodynamics:* agonist for nuclear transcription factor peroxisome proliferator-activated receptor, inhibits lipoprotein lipase, and regulates the synthesis of apolipoprotein A-1. Results in VLDL catabolism, elimination of triglyceride particles, and fatty acid oxidation. Lowered VLDL levels, triglycerides and increased HDL occur. *Pharmacokinetics:* Absorption: increased with meals Distribution: widely in tissues Protein binding: >99% Metabolism: plasma and tissue esterases; is inactivated by	*Side effects:* Common: increased liver enzymes (ALT/AST), headache, urticarial, abdominal pain, constipation, nausea, back pain, respiratory disorder Rare: increased CPK, rhabdomyolysis (with concomitant use with HMG CoA reductase inhibitors), abnormal vision, agranulocytosis, anaphylaxis, acute renal failure, cirrhosis, hepatitis, cholecystitis, colitis, deep vein thrombosis, diarrhea, duodenal ulcer, diabetes mellitus, Stevens-Johnson syndrome, thrombocytopenia, weight gain/loss (LexiComp, 2013)	*Contraindications:* Hypersensitivity to medication, peanut allergy, soya lecithin allergy, hepatic dysfunction, unexplained elevated liver enzymes, severe renal impairment, pre-existing gallbladder disease. Disease-related precautions: cholelithiasis, mild renal impairment (may cause elevated serum creatinine, dosage adjustments may be needed), patients at risk for venous thromboembolism. Avoid use in elderly as most have some type of renal impairment. Stop medication if pancreatitis occurs

	glucuronidation hepatically or renally Half-life elimination: 20 hours, prolonged in renal impairment Time to peak serum concentration: 2-8 hours Excretion: mostly urine, some in feces (LexiComp, 2013)		(may represent failure of efficacy of drug). Drug to drug interactions: anticoagulants (inhibits CYP2A6, which may increase warfarin levels) (LexiComp, 2013)
Nicotinic Acid (niacin, niacor, niaspan, slo-niacin) Niacin CR 1000mg (100): $15.99 Niaspan 1000mg (30): $161.98 Slo-Niacin 500mg (100): $25.99 Niacin 500mg (100): $11.99 (LexiComp, 2013)	*Pharmacodynamics:* as a part of two coenzymes which facilitates lipid metabolism, tissue respiration and glycogenolysis. Inhibits synthesis of very low density lipoproteins and low density lipoproteins *Pharmacokinetics:* Metabolism: first pass effect extensive; converted to other metabolites Absorption: extensive and rapid Distribution: mainly hepatic, renal, and adipose tissue Half-life elimination: 20-45 minutes Time to peak serum concentration: 30-60 minutes for immediate release. 4-5 hours for extended release Excretion: mostly in urine 60-88% (LexiComp, 2013)	*Side effects:* Common: arrhythmias, atrial fibrillation, flushing, hypotension, palpitations, tachycardia, chills, headache, dizziness, migraine, insomnia, nervousness, dry skin, rash, pruritus, rash, skin discoloration, glucose intolerance, gout, hypophosphatemia, hyperuricemia, diarrhea, flatulence, nausea, vomiting, peptic ulcers, thrombocytopenia, hepatitis, high bilirubin, increased transaminases, cough, dyspnea Rare: anaphylaxis, angioedema, CPK increased (with concurrent HMG-CoA reductase inhibitors), leg cramps, myopathy, myalgia, rhabdomyolysis (with concurrent HMG-	*Contraindications:* Hypersensitivity to medication, active hepatic disease, active peptic ulcer, increased unexplained transaminases, arterial hemorrhage. Secondary causes for hypercholesterolemia should be looked at and treated appropriately prior to initiation of medication Disease-related precautions: use in caution with unstable angina or myocardial infarction, diabetes (may increase glucose, monitor blood glucose), gallbladder disease (may exacerbate), gout, hepatic impairment, and heavy alcohol ingestion, and renal impairment Drug to drug interactions: use caution with patients taking anticoagulants

		CoA reductase inhibitors), laryngismus, vesiculobullous rash (LexiComp, 2013)	(may increase prothrombin time), HMG-CoA reductase inhibitors (rare cases may cause rhabdomyolysis during concomitant use) (LexiComp, 2013)
Selective Cholesterol Absorption Inhibitors (Ezetimibe) Ezetimibe 10mg (30): $145.99 (LexiComp, 2013)	*Pharmacodynamics:* The brush border of the small intestine inhibits absorption of cholesterol by a sterol transporter leading to decreased hepatic cholesterol stores and increased clearance of blood cholesterol. Decreases total cholesterol, triglycerides, LDL, while increasing HDL *Pharmacokinetics:* Metabolism: glucuronide conjugation in liver and small intestine; forms active metabolite Protein binding: >90% to plasma proteins Bioavailability: variable Half-life elimination: 22 hours Time to plasma peak concentration: 4-12 hours Excretion: mostly in feces, some in urine (LexiComp, 2013)	*Side effects:* Common: fatigue, diarrhea, arthralgia, URIs, sinusitis, Rare: anaphylaxis, abdominal pain, angioedema, autoimmune hepatitis, increased CPK, depression, erythema multiforme, dizziness, headache, myalgia, nausea, pancreatitis, paresthesia, rash, rhabdomyolysis, thrombocytopenia (LexiComp, 2013)	*Contraindications:* Hypersensitivity to drug, hepatic disease patient's on HMG-CoA reductase inhibitor, unexplained elevated serum transaminases Disease-related precautions: prior to initiation, patient's should be started on cholesterol lowering diet for 6 weeks and then continued. Drug to drug interactions: cyclosporine and fibric acid derivatives may increase levels and effects of drug (LexiComp, 2013)
Omega-3-Acid Ethyl	*Pharmacodynamics:*	*Side effects:*	*Contraindications:*

Esters (Lovaza) Lovaza 1g (120): $190.99 (LexiComp, 2013)	Possible actions include; hepatic synthesis reduction of triglycerides, an increase in lipoprotein lipase activity, and inhibiting acetyl CoA. *Pharmacokinetics:* unknown (LexiComp, 2013)	Common: increased liver enzymes (ALT, AST), pruritus, rash Rare: anaphylaxis, arrhythmia, asthma, bleeding, epistaxis, gastritis, fever, hypertension, melena, vasodilation, sudden death (LexiComp, 2013)	Fish allergy Avoid alcohol use Disease-related precautions: rule out depression with flu like symptoms Drug to drug interactions: Beta blockers may reduce effectiveness, SSRIs may produce additive effects with concomitant use (LexiComp, 2013)

IV. Effective Drug Classification: HMG-CoA Reductase Inhibitors

Drug Name	Efficacy	Safety	Suitability	Cost
Atorvastatin (Lipitor) (LexiComp, 2013)	*Pharmacodynamics:* Inhibits 3-hydroxyl-3-methylglutaryl-coenzyme A reductase. This halts the rate limiting step in cholesterol biosynthesis resulting in LDL catabolism. *Pharmacokinetics:* Onset of action: 3-5 days, max reduction of cholesterol and triglycerides 2 weeks Absorption: rapid Distribution: Vd: 381 L Protein binding: >98% Metabolism: hepatic Bioavailability: 14% Half-life elimination: 14	*Drug interactions:* Avoid concomitant use with bosutinib, cyclosporine, gemfibrozil, pimozide, fusidic acid, posaconazole, red yeast rice, silodosin, telaprevir, tipranavir, vincristine May increase levels of: aliskiren aripipazole, bosutinip, daptomycin, digoxin everolimus, diltiazem ketoconazole, midazolam,	*Patient education:* Take with or without food. Avoid grapefruit juice, and excessive alcohol ingestion. Report unusual muscle cramps or weakness, jaundice, easy ecchymosis or bleeding, and unusual fatigue Monitor: Baseline liver function panel, CPK levels, renal panel, total cholesterol, HDL, LDL, triglycerides. Follow up with repeat lab values	Atorvastatin 10mg (30): $99.99 20mg (30): $129.99 40mg (30): $129.99 80mg (30): $129.99 Lipitor 10mg (30): $119.99 20mg (30): $164.99 (LexiComp, 2013)

	hours Time to serum peak concentration: 1-2 hours Excretion: bile and urine	lomitapide, pimozide, silodosin, verapamil prucalopride, vincristine Atorvastatin may be increased by: amiodarone, colchicine, cyclosporine, CYP3A4 inhibitors (strong and moderate), danazol, diltiazem, fenofibrate, fluconazole, gemfibrozil, grapefruit juice, Itraconazole, ketoconazole, macrolide antibiotics, niacin, protease inhibitors, quinine, red yeast rice, sildenafil, verapamil, voriconazole May decrease the levels of: dabigatran etexilate, lanthanum Drugs that may decrease atorvastatin: antacids, bile acid sequestrants, bosentan, CYP3A4	(total cholesterol, HDL, LDL, triglycerides) 6 to 8 weeks after initiation of therapy to determine improvement or adjustment in dose needed. Follow up with all other lab values previously obtained at baseline if symptomology warrants. (LexiComp, 2013)	

		inducers (strong), deferasirox, fosphenytoin, phenytoin, rifamycin derivatives, St. Johns wort (LexiComp, 2013)		
Fluvastatin (Lescol) (LexiComp, 2013)	*Pharmacodynamics:* Competitively inhibits 3-hydroxyl-3-methylglutaryl-coenzyme A reductase. This halts the rate limiting step in cholesterol biosynthesis resulting in increased HDL and decreased total cholesterol, LDL and VLDL. *Pharmacokinetics:* Onset of action: maximum LDL reduction occurs within 4 weeks Distribution: Vd: 0.35 L/kg Protein binding: >98% Metabolism: oxidative metabolism via CYP2C9 to inactive and active metabolites. Extensive first-pass hepatic extraction. Bioavailability: 24% Half-life elimination: <3 hours for capsule. 9	*Drug interactions:* Avoid concomitant use with fusidic acid, gemfibrozil, pimozide, and red yeast rice <u>may increase levels of:</u> carvedilol, CYP2C9 substrates, daptomycin, lomitapide, pazopanib, trabectedin, and vitamin K antagonists <u>Fluvastatin levels may be increased by:</u> amiodarone, colchicine, cycolosporine, cyproterone, fenofibrate, fenofibric acid, fluconazole, fusidic acid, gemfibrozil, mifepristone, niacin, and red yeast rice. <u>Fluvastatin may</u>	*Patient education:* Take with or without food. Avoid excessive alcohol ingestion. Report unusual muscle cramps, weakness, and fatigue, jaundice, and easy ecchymosis or bleeding. <u>Monitor:</u> Baseline liver function panel, CPK levels, renal panel, total cholesterol, HDL, LDL, triglycerides. Follow up with repeat lab values (total cholesterol, HDL, LDL, triglycerides) 6 to 8 weeks after initiation of therapy to determine improvement or adjustment in dose needed.	Lescol 20mg (30): $117.59 40mg (30): $109.19 Lescol XL 80mg (30): $145.99 (LexiComp, 2013)

	hours for extended release Time to serum peak concentration: 1 hour, 3 hours for extended release Excretion: 90% feces, 5% urine (LexiComp, 2013)	decrease the levels of: lanthanum Drugs that may decrease fluvastatin: antacids, cholestyramin resin, etravirine, fosphenytoin, phenytoin, rifamycin derivatives (LexiComp, 2013)	Follow up with all other lab values previously obtained at baseline if symptomology warrants. (LexiComp, 2013)	
Pitavastatin (Livalo) (LexiComp, 2013)	*Pharmacodynamics:* Competitively inhibits 3-hydroxyl-3-methylglutaryl-coenzyme A reductase. This halts the rate limiting step in cholesterol biosynthesis resulting in LDL catabolism. *Pharmacokinetics:* Distribution: Vd: 148L Protein binding: >99% Metabolism: Hepatic via UGT1A3 and UGT2B7; minimal via CYP2C9 and CYP2C8 Bioavailability: 51% Half-life elimination: 12 hours Time to serum peak concentration: 1 hour Excretion: 79%	*Drug interactions:* Avoid concomitant use with cyclosporine, fusidic acid, gemfibrozil and red yeast rice. May increase levels of: daptomycin, pazopanib, trabectedin, and vitamin K antagonists. Drugs may increase levels of ptiavastatin: atazanavir, colchicine, cyclosporine, bezafibrate, danazol, fenofibrate, fenofibric acid, fusidic acid, gemfibrozil, macrolide antibiotics, niacin, red yeast	*Patient education:* Take with or without food. Avoid excessive alcohol ingestion. Report unusual muscle cramps, fatigue, and weakness, jaundice, and easy bruising or bleeding. Monitor: Baseline liver function panel, CPK levels, renal panel, total cholesterol, HDL, LDL, triglycerides. Follow up with repeat lab values (total cholesterol, HDL, LDL, triglycerides) 6 to 8 weeks after initiation of	Pitavastatin 2mg (30): $141.99 (LexiComp, 2013)

	feces, 15% urine (LexiComp, 2013)	rice, sildenafil, and rifamycin derivatives. <u>May decrease the levels of:</u> lanthanam <u>Drugs that may decrease levels of pitavastatin:</u> Antacids, St. Johns wort, and bosentan (LexiComp, 2013)	therapy to determine improvement or adjustment in dose needed. Follow up with all other lab values previously obtained at baseline if symptomology warrants. (LexiComp, 2013)	
Lovastatin (Mevacor) (LexiComp, 2013)	*Pharmacodynamics:* Inhibits 3-hydroxyl-3-methylglutaryl-coenzyme A reductase. This halts the rate limiting step in cholesterol biosynthesis *Pharmacokinetics:* <u>Onset of action:</u> 3 days for LDL reduction <u>Absorption:</u> 30% <u>Protein binding:</u> >95% <u>Metabolism:</u> extensive first pass effect, hepatic <u>Bioavailability:</u> Increased with extended release tablets <u>Half-life elimination:</u> 1-1.7 hours <u>Time to serum peak concentration:</u> 2-4 hours for immediate release, 12-14 hours for extended release <u>Excretion:</u> mainly in	*Drug interactions:* Avoid concomitant use with cyclosporine, CYP3A4 inhibitors (erythromycin), fusidic acid, gemfibrozil, lomitapide, mifepristone, pimozide, protease inhibitors, red yeast rice, telaprevir <u>may increase levels of:</u> ariprizole, daptomycin, diltiazem, pazopanip, trabectedin, vitamin K antagonists, pimozide <u>Drugs that may increase levels of Lovastatin:</u>	*Patient education:* Take with food in the evening. Avoid excessive alcohol ingestion. Report unusual muscle cramps or weakness, jaundice of skin or sclera, unusual ecchymosis, and unusual fatigue. <u>Monitor:</u> baseline liver function panel, CPK levels, renal panel, total cholesterol, HDL, LDL, triglycerides. Follow up with repeat lab values (total cholesterol, HDL, LDL, triglycerides) 6 to 8 weeks after	Altoprev 20mg (30): $399.98 Lovastatin 10mg (45): $47.99 20mg (30): $22.99 40mg (30): $35.99 Mevacor 40mg (30): $146.00 (LexiComp, 2013)

	feces, some in urine (LexiComp, 2013)	amiodarone, colchicine, cyclosporine, CYP3A4 inhibitors (moderate and strong), cyproterone, danazole, diltiazem, erythromycin, fenofibrate, fluconazole, fusidic acid, gemfibrozil, grapefruit juice, lomitapide, macrolide antibiotics, niacin, protease inhibitors, quinine, red yeast rice, sildenafil, telaprevir, verapamil May decrease the levels of: lanthanum Drugs that may decrease Lovastatin: antacids, bosentan, CYP3A4 inducers (strong), deferasirox, etravirine, fosphenytoin, phenytoin, rifamycin derivatives, St. Johns wort, tocilizumab (LexiComp,	initiation of therapy to determine improvement or adjustment in dose needed. Follow up with all other lab values previously obtained at baseline if symptomology warrants. (LexiComp, 2013)	

		2013)		
Pravastatin (Pravachol) (LexiComp, 2013)	*Pharmacodynamics:* Competitively inhibits 3-hydroxyl-3-methylglutaryl-coenzyme A reductase. This halts the rate limiting step in cholesterol biosynthesis. *Pharmacokinetics:* Onset of action: several days Absorption: rapidly absorbed; average 34% Protein binding: 50% Metabolism: Hepatic multiple metabolites Bioavailability: 17% Half-life elimination: 77 hours Time to serum peak concentration: 1-1.5 hours Excretion: 70% feces, 20% urine (LexiComp, 2013)	*Drug interactions:* Avoid concomitant use with fusidic acid, gemfibrozil, pimozide, and red yeast rice May increase levels of: aripiprazole, cyclosporine, lomitapide, daptomycin, pimozide, paroxetine, and vitamin K antagonists Drugs that may increase levels of pravastatin: bezafibrate, cyclosporine, colchicine, boceprevir, darunavir, fenofibrate, fenofibric acid, gemfibrozil, Itraconazole, niacin, and red yeast rice May decrease the levels of: lanthanum Drugs that may decrease pravastatin: bile acid sequestrants, fosphenytoin, efavirenz, phenytoin, rifamycin	*Patient education:* Take medication at the same time each day. Take with or without food. Avoid excessive alcohol ingestion. Report unusual muscle cramps, fatigue and weakness, jaundice and easy ecchymosis or bleeding. Monitor: Baseline liver function panel, CPK levels, renal panel, total cholesterol, HDL, LDL, triglycerides. Follow up with repeat lab values (total cholesterol, HDL, LDL, triglycerides) 6 to 8 weeks after initiation of therapy to determine improvement or adjustment in dose needed. Follow up with all other lab values previously obtained at baseline if	Pravachol 10mg (30): $139.99 20mg (30): $121.99 40mg (30): $172.99 80mg (30): $191.66 Pravastatin sodium 10mg (30): $18.99 20mg (30): $27.99 40mg (30): $25.99 80mg (30): $119.99 (LexiComp, 2013)

		derivatives, and saquinavir (LexiComp, 2013)	symptomology warrants. (LexiComp, 2013)	
Rosuvastatin (Crestor) (LexiComp, 2013)	*Pharmacodynamics:* Competitively inhibits 3-hydroxyl-3-methylglutaryl-coenzyme A reductase. This halts the rate limiting step in cholesterol biosynthesis resulting in compensatory stimulation of LDL catabolism. *Pharmacokinetics:* Onset of action: 1 to 4 weeks Distribution: Vd: 134L Protein binding: 88% Metabolism: Hepatic and via CYP2C9 Bioavailability: 20%. High first-pass extraction from liver (Asian patients have noted to have an increased bioavailability) Half-life elimination: 19 hours Time to serum peak concentration: 3-5 hours Excretion: 90% in feces (LexiComp, 2013)	*Drug interactions:* Avoid concomitant use with fusidic acid, gemfibrozil, and red yeast rice May increase levels of: daptomycin, pazopanib, trabectedin, and vitamin K antagonists. Drugs that may cause increased levels of rosuvastatin: bezafibrate, amiodarone, colchicine, cyclosporine, dronedarone, fenofibrate, fenofibric acid, fusidic acid, gemfibrozil, Itraconazole, niacin, protease inhibitors, and red yeast rice. May decrease the levels of: lanthanum Drugs that may decrease levels of rosuvastatin: antacids (LexiComp, 2013)	*Patient education:* Take medication at the same time each day, with or without food. Avoid excessive alcohol ingestion. Report unusual muscle cramps, fatigue, and weakness, jaundice, easy ecchymosis, and bleeding. Monitor: Baseline liver function panel, CPK levels, renal panel, total cholesterol, HDL, LDL, triglycerides. Follow up with repeat lab values (total cholesterol, HDL, LDL, triglycerides) 6 to 8 weeks after initiation of therapy to determine improvement or adjustment in dose needed. Follow up with all other lab values previously	Crestor 5mg (30): $154.99 10mg (30): $154.99 20mg (30): $155.98 40mg (30): $155.98 (LexiComp, 2013)

			obtained at baseline if symptomology warrants. (LexiComp, 2013)	
Simvastatin (Zocor) (LexiComp, 2013)	*Pharmacodynamics:* Competitively inhibits 3-hydroxyl-3-methylglutaryl-coenzyme A reductase. Methylated derivative of lovastatin. Catalyzes the rate limiting step in cholesterol synthesis. *Pharmacokinetics:* Onset of action: > 3 days. Peak effect: 2 weeks Absorption: 85% Protein binding: 95% Metabolism: Hepatic via CYP3A4. Extensive first-pass effect Bioavailability: <5% Half-life elimination: unknown Time to serum peak concentration: 1.3-2.4 hours Excretion: 60% feces, 13% urine (LexiComp, 2013)	*Drug interactions:* Avoid concomitant use with boceprevir, cyclosporine, CYP3A4 inhibitors (strong), erythromycin, fusidic acid, gemfibrozil, protease inhibitors, mifepristone, red yeast rice, and telaprevir. May increase levels of: aripiprazole, daptomycin, diltiazem, vitamin K antagonists, and trabectedin. Drugs that may increase levels of simvastatin: amlodipine, amiodarone, boceprevir, colchicine, cyclosporine, CYP3A4 inhibitors (strong and moderate), cyproterone, danazol, diltiazem,	*Patient education:* Take at the same time each day in the evening. Take with or without food. Avoid grapefruit juice, green tea, and excessive alcohol ingestion. Report unusual muscle cramps, fatigue and weakness, jaundice, easy ecchymosis or bleeding. Monitor: Baseline liver function panel, CPK levels, renal panel, total cholesterol, HDL, LDL, triglycerides. Follow up with repeat lab values (total cholesterol, HDL, LDL, triglycerides) 6 to 8 weeks after initiation of therapy to determine improvement or adjustment in	Simvastatin 5mg (30): $17.99 10mg (30): $19.99 20mg (30): $27.99 40mg (30): $27.99 80mg (30): $35.99 Zocor 5mg (30): $77.30 10mg (30): $100.99 20mg (30): $173.99 40mg (90): $465.99 80mg (30): $178.99 (LexiComp, 2013)

		fenofibric acid, fluconazole, fusidic acid, gemfibrozil, grapefruit juice, green tea, ivacaftor, lomitampide, macrolide antibiotics, niacin, niacinamide, protease inhibitors, red yeast rice, quinine, sildenafil, telaprevir, and verapamil <u>May decrease the levels of:</u> lanthanum <u>Drugs that may decrease levels of simvastatin:</u> bosentan, CYP3A4 inducers (strong), deferasirox, etravirine, fosphenytoin, phenytoin, rifamycin derivatives, St. Johns wort, and tocilizumab (LexiComp, 2013)	dose needed. Follow up with all other lab values previously obtained at baseline if symptomology warrants. (LexiComp, 2013)	

V. Drug of Choice: Atorvastatin (Lipitor)

The drug of choice for treatment of hyperlipidemia in a patient who is post myocardial infarction is atorvastatin. A recent study compared atorvastatin versus pravastatin in a

randomized control trial. At the two year follow up results revealed the patients taking atorvastatin had a 16% reduction in progression of CVD (Blaha, Ketlogetswe, Nudmele, Gluckman, & Blumenthal, 2011). Another study revealed better lowering of LDL-C with atorvastatin compared with simvastatin (The Medical Letter, 2011). Efficacy of atorvastatin in a systematic review revealed LDL-C levels were lowered between 36-53% depending on dosage (Adams, Tsang, & Wright, 2012). Secondary prevention of CVD is the primary goal by lowering lipid levels with HMG CoA reductase inhibitors.

Atorvastatin 80mg by mouth daily is the ordering dose as secondary prevention of major cardiovascular events. High dose statin therapy decreases progression of CVD (The Medical Letter, 2011). A renal panel, liver function panel, CPK level and a lipid profile are all baseline labs that need to be obtained prior to initiation of therapy. Discharge teaching should include lifestyle modifications; low carbohydrate diet, exercise regimen, and avoidance of risk factors such as smoking, and alcohol. Also, it is important to instruct him to report symptoms of unusual muscle cramps, fatigue or weakness, jaundice, and bruising or bleeding easily (LexiComp, 2013). After the patient is discharged from the hospital follow up is necessary within four to six weeks to determine if the treatment is effective. An APN with a current CTP has the authority to prescribe HMG-CoA reductase inhibitors in the state of Ohio (Ohio Board of Nursing, 2013).

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