**Clinical Case Segment December 2015 StuNews**

**Reviewed by the 2015 ACP Clinical Pharmacy Challenge Exam Panel**

Vignette: A 67 year-old man is admitted to the coronary care unit for an episode of acute decompensated heart failure. He notes progressively increased dyspnea on exertion, orthopnea (now needs 4 pillows at night to sleep), swollen legs (3+ edema) and a 15 pound weight gain in the past 3 weeks. He reports eating at McDonald’s “a lot” lately since his wife has been visiting relatives out of state for the past month. He states he is adherent to his medications. He has been stable on his current medication regimen for the past 6 months.

Past Medical History: Idiopathic dilated cardiomyopathy (left ventricular ejection fraction = 25%), hypertension, and dyslipidemia.

Social History: (-) alcohol; (-) tobacco; (-) intravenous drug use

Current Medications:

Ramipril 10 mg orally once daily;

Carvedilol 25 mg orally twice daily;

Furosemide 60 mg orally twice daily;

Atorvastatin 20 mg orally once daily;

Digoxin 0.125 mg orally once daily

Allergies: No known drug allergies

Vital Signs: Blood pressure 115/75 mmHg; heart rate 85 beats/minute; Respiratory rate 25 breaths/minute; temperature 37°C (98.7°F); Height 68 inches (173 cm); Weight 82 kg (dry weight 77 kg)

Lab Values: Na 128 mEq/L (SI 128 mmol/L); K 4.9 mEq/L (SI 4.9 mmol/L); Cl 102 mEq/L (SI 102 mmol/L); CO2 24 mEq/L (SI 24 mmol/L); BUN 15 mg/dL (5.36 mmol/L); SCr 1.1 mg/dl (97.24 micromoles/L); BNP 2300 pg/mL; Troponin-I 0.1 ng/mL (SI 0.1 mcg/L); digoxin 0.8 ng/mL (SI 1.02 nmol/L)

Procedure Data: Chest radiograph: Small effusion in left lower lobe

Electrocardiogram: sinus tachycardia; no ST-segment abnormalities

Other Data: Significant findings on physical examination- (+) Jugular venous distension (JVD); scattered crackles in both lung fields; (+) S3; 3+ pedal edema; Alert and oriented x3

**Question 1= 100 points**

In which hemodynamic subset should this patient’s heart failure be classified?

1. Cold and dry
2. Cold and wet
3. Warm and dry
4. Warm and wet

Answer: 4. Warm and wet

Rationale: This patient has no signs of hypoperfusion to his vital organs (i.e. renal impairment, cognitive impairment, hepatomegaly); therefore, he would be considered to be warm (vs. cold). He does have signs/symptoms of volume overload, including pulmonary and peripheral edema; therefore, he would be considered wet (vs. dry). Therefore, Answer 4 is correct.

Citation: Nohria A, Tsang SW, Fang JC, et al. Clinical assessment identifies hemodynamic profiles that predict outcomes in patients admitted with heart failure. J Am Coll Cardiol 2003;41:1797-804.

**Question 2- 200 points**

What is the **most** appropriate initial dose of furosemide to administer to this patient?

1. 10 mg/hour continuous infusion
2. 40 mg intravenously
3. 80 mg intravenously
4. 120 mg orally

Answer: 3. 80 mg intravenously

Rationale: If patients with acute heart failure are already receiving loop diuretic therapy, the initial intravenous dose should equal or exceed their chronic oral daily dose. This patient was taking 120 mg/day of oral furosemide. An equivalent dose of intravenous furosemide would be 60 mg daily. Therefore, the initial intravenous dose of furosemide should be at least 60 mg , making the 80mg intravenous option the best choice (Option 3 is correct). A continuous infusion of furosemide (Option 1) should be reserved for patients who do not respond to intermittent bolus therapy. Giving an intravenous dose of 40 mg of furosemide would be less than what he was taking on an outpatient basis; therefore, Option 2 is incorrect. Patients with acute heart failure should initially be treated with intravenous loop diuretic therapy due to increased mucosal edema and decreased intestinal perfusion; drug delivery to the kidney is reduced when given orally in these patients. Thus intravenous therapy is recommended (Option 4 is incorrect).

Citation: Yancy CW, Jessup M, Bozkurt B, et al. 2013 ACCF/AHA guideline for the management of heart failure: a report of the American College of Cardiology Foundation/American Heart Association Task Force on Practice Guidelines. J Am Coll Cardiol 2013;62:e147-239.

**Question 3- 200 points**

What other changes to the medication regimen are appropriate at this time?

1. Discontinue the digoxin since his serum concentrations are supratherapeutic.
2. Discontinue the carvedilol since this medication is contributing to his worsening heart failure symptoms.
3. Initiate enoxaparin 30 mg subcutaneously twice daily for venous thromboembolism prophylaxis.
4. Initiate nitroglycerin intravenous infusion to reduce preload.

Answer: 4. Initiate nitroglycerin intravenous infusion to reduce preload.

Rationale: Nitroglycerin (Answer 4) is one of the venous vasodilators that could be used in a "wet" patient with acute heart failure to further reduce preload. Intravenous nesiritide is also appropriate options for this patient. The target digoxin concentration in patients with heart failure is 0.5 - 0.9 ng/mL (SI 0.64-1.15 nmol/L). This patient's digoxin concentration is therapeutic; therefore, the digoxin should be continued. Discontinuing digoxin therapy could cause further worsening heart failure symptoms (Option 1 is incorrect). This patient has been stable on his heart failure medication regimen for the past 6 months. Therefore, his worsening heart failure symptoms are not due to the beta-blocker therapy. The carvedilol should be continued. Abrupt discontinuation of the beta-blocker therapy could cause worsening of his heart failure symptoms (Option 2 is incorrect). Patients with acute heart failure should receive venous thromboembolism prophylaxis. The dose of enoxoparin for this purpose should be 40 mg subcutaneously once daily; the dose of 30 mg subcutaneously twice daily is for patients who have undergone hip or knee replacement (Option 3 is incorrect).

Citation: Yancy CW, Jessup M, Bozkurt B, et al. 2013 ACCF/AHA guideline for the management of heart failure: a report of the American College of Cardiology Foundation/American Heart Association Task Force on Practice Guidelines. J Am Coll Cardiol 2013;62:e147-239.

**Question 4- 300 points**

The next morning during rounds, the patient begins complaining of chest pain and shortness of breath. His vitals are blood pressure 80/50 mmHg, heart rate 180 beats/minute. The ECG reveals a regular, narrow-complex tachycardia (QRS <120 milliseconds). Which treatment is most appropriate for this patient?

1. Adenosine 6 mg intravenous push
2. Amiodarone 300 mg intravenous push
3. Epinephrine 1 mg intravenous push
4. Synchronized cardioversion 100 joules

Answer: 4. Synchronized cardioversion 100 joules

Rationale: This patient is likely experiencing a supraventricular tachycardia. However, because he is experiencing chest pain and hypotension, the most appropriate treatment as recommended by the ACLS guidelines, would be immediate synchronized cardioversion to terminate the arrhythmia (Answer 4). If this patient were hemodynamically stable, adenosine would be the preferred treatment approach (Answer 1). Both amiodarone 300 mg via intravenous push (Answer 2) and epinephrine (Answer 3) are therapies used for pulseless ventricular tachycardia or ventricular fibrillation. This patient has a pulse; therefore, these answers are incorrect.

Citation: Neumar RW, Otto CW, Link MS, et al. Part 8: adult advanced cardiovascular life support: 2010 American Heart Association Guidelines for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care. Circulation 2010;122(suppl 3):S729-S767.

**Question 5- 300 points**

The patient’s tachycardia is successfully terminated and his acute heart failure improves over the next 3 days. He now has 1+ lower extremity edema and crackles in both lung bases. Vital signs are: blood pressure 110/75 mmHg, heart rate 82 beats/minute. Pertinent labs are: K 4.2 mEq/L (SI 4.2 mmol/L), digoxin 0.8 ng/mL (SI 1.02 nmol/L), calculated creatinine clearance 46 mL/min (SI 0.77 mL/s). Which would be the most appropriate change to make to this patient’s drug regimen at this time?

1. Add isosorbide mononitrate 30 mg orally once daily
2. Add spironolactone 12.5 mg orally once daily
3. Increase carvedilol to 50 mg orally twice daily
4. Increase ramipril to 20 mg orally once daily

Answer: 2. Add spironolactone 12.5 mg orally once daily

Rationale: Aldosterone receptor antagonists are recommended in patients with New York Heart Association class II–IV heart failure and a left ventricular ejection fraction of 35% or less, unless contraindicated, to reduce morbidity and mortality. This patient's creatinine clearance is greater than 30 mL/min (SI 0.50 mL/s) and he does not have hyperkalemia. Therefore, adding spironolactone would be the most appropriate option for this patient (Answer 2). Combination hydralazine and isosorbide dinitrate therapy is recommended to reduce morbidity and mortality for black patients with New York Heart Association class III–IV heart failure with reduced ejection fraction who are receiving optimal therapy with angiotensin-converting enzyme inhibitors and beta blockers, unless contraindicated. These drugs are to be used in combination and not individually as monotherapy; therefore, Answer 1 is incorrect. This patient's carvedilol and ramipril are both at target doses; therefore, no additional benefit will be derived by increasing the doses of either of these medications (Answers 3 and 4).

Citation: Yancy CW, Jessup M, Bozkurt B, et al. 2013 ACCF/AHA guideline for the management of heart failure: a report of the American College of Cardiology Foundation/American Heart Association Task Force on Practice Guidelines. J Am Coll Cardiol 2013;62:e147-239.