Question 1: Cardiovascular Disasters in Pregnancy

A 39-year-old patient presents at the beginning of her third trimester of pregnancy with complaints of pedal edema, fatigue, and shortness of breath that is more pronounced than during her 2 previous pregnancies. She also has intermittent chest pain and palpitations. She has no other medical history and is not obese.

Her troponin level and findings on electrocardiography are all normal. Her brain natriuretic peptide (BNP) level is 120 pg/mL. How should this BNP level be interpreted in this patient?

- The level is diagnostic of decompensated cardiomyopathy.  
- The level is associated with an increased risk for an adverse cardiac event with a poor outcome.  
- The level is diagnostic of New York Heart Association (NYHA) class IV congestive heart failure.  
- The level is normal for a third trimester pregnancy.

Remediation:
BNP is a convenient marker of congestive heart failure because an overworked heart will secrete increased amounts. However, BNP also naturally doubles during normal pregnancy. When a pregnant patient presents with cardiovascular symptoms (such as the above patient), physicians must be able to interpret BNP values in the context of pregnancy.

Diagnosing Congestive Heart Failure:
In pregnant patients, a BNP value below 100 pg/mL excludes a diagnosis of decompensated heart failure. Values between 100 pg/mL and 300 pg/mL indicate potential cardiac disease, whereas values above 300 pg/mL indicate the definite presence of congestive heart failure.
Increased Risk for Sudden Cardiac Event with Poor Outcome:
One study showed that a BNP value above 100 pg/mL is not only a predictor of cardiomyopathy in pregnancy and, more importantly, a sensitive (but not specific) predictor of sudden a cardiac event with a poor outcome, especially if overt left ventricular dysfunction is already present.

Other Approaches:
The NYHA heart failure classification system is as follows (note that it does NOT utilize BNP levels):

- **Grade I** = Patients with cardiac disease but resulting in no limitation of physical activity. Ordinary physical activity does not cause undue fatigue, palpitation, dyspnea, or anginal pain.
- **Grade II** = Patients with cardiac disease resulting in slight limitation of physical activity. They are comfortable at rest. Ordinary physical activity results in fatigue, palpitation, dyspnea, or anginal pain.
- **Grade III** = Patients with cardiac disease resulting in marked limitation of physical activity. They are comfortable at rest. Less than ordinary activity causes fatigue, palpitation, dyspnea, or anginal pain.
- **Grade IV** = Patients with cardiac disease resulting in inability to carry on any physical activity without discomfort. Symptoms of heart failure or the anginal syndrome may be present even at rest. If any physical activity is undertaken, discomfort increases.

Pre-Existing Heart Disease:
In pregnant patients with pre-existing cardiac disease, the following 4 red flags signal an increased risk for sudden cardiac events with poor outcomes:

- Arrhythmia or previous cardiac event (acute coronary syndrome, stroke, transient attack)
- NYHA classes II to IV heart failure or cyanosis
- Left heart obstruction (mitral valve area 2 cm$^2$; aortic valve area < 1.5 cm$^2$; peak left ventricular outflow gradient > 30 mm Hg)
- Ejection fraction < 40%

Caution: pregnant patients with pre-existing cardiac disease, but WITHOUT these 4 red flags, may still be at risk for a cardiac event with rapid deterioration.

Reference:
Question 2: Accidental Hypothermia

A middle-aged man is found under a bridge in the winter. He is shivering and confused, and he has the smell of alcohol on his breath. A prehospital temperature check registers a “low” temperature, which means a temperature lower than 35°C.

How should this patient be managed?

- He should be rewarmed with blankets, warm oral fluids, and heating packs, and released after rewarming to 37°C.
- He should be transported to the hospital for peritoneal rewarming until his core temperature is 35°C.
- He should be transported to the hospital for bladder lavage to prevent after drop core cooling during peripheral rewarming.
- **He should be rewarmed en-route to the hospital with blankets and heating packs and then hospitalized to manage his confusion.**

Remediation:
This patient was shivering, which is a sign that his core temperature was within the range of Swiss stage 1 hyperthermia. Normally, patients with stage 1 hypothermia can be warmed and released in the field; however, if confounding factors are present, then they should be transported to a hospital for treatment of these other factors.

Patients with stage I hypothermia are expected to be alert; however, this patient is confused, which is a sign of confounding factors being present (in this case, alcohol intoxication, trauma?). At a minimum, this patient is at risk for re-exposure if he were to be released in the field after rewarming, so he cannot be released in the field.

In the field, the Swiss staging system for hypothermia is more effective than measuring core temperature:

- Stage I: Conscious patient, shivering, corresponds to a core temperature of 32 - 35°C
- Stage II: Impaired consciousness, no shivering, corresponds to a core temperature of 28 - 32°C
- Stage III: Unconscious patient, corresponds to a core temperature of 24 - 28°C
- Stage IV: No vital signs, corresponds to a core temperature of < 24°C

Cardiac instability becomes significant in patients with a core temperature equal to or less than 28°C.

In general, patients with hypothermia require less aggressive rewarming than once thought. Body cavity lavage is indicated in patients with hypothermia and cardiac arrest when extracorporeal membrane oxygenation or cardiopulmonary bypass is unavailable.

Reference:
Question 3: Collagen Vascular/Immune Complex Disorders

A 57-year-old man presents with low-grade fever, malaise, fatigue, anorexia with a 10-lb weight loss, myalgia, and arthralgia of the large joints that has been progressively worsening for 4-5 weeks. Over the last 1-2 weeks, he has noted nonspecific abdominal discomfort, peripheral numbness, and flank pain. Most concerning to the patient is a foot ulcer (see image), which has developed during this 1-2-week period.

In addition to the ulcer, the examination is significant for hypertension. Polyarteritis nodosa (PAN) is strongly suspected. You perform the appropriate diagnostic testing and initiate treatment. Which of the following statements is likely to be TRUE if the diagnosis is correct?

- Immunofluorescence studies are likely to be negative for antineutrophil cytoplasmic antibodies (ANCAs).
- Little treatment is necessary because this is likely to be a short illness with a self-limited course.
- Biopsy results will show this to be a necrotizing inflammation of small- or medium-sized arteries without glomerulonephritis or vasculitis in the arterioles, capillaries, or venules.
- Treatment with steroids and cyclophosphamide should be started immediately regardless of underlying etiologies.
- Joint aspirates are highly likely to show crystal formation and inflammatory leucocytosis.
Remediation:
PAN is a systemic necrotizing vasculitis that can cause multiorgan damage and destruction throughout the body. The arterial damage begins preferentially at bifurcations, causing microaneurysms that rupture, thrombose, and lead to distal ischemic changes. Cutaneous manifestations of PAN reflect the necrotizing inflammatory processes in small- and medium-sized arteries.

ANCA immunofluorescence is very often positive.

Biopsy results will show this to be a necrotizing inflammation of small- or medium-sized arteries without glomerulonephritis or vasculitis in arterioles, capillaries, or venules, which separates PAN from microscopic polyangiitis.

The untreated illness is usually fatal. Current treatment includes steroids and cyclophosphamide, except in cases triggered by hepatitis B (viral replication may increase during steroid treatment). Antivirals may need to be added to the treatment regimen in selected cases.

References:

Question 4: Selected Oncologic Emergencies

A 57-year-old woman with a 4-year history of metastatic breast cancer was found by her family to be very lethargic and sleepy. She had previously been acting strangely and complaining of nausea, constipation, abdominal pain, and constant thirst. Which of the following statements is CORRECT, given her most likely diagnosis?

- It occurs only in the presence of bone metastases.
- **Even in cancer patient, it may be caused by benign conditions such as hyperparathyroidism and Paget’s disease.**
- Hyperkalemia is also present in 50% of patients.
- **Electrocardiogram shows a prolonged QT interval.**

**Remediation:**
Hypercalcemia is a complication of malignancies that occurs in about 20% of cancer patients. It can occur in the absence of bony metastases and may be a reaction to various substances such as prostaglandins, native parathyroid hormone, and steroids. The most common cause, however, is production of parathyroid hormone related protein (PTHrP) by the tumor in patients with advanced disease. Benign causes are also possible, even in a cancer patient, and should be pursued during the first episode of hypercalcemia.

With acute onset, patients may be comatose, with calcium levels of only 12 to 13 mg/dL. Signs and symptoms include marked central nervous system effects leading to personality changes, lethargy, and eventual coma. Patients may also develop anorexia, nausea, vomiting, constipation, polyuria, polydipsia, and abdominal pain. Electrocardiogram shows shortened QT interval.

Half of hypercalcemic cancer patients also have hypokalemia (not hyperkalemia) before therapy and should receive potassium replacement.

**Reference:**
Marx: Rosen’s Emergency Medicine, 7th ed. Chapter 121: Selected Oncologic Emergencies