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## Superior Vena Cava Endocarditis in a Patient with Anterior Chest Wall Tunneled Catheter for Hemodialysis

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### Abstract

**Background**—Healthcare related bacterial endocarditis represents a significant portion of endocarditis seen today. Suspicion for these infections should be particularly high in patients with chronic indwelling central venous catheters, and most notably, in patients with hemodialysis catheters. These infections may have a predilection for the superior vena cava due to proximity of the catheters to the great veins of the neck. Transthoracic echocardiography and/or trans-esophageal echocardiography should be done promptly in patients in which there a high suspicion for such infections, in order to identify these lesions, and guide appropriate management with either antibiotics or surgical intervention.

**Case presentation**—We present a 59-year-old female with multiple comorbidities including diabetes mellitus and end-stage renal disease requiring dialysis via an anterior chest wall catheter, who presented with fever, chills, and abdominal pain. She was found to have pus in and around her catheter. Further evaluation with trans-esophageal echocardiography revealed the presence of a superior vena cava vegetation extending into the right atrium. She received a 6 week course of appropriate antibiotics with repeat trans-esophageal echocardiography showing a significant reduction in the size of the vegetation. Patient remained afebrile, and without leukocytosis and negative blood cultures for the remainder of her hospital stay.

### Keywords

superior vena cava endocarditis; catheter related endocarditis

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## 1. Introduction

Healthcare related bacterial endocarditis represents about a quarter of all cases of infectious endocarditis<sup>1</sup>. Staphylococcus aureus being the most common causal organism was the single most important factor associated with in-hospital death in these patients. Generally, in cases of bacterial endocarditis whether community acquired or healthcare related, patients with staphylococcus aureus infection had a worse clinical outcome [1].

A common risk factor for healthcare related bacterial endocarditis is the presence of an indwelling central venous catheter. These catheters come with many potential risks, including central venous catheter associated blood stream infections. These infections have been reported to cause about a 12–25% mortality in patients who are critically ill, and have also significantly added to the general healthcare expenditure.

In medical literature to date, there has been relatively few cases reported of bacterial endocarditis of the superior vena cava; and many of these cases have been associated with the presence of a central venous catheter [3,4]. Other cases of right sided healthcare associated endocarditis have been reported, which were also associated with the presence of central venous catheters [5,6].

## 2. Case Presentation

A 59-year-old female presented with 2 days of fever, chills, a non-productive cough, abdominal pain radiating to the back, and right knee. She was brought in from a homeless shelter and has had multiple previous emergency department visits for hypoglycemia. Her medical history includes Diabetes Mellitus on Insulin therapy, End-stage Renal Disease on dialysis via an anterior chest wall catheter, hypertension, and visual impairment secondary to bilateral cataracts. Surgical history is significant for an above the knee amputation on the left, secondary to osteomyelitis. The patient reported noncompliance with her medications including Insulin.

Upon presentation, she was found to have a temperature of 102.9F (39.4C), a heart rate of 127bpm, and a blood pressure of 143/79 mmHg. Physical examination was remarkable for the presence of a left anterior chest wall catheter, swollen right knee and left hip, and the presence of sacral stage II tissue injuries with no obvious signs of infection. The site of the left above the knee amputation was clean. There were no murmurs, rubs, or gallops heard on cardiac exam, and respiratory examination was entirely unremarkable as well. On a laboratory analysis, her total white blood cell count was 15,000/microliter, glucose level was 691mg/dL, bicarbonate 15mEq/dL (with an anion gap of 23), beta-hydroxybutyrate 1.4mmol/L, and troponin was 0.8ng/mL. Blood urea nitrogen and creatinine were elevated in correlation with her end stage renal disease. Potassium and sodium levels were 5.6 and 134 mEq/dL respectively, which were in correlation with her elevated glucose levels. Based on these results and her overall clinical picture, she was started on treatment for diabetic ketoacidosis. Although due to her fever and leukocytosis, a thorough workup was performed to explore potential sources of infection. Her anterior chest wall catheter was examined which revealed a collection of pus in and around the catheter, and crusted over secretions

at the venotomy site. Blood cultures were sent as well. She was treated empirically with cefepime and vancomycin, as we awaited the results of her blood cultures. The left anterior chest wall catheter was removed and the tip was sent for culture. CT scan of the chest showed few small pulmonary nodules in both lung fields, with one containing central air. These may have possibly been due to septic emboli. Blood cultures after 24hrs revealed the growth of gram-positive cocci in clusters which was later identified as methicillin sensitive staphylococcus aureus. Catheter tip also grew the same organism. Patient was started on nafcillin.

The patient also underwent a comprehensive cardiology evaluation, in view of her elevated troponin and EKG findings. Her EKG revealed sinus tachycardia and left ventricular hypertrophy. A transthoracic echocardiography was done which revealed a reduced left ventricular ejection fraction of 44%, no wall motion abnormalities, and an estimated peak pulmonary artery pressure was 40mmHg. No vegetations were seen.

After the patient's diabetic ketoacidosis has resolved, she continued have an elevated temperature and persistent leukocytosis, despite nearly 5 days of antibiotic therapy. Therefore, a trans-esophageal echocardiogram (TEE) was done to further investigate. TEE showed the presence of a large mass measuring at least 20 mm x 10 mm in the distal superior vena cava, with a highly mobile component, 20 mm in length, projecting into the right atrium, suggestive of a vegetation (Figure 1). Infectious diseases was consulted and recommended surgical removal of the mass, although the cardiothoracic surgery team recommended that antibiotics be continued for at least two weeks followed by a repeat trans-esophageal echocardiography, before surgery can be considered. Blood cultures were eventually negative after about 7 days of antibiotics, but her fever and leukocytosis persisted.

During the early in-patient period, patient received a new double-lumen dialysis catheter via the right internal jugular vein which was later removed due to concerns for persistent fever and leukocytosis. She then received several dialysis catheters which were removed as soon as possible after use. She would later receive a new tunneled right groin hemodialysis catheter after her clinical condition improved.

The patient continued to receive nafcillin. After about 14 days of therapy, her leukocytosis resolved, although her fever has persisted. Repeat trans-esophageal echocardiography after about 4 weeks of total nafcillin treatment, showed a reduction in the size of the mass which no longer had a mobile portion projecting into the right atrium. Nafcillin was discontinued after about 6 weeks of use due to concerns for drug induced fever in the presence of negative blood cultures, absence of leukocytosis and improvement of the patient's overall clinical picture.

Upon further investigation of the patient's persistent fever, a nuclear bone scan was performed to evaluate for osteomyelitis. This revealed increased uptake in the stump of the left above the knee amputation. Subsequent X-rays showed no acute findings, however, chronic osteomyelitis could not be ruled out. Fevers subsided 2 days after discontinuation of nafcillin.

The patient had a one-time episode of fever after about 3 weeks, which was treated with a few doses of post dialysis vancomycin therapy. After this episode resolved, no growth was apparent on repeat blood cultures, and she no longer had an elevated leukocyte count. At this time although she was clinically stable, she remained in the hospital due to unforeseen social issues acting as a barrier to discharge.

### 3. Discussion

The above represents a case of catheter related superior vena cava endocarditis, a rare yet fascinating disease process. We presume our patient's case to be of bacterial origin, though there have also been reports of fungal catheter related endocarditis [7,8]. The significance of this case is tied to its etiology and the prevalence of patients requiring indwelling central venous catheters. The considerations for such patients and prompt identification of complications of these catheters including the presence of blood stream infections and endocarditis, and appropriate choice and course of management.

Although there is substantial evidence of an increase in morbidity and mortality associated with the use of central venous catheters as the primary access method for patient's requiring hemodialysis, this method is still in use for approximately 25% of patients requiring hemodialysis in the United States. [9,10] According to the National Institute for Diabetes, Kidney and Digestive Diseases, the prevalence of end stage renal disease has continued to increase by about 21,000 cases per calendar year despite a plateau in the incidence of cases since 2010. This emphasizes an increase in the number of patients that currently require dialysis and an overall increase in the use of central venous catheters for these treatments.

Due to anatomical proximity, infections of central venous dialysis catheters entering the superior vena cava, are likely to spread to the endocardium of the heart and may ultimately cause endocarditis. Although endocarditis is commonly associated with the heart valves, due to hemodynamics surrounding these structures, endocarditis involving the superior vena cava and right atrium, although quite uncommon, have also been reported. All forms of endocarditis require the appropriate diagnoses, characterization, and treatment.

Suspicion of systemic infection related to the presence of central venous catheters should trigger concerns for the possibility of cardiac involvement of these infections. There are some recommendations for removal of these catheters, in cases of sepsis even in the absence of endocarditis, to inhibit the possibility of potential catheter seeding. [5] Prophylactic removal of a central venous catheter is recommended in patients with sepsis due to an infection of a different site, to prevent the possibility of potential infectious seeding of the catheter, and ultimately endocarditis.

Trans-thoracic echocardiography should be the initial test of choice for these patients, as it is a completely noninvasive diagnostic modality that can provide a visual representation of the heart and its valves. However, this test is often limited in the sense that it may not adequately capture the extent and size of a vegetation, or may even miss the vegetation entirely. [7] Therefore, a trans-esophageal echocardiogram is often indicated in these cases for better identification and diagnosis of endocarditis, and ultimately for greater diagnostic utility.

Other than immediate removal of the central venous catheter, patients should be started on intravenous antibiotics according to the blood and catheter tip culture and sensitivity data. A duration of about 6 weeks is often indicated for the intravenous antibiotic treatment of endocarditis, with repeated serial imaging to monitor clinical improvement, or to rule out further complications of the disease process such as an increase in vegetation size, or abscess formation. Heavy consideration should also be made for possible surgical removal of these vegetations, depending on the overall clinical picture. In addition, patients requiring central venous catheters for hemodialysis should be evaluated for creation of arterio-venous fistulas to avoid the need for continued use of the catheters in order to prevent future occurrences of such serious systemic infections.

#### 4. Conclusion

Endocarditis of the superior vena cava is a rare yet significant cause of morbidity and mortality in patients requiring hemodialysis in the United States. This is especially notable in those who use a central venous catheter as their primary access site. In these patients, early diagnosis and treatment with echocardiography and antibiotics respectively should be considered if there is a high clinical suspicion of infection. Surgical intervention may also be considered based on serial imaging and the lack of clinical improvement despite targeted antibiotic therapy.

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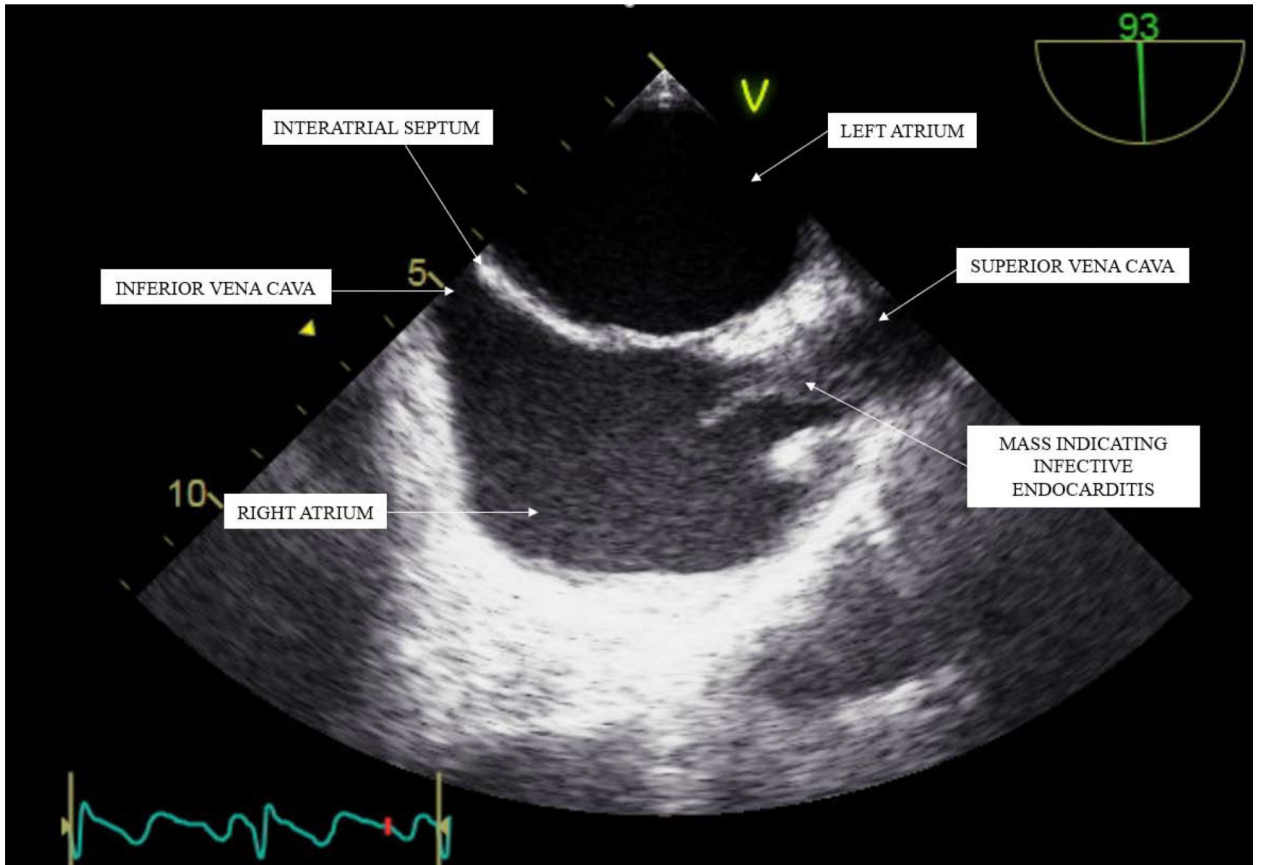
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**Figure 1.**  
Indicating mass in superior vena cava extending into right atrium