Infected Retained Catheter-Related Sheath, an Underrecognized Complication of Central Venous Catheter Insertion: A Case Report

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Financial support: None declared
Conflict of interest: None declared

Patient: Female, 45-year-old
Final Diagnosis: Infected retained catheter-related sheath
Symptoms: Fever • Nausea • Vomiting
Medication: —
Clinical Procedure: Mechanical thrombectomy • transesophageal echocardiogram
Specialty: Cardiology • Infectious Diseases

Objective: Unusual clinical course

Background: Central venous catheters are indicated for a variety of conditions, including hemodynamic monitoring, hemodialysis, and long-term antibiotic and chemotherapy delivery. Several million are placed each year. Development of a fibrin sheath around the catheter is a common occurrence, with a reported incidence of 42-100% within 7 days of catheter placement. It is uncommon for these sheaths to be left in the patient upon removal of the catheter and even far more uncommon for these retained sheaths to lead to complications.

Case Report: We present the case of a 45-year-old woman with a previous history of superior mesenteric artery syndrome and chronic protein calorie malnutrition on total parenteral nutrition through a long-term indwelling central venous catheter. She presented with concerns of persistent bacteremia despite outpatient intravenous antibiotic therapy, requiring removal of her central venous catheter. A transesophageal echocardiogram was performed to rule out infective endocarditis. Findings showed a highly mobile mass extending from the superior vena cava into the right atrium, most consistent with a retained catheter-related sheath. Due to concern for this being a nidus of her persistent bacteremia, she underwent mechanical thrombectomy, with excellent results and subsequent clearing of her bacteremia.

Conclusions: Placement of central venous catheters is becoming a commonplace occurrence, with millions placed each year. Retained catheter-related sleeves are a potential complication, with further research needed to help determine the clinical significance and best treatment approach.

Keywords: Central Venous Catheters • Echocardiography, Transesophageal • Thrombectomy

Full-text PDF: https://www.amjcaserep.com/abstract/index/idArt/936290
**Background**

Central venous catheter (CVC) insertion is indicated for a variety of conditions, including hemodynamic monitoring, hemodialysis, and long-term antibiotic and chemotherapy delivery. Several million are placed each year in the United States alone [1]. Formation of a sheath is common on an indwelling catheter and has been reported in the range of 42% to 100% within 7 days of catheter insertion. A rarer complication is when this sheath is retained after removal of the CVC, also known as a catheter-related sheath, which occurs in approximately 13% of patients [2].

**Case Report**

A 45-year-old woman with a past medical history of superior mesenteric artery syndrome and chronic protein calorie malnutrition on total parenteral nutrition (TPN) presented to the hospital with a primary concern of persistently positive blood cultures. Four months prior to presentation, the patient had a right-sided tunneled catheter placed for TPN administration. She initially tested positive for *Streptococcus mitis* as an outpatient and received 2 weeks of outpatient intravenous (i.v.) antibiotics. She subsequently had her blood cultures redrawn and had evidence of persistent bacteremia associated with fever, nausea, and vomiting, which prompted her presentation.

Vital signs on presentation were a heart rate of 73 beats per minute, respirations 18 per minute, temperature 36.7°C, blood pressure 112/56 mmHg, and pulse oximetry 99% on room air. A physical exam demonstrated a cachectic patient with an indwelling tunneled catheter with no evidence of surrounding erythema or purulent drainage. Her bloodwork was significant for a leukocytosis of 19 500. Repeat blood cultures were drawn and returned positive for *Streptococcus parasanguinis*. The decision was made to remove the patient’s tunneled catheter due to the concern over this being a nidus for her infection. Repeat blood cultures were drawn and subsequently were positive for *Staphylococcus hominis*. A transthoracic echocardiogram was performed and demonstrated no evidence of intracardiac vegetation. Given the persistent bacteremia, a transesophageal echocardiogram (TEE) was performed to rule out endocarditis. A long, tubular, and highly mobile echodensity was visualized in the superior vena cava extending into the right atrium, most consistent with a retained catheter-related sheath (Figure 1).

A multi-disciplinary discussion occurred between Infectious Disease and Cardiology, prompting a decision to remove the retained sheath due to the concern of it providing a nidus for her bacteremia. This was successfully performed 4 days after her tunneled catheter had been removed via a percutaneous approach using a mechanical thrombectomy device (Figure 2). Right femoral venous access was obtained and a 14 French sheath was placed. Fluoroscopic guidance was used to advance the thrombectomy catheter into the right atrium, where it was then visualized using TEE. Transesophageal echocardiography was utilized to localize the retained sheath in the right atrium and to help direct the thrombectomy catheter and to ensure all of the retained sheath had been removed. The patient did well after the procedure, with normalization of her white blood cell count and subsequent clearing of the bacteremia. She was discharged home to continue antibiotic therapy.

![Figure 1. Transesophageal echocardiogram demonstrating a long, tubular, highly mobile mass extending from the superior vena cava into the right atrium, most consistent with a retained catheter-related sheath. a. Superior vena cava. b. Retained catheter-related sheath. c. Right atrium.](image)

![Figure 2. A 10-cm segment of catheter-related sheath removed using mechanical thrombectomy.](image)
**Discussion**

The development of sleeves around catheters has been noted dating as far back as 1964 [3]. They can form on the outside of an implanted catheter as quickly as within 24 h. They are initially composed of a film of fibrin, laminin, collagen, fibronectin, and immunoglobulins and evolve over time to contain smooth muscle cells. These sheaths have been proposed as a cause for indwelling catheter dysfunction and can serve as a potential nidus for infection [4]. When the catheter is removed, there is potential for this sheath to be left in the vessel [5].

Central venous catheters are responsible for over 90% of all catheter-related bloodstream infections. Catheter-related sheaths increase bacterial ability to adhere to a catheter. As a result, infected sheath-coated catheters lead to bacteremia in 84% of patients. In comparison, infected non-sheath-coated catheters lead to positive blood cultures in only 21% of patients [6]. The rates of infection associated with a catheter-related sheath after removal of the central venous catheter is unknown. Fibrinogen and laminin serve as binding sites for candida and *Staphylococcus aureus*, while coagulase-negative staphylococcus bind more avidly to fibronectin [7].

Despite the known occurrence of this event, the optimal strategy for handling these retained fibrin sleeves is not well established. When the sheath is retained in the blood stream after catheter removal, it may provide a nidus for infection. Choi et al describe a similar case of persistent bacteremia associated with a retained catheter-related sheath treated with mechanical thrombectomy [8]. In addition to the infection risk, they cited reduction in future risk of embolization as a potential benefit for removal of the retained catheter-related sheath. Mechanical thrombectomy has been studied in a variety of clinical scenarios, including acute coronary syndrome, pulmonary embolism, acute ischemic stroke, and peripheral vascular disease. In the EXTRACT-PE trial, mechanical thrombectomy had an advantageous safety profile with a 1.7% rate of major adverse events [9]. Given the relatively low risk of performing mechanical thrombectomy, and the belief that the retained sleeve was contributing to the patient’s persistent bacteremia, the decision to perform thrombectomy was made, with an excellent result.

**Conclusions**

Ultimately, the treatment approach for retained catheter-related sheaths is a technically challenging scenario. Many are asymptomatic and only detected incidentally. In patients with long-term indwelling central venous catheters, the potential for complications arising from retained sheaths needs to be considered with recommendations for removal in select scenarios. Each patient requires an individualized treatment approach and further research is needed to identify an optimal treatment algorithm.

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