

Lung: Case Report

Minimally Invasive Treatment of Tunneled Central Venous Catheter–Associated Venobronchial Fistula

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thrombus formation, and venous stenosis. In approximately 5% of patients, improper catheter tip positioning increases the risk of erosion into adjacent structures.¹

Venobronchial fistula (VBF) is a rare complication of tunneled catheters. Large-bore catheters and left-sided catheter placement increase vascular erosion risk.³ In addition to exposing airway to infused contents, fistulas can lead to air embolisms into the venous circulation or potentially fatal bleeding into the lungs.² There is also risk for pneumonia or bacteremia.⁴

We describe a case of catheter-associated VBF treated minimally invasively with bronchoscopy, fluoroscopic visualization, and a multidisciplinary team.

Venobronchial fistula (VBF) is a rare complication of central venous access. We describe a 30-year-old woman with VBF associated with a tunneled venous catheter. She presented with a drowning sensation associated with infusions. Extravasation of contrast material on fluoroscopy confirmed the presence of a fistula between the superior vena cava and bronchial tree. After multidisciplinary planning, the patient underwent catheter removal. An interventional pulmonologist placed a bronchial blocker and a cardiac surgeon positioned an endovascular occlusion balloon to mitigate life-threatening risk of intrabronchial hemorrhage. This highlights the importance of a multidisciplinary team to manage risks associated with catheter removal in patients with VBF.

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A 30-year-old woman with gastroparesis was unable to maintain hydration enterally. Six months before presentation, a tunneled left subclavian central venous catheter was placed at an outside institution for intravenous hydration and medications.

She was admitted to an outside hospital with inability to tolerate oral intake. She reported 2 to 3 weeks of a drowning sensation and a productive cough containing clear sputum during and a few hours after catheter access. Chest radiography appeared to show the catheter tip in the superior vena cava (SVC). However, a fluoroscopic study with contrast material administered through the catheter demonstrated extravasation from the catheter tip to the right bronchial tree (Figure 1). Computed tomography scan with intravenous administration of contrast material showed the tip penetrating the SVC above the superior branch of the pulmonary vein into the bronchus (Figure 2). There was a soft tissue prominence at the distal catheter tip and mural thrombus at the erosion site. The patient was transferred to our tertiary care institution for further management.

On arrival, she was hemodynamically stable with adequate oxygen saturation on room air without airway compromise. After assessment by a thoracic surgeon, a multidisciplinary team planned for catheter removal in the operating room with interventional pulmonology and cardiac surgery teams present in the event of intrabronchial hemorrhage. Under general anesthesia with a single-lumen endotracheal tube, the interventional pulmonologist performed flexible bronchoscopy. Sterile methylene blue flushed through the tunneled catheter showed dye entering the right upper lobe

Tunneled central venous catheters are used to facilitate vascular access for patients requiring frequent intravenous infusions, including systemic chemotherapy, medication infusions, total parenteral nutrition (TPN), and hydration.¹ Tunneled catheters decrease the risk of infection and can be implanted for years.² Short-term complications are relatively rare and include pneumothorax, catheter tip malpositioning, and vascular perforation.² Delayed complications include catheter failure, infection,

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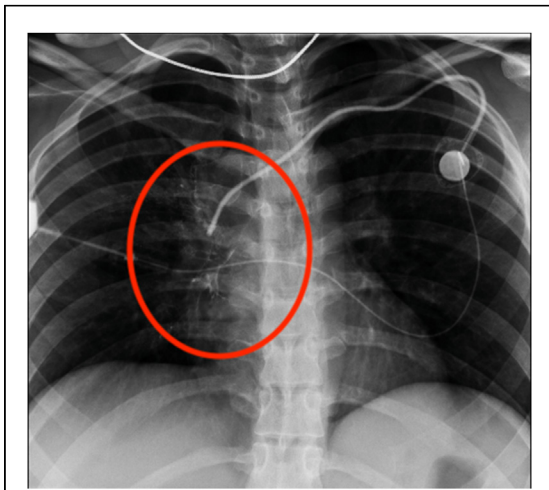


FIGURE 1 Preoperative chest fluoroscopy image demonstrating left tunneled central venous catheter with tip in superior vena cava. The circle shows contrast material outlining the right bronchial tree.

bronchus through a small fistulous tract (Figure 3). A bronchial blocker was placed at this location and left deflated. Concurrently, the cardiac surgeon percutaneously accessed the right common femoral vein and advanced a guidewire into the SVC. This was done preemptively should an endovascular rescue balloon, such as Atlas percutaneous transluminal angioplasty dilation catheter (BD Biosciences) or XXL balloon dilation catheter (Medline), be needed to tamponade bleeding through emergent SVC occlusion. With these safeguards in place, the thoracic surgeon removed the catheter. During removal, the fistula site, directly observed through bronchoscopy, had no bleeding. Contrast material administered through the femoral venous sheath confirmed no extravasation. A Valsalva maneuver and placement in the Trendelenburg position both confirmed no active bleeding. Transthoracic echocardiography ruled out pericardial effusion. She was extubated and recovered without complication. On postoperative day 2, computed tomography of the chest showed fistula resolution with persistent mural thrombus, for which she was systemically anticoagulated.

COMMENT

Fistulization between the venous system and the tracheobronchial tree due to central venous catheter placement is a known but rare complication.^{2,4} Potential causes include angle tip, cut catheter tips, caustic agents such as chemotherapy or TPN, and mechanical stress.³⁻⁶ These factors promote inflammation that can compromise vessel integrity and predispose to fistula formation.

Similar to previously described cases, our patient had a left-sided catheter. Duntley and coworkers³ proposed that left-sided central catheters are typically positioned at the confluence of the SVC and azygos vein, with the tip lying at an acute angle. Mechanical stress of the catheter tip within the SVC is associated with increased fistula risk.³ A suboptimal angle of the left-sided catheter probably increased endothelial erosion risk in our patient.

We describe a patient with VBF from a tunneled catheter placed for intravenous hydration and medications; current literature primarily describes similar cases in patients receiving chemotherapy or TPN. Chemotherapeutic agents and TPN are known to be sclerotic and are typically delivered through central access to prevent peripheral vein thrombophlebitis.⁷ Although 0.9% normal saline is a commonly used intravenous fluid, its acidity (pH 5.5) could potentially be caustic.⁸ The symptoms of our patient were also unique. Whereas she had a cough consistent with prior cases, her drowning sensation has not been previously described and was ultimately what raised clinical suspicion of VBF.

Although urgent catheter removal is indicated for VBF, there is risk of airway hemorrhage, as described in prior case reports.^{4,6} Given the rare nature of catheter-associated VBFs, there is no standardized approach to catheter removal that mitigates this bleeding risk. Previous cases describe blind catheter removal at the bedside or in the operating room. Other cases describe surgical access through a right thoracotomy or transverse tracheotomy incision to directly control the fistula and to prevent hemorrhage.^{4,6} However, these approaches are invasive and may be unnecessarily morbid. To determine the safest option for our patient,



FIGURE 2 Coronal view of preoperative chest computed tomography scan with contrast enhancement. The arrow indicates a hyperdense object (catheter tip) protruding through the superior vena cava wall.

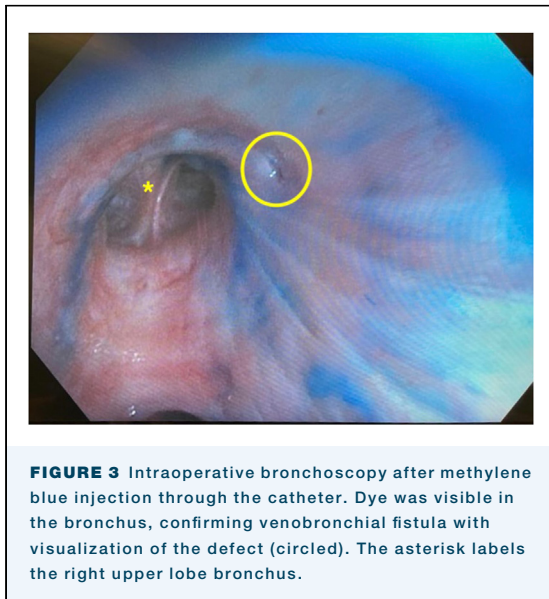


FIGURE 3 Intraoperative bronchoscopy after methylene blue injection through the catheter. Dye was visible in the bronchus, confirming venobronchial fistula with visualization of the defect (circled). The asterisk labels the right upper lobe bronchus.

we had extensive preoperative multidisciplinary discussions between interventional pulmonology, cardiac surgery, and thoracic surgery physicians, with creation of an intraoperative plan to safely remove the tunneled catheter and to prepare for potential hemorrhage.

With endobronchial and endovascular tools at our disposal, we were able to take a minimally invasive approach to safely remove the catheter. Interventional

pulmonologists placed a bronchial blocker to occlude the bronchial side of the fistula, which was precautionary against airway compromise from intrabronchial hemorrhage. Subsequently, femoral venous access by the cardiac surgeon addressed the vascular component of the fistula. A readily available endovascular balloon could occlude flow from the SVC into the airway in the event of bleeding. Last, our patient's fistula location would have necessitated right thoracotomy or median sternotomy to obtain direct access. Whereas our team was ready to convert to an open procedure, we were able to successfully manage our patient's VBF minimally invasively.

In conclusion, VBF is a rare complication of tunneled central venous catheter placement. Clinical presentation, fluoroscopy, and cross-sectional imaging aid in diagnosis. Access to a bronchial blocker and endovascular balloon allows a safe, minimally invasive approach to catheter removal. This case highlights the importance of multidisciplinary collaboration and proactive preparation for managing possible fatal complications.

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PATIENT CONSENT

Obtained.

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