The azygos system as a rare alternative for chronic indwelling catheters placement

Mireille A. Moise, MD,[a] Neal Hadro, MD,[b] Hazem El-Arousy, MD,[a] and **Javier A. Alvarez-Tostado, MD,[b]**
Cleveland and Garfield Heights, Ohio

Chronic indwelling catheters are plagued with a high rate of complications, including infection, central venous occlusion, or thrombosis. When direct access to the superior or inferior vena cava is not possible, venography may identify alternatives that might be viable with current endovascular techniques. This case report describes the successful placement of a tunneled catheter for total parenteral nutrition in the azygos arch through a small collateral vein from the left jugular vein in a patient with no other alternatives because of superior vena cava occlusion and inferior vena cava thrombophlebitis. (J Vasc Surg 2009;50:655-8.)

Long-term indwelling catheters are lifesaving in a number of chronic conditions such as end-stage renal disease requiring hemodialysis and malnutrition requiring total parenteral nutrition. The catheters are preferentially placed in the superior vena cava (SVC) through the jugular veins (internal and external jugular veins, respectively) or subclavian veins. If upper central venous access is unavailable, catheters have also been placed in the inferior vena cava (IVC) by way of the femoral vein or a translumbar approach.

Unfortunately, chronic indwelling catheters are plagued with complications, including infection, venous thrombosis, and occlusion.[1] In addition, the longevity of these catheters is hampered by the number of catheters a patient has had and the number of years the catheter has been in place.

When the SVC and IVC are occluded or unavailable, alternate access sites need to be considered. The azygos vein is an important alternate pathway of venous drainage that often becomes dilated in cases of SVC occlusion. The azygos vein ascends from the abdomen into the chest, arching anteriorly to enter the posterior wall of the SVC. We present a case where a Hickman catheter (Bard, Salt Lake City, Utah) for total parenteral nutrition was placed in the azygos vein in a patient with SVC occlusion and septic thrombophlebitis of the IVC.

CASE REPORT

A 67-year-old man presented to the emergency department with a 6-day history of right flank pain. He denied fever, chills, or any other associated symptoms. His medical history was significant for lupus anticoagulant diagnosed after an episode of mesenteric venous thrombosis requiring an extensive bowel resection 17 years earlier. Short gut subsequently developed, and the patient required life-long total parenteral nutrition. The patient was prescribed long-term anticoagulation therapy for his hypercoaguable state.

From the Cleveland Clinic Foundation Main Campus,[a] and Marymount Hospital, Cleveland Clinic Foundation.[b]

Competition of interest: none.

Correspondence: Javier Alfredo Alvarez-Tostado, MD, Cleveland Clinic Foundation, Department Vascular Surgery, 12000 McCracken Rd, Garfield Heights, OH 44125 (e-mail: alvarej3@ccf.org).

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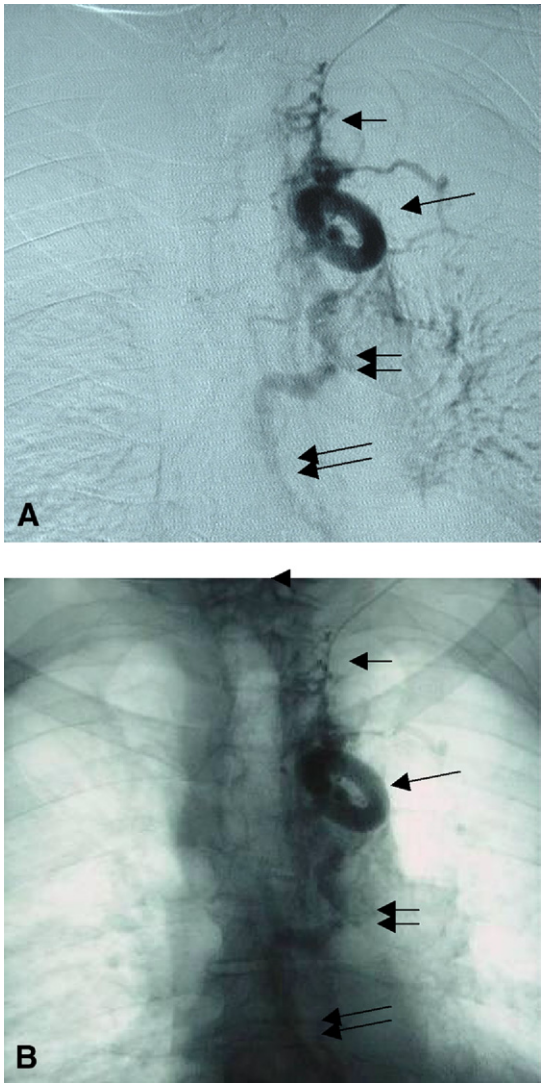

Fig 1. A, This angiogram shows a subtracted view from a venogram taken from the left internal jugular vein. **B**, This angiogram shows the unsubtracted view from a venogram taken from the left jugular vein. The *short single arrow* points to the left internal jugular, the *long single arrow* indicates the large dominant collateral, the *short double arrows* point to the accessory hemiazygos vein, and the *long double arrows* point to the azygos vein.

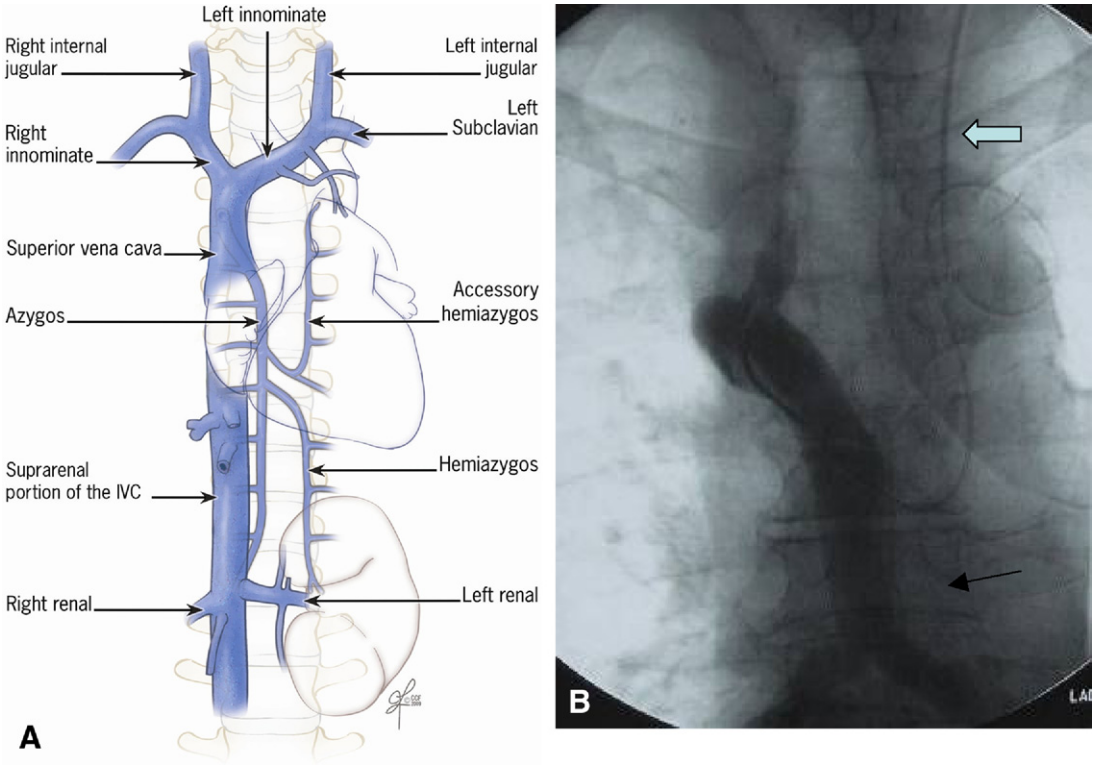

Fig 2. A, Illustration shows the azygos venous system. **B,** Dilated azygos vein in our patient. The *block arrow* points to the Kumpe (Cook Medical, Bloomington, Ind) catheter, and the *straight arrow* points to the dilated azygos vein.

Approximately 1 year earlier, the patient had an episode of septic phlebitis of the great vessels of the chest that necessitated removal of a right internal jugular Hickman catheter and placement of a left femoral Hickman catheter.

The patient's physical examination was remarkable for a temperature of 38.8°C, right flank tenderness on palpation without peritonitis, and evidence of collateral circulation formation in his left chest and neck. A computed tomography (CT) scan of his abdomen and pelvis showed air in the IVC consistent with septic thrombophlebitis. Removal of the tunneled left femoral vein catheter with its tip in the IVC was recommended.

Because all of his nutrition was provided intravenously, placement of a new catheter was essential. A peripherally inserted central catheter was attempted through a brachial vein approach. This was unsuccessful, however, because of bilateral axillary vein occlusion with multiple venous collaterals within the upper arms and chest wall. An ultrasound scan of the neck showed an occluded right internal jugular vein with an apparently patent and dilated left internal jugular vein. Ultrasound guidance was used to access the left internal jugular vein, and a venogram was obtained to determine the status of his central venous system. The left internal jugular vein was occluded proximally as well as the left subclavian vein, left innominate, and superior vena cava.

There were collateral vessels from the junction of the left jugular and left subclavian, with a large collateral forming a spiral before heading posterior, providing branches to the accessory hemiazygos vein with collaterals going from this vein to the azygos system (Fig 1). Considering his life-threatening condition with mandatory requirement for antibiotics and nutrition, and no useful access in the upper extremities and neck vessels due to central vein occlusions, we decided to place a tunneled catheter into the azygos arch.

There was one dominant collateral vessel. Using a hydrophilic 0.035-inch wire and a Kumpe catheter (Cook Medical, Bloomington, Ind) we were able to access this collateral into the azygos arch (Fig 2). We used roadmapping to follow its very tortuous course and prevent perforation**.** A counterincision in the left upper chest and subcutaneous tunnel to the neck incision was made. A 9.5F single-lumen Hickman was chosen. Not able to advance the peel-away sheath through the tortuous anatomy, we decided to advance the catheter over a hydrophilic wire. The initial attempt was unsuccessful due to lack of trackability caused by the softness of the catheter and the diameter of the small collateral vessels. We decided to use balloon angioplasty in the collateral veins from the azygos vein to the internal jugular with a 4- × 100-mm Sterling balloon (Boston Scientific, Natick, Mass).

After angioplasty, the catheter was advanced slowly into the azygos arch. A completion venogram through the catheter showed the catheter was adequately positioned into the azygos arch, despite the tortuous appearance of the catheter caused by the vein's anatomy (Fig 3).

The infected left tunneled femoral catheter was removed, and he has been maintained on intravenous antibiotics. The results of cultures to date have remained negative. The patient's postopera-

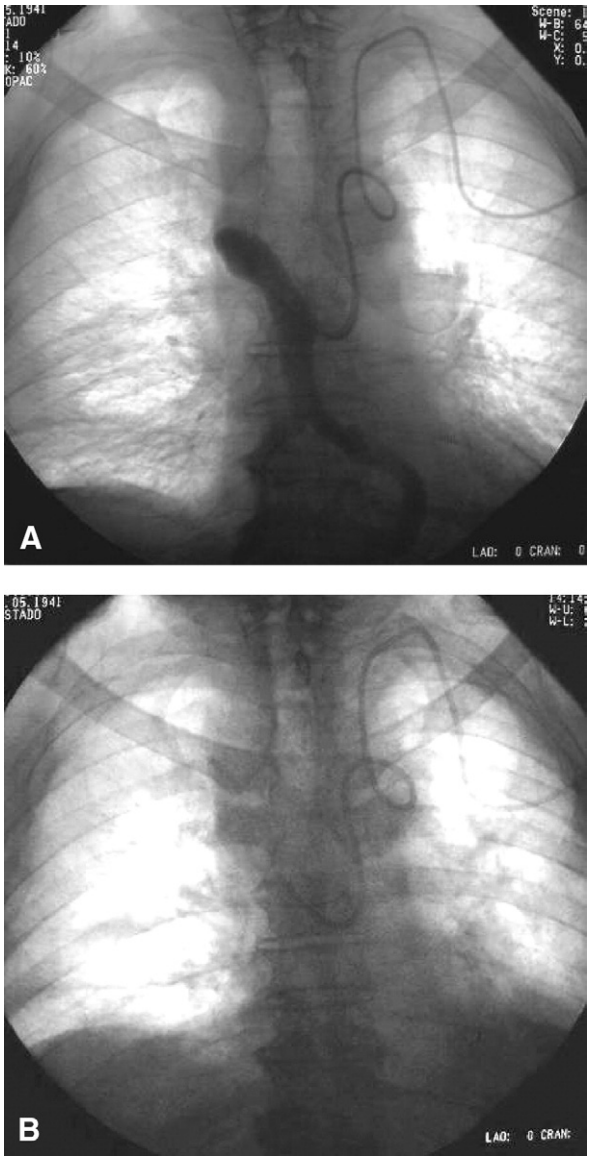

Fig 3. A, The final position of the Hickman catheter (Bard, Salt Lake City, Utah) in the azygos vein is shown with the administration of contrast. **B**, The final position of the Hickman catheter in the azygos vein is shown without the administration of contrast.

tive course was uneventful. Oral anticoagulation was resumed, as well as his parenteral nutrition. His catheter was patent at 5-months follow-up.

DISCUSSION

Obliteration of central veins by central venous catheters from venous stenosis or thrombosis can be devastating to the patient who depends on central venous catheters for life-sustaining therapies. Similarly, it presents a challenging problem to the clinician providing patient care. Several collateral pathways exist in case of vena cava obstruction. The three most common ones are the vertebral–azygos–hemiazygos pathway (Fig 2), the internal and external mammary pathway, and the left renal–hemiazygos pathway.[2] Placement of indwelling catheters in the often-compensatory dilated azygos vein is an option when the SVC and IVC are both inaccessible, particularly when percutaneous attempts to recanalize either of them are unsuccessful.

Unintentional as well as intentional cannulation of the azygos vein with indwelling catheters has been reported. In six reported cases of intentional cannulation of the azygos vein for long-term intravenous access, only two were accessed percutaneously. A thoracotomy was performed in two patients, and a thoracoscopic approach was used in another.[3-5] Meranze et al[6] performed a combined percutaneous and surgical approach.[6] With regard to percutaneous placement, Patel et al[7] reported placing a Hickman catheter percutaneously directly into the azygos vein through a translumbar approach using real-time ultrasound imaging.[7] These catheters were placed to circumvent a thrombosed or occluded SVC. In the other percutaneous case, access was obtained through the internal jugular vein.[8] The IVC was open but was unavailable because of an existing catheter. The catheter in one case was placed for dialysis access, and flow rates of ≥300 mL/min were achieved.[8]

In our patient, the SVC and IVC were both unavailable. By using a dilated collateral network, we were able to access the azygos vein. Manipulating wires and catheters through collateral vessels can be daunting because these vessels are often fragile, tortuous, and unpredictable in their course. Roadmapping is a very useful feature to reduce the potential for perforation.

In addition, these catheters are normally placed through a relatively short dilator into the central vein. They are not intended to track over a wire, which can make advancing them over long distances quite challenging. To advance the wire and sheath, we were forced to gently dilate the collateral with balloon angioplasty to allow the catheter to track over the wire. A hydrophilic wire may be helpful as well to aid in advancing the catheter.

CONCLUSIONS

Our experience and the experience of others demonstrates that placement of an indwelling catheter in the azygos vein can be performed successfully and should be considered when the SVC and IVC are inaccessible. The fate of this catheter will probably be similar to the natural history of other central venous catheters: central venous occlusion and infection. The riskiest part of this procedure was navigating through collateral pathways, but once the catheter has been placed with the tip inside a dilated central vein (azygos), we have no reason to believe that it is any more compromised than other central catheters.

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