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Sharp Central Venous Recanalization by Means of a TIPS Needle

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Abstract

The purpose of this study was to perform an alternative technique for recanalization of a chronic occlusion of the left brachiocephalic vein that could not be traversed with a guidewire. Restoration of a completely thrombosed left brachiocephalic vein was attempted in a 76-year-old male hemodialysis patient with massive upper inflow obstruction, massive edema of the face, neck, shoulder, and arm, and occlusion of the stented right brachiocephalic vein/superior vena cava. Vessel negotiation with several guidewires and multipurpose catheters proved unsuccessful. The procedure was also non-viable using a long, 21G puncture needle. Puncture of the superior vena cava (SVC) at the distal circumference of the stent in the right brachiocephalic vein/superior vena cava, however, was feasible with a transjugular intrahepatic portosystemic shunt (TIPS) set under biplanar fluoroscopy using the distal end of the right brachiocephalic vein as a target, followed by balloon dilatation and partial extraction of thrombotic material of the left brachiocephalic vein with a wire basket. Finally, two overlapping stents were deployed to avoid early re-occlusion. Venography demonstrated complete vessel patency with free contrast media flow via the stents into the SVC, which was reconfirmed in follow-up examinations. Immediate clinical improvement was observed. Venous vascular recanalization of chronic venous occlusion by means of a TIPS needle is feasible as a last resort under certain precautions.

Key words: Brachiocephalic vein—Occlusion—Trans-luminal angioplasty—TIPS—Hemodialysis

Central thoracic vein obstruction can result in extensive edema of the upper extremities and cause painful swelling of the limb. Furthermore, in hemodialysis patients, insufficient central drainage can result in dysfunction of the arteriovenous shunt. If recanalization of the occluded vein is impossible, a ligation of that fistula might be required. Recanalization of arteries and veins are a common procedure in interventional radiology either by thrombectomy, thrombolysis, or balloon dilatation and stenting. It is a safe and effective treatment of vascular obstruction. This study reports a novel technique using a transjugular intrahepatic portosystemic shunt (TIPS) puncture set to traverse a chronically occluded left brachiocephalic vein (LBCV) that could not be overcome by any guidewire.

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Case Report

A 76-year-old man with end-stage renal failure, being temporarily dialyzed via a left internal jugular vein dual-lumen catheter because hemodialysis via the shunt at the left forearm was insufficient, presented with progressively worsening inflow congestion. Resuscitation had already been done because of respiratory failure; thus, he was intubated. Computed tomography (CT) showed a chronic occlusion of the stent in the right brachiocephalic vein/superior vena cava (SVC), a chronically occluded right subclavian vein, and right internal jugular vein. The SVC was patent. Additionally, an approximate 2-cm occlusion of the LBCV was delineated along with multiple subcutaneous, muscular, and mediastinal collaterals and a massive edema.

The following interventional procedure was performed on an Integris V 3000 (Philips, Best, The Netherlands). First, the left internal jugular vein dual-lumen catheter was replaced by a short 10F vascular sheath (Terumo, Leuven, Belgium). With contrast material manually injected through the sheath, mainly wall adherent thrombus and occlusion of the LBCV was seen (Fig. 1).

The occlusion could not be passed antegradely with regular wires and catheters. A femoral approach was impossible because of thrombosis of the common femoral vein on both sides. Because of the multiple unsuccessful attempts and the life-threatening situation of the patient, we considered alternative methods for recanalization.

In view of the short occlusion, we attempted sharp recanalization using a long, 21G puncture needle (Terumo, Leuven, Belgium), which failed. Finally, we resorted to a TIPS set (Cook, Bjaeverskov, Denmark), which consists of an introducer catheter (10F), curved guiding cannula, and a flexible puncture needle (20G) covered with a catheter (5F) (Fig. 2). Under bi-planar fluoroscopic guidance, puncture of the SVC at the distal circumference of the stent in the right brachiocephalic vein/SVC was performed using the distal end of the right brachiocephalic stent as a target (Fig. 3A). During the procedure, the stylet was advanced, aiming at the distal end of the right brachiocephalic stent; movement of the struts under bi-planar fluoroscopy confirmed a correct entrance point. The intravascular position was assured by contrast media injection (Fig. 3B). Subsequently, a stiff 0.035-in. Amplatz wire (Cook, Bjaeverskov, Denmark) was placed through the guiding cannula into the SVC, followed by balloon dilatation of the LBCV tract with a 6/20-mm Fox balloon catheter and then a 10/20-mm Fox balloon catheter (Abbott Vascular, Pregassona, Switzerland). After each dilatation, contrast medium was injected in order to rule out extravasation.

Additionally, thrombotic material of the LBCV was partially extracted with a wire basket (Cook, Bjaeverskov, Denmark). Because of the long-segment narrowing of the LBCV, two overlapping self-expandable Easy Wallstents (14 mm in diameter, 89 and 64 mm in length; Boston Scientific,

Fig. 1. Wall adherent thrombi in the LBCV (arrows) occluded distal vessel with no contrast media flow to the SVC; note the mediastinal collaterals.

Galway, Ireland) were deployed without bridging of the left subclavian vein to avoid early reocclusion. These stents were further dilated with a Fox balloon catheter (Abbott Vascular, Pregassona, Switzerland) in order to achieve a satisfying result.

Control venography performed antegradely through the left jugular sheath confirmed successful reopening of the occluded LBCV with unimpeded contrast media flow into the SVC and without contrasting collaterals. Repeated venography showed the absence of extravasation. With use of this new technique, recanalization was successful without any complications. There were stable vital signs and complete blood cell count after the procedure. The next day, the neck, shoulder, face, and arm edema decreased significantly. Three days after the procedure, a chest CT was performed that reconfirmed the result and excluded pulmonary embolism. Upper-extremity venography performed 12 days later again demonstrated the patency of the LBCV (Fig. 4).

Three weeks after recanalization, hemodialysis through the left forearm arteriovenous shunt-graft was effective, but the patient died due to multiorgan failure because of other underlying diseases.

Discussion

Sufficient venous outflow is necessary for adequate function of hemodialysis access. Central venous obstruction is one common reason for shunt dysfunction in chronic hemodialysis patients. In the upper extremity, it mostly occurs secondary to previous subclavian catheter placement procedures used for temporary hemodialysis access. The incidence of catheter-related subclavian vein stenosis has been reported to be as high as 40% [1]. In our case, the stent placed in the contralateral right brachiocephalic trunk might have been responsible for the occlusion of the left trunk [2]. Chronically occluded veins such as those in hemodialysis patients are often refractory to traversal by guidewires and catheters. Balloon angioplasty literature points out that failure to traverse central venous occlusions might be as high as 24% [3]. In this case, the hemodialysis arteriovenous graft can be surgically ligated, after which the extremity might be unusable for further hemodialysis. Surgical options such as patch angioplasty or bypass procedures are associated with a high morbidity in these patients with their often serious comorbid diseases and, in addition, are complicated because the vessels are located deep in the thorax [4]. To prevent recurrent central venous stenosis, endovascular irradiation has been used, but the patency after angioplasty and stenting of central venous stenosis in hemodialysis patients could not be prolonged [5].

Hence, percutaneous endovascular methods are frequently preferred as therapeutic alternatives to open surgery. It is essential for endovascular treatment that a guidewire can traverse the occlusion. If this is not possible, sharp puncture might be necessary using certain precautions. Nevertheless, before using sharp central thoracic venous puncture, one should consider the less invasive femoral approach for passing the occlusion.

The safety point in our case was that the right brachiocephalic stent could be used as a target and, in addition, the occlusion was short. It is crucial to advance the TIPS needle or any other needle only under direct fluoroscopy in at least two planes with subsequent contrast injection to ensure intravascular location. Finally, a pull-back venography should be performed to exclude extraluminal extravasation.

Preliminary works on sharp venous system recanalization have been reported. Ferall et al. [6] described a technique of central venous catheter placement in patients with occlusion of the jugular and subclavian veins. They used a transfemorally placed loop snare as a target at which a 21G needle was directed percutaneously. However, one of their patients had major bleeding at the insertion site. Farell et al. [7] used two types of device: a 0.038-in. trocar stylet within a 5F sheath from a Rosch-Uchida transjugular liver access set (Cook) from a brachial/basilic vein approach and a custom-made curved sheathed needle system (Cook) consisting of a 21G stylet needle, within a 5F tapered Teflon catheter and a 7F Teflon catheter, from a femoral approach, using a transbrachially placed guidewire as a target. The authors preferred passage of the needle in a cephalic rather than a caudal direction because of the lower venous pressure below the occlusion for better control in case of extravasation. In a study by Gupta et al. [8], an occlusion balloon positioned femorally in the central vessel served as a target during sharp puncture. The 18G needle was advanced until it indented and perforated the occlusion balloon, assuring intraluminal traversal of the occluded segment.

The main risks of this procedure include pneumothorax/mediastinum and hemothorax/mediastinum. If extraluminal extravasation is noted, a covered stent should be placed. Stenting of the brachiocephalic vein occlusion is recommended because it extends the cumulative patency rates. However reobstruction is seen frequently. In one of the largest series, 3-month, 6-month, 1-year, and 2-year primary patency rates of 92%, 84%, 56%, and 28%, respectively, were reported [9]. After stent placement, multiple reinterventions are often needed to prolong patency [10]. It has been recommended to perform sharp punctures only in short right-sided occlusion segments to minimize the risk of creating an extraluminal tract [8], but herein it was demonstrated that with a localized target like a stent, left-sided sharp puncture with a TIPS needle is feasible.

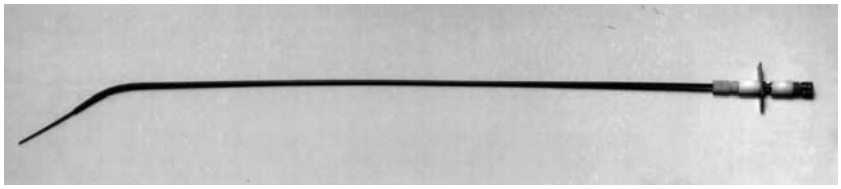

Fig. 2. TIPS set, which consists of an introducer catheter (10F), curved guiding cannula, and a flexible puncture needle (20G) covered with a catheter (5F).

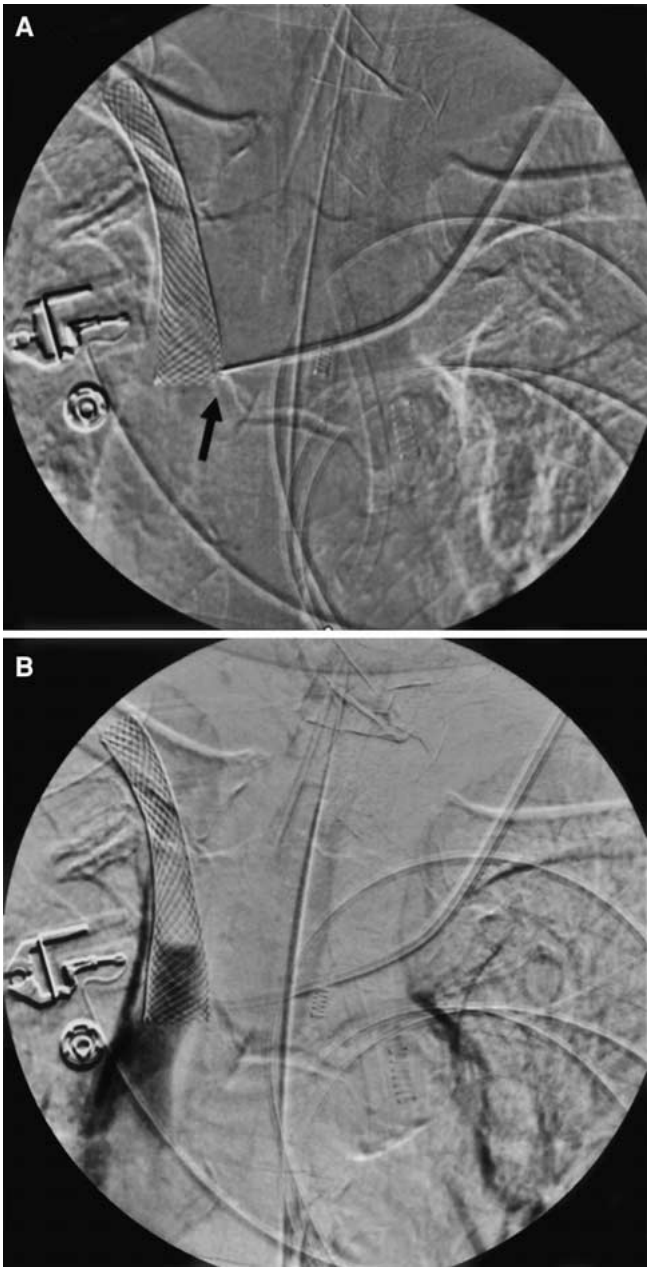

Fig. 3. Sharp puncture with the TIPS set: (**A**) at the distal circumference of the stent in the right brachiocephalic vein /SVC (arrow); (**B**) control venography confirming the intravascular position.

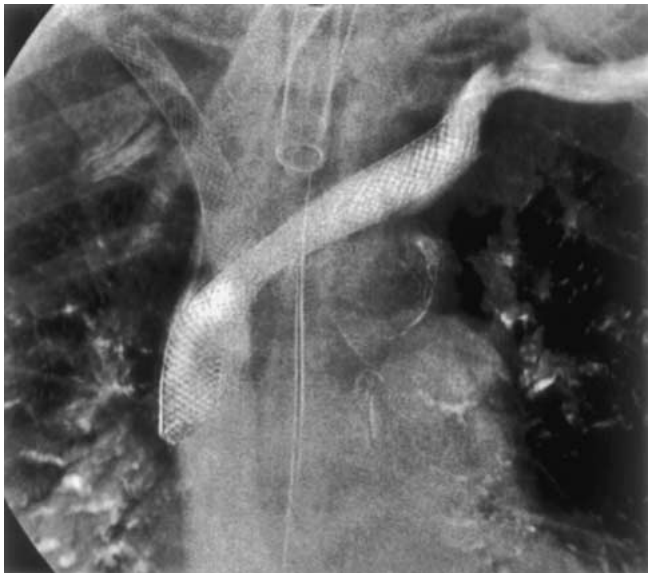

Fig. 4. Upper-extremity venography performed 12 days later demonstrated the patency of the LBCV.

Conclusion

To our knowledge, the illustrated procedure by sharp puncture with a TIPS set has not yet been described in the literature. This technique is an alternative to other sharp puncture techniques in the treatment of chronic central venous occlusions, especially of the LBCV because of its curved course, that are refractory to traversal using traditional catheter and guidewire techniques. It is a minimally invasive option with good morphologic and functional results as well as rapid clinical relief. This technique might be useful in preserving the functionality of left-sided dialysis shunts and grafts. Extreme caution is advocated in order to avoid perforation, which would lead to life-threatening bleeding. The procedure should be performed by experienced interventional radiologists.

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