Novel technique of stent retrieval after migration to the right heart

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ABSTRACT

Central venous obstruction in the symptomatic patient is often treated with endovascular stenting. A rare, but serious, complication of this treatment is migration of the stent from the original site of deployment. Treatment of this complication requires either open or endovascular retrieval of the displaced stent. To treat a rare, but potentially devastating, complication, we have presented an effective endovascular method for migrated stent retrieval using a combination of a large bore sheath, balloon, and snare. (J Vasc Surg Cases Innov Tech 2021;7:781-4.)

Keywords: Balloon; Cardiac; Foreign body; Snare; Stent migration

Treatment of central venous obstruction often involves stenting of the compressed vein, which can provide significant symptom improvement.[1,2] A feared complication of venous stenting is stent migration, especially if it embolizes to the right heart, where it can cause valvular or myocardial damage and, in some cases, lead to heart failure.[3] In the present report, we have described the case of a patient with central venous obstruction secondary to May-Thurner syndrome (MTS) who underwent stenting of the left iliac vein and experienced stent embolization to the right heart. The patient provided written informed consent for the report of their case details and imaging studies. We have described an endovascular technique for successful retrieval of deployed stents that have migrated to this anatomic location.

CASE REPORT

A previously healthy 27-year-old woman had presented to an outside hospital for back pain that had developed into left groin pain and left lower extremity swelling. The patient was found to have an extensive iliofemoral deep vein thrombosis secondary to MTS. She underwent mechanical thrombectomy and thrombolysis with attempted stent placement in the left common iliac vein without intravascular ultrasound guidance. A 12 $\times$ 40-mm self-expanding stent was used. During the procedure, the stent had migrated to the right atrium, and the initial attempts at endovascular retrieval were unsuccessful. Fluoroscopy confirmed the stent's location across the tricuspid valve. The stent was then secured in place with wires between the right internal jugular vein (IJ) and the right common femoral vein access sites, and the patient was transferred to us for further treatment.

The patient was taken to the hybrid operating room with cardiac surgery personnel on standby in case endovascular retrieval was unsuccessful. Transesophageal echocardiography (TEE) confirmed the stent location across the tricuspid valve (Fig 1) with wide open tricuspid regurgitation. The sheath in the IJ was exchanged for a 14F sheath. We initially attempted to remove the stent by passing a guidewire through the stent lumen to snare the end of the wire. This was unsuccessful because the guidewire kept passing through the interstices of the stent and resistance was encountered with traction, raising concerns that such extraction would disrupt the tricuspid valve mechanism. Next, a J-tipped wire was passed down the IJ through the lumen of the stent and into the right ventricle and pulmonary artery. An 18-mm balloon was passed down over the wire, past the distal end of the stent. Multiple attempts at stent retrieval were performed by inflating the balloon within and distal to the stent and retracting the balloon in the hope that the stent would lodge around the balloon and could be pulled from the right atrium. This maneuver was unsuccessful because of the balloon slipping through the stent despite the use of an 18-mm balloon and increasing inflation pressures.

We decided to attempt to secure the stent to the balloon with a snare to improve fixation and traction on the stent. The wire through the lumen of the stent was maintained, and a 25-mm goose neck snare was passed over the wire and left open. Next, a balloon was passed over the wire, through the open snare and into the stent. The balloon was then inflated within the stent, and the snare was tightened while partially deflating the balloon to create a waist on the balloon (Fig 2). The balloon and snare were pulled together, allowing the stent to be disengaged from the tricuspid valve and into the superior vena cava. As the balloon, stent, and snare neared the sheath, we gradually deflated the balloon to invaginate the stent into the sheath. The full length of the stent was unable to be pulled into the sheath and appeared to be slipping; thus, once we had more than one half of the stent inside the sheath, we removed the entire

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Author conflict of interest: none.

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The editors and reviewers of this article have no relevant financial relationships to disclose per the Journal policy that requires reviewers to decline review of any manuscript for which they may have a conflict of interest.

2468-4287

https://doi.org/10.1016/j.jvscit.2021.09.008

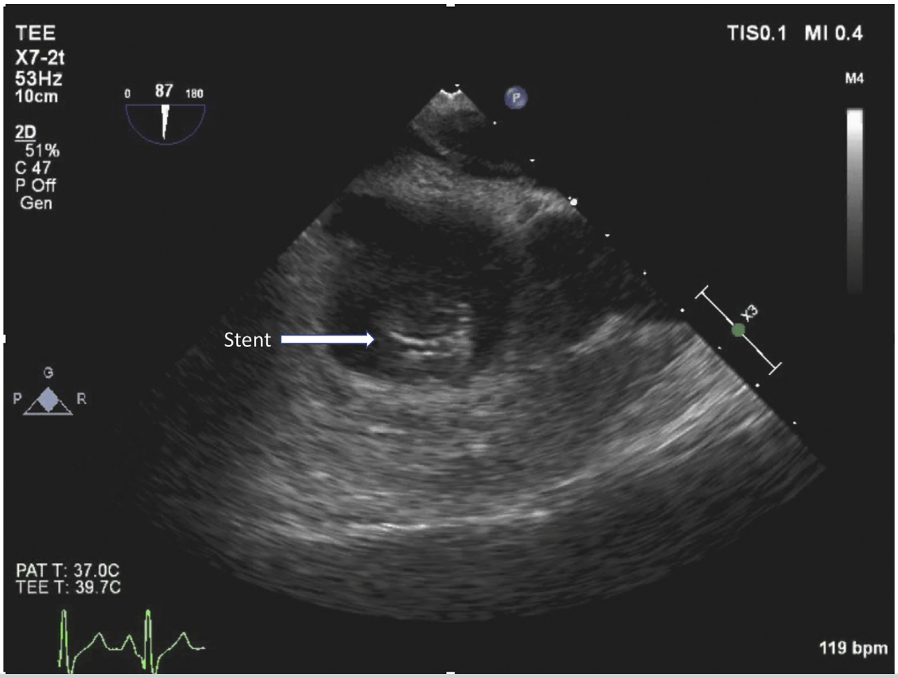

Fig 1. Transesophageal echocardiography (*TEE*) confirming stent location (*arrow*) across tricuspid valve.

complex of sheath, stent, snare, and balloon (Fig 3) from the neck over the wire. The stent was found to be intact, and no fragments were visualized on completion fluoroscopy. TEE was used intraoperatively to measure tricuspid regurgitation before, during, and after stent retrieval. Completion TEE showed mild tricuspid valvular regurgitation. Anticoagulation therapy was started, and the patient was discharged on postoperative day 2. Follow-up echocardiography demonstrated asymptomatic trace tricuspid regurgitation. At the 1-year follow-up, repeat echocardiography showed a normal tricuspid valve with a continued trace of tricuspid regurgitation. Lower extremity duplex ultrasound showed continued compression of the left iliac vein but no deep vein thrombosis recurrence. Understandably, she has been reluctant to undergo stenting of her left iliac vein and has continued anticoagulation therapy.

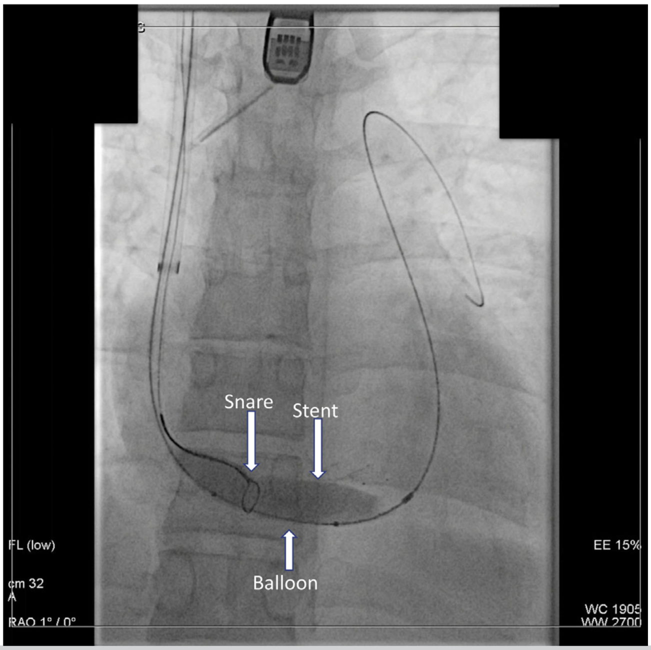

Fig 2. Tightened snare around the insufflated balloon creating a waist on the balloon.

DISCUSSION

The standard treatment of MTS in the symptomatic patient involves iliac vein stenting, which has been shown to have a 1-year patency rate of ~93%.[4,5] Stent migration is a life-threatening, although rare, complication of iliac vein stenting with an incidence of 1.4% to 6.25%.[6] Venous stent migration has various causes, many of which can be attributed to the inherent properties of the venous anatomy, such as increased compliance compared with the arterial system, venous intraluminal irregularities, and arterial pulsatility and pressure over the vein causing stent dislodgement over time. The risk of venous stent migration is additionally increased by preventable causes such as trauma to the site and stent undersizing, which can lead to poor stent–venous wall contact.[3] The use of intravascular ultrasound to ensure correct stent sizing for the expected landing zone will minimize stent undersizing. Stents placed in the iliac veins must be adequately sized by diameter and length for good apposition and to land securely in the normal vein on either side of the lesion. The use of intravascular ultrasound

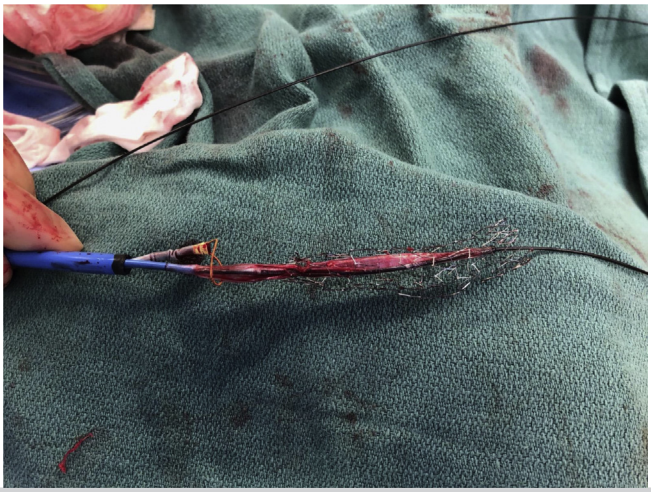

Fig 3. Photograph showing removed sheath, snare, stent, and balloon.

has been found to be more effective in treating iliofemoral venous lesions not accurately appreciated on venography.[7] Stents that are self-expanding, undersized, and too short have a greater risk of embolization.

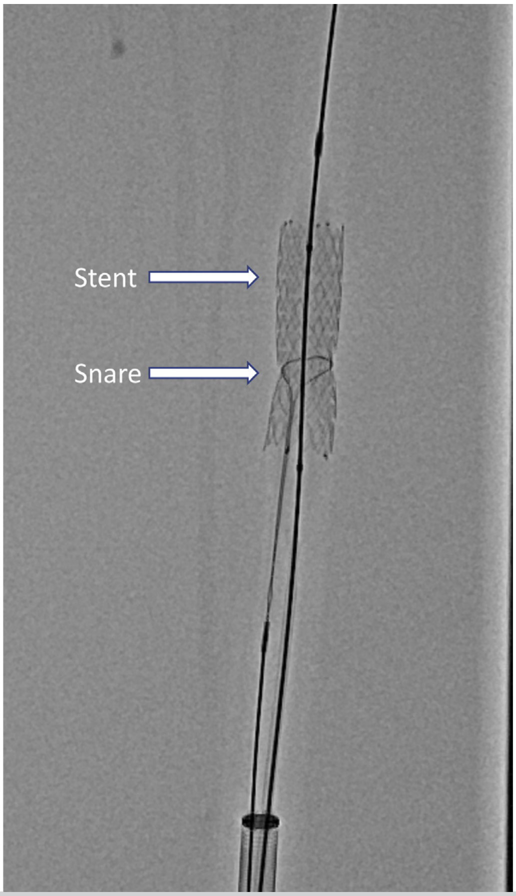

Fig 4. Model depicting wire and balloon placed through the stent with a snare around the stent.

A recently reported literature review found four case reports describing stent migration to the right heart in patients with MTS. Only one of these cases resulted in successful snare recovery of the displaced stent. The other three had required open surgical retrieval, resulting in significant postoperative complications, including stroke, hemopericardium, and valvular damage.[3,6] This highlights the importance of developing more effective techniques for snare removal of displaced stents, and the need for maximal attempts at endovascular retrieval to minimize the morbidity and mortality associated with open heart surgery.

The dual use of the balloon and snare helps to prevent further complication of stent fracture and migration and to ensure efficient removal. A model depicting the wire and balloon placed through the stent with a snare placed over the outside of the stent is shown in Fig 4. The model with the balloon insufflated is shown in Fig 5. This method helps to improve traction on the stent and decrease the risk of stent fracture and further embolization. Similar techniques have been described, which

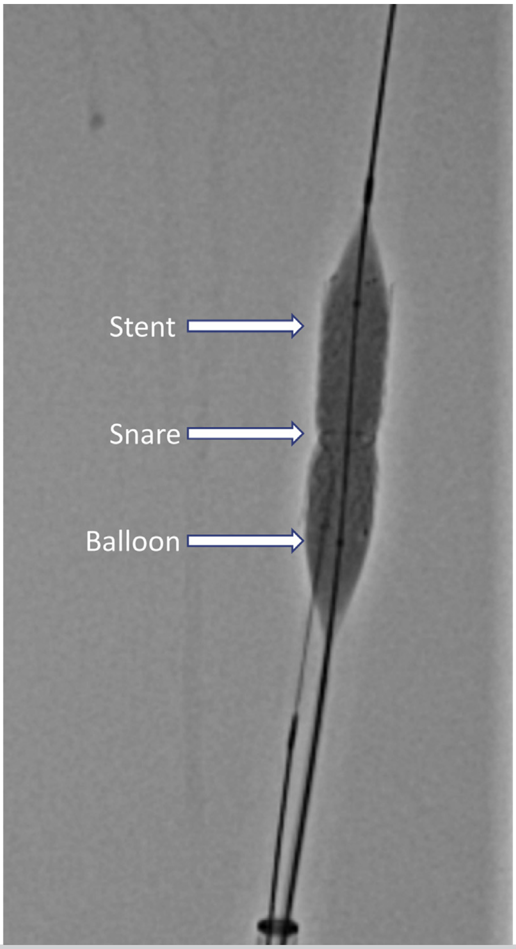

Fig 5. Model depicting wire and balloon placed through the stent with a snare around the stent and the balloon insufflated.

mainly involve snaring the stent and either collapsing it into the sheath or passing the sheath over the stent to recapture it.[8,9] Although appropriate in other anatomic areas, we believe that these methods risk stent fracture, shearing, and tearing of the chordae tendineae.

CONCLUSIONS

We have described a straightforward and effective endovascular method for retrieving migrated stents using both a snare and a balloon simultaneously, which is especially suited to large stents lodged in the right heart. Endovascular retrieval should be strongly favored because of the major complications associated with open surgical retrieval.[6]

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Submitted Apr 15, 2021; accepted Sep 12, 2021.