It works there too! Use of the endovascular occlusion balloon to rescue left subclavian vein injury during lead extraction

Amarbir Bhullar, MD,* Sean Alcantara, MD,† Pey-Jen Yu, MD,‡
Laurence M. Epstein, MD, FHRS*

*From the *Cardiology, Northwell Health, Manhasset, New York, †Vascular Surgery, North Shore University Hospital, Manhasset, New York, and ‡Cardiac Surgery, North Shore University Hospital, Manhasset, New York.*

Introduction

Medical practice has often seen the use of medications and technology in ways not initially intended. This has been particularly true for transvenous lead extraction (TLE). While new tools have improved the efficacy and safety of TLE, life-threatening complications can still occur. Superior vena cava (SVC) tear is the most lethal of these complications.[1] The Bridge Occlusion Balloon® (Bridge) (Phillips, Amsterdam, Netherlands) was approved by the US Food and Drug Administration in 2016. It is a compliant 80 mm endovascular balloon designed to temporarily occlude the site of injury in the event of an SVC tear, providing time and stability to initiate a definitive repair.[2] We report the use of the Bridge from a superior approach to treat a left subclavian vein tear to allow for definitive treatment.

Case report

The patient is a 79-year-old woman with a past medical history of coronary artery disease, hypertension, and atrial fibrillation. Owing to tachy-brady syndrome the patient underwent initial VVI pacemaker (PCM) placement approximately 30 years prior. She underwent upgrade to a dual-chamber device and ultimately an AVJ ablation for refractory atrioventricular junction. Thirteen years ago, the patient underwent TLE and reimplantation owing to lead fracture (atrial and ventricular Medtronic 5076). Owing to worsening left ventricular (LV) function and the development of heart failure, the patient was again upgraded to a biventricular PCM 11 months prior. Implantation of the LV lead (Boston Scientific 4674) required venoplasty owing

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KEY TEACHING POINTS

- Vascular tears can occur during transvenous lead extraction and can be life threatening, so you must be prepared.
- The Bridge Occlusion Balloon (Phillips, Amsterdam, Netherlands) can control bleeding and allow time for definitive treatment.
- The Bridge Occlusion Balloon can be used from a superior approach to treat a left subclavian tear.

to significant stenosis in the distal left subclavian at the junction with the brachiocephalic vein. During follow-up, noise was found on both the atrial and right ventricular leads. After discussion of options, the patient opted for extraction and reimplantation. The plan was to extract and replace the 13-year-old atrial and ventricular leads and preserve the 11-month-old LV lead.

The procedure was performed in a hybrid operating room, under general anesthesia, with invasive blood pressure monitoring and a transesophageal echo probe in place. Sheaths (6F) were placed in both femoral veins (FV). A super-stiff guidewire was advanced to the right internal jugular vein through the right FV to serve as a guide should the Bridge be required. A 5F quadripolar catheter was advanced through the left FV to provide temporary pacing. The leads were freed, anchors removed, and active fixation retracted. The leads were cut and locking stylets (LLD EZ; Phillips, Amsterdam, Netherlands) placed distally. Initially a 14F laser sheath (GlideLight; Phillips, Amsterdam, Netherlands) was utilized to free the leads from encapsulating scar tissue. The atrial lead was approached first. There were dense adhesions at the venous entry site and significant lead-to-lead adhesions along the course of the left subclavian vein. The sheath could not be advanced beyond

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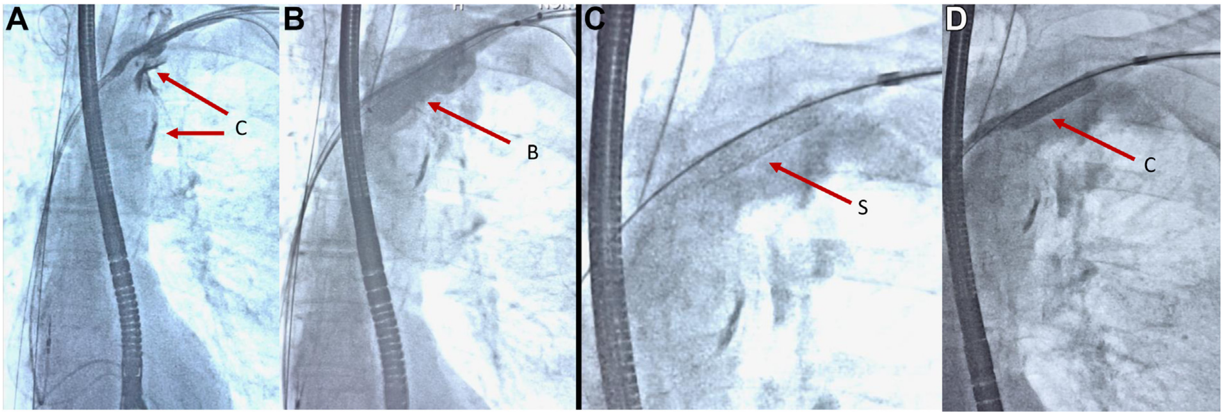

Figure 1 **A:** Contrast (C) extravasation into extravascular space at the site of the tear in the left subclavian vein. **B:** The Bridge (Phillips, Amsterdam, Netherlands) balloon (B) positioned across the site of the tear in the left subclavian vein and inflated with 20 cc of contrast/saline mixture. **C:** Covered stent (S) deployed across the site of the tear in the left subclavian vein. **D:** Repeat venogram showing no extravasation of contrast (C) after covered stent deployment.

the distal portion of the left subclavian, just prior to the brachiocephalic vein at the site of the prior venoplasty. The sheath was upsized to a 16F, which was then advanced to the proximal SVC, at which point the atrial lead became free and was removed. An attempt to place a guidewire through the laser sheath to maintain access was unsuccessful owing to SVC stenosis at this site.

The right ventricular lead was approached next. The sheath could not be advanced beyond the point of the SVC stenosis. The laser sheath was exchanged for a 13F mechanical sheath (TightRail; Phillips, Amsterdam, Netherlands), which was advanced beyond the point of SVC stenosis into the right atrium. The right ventricular lead was removed with countertraction and 2 guidewires were advanced through the sheath to maintain access. There was a transient drop in blood pressure. No pericardial effusion was seen on transesophageal echocardiogram and the lung fields were clear. Since the transient drop in blood pressure may have been due to loss of AV and V-V synchrony, a new atrial lead was implanted to achieve atrioventricular pacing with the preserved LV lead. The patient developed recurrent hypotension and haziness was now seen over the left lung field, and the transesophageal echocardiogram demonstrated a left-sided pleural effusion, without pericardial effusion. Cardiac and vascular surgery were called. Using a previously placed guidewire, a 5F dilator was placed and a left subclavian venogram was performed. This demonstrated extravasation of contrast into the extravascular pleural space (Figure 1A, Supplemental Video 1). An Amplatz Super Stiff 0.35/145 cm guidewire (Boston Scientific, Natick, MA) was placed via the dilator into the inferior vena cava. As the patient was becoming more hemodynamically unstable, the Bridge balloon was advanced over the guidewire in the left subclavian vein with the proximal and distal markers spanning the site of the tear. It was inflated with 20 cc of a contrast/saline mixture (Figure 1B). This resulted in rapid stabilization of the patient. The cardiac surgeon felt this would be a very difficult location to perform an open repair, and vascular surgery felt it was amenable to stenting. The newly placed atrial and previously placed LV leads were removed to avoid jailing of the leads with a covered stent. The Balloon was deflated and removed, and vascular surgery placed an 8 $\times$ 39 mm VBX covered stent (WL Gore, Newark, DE) across the site of subclavian vein tear (Figure 1C). A repeat venogram demonstrated no further extravasation (Figure 1D). A left chest tube was placed by cardiac surgery to drain the hemothorax. New atrial, right ventricular, and LV leads were placed through the stent and a biventricular PCM was reimplanted. The patient made a good recovery and was ultimately discharged.

Discussion

We describe the first reported use of the Bridge Occlusion Balloon from a superior approach to treat a left subclavian vein tear. Vascular injuries during TLE are medical emergencies, and delay in treatment increases morbidity and mortality. The Bridge Occlusion Balloon has been demonstrated to be lifesaving in cases of SVC tear.[3] A tear in the left subclavian vein resulting in hemothorax is an unusual complication of TLE. This patient may have been at higher risk of subclavian injury owing to the multiple prior interventions, including TLE and venoplasty of left subclavian vein.[4] In the setting of a rapid developing hemothorax resulting in hemodynamic collapse, the use of the Bridge from the superior approach allowed for stabilization and definitive treatment. This case report demonstrates that the Bridge rescue balloon can be used, "off label," outside of the SVC, and via access other than the femoral vein.

Conclusion

Vascular tears are a rare but life-threatening complication of TLE. The Bridge Occlusion Balloon has been shown to be lifesaving. This case report demonstrates that the Bridge rescue balloon can be used outside of the SVC and via access other than the femoral vein.

Appendix

Supplementary data

Supplementary data associated with this article can be found in the online version at https://doi.org/10.1016/j.hrcr.2021.03.012.

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