Endovascular stenting of external iliac vein injury during anterior spine exposure

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ABSTRACT

Anterior lumbar interbody fusion (ALIF) is a standard approach for the surgical management of patients with severe degenerative disease at the L4-L5 and lumbosacral (L5-S1) levels. ALIF is performed through retroperitoneal exposure but harbors a small risk of major vascular injury. In this case, we describe an emergent endovascular repair of an external iliac vein injury that occurred during ALIF with long-term follow-up. We discuss specific strategies in the decision making and technique that led to a successful outcome in this case. Endovascular stent grafting is a potential bailout option for serious iliac vein injury. (J Vasc Surg Cases Innov Tech 2024;10:101506.)

Keywords: Anterior spine exposure; Endovascular technique; Venous injury

Anterior lumbar interbody fusion (ALIF) provides direct access to the anterior lumbar spine for discectomy and placement of a prosthetic implant. Retroperitoneal exposure is performed with mobilization of the viscera, ureter, and iliac arteries and veins to provide a clear window of access to the disc space of interest. A major vascular injury is a dreaded and rare complication of anterior spine exposure and occurs on the order of 1.4% to 3%.[1-4] In particular, the thin-walled iliac veins and branches are at risk of traction injury during mobilization, retractor placement, and instrumentation. Typical repair of major venous injuries involves proximal and distal control with compression and direct suture repair of the defect. We describe a challenging case with endovascular repair of a left external iliac vein injury using covered stent grafts buttressed with external sutures. The patient provided written informed consent for the report of his case details and imaging studies.

CASE REPORT

A 52-year-old man with a history of appendectomy and left inguinal hernia repair presented with L5 radiculopathy. Magnetic resonance imaging demonstrated L5-S1 spondylolisthesis and disc herniation. A left-sided paramedian incision and retroperitoneal exposure for L5-S1 was performed by an experienced cardiothoracic surgeon. During mobilization of the retroperitoneal contents and before setup of the spine retractor, a traction injury was sustained to the left external iliac vein (EIV). The EIV was noted to be tethered from prior adhesions, probably from the hernia repair. Control of the inflow source of bleeding (ie, the EIV) was achieved by compression of the vein with sponge sticks against the suprainguinal region (Fig 1, *A*). Profuse bleeding occurred with brief release of the sponge stick tamponade, and the injury could not be well visualized. A second vascular surgeon was called to assist. Femoral vein cutdown was considered for inflow control and direct repair, as was vein ligation. An endovascular option was proposed.

Ultrasound-guided access to the left femoral vein was achieved, and a percutaneous sheath was placed. A hydrophilic wire was navigated into the vena cava with temporary release of the sponge stick tamponade. The largest diameter Viabahn covered stent (13 mm × 100; W.L. Gore & Associates) was deployed in the EIV (Fig 1, *B*). Some residual bleeding caudal to the stent was temporarily managed by balloon inflation (Fig 1, *C*). A second Viabahn stent (13 mm × 50) was deployed, overlapping with the first stent (Fig 1, *D*). The decision to extend the stent below the inguinal ligament was believed necessary to control hemorrhage but also thought reasonable based on experience with stenting thrombotic venous disease and literature that supports bare metal venous stenting across the inguinal ligament for thrombotic venous disease.[5]

Brief assessment of prior cross-sectional computed tomography imaging showed an EIV measuring 9 to 13 mm. Finally, eight 5-0 Prolene "pexy" sutures were placed at intervals through the vein wall into the stents to potentially prevent the risk of late migration of the stents. The estimated blood loss for the operation was 2300 mL. The patient was hemodynamically stable, and the spinal operation was completed. Postoperative computed tomography venography demonstrated patent stents extending from the left EIV through the common femoral vein with no hematoma (Fig 2). He took baby aspirin for 1 year. Follow-up duplex ultrasound scans for 3 years postoperatively reveal patent stents with normal phasic waveforms (Fig 3). The patient has an active lifestyle with no leg edema.

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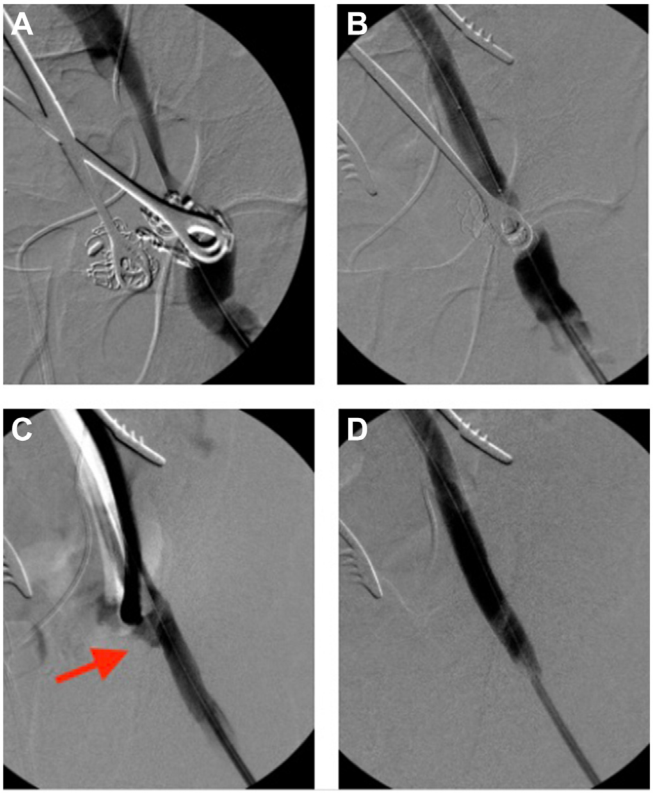

Fig 1. Sequential venograms of the left external iliac vein (EIV) injury and stenting. **A,** Venogram demonstrating limited filling of the injured EIV while compressed by two sponge sticks. **B,** Venogram after initial stent placement. **C,** Residual extravasation of contrast was noted caudal to the first stent (*red arrow*). Note the motion artifact from the adjacent suction tip. **D,** A second overlapping stent was deployed and resulted in hemorrhage resolution.

DISCUSSION

In the field of spine surgery, expanded indications and improved technology have led to a worldwide increase in the volume of lumbar fusions over several decades.[6] Accordingly, there is a need to train the next generation of vascular surgeons who will play a pivotal role both in ALIF exposure and in the management of iatrogenic vascular injuries.[3] In retrospective series, minor vascular injuries are reported in the range of 3.8% to 24%, with major vascular injuries reported in 1.4% to 3% of ALIFs.[1-4,7] Mobilization of the thin-walled iliac veins during blunt retroperitoneal dissection and retractor positioning is necessary for L4-L5 and L5-S1 exposures. Even a small injury to the iliac vein or side branch can cause significant blood loss and is challenging to repair through the narrow, deep window of exposure. Given the low incidence of major vascular injury, it is difficult to identify the specific risk factors even when subjected to systematic review.[8] Venous injury is more common at the L4-L5 level due to the need to mobilize and divide the iliolumbar vein branches.[2,3,9] Retroperitoneal scarring from prior surgery or infection (eg, diverticulitis), pelvic radiation, or an iliocaval anatomic variation can potentially increase the risk of vessel injury.

Our practice for managing venous injury during ALIF is to first communicate the level of concern with the operating room team, next to call for a second surgeon with experience in hemorrhage control, and, third, to isolate the injury with proximal and distal compression. Once the laceration is visualized, primary suture repair can generally be performed. Extensive venous injury can rarely necessitate ligation if adequate control cannot be obtained. Endovascular management of iliac vein injuries is a potential option, especially when satisfactory inflow or outflow control cannot be obtained. Endovascular repair of common iliac vein or caval injury can require larger stent graft components, such as used for aneurysm repair. Sizing is problematic in an emergency, and treatment is likely to occur without the benefit of intravascular ultrasound. Injury at the iliac vein confluence is particularly hazardous; however, stent graft repair risks jailing the contralateral side and leading to subsequent deep vein thrombosis. Bonasso et al[10] described a series of three cases managed successfully with endovascular stent grafts with short-term follow-up. In another institutional series of 914 patients, 4 patients (0.4%) underwent rescue endovascular stenting for a major venous injury.[11] Two of these patients developed postoperative deep vein thrombosis related to the procedure.

The choice in our case to use postoperative aspirin monotherapy was based on several factors. Following spinal surgery, we prefer to avoid anticoagulation in the immediate perioperative setting due to risk of spinal epidural hematoma. The decision was also believed reasonable after extrapolating from the experience with nonthrombotic venous stenting. Consensus guidelines for an antithrombotic regimen after stenting of nonthrombotic venous disease are lacking, and a variety of options have been described after venous stenting for nonthrombotic disease.[12,13]

One of the feared risks of venous stenting is migration of the stent, with potential adverse sequelae.[14,15] Sizing of the stent is paramount to preventing this complication; however, the need for expediency with venous injury limits the surgeon's ability to carefully size the stent and use intravascular ultrasound, as is customary in elective cases. In the present case, we placed external "pexy" sutures though the wall of the vein into the stents to mitigate the risk of migration. The use of these buttressing sutures is a simple "belt and suspenders" option when the vein is already exposed, and the hemorrhage has ceased. It behooves the spine access team to have ready access to endovascular tools, including stent grafts, for the rare occasion that endovascular rescue is required.

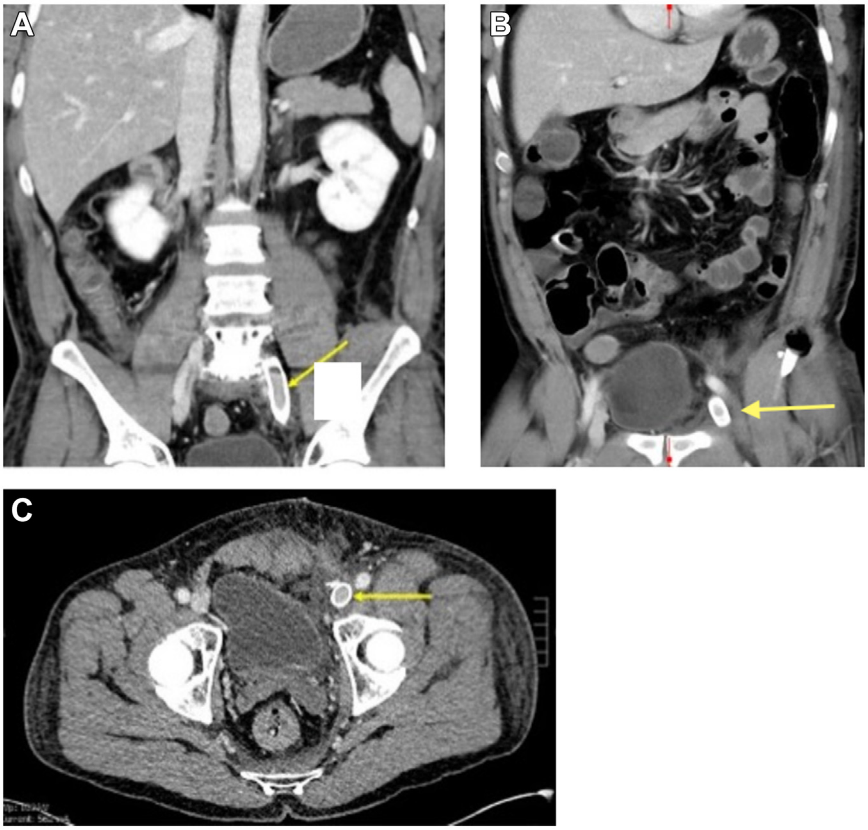

Fig 2. Computed tomography venogram after endovascular stent graft repair of venous injury to left external iliac vein (EIV) that occurred during anterior lumbar interbody fusion (ALIF). **A,** Coronal view of patent iliac vein stent. **B,** Coronal view of iliac vein stent showing extension beyond the inguinal ligament. **C,** Axial view of iliac vein stent.

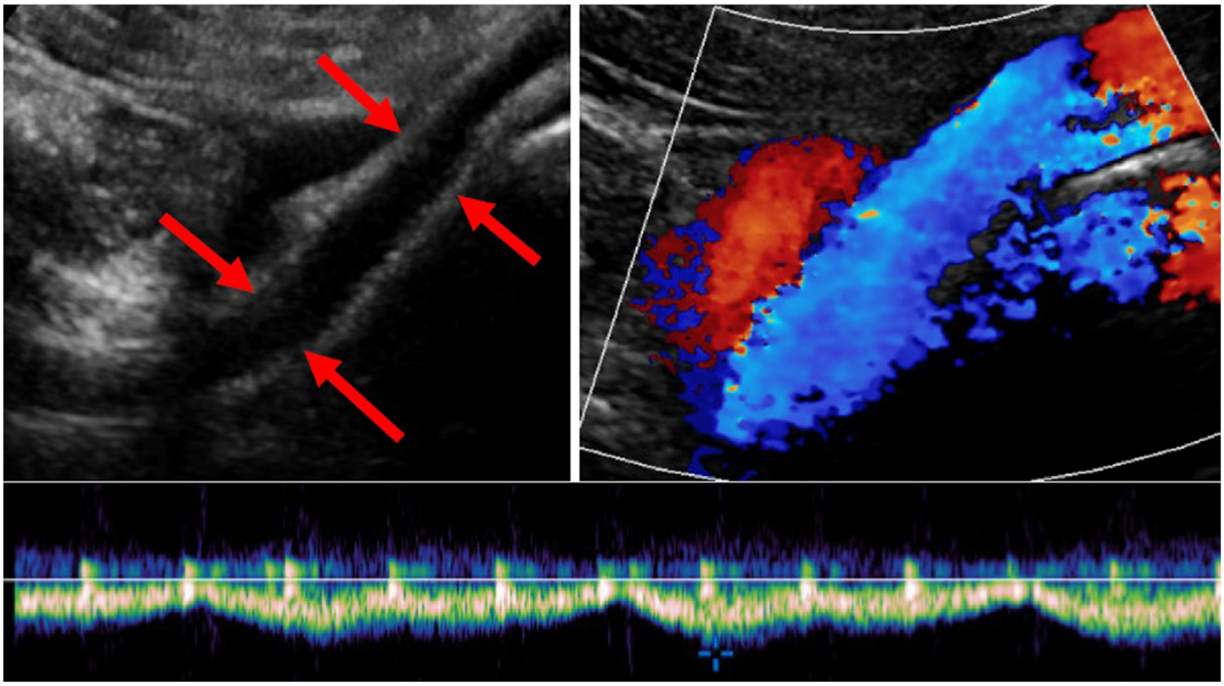

Fig 3. Duplex ultrasound showing iliac vein stents in B-mode (*red arrows* mark sides of stent in longitudinal view). Color flow shows flow in stent, and Doppler waveform demonstrates respiratory phasicity.

CONCLUSIONS

Endovascular covered stenting is a feasible bailout option for vein injury during spine access surgery when traditional open methods of hemorrhage control fail. Plicating external sutures are a simple adjuvant technique that can mitigate the risk of stent migration. Long-term follow-up is advisable for surveillance of stent patency and position.

DISCLOSURES

None.

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