

Vertebroplasty-associated cement leak leading to iatrogenic venous compression and thrombosis

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ABSTRACT

A 91-year-old woman presented with left lower extremity swelling and pain diagnosed as phlegmasia cerulea dolens. Doppler ultrasound and venography revealed extensive left lower extremity deep venous thrombosis. Review of prior images revealed cement leakage causing compression of the left common iliac vein. She underwent successful mechanical thrombectomy using the ClotTrievers device (Inari Medical, Irvine, Calif) and subsequent stent placement. Phlegmasia cerulea dolens resolved on the following day, and the stent remained patent at the 1-month follow-up appointment. Cement leakage from L5 vertebroplasty can cause extrinsic compression on the left common iliac vein, resulting in iatrogenic venous compression syndrome and the development of deep venous thrombosis in the affected lower extremity. (*J Vasc Surg Cases and Innovative Techniques* 2019;5:561-5.)

Keywords: Vertebroplasty; Cement leakage; Stenosis; Common iliac vein; Venous compression syndrome; Deep venous thrombosis

Percutaneous vertebroplasty is a common procedure performed to treat painful osteoporotic or malignant disease-related vertebral compression fractures in patients nonresponsive to conservative management.¹ We report a case of cement leakage anterior to the L5 vertebral body after vertebroplasty that caused extrinsic compression and severe stenosis of the proximal left common iliac vein, resulting in extensive left lower extremity deep venous thrombosis (DVT). The patient underwent successful mechanical thrombectomy and stent placement across the stenotic segment. A written consent for publication of this case report was obtained from the patient.

CASE REPORT

A 91-year-old woman presented to our emergency department 2 days after she started to experience swelling, pain, and erythema in her left lower extremity. Physical examination revealed severe edema and pigmentation of the left lower extremity, diminished left dorsalis pedis artery pulse, and

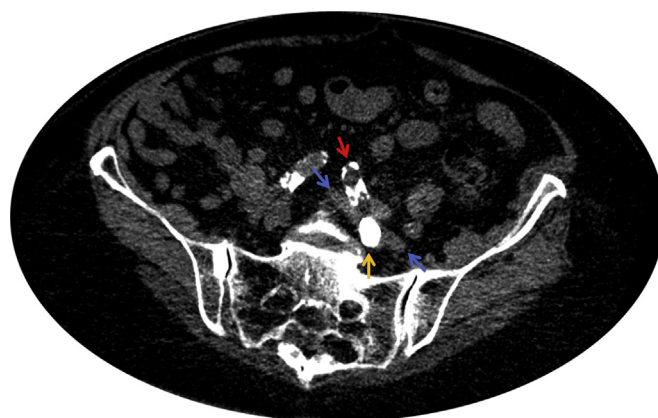


Fig 1. Axial image of non-contrast-enhanced computed tomography (CT) scan of the pelvis approximately 2 years after vertebroplasty shows extravertebral leakage of the cement (*yellow arrow*), mass effect over the left common iliac vein (*blue arrow*), and left common iliac artery (*red arrow*).

nonpalpable left posterior tibial artery pulse consistent with phlegmasia cerulea dolens.

Doppler ultrasound showed occlusive thrombus extending from the left tibioperoneal trunk to the external iliac vein along with nonocclusive thrombus in the profunda femoris and proximal segment of the femoral vein. On review of the patient's non-contrast-enhanced computed tomography (CT) scan of the pelvis taken 2 months earlier, cement leakage from an L5 vertebroplasty that was performed approximately 3.5 years ago was noted (*Fig 1*), resulting in compression of the left common iliac vein. The acute DVT presentation was presumed to be related to recent immobilization, given the patient's history of difficulty with ambulation.

The distal left popliteal vein was accessed through a standard Seldinger approach, followed by placement of a 13F ClotTrievers (Inari Medical, Irvine, Calif) sheath (*Fig 2*). Venography revealed

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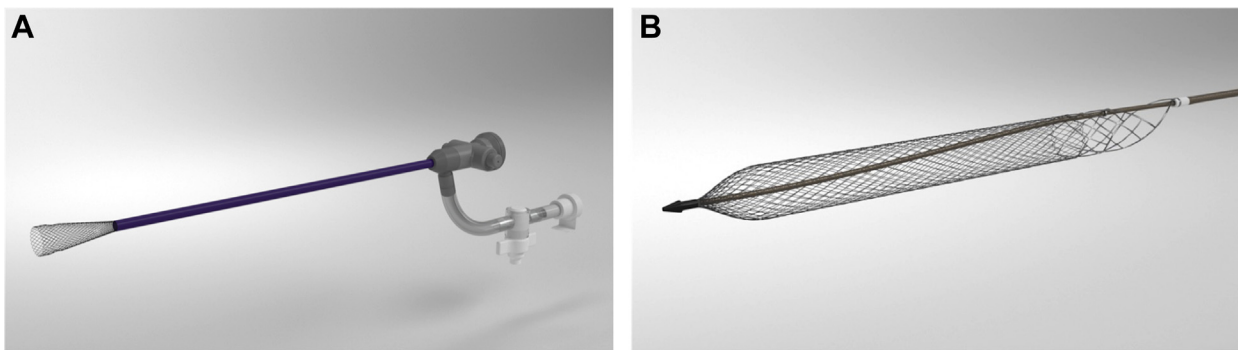


Fig 2. Schematic picture of the Inari ClotTrievers thrombectomy device. The Inari ClotTrievers thrombectomy device includes a self-deployed funnel (**A**) and a thrombectomy catheter (**B**). The ClotTrievers catheter was advanced through the ClotTrievers sheath, beyond the thrombosed segments, just distal to the inferior vena cava (IVC) confluence. The nitinol coring element with the attached collection bag, the essential thrombectomy component of the ClotTrievers catheter, was then deployed and slowly retracted toward the sheath. (Courtesy Inari Medical, Irvine, Calif.)

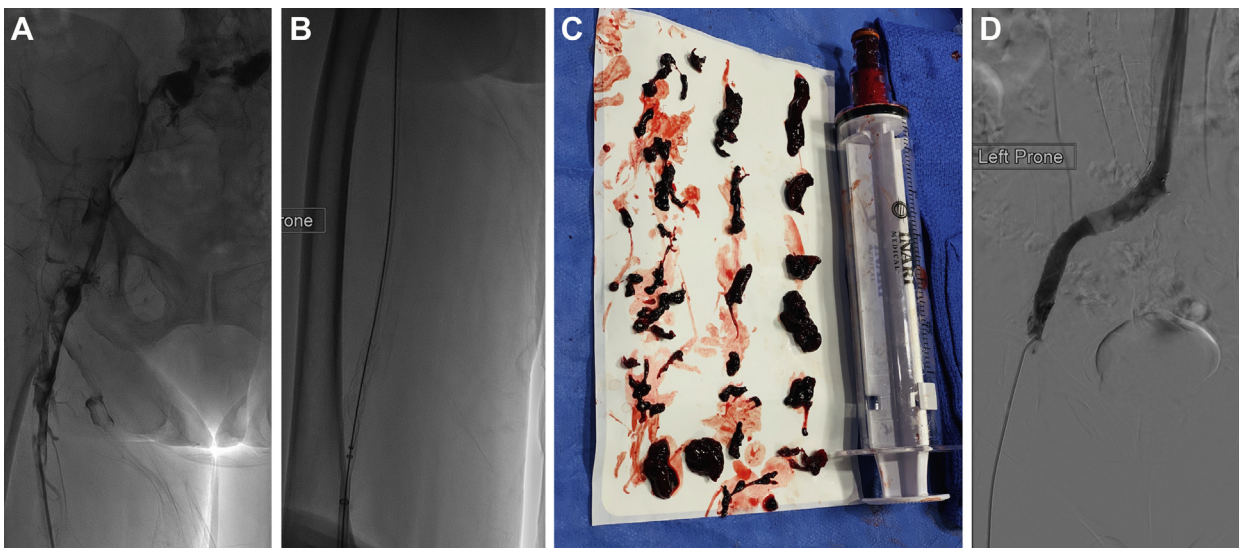


Fig 3. **A**, Preliminary venography of the left lower extremity. Catheter venogram showed patency of the distal and mid femoral vein but confirmed extensive thrombosis extending from proximal left femoral vein through left common iliac vein. **B**, Mechanical thrombectomy. The retrieval nitinol net of the Inari ClotTrievers thrombectomy device (Inari Medical Inc, Irvine, Calif) was deployed and the system retracted into the sheath. **C**, A significant amount of acute and chronic clots was retrieved using the Inari ClotTrievers device. **D**, Final venography shows improved blood flow in the left common iliac vein stent but mass effect from cement leakage.

occlusive thrombus extending from the proximal segment of the left femoral vein into the common femoral vein, external iliac vein, and origin of the left common iliac vein (Fig 3, A). The inferior vena cava (IVC) was patent. The thrombosed area was crossed using a 0.035-inch angled Glidewire (Terumo Interventional Systems, Somerset, NJ) through a 5F angled Glidecath. Once access into the IVC was obtained, the Glidewire was exchanged for a 0.035-inch Super Stiff Amplatz wire (Boston Scientific, Marlborough, Mass) whose tip was positioned into the hepatic IVC. The ClotTrievers thrombectomy device was then used. This device consists of a ClotTrievers sheath, which includes a self-deployed funnel and a thrombectomy catheter (Fig 2). The

ClotTrievers catheter was proximally advanced through the ClotTrievers sheath, beyond the thrombosed segments, just distal to the IVC confluence. The nitinol coring element with the attached collection bag, the essential thrombectomy component of the ClotTrievers catheter, was then deployed and slowly retracted toward the sheath (Fig 3, B). During retraction, resistance due to extruded cement compression from the previous L5 vertebroplasty was noted in the proximal left common iliac vein. A significant amount of thrombus was removed by the ClotTrievers catheter in two sweeps (Fig 3, C). Repeated venography showed nearly complete thrombus removal but a persistent severe stenosis at the left common iliac vein. Given the

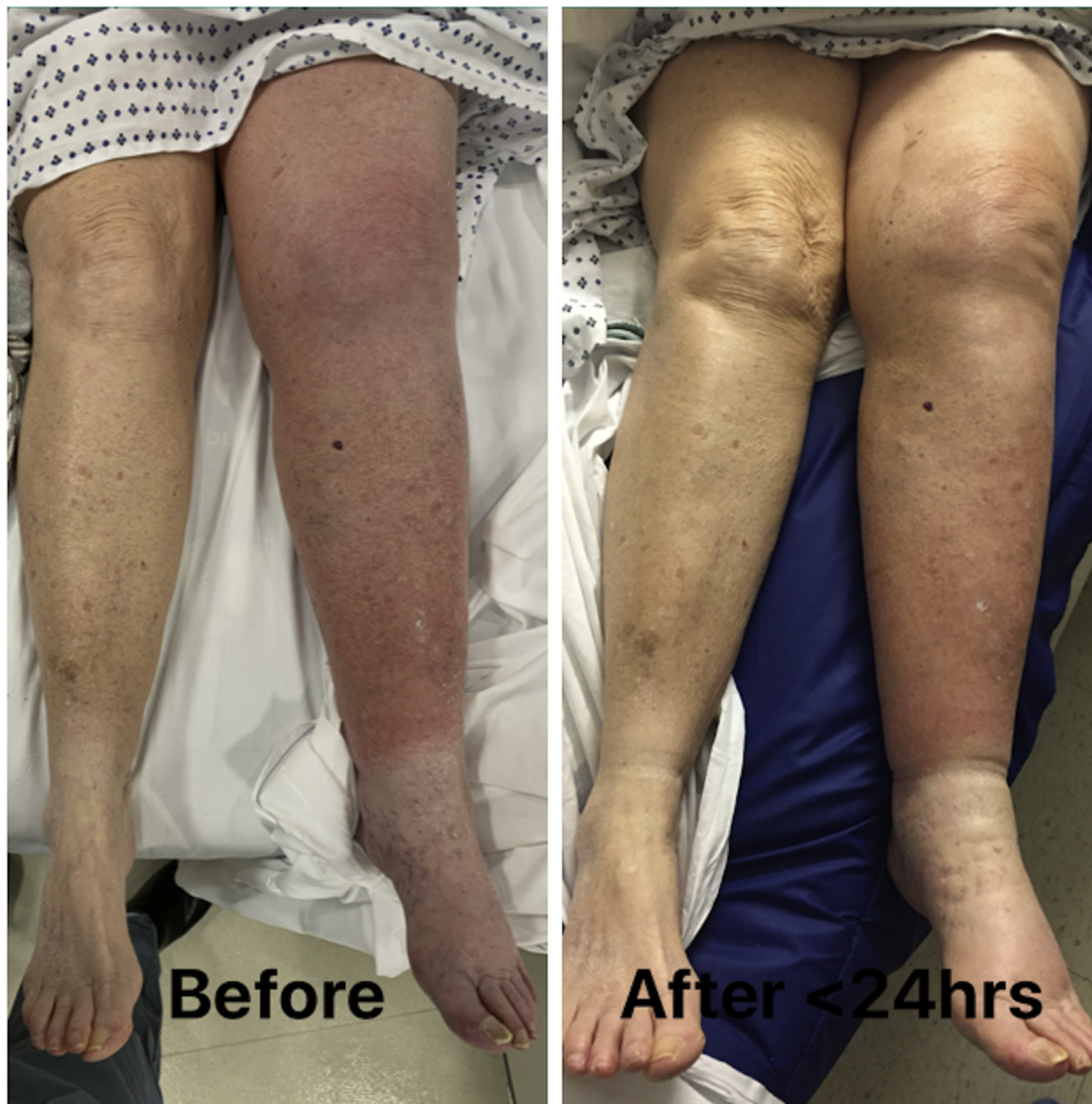


Fig 4. Pictures of left lower extremity before and after thrombectomy show significant improvement of the left lower extremity phlegmasia cerulea dolens.

degree of extrinsic compression over the left common iliac vein, the patient would remain at significant risk for rethrombosis. Therefore, venoplasty was performed with a 10-mm Mustang balloon (Boston Scientific) at the site of stenosis, with subsequent deployment of a 14-mm \times 10-cm E-Luminexx stent (Bard Peripheral Vascular, Tempe, Ariz). Final venography demonstrated patent left popliteal, femoral, common femoral, external iliac, and common iliac veins with a widely patent stent (Fig 3, D).

Phlegmasia cerulea dolens of the left lower extremity was significantly improved 1 day after intervention (Fig 4). The patient had normal renal function (serum creatinine

concentration of 0.78 mg/dL) and was prescribed apixaban 2.5 mg twice daily for 6 months, given her age.² One-month follow-up CT venography demonstrated patency of the stent at the level of the prior occlusion (Fig 5). The patient remained asymptomatic on a subsequent clinic visit 3 days after CT venography, and there was no edema or discoloration on physical examination.

DISCUSSION

This is a case of iatrogenic chronic venous compression syndrome after vertebroplasty and cement leakage. Our patient presented with left lower extremity DVT, which



Fig 5. Computed tomography (CT) venography of the pelvis. Axial view demonstrates cement leakage from L5 vertebroplasty causing 40% to 50% luminal stenosis; the left common external iliac vein stent is patent.

was successfully treated by mechanical thrombectomy using the Inari ClotTrievers device; the underlying proximal left common iliac vein compression was addressed with an E-Luminexx stent.

The left common iliac vein passes between the right common iliac artery anteriorly and the sacral promontory-fifth lumbar vertebral body posteriorly (variability dependent on the level of the ilio caval junction). Extrinsic venous compression commonly occurs secondary to mass effect from adjacent arteries (as seen in May-Thurner syndrome), ligament, muscle, or osseous structure in this tight anatomic space.³ By the same mechanism, vertebroplasty-associated cement leakage at the L5 vertebra can predispose to venous compression syndrome by causing extrinsic compression against the proximal left common iliac vein at this level. This pathophysiologic change mimics May-Thurner syndrome.⁴ Although rare, given the similar presentation, it would be prudent to exclude mass effect from cement leakage after vertebroplasty in evaluating patients with DVT from iliac vein compression in the proper clinical scenario. Venous compression becomes clinically significant when the venous pressure increases or flow direction changes, leading to insufficient drainage, edema, and pain.⁵ Endothelial injury at the site of venous compression predisposes the patients to acute or chronic venous thrombosis.⁵ Development of thrombosis can result in venous hypertension in downstream veins, which can be manifested clinically as phlegmasia cerulea dolens or alba.^{5,6}

Despite modification in the procedure and cement composition, cement leakage remains the most common complication of the vertebroplasty, reported in 30% to 65% of patients with osteoporotic vertebral collapse and in 38% to 72.5% of patients with malignant collapse.⁷⁻⁹ Intravertebral vacuum cleft and end-plate cortical disruption are identified as disease-related risk

factors for vertebroplasty cement leakage. Cement viscosity and injected volume are known as procedure-related risk factors.¹⁰ Although cement leakage is generally asymptomatic, it can be associated with serious complications, including neurologic deficits and even death due to pulmonary embolism.¹⁰⁻¹² In our case, cement leakage from L5 vertebroplasty resulted in compression of the left common iliac vein.

In general, venous compression diagnosis is based on clinical evaluation and appropriate imaging. Signs and symptoms include pain, edema, venous thrombosis, and varicosities. Whereas the "gold standard" for image diagnosis is catheter venography and pressure gradient measurement, the role of intravascular ultrasound should not be underestimated and can prove invaluable.¹³ Furthermore, most clinicians are likely to stent a clinically symptomatic narrowed iliac vein on intravascular ultrasound or venography even if there is no gradient.

In our case, review of the previous CT scan and visualization of cement leakage with mass effect over the left common iliac vein were essential in determining the underlying cause of an acute DVT. Once the diagnosis was established, mechanical thrombectomy was performed using the Inari ClotTrievers device, given history of prior success with this device in our institution. The device's large coring element was specifically designed for the venous system to address large occlusions, as was present in our case. However, AngioJet (Boston Scientific) or Penumbra catheter (Penumbra, Alameda, Calif) could also have been used. To treat the underlying cause, venoplasty was performed, and the stenotic area was stented using an E-Luminexx stent. Both Wallstents (Boston Scientific) and E-Luminexx stents are appropriate choices in this clinical scenario, and we deployed E-Luminexx stent because of past experience at our center and the availability of the correct size at the time of the procedure. In general, venoplasty and stent placement should be considered to address the acute disease and the compression syndrome.⁵

CONCLUSIONS

This case describes an iatrogenic venous compression syndrome due to complication of cement leak after L5 vertebroplasty, resulting in extensive left lower extremity DVT. The acute thrombosis was successfully treated with mechanical thrombectomy and stenting of the compressed area in a single session.

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