

Soleal venous aneurysm in a patient with a history of pulmonary embolism

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ABSTRACT

A lower extremity venous aneurysm is an uncommon vascular disease known to increase a patient's risk of pulmonary embolism. Although most will be popliteal venous aneurysms, crural aneurysms have been rarely documented. We have presented a rare case of a soleal venous aneurysm in a patient with a history of pulmonary embolism. Risk-reducing open aneurysm resection with lateral venorrhaphy was performed. (*J Vasc Surg Cases Innov Tech* 2022;8:729-31.)

Keywords: Deep venous thromboembolism; Pulmonary embolism; Soleal vein; Venous aneurysm

A venous aneurysm in the lower extremities is an uncommon vascular disease. However, it poses a significant risk of pulmonary embolism (PE). Most venous aneurysms will be found in the popliteal vein, although a few cases have also been reported in the femoral vein and, very rarely, in the crural veins, such as the gastrocnemius vein and sural vein.¹⁻³ Studies have reported up to a 50% risk of PE in patients with a popliteal venous aneurysm; therefore, excision has been strongly recommended.² We have presented a case of a soleal venous aneurysm in a patient with a history of PE. The soleal vein is an intramuscular crural deep vein. Autopsy studies have shown the soleal vein will frequently be the initial site of thrombus formation in patients with fatal PEs without initial lower extremity symptoms.^{4,5} Given our patient's history of unprovoked PEs and the high-risk nature of venous aneurysms, he underwent risk-reducing, open soleal venous aneurysm resection with lateral venorrhaphy. The patient provided written informed consent for the report of his case details and imaging studies.

CASE REPORT

A 78-year-old man with a history of unprovoked PEs was found to have a 3.0-cm × 2.6-cm saccular venous aneurysm of the left soleal vein on a duplex ultrasound study. Two years before his aneurysm diagnosis, he had been admitted to the intensive care unit with an acute PE after presenting to the emergency

department with shortness of breath and syncope. He had had an elevated D-dimer of 3652 ng/mL and large bilateral segmental filling defects on computed tomography of the chest consistent with a PE (Fig 1). He had had no lower extremity symptoms, and duplex ultrasound at the time had not shown any deep vein thrombosis (DVT) or aneurysm. He received intravenous anticoagulation therapy and was discharged with planned lifelong novel oral anticoagulant therapy in accordance with the recommendations of hematology. The findings from the ensuing workup, including hypercoagulability studies, echocardiography, and computed tomography of the abdomen and pelvis, were unremarkable. His recurrent syncopal episodes prompted referral to vascular surgery 2 years later. Repeat lower extremity venous duplex ultrasound scans were obtained because the previous scans had not included the crural or ilio-caval veins. Subsequently, a left lower extremity soleal vein aneurysm was found (Fig 2). The patient had no history of lower extremity trauma, vascular intervention, or other surgical procedures. He had no complaints of lower extremity pain or swelling, and no positive findings on physical examination. Because of his history of unprovoked PEs, excision of the soleal vein aneurysm was offered to reduce his risk of PE recurrence. A left lower extremity regional nerve block was performed, and the patient was lightly sedated. The left soleal vein aneurysm was localized, and its flow pattern was assessed using left lower extremity venography via left pedal vein access (Fig 3). Dilated soleal veins with reflux flow were found at the site of the aneurysm; however, no evidence of arteriovenous malformation or fistula was found. The venous aneurysm was visualized at the left mid-leg with connection to the soleal vein. A longitudinal incision was made along the left posteromedial leg, and the fascia of the superficial posterior compartment was opened. Intraoperative ultrasound was performed, which aided in identifying the aneurysm located inside the soleal muscle. On further exploration, the aneurysm was exposed and dissected out carefully (Fig 4). The aneurysm appeared to be 5-cm long and 3.5-cm wide, with a 1-cm pedicle connecting it to the left soleal vein, which was 1 cm in diameter. The aneurysm was resected, and the neck was closed primarily via lateral venorrhaphy to preserve flow of the soleal vein because it was significantly dilated (Fig 5). Patency of the soleal vein was

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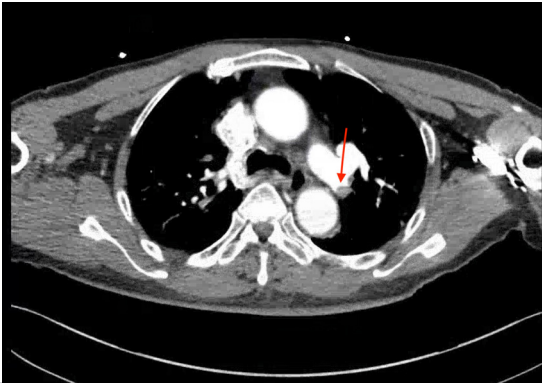


Fig 1. Computed tomography scan of the chest showing a large left pulmonary artery segment filling defect (arrow) consistent with a pulmonary embolism (PE).

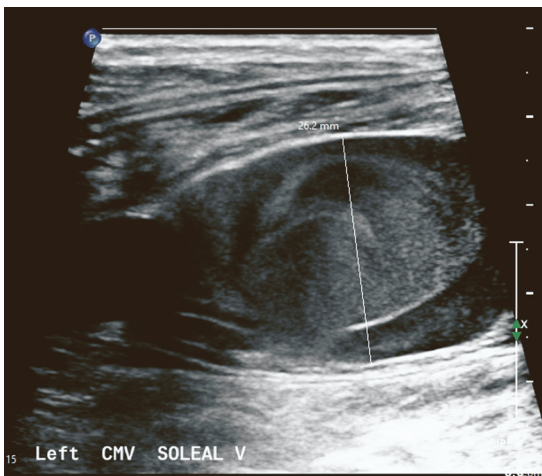


Fig 2. Venous duplex ultrasound of left lower extremity saccular venous aneurysm with a connection to the soleal vein (V). CMV, crural muscle vein.

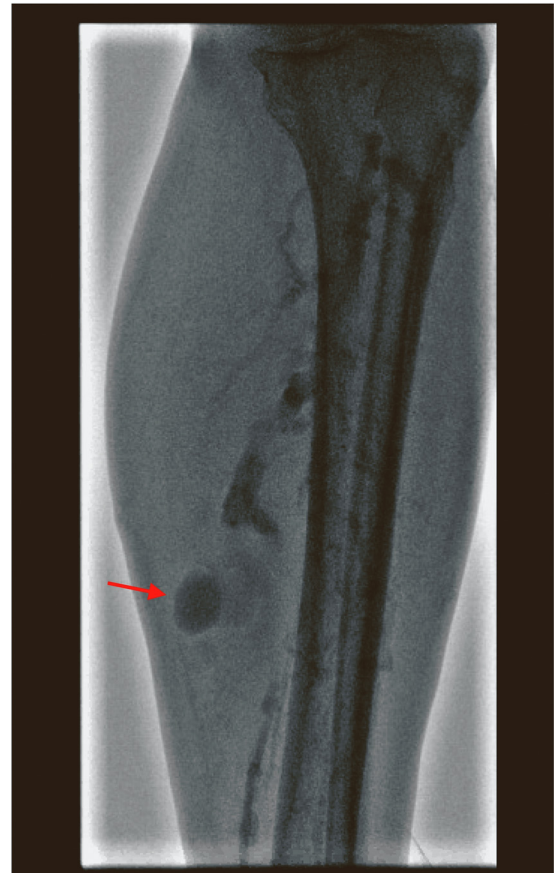


Fig 3. Venography was performed to identify the venous aneurysm (arrow) at the left mid-leg.

confirmed with intraoperative Doppler ultrasound, and the incision was closed in layers. The patient recovered well postoperatively. Histopathologic analysis of the specimen yielded no specific findings or insight regarding the cause of this pathology. Following discussion with hematology, a consensus was reached to discontinue the patient's novel oral anticoagulant therapy. Follow-up with repeat lower extremity duplex ultrasound scans at 2 weeks, 3 months, 6 months, and 1 year showed no DVT or aneurysm recurrence, and the patient has had no clinical signs or symptoms of DVT or PE.

DISCUSSION

The first case of a lower extremity venous aneurysm was reported in 1968 by May and Nissel,⁶ who had described a popliteal aneurysm. The association between lower extremity venous aneurysms and PE was first described by Dahl et al⁷ in 1976. A systematic review of primary venous aneurysms by Teter et al¹ showed that PE was the initial

presentation in 25% to 50% of patients with lower extremity aneurysms. Similarly, our patient had lacked any lower extremity symptoms both at the diagnosis of his unprovoked PEs and at the diagnosis of his lower extremity aneurysm.

A soleal venous aneurysm is exceedingly rare. A PubMed search yielded one reported case in a patient with recurrent DVT.³ The etiology of our patient's soleal vein aneurysm is unknown. The venous reflux seen on venography and venous duplex ultrasound could have been a contributing factor to aneurysm formation; however, no arteriovenous malformation was identified. We suggest that the potential for PE secondary to this vascular pathology is similar to that for popliteal aneurysms. A postmortem study of venous thromboembolism in patients diagnosed with an acute PE found that >90% of them had had soleal vein thrombus.⁵ The investigators concluded that the unique anatomy of the soleal vein, with its many branches and fewer valves, confers a high propensity to the formation of an organized thrombus.⁵ It has been suggested that an organized soleal venous thrombus is the catalyst for thrombus propagation proximally, eventually producing a large thromboembolism.^{4,5} We suspect our patient's unprovoked PE was directly related to the ideal



Fig 4. The aneurysm was measured intraoperatively and was 5-cm long and 3.5-cm wide, with a 1-cm pedicle connecting it to the left soleal vein.

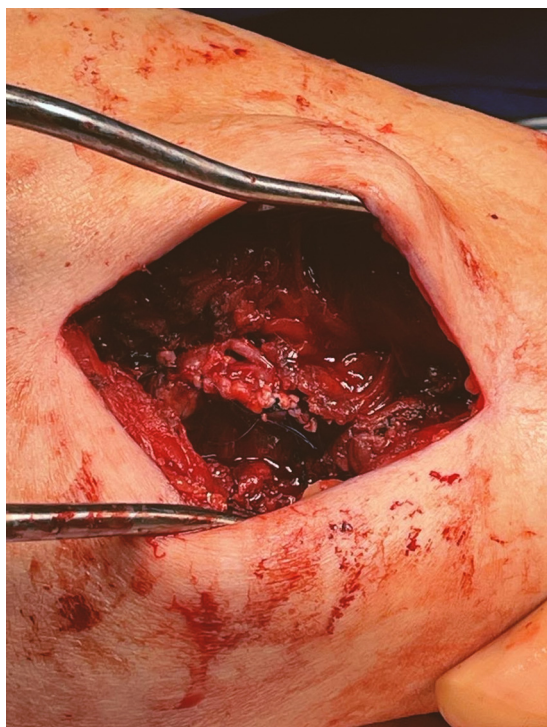


Fig 5. The aneurysmal sac was excised, and lateral venorrhaphy was performed with 6-0 Prolene running suture.

thrombogenic conditions created by his soleal venous aneurysm. Moreover, this hypothesis was further substantiated by the patient's recurrent syncopal events, which resolved postoperatively. Extrapolating from the recommendations regarding popliteal venous aneurysms, surgical excision was recommended.⁸⁻¹¹ In the setting of venous aneurysms, surgical excision should be considered superior to medical therapy for the prevention of PEs and results in a low recurrence rate.⁸⁻¹² Our surgical approach mimicked that for popliteal aneurysms. However, owing to the intramuscular location of the soleal vein, intraoperative ultrasound was essential for its successful management and limited unnecessary dissection.

Soleal venous aneurysms have been extremely rare in the literature. To the best of our knowledge, we have reported the first case of a soleal vein aneurysm in association with PE. Our patient was treated successfully with open resection of the aneurysm and lateral venorrhaphy.

CONCLUSIONS

Crural aneurysms, such as a soleal vein aneurysm, should be considered in patients with a history of unprovoked PEs. We propose surgical resection of the aneurysm to prevent recurrent PEs.

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