

Contemporary management of lower extremity venous aneurysms



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ABSTRACT

Objective: Lower extremity venous aneurysms may lead to serious morbidity in patients, including pulmonary embolism (PE) and chronic venous insufficiency. Presently, because of the low incidence of these aneurysms, no consensus for their treatment exists. The purpose of this study was to review the presentation and management of lower extremity venous aneurysms at our institution.

Methods: A retrospective review of all patients with isolated lower extremity venous aneurysms treated at a single tertiary care medical center from 2005 to 2017 was conducted.

Results: Five male and six female patients with lower extremity venous aneurysms were identified, with a mean age of 50.4 years. Three patients presented with deep venous thrombosis or PE, three presented with pain, and five venous aneurysms were found incidentally. Nine of 11 patients had aneurysms involving the popliteal vein; one was in the iliac vein, and one was in the common femoral vein. Diagnosis was made by duplex ultrasound in five patients, magnetic resonance imaging in five patients, and computed tomography venography in one patient. Mean aneurysm to adjacent vein ratio was 2.62. No patients who had venous aneurysms discovered incidentally suffered thromboembolic complications. Three patients who were initially treated conservatively went on to eventual surgical intervention. Six patients underwent surgical intervention. The indication for operation was deep venous thrombosis or PE in three patients and lower extremity swelling in three patients; all were symptomatic at presentation. Three patients had simple venorrhaphy, two patients had aneurysmectomy and ligation of the vein, and one patient underwent aneurysmectomy with placement of an interposition vein graft. Mean follow-up was 26 months, with no recurrent thromboembolism. Perioperative complications included postoperative hematoma (one) and superficial thrombophlebitis (one).

Conclusions: Lower extremity venous aneurysms continue to represent a rare yet potentially morbid vascular disease. Symptomatic patients demonstrated a clear benefit from surgery vs conservative management. Larger, multicenter studies are required to properly characterize the natural history and management of this disease. (*J Vasc Surg: Venous and Lym Dis* 2019;7:860-4.)

Keywords: Venous aneurysm; Deep venous thrombosis (DVT); Thromboembolism; Lower extremity; Low-frequency

Peripheral venous aneurysms are a rare pathologic process for which no standard of care is established. Most often described in the popliteal location, lower extremity venous aneurysms carry an established risk of morbidity and mortality associated primarily with clinically significant thromboembolism.¹⁻³ The true prevalence of lower extremity venous aneurysmal disease is unknown, and since first being described by

May and Nissl in 1968,⁴ only case reports and small series have been published. A recent German series of 39 cases reported the prevalence of popliteal aneurysms to be 0.06% among patients with some venous disorder.⁵ Aneurysms are reported equally in both sexes and affecting all ages.³ The largest current meta-analysis of lower extremity venous aneurysms, published by Maldonado-Fernandez et al⁶ in 2013, summarized the diagnosis and treatment of 212 cases of only popliteal venous aneurysms.

No standard size criteria of venous aneurysms exists; however, they are commonly described as a solitary area of venous dilation, not within a varicose vein and not associated with a pseudoaneurysm or arteriovenous fistula.⁷ Previous authors have suggested that dilation between two and three times normal vein diameter in association with turbulent flow confers additional thromboembolic risk, but this remains controversial.^{5,8,9}

The risk of pulmonary embolism (PE) is between 25% and 50%, and PE may be the presenting symptom in up to 80% of patients.⁹⁻¹¹ In addition to symptoms resulting from thromboembolic complications, patients may

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also have sequelae of chronic venous disease or pain associated with the compressive effect of larger aneurysms.^{9,11}

A potentially devastating process, the low prevalence and often late presentation of this disease has nonetheless led to continued variability in diagnosis and treatment. Sessa et al⁹ in 2000 first recommended active screening for popliteal venous aneurysmal disease in all patients undergoing leg duplex ultrasound imaging or with unprovoked deep venous thrombosis (DVT) or PE. Both Sessa et al⁹ in 2000 and Maldonado-Fernandez et al⁵ in 2013 also recommended surgery as the first choice for treatment of all sacular lower extremity venous aneurysms and fusiform aneurysms containing thrombus or >2 cm in diameter. Surgical approaches are varied and still largely dictated by individual center and surgeon experience. The treatment of asymptomatic patients remains controversial as multiple case reports describe no thromboembolic events up to 2 years in asymptomatic patients with smaller aneurysms followed up with surveillance duplex ultrasound imaging.^{12,13}

Previous characterizations and recommendations of lower extremity venous aneurysms have focused only on popliteal aneurysms, and the essential question of acute surgical intervention vs medical management for lower extremity venous aneurysms remains unanswered. We have characterized the diagnosis, natural history, and treatment outcomes of lower extremity deep venous aneurysms in a single center.

METHODS

A single-center retrospective review of all venous aneurysms at UCLA Medical Center between 2005 and 2017 was conducted. Only true iliac and lower extremity venous aneurysms were included.

Inclusion criteria were imposed to select for true lower extremity venous aneurysms. Vein diameter immediately adjacent to the aneurysmal portion was measured from radiographic studies in each case, and an aneurysm/vein size ratio was created. Only patients with a ratio >1.5 were included in the study. Patients with aneurysmal veins related to an arteriovenous fistula or venous malformation were excluded.

Patients' demographic and clinical data, including smoking history, venous insufficiency, history of trauma, and other arterial aneurysmal disease, were reviewed. Clinical presentation, location, size, and morphology data were also collected. All aneurysms were confirmed by imaging (magnetic resonance imaging, computed tomography venography, or duplex ultrasound) and assessed for the presence of concomitant venous reflux and thrombus. The indications for treatment and surveillance were at the individual surgeon's discretion. Surgical approach, postoperative anticoagulation, and follow-up were recorded. Patients were followed up with clinical examination and imaging. All patient records were

ARTICLE HIGHLIGHTS

- **Type of Research:** Single-institution, retrospective cohort study
- **Key Findings:** Of 11 patients with lower extremity venous aneurysms, 3 presented with deep venous thrombosis or pulmonary embolism, 3 presented with pain, and 5 venous aneurysms were found incidentally. Diagnosis was made by duplex ultrasound in five patients, magnetic resonance imaging in five patients, and computed tomography venography in one patient. Mean aneurysm to normal adjacent vein ratio was 2.62. Three patients treated initially conservatively went on to surgical intervention. The indication for operation was deep venous thrombosis or pulmonary embolism in three patients and lower extremity pain or swelling in three patients. Mean follow-up was 26 months, with no recurrent thromboembolism in surgically treated patients.
- **Take Home Message:** Although further studies of this rare disease are needed, all symptomatic patients clearly warrant operative intervention, and the risk of thromboembolism in asymptomatic patients requires close follow-up and consideration for surgery as a primary treatment.

reviewed with the approval of the University of California Los Angeles Institutional Review Board and without informed consent.

RESULTS

Eleven lower extremity and iliac venous aneurysms were identified in five male and six female patients with a mean age of 50.4 years. Two (18%) patients had a smoking history and three (27%) had a history of hypertension. One patient had known connective tissue disease, and no patients had a previously diagnosed hypercoagulable disorder. Two patients had arterial aneurysmal disease, one patient with known abdominal aortic aneurysm and one with concomitant iliac artery aneurysm. Three patients had local blunt trauma associated with presentation. Average body mass index of the patients was 26.9 kg/m².

Nine (82%) of 11 patients had aneurysms involving the popliteal vein; one was in the iliac vein and one was in the common femoral vein. Nine of 11 venous aneurysms were left sided. Three (27%) patients presented with DVT or PE, three presented with pain or swelling, and five (45%) venous aneurysms were found incidentally (Table). Diagnosis was made by ultrasound in five patients, magnetic resonance imaging in five patients, and computed tomography venography in one patient. Four patients had evidence of deep venous reflux on diagnostic ultrasound imaging. Mean aneurysm to adjacent vein ratio was 2.62.

Table. Presentation and management of lower extremity venous aneurysms by location

	Clinical presentation	Location	Size ratio	Thrombus	Conservative management	Surgery	Time to surgery, months	Follow-up, months	Complications
1	Incidental	Right popliteal	2.8	No	Aspirin	No		101	None
2	DVT	Left CFV	3.1	Yes	Warfarin	Aneurysmorrhaphy	3	40	None
3	Pain	Left popliteal	1.83	No	Aspirin	No		4	Growth by 0.1 cm at 6 months
4	Pain	Left popliteal	2.67	No	Warfarin	Plication	2	5	Postoperative hematoma
5	Recurrent aneurysm	Left popliteal			No	Interposition	0	37	Postoperative graft thrombosis requiring thrombolysis; growth by 0.3 cm of vein graft at 1 year
6	Incidental	IVC, iliac	1.7	No	Aspirin, rivaroxaban	No		48	None
7	Recurrent PE	Left popliteal	4.62	No	Warfarin	Aneurysmorrhaphy	1	24	Postoperative superficial thrombophlebitis
8	Incidental	Left small saphenous-popliteal	2.2	No	No	Excision, ligation	1	13	None
9	PE	Left soleal	2.18	Yes	No	Excision, ligation	1	1	None
10	Incidental	Left popliteal	2.5	Yes	Warfarin	No		6	Hemorrhagic stroke
11	Pain	Left popliteal branch		No	Observation	No		11	None

CFV, Common femoral vein; DVT, deep venous thrombosis; IVC, inferior vena cava; PE, pulmonary embolism.

Eight patients (three asymptomatic patients and five symptomatic patients) were initially treated conservatively with surveillance or therapeutic anticoagulation. Three were observed with routine yearly follow-up only, and five were prescribed therapeutic anticoagulation. Two patients suffered venous thromboembolic events while receiving anticoagulation and went on to eventual surgical intervention. One patient initially managed with anticoagulation also required eventual surgical intervention for worsening pain. All patients going on to require surgical intervention were symptomatic on initial presentation. No patients who had venous aneurysms discovered as incidental findings on imaging suffered thromboembolic complications at a mean follow-up of 36 months. One patient prescribed therapeutic anticoagulation for DVT suffered a hemorrhagic stroke.

Six total patients underwent surgical intervention. The indication for operation was DVT or PE in three patients and lower extremity swelling or pain in three patients. The average time from diagnosis to operation was 1.3 months. One patient had previous surgical intervention at another institution with recurrent aneurysm formation, requiring surgical reintervention. Three patients had simple venorrhaphy, two had aneurysmectomy and ligation of the vein, and one patient underwent aneurysmectomy

with placement of an interposition vein graft. In cases of ligation, the popliteal segment was preserved, and the adjacent aneurysmal vein was ligated and divided. Five of six patients received postoperative anticoagulation. The duration of postoperative anticoagulation varied between 1 month and indefinitely.

Mean follow-up for all patients was 26 months, and patients were followed up with clinical examination and duplex ultrasound or magnetic resonance imaging. All surgically treated patients had patent venous systems without recurrence of symptoms through the follow-up period. There was one postoperative hematoma and one instance of postoperative superficial thrombophlebitis.

DISCUSSION

Lower extremity venous aneurysms carry a significant risk for thromboembolism, but no uniform classification or treatment algorithm of this disease process exists. Whereas previous characterizations of venous aneurysms have assigned definitions on the basis of size, the true correlation between aneurysm size and thromboembolic risk remains unknown. Our study defined venous aneurysms as having a >1.5 aneurysm/normal vein size ratio on imaging. No statistically significant correlation between aneurysm size and thromboembolic risk could be made;

however, the ratio for patients presenting with PE was 3.3 vs 2.3 in those presenting with pain or asymptotically.

A variety of causes of venous aneurysms have been suggested, including congenital weakness, trauma, and degenerative changes. The exact cause of individual aneurysms is likely to be related to their location, and lower extremity venous aneurysms are likely to be the result of a combination of congenital and mechanical factors. Previous histologic studies have noted densely fibrotic adventitia and inflammation in addition to intima and media degeneration secondary to shear stress.^{2,10,14} More than a quarter of patients in our series had recent trauma associated with presentation, indicating a possible role of some secondary inflammatory process in the development of these aneurysms.

As reflected in the literature and our series, the majority of lower extremity aneurysms present in the popliteal location. Whereas PE has been the prevalent presenting symptom in previous large series, more than half of the symptomatic patients in our series presented with pain or lower extremity swelling.⁹⁻¹¹ These may represent late symptoms related to post-thrombotic sequelae or valvular dysfunction secondary to the dilated segment of the vein. Two of three patients presenting with lower extremity symptoms, without evidence of acute thrombus on ultrasound, had venous insufficiency at the level of the aneurysm. One patient was not evaluated for insufficiency by ultrasound.

Duplex ultrasound is the primary mode of diagnosis for venous aneurysms, although previous authors have suggested the need for venography before any intervention to better define the venous anatomy.⁹ Only 50% of patients undergoing surgery had computed tomography or magnetic resonance venography before intervention in our series, without any effect on outcome. Duplex ultrasound may therefore be sufficient for both diagnosis and evaluation for surgical intervention.

Symptomatic patients with lower extremity venous aneurysms warrant surgical intervention as anticoagulation alone is insufficient to alleviate compressive symptoms or to minimize their risk of further thromboembolic events. Even with therapeutic anticoagulation, the aneurysm represents an environment for continued clot formation and propagation. Two of five patients managed conservatively suffered thromboembolic events while being treated with therapeutic anticoagulation. Previous case reports and small series have similarly shown a >60% risk of recurrent thromboembolism with anticoagulation alone.^{2,15-17} Conversely, no instances of recurrent PE after surgical intervention have been reported. Although the exact risk of thromboembolism cannot be predicted on the basis of duplex ultrasound or venography imaging, select asymptomatic patients probably also benefit from surgical intervention. No asymptomatic patients suffered thromboembolism in our series, and defining exactly which

asymptomatic patients might benefit from surgical intervention remains unclear.

Different surgical approaches to repair, including tangential aneurysmectomy with lateral venorrhaphy and aneurysm resection with interposition vein graft, have been described. Regardless of approach, the principles of maintaining venous continuity and excluding diseased vein should be adhered to. Limited to previous small series, the outcomes of each surgical approach are still largely unknown, but recurrences have been described up to 4 years postoperatively.^{18,19}

Similarly, the role of postoperative anticoagulation remains unknown. The literature has previously recommended anticoagulation for between 3 and 6 months; however, duration remains largely at the individual surgeon's discretion.^{5,9,14} Clinical and imaging follow-up is scantily described in previous reports, but it has been our institution's practice to observe patients with duplex ultrasound imaging yearly as an economical, noninvasive means of evaluation for recurrent aneurysmal or thrombotic disease. Magnetic resonance venography is used only if the vein cannot be sufficiently visualized with ultrasound.

Our study represented only a small, single-center experience, and the diagnosis and management of venous aneurysmal disease still warrant further evaluation. Larger, multicenter studies are needed not only to better characterize the natural history of peripheral venous aneurysms but also to direct best practices for the diagnosis, treatment, and surveillance of these patients.

CONCLUSIONS

Venous aneurysms are a rare pathologic process yet carry significant morbidity and mortality related to thromboembolism. Still, no consensus definition of venous aneurysms exists as no correlation between size and thromboembolic risk has been established. Lower extremity aneurysms carry the greatest risk of life-threatening PE, and symptomatic patients clearly benefit from surgery. In the case of asymptomatic disease, the risk of failure of conservative management is significant, and these patients too may benefit from primary surgical intervention.

The postoperative and long-term management of these patients remains poorly characterized, and further studies are necessary to understand post-thrombotic sequelae and best follow-up. As demonstrated in our study, there is great variety in the management of these patients, and more data are required to better understand this disease. Future investigation of this infrequent disease will require multi-institutional participation and collaboration.

AUTHOR CONTRIBUTIONS

Conception and design: RP, DB, KW, PL

Analysis and interpretation: RP, DB, KW

Data collection: RP, SH

Writing the article: RP, SH, DB

Critical revision of the article: RP, DB, KW, PL

Final approval of the article: RP, SH, DB, KW, PL

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REFERENCES

1. Grice GD 3rd, Smith RB 3rd, Robinson PH, Rheudasil JM. Primary popliteal venous aneurysm with recurrent pulmonary emboli. *J Vasc Surg* 1990;12:316-8.
2. Aldridge SC, Comerota AJ, Katz ML, Wolk JH, Goldman BI, White JV. Popliteal venous aneurysm: report of two cases and review of the world literature. *J Vasc Surg* 1993;18:708-15.
3. Gillespie DL, Villavicencio JL, Gallagher C, Chang A, Hamelink JK, Fiala LA, et al. Presentation and management of venous aneurysms. *J Vasc Surg* 1997;26:845-52.
4. May R, Nissl R. [Aneurysms of the popliteal vein]. *Fortschr Geb Rontgenstr Nuklearmed* 1968;108:402-3.
5. Noppeney T, Kopp R, Pfister K, Schierling W, Noppeney J, Cucuruz B. Treatment of popliteal vein aneurysms. *J Vasc Surg Venous Lymphat Disord* 2019;7:535-42.
6. Maldonado-Fernandez N, Lopez-Espada C, Martinez-Gamez FJ, Galan-Zafra M, Sanchez-Maestre ML, Herrero-Martinez E, et al. Popliteal venous aneurysms: results of surgical treatment. *Ann Vasc Surg* 2013;27:501-9.
7. Papadimitriou D, Tachtsi M, Pitoulias G, Atmatzidis S, Fycatas P, Christopoulos D. Venous aneurysms—an uncommon but potentially life threatening disease: a case report. *Eur J Vasc Endovasc Surg* 2009;38:780.
8. McDevitt DT, Lohr JM, Martin KD, Welling RE, Sampson MG. Bilateral popliteal vein aneurysms. *Ann Vasc Surg* 1993;7:282-6.
9. Sessa C, Nicolini P, Perrin M, Farah I, Magne JL, Guidicelli H. Management of symptomatic and asymptomatic popliteal venous aneurysms: a retrospective analysis of 25 patients and review of the literature. *J Vasc Surg* 2000;32:902-12.
10. Calligaro KD, Ahmad S, Dandora R, Dougherty MJ, Savarese RP, Doerr KJ, et al. Venous aneurysms: surgical indications and review of the literature. *Surgery* 1995;117:1-6.
11. Teter KA, Maldonado TM, Adelman MA. A systematic review of venous aneurysms by anatomic location. *J Vasc Surg Venous Lymphat Disord* 2018;6:408-13.
12. Rubin B, Beak B, Reilly J. Fusiform aneurysms of the popliteal vein. Presented at: Seventh Annual Meeting of the American Venous Forum; February 23-25 1995. Fort Lauderdale, Fla.
13. Labropoulos N, Volteas SK, Giannoukas AD, Touloupakis E, Delis K, Nicolaides AN. Asymptomatic popliteal vein aneurysms. *Vasc Surg* 1996;30:453-7.
14. Vermeer NC, Elshof JW, Vriens PW. Clinical presentation, diagnosis, and treatment of venous aneurysms. *J Vasc Surg Venous Lymphat Disord* 2014;2:349-53.e3.
15. Greenwood LH, Yrizarry JM, Hallett JW Jr. Peripheral venous aneurysms with recurrent pulmonary embolism: report of a case and review of the literature. *Cardiovasc Intervent Radiol* 1982;5:43-5.
16. Donald IP, Edwards RC. Fatal outcome from popliteal venous aneurysm associated with pulmonary embolism. *Br J Radiol* 1982;55:930-1.
17. Nasr W, Babbitt R, Eslami MH. Popliteal vein aneurysm: a case report and review of literature. *Vasc Endovascular Surg* 2007;41:551-5.
18. Falls C, Eslami MH. Recurrence of a popliteal venous aneurysm. *J Vasc Surg* 2010;51:458-9.
19. Gasparis AP, Awadallah M, Meisner RJ, Lo C, Labropoulos N. Recurrent popliteal vein aneurysm. *J Vasc Surg* 2010;51:453-7.

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