ORIGINAL ARTICLE

INSTITUTIONAL EXPERIENCE WITH VENOUS ANEURYSMS – INSIGHTS ON THE NATURAL HISTORY AND OUTCOMES OF SURGICAL TREATMENT

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Abstract

Introduction: *Venous aneurysms are rare, so their natural history is not fully understood. Indications for treatment are often determined by the location and size of the aneurysm; however, considering the scarcity of data, there are no specific recommendations. Surgery is the mainstay for venous aneurysm treatment, but some authors reported successful endovascular treatment. We intend to describe our experience with this type of rare disorder.*

Methods: *A post hoc observational study of a prospectively maintained registry including consecutive patients admitted with the diagnosis of a venous aneurysm at different locations between January 2007 and September 2021. Demographic data, anatomic location, and medical history, including trauma or venous surgery, were analyzed. All vascular reconstructions and outcomes have been evaluated.*

Results: *We identified 30 venous aneurysms in 24 patients. Fifteen patients were male (63%). The most common anatomical location was the popliteal vein (n=19; 63%). Four patients had multiple venous aneurysms, and three patients had synchronous arterial aneurysms. Twelve (63%) of the popliteal vein aneurysms identified were surgically treated, most commonly by tangential aneurysmectomy and lateral venorrhaphy. The average diameter at the time of surgery was 22,8±3,6 mm. After discharge, all patients were anticoagulated for 6 to 12 months, in most cases with rivaroxaban. With a median follow-up time of 32 months (12 – 168 months), primary patency was 92%. Aneurysm recurrence was only observed in one case (1/12; 8%) with non-occlusive thrombosis of the aneurysm 14 years after surgery. One patient had a 21 mm gemelar vein aneurysm, having been proposed for surgery, with thrombosis before the intervention. Two patients had common femoral vein aneurysms treated with partial aneurysmectomy and lateral venorrhaphy without thromboembolic events during follow-up. Two patients presented with portal system aneurysms, one associated with portal hypertension. No treatment was performed, and an increase in aneurysm size was observed during follow-up. Another patient presented with acute deep vein thrombosis on chronically thrombosed bilateral iliac vein aneurysms. Three patients had aneurysms of the superficial venous system associated with previous trauma, which were treated with simple ligation and excision.*

Conclusion: *Venous aneurysms are rare and most commonly located in the popliteal vein, which seems to be associated with chronic venous disease. Treating these aneurysms, even without symptoms, can be important to avoid thromboembolic complications. However, close long-term follow-up with duplex ultrasound should be considered to detect late recurrence. Aneurysms from other locations are even rarer, and treatment decisions should be individualized, weighing the risks and benefits of the intervention.*

Keywords: *aneurysm [MeSH], popliteal vein [MeSH], venous thrombosis [MeSH], pulmonary embolism [MeSH], portal vein [MeSH].*

INTRODUCTION

Venous aneurysm corresponds to an isolated dilatation of all layers of the vein wall unrelated to varicose veins.[1] These aneurysms are extremely rare but have been described in all veins in the human body, most reported in the popliteal vein.[2] They can occur at any age with a roughly identical gender distribution.[3,4] Venous aneurysms can be classified as primary or secondary to trauma, connective tissue disorder, or vascular malformation. Other mechanisms, such as local inflammation, have been proposed to contribute to aneurysmal degeneration, but most cases have an unknown etiology.[5] Histological studies have demonstrated fragmentation of elastic lamellae with a reduction of smooth

muscle cells in the vein wall and infiltration of inflammatory cells into the intima. An increase in the expression of matrix metalloproteinases (MMP), similar to what occurs in abdominal aortic aneurysms, was also observed.[6,7]

Treatment was classically recommended since all these aneurysms could be associated with venous thromboembolism and even rupture.[2] However, due to their rarity, there is a lack of knowledge regarding the actual natural history, and there is no consensus on the indications for the treatment.[3] This study intends to describe our experience with this type of rare disease.

METHODS

Study design

A post hoc analysis of prospectively collected data, including patients admitted at a single institution with a diagnosis of venous aneurysm between January 2007 and September 2021, has been made. All patients with a venous aneurysm in any location with at least one year of follow-up were included, whether they had undergone surgical or conservative treatment. We defined a venous aneurysm as a dilatation greater than 50% compared with the normal proximal vein diameter. Patients with venous aneurysms associated with vascular malformations were excluded.

The institutional review board approved the study and written informed consent was obtained from all patients or legal representatives to use clinical data and images.

Patients

The electronic records of included patients were reviewed regarding demographics, clinical presentation, and diagnostic imaging type. All duplex ultrasound scans (DUS) and computed tomography (CT) imaging findings have been reviewed for aneurysm extension, morphology (fusiform or saccular), and parietal thrombus. We also reviewed all available imaging data to identify arterial or venous aneurysms in other locations. Data on the history of trauma, chronic venous disease (CVD), and prothrombotic risk factors have been collected. A history of ligation of the saphenopopliteal junction ipsilateral to the popliteal vein aneurysm (PVA) was considered a positive history of trauma. We defined the presence of CVD as the previous existence of any symptomatic morphological or hemodynamic impairment of the venous system of the lower limbs on vascular ultrasound or a prior history of varicose vein surgery, following the reported definition.[8]

Management approach after venous aneurysm diagnosis, surgery type, long-term anticoagulation, and follow-up were analyzed. Institutional indications for venous aneurysm treatment included symptomatic patients, the presence of parietal thrombus, and PVA with a greater than 20 mm diameter. A CT-angiography or catheter-based venography was performed for adequate planning in all patients proposed for surgery. All surgically treated patients with aneurysms of lower limb deep veins were followed with DUS at 3, 6 months, and yearly after. Similarly, the follow-up of conservatively managed patients included a vascular or abdominal ultrasound every 6 to 12 months, depending on the location of the aneurysm. Patients managed conservatively for lower limb deep vein aneurysms were put under anticoagulation. The primary outcomes evaluated included venous thromboembolic events and aneurysm recurrence after surgical treatment.

Popliteal Vein Aneurysm Surgery

A posterior approach to the popliteal vein was used to treat PVA. A lazy-S incision was made with the patient in the prone position and the knee slightly flexed (Figure 1A). The small saphenous vein was identified, which could be preserved or ligated according to the anatomical relationship with the venous aneurysm. After opening the deep fascia, the sural, common peroneal, and tibial nerves were dissected and retracted laterally, exposing the tibial vessels. Careful isolation of the aneurysm was performed to avoid rupture of the thin wall, with ligation of small collateral veins originating from the aneurysm sac (Figure 1B). In the case of saccular aneurysms, a clear demarcation of the healthy vein and the aneurysmal wall was usually evident (Figure 1C). After systemic heparinization with 70-100 IU/kg of unfractionated heparin, the popliteal vein was clamped in the segments of normal caliber, and the disease vein wall was fully resected (tangential aneurysmectomy) (Figure 1D-E). Thrombus was removed when present. In some patients, tangential clamping at the base of the aneurysm was performed followed by venorrhaphy with running horizontal mattress stitch, as first described by Aldridge et al.[9] If it was needed, to obtain an adequate caliber of the vein, reconstruction using a vein patch was performed (Figure 1F). It was up to the surgeon to use an external Dacron wrapping.

Table 1 **Anatomic location of venous aneurysms**

Location	Frequency (%)
Head and neck	
Internal jugular vein	1/30 (3,3%)
Intra-abdominal	
Hepatic vein	1/30 (3,3%)
Superior mesenteric vein	1/30 (3,3%)
External iliac vein	2/30 (6,7%)
Extremities	
Deep vein aneurysms	
Common femoral vein	2/30 (6,7%)
Popliteal vein	19/30 (63,3%)
Gemelar vein	1/30 (3,3%)
Superficial vein aneurysm	3/30 (10,0%)

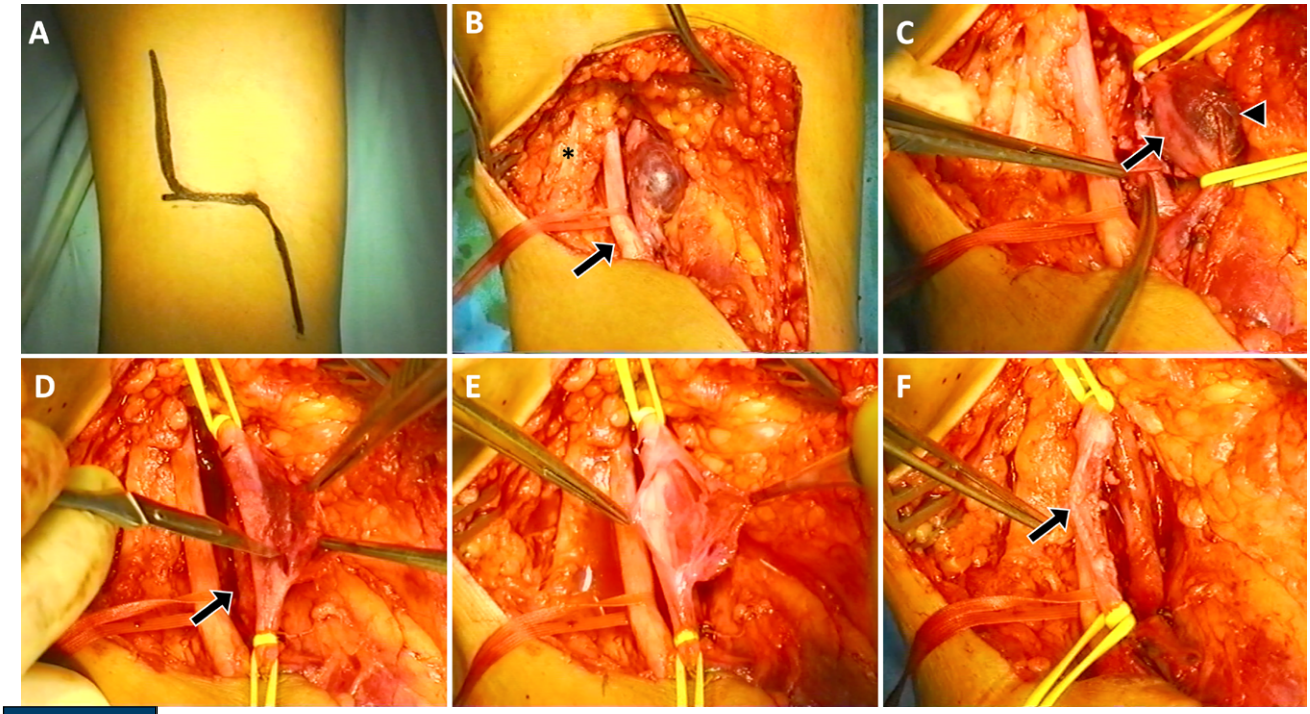

Figure 1

The posterior surgical approach for popliteal vein aneurysm treatment. A - Lazy-S skin incision. B – Lateral retraction of the common peroneal (*) and tibial (arrow) nerves exposing the popliteal vein aneurysm. C – Popliteal vein aneurysm dissection. It is possible to observe a clear distinction between the normal wall of the popliteal vein (arrow) from the degenerated wall of the saccular aneurysm (arrowhead). D-E – Aneurysm wall resection. The popliteal artery (arrow) lies deep and medial to the vein. F – Reconstruction of the popliteal vein with a venous patch (arrow).

Common Femoral Vein Aneurysm Surgical Treatment

Common femoral vein aneurysms were approached through a longitudinal inguinal incision slightly medial to the femoral pulse and just distal to the inguinal ligament. The subcutaneous cellular tissue was divided with careful dissection of the venous aneurysm to avoid rupturing the vein wall. Tangential clamping at the base of the aneurysm was performed, followed by venorrhaphy with a running horizontal mattress stitch and a reinforcing running stitch.

Data analysis

Data analysis was limited to descriptive statistics due to the small sample size. The categorical variables are represented as counts and percentages. Continuous variables are described as median and range or mean and standard deviation.

RESULTS

A total of 30 venous aneurysms were identified in 24 patients, most of them males (15/24; 63%). Patients were categorized according to the anatomical location of the aneurysm (Table 1) using a previously described classification.[2]

Deep vein aneurysms of the lower extremities

Eighteen patients with a total of 22 deep vein aneurysms of the lower limbs have been identified (Table 2). The median age at the time of diagnosis was 57,5 years (35-75 years,) and ten were male (56%). A saccular morphology was identified in 19 of these aneurysms (86%). Fusiform venous aneurysms included a patient with bilateral fusiform popliteal vein aneurysms and a common femoral vein aneurysm.

The most common anatomical location was the popliteal vein (n=19). Four patients (22%) had multiple venous aneurysms: two with bilateral PVA, one with bilateral popliteal and unilateral common femoral vein aneurysms and another patient with a concomitant 27 mm left internal jugular vein aneurysm associated with a PVA. Three patients had a positive history of arterial aneurysms.

Popliteal vein aneurysms

In 12 of the PVA identified (63%), there were no aneurysm-associated symptoms. In six aneurysms, the patients reported localized swelling (32%), and the remaining four were associated with localized swelling and pain (21%). None of these patients presented with deep vein thrombosis (DVT) or pulmonary embolism symptoms.

The diagnosis was made by DUS, except for one patient in whom the presence of the PVA was incidentally noted in a magnetic resonance imaging (MRI) performed for knee joint injury. History of trauma to the popliteal fossa ipsilateral to the venous aneurysm was identified in 6 cases (32%). Half of the patients had evidence of CVD, and in 3 cases (16%), there was a history of varicose veins surgery, two of which had undergone a surgical approach of the saphenopopliteal junction and proximal small saphenous vein excision (11%). In addition, one patient had a previous

Table 2 **Characteristics of patients with deep vein aneurysms of the lower extremities.**

Age median (range)	**57,5 (35-75)**
Male n(%)	**10 (56%)**
Multiple venous aneurysms n(%)	**4 (22%)**
Synchronous arterial aneurysms n(%)	**3 (17%)***
Morphology	
Saccular n(%)	19/22 (86%)
Fusiform n(%)	3/22 (14%)
POPLITEAL VEIN ANEURYSMS	
Trauma history n(%)	**6/22 (33%)**
Chronic Venous Disease n(%)	**9/16 (50%)**
Bilateral PVA n(%)	**3/16 (19%)**
Diameter of PVA surgically treated, mean ± SD	**22,8 ± 3,6**
Diameter of PVA conservatively managed, mean ± SD	**20,0 ± 3,5**
Surgical treatment	
Tangential aneurysmectomy with lateral venorrhaphy n(%)	7 (58%)
Tangential aneurysmectomy with lateral venorrhaphy and saphenectomy (SSV) n(%)	1 (8%)
Tangential aneurysmectomy and vein reconstruction with vein patch n(%)	3 (25%)†
Tangential aneurysmectomy with lateral venorrhaphy (external Dacron wrapping) n(%)	1 (8%)
COMMON FEMORAL VEIN ANEURYSMS	
Trauma history (previous saphenofemoral junction ligation) n(%)	**2 (100%)**
Chronic Venous Disease n(%)	**2 (100%)**
Diameter of CFV aneurysm mean ± SD	**36,5 ± 3,5**
Surgical treatment	
Tangential aneurysmectomy with lateral venorrhaphy n(%)	2 (100%)

PVA - Popliteal Vein Aneurysm; SSV - Small Saphenous Vein;
*Synchronous arterial aneurysms identified included a saccular medial cerebral artery aneurysm, an ascending thoracic aortic aneurysm, and an abdominal aortic aneurysm.
†The venous patch used included the ipsilateral small saphenous vein (n=2) and the contralateral great saphenous vein (n=1).

history of femoropopliteal DVT ipsilateral to the PVA, but the aneurysm was not identified then.

Twelve (12/19; 63%) of the PVA were surgically treated. In two PVA, a mural thrombus was observed and removed during surgery. The median diameter of the PVA at the time of treatment was 22,8±3,6 mm. CT-phlebography or catheter-based venography was performed before surgery (Figure 2). Types of surgical treatment are detailed in table 2 and consist of a tangential aneurysmectomy with lateral venorrhaphy or tangential aneurysm resection and venoplasty using a venous patch. An external wrapping using a Dacron graft after venorrhaphy was used in one patient. There were no intraoperative complications in any of the patients. A histological study of the aneurysm wall revealed a nonspecific inflammatory infiltrate in all cases. After discharge, all patients were anticoagulated for 6 to 12 months, in most cases with rivaroxaban (9/12; 75%), while a vitamin K antagonist was used in the remaining (3/12; 25%).

Morbidity was only observed in one patient (8%), which manifested allodynia on the distal outer surface of the leg and foot, consistent with a sural nerve injury confirmed by electromyography. There were no hematomas requiring surgical drainage or surgical wound infections.

With a median follow-up time of 32 months (12-168 months), primary patency was 92%. Aneurysm recurrence was only observed in one case (1/12; 8%) with non-occlusive thrombosis of the aneurysm 14 years after surgery. No significant complications were observed in the remaining patients, including DVT or pulmonary embolism.

In patients managed conservatively, the mean diameter of PVA was 20,0±3,5 mm. With a median follow-up time of 21 months (12 – 30 months), no significant aneurysm growth was observed, and all patients remained free of thromboembolic events.

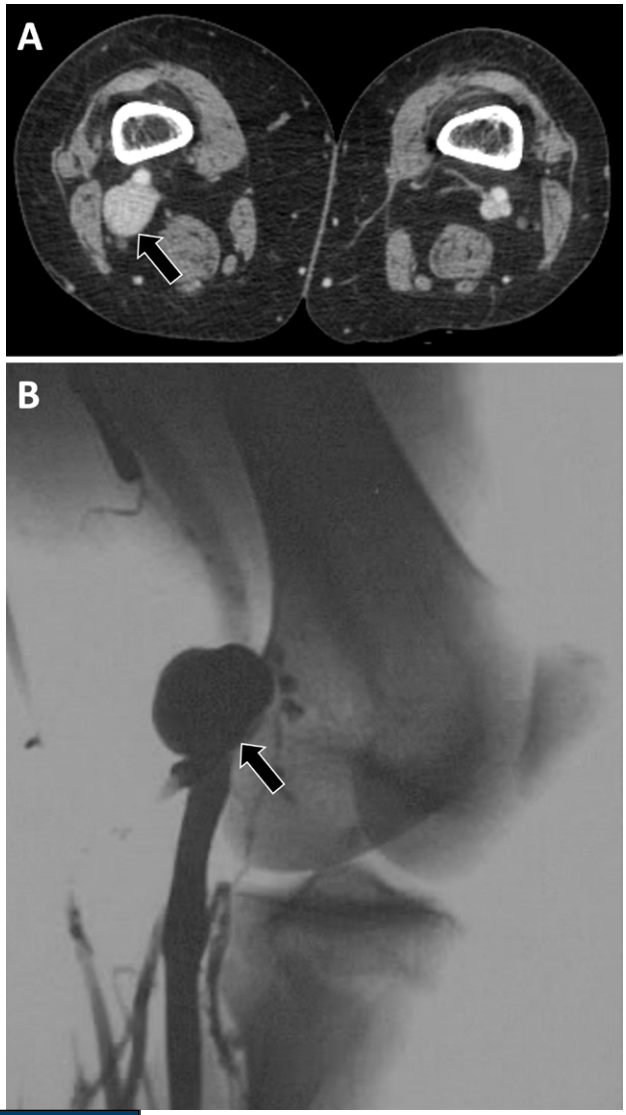

Figure 2 *Axial view of computed tomography (A) and catheter-based venography (B) demonstrate a saccular popliteal vein aneurysm (arrow).*

Common femoral and gemelar veins aneurysms

Two common femoral vein aneurysms were identified. Patients manifested a painless local swelling and were diagnosed by DUS with additional characterization by CT-angiography (Figure 3). Both cases had a history of high ligation and stripping of the great saphenous vein at the ipsilateral limb. Both were treated with tangential aneurysmectomy with lateral venorrhaphy uneventfully. The diameter of the aneurysms at the treatment was 34 and 39mm. A histological study of the aneurysm wall revealed a nonspecific inflammatory infiltrate in both cases. The patients were anticoagulated with rivaroxaban for six months, and no postoperative morbidity was observed. There were no complications with a follow-up time of 26 and 30 months.

A 21mm saccular medial gemelar vein aneurysm was identified in a patient complaining of localized calf painless swelling. The patient was put under elastic compression therapy. No evidence of CVD existed. Surgical treatment was proposed, but the patient preferred to postpone the intervention, and aneurysm thrombosis occurred 32 months after the diagnosis. The patient completed six months of anticoagulation with rivaroxaban. With an additional follow-up of 18 months, no other events of venous thromboembolism were observed.

Venous aneurysms of the abdomen and pelvis

Three patients with abdominopelvic venous aneurysms were identified (Table 3) with a median age at diagnosis of 67 years (45-70 years), two males. A 24mm aneurysm of the intrahepatic portal vein (Figure 4) with no associated symptoms, portal hypertension, or liver disease has been identified. It currently has a follow-up of 60 months, and the aneurysm has grown to 26mm, remaining free of parietal thrombus. In another patient with a history of HIV infection followed by non-cirrhotic portal hypertension caused by didanosine and with a history of portal vein thrombosis, a 34 mm saccular aneurysm of the superior mesenteric vein was observed in the abdominal ultrasound, confirmed by CT-angiography (Figure 5). Due to the high surgical risk, no interventions have been proposed. The patient was also not anticoagulated due to the bleeding risk associated with the presence of bulky esophageal varices. At 12 months of follow-up, an increase in the size of the aneurysm to 38 mm was observed, maintaining parietal thrombosis.

Bilateral external iliac vein aneurysms were observed in a patient with post-thrombotic syndrome (PTS) due to a history of lower limb DVT in both legs, with the first episode 30 years before. The patient presented significant edema and pain in the left leg. A CT-angiography revealed the presence of bilateral fusiform thrombosed external iliac vein aneurysms, with 45mm and 63mm on the right and left (Figure 6). In the left lower limb, the thrombosis extended to the common femoral and femoral vein, probably corresponding to an acute on chronic DVT. Catheter-

Figure 3 *Computed tomography (axial view) reveals a fusiform 38 mm left common femoral vein aneurysm.*

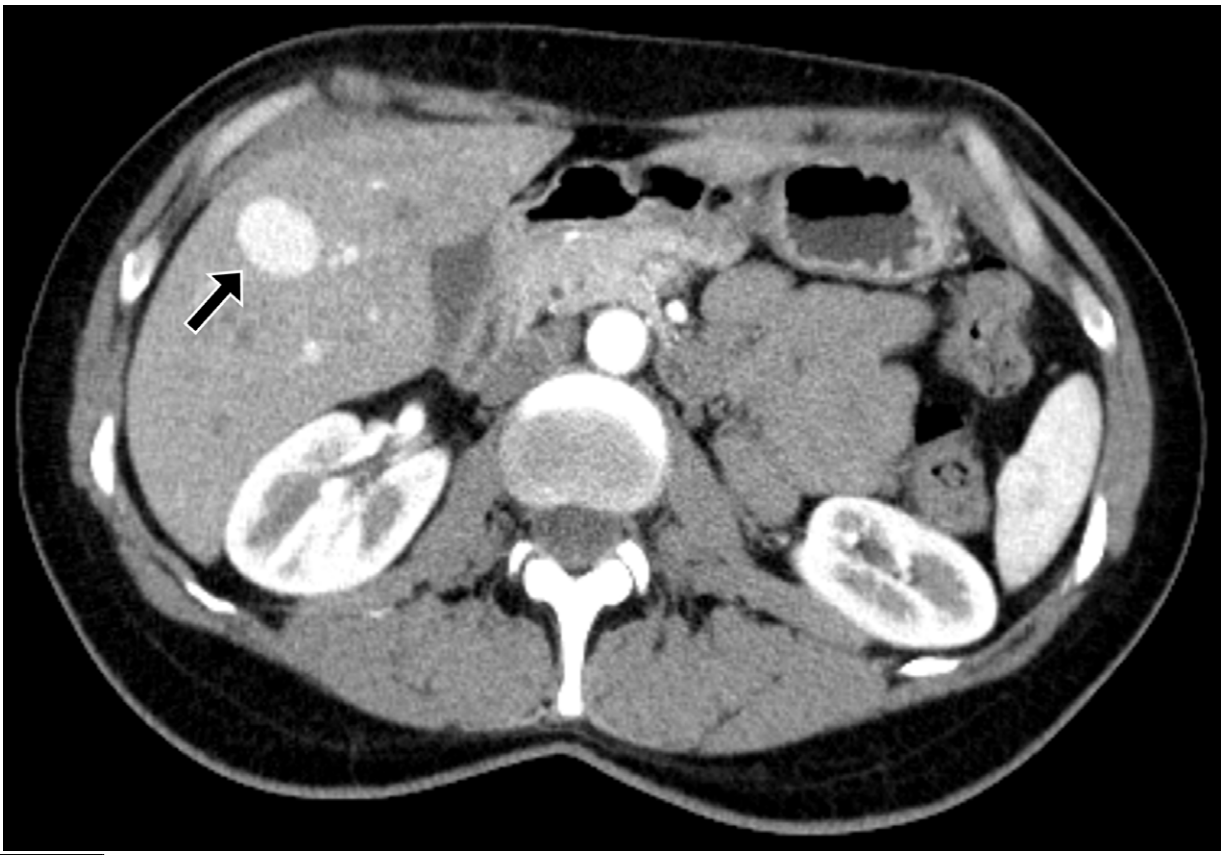

Figure 4 *A 26mm aneurysm of the intrahepatic branch of the portal vein to hepatic segment V was observed on the axial view of computed tomography.*

Table 3 **Characteristics of patients with aneurysms of the abdomen and pelvis identified.**

AGE / GENDER	ANEURYSM LOCATION	MORPHOLOGY/ SIZE	RELEVANT COMORBIDITIES	HISTORY OF VENOUS DISORDERS	PRESENTATION SYMPTOMS	IMAGING	MANAGEMENT	OUTCOME / FOLLOW-UP
45y/ female	Intrahepatic portal vein*	Saccular 24 mm	Hepatic angioma	CVD (varicose veins)	Asymptomatic / Incidental finding	US, CT	Surveillance	2 mm growth / 60 months
67y/ male	Superior mesenteric vein	Saccular 34 mm	Portal hypertension†; HIV infection; Diabetes;	Portal vein thrombosis	Asymptomatic / Incidental finding	US, CT	Surveillance	4 mm growth / 12 months
70y/ male	Bilateral external iliac vein	Fusiform 45 mm (right) 63 mm (left)	Penile cancer	DVT - Post-thrombotic syndrome	DVT (edema and pain of the left lower limb)	US, CT	Anticoagulation	Post-thrombotic syndrome / 58 months

CVD – Chronic Venous Disease; US – Ultrasound; CT – Computed Tomography; HIV – Human Immunodeficiency Virus; DVT – Deep Vein Thrombosis.
*Aneurysm of the intrahepatic branch of the portal vein to segment V of the liver.
†Non-cirrhotic portal hypertension caused by the antiviral drug didanosine.

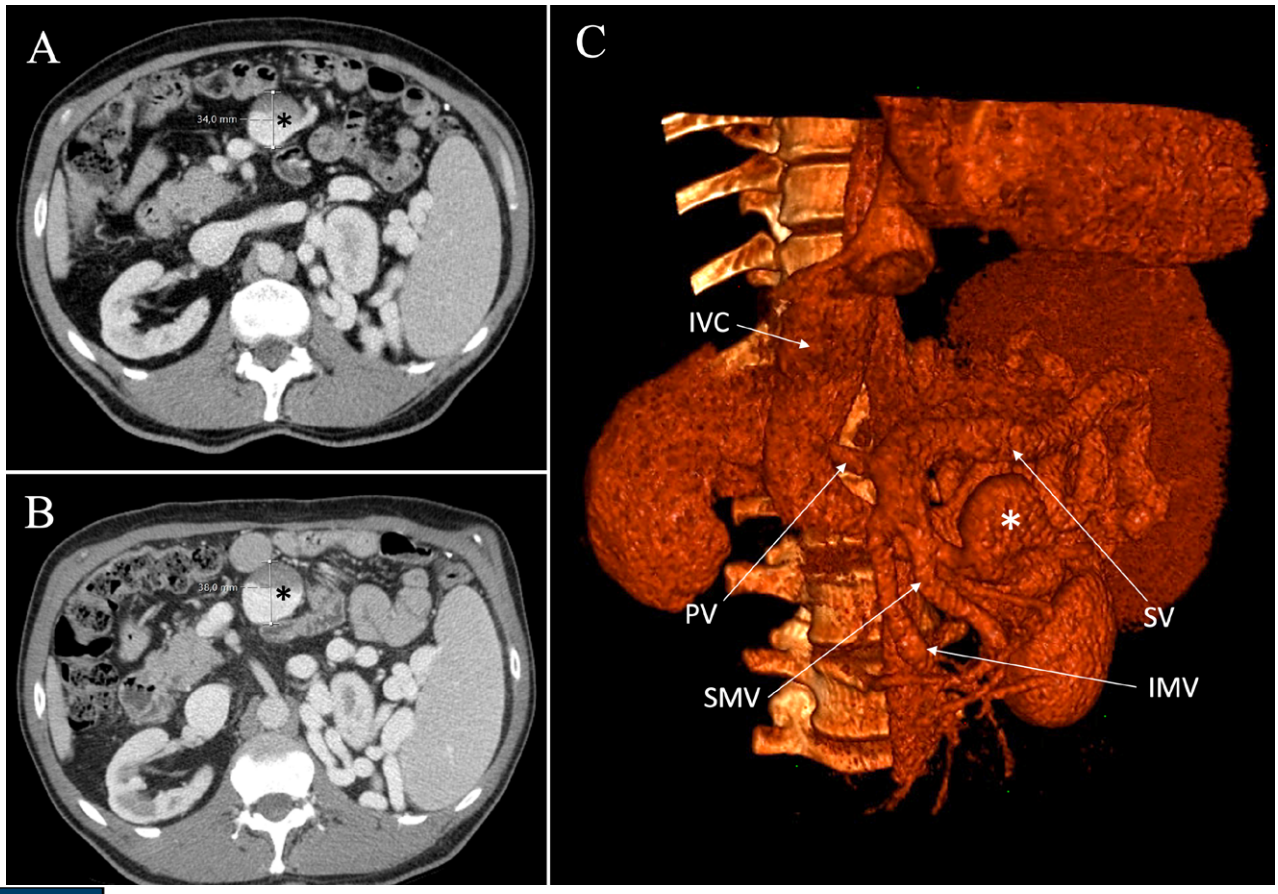

Figure 5 *A) Computed tomography computed tomography-angiography revealed the presence of a 34 mm aneurysm of the superior mesenteric vein with partial thrombosis (asterisk). Computed tomography-angiography also showed a marked reduction in the caliber of the portal vein and ectasia of the splenic and left renal veins creating a splenorenal shunt (arrows). (B) Venous aneurysm (asterisk) growth to 38mm after 12 months of follow-up, maintaining mural thrombosis. (C) The 3D reconstruction confirmed the saccular morphology of the aneurysm (asterisk). IVC - Suprahepatic inferior vena cava; PV – Portal vein; SMV – Superior mesenteric vein; SV – Splenic vein; IMV – Inferior mesenteric vein.*

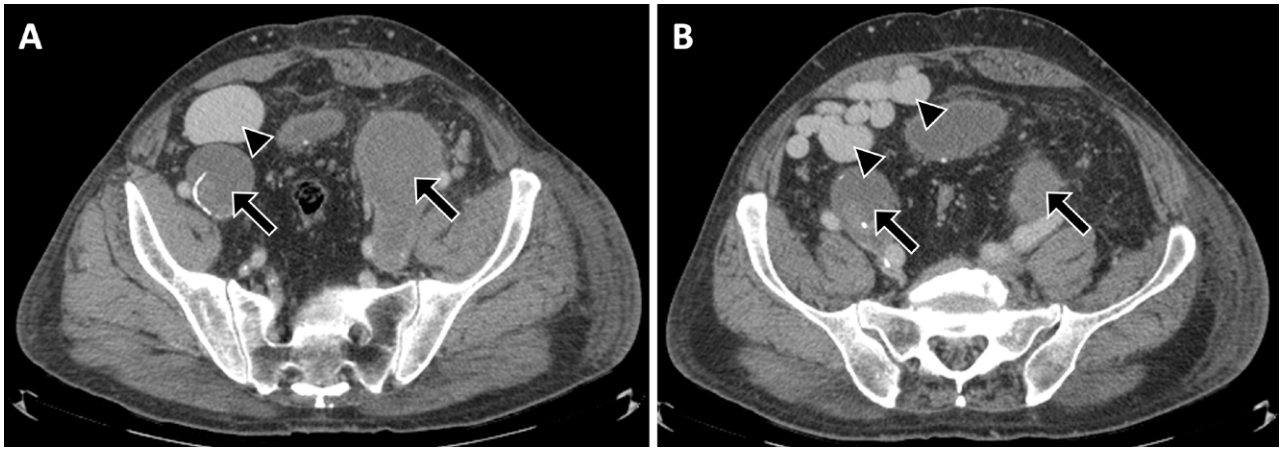

Figure 6 *Thrombosed giant external iliac vein aneurysms (arrow). It is possible to observe marked ectasia of collateral veins to drain the lower limbs (arrowhead).*

directed thrombolysis was performed on the left lower limb, improving collateral venous flow and the patient's symptoms. The venous aneurysm was impossible to cross with a guide wire, probably due to long-lasting thrombosis, so aneurysm recanalization was not achieved. The patient was anticoagulated for 12 months. With 52 months of follow-up, he is under conservative treatment for PTS. No pulmonary embolism events were recorded.

Extremities superficial venous aneurysms

Three patients with extremities superficial venous aneurysms were identified with a median age of 56 years (41-62 years), two males. The mean diameter of the degenerated veins was 21,3±2,5mm and included the cephalic vein, cubital vein, and dorsal foot vein, all aneurysms having a saccular morphology (Figure 7). All patients reported localized swelling and pain. The diagnosis was made based on DUS. None of the patients had CVD. All aneurysms were treated with surgical ligation and excision. No intercurrences were observed, with a mean follow-up time of 3 months.

DISCUSSION

Venous aneurysms are rare and may be under-reported.[3] We identified a clear predominance of aneurysms located in the popliteal vein, similar to what is reported in previous publications.[2,10] The existence of bilateral PVA is rare[11,12] and in our series, it was identified in three patients. It was interesting to note that four patients had multiple venous aneurysms, and three had a history of arterial aneurysms. There is an increase in the expression of MMP-2, MMP-9, and MMP-13 in the venous aneurysm wall, similar to abdominal aortic aneurysms.[7] However, there is a lack of publications describing synchronous venous and arterial aneurysms. Some authors suggested the existence of a congenital localized defect in the vein wall degenerating and gradually expanding, culminating in the formation of the venous aneurysm.[11] The aneurysmatic vein is macroscopically very thin-walled and clearly different from the normal vein wall. Trauma can be implicated and has been identified in some patients in this study. A saccular morphology seems predominant, having higher thromboembolic risk[3,11] but variable prevalence has been reported in different series.[1,4,11,13,14]

In the case of aneurysms of the deep veins of the lower extremities, none of the patients had venous thromboembolism as a form of presentation. Most patients were asymptomatic or complained of pain and local swelling. The slow and often turbulent flow in PVAs can lead to local thrombus formation without causing symptoms in the leg. Thrombosis of the entire aneurysm and progressive symptomatic DVT was described only in a few cases.[15] PVA more frequently manifests as pulmonary embolism, often in patients younger than 50 years old.[2,12] Local symptoms at the calf or knee could occur due to the aneurysm; often, the aneurysm is asymptomatic and is detected as an incidental finding when the patient is examined with DUS for symptoms of CVD in the leg or with CT or MRI due to knee joint pathology. Although the aneurysm has a thin wall, the rupture of a PVA has never been reported.[4]

Concomitant CVD was identified in 50% of cases. The strong association of PVA with CVD may not only be associated with a similar pathophysiological mechanism of vascular ectasia and valve dysfunction but is also related to the almost universal use of DUS nowadays. In studies where patients were scanned with DUS for venous diseases, PVAs have been found in approximately 0.1-0.2%.[16,17] Currently, DUS is the most common way of diagnosing

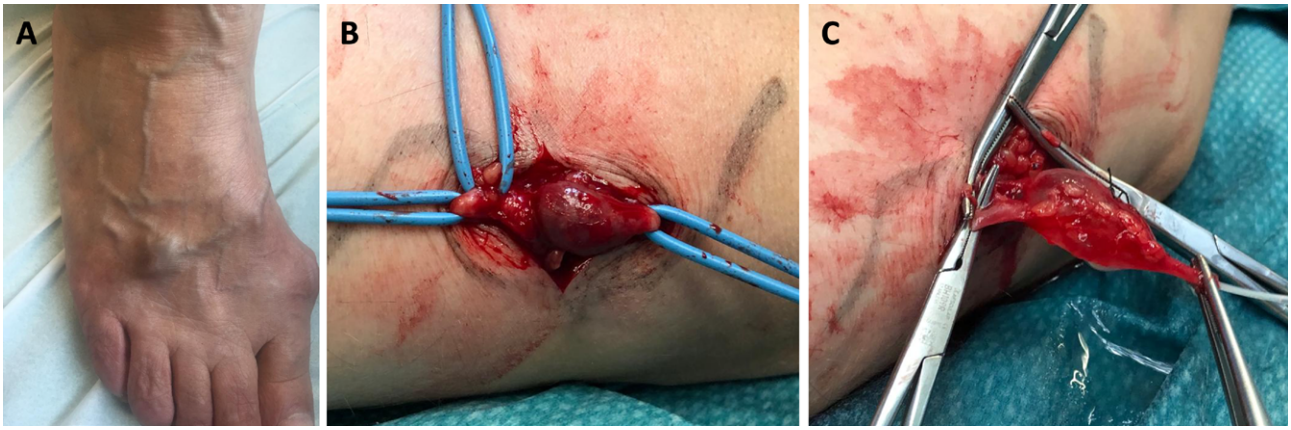

Figure 7 *Superficial venous aneurysms. A – Aneurysm of a foot dorsal vein. B-C Ligation and excision of a saccular aneurysm of the cubital vein*

venous aneurysms of the lower limbs. Differential diagnosis includes popliteal cysts (Baker's cyst) or arterial aneurysms.[18] It can be complemented with CT- or MRI-phlebography, which may be important for anatomical characterization before intervention and identification of aneurysms in other locations.

Indications for treatment of PVAs are not well established. In less than 20mm aneurysms with fusiform morphology, the risk of thromboembolism is low, and there is no indication for surgery.[11] Classically, treatment was recommended for all symptomatic patients or those with aneurysms larger than 20mm due to the unpredictable risk of pulmonary embolism.[1,4,11,12,19] However, a recent systematic review suggested only treating symptomatic aneurysms or those with evidence of mural thrombus.[2] Some authors have demonstrated that asymptomatic, low-risk aneurysms can be appropriately managed with surveillance.[11,20] With the liberal use of DUS, more asymptomatic PVA will be identified, making it essential to know those who benefit from surgical repair. In our series, the indication for treatment included all aneurysms larger than 20mm, the presence of symptoms, or mural thrombus. In most cases, tangential aneurysmectomy and lateral venorrhaphy was performed. This operation is particularly appropriate for saccular aneurysms, but it could also be performed for fusiform aneurysms.[11,21] Thrombus removal with the need to open the aneurysm sac should be performed if present. Alternative surgical techniques include an interposition bypass with a vein graft or resecting the entire aneurysm with end-to-end anastomosis.[1,4,11,21] We obtained favorable results with a long-term follow-up, low morbidity, no pulmonary embolism, and only one case of recurrence after 14 years with non-occlusive thrombosis of the aneurysm. We probably did not observe any cases of pulmonary embolism because we were liberal in indicating the treatment of asymptomatic aneurysms larger than 20mm. However, we cannot rule out asymptomatic pulmonary embolism in these patients. Popliteal aneurysm recurrence after surgical treatment is rarely reported in the literature.[11] The causes are not established, having already been associated with incomplete resection of the diseased vein wall.[17] The degeneration of another venous segment may also be responsible. This demonstrates the relevance of maintaining adequate long-term follow-up with DUS. The external prosthetic wrapping could avoid recurrence, but no published data support this hypothesis.

Non-surgically approached patients were put under anticoagulation. However, although some authors propose it for greater than 20mm PVA, anticoagulation does not protect against thrombosis, as a 60% risk of recurrent thromboembolism with anticoagulation alone was reported.[21] The slow venous flow associated with vein ectasia provides the ideal conditions for clot formation.[22] However, anticoagulation is mandatory after surgical treatment, and most authors recommend at least 3-6 months of anticoagulation after the procedure.[21]

Unlike aneurysms of the lower extremities, in cases of abdominal venous aneurysms, there is a substantial risk of rupture and massive gastrointestinal bleeding from fistulization.[2] Treatment should be considered, especially when symptomatic or expanding.[23] Portal system aneurysms can be congenital due to incomplete involution of the right distal vitelline vein or most commonly acquired.[23] The latter is often related to portal hypertension, which due to the increase in venous pressure, causes intimal thickening and media hypertrophy with eventual fibrotic replacement culminating in wall weakening.[24,25] In our series of two portal system aneurysms identified, only one was associated with portal hypertension. These aneurysms are usually asymptomatic or are manifested by nonspecific abdominal pain. The rupture risk is small but increases proportionally

to portal vein pressure.[25] Thrombosis of the aneurysm and portal vein is more common, occurring in 20% of patients, and is usually associated with abdominal pain carrying a risk of venous mesenteric ischemia.[23] Portal vein aneurysms have historically been treated by surgical aneurysmorrhaphy, but a post-operative mortality of 17.5% has been reported in a systematic review.[23] Some authors argue that stable asymptomatic portal vein aneurysms could be conservatively managed by serial imaging. The intervention should be reserved for symptomatic patients with aneurysms greater than 30mm, or with progressive enlargement. [23,26] In aneurysms related to portal hypertension, TIPS can be an effective treatment by reducing the portosystemic pressure gradient.[26] In the patient with a superior mesenteric vein aneurysm, it was considered that the risks of surgical intervention or even anticoagulation outweighed the benefits of treatment. No aneurysm thrombosis occurred after one year but the aneurysm increased in size.

Iliac vein aneurysms are extremely rare, with a few cases reported in the literature.[27] They can present with thromboembolism, abdominal pain, or even lower urinary tract symptoms.[27] In the patient with bilateral chronically thrombosed external iliac veins, acute on chronic DVT was observed, improving with thrombolysis.

We had some patients with superficial venous aneurysms in our series. Venous thromboembolism is extremely rare in these aneurysms, so anticoagulation is probably not beneficial.[22,28] These aneurysms are often asymptomatic and described in the saphenous systems.[29] Surgical excision can be performed to resolve symptoms such as pain or even aesthetic reasons.[20] There are also reports of successful treatment of these aneurysms with liquid/foam sclerotherapy.[30]

Limitations of this study must be considered in the interpretation of these results. As a single-center study, the sample size is small, so findings on this rare disease are not easily generalized. However, with some exceptions, patients have an extended follow-up. All patients admitted to the institution with venous aneurysms were included reducing the risk of selection bias.

CONCLUSION

Venous aneurysms are extremely rare and are located mainly in the popliteal vein. The aneurysm could be asymptomatic until it suddenly causes a pulmonary embolism making the therapeutic decision challenging. As the risk of venous thromboembolism is not negligible in asymptomatic PVA greater than 20 mm and not prevented with anticoagulation, surgical treatment can be considered. Our series shows that surgical repair of popliteal and common femoral vein aneurysms has good long-term results. Follow-up with DUS should be considered in the long term due to the risk of recurrence. In the case of abdominopelvic venous aneurysms, the surgical decision must be individualized, weighing the risks and benefits of the intervention.

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