Management of symptomatic and asymptomatic popliteal venous aneurysms: A retrospective analysis of 25 patients and review of the literature

Carmine Sessa, MD, Philippe Nicolini, MD, Michel Perrin, MD, Issam Farah, MD, Jean-Luc Magne, MD, and Henri Guidicelli, MD

Objectives: Popliteal venous aneurysms (PVAs) are an uncommon but potentially life-threatening disease because they can be a source for pulmonary emboli (PE). With the widespread use of venous duplex scanning, PVAs are increasingly found in patients with deep or superficial vein insufficiency, and questions have arisen as to the management of these aneurysms. The purpose of this study was to review our experience in the management of PVAs diagnosed in patients with PE and in patients with chronic venous diseases.

Methods: Twenty-five patients with PVAs were treated in two centers between 1985 and 1999. There were 20 women and five men, with an average age ranging from 33 to 79 years (mean age, 59 years). Twenty-four percent (6/25) presented with PE, and 76% (19/25) of PVAs were discovered during investigation for chronic venous disease (varicosities, n = 13; post-thrombotic symptoms, n = 6). The diagnosis of PVA was achieved in all cases with venous duplex scanning and phlebography. Aneurysms were located in the proximal popliteal vein (n = 17) and at the saphenopopliteal junction (n = 8). Seventy-two percent (18/25) of PVAs were saccular, and 40% (10/25) had an intraluminal thrombus. Two patients with PE underwent cardiac arrest, with one requiring a pulmonary embolectomy. The Fisher exact test showed a statistically significant correlation between PE and the presence of thrombus (50% vs 7% without thrombus, P = .02).

Aneurysms were treated with tangential aneurysmectomy and lateral venorrhaphy (n = 19), resection with end-to-end anastomosis (n = 2), resection with interposition of the greater saphenous vein (n = 2) or the superficial femoral vein (n = 1), and resection with vein transposition (n = 1). Two patients who experienced a PE had an inferior vena cava filter placement before surgical repair of the PVA.

Results: Mean follow-up was 63 months (range, 11-168 months). No operative deaths occurred, and no patient had evidence of a recurrent PE. Postoperative minor complications (20%) included transient common peroneal nerve palsy (n = 2), postoperative hematoma (n = 2), and wound infection (n = 1). Postoperative thrombosis of the surgical repair occurred in three patients, and patency was restored with anticoagulation therapy.

Conclusion: Despite its rarity, PVAs should be ruled out with venous duplex scanning in patients with PE and in patients presenting with chronic venous diseases. Because of the unpredictable risk of thromboembolic complications, surgical treatment that is accompanied by a low morbidity rate is indicated in all PVAs. Tangential aneurysmectomy with lateral venorrhaphy is the procedure of choice. (J Vasc Surg 2000;32:902-12.)


Primary venous aneurysms are uncommon and in most cases of little clinical significance, whereas popliteal venous aneurysms (PVAs) are a form of potentially life-threatening disease because they have been recognized to be a source of recurrent pulmonary emboli (PE). Nearly all the patients reported on in the literature are symptomatic, with the most common symptoms being PE and post-thrombotic syndrome. In 1968, May and Nissel were the first to describe a PVA associated...
with foot and ankle swelling. The first case of recurrent PE from a PVA was reported by Dahl et al in 1976. In 1977, Harold and Friedman described a PVA in a 17-year-old boy who presented with an asymptomatic mass behind the knee. With the more liberal use of venous duplex scanning, asymptomatic PVAs will be incidentally found in patients being investigated for deep or superficial vein insufficiency. Although the treatment of symptomatic PVAs is surgical, the management of asymptomatic patients still remains controversial. A few recent reports have suggested that asymptomatic PVAs should remain under close surveillance with duplex scanning and that surgery should be considered only if thromboembolic events occur.

We report our experience in the management of PVAs in patients with PE and chronic venous diseases and review the current diagnostic and therapeutic alternatives reported in the literature.

**METHODS**

Table I summarizes the 25 patients with PVAs treated between 1985 and 1999 in two institutions (Clinique du Grand Large in Lyon and the Vascular Surgery Department of Grenoble University Hospital). The records were retrospectively reviewed with regard to clinical presentation, diagnostic methods, surgical treatment, and outcome. The study population consisted of 20 women and five men with a mean age of 59 years (range, 33-79 years).

**Clinical presentation.** Six (24%) patients presented with pulmonary embolism, and 19 (76%) patients were seen with symptoms related to chronic venous diseases, including superficial vein insufficiency (n = 13), leg swelling (n = 2), and venous ulceration (n = 4, Table I). Among patients who presented with PE, two patients underwent cardiac arrest. One of them underwent pulmonary artery embolectomy under circulatory arrest with uneventful postoperative recovery. Two patients who had previously presented an episode of PE of unknown source had recurrent PE when oral anticoagulation was discontinued 6 months later. Duplex scanning of the lower limb showed a PVA that had probably been missed at the time of the first episode of PE. Four patients in whom PVAs were diagnosed during workup for superficial vein insufficiency had previously undergone a lesser saphenectomy.

**Diagnosis.** Diagnosis of a PVA was achieved in all cases with venous duplex scanning (Fig 1), and all patients underwent preoperative ascending phlebography (Fig 2, A and B; Fig 3, A; and Fig 4, A). Computed tomography (CT) scanning (Fig 4, B) and, more recently, magnetic resonance imaging (MRI; Fig 5) have also been performed in some patients. Aneurysms were located in the proximal popliteal vein in 17 patients and involved the saphenopopliteal junction in eight patients. One patient had a bilateral PVA, and five patients had deep vein reflux above or at the level of the aneurysm.

**Anatomic features.** Eighteen aneurysms were saccular (72%; Fig 2, A; Fig 3, A; and Fig 4, A), and seven aneurysms were fusiform (28%; Fig 2, B). Intraluminal thrombus was detected in nine saccular aneurysms (40%; Fig 3, A, and Fig 4, A) and in one fusiform aneurysm (14%). Patients who presented with PE (n = 6) had a saccular aneurysm in five cases, with presence of thrombus in three cases and a fusiform aneurysm with thrombus in one case. Correlation of pulmonary embolism with aneurysmal shape, size, and presence of thrombus was performed with the Fisher exact test. Only the presence

<table>
<thead>
<tr>
<th>Pulmonary emboli (n = 6 [24%])</th>
<th>Two with cardiac arrest</th>
<th>Two with recurrent PE after discontinuation of anticoagulant</th>
</tr>
</thead>
<tbody>
<tr>
<td>Type of aneurysm</td>
<td>Saccular: 5 (80%)</td>
<td>Thrombus: 4 (83%)</td>
</tr>
<tr>
<td></td>
<td>Fusiform: 1 (16%)</td>
<td>Thrombus: 1 (100%)</td>
</tr>
<tr>
<td>Chronic venous diseases (n = 19 [76%])</td>
<td>Varicosities (n)</td>
<td>13</td>
</tr>
<tr>
<td></td>
<td>Leg swelling (n)</td>
<td>2</td>
</tr>
<tr>
<td></td>
<td>Venous ulcer (n)</td>
<td>4</td>
</tr>
<tr>
<td>Type of aneurysm</td>
<td>Saccular: 13 (68%), Thrombus: 5 (38%)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Fusiform: 6 (31%), Thrombus: 1 (16%)</td>
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</table>
of thrombus was statistically significant (50% vs 7% without thrombus, \( P = .02 \)). The mean diameter of the PVAs was 37 mm, ranging from 25 to 60 mm. The mean diameter of the PVAs with PE was 30 ± 8 mm (range, 22-40 mm), whereas the mean diameter of the PVAs without PE was 38 ± 9 mm (range, 25-60 mm).

**Treatment and operative technique.** Treatments and operative techniques are listed in Table II. All patients underwent operative repair, which was carried out through a posterior incision at the popliteal fossa. Tangential aneurysmectomy with lateral venorrhaphy was performed in 89% (16/18) of saccular aneurysms and in 43% (3/7) of fusiform aneurysms.

The PVA was exposed, and a vascular clamp was placed tangentially across the transition between the aneurysm and the popliteal vein, as described by Aldridge et al.\(^3^4\) The clamp was undersewn with a running mattress 6-0 vascular suture. The aneurysm was resected, the clamp was removed, and a second layer of over-and-over running suture was used to reinforce the free venous edges external to the mattress closure.

Two patients with saccular PVAs were treated with resection of the aneurysm and an end-to-end anastomosis. The remaining four patients underwent various other procedures, including resection of the aneurysm with transposition of the tibioperoneal trunk into the anterior tibial vein (n = 1), interposition vein grafting with the greater saphenous vein (ipsilateral, n = 1; contralateral, n = 1), and contralateral superficial femoral vein (n = 1, Table II). An external wrapping with polytetrafluoroethylene was used in one patient to reinforce the vein wall of a fusiform aneurysm after tangential

**Table II.** Surgical management of patients with PVAs (n = 25)

<table>
<thead>
<tr>
<th>Saccular aneurysms</th>
<th>18 (72%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tangential aneurysmectomy with lateral venorrhaphy</td>
<td>16 (88%)</td>
</tr>
<tr>
<td>Resection with end-to-end anastomosis</td>
<td>2 (11%)</td>
</tr>
<tr>
<td>Fusiform aneurysms</td>
<td>7 (28%)</td>
</tr>
<tr>
<td>Tangential aneurysmectomy with lateral venorrhaphy (external PTFE wrapping n = 1)</td>
<td>3 (43%)</td>
</tr>
<tr>
<td>Resection with vein grafting</td>
<td>3 (43%)</td>
</tr>
<tr>
<td>Contralateral GSV</td>
<td>1</td>
</tr>
<tr>
<td>Homolateral GSV</td>
<td>1</td>
</tr>
<tr>
<td>Contralateral SFV</td>
<td>1</td>
</tr>
<tr>
<td>Resection with vein transposition*</td>
<td>1 (14%)</td>
</tr>
<tr>
<td>Other procedures</td>
<td></td>
</tr>
<tr>
<td>Lesser saphenectomy</td>
<td>8</td>
</tr>
<tr>
<td>Greater saphenectomy</td>
<td>7</td>
</tr>
<tr>
<td>Vena cava filter</td>
<td>2</td>
</tr>
</tbody>
</table>

*Transposition of the tibioperoneal trunk into the anterior tibial vein.

GSV, Greater saphenous vein; PTFE, polytetrafluoroethylene; SFV, superficial femoral vein.
aneurysmectomy. Two patients who had PE with cardiac arrest underwent a concomitant inferior vena cava filter placement.

A lesser saphenectomy (n = 8) and a bilateral greater saphenectomy (n = 3) were performed during the treatment of the PVA. Four patients underwent greater saphenectomy as a separate procedure.

Postoperatively, all patients began receiving heparin for 2 to 3 days, and 20 patients have been switched to a coumadin regimen for 3 months. A low-molecular-weight heparin was used for 3 weeks in the last five patients after tangential aneurysmectomy.

RESULTS

No patient was lost to follow-up, and mean follow-up was 63 months (range, 11–168 months). No operative deaths occurred, and no patient had evidence of recurrent PE. One patient died 7 years postoperatively of liver cirrhosis. Five (20%) complications occurred and consisted of transient common peroneal nerve palsy (n = 2), inconsequential postoperative hematomas (n = 2), and wound infection (n = 1). In our early experience all patients underwent duplex scanning with phlebography before being discharged from the hospital. Currently, follow-up is performed with serial duplex scanning. Early postoperative vein thrombosis of the surgical repair occurred in three patients and involved a tangential aneurysmectomy, a resection with end-to-end anastomosis, and a resection with an interposition graft with the contralateral superficial femoral vein. Patients continued anticoagulation therapy for 3 months, and the popliteal vein repairs were found to be patent at subsequent follow-up. During follow-up, six patients who underwent tangential aneurysmectomy (n = 5) and resection with an end-to-end

Table III. Clinical features of patients with PVAs (n = 117)

<table>
<thead>
<tr>
<th>Symptoms</th>
<th>Review of the literature (n = 92)</th>
<th>Present series (n = 25)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>PE</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Chronic venous disease</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Phlebitis</td>
<td>47* (51%)</td>
</tr>
<tr>
<td></td>
<td>Popliteal mass</td>
<td>7 (7%)</td>
</tr>
<tr>
<td></td>
<td>Leg swelling, pain</td>
<td>5 (5%)</td>
</tr>
<tr>
<td></td>
<td>Venous ulcer</td>
<td>10 (10%)</td>
</tr>
<tr>
<td></td>
<td>Angiodysplasia†</td>
<td>17 (18%)</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Venous ulcer</td>
<td>2 (2%)</td>
</tr>
<tr>
<td></td>
<td>Angiodysplasia‡</td>
<td>4 (4%)</td>
</tr>
</tbody>
</table>

*Paradoxical emboli (n = 3).
†See references 51, 55, and 56.
‡See reference 51.
anastomosis (n = 1) were found to have a small fusiform dilatation (12-20 mm) of the popliteal vein above or at the level of the surgical repair. In this group the PVAs were saccular in three patients and fusiform in three patients, and two patients presented a persistent deep vein reflux. Four years later, one patient had a small (20 mm) fusiform and thrombus-free aneurysm of the contralateral popliteal vein and is currently under surveillance.

DISCUSSION

Definition and pathogenesis. Although dilatation of the termination of an incompetent short saphenous vein is occasionally seen, aneurysmal dilatation of the popliteal vein is rare.31 The definition of venous aneurysm still remains controversial, and in the literature there are no size criteria to definitively label a venous dilatation as an aneurysm. It is likely that there is a spectrum of progressive focal enlargement before aneurysmal formation. This has been defined by MacDevitt et al32 as a persistent isolated dilatation of twice the normal vein diameter that is generally between 5 and 7 mm. However, we agree with Maleti et al49 that the critical diameter to define a venous fusiform dilatation as an aneurysm must be at least three times (> 20 mm) that of the normal popliteal vein.

The pathogenesis of PVA is uncertain. Trauma, inflammation, congenital weakness, and localized degenerative changes have been suggested as possible causes.4,58-62 In the congenital form with a true aneurysm, the mechanism is thought to be the aneurysmal dilatation of a weak vein wall, mainly as a result of venous hypertension caused by obstruction of venous outflow or deep vein reflux.22,31,46 Local factors in the popliteal fossa may certainly play an important role. Thiery58 reported a case of congenital dilatation of the popliteal vein caused by a branch of the sciatic nerve. Because PVAs have been found in patients with either deep or superficial venous insufficiency, it is suggested that aneurysmal dilatation is a response to increased hemodynamic pressure at a site of mural weakness.5,16,31 However, the fact that most venous aneurysms occur in the lower limb and in the neck, where there is a low pressure, would rule out high venous pressure as a cause.31,41 It is likely that a combination of congenital and acquired mechanisms is involved, in that PVAs may arise in congenitally predisposed patients as a consequence of mechanic factors, rheologic factors, or both.25,34,61 PVAs occur at any age (12-82 years) and occur more frequently in women. The youngest patient was reported in 1997 by Carlin et al46 and involved a 12-year-old girl with Klippel-Trénaunay syndrome who presented with a massive PE. PVAs may develop in patients with angiodysplasia, as reported by Cormier et al.51 Histologic studies reported in the literature have shown a thickened and fibrous intima with a marked decrease in smooth muscle cells in the media that can be thin or absent and in different stages with present or absent internal elastic lamina.10,34,59,61,62

Clinical presentation. Since the first reports, nearly all PVAs have been discovered in patients with thromboembolic complications.5-48 In addition to the 25 cases reported herein, there are 92 cases published in the world literature,5,51,55,56 giving a total of 117 cases available for analysis (Table III). Collectively, 53 (45%) patients (six in our series) presented with PE;

Fig 4. Venography (A) and CT (B) scans show a saccular aneurysm with intraluminal thrombus extending into the popliteal vein.
and 64 (55%) PVAs were incidentally discovered in patients during investigation for chronic venous diseases, including post-thrombotic symptoms (n = 34) and varicosities (n = 30). In this latter group 17 patients in the literature51,55,56 and 13 patients in our series presented with superficial vein insufficiency. The high incidence of PVAs found in patients with varicosities in our series is due to the fact that since our first cases of PVA,8 all patients presenting with PE or venous diseases undergo lower extremity venous duplex scanning of their popliteal fossa to detect PVAs.

Given the rarity of symptoms directly related to the aneurysm, it is likely that the incidence of undiagnosed and asymptomatic venous aneurysms in the general population may be higher.9,31,55 With the more extensive use of duplex scanning, PVAs will be identified with increasing frequency in patients with PE and no obvious source of thromboembolic complications and in patients investigated for chronic venous diseases. In the literature only a few aneurysms were identified by physical examination or were accompanied by leg pain and swelling; however, it is not clear whether the latter symptoms were related to the aneurysm.11,48,51 Most of the aneurysms were located in the proximal popliteal vein, and seven cases were bilateral,28,32,43,49 including one case in our series. The aneurysms were saccular in about 75% of patients (Fig 2, A; Fig 3, A; and Fig 4, A), fusiform in 20% (Fig 2, B), and not specified in 5%. Thrombus formation within the aneurysmal sac has been detected in about two thirds of all patients. Although large or saccular aneurysms are recognized to be more prone to thromboembolic complications,1,44,52,57,61 there is no clear evidence of a critical diameter or a specific type. Small aneurysms carry the same risk as larger ones in the reported literature16,31 and in our series (Fig 4, A). One case of fusiform aneurysm with thromboembolic complications was reported by Ostyn et al,30 and another case with pulmonary embolism occurred in our series. Chahlaoui et al16 reported the fatal case of a patient with multiple recurrent episodes of PE who was found to have a small saccular PVA (20 mm × 20 mm). During venography, the thrombus was seen breaking off, and the patient suddenly collapsed and died the day after the venogram. This gives support to the hypothesis that PVAs act as a thrombus generator, intermittently releasing emboli to the lung. This case, which presented acutely and without local clinical signs from the aneurysm, demonstrates the potential fatality of thromboembolism from small PVAs.

Rupture of the PVA has never been reported in the literature. In patients with chronic venous diseases, seven (0.2%) fusiform aneurysms were discovered in five patients in 2507 duplex examinations,55 and seven (0.18%) saccular aneurysms were diagnosed in a series of 3880 duplex examinations performed for both deep vein thrombosis and superficial vein insufficiency.56 In our series four fusiform and nine saccular aneurysms were incidentally discovered in patients investigated for superficial vein insufficiency. In this group the aneurysms reported in the literature51,55,56 and in our series were all free of thrombus on duplex scan examination.

Diagnosis. In earlier reports ascending venography was considered the imaging technique of choice. Currently, venous duplex scanning is considered to be the best noninvasive diagnostic method for the diagnosis of PVAs.1,10,11,34,36,56,63-68 Duplex scanning is reliable in defining the true size of the aneurysm and the extent of thrombus within the aneurysmal sac (Fig 1). It is also useful to document venous patency after aneurysm repair. More recently, other diagnostic

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Table IV. Surgical treatment of PVAs

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Review of the literature (n = 83)</th>
<th>Present series (n = 25)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Tangential aneurysmectomy with lateral venorrhaphy (two-vein patching)</td>
<td>48</td>
<td>19</td>
</tr>
<tr>
<td>Resection and end-to-end anastomosis</td>
<td>5</td>
<td>2</td>
</tr>
<tr>
<td>Resection with vein grafting</td>
<td>11</td>
<td>3</td>
</tr>
<tr>
<td>Resection and PTFE grafting</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Ligation with vein grafting</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Resection with vein transposition</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tibioperoneal trunk into the anterior tibial vein</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Medial gastrocnemius vein</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Resection without venous continuity</td>
<td>6</td>
<td>0</td>
</tr>
<tr>
<td>Ligation</td>
<td>6</td>
<td>0</td>
</tr>
<tr>
<td>Vena cava filter</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>Pulmonary artery thrombectomy under circulatory arrest plus vena cava filter</td>
<td>1 (died)</td>
<td>1 (alive)</td>
</tr>
</tbody>
</table>

PTFE, Polytetrafluoroethylene.
methods, such as CT scanning (Fig 4, A) and MRI (Fig 5) have also been used and offer valuable anatomic information.9,36,46 Although duplex scanning, CT scanning, and MRI are important noninvasive diagnostic modalities, we and others1,11,31,46,48,69 believe that venography is mandatory to precisely define the venous anatomy before surgical repair, particularly in patients with a prior history of deep vein thrombosis. In the literature PVAs were diagnosed with venography in about two thirds of the cases and with duplex scanning in the other cases. It has been suggested that healthy patients with no underlying predispositions for deep vein thrombosis and without clinical signs of lower extremity thrombosis should undergo venography when duplex scanning fails to demonstrate a possible source of thromboembolism.48,69 Although duplex scanning is considered to be the best noninvasive diagnostic test, venography remains the most specific and sensitive test for the diagnosis of PVAs.1,11,31,69

**Treatment.** Given the asymptomatic nature of this condition and the potential for serious thromboembolic complications, PVAs should be treated accordingly. In symptomatic patients with PE, surgery represents the treatment of choice.5-48 whereas in patients with chronic venous diseases the management still remains controversial.44,49,55-57 Anticoagulation alone has proved to be inadequate in patients with PE and carries a high incidence (80%) of recurrence.7,11,18,28,34,36,48 Experience with two fatal cases in the literature7,18 showed that despite therapeutic levels of anticoagulation, thrombus may continue to form and embolize. Moreover, six of the 10 patients who were initially treated with anticoagulation presented with recurrent thrombosis in the popliteal vein or PE before having surgical correction of the aneurysm.5,11,12,18,19,63 Given the high risk of recurrence of thromboembolic events with anticoagulation alone, surgical treatment of PVAs is indicated in all symptomatic patients. Recurrence of PE after surgery has never been reported.

Tangential aneurysmectomy with lateral venorrhaphy has been the most commonly performed procedure, and it is recommended for saccular aneurysms. Forty-eight patients in the literature and 19 patients in our institutions were treated with this technique previously described by Aldridge et al (Table IV).34

Aneurysm resection with preservation of venous continuity is recommended when tangential aneurysmectomy cannot be satisfactorily performed or in patients with fusiform aneurysms because of the risk of leaving a diseased vein wall that may continue to enlarge. Various techniques for venous reconstruction have been used and are reported in Tables II and IV. Saccular aneurysms may be treated by resection with end-to-end anastomosis of the popliteal vein when the venous continuity can be restored without tension. Resection of the aneurysm with vein interposition grafting or vein transposition was performed in 17 patients (four patients in our series) with the lesser saphenous vein, greater saphenous vein, superficial femoral vein, and internal jugular vein.5,12,20,35,42,48,51 The superficial femoral vein with a competent valve can be used to treat PVAs in patients with symptomatic deep vein reflux.31,47 Saphenous vein patching after aneurysmectomy has also been used in two patients.15,39 An interposition panel graft constructed from the contralateral greater saphenous vein was used to reestablish venous continuity and match the caliber of the native popliteal vein.36 Although an ipsilateral greater saphenous vein has been used in one case of our series, this strategy should be avoided because of the risk of losing a potential avenue for venous drainage should a thrombosis of the surgical repair occur. However, an ipsilateral greater saphenous vein was used in one patient in our series because it was the only autologous conduit available for reconstruction of the popliteal vein after resection of the PVA.

The ipsilateral greater saphenous vein was removed with the PVA in three patients in our series because of associated symptoms from varicosities, and none of them had thrombosis of the popliteal vein. Nevertheless, we recommend greater saphenectomy to be performed when needed as a separate procedure
after the venous aneurysmectomy (four patients in our series). An incompetent lesser saphenous vein can be removed at the time of the venous reconstruction, especially when the aneurysm involves the saphenopopliteal junction.

There was no operative mortality or early or late recurrent PE after surgery or after thrombosis of the venous reconstruction. Long-term patency of popliteal vein reconstruction is poorly documented in the literature. The fate of the veins in which aneurysm resection with an end-to-end anastomosis was performed is unknown. Popliteal veins repaired with vein patching and vein graft reconstruction remained patent. Thrombosis occurred in the patients treated with an interposition graft with an internal jugular vein.\(^\text{20}\) Other postoperative complications included transient nerve injury or consequent hematomas as a result of anticoagulation.

Management of asymptomatic aneurysms still remains a controversial issue. Asymptomatic patients with saccular aneurysms of any size or those with large fusiform PVAs should undergo surgery regardless of the presence of thrombus because of the unpredictable risk of thromboembolic complications.\(^\text{22,26,44,55,56}\) These aneurysms have relatively slow venous flow, and their location near an active joint may predispose to the formation and release of thrombus.\(^\text{16}\) Conversely, small fusiform (\(\leq 20\) mm) aneurysms without thrombus are deemed to carry a lower risk of embolic complications but should remain under close surveillance with duplex scanning.\(^\text{15,22,26,55-57}\)

There are two reports in the literature of asymptomatic PVAs that remained under surveillance without treatment.\(^\text{55,56}\) Rubin et al\(^\text{55}\) reported a series of five patients with seven fusiform aneurysms involving the popliteal vein (\(n = 5\)) or distal superficial femoral vein (\(n = 2\)). The patients were asymptomatic, and there was no thrombus inside the aneurysm. The mean aneurysmal size in this series was 12.9 mm (range, 9.1-17 mm). Although untreated, none of these patients had thromboembolic problems, but the size of the aneurysm was quite small, and the follow-up was short. The authors concluded that patients with a fusiform aneurysm, lack of thrombus inside the aneurysm, and no current or prior history of thromboembolic symptoms represent a group of patients in whom the natural history of PVA appears benign. The authors suggest following the patients with serial duplex scanning studies to identify further aneurysmal enlargement or thrombus formation. Labropoulos et al\(^\text{56}\) reported seven patients who were incidentally found to have a saccular PVA during investigation for varicose veins. The largest aneurysm diameter ranged from 20 to 28 mm. Because there was no history of thromboembolism and no evidence of thrombus inside the aneurysmal sac, no treatment was offered, and the patients were closely followed. Over a period of 2 months to 2 years, all patients remained free of thromboembolic complications. Two patients underwent a varicose vein operation without prophylaxis and had uneventful postoperative recoveries.

Rubin et al,\(^\text{55}\) Labropoulos et al,\(^\text{56}\) and others\(^\text{15,57}\) recommend close surveillance with duplex scanning for asymptomatic patients and the consideration of surgery if thromboembolic manifestations occur. However, given the asymptomatic nature of these aneurysms and the high potential for serious pulmonary embolization, these recommendations will have to be supported by other long-term observations.

The role of prophylactic anticoagulation in patients with small asymptomatic fusiform aneurysms is not clearly established in the literature.\(^\text{55,56}\) It is our policy, in the absence of other thromboembolic risk factors, not to use prophylactic anticoagulation.

As a matter of fact, there is no reliable diagnostic test, and duplex scanning cannot identify the risk of thrombus formation because venous stasis with slow flow is found in all venous aneurysms, regardless of the size and shape. With the more liberal use of venous duplex scanning, it is probable that asymptomatic PVAs will be identified in the future with increasing frequency. Because of the relative rarity of this situation, it is unlikely that one surgeon or institution will have significant experience in dealing with this problem. Nevertheless, in patients who have a PVA incidentally identified, there will be a question as to the management of this condition. The size and shape of the aneurysm, the presence of thrombus, and the high potential for severe PE, even after adequate anticoagulation, should be considered in the management plan. We recommend resection of the aneurysm and preservation of venous continuity.

The role of long-term postoperative anticoagulation is unclear. Aldridge et al\(^\text{34}\) recommend a short course of postoperative anticoagulation, especially after tangential aneurysmectomy, advocating that the aneurysmal sac and the residual thrombus be removed. In the literature most patients received oral anticoagulation for 3 to 6 months.\(^\text{34}\) We recommend compression stockings to our patients and low-molecular-weight heparin for 3 weeks after tangential aneurysmectomy. We recommend oral anticoagulation therapy for 3 months in the presence of risk factors for thrombotic complications or after complex surgical repair. Hobson et al\(^\text{70}\) and Cheatle and Perrin\(^\text{31}\) sug-
gest using an external pneumatic compression device to increase the velocity of venous return and reduce the risk of postoperative thrombosis.

Thrombolytic therapy has been used as part of the initial treatment, especially in patients who are first seen with PE. In the literature four patients received streptokinase before undergoing surgical repair of the aneurysm. Lytic therapy can improve cardiopulmonary function and can also reduce or eliminate the thrombus in the aneurysm, facilitating the surgical repair. Regarding vena cava filter placement, six patients had a vena cava filter, including the two patients reported herein. Percutaneous vena cava filter placement seems a reasonable alternative for elderly or debilitated patients who are considered to be poor candidates for oral anticoagulation or in patients with severe PE with cardiac arrest.

**Conclusion.** PVAs are an uncommon but potential source of serious thromboembolic complications. Despite their rarity, they should be ruled out in patients presenting with a history of repeated PE and no obvious embolic source or thromboembolic risk factors. Because of the high risk of recurrent PE, surgery is indicated in all symptomatic PVAs. Patients with asymptomatic saccular or large (> 20 mm) fusiform aneurysms should also be treated surgically, regardless of the presence of thrombus, because of the unpredictable risk of thromboembolic complication. Tangential aneurysmectomy with lateral venorrhaphy is the treatment of choice for saccular PVA. Aneurysm resection with preservation of venous continuity is recommended when tangential aneurysmectomy cannot be satisfactorily performed, as well as for patients with fusiform aneurysms. Asymptomatic patients with small fusiform (≤ 20 mm) and thrombus-free PVAs may remain under close surveillance, with surgery performed if a thrombus is detected in the aneurysm, if the aneurysm enlarges, or if thromboembolic complications occur. This policy will need to be supported by other long-term follow-up studies.

**REFERENCES**


41.图片来源

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DISCUSSION

Dr William H. Pearce (Chicago, Ill). Thank you Dr Comerota. Ladies and gentleman, and Dr Sumner. This was an excellent presentation, and I appreciate having the manuscript in advance. Venous aneurysms are most commonly associated with a congenital venous malformation such as a Klippel-Trénaunay syndrome or an association with high-flow arteriovenous malformation. These isolated popliteal venous aneurysms that have been discussed this morning are very unusual. As has been pointed out, less than 100 of these aneurysms have been reported in the literature. This series is unique by its size, 25 aneurysms, and with a high association with varicose veins, 52%. In addition, the females outnumbered the males 4 to 1. All of these patients underwent surgical repair, and it appears that there is excellent long-term patency. They also emphasized that the proximal control prior to opening these aneurysms is important. In the paper the authors describe this as thrombus producing, and I would take issue with this statement since many of the patients in this series were in fact asymptomatic. I have several questions that I would like the authors to address.

The first question is, with the large numbers of patients with associated varicose veins, did they have, in your opinion, a mild congenital venous malformation that created this association between superficial disease and deep disease?

All of your patients underwent surgical repair, but you also advocated that we should observe some of these patients. Have you in your own practice observed patients, and how have you followed them?

Finally, in 28% of the patients the greater saphenous vein from the ipsilateral side was removed as part of the surgery for the varicose vein surgery. Removing the ipsilateral greater saphenous vein may be ill advised if the deep repair failed. We reported a number of years ago using the contralateral greater saphenous vein as a panel graft to restore and reconstruct large popliteal venous aneurysms.

The paper was well presented, it is a large experience, and I would like to thank the forum for the privilege of discussing this paper. Thank you.

Dr Carmine Sessa. Dr. Pearce, I thank you for your kind comments and your questions.

In regard to your first question, we don’t have in our series any patient with angiodysplasia or other congenital venous malformation. There are in the literature five cases of angiodysplasia associated with popliteal venous aneurysm (PVA): one case involved a 12-year-old girl with Klippel-Trénaunay syndrome who presented with a massive pulmonary emboli, and four cases of angiodysplasia have been reported by Cormier.

Aneurysmal dilatation of the popliteal vein in patients with deep or superficial venous insufficiency might be a consequence of venous hypertension caused by obstruction of venous outflow or by deep vein reflux at a site of mural weakness.

The high incidence of patients with varicosities in our series is due to the fact that since our first cases of PVA, all patients presenting with pulmonary emboli or venous disease undergo lower extremity venous duplex study of their popliteal fossa to detect PVA.

Regarding the second question we have a few patients with small fusiform and thrombus-free aneurysms (less than 20 mm) that are under surveillance with duplex ultrasound every 6 months. These aneurysms are deemed to carry a lower risk of thromboembolic complications, and it seems reasonable to perform surgery if a thrombus is detected in the aneurysm, if the aneurysm enlarges, or if thromboembolic complications occur.

Your last question about the issue of removing the ipsilateral greater saphenous vein at the time of PVA repair brings up a few comments. We removed the ipsilateral greater saphenous vein with the PVA in three patients of our series because of associated symptoms from varicosities, and none of them developed thrombosis of popliteal vein. Four patients underwent greater saphenectomy as a separate procedure.

Nevertheless, it is advisable to perform greater saphenectomy as a separate procedure after the venous aneurysmectomy in order to leave a potential way for venous drainage should a thrombosis of the surgical repair occur. For the same reason the strategy of using an ipsilateral greater saphenous vein to reconstruct the popliteal vein should be avoided unless the greater saphenous vein remains the only autologous material available as in one case of our series. Oppositely, an incompetent less saphenous vein can be removed at the time of the venous reconstruction especially when the aneurysm involves the saphenopopliteal junction.