

CASE REPORT

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Traumatic Venous Aneurysm of the Popliteal Vein with Outcome: A Case Report and Review of the Literature

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ABSTRACT: A case of sudden death due to recurrent pulmonary thromboembolism is described. The fatality took place three and a half weeks following blunt trauma to the left popliteal region. The patient died unexpectedly. Autopsy revealed the source of the emboli as a sacciform venous aneurysm of the popliteal vein, an entity seldom described, but important to consider in cases of soft tissue popliteal masses or unexplained pulmonary embolism, especially in otherwise healthy individuals.

KEYWORDS: forensic science, traumatic venous aneurysm, sudden death, pulmonary embolism

Aneurysmal dilatations of arterial vessels are well recognized in forensic medical casework and account for a sizeable proportion of sudden extracardiac fatalities (33), whereas venous “aneurysms” are extraordinarily rare entities (63). A number of case reports deal with vena caval (1), intracerebral (43,66), mediastinal (52), mesenteric (36), iliac (48), inguinal (62), axillary (45), jugular (18,35), and cervical (21) venous aneurysms as well as instances occurring within lower (16,22,44,46,51,53,54,61) and upper limb veins (2,5,24,47,49,56,57). Depending on their location, venous aneurysms can compromise adjacent anatomical structures (64) and constitute a diagnostic challenge for the clinician and the forensic pathologist, as illustrated by the current case of sudden death caused by recurrent pulmonary embolism from a popliteal venous aneurysm.

Case Report

Clinical History

A 31-year-old professional ice hockey player had suffered a minor blunt trauma to the back of his left knee at the end of March. A few days later he stumbled during a game and sustained a minor

strain of the right knee joint; he presented at a surgeon’s office a week later. At this time the clinician diagnosed bilateral instability of the medial ligaments, considered to be due to repeated trauma during his career. The patient himself complained of mild pain at the left medial compartment of the knee joint, but there was no accompanying impairment of flexion or rotational movements. Because of progressive swelling at the back of the left knee, he was transferred to a cardiovascular clinic, where duplexsonography was performed. This revealed a “cystic mass” measuring $4.5 \times 4.5 \times 4$ cm between the popliteal artery and vein, which was interpreted as a Baker’s cyst. However, the radiological report did not exclude the possibility of a vascular anomaly being the underlying entity. The patient, free of symptoms beforehand, developed mild exertional dyspnea around April 10th, which worsened in the following few days and was accompanied by a cough. After these symptoms became worse and an episode of shaking and chills had occurred, he was admitted to the hospital, where a diagnosis of bronchopneumonia was made on April 16th on the basis of disseminated infiltrates in both lower lung fields on chest X-ray. Nuclear magnetic resonance tomography of the lower limbs was carried out, and a “cystic formation” of the proximal popliteal region was identified dorsal to the popliteal artery, between the medial and lateral aspects of the gastrocnemius muscle and presumed to represent a bleeding into a structure such as a synovial cyst. Since the patient refused to stay in the hospital, antibiotic therapy was initiated and strict bed rest was advised. The next day, with left-sided chest pain and dyspnea on mild exertion, antibiotics were administered, and the patient declined further hospital treatment. Against medical advice, he attended a game of his hockey club as a spectator on April 20th, after which he suddenly collapsed and died despite resuscitation by a physician who was present at the scene.

Autopsy

Forensic autopsy revealed massive pulmonary thromboembolism with associated acute cor pulmonale as the cause of death. Both pulmonary arterial trunks were obstructed by multiple thromboemboli, most of which demonstrated a striated surface and were firmly adherent to the arterial intima. Dissection of the lower extremity vessels in a search of the source of the thromboemboli identified a saccular dilatation of the left popliteal vein (Fig. 1). It measured about 4 cm in diameter, was circular, and some dark-red thrombi were found inside the cavity and at the entrance, adherent

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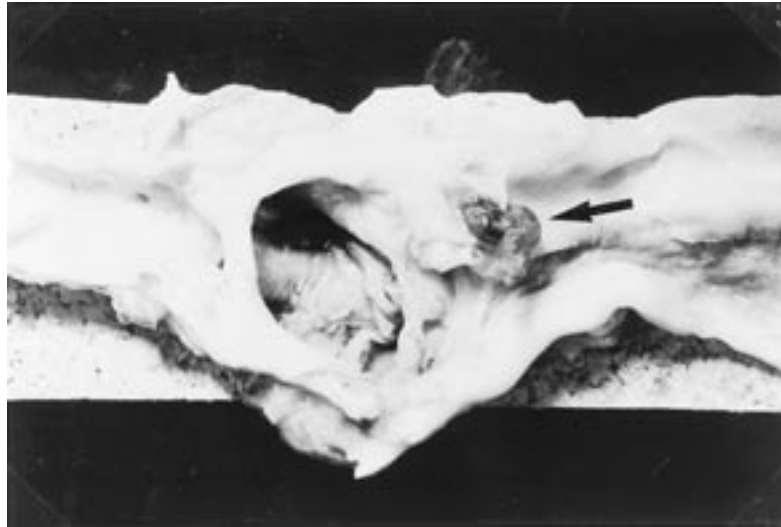


FIG. 1—Popliteal vein after fixation, with aneurysm and an adherent fragment of thrombus (arrow) next to the dilated segment of the vessel.

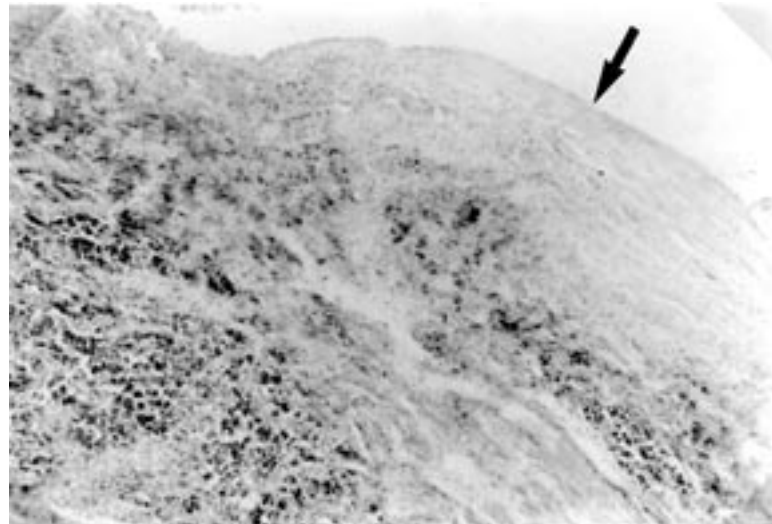


FIG. 2—Soft tissue from the vicinity of the popliteal vessels with aggregation of siderophages extending below the synovial membrane (arrow) of the articular cavity of the knee joint (25 \times Azan stain).

to the vessel wall (arrow in Fig. 1). No vascular connection to the neighboring artery could be found. The deep venous system of both legs was normal. No other pathology findings were detected during the postmortem examination.

Histology

Sections from both lungs showed large zones of hemorrhagic infarction around vessels obstructed by thromboemboli, especially beneath the visceral pleura.

In specimens obtained from the popliteal region extending to the articular cavity, a dense aggregation of siderophages in the soft tissue (Fig. 2) was noted: The iron-laden macrophages were intermingled with erythrocytes and were predominantly in the deeper zone next to the synovial membrane (arrow in Fig. 2).

The wall of the affected vessel exhibited fibrous thickening in the transitional zone between the undamaged region and the aneurysm. Along the course of the vein, the intact intima was

abruptly replaced by a richly collagenized tissue interwoven with large amounts of active fibroblasts and granulation tissue. The thrombus comprised dense masses of shadowy erythrocytes in the center and peripheral layers of leukocytes with pyknotic nuclei entrapped in fibrin. At the margin there was evidence of extension of collagen into the thrombus and invasion by macrophages marking the onset of organization.

The histological findings in the lung were consistent with a thromboembolus of about eight to ten days age (31), and the aneurysm of about three weeks between trauma and death.

Analysis of Radiology Findings

Two nuclear magnetic resonance tomograms clearly showed aneurysmal dilatation of the popliteal vein in the coronal and axial plain views (Figs. 3 and 4), more prominent after electronic suppression of the fatty tissue resonance. An efflux of contrast medium to the cranial and caudate portions of the vein was observed (Fig.



FIG. 3—NMR tomogram in coronal plain view exhibiting vascular dilatation in the left popliteal region between the lumen of the popliteal artery (large arrow) and its venous counterpart (small arrow).

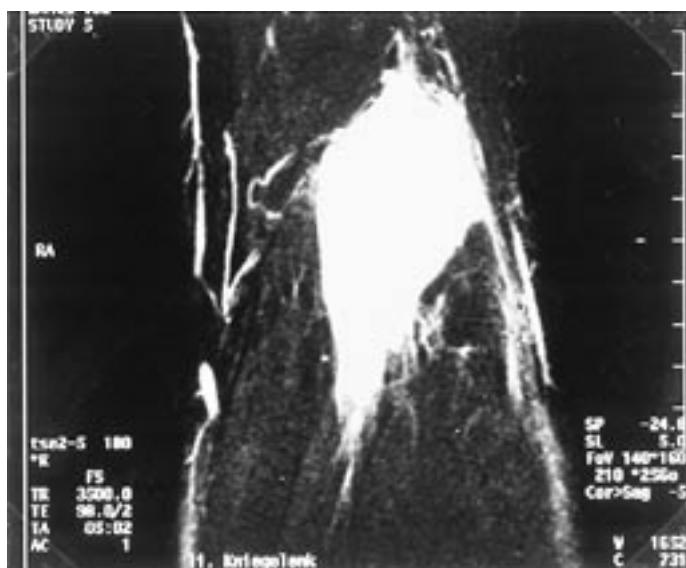


FIG. 4—NMR tomogram in axial plain view with aneurysmal sac of the popliteal vein and efflux of contrast medium to the cranial and caudate course of the vessel.

4). Here, the “neck” of the aneurysm broadly overlapped the course of the vessel (Fig. 3). The wall of the popliteal artery was intact (Fig. 3) and easy to separate from the aneurysmal mass that surrounded the venous lumen.

Discussion

The term “aneurysm,” once solely reserved for arteries (29), has seldom been applied to venous dilatations (2,5,16,41). Although the etiology of these lesions seems far from clear (49), venous aneurysms are a well-known complication of chronic hemodialysis (27) and arteriovenous fistulae (65). They can be classified into two categories, namely congenital or acquired (35), and in terms of the morphology of the dilatation, either as saccular or fusiform (42).

Histologically, if all mural layers (10) are included in the absence of signs of mechanical injury, the aneurysm is called a “primary” or “true” lesion (11,22,42,62). A “false” or “pseudoaneurysm” is one that shows absence of smooth muscle (68) and features such as collagenous hyalinization (66), dissection into the vessel walls, or signs of inflammation (64). The latter form has been estimated to be substantially less common (66,68).

Some authors suggest that a preexisting weakness of the vessel wall associated with an insufficiency of elastic fibers (7,39) and/or lack of the muscular coat is the basic prerequisite for an aneurysmal development in veins, also in so-called “idiopathic” cases (35,52), giving rise to flow stagnation (61), dilatation, and thrombosis (6,35). Schatz and Fine (57), however, emphasized endophlebohypertrophy and phlebosclerosis as important factors in the pathogenesis of the five extremity aneurysms discussed. Only a few cases are obviously of traumatic origin (9,42,44,53), one of them, ironically, in a 15-year-old hockey player (3).

Popliteal venous aneurysm, though uncommon, presents a high risk of pulmonary embolism, since all but 8 of the 36 cases published to date (see Table 1) have sustained this complication, and two patients were reported to have died in its course (14,15). The clinical diagnosis is difficult to make because patients frequently remain either free of long-term symptoms (12,19), or only complain of nonspecific signs such as a local nonpulsatile swelling or calf fatigue (26,28), causing delay in treatment (23).

The abnormality described here is noteworthy for both clinicians (34,67) and forensic pathologists. The surgeon should include it into the differential diagnosis when confronted with pulmonary embolism, especially if the patient lacks the classical risk factors of obesity, pregnancy, hypercoagulability, malignancy, immobilization, and angiodysplasias (16,33,46). Any soft tissue mass in the popliteal region should be thoroughly investigated (42), and if there is any suspicion of a venous aneurysm, venography of the leg should be performed. For the forensic pathologist, dissection of the popliteal vein during autopsy should become routine practice in all examinations of sudden death by pulmonary embolism to demonstrate the source of the embolus.

TABLE 1—*Popliteal (solely) venous aneurysms reported in the literature.*

Author	No. of Cases	Sex of the Patients	Pulmonary Embolism	Presenting Symptoms	Etiology of the Aneurysm (as Assumed in the References)	Clinical Outcome
1. Bouchet et al. (4)	2	2x Females	Yes	1x coma, 1x severe chest pain and fever	Undecided	2x surgical excision, 1x persisting aphasia
2. Chahlaoui (7)	1	Female	Yes	Dyspnea, chest pain	Idiopathic	Surgical excision
3. Chatelard et al. (8)	1	Male	Yes	Basal chest pain, fever	Idiopathic	Surgical excision
4. Corsi et al. (10)	1	Female	No	Pain during walking and standing	Undecided	Anticoagulation due to old age
5. Dahl et al. (11)	1	Female	Yes	Dyspnea, pain in the leg	Idiopathic	Surgical excision
6. Debing et al (12)	2	Male	Yes	Chest pain, hemoptysis, dyspnea	Undecided	1x surgical excision, 1x anticoagulation + implantation of vena cava filter
7. Dimaria et al (13)	1	Male	Yes	Loss of conscience, epigastric pain	Undecided	Surgical excision
8. Donald and Edwards (14)	1	Male	Yes	Chest tightness, tachycardia dyspnea	Idiopathic	Death due to pulmonary thromboembolism
9. Dujardin et al. (15)	3	2 Females, 1 Male	2x yes, 1x no	2x recurrent phlebitis, 1x clinical signs of right ventricular insufficiency	1x phlebitis, postpartum and recurrent phlebitic episodes with pulmonary embolism for 28 years, 2x undecided	1x implantation of a vena cava filter and death due to cardiac failure 12 h after operation, 1x surgical excision, 1x surgical exeresis
10. Gallagher and Hageman (18)	1	Male	Yes	Dyspnea, syncopes	Idiopathic	Surgical excision
11. de Gennes et al. (19)	1	Female	Yes	Arterial hypotension, dyspnea	Undecided	Surgical excision
12. Grice et al. (22)	1	Male	Yes	Diagnosis after recurrent embolism	Idiopathic	Surgical excision
13. Gunness et al. (24)	1	Male	Yes	Massive dyspnea, cardiac arrest	Undecided	Surgical excision
14. Harolds and Friedman (25)	1	Female	No	Calf fatigue, cramps (tributary of the popliteal vein)	Varicosis	Surgical excision
15. Helsted et al. (27)	3	2x male, 1x female	1x yes, 2x no	1x ankle edema, 2x swelling and tenderness of the thigh, resp. the calf	1x thrombophlebitis, 28 yrs. prior to admission, 2x idiopathic	1x conservative anticoagulative treatment 2x surgical excision
16. Katz and Comerola (30)	1	Female	Yes	Shortness of breath	Idiopathic	Surgical excision
17. Manthey et al. (35)	1	Female	Yes	Paradoxical embolization with hemiplegia	Undecided	Anticoagulation and subsequent surgical excision
18. May and Nissi (36)	1	Female	No	Swelling of the leg	Idiopathic	Not mentioned
19. May and Mignon (37)	1	Male	No	No complaints, finding by chance	Unknown	Not metioned
20. Noon et al. (39)	1	Male	Yes	Exertional dyspnea	Blunt trauma 16 years before	Surgical excision after ischemic compression of neighboring artery
21. Persson et al. (47)	1	Male	Yes	Acute thrombophlebitis + chest pain	Idiopathic	Surgical excision
22. Ross et al. (52)	2	1x male, 1x female	2x yes	2x chest pain, 1x hemoptysis	2x idiopathic	2x surgical excision
23. Schmidberger et al. (55)	1	Female	No	Progressive varicosis	Varicophlebitis vs. idiopathic	No therapy at the time of publication
24. Seino et al. (56)	1	Female	Yes	Exertional dyspnea, chest oppression, palpitation	Undecided	Surgical excision

continues

TABLE 1—Continued.

Author	No. of Cases	Sex of the Patients	Pulmonary Embolism	Presenting Symptoms	Etiology of the Aneurysm (as Assumed in the References)	Clinical Outcome
25. Silvestri et al. (57)	1	Female	Yes	Signs of severe pulmonary embolism	Undecided	Fibrinolysis
26. Weinmann et al. (66)	1	Female	Yes	Dyspnea, vomiting back pain	Idiopathic	Surgical excision

References

- Abbott OA, Leigh TF. Aneurysmal dilatation of the superior vena caval system. *Ann Surg* 1950;159:858-72.
- Anjaria PD, Vaidya PD, Vahia VN, Dalvi CP. Venous aneurysms. *J Postgrad Med* 1983;20:142-4.
- Aprin H, Schwartz GB, Valderamma E. Traumatic venous aneurysm. *Clin Orthop* 1987;217:243-6.
- Bouchet C, Magne JL, Lacaze R, Lebrun D, Franco A, Guidicelli H. L'anévrysme de la veine poplitée. *J Mal Vasc (Paris)* 1986;11:190-3.
- Buckberg GD, McReynolds DG. Venous aneurysm of the upper extremity. *Am Surg* 1971;37:83-6.
- 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.
- Chahlaoui J, Julien M, Nadeau P, Bruneau L, Roy P, Sylvestre J. Popliteal venous aneurysm: a source of pulmonary embolism. *Am J Roentgenol* 1981;136:415-6.
- Chatelard P, Devolve C, Souquet PJ, Gilly F, Loire R, Bouchet A. Anévrysme veineux poplitée et embolies pulmonaires récidivantes. *Arch Mal Coeur* 1990;83:2147-9.
- Cooke BED. Aneurysm of a small vein in the cheek. *Proc R Soc Med* 1952;45:215-6.
- Corsi M, Martone N, Palusci C, Caratuzzolo M. L'aneurisma bilaterale della vena poplitea. *Minerva Cardioangiol* 1996;44:591-3.
- Dahl JR, Freed TA, Burke MF. Popliteal vein aneurysm with recurrent pulmonary thromboemboli. *JAMA* 1976;236:2531-2.
- Debing E, Vanhulle A, Verhaege W, van den Brande P. Popliteal venous aneurysm with pulmonary embolism. *J Cardiovasc Surg* 1998;39:569-72.
- Dimaria G, Zittoun R, Reynes M. Anévrysme veineux poplitée révéla par une embolie pulmonaire. *Ann Cardiol Angéiol* 1981;30:337-8.
- Donald IP, Edwards RC. Fatal outcome from popliteal venous aneurysm associated with pulmonary embolism. *Br J Radiol* 1982;55:930-1.
- Dujardin JJ, Joly P, Fay JJ, Ducloux G, Lekieffre J, Dormal P, et al. Anévrysme veineux poplitée. *Ann Cardiol Angéiol* 1987;36:413-6.
- Federman J, Anderson ST, Rosengarten DS, Pitt A. Pulmonary embolism secondary to anomalies of deep venous system of the leg. *Br Heart J* 1977;39:547-52.
- Furukawa T, Yamada T, Mori Y, Shibakiri I, Fukakusa S, Tamaki M, et al. A case of aneurysm of the jugular and mediastinal veins—radioisotopic blood pool study of venous aneurysm. *Eur J Nucl Med* 1984; 9: 196-8.
- Gallagher JJ, Hageman JH. Popliteal vein aneurysm causing pulmonary embolus. *Arch Surg* 1985;120:1173-5.
- Gennes C de, Verny C, Ankri I, Huong Du IT, de Lassalle M, Bousquet D, et al. Anévrysme veineux poplitée révéla par des embolies pulmonaires récidivantes. *J Mal Vasc (Paris)* 1989;14:343-6.
- Gilbert MG, Greenberg LA, Brown WT, Puranik S. Fusiform venous aneurysm of the neck in children: a report of four cases. *J Pediatr Surg* 1972;7:106-11.
- Greenwood LH, Yrizarry M, Hallett, Jr. JW. Peripheral venous aneurysms with recurrent pulmonary embolism: report of a case and review of the literature. *Cardiovasc Intervent Radiol* 1982;5:43-5.
- Grice GD, Smith RB, Robinson PH, Rheudasil JM. Primary popliteal venous aneurysm with recurrent pulmonary emboli. *J Vasc Surg* 1990;12: 316-8.
- Guiral J, Ortega M, Manzanares J. Arteriovenous fistula with venous aneurysm as a complication of the trapeziometacarpal arthrodesis. *Acta Orthop Belg* 1993;59:404-5.
- Gunness TK, Vernhet JC, Carrie JM, Cérène A. Anévrysme de la veine poplitée responsable d'embolie pulmonaire. *Sem Hôp Paris* 1988;64: 2145-6.
- Harolds JA, Friedman MH. Venous aneurysms. *South Med J* 1977; 70:219-21.
- Hashmonai M, Schramek A, Szyman P, Auslaender L. Saccular aneurysm of the venous limb of an arteriovenous fistula complicating its use in chronic hemodialysis. *Angiologica* 1973;10:294-8.
- Helsted M, Vilman P, Jacobsen B, Christoffersen JK. Popliteal venous aneurysm with and without pulmonary embolism. *Eur J Vasc Surg* 1991; 5:33-342.
- Hilscher WM: Zur Frage der venösen Aneurysmen. *Fortschr Geb Roentgenstr Neuen Bildgeb Verfahr* 1955;82:244-7.
- Janssen W. Forensic histopathology. Berlin, Heidelberg, New York, Tokyo: Springer, 1984;113-4.
- Katz ML, Comerota AJ. Diagnosis of a popliteal venous aneurysm by venous duplex imaging. *J Ultrasound Med* 1991;10:171-3.
- Knight B. Forensic pathology, 2nd ed. London, Sydney, Auckland: Arnold, 1996;504-7.
- Krinsky G, Johnson G, Rofsky N, Shapiro R, Yang B, Weinreb J. Venous aneurysms: MR diagnosis with the "layered gadolinium" sign. *J Comp Assist Tomogr* 1997;21:623-7.
- Koh S-J, Brown RE, Hollabaugh RS. Venous aneurysm. *South Med J* 1984;77:1327-8.
- Lerch R, Wölflle KD, Loeprecht H. Superior mesenteric venous aneurysm. *Ann Vasc Surg* 1996;10:582-8.
- Manthey J, Munderloh KH, Mautner JP, Kohl M, Frohlich G. Popliteal venous aneurysm with pulmonary and paradoxical embolization. *Vasa* 1994;23:264-7.
- May R, Nissl R. Aneurysms der vena poplitea. *ROFO* 1968;108:402-3.
- May R, Mignon G. Spindelförmige aneurysmen der V. femoralis und V. poplitea. *ROFO* 1978;129:4.
- Matejcek E, Milichovsky E. Über das venöse aneurysma. *Zentralbl Chir* 1959;84:503-6.
- Noon GP, Zamora JL, Pratt CM, Willingham I, Short HD. Popliteal vein pseudoaneurysm: a case report. *Surgery* 1984;96:942-5.
- Nopajaroonsri C, Lurie AA. Venous aneurysm, arterial dysplasia, and near-fatal hemorrhages in neurofibromatosis type 1. *Hum Pathol* 1996; 27:982-5.
- Otto S, Religa G, Polanski JA. Aneurysm of the posterior tibial vein. A case report. *Mat Med Pol* 1997;28:71-2.
- Owen WJ, McColl I. Venous aneurysm of the axilla simulating a soft tissue tumour. *Br J Surg* 1980;67:577-8.
- Paes E, Vollmar JF. Aneurysma transformation in congenital venous angiodyplasias in lower extremities. *Int J Angiol* 1991;9:90-6.
- Paes T, Andrews S, Wyatt A. Acquired venous aneurysms. *Br J Sp Med* 1991;25:149-50.
- Parer JT, Lichtenberg ES, Callen PW, Feduska N. Iliac venous aneurysm in a pregnant patient with a renal transplant. *J Reprod Med* 1984;29: 869-71.
- Perler BA. Venous aneurysm. *Arch Surg* 1990;125:124.
- Persson BG, Donnér M, Petersson B, Eklöf B, Wintzell K. Aneurysm of the popliteal vein as a cause of pulmonary embolism. *Acta Med Scand* 1980;208:407-10.
- Quandalle P, Saudemont A, Chambon JP, Wurtz A. L'anévrysme des veines profondes des membres inférieurs. *J Chir (Paris)* 1989;126: 586-90.
- Rappaport DC, Ros PR, Moser RP. Idiopathic dilatation of the thoracic venous system. *Can Assoc Radiol J* 1992;43:385-7.

50. Rocha L, Toledo L. A para meniscal traumatic arterio-venous aneurysm. *J Cardiovasc Surg* 1970;11:252-3.
51. Roizenthal M, Hartnell GG, Perry LJ, Kane RA. Pseudoaneurysm of the common femoral vein as a late complication of right heart catheterization. *Cardiovasc Intervent Radiol* 1994;17:301-3.
52. Ross GJ, Violi L, Barber LW, Vujic I. Popliteal venous aneurysm. *Radiology* 1988;168:721-2.
53. Sarap MD, Wheeler WE. Venous aneurysms. *J Vasc Surg* 1988;8:182-3.
54. Schatz IJ, Fine G. Venous aneurysms. *N Engl J Med* 1962;266:1310-2.
55. Schmidberger H, Hackl A, Ludwig G. Aneurysma der Vena poplitea. *ROFO* 1979;131:553-4.
56. Seino Y, Fujimori H, Shimai S, Tanaka T, Takano T, Hayakawa H, et al. Popliteal venous aneurysm with pulmonary embolism. *Intern Med* 1994;33:779-82.
57. Silvestri M, Villain P, Bouvier JL, Elias A, Benichou M, Serradimigni A. L'anévrysme veineux poplitée: une cause rare d'embolie pulmonaire. *Presse Med* 1987;16:2127.
58. Smets D, Debing E, De Raeve H, Van den Brande P. Venous aneurysm four years after greater saphenous vein stripping. *Acta Chir Belg* 1997;97:194-5.
59. Sproul G. Venous aneurysm: a rare cause of reducible inguinal mass in infancy. *Surgery* 1965;58:1027-30.
60. Stehbens WE, Lie JT, editors. *Vascular pathology*. London: Chapman & Hall, 1995;407-8.
61. Taira A, Akita H. Ruptured venous aneurysm of the persistent left superior vena cava. *Angiol* 1981;32:656-9.
62. Thompson NW, Lindenauer M. Central venous aneurysms and arteriovenous fistulas. *Ann Surg* 1969;170:852-6.
63. Tyson GW, Jane JA, Strachan W. Intracerebral hemorrhage due to ruptured venous aneurysm. *J Neurosurg* 1978;49:739-43.
64. Volteas SK, Labropoulos N, Nicolaides AN. The management of venous aneurysms of the lower extremities. *Panminerva Med* 1998;40:89-93.
65. Watson MD, Kaye JJ. Traumatic venous aneurysm presenting as a ganglion cyst. *J Bone Joint Surg A* 1988;70:1248-50.
66. Weimann S, Sandbichler P, Flora S. Aneurysma der vena poplitea als quelle einer lungenembolie. *Langenbeck Arch Chir* 1986;367:107-12.

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