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CASE REPORT

PATHOLOGY/BIOLOGY

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Femoral Artery Pseudoaneurysm and Sudden Death

ABSTRACT: Pseudoaneurysm formation may be a late complication of vascular grafting. A case of sudden death in an 83-year-old woman with a previous aortobifemoral bypass graft is reported that was due to spontaneous hemorrhage from a pseudoaneurysm of the graft site that had eroded through the overlying skin and subcutaneous tissues. Pseudoaneuryms do not have to be of a particularly large size for rupture to occur. Social isolation and age-related cognitive impairment may delay treatment in older individuals resulting in a lethal outcome. The elderly are also more vulnerable to serious morbidity and death under these circumstances owing to significant underlying cardiovascular and respiratory disease and/or anticoagulant medication. Rarer conditions that may cause pseudoaneurysms include tumors and vasculidites. The possibility of an infectious contribution to the pseudoaneurysm should be considered and microbiological sampling undertaken.

KEYWORDS: forensic science, pseudoaneurysm, hemorrhage, aortobifemoral bypass, sudden death

Acute and life-threatening hemorrhage from the arms and legs most commonly results from major trauma such as a motor vehicle crash; however, there are a number of conditions where significant hemorrhage may appear spontaneously or be initiated by minor injury (1,2). A case of unexpected death in an elderly woman is reported, to demonstrate the features of fatal hemorrhage owing to pseudoaneurysm rupture following previous surgical vascular grafting. Complicating factors in the elderly include significant underlying diseases and medications that may predispose to hemorrhage.

Case Report

An 83-year-old woman with a history of previous myocardial infarction, hypertension, and severe peripheral vascular disease necessitating aortobifemoral bypass grafting 5 years previously was found dead on the floor of her bathroom in a pool of blood.

At autopsy, the most significant finding was of a slightly raised area in the right groin with a central 8-mm hemorrhagic defect (Fig. 1). This was associated with blood staining of the right leg, right hand, and inner aspect of the left leg. Dissection of the soft tissues underlying the ulcer revealed an intact aortobifemoral graft with a 15-mm pseudoaneurysm attached to the anteromedial aspect of the right-sided distal anastomosis between the graft and the native atherosclerotic femoral artery. The pseudoaneurysm had ruptured through the overlying ulcerated area (Figs 2 and 3). Histology confirmed the presence of a fibrous-walled pseudoaneurysm attached to the surgical anastomosis site.

Other findings included significant atherosclerotic arterial disease elsewhere involving the aorta, carotid, and coronary arteries, the latter associated with myocardial fibrosis in keeping with previous ischemic damage. There was also emphysema. There was no evidence of trauma, and there were no other organic diseases present that could have caused or contributed to death. Death was attributed to exsanguination from an ulcerated pseudoaneurysm arising at the anastomotic junction of the right femoral artery and an aortobifemoral graft. Complicating factors included coronary artery atherosclerosis and emphysema. There was no history of anticoagulant use.

Discussion

Spontaneous hemorrhage from limb vessels may involve both arterial and venous systems, with arterial complications often associated with previous vascular surgery. Victims are usually elderly, as older individuals are more likely to have had vascular grafting in the form of arteriovenous shunts or arterial grafts, both of which may be complicated by significant hemorrhage. Elderly victims may also be living on their own and may have age-related cognitive impairment that reduces their level of awareness of the potential seriousness of their situation or that prevents them from seeking help in a timely manner (1). These factors may have contributed to the lethal outcome in the reported case. General frailty may also predispose to falls with resultant injury to fragile skin and subcutaneous tissues.

Minor injuries to the legs in the elderly may result in lethal hemorrhage from dilated subcutaneous varices (3,4). Varicosities develop because of valvular incompetence and failure of the peripheral musculovenous pump and are found in 10–40% of Western men and 25–33% of Western women, with the saphenous vein most often affected. Varicose veins may also be initiated by pregnancy, deep vein thrombosis, obesity, ascites, or abdominal tumors, all of which impede the flow of draining leg veins (1). Bleeding varices may also be associated with chronic ulceration,

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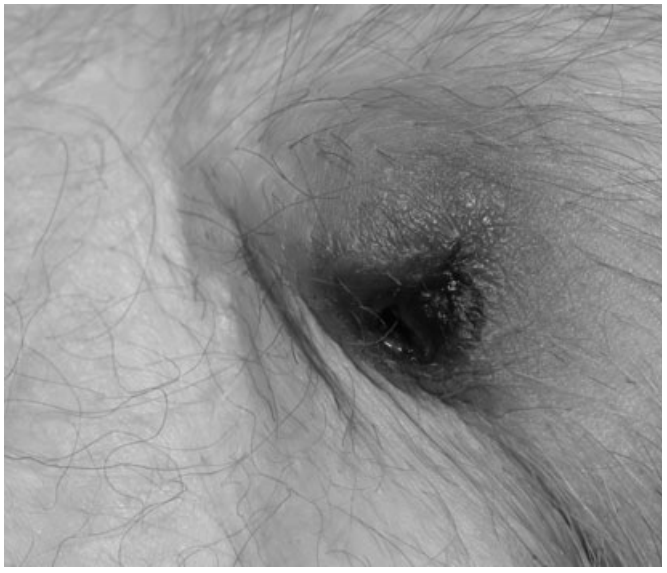

FIG. 1—*Swelling and ulceration of the right groin in an 83-year-old woman. The defect showed a small amount of surrounding interstitial hemorrhage.*

FIG. 2—*Dissection of underlying soft tissues revealed previous aortobifemoral grafting with a 15-mm pseudoaneurysm attached to the anteromedial aspect of the right-sided distal anastomosis between the graft and the native atherosclerotic femoral artery. The site of rupture is indicated with an arrow.*

and the resultant pattern of blood spatter may resemble an arterial hemorrhage, as a fine jet of blood is sprayed out under significant pressure (5).

Arteriovenous shunts are usually created to enable repeated vascular punctures for hemodialysis. Unfortunately, anticoagulant therapy, sepsis, hypertension, and repetitive trauma from venesection all predispose to spontaneous hemorrhage from these sites. Suicidal cutting of shunt tubing has also been reported (6,7).

Vascular grafts are used to bypass obstructions to blood flow in narrowed arteries severely affected by atherosclerosis. Synthetic grafts include those made from Dacron, polytetrafluoroethylene, and other materials. Early complications include embolism with distal limb ischemia, anastomotic hemorrhage, and intestinal ischemia resulting from aortic surgery (8,9). The incidence of infection

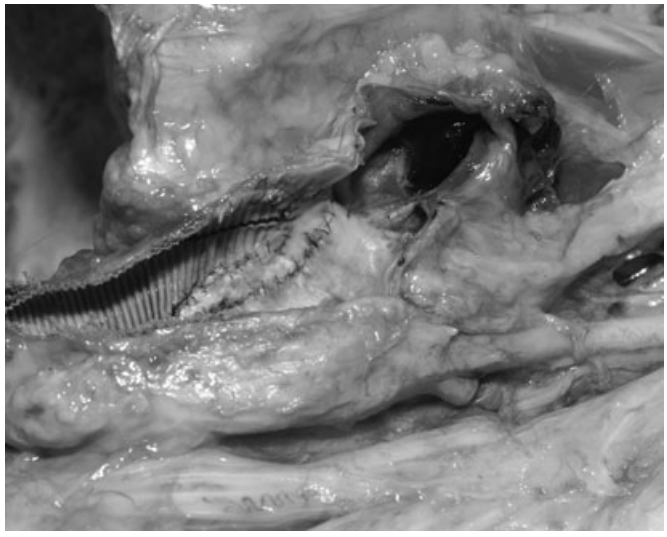

FIG. 3—*Opening of the graft revealed intact surgical sites with the attached pseudoaneurysm that had formed at a point of dehiscence.*

in these grafts is between 1.5 and 6%, and the incidence of developing an anastomotic pseudoaneurysm is <2% (10). Thrombosis may also cause graft dysfunction, most often owing to a narrowed anastomotic site (10,11). Other synthetic graft complications include aneurysmal dilation, aortoenteric fistulae, and fabric erosion in Dacron grafts (12). A very rare complication is the development of angiosarcomas in Dacron grafts, with material having small (<4 μ) pores manifesting the greatest carcinogenic potential (13).

Pseudoaneurysms, or so-called false aneurysms, communicating hematomas, or "pulsatile hematomas," are persistent vascular defects created by tears through all layers of a vessel wall with extravasion of blood into a space confined by surrounding fibromuscular tissue called the "sac." The sac is connected to the defect in the arterial wall by a sinus tract, called the "neck" (14–16). The majority of pseudoaneurysms are iatrogenic occurring in the femoral artery following 0.1–0.2% of angiograms and in 0.8–2.2% of procedures such as coronary angioplasty (15,17). Atheromatous plaques may also cause pseudoaneurysms by ulcerating the aortic wall and disrupting the internal elastic lamina (14).

Pseudoaneurysms may also occur at sites of arterial anastomoses at variable times after surgery, as in the reported case. If a pseudoaneurysm forms <2 years after surgery, the presence of secondary infection should be considered (15). The most common pathogenic organisms are *Staphylococcus aureus* and *Salmonella*; however, a study by Seabrook et al. revealed occult infection with coagulase-negative staphylococci in 60% of cases of anastomotic femoral pseudoaneurysms (14,18). Vascular degeneration may be worsened by bacterial generation of metalloproteinases and other cytotoxins (19). No histologic evidence of sepsis was identified in the current case, although microbiological studies were not undertaken.

Less common causes of pseudoaneurysm that should be considered at autopsy include local benign or malignant tumors that may erode arterial walls (2,14) and vasculitis in conditions such as Behçet's syndrome, systemic lupus erythematosis, polyarteritis nodosa, and Takuyasu's arteritis. Pseudoaneurysms in the latter conditions most frequently arise in the aorta, followed by the pulmonary, femoral, subclavian, and popliteal arteries (14). Pseudoaneurysms may also develop after vascular trauma from stab or gunshot wounds, or from arterial puncture, particularly if there has been too short a period of manual compression following the procedure (19), for example, following injection of illegal drugs

into the groin. This may also result in local sepsis and abscess formation which may also precipitate hemorrhage (2). Pseudoaneurysm formation is not a complication that is usually documented in reviews of endovascular revascularization procedures (20,21).

Pseudoaneurysm formation is increased by hypertension, anticoagulation, severe peripheral vascular disease, premature ambulation, increasing age, obesity, and female gender (15,19). Smoking may also accelerate the risk because of its effect on the activity of matrix metalloproteinases and their inhibitors, which may alter connective tissue metabolism and impair tissue repair mechanisms (19). Chronic obstructive pulmonary disease, as in the current case, may be an associated risk factor owing to systemic factors that can cause elastolysis and connective tissue degeneration (19).

In the reported case, there was no history to suggest that the pseudoaneurysm had been diagnosed before death, and this may have been because of its relatively small size. However, in symptomatic cases following arterial puncture, there may be pain, tenderness, and swelling with a pulsatile mass, a palpable thrill, and on occasion an audible systolic bruit. If leakage has occurred, there may be severe bruising and features of hypovolemia (15,22). The clinical diagnosis can be made by identifying characteristic flow patterns on arterial Duplex ultrasound (15,17).

Complications of pseudoaneurysms include thrombosis, distal embolization, distal vascular insufficiency, neuropathy, infection, and local skin ischemia with breakdown of the overlying skin (as was seen in the reported case owing to pressure necrosis) (17,23). The most significant complication is rupture with hemorrhage which may be sufficient to cause considerable morbidity if treatment is delayed (24,25). Unfortunately, in isolated elderly individuals, significant hemorrhage may occur rapidly before assistance can be sought or adequate pressure can be applied to the bleeding point. Pseudoaneuryms do not have to be of a particularly large size for rupture to occur. Underlying cardiovascular and respiratory disease, as in the reported case, may also predispose to early collapse once hypovolemia is established, and anticoagulation or thrombocytopenia may predispose to hemorrhage. Although considerable amounts of blood may be present at the death scene, acute trauma is usually not a factor in these kinds of exsanguinations.

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