Aneurysm of the femoral artery occupationally exposed to a vibratory tool for more than 10 years

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The first case of an aneurysm of the femoral artery occupationally exposed to a vibratory tool is described. A 72-year-old man with a right common femoral artery aneurysm had an occupational history of using a “breaker,” which breaks concrete into pieces by means of powerful vibration, on the right groin for more than 10 years. The patient underwent aneurysmectomy and graft replacement, with reconstruction of the deep femoral artery. Pathologic examination of the resected aneurysm revealed fibrosis and lipid deposition in the intima, well-maintained elastic fibers without disruption in the media, and thickened adventitia, in place of the typical findings of atherosclerosis. (J Vasc Surg 2004;39:1125-7.)

Chronic, repetitive blunt trauma can cause crutch-induced axillary artery aneurysms or ulnar artery aneurysms (hypotherner hammer syndrome). We describe the first case of an aneurysm of the femoral artery occupationally exposed to a vibratory tool, and discuss the development of aneurysms due to repeated blunt trauma.

CASE REPORT

A 72-year-old man with an expanding pulsatile tumor in the right inguinal region was referred to our department. The patient had an occupational history of using a “breaker,” which breaks concrete into pieces by means of powerful vibration, on the right groin for more than 10 years, when he was in his fifties and sixties. The air pressure used to power the tool is typically adjusted at approximately 0.6 MPa, and the vibration frequency ranges from 1000 to 2000 Hz. There had been neither other trauma in the right inguinal region nor history of puncture of the right femoral artery. The patient had neither symptoms of claudication nor Raynaud-type phenomenon in the hands. No aneurysms of the abdominal aorta, the bilateral iliac arteries, the left femoral artery, and the bilateral popliteal arteries were recognized on computed tomography (CT) scans. The pulses of the right popliteal, tibialis posterior, and dorsalis pedis arteries were well-palpable, and there was no history of distal embolization. The patient did not have diabetes mellitus, but did have hypertension, and had been smoking tobacco products. CT scans disclosed an aneurysm of the right common femoral artery, 35 mm in maximum diameter, with a mural thrombus (Fig 1, A). According to our surgical indications for asymptomatic femoral artery aneurysm, that is, maximum diameter greater than approximately twice the normal proximal arterial caliber or presence of a mural thrombus, the patient underwent aneurysmectomy and graft replacement with a knitted Dacron prosthesis and reconstruction of the deep femoral artery (Fig 1, B). Pathologic examination of the resected aneurysm revealed fibrosis and lipid deposition in the intima, well-maintained elastic fibers without disruption in the media, and thickened adventitia, in place of the typical findings of atherosclerosis (Fig 2).

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Competition of interest: none.

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0741-5214/$30.00

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DISCUSSION

True arteriosclerotic aneurysms of the femoral artery are rare, but they are dangerous lesions that may thrombose, embolize, or rupture. They are often bilateral, and frequently the patient has other aneurysms in the abdominal aortic or popliteal artery. True femoral artery aneurysms are attributed to weakening of the arterial wall from atherosclerosis. Conjecture concerning arterial wall vibration proximal to major branchings generated by turbulence is one hypothesis of the cause of femoral artery aneurysms, which may be representative of the same process that affects the abdominal aorta proximal to its bifurcation.

Fig 2. Pathologic examination of the resected aneurysm revealed fibrosis and lipid deposition in the intima, well-maintained elastic fibers without disruption in the media, and thickened adventitia, in place of the typical findings of atherosclerosis. A, Original magnification ×4; B, original magnification ×10; C, original magnification ×20. Elastic van Gieson stain.

Fig 3. Immunoperoxidase staining against CD31 (A, original magnification ×10) and smooth muscle actin (B, original magnification ×4) disclosed no endothelial cells and disrupted smooth muscle cells in the media.
panying the turbulence is vibration of the arterial wall downstream from the stenosis, which can be readily palpated and includes frequency components within the audio range (bruit). The most widely accepted hypothesis to explain the development of poststenotic dilatation implicates vibration leading to structural fatigue of the connective tissue elements.5 It has been implied that the stenosis produces turbulent flow and associated pressure fluctuations, which in turn cause the artery wall to vibrate, leading to weakening of the elastin fibers in the artery wall. This process would appear to be akin to the phenomenon of structural fatigue of materials under dynamic loads.4 On the other hand, Gow et al3 reported the failure of vibration, chronically maintained by attaching an electromagnetic and pneumatic vibrator to the aortic wall in rabbits, to produce dilatation of the aorta. Boughner and Roach,5 however, showed that the radius of isolated human external iliac arteries, which were distended with 100 mm Hg pressure and vibrated with specific frequencies from 30 to 400 Hz, increased at a rate of 7.1% ± 3.4% per day. Vito et al6 also indicated that specimens of human iliac arteries exposed to vibration exhibited some dilatation, the average percentage increase in diameter being in the range 0.22% to 0.42% per hour. In the present case mechanical vibration had been inflicted on the femoral artery occupationally for more than 10 years, and may have induced the true aneurysm. To our knowledge, no case of femoral artery aneurysm associated with occupational exposure of a vibratory tool has been previously reported.

Regarding development of aneurysms from chronic, repetitive blunt trauma, crutch-induced axillary artery aneurysms and ulnar artery aneurysms are well-known. Crutch-induced blunt trauma produces axillary artery aneurysms in older patients, and was first described by Rob and Standeven in 1956.7 At pathologic examination of these aneurysms, Danese et al8 described fragmentation of elastic fibers and fibrosis of media. Abbott and Darling9 have also reported markedly thickened walls, wrinkled and roughened intima, severe fraying and fragmentation of the elastica instead of the more typical changes of atherosclerosis. A Roman coachman, and was described by Guattani 10 in 1934. Trauma to the hand as the cause of this disorder has been identified, and in 1970 Conn et al12 coined the term “hypothener hammer syndrome.” Several pathologic studies of ulnar artery aneurysms have been documented. Von Kuster and Abt13 reported that the internal elastic lamina was not identified, and only a thin layer of the media remained, with a thick layer of dense fibrous tissue present on the luminal aspect. Granulation tissue was noted between the media and adventitia, and focal acute hemorrhage was present in and adjacent to the granulation tissue. Pineda et al14 demonstrated the striking degree of both acute and chronic inflammation present throughout the vessel wall. Vayssairat et al15 reported that the most striking abnormalities of the aneurysms were the reduction of thickness of the medial part of the ulnar artery, fewer and disorganized muscular fibers, fibrosis without inflammatory exudates, and the thick intima in an aspecific manner. Ferris et al16 reported that hyperplastic proliferation of the intima or media and disruption of the internal elastic lamina were present, consistent with the diagnosis of fibromuscular dysplasia. They proposed that hypothenar hammer syndrome occurs when persons with preexisting palmar ulnar artery fibrodysplasia experience repetitive palmar trauma.

In the present femoral artery aneurysm, elastic fibers in the media were well-maintained without disruption, different from the above-mentioned findings in crutch-induced axillary artery aneurysms demonstrated by Danese et al8 or Abbott and Darling9 and in ulnar artery aneurysms described by others.13,15,16 It is possible, however, that femoral artery aneurysm may be induced by chronic vibration, because of the thickened adventitia and well-maintained elastic fibers in the media without disruption, as opposed to typical atherosclerotic changes.

We thank Emeritus Professor Dr Kiyoshi Inada, Gifu University, for assistance in preparing the manuscript.

REFERENCES


Submitted Sep 20, 2003; accepted Dec 18, 2003.
Available online Feb 6 2004.