

Surgical Experience of Post-Traumatic Pseudo aneurysm of the Brachial Artery at a tertiary care hospital

Behram Khan Kakar, Khan Muhammad Babar, Aziz Khan, Mezhar Naeem, Innam Khan
Civil Sandmen Teaching Hospital, Quetta.

Abstract

Objective: To determine the frequency of peripheral artery aneurysms in the upper extremities.

Methods: A descriptive study of acute vascular injury patients presenting to the emergency department of Civil Sandmen Teaching Hospital Quetta, from August 1995 to July 2003, was undertaken. We performed aneurysmal resection together with saphenous vein graft interposition in 7 patients with a diagnosis of post-traumatic brachial pseudo aneurysm.

Results: Three patients had gunshot wounds (44%), 3 (42.8%) stab wounds and one patient (14.2%) had blunt trauma. The mean duration from injury to hospital admission was 26.7 months (range 17 months-7 years). All patients underwent color-flow arterial Doppler ultrasonography and aneurysmal resection and saphenous vein graft interposition. There was no instance of death or ischaemic extremity loss. Patients were discharged from the hospital a mean of 3.2 days after surgery (range 2-6 days). Early and late graft patency rates were 100%. We followed the patients' cases for a mean of 3.4 years (range 1 month-7 years).

Conclusion: Very rarely, post-traumatic upper extremity pseudo aneurysms show symptoms after a long period of time. Diagnosis was very easy with a review of the patient's history and a physical examination. Surgical reconstruction is the preferred treatment for such cases (JPMA 56:409;2006).

Introduction

Pseudo aneurysms result from disruption of a vessel wall continuity resulting in bleeding into the surrounding tissues and circulating blood being contained in a cavity surrounded only by adjacent tissues, fascia, and thrombus but not by normal arterial wall components as in true aneurysms. Post-traumatic pseudo aneurysm development is very rare in the peripheral arteries and is generally a late sequelae of trauma. The frequency of peripheral artery pseudo aneurysms is lesser in the upper extremities as compared to the lower extremities.¹ Their diagnosis and surgical treatment are extremely important, because they can cause severe disability, including loss of upper extremity and hand. Peripheral artery pseudo aneurysms in distal locations, particularly in the brachial artery with localization at the forearm, cause thromboembolic complications in the hands and fingers.² When treatment is delayed, haemorrhage, venous oedema at the extremity, cutaneous erosion, and adjacent neurological structure compression can develop due to enlargement of the pseudo aneurysms.³ The first symptom of upper extremity aneurysms can be nerve injury or adjacent nerve compression.⁴ In many cases, unless a complication such as acute disruption, thrombosis, or bleeding occurs,³ the diagnosis is incidental. Differential diagnosis includes simple haematoma, tissue oedema, thrombosed

aneurysm, and lymphadenopathy. Care must be taken not to injure the nerves and veins adjacent to a pseudo capsule or scar tissue during surgical procedures.³

The objective of this study was to determine the frequency of peripheral artery aneurysms in the upper extremities.

Patients and Methods

From July 1995 through August 2003, we performed reconstruction with aneurysmal resection and saphenous vein graft interposition in 7 patients because of post-traumatic brachial artery pseudo aneurysms. The patients presented with a pulsating mass at the brachial artery level, which had developed in the late post-traumatic period.

The presenting sign in our patients was the appearance of an asymptomatic, painless, pulsatile mass in the cubital fossa. We evaluated the upper extremities for ischemia, after complete history, and thorough physical examination. Doppler ultrasonography was performed preoperatively and during the late postoperative period (after 3 months). No patient had an arteriovenous fistula. A common result of the postoperative evaluation was arterial flow delay at the hand and wrist level. Each patient underwent surgery after the diagnosis of late post-traumatic brachial artery pseudo aneurysm was made.

Under general anaesthesia, with single lumen

endotracheal intubation, patients were placed in the supine position. Routine monitoring included transcutaneous oxygen saturation, blood pressure, and electrocardiogram. We performed our standard "S" incision over the pulsating mass to the brachial region. A double layer of skin covering the aneurysm was detached. Retracting the proximal and then the distal part of the brachial artery with nylon tape completed exploration. In the same fashion, the surgical region was controlled by retracting the brachial vein and nerve. After administering 1 cc heparin (5,000 IU) intravenously, we clamped the proximal and distal vascular structures and opened the capsule of the pseudo aneurysm with a direct incision. Organized thrombus in the aneurysm was removed. The capsule was dissected and evaluated histopathologically and microbiologically. In order to avoid increasing the risk of major haemorrhage or nerve injury, we did not resect the aneurysmal pouch completely. We limited the resection by preserving the adjacent tissues. After retrograde flow was restored, a 5-6 cm arterial segment that included the pseudoaneurysmal region was resected. Saphenous vein graft interpositioning was then performed, because none of the patients had a vascular structure that was conducive to end-to-end anastomosis. A closed drainage system was placed in the aneurysmal pouch. After haemostasis was achieved, the incision was closed.

Results

Reconstruction with aneurysmal resection and saphenous vein graft interpositioning was performed in all 7 patients because of post-traumatic brachial artery pseudo aneurysms. Six were males (90%) and one was female (10%). The mean age was 33.5 years (range 22-43 years).

The causes of the pseudo aneurysms were gunshot wounds in 3 patients (44%) and stab wounds in 4 (56%). The mean duration between the date of injury and admission to our clinic was 26.7 months (range 17 months-7 years). No patient had manifested a vascular problem at the time of injury. Physical examination in all patients showed a mass with systolic soufflé in the region of the elbow. Radial and ulnar pulses of the affected upper extremities could be detected manually. Results of the Allen test were negative in all cases. Five patients (77%) experienced pain and swelling of the forearm, hand, and fingers, especially in winter. Results of routine biochemical, bleeding, and coagulation time tests were within the normal ranges.

There was no instance of death or ischemic extremity loss. Histopathologic evaluation of the pseudoaneurysmal capsules showed that they were all haematomas, with extravasation in the vessel wall lumen, inflammatory infiltration, and hyalinization. Results of microbiologic examination of the aneurysmal capsule were negative for microorganisms. One patient who was admitted

to the clinic 7 years after a gunshot injury had undergone an unsuccessful percutaneous thrombin injection a year before at another institution. In all cases, pulsation was positive upon digital examination at the radial and ulnar arteries during the early postoperative period, and the mean time to discharge was 3.2 days (range 2-6 days). No patient required embolectomy in the early or late postoperative period. The late postoperative follow-up examinations were performed at our clinic, and Doppler ultrasonography was performed after 3 months. The early and late graft patency rate was 100%, and we found no other sequelae during the late period. The mean follow-up was 3.4 years (range 1 month-7 years).

Discussion

Aneurysms at less common locations are generally due to major trauma, syphilis, Marfan syndrome, or infection. Aneurysms can develop in all arteries of the human body.⁵ Atherosclerotic aneurysms are often seen in large arteries and in patients of advanced age, but pseudo aneurysms due to penetrating or blunt trauma are seen in patients of every age and at any location.^{6,7} Frequency of pseudo aneurysms in the upper extremities is much lower than that in the lower extremities. However, as life span is increasing and diagnostic and evaluation processes improving, the detection of such pseudo aneurysms is becoming more common.⁸ Infection, polyarteritis nodosa, congenital arterial defects, and especially trauma play a role in the pathogenesis of upper extremity pseudo aneurysms. Atherosclerotic aneurysm of the brachial artery is very rare.⁸ If the only causal factor is trauma, the aneurysm takes the form of a pseudo aneurysm. Most pseudo aneurysms are the result of penetrating injuries.⁶ Minor blunt trauma may cause pseudo aneurysms in patients who are prone to haemorrhage.⁹ Sometimes, as in our series, patients are admitted to hospitals with pseudo aneurysms months or years after the trauma.^{1,6,10,11} In a series by Cakir and associates,¹² 36% of patients had venous oedema distal to the pseudo aneurysm which was also present in our patients. Aneurysms of 2 cm or less in diameter can be silent or asymptomatic for a long period.¹³ Such aneurysms can be diagnosed easily by complete medical history and physical examination. Color-flow Doppler ultrasonography is a noninvasive method that can provide sufficient diagnostic information to plan the surgical procedure. Upper extremity arterial Doppler ultrasonography and magnetic resonance angiography can be used as diagnostic tools, but the gold standard is selective upper extremity arteriography.^{11,14} Doppler ultrasonographic evaluation is sufficient for late postoperative follow-up evaluation.¹¹ Treatments for pseudo aneurysms that can be performed under color-

Doppler ultrasonographic guidance are manual compression, ligation, endovascular graft implantation, embolization, ultrasound-guided thrombin injection, and surgical reconstruction.^{2,6,8,10,12,13} If the procedure is for a lesion in a noncritical distal vessel and does not cause severe ischemia, or if it is clear that the collateral circulation will be sufficient after ligation, then distal and proximal ligation and resection of the pseudo aneurysm can be performed.¹⁵ In addition, these procedures can be performed for pseudocysts and pseudo aneurysms that have developed after pancreatitis.¹⁶ A single small aneurysm distal to the brachial bifurcation can be ligated. However, if there is more than 1 aneurysms at the brachial truncus or in the distal region, reconstruction is necessary for the viability of the extremity, as in our patients.^{7,10,11} Endovascular graft implantation is a new, minimally invasive intervention, and it can be used for aneurysms and pseudo aneurysms of the peripheral arterial system and for arteriovenous fistulas.¹⁷ The technique, however, is expensive, and its long-term results are not yet known.

Other methods, such as embolization and ultrasound-guided thrombin injection, are not widely used for pseudo aneurysm therapy. Embolization of pseudo aneurysms can be achieved only by embolization of the sac: the pedicle of the sac must be small, and the aneurysm must not disturb the distal circulation to any great extent. Another method-embolization of the artery from the distal and proximal arterial segments can be used if the collateral circulation is sufficient.^{18,19} For many vascular problems, endovascular techniques (or, as in one of our patients, percutaneous thrombin injection, which failed) have been used. Traditional surgery is still considered to yield the best results.^{2,11} However, the most convenient method (surgery, obstruction with a percutaneous balloon, embolization, or a combination stent-graft) must be selected according to the location, size, pathogenesis, and accessibility of the pseudo aneurysm.¹¹ If the pseudo aneurysm originates from an arterial side branch or an unimportant artery, the arterial entrance and aneurysm can be occluded without excessive concern for the blood supply to the distal tissues.^{17,20} Aneurysms situated in larger branches, such as the brachial artery (which is convenient for graft interposition), can be treated by resection of the diseased part and end-to-end anastomosis or with graft interpositioning.^{14,15,21} To maintain arterial continuity and to save the extremity, most pseudo aneurysms of the upper extremity, especially of the brachial region, should be treated with reconstruction using saphenous vein interposition. Special care must be taken with regard to brachial artery ligation, which can lead to amputation.^{21,22} The amputation rate is more than 50% after brachial

artery ligation versus 6% after reconstruction.²² When pseudo aneurysms are at the brachial bifurcation and proximal to it, saphenous vein graft interpositioning is preferred to maintain arterial continuity and the viability of the extremity.^{2,8,11} For these reasons, we used saphenous vein interpositioning for all our patients.

In conclusion, pseudo aneurysm distal to the axillary artery is rare and is frequently the result of a gunshot or stab wound. Axillary and distal peripheral artery pseudo aneurysms of the upper extremity are less dangerous than are thoracic and abdominal aortic aneurysms. However, thromboembolisms of the extremity can lead to gangrene and amputation; therefore, surgical treatment is important. We recommend not delaying surgical therapy but performing surgical repair routinely for aneurysms and performing revascularization selectively if necessary.

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