

A case of aneurysmal dilation of a brachial artery after venous outflow resection

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ABSTRACT

Dilation throughout the brachial artery in the setting of an arteriovenous fistula is a common occurrence, but focal aneurysmal dilation is not often visualized. Progressive enlargement of a focal arterial segment warrants intervention before negative sequelae. We present the case of a 38-year-old man with history of left upper extremity brachiocephalic fistula who had an enlarged brachial artery and progressive aneurysmal dilation of the distal aspect after ligation and excision of a dilated venous outflow component. The patient was successfully treated with resection and end-to-end reconstruction of the brachial artery, with resolution of pain and improvement in the functionality of his extremity. This case highlights the possible challenges encountered in such situations, when the anatomy is so distorted that it is difficult to clearly delineate on preoperative imaging. (*J Vasc Surg Cases and Innovative Techniques* 2018;4:335-8.)

Keywords: Arteriovenous fistula; Aneurysmal dilatation; Arteriomegaly; Venous outflow

CASE REPORT

The patient is a 38-year-old man with hypertension-induced end-stage renal disease. His access history was significant for a radiocephalic fistula that had developed a pseudoaneurysm and was subsequently ligated. This was followed by creation of a brachiocephalic fistula in 2007, which also developed an aneurysmal venous outflow component. In 2013, the patient successfully received a kidney transplant. Because he no longer needed his dialysis access, he eventually had it ligated. This was done in 2016 at a referring institution by a small cutdown near the anastomosis at the level of the antecubital fossa.

He presented to our emergency department 2 weeks later with painful fluctuance near the incision and continued aneurysmal dilation of the residual stump of the venous outflow component. Arterial duplex ultrasound demonstrated no evidence of pseudoaneurysm but an enlarged remnant vein with persistent flow through numerous large venous branches that had become the path of least resistance after ligation. This was confirmed with computed tomography angiography, which additionally demonstrated no evidence of extravasation but flow within the venous outflow and arteriomegaly throughout the length of the brachial artery (Fig 1). Because of the pain and continued flow in the grossly enlarged venous outflow segment, he was taken to the operating room for excision of the aneurysmal cephalic vein and ligation of branches. He did

well after surgery, and at his first follow-up visit, he had no issues with function or sensation in his hand and was recovering well.

He was admitted 5 months later for a viral infection, at which time the vascular surgery service was consulted for evaluation of a large and painful focal dilation of the left brachial artery. Physical examination demonstrated significant bulging of the soft tissue just proximal to the antecubital fossa but no evidence of ischemic or neurologic symptoms. Further outpatient workup included arterial duplex ultrasound, computed tomography angiography, and vein mapping with a plan to perform brachial artery resection and bypass. The operation was cancelled secondary to another viral infection once again necessitating hospitalization.

Unfortunately, the patient was lost to follow-up until he presented several months later with rapid enlargement and worsening pain at the level of the antecubital fossa. The other examination findings were similar. The patient was admitted and taken to the operating room for exploration and arterial reconstruction as had been previously planned. An incision was made at the level of the axilla to gain proximal control of the ectatic brachial artery; distal control was achieved at the level of the antecubital fossa. Once proximal and distal control had been established, an incision was made along the entire length of the brachial artery to facilitate exposure. The dissection was tedious because of significant inflammation and dense fibrotic tissue, and particular care was taken to preserve the median and ulnar nerves. Once fully exposed, the aneurysm demonstrated characteristics suggestive of a contained rupture in the distal medial aspect that may have explained the rapid enlargement. It was difficult to tell exactly where the dilation began, but it appeared to be most pronounced at the level of the vein cuff from the initial brachiocephalic fistula ligation (Fig 2). As the brachial artery was ectatic and redundant throughout, we were able to resect the aneurysm, to fully mobilize the brachial artery over its length, and to perform primary brachial-brachial anastomosis in an end-to-end fashion with 5.0 Prolene and a two-suture running technique. The beveled end-to-end anastomosis provided a better size match than a

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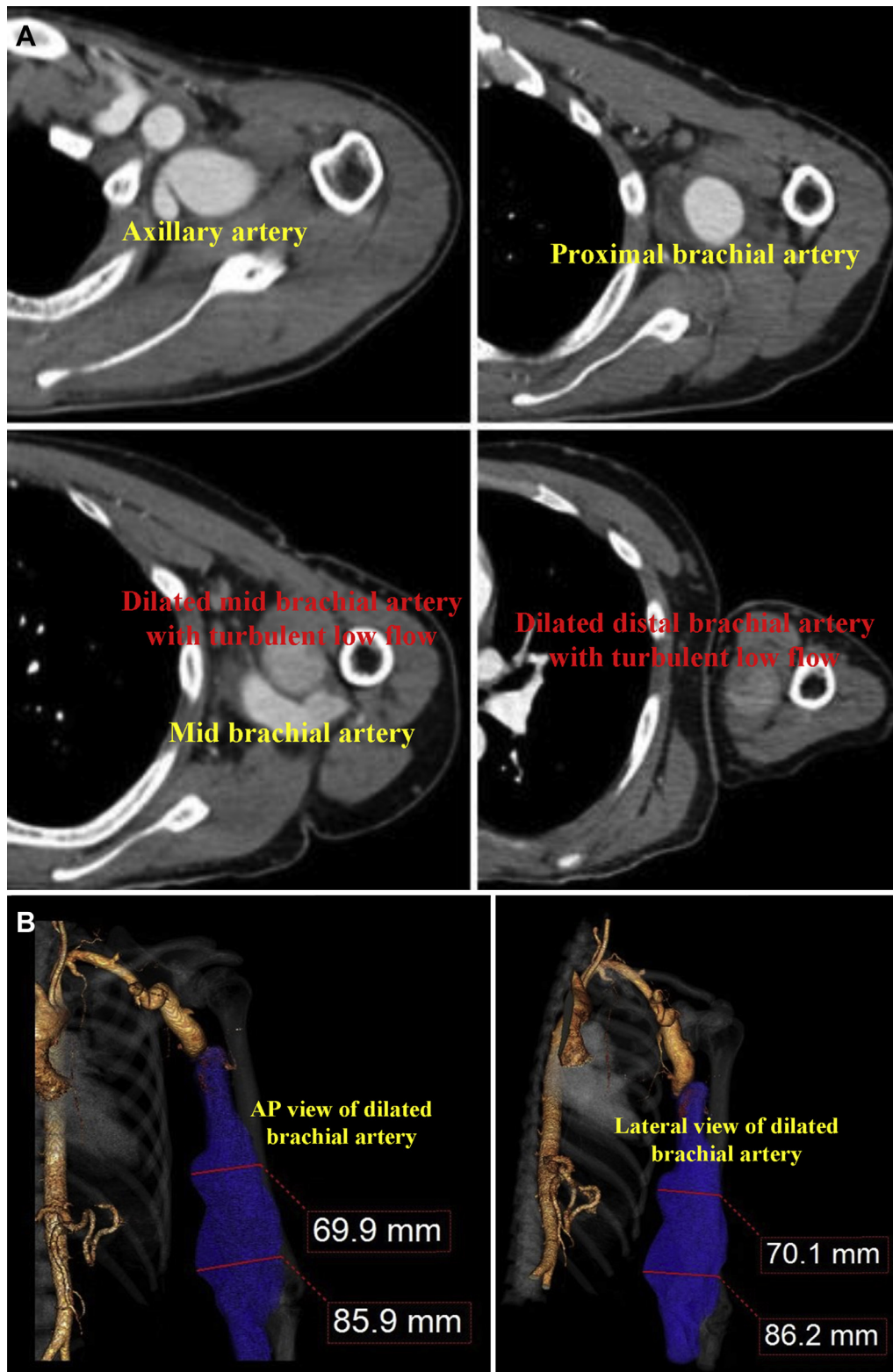


Fig 1. Computed tomography angiography axial images of dilated left brachial artery and three-dimensional reconstruction of the aneurysm. AP, Anteroposterior.

vein graft would have. Excess skin was removed, and the incision was closed. He did well postoperatively with no neurologic deficit and was discharged on postoperative day 2 (Fig 3). The

patient failed to return to clinic beyond his 1-month follow-up, but we were able to contact him by telephone. At 11 months, he continues to have full motor and sensory function of his

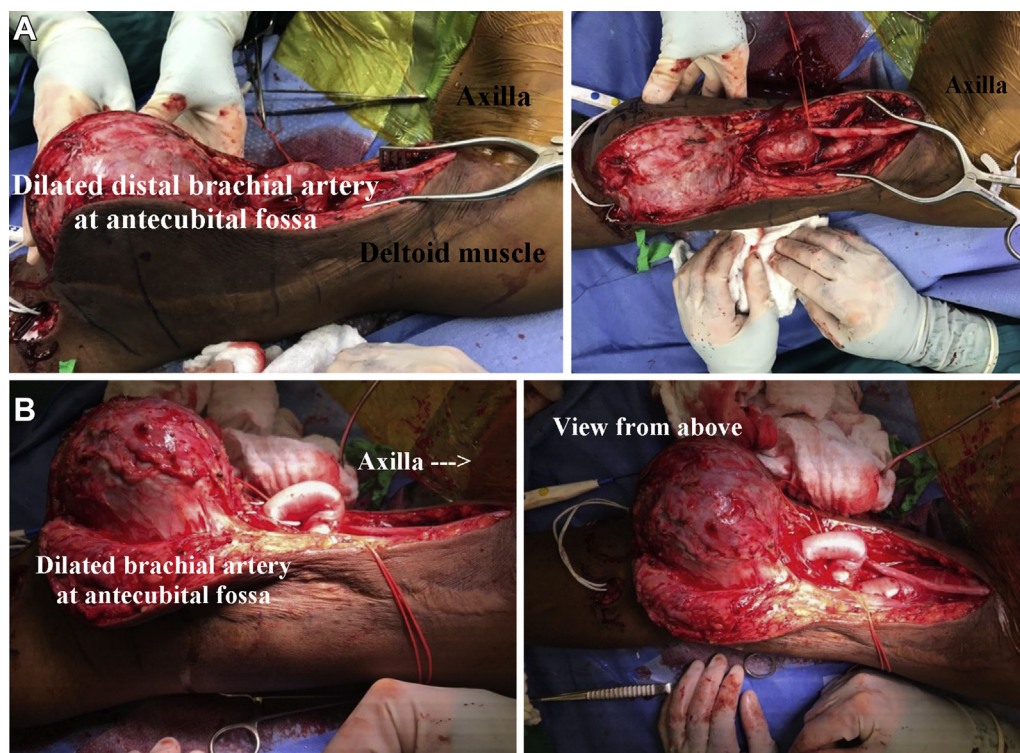


Fig 2. Vein patch aneurysm and aneurysmal dilation of the brachial artery.

arm and hand with no further aneurysmal dilation and only mild residual pain in the axillary portion of the incision.

The patient provided consent for deidentified publication of this case report.

DISCUSSION

True aneurysmal degeneration of the brachial artery is a relatively rare condition, with a reported incidence in the literature of <1%.¹ The pathophysiologic mechanism of brachial artery aneurysms involves local hemodynamic factors such as increased flow that lead to endothelial production of nitric oxide and reactive oxygen species; this results in upregulation of matrix metalloproteinase production and damage to the arterial wall.^{2,3} Shear stress leads to a weakened wall and aneurysmal degeneration.^{4,5} Aneurysm development can occur in both active fistulas and those that have been ligated, with an average time of 10 to 20 years from creation to aneurysmal dilation.^{2,6-8} Patients who have received a kidney transplant constitute a group at particularly increased risk, with reports of immunosuppression potentially contributing to more rapid aneurysm development and rupture.^{2,9-12}

The clinical picture can involve hand ischemia from distal embolization, occurring in up to 47% of patients, and neuropathy from median nerve compression or entrapment.^{7,13} Aneurysmal symptoms are commonly secondary to mass effect as frank rupture is exceedingly rare.^{3,7,8} Diagnostic evaluation can begin with duplex

ultrasound to obtain a baseline evaluation of blood flow to the hand; this should be combined with cross-sectional imaging to better delineate anatomic relationships between the artery and surrounding structures.

Repair is advocated in patients who are symptomatic, specifically with pain, overlying skin breakdown, hand ischemia, or rapid enlargement of the aneurysm.^{6,14} Various techniques have been described, with the most common being aneurysm resection and placement of an interposition graft consisting of either saphenous or arm vein.^{3,6-8,11,15-17} Other conduits, such as prosthetic graft, hypogastric artery, and superficial femoral artery, have also been described.^{1,6,18,19} Alternative techniques for repair consist of primary end-to-end reconstruction and aneurysm plication, the latter being useful in the presence of diffuse or tandem aneurysmal degeneration over long arterial segments that cross the elbow joint.^{4,6,8}

This case illustrates many of the preceding statements. In addition, it highlights the importance of clearly understanding each patient's vascular anatomy and surgical history. Thoughtful preoperative planning is essential and should include vein mapping for potential bypass. In our patient, we believe that aneurysmal degeneration of the vein patch occurred and presented as the large painful mass that brought us to the operating room. The remainder of the brachial artery was also grossly aneurysmal, and this is consistent with the high-flow theories proposed by others. Such diffuse arteriomegaly is significantly less common than focal aneurysmal



Fig 3. Left upper extremity after closure.

dilation and is challenging to repair without an extensive dissection and the inherent risk of neurovascular injury. When the artery is redundant by virtue of its expansion, we believe that control, limited mobilization, resection, and end-to-end primary repair represents a safe and effective treatment option.

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