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Case Report

# Critical stenosis of axillary artery treated with percutaneous angioplasty and stenting: a case report and review of the literature☆

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ABSTRACT

Focal axillary artery stenosis or occlusion is a rare occurrence that is most commonly encountered after severe trauma involving the shoulder joint or proximal humerus. Other etiologies that can lead to axillary artery injury or pathology include different vasculitides, radiation arteritis, crutch-injury, and peripheral arterial disease. In this case report, a 70-year-old woman was referred for asymmetrically decreased right brachial artery systolic pressure and right-hand paresthesia with overhead abduction. Further evaluation with imaging revealed critical stenosis of the right axillary artery. The focal stenotic lesion was treated with drug-coated balloon angioplasty and stent placement leading to in-line flow and resolution of symptoms. Duplex exam 6 months post-treatment demonstrated a widely patent right axillary artery stent without stenosis. Biannual clinic visits up to 2 years post stent placement confirmed resolution of symptoms.



## Introduction

Focal stenosis or occlusion of the axillary artery is a rare condition most commonly associated with trauma to the proximal humerus or with shoulder joint injury. Other etiologies that can lead to axillary artery stenosis or occlusion include iatrogenic injury from axillary artery access, crutch injury, vasculitides (eg, fibromuscular dysplasia, Takayasu arteritis, and giant cell arteritis), radiation-induced arteritis, and peripheral arterial disease. Regardless of the etiology, focal axillary artery stenosis is rarely encountered in vascular medicine in contrast to the more commonly seen peripheral arterial disease entities involving the lower extremities, aortoiliac vessels, renal or mesenteric arteries, which have extensive endovascular treatment data and established treatment algorithms. Given its relative rarity, there is paucity of literature describing endovascular treatment of axillary artery stenosis, with the most relevant literature describing treatment of subclavian artery stenosis in the context of thoracic outlet syndrome. In this report, we describe the diagnostic modalities, endovascular

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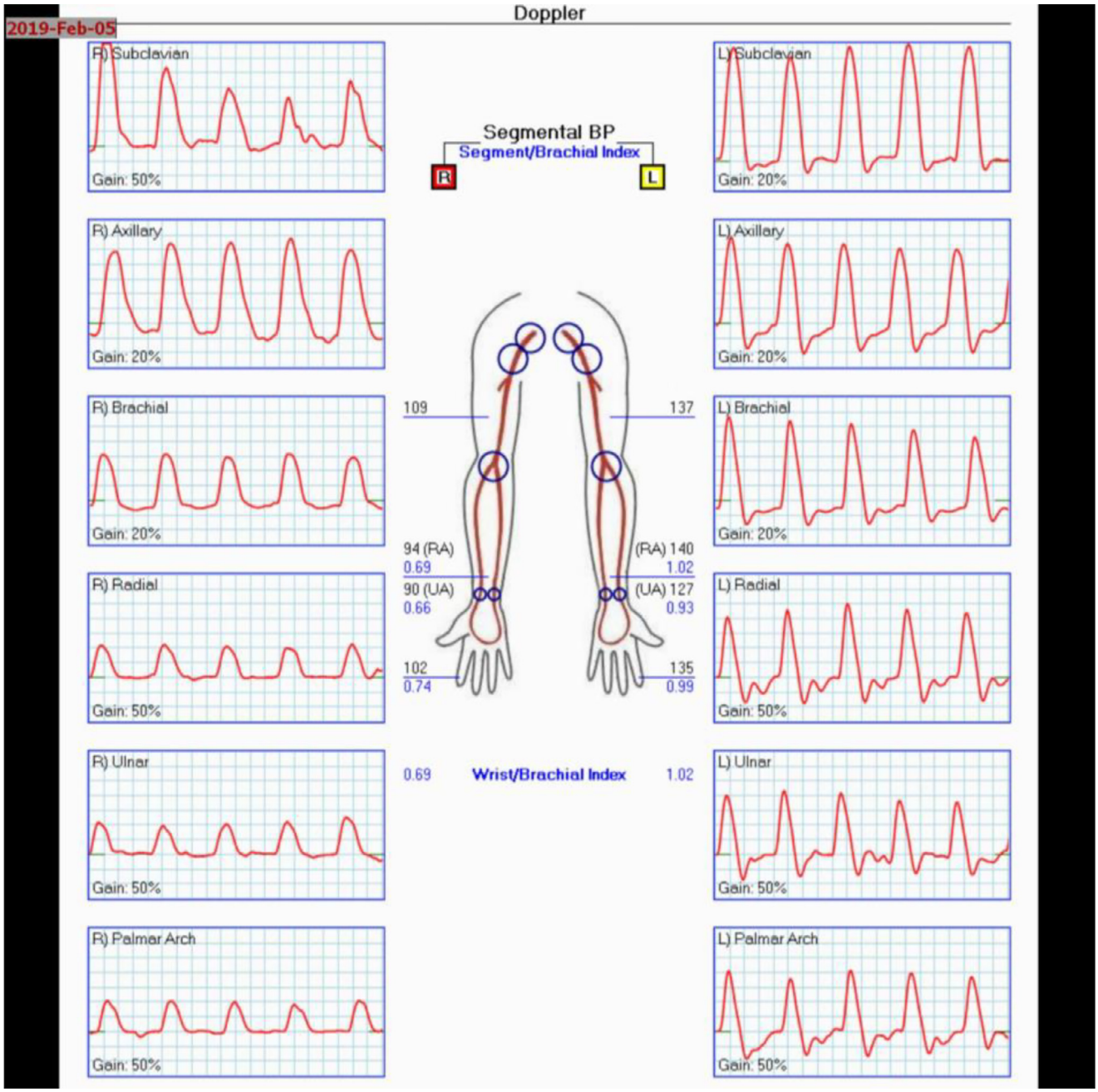


**Fig. 1 – (a) Bilateral upper extremity wrist-brachial indices showing significantly reduced right systolic brachial artery pressure compared to left (27 mm Hg difference) resulting in reduced right wrist-brachial index of 0.69. (b) Right upper extremity arterial duplex showing segmental increased systolic velocity of 433 cm/sec compared to 63 cm/sec in proximal right axillary artery. The increase in velocity from 63 to 433 cm/sec is > 4 fold increase which is consistent with >75% stenosis based on lab criteria.**

treatment and 2-year follow-up of symptomatic, focal, critical axillary artery stenosis.

## Case report

A 70-year-old woman with no contributing past medical history was referred to vascular and interventional radiology for evaluation of asymmetrically reduced right brachial artery systolic pressure incidentally identified during a routine clinic visit. During systolic blood pressure acquisition, it was noted that the patient was borderline hypotensive when blood pressure measurement was obtained from the right upper extremity (100/80 mm Hg) while the contralateral pressure measurement was 134/90 mm Hg. Blood pressure measurements were repeated twice with different sized cuffs, confirming the dis-

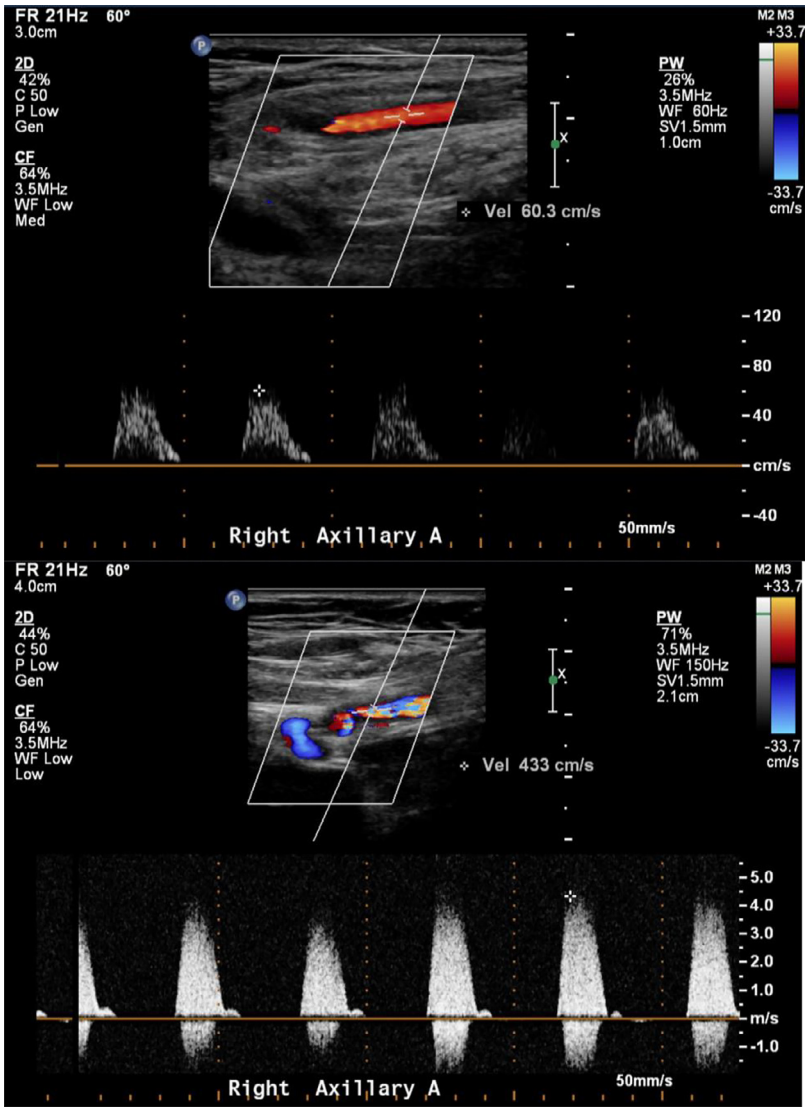


**Fig. 1 – Continued**

crepancy between the brachial artery pressures. A detailed history revealed that the patient experienced a right upper extremity traction injury approximately 6 years prior, believed to have caused transient subluxation of the right shoulder. This injury occurred when she grasped her partner's hand while falling backwards from an elevated deck resulting in what was described as a transient anterior subluxation of the right shoulder. The injury was treated conservatively and after a few weeks her shoulder pain resolved. The patient began to develop paresthesia of her right hand digits during exercise in the ensuing months. Over the past 5 years her right upper extremity paresthesia worsened, specifically with right upper arm exertion or overhead movements. The patient attributed these symptoms to deconditioning. Noninvasive testing, including bilateral wrist-brachial indices (Fig. 1 a) and right upper extremity arterial ultrasound duplex (Fig. 1 b), were obtained, revealing significantly reduced right brachial arterial pressure with >75% stenosis of the right axillary artery by duplex lab criteria. CTA of the chest and proximal right upper extremity (not shown) revealed critical (>90%) stenosis of the right axillary artery. On exam, right radial pulse was 1+ compared to 3+ on the left. The right upper extremity had full range of motion and 5/5 grip strength. In light of the lifestyle-limiting right upper extremity arterial pathology, it was decided to proceed with diagnostic angiogram with intent to treat.

With the patient in supine position, the right common femoral artery was accessed with a micro-puncture set. A common femoral artery approach was chosen over a right radial approach in order to ensure accommodation of a 7 French sheath. The right brachiocephalic artery was tortuous (Fig. 2 a). The right subclavian artery was cannulated with a Storq wire (Cardinal Health, OH) and an angled 5 French glide catheter (Terumo, NJ). The wire was carefully advanced into the right brachial artery under fluoroscopic guidance. A 70 cm 6-French Raby sheath (Cook Medical, IN) was advanced over a Rosen wire (Boston Scientific, MA) to the level of the distal right subclavian artery. The patient was anticoagulated with

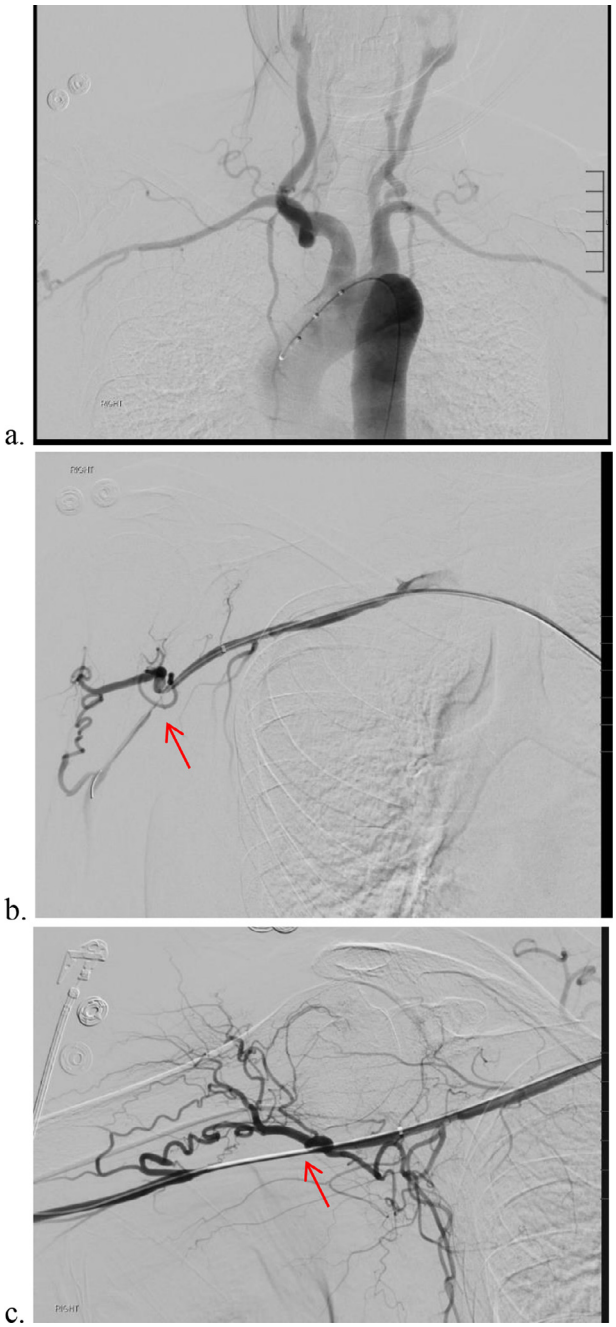


**Fig. 2 – (a) Aortic DSA flush run showing tortuous right brachiocephalic artery. (b) DSA showing critical stenosis (arrow) of the right axillary artery with the wire being nearly occlusive. (c) Magnified DSA through sheath showing critical stenosis (arrow) and multiple collateral arteries along the proximal right upper extremity and right humeral head.**

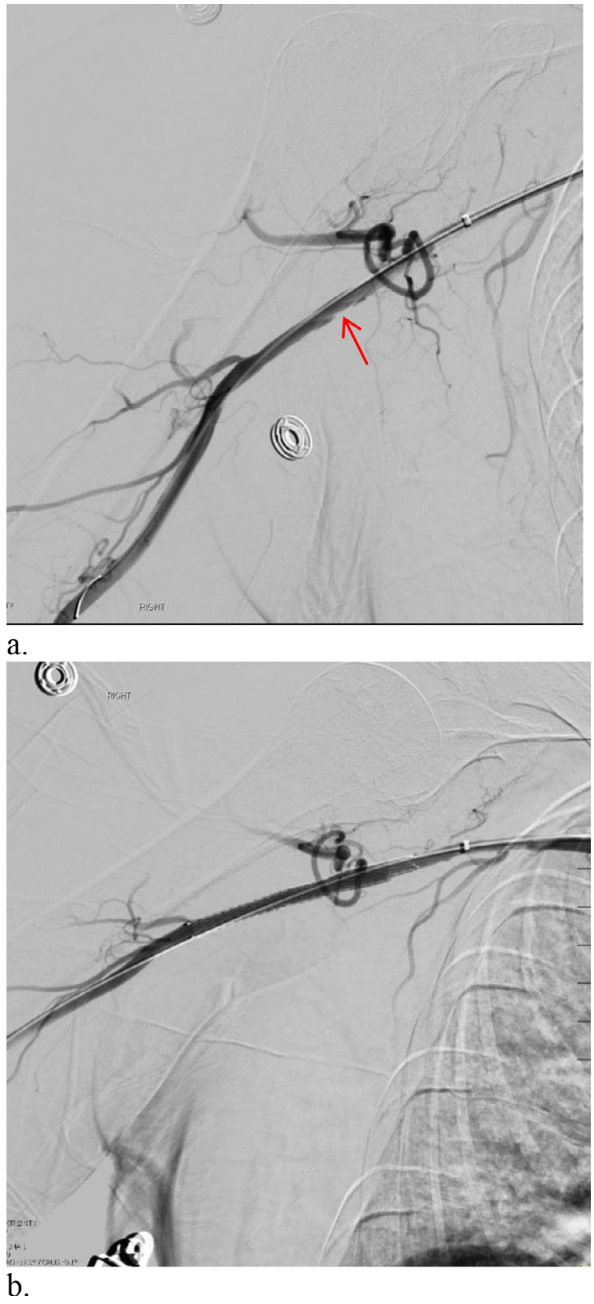


**Fig. 3 – (a) DSA of the right upper extremity post angioplasty showing markedly improved flow through the right axillary artery with two small dissections flaps (arrow). (b) DSA of the right upper extremity post stent placement showing resolution of the stenosis and dissection flaps. Decrease in collateral perfusion was also noted.**

heparin with ACT maintained between 250 and 300 throughout the procedure. Digitally subtracted angiography (DSA) revealed critical stenosis of the right axillary artery with the wire being occlusive (Fig. 2 b). Angioplasty of the right axillary artery was performed with a 4 × 40 mm drug-coated balloon (Medtronic, TX) (Fig. 3 a). Angioplasty resulted in excellent in-line flow with near complete resolution of the stenosis. Unfortunately, DSA post angioplasty revealed at least 2 dissections flaps along the angioplasty site. Prolonged angioplasty did not resolve the dissection; therefore, it was decided to place a self-expanding stent across the dissection flap. A 5 × 50 mm Protégé stent (Medtronic) was placed under fluoroscopic guidance (Fig. 3 b). A final angiogram showed resolution of the axillary artery stenosis and dissection flaps with ex-

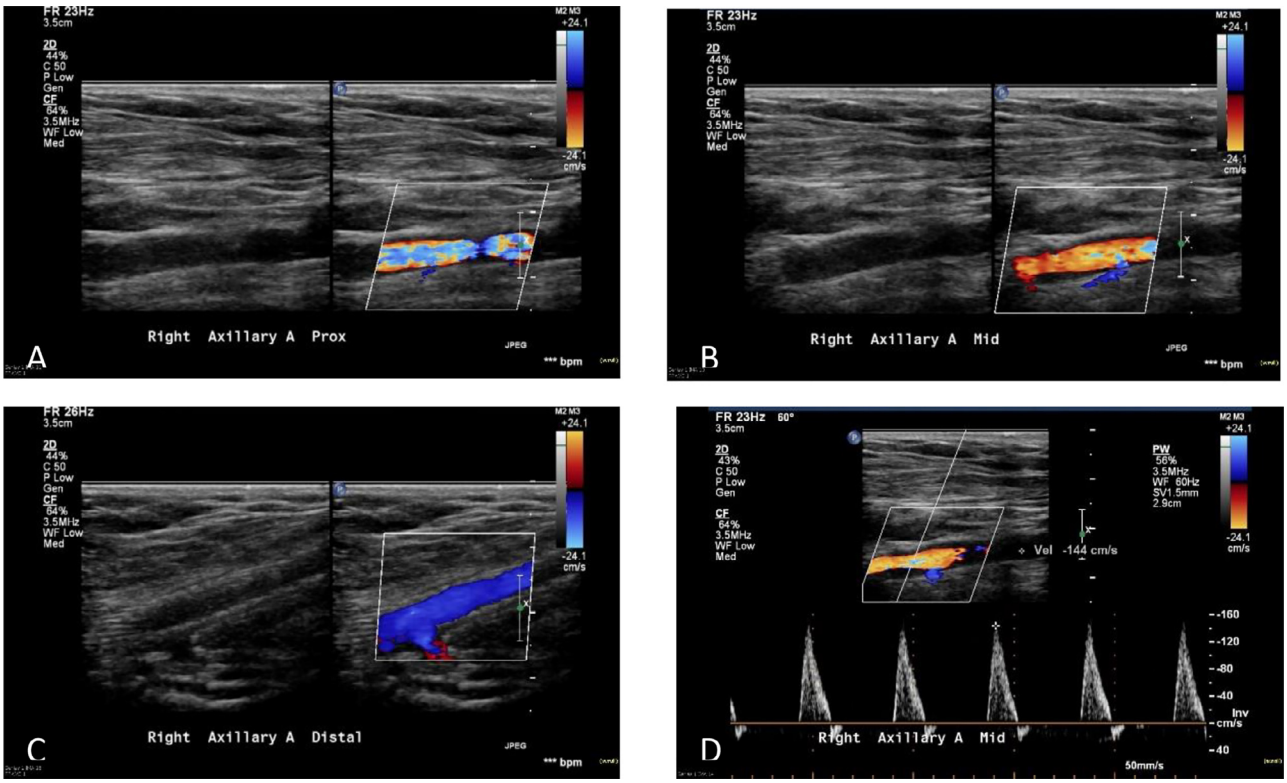


**Fig. 4 – Arterial duplex obtained 6 months post angioplasty and stenting of the right axillary artery. Panels A, B, and C show gray scale and color duplex of the proximal, mid and distal axillary arteries. The stent can be seen in the distal segment of the axillary artery (panel C). Panel D shows color Doppler duplex with normal systolic velocity of 144 cm/sec (compared to 433 cm/sec pretreatment, see Fig. 1).**

cellent in-line flow through the brachial and axillary arteries. The access site was closed with a Mynx closure device (Cardinal Medical, OH) and manual compression. The patient was placed on daily 75 mg of clopidogrel for 3 months and 81 mg of aspirin indefinitely. Follow up arterial duplex 6 months post stent placement, showed a widely patent right axillary artery and axillary stent with no significant stenosis (Fig. 4 ). Patient also remained symptoms-free 2 years post-treatment.

## Discussion

With different advancement in techniques and devices, endovascular treatment of peripheral arterial disease, and arterial injury has become the first line method of treatment over the past 2 decades [1–3]. This is particularly true for treatment of peripheral arterial disease of the aorto-iliac vessels and lower extremities. With increasing technology that is more widely available, percutaneous endovascular angioplasty, atherectomy and stenting is now accepted as first line treatment option of peripheral arterial disease in patients meeting appropriate criteria [1,4]. Despite the abundance of data and reports describing endovascular treatment of peripheral arterial disease in the lower extremities, there is a lack of data regarding endovascular treatment of upper extremity arterial disease, particularly the axillary artery. A few case reports have described endovascular treatment of symptomatic axillary artery stenosis. Valentin et al [5], performed a percutaneous transluminal angioplasty and stent placement in a patient with a short-segment left axillary artery occlusion secondary to left shoulder trauma. At 6 months follow-up, the axillary artery remained patent [5]. Anzuini et al [6], performed directional atherectomy and balloon angioplasty of a heavily calcified axillary artery lesion that was causing critical hand ischemia and trophic fingertip lesions. Clinical follow-up at 3 years showed healing of the fingertip lesions, equalization of bilateral brachial artery pressures, and a residual but not critical stenosis at the original lesion site [6]. Bucci et al performed angioplasty and placement of a drug-eluting stent on a patient with radiotherapy-related axillary artery thrombosis, with 18-month follow-up demonstrating acceptable function, range of motion, and normal radial and ulnar pulses [7]. Al'Aref et al [8] performed percutaneous transluminal angioplasty using a drug-coated balloon to treat right axillary artery stenosis. Follow up out to 12 months showed patency without flow-limiting stenosis [8]. Similarly, Vijayvergiya et al [9] presented two cases of axillary artery stenosis treated with stent placement with patency maintained out to 1 year. These 2 cases presented by Vijayvergiya are unique in that the etiology of the focal axillary artery stenosis was described as secondary to atherosclerotic disease, lacking any history of trauma [9]. The aforementioned case reports in combination with our own experience indicate that endovascular treatment of symp-

tomatic axillary artery stenosis is a minimally invasive treatment option with good short-term patency (6 months to 24 months) that can be attempted prior to surgery. While long-term patency data is unavailable, the available case reports have shown remarkable outcomes for patients with axillary artery stenosis treated with angioplasty and/or stent placement, particularly in the context of trauma or etiologies distinct from peripheral arterial disease.

Compared to penetrating trauma and traction injuries, axillary artery injuries caused by blunt force trauma can have different presentation, severity and treatment algorithm. When axillary artery injury is due to blunt force trauma, each patient should be evaluated independently for optimal treatment options based on risk factors, institutional expertise and severity of trauma. Angus et al [10] found that patients with blunt trauma to the axillary artery treated surgically had longer hospital stays and complication rates than those treated with surgery for penetrating traumas. In their study, Angus showed that axillary artery injury secondary to blunt trauma can have excellent outcomes with endovascular treatment [10].

Other than peripheral arterial disease and trauma, the upper extremity arteries can be affected by different vasculitides, particularly the larger caliber arteries including the brachial and axillary arteries. Albeit rare, fibromuscular dysplasia can lead to axillary artery stenosis . In the context of fibromuscular dysplasia, axillary artery stenosis commonly occurs with other arterial stenoses (eg, carotid artery and/or renal artery stenosis). Higashimori et al [11] describes a case report of a patient with fibromuscular dysplasia affecting the axillary artery and renal artery stenosis. The axillary artery was initially treated with angioplasty, but a stent was required to treat a dissection identified post angioplasty [11].

## Conclusion

Symptomatic upper extremity arterial disease secondary to axillary artery stenosis or occlusion is rarely encountered in comparison to lower extremity arterial disease or upper extremity arterial pathology involving other vascular segments (eg, subclavian or brachial arteries). To date, there is no consensus on best practice techniques and treatment algorithms for endovascular treatment of the axillary artery. In this case report we describe the successful treatment of a symptomatic, focal right axillary artery critical stenosis related to a transient right shoulder subluxation injury. Angioplasty with a drug-coated balloon followed by stent placement resulted in complete resolution of the axillary artery stenosis and symptom resolution at 2-year follow up. Our case report, in combination with other similar case reports, suggests that endovascular treatment of the axillary artery stenosis is a minimally invasive treatment option with excellent short-term outcomes for appropriately selected patients. More data is needed to assess the long-term outcomes of endovascular treatment of axillary artery stenosis or occlusion.

## Patient consent statement

The authors, confirm that written consent for publication of this case was obtained from the patient.

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