Trans-femoral thromboaspiration for upper extremity ischemia

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ABSTRACT

INTRODUCTION: Endovascular trans-femoral access catheter aspiration of thrombus within the proximal subclavian, brachial, radial and ulnar arteries for symptomatic upper extremity ischemic pain has not been previously reported. We describe a case in which a successful clinical outcome was achieved using long length neuro-endovascular aspiration catheters.

PRESENTATION OF CASE: A 45 year old female presented with diffuse left upper limb pain. Sonography revealed compromised upper extremity blood flow. Thrombus was identified in the proximal left subclavian artery by CT angiography. Surgical retrograde brachial artery access thrombectomy was performed. Occlusion of the left vertebral artery with embolic infarcts of the cerebellar hemispheres was noted post-procedurally.

Trans-femoral mechanical aspiration thrombectomy and angioplasty of the subclavian, brachial, ulnar and radial arteries was subsequently performed with successful recanalization.

CONCLUSION: Recanalization of vasculature to the upper arm through safer femoral access can be achieved with thrombo-aspiration catheters of sufficient length.

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1. Introduction

Endovascular trans-femoral access catheter aspiration of thrombus within the proximal subclavian, brachial, radial and ulnar arteries for symptomatic upper extremity ischemic pain has not been previously reported. We describe a case in which a successful clinical outcome was achieved using long length neuro-endovascular aspiration catheters.

2. Case presentation

A 45 year old female presented with a one week history of diffuse left upper limb pain without dysesthesia. She had a history of type 2 diabetes mellitus and hypertension for 10 years. There was no prior history of cold exposure or Reynaud’s phenomenon. She had smoked 1 pack of cigarettes per day for a total of 20 years and stopped smoking 5 years ago. On examination, the left hand appeared cyanotic with a faint, but detectable radial pulse (+1) and good capillary refill. The left hand was lighter cooler than the right side. Blood pressure obtained from the right upper extremity was 176/109 mm Hg. Her Hemoglobin was 7.9 mg/dl with a hypocromatic microcytic profile. The platelet count was 283 000/microliter of blood. Her INR was 1.2. Her homocysteine, fibrinogen, antithrombin III and factor V levels were normal. The prothrombin gene mutation was absent. Trans-esophageal echocardiogram was unremarkable.

Grey scale and spectral wave form sonography of the left ulnar and radial arteries identified monophasic wave forms with normal velocity compatibly with more proximal compromised flow (Fig. 1). CT angiography (Lightspeed VCT 64, GE Healthcare, Milwaukee, Wisconsin, USA) of the chest identified a 2 cm long thrombus adherent to the wall of the left subclavian artery at its origin (Fig. 2). Intravenous Heparin was commenced. Left subclavian artery Foga- rthy thrombectomy was performed with surgical access through the brachial artery. Post surgical thrombectomy, the patient developed left facial weakness and difficulty swallowing. An MRI (Optima 450w, GE Healthcare, Milwaukee, Wisconsin, USA) revealed acute embolic infarcts within the cerebellar hemispheres and left medulla (Fig. 3). A repeat CT angiography of the neck identified thrombotic occlusion of the left intracranial and cervical vertebral arteries with recurrent/residual thrombus within the proximal left subclavian artery (Fig. 4). The patient’s pain in the upper extremity increased. A repeat ultrasound showed monophasic waveform within the proximal left brachial artery which appeared patent with a peak systolic velocity of 23 cm/s. Occlusive thrombosis involving the mid and distal segments of the brachial artery was identified. Collateral reconstitution of blood flow within the radial and ulnar arteries was noted.

Endovascular trans-femoral thromboaspiration was performed under endotracheal general anesthesia. Diagnostic digital subtrac- tion angiography revealed a bovine configuration of the aortic arch and confirmation of non-flow limiting thrombus within the
Fig. 1. Grey scale and spectral wave form sonography of the left ulnar and radial arteries show monophasic wave forms with normal velocity compatibly with proximal compromised flow.

Fig. 2. CT angiogram (Axial (A) and sagittal (B) sections) of the chest shows eccentric thrombus along the proximal left subclavian artery wall (black arrows).

Fig. 3. Diffusion weighted axial MRI sections through the posterior fossa acquired post surgical embolectomy identifies acute embolic infarcts of the lateral medulla and peripheral right cerebellum.
proximal aspect of the left subclavian artery (Fig. 5). Thromboembolic occlusion at the origin of the left vertebral artery was also confirmed. A 5 French Envoy guide catheter (Codman, Raynham, MA) was delivered via the right common femoral artery to the proximal aspect of the left subclavian artery, through which an Aviator balloon (7 mm × 20 mm) (Cordis, Warren, NJ) was positioned within the distal aspect of the brachial artery. A Neuron MAX (Penumbra Inc., Alameda, CA) guide catheter with left common femoral artery was used to aspirate the thrombus at the left subclavian artery. Simultaneous inflation of the balloon was performed to prevent distal migration of thrombus. Post aspiration, the Neuron MAX guide catheter was advanced to the left axillary artery. Digital subtraction angiography of the left axillary artery revealed complete occlusion at the junction of the left axillary and brachial arteries (Fig. 6). Thromboaspiration at the proximal brachial artery was performed with advancement of a 5 Max ACE reperfusion catheter (Penumbra Inc., Alameda, CA) through the Neuron MAX guide catheter. Thromboembolic occlusion at the distal aspect of the left brachial artery was identified in conjunction with focal narrowing at the previous surgical access site. Angioplasty at the focal stenosis was performed with the Aviator balloon (7 mm × 20 mm) at the distal aspect of the left brachial artery. The SMAX ACE reperfusion catheter was then used for thromboaspiration at the proximal radial and ulnar arteries. Partial recanalization of the radial and ulnar arteries was achieved with successful recanalization of the superficial palmar arch and satisfactory arterial flow to the digits (Fig. 7). Good capillary refill of the left hand digits was identified post procedurally. At a four month follow up, the patient was pain free with no loss of function in the left hand and with improvement in her swallow function. Ultrasound at follow up showed improved velocities within the brachial, ulnar and radial arteries (Fig. 8).

3. Discussion

In a study of 547 cases of limb ischemia, 17.7% was identified in the upper limb [1]. Patients present with pulselessness, coldness, pain, paresthesia and limb dysfunction [1]. A thromboembolic source as etiologic consideration was identified in 35% of patient followed by traumatic vascular injury in 31% and atherosclerotic steno occlusive disease in 17% [2]. The remainder are consequent to subclavian steal syndrome, thoracic outlet compression and iatrogenic arterial injury. In 3% of cases the etiology is indeterminate. In another study 95% was consequent to cardiac dysrhythmia [3]. Systemic causes that induce hyper-coagulable states such as nephrotic syndrome have been reported to cause extensive upper extremity arterial thrombosis [4]. Most emboli lodge in the brachial artery followed by the axillary artery [5]. Proximal subclavian thrombus as in our patient has been reported in the context of free floating thrombus within the proximal descending aorta [6]. Simultaneous

Fig. 4. Repeat CT angiography of the neck identified thrombotic occlusion of the left intracranial and cervical vertebral arteries (arrow in Fig. A) with recurrent/residual thrombus within the proximal left subclavian artery (arrow in Fig. B).

Fig. 5. Digital subtraction angiography of the aortic arch demonstrating residual thrombus at the proximal left subclavian artery (A). Inflation of balloon within the brachial artery (black arrow) during thromboaspiration of the subclavian artery.
transfemoral catheter aspiration of thrombus within the proximal subclavian, brachial, radial and ulnar arteries has not been previously described.

Successful upper limb ischemia thrombectomy has been performed with retrograde brachial and radial artery access [7]. Percutaneous retrograde aspiration thrombectomy with a high success rate for upper limb ischemia through brachial artery access, was utilized for residual thrombus after initial transfemoral thrombolysis and balloon catheter thrombus maceration failure [8]. Retrograde placement of conventional 6 French and 7 French guide catheters through the brachial artery resulted in an 18% rate of access site vessel injury [8]. Antegrade access thorough the brachial artery for thromboaspiration of the radial artery, post flow limiting thrombus formation after cardiac catheterization has been reported [9]. Successful use of rotational thrombectomy devices for upper limb ischemia has been described [10]. Successful transfemoral percutaneous aspiration thrombectomy of the upper limb, particularly of the the distal arm requires catheters of sufficient length. We describe a case in which long aspiration catheters designed for intracranial thromboaspiration was used for symptomatic upper limb ischemia from thrombus within the proximal subclavian, brachial, radial and ulnar arteries.

Conservative management results in poor functional outcomes and high rates of persistent claudication [11]. Pharmacologic thrombolysis alone results in a 50% complete recanalization for upper extremity ischemia [12]. A higher frequency of hemorrhagic complications relative to surgery was noted when used in the lower extremity [13]. Surgical Fogarty embolectomy has a 20% complication rate with a re-occlusion rate of 9%, requiring limb amputation in 2% of patients [14]. Surgical thrombectomy failure mandates further evaluation by catheter based angiography and may occur due to subclavian artery inflow lesions such as arterial thoracic outlet syndrome, thrombosis within a subclavian artery aneurysm or ulcerated plaque [13]. Clinical outcomes post-surgical embolectomy are better in patients which limb ischemia caused by embolism rather than local thrombosis [1]. The operative mortality of Fogarty embolectomy mortality can be as high as 12%, mostly related to cardiac comorbidity and may require multiple attempts in 5% of cases [15]. However, long term successful functional outcomes for surgical embolectomy are 95%, supporting this method as the primary management method for upper limb ischemia [14].

Cerebral infarction remains a significant cause of morbidity and mortality in surgical embolectomy [3,14,16]. Successful thromboaspiration of the left subclavian artery was performed in our case with the prior procedural identification an occluded left
vertebral artery by CT angiography. There was therefore no risk of propagating additional thrombus to the intracranial posterior circulation. Balloon protection was utilized to prevent distal migration of thrombus to the brachial artery. Recanalization of vasculature to the upper arm through safer femoral access was achieved with thromboaspiration catheters of sufficient length.
Conflict of interest

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Ethical approval

Not applicable.

Consent

The patient provided consent for the publication.

Author contribution

Ajeet Gordhan; all aspects of the publication.

Guarantor

Ajeet Gordhan.

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