

# Endovascular treatment of a symptomatic aneurysm of the left subclavian artery

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Upper extremity ischemia is a rare entity usually due to emboli of arterial origin. Such thromboemboli produce acute symptoms of sufficient severity as to necessitate early surgical intervention. We report the case of a patient with severe ischemia in his left hand, in whom the embolic source was a mural thrombus localized at the level of a saccular aneurysm of the subclavian artery. After having excluded the presence of a thoracic outlet syndrome, the lesion was successfully treated by means of percutaneous implantation of a stent graft with the exclusion of the aneurysm and the sealing of the thrombus.

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## Introduction

Upper extremity ischemia is much rarer than lower limb or cerebral ischemia. The embolic source in the latter cases is more frequently atheromas or cardiac emboli but, in most cases of upper extremity ischemia, the embolic source is a mural thrombus localized in the subclavian artery<sup>1</sup>.

We here report our personal experience with the endoluminal treatment of a thrombotic lesion located at the level of an aneurysm in the subclavian artery.

## Case report

A 79-year-old male was admitted to our Emergency Department complaining of severe pain in his left hand lasting for > 24 hours and associated with digital ischemia (cyanosis and edema) (Fig. 1, left and middle panels). He was hypertensive, a heavy smoker (30 cigarettes/day), and denied any inflammatory or autoimmune disorders. Clinical examination revealed edema and cyanosis of the left hand, with the presence of faint brachial, radial and ulnar pulses. Radiography excluded the presence of a cervical or anomalous first rib, or pathology of the left clavicle. A duplex scan showed the presence of a subclavian artery aneurysm (11 mm in diameter) with localized thrombotic deposition in its distal segment (Fig. 1, right panel); the flow signal

was reduced in the palmar arch and absent in the first and second digital arteries.

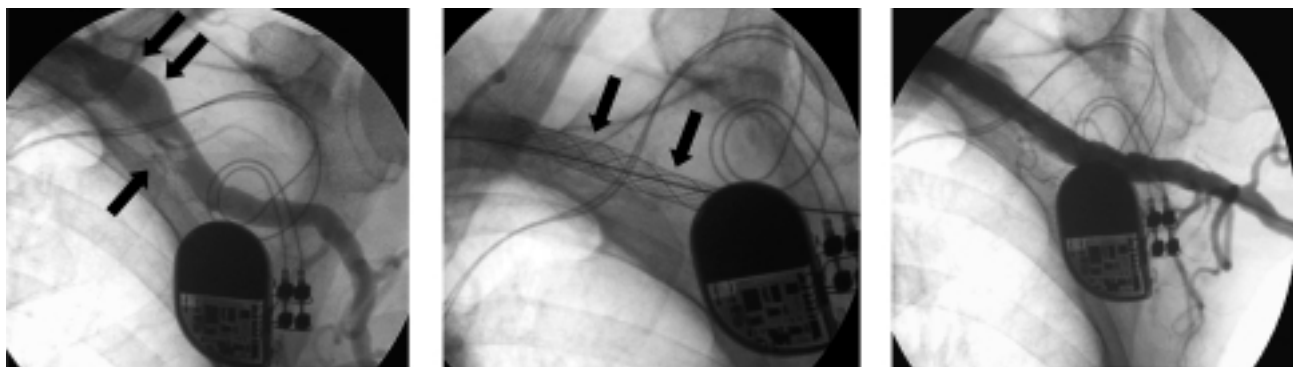
The patient was urgently transferred to our catheterization laboratory for angiographic examination. An ectatic left subclavian artery was documented. It was characterized by the presence of a saccular aneurysm involving the middle segment of the vessel (Fig. 2, left panel). An evident endoluminal defect was documented, whereas no dynamic flow obstruction was observed during left arm hyperabduction.

We chose an endovascular approach to exclude the aneurysm and seal the thrombus. The patient was pre-treated with heparin 5000 IU, aspirin 100 mg and clopidogrel 600 mg. A 10-mm diameter, 50-mm long WallStent graft (Boston Scientific Corporation, Natick, MA, USA) was advanced over a 35" guidewire through a 9F sheath introducer inserted into the surgically exposed left brachial artery, and positioned in the left subclavian artery under fluoroscopic control. After deployment, it was dilated using a 9-mm balloon catheter inflated to 6 bar in order to fully expand it and optimize its apposition to the arterial wall (Fig. 2, middle panel). Final angiography documented the complete exclusion of the aneurysm and optimal distal blood flow. No evidence of an endoluminal defect was documented (Fig. 2, right panel).

The pain subsided over the next 2 days with a return to normal left hand perfusion. A control duplex scan after 6 days showed good stent strut apposition to the artery



**Figure 1.** Left and middle panels: the volar and palmar surfaces of the left hand showing considerable cyanosis and edema. Right panel: duplex scan of the subclavian artery aneurysm (11 mm in diameter) with localized thrombotic deposition (arrow).

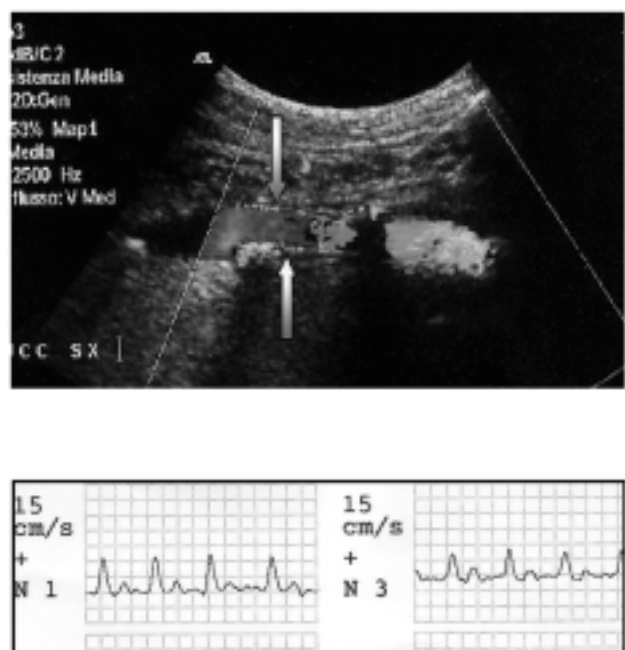


**Figure 2.** Left panel: baseline angiographic view of the left subclavian artery with the aneurysmal dilation and endoluminal defect (arrows). Middle panel: view of the WallStent graft just after deployment. Right panel: final angiographic result demonstrating exclusion of the aneurysm.

wall, with no migration, deformation or stent-graft fracture (Fig. 3, upper panel): the blood flow velocity in the subclavian artery was normal, as was that in the palmar arch and the first two digital arteries (Fig. 3, lower panel). The patient was discharged 7 days after admission and he was asymptomatic 3 months after the procedure.

## Discussion

Emboli in the upper extremities have a different origin from those in the lower extremities because of the infrequent incidence of atherosclerosis. The main embolic source is a mural thrombus in the subclavian artery caused by vessel damage due to the compression of the artery itself at the track outlet<sup>1</sup>. Other possible causes of damage are chronic minimal repetitive injury consequent to prolonged trauma due to an anomalous cervical rib or axillary crutches. The presence of aneurysms (traumatic or a post-stenotic dilation beyond a compressing structure) may also favor intravascular thrombosis. The early symptoms are related to the occlusion of the digital and hand vessels, and consist of



**Figure 3.** Upper panel: duplex scan of the stent graft showing adequate strut apposition (arrows). Lower panel: continuous wave Doppler signals with normal blood flow velocity patterns in the palmar arch and digital arteries

episodic pallor or cyanosis, paresthesia, coldness, and pain with cold sensitivity suggesting Raynaud's syndrome or even digital gangrene; the symptoms may then progressively involve the forearm and arm<sup>2</sup>. The differential diagnosis and the identification of the source of microemboli may be difficult<sup>1,2</sup>.

In case of a symptomatic aneurysm, the aim of treatment is to eradicate the embolic source. The surgical approach has been used for many years, but requires general anesthesia, is highly invasive, and is burdened by a high incidence of complications due to the difficulty encountered in gaining access to the lesion. Although supra- and infra-clavicular surgical exposures may be used, a more aggressive operative approach by means of median sternotomy, clavicular resection or thoracotomy may be needed to achieve better subclavian artery exposure and vascular control<sup>2</sup>. When a thoracic outlet syndrome is excluded, the endovascular repair of the subclavian artery aneurysm by means of a transluminally placed stent graft may be an attractive option because it is simple, less invasive and reduces the length of hospitalization. This approach seems to be particularly useful in such patients, who are usually critically ill due to other coexistent injuries or medical comorbidities<sup>1,2</sup>.

The main indications for percutaneous treatment reported in the current literature are iatrogenic injuries (such as inadvertent artery puncture during the placement of cardiac pacemakers, or disruption during balloon dilation), and aneurysms in patients with inflammatory, autoimmune or degenerative connective tissue disorders<sup>3-8</sup>. In our patient, the etiology could be attributed to atherosclerosis, as it was possible to exclude a traumatic origin or the presence of compression leading to a thoracic outlet syndrome. The peculiarity of our case consists of the fact that the endovascular approach with a self-expanding stent graft was selected with two aims: 1) to treat the aneurysm; and 2) to seal the thrombus between the graft and the vessel wall, avoiding any

further possibility of distal embolization. For this reason, we used gentle balloon post-dilation of the device in order to guarantee its correct apposition to the vessel wall, and adopted intensive antiplatelet therapy associated with anticoagulation in order to improve microvascular perfusion and avoid stent thrombosis.

In conclusion, subclavian artery aneurysms are relatively rare, and the therapeutic approach depends on the etiology, location and size of the aneurysm. In selected cases, the endovascular treatment with the use of stent-graft insertion may be a safe and effective alternative to surgery.

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