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CASE REPORT

TRANSPOSITION OF SUBCLAVIAN ARTERY – IS IT THE APPROPRIATE CHOICE?

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ABSTRACT

Introduction: To present patients with symptomatic subclavian artery disease and treatment possibility.
Case report: A 53-year-old female was admitted with vertigo and left arm claudication. Duplex-scan and MSCT arteriography verified subclavian artery occlusion. After the endovascular treatment failure, the patient was switched to surgical treatment – subclavian artery transposition. After the successful surgical treatment, the patient was discharged on the second postoperative day. If the patient is a candidate for surgery, the literature review shows good initial and long-term results after the subclavian artery transposition, and emphasizes this technique as superior.
Conclusion: Subclavian carotid transposition is a safe and effective method of treatment in patients after endovascular treatment failure or other indication. Also, the surgical treatment is technically demanding because of the difficult access to the vessel origin, and it requires experienced surgeons.

Key words: subclavian artery, surgery, atherosclerosis

INTRODUCTION

Atherosclerotic steno-occlusive disease of the proximal part of the subclavian artery (SA) is an important cause of posterior circulation ischemia, upper limb ischemia, hand claudication, digital embolization, and angina in patients with a left internal thoracic artery (LITA) graft [1–8]. Also, an additional indication for treatment includes increased inflow for scheduled coronary artery bypass surgery – LITA (left internal thoracic artery) graft [9] and before the thoracic endovascular aortic repair (TEVAR) because the devices are typically placed over the left subclavian artery (LSA) and can result in spinal cord or arm ischemia.[10,11]

There are two modalities of treatment of the steno-occlusive subclavian artery (SA) disease: endovascular treatment (EVT) and open surgery. During the last four decades, a number of surgical techniques have been developed for SA reconstruction including: SA transposition, carotid-subclavian bypass and other extra-anatomic reconstruction including axillo-axillary bypass.

Even EVT have several advantages and seems superior [12], open surgery procedures are indicated in patients with long occlusions (≥4 cm) combined with severe calcification, in patients with occlusions close to the vertebral artery ostium or after EVT failure. [12]

In addition, surgical treatment is indicated in patients with arteritis, aneurysm, before scheduled TEVAR procedure to provide adequate proximal landing zone or in case of arterial injuries. In this report we present a case of a successful SA transposition after EVT failure with literature overview of the possibilities and results of SA steno-occlusive disease treatment.

CASE REPORT AND SURGICAL TECHNIQUE

A 53-year-old female was admitted with vertigo and left arm claudication. Her risk factors were smoking (≥ 20 years) and hypertension. Beside the antihypertensive therapy, levothyroxine was prescribed for several months because of myxedema. On admission, the full laboratory tests including thyroid hormones were in the normal range, with obstructive type reduction of the lung function (FEV 1 – 65%). The preoperative evaluation included extracranial carotid arteries duplex ultrasound scanning as well as subclavian and vertebral arteries and segmental pressure measurement of both upper limb arteries. A duplex scan (GE Vivid 7, GE Healthcare, Wauwatosa, WI, U.S.A.) verified a left SA occlusion with retrograde in the left vertebral artery with no significant stenosis on the carotid arteries. Multislice CT angiography (MSCT; GE Light Speed VCT64, GE Healthcare, Milwaukee, WI, USA.) showed LSA proximal occlusion (length of 20mm) (Figure 1).

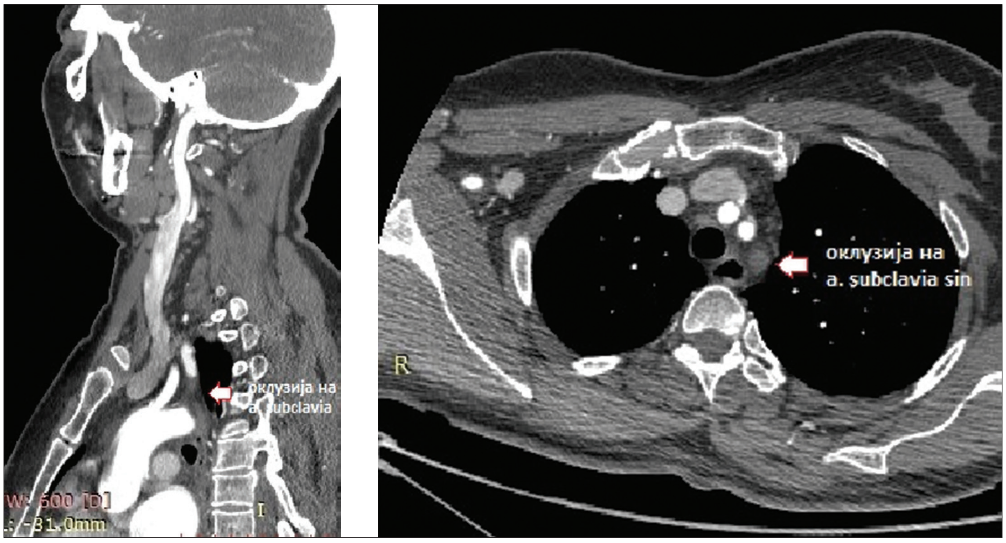

Figure 1. Occlusion of the ostial part of the left subclavian artery – white arrow; a) sagittal projection; b) axial projection.

The indication for EVT was made by a vascular surgeon and interventional radiologist.

However, percutaneous recanalization failed in this patient using both (femoral and arm) approach due to the inability to cross the lesion with 0.014-in. and 0.035-in. guide wire and the patient was switched to subclavian transposition surgery.

Surgical technique. Via a longitudinal incision over the anterior edge of the left sternocleidomastoid muscle, which begins from incisura jugularis and ends over the anterior edge of the muscle at the level of the thyroid cartilage, we approached the deeper structures. Platysma was cut and medial to the internal jugular vein, the omohyoid muscle was cut first and the common carotid artery (CCA) was isolated for the whole of its length. At the most proximal part of CCA, the medial of the medial head of the sternocleidomastoid muscle in direction towards back, ligating thoracic duct and vertebral vein, the approach for the proximal segment of SA was made. The artery was carefully isolated especially the proximal origin segment and distally to the origin of LIMA. The vertebral artery was separately isolated. The procedure was performed under a systemic anticoagulation (heparin in doses of 100 units/kg) to have the activated clothing time between 250 and 300 seconds. After clamping and cutting of the proximal part of the SA, the blind end of the artery was suture ligated with non resorbable suture, and the distal part was positioned for the anastomosis with CCA under the angle of 90°. With a 4mm puncher, the hole at the side of the CCA was made which was extended afterwards and anastomosed with continuous suture Prolene 6-0. (USP). Flushing was made at the end of the anastomosis and normal pulses were obtained at the subclavian, vertebral, radial and ulnar artery. After the surgery, the patient had no neurological deficits and was extubated in the operating room. The patient was discharged on the second postoperative day with standard therapy (Acetil-salicid acid 100 mg/d) and normal arm/hand pulses. Two weeks later a control color duplex was made and revealed normal flow direction.

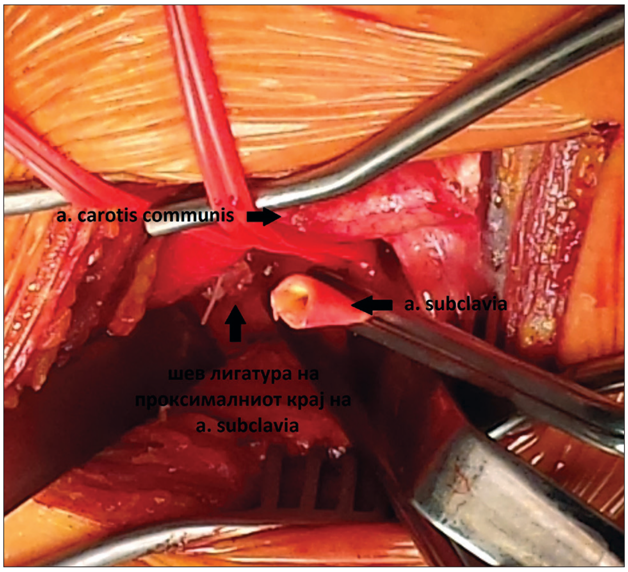

Figure 2. Operative field with longitudinal incision parallel to the medial border of the left sternocleidomastoid muscle. 1. Common carotid artery – upper arrow; 2. Resected left subclavian artery – right lower arrow; 3. Suture ligation of the proximal part of the left subclavian artery – left lower arrow.

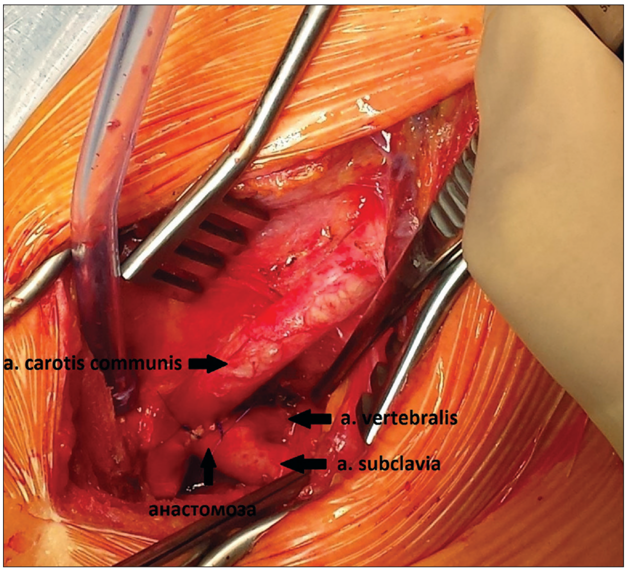

Figure 3. Transposition of the left subclavian artery to the left common carotid artery; 1) Common carotid artery – left upper arrow; 2) Left vertebral artery – right upper arrow; 3) Left subclavian artery – right lower arrow; 4) Anastomosis between the left subclavian artery and the left common carotid artery in termino-lateral fashion.

DISCUSSION

Numerous previous published studies have shown the results of surgical treatment of SA steno-occlusive disease. [13,14,15,16]

There are several surgical techniques for the treatment of SA steno-occlusive disease (including anatomical, extra-anatomical and bypass procedure); but in clinical practice, surgical treatment is technically demanding because of the difficult access to the vessel origin, and it requires experienced surgeons. In addition, the mortality rates after surgery range from 0% to 2.2%, and the risk of cranial neuropathies (such as Horner syndrome) and non-neurologic complications (lymphocele, wound infection, and pneumothorax) is 0%-12%. [13,16,17] On the other hand, the long-term results after surgical treatment vary. Extra-anatomic reconstruction including axillo-axillary bypass grafting is associated with poor long-term results. Superior surgical technique is subclavian-carotid transposition (SCT) with excellent long-term results. [16] Also, Cinà et al. [18] in their review concluded that SCT is safe and effective for reconstruction of the first segment of the SA and patency rates and clinical symptoms freedom are higher with SCT than with carotid subclavian bypass.

However, advances in endovascular techniques provide similar success rates as surgical treatment. [12] But, as it was mentioned above, there are several limitations for EVT. One on the most important is ensuring adequate proximal landing zone for TEVAR procedure to prevent posterior cerebral circulation, prevention of the arm circulation, preservation of LIMA in patients with LIMA – coronary bypass and preservation of C4 collaterals in prevention of perfusion of the spinal cord.

Apart from the advances that the transposition offers as a procedure: easier, faster, excellent patency rate, without prosthetic material, elimination of the type 2 endoleak, we think that the approach has its own role in avoidance of possible complications. This collar incision offers better and easier approach to carotid bifurcation if there is a need for carotid endarterectomy. Also, it offers comfort during performing the procedure because of the avoidance of working in the narrow and limited field (between the two heads of the sternocleidomastoid muscle). Avoidance of possible complications is another advantage because the preservation of the anterior scalene muscle where the anatomic/topographic position of the phrenic nerve is preserves the nerve from possible injury.

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Резиме

ТРАНСПОНИРАЊЕ НА СУБКЛАВИЈАЛНА АРТЕРИЈА – ДАЛИ Е ТОА СООДВЕТЕН ИЗБОР?

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Апстракт

Вовед: Да се претставаат пациенти со симптоматска болест на супклавијалната артерија и можноста за третман.

Приказ на случај: 53-годишна жена беше примена со вртоглавица и со клаудикација на левата рака. Дуплекс-скенирањето и МСКТ-артериографијата ја потврдија оклузијата на супклавијалната артерија. По неуспехот на ендоваскуларниот третман, пациентот беше префрлен на хируршки третман – супклавијална артериска транспозиција. По успешниот хируршки третман, пациентот е отпуштен на вториот постоперативен ден. Ако е пациентот кандидат за операција, прегледот на литературата покажува добри почетни и долгорочни резултати на супклавијалната артерија и ја истакнува оваа техника како супериорна.

Заклучок: Транспозицијата на супклавијалната каротида е безбеден и ефикасен метод на лекување кај пациентите по неуспехот на ендоваскуларниот третманот или друга индикација. Исто така, хируршкиот третман е технички напорен, поради тешкиот пристап до потеклото на садот, и тоа бара искусни хирурзи.

Клучни зборови: супклавијална артерија, хирургија, атеросклероза