

## VERTEBRAL ARTERY TRANSPOSITION TO THE THYROCERVICAL ARTERY AND CAROTID – SUBCLAVIAN SAPHENOUS BYPASS IN A CASE OF SUBCLAVIAN STEAL SYNDROME: CASE REPORT

### SUBKLAVYEN STEAL SENDROMLU BİR VAKADA VERTEBRAL ARTER THYROSERVİKAL TRANSPOZİSYON VE KAROTİKO – SUBKLAVYEN SAFEN BYPASS: OLGU SUNUMU

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#### Abstract

Subclavian steal syndrome occurs when there is stenosis of the subclavian artery proximal to vertebral artery. The vertebral artery originates from the subclavian artery just before the origin of internal mammary artery and, the most common lesion of the vertebral artery is an atheromatous plaque located at its origin from the subclavian artery. This circumstance may cause diverse angina and neurological symptoms including vertigo, ataxia, visual disturbance and cerebral ischemia. Therefore, surgical reconstruction of the subclavian artery and vertebral artery should be done to relieve symptoms of ischemia. We present a patient who underwent vertebral artery transposition to thyrocervical artery concomitant with carotico-subclavian saphenous bypass due to subclavian artery and vertebral artery stenosis. (Pam Med J 2009;2(3):146-9).

**Keywords:** Subclavian steal syndrome, vertebral artery stenosis, vertebral artery transposition, thyrocervical artery.

#### Özet

Subklaviyen steal sendromu vertebral arter proksimalinde subklaviyen arterde stenoz varlığında gelişir. Vertebral arter internal mammary arterin hemen öncesinde subklaviyen arterden köken alır ve en sık görülen lezyon subklaviyen arterden çıktığı noktada lokalize ateromatöz plakdır. Bu durumda vertigo, ataksi, görme bozukluğu, serebral iskemiye içeren nörolojik semptomlar ve angina gelişebilir. Bundan dolayı subklaviyen ve vertebral arterin cerrahi tedavisi semptomların giderilmesi için gereklidir. Subklaviyen ve vertebral arter stenozundan dolayı karotiko-subklaviyen safen bypass ile eş zamanlı vertebral arter-tiroservikal arter transpozisyonu uygulanan bir hasta sunuyoruz. (Pam Tıp Derg 2009;2(3):146-9).

**Anahtar kelimeler:** Subklaviyen steal sendromu, vertebral arter stenoz, vertebral arter transpozisyon, tiroservikal arter

#### Introduction

Subclavian steal syndrome (SSS) occurs when there is stenosis of the subclavian artery (SCA) proximal to the vertebral artery (VA) [1]. In this circumstance, there is a blood flow in the reverse direction in the internal mammary artery (IMA) and the VA on the affected side [2]. The VA originates from the SCA just before the origin of the IMA, and the most common lesion of the VA is an atheromatous plaque located at its origin from the SCA [3]. This circumstance may cause diverse angina and ne

urological symptoms including vertigo, ataxia, visual disturbance and cerebral ischemia [2]. Therefore, surgical reconstruction of the SCA and VA should be done to relieve symptoms of ischemia [4]. Management of SCA and VA occlusive diseases may include various surgical options.

We present a patient who underwent VA transposition to thyrocervical artery (TA) concomitant with carotico-subclavian saphenous bypass due to SCA and VA stenosis.

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### Case Report

A 59-year-old male patient diagnosed with stable angina, dizziness, partial aphasia and left upper claudication was admitted to our cardiovascular surgery department. The patient's medical history included uncontrolled hypertension and transient ischemic attack. Results of the physical examination were no left radial or ulnar pulses. A blood pressure difference of more than 30 mmHg between the right and left upper extremity was measured. Doppler study of the extracranial vessels demonstrated 70% narrowing at the proximal left SCA and proximal of the VA. In addition, it revealed retrograde and slow blood flow from the basilar artery to the left VA. Peripheral angiography revealed about 80% stenosis of the proximal left SCA and at the origin of the VA (Figure 1).



**Figure 1.** Preoperative angiographic imaging

The right VA and carotid artery (CA) appeared normal. Coronary angiography revealed about 70% stenosis of the proximal left anterior descending artery (LAD). Initially, the patient underwent transluminal angioplasty with stent placement to the LAD. Later, the SCA was approached by supraclavicular incision and dividing the scalenus anticus muscle and gently retracting the phrenic nerve. The neurovascular bundle of the neck was retracted medially, and the common CA and VA were identified. The saphenous-carotid proximal end-to-side anastomosis was performed. Thereafter, the saphenous vein graft - SCA end-to-side anastomosis was performed (Figure 2).



**Figure 2.** Peroperative from the CA to SCA saphenous vein anastomosis imaging

The proximal of the VA was transected, and then ligated. The diameter and length of the VA was favorable to branch the TA and there was no king configuration. We ligated a branch of the TA and proximal VA to stump the branch of the TA, and end-to-side anastomosis was performed (Figure 3).



**Figure 3.** Peroperative proximal of the VA to branch of the TA anastomosis imaging

Postoperative imaging via arteriography was performed (Figure 4), and additionally saphenous graft vein patency was confirmed by the doppler scanning. There were no postoperative complications and the patient was discharged symptom-free on the postoperative third day.



**Figure 4.** Postoperative angiographic imaging

### Discussion

Subclavian steal from the cerebral circulation through the VA, which is the most common type, was first reported by Contorni in 1960 [2]. In 1962, Hutchinson et al first described complex stenosis in the VA [3]. Anatomically, the VA is divided into four segments. The first segment of the VA from its point of origin from the SCA to its point of entry into the transverse foramen, is known as the V1 segment [5]. This segment, especially at the junction of the SCA and VA, is most frequently involved in atherosclerotic disease [5]. Proximal VA stenosis is seen in 18% of cases on the right, and 22.3% on the left [6]. The V1 segment is easily distinguished from the thyrocervical trunk (TT) and costacervical trunks by its lack of proximal branches [7]. The diameter of the individual VA is quite variable, ranging from 0.5 to 5.5 mm, and is of much smaller relative caliber than the SCA [5,6].

Angiography is considered the gold standard in assessing VA lesions. But angiographic assessment of the origin of the VA can be difficult. About 53% of the VA originates from the ventral, caudal or dorsal aspect, and the proximal part of the VA may be superimposed upon the opacified SCA [8]. Duplex and color-coded Doppler sonography may be better for providing important information about the direction of blood flow and stenosis of the VA [8].

The surgical strategies for atherosclerotic disease of the proximal V1 segment of the VA include endarterectomy, transpositions and bypass [9]. These include the direct endarterectomy of the VA at its origin, surgical angiop-

lasty of the VA with a vein patch, a vein and/or a synthetic graft from the SCA or CA to the VA, and transposition of the VA directly to the SCA, to the CA, or to the TA [10]. The other technique may be endovascular treatment such as balloon angioplasty and stent procedure in the high-risk patients [11]. CA-to-SCA bypass is a less traumatic and easy-to-perform technique. Among the grefts used in this technique, PTFE grafts have the highest patency rates [12]. However, saphenous vein may ensure better results when its in good quality with a diameter above 5mm. Therefore, a good quality saphenous vein as a native graft should be kept in mind in higher long-term patency. We think new generation antiplatelet agents would also contribute to higher long-term patency rates of the saphenous veins clinical practise. Law et al reported that there were no statistically significant difference between symptom free survival of these two grafts [12]. The most common transposition used is VA-to-CA, and this procedure is ideal for the surgical management of stenosis of VA origin and for the treatment of SSS [3, 10]. However, in our patient, VA-to-CA transposition was not suitable due to the saphenous vein had been anastomosed to the CA already. In addition, if the wall of CA is thick, it may cause longer clamping time due to being technically challenging. But successful anastomosis of the VA to the TT or one of its branches can be easily done [10]. In our case, the TT appeared as a good inflow artery. Yet there are two possible problems with this procedure. First, after the operation, acute occlusion can appear due to angulation on the anastomosis side, if the TT arose somewhat more anteriorly than usual. The latter is a size mismatch between the VA and TT or its branches. This size mismatch is the essential cause of the complications, and sudden alteration in the cross-section area induces turbulence of the blood flow. Diaz and coworkers proposed that in half of the cases, an occlusion develops in the VA-TT or one of its branches anastomosis, and they attributed this complication to size mismatch [13], as turbulence or non-laminar flow exists at the point of the branching to Reynolds number ( $Re = \rho V D / \mu$ ) [14]. Qu et al [15] reported that a thyroid artery or transverse cervical artery more than 2 mm in diameter could be a suitable free length for end-to-side anastomosis with the VA. Again, they reported that the TA had caliber to the VA so that end-to-end anastomosis could be carried out between them. Here, the advantages of end-to-side anastomosis include diminished effect of vasospasm, protection of dis-

tal blood flow, applicability to the large vessel, and simple planning.

We ligated a branch of the TA, and the V1 segment of the VA was anastomosed to the stump using microvascular bulldog. This technique used for transposition is a simple, minimally traumatic operation. There is a potential risk of trans-clamping ischemia due to VA-to-CA transposition. Therefore, the carotid clamp time and operating time may be reduced with this technique in combined operations such as CA-SCA bypass due to SSS and thus, neurological complications may be prevented by a shortened clamp time.

Consequently, this procedure may be effective as an alternative technique to VA-CA transposition. We think that transposition of the proximal segment of the VA to the branches of the TA may be used in SSS surgery that requires VA operations.

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