

# Thoracic Outlet Syndrome in Athletes

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## ABSTRACT

Can playing sports cause neurovascular compression syndrome? Sport related compression syndrome can be defined as a condition characterized by various symptoms related to compression of neurovascular elements by surrounding tissues, which appearance or exacerbation is associated with physical activity.

**Keywords:** Athletes; Thoracic Outlet Syndrome

## Introduction

An overuse injury of physical activity resulting in pain and muscle stiffness can emerge in areas where the space available for tissues (e.g., muscles, nerves, and blood vessels) is limited. During exercise, the tissue is pressed against another structure and becomes ischemic, deinnervated, inflamed or damaged. A great variety of abnormal compressions of nerve, arterial, and rather seldom venous structures, may appear in athletes and other physically active individuals, including the most frequent conditions such as: thoracic outlet syndrome, popliteal artery entrapment syndrome, chronic exertional compartment syndrome, acute exertional compartment syndrome, upper extremity exertional compartment syndrome. The purpose of this short review is to present the anatomy, pathophysiology, diagnosis, and treatment of these pathologies.

### Thoracic Outlet Syndrome

Thoracic outlet syndrome (TOS) consists of a group of distinct disorders produced by compression of the vessels and nerves of the upper limbs when they pass into the arms from the neck [1]. TOS is an often-misdiagnosed cause of neck, shoulder and arm ailments [1-4]. Although the term thoracic outlet syndrome and its definition (state with compression of neurovascular bundle in the thoracic

outlet region) was proposed in 1956 by Peet, its proper diagnostic and therapeutic management remains controversial [1-10]. The complexity of TOS arises from the statement that many different disorders such as cervical rib syndrome, Naffziger's syndrome - anterior scalenus muscle syndrome, costoclavicular syndrome, hyperabduction, clavicle fracture, pectoral minor muscle syndrome, head of humeral bone syndrome, exertional axillary vein thrombosis, result in TOS appearance [1].

The stage, level and type of compression or the stretching of the neurovascular bundle is responsible for observed clinical signs and symptoms [1-10]. Patients suffering from TOS can be divided into four groups presenting properly neurological, arterial, venous and mixed symptoms. Approximately 95% of patients suffer from neurological symptoms, but most of them present also vascular symptoms [1]. Neurogenic type, the most frequent kind of TOS, is characterized by dysesthesia (hyperesthesia, hypoesthesia, paresthesia), vasomotor disturbances and pain which can affect each part of the upper limb, radiate to the neck and even imitate stenocardial pain (pseudoangina). Marked muscular atrophy can be observed because of progression of this condition. Many authors studying the problem of compression in the region of thoracic outlet pay at-

tention on the presence of vascular complications [2-10]. Venous thrombosis is the most serious complication of vein compression in TOS. The vascular-venous type characterized by edema, hand or finger cyanosis and their thickening appears both abruptly, usually in association with physical effort involving the shoulder girdle and chronically, whereas vascular-arterial type is described as acute or chronic ischemia of the upper limbs or the presence of local complications including subclavian artery aneurysm or distal microembolisation [1-10].

The appearance or intensification of TOS symptoms are related to the certain positions of the body (physiological dropping of the shoulder girdle, faulty posture: anteversion of the pelvis with lumbar lordosis abolition, reduction of pectoral kyphosis) or to upper limb position and movement. Exertional elevation and abduction of the arm as well as prolonged forced upper extremity position which can occur during sleep are considered to be of great significance for the syndrome's appearance (nerve and artery compression, Paget-Schroeter syndrome) while restitution of neutral position is associated with pain relief and reduction of other symptoms. TOS occurs mainly in young athletes, especially those practicing strength disciplines (bodybuilding, weightlifting, rowing) and sports requiring wide range of movements in the shoulder joint (gymnastics, swimming) [1-10].

The diagnosis of TOS consists of clinical tests, noninvasive examinations (X-rays, Duplex-Doppler ultrasound) and invasive methods (fleboigraphy, arteriography, electromyography) in selected cases. Both conservative and surgical methods can be used for the treatment of TOS. Conservative therapeutical attempts including rehabilitation, painkillers or physiotherapy should precede invasive surgical treatment procedures [1-3]. The standard surgical treatment includes the first rib resection and excision of other bone (i.e., additional cervical rib) or fibromuscular anomalies, such as scalenectomy. The transaxillar access provides the best cosmetic results which is quite important especially for women. The complications of compression of the artery require decompressing surgery and vascular reconstruction. The necessity of vascular anastomoses determines the over and/or subclavicular access. In the case of aneurysm the vascular prosthesis or saphenous vein interposition can be used.

Because of the risk of compression there is an indication for reinforced prosthetic grafts. There are reports of endovascular procedures of treating the aneurysms and stenoses of subclavian artery in TOS. Endoluminal procedures of treatment of subclavian

artery aneurysms or stenoses caused by TOS are also described. The stenoses observed after such therapy show that this procedure however must always be simultaneous with decompression procedures [4,5,8]. Open surgery decompression of the subclavian vein prevents the restenosis. Currently the venous thrombectomy is very rarely performed because of the risk of the recurrent thrombosis. Indications for surgical treatment in neurological TOS include anomalies in nerve conduction or somatosensory evoked potentials disturbances. The surgery prevents the irreversible brachial plexus degeneration and enables fast recovery and immediate return to previous sport activity [3-10].

## Summary

Compression syndromes are considered to be of great significance for neurovascular symptoms in athletes and other physically active individuals. They result in exercise-induced pain, swelling, paresthesias, ischemia and intermittent claudication that can significantly affect athletic performance. Therefore, the importance of a careful clinical investigation and early diagnosis should be emphasized to provide appropriate conservative or surgical treatment and prevent further complications.

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