

Thoracic outlet syndrome

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ÖZET

Torasik outlet sendromu

Torasik outlet sendromu (TOS), klinik özellikleri itibari ile fizik tedavi, ağrı tedavisi, ortopedi, beyin cerrahisi, iç hastalıkları gibi birçok disiplini birlikte ilgilendiren bir sendromdur. Etiyolojide sıklıkla brakial pleksus ve ilgili yapıların servikal bölgeden aşağı doğru seyirleri sırasında interskalen üçgen, kostaklavikular üçgen ya da subkorakoid bölgede sıkışmaları bulunmaktadır. Bu sıkışma ya da entrapman servikal kotlardan, belirgin C₇ transvers çıkıntısı varlığından, daha sıklıkla da ilgili alanda bulunan fibröz bantlardan oluşmaktadır. Hastalar genellikle skapuladan üst ekstremiteye yayılan ağrı, uyuşma hissi, kimi zaman renk değişikliği ile başvururlar. Sıklıkla kadınlarda ve 20-50 yaşlar arasında görülür. Semptomlar ağır taşımak, kolları kaldırmak ile artmaktadır. Tanı ve tedavi açısından nörolojik semptomların hakim olduğu nörojen TOS, vasküler semptomların ön planda olduğu vasküler TOS ve her iki grubu tam olarak yansıtmayan non-spesifik TOS diye ayırmak yararlı olmaktadır. Tanıya klinik muayene, provokatif testler, ultrasonografi; gerekli durumlarda Doppler ultrasonografi, anjiyografi, manyetik rezonans görüntüleme ile ulaşılmaktadır. Konservatif tedavi yeterli olmadığında ise cerrahi tedavi uygulanır.

Anahtar kelimeler: Torasik outlet sendromu, entrapman sendromları, üst ekstremité ağrısı

SUMMARY

Diagnosis and treatment of thoracic outlet syndrome (TOS) involves neurologists, physiatrists, family physicians, orthopedic surgeons, vascular surgeons, thoracic surgeons, neurosurgeons and sometimes psychiatrists. It is generally accepted that TOS is caused by compression of brachial plexus elements or subclavian vessels in their passage from the cervical area toward the axilla and proximal arm either at the interscalene triangle, the costoclavicular triangle, or the subcoracoid space. Cervical ribs, anomalous muscles, and fibrous bands may further constrict these areas. Patients with thoracic outlet syndrome usually have aching type pain radiating from their scapula down the upper extremity. It is more common in women, and between 20 and 50 years of age. In order to diagnose accurately, clinical presentation may be evaluated as neurogenic TOS, those with compression of the brachial plexus, or vascular TOS, those with compression of the subclavian vessels and nonspecific-type TOS. The diagnosis of TOS can be made by history, physical examination, provocative tests, ultrasound, radiological evaluation and electrodiagnostic evaluation. For most patients with TOS, conservative treatment is offered. Definitive treatment involves surgical decompression of the related structures.

Key words: Thoracic outlet syndrome, entrapment syndromes, upper extremity pain

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Introduction

The term thoracic outlet syndrome (TOS) was first used by Peet in 1956 to indicate compression of neurovascular structures in the interscalene triangle. It used to be referred as scalenus anticus syndrome, costoclavicular syndrome, hyperabduction, cervical rib or 1st rib syndrome according to the possible etiology (Saramasam et al. 2004).

Reviewing the data; we can say that TOS has been one of the most controversial clinical entities. Diagnosis and treatment of TOS involves neurologists, family physicians, orthopedic surgeons, physiatrists, vascular surgeons, thoracic surgeons, neurosurgeons and sometimes psychiatrists. It is generally accepted that TOS is caused by compression of brachial plexus elements or subclavian vessels in their passage from the cervical area toward the axilla and proximal arm. Congenital bony structures, fibromuscular anomalies, posture may be responsible for the compression. Movements may also increase compression (McGillicudy 2004). Lack of objective confirmatory tests for TOS causes disagreement among clinicians on its true incidence. The reported incidences of TOS are ranging from 3 to 80 cases per 1000 population (Huang and Zager 2004). However there are a variety of diseases that mimic TOS (Table 1), which must be eliminated through diagnosis of TOS.

Clinical Presentation

Patients with thoracic outlet syndrome usually have aching type pain radiating from their scapula down the upper extremity. Elevation of arm, trauma, carrying heavy objects increases the pain. Pain is usually accompanied by numbness, tingling, weakness, swelling, coolness and discoloration (Roos 1999).

TOS is more commonly observed in women, and the onset of symptoms usually occurs between 20 and 50 years of age. But sometimes it can be diagnosed even in children (Vercellio et al. 2003). Huang and Zager reported a practical approach for clinical presentation by dividing patients with TOS into three groups: 1) those with compression of the brachial plexus, also called neurogenic TOS; 2) those with compression of the subclavian vessels (either artery or vein), also called vascular TOS; and 3) those with nonspecific-type TOS, sometimes referred to as the disputed or common type of TOS, consisting poorly defined chronic

pain syndrome with features suggestive of brachial plexus involvement (Huang and Zager 2004). In some cases the neurological and vascular components may coexist. The neurogenic type of TOS is seen clinically more common than vascular TOS. The nonspecific-type TOS refers to a large group of patients with unexplained pain in the arm, scapular region, and cervical region (Huang and Zager 2004). Patients' symptoms are frequently triggered by a trauma such as a motor vehicle accident. The diagnosis of nonspecific-type TOS depends on the presence of provocative reproduction of symptoms as well as the absence of any other specific diagnosis. Actually, TOS has sometimes been blamed to be overdiagnosed and sometimes just the opposite. And occasionally it may overlap with other entrapment syndromes. The question if entrapment neuropathies exist together always remains. Seror et al. (2005) evaluated 100 female patients diagnosed with carpal tunnel syndrome (CTS) for incidence of TOS both clinically and electrodiagnostically. They resulted that none of the patients had evidence of TOS and there is no link between CTS and TOS.

Anatomy

The neurovascular bundle (brachial plexus trunks and the subclavian vessels) courses from the base of the neck towards the axilla and the proximal arm. The first important narrow one is the most proximal, the interscalene triangle. The interscalene triangle is bordered by the anterior scalene muscle anteriorly, the middle scalene muscle pos-

Table 1: Differential diagnosis of thoracic outlet syndrome.

Cervical disc disease
Cervical facet disease
Maglinancies (Pancoast tumor, local tumors; eg. nerve sheath tumors, spinal cord tumors)
Peripheral nerve entrapments (ulnar and/or median nerve entrapment)
Brachial plexitis
Shoulder pathology (e.g. rotator cuff injuries)
Muscular spasms, fibromyalgia
Neurologic disorders (multiple sclerosis)
Chest pain, angina
Vasculitis
Vasospastic disorder (Raynaud disease)
Neuropathic syndromes of upper extremity (complex regional pain syndrome I, II)

Table 2: The provocative clinical tests in the diagnosis of thoracic outlet syndrome.

Adson Test: With the patient in the seated position radial pulse is palpated. The patient is instructed to rotate his head and elevate his chin to the tested side. If there is a decrease or absence of pulse the test is positive showing that vascular component of neurovascular bundle is compressed by scalenus anterior muscle or cervical rib.

Costoclavicular Test: With the patient in the seated position radial pulse is palpated. The patient is told to force his shoulders posteriorly and hyperflex his chin. If there is a decrease or absence of pulse, the test is positive showing that vascular component of neurovascular bundle is compressed between the clavicle and the first rib.

Wright's Test: With the patient in the seated position radial pulse is palpated. And the arm is hyperabducted. If there is a decrease or absence of pulse the test is positive showing that axillary artery is compressed by either pectoralis minor muscle or coracoid process.

Traction Test: With the patient in the seated position radial pulse is palpated. And the arm is tracted. The test is performed for both sides. If there is a decrease or absence of pulse on one side the test is positive suggesting that cervical rib must be evaluated.

Halstead Maneuver: With the patient in the seated position radial pulse is palpated. While tracking the arm the patient is asked to hyperextend his head. The test is performed bilaterally. If there is a decrease or absence of pulse on one side the test is positive suggesting that cervical rib must be evaluated or there is compression at scalenus anterior muscle.

teriorly, and the medial surface of the first rib inferiorly. The trunks of the brachial plexus and the subclavian artery are located in this triangle. The costoclavicular triangle is bordered anteriorly by the middle third of the clavicle, posteromedially by the first rib, and posterolaterally by the upper border of the scapula. And the third one is the subcoracoid space beneath the coracoid process. The brachial plexus and its elements can be compressed in any of the above mentioned anatomical areas. However in most of the cases the compression seems to be within the interscalene triangle.

Etio-pathology

Cervical ribs, anomalous muscles, and fibrous bands may constrict this triangle further. Fibrous bands are a more common cause of TOS than rib anomalies (Charon et al. 2004, Huang and Zager 2004). The anomalous bands may originate from a cervical or rudimentary 1st thoracic rib, C₇ vertebra, the suprapleural membrane or the scalene muscles. Motor vehicle accident or repetitive trauma to the plexus elements, which may occur in a variety of occupations such as sports, and hobbies, are thought to play an important role in the pathogenesis of TOS and its occurrence (Roos 1999). Trauma and repetitive micro-trauma seems to have important role in the pathogenesis. Sanders et al. (1990) and Machleder et al. (1986) evaluated scalene muscles after trauma in different studies. They both found similar hystopathological changes after trauma.

Diagnosis

The diagnosis of TOS can be made by history, physical examination, provocative tests, ultrasound, radiological evaluation and electrodiagnostic evaluation. It must always kept in mind that TOS diagnosis is usually confirmed by elimination of other causes with similar clinical presentation. Especially differential diagnosis of cervical radiculopathies and upper extremity entrapment neuropathies can be hard (McGillicuddy 2004).

The provocative tests (e.g., Adson test, Table 2) are themselves nonspecific. There are no reliable provocative tests, however certain provocative maneuvers, e.g. 90° abduction and external rotation like in EAST sign has predictive value (Roos 1999) in screening. Gillard et al. evaluated 48 thoracic outlet syndrome patients with provocative tests, ultrasound, electrophysiologic tests and computed tomography for diagnosis. In their survey, they found that provocative tests; Adson test and hyperabduction test had 72 % and 53 % specificity and sensitivity, respectively (Gillard et al. 2001). EAST test is 3 minutes elevated arm stress test. Roos describes that light exercise in 90° abduction and external rotation causes maximum compression of the brachial plexus and subclavian vessels by narrowing the costoclavical space. Tinel's sign over the supraclavicular fossa also seems to be important (Roos 1999).

Nerve conduction studies and electromyography are often helpful as components of the diagnostic evaluation of patients with suspected TOS. Nerve conduction studies usually reveal decreased ulnar

sensorial potentials, decreased median action potentials, normal or close to normal ulnar motor and median sensorial potentials (Huang and Zager 2004). Vascular TOS can be identified with venography and arteriography. Paget-von Schrotter syndrome (thrombosis of the subclavian vein) is usually seen in younger men associated with hard work. Patients often present with edema and cyanosis of the upper extremity or distended superficial veins of the shoulder and chest. Compression of the subclavian artery also occurs in young adults with too much arm activity. Pallor, pulselessness, and coolness usually accompany it. Decreased blood pressure greater than 20 mmHg in the affected arm compared with the contralateral arm is often a reliable indicator of arterial involvement. Duplex ultrasonography, magnetic resonance arteriography, computed tomographic angiography, and arteriography is used to confirm the diagnosis (Huang and Zager 2004, McGillicuddy 2002, Wilborn 1999).

Besides the electrophysiological studies, imaging studies can provide useful information in the diagnosis of TOS. Cervical spine and chest x-rays are important in the identification of bony abnormalities, cervical ribs or prominent, often "peaked" C₇ transverse processes. Cervical ribs are reported in approximately 10 % of patients with TOS. The estimated incidence of anomalous ribs as revealed by routine chest x-rays in the general population varies from less than 0.01 % to 0.5 % (Charon et al. 2004, Huang and Zager 2004). However, most cervical ribs are asymptomatic.

Magnetic resonance imaging and computed tomography are more useful for the identification of tumors or degenerative diseases of the cervical spine rather than to establish the diagnosis of TOS.

Treatment

For most patients with TOS, common practice is to offer a course of conservative treatment. Conservative management includes modification of behaviors by avoiding provocative activities and arm positions, physical therapy programs that strengthen the muscles of the pectoral girdle and help to restore normal posture (Lindgren 1997, Novak et al. 1995). The reported improvement with conservative management of TOS ranges from 50 to 90 % (Wilborn 1999, Novak et al. 1995, Kenny et al. 1993, Aligne and Barral 1992).

Definitive treatment involves surgical decompression of the subclavian artery or vein and reconstruction of the damaged vessel if needed.

Despite surgery recurrence of TOS may be seen clinically, usually in a low ratio. Ambrad-Chalela reported 17 recurrence cases of neurogenic TOS after surgery of 500 patients. Surgical techniques, limits of excisions are important determinants in success of surgery (Ambrad-Chalela et al. 2004). Degeorges et al. also reviewed 155 TOS patients who underwent surgery (a total of 176 cases). They performed first rib resection with/without anterior scalenus muscle, fibrous and muscular structures depending on the cases. They resulted in 49.4 % excellent and 34.6 good functional recovery in a mean follow-up of 7.5 years (Degeorges et al. 2004).

From hypothetical point of view, regional steroid injections, local anesthetic injections, heparin injections may be alternative treatment options. However there are no published data on the topic.

Conclusion

The diagnosis of TOS requires both appropriate clinical and investigative findings. Symptoms are complicated and may overlap with the symptoms of other cervical pathologies. The first step toward diagnosis is keeping in mind the existence of TOS. The lack of definite diagnostic tools brings the necessity of a detailed examination of patients, consultation with other disciplines, elimination of other possible causes and using sophisticated diagnostic techniques in certain cases.

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