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DESCRIPTION

Thoracic outlet syndrome (TOS) occurs when nerves and/or vessels are compressed in the core of the neck resulting in problems with nerve and vascular functions, both locally and distally (Ruckley, 1983). TOS has a number of possible origins including pressure due to a cervical rib, a defect in the clavicle or first rib, an aneurysm, a tumor, problems with the anterior scalene muscle, a contraction of the costoclavicular space, and/or other space-inhabiting lesions (Woods, 1978). Consequently, compression occurs at different areas including the thoracic outlet, the cubital tunnel, the carpal tunnel, and Guyon's canal. In some cases, several points of compression may occur between the cervical spine and hand with less pressure producing symptoms in each area. In fact, multiple crush syndrome exists when a patient has concomitant TOS, carpal tunnel syndrome, and ulnar nerve compression at the elbow (Urchel & Kourlis, 2007).

Women, particularly those who are slim and/or have dropping shoulders, are more likely to have TOS than men (Ruckley, 1983). According to Woods (1978), 71% of the cases he reviewed were women, while 29% were men. In addition, the range of the patients' ages was 10-84, with 37 being the mean (Woods, 1978).

NEUROPATHOLOGY/PATHOPHYSIOLOGY

As suggested, TOS originates from compression of nerves or blood vessels, or both, because of a disruption of the passageway through the area between the base of the neck and the armpit known as the thoracic outlet. The anatomical location of the thoracic outlet is surrounded by muscle (e.g., anterior scalene muscle), bone (e.g., clavicle or ribs), and other tissue. Any defect or alteration of these tissues that infringes upon the thoracic outlet, thereby compressing the nerves (i.e., brachial plexus) and/or vessels (subclavian artery and veins) that pass through the tunnel leads to TOS. Given that this can occur at different sites from different tissues, functional outcomes can vary, therefore TOS may be best classified as an umbrella diagnosis representing an entire group of disorders.

Eighty to 90% of TOS cases are comprised of neurological defects, which occur more in women, whereas vascular compression occur more in men. However, vascular symptoms present more serious health issues, as irreversible hand injury and damage to the entire arm may occur. Neurological symptoms are usually less critical, as an aching pain in the neck, arm, and/or shoulder is most often reported (Ruckley, 1983).

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Thoracic outlet syndrome (TOS) is the name given for a spectrum of symptoms caused by compression of the brachial nerve plexus, which innervates...

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A condition that is due to compromise of blood vessels or nerve fibers between the armpit (axilla) and the base of the neck, because of compression

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The compression against the first rib causes several vascular and nerve problems including edema, venous distension, Paget-Schroetter's syndrome, loss of a pulse, aneurysm, paresthesias, motor weakness, Raynaud's phenomenon, ischemia, and temperature changes (Urchel & Kourlis, 2007).

In a study by Urchel and Kourlis (2007), no patients died due to TOS. One of the main complications occurred when the remains of a rib were left in the first surgery, which caused TOS to recur. In very few patients, a large amount of bleeding, nerve injuries, and Horner's syndrome occurred. In their study on 5,102 patients with TOS, Urchel and Kourlis (2007) found that the outcome was good in 85%, fair in 12%, and poor in only 3%. In addition, 95% of the patients reported progress shortly after surgery (Urchel & Kourlis, 2007).

Repetitive motions, especially of the hands and shoulders, often cause TOS. Clavicular trauma from pregnancy, polio, and bad posture can also cause TOS. Furthermore, breast surgery, such as radical mastectomies and implants, can contribute to TOS. Two other causes include hypertrophy and extreme opening of the median sternotomy retractor (Urchel & Kourlis, 2007). The most common cause of TOS is a neck injury resulting from an auto accident, which accounted for 61% of the 459 cases Woods (1978) reviewed. More specifically, rear-end collisions, resulting in a whiplash injury accounted for 44% of the cases. Industrial accidents were responsible for 23% of the TOS cases, and miscellaneous trauma accounted for 8% (Woods, 1978).

NEUROPSYCHOLOGICAL/CLINICAL PRESENTATION

Woods (1978) reviewed 459 patients with TOS, documenting the various symptoms that appeared related to the disorder. There were several symptoms that occurred in the majority of TOS patients, such as arm pain, neck pain/stiffness, numbness and tingling of the hand, weakness of grip, and anterior scalene pressure (Woods, 1978). These represent the hallmark symptoms that correspond with the anatomical abnormalities of TOS impacting the subclavian artery and/or veins and the brachial plexus. In comparison, the clinical presentation in vascular TOS is usually acute, and depends upon whether the compression is arterial or venous (Sessions, Ranavaya, & Brooks, 2002).

Beyond those sensory and motor symptoms noted above, Woods (1978) reported several neuropsychological effects the disorder had on his patients. Forty-eight percent reported postural vertigo, 44% reported blurred vision, 54% reported retro-orbital pain, and 31% reported problems with concentration, focusing, and memory. Moreover, 85% reported occipital headaches, 18% stated their gait had become unsteady, while 11% reported syncopal attacks. All of these were due to vertebral artery compression (Woods, 1978). Sessions et al. (2002) present the number of cases with TOS who have headaches that initiate in the occipital lobe, and then spread over the rest of the cranium, becoming global tension headaches. Although it is uncommon, the cephalalgia is hemicranial and can cause unilateral facial pain on the side of the TOS; these can become more painful than the upper extremity symptoms (Sessions et al., 2002).

Fields, Lemak, and Ben-Menachem (1986) identified several neurological effects due to TOS in a major-league baseball pitcher. His depth perception as well as his ability to transfer two-dimensional displays into three-dimensional displays was impaired. A neuro-ophthalmologic evaluation divulged no left visual field deficit, but during testing, the most frequent error the baseball pitcher made was the rotation of objects in space, which affected his ability to catch the balls returned on his left side by the catcher. When presented with a stimulus from both sides, he was unaware of the object in his left visual field. The neuro-ophthalmologic assessment also showed the presence of an incongruous upper left homonymous quadrantanopia, as well as acquired myopia secondary to ciliary spasm. Moreover, he also experienced weakness on the left side of his face (Fields et al., 1986).

The frustration involved with trying to obtain successful treatment may cause patients to lose motivation, and often there are deficits in their home, work, and social lives. More specifically, many patients reported difficulties styling their hair, driving, opening jars/bottles, and completing household chores such as vacuuming (Sessions et al., 2002).

DIAGNOSIS

Accurate diagnosis of TOS must include a history of the patient and physical examination (Urchel & Kourlis, 2007). Woods (1978) discusses the necessity of a psychological evaluation, because each TOS case requires legal attention that is often complicated by the fact that patients commonly suffered from financial losses due to disability (Woods, 1978). Many tests are used to diagnose TOS including EMG, nerve conduction velocity (NCV), and cervical spine and chest radiographic studies, such as MRI (Urchel & Kourlis, 2007). Radiographs of the cervical spine should be employed in all TOS patients (Ruckley, 1983). Urchel and Kourlis (2007) found that when the NCV moved down to less than 85 m/s of the median or ulnar nerves across the thoracic outlet, the patient had TOS. Such methods are essential when attempting to differentiate TOS from those presentations that may demonstrate some degree of clinical overlap including but not limited to brachial neuritis, carpal tunnel syndrome, cervical radiculopathy, peripheral neuropathy, reflex sympathetic dystrophy, and rotator cuff instability. Connective tissue diseases or infections may also be considered.

TREATMENT

Many TOS patients, especially those with an NCV surpassing 60 m/s, benefit from physical therapy; however, those with motor and vascular nerve difficulties cannot undergo physical therapy. Physical therapy serves to improve posture, strengthen the shoulder, loosen the muscles in the neck, and allow for space between the first rib and the clavicle. Patients may also need to modify their sleep and work habits, and lose weight (Uchel). Woods (1978) treated his patients with TOS with medications,

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such as muscle relaxants, anti-inflammatory drugs, and ibuprofen. Almost one-fourth of his patients received physiotherapy, which proved beneficial in about 50% of the cases. In some of his patients, Woods also used transcutaneous electrostimulation, which temporarily relieved the pain for some of these patients (Woods, 1978).

Surgery might be necessary if patients have an NCV of less than 60 m/s (Urchel & Kourlis, 2007). Due to the possibility for severe complications, surgery should be carried out by a well-qualified and experienced surgeon (Ruckley, 1983). According to Urchel and Kourlis (2007), surgery first entails anterior scalenectomy, neurolysis of C7, C8, and T1 nerve roots and brachial plexus, first rib resection, and resection of the costoclavicular ligament. Patients with pseudo recurrences and real recurrences required a second procedure (Urchel & Kourlis, 2007).

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