



Anterior scalene injections in the treatment of the disputed type thoracic outlet compression syndrome

Tartışmalı tip torasik çıkış kompresyon sendromu tedavisinde anterior skalen enjeksiyonların rolü

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Objectives: We evaluated the efficacy of anterior scalene injections added to treatment with exercise and medications in patients with the disputed type thoracic outlet compression syndrome (TOCS).

Patients and methods: The study included 60 patients (55 females, 5 males; mean age 34 years; range 20 to 54 years) who were clinically diagnosed as disputed type TOCS. The main complaint was generalized pain in the upper extremity and neck in 42 cases (70%) and shoulder pain in 18 cases (30%). The average duration of symptoms was 11 months (range 15 days to 6 years). The patients were randomly divided into two groups. One group (30 patients, 38 extremities) was prescribed a home exercise program with proper medications, while the other (30 patients, 40 extremities) additionally received corticosteroid injections into the anterior scalene muscle. The results were evaluated with the use of a visual analog scale (VAS) before treatment and after the first, third, and sixth weeks, and then, the third and sixth months of treatment.

Results: The mean VAS scores of the two groups were similar before the treatment. Compared to the exercise group, significantly lower mean VAS scores were observed in the injection group in the first, third, and sixth weeks ($p<0.001$). However, the difference was not significant in the third and sixth months ($p>0.05$). The mean VAS scores obtained before the treatment and at the end of the follow-up showed a significant improvement in both groups ($p=0.001$).

Conclusion: We recommend anterior scalene injections during acute exacerbations of the disease for pain control and relief in patients with the disputed type TOCS.

Key words: Exercise therapy; injections, intramuscular; methylprednisolone; neck muscles/pathology; posture; thoracic outlet syndrome/therapy; treatment outcome.

Amaç: Bu çalışmada, tartışmalı tip torasik çıkış kompresyon sendromlu (TÇKS) hastalarda egzersiz ve ilaç tedavisine eklenen anterior skalen enjeksiyonların etkinliği değerlendirildi.

Hastalar ve yöntemler: Çalışmaya klinik olarak tartışmalı tip TÇKS tanısı konan 60 hasta (55 kadın, 5 erkek; ortalama yaş 34; dağılım 20-54) alındı. Hastaların başvuruda ana yakınmaları üst ekstremiteler ve boyunda ağrı ($n=42$, 70%) ve omuz ağrısı ($n=18$, 30%) idi. Semptomların ortalama süresi 11 ay (dağılım 15 gün-6 yıl) bulundu. Hastalar randomize olarak iki gruba ayrıldı; bir gruba (30 hasta, 38 ekstremiteler) bu hastalık için tasarlanmış ev egzersizi ve uygun ilaç tedavisi uygulanırken, diğer gruba (30 hasta, 40 ekstremiteler) bu tedaviye ek olarak anterior skalen kortikosteroid enjeksiyonu uygulandı. Sonuçlar, tedavi öncesinde ve tedavinin birinci, üçüncü ve altıncı haftalarında, daha sonra da üçüncü ve altıncı aylarda görsel analog skala (GAS) ile değerlendirildi.

Bulgular: Tedavi öncesinde iki grubun ortalama GAS skorları benzer bulundu. Enjeksiyon yapılan grupta ortalama GAS skorları birinci, üçüncü ve altıncı haftalarda egzersiz grubuna göre anlamlı düşme gösterdi ($p<0.001$). Ancak, üçüncü ve altıncı aylardaki skorlar açısından iki grup arasında anlamlı farklılık bulunmadı ($p>0.05$). Her iki gruba da, tedavi öncesine göre, izlem sonunda elde edilen GAS skorları anlamlı düzelme göstermekteydi ($p=0.001$).

Sonuç: Tartışmalı tip TÇKS'li hastalarda, hastalığın akut alevlenmeleri sırasında ağrı kontrolü ve rahatlama sağlamak amacıyla anterior skalen enjeksiyonlarını öneriyoruz.

Anahtar sözcükler: Egzersiz tedavisi; enjeksiyon, intramusküler; metilprednizolon; boyun kasları/patoloji; postür; torasik çıkış sendromu/tedavi; tedavi sonucu.

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The disputed type neurogenic thoracic outlet compression syndrome (TOCS) is a common cause of chronic upper extremity pain which may cause considerable disability. Atasoy^[1] claimed that 20% to 25% of all patients referring to a hand surgery clinic had a positive history or findings of TOCS. Unfortunately, as the name implies, the diagnosis and, thus, treatment of the disease is disputed. While some authors report high incidences, some do not believe its existence.^[1] In either way, there is a group of patients suffering from chronic upper extremity pain and seeking treatment. The disputed type TOCS does not convey positive objective findings and no specific test is available for diagnosis. Diagnosis is via described provocative tests. Yet, misdiagnosis is common. Recalcitrant cases diagnosed as carpal tunnel or cubital tunnel syndrome, epicondylitis, rotator cuff tendinitis, impingement syndrome, or cervical radiculopathy should be evaluated for the presence of double crush syndrome secondary to TOCS. There are many treatment options like postural exercises, strengthening and stretching exercises, physiotherapy modalities, nonsteroid anti-inflammatory, muscle relaxant and antidepressant medications, anterior scalene injections, and finally surgical decompression.

This study was designed to test the effectiveness of anterior scalene injections compared to the exercise and medication programs in patients with the disputed type TOCS.

PATIENTS AND METHODS

The study included 60 patients (55 females, 5 males; mean age 34 years; range 20 to 54 years) who were diagnosed as disputed type TOCS. Of these, 42 patients had work which required them to spend most of their time against a computer. The main complaint was generalized upper extremity and neck pain in 42 cases (70%) and shoulder pain in 18 cases (30%). The average duration of symptoms was 11 months (range 15 days to 6 years). All the patients had myofascial trigger points either at the upper trapezius, levator scapulae, or the rhomboids. Eighteen cases (30%) had bilateral symptoms. Complaints were in the right extremity in 24, and in the left extremity in 18 cases. Symptoms and signs are summarized in Table I.

Inclusion criteria were upper extremity pain with positive Roos and Wright tests, and exacerbation

of symptoms with digital anterior scalene compression. Exclusion criteria included patients who had (i) objective findings of neurological or vascular compression suggesting true neurogenic type TOCS; (ii) signs of shoulder impingement, rotator cuff problems, or instability findings; (iii) a positive Spurling sign indicating a cervical disc pathology; and (iv) findings of objective carpal tunnel or cubital tunnel syndrome suggesting double crush syndromes. Since the diagnosis of the disputed type TOCS is mainly a matter of exclusion we tried to rule out all disorders in the differential diagnosis list.

Anteroposterior cervical and posteroanterior chest radiographs were obtained to determine the presence of apophysomegaly of the transverse process of the seventh cervical vertebra and cervical ribs, and to rule out Pancoast tumors. Four patients (7%) had bilateral, and two patients (3%) had unilateral cervical ribs. Apophysomegaly was detected in 32 cases (53%). There were no Pancoast tumors.

The patients were randomly divided into two groups in order of referral, i.e. one in every two referrals was included in the injection group. Group 1 consisted of 38 extremities of 30 patients, and group 2 consisted of 40 extremities of 30 patients. Group 1 was assigned to postural recommendations (work-hygiene), nonsteroid anti-inflammatory and muscle relaxant medications, and the exercise program described by Lindgren.^[2] The exercise program was continued at home for six months and the patients were called by phone twice a month to increase their motivation to keep up with the treatment program.

Group 2 was assigned to receive, in addition to the treatment regimen of group 1, anterior scalene intramuscular injection of 40 mg of methylprednisolone acetate in 3 ml of 0.5% bupivacaine HCl. The injection was made as described by Atasoy.^[1] The point of entry was 1.5 inches proximal to the clavicle at the lateral border of the sternocleidomastoid muscle. After penetration into the skin, multiple areas of the muscle were infused. Prior to every push on the piston of the injector, aspiration was attempted to avoid injection into the external jugular vein. Palpation of the anterior scalene muscle during the procedure ensures intramuscular delivery and avoidance of injury to the phrenic nerve.

TABLE I
The symptoms and signs of the patient group

		No. of extremities	Percentage (%)
Symptoms	Pain with hyperabduction of the arm	78	100
	Fatigue with hyperabduction of the arm	78	100
	Pain with lifting an object of moderate weight	66	85
	Night pain	57	73
	Chest pain	32	41
	Feeling of coldness of the hand	19	24
	Difference in colors of the hands	12	15
	Paresthesia at ulnar side of the hand	56	72
	Paresthesia in the whole hand	24	31
Signs	Upper thoracic postural kyphosis & cervical lordosis	52 of 60 patients	87
	Roos test	78	100
	Wright test	78	100
	Coracoclavicular compression test	42	54
	Halstead maneuver	41	53
	Cervical rotation lateral flexion test	24	31
	Anterior scalene tenderness	67	86
	Anterior scalene compression test	78	100

Since the only symptom of the disputed type TOCS is pain and since the syndrome lacks positive findings, the most objective evaluation method was to use a visual analog scale (VAS). Before the treatment, all the patients were asked to place their pain on a 101-point VAS. This procedure was repeated in the first, third, and sixth weeks, and then, in the third and sixth months.

RESULTS

Temporary hypoesthesia, lasting 4 to 6 hours, at the ulnar nerve distribution was encountered in nine (23%) of the scalene injected extremities. In one case, blood was aspirated from the jugular vein, which required to change the injection site immediately. A supraclavicular hematoma formed and then resolved spontaneously in a week without giving any discomfort to the patient. Temporary dysphagia and sympathetic block developed in two patients, respectively. Ten patients experienced temporary dizziness during 3 to 5 minutes after the procedure, which we believed was of anxiety. There were no incidences of pneumothorax or dyspnea. Seven patients had relief with injection, but the pain started to increase one week later. To these patients, another injection was given in the first week. The average VAS scores are given in Table II. On nonpara-

metric and parametric statistical assessment, no significant difference was found between the VAS scores of group 1 and 2 at the referral time (Wilcoxon test, $p=0.191$; t-test, $p=0.167$). Comparison of the two groups in the first, third, and sixth weeks showed significantly lower mean VAS scores for each time interval in group 2 ($p<0.001$, Wilcoxon test and t-test). However, the difference between the mean VAS scores of the two groups was not significant in the third and sixth months ($p>0.05$). Comparison of the mean VAS scores obtained before the treatment and at the end of the follow-up (6th month) showed a significant improvement in both groups (Wilcoxon test, $p=0.001$; t-test, $p=0.001$).

TABLE II

	Visual analog scale (VAS) scores of the extremities			
	Group I (n=38)		Group II (n=40)	
	Mean VAS	Range	Mean VAS	Range
Referral	75	40-100	79	60-100
1st week	58	20-90	24	0-70
3rd week	62	10-95	22	0-80
6th week	53	0-90	36	0-90
3rd month	64	15-90	58	0-100
6th month	62	0-100	65	0-100

DISCUSSION

Thoracic outlet compression syndrome is classified by Wilbourn and Porter^[3] as vascular and neurogenic. The neurogenic type can either be true neurogenic with objective findings such as sensory and motor loss or muscular atrophy, or disputed with symptoms suggesting neural compression in the absence of objective findings. The latter is a common disorder which is frequently underdiagnosed. Its incidence is thought to be 1% to 2%.^[11] There is no diagnostic gold standard tool and the diagnosis remains clinical and is mostly exclusive. Many treatment modalities exist, including exercise, physiotherapy agents, nonsteroid anti-inflammatory, muscle relaxant, and antidepressant medications, orthoses, work hygiene, postural exercises, and recommendations. With an exercise program implemented during hospitalization for 4 to 24 days and at home following discharge, Lindgren^[2] achieved satisfactory results in 88%.

We prescribed nonsteroid anti-inflammatory medications and muscle relaxants to all the patients. We gave recommendations to correct the posture at work, to apply local massage and heat to myofascial trigger points, to avoid exacerbating activities such as hyperabduction or heavy weight lifting. We started the exercise program described by Lindgren^[2] on an outpatient basis. To enhance motivation to continue the exercise program, we made our nurse, who also was a patient of this study, call the patients every two weeks. We observed that the typical TOCS patient was a middle-aged woman who worked against a computer and had very little daily physical activity and time for regular physical activity. It was very difficult for this group of patients to pursue a long-term exercise program. To solve this difficulty, Lindgren^[2] first enrolled the patients in an inpatient rehabilitation program for an average of 11.4 days. We feel that this may not always be feasible because of the frequency of the disease and on economic grounds. In our series, the patients were generally unwilling to continue the exercises for prolonged periods. They were either doing the exercises 7 to 10 days after our initiative calls or when their symptoms exacerbated.

The anterior and middle scalene muscles are blamed to play a major role in the pathophysiology of TOCS. Both muscles are inserted to the first rib and function to elevate it during respiration and

neck movements. These insertions sometimes overlap forming a V or combine forming a U, which in both cases create a narrow space for neurovascular structures.^[11] Inflammation, scarring, spasms, and contracture of the scalene muscles have been reported.^[4] Most of the exercises prescribed for TOCS aim to stretch and relax these muscles. We believe that corticosteroid injections act in a similar way reversing the inflammatory changes.

Anterior scalene injections under electromyographic control were used by Jordan and Machleder^[5] to predict outcome of surgical treatment for TOCS. They found a correlation between the better results of surgical treatment and the cases who responded to injections. Their study group consisted of patients waiting for surgical decompression; i.e. mostly true neurogenic and vascular types which form a very little percentage of patients with TOCS. The disputed type is more common, and since the severity of compression is less, better results can be expected after injections. We obtained relief with injections in nearly all cases, but the duration of relief varied considerably. The complications were minor and temporary, which, we believe, makes electromyographic guidance unnecessary.

In the first group, despite significant decreases in the overall VAS scores, the patients were not satisfied with the results. They were relatively more comfortable during the time when they were on medication, but as soon as they were to perform some exertion, the symptoms recurred and continued for several days. In comparison to group 1, group 2 patients showed significant decreases in VAS scores between the first and sixth weeks. However, in the third and sixth months, the differences between the two groups were insignificant.

From the history of the patients, one point should, we believe, be emphasized. Some patients who had symptoms for more than a year reported that they had been relatively more comfortable during some part of their lives when they had performed regular exercises, especially swimming or fitness.

A reasonable treatment program can be implemented covering the use of nonsteroid anti-inflammatory and muscle relaxant medications, postural recommendations, work hygiene, and regular fitness or swimming programs of long-duration. Since these are more appealing to patients than home exercises, patients may get used to them and

continue for longer periods. On the other hand, painful periods may be managed by the use of anterior scalene injections. Repeat injections also confer symptom-free intervals. A longer-lasting medication for the blocks may also increase the length of these intervals. We are currently conducting a study on botulinum toxin injections into the anterior scalene muscle.

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