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Efficacy of Collar Treatment for Patients with Cervical Spondylatrosis Complaining of Vertigo

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Abstract. Objective: Efficacy of collar treatment on clinical symptoms and vertebral blood flow was examined in 23 patients with cervical spondylartrosis complaining of vertigo. Methods: In pretreatment and posttreatment periods, the following parameters were studied: 1) frequency of cervicocephalic symptoms, 2) influence of severity of the vertigo on daily life activity, 3) range of active cervical joint movement, 4) pain in cervical palpation, 5) vertebral blood flow by Doppler ultrasonography, and audiologic and brainstem auditory evoked potential (BAEP) examinations for hearing. Results: Following 1 month of collar treatment, vertigo and amnesia were the only symptoms which were significantly relieved ($p=0.01$, $p=0.03$). In addition, the severity of the symptoms were noticeably decreased. Range of cervical joint movements on extention, lateral flexion and rotation were increased. Cervical palpation was reduced and the pain was less. However, no change was observed in vertebral blood flow, audiometric and BAEP examinations. Conclusion: It was concluded that vertigo in cervical spondylartrosis was not a consequence of vertebrobasillar insufficiency. Hypertonicity in cervical muscles was the primary reason for vertigo in these patients.
Key words: Spondylartrosis, Vertigo, Therapy.

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INTRODUCTION

Cervical spondylartrosis is a clinical entity caused by degeneration of the structures of the cervical vertebral column. Primary pathological alterations consist of degeneration of intervertebral disks, hypertrophy of joint facets and laminae of the vertebrae and segmental instability in the vertebral column. Clinical symptoms can be classified as local cervical syndrome, cervicobrachial syndrome, cervicocephalic syndrome and cervicome dullary syndrome according to where the pathological changes occur[1)].

Vertigo defined as the illusory sensation of unidirectional movement is included in the cervicocephalic syndrome group[2)]. It is claimed that vertebrobasillar insufficiency caused by compression of the vertebral artery by osteophytes on the cervical vertebral is a predominant factor for vertigo[1)]. That the sudden onset vertigo is the most frequent symptom experienced by the patients with vertebrobasilar insufficiency seems to support this[3, 4)]. In addition, other neurological symptoms such as motor dysfunction, visual loss, diplopia and dysartria are often associated with vertigo[5)]. However, vertigo may also occur in the absence of other symptoms. This might lead to misdiagnosis of vertigo with peripheral vestibular disorders. This

suggests complete differential diagnosis.

Treatment modalities in cervical syndromes consist of heat application, collar treatment, medication use, massage, electrotherapy and traction, and exercises[1]. Cervical collar treatment is said to be effective at reducing the compression of the vertebral artery by fixing and distracting the cervical spine[1, 5]. However, the effect of collar treatment on vertebral blood flow has not been studied exhaustively.

In this study we examined the efficacy of collar treatment in cases of cervical spondylartrosis with vertigo and whether the vertebral blood flow increases after collar treatment.

MATERIALS AND METHODS

Patients with neck pain, limitation of neck movements and vertigo were included in the study. Complete otorhinolaryngologic, neurologic and locomotor system examinations were performed. Only the patients with vertigo caused by cervical spondylosis were included.

Age, gender and occupation of the patients were recorded. We also asked patients about the occurence of headache, vertigo, amnesia, drop attack, nausea, pain in the eye, blurring of vision, flittering scotoma, paresthesia in the face, dysphagia, hypoacusia, tinnitus, and earaches.

The duration of the complaints at the cervical region were ascertained and the severity of the complaints were graded according to a visual analog scale (VAS) and the effects of the symptoms on the activities of daily living (ADL). Symptoms which did not have any effect on ADL were grouped as mild, symptoms restricting the ADL partially were grouped as intermediate, and symptoms restricting the ADL partially were grouped as intermediate, and symptoms restricting the ADL totally were grouped as severe[6]. Based on the patient decleration, the severity of the symptoms were graded on a 10 cm line, on which 0 denoted the absence of symptoms and 10 denoted the most severe.

Active range of motion (ROM) in the cervical spine was evaluated by examination of flexion, extension, right/left rotation and right/left lateral flexion movements. Restriction of the active ROM was defined as mild if it was greater than 75%, intermediate if it was between 25% and 75%, and severe if it was less than 25%. The value of the side most influenced was utilized in the analysis.

The cervical region was examined by palpating the superior nuchal ligament, zygapophyseal joints, spinous processes, paracervical muscles and Amold's region. the VAS might lead to misinterpretations since pain can radiate in neck pathologies and it can be localized at various regions[7]. Thus the severity of the pain was classified as absent, mild, intermediate, slightly severe and severe. The most painful values were utilized in the analysis.

Accompanying radicular symptoms were evaluated by the Spurling test. Differential diagnosis was carried out by using the Adson test, shoulder depression test, and Roos test. Patients with negative test results were included in the study.

Postural abnormalities at the neck were evaluted as normal or abnormal.

Hearing of the patients was evaluted by audiometric examination using an Interacoustics clinical audiometer AC 40. In order to eliminate possible causes of conduction type hearing loss, tympanometric examination was performed using an Interacoustics impedance audiometer AZ 26. Brainstem evoked response audiometry (BERA) was also carred out and 1–3, 3–5 and 1–5 interpeak latencies were recorded.

Bilateral vertebral artery flow volume was measured by Doppler ultrasonographic (US) examination (Hewlett-Packard image point, 5–10 mHz multifrequency linear transducer). Doppler US was performed in a supine position with the head in a neutral position. Centralizing the 7th cervical vertebra, conventional radiographic examination was studied in the antero-posterior, lateral, right and left oblique positions. Radiographs were blindly evaluated using Kellgren and Lawrence scales[8]. Patients with osteoarthrosis scored 2 or more were included in the study.

Sedimentation rate, complete blood count, routine biochemistry and urine analysis were performed. Patients who had normal values were included.

Patients were instructed to use a cervical rigid collar along with isometric excercises 10 times, twice a day. Prior to the excercises, hot pack application was recommended. Patients who completed the recommended treatment scheme successfully after 4 weeks, were re-evaluted by clinical, audiologic and Doppler US examinations. Adjuvant medical treatment was not given during

Table 1. Frequency of the cervicocephalic symptoms

Symptoms	Pre-treatment	Post-treatment	P value
Headache	16 (69.6%)	12 (52.2%)	0.12
Vertigo	23 (100%)	16 (69.6%)	0.01*
Amnesia	16 (69.6%)	10 (43.5%)	0.03*
Drop attack	1 (4.3%)	0	1.0
Nausea	11 (47.8%)	8 (34.8%)	0.45
Pain in the eye	6 (26.1%)	3 (13.0%)	0.37
Flittering scotoma	5 (21.7%)	3 (13.0%)	0.50
Blurring of the vision	7 (30.4%)	3 (13.0%)	0.21
Hypoesthesia in face	3 (13.0%)	2 (8.7%)	1.0
Dysphagia	7 (30.4%)	3 (13.0%)	0.21
Hypoacousia	10 (43.5%)	11 (47.8%)	1.0
Tinnitus	13 (56.5%)	17 (73.9%)	0.21
Pain in the ear	4 (17.4%)	5 (21.7%)	1.0

Table 2. Evaluation of severity of complaints on the daily life activities (ADL)

Effect on ADL	Pre-treatment	Post-treatment
Absent	–	10 (43.5%)
Slight	7 (30.4%)	9 (39.1%)
Moderate	6 (26.1%)	3 (13.0%)
Severe	10 (43.5%)	1 (4.3%)

this period.

Statistical analysis of the results were performed using the Mc Nemar, Wilcoxon signed rank test and Spearman correlation analysis of the SPSS statistics computer program.

RESULTS

Twenty three patients who completed the treatment program were analyzed. Their mean age was 49.8 ± 9.14 (range, 33–68). There were 19 (82.6%) female and 4 (17.4%) male patients. Thirteen patients (56.5%) were house wives and 10 (43.5%) were working officially.

Pre- and post-treatment frequencies of the cervicocephalic symptoms and statistical analysis are listed in Table 1. After treatment, the incidence of vertigo and amnesia had decreased significantly (p: 0.01 vs p: 0.03).

The average duration of complaints was 873.87 ± 1208.75 days (7-3650). Prior to treatment the mean VAS score was 7.78 ± 1.86 but it was 3.61 ± 2.46 after treatment. The difference was statistically significant. The severity of the complaints as evaluated by their effects on the ADL are shown in Table 2. There was a significant decrease in the severity of the complaints after treatment (p: 0.0002).

Evaluation of the active ROM in the cervical spine before and after treatment are shown in Table 3. Alteration in extension, lateral flexion and rotation were statistically significant ($p<0.05$).

The presence of pain with palpation of the cervical spine before and after treatment is recorded in Table 4. There was a statistically significant difference.

The Spurling test was positive in 8 (34.7%) cases. Prior to treatment there was a postural abnormality in 2 (8.6%) cases. However, one of them attained normal posture after treatment.

Audioilogic and BAEP examinations of the

Table 3. Evaluation of range of cervical joint movement (RJM)

RJM	Flexion		Extension		Lateral flexion		Rotation	
	Pre-Tr	Post-Tr	Pre-Tr	Post-Tr	Pre-Tr	Post-Tr	Pre-Tr	Post-Tr
Slight	22 (95.7%)	23 (100%)	9 (39.1%)	17 (73.9%)	4 (17.4%)	12 (52.2%)	4 (17.4%)	12 (52.2%)
Moderate	1 (4.3%)	–	14 (60.9%)	6 (26.1%)	19 (82.6%)	11 (47.8%)	19 (82.6%)	11 (47.8%)
P value	p>0.05		p<0.05		p<0.05		p<0.05	

Table 4. Evaluation of pain with cervical palpation

Severity of pain	Pre-treatment	Post-treatment
Absent	–	6 (26.1%)
Mild	4 (17.4%)	7 (30.4%)
Moderate	7 (30.4%)	7 (30.4%)
Slightly severe	11 (47.8%)	3 (13.0%)
Severe	1 (4.3%)	–

patients and VA flow volume values are shown in Table 5. There were no statistically significant differences in the parameters studied before and after treatment.

Evaluation of the degree of the spondylartrosis of the patients according to the Kellgran and Lawrence system revealed 7 (30.4%) patients with 2nd degree, 11 (47.8%) patients with 3rd degree, and 5 (21.7%) with 4th degree. There was a statistically significant relationship between the scores in the Kellgran and Lawrence system and the age of the patients. There was no correlation between the VA volume and age, tympanometric findings, score in the Kellgren and Lawrence system, severty of the complaints (VAS) and effects of complaints on ADL, respectively.

DISCUSSION

Cervical vertebral pathology is one of the main factors in the etiology of vertigo apart from primary diseases of the labyrinth and cerebellum and brainstem. The first mechanism claimed to play a role in the pathophysiology of the vertigo in cervical diseases[9] is ischemia of the vestibular nuclei in the brainstem. This may be caused either by vasoconstriction of the vertebral arteries due to irritation of the cervical sympathetic system by osteophytes and other cervical lesions, or by decrease of the basillary arterial flow rate due to external or internal mechanical factors[1, 6, 9]. A second mechanism is an abnormality in the tonic neck reflexes. Decrease or increase of the activity in the proprioceptors localized at the neck muscles, atlantoaxial and atlantooccipital joints and the first three cervical spinal nerves can lead to abnormality in tonic reflexes in the neck.

None of the treatment modalities for the neck pathologies has a significant advantage over the others. However, it has been proposed that support for the neck is superior than traction[7]. A cervical collar causes immobilization of the cervical region, decreases mechanical stress on the joints, ligaments and muscles, decreases painful spasms by supporting muscles, relaxes the muscles, and aids rapid tissue recovery[10, 11]. Cervical immobilization prevents all movements which mechanically irritate the nerve roots and sensory receptors on the posterior longitudinal ligaments. In addition, collar treatment has the effect of warming and distracting the neck1).

In addition to collar treatment, isometric exercises are recommended to strengthen the neck muscles[1, 11]. Superficial heat application leads to relaxation of muscle spasm and if applied before exercise it helps better toleration of the exercises.

In the light of the above results we suggested a physical therapy program including a collar, superficial heat application and isometric exercises for 4 weeks. This treatment protocol resulted in a decrease of vertigo and a decrease in the severity of cervicocephalic symptoms. In addition, we observed significant improvements in active ROM at the cervical spine in rotation, lateral flexion and extension movements of the neck, and decrease in pain with cervical spine palpation. However, VA flow volume measured by Doppler US did not show

Table 5. Results of BAEP, Audiometry and VA Flow on the right and left sides

Parameter	Right		Left	
	Pre-treatment	Post-treatment	Pre-treatment	Post-treatment
I-V Interpeak latency	3.82 ± 0.27 msec	3.72 ± 0.53 msec	3.97 ± 0.30 msec	3.93 ± 0.36 msec
III-V Interpeak latency	1.74 ± 0.27 msec	1.73 ± 0.23 msec	1.76 ± 0.26 msec	1.84 ± 0.40 msec
I-III Interpeak latency	2.08 ± 0.30 msec	2.11 ± 0.30 msec	2.21 ± 0.32 msec	2.10 ± 0.23 msec
Mean air conduction	16.00 ± 11.41 dB	15.10 ± 11.70 dB	18.87 ± 19.01 dB	17.65 ± 17.57 dB
Mean bone conduction	5.52 ± 4.86 dB	5.91 ± 5.53 dB	6.43 ± 9.01 dB	7.43 ± 9.33 dB
Compliance	0.60 ± 0.35 ml	0.61 ± 0.34 ml	0.60 ± 0.34 ml	0.61 ± 0.32 ml
Middle ear pressure	48.80 ± 18.01 daPa	53.5 ± 40.04 daPa	63.48 ± 56.93 daPa	52.0 ± 44.53 daPa
VA flow volume	2.44 ± 1.10 ml	2.40 ± 0.97 ml	2.65 ± 0.67 ml	2.96 ± 1.40 ml

any significant difference. This implies that collar treatment causes recovery of vertigo by influencing reflex mechanisms rather than ischemic mechanisms. Collar treatment, superficial heat application and isometric exercises effected the tonic neck reflexes by relaxing the muscles.

In the literature, there are studies examining the effect of various physical therapy protocols on the symptoms of patients with vertebrobasillar insufficiency (VBI). Aydın et al.[6] studied the VA narrowing by magnetic resonance angiography in patients with cervical spondylosis. They found equal narrowing along the entire VA and indicated that this is a result of vasospasm of VA due to irritation of the cervical sympathetic chain. That the VAs were dilated along the entire VA after treatment was interpreted as the result of the sympathetic inhibitory effect of ultrason in moderate dosages. Nevertheless, there is no consensus on this subject. Animal studies revealed no change in the VA flow rate after stimulation of the cervical sympathetic system[9]. Strek et al.[12] found a relationship between degenerative changes of the cervical region and VA flow. However, their study lacked an analysis of the symptoms. We did not find any relation between VA flow volume and degree of degenerative changes as scored by the Kellgren-Lawrence scale.

Cerrahoglu et al.[13] treated patients with VBI with a physical therapy program composed of traction, hotpack, ultrasound and exercise. They found that after treatment VA flow was significantly improved in normal and hyperextension positions. They did not comment on the etiology of VBI.

The arterial supply of the inner ear originates from the basillar artery at the union of the two VAs in 17% of cases. This anatomic relationship indicates that any change in the VA flow might have an effect on inner ear arterial supply in some cases. It may even lead to hearing loss. It has been reported that permanent or transient decrease in blood flow in specific areas of the brain might cause dizziness and sometimes sensorineural hearing loss[3, 14, 15].

The effect of the occlusion of the vertebrobasillar arterial system on the right and left inner ear blood flow balance, and difference in blood flow disturbance of the cochlea and ampullae of the semicircular canals was examined in rats. No difference was found in either the blood flow of the bilateral cochlea and ampulla or in their ratios on both sides. There was no difference in the cochlea, ampulla ratio between control and occlusion groups. This indicated that VA occlusion did not result in a decrease in selective blood flow to the inner ear[16].

Audiometric and tympanometric evaluation of our patients revealed no difference between the pre-treatment and post-treatment hearing level. This might be explained by there being no change of VA flow volume detected in our patients before and after treatment. BAEP examination demonstrating no change before and after treatment also suppports these findings.

In conclusion, the present study indicated that collar treatment led to recovery of vertigo by way of effecting the reflex mechanism of vertigo. However, there is still a need for exhaustive studies on the etiopathogenesis of vertigo in cervical sponylosis. It is also necessary to perform studies comparing the effect of various physical therapy models on the etiologic factors of vertigo.

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