

ARAŞTIRMA YAZILARI**RESEARCH PAPERS****THE EFFECT OF PHYSICAL THERAPY ON VERTEBROBASILAR INSUFFICIENCY SYNDROME SECONDARY TO CERVICAL SPONDYLOSIS****Funda TAŞÇIOĞLU, Demet ÖZBABALIK, Cengiz ÖNER, Nevzat UZUNER, Pınar ULAŞAN, Gazi ÖZDEMİR****Osmangazi University, Faculty of Medicine, Departments of Physical Therapy and Neurology, Eskişehir - Turkey****SUMMARY**

We aimed to investigate the effect of physical therapy in patients with vertebrobasilar insufficiency syndrome (VBIS) secondary to cervical spondylosis. Fifty-five patients with VBIS were randomized as physical (32 patients) and medical therapy (23 patients). Physical therapy including infrared, cervical traction, ultrasound and TENS was applied to group 1. Group II received tenoxicam, paracetamol, phenprobamate, and pentoxifyllin for 15 days. The blood flow velocities (cBFV) of the vertebral and basilar arteries were recorded by transcranial Doppler ultrasonography (TCD). A four points scale was used to evaluate the intensity of symptoms due to vertigo (0= none, 1= mild, 2= moderate, 3= severe). In group 1; cBFV in right and left VA, and in basilar artery increased significantly ($p<0.01$, $p<0.05$, and $p<0.05$, respectively). In group 2, no significant difference in cBFV was observed. When the groups were compared with each other, no significant difference was found. At the end of the treatment, a statistically significant improvement in the scores of subjective vertigo was observed in both groups ($p<0.001$, $p<0.05$). Comparison of the post-treatment scores for vertigo between the groups showed significant improvement in favor of the physical therapy group ($p<0.05$). Our results suggested that physical therapy might be a suitable alternative in the treatment of VBIS secondary to cervical spondylosis.

Key Words: Cervical spondylosis, physical therapy, transcranial Doppler, vertebrobasilar insufficiency syndrome,

SERVİKAL SPONDİLOZA BAĞLI VERTEBROBAZİLAR YETMEZLİK SENDROMUNDA FİZİK TEDAVİ ETKİNLİĞİ

Bu çalışmamızın amacı, servikal spondilozla bağlı vertebrobasilar yetmezlik sendromu (VBYS) olan hastalarda fizik tedavi uygulamalarının etkinliğini araştırmaktır. Bu amaçla 55 hasta çalışmaya alındı ve randomize olarak fizik tedavi (grup 1, n=32) ve medikal tedavi (grup 2, n=23) gruplarına ayrıldı. Birinci gruptaki hastalara infraruj, servikal traksiyon, ultrason ve TENS' den oluşan fizik tedavi programı uygulandı. İkinci gruptaki hastalara ise tenoksikam, parasetamol, fenprobamat ve pentoksifilin tedavisi 15 gün süre ile verildi. Vertebral ve basilar arter kan akım hızları transkraniyal Doppler ultrasonografi (TCD) ile ölçüldü. Vertigoya ait semptomların şiddetini değerlendirmek amacıyla dört puanlı bir skala kullanıldı (0= semptom yok, 1= hafif, 2= orta, 3= şiddetli). Fizik tedavi uygulanan grupta, tedavi sonrasında sağ vertebral ($p<0.01$), sol vertebral ($p<0.05$) ve basilar arter ($p<0.05$) kan akım hızlarında anlamlı artışlar saptandı. Medikal tedavi uygulanan grupta ise anlamlı bir değişiklik bulunmadı. Gruplar birbiri ile karşılaştırıldığında da bir farklılık saptanmadı. Tedavi sonrasında vertigoya ait semptomlar açısından her iki grupta da anlamlı düzelme olduğu gözlemlendi (grup 1; $p<0.001$, grup 2; $p<0.05$). Bu parametre açısından gruplar birbiri ile karşılaştırıldığında, fizik tedavi grubu lehine anlamlı bir farklılık saptandı ($p<0.05$).

Elde ettiğimiz hemodinamik ve klinik sonuçlar, servikal spondilozla bağlı VBYS'u olan hastalarda fizik tedavinin uygun bir seçenek olduğunu düşündürdü.

Anahtar Sözcükler: Fizik tedavi, servikal spondiloz, transkraniyal Doppler, vertebrobasilar yetmezlik sendromu

INTRODUCTION

Disturbances of the vertebrobasilar circulation are often seen in the elderly population and usually described as "vertebrobasilar insufficiency" (VBI). However, the term VBI is only a description of a syndrome and not a definitive diagnosis (1). This syndrome is characterized by vertigo, dizziness, falls, motor dysfunction, sensorial disturbance, visual loss, diplopia and dysarthria (2). Although atherosclerotic disease is the most common cause of

vertebrobasilar ischemic insufficiency, the vertebral artery is susceptible to other pathologies (3). Symptoms of vertebro-basilar artery insufficiency may be produced by spondylotic vertebral artery compression. Osteophytes projecting from the uncovertebral joints may intrude into the foramina transversaria and compress the vertebral artery (4). In 1960, Sheehan described the syndrome of spondylotic vertebral artery compression and showed arteriographically that the osteophytes of cervical spondylosis may lead to vertebrobasilar

insufficiency (5). Subsequently, some case reports were published about VBI due to spondylotic compression of the vertebral artery (6,7).

In the clinical practice the diagnosis of VBI is sometimes difficult and it should be searched carefully by clinical and laboratory examinations, including clinical findings, extra and intracranial cerebrovascular Doppler sonography, computed tomography, intraarterial digital angiography and magnetic resonance imaging (1). The technique of transcranial Doppler ultrasonography (TCD) was introduced in 1982 (8). This technique permits the direct measurement of blood flow velocity in the intracranial segments of the VA and basilar arteries and it serves as a non-invasive and objective method for the initial screening of patient's hemodynamic status (9).

The treatment of VBIS caused by degenerative changes proves to be a difficult task (10). Although surgical techniques such as decompression of osteophytic vertebral artery stenosis are applied in many studies, this is seldom necessary (4). Conservative treatment usually leads to temporary improvement (10), but the success of medical and physical therapy is unclear yet.

We aimed to investigate the effect of physical therapy in patients with VBIS secondary to cervical spondylosis by using TCD.

MATERIAL and METHODS

This study was conducted by the departments of Neurology and Physical Therapy and Rehabilitation at Osmangazi University

Patients

Fifty-five patients who had isolated vertigo or dizziness were included to the study. In order to eliminate other pathologies that can cause vertigo or dizziness, the patients who have hearing problem, hypertension, significant cardiac disease, iron deficiency anemia, vitamin B12 deficiency, impaired motility in gallbladder, motor, sensory and cranial deficit, urinary tract infection, hypercholesterolemia, and serious gastrointestinal complaints were excluded. All patients underwent neurologic, audiological, and physical examination. No neurological deficits were detected in patients.

Laboratory investigation consisted of plain radiographs (anteroposterior, lateral and oblique), hematological and biochemistry measurements, audiogram, caloric test, gallbladder sintigraphy and transcranial Doppler examination. In all cases

MR was performed to rule out cerebral lesions leading to vertebrobasilar ischemia. Radiological examination revealed degenerative changes in the cervical spine and lateral osteophytes were found at C4, C5, and C6 in all patients.

Study design

We conducted a clinical, randomized study, comparing the efficacy of physical therapy and medical treatment in patients with VBIS secondary to cervical spondylosis. At baseline visit, fifty-five patients were randomly assigned to receive either physical therapy (Group1, n=32) or medical treatment (Group 2, n= 23).

The ethics committee of the Osmangazi University Medical School approved this study.

Treatments

Group 1

To the first group consisting of 32 patients a physical therapy program was applied to the cervical region for a period of 15 days and this program contained the following physical therapy modalities:

- Infrared: An infrared device with a 250 W heat lamp was applied to the cervical region for 20 minutes.

- Ultrasound treatment was performed with the Sonopuls 434 (Enraf Nonius, Netherlands). A continuous mode was used at a frequency of 1 MHz, and intensity of 1.5 watt/cm². Each treatment lasted 5 minutes.

-Transcutaneous electrical nerve stimulation (TENS): An eight-channel devise (Audio Treater II, Model KL-101, OG GIKEN CO., Ltd. Japan) was used. The electrodes were placed on the cervical region. High frequency (100 Hz, 50 µs) TENS was applied at an intensity that the patient could tolerate (15-20 mA) for 20 minutes

-Cervical traction (ITO- TRAC, TR-200, Japanese) was applied with a power of 30 lbs and at a 25-30° cervical flexion position for 20 minutes and intermittently. The patients sat facing the unit at a distance of 1 to 2 feet, so that the angle of pull is approximately 25 to 30 degrees to the vertical.

Group 2

Twenty-three patients in the second group were given orally tenoxicam, 20mg/day, paracetamol, 1.5gr/day, phenprobamate, 1200mg/day, and pentoxifyllin, 800 mg/day for 15 days.

A four points scale was used to evaluate the intensity of symptoms due to vertigo (0= none, 1= mild, 2= moderate, 3= severe).

TCD monitoring

The blood flow velocities were recorded before and after the treatment by TCD (Multidop X4 DWL and TCD8 software, Elektronische Systeme GmbH, Sipplingen) was used for recording of both vertebral artery (VA, 65-85mm) and basilar artery (BA, 70-90) using 4 MHz probes (pulsed wave) through the occipital window. Blood flow velocity (BFV) measurements were taken as sample volume set narrowly. The data was recorded as the peak systolic velocity measured by device. This test was performed at baseline and at the end of the treatment.

Statistically methods

Statistical analysis was performed using the statistical software package (SPSS). While group comparisons were made via t-test, paired student t-test was used for intragroup comparisons. For categorical analysis, χ^2 and Fisher's exact test was used. The results are expressed as mean \pm SD and $p < 0.05$ was accepted for statistical significance.

RESULTS

Fifty-five patients were included in the trial and were assigned to two groups. Two patients in the physical therapy group, and three patients in the medical treatment group dropped out and a total of 50 patients completed the study. Table 1 summarizes the demographic characteristics of the patients who completed the study period. There were no statistically significant differences in demographic data between the two groups

In group 1; blood flow velocity (cBFV) in right and left VA, and in basilar artery increased significantly at the end of the treatment ($p < 0.01$, $p < 0.05$, and $p = 0.05$, respectively). In group II, no significant difference in cBFV was observed. When the groups were compared with each other, no significant differences were found between the groups ($p > 0.05$) (Table 2).

At the end of the treatment, a statistically significant improvement in the scores of subjective vertigo was observed in both groups (Group 1; $p < 0.001$, Group 2; $p < 0.05$). Comparison of the post-treatment scores for vertigo between the groups showed significant improvement in favor of the physical therapy group ($p < 0.05$).

No adverse events due to the applied treatment were observed in either group.

DISCUSSION

Cervical spondylosis is one of the most

Table 1: Baseline characteristics of the patients

	Group 1 (n= 30)	Group 2 (n= 20)
Age (years)	54.71 \pm 8.21	57.09 \pm 9.81
Symptom duration (months)	6.33 \pm 2.52	5.80 \pm 2.35
Sex (Female/Male)	22/8	14/6

Table 2: Hemodynamic results of RVA, LVA, and BA measured by

Transcranial Doppler			
RVA	Group 1(n=30)	Group 2(n=20)	p
Pre-treatment	46.17 \pm 15.31	43.25 \pm 15.62	NS
Post-treatment	50.16 \pm 18.22	44.50 \pm 12.90	NS
p	<0.01	NS	
LVA			
Pre-treatment	44.46 \pm 17.81	42.70 \pm 11.56	NS
Post-treatment	47.36 \pm 16.39	43.35 \pm 17.26	NS
p	<0.05	NS	
BA			
Pre-treatment	45.23 \pm 16.71	43.15 \pm 13.46	NS
Post-treatment	48.67 \pm 18.82	43.85 \pm 14.54	NS
p	<0.05	NS	

Table 3: Vertigo scores of the patients

	Pre-treatment				Post-treatment				p value
	0	1	2	3	0	1	2	3	
Group 1 (n=30)	-	4	19	7	9	13	8	0	<0.001
Group 2 (n= 20)	-	2	15	3	1	11	4	4	<0.05
p value	NS				<0.05				

frequent extravascular causes of vertebrobasilar insufficiency syndrome (11). Degenerative changes, especially the osteophytes in uncovertebral joint regions may cause narrowing of the vertebral canal, most frequently in the lower cervical spine segment and this leads to local disturbances in the vertebrobasilar blood flow (10). The most frequent loci of disease are the C5 to C6 and C4 to C5 interspaces (5). Strek has demonstrated a pathological decrease of vertebral artery flow velocity in association with degenerative changes in the cervical spine (12).

The results in the literature seemed to show

high effectiveness of different surgical treatments of vascular syndromes caused by flow disturbances in the vertebral artery (10), but there is little information available from trials to support the use of physical medicine modalities, such as exercise, traction, acupuncture, heat/cold applications, electrotherapies, and cervical orthoses. Especially in patients who have mild symptoms, we believe that there is a need for new conservative treatment approaches.

With the assumption that this is a new topic, we planned to investigate the effect of physical therapy on vertebrobasilar blood flow and clinical symptoms in patients with VBI secondary to cervical spondylosis. The results that we obtained demonstrated a significant increase in blood flow of both vertebral arteries and basilar artery in physical therapy group.

We thought that the results of the present study were interesting. What is the underlying mechanism in the increase of blood flow of the vertebral arteries obtained by the physical therapy? Since there is no previous controlled, randomized clinical trial testing the efficacy of physical therapy, it is difficult to make comments on the results that we obtained. However, the results of some experimental studies, which are investigating the effects of the physical therapy modalities that we applied in this study, may help us to make some comments.

The goal of cervical traction is to obtain pain relief and functional improvement. No consensus with regard to maximal clinical benefit has emerged. Although specific clinical indications for traction are controversial, the anatomical basis for the use of traction is well established (13). Traction has been shown to enlarge intervertebral foramina, separate apophyseal joints, stretch muscles and ligaments, enlarge the intervertebral space (14-16). With regard of the increased blood flow velocities in vertebral arteries, it may be suggested that cervical traction may lead to enlargement of the intervertebral foramina and reduce the compression on the vertebral arteries. Many authors have suggested that optimum benefit occurred at 25-30 degrees of flexion and at least 25 lbs. of force is necessary for the separation of posterior vertebral segments (17, 18). Therefore, we chose a 30 lbs force and a 25-30° flexion as a reasonable application both clinically and experimentally.

Ultrasound is a physical modality, which was

used in the treatment of osteoarthritis and it is primarily used for its ability to deliver heat to deep musculoskeletal tissues, such as tendon, muscle, and joint structures. The therapeutic effects of heat are likely to involve increased regional blood flow, increased soft tissue extensibility, and decreased pain and muscle spasm (19). Moreover, it has been suggested that ultrasound may affect peripheral sympathetic nerve fibrils (20). Some investigators have postulated that vertebrobasilar symptoms might be caused by reflex vasospasm of the vertebral artery which can be mediated by the sympathetic contributions to the sinuvertebral nerves from the stellate ganglion, rami communicantes, or perivascular plexus (21). Both inhibition of the peripheral sympathetic nerves and the increase of regional blood flow may be suggested as effective factors for the increase of blood flow in vertebral arteries.

Since analysis of vertebral artery blood flow by Doppler is a safe and non-invasive method, it enabled us to diagnose patients in whom minor pathological changes within the arteries led to hemodynamic insufficiency, causing symptoms such as tinnitus, dizziness and sensorineuronal hearing loss. In terms of actual diagnosis, there has been a lack of unanimity as regards the technical aspects of recording true vascular flow by means of the Doppler technique.

This would suggest that individual vascular mechanisms might compensate the changes in the VA. For example, individual differences in arterial collateralization, the variant anatomy of the Circle of Willis, and individual mechanisms of autoregulation could account for the ability of these patients to maintain normal blood flow in the BA. Within the posterior circulation, there are multiple collateral channels for augmenting flow. Reduction of flow through a VA can often be compensated by collaterals from the opposite VA, the thyrocervical trunk and occipital artery coming off the external carotid artery (8).

This study shows TCD to be very successful in identifying the basal cerebral arteries in elderly man. The dynamic aspect of Doppler sonography as a method for assessment of cerebral blood flow and autoregulation is very fascinating and in future may become even more important. TCD has yielded important information on the hemodynamics of the vertebrobasilar system, but in its present form difficulties in interpretation still exist (22). Flow velocities are often reduced on the

side of significant extracranial occlusive lesions such as atherosclerotic stenosis or dissections. TCD gives some evidence of the functional impact of the extracranial occlusive lesions on intracranial flow (23).

In conclusion, our hemodynamic and clinical results showed that physical therapy might be a suitable alternative in the treatment of VBIS secondary to cervical spondylosis. Since vertebral artery compression is relatively frequent in older population commonly suffering from cervical spondylosis, we suggest that appropriate conservative treatments are necessary for such patients.

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