

Effects of Physiotherapy Treatment for Spinal Artery Syndrome

Saidov Sukhrob Rustamovich*, Urinov Muso Boltaevich

Bukhara State Medical Institute, Uzbekistan

Abstract The purpose of the study: Determination of the effect of physiotherapy procedures in patients with the observed vertebral artery syndrome. **Materials and methods.** The study involved patients aged 18 to 44 years. Theoretical analysis and generalization of information sources on the topic of scientific research within the framework of the study, O.M. Clinical assessment of vegetative diseases, comprehensive ultrasound examination of the blood vessels of the head and neck with a vein examination to identify signs of vegetative changes. **Results.** Physiotherapy helps to restore the volume of active movements of the cervical vertebrae ($r < 0.05$). On average, 75% of patients reported the disappearance of the main symptoms, while the rest noted a decrease in their nature. During functional tests, the rate of systolic blood flow in the cerebrospinal arteries increased ($r < 0.05$). **Conclusion:** the results of the study show that the use of physiotherapy procedures in patients with the observed spinal artery syndrome helps to reduce the clinical picture of the disease, restore proper spinal biomechanics and improve blood flow in the spinal arteries.

Keywords Physiotherapy, Vertebral artery syndrome, Isometric muscle relaxation, Neck biomechanics, Neck goniometry, Ultrasound examination of vertebral arteries

1. Introduction

Vertebral artery syndrome is a combination of a number of different vascular, vestibular, traumatic, and vegetative diseases accompanied by narrowing of one or both vertebral arteries. This is observed with painful migraines, hearing, vision, and consciousness disorders, and can lead to stroke, disability, irreversible brain damage, and disability. Patients with this diagnosis go beyond the usual rhythm of life for a long time, lose their ability to work and need qualified treatment. But in order for it to be successful, it is important to clearly identify the cause of the development of vertebral artery syndrome and monitor it.

2. Relevance

Economic losses due to disability of patients with vertebrogenic pathology occupy the first place among all diseases of the nervous system [1,2]. Ensuring proper biomechanics of the body is an integral part of the functioning of the whole organism and an important indicator of health [3]. There have been changes in the living conditions of modern humans, manifested in urbanization, low physical activity, changes in nutrition and food quality, as well as the introduction

of digital technologies in all areas of life. Nowadays, with the widespread adoption of gadgets, he works for a long time in the forced position of the head and body [4]. This, in turn, causes mechanical stress on the cervical spine and leads to a number of disorders of the biomechanics of the spine. Prolonged flexion of the cervical spine is an important mechanical risk factor for chronic neck pain and increases compression of the cervical spine by 1.6 times compared to neutral [5,6,7].

Constant stable compression of the cervical spine is one of the functional factors causing deformation of the vertebral arteries and, consequently, reducing blood flow through these arteries [8]. The weakness of the vertebral artery to deformation during prolonged blood circulation of the cervical spine in full, which leads to impaired blood flow and possible Vertebrobasillary anatomical relationships of the suboccipital vertebral artery, in particular, a decrease in diameter during ipsilateral blood circulation of the cervical spine was sufficient to lead to impaired blood flow. In these patients, there was no significant effect of stretching the vertebral artery during contralateral rotation. Narrowing of the reflex, compression of the vertebral arteries and their deformation manifest themselves as vertebral artery syndrome, which includes a complex of cerebral, vascular and autonomic syndromes [9,10,11]. The development of Vertebrobasillary insufficiency in young people, which occurs against the background of pathological biomechanical changes in the cervical spine, inevitably affects the quality of life, which

* Corresponding author:

pro.ilmiy@bsmi.uz (Saidov Sukhrob Rustamovich)

Received: Jan. 25, 2025; Accepted: Feb. 22, 2025; Published: Mar. 10, 2025

Published online at <http://journal.sapub.org/ajmms>

(according to WHO) is an integral characteristic of the patient's physical, psychological, emotional and social activity based on subjective perception [12,13,14,15].

The main pathogenetic mechanism of spinal artery syndrome is compression of the arterial trunk, narrowing of the vascular cavity due to the autonomic plexus and reflex spasm, which reduces blood flow to the back of the brain, followed by the development of cerebral insufficiency.

3. The Aim of the Study

The aim of the study was to determine the effect of physiotherapy procedures on patients with the observed vertebral artery syndrome.

4. Materials and Methods

40 patients with vertebral artery syndrome aged 18 to 44 years participated in the study. A research plan has been developed to achieve the purpose of the study. This made it possible to obtain fairly complete and reliable information about each task, as well as to complete them sequentially. During an objective examination of patients, the volume of active movements in the cervical spine was determined. Goniometry allows you to assess the volume of movements in the cervical spine, determine flexion, extension, left-sided and right-sided flexion and rotation in the cervical spine. When assessing movements in the cervical spine, a special protractor was used.

In addition to neurological and general clinical examination, O is used in the assessment of vegetative diseases. M. Wayne introduced the "examination for signs of vegetative changes. A score of more than 15 points indicated the presence of autonomic dysfunction.

All patients underwent a comprehensive ultrasound examination of the vessels of the head and neck, which included duplex scanning of these vessels using standard ultrasound and functional tests with head rotation. All subjects underwent duplex scanning of blood vessels as part of standard treatment using functional vertigo tests before and after applying a comprehensive program of physiotherapy procedures. The velocity parameters of the blood flow, i.e. the maximum blood flow rate, have been changed. The study also included functional tests that included head tilts back and forth and right and left.

The physiotherapy program included therapeutic gymnastics, therapeutic and preventive exercises, postisometric muscle relaxation and light physical exercises to eliminate functional blocks in the spinal and motor segments of the cervical spine. Physiotherapy procedures were performed three times a week in the form of symmetrical, asymmetric and perturbative exercises, developed individually for each patient, taking into account the characteristics of the figure and, accordingly, the biomechanics of the spine. Therapeutic sessions usually lasted up to 30 minutes, and the course of physical therapy

lasted 4 weeks.

5. Results

All subjects underwent clinical examination, cervical spinal goniometry, comprehensive ultrasound of the vessels of the head and neck. Vegetative state o. M. It was identified by Wayne using a "survey to identify signs of vegetative change". Subjects were found to have hemodynamic disorders in cerebral arteries of varying degrees. All examinations were carried out before the start of the physiotherapy course and after the end of the physiotherapy course, which lasted 4 weeks. Among the study participants, the main complaints are weakness (87.5%), dizziness (83.3%), headache localized in the neck and back of the head, spreading forward and exacerbated by head movements (75%), neck pain in the shoulder and arm (45%), dizziness (70%). In addition, patients complain of fatigue (42.5%), photopsies (51.9%), weather sensitivity (41.6%) and noise in the ear (31.2%) (Table 1). Complaints of dizziness after a course of physiotherapy disappeared in 92% of patients, weakness - in 86%, neck pain - in 56%, photopsia - in 23%, dizziness - in 55% and headache - in 30%. A similar trend was observed with the loss of complaints such as noise in the ear in 57% and weather sensitivity in 25%. The remaining subjects showed fewer symptoms (Figure 1).

Biomechanical disorders of the cervical vertebrae were found in all patients in the form of a limited number of active and/or passive movements in the cervical spine and signs of instability of the movable segments of the vertebrae. According to goniometry performed before the start of the course of physiotherapy, patients showed a decrease in flexion, extension and extensibility compared to normal values (Table 2). In particular, the bending rate was 39.5 ± 3.8 ($m = \pm 0.7$) at 450 degrees, 49.2 ± 7.6 ($m = \pm 1.5$) at 600 degrees, the bending rate was 35.4 ± 2.6 ($m = \pm 0.5$) to the right at 400 degrees, and 35.7 ± 2.6 ($m = \pm 0.5$) to the left. Table 2 shows that after a course of physiotherapy, the volume of movement in the cervical spine has significantly improved and/or recovered. These bending indices were 43.6 ± 1.8 ($m = \pm 0.3$), stretching - 54.5 ± 4.3 ($m = \pm 0.8$), bending forward - 38.9 ± 1.5 ($m = \pm 0.3$) and bending to the left - 39.0 ± 1.4 ($m = \pm 0.2$), respectively. These indicators have statistical significance.

Table 1. Volume of movement in the cervical vertebrae

Type of movement (normal)		before treatment (n=40)	after treatment (n=40)
flexion (45°)		39.5 ± 3.8 ($m = \pm 0.7$)	43.6 ± 1.8 ($m = \pm 0.3$)
extension (50-60°)		49.2 ± 7.6 ($m = \pm 1.5$)	54.5 ± 4.3 ($m = \pm 0.8$)
The fold° (40°)	the right one	35.4 ± 2.6 ($m = \pm 0.5$)	38.9 ± 1.5 ($m = \pm 0.3$)
	left	35.7 ± 2.6 ($m = \pm 0.5$)	39.0 ± 1.4 ($m = \pm 0.2$)

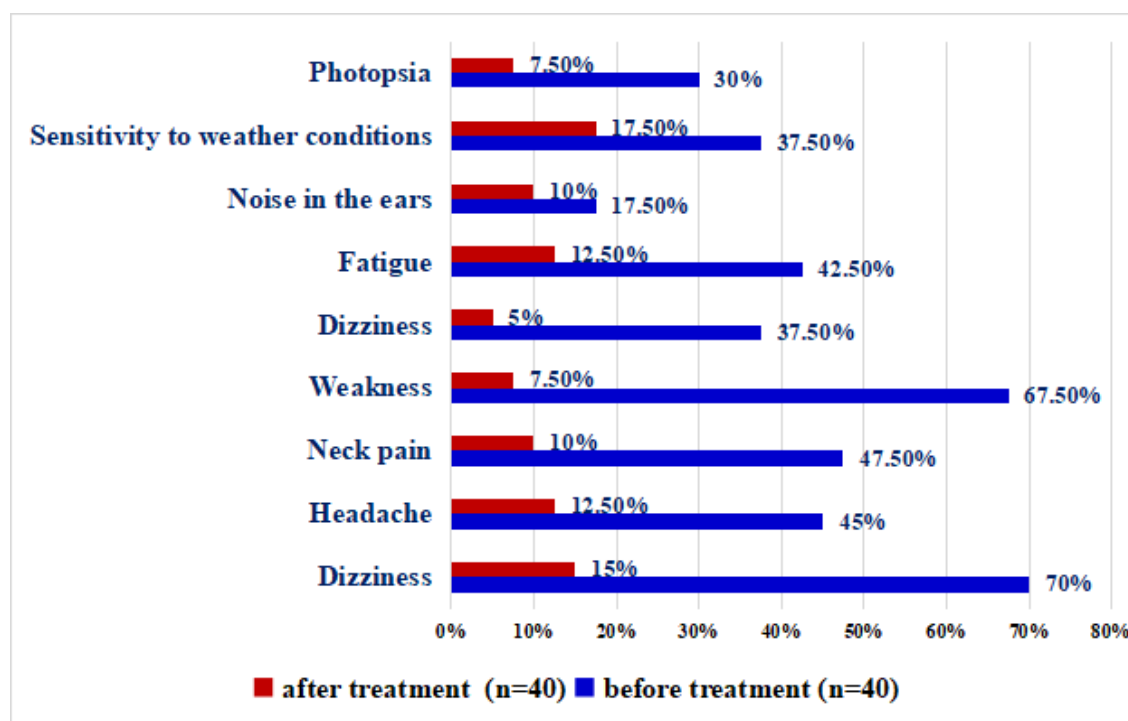


Figure 1. Dynamics of the frequency of subjective symptoms among the study participants

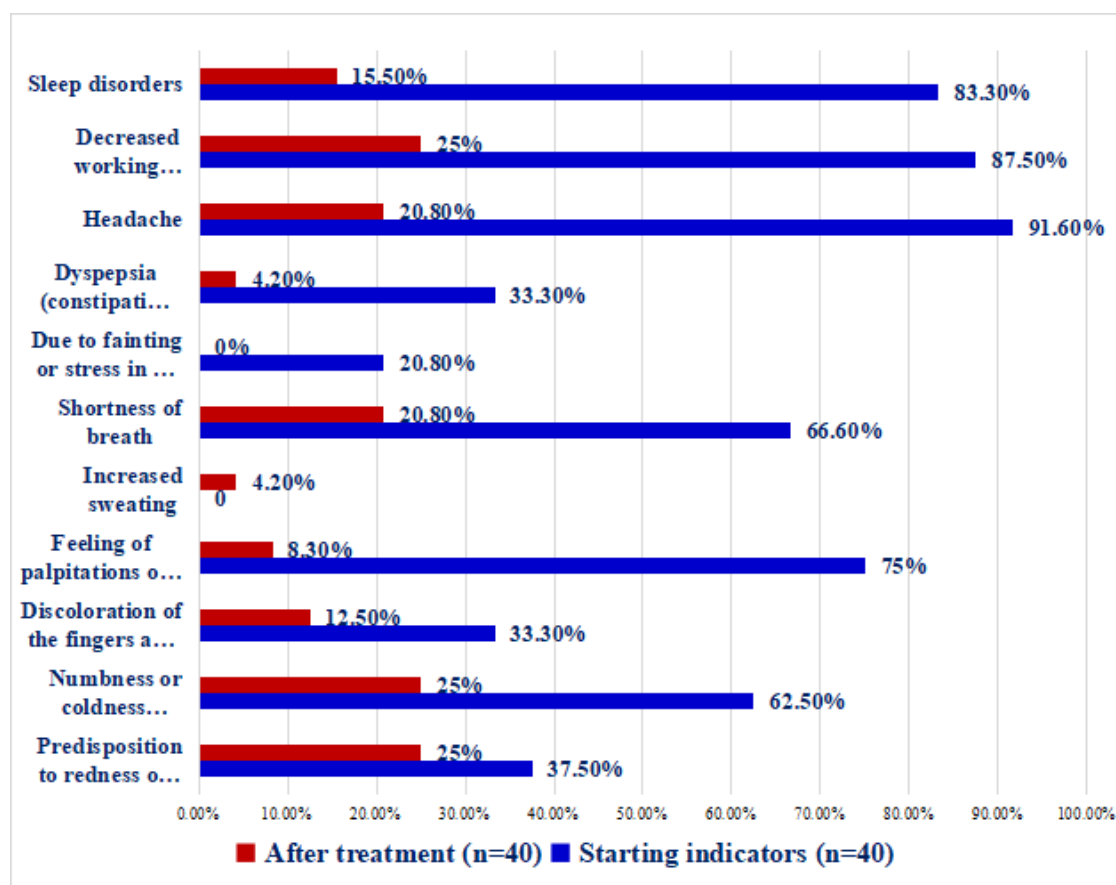


Figure 2. O. M. Determination of signs of vegetative changes based on the results of Wayne's examination before and after physiotherapy treatment

O. M. The results of the examination of patients using the Wayne survey to identify signs of vegetative changes

indicate significant changes in the initial vegetative state (Fig. 2). In particular, the most common clinical signs were

headache (91.6%), decreased ability to work and fatigue (87.5%), sleep disorders (83.3%), heart rate (75%), shortness of breath (66.6%), etc. M.'s vegetative state after a course of physiotherapy was re-evaluated using a Wayne survey. As can be seen from the table, the number of patients with complaints after a course of physiotherapy decreased significantly. Statistical processing of the survey results showed the following results: the average score before the course of physical therapy was 37.7 ± 13.8 ($m = 2.8$), and after the course of physical therapy – 8.8 ± 7.4 ($m = 1.5$). The Student's coefficient (t) was 0.05 at $p < 2$, which indicates the statistical reliability of the results obtained.

All patients underwent a comprehensive ultrasound examination of the vessels of the head and neck, which included duplex scanning of these vessels using standard ultrasound and functional tests with head rotation. According to the results of many studies, the diagnostic value of ultrasound in diseases of the vertebral arteries is 85-98%. Ultrasound data (Figure 2) indicate a violation of blood flow in the vertebral arteries during functional tests.

Table 2. Ultrasound examination parameters

		before treatment (n=40)	after treatment (n=40)
Right vertebral artery	Diameter (mm)	3.55	3.55
	Maximum systolic velocity (CM/SEC)	57.21	58.08
	Maximum systolic velocity (CM/sec) in functional tests	38.91	44.25*
left vertebral artery	Diameter (mm)	3.48	3.49
	Maximum systolic velocity (CM/sec)	54.21	55.46
	Maximum systolic velocity (CM/sec) in functional tests	36.86	44.25*

Note * statistically significant result

The diameter and peak of systolic blood flow in the right and left vertebral arteries did not actually change after the course of physiotherapy. During functional tests, the highest systolic blood flow increased by 12% in the right vertebral artery and 16% in the left vertebral artery, which is a statistically significant result.

The neurophysiological effects of physiotherapy include isometric muscle relaxation, correction of spinal biomechanics through physical exercise, and hypoalgesia, which develops as a result of a psychosomatic and psychophysiological reaction of the entire body, manifested in changes in muscle tone, improves pain tolerance and self-control processes. Fight the main cause of the occurrence and consolidation of blood flow disorders in the vertebrobasilar sac, by influencing the cervical spine with the help of maybe physiotherapy procedures. Disorders of the biomechanics of the yin spine require mobility and constant careful study in order to truly treat and correct vertebral artery syndrome.

6. Conclusions

Reflex narrowing, compression of the vertebral arteries and their deformation manifest themselves as vertebral artery syndrome, which includes a complex of cerebral, vascular and autonomic syndromes. Physiotherapy procedures for vertebral artery syndrome give a positive result, which was confirmed by the loss or decrease of clinical manifestations of this pathology, confirmed by ultrasound, goniometry and studies of autonomic functions.

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