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NEUROLOGY

Kalashnikov V.I.

CEREBRAL HEMODYNAMICS AND CEREBROVASCULAR REACTIVITY IN PATIENTS WITH VERTEBROGENIC CERVICOCRANIALGIA

Kharkov Medical Academy of Postgraduate Education, Ukraine

Abstract: The application of the Transcranial Doppler sonography in patients with cervicocranialgia is discussed. The review of the original observation of the state of the arterial and vemous cerebral hemodynamics and cerebrovascular reactivity in these patients is presented. The authors performed clinical and Doppler sonography examinations of 148 patients with cervicocranialgia aged 18 to 45 years. According to the Doppler examination, patients mainly presented with cervicocranialgia, increased velocity parameters and functional asymmetries of blood flow in the basilar and vertebral arteries. Patients with cervicocranialgia had excessive blood supply in vertebral veins and direct sinus. Hyperreactivity in vertebral veins and direct sinus during orthostatic load is probably associated with the impaired regulation of cerebral blood flow at neurogenic level.

KeyWords: Cervicogenic headache, cervicocranialgia, Transcranial Doppler sonography, cerebral hemodynamics, cerebrovascular reactivity. functional X-ray study of cervical spine.

INTRODUCTION

Cervicogenic headache (CGH) is one of the best-known and most common neurological diseases occurring in the adult population. [1, 2]. The concept of CGH comprises the types of headaches having different origins, which are associated with pathology in the cervical spine and its other structural areas. GGH is induced by diverse pathogenic mechanisms and has different clinical manifestatiohs so it is reffered to different classifications categories [3]. The prevalence of CH in the population is as high as 20%. Pathological changes in the upper cervical spinal segments form the basis of the neuroanatomy of CH. [4]. Its diagnosis is based on the diagnostic criteria of the Cervicogenic Headache International Study Group and on the criteria of the Classification of Headache Disorders, 2nd Edition (2004) [5].

Corresponding Author:
Valeriy Kalashnikov, MD, PhD, Associate professor, Kharkiv Medical Academy of Postgraduate Education, Kharkiv, Ukraine. E-mail: val_kalash@mail.ru

Headache is the initial symptom of the majority of vascular diseases of the brain; hence, diagnosis of the causes of headache becomes essential for preventing the development of vascular disease [6, 7]. The available published data contain no results of a comprehensive study of the arterial and venous hemodynamics, cerebrovascular reactivity (CVR) in patients with CH. All the mentioned above determines the timeliness of our research.

2 PURPOSES, SUBJECTS and METHODS:

2.1 Purpose

is to study the cerebral hemodynamics and CVR using Transcranial Doppler sonography in patients with CGH.

2.2 Subjects & Methods

The study implied examination of 148 young patients (aged 18-45, 67 female and 81 male) with CGH. Cervicogenic headache manifested itself as cervicocranialgia (CCA). Diagnosis was made according to the criteria of the International Classification of HD, 2nd revision (2003).

All the patients underwent functional X-ray study of cervical spine with bending and unbending. Using the

method of Transcranial Doppler sonography (TDS), we studied the values of blood flow velocity (BFV) in vertebral (VA) and basilar (BA) arteries, vertebral veins (VV), tentorial sinus (TS) at rest and under functional loads.

The state of cerebrovascular reactivity was assessed using the following functional loads: functional metabolic test (coefficient of reactivity CrFMT), orthostatic load (CrOL), antiorthostatic load (CrAOL). The control group (CG) included 50 clinically healthy volunteers of both sexes, of appropriate age. The study results were processed by variation statistics with the calculation of arithmetical mean values: M±m, sigma, using spreadsheets «Exel-5".

Conflict of interests

There is no conflict of interests.

3 RESULTS AND DISCUSSION

The pain in patients with CCA was characterized by the following features: predominant occipital localization of pain (91.3%). The pulsating type of pain was observed in 18.4% of patients, bursting in 56.2%, their combination in 25.4%. Mainly left-sided localization of the pain attack was observed in 36.4% of patients, mainly right-sided in 30.2%, alternating sides in 33.4 %. Attacks on awakening occurred in 48.8% of patients, daily attacks in 22.3%, at night in 29.9%.

Patients with CCA in addition to the basic complaints presented with the following symptoms: dizziness, insomnia, decreased performance, increased fatigue, emotional instability, pain in the heart. Dizziness, as a rule, of non-systemic nature, was occasionally observed in 61.2% of patients. Unstable noise in the head bothered respectively 29.4%. Sleep disorders in the form of difficulty in falling asleep, restless, intermittent, superficial sleep occurred in 18.6% of patients.

Fatigue, weakness, decreased performance were observed in 22.3% of patients, emotional instability, irritability, tearfulness in 19.8% of patients. Complaints of the confusion, memory and attention loss were reported by 10.8% of patients.

Neurological examination of patients revealed an increase in tendon reflexes in 36.7% of cases, vegetative stigma in 34.8%, Romberg's sign in 17.2%, mild oculomotor disturbances in 15.1%, mild asymmetry of facial muscles in 10.6% of patients.

X-ray study of patients with CH more often revealed the signs of initial osteochondrosis of cervical spine and instability in one or several motion segments. All the patients with scalene instability manifested hyperreactivity to tests with bending and unbending and rotation loads combined with regional changes of hemodynamics in BA and one or both VAs. (Fig.1)

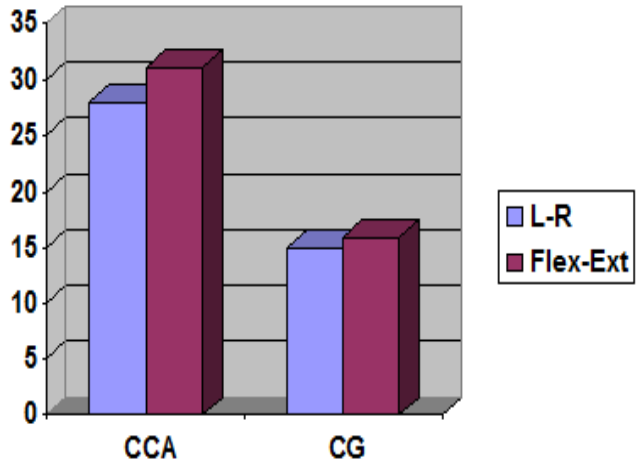

Fig.1 Reactivity (%) to functional load (left-right rotation, flexion-extension) in patients with cervicocranialgia

Hemodynamic disturbances in the individuals under examination often were manifested in the form of strengthened BFV in both VAs in 46.3% of cases, vasospasm in one VA and/or BA in 32.7%, blood flow asymmetry (25-30%) through VA in 37.8% (Fig.2).

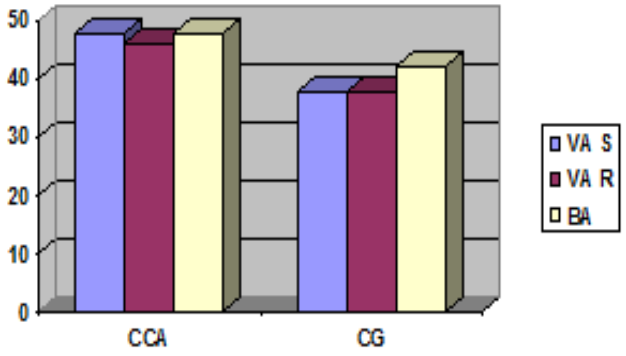

Fig.2 Blood flow velocity in the vertebral arteries and basilar artery in patients with cervicocranialgia

The CrFMT parameters were significantly increased (1.26 ± 0.04 (p <0.05) in patients with CCA (Fig,3).

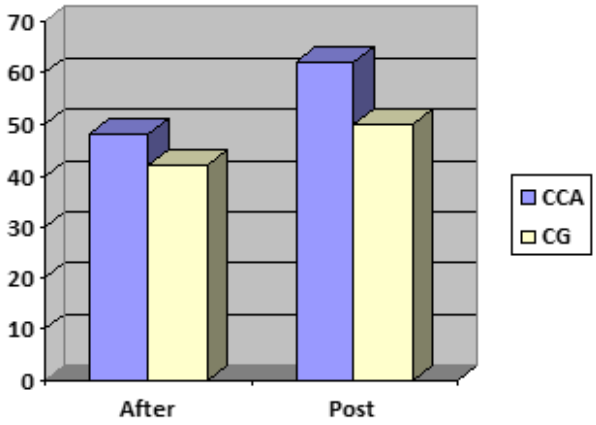

Fig.3 Blood flow velocity in the basilar arteries secondary to functional metabolic test

The vast number of patients with CCA had increased blood flow velocity in TS (37.3±3.6 cm/s) and VV (29.6±3.1 cm/s). Patients with CCA presented with an increase in systolic BFV in 48.2% in VV and in 29.4% of patients in TS (Fig.4).

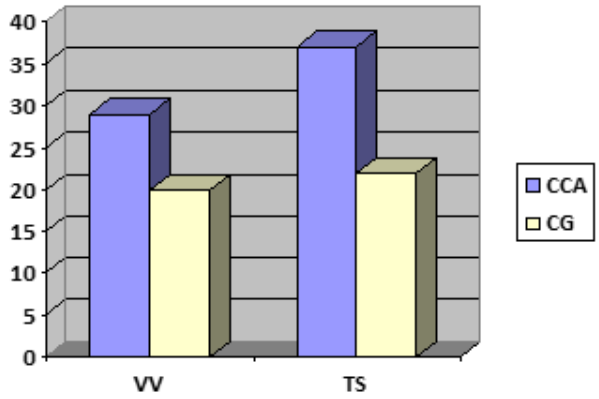

Fig.4 Blood flow velocity in the vertebral veins and tentorial sinus in cervicocranialgia

The orthostatic load indicated increased blood flow in the VV in patients with CCA by 66.5 ± 7.7%, and in the control group by 88.4 ± 11.7% (p <0.05). (Fig.5).

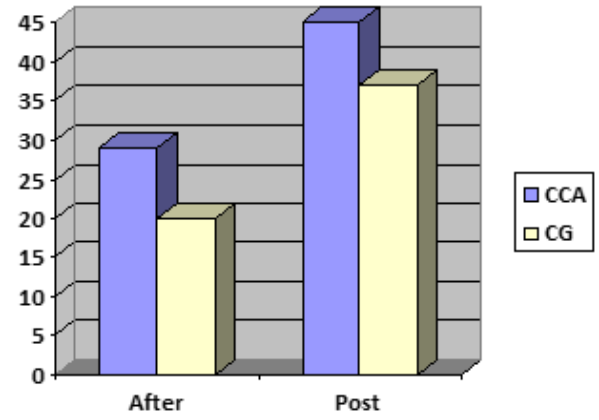

Fig.5 Blood flow velocity in the vertebral veins secondary to orthostatic load

Blood flow in patients with CCA during the orthostatic load was reduced in the TS by 36.3 ± 7.2%, and by 29.6 ± 6.7% in the CG (Fig. 6) .

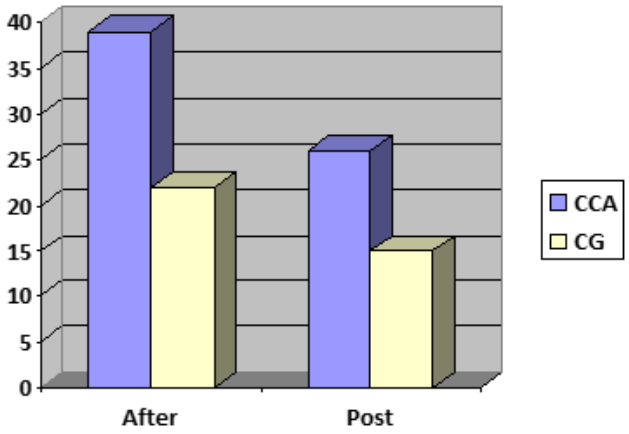

Fig.6 Blood flow velocity in tentorial sinus secondary to orthostatic load

During the antiorthostatic load the blood flow velocity in the VV decreased by 20.2 ± 3.4% in patients with TTH, and 27.6 ± 4.5% in the CG.(Fig.7)

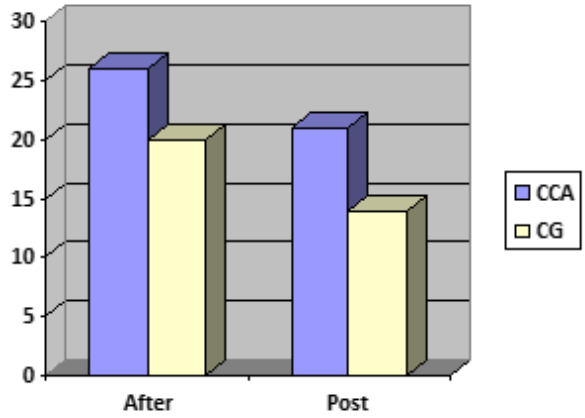

Fig.7 Blood flow in the vertebral veins secondary to antiorthostatic load

The blood flow velocity in patients with CCA in the SS was increased by 33.5 ± 8.3%, and by 30.6 ± 4.5% in the CG (Fig.8).

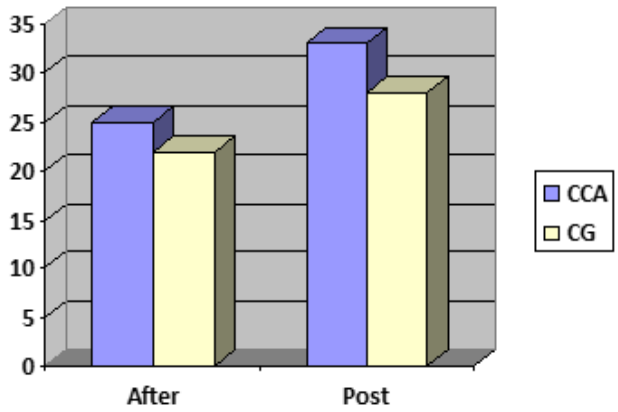

Fig.8 Blood flow velocity in tentorial sinus secondary to antiorthostatic load

4 CONCLUSIONS

Cervicogenic headache in young patients is mainly determined by the scalene instability of cervical spine. Hyperreactivity to rotation tests correlates with the presence of cervical spine instability. Cerebral hemodynamics in patients with CCA is characterized by angiodistonic manifestations, such as increased velocity parameters and functional asymmetries of blood flow in the BA and VA. Patients with CCA mainly present with venous discirculation in VV and TS. Hyperreactivity to FMT is typical for patients with CCA and reflects the tension of the metabolic regulation path of cerebral blood flow. Hyperreactivity in VV and TS during OL is probably associated with the violation of the regulation at neurogenic level of cerebral blood flow. It is necessary to perform a complex Doppler and X-ray study of all patients with supposed CCA.

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