

ASSESSMENT OF CEREBRAL HEMODYNAMICS IN PATIENTS WITH ISCHEMIC STROKE

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ABSTRACT

As you know, cardiovascular diseases are a common cause of death and disability, among them a special place is occupied by stroke. To determine the quantitative parameters of blood flow of the main brain vessels in patients with left hemispheric ischemic stroke (HIS). Transcranial dopplerography (TD) of the middle cerebral artery (MCA) and middle cerebral vein (MCV), the Rosenthal's vein, the Galena's vein and Straight sinus (SS) was performed in 89 patients with HIS. The comparative group (CG) was organized from 52 patients without cardiovascular diseases. The maximum systolic velocity (Vs), the end diastolic velocity (Vd), the resistance index (RI) in MCA, and the Vs of the main brain veins were determined. Systolic blood flow velocity in the mid-cerebral artery in 85.4% of patients was below 70 cm/s and averaged, 54.9 ± 7.1 cm/s. In 9.2% of cases, the size of the affected area in the left hemisphere did not exceed 1 cm according to the results of tomography, and in 90.8% of cases it ranged from 1 cm to 2 cm According to the results of TD, MSA stenosis was detected in 78 (87.6%) cases, which was confirmed by MRI angiography. Among the patient with the Hemispheric ischemic stroke the Rosenthal's vena was visualized in 81 (91,0%) cases, the Galen's vena – in 83 (93,3%) cases, the median cerebral vein (MCV) - in 75 (84,3%) and the Straight sinus - in 79 (88,9%) cases, respectively. In a patients of the comparative group, visualization of this veins was successful in 42 (80.8%), 47 (90.4%), 31 (59.6%) and 32 (61.5%) cases, respectively. In a patients with HIS, all the main cerebral veins were visualized significantly ($P < 0.05$ and $P < 0.001$) more often than in the CG (with the exception of the Galen vein). In a patient with HIS Vs in the deep median cerebral vein was 25.3 ± 3.6 cm/s; in the basal vein of the brain -24.9 ± 2.6 cm/s; in the large vein of the brain -26.3 ± 2.1 cm/s; in the direct sinus, 32.1 ± 2.6 cm/s, respectively. Stenosis of the middle cerebral artery, a decrease in systolic blood flow velocity less than 70 cm/s, an increase in resistance index more than 0.70 and in the pulsation index more than 1.35 is a frequent finding in ischemic stroke. The correspondence between the severity of the stroke and the value of the systolic blood flow velocity in the cerebral veins was revealed. Good visualization of the main cerebral veins is due to the increase in blood flow velocity in them.



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1. Introduction

It is known that about 20% of cardiac output through the carotid arteries enters the brain. The degree of cerebral stenosis determines the volume of blood flow to the brain. At the same time, the severity of clinical symptoms depends not only on the degree of arterial hemodynamic impairment, but also on the state venous blood flow from the brain. Previous studies have shown that the clinical symptoms of ischemic stroke are determined not only by the volume of blood flowing through the arterial vessels, but also by the outflow of blood through the venous vessels from the brain [1], [2]. Developed by Singer O.C., et al. (2005) the clinical scale provides the accuracy of determining the occlusion of the cerebral artery about 85% [3]. Research results Allen LM., et al. (2012) using CT and MR angiography made it possible to determine the area of arterial occlusion, the mechanisms of stroke development and the prevalence of the affected area [4]. In recent years, transcranial dopplerography has been used to determine cerebral hemodynamics in various pathological conditions [5], [6]. Objective to determine the quantitative parameters of blood flow of the main brain vessels in patients with left hemispheric ischemic stroke.

2. Patients and Methods

Transcranial dopplerography (TD) of the middle cerebral artery (MCA) and middle cerebral vein (MCV), the Rosenthal's vein, the Galena's vein and Straight sinus (SS) was performed in 89 patients with hemispheric ischemic stroke (HIS). The age of the subjects varied within 43-78 years, there were 41 men (46.1%), women 48 (53.9%). The comparative group (CG) was organized from 52 patients without cardiovascular diseases. The following quantitative blood flow parameters were determined: systolic and diastolic velocity (V_s , V_d), mean systolic velocity (TAMX), resistant and pulsation indices (RI and Pi) in MCA and V_s of the main cerebral veins. Statistical analysis consisted in unpaired comparisons of unpaired groups, performed with the Fisher's exact test for categorical data. The significance level, two-tailed, was set at ≤ 0.05 for moderately significant, at ≤ 0.01 for significant and at ≤ 0.001 for highly significant.

3. Results

Systolic blood flow velocity in the mid-cerebral artery in 85.4% of patients was below 70 cm/s and averaged, 54.9 ± 7.1 cm/s. In 9.2% of cases, the size of the affected area in the left hemisphere did not exceed 1 cm according to the results of tomography, and in 90.8% of cases it ranged from 1 cm to 2 cm. According to the results of TD, MSA stenosis was detected in 78 (87.6%) cases, which was confirmed by MRI angiography. TCD in 37 (41.6%) cases showed moderate or severe stenosis of first segment of the left MCA, which was confirmed in 35 cases with MRI angiography (Figure 1, 2). On the 3rd week from the beginning of the stroke, repeated transcranial dopplerography was performed. Under dynamic observation, fatal outcome was noted in three cases, serious complications in 34 patients.

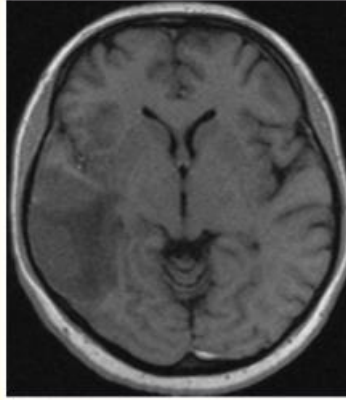


Figure 1: MRI with ischemic stroke in the left MCR basin (left hypodence zone).

4. Discussion

In earlier studies, the role of Doppler sonography in assessing the patency of cerebral vessels in patients with acute stroke was shown. Trained medical staff can perform an ultrasound examination of the brain's blood vessels within minutes [7- 9]. A high correlation was found between the extracranial venous blood flow and the degree of cerebral venous insufficiency in patients with multiple sclerosis [10].

Cerebral perfusion and venous outflow resistance, factors, that determine cerebral venous pressure. This affects the speed of the venous blood flow and contributes to the development of cerebral edema in patients with ischemic stroke. In ischemic stroke, there is an inverse relationship between arterial and venous cerebral blood flow - the first decreases more often, the second increases. We have established a positive relationship between the systolic blood flow velocity in the main veins of the brain and the severity of ischemic stroke.

5. Conclusions

Stenosis of the middle cerebral artery, a decrease in systolic blood flow velocity less than 70 cm/s, an increase in resistance index more than 0.70 and in the pulsation index more than 1.35 is a frequent finding in ischemic stroke. The correspondence between the severity of the stroke and the value of the systolic blood flow velocity in the cerebral veins was revealed. Good visualization of the main cerebral veins is due to the increase in blood flow velocity in them.

6. REFERENCES

- [1] Shieds J. (1973) Handbook of abnormal psychology, London: Pitman medical publishing.
- [2] Maruta N., Pan'ko T., Fedchenko V., Kutikov O. The role of psychotraumatization factors in formation of anxious-phobic disorders. Proceedings of the WPA International Congress 2012 (Prague, Czech Republic, October 17-21, 2012), Prague, Ceska a slovenska psychiatrie, p. 251.
- [3] Herasymenko L.O. (2018) Psihosotsial'na dezadaptatsiya (suchasni kontseptual'ni modeli) [Psychosocial disadaptation (modern conceptual models)]. Ukraïns'kii visnik psihonevrologiyi, no 1, pp. 62-65.
- [4] Skrypnikov A.M., Herasymenko L.O., Isakov R.I. (2016) Psihosotsial'na dezadaptatsiya pri posttravmatichnomu stresovomu rozladi u zhinok [Psychosocial disadaptation in post-traumatic stress disorder in women]. Poltava: ASMI. (in Ukrainian)

[5] Breslau N. Trauma and posttraumatic stress disorder in the community / N. Breslau [et al.] // Archives of General Psychiatry. – 1998. – №. 55. – P. 626-632.

[6] Goldberger L., Breznitz S. (2012) Handbook of stress. Theoretical and clinical aspects, New York: The Free Press.

[7] McGrath E. Women and depression: Risk factors and treatment issues / McGrath E. [et al.]. – Washington : Am. Psychol. Ass., 1990. – 14 p.

[8] Rean A., Kudashev A., Baranov A. (2002) Psihologija adaptacii lichnosti. [Psychology of personality adaptation]. Saint Petersburg : Medicinskaja pressa. (in Russian)

[9] Chaban O.S., Khaustova O.O. Dezadaptatsiya lyudini v umovah suspil'noyi krizi: novi sindromi ta napryamki yih podolannya [Maladjustment of a person in a social crisis: new syndromes and ways to overcome them]. Journal of Psychiatry and Medical Psychology, 2009, no 3, pp. 13-21.

[10] Foa E.B., Rothbaum B.O. Treating the trauma of rape Cognitive- behavioral therapy for PTSD. New York. Guilford Press, 286 p.

[11] Feldmann T.B., Bell R.A. Juror stress: identification and intervention // Bull. Am. Acad. Psychiatry. Eaw. — 1993. — Vol. 21, № 4. — P. 409-417.

[12] Kinzie, J. D., & Leung, P. (1989). Clonidine in Cambodian patients with posttraumatic stress disorder. Journal of Nervous and Mental Disease, 177(9), 546–550

[13] Foa E.B., Davidson I.R.T., Diagnostic issues in post-traumatic stress disorder: Considerations for the DSM-IV // J. Abnorm. Psychol. -1991. — Vol. 100, № 3. — P. 346 — 355.

[14] Krupnick J.L., Green B.L., Miranda J. Interpersonal psychotherapy for low-income women with PTSD // Arch. 63 Gen. Psychiatry. - 2000. - Vol. 57. - P. 459-466.

[15] Davidson J., Hugnes D., Blazer D., George L.K. (1991) Post-traumatic stress disorder in the community An. epidemiological study. Psychological Medicine, 21, 713-721.

[16] Horowitz M.J., Weis 0 S. Mannar C, Diagnosis of posttraumatic stress disorder//J. Nerv. Mem Dis. — 1980. -Vol. 175, № 5. — P. 267-268.

[17] Skrypnikov A. Specific of social support and guilt, anxiety and stress in family relations in women with depressive disorders of different genesis and psychosocial maladaptation /A. Skrypnikov, R. Isakov // Norwegian Journal of development of the International Science. – 2019. – № 32. – P. 13–21.

[18] Pearlin L.I. The social contexts of stress / L.I. Pearlin // Handbook of stress. Theoretical and clinical aspects / Eds. L. Goldberger, S. Breznitz. N.Y.: The Free Press, 2012. - P. 367-379.

[19] Herasymenko L. O. Psychosocial aspects of adjustment disorders in women / L. O. Herasymenko // Wiadomosci Lekarskie. – 2020. – T. LXXIII, № 2. – P. 352–354.