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**APPLICATION EXPERIENCE OF MECHANICAL THROBECTOMY FOR PATIENTS WITH
HEMISPHERIC ISCHEMIC STROKE**

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Abstract.

The paper provides the comparative analysis of endovascular and conservative treatment of patients with ischemic stroke. The neurological deficit was assessed at an admission, on the 20-th day and in 3 months. The results of our study showed a significant improvement of functions and the reduction of disability among the patients with endovascular treatment.

Key words: Ischemic stroke, endovascular treatment, thrombectomy, hemorrhagic transformation.

Introduction. A great social and medical significance of cardiovascular diseases (CVD) is conditioned by a continuing high incidence, the growth of these diseases detection by 7-10% at a dispensary inspection every year, a high mortality and disability. A stroke occupies a leading position in vascular pathology structure. It becomes a burden for a patient, relatives and society as a whole. According to the National Association register for stroke combat, every fourth patient dies, 31% of stroke patients require an assistance for personal care, 20% can not walk alone [1]. RF economic damage from IS amounted to 8.2 trillion rubles during the period from 2005 to 2015, and the direct costs of ischemic patient treatment make 57.2 billion rubles per year [2-6]. In this regard the search for new approaches and stroke treatment methods is a relevant issue.

The aim of our work is the comparative assessment of mechanical thrombectomy and conservative therapy methods effectiveness among the patients with hemispheric ischemic stroke (IS).

Main part. The study included 68 patients. The first main group included 32 people who underwent mechanical thrombectomy. Inclusion criteria: ischemic stroke, according to computed tomography (CT), a large vessel occlusion according to CT angiography data, the time factor from the first symptoms prior to operation makes no more than 12 hours. Thrombectomy was performed using Solitaire device. 8 patients of the main group also experienced the

introduction of recombinant human plasminogen activator (rt-PA), Alteplase drug (Actilise) at the rate of 25% from the dose of 0.9 mg/kg according to a patient's weight. The 2-nd control group included 36 patients who underwent conservative therapy. Both groups are comparable by sex, age and stroke severity. The patients of the 2-nd group did not experience a systemic thrombolytic therapy (TLT) due to the presence of contraindications, or in connection with the admission outside the therapeutic window. All patients were followed up in an intensive care unit during the first day. Antiplatelet therapy and antihypertensive treatment, which continued throughout the period of observation was appointed to all patients during an admission. The patients of both groups were treated strictly in accordance with care procedures and standards for the patients with an acute stroke (AS) [7].

In order to assess the severity of neurological symptoms NIHSS scale was used. The evaluation was conducted on admission, on 18-21 days and 3 months after (day 86-92). The degree of functional recovery concerning the damaged neurological functions and disease outcomes was determined by the modified Rankin Scale (RS).

The clinical and demographic characteristics of both groups of patients are shown in Table 1.

Table 1. Clinical and demographic characteristics of patients

Item №	Characteristic	Main group		Control group	
		32 men	%	36 men	%
1.	Age	62.8±3.2		66.2±2.4	
2.	Sex (of a male)	25	80%	27	75%
3.	Time from the onset of illness to hospitalization	386±24		340±22	
4.	Time from the admission to the hospital until therapy initiation	68±12		38±8	
5.	NIHSS at admission	12.8±2.0		14±1.0	
6.	IS subtype:				
	- atherothrombotic	19	60	11	30%
	- cardioembolic	13	40%	9	25%
	- not cleared	-	-	6	17%
7.	Localization of occlusion:				
	- absent	-	-	13	36%
	- Internal carotid artery (ICA)	19	60%	6	17%
	- Middle cerebral artery (MCA)	9	28%	8	22%
	Vertebra-basilar artery (VBA)	4	12%	9	25%
8.	i/a TLT	8	25%	-	-
9.	THRIVE:				
	0-2 (64,7%)	10	31%	2	5%

	3-5 (43,5%)	22	69%	21	58%
	6-9 (10,6%)	0		13	36%

Males predominated in both groups, 80% and 75% respectively. The greatest elapsed time from the onset of the disease before the operation was 11 hours and 40 minutes, the minimum elapsed time made 4 hours 25 minutes. The average time from the first symptoms to a clinic door made 386 ± 24 min in group 1 and 340 ± 22 min in group 2. The time from the admission to a clinic prior till the treatment in an operation room made 68 ± 12 min. The score according to NIHSS scale made 12.8 ± 2.0 in the main group and 14 ± 1.0 in the control group. The most difficult patient in the main group was had 20 points, and the most difficult patient in group 2 had 16 points.

All the patients of the main group revealed an occlusion according CT angiography data: 19 patients (60%) - ICA, 9 patients (28%) - MCA, 4 patients (12%) - vertebrobasilar-basilar artery (VBA). 13 patients of the control group (36%) revealed no occlusion, ICA occlusion was experienced by 6 patients (17%), MCA - 8 patients (22%) and VBA - 9 patients (25%). So, we pay attention that the main group consisted of patients with a large vessel occlusion, which was one of the main indications for thrombectomy.

It is known that the degree of blood flow recovery is an important predictor of a good clinical outcome of thrombectomy application during an IS. The study results of MERCI trials and multi-MERCI trial demonstrated that the likelihood of a favorable clinical outcome was increased 2.6 fold and 90-day survival rate increased 2.2 times after a full restoration of blood flow in intracranial arteries. The partial restoration of blood flow leads to an unfavorable clinical outcome due to the preservation of tissue ischemia, tissue edema, and reocclusion development risk among one third of patients [8]. Penumbra POST Trial study demonstrated a favorable clinical outcome among 45% of patients with a successful recanalization and only 13% of patients had no effective blood flow recovery [9].

In order to estimate the probability of a clinical outcome during the application of endovascular AIS treatment methods THRIVE scale was proposed (Total Health Risks In Vascular Events score). This scale takes into account the following parameters: the neurological deficit at admission (NIHSS scale) (<10-0 points, 11-21 - 2 points, 1 > 21 - 4 points), a patient's age (<59 years - 0 points, 60-79 - 1 point > 80 years - 2 points). The presence of comorbidities (diabetes, hypertension, atrial fibrillation) added one point for each disease. A retrospective analysis of intra-arterial recanalization technique application demonstrated that the patients who scored 0-2 points (according to THRIVE scale) at admission, had the probability of a favorable clinical outcome which made 64.7% among the patients who scored 3-5 points - 43.5%, and at 6-9 points a favorable clinical outcome was observed only in 10.6% of cases

($P < 0.001$) [10]. So, according to THRIVE scale 10 patients (30%) had 0-2 points in the main group and their "chances" on a blood flow restoration after endovascular treatment was up 65% and 3-5 scores were observed among 22 patients (70%), which allowed us to expect the recanalization in 43% of cases. The patients with the score above 5 did not experience a prompt treatment. There were 13 such patients in the control group, which makes 35% and this was also one of the reasons for a prompt treatment absence during the detection of a large vessel complete occlusion.

The statistical processing of the obtained data was also performed using SPSS8.0 software. The probability value of less than 0.05 reflected the statistical significance. The treatment outcomes were assessed by patient survival, the occurrence of complications and the severity of neurological deficits after 18-20 days of treatment and 3 months after the discharge from the hospital. The patient treatment outcomes in both groups over time are shown in Table 2.

Table 2. Patient treatment outcomes in both groups over time

Item №	Characteristic	Main group		Control group	
		32 patients	%	36 patients	%
1.	Complications during treatment:				
	- symptomatic hemorrhagic transformation	6	20%	2	5%
	- pneumonia	-	-	4	13%
	- heart rate violation	2	8%	5	15%
	- iliofemoral thrombosis	-	-	1	3%
	- thromboembolism of pulmonary artery	-	-	1	3%
2.	Treatment results by the 20-th day:				
	- mortality	3	10%	4	12%
	- NIHSS	4.0±2.0		9.0±1.2	
	- SHR 0-2	24	75%	14	39%
	- SHR 3	2	6%	14	39%
	- SHR >3	3	9%	4	11%
3.	Treatment outcome in 3 months:				
	- mortality	0		2	5%
	- NIHSS	4.0±1.4		8.0±1.0	

- SHR 0-2	25	78%	14	39%
- SHR 3	2	6%	14	39%
- SHR >3	2	6%	2	6%

It should be noted that there were less complications among the patients who received endovascular treatment than in the control group. The symptomatic hemorrhagic transformation was observed among 6 patients (19%) of the main group against two cases in the control group (5%). The rhythm disturbance was also noted in 2 cases besides hemorrhagic transformation. The complications in the control group is the pneumonia for 4 patients (13%), the violation of rate was observed in 5 cases (15%). At that 4 patients had the medical history not burdened with arrhythmia. One case was represented by ileofemoral thrombosis (IFT) and by the thromboembolism of a pulmonary artery (TEPA).

Lethal outcome occurred in 3 cases (10%) in the main group, of which the cause in two cases was represented by swelling and brain dislocation among the patients with hemorrhagic transformation and there was a fatal rhythm disturbance in one case. The patient had the cardioembolic subtype of stroke and the ischemia size of 60 ml. In the control group the fatal outcome was experienced by 4 patients (11%), the causes for two cases were represented by hemorrhagic transformation with the subsequent development of cerebral edema, and one case was represented by pneumonia and dysrhythmia.

After 3 months, 2 deaths were observed in the control group of patients, the cause of deaths is not known, unfortunately. The main group did not show any deaths.

The neurological symptoms regressed among the patients of the main group and differed significantly ($P < 0.005$) by the point assessment of NIHSS scale 12.8 ± 2.0 vs. 4.0 ± 2.0 at discharge, the same trend was observed 3 months later, reflecting an early restoration of lost functions among the patients who received endovascular treatment. The control group did not show any significant differences by NIHSS scale at discharge (14.0 ± 1.0 vs. 9.0 ± 1.2 points). The neurological deficit regressed to 7.8 ± 1.0 after 3 months. A significant difference was not observed, but a complex of carried out rehabilitation treatment at the hospital led to some positive results. The evaluation results according to Rankin scale were indicative on 18-20-th day and after 3 months in both groups. A moderate violation of life activity, but with the preservation of independent walk function in the main group was observed among 2 patients (7%), while in the control group moderate impairment (SHR score - 3) was observed among 14 patients, accounting for 40%. The same differences persist after 3 months. The vast majority of patients 24 (75%) who received surgical

treatment had a light impairment of life activity (SHR 0-2) vs. 14 patients (39%) of the control group ($P < 0.005$). Our study included the patients undergoing treatment at OGBUZ "Belgorod Regional Hospital named after St. Joasaph" in 2014-2015. Currently, a variety of intra-arterial endovascular procedures are available and performed for the treatment of patients with acute ischemic stroke who come to a clinic with severe neurological deficit. There are notable results of three large stroke therapy research IMS III, SYNTHESIS and MR Rescue completed in 2013. These studies evaluated the efficacy of endovascular treatment against acute ischemic stroke and they did not show any significant clinical efficacy of endovascular treatment. Thus the medical community has doubts and issues about the prospects for the endovascular treatment of an acute ischemic stroke [11]. But with a careful selection of patients, at the presence of a highly professional team of x-ray surgeons, a consistent work of a multidisciplinary team we received positive treatment results also among the patients admitted outside the therapeutic window which is especially pleasant.

The published research results MR CLEAN confirmed that this therapy is safe and effective. And the results of EXTEND-IA, ESCAPE and SWIFT PRIME studies represent new evidence of a potentially favorable outcome from an ischemic stroke among the patients with large vessel occlusion [11] (Table 3).

Table 3. Outcomes of an acute stroke treatment according to evidence-based medicine.

Study	Therapy	Patients with positive results (0-2 points according to MSHR scale) In 90 days [%]
MR CLEAN	Thrombectomy	33
	Drug therapy	19
ESCAPE	Thrombectomy	53
	Drug therapy	29
EXTEND-IA	Thrombectomy	71
	Drug therapy	40
SWIFT ⁴ -PRIME	Thrombectomy	60
	Drug therapy	36

Summary. The results of our study showed the significant improvements of functions and lesser disability among 75% of the patients who received endovascular treatment. Thrombectomy is safe at an ischemic stroke, the use of this method of treatment gives the chances of a favorable outcome for the patients with large extra- and intracranial vessel occlusion, including those admitted outside the therapeutic window.

Conclusions. We believe that the key of successful treatment is a careful selection and an individual approach to each patient, as well as the coherence of actions at the prehospital stage and a multi-disciplinary highly professional team at a hospital. Due to an early neurological improvement of the patients who underwent thrombectomy, the duration of

hospitalization period and the lack of need for a long-term rehabilitation are possible. They will also reduce the cost of stroke treatment.

References

1. Gusev E.I., Skvortsova V.I., Stakhovskaya L.V., 2007. The problem of stroke in Russian Federation: the period of active joint actions, *Journal of Neurology and Psychiatry named after Korsakov*, 8: 81-84.
2. Gusev E.I., Skvortsova V.I., Stakhovskaya L.V., 2007. The issue of stroke in Russian Federation: the period of active joint actions. *Journal of Neurology and Psychiatry named after S.S. Korsakov*, 107: 8: 4-10.
3. Gusev E.I., Skvortsova V.I., Krylov V.V., 2007. The decrease of mortality and disability from cerebrovascular diseases in Russian Federation. The collection of materials from the 80-th session of the Meeting of RAMS, 210 p.
4. Evzelman M.A., 2003. Ischemic stroke. Orel, p. 292.
5. Evzelman M.A., Bairakov V.I., 2006. The organization of care for the patients with cerebrovascular diseases. *The issues of social hygiene, health care and history of medicine*, 5: 43-46.
6. Stakhovskaya L.V., Klochikhina O.A., Bogatyreva M.D. et al, 2013. Epidemiology of stroke in Russia according to the results of territorial and population register (2009 - 2010). *Journal of Neurology and Psychiatry named after S.S. Korsakov. Stroke*, 5: 4-10.
7. The procedure of medical care provision for the patients with acute ischemic stroke (approved by the order of Russian Federation Ministry of Health issued on November 15, 2012 № 928n).
8. Fields, D., Lutsep, L., Smith, S., 2011 Higher degrees of recanalization after mechanical thrombectomy for acute stroke are associated with improved outcome and decreased mortality: pooled analysis of the MERCI and Multi MERCI trials, *AJNR*, 32: 2170-2174.
9. Tarr, R., Hsu, D., Kulcsar, Z. et al., 2010. The POST trial: initial post-market experience of the Penumbra system: revascularization of large vessel occlusion in acute ischemic stroke in the United States and Europe. *J NeuroIntervent Surg*, 2(4):341-344.
10. Flint, C., Cullen, P., Faigeles, S. et al., 2010. Predicting long-term outcome after endovascular stroke treatment: the totaled health risks in vascular events score. *AJNR*, 31: 1192-1196.
11. Koen, H. 2015. Modern concepts of acute stroke treatment. M, 145 p.