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Mechanical thrombectomy in acute ischemic stroke: Upper-Silesian Medical Center in Katowice experiences based on the treatment of the first 500 patients

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INTRODUCTION

Cardiovascular diseases constitute a significant clinical and economic problem. Stroke is also one of the most important causes of disability in Europe [1].

Subsequent randomized clinical trials (MR CLEAN [2], ESCAPE [3], REVASCAT [4]) confirmed the validity of mechanical thrombectomy (MT) for the acute phase of ischemic stroke therapy.

The pilot program for the treatment of ischemic strokes by MT based on a centralized system is being carried out in the Silesian Province. Patients are referred to the central treatment center after preliminary diagnosis in regional centers for targeted treatment. In order to provide medical services for the 24/7, various groups of specialists were engaged into medical duty: interventional cardiologists (ICs), vascular surgeons, interventional radiologists (other specialists OS)

The aim of the study is to compare clinical outcomes of acute stroke patients treated by ICs or

treated by OS. MT was used as a treatment method. In order to perform the MT procedure the available infrastructure of the invasive cardiology department (CathLab) was used.

METHODS

We present the single-center, prospective study. We included 500 ischemic stroke patients (mean [standard deviation, SD]) age 67 (9) years; 52% women) with confirmed large vessel occlusion (LVO). The first patient included in the study was in November 2018 and the last one in June 2021. The patients were consecutive. The procedures were performed by ICs (n = 174), and by OS (n = 326). The study was conducted over a two-year period. The study was based on a protocol approved by the Bioethical Committee of the Medical University of Silesia. Based on the assumptions of the central system, patients were referred for treatment from 20 regional neurological departments for further investigation. After initial verification and confirmation of the ischemic stroke in an imaging examination in a regional hospital, a patient was transferred to a central hospital. The final decision and qualification of the patient for treatment was made by a neurologist at the central hospital. The maximum time from the onset of symptoms to starting treatment could not exceed 6 hours. The detailed exclusion criteria, periprocedural pharmacological therapy and technical aspects of the procedure are described in detail in another publication. [5]. Catheter thrombectomy was performed according to the weekly schedule of 3 vascular surgeons (covering 3 days a week), 2 neuroradiologists (operating 2 days a week) and 2 ICs (2 days a week). The ICs training included: (1) participation in 150 procedures in the field of neuroradiology, including at least 50 performed independently (supplying cerebral vascular malformations, embolization of aneurysms, angiomas, fistulas, placement of intracranial stents, thrombectomy) or performing 50 procedures in the field of endovascular treatment, including at least 5 performed independently in the presence of a proctor; (2) participation in the training course Intravascular treatment of ischemic cerebral strokes or a course at a foreign MT treatment center; (3) 3-month internship in a ward in a neurology department with a stroke unit, in order to learn about the MT treatment procedures applicable in Poland.

Statistical analysis was performed with SPSS v25.0 Software (IBM Corp, Armonk, NY, US). The original data were presented on the basis of median (interquartile range [IQR]) and quantitative variables were described as the mean and standard deviation (SD) (parameters with normal distribution) . Throughout the analysis, the Student's T-test was used for normal distribution, while the Mann-Whitney U test was used to compare continuous variables with abnormal distribution. The assumption of the normal distribution was tested using the Shapiro Wilk test. Pearson's chi-square test was used for the qualitative parameters. A *P*-value of less than 0.05 was considered statistically significant.

RESULTS AND DISCUSSION

Five hundred patients were enrolled in the study. Patients were allocated to two groups: treated by ICs or treated by OS, according to the randomization described previously. The study groups did not differ statistically in basic characteristics (Supplementary materials, *Table S1*). The procedure was performed on median 255 (IQR, 210–302) minutes after the onset of symptoms. In 13% (61 strokes) strokes concerned the internal carotid artery basin. TICI (Thrombolysis in Cerebral Infarction) score 2b or 3 was considered to be angiographic success. TICI 2b or 3 was obtained in 341 patients (68.2 %). Clinical results were assessed using a modified Rankin scale (mRS). The median of mRS score on discharge was 4 (IQR, 2–5). The thrombectomy procedure was performed in 174 patients (34.8%) by the ICs. There was no difference in the angiographic results (TICI 2b or 3 ICs vs. OS, 65.8% vs. 69.6%; $P = 0.68$) in procedures performed by ICs or OS. In-hospital deaths have been reported in 21.7% in ICs group and 16.3 in OS group ($P = 0.13$), the 3-month mortality and the mRS score after 3 months are correspondingly: 30.6% vs. 28.1% ICS group vs OS group ($P = 0.58$) and mRS median score 3 (IQR, 1–4) vs. median 3 (IQR, 1–4) ICs group vs. OS group ($P = 0.1$) (**Figure 1**).

Widespread acceptance of the efficacy of MT in treating acute stroke occurred in 2015 with the publication of a series of clinical trials demonstrating benefit of endovascular treatment methods. Currently, 17 centers conduct a MT program in Poland. MT to treat LVO causing a stroke is one of the most effective treatments in medicine, with a number needed to treat to improve clinical outcomes as low as 2.6 [6]. The effectiveness of the therapy largely depends on the time from the starting symptoms to the beginning of the therapy. This time period is referred to as “door to puncture”(DTP) -time from arrival to hospital to groin access for MT. A centralized system allows to shorten the DTP time. Research confirms that referring patients from local centers to central ones, operating in the 24-hour on-call mode, does not worsen the long-term prognosis of patients [7].

Cardiologists have a long track record in cardiovascular interventional therapy. Functioning today CathLabs provide consistent and reliable management for the majority of patients concerned. Experienced cardiologists achieve a similar percentage of satisfactory MT angiographic results (TICI 2b or 3) as vascular surgeons, interventional radiologists or neurosurgeons [8]. However, despite successful attempts to use CathLab facilities in Poland and the experience of ICs in the treatment of ischemic stroke using MT, there are still few cardiology centers offering this method of treatment [9]. As noted by Grunwald et al. in their editorial, not all neurologists agree that large medical centers with a neurosurgical and radiological background are only proper way of reporting the MT program. The availability of such highly specialized centers is limited. It should be remembered that the clinical outcomes of MT treatment depend mainly on early reperfusion, and

not on the type of center that performs the procedure [10].

It should be noted that, there are significant differences between the coronary and cerebral vessels, such as the fragility of the cerebral circulation. Perhaps this is the reason why procedures performed by cardiologists took longer than those performed by other specialists. However, the short-term and long-term outcomes of patients after MT procedure do not differ significantly depending on specialty of the operator. It is worth noting that ICs quickly mastered the treatment technique at a level comparable to that of OS. In the first study published from our center, 55.7% of ICs obtained the TIMI 2b-3 value, in the current study, which was carried out on 500 patients, this percentage increased to 65.8% (ICs 65.8% vs. OS 69.6%; $P = 0.43$) [8]. In our study and in the results of other centers, the treatment result depends mainly on the extent of the stroke, duration of symptoms and comorbidities, and not on the operator's specialization [11].

Taking into account, not worse results of the treatment of ischemic stroke by ICs using the MT method, a wider involvement of ICs should be considered.

Supplementary material

Supplementary material is available at https://journals.viamedica.pl/kardiologia_polska

Article information

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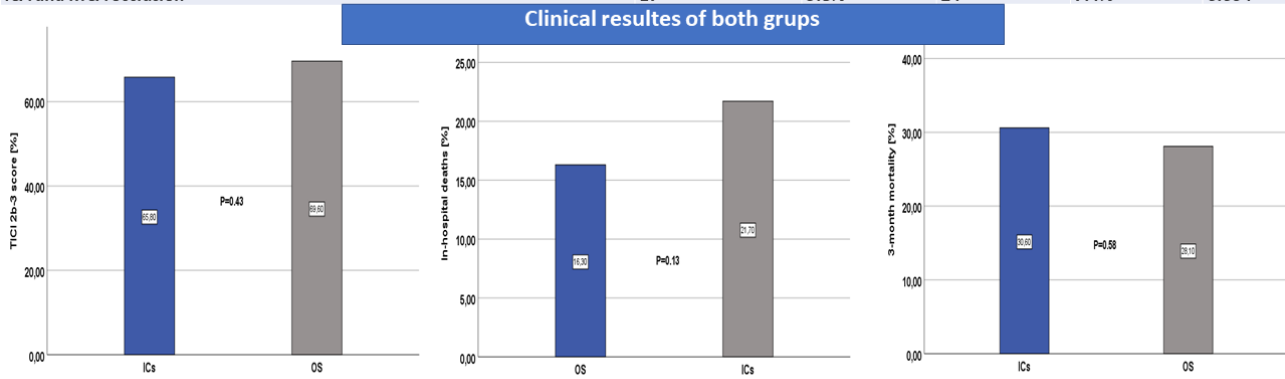
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Angiographic characteristic of both groups					
	ICs		OS		P-value
	median	IQR	median	IQR	
Time from symptom onset to revascularization [min.]	255	225-305	250	210-295	0.83
Duration of intervention [min.]	118	80-150	110	70-135	0.02
	n	n(%)	n	n(%)	P-value
ICA occlusion	21	12.1%	37	11.4%	0.92
MCA occlusion	132	75.9%	199	61.0%	0.44
ICA and MCA occlusion	17	9.8%	24	7.4%	0.054



ICs- interventional cardiologists, ICA- internal carotid artery, IQR- interquartile range, MCA- middle cerebral artery, OS- other specialists, TICI- Thrombolysis In Cerebral Infarction

Figure 1. Angiographic characteristic of both groups

Abbreviations: ICS, interventional cardiologists; ICA, internal carotid artery; IQR, interquartile range; MCA, middle cerebral artery; OS, other specialists; TICI, Thrombolysis in Cerebral Infarction