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Short Communication

ISCHEMIC STROKE DUE TO MIDDLE CEREBRAL ARTERY M1 SEGMENT OCCLUSION: LATVIAN STROKE REGISTER DATA

Ramona Valante[1], Inese Blimhena[1], Evija Miglāne[1, 2], Andrejs Millers[1, 2], Artūrs Balodis[3] , and Elīna Pūcīte[1, 2 #]

[1] Pauls Stradiņš Clinical University Hospital, Department of Neurology, Pilsoņu iela 13, LV-1002, Rīga, LATVIA

[2] Rīga Stradiņš University, Department of Neurology and Neurosurgery, Pilsoņu iela 13, LV-1002, Rīga, LATVIA

[3] Pauls Stradiņš Clinical University Hospital, Department of Diagnostic Radiology Institute, Pilsoņu iela 13, LV-1002, Rīga, LATVIA

[#] Corresponding author; elina.pucite@rsu.lv

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The occlusion of middle cerebral artery (MCA) is the most common cause of ischemic stroke. A retrospective single centre analysis of ischemic stroke was conducted using data from the Latvian Stroke Register in the period from January 2013 till December 2014. The study included 478 patients who had confirmed MCA occlusion using computed tomography angiography (CTA). Half of the patients were males — 237 (49.6%), average age 69.51, average age of females was 74.58 years. Cardioembolic stroke was the most common cause of MCA M1 segment occlusion in 294 (61.5%) cases. Small cerebral artery occlusion was not a cause of M1 MCA occlusion. The reperfusion therapy group consisted of 209 patients and the conservative therapy group of 269 patients. Both groups presented similar neurological status when they were admitted to hospital. However, the reperfusion therapy group had better neurological status (NIHSS 6.82) than in the conservative therapy group (NIHSS 8.2) at the time period when patients were discharged from hospital ($p < 0.05$). There were more cases of good functional outcome (39.2%) and less of poor (34.5%) in the reperfusion group, as well as less mortality — 7.6%. Middle cerebral artery (MCA) is the most common site of stroke and the most common cause of its occlusion is cardioembolism. There is high incidence of recurrence of stroke due to M1 MCA occlusion. Both groups presented a similar neurological status on admission, but more improvement was seen in the reperfusion therapy group after discharge of patients from hospital. The functional outcome was also better in the reperfusion therapy group.

Key words: *ischemic stroke, middle cerebral artery, computed tomography angiography, reperfusion therapy, conservative therapy.*

The occlusion of middle cerebral artery (MCA) is the most common cause of ischemic stroke (Shi *et at*., 2010). The MCA is one of three major paired arteries that supply the brain with blood, and it is the largest branch of the internal carotid artery. The MCA supplies blood to an extremely large portion of brain: part of frontal lobe, lateral surface of temporal and parietal lobes (DeLong, 1973).

It is known that occlusion of a large cerebral artery such as the middle cerebral artery M1 segment can lead to severe damage of the brain or result even in death. Cases of the whole MCA territory involvement have been often described in the literature; the neurological deterioration can occur rapidly within 24 hours of symptom onset and has been termed "malignant MCA infarction" (Treadwell and Thanvi, 2010). However, there are few papers with discussion of M1 MCA infarction when symptoms are not so severe. Also, there has been no review about the situation in Latvia on patients with MCA M1 occlusion.

The aim of this study was to prepare a review of patients with M1 MCA infarction in patients treated in the Pauls Stradiņš Clinical University Hospital and to compare the outcome and efficiency of the used treatment.

A single-centre study was performed. It was a retrospective analysis of ischemic stroke patient data from the Latvian Stroke Register. A special questionnaire was obtained for each patient, which included different parameters of patient's neurological status, imaging and therapy.

The data of all patients who were hospitalised in Pauls Stradiņš Clinical University Hospital at the Department of Neu-

rology during the period from January 2013 till December 2014 with diagnosis ischemic stroke were reviewed. During this time, 2179 patients were admitted with diagnosis ischemic stroke. Of them, 1656 (75%) had cerebral infarction of the middle cerebral artery.

The subtypes of cerebral infarction were defined by TOAST (Trial of ORG 10172 in Acute Stroke Treatment) criteria (Adams *et al*., 1993).

The neurological status of patients was evaluated using the National Institute of Health Stroke Scale (NIHSS) at the time when they were admitted as well as when they were discharged from hospital. Besides NIHSS, the modified Rankin Scale (mRS) was used and the functional outcome was defined as ''good'' (mRS 0-2), ''moderate'' (mRS 3), and ''poor'' (mRS 4-5).

The data were summarised using descriptive statistics: average, percentage standard deviation with median range. Independent variables like NIHSS and functional outcome (mRS) were analysed using the T test and chi-square test. All statistical analyses were performed using Windows Excel 2010. A p-value < 0.05 was considered statistically significant.

MCA occlusion was confirmed in 478 patients by using computed tomography angiography (CTA). Average age of patients was 72.06 (SD +/ –10.07) years. Half of the patients were males — 237 (49.6%), average age 69.51 (SD ± 9.77), average age of females was 74.58 (SD ± 9.71) years (Table 1).

Using TOAST criteria the most common cause of M1 MCA occlusion was cardioembolic stroke in 294 (61.5%) cases. The second most common cause was stroke due to large artery atherothrombosis in 138 (28.9%) cases. Small cerebral artery occlusion was not a cause of M1 MCA occlusion (Table 2).

Patients were divided into two groups according to the used therapy. The reperfusion therapy group consisted of 209 (43.7%) patients who were admitted in a therapeutic time window and had no contraindications for therapy. The other group consisted of 269 (56.3%) patients who received conservative therapy.

One hundred twenty four (59.3%) patients in the reperfusion therapy group received intravenous thrombolysis, 58 (27.8%) patients received mechanical thrombectomy and 27 (12.9%) patients had combined reperfusion therapy.

On admission there was no significant difference in the severity of the neurological status between the reperfusion and conservative therapy grous. Average NIHSS was 13.64 ± 6.4 in the reperfusion therapy group, and 12.73 ± 6.31 for patients who did not receive reperfusion therapy (p < 0.140).

There was a significant improvement of the neurological status in both groups when patients were discharged from hospital. The reperfusion therapy group had a better neurological status (NIHSS 6.82 ± 5.31) than in the conservative therapy group (NIHSS 8.2 ± 6.23 (p < 0.04998) (Table 3).

There was also a significant improvement in the functional outcome in patients who received reperfusion therapy. There were more patients with good functional outcome (mRS 0–2) in the reperfusion therapy group (39.2%) and less patients with poor functional outcome (mRS 4–5 in 34.5% of patients). Also, the mortality rate was lower in the reperfusion therapy group — 7.6% (p < 0.01) (Table 4).

In Europe, mean age of stroke patients is 71.8 years for males and 76 years for females (Appelros *et al.,* 2009). In this study the mean age for males was 69.51 and for females

Table 1

BASELINE PATIENT CHARACTERISTICS

	n = 478 (%)	Mean ± SD (min – max)
Male	237 (49.6%)	
Age, years		69.51 ± 9.77 (32–91)
Female	241 (50.4%)	
Age, years		74.58 ± 9.71 (38–91)
AH	394 (82.4%)	
AF	272 (56.9%)	
Previous TIA	8 (1.7%)	
Previous CI	176 (3.8%)	
Average days spent in hospital		10.61 ±5.04 (1–43)
Reperfusion therapy	209 (43.7%)	

AH – arterial hypertension, AF – atrial fibrillation, TIA – transitory ischemic attack, CI – cerebral infarction

Table 2

SUBTYPES OF ISCHEMIC STROKE OF PATIENTS WITH M1 MCA OCCLUSION

	n = 478 (%)
Large artery atherosclerosis	138 (28.9%)
Cardioembolism	294 (61.5%)
Small artery occlusion	0
Other causes	10 (2.1%)
Undetermined causes	36 (7.5%)

Table 3

AVERAGE NIHSS IN PATIENT GROUPS ON ADMISSION AND AT TIME WHEN PATIENTS WERE DISCHARGED FROM HOSPITAL

	Reperfusion therapy	Conservative therapy	
NIHSS on admission mean ±SD	13.64 ±6.41	12.73 ± 6.31	p > 0.140
NIHSS on discharge mean ±SD	6.82 ±5.31	8.2 ± 6.23	p < 0.05
	p < 0.00001	p < 0.00001	

Table 4

EVALUATION OF FUNCTIONAL OUTCOME USING MRS IN PATIENT GROUPS AT TIME WHEN PATIENTS WERE DISCHARGED FROM HOSPITAL

		Reperfusion therapy n = 214 (%)	Conservative therapy n = 386 (%)
mRS	0-2	82 (39.2%)	69 (25.7%)
	3	39 (18.7%)	48 (17.8%)
	4-5	72 (34.5%)	116 (43.1%)
	Exitus letalis	16 (7.6%)	36 (13.4%)

$p < 0.01$

— 74.58 years. The mean age for patients in our study was similar to the average in Europe.

This study showed that the most common cause of M1 MCA occlusion was cardioembolism — 61.5% of cases. The literature on stroke epidemiology provides differing data on incidence of stroke causes. There are studies that show large artery atherothrombosis as the main cause of stroke, even in 50% of cases (Murtagh and Smalling, 2006; Ferro, 2003). Cardioembolic stroke was present only in 14–30 % of cases in some studies (Ferro, 2003; Arboix and Alio, 2010; 2012). However, in more recent published studies cardioembolic stroke has been pointed out as the main cause for ischemic stroke (Hannon *et al*., 2009; Marnane *et al*., 2010; Palm *et al*., 2012). The diverse data of incidence of stroke causes can be associated with various patient pools that are analysed. In our study, we analysed only patients with M1 MCA occlusion, and it is known that cardioembolism most often causes occlusion of large vessels.

Recurrent stroke is highly prevalent among stroke survivors and is a major cause of morbidity and mortality in these patients. Several studies have shown that 9–14 % of stroke patients experienced recurrence within two years after the initial stroke (Lee *et al.,* 2015). Our study showed higher incidence of recurrent stroke — 38.5%. Probably one of the reasons could be that the patient group consisted of those with large artery occlusion and more than half of strokes were due to cardioembolism, which had higher incidence of recurrence.

Patients with M1 MCA occlusion, who received reperfusion therapy, presented a slightly more severe neurological deficit than those patients who received conservative therapy. This slight difference of severity of neurological status can be due to the collateral system of blood vessels. This was not reviewed in this study, but there are a many papers that show the importance of the artery collateral system for good outcome in patients with ischemic stroke (Nayak *et al*., 2010; Shi *et al*., 2010; Rohan *et al*., 2014). More recent studies indicate the importance of choosing correct treatment options for patients with large vessel occlusions, and point out the effectiveness of combined reperfusion therapy (Campbell *et al.,* 2015; Goyal *et al*., 2015). In our study, reperfusion therapy was received by 43.7% of patients and combined therapy was used in 12.9% of cases. There was better functional outcome in patients who received reperfusion therapy than in patients who received conservative therapy. Therefore, proper evaluation of the neurological status, indications and contraindications for different procedures are the main aspect in benefiting good outcome for the patient.

The middle cerebral artery (MCA) is the most common site of stroke and the most common cause of its occlusion is due to cardioembolism. There is high incidence of recurrence of stroke due to M1 MCA occlusion. Both groups, reperfusion and conservative therapy groups, presented similar neurological status on admission, but more improvement was seen in the reperfusion therapy group after discharge of patients from the hospital. The functional outcome was also better in the reperfusion therapy group.

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IŠĒMISKS INSULTS SAKARĀ AR *ARTERIA CEREBRI MEDIA* M1 SEGMENTA OKLŪZIJU: INSULTA REĢISTRA DATI

Išēmisks insults visbiežāk notiek vidējās cerebrālās artērijas apasiņošanas baseinā. Tika veikts retrospektīvs Insulta reģistra datu pētījums. Pētījumam tika atlasīti un apstrādāti pacientu dati laika periodā no 2013. gada janvāra līdz 2014. decembrim. Datu analīzei tika atlasīti 478 pacienti, kuriem ar angiogrāfijas metodi, bija apstiprināta ACM oklūzija. Puse no pacientiem bija vīrieši 237 (49,6%) ar vidējo vecumu 69,51 gadi, sievietēm vidējais vecums bija 74,58 gadi. Biežākais insulta cēlonis bija kardioembolija — 294 (61, 5%) gadījumos. Sīko asinsvadu saslimšana nebija kā cēlonis ACM M1 segmenta oklūzijas gadījumā. Reperfūzijas terapiju saņēma 209 (43,7%) pacienti. Iestājoties neiroloģiskais stāvoklis abās grupās bija līdzīgs, taču izrakstoties lielāks uzlabojums bija reperfūzijas terapijas grupā NIHSS 6,82 salīdzinot ar konservatīvas terapijas grupu — NIHSS 8,2 (SD ± 6,23) ($p < 0,05$). Izrakstoties pacientu funkcionālais stāvoklis bija labāks reperfūzijas grupā, mRS 0–2 bija 39,2% gadījumu, kā arī slikts funkcionālais iznākums (mRS 4–5) bija sastopams retāk – tikai 34,5% gadījumu. Mirstība arī bija zemāka reperfūzijas grupā — 7,6%, salīdzinot ar konservatīvās terapijas grupu – 13,4%. Biežākais cēlonis ACM M1 segmenta oklūzijas insultam ir kardioembolija. Pacientiem ir liela atkārtotu insultu incidence. Iestājoties reperfūzijas terapijas un konservatīvas terapijas grupu pacientiem neiroloģiskais stāvoklis bija līdzīgs. Taču reperfūzijas grupā pacientiem izrakstoties bija ievērojamāks uzlabojums novērtējot neiroloģisko stāvokli. Arī funkcionālais stāvoklis izrakstoties bija labāks pacientiem, kas saņēma reperfūzijas terapiju.