Clinical neurological characteristics of ischemic stroke subtypes in acute phase

S. I. Shkrobot, N. R. Sokhor, L. S. Milevska-Vovchuk, I. Ya. Krynytska,
M. I. Marushchak, L. V. Shkrobot, O. R. Yasnij

I. Horbachevsky Ternopil State Medical University, Ukraine

Objectives. The aim of the present study was to clarify clinical neurological characteristics and different ischemic stroke subtypes unfavorable course predictors in acute phase.

Material and methods. 482 patients with different ischemic stroke subtypes were observed. Among them there were 125 (25.9 %) with cardioembolic infarct (CEI), 119 (24.7 %) with large artery atherosclerosis (LAAS) infarct, 122 (25.3 %) with lacunar stroke (LAC), 116 (24.1 %) with stroke of undetermined etiology (UDE). The comparative analysis of clinical picture was performed. The predictors of unfavorable course of acute phase were established.

Results. We have found out that severe neurological deficit, high mortality and the worst functional outcome during the first 14 days were observed in patients with CEI and LAAS. The highest frequency of early neurological deterioration (END) was detected at LAC (in 22.7 % of patients). There was a relationship between END and presence of transient ischemic attack (TIA) in past medical history, the level of systolic blood pressure (SBP) at the beginning of the disease and the degree of carotid arteries stenosis on the side of lesion. The patients with LAC had mild neurological deficit and better prognosis compared with other ischemic stroke subtypes. Among the clinical factors that have impact on the CEI, LAAS and UDE acute phase course were: the size of lesion, the level of consciousness on the 1st day, the baseline SBP, patient's age. At LAAS, the presence of transient ischemic attack (TIA) in past medical history and low SBP in the onset of the disease (less than 140 mm Hg) has an additional prognostic value for an unfavorable functional outcome. The severity of LAC in acute period depended on its localization and size. Localization of LAC in the internal capsule, thalamus and pons were characterized by the highest severity.

Conclusions. Clinical neurological features of ischemic stroke depend on its subtype and have some prognostic value for the course of different ischemic stroke subtypes in acute phase.

Клініко-неврологічні особливості перебігу підтипів ішемічного інсульту в гострому періоді

С. І. Шкробот, Н. Р. Сохор, Л. С. Мілевська-Вовчук, І. Я. Криницька, М. І. Марущак, Л. В. Шкробот, О. Р. Ясній

Мета роботи – уточнити клініко-неврологічні особливості та предиктори несприятливого перебігу різних підтипів ішемічного інсульту в гострому періоді.

Матеріали та методи. У 482 осіб із різними підтипами ішемічного інсульту (125 (25,9 %) з кардіоемболічним інсультом (КЕІ), 119 (24,7 %) – з атеротромботичним інсультом (АТІ), 122 (25,3 %) – з лакунарним інсультом (ЛІ) та у 116 (24,1 %) пацієнтів – з інсультом невизначеної етіології (ІНЕ) здійснили порівняльну характеристику особливостей клінічної симптоматики та визначили предиктори несприятливого перебігу гострого періоду.

Результати. Встановили, що найтяжчий неврологічний дефіцит, найвища смертність і гірший функціональний результат протягом перших 14 днів захворювання спостерігались при КЕІ та АТІ. Найвища частота раннього неврологічного погіршення (РНП) виявлена при АТІ (у 22,7 % пацієнтів). Спостерігалась залежність між РНП із наявністю в анамнезі транзиторної ішемічної атаки (ТІА), рівнем систолічного артеріального тиску (САТ) у дебюті захворювання та ступенем стенозу сонних артерій на стороні вогнища. У пацієнтів із ЛІ був найлегший неврологічний дефіцит, а також кращий прогноз серед усіх підтипів ішемічного інсульту. Ранній рецидив інсульту був найпоширенішим при АТІ. Серед клінічних чинників, котрі впливають на перебіг гострого періоду КЕІ, АТІ та ІНЕ, найбільшу вагу мають розмір вогнища, рівень свідомості у 1 добу, вихідний САТ, вік хворого. При АТІ додаткове прогностичне значення для несприятливого функціонального результату має наявність в анамнезі ТІА та низький САТ у дебюті захворювання (менше ніж 140 мм рт. ст.). Тяжкість ЛІ в гострому періоді залежала від його локалізації та розмірів. Найбільшою тяжкістю характеризувались ЛІ з локалізацією у внутрішній капсулі, таламусі та мосту.

Висновки. Клініко-неврологічні особливості ішемічного інсульту залежать від його підтипу й мають певне прогностичне значення для перебігу різних підтипів у гострому періоді.

Клинико-неврологические особенности течения подтипов ишемического инсульта в остром периоде

С. И. Шкробот, Н. Р. Сохор, Л. С. Милевская-Вовчук, И. Я. Криницкая, М. И. Марущак, Л. В. Шкробот, О. Р. Ясный

Цель работы – уточнить клинико-неврологические особенности и предикторы неблагоприятного течения различных подтипов ишемического инсульта (ИИ) в остром периоде.

Материалы и методы. У 482 больных с различными подтипами ишемического инсульта (125 (25,9 %) с кардиоэмболическим инсультом (КЭИ), 119 (24,7 %) – с атеротромботическим инсультом (АТИ), 122 (25,3 %) – с лакунарным

инфарктом (ЛИ), 116 (24,1 %) – с инсультом неопределенной этиологии (ИНЭ) проведена сравнительная характеристика особенностей клинической симптоматики и определены предикторы неблагоприятного течения острого периода.

Результаты. Установлено, что самый тяжелый неврологический дефицит, высокая смертность и худший функциональный результат в течение первых 14 дней наблюдались при КЭИ и АТИ. Самая высокая частота раннего неврологического ухудшения (РНУ) выявлена при АТИ (у 22,7 % пациентов). Наблюдалась зависимость между РНУ с наличием в анамнезе транзиторной ишемической атаки (ТИА), уровнем систолического артериального давления (САД) в дебюте заболевания и степенью стеноза сонных артерий на стороне очага. У пациентов с ЛИ был самый легкий неврологический дефицит, а также наилучший прогноз среди всех подтипов ИИ. Установлено, что среди клинических факторов, которые влияют на течение острого периода КЭИ, АТИ и ИНЭ, наибольший вес имеют размер очага, уровень сознания в первые сутки, исходное систолическое артериальное давление (САТ), возраст больного. При АТИ дополнительное прогностическое значение для неблагоприятного функционального результата имеет наличие ТИА в анамнезе и низкий САТ в дебюте заболевания (менее 140 мм рт. ст.). Тяжесть ЛИ в остром периоде зависела от его локализации и размеров. Наибольшей тяжестью характеризовались ЛИ с локализацией во внутренней капсуле, таламусе и мосте.

Выводы. Клинико-неврологические особенности ишемического инсульта зависят от его подтипа и имеют определенное прогностическое значение для течения различных подтипов в остром периоде.

Introduction

Cerebral ischemic stroke with coronary heart disease and cancer are the leading causes of morbidity, mortality and disability in the population of Ukraine. Only 10–20 % of all the patients after stroke return to work. Only 8 % of them maintain their professional competence, 25 % of them require assistance and only about 10 % of them return to the previous life activity.

Ischemic stroke is a common multifactorial disease, which develops due to a number of genetic mutations and environmental factors [1].

One of the major advances in modern angioneurology is the concept of heterogeneity of ischemic stroke and its division on various subtypes. In this case, common to all subtypes of brain infarction is only the final stage of the destructive process, while their pathogenesis is different. Major risk factors of stroke have been already described in the literature. Their preventive measures are mainly based on eliminating or weakening of modifying factors influence. Large multicenter studies have showed that the different ischemic stroke subtypes are associated with various risk factors [2,3]. However, nowadays the peculiarities of neurological symptoms, topographical features in the case of primary and recurrent stroke subtype according to etiopathogenetic ischemic stroke subtype have not been completely studied. This fact demands the risk factors and predictors of unfavorable course analysis separately in each pathogenetic ischemic stroke subtype.

Objectives

The aim of the present study was to clarify clinical neurological characteristics and different ischemic stroke subtypes unfavorable course predictors in acute phase.

Materials and methods

Subjects for the present analysis (four hundreds and eighty two patients) were selected from an ongoing prospectively collected cohort of patients with ischemic stroke subtypes, admitted to the neurological departments in Ternopil Regional Communal Clinical Psychoneurological Hospital. Among them there were (279 57.9 %) male and 203 (42.1 %) female patients from 45 up to 74 years old. An average age of the patients was (60.95 ± 0.56) years old. Two age

categories of patients were studied. The first one included 216 patients at the age of 45–59 years old (the first age group). The second one consisted of 266 patients at the age of 60–74 years old (the second age group).

Diagnosis of ischemic stroke subtype was based on the mechanism of its development (Special Report from the National Institute of Neurological Disorders and Stroke, 1990. Classification of cerebrovascular disease III. Stroke 21:637–676). Totally there were 125 patients with cardioembolic infarct (CEI) (25.9 %), 119 patients – with large arteries atherosclerosis (LAAS) (24.7 %), 116 patients with stroke of undetermined etiology (UDE) (24.1 %) and 122 patients with lacunar stroke (LAC) (25.3 %).

Patients were included if they presented with verified diagnosis of ischemic stroke on non-contrast computed tomographic scan (NCCT) or magneto-resonance imaging (MRI). Exclusion criteria were as follows: (1) the presence of repeated ischemic strokes and impaired consciousness deeper than sopor (according to Glasgow scale less than 9–10 points), (2) chronic heart failure II B–III stages, III or higher functional class by New York Heart Association (NYHA), (3) chronic kidney disease (filtration rate ≤60 mL/min).

All the examined patients were performed clinical neurological examination with a thorough study of the past medical history, characteristics of stroke, the dynamics of physical and neurological status. At the initial examination Glasgow coma scale was used (Teasdale G., 1974) to determine the degree of suppression of consciousness. Neurological deficit was studied in dynamics on the 1rst, the 7th and the 14th day of the disease according to the National Institutes of Health Stroke Scale (NIHSS) (Odderson I. R., 1999), the degree of everyday activity was established due to Barthel index (BI), and functional stroke outcome on the 14th day was examined by means of modified Rankin scale (mRs). Based on NIHSS all strokes were divided into: minor (score 1–4) – 138 (28.6 %), moderate (score 5–15) – 234 (48.5 %), moderate\severe (score 15–20) – 93 (19.3 %) and severe stroke (score 21–42) – 17 (3.5 %) patients. The direction of changes in the neurological status in acute phase of brain infarction we determined during the first 3 days after onset of the disease. Neurological improvement or deterioration was determined due to the results of NIHSS scale (difference in 3 points).

All patients underwent either CT scan (Astelon 4, Toshiba) or MRI (Simens, Magnetom Avanto, 1.5 TI) in order to confirm the diagnosis of stroke and determine infarct's localization and volume. According to the results all

the patients were divided into 3 groups: small infarct (up to 10 sm^3) – 161 (33.4 %), medium infarct (10–100 sm^3) – 235 (48.8 %), large infarct (>100 sm^3) – 86 (17.4 %) patients.

The patients were observed after hospitalization during the acute phase of ischemic stroke on stated dates at the 1st, the 7th and the 14th day of the disease. Statistical analysis of the results was made by means of IBM SPSS Statistics using Wilcoxon–Mann–Whitney U-criterion (for independent samples), Wilcoxon t-test (for dependent samples), t-criterion Wilcoxon (for dependent samples) and factor of pair linear correlation (r). To predict the severity of acute phase of ischemic stroke statistical method of multiple linear regression with the coefficient of multiple correlation (R) determination was used.

Results and discussion

All the patients with CEI were diagnosed atrial fibrillation (AF): 16.8 % – a permanent form, 55.2 % – persistent one and 28.0 % – paroxysmal form. Among other concomitant diseases we observed postinfarction cardiosclerosis (11.2 %), high blood pressure (59.2 %), coronary heart disease (46.4 %), obesity of the Ist – IInd stage (13.6 %). According to the results of CT-scan and MRI the infarct volumes were as follows: small (11.2 %), medium (64.0 %), large (24.8 %). The average infarct volume was (83.4 ± 7.8) cm^3. We have found that cardioembolic subtype of ischemic stroke was mainly severe (30.4 %) and moderate\severe (41.6 %) with slow regression of neurological symptoms and the degree of everyday activity recovery with a significant improvement on the 14th day. A good functional result according to mRs was marked on the 14th day in 46.4 %, the moderate level of disability – in 14.3 %, severe – in 31.2 % of patients. Factors that contribute to the outcome of CEI in acute phase included the infarct volume, the presence of general cerebral symptoms and hemorrhagic transformation, the degree of heart failure. Combination of AF with high blood pressure significantly more frequent (compared with patients without high blood pressure) contributes to severe CEI (P < 0.05): 50.0 % compared to 23.3 % of all cases.

In 15.2 % of patients with CEI we observed early neurological deterioration (END), associated mainly with hemorrhagic transformation (HT). Among the factors that contribute to the HT were severe stroke, disorders of consciousness at admission, the large volume of stroke, combination of AF with hypertension, high blood pressure at the onset of the disease (systolic blood pressure (SBP) higher than 170 mm Hg.).

The method of multiple linear regression for severity of CEI was based on such factors as the volume of infarct, the patient's age, SBP at the onset of the disease, the results of Glasgow scale. Through this method we calculated the coefficient of multiple correlation (R), which on the 1st day was – 0.56, P < 0.0001, on the 7th day R = 0.61, P < 0.0001, on the 14th day R = 0.60, P < 0.0001.

In patients with LAAS among the concomitant diseases we recorded atherosclerosis (23.5 %), combination of atherosclerosis and hypertension (66.4 %), coronary heart disease (42.9 %), diabetes mellitus (22.7 %), alimentary obesity (59.7 %). In previous medical history 21.8 % of patients had TIA, 85.7 % of patients had signs of atherosclerotic lesion of other vascular pools. In 9.2 % of patients during the first 14 days of LAAS we observed recurrent cerebrovascular events (TIA or ischemic stroke). Acute phase of LAAS was characterized as moderate\severe and severe strokes (in 73.9 % of patients). There was the predominance of medium and large infarcts (in 94.2 %). In 22.7 % of patients we observed early neurological disorders. END was associated with completion of ischemic zone, edema and recurrent cerebrovascular events. We have found a relation between END and TIA presence in previous medical history (r = 0.60, P = 0.008), the level of SBP at the onset of the disease (r = -0.66, P = 0.003) and the degree of carotid stenosis on the side of lesion (r = 0.56, P = 0.007). Taking into account such factors as age, SBP, infarction volume, degree of consciousness according to Glasgow scale on the 1st day of LAAS, the coefficient of multiple correlation was R = 0.50, P = 0.010. There was an inverse relationship between the level of SBP and severity of LAAS. Unfavorable factor for the LAAS course was SBP less than 140 mmHg. On the 7th day at the same factors R was 0.74, P < 0.0001, on the 14th – 0.62, P < 0.0001. With the introduction of additional factor such as TIA in previous medical history on the 7th day R increased to 0.77, P < 0.0001.

In patients with UDE among concomitant diseases, we diagnosed isolated hypertensive disease (40.5 %), a combination of arterial hypertension and atherosclerosis (57.0 %), a combination of arterial hypertension and type 2 diabetes mellitus (3.5 %). In all patients UDE developed on the background of hypertensive crisis. This subtype of ischemic stroke was characterized by medium (63.8 %) and small (15.5 %) infarcts. Infarcts were localized mainly in parietal and temporo-parietal zones (51.7 %). Usually we observed minor (34.5 %) and moderate strokes (50.9 %). On the 7th day of the disease in 73.1 % and on the 14th day of the disease – in 84.5 % of patients we recorded significant positive dynamics of neurological deficit. There was a weak correlation between the severity of UDE and its volume on the 1st day (r = 0.28, P = 0.021), moderate – on the 7th day (r = 0.40, P = 0.018) and on the 14th day (r = 0.37, P = 0.011). On the 1st day of stroke severity depended on the infarct localization (r = 0.33, P = 0.011). The most severe UDE were diagnosed at temporal-parietal localization. On the 14th day we found a reliable link between the UDE severity and infarct localization (r = 0.36, P = 0.019). We haven't found a direct relationship between the patients' age, SBP at the onset of the disease with the degree of neurological deficit in different terms of UDE acute phase.

Taking into account the age, baseline SBP, GS, the UDE volume, the coefficient R, designed by means of multiple linear regression, on the 1st day was 0.51, P < 0.001, on the 7th day – 0.62, P < 0.001, on the 14th day – 0.60, P < 0.001.

In 95.1 % of all the patients with LAC we diagnosed high blood pressure. Among other comorbidity there were diabetes mellitus (25.5 %), coronary heart disease (37.7 %), arrhythmia (paroxysmal beats) (6 %). Among the risk factors we identified hyperlipidemia (27.4 %), current smoking (28.6 %) and alimentary obesity (17.2 %). In 95.1 % of patients we observed typical lacunar syndromes: motor (26.2 %), sensory (17.2 %), sensory-motor (25.4 %), atactic hemiparesis (6.7 %) and syndrome of dysarthria – clumsy hand (19.8 %). According to the NIHSS scale, we diagnosed

moderate stroke in 57.4 % of patients, minor stroke – in the 36.9 % and severe stroke in 5.7 % of all the patients. Significantly higher severity of stroke was observed in middle-aged patients compared with older ones (P < 0.05). At all variants of clinical syndromes we observed a significant regression of focal signs on the 7th and the 14th day of the disease, indicating a good prognosis for LAC in acute phase. In 77.0 % of patients lacunar lesions were multiple with size about 10 mm, despite the first episode of acute cerebrovascular accident. These data indicate the existence of previous lesions of perforating small arteries, silent ones, without clinical manifestations. These findings have been proved by other studies [4]. Lacunar lesions in semioval center and striatum with size about 10 mm clinically manifested as minor stroke. LAC in white matter of frontal and parietal lobes had clinical signs only if their size exceeded 7 mm. LAC in internal capsule, thalamus and pons always had severe course (moderate or severe). Neurological deficit was mainly typical for white matter lesions, the main pathways of brain lesions. Studying the predictors of the severity of LAC in acute phase we used a regression model including patients' age, the initial SBP and size of the focus. We have not found significant impact of these parameters on the LAC severity on the 1st, the 7th and the 14th day of the disease (R indicator was within 0.228–0.275, P < 0.05).

We performed the comparative characteristics of patients with ischemic stroke different subtypes with the assessment of demographic characteristics, risk factors, severity of brain infarction and early stroke outcomes (*Table 1*).

The oldest patients were those with CEI and LAAS. Significantly younger patients were those with LAC. There were more males (in percentage) at LAAS and LAC. Male largest percentage was at LAAS and LAC. We observed significant difference in gender identity according to the pathogenetic ischemic stroke subtype. Most of male patients had LAAS. The smallest proportion of male was observed among those with CEI. Most of female had CEI. The last fact can be explained by greater frequency of AF among female patients. CEI and LAAS were mainly associated with older male, LAC and UDE – with the youngest ones.

The relative contribution of different etiologic factors differs among different age groups. UDE more often (compared with other ischemic stroke subtypes) occurred in middle-aged patients (from 45 up to 60 years old); CEI on the background of AF was more common among older people (at the age of 60–74 years) compared to the UDE and LAC.

Modified risk factors and comorbidities significantly differ in different ischemic stroke subtypes (*Table 2*).

TIA in anamnesis prevailed at LAAS and was not typical for CEI. High blood pressure was the most common risk factor of stroke and observed in all ischemic stroke subtypes. However, despite the high prevalence of high blood pressure (HBP) in all ischemic stroke subtypes, it was much more common for UDE and LAC compared with LAAS. It was also significantly higher at LAAS compared with CEI. Diabetes mellitus was more often observed in patients with LAC compared with other ischemic stroke subtypes.

Hypercholesterolemia was often observed in patients with LAAS and was rare in other ischemic stroke subtypes.

The results of hypercholesterolemia as a stroke risk factor are controversial. The high prevalence of hypercholesterolemia in LAAS coincides with the results of previous studies that showed hypercholesterolemia as a stroke risk factor due to the atherosclerosis of large arteries. The incidence of ischemic heart disease (IHD) was significantly higher in CEI and LAAS compared with UDE. The patients with LAAS had significantly higher incidence of peripheral arteries disease.

HBP was mainly observed in CEI. All ischemic stroke subtypes were characterized by elevated average blood pressure. At LAC and UDE the baseline SBP was significantly higher compared with CEI and LAAS. Blood pressure above 200/120 mm was observed in 39.4 % of patients with LAC, 33.9 % – with UDE, in 21.6 % – with CEI and in 18.5 % patients with LAAS. Seizures at onset were observed in 7.2 % of patients with CEI, in 5.0 % – with LAAS and 3.4 % – with UDE. Epileptic seizures were not typical for patients with LAC.

During the first week recurrent ischemic cerebrovascular events were recorded in 15 patients. Repeated episodes of ischemic strokes or TIA were detected in 9.2 % of patients with LAAS and 4.8 % – with CEI.

Neurological deficit at admission was the most remarkable in CEI and LAAS (there were no significant difference between CEI and LAAS) (*Table 3*). The lowest severity of stroke was observed in LAC and UDE.

As it is shown in the *Table 3*, the severity of CEI significantly reduced only on the 14th day of the disease, the severity of UDE and LAC had already been significantly reduced on the 7th day of stroke. We noted that severity of stroke in LAAS on the 7th and 14th day of the disease did not differ significantly compared with baseline values. We have found a reliable difference between the severity of CEI, LAAS and severity of UDE, LAC on the 1st day, 7th day and 14th day. Also there was a significant difference between the severity of UDE and LAC on the 1st, 7th day and 14th day.

The degree of daily functioning was significantly improved in LAC and UDE on the 7th and 14th day compared to the first day of the disease (*Table 4*).

BI in LAC and UDE was significantly higher during the observation time compared with patients with CEI and LAAS. In LAAS we observed significantly lower values in relation to the patients with CEI on the 7th day. The analysis of the degree of disability in different ischemic stroke subtypes on the 14th day of the disease has showed that the average score for mRs was as follows: in CEI – 2.93 ± 0.17, in LAAS – 3.23 ± 0.21, in UDE – 2.30 ± 0.17 and in LAC – 1.92 ± 0.16 points. That means in LAC and UDE had significantly higher indexes of functional dependence according to mRs compared to CEI and LAAS (P < 0.0001). These data demonstrate that good functional outcome (according to mRs from 0 to 2 points) was often observed in LAC – in 75.0 % and UDE – in 58.3 % of patients. Unlike LAC, in other ischemic stroke subtypes good functional result was marked significantly less. Thus, only 15 (48.4 %) patients with LAAS and 12 (46.2 %) patients with CEI were scored according to mRs 0–2 points. The average level of disability was diagnosed in 6 (19.3 %) patients with LAAS, 5 (19.2 %) – with CEI, 6 (18.75 %) –with LAC and 4 (16.7 %) patients with UDE. Severe degree of disability (mRs 4–5 points) in LAAS was observed in 10 (32.2 %), in CEI – 9 (34.2 %), LAC – 2 (6.25 %), UDE – 6 (25.0 %) patients.

Table 1. Distribution of patients according to the age and sex with different ischemic stroke subtypes

Index	LAAS	CEI	LAC	UDE
General group	119	125	122	116
Female	40 (33.6 %)	64 (51.2 %)	51 (41.8 %)	48 (42.1 %)
Male, n (%)	79 (66.4 %)	61 (48.8 %)	71 (58.2 %)	66 (57.9 %)
Age of patients, years	67.24 ± 1.27	69.61 ± 1.40	57.46 ± 1.64	60.74 ± 0.81
Age (female), years	67.74 ± 1.70	72.01 ± 1.33	58.62 ± 1.84	62.10 ± 1.02
Age (male), years	64.75 ± 1.81	67.16 ± 1.92	56.42 ± 1.54	59.11 ± 0.90
Patients at the age of 45–59, n (%)	51 (42.9 %)	47 (37.6 %)	65 (53.3 %)	53 (46.5 %)
Patients at the age of 60–74, n (%)	68 (57.1 %)	79 (62.4 %)	57 (46.7 %)	61 (53.5 %)

Table 2. Modified risk factors and comorbidity in different ischemic stroke subtypes, n (%)

Risk factors	LAAS	CEI	LAC	UDE
TIA in anamnesis	24 (20.2 %)	10 (8.0 %)	16 (13.1 %)	13 (11.4 %)
HBP	83 (69.7 %)	74 (59.2 %)	116 (95.1 %)	109 (95.6 %)
DM	27 (22.7 %)	19 (15.2 %)	32 (25.5 %)	12 (10.3 %)
High cholesterol level	50 (42.0 %)	35 (28.0 %)	32 (26.2 %)	25 (20.0 %)
IHD	51 (42.9 %)	58 (46.4 %)	46 (37.7 %)	34 (29.3 %)
Cardiac arrhythmia	8 (6.7 %)	125 (100 %)	13 (10.7 %)	12 (10.3 %)

Table 3. The severity of different ischemic stroke subtypes on the 1st, 7th and 14th day of the disease according to NIHSS scale (M ± m), points

Stroke subtype	NIHSS		
	The day of the disease		
	1st	7th	14th
CEI (n = 125)	11.42 ± 0.54[1]	10.20 ± 0.48[1]	8.95 ± 0.59[1]
LAAS (n = 119)	11.27 ± 0.57[1]	12.26 ± 0.69[1]	10.65 ± 0.60[1]
UDE (n = 116)	9.24 ± 0.54*	7.77 ± 0.49*	6.56 ± 0.38*
LAC (n = 122)	6.72 ± 0.42*[1]	5.80 ± 0.41*[1]	4.27 ± 0.50*[1]

*: significant difference in relation to the values of patients with CEI and LAAS (P < 0.0001); [1]: significant difference in relation to the values of patients with UDE (P < 0.0001).

Table 4. The degree of daily functioning according to BI on the 1st, 7th and 14th day of the disease (M ± m)

Type of stroke	BI, points		
	1st day	7th day	14th day
CEI (n = 125)	38.63 ± 2.71	46.21 ± 2.76	54.29 ± 3.51
LAAS (n = 119)	39.63 ± 3.45	38.02 ± 3.78[2]	49.40 ± 4.92
UDE (n = 116)	50.97 ± 2.21*	61.63 ± 2.49*	71.06 ± 3.03*
LAC (n = 122)	63.37 ± 2.46*[1]	71.64 ± 2.47*[1]	80.05 ± 3.51*[1]

*: significant difference in relation to the values of patients with CEI and LAAS (P < 0.0001); [1]: significant difference in relation to the values of patients with UDE (P < 0.0001); [2]: significant difference in relation to the values of patients with CEI (P < 0.0001).

Mortality among examined patients within 14 days was in 10 (2.1 %) cases. The highest mortality was observed in CEI – 5 (4.0 %) patients. In LAAS and UDE mortality was 4 (3.4 %) and 1 (0.8 %) cases, respectively. The estimated worldwide 30-day case fatality rate after the first ischemic stroke ranged from 16 to 23 percent, though there was wide variation in reports from different countries [5,6].

Thus, we have found that CEI on the background of AF is associated with the highest mortality and the most severe neurological deficit in acute phase that coincides with the data of other authors [7]. Patients with LAC in the acute phase had less neurological deficit that had been proved by the results of other studies [8]. Although recent studies have found that the LAC is associated with the highest risk of recurrent stroke and hospitalizations [9]. Similarly, it has been shown that the LAC during the 12-year follow up for acute stroke code LAC related is associated with worse long-term survival and a higher risk of cardiac

death compared with other ischemic stroke subtypes [10]. It may be due to morphological and structural changes in the brain on the background of which this ischemic stroke subtype and target organ damage develop as a result of severe arterial hypertension.

Conclusions

1. In the acute phase of ischemic stroke the worst neurological deficit, the highest mortality and the worst functional outcome during the first 14 days were observed in CEI and LAAS. In patients with LAC we observed mild neurological deficit and better prognosis compared with other ischemic stroke subtypes. Early recurrence of stroke was typical for patients with LAAS.

2. Among the clinical factors that have an impact on the acute phase of CEI, LAAS and UDE course were: weight, the lesion size, the level of consciousness on the 1st

day, baseline SBP and patient's age. In LAAS additional predictive value for poor functional outcome in acute phase had a past medical history of TIA and low SBP at the onset of the disease (less than 140 mm Hg.).

Prospects for further research will consist in the study of metabolic, immune-inflammatory and hemodynamic predictors of ischemic stroke various subtypes course in acute period.

References

[1] Tuttolomondo, A., & Pinto, A. (2014) Ischemic stroke subtypes and the implications for stroke management. *Future Neurol.*, 9(6), 567–570. doi: org/10.2217/fnl.14.53.

[2] Ohira, T., Shahar, E., Chambless, L. E., Rosamond, W. D., Mosley, T. H. Jr., & Folsom, A. R. (2006) Risk Factors for Ischemic Stroke Subtypes. The Atherosclerosis Risk in Communities Study. *Stroke*, 37, 2493–2498. doi: 10.1161/01.STR.0000239694.19359.88.

[3] Arboix, A. (2015) Cardiovascular risk factors for acute stroke: Risk profiles in the different subtypes of ischemic stroke. *World J Clin Cases*, 3(5), 418–429. doi: 10.12998/wjcc.v3.i5.418.

[4] Sarchielli, P., Nardi, K., Chiasserini, D., Eusebi, P., Tantucci, M., Di Piero, V., et al. (2013) Immunological Profile of Silent Brain Infarction and Lacunar Stroke. *PLoS ONE*, 8(7), e68428. doi: 10.1371/journal.pone.0068428.

[5] Grysiewicz, R. A., Thomas, K., & Pandey, D. K. (2008) Epidemiology of ischemic and hemorrhagic stroke: incidence, prevalence, mortality, and risk factors. *Neurol Clin*, 26(4), 871–95. doi: 10.1016/j.ncl.2008.07.003.

[6] Feigin, V. L., Lawes, C. M., Bennett, D. A., & Anderson, C. S. (2003) Stroke epidemiology: a review of population-based studies of incidence, prevalence, and case-fatality in the late 20th century. *Lancet Neurol*, 2(1), 43–53. doi: 10.1016/S1474-4422(03)00266-7.

[7] McGrath, E. R., Kapral, M. K., Fang, J., Eikelboom, J. W., Conghaile, A., Canavan, M., & O'Donnell, M. J. (2013) Association of atrial fibrillation with mortality and disability after ischemic stroke. *MJ Neurology,* 27, 81(9), 825–32. doi: 10.1212/WNL.0b013e3182a2cc15.

[8] Arboix, A., & Martí-Vilalta, J. L. (2009) Lacunar stroke. *Expert Rev Neurother.*, 9(2), 179–96. DOI: 10.1586/14737175.9.2.179.

[9] Jones, S. B., Sen, S., Lakshminarayan, K., & Rosamond, W. D. (2013) Poststroke Outcomes Vary by Pathogenic Stroke Subtype in The Atherosclerosis Risk in Communities Study. *Stroke*, 44(8), 2307–2310. doi: 10.1161/STROKEAHA.113.000830.

[10] Melkas, S., Laurila, J. V., Vataja, R., Oksala, N., Jokinen, H., Pohjasvaara, T., et al. (2012) Post-stroke delirium in relation to dementia and long-term mortality. *Int J Geriatr Psychiatry*, 27(4), 401–8. doi: 10.1002/gps.2733.

Information about authors:

Shkrobot S. I., MD, PhD, DSc, Professor, Head of Department of Neurology, Psychiatry, Narcology and Medical Psychology, I. Horbachevsky Ternopil State Medical University, Ukraine.
Sokhor N. R., MD, PhD, DSc, Associate Professor, Department of Neurology, Psychiatry, Narcology and Medical Psychology, I. Horbachevsky Ternopil State Medical University, Ukraine.
Milevska-Vovchuk L. S., MD, PhD, Associate Professor, Department of Neurology, Psychiatry, Narcology and Medical Psychology, I. Horbachevsky Ternopil State Medical University, Ukraine.
Krynytska I. Ya., MD, PhD, DSc, Associate Professor, Head of the Department of Clinical Laboratory Diagnostics, I. Horbachevsky Ternopil State Medical University, Ukraine.
Marushchak M. I., MD, PhD, DSc, Associate Professor, Head of the Department of Functional Diagnostics and Clinical Pathophysiology, I. Horbachevsky Ternopil State Medical University, Ukraine.
Shkrobot L. V., MD, PhD, DSc, Chief Doctor, Ternopil Regional Oncology Health Center, Ukraine.
Yasniy O. R., MD, PhD, Associate Professor, Department of Primary Health Care and Family Medicine, I. Horbachevsky Ternopil State Medical University, Ukraine.

Відомості про авторів:

Шкробот С. І., д-р мед. наук, професор, зав. каф. неврології, психіатрії, наркології та медичної психології, ДВНЗ «Тернопільський державний медичний університет імені І. Я. Горбачевського МОЗ України».
Сохор Н. Р., д-р мед. наук, доцент каф. неврології, психіатрії, наркології та медичної психології, ДВНЗ «Тернопільський державний медичний університет імені І. Я. Горбачевського МОЗ України».
Мілевська-Вовчук Л. С., канд. мед. наук, доцент каф. неврології, психіатрії, наркології та медичної психології, ДВНЗ «Тернопільський державний медичний університет імені І. Я. Горбачевського МОЗ України».
Криницька І. Я., д-р мед. наук, доцент, зав. каф. клініко-лабораторної діагностики, ДВНЗ «Тернопільський державний медичний університет імені І. Я. Горбачевського МОЗ України».
Марущак М. І., д-р мед. наук, доцент, зав. каф. функціональної діагностики та клінічної патофізіології, ДВНЗ «Тернопільський державний медичний університет імені І. Я. Горбачевського МОЗ України».
Шкробот Л. В., д-р мед. наук, головний лікар Тернопільського обласного онкологічного диспансеру, Україна.
Ясній О. Р., канд. мед. наук, доцент каф. первинної медико-санітарної допомоги та сімейної медицини, ДВНЗ «Тернопільський державний медичний університет імені І. Я. Горбачевського МОЗ України».

Сведения об авторах:

Шкробот С. И., д-р мед. наук, профессор, зав. каф. неврологии, психиатрии, наркологии и медицинской психологии, ГВУЗ «Тернопольский государственный медицинский университет имени И. Я. Горбачевского МЗ Украины».
Сохор Н. Р., д-р мед. наук, доцент каф. неврологии, психиатрии, наркологии и медицинской психологии, ГВУЗ «Тернопольский государственный медицинский университет имени И. Я. Горбачевского МЗ Украины».
Милевская-Вовчук Л. С., канд. мед. наук, доцент каф. неврологии, психиатрии, наркологии и медицинской психологии, ГВУЗ «Тернопольский государственный медицинский университет имени И. Я. Горбачевского МЗ Украины».
Криницкая И. Я., д-р мед. наук, доцент, зав. каф. клинико-лабораторной диагностики, ГВУЗ «Тернопольский государственный медицинский университет имени И. Я. Горбачевского МЗ Украины».
Марущак М. И., д-р мед. наук, доцент, зав. каф. функциональной диагностики и клинической патофизиологии, ГВУЗ «Тернопольский государственный медицинский университет имени И. Я. Горбачевского МЗ Украины».
Шкробот Л. В., д-р мед. наук, главный врач Тернопольского областного онкологического диспансера, Украина.
Ясный О. Р., канд. мед. наук, доцент каф. первичной медико-санитарной помощи и семейной медицины, ГВУЗ «Тернопольский государственный медицинский университет имени И.Я. Горбачевского МЗ Украины».