Medical University - Varna
„Prof. D-r Paraskev Stoyanov”

Faculty „Medicine“
Department „ Nervous diseases and neuroscience“

PROGNOSTIC MARKERS FOR RECOVERY OF APHASIA AFTER ISCHEMIC STROKE

Radina Svetlozarova Fuchidzhieva, MD

Science supervisor:

Prof. Silva Peteva Andonova-Atanasova, Md, DSc

Varna, 2021 г.

Table of Contents

ABBREVIATIONS USED

IS – ischemic stroke

DM – diabetes mellitus

AH – arterial hypertension

TIA – transient ischemic attack

AF – atrial fibrillation

CT – computed tomography

MRI - magnetic resonance imaging

LMCA - left middle cerebral artery

SA - sensory aphasia

MA - motor aphasia

SMA - sensorimotor aphasia

PSD - post-stroke depression

BDAE - Boston Diagnostic Test for Aphasia

WAB - Western battery for aphasia

ASPECTS Alberta Stroke Program Early CT score

NIHSS - National Institute of Health Stroke Scale

ART – Aphasia Rapid Test

AHS – Aphasia Handicap Scale

DALYs - disability-adjusted life-years

tPA - tissue plasminogen activator

DWI – diffusion-weighted imaging

Positron Emission Tomography – PET

Single Photon Emission Computerized Tomography – SPECT

DWI – diffusion-weighted imaging

PWI – perfusion weighted imaging

ANOVA – analysis of variance

TOAST - The Trial of Org 10172 in Acute Stroke Treatment

NGA - Norsk grunntest for afasi

ANELT - Nijmegen everyday language test

1. INTRODUCTION

Stroke, as defined by the World Health Organization, is a rapid development of clinical signs of focal brain dysfunction lasting more than 24 hours or leading to death for no reason other than vascular origin. Subarachnoid hemorrhage is not included.

Disorders of language activity, i.e. of the processes of language coding (generation, creation of language messages) and of language decoding (understanding, comprehension of the perceived language messages) are denoted by the term aphasia. The main types of aphasia are two: motor and sensory. In motor aphasia (MA) the language coding is disturbed - the production of spontaneous speech is disturbed and the defect is realized by the patient (non-fluent speech). In sensory aphasia (SA), both language coding and language decoding are impaired, and the defect is not recognized by the patient (fluent speech). (Mavlov, 2000)

The following types of aphasia are described, corresponding to the damage of certain areas or their connections: 1. Cortical motor aphasia (damage in the motor center, Brocka's aphasia) - preserved comprehension, fluent speech and impaired repeating, 2. Cortical sensory aphasia (damage in higher auditory center, Wernicke's aphasia) - difficulties in speech comprehension, smooth but often meaningless speech and impaired repeating; 3. Conductive aphasia (broken connections between preserved speech centers) - preserved understanding and spontaneous speech, impossible repeating; 4. Transcortical motor aphasia (broken connections between the motor speech center and the center of concepts) - it is like cortical motor aphasia, but with preserved repeated speech; 5. Subcortical motor aphasia (broken connections between the motor center of speech and the executive speech organs) - difficult spontaneous speech with preserved understanding and repetition; 6. Transcortical sensory aphasia (damage to the connection between the auditory speech center and the center of concepts) - it is like cortical sensory aphasia, but with preserved repeated speech; 7. Subcortical sensory aphasia or verbal deafness (broken connections between the primary auditory cortex and the Wernicke area) - impaired comprehension and repetition with preserved spontaneous speech. 8. Complete aphasia (total, global) - mixed with the characteristics of the aphasia of Brocka and Wernicke. Spontaneous speech is missing or the patient repeats the same word (speech embolus). Comprehension, naming, repetition, reading and writing are impaired. (Shotekov, 2004)

According to Plowman and co-authors, about 795,000 people in the United States suffer a stroke each year, and many are left with serious long-term disabilities. About 100,000 of them will experience aphasia during the acute phase of recovery, and approximately one million Americans live with the disorder. (Plowman et al., 2012)

Aphasia is a common symptom of stroke. It is considered to be a serious injury by patients and their relatives and therefore knowing the prognosis and recovery time is important for rehabilitation planning and for informing the patient and his family. The improvement of aphasia takes place mainly within the first 3 months. (Pedersen et al., 1995)

According to data from the National Center for Public Health and Analysis in Bulgaria for the first 6 months of 2021 there are 20,451 patients who had stroke. The total number of performed fibrinolytic treatment is 464, and of the performed angioplasty or surgical intervention is 17. The data for 2019 show that patients with stroke were 52 891. The total number of fibrinolytic treatment in 2019 was 1 119, and of the angioplasty or surgical intervention were 79. From the data for 2020 there were a decline in hospitalized patients with acute cerebrovascular disease.

The results are as follows - total number of patients with stroke - 43 391, total number of fibrinolytic treatment - 954, total number of angioplasty or surgery - 74.

2. PURPOSE, TASKS AND HYPOTHESIS

2.1. Goals

1. To conduct a comparative study of aphasic disorders in patients with acute ischemic stroke with/without differentiated treatment with intravenous thrombolysis

2. To determine the prognostic markers for recovery of aphasia in both groups.

2.2. Tasks

1) To characterize the patients with stroke who have passed through the Second Clinic of Nervous Diseases of the University Hospital "St. Marina"- Varna for 2020-2021;

2) To determine the number and frequency of risk factors in patients with acute ischemic stroke and aphasia;

3) Using CT (using the ASPECT scale) to examine changes in the brain parenchyma in patients with aphasia with / without thrombolysis;

4) To study the evolution of aphasia and the model of recovery in some types of aphasia (Brock and Wernicke)

5) To look for correlations between the recovery of aphasic disorders and the performed treatment - differentiated / undifferentiated, as well as between the recovery of aphasic disorders and the change in motor deficit, assessed using the NIHSS scale

6) To prepare a profile of the patient for the outcome of the disease depending on the studied indicators

2.3. Hypotheses

1) It is assumed that the intravenous thrombolysis leads to faster recovery of motor deficit and aphasia, assessed using the NIHSS scale and scales for assessment of aphasia - ART and AHS.

2) It is assumed that the factors influencing the recovery of aphasia after ischemic stroke are the size of the lesion and the initial severity of the aphasia.

3. MATERIAL AND METHODS

3.1. Subject of research

Aphasia and motor deficit in patients with ischemic stroke in the left middle cerebral artery were studied.

3.2. Object of research

The study included 67 patients with ischemic stroke in the left middle cerebral artery, divided into two groups: 17 patients treated with thrombolysis (clinical group) and 50 without thrombolysis (control group), who underwent First and Second clinics for nervous diseases at the University Hospital "St. Marina "- Varna for the period January 2020 to July 2021.

Patients were selected according to specific criteria for inclusion and exclusion in the study.

Criteria for inclusion in the study:

- Patients with first ischemic stroke
- Confirmed ischemic stroke by computed tomography or magnetic resonance imaging
- Localization of the stroke in the dominant cerebral hemisphere - the territory of the left cerebral artery
- Lack of quantitative and qualitative disorders of consciousness
- Steady state to complete the study on the seventh day of the stroke
- Patients over 18 years
- Patients who have signed informed consent

Exclusion criteria:

- Lack of signed informed consent
- Patients under 18 years
- Patients with quantitative disturbances of consciousness
- Patients with intraparenchymal cerebral hemorrhage or subarachnoid hemorrhage
- Patients with previous ischemic stroke
- Patients with dementia or psychiatric diseases
- Patients with evidence of substance abuse

During the study period, the thrombolysis was performed in 83stroke patients, of which in only 17 cases the patients meet the set criteria for inclusion in the study (20.5%), which means that the range is 100%.

3.2.1. Specific studies

In order to achieve the research goal and to complete the formulated tasks, the data of the patients with stroke in the territory of the left middle cerebral artery were studied and analyzed. The patients were examined according to the standard protocol: medical history and comorbidities, physical examination, computed tomography or magnetic resonance imaging.

Based on these data, the diagnosis of stroke in the territory of the left middle cerebral artery was made.

The two groups of studied patients were detailed by sex, age, risk factors, comorbidities and therapy with intravenous thrombolysis. All patients completed the following questionnaires: Scale for assessing the severity of strokes, Scale for assessing aphasia, Scale for assessing the outcome of aphasia in the third month after stroke, Scale for assessing early ischemic changes in acute ischemic stroke in the anterior circulation and questionnaire.

3.3. Research methods

3.3.1. Image methods

The tests were performed on a Siemens Spirit and Siemens Definition CT scanner using a standard native head scanning protocol. The tests were performed on a Siemens Magnetom Verio 3T magnetic resonance imaging device.

3.3.2. Stroke Severity Scale - National Institute of Health Stroke Scale - NIHSS

National Institute of Health Stroke Scale (NIHSS) - The stroke severity assessment scale is used to determine the severity of a stroke on the basis of which to predict the clinical outcome (Appendix 1).

3.3.3. Aphasia Rapid Test (ART)

ART is a 26-point scale assessing the severity of aphasia in patients with acute stroke in less than 3 minutes (Appendix 2).

3.3.4. Aphasia Handicap Scale (AHS) for assessing the outcome of aphasia in the third month after stroke

Outcome of 3rd month aphasia, assessed with Aphasia Handicap (AHS), 0–5 points, similar to the modified Rankin scale, as a result of aphasic disability. (Appendix 3).

3.3.5. ASPECTS (Alberta Stroke Program Early CT score)

System for assessment of early ischemic changes in acute ischemic stroke in the area of the anterior circulation (Appendix 4).

3.3.6. Sociological research

Questionnaire (Appendix 5)

3.3.7. Statistical methods

- Dispersion analysis
- Variation analysis
- Correlation analysis
- Regression analysis
- Risk assessment analysis
- Prognostic analysis
- Comparative analysis

Graphic and table methods were used to visualize the results.

For all analyzes performed is assumed an acceptable level of significance $p < 0.05$ with a confidence interval of 95%.

The data was processed using SPSS v.20.0 for Windows.

The clinical study was conducted after obtaining permission from the Commission for Ethics of Scientific Research at the Medical University - Varna - Protocol / decision №89 / 19.12.2019. All participants or their relatives in the study have completed informed consent.

4. RESULTS

4.1 To characterize the patients with stroke who have passed through the Second Clinic of Nervous Diseases of the University Hospital "St. Marina"- Varna for 2020-2021

A retrospective and prospective analysis of 716 patients with ischemic stroke, coded according to ICD X as I63.3 and I63.4, who passed through the Second Clinic of Nervous Diseases of the University Hospital "St. Marina "- Varna for the period from 01.2020 to 07.2021 including. The mean age of the patients was 72.5 years ± 11.4 years, with a minimum of 20 years and a maximum of 96 years (Fig. 1).

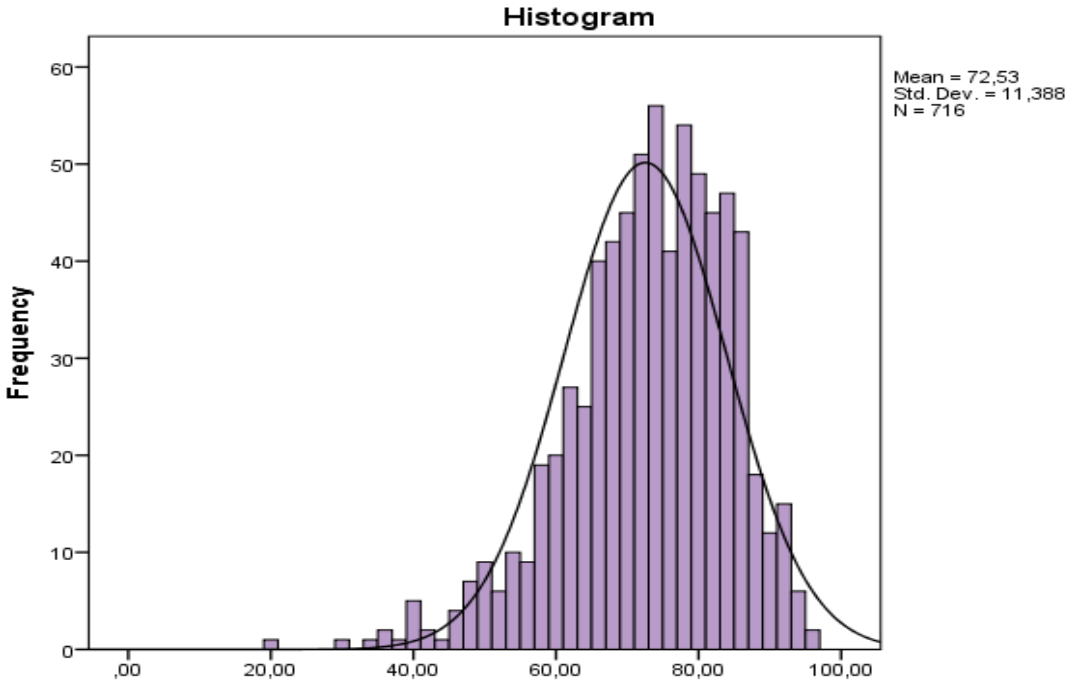

Fig. 1. Distribution according to the age of the patients

No gender difference was found, with a slight predominance of women (52.5% women and 47.5% men, respectively). There was a significant difference in terms of age and gender showing that stroke in women occurred significantly later (p <0.001) (Fig. 2).

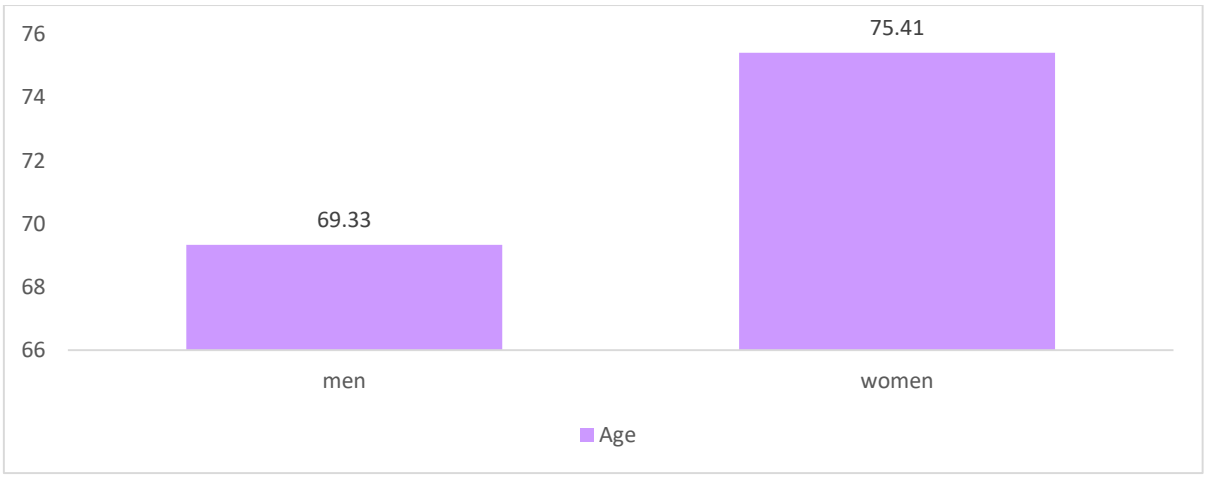

Fig. 2. Mean age by sex of stroke patients

The two diagnoses considered according to the International Classification of Diseases are I63.3 and I63.4. More than 2/3 (68.0%) of patients have a cerebral infarction caused by cerebral artery thrombosis and 32.0% have a cerebral infarction caused by cerebral artery embolism. It was found that males have 1.58 times higher risk of developing cerebral infarction caused by cerebral artery thrombosis (OR = 1.58 (1.15-2.18) p = 0.003)

A significant difference was also found with respect to the mean age of patients (p <0.001) (Fig. 3). Cerebral infarction caused by cerebral artery thrombosis occurs in patients over 70 years, while cerebral infarction caused by embolism is more common in patients over 75 years.

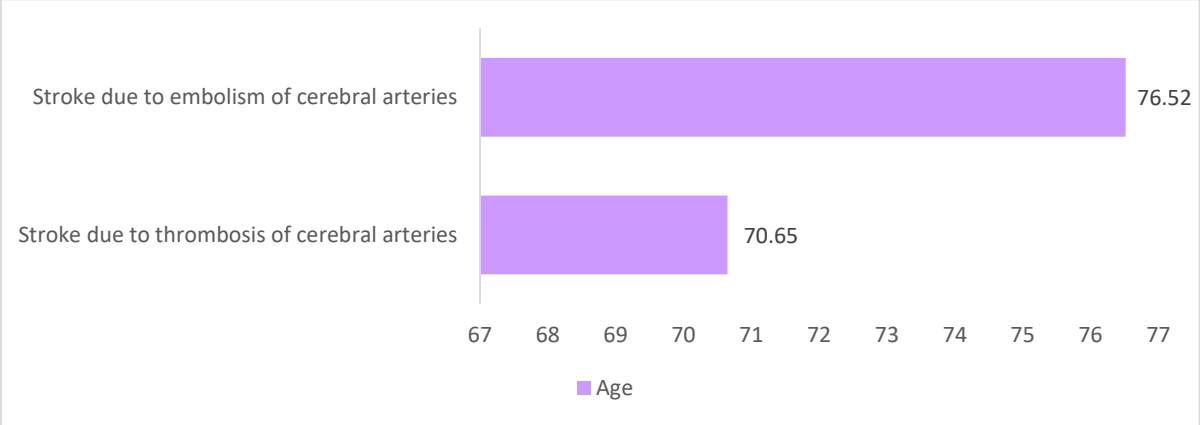

Fig. 3. Average age in the diagnosed diagnoses of stroke

There was a difference in the survival of patients according to the type of cerebral infarction (p <0.001), as patients with cerebral infarction caused by thrombosis survived in 71.5% of cases, while patients with cerebral infarction caused by cerebral artery embolism experienced only in 58.1% of cases. On the other hand, cerebral infarction caused by cerebral artery embolism was found to carry a 1.8 higher risk of death (OR = 1.8 (1.3-2.5) p <0.001).

A significant difference was also found in the age according to the gender and the diagnosis of patients (p <0.001).The difference in mean age between men and women with cerebral infarction caused by cerebral artery thrombosis is about 6 years, and in patients with cerebral heart attack caused by cerebral artery embolism is about 5 years (Fig. 4).

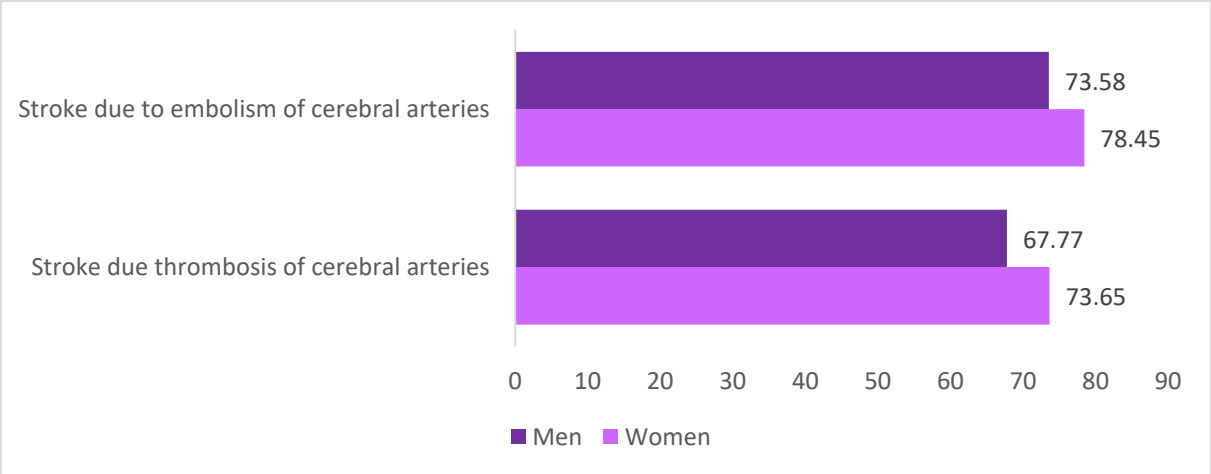

Fig. 4. Average age of the examined patients according to gender and diagnosis

According to the outcome of the stroke in the hospitalization period, a significant difference in age was found between deceased and survived patients with cerebral infarction caused by thrombosis of cerebral artery ($p < 0.001$). However, in both diagnoses, the patients who died were older than those who survived (Fig. 5).

The average number of bed-days for both diagnoses was 7.09 ± 5.30, ranging from 0 to 41. According to the clinical pathway, the number of bed-days for patients with the diagnoses was 4, which means that 68.3% of patients have an increased number of bed-days (Fig. 6).

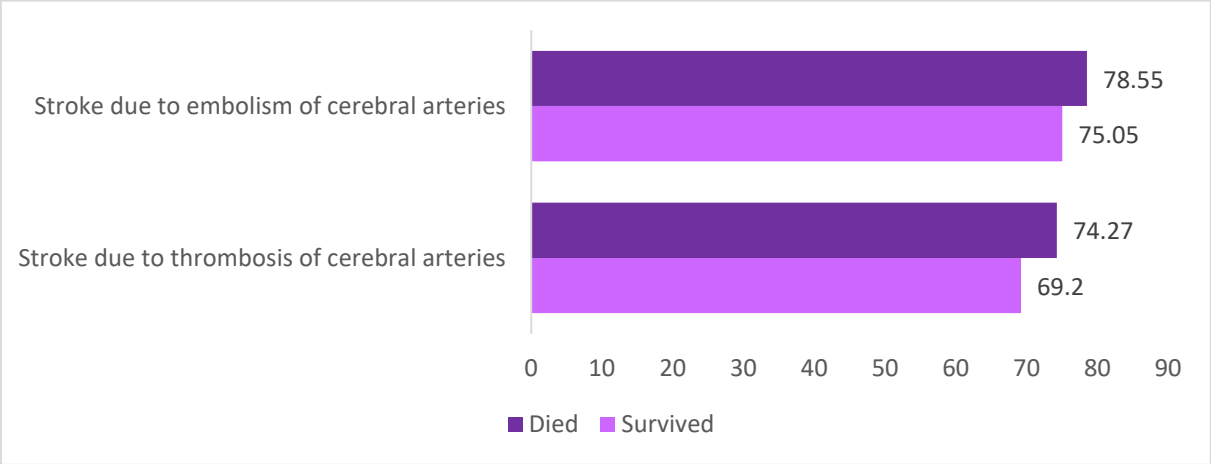

Fig. 5. Average age of the examined patients according to the status and diagnosis

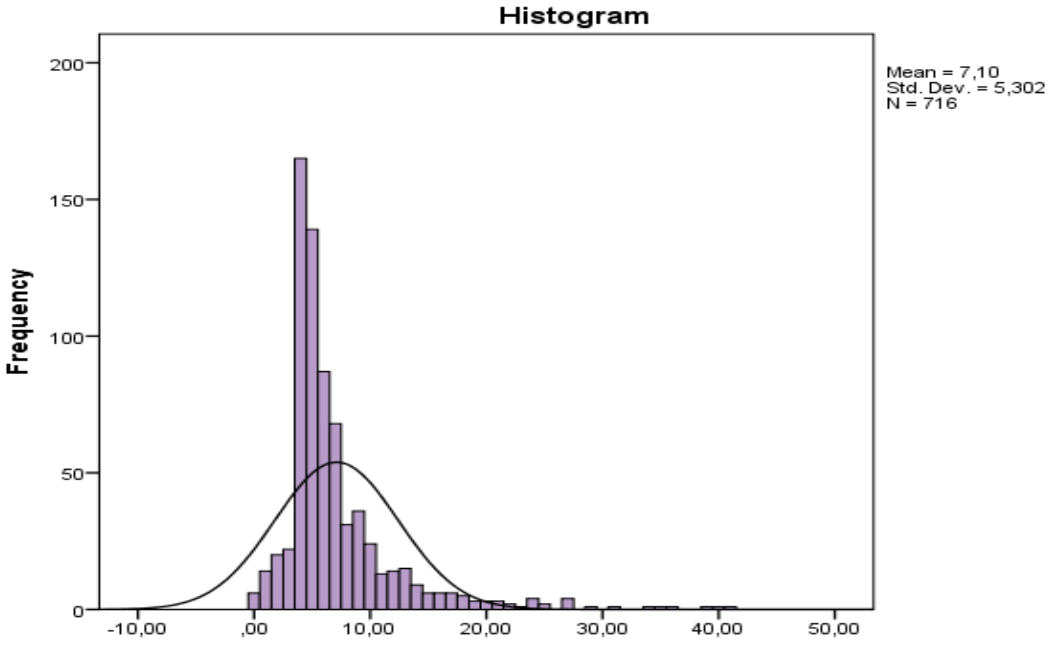

Fig. 6. Average number of bed-days

There was no significant difference in the mean number of bed-days according to the diagnosis of patients, as the average number of bed-days in patients with cerebral infarction caused by cerebral artery thrombosis was 6.98 ± 5.32, and the average number of bed-days in patients with cerebral infarction caused by cerebral embolism arteries is 7.34 ± 5.26.

On the other hand, a significant difference was found in the average number of bed-days according to the sex of the patients, with women staying longer than men (p = 0.048) (Fig. 7). There was no difference in the average number of bed-days according to the diagnosis and sex of the patients.

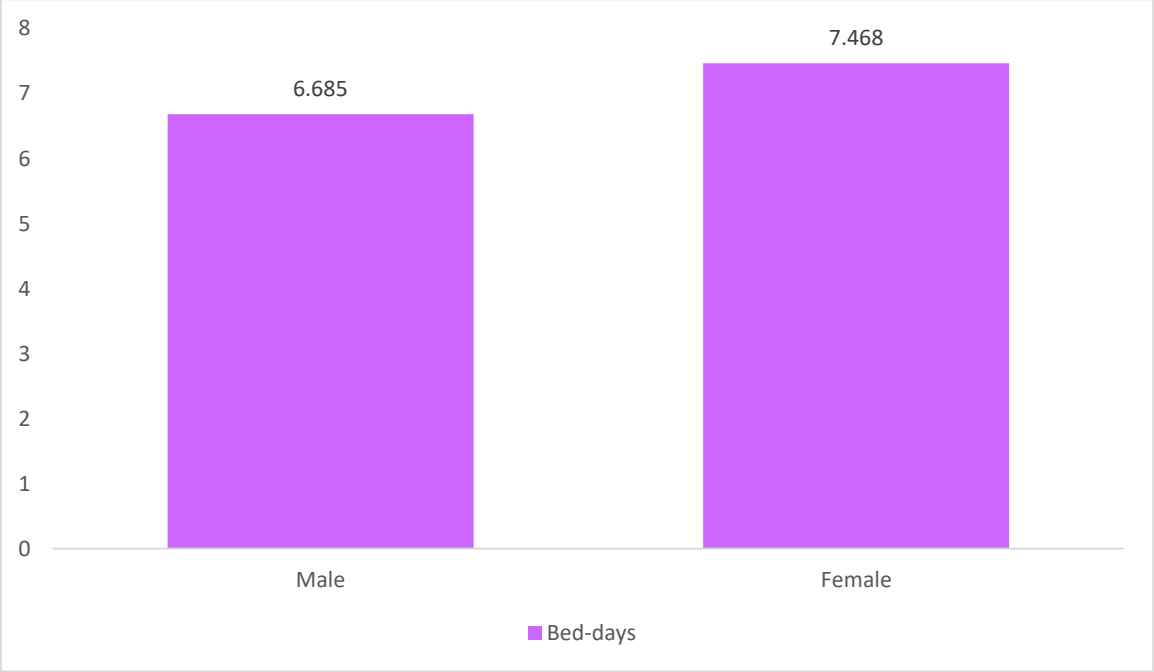

Fig. 7. Average number of bed - days by sex

A significant difference was found in the average number of bed-days between survivors and died patients (p = 0.002), noting that the survived patients spend less days in the hospital (Fig. 8).

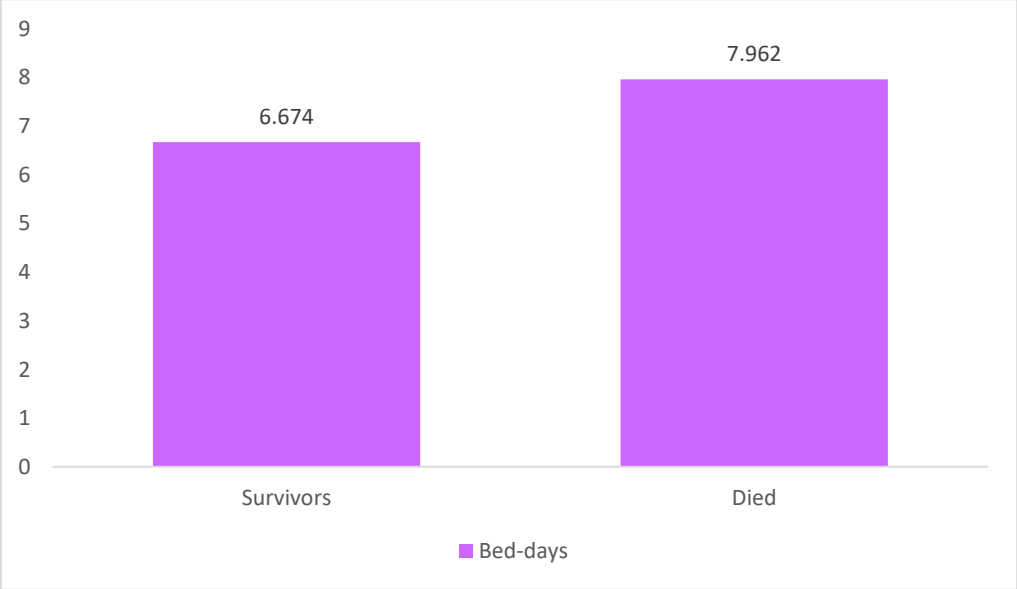

Fig. 8. Average number of beds according to status

A significant difference was found in the mean number of bed-days between survived and died patients with cerebral infarction caused by cerebral artery thrombosis ($p < 0.05$). The deceased patients with this diagnosis lie 2 days longer (Fig. 9).

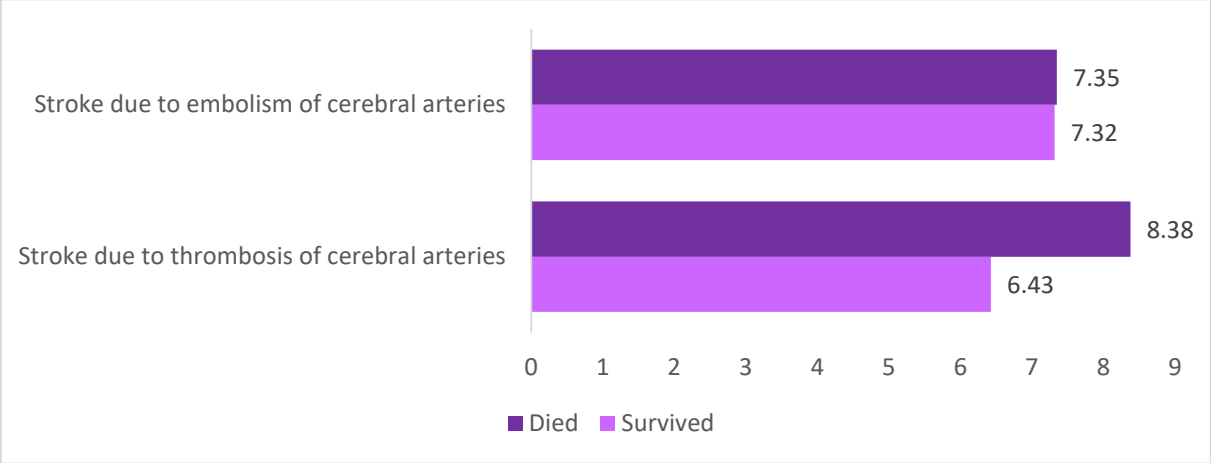

Fig. 9. Average number of beds of the examined patients according to the status and diagnosis

No relationship was found between the age of the patients and the number of bed-days. According to the results of the study, 89.8% of the patients with stroke also have hypertension, as the distribution of the more common concomitant diseases are presented in fig. 10.

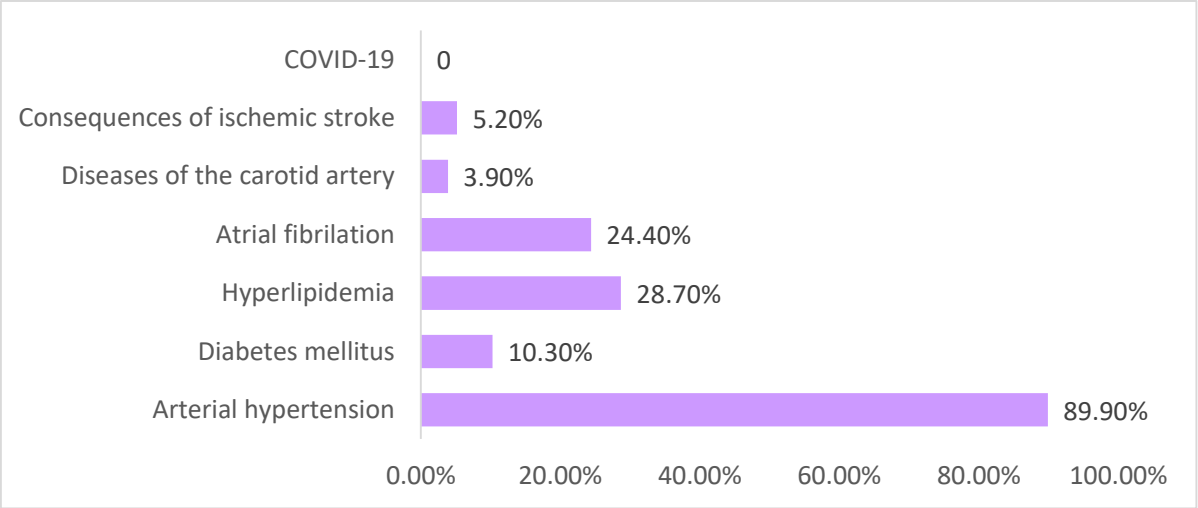

Fig. 10. Concomitant diseases

Treatment with thrombolysis was performed in 68 patients (9.5%). The mean age of patients was 71.5 years ± 8.9 years (47 years - 86 years) and did not differ significantly from the mean age of patients without thrombolytic treatment (72.7 years ± 11.6 years).

There was no significant difference according to gender and thrombolytic treatment, although there is a slight predominance of men (Fig. 11).

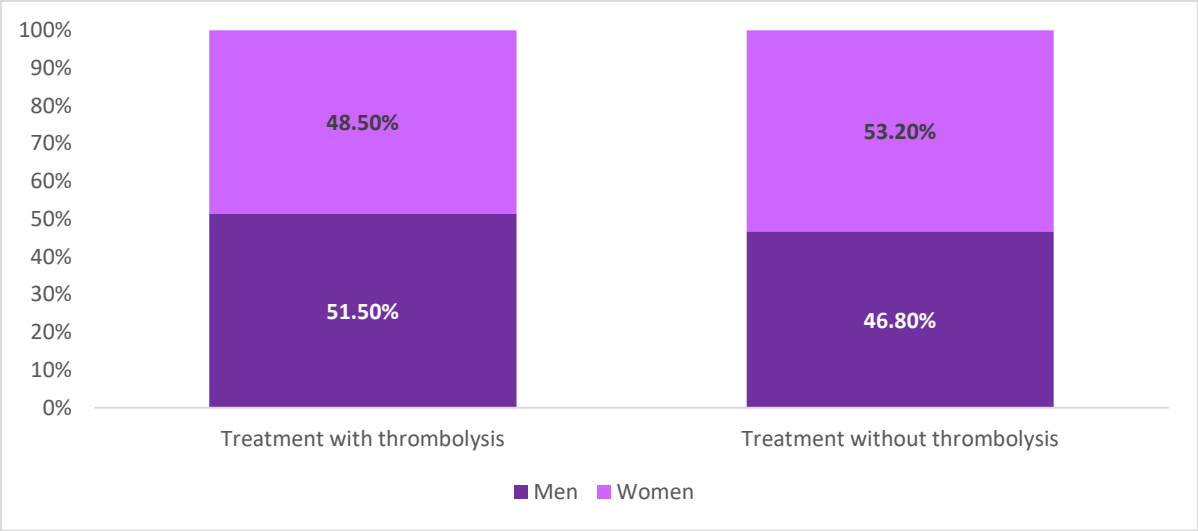

Fig. 11. Distribution by sex and treatment performed

There was a significant difference in hospital stay between the two study groups (p = 0.009). Patients with thrombolytic treatment are staying for about 2 days longer (Fig. 12).

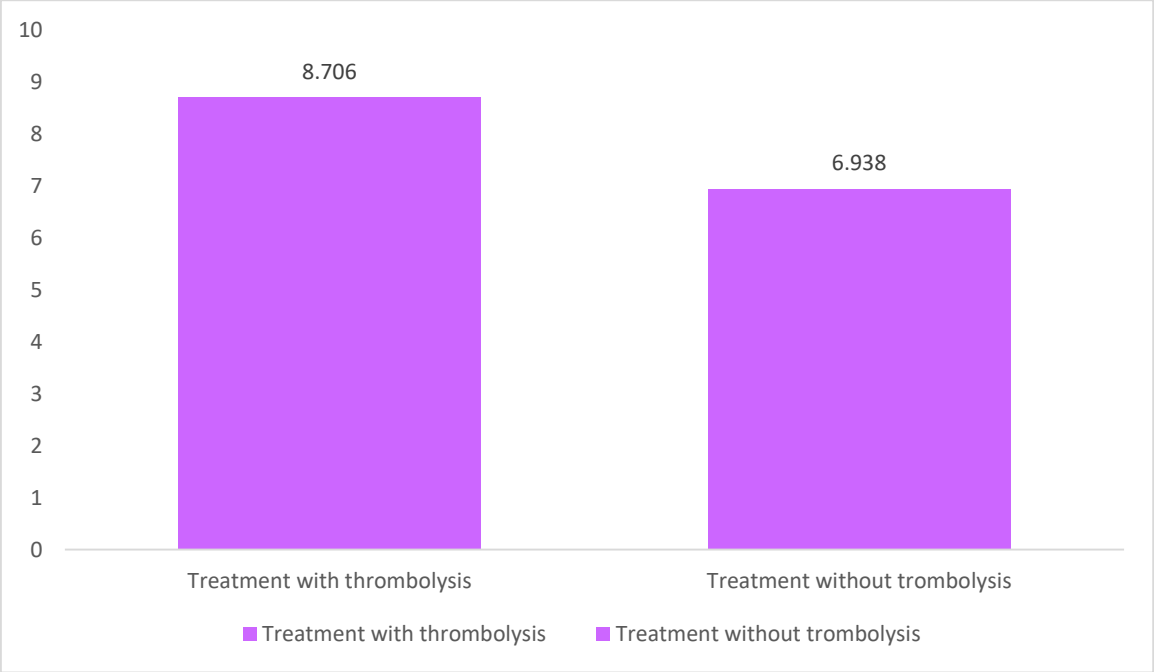

Fig. 12. Average number of beds according to the conducted therapy

The results of the analysis show that ¾ (75.0%) of patients treated with thrombolysis survive, and that treatment can be defined as a positive survival factor (RR = 1.475 (0.919-1.010), p <0.05) (Fig. 13).

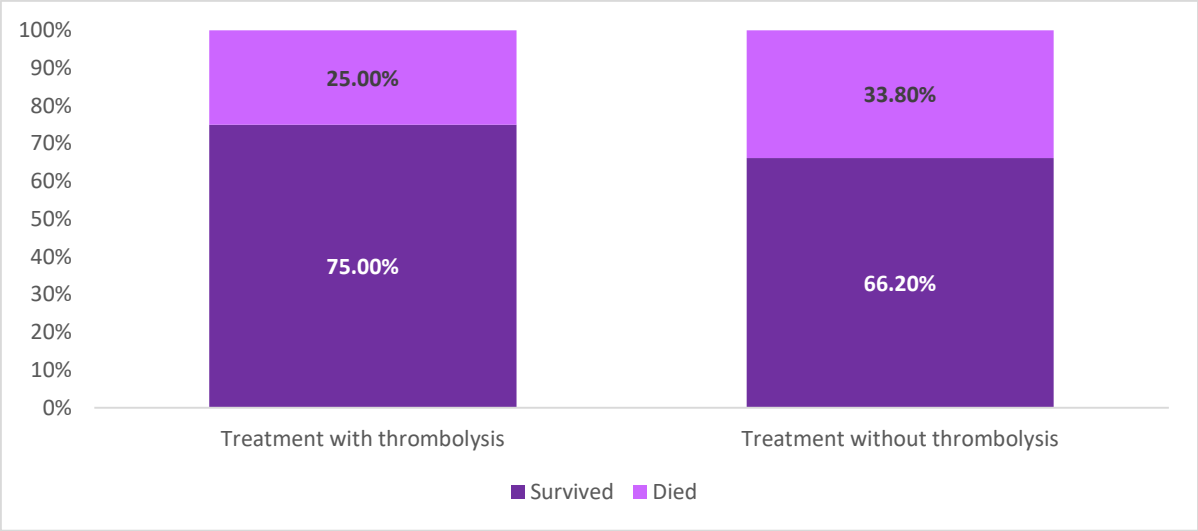

Fig. 13. Distribution by survival and treatment performed

There was no significant difference in concomitant diseases according to the treatment.

4.2. To determine the number and frequency of risk factors in patients with acute ischemic stroke and aphasic disorders

During the study period, thrombolytic treatment was performed in 83 patients with a diagnosis of I63.3 or I63.4 cerebral infarction, of which only 17 met the criteria for inclusion in the present study. On the table. 1 is presented the characteristics of the patients.

Table. 1. Characteristics of patients

Indicator		Clinical group	Control group
Age (in years)	mean±SD (range)	72.0±6.9 (58-83)	69.9±9.9 (46-86)
Sex	Men	11/64.7%	29/59.2%
	Women	6/35.3 %	20/40.8%
Education	Elementaryeducation	0/0 %	1/ 2.0 %
	Primary education	2/11.8 %	10/20.4 %
	Secondary education	8/47.1 %	29/59.2 %
	A college education	0/0%	3/6.1 %
	University education	5/29.4 %	2/4.1 %
	No information	2/11.8 %	4/8.2 %

The results of the analysis show that there is no significant difference in demographic indicators between patients in the clinical and control groups. Both groups are dominated by men and people with secondary education.

No significant difference was found in terms of smoking, with non-smokers predominating in both groups (Fig. 14).

It is interesting about the alcohol consumption that the majority of patients in both groups said that they did not consume alcohol (Fig. 15).

A significant proportion of patients have concomitant diseases (92.4%). The most common diseases are those of the cardiovascular system (Fig. 16).

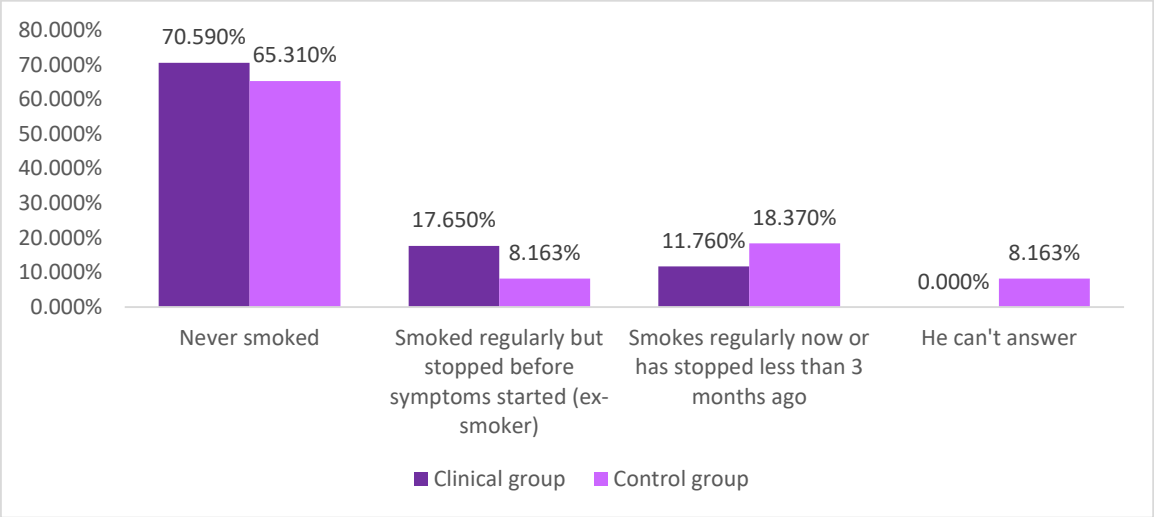

Fig. 14. Distribution according to smoking

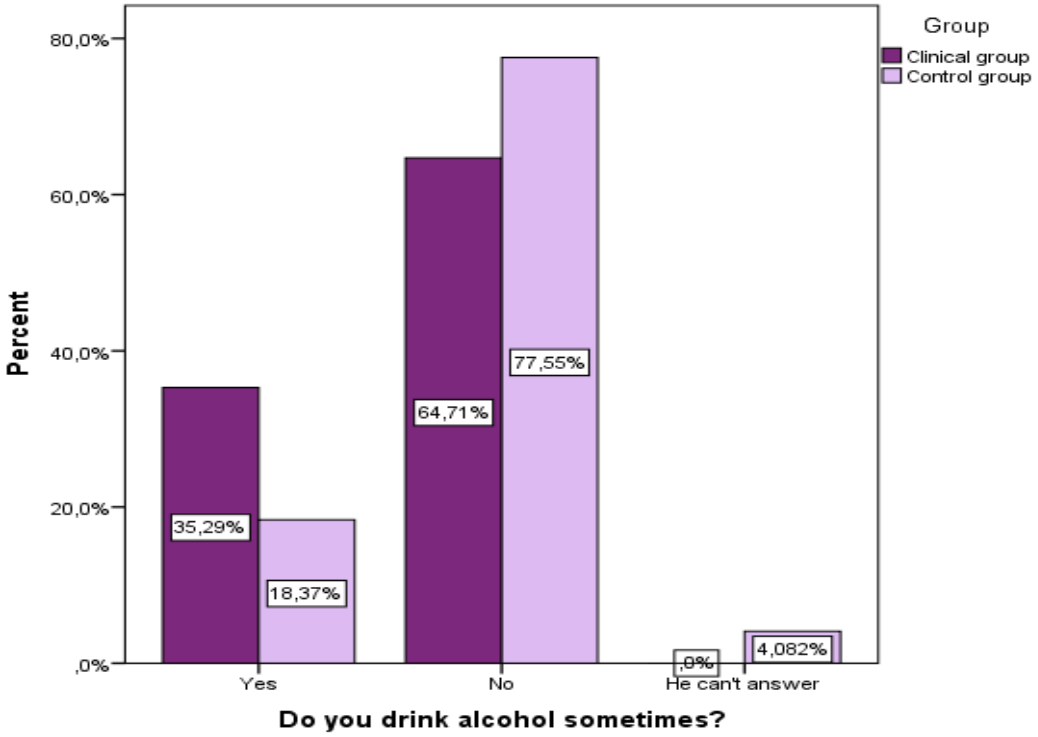

Fig. 15. Distribution according to alcohol consumption

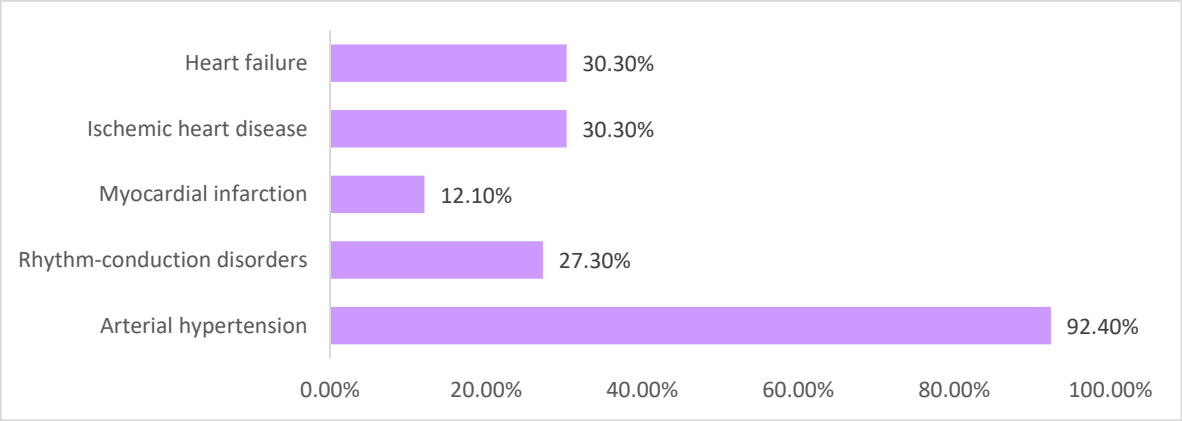

Fig. 16. Distribution according to the cardiovascular diseases

The results of fig. 16 show that the highest relative share is hypertension (92.4%), followed by heart failure (30.30%), ischemic heart disease (30.30%), rhythm-conduction disorders (27.30%), and the fewest patients had myocardial infarction (12.1%).

There was no significant difference in the incidence of concomitant cardiovascular disease in the two groups of patients (Fig. 17).

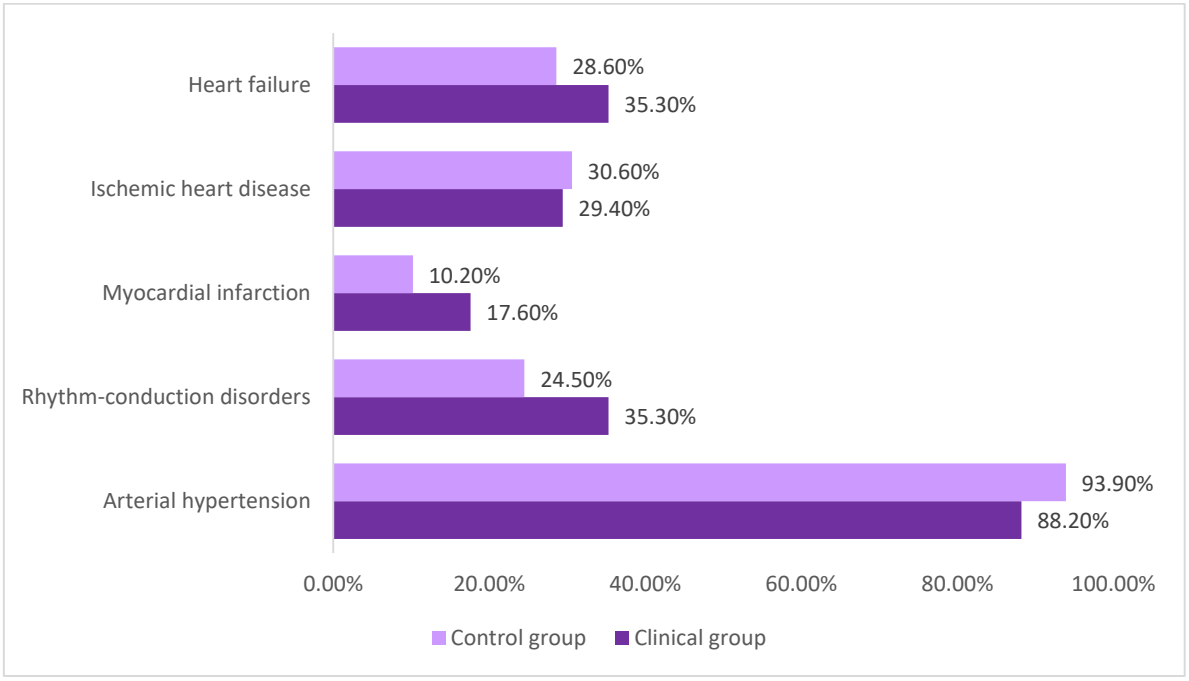

Fig. 17. Distribution according to cardiovascular diseases and the studied group

Among the endocrine diseases with the largest relative part are diabetes mellitus (30.3%) and dyslipidemia (36.4%). One patient has Graves' disease and autoimmune thyroiditis. Although no significant difference was found in the study groups, it can be said that the relative part of diabetes mellitus and dyslipidemia is twice lower in patients in the clinical group (Fig. 18).

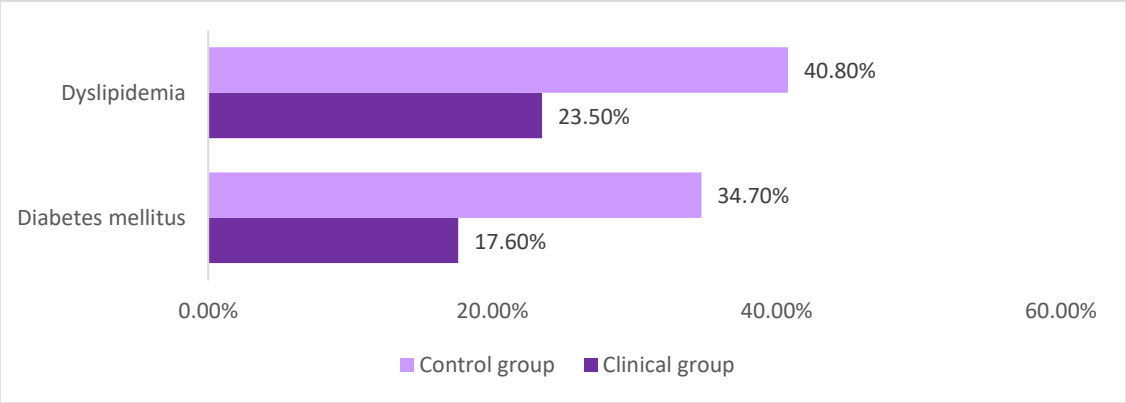

Fig. 18. Distribution according to the available endocrine diseases and the studied group

From the diseases of the respiratory system, 6.1% of patients have chronic bronchitis and 1.5% have bronchopneumonia.

From the group of diseases of the gastrointestinal tract, one patient has duodenal ulcer and hepatitis A, and two have gastritis and two - gastroesophageal reflux disease.

Two patients have chronic pyelonephritis as a concomitant disease and three have nephrolithiasis.

From surgical diseases there are two patients who have an inguinal hernia, one - appendicitis and one - cholecystectomy.

Three patients have gonarthrosis and the same number have concomitant coxarthrosis. There are four patients with gout and two have osteoporosis.

One patient has a femoral fracture, two patients have a lumbar disc herniation.

37.9% of the examined patients had chronic carotid-vertebro-basilar insufficiency, and a significant difference was found between the relative part of the disease in the patients from the clinical and control groups (p = 0.009) (Fig. 19).

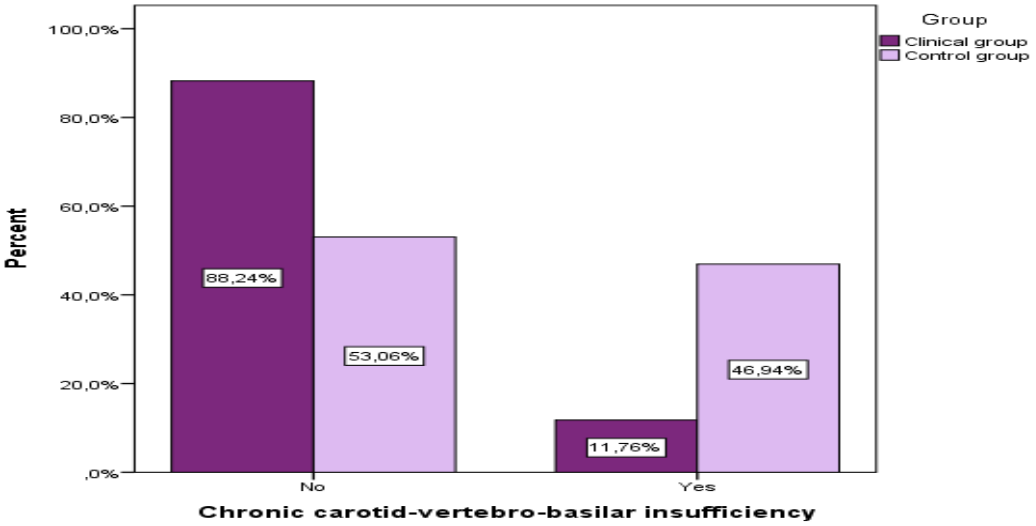

Fig. 19. Distribution according to chronic carotid-vertebro-basilar insufficiency

The degree of chronic carotid-vertebro-basilar insufficiency correlates moderately in direct proportion to the occurrence of ischemic stroke (r = 0.317; p = 0.009), which shows that the greater the degree of chronic carotid-vertebro-basilar insufficiency, the greater is the likelihood of an ischemic stroke.

The presence of chronic carotid-vertebro-basilar insufficiency increases the risk of ischemic stroke 6.6-fold (OR = 6.64 (1.37-32.16)).

Only one patient has a migraine.

More than half of the examined patients (56.1%) reported taking antihypertensive drugs, followed by those taking antiplatelet drugs (30.3%) (Fig. 20).

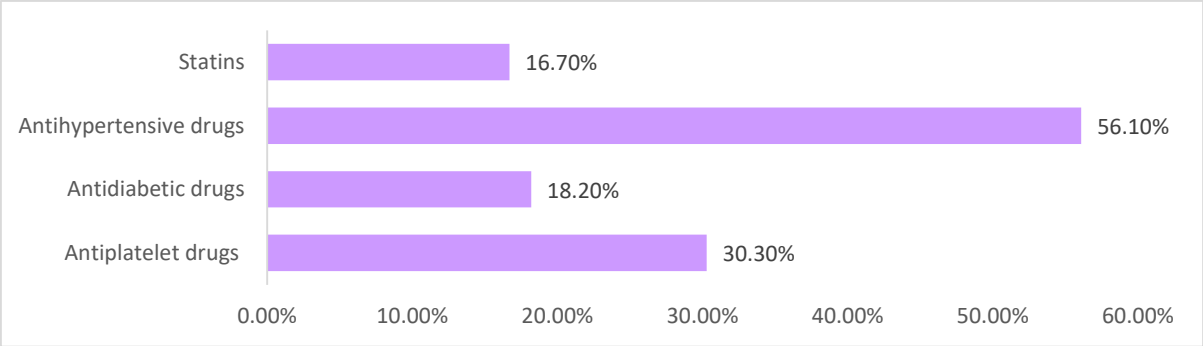

Fig. 20. Relative share of the intake of the separate groups of medicines

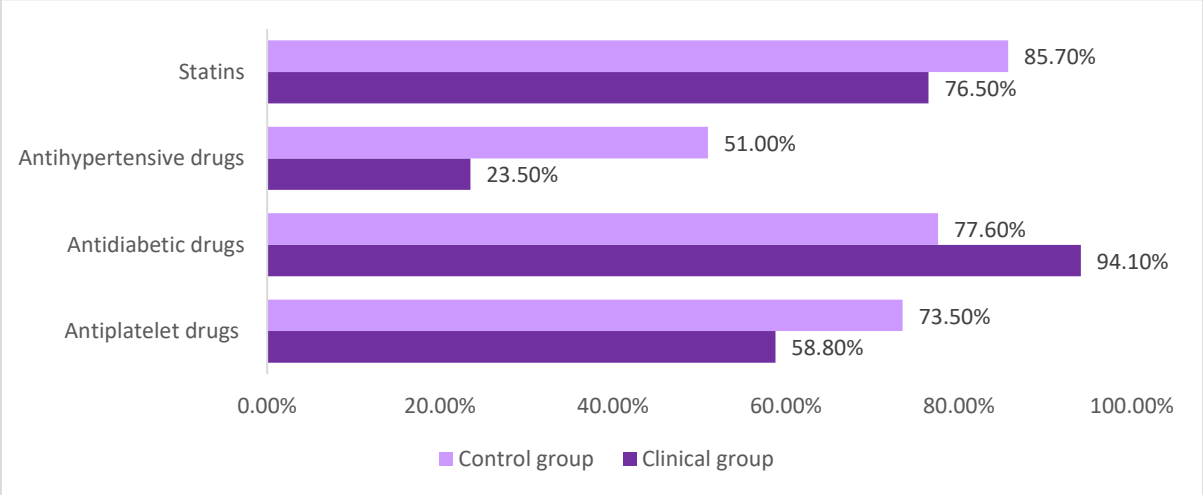

Fig. 21. Relative share of the intake of the separate groups of medicines according to the studied group

The analysis of the individual drugs showed that three patients took Clopidogrel and one patient took Xarelto, Eliquis and Pradaxa. Four patients are on insulin therapy. Six patients received moxonidine and other antihypertensive drugs.

Fig. 22 presents the drugs with a higher frequency of use. Half of the patients reported taking beta-blockers, while 33.3% of the patients took calcium antagonists.

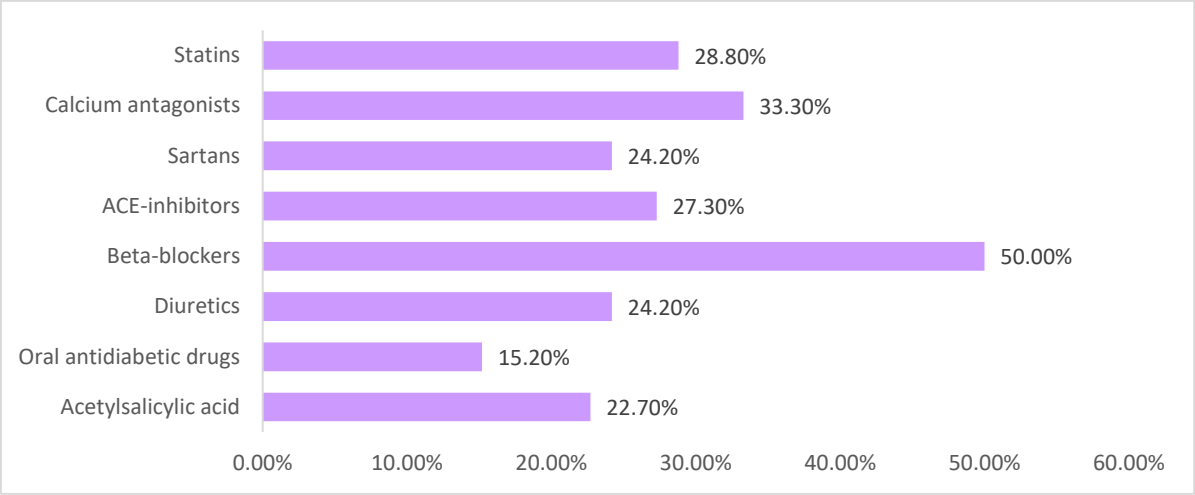

Fig. 22. Relative share of the most commonly used drugs

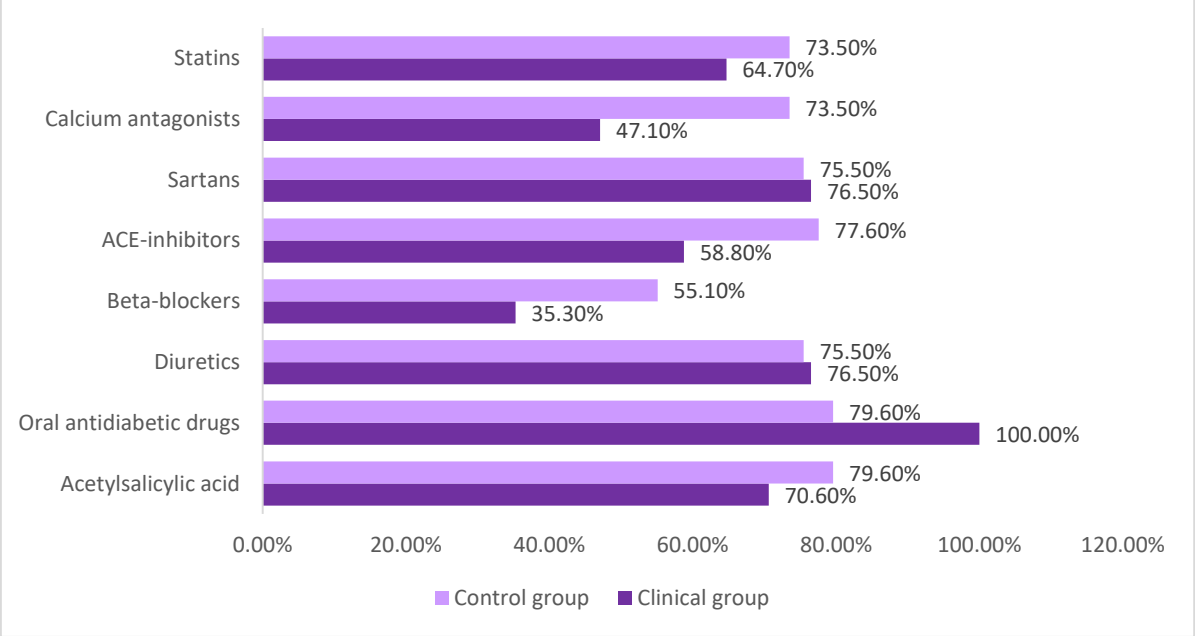

Fig. 23. Relative share of the most frequently used drugs according to the studied groups

A significant difference in medication intake between patients in the clinical and control groups was found with respect to oral antidiabetic drugs ($p = 0.039$), where all patients in the clinical group used drugs from this group and calcium antagonists ($p = 0.047$), where patients from the control group had a higher frequency of taking these drugs (Fig. 23).

4.3. Using CT (using the ASPECT scale) to study changes in the brain parenchyma in patients with aphasia with / without thrombolysis

There was a significant difference in the mean number of points according to the ASPECT scale between patients in the clinical and control groups ($p = 0.021$) (Fig. 24).

From the studied patients only 13.8% (9 patients) had a poor prognosis according to the ASPECT scale with a score below 7 points, of which only one underwent thrombolytic therapy.

No relationship was found between the age of the patients and the number of points on the ASPECT scale.

The results of the analysis show that better results are obtained in women (Fig. 25).

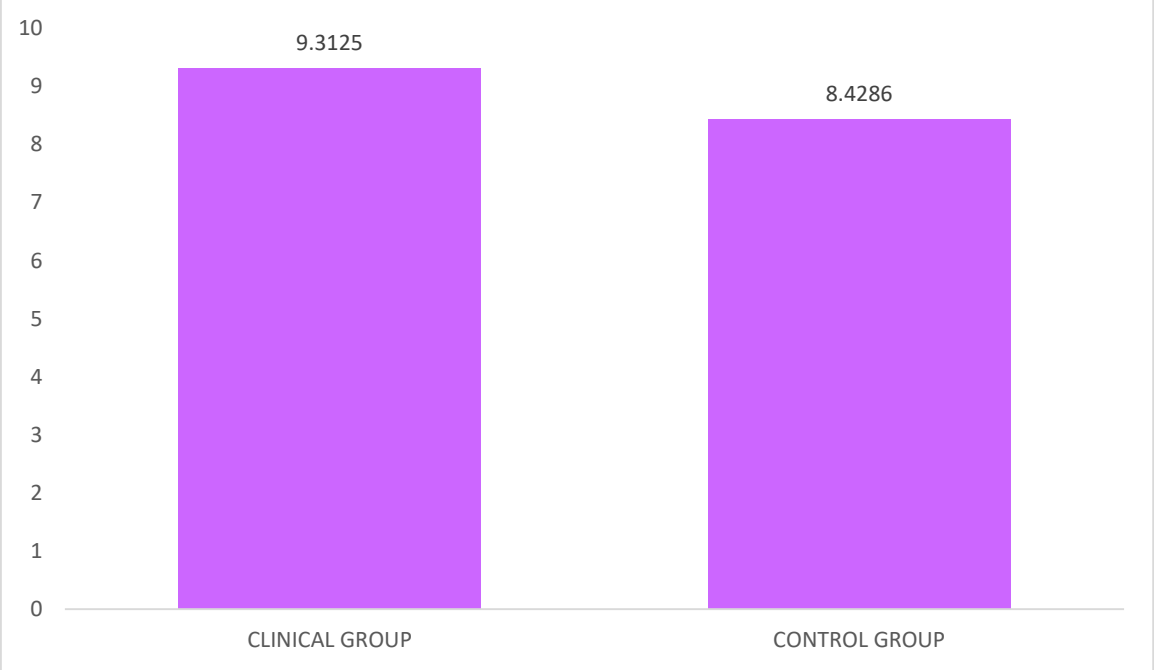

Fig. 24. Average number of points according to the ASPECT scale and the study group

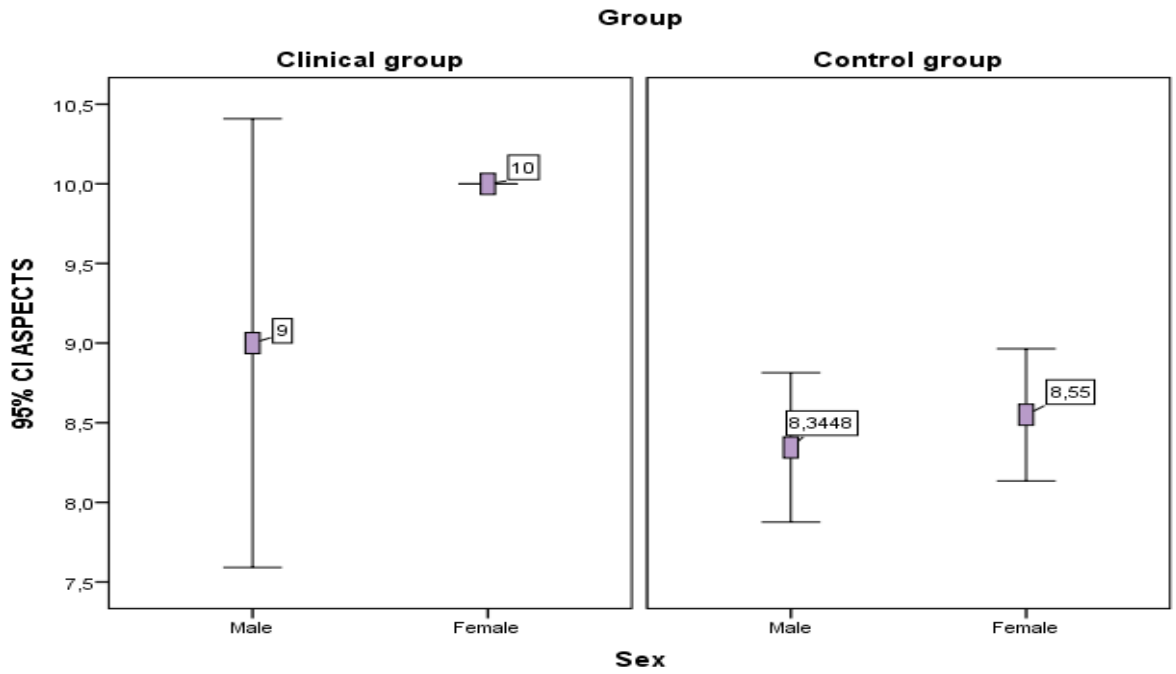

Fig. 25. Average number of points on the ASPECTS scale according to the studied group and sex

The analysis of concomitant diseases shows that ischemic heart disease increases 4 times the risk of poor prognosis in stroke according to the ASPECT scale (OR = 4.11 (0.478-35.310) p = 0.017).

The use of aspirin doubles the probability of a favorable outcome of stroke (OR = 2.1 (0.441-9.491) p = 0.036).

4.4. To study the evolution of aphasia and the model of recovery in some types of aphasia (Brock and Wernicke)

The evolution of aphasia was assessed with two scales, The Aphasia Rapid Test (ART) and Aphasia Handicap Scale (AHS). (Azuar et al., 2013; Benghanem et al., 2019; Buivolova et al., 2020)

The ART scale assesses aphasia on the first, seventh, and 90th days of stroke. The results of the follow-up of the patients showed that in both study groups there was a significant improvement on the 90th day compared to the first day (p <0.001) (Fig. 26).

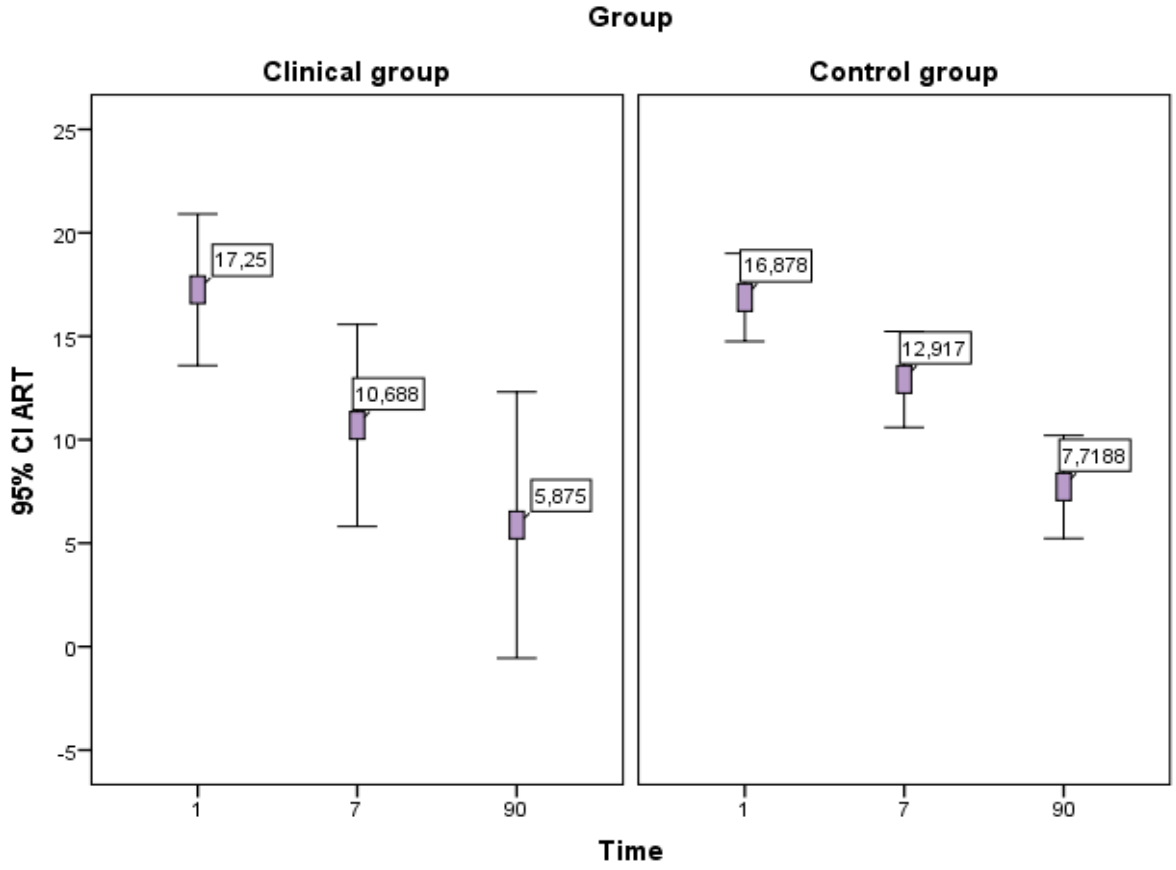

Fig. 26. Mean value of the ART scale according to the follow-up time and the study group

The results of the analysis of the ART scale show that there is a significant difference according to the studied group and gender. In the clinical group, women showed significantly better results than men (p <0.001). On the other hand, the control group reported significantly better results

in men than in women (p <0.001). Thrombolytic therapy achieved significantly better results in women (p <0.001), while in men no significant difference was found (Fig. 27).

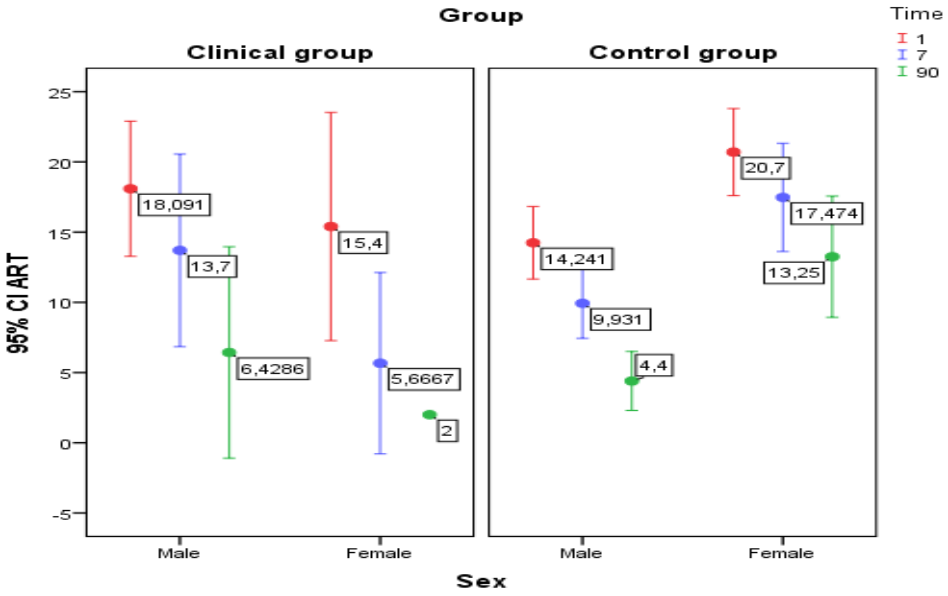

Fig. 27. Mean value of the ART scale according to follow-up time, study group and sex

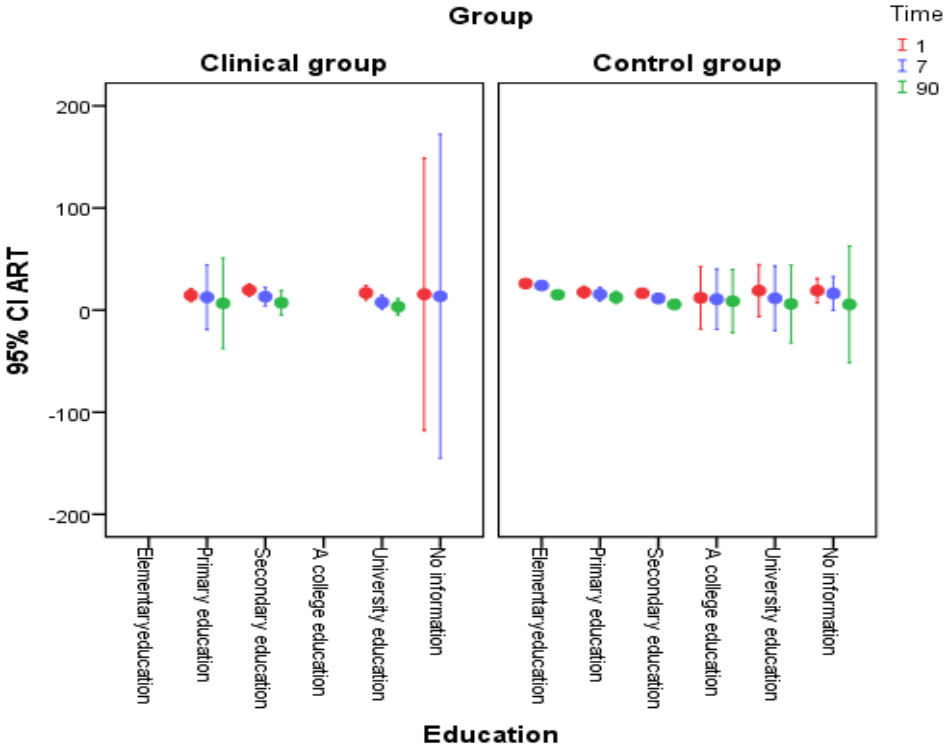

Fig. 28. Mean value of the ART scale according to follow-up time, study group and education

No relationship was found between the patient's age and the degree of recovery of aphasia assessed by the ART scale (Fig. 29).

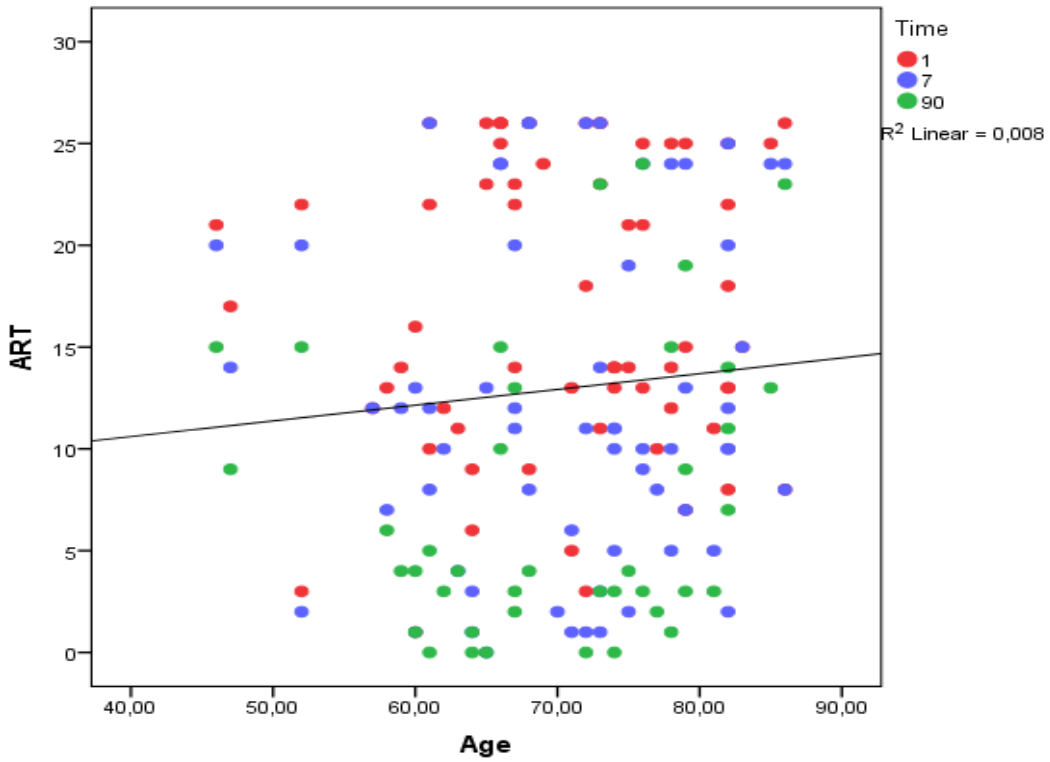

Fig. 29 Correlation analysis of patient's age and ART scale

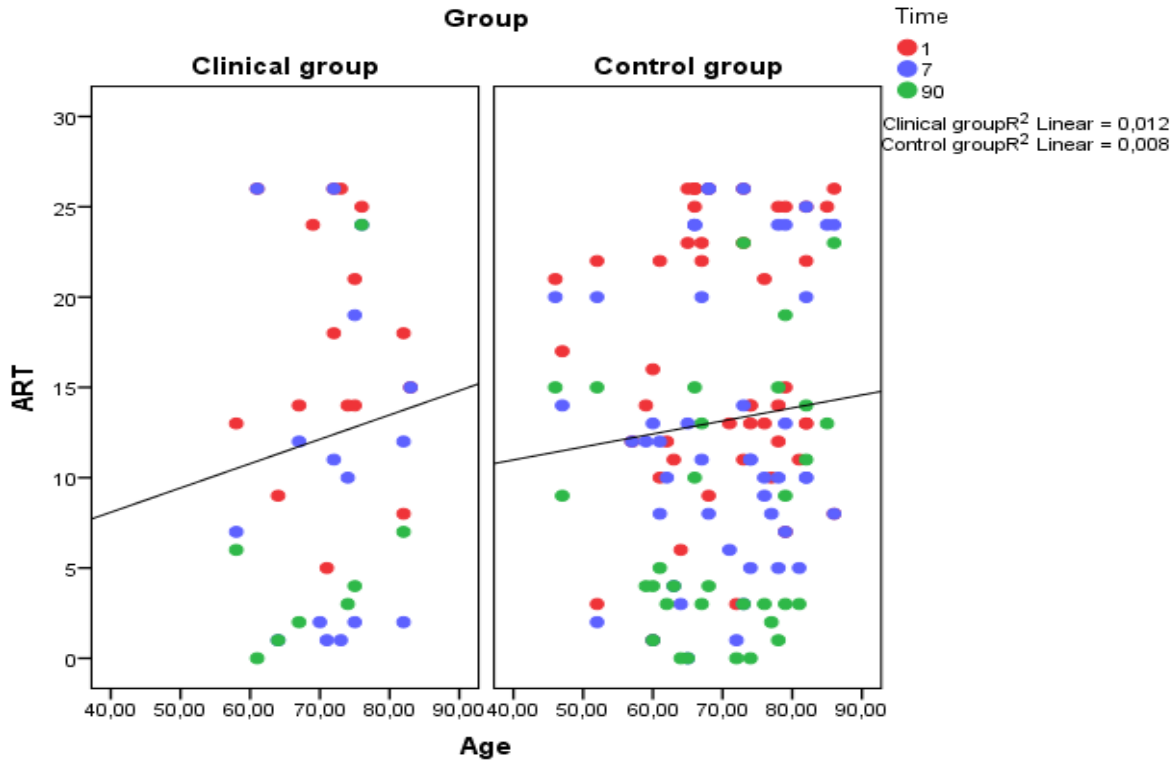

Fig. 30. Correlation analysis of the patient's age, ART scale and study group

Analysis of the relationship between stroke severity measured by the ASPECT scale and the ART scale revealed an inversely proportional moderate dependence (r = -0.373; p = 0.014),

which showed that higher stroke severity was associated with more difficult recovery, as stroke severity was associated with 13.9% of the recovery process assessed by the ART scale (Fig. 31).

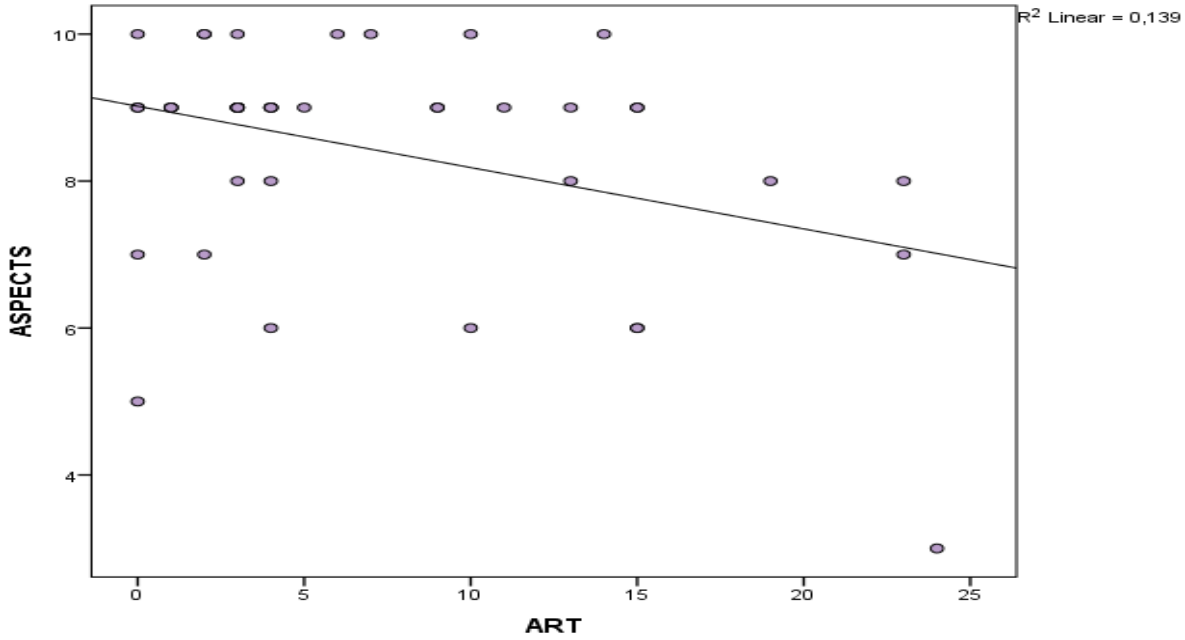

Fig. 31. Correlation analysis between the ASPECTS scale and the ART scale

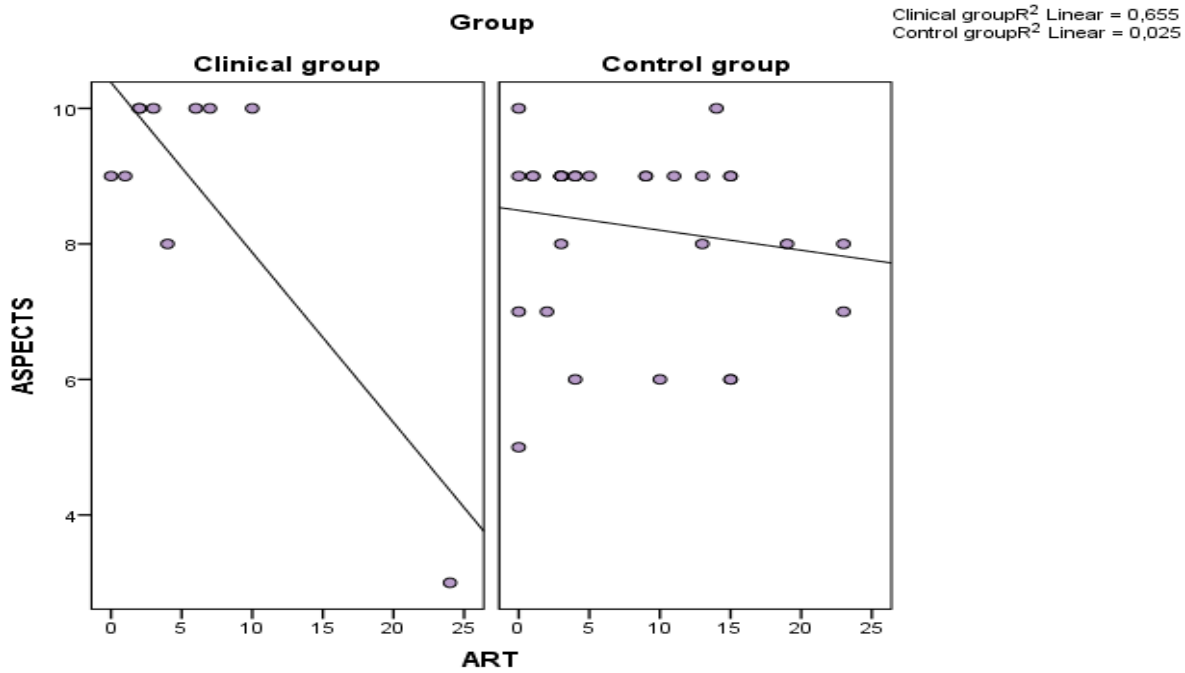

Fig. 32. Correlation analysis between the ASPECT scale and the ART scale in the studied groups

On the other hand, it was found that against the background of thrombolytic therapy, the ASPECT scale and the ART scale correlated strongly inversely (r = -0.810; p = 0.005), with

stroke severity associated with 65.5% of the recovery process assessed with the ART scale (Fig. .32)

According to the AHS assessment, it can be reported that 40.9% of the monitored patients have communication difficulties (Fig. 33). Normal communication was achieved in 18.2% of patients, and with minor speech disorders were found in 40.9% of patients.

There was no significant difference in the recovery of patients assessed by the AHS scale in the clinical and control groups, although in patients with thrombolytic therapy only one patient had severe communication disorders, and in 27.3% the difficulties were mild. In the control group with moderate and severe communication difficulties were 24.2% of patients (Fig. 34).

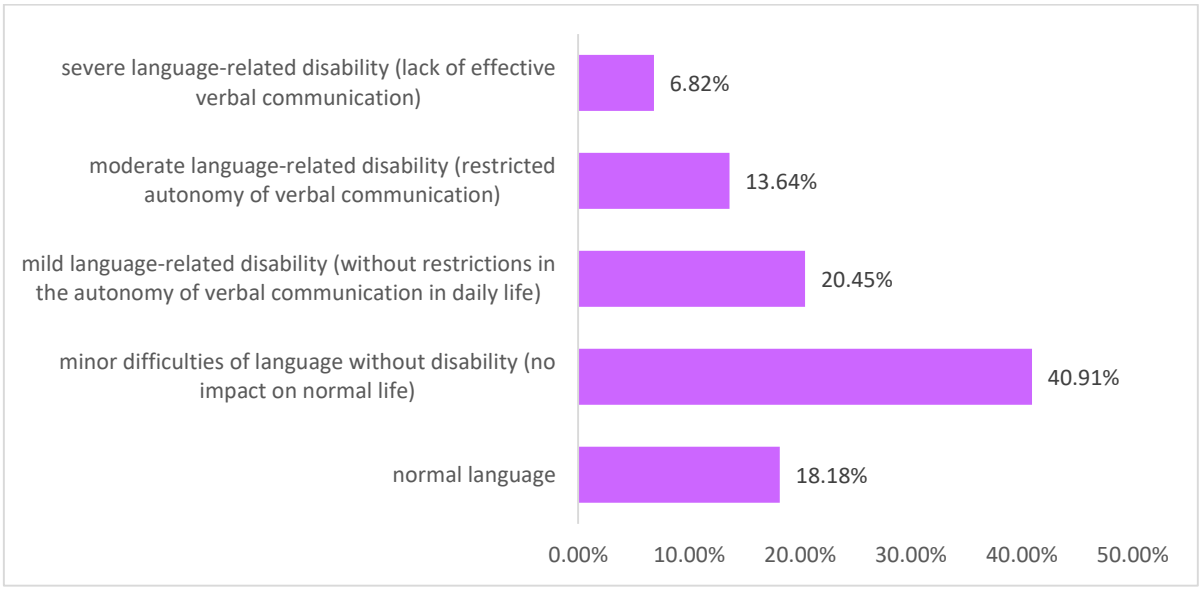

Fig. 33. Distribution according to the AHS scale

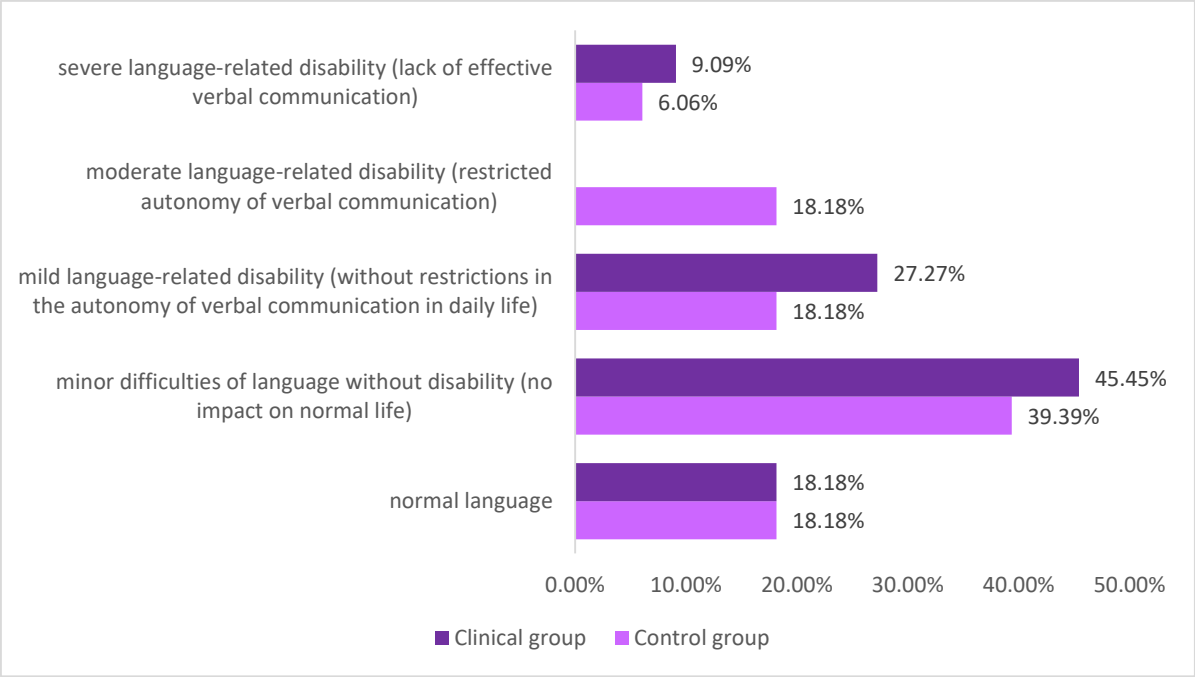

Fig. 34. Distribution according to the AHS scale according to the studied group

There was no significant difference in the results on the AHS scale according to the sex and age of the patients.

A comparative analysis of stroke severity and patient recovery according to the AHS scale revealed a significant difference ($p = 0.025$) and inversely moderate dependence ($r = -0.316$; $p = 0.036$), which showed that a higher ASPECT score was associated with better recovery on the AHS scale (Table 2).

When monitoring the relationship between the ASPECT stroke severity scale and the AHS scale according to the applied thrombolytic therapy, it was found that both in the clinical group ($p = 0.008$) and in the control group ($p = 0.023$) there was a significant difference in the results. However, only in the clinical group was an inversely strong relationship found between the ASPECTS scale for stroke severity and the AHS scale ($r = -0.766$; $p = 0.006$) against the background of thrombolytic therapy (Table 3).

		AHS					Total
		normal language	minor difficulties of language without disability (no impact on normal life)	mild language-related disability (without restrictions in the autonomy of verbal communication in daily life)	moderate language-related disability (restricted autonomy of verbal communication)	severe language-related disability (lack of effective verbal communication)	
ASPECTS	**3**	0	0	0	0	1	1
	5	1	0	0	0	0	1
	6	0	0	3	1	0	4

	7	1	1	0	1	0	3
	8	0	1	1	2	1	5
	9	4	12	3	2	0	21
	10	2	4	2	0	1	9
Total		8	18	9	6	3	44

Table. 2 Comparative analysis between the ASPECTS stroke severity scale and the AHS scale

Group			AHS					Total
			normal language	minor difficulties of language without disability (no impact on normal life)	mild language-related disability (without restrictions in the autonomy of verbal communication in daily life)	moderate language-related disability (restricted autonomy of verbal communication)	severe language-related disability (lack of effective verbal communication)	
Clinical group	ASPECTS	3	0	0	0		1	1
		8	0	0	1		0	1
		9	1	1	0		0	2
		10	1	4	2		0	7
	Total		2	5	3		1	11
Control group	ASPECTS	5	1	0	0	0	0	1
		6	0	0	3	1	0	4
		7	1	1	0	1	0	3
		8	0	1	0	2	1	4
		9	3	11	3	2	0	19
		10	1	0	0	0	1	2
	Total		6	13	6	6	2	33

Table 3. Comparative analysis between the ASPECTS scale for stroke severity and the AHS scale according to the studied groups

4.5. To look for correlations between the recovery of aphasia disorders and the performed treatment - differentiated / undifferentiated, as well as between the recovery of aphasia disorders and the change in motor deficit, assessed using the NIHSS scale

In the analysis, the assessment of the recovery of aphasia and the change in motor deficit used the NIHSS scale, and found a significant difference in the follow-up process ($p < 0.001$). Patients on the first day had significantly higher values (10.68 ± 5.73), while on the 90th day the results were more than twice lower (4.05 ± 3.83) (Fig. 35).

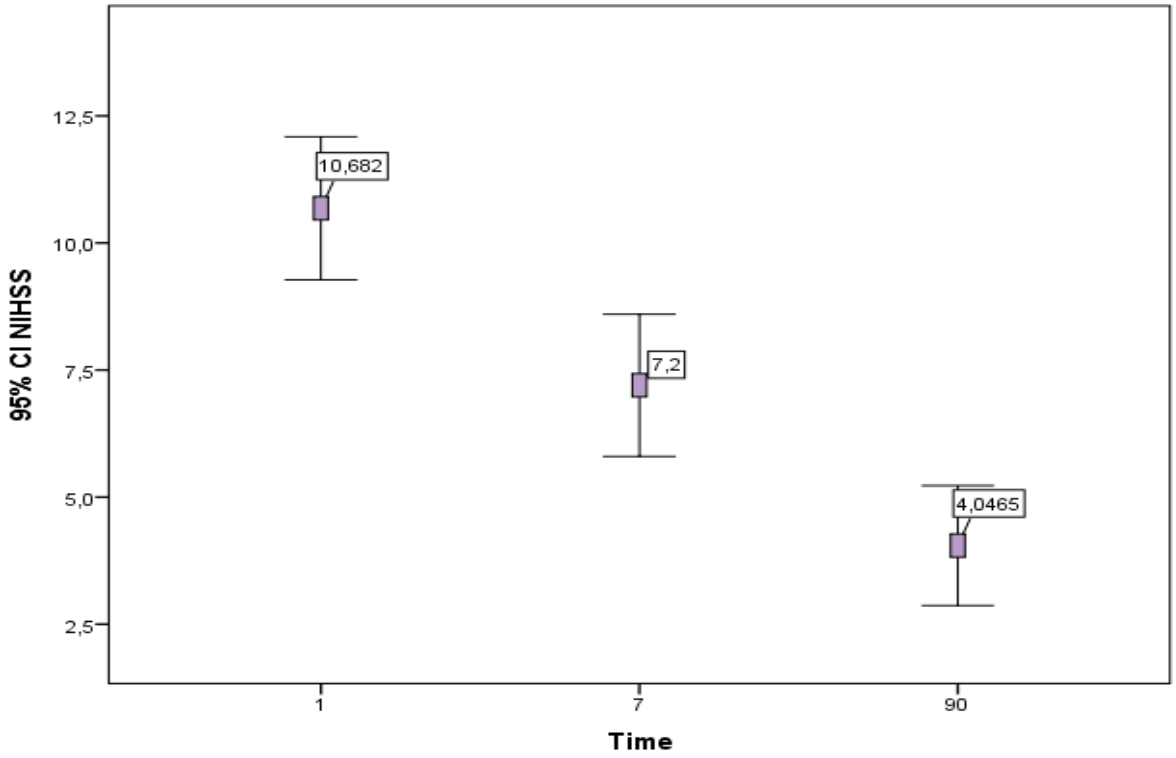

Fig. 35. Mean NIHSS scale values in the follow-up period (1, 7 and 90 days)

Fig. 36 presents a comparative analysis of the results of the NIHSS scale in patients treated with thrombolysis and the control group. There was a significant difference in the NIHSS scale values on the first and 90th day of follow-up ($p < 0.001$) in both groups. On the other hand, there was a difference between the results of the NIHSS scale on the first day of treatment in the two groups of patients ($p < 0.001$), and patients who received thrombolysis treatment had a more severe stroke. On the other hand, on day 90, significant improvement was achieved, which did not differ significantly between the two groups of patients.

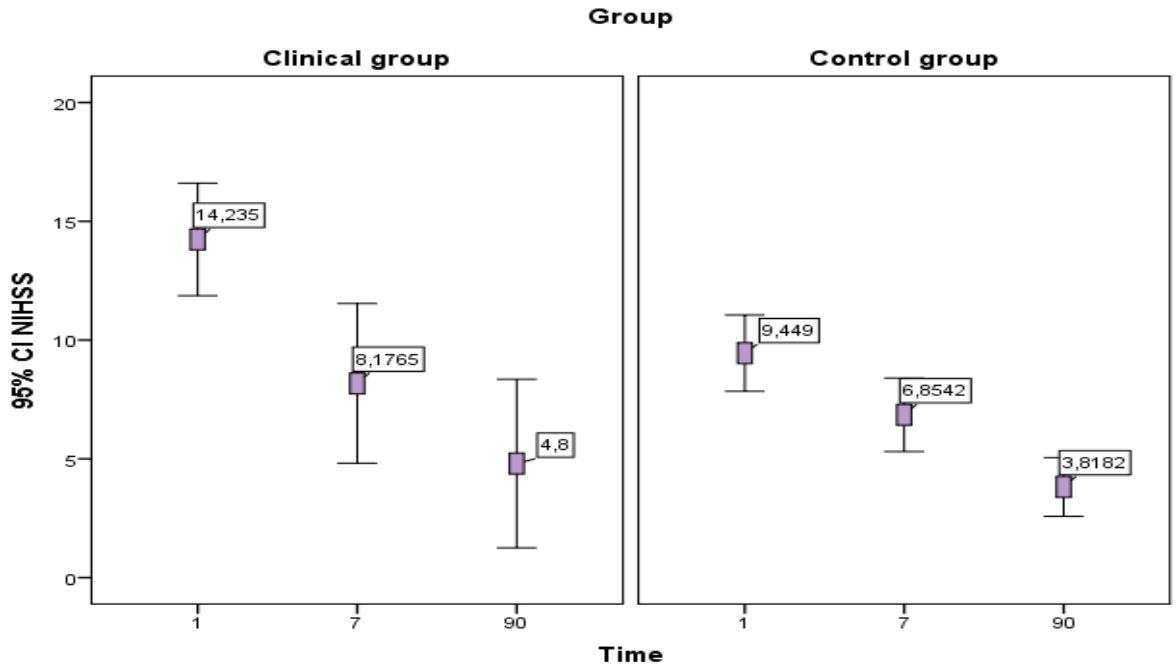

Fig. 36. Mean NIHSS scale values at follow-up (1, 7 and 90 days) and thrombolysis treatment

A significant difference was found with respect to patient recovery and gender ($p < 0.001$) (Fig. 37). In both sexes there was a significant improvement in the results of the 90th day compared to the first day ($p < 0.001$), but in women there is a more severe course of stroke and therefore more difficult recovery than men ($p < 0.001$). On day 90, the NIHSS scale was three times higher in women than in men.

Fig. 38 presents an analysis of the results of the NIHSS scale according to gender and the studied group of patients. The results show several significant differences. In both groups, women had a more severe stroke compared to men ($p < 0.001$). In the clinical group, women on the 7th day of follow-up showed significantly better results compared to baseline ($p < 0.001$) as well as compared to men ($p < 0.001$). On the other hand, these results did not change until day 90, while in men improvement continued ($p < 0.001$). In the control group, the results followed the established tendency to improve in both men and women ($p < 0.001$).

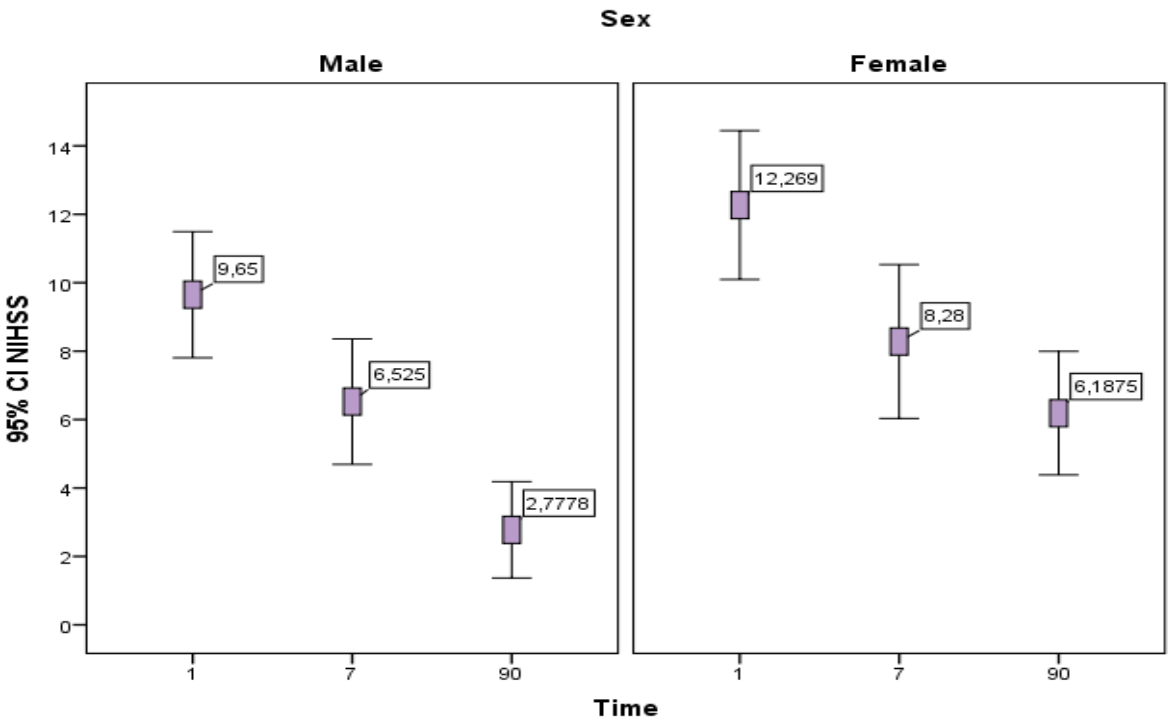

Fig. 37. Mean values of the NIHSS scale in the follow-up period (1, 7 and 90 days) and sex

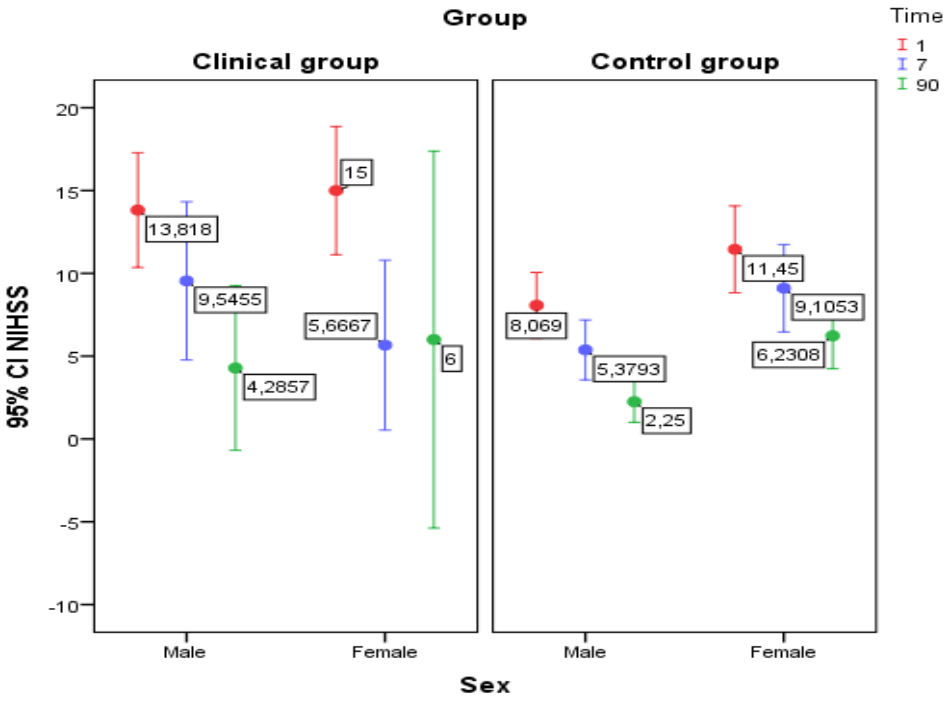

Fig. 38. Mean values of the NIHSS scale in the follow-up period (1, 7 and 90 days) and sex and study groups of patients

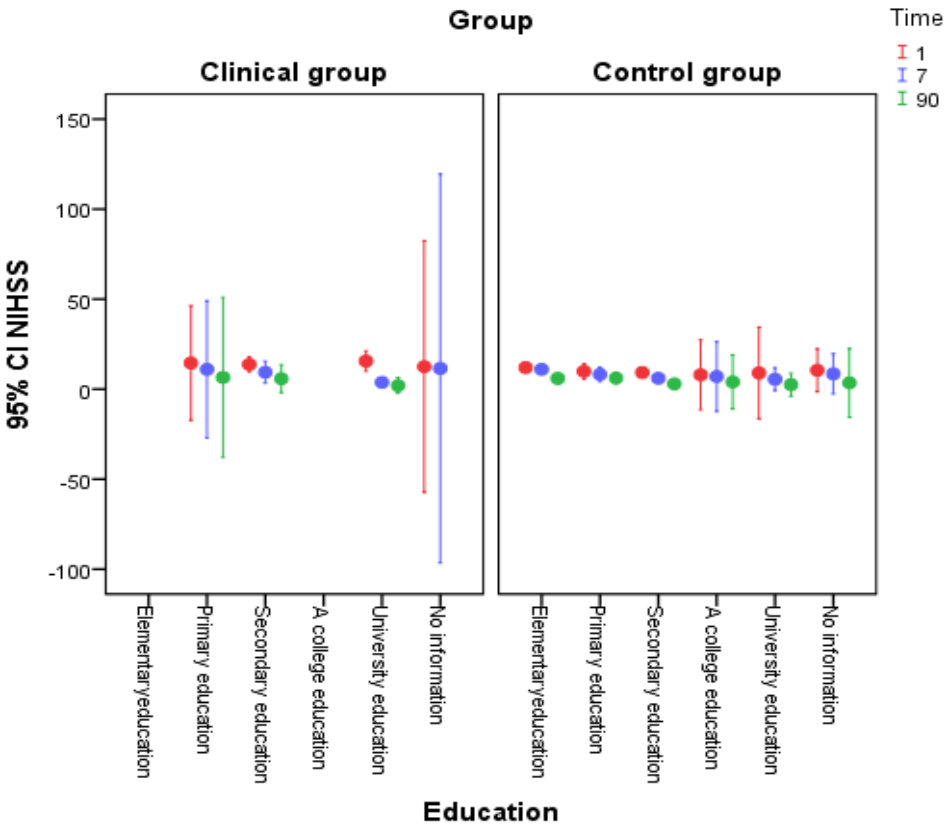

Fig. 39. Mean values of the NIHSS scale in the follow-up period (1, 7 and 90 days) and education and study groups of patients

There was no significant difference in the values of the NIHSS scale in the study period according to the educational degree in both study groups of patients (Fig. 39).

There was a weak proportional relationship between the NIHSS scale and the age of the patients ($r = 0.147$; $p = 0.05$), which shows that with increasing age the possibility of better results in recovery from stroke decreases (Fig. 40). Similar results were found in the analysis of the relationship between age and the NIHSS scale in the two study groups (Fig. 41).

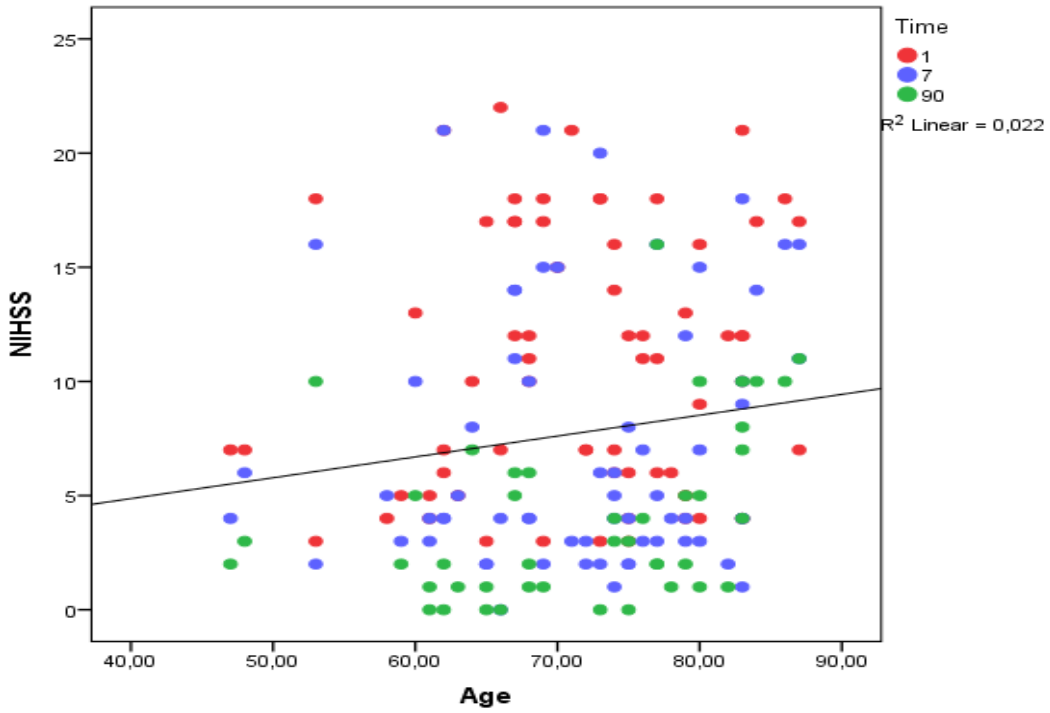

Fig. 40. Correlation analysis between age and NIHSS scale

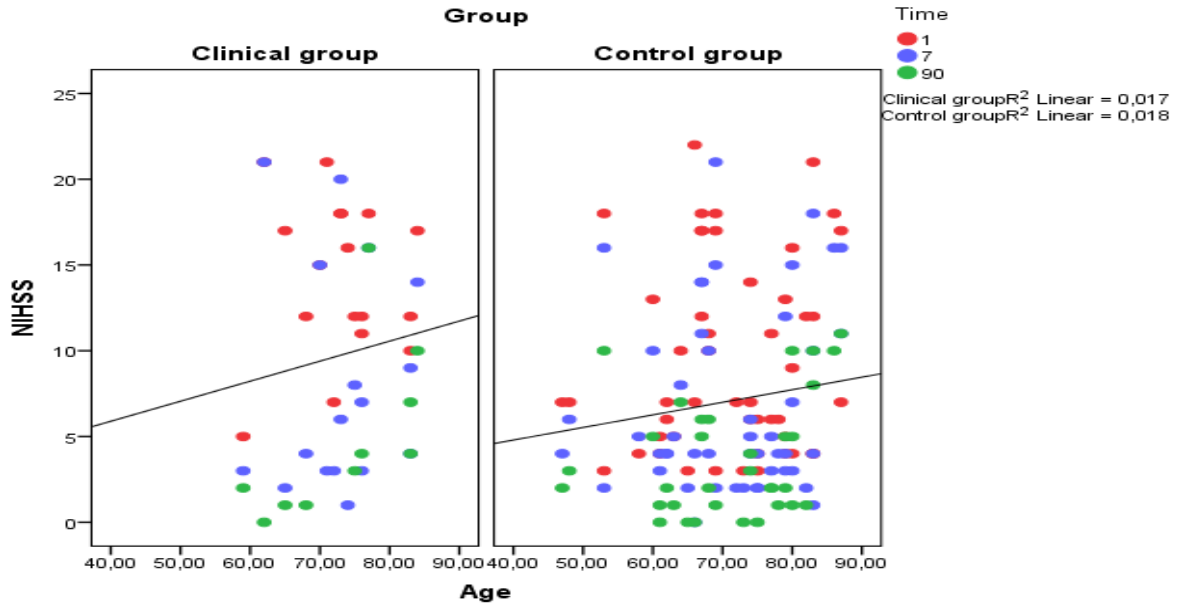

Fig. 41. Correlation analysis between age and NIHSS scale in the studied groups

There was a significant difference between the results on the NIHSS scale for motor ($p < 0.001$) and speech ($p < 0.001$) function at the beginning of the follow-up and on day 90 (Fig. 42). The results for both functions showed twice lower values on day 90, so it can be said that twice as much improvement in function was achieved at the end of follow-up compared to baseline.

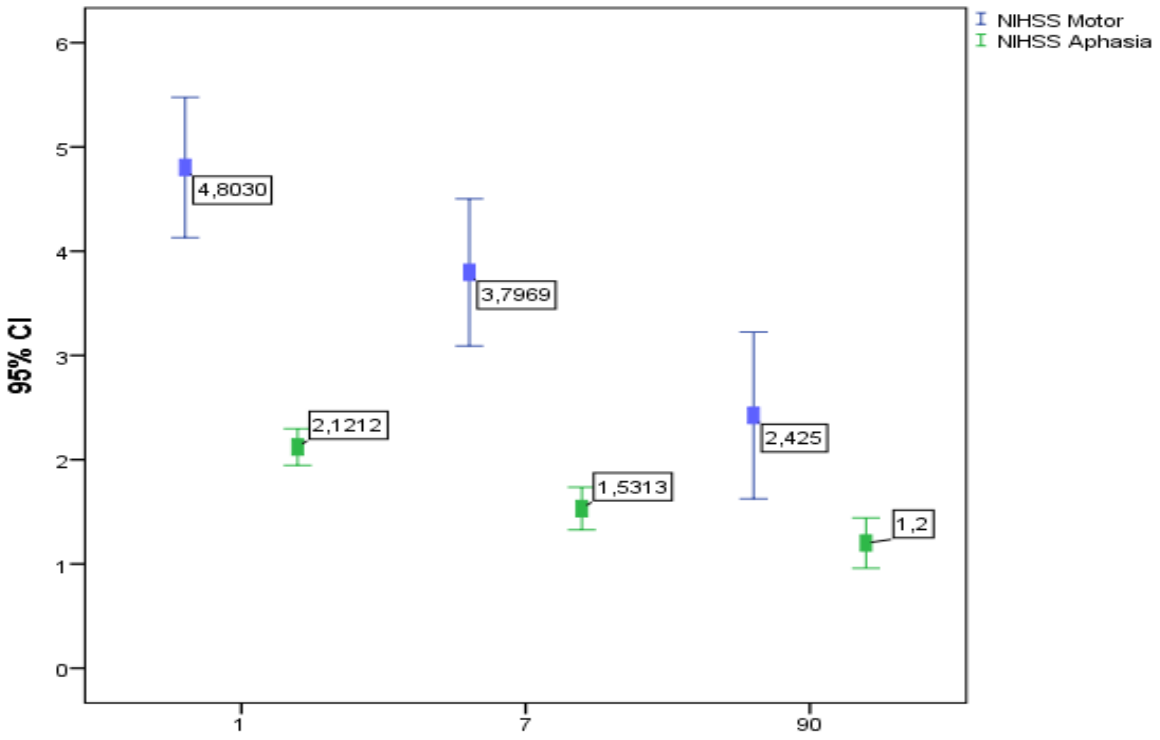

Fig. 42. Mean values of the NIHSS scale for motor and speech function in the follow-up period (1, 7 and 90 days)

The study of changes in the NIHSS scale for motor and speech function for the study period according to the two groups of patients shows that there is a significant difference in motor function in patients from the clinical and control groups ($p < 0.001$), and in the clinical group patients have more difficulty of this function (Fig. 43). The results in the NIHSS scale for speech function did not differ significantly in the two study groups. In all of them, the already established trend of a twofold improvement in the condition on the 90th day compared to the first day of follow-up is preserved.

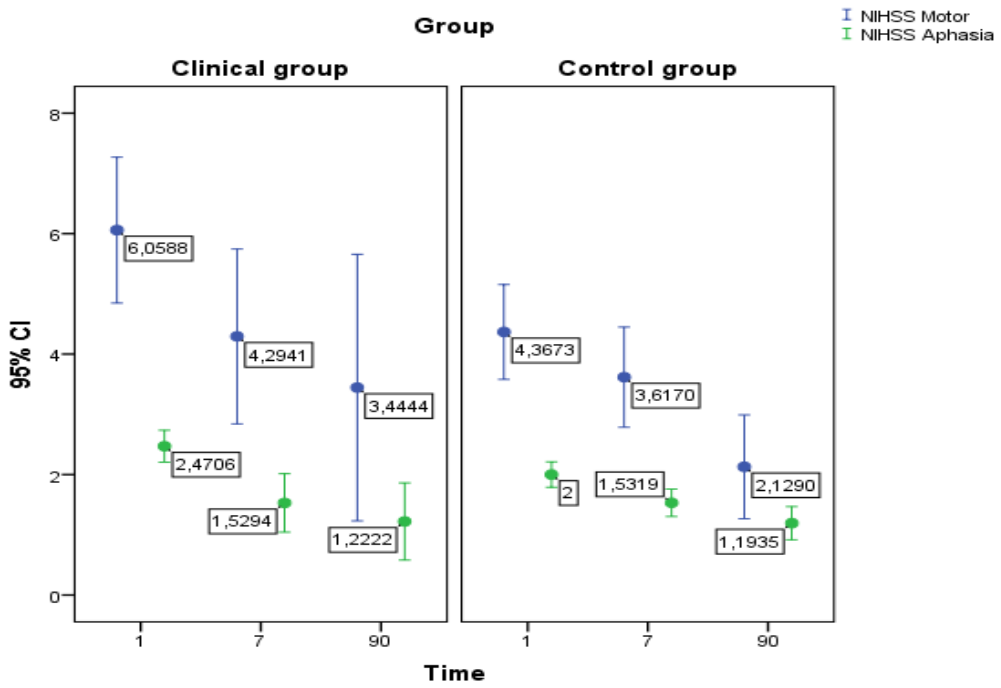

Fig. 43. Mean values of the NIHSS scale for motor and speech function in the follow-up period (1, 7 and 90 days) according to the studied groups

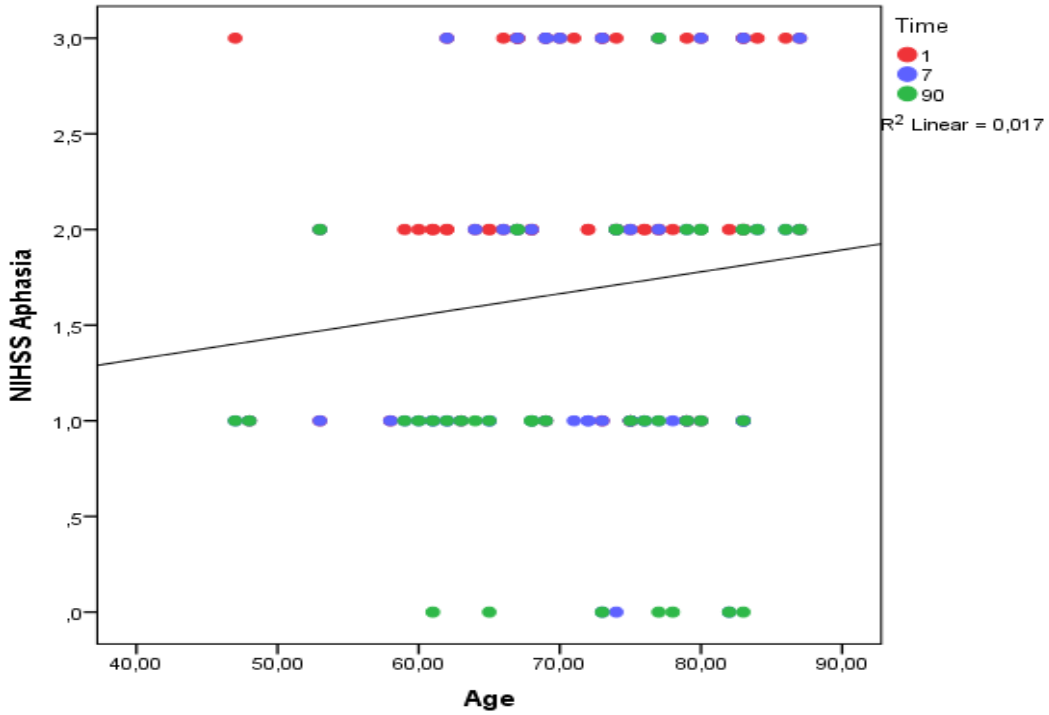

Fig. 44. Correlation analysis between age and the NIHSS scale for speech function

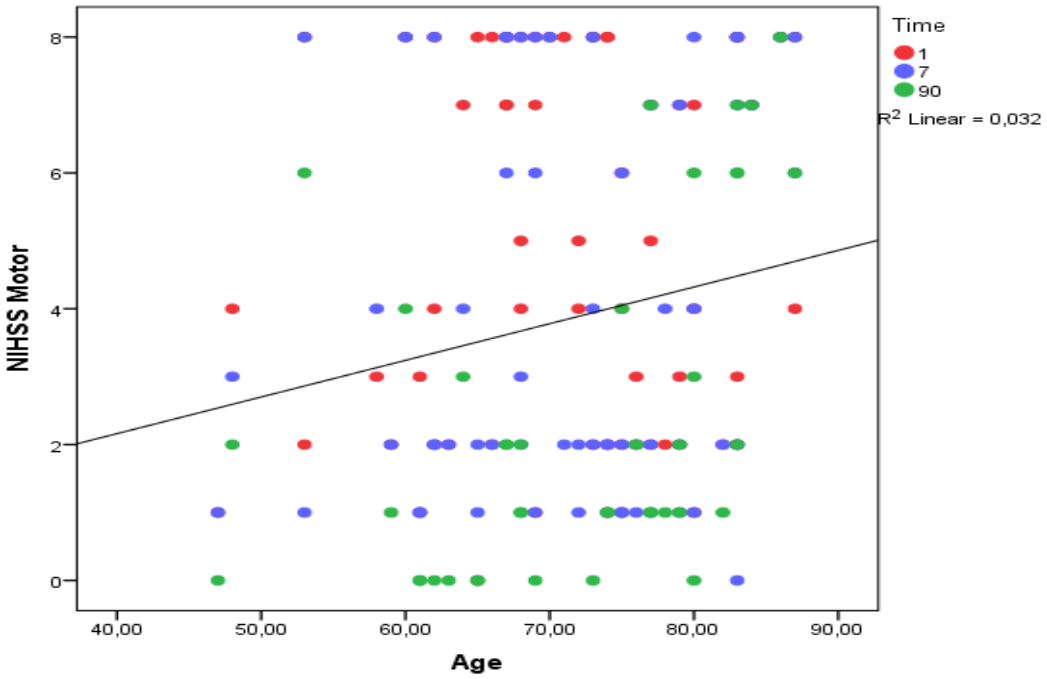

Fig. 45. Correlation analysis between age and NIHSS scale for motor function

In the analysis of the dependence between the NIHSS scale for motor and speech function and age, it was found that age does not correlate with the recovery of speech function, and with motor a weak proportional dependence (r = 0.180; p = 0.019) was found, which shows that with the increasing of the age it becomes more difficult to recover the motor function (Fig. 44 and Fig. 45).

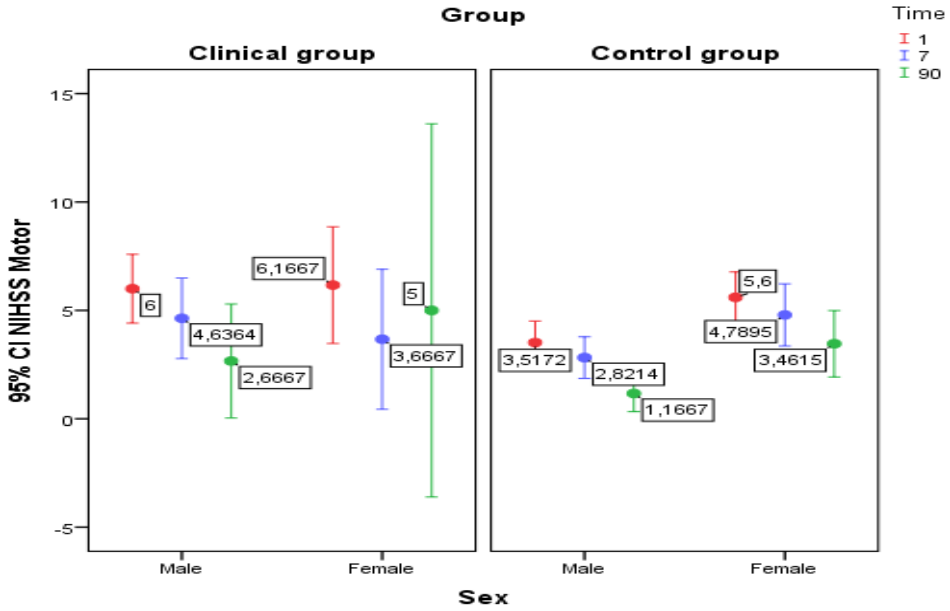

Fig. 46. Comparative analysis of the NIHSS scale for motor function by gender and study group

There was a significant difference in the recovery of motor function on day 90 compared to the onset of the accident in both the clinical ($p < 0.05$) and control group ($p < 0.05$) in both sexes (Fig. 46). In the clinical group on the first day the same results were found on the NIHSS scale for motor function in men and women, but on the 90th day in women there was a return to the original state, while in men the tendency to improve is maintained ($p < 0.01$). . In the control group, higher results were observed in women compared to men ($p < 0.05$), but in both groups there was a significant improvement on day 90.

Regarding the speech function, a significant difference was also found on the 90th day compared to the beginning of the incident in both the clinical ($p < 0.05$) and control group ($p < 0.05$) in both sexes (Fig. 47). In the clinical group, the same results were again found in both sexes, but in men the tendency to improve is preserved, while in women the results achieved on the 7th day of follow-up are preserved. In the control group, higher results were observed in women compared to men ($p < 0.05$), but in both groups there was a significant approval on the 90th day.

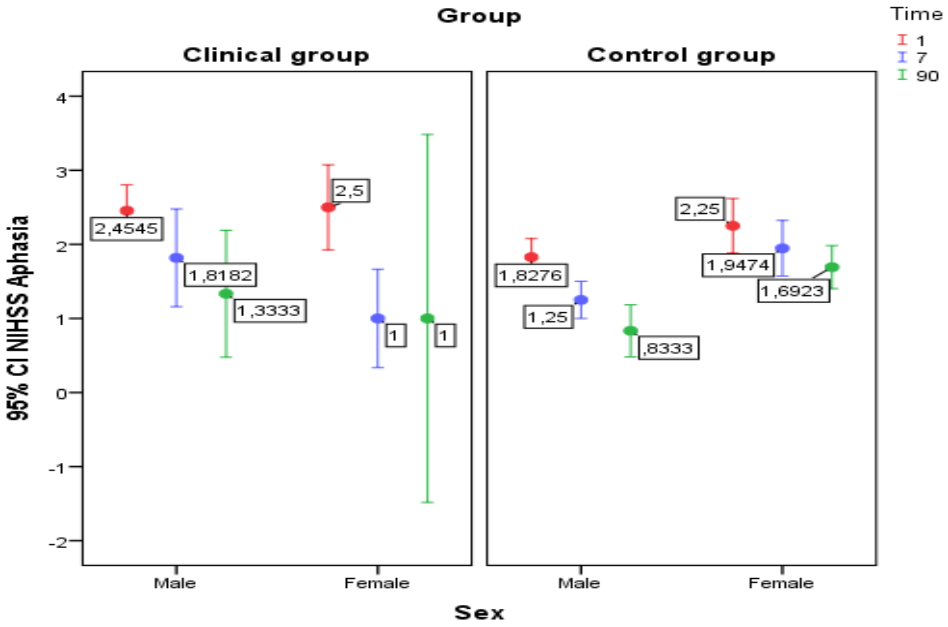

Fig. 47. Comparative analysis of the NIHSS scale for speech function by gender and study group

Fig. 48 and Fig. 49 shows the change in motor and speech function during the follow-up period according to the educational degree and the studied group. The results show that education does not significantly affect the improvement of motor and speech function after a cerebrovascular accident.

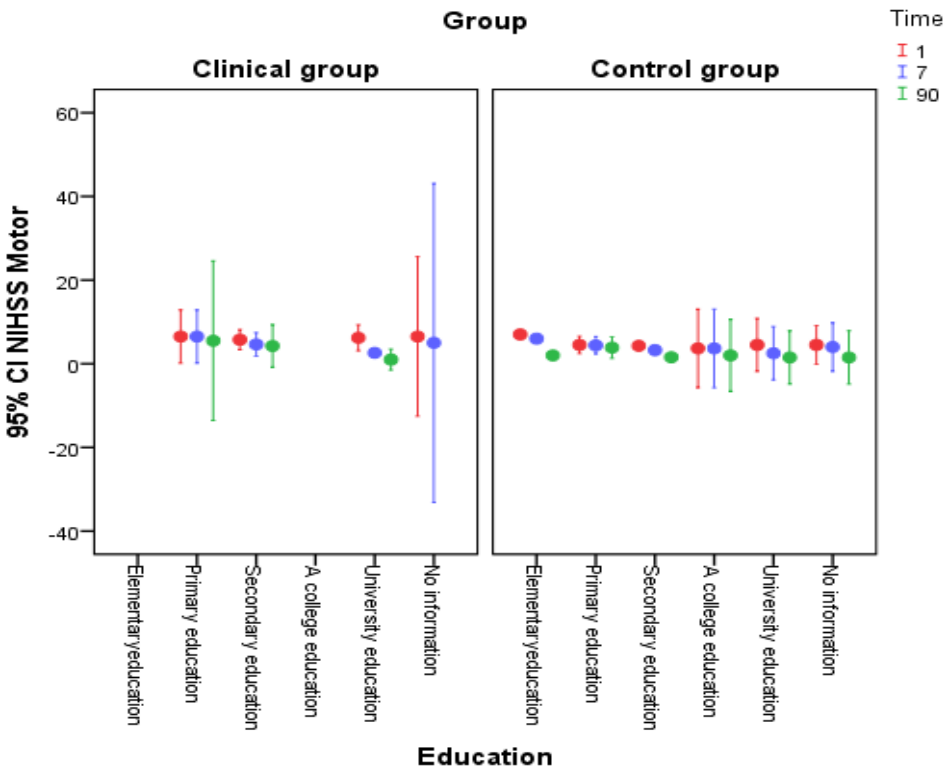

Fig. 48. Comparative analysis of the NIHSS scale for motor function according to education and study group

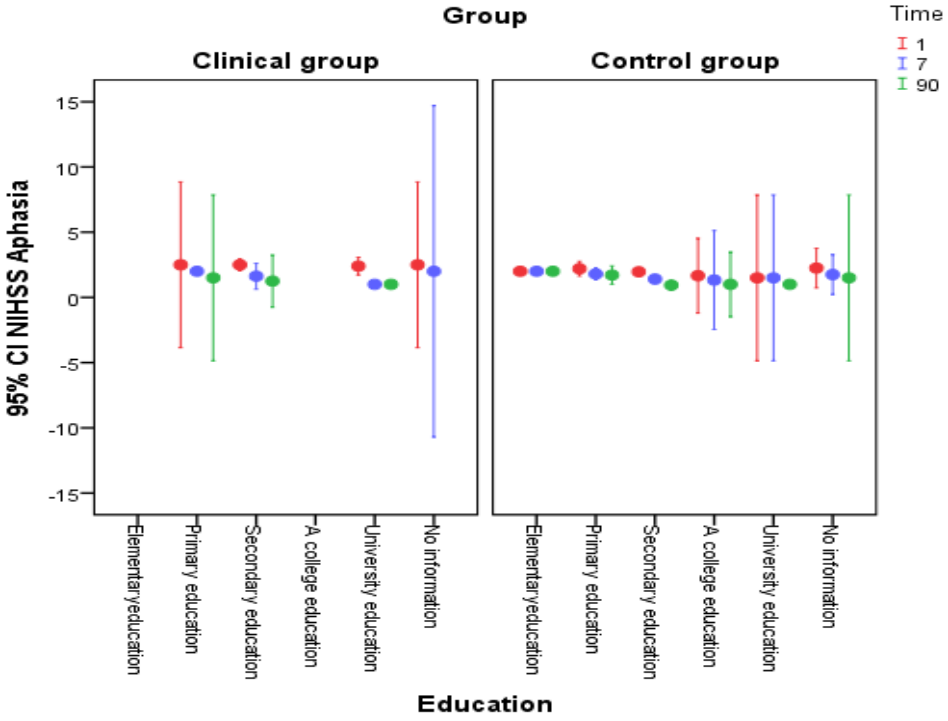

Fig. 49. Comparative analysis of the NIHSS scale for speech function according to education and the study group

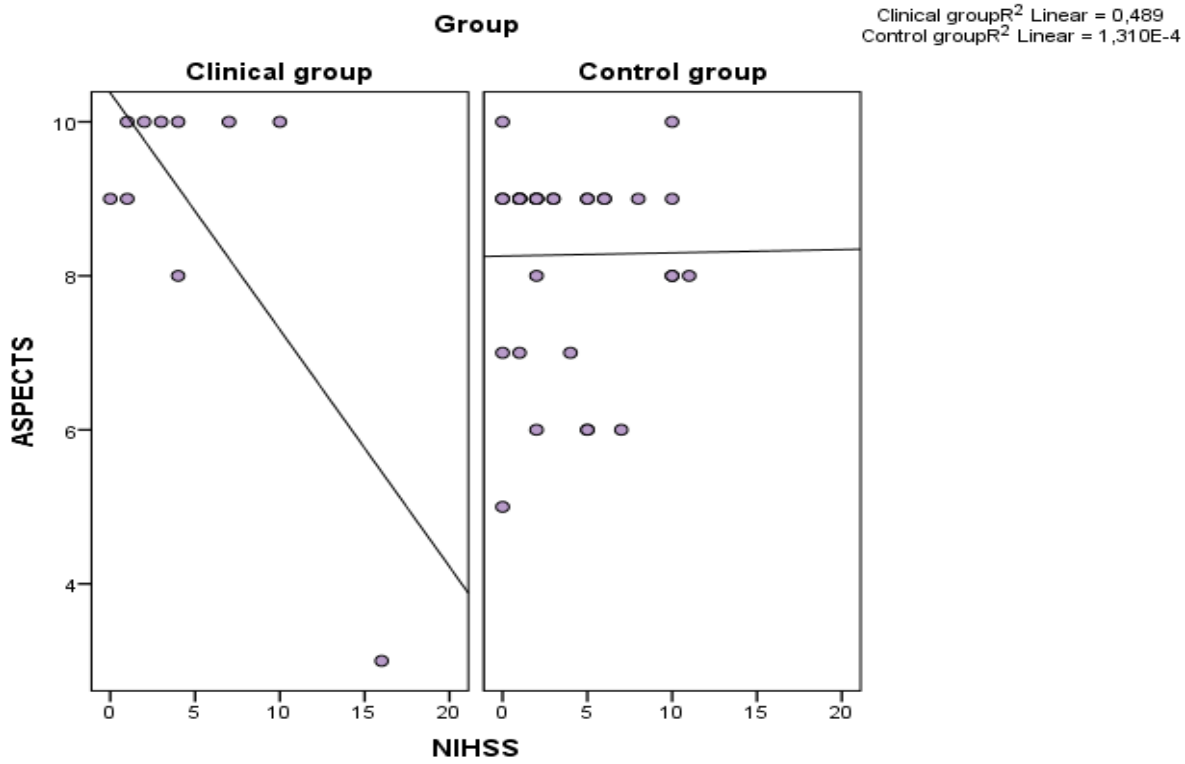

Fig. 50. Correlation analysis between the ASPECT scale and the NIHSS scale according to the study group

In the background of thrombolytic therapy, the ASPECT scale and the NIHSS scale correlated strongly inversely (r = -0.699; p = 0.024), with stroke severity associated with 48.9% of the recovery process assessed with the NIHSS scale (Fig. 50).

In the background of thrombolytic therapy, the ASPECT scale and the NIHSS motor function scale correlate moderately inversely (r = -0.348; p = 0.036), with stroke severity associated with 12.1% of the recovery process assessed with the NIHSS motor function scale (Fig. 51)

In the background of thrombolytic therapy, the ASPECT scale and the NIHSS scale for speech function correlated strongly inversely (r = -0.763; p = 0.017), with stroke severity associated with 58.2% of the recovery process assessed with the NIHSS scale for speech function (Fig. 52)

There was also a significant difference in the strength of the relationship between the ASPECT scale and the NIHSS scale for motor and speech function (p <0.001), and against the background of thrombolytic therapy better results are achieved in the restoration of speech function.

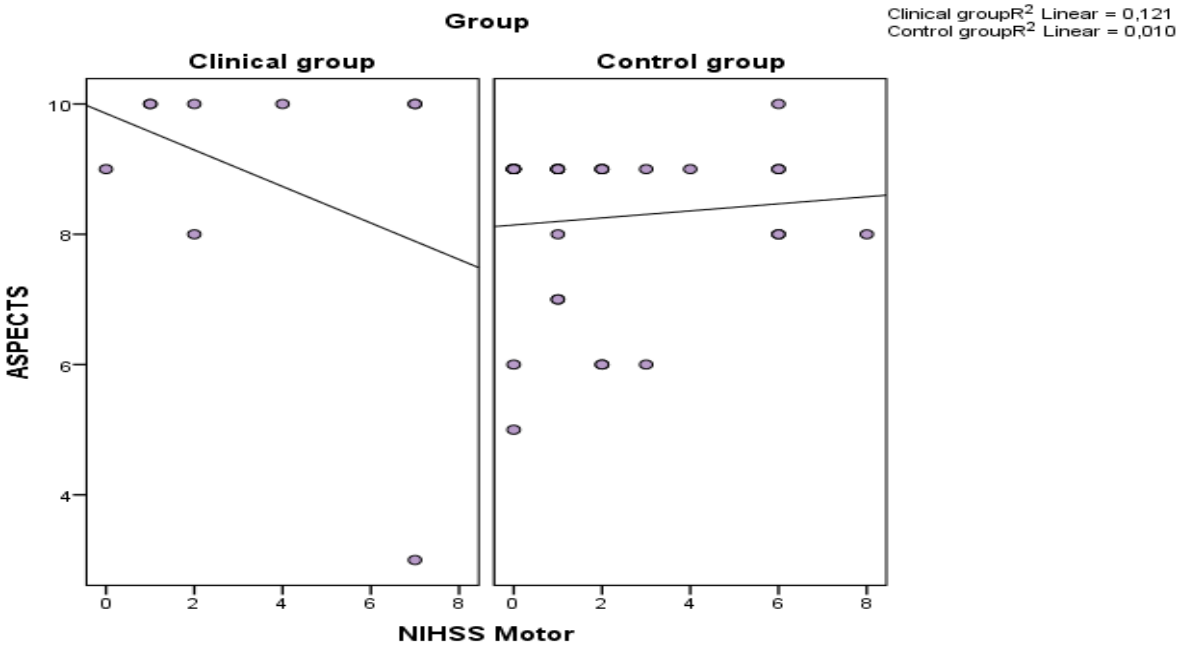

Fig. 51. Correlation analysis between the ASPECT scale and the NIHSS scale for motor function according to the studied group

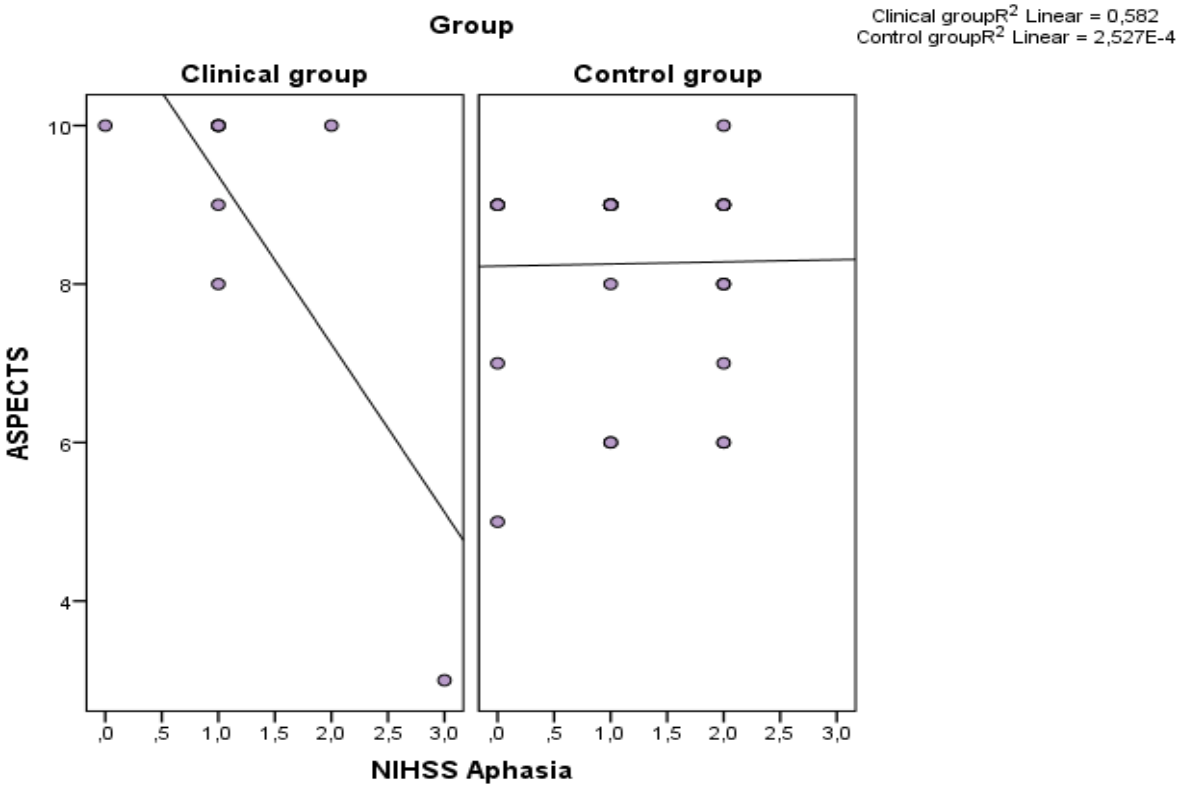

Fig. 52. Correlation analysis between the ASPECT scale and the NIHSS scale for speech function according to the studied group

4.6. To make a profile of the patient for the outcome of the disease depending on the studied indicators

In order to prepare a profile for the outcome of the disease, the relationship of the NIHSS scale for speech function with the ART scale and the AHS scale, as well as the relationship between the last two scales, is examined.

The results of the analysis show that the NIHSS scale for speech function correlates directly with the ART scale (r = 0.772; p <0.001), as a coincidence of the results in terms of improving the condition of patients was achieved in 59.7% of cases (Fig. 53)

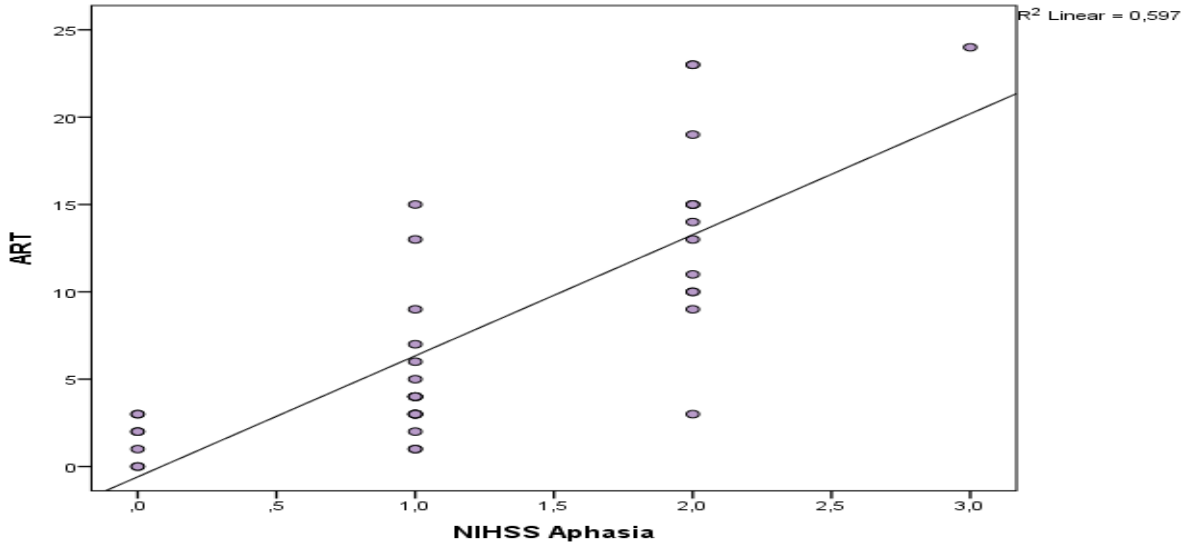

Fig. 53. Correlation analysis between the NIHSS scale for speech function and the ART scale

The results of the analysis show that the NIHSS scale for speech function correlates directly proportionally with the AHS scale (r = 0.764; p <0.001), as a coincidence of the results in terms of improving the condition of patients was achieved in 58.3% of cases (Fig. 54)

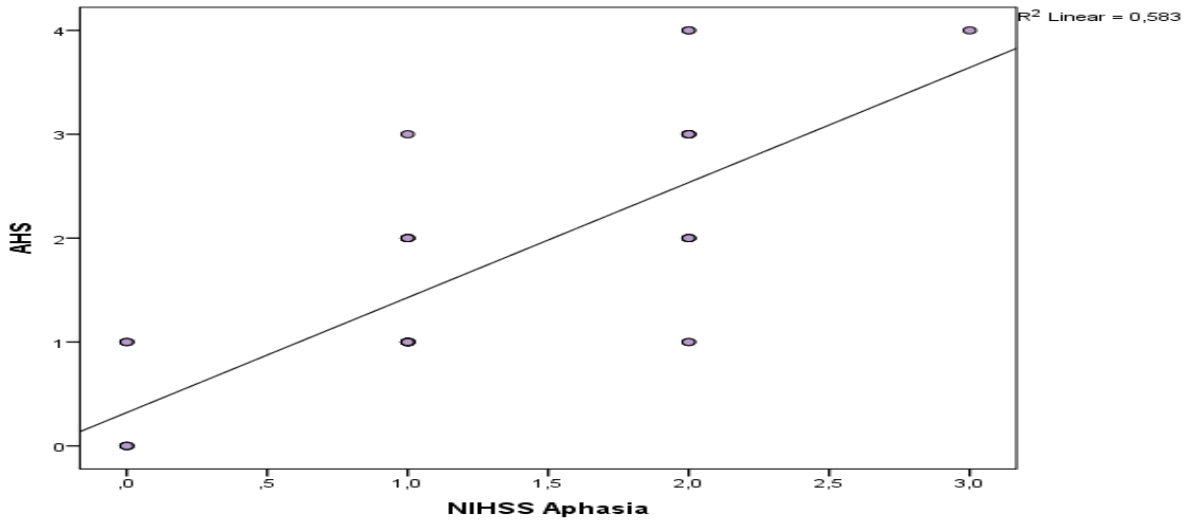

Fig. 54. Correlation analysis between the NIHSS scale for speech function and the AHS scale

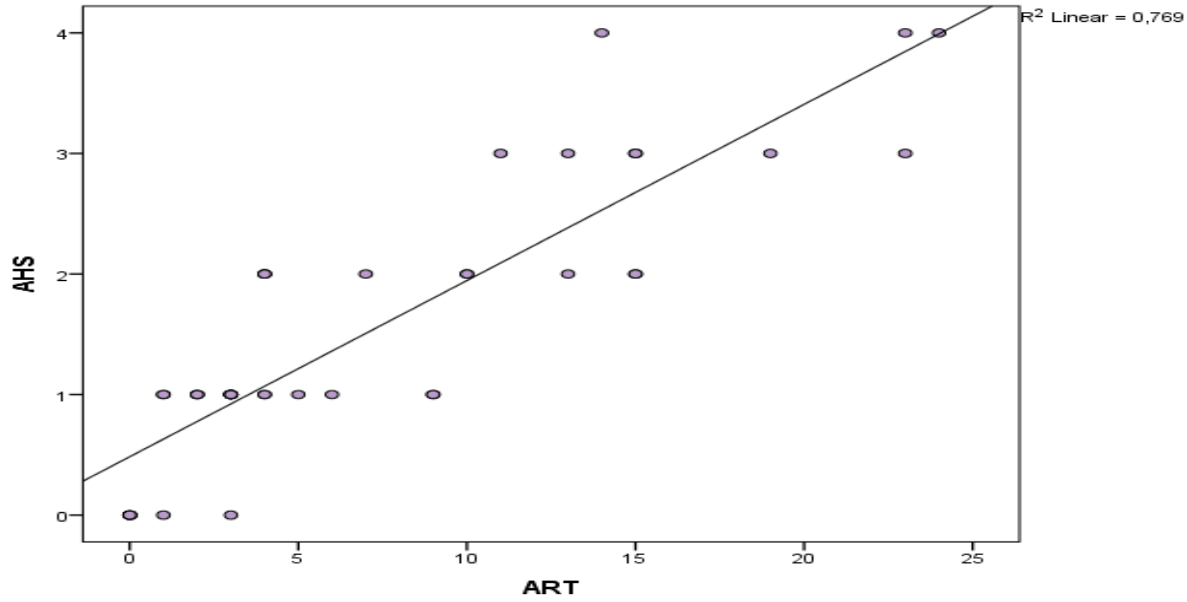

Fig. 55. Correlation analysis between ART scale and AHS scale

The results of the analysis show that the ART scale correlates proportionally strongly with the AHS scale ($r = 0.877$; $p < 0.001$), as a coincidence of the results in terms of improving the condition of patients was achieved in 76.9% of cases (Fig.55).

The following factors can be deduced from the performed analyzes, which determine the profile for favorable recovery of aphasia in patients who have survived an ischemic stroke:

• Male gender

• Age <75 years

• ART scale <8

- AHS scale <1
- ASPECTS scale> 5
- Lack of rhythm-conduction disorders
- Lack of heart failure
- Non-smoker / ex-smoker
- Conducted thrombolytic therapy

5. DISCUSSION

Stroke is defined by the World Health Organization as "rapidly developing clinical signs of focal brain dysfunction lasting more than 24 hours or leading to death for no apparent reason other than vascular origin". (Liebeskind et al., 2003)

Stroke is one of the leading causes of morbidity and mortality worldwide and ranks third as the most common cause of death in developed countries, leading to long-term disability and accounting for 4.4 million deaths worldwide (Busch et al., 2017); (Feigin et al., 2003); (Naghavi et al., 2017); (Sedova et al., 2021); (Welch et al., 2004) The severity of stroke varies widely, from complete recovery on the one hand to fatal and non-fatal events with neurological deficits and functional impairments on the other. (Bath et al., 2000); (Welch et al., 2000)

Stroke is classified into two main types: ischemic and hemorrhagic. Ischemic stroke is the most common and represents 85% of all strokes, while hemorrhagic stroke represents 15% of strokes - intracerebral 10%, subarachnoid 5% (Welch et al., 2004).

Ischemic stroke is a leading cause of morbidity and mortality in developed countries around the world. About 8–12% of patients die within 30 days of stroke onset, and those who survive are at increased risk of subsequent stroke (Diener et al., 2008).

The results of the present study support those published by Stahmeyer et al. about an increased risk of mortality in patients with cerebral infarction (Stahmeyer et al., 2019), and in our patients cerebral infarction caused by embolism of cerebral artery carries a higher risk of poor outcome. Our results show that 58% of these patients survive, while patients with cerebral infarction caused by cerebral artery thrombosis survive in 71.5% of cases. Ischemic stroke increases sharply with the age and is about 200 per 100,000 per year, with a prevalence of 5-12 per 1,000 population. Stroke mortality rates is different between the countries, ranging from 20 to 250 per 100,000 population per year (Hankey et al., 2005). This is also established in the present study with the elderly patients. We found that the average age of stroke due to thrombosis of cerebral arteries was over 70 years, while stroke caused by cerebral artery embolism occurred at an average age of over 75 years. There was a difference in the survival of patients according to the type of cerebral infarction ($p < 0.001$), as patients with cerebral infarction caused by thrombosis survived in 71.5% of cases, while patients with cerebral infarction caused by embolism, survive in only 58.1% of cases. He found that cerebral infarction caused by embolism carried a 1.8-fold higher risk of death (OR = 1.8 (1.3-2.5) $p < 0.001$).

Ischemic stroke accounts for up to 85% of all strokes, which are mainly caused by thrombosis or embolism of cerebral vessel. (Appelros et al., 2009). The present study found that more than 2/3 (68%) of patients with cerebral infarction caused by thrombosis and 32% had cerebral infarction caused by embolism.

Risk factors for ischemic stroke are classified as modifiable and non-modifiable. Non-modifiable factors include: sex, age, race, family history, genetic and low birth weight, while modifiable risk factors include: hypertension, diabetes mellitus, hyperlipidemia, atrial fibrillation, smoking, obesity, carotid artery disease, hyperhomocysteinemia, hypercoagulable conditions and some biomarkers (Romero et al., 2008). In the present study, it was found that a significant proportion of patients have concomitant hypertension (89.8%), hyperlipidemia

(28.7%), atrial fibrillation (24.4%) and diabetes mellitus (10.3%), which confirms the results of the scientific literature.

High blood pressure is common in acute ischemic stroke. Although blood pressure drops spontaneously within 90 minutes after the onset of stroke (Britton et al., 1986), about one-third of patients continue to have hypertension, which increases the risk of poor prognosis (Willmot et al., 2004).

Hyperglycemia occurs in about 20-40% of patients with acute stroke without a previous diagnosis of diabetes mellitus (Kiers et al., 1992). 28.7% of the patients in the current study were with diabetes mellitus. There is many clinical evidences that correlate between the hyperglycemia at the onset of acute ischemic stroke, leading to a poor prognosis (Baker et al., 2011).

However, there is still limited information for the role of risk factors and the clinical course in the etiological subtypes of stroke.

Stroke is an important public health issue and a burden on the community and health care providers. It is the third most common cause of death after coronary heart disease and cancer, not only in developed countries but worldwide. Stroke occurs mainly in middle and late life. Ischemic strokes occur mostly between the ages of 71 and 80 (Ayala et al., 2002). Several evidences suggest that hypertension, diabetes, hyperlipidemia, coronary heart disease, atrial fibrillation, smoking, polycythemia, and carotid stenosis are all contributing factors to stroke. The prevalence of risk factors varies in different communities. Despite numerous previous studies of stroke risk factors, much remains unknown and several discrepancies remain. Differences in the prevalence of stroke risk factors in different communities are probably due to differences in culture, disease patterns, lifestyles, and distribution of different ethnic groups.

Men are at higher risk than women and stroke affects mainly men older than 45 years. The most important etiologies of ischemic stroke include atherosclerosis of large arteries, cardioembolism and cerebral disease of small vessels. Less common causes of stroke are cervical artery dissection, cerebral vasculitis, coagulopathies, hematological disorders, and others (Barech et al., 2010).

In our study, the incidence of stroke was higher among men, where the male: female ratio was 3: 1. Khan et al. note the ratio of men: women 3.5: 1. Our finding is consistent with the findings of other authors (42.4% women: 57.6% men Grau et al., 2001); (Ayala et al., 2002).

The reason for the difference in the male-female ratio is probably due to differences in the frequency and control of stroke risk factors such as hypertension, ischemic heart disease, peripheral artery disease and smoking. (Mozaffar et al., 2003). Studies show that all of the above risk factors are more common in men. (Ayala et al., 2002); (Appelros et al., 2009); (Shahar et al., 2003). Another explanation may be the positive effect of estrogen on cerebral circulation. (Petitti et al., 1998)

The complex interaction between genetics, vascular risk factors, and their impact on stroke incidence and mortality may explain the increased likelihood of stroke in men.

As mentioned, the average age of the patients in our study was 72 years. Previous studies in different populations have found that the prevalence of stroke increases with age. (Curb et al., 1996)

Some researchers believe that the risk of stroke doubles for each decade after the age of 55. (Brown et al., 1989)

The peak age in our subjects is consistent with the findings of other studies (Ong et al., 2002); (Harmsen et al., 2006); (Mushtaq et al., 2009). In old age, the effect of an increasing incidence of contributing factors such as hypertension, diabetes and hyperlipidemia may be the reason for the increased prevalence. (Ayala et al., 2002); (Khan et al., 2006); (Mushtaq et al., 2009); (Hayashi et al., 2009)

The majority of adult patients had aphasia. Previous studies have reported that the incidence of aphasia in stroke patients ranges from 21% to 38%. (Simons et al., 1998)

In the present study, all of the studied patients have aphasia. There is also a significant relationship between elder age and the incidence of aphasia. Engelter et al. demonstrated that one in seven patients with ischemic stroke under the age of 65 had aphasia, while this proportion tripled in patients > 85 years of age. (Carlo et al., 1999); (Engelter et al., 2006)

Hypertension is a leading factor for atherosclerosis, which leads to thrombosis and rupture of blood vessels. In our study, hypertension was present in 92.4% of the cases. This correlates with the finding reported by Mushtaq et al. (65%), but this figure is much lower than other studies reported by Feigin et al. from Russia - 84.8%, Ong et al. from Singapore - 71.5%. (Mushtaq et al., 2009); (Feigin et al., 1998); (Ong et al., 2002);

Diabetes mellitus is the second most common risk factor in our study. In 30.3% of the patients in the current study, they had diabetes, which is much lower than in the other studies - Mushtaq et al. found 36% in patients with diabetes and stroke, Khan et al. reported 30% among patients. The incidence of diabetes among stroke patients in other countries varies from 7% to 41%. (Feigin et al., 1998); (Ong et al., 2002); (Kissela et al., 2005); (Grau et al., 2001)

Hu et al. found that hypertension and diabetes are strong predictors of stroke. However, as well arterial hypertension and diabetes or a combination of both, can increase the risk of a stroke. (Hu et al., 2005); (Kissela et al., 2005)

In our study, the majority of patients with diabetes also had arterial hypertension.

Many researchers report a strong link between stroke and the presence of symptomatic or asymptomatic heart disease. (Tanne et al. 2002)

Dyslipidemia is present in 36.4% of our patients, which corresponds to 11-23% reported in other studies. The higher prevalence of dyslipidemia in our study may be due to smoking and diabetes.

Smoking is a powerful risk factor for ischemic stroke. The mechanisms by which smoking is thought to increase the likelihood of ischemic stroke include: elevated fibrinogen levels, platelet adhesion, and decreased cerebral blood flow, mainly due to the formation of atheroma associated with smoking and higher blood pressure in chronic smokers. (Kelly et al. 2008); (Struijs et al. 2005).

The current study registered 33.3% of male patients with smoking, which is lower than the 53% reported by Basharat et al. (Basharat et al., 2002)

The incidence, subtypes and long-term prognosis of aphasia in acute stroke have been analyzed in previous studies (Kauhanen et al., 2000); Pedersen et al., 1995); (Engelter et al., 2006); (Demeurisse et al., 1980); (Inatomi et al., 2008).

Differences in the ratio of aphasia subtypes may also relate to the time of assessment, as it is known that the aphasia subtype may vary during the acute phase.

The present study has four main features. First, all patients with acute ischemic stroke had aphasia on admission. Second, NIHSS on admission is a significant and independent factor associated with the presence of aphasia on admission. Third, early improvement was observed in a significant proportion of patients with aphasia after treatment with intravenous thrombolysis. Finally, a history of hypercholesterolemia and NIHSS on admission are significant and independent factors associated with early improvement of aphasia during the acute phase.

In the present study, 43.1% of patients had global aphasia, which is more or less according to a study by Brust et al., 1976, in which 61% of patients had global aphasia. The incidence of global aphasia was lower in the other two studies, but these patients were evaluated early in the study period. (Kauhanen et al., 2000); (Minematsu et al., 1989)

Neurological severity assessed by NIHSS at admission was the only significant independent factor associated with the presence of aphasia at admission in the present study ($p < 0.001$). In previous studies, female gender, advanced age and cardioembolism have been associated with aphasia. Atrial fibrillation is more common in older women (Petty et al., 2000), and cardioembolic stroke is more severe than other types of stroke. (Roquer et al., 2003). In the present study, the severity of the stroke may be related to the appearance of an extensive lesion that involves the cortex associated with the language.

In the present study, early improvement in the first 7 days after the onset of stroke was observed in almost all patients with aphasia treated with intravenous thrombolysis. Follow-up periods vary between the studies cited, but are sometimes shorter than 3 weeks. (Wade et al., 1986). However, the frequency of early improvement is generally comparable between the different studies. (Kauhanen et al., 2000); (Pedersen et al., 1995); (Engelter et al., 2006). The relationship between the severity of neurological deficit and the outcome of aphasia has been described by Wade et al. who follow the long-term prognosis of aphasia. (Wade et al. 1986). Initial NIHSS score >7p. has been shown to be an independent risk factor for ischemic stroke progression (DeGraba et al., 1999). The present study demonstrated an association between the severity of aphasia and early improvement in treatment with intravenous thrombolysis.

The ART scale is designed to quantify the severity of aphasia in less than 3 minutes in patients with acute stroke by assessing the four main components affected by classical aphasic syndromes - comprehension, repetition, naming and fluency. (Laska et al., 2007). It was created for French- and English-speakers, Portuguese and Italians, and recently for Russians. (Buivolova et al., 2020). In our study, it was shown that the results of the analysis show that the NIHSS scale for speech function correlates strongly in direct proportion to the ART scale ($r = 0.772$; $p < 0.001$), as a coincidence of the results in terms of improvement in patients was achieved in 59.7 % of cases. This is consistent with literature data for a similar outcome of 61%

(Cloutman et al., 2009), while other studies indicate a 36–57% improvement in patients. (Inatomi et al., 2008; Maas et al., 2012; Pedersen et al., 2004).

The AHS scale is similar to the modified Rankin scale, assessing the degree of disability resulting from aphasia. The outcome of aphasia is assessed as a good (AHS 0–2) or poor (AHS 4–5) result. (Azuar et al., 2013). The results of the analysis show that the ART scale correlates strongly in direct proportion to the AHS scale ($r = 0.877$; $p < 0.001$), as a coincidence of the results in terms of improving the condition of patients was achieved in 76.9% of cases.

In other studies, the severity of indeterminate aphasia and global aphasia (Brust et al., 1976); (Sarno et al., 1979) (Demeurisse et al., 1980) is a factor predicting a poor outcome. Differences in the outcome of aphasia may relate to the mechanisms of recovery in the acute to chronic phases and it is assumed that they differ.

6. CONCLUSION

In the present study, we analyzed the risk profile of patients with ischemic stroke in the territory left middle cerebral artery and aphasia. We monitored and compared dynamically the recovery of motor deficit and aphasia at three moments - on the first and seventh day after the onset of cerebrovascular accident and on the third month after discharge in patients with intravenous thrombolysis and in patients treated with conservative therapy. We assessed the evolution of aphasia and the recovery pattern. We studied the changes in the brain parenchyma.

We analyzed in dynamics a total of 67 patients with ischemic stroke in the territory of left cerebellar artery, divided into two groups: 17 patients treated with intravenous thrombolysis (clinical group) and 50 without thrombolysis (control group).

We found a significant difference in age and sex at the onset of ischemic stroke. In women, the disease occurs at a much later age, and males carry a 1.58-times higher risk of developing a cerebral infarction caused by thrombosis.

Among the studied patients with the largest relative share is hypertension (92.4%), followed by heart failure (30.30%), ischemic heart disease (30.30%), arrhythmias (27.30%). The fewest stroke patients have survived myocardial infarction (12.1%). Among the endocrine diseases with the largest relative share are diabetes mellitus (30.3%) and dyslipidemia (36.4%). With chronic carotid-vertebro-basilar insufficiency are 37.9%. We found that the greater the degree of chronic carotid-vertebro-basilar insufficiency, the bigger is the likelihood of ischemic stroke. We have proven that its presence increases the risk by 6.6 times.

Regarding the changes in the brain parenchyma, assessed on the ASPECT scale, in patients with ischemic stroke and aphasia with / without intravenous thrombolysis, no relationship was found between the age of the patients and the score of points on the ASPECT scale. However, the analysis of concomitant diseases and changes in cerebral parenchyma showed that ischemic heart disease increased 4 times the risk of poor prognosis of stroke according to the ASPECT scale.

The evolution of aphasia in both groups of patients was assessed with two scales: The Aphasia Rapid Test (ART) and Aphasia Handicap Scale (AHS), and in both groups there was a significant improvement at the 90th day compared to the first day. The results of the analysis of the ART scale showed that there is a significant difference according to the studied group and gender. Thrombolytic therapy achieves significantly better results in women, while in men no such difference is found. We did not establish a relationship between the age of the patients and the degree of recovery of aphasia assessed by the ART scale. In a comparative analysis between the ASPECT scale and the ART scale, an inversely moderate dependence was found, which shows that higher stroke severity is associated with more difficult recovery, with stroke severity associated with 13.9% of the recovery process estimated by ART scale. On the other hand, at the background of thrombolytic therapy, the ASPECT scale and the ART scale were found to be strongly inversely correlated, with stroke severity associated with 65.5% of the recovery process assessed with the ART scale. Regarding the AHS scale in the clinical and control groups, we did not find a significant difference in terms of the restoration of aphasia by

sex and age. A comparative analysis of the relationship between the ASPECTS and the AHS scale revealed that there was a significant difference in results in both the clinical group and the control group. Only in the clinical group was an inversely strong relationship between the ASPECT scale of stroke severity and the AHS scale in the setting of thrombolytic therapy.

In the analysis of the recovery of aphasic disorders and motor deficits, we used the NIHSS scale and found a significant difference in the follow-up process. Patients on the first day had significantly higher values, while on the 90th day the results were more than twice lower. There was a significant difference in the NIHSS scale values on the 1st and 90th day of follow-up in patients with intravenous thrombolysis and in patients with conservative therapy. A significant difference was found in the recovery of patients and gender, with women in both groups having a more severe stroke and therefore more difficult recovery compared to men. On day 90, the NIHSS scale was three times higher in women than in men. In a correlation analysis of the relationship between motor and speech function, assessed on the NIHSS scale, and age, it was found that age does not correlate with the restoration of speech function, and in motor function a weak proportional relationship was found, which shows that with increasing age makes it harder to recover from a motor deficit. Regarding the speech function, a significant difference was found on the 90th day compared to the beginning of the incident in both the clinical and the control group in both sexes. In the clinical group, the same results were again found in both sexes, with men maintaining the tendency to improve, while in women the results achieved on the 7th day of follow-up were maintained. We found that education did not significantly affect the improvement of motor and speech function after a cerebrovascular accident.

The ASPECT scale and the NIHSS scale in the clinical group correlated strongly inversely, with stroke severity associated with 48.9% of the recovery process assessed with the NIHSS scale. We found a significant difference in the strength of the relationship between the ASPECTS scale and the NIHSS scale for motor and speech function, and against the background of thrombolytic therapy better results are achieved in the restoration of language function. Against the background of thrombolytic therapy, the ASPECT scale and the NIHSS motor function scale correlate moderately inversely, with stroke severity associated with 12.1% of the recovery process assessed with the NIHSS motor function scale. Against the background of thrombolytic therapy, the ASPECT scale and the NIHSS scale for speech function correlate strongly inversely, with the severity of the stroke being associated with the recovery process assessed with the NIHSS scale for speech function.

In preparing the aphasia outcome profile, we examined the relationship of the NIHSS speech function scale to the ART scale and the AHS scale, as well as the relationship between the last two scales. The results of the analysis show that the NIHSS scale for speech function correlates strongly proportionally with the ART scale, as a coincidence of the results in terms of improving the condition of patients was achieved in 59.7% of cases. The results of the analysis show that the NIHSS scale for speech function correlates strongly proportionally with the AHS scale, as a coincidence of the results in terms of improving the condition of patients was achieved in 58.3% of cases. The results of the analysis show that the ART scale correlates proportionally strongly with the AHS scale, as a coincidence of the results in terms of improving the condition of patients was achieved in 76.9% of cases. These values indicate that the ART and AHS scales

will be reliable tools for rapid and accurate assessment of aphasia at the patient's bed and in monitoring the quality of life on the 90th day of the disease.

The results of our study confirm the thesis that intravenous thrombolysis leads to faster recovery of motor deficit and aphasia. The recovery of aphasia is related to the size of the lesion and the initial severity of the aphasia. Our results show ischemic stroke as a polyetiological disease with significant differences in age, sex and distribution of risk factors. Therefore, future studies on stroke risk factors, etiology, and current treatment strategies are recommended to develop a plan to better control and prevent ischemic stroke.

7. CONCLUSION REMARKS

Based on the results of our study and the data from the literature review, the following conclusions can be made:

1. The characteristics of patients with ischemic stroke show that the disease occurs at a later age in women. Male gender is a risk factor for ischemic stroke caused by thrombosis. Ischemic stroke caused by an embolism carries a higher risk of death.

2. The analysis of risk factors in patients with ischemic stroke and aphasia confirms the literature data. Risk factors include hypertension, diabetes mellitus, atrial fibrillation, dyslipidemia, male gender, and smoking.

3. It has been shown that patients with ASPECTS> 5p. have better chance for recovery of the aphasia.

4. Patient follow-up and analyzes have shown that treatment with thrombolysis has a positive effect on both the outcome of the disease and aphasia. Women have more severe aphasia than men and, despite treatment with thrombolysis, show poorer recovery. This may be due to the older age of women on admission. This correlates negatively with the NIHSS, ART and AHS scales.

5. The studied patients stand out with more severe motor deficit than speech deficit, assessed by NIHSS, who after better treatment with thrombolysis achieve better recovery.

6. Favorable recovery of aphasia is associated with:

• Male

• Younger age

• No arrhythmias, heart failure

• Non-smokers

• Intravenous thrombolysis

• ASPECTS> 5p.

• ART <8p.

• AHS <1p.

8. CONTRIBUTIONS

With original character:

1. For the first time in our country a detailed analysis of the literature data was performed regarding the role of treatment with intravenous thrombolysis in patients with ischemic stroke in the left middle cerebral artery and the recovery of aphasia.
2. For the first time in our country the degree of recovery of motor deficit and aphasia in patients with ischemic stroke up to the third month from the onset of the disease have been monitored in dynamics.
3. For the first time in our country a comparative analysis of the degree of recovery of motor deficit and aphasia was performed in patients with intravenous thrombolysis and in those without differentiated treatment.

With confirmatory character:

1. There have been identified risk factors that influence the outcome of thrombolysis treatment in relation to the recovery of aphasia, demonstrating their influence in relation to the recovery of aphasia.

2. A patient profile has been determined for favorable recovery of aphasia with intravenous thrombolysis among patients with ischemic stroke.

3. A patient profile has been determined for more severe aphasia among patients with ischemic stroke.

4. The role of the ART, AHS, ASPECT and NIHSS scales has been proven as reliable tools for assessing aphasia and prognosis from treatment with intravenous thrombolysis.

9. PUBLICATIONS RELATED TO THE DISSERTATION

1. Prognostic factors for the recovery of aphasia after ischemic stroke - review - **Radina Fuchidzhieva**, Varna Medical Forum, Volume 10, 2021, Issue 1, pp. 64-68
2. Quality of life in patients with aphasia after acute ischemic stroke - review – **Radina Fuchidzhieva**, Varna Medical Forum, Volume 10, 2021, Issue 1, pp. 69-72
3. Endovascular treatment for acute ischemic stroke - current recommendations of the European Stroke Organization - Michael Tsalta-Mladenov, Vladina Dimitrova, **Radina Fuchidzhieva**, Darina Georgieva-Hristova, Silva Andonova, Varna Medical Forum, vol. 8, 2019, issue 2, p. 14-19

SCIENTIFIC EVENTS

1. **Radina Fuchidzhieva**, S. Andonova, E. Kalevska - "Clinical case of a patient with Markiafava-Binyami disease", Fifth National Congress with international participation of the Bulgarian Association of Neurosonology and Cerebral Hemodynamics, Sofia, 2019 – poster
2. **R. Fuchidzhieva**, P. Nikolay, M. Tsalta, V. Dimitrova, D. Georgieva, S. Andonova - "Recovery of aphasia and motor deficit in patients with intravenous thrombolysis for the period 2017-2019" - XIX National Congress in Neurology with international participation, 29.10-01.11.2020 – poster
3. **R. Fuchidzhieva**, K. Georgiev, M. Tsalta-Mladenov, D. Georgieva, S. Andonova – Two Clinical Cases of Guillian-Barre Syndrome After Covid-19 Infection, 7th European Stroke Organisation Conference – Vitual, 01-03.09.2021 – poster
4. Tsalta-Mladenov, V. Dimitrova, A. Yankova, **R. Fuchidzhieva**, D. Georgieva-Hristova, S. Andonova - "Cerebrovascular risk factors and assessment of the real risk of ischemic stroke", XIX National Congress on Neurology with international participation, 29.10-01.11.2020 – poster
5. M. Tsalta-Mladenov, **R. Fuchidzhieva**, V. Dimitrova, S. Andonova - „Prospective evaluation of qualitative parameters in treatment of acute ischemic stroke in UMHAT "St. Marina", Varna, Bulgaria using the Res-Q registry database" ESOC 2019 – 5th European Stroke Organisation Conference" (Milan, Italy) - poster
6. M. Tsalta-Mladenov, V. Dimitrova, **R. Fuchidzhieva**, S. Andonova, "Health-related quality of Life After Ischemic Stroke in North-East Bulgaria", First Joint ESO-WSO Conference, 07-09.11.2020 – poster

In connection with the development of this dissertation, the author thanks:

• to her research supervisor - Prof. Silva Peteva Andonova - Atanasova, MD, DSc - for the guides in the practical work and the help in writing the dissertation;

• the entire team of the First and Second Neurological Clinics of the University Hospital "St. Marina "- Varna for the provided support and assistance;

• to her family