Original Article

Factors influencing the one-year survival rate of patients after stroke in aktobe region: a cohort study

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ABSTRACT

Background

Predictors of stroke outcomes are still poorly understood. In the Kazakh scientific literature, there are only some works considering the determinants of stroke outcomes, despite the high prevalence of this disease.

Objectives

The aim of the study was to analyze the influence of risk factors on the annual survival of stroke patients in the population of residents of the Aktobe region.

Methods

The cohort study included all cases of cerebral strokes in Aktobe from 01.01.2021 to 01.01.2022(n=754). The survival rate of patients with MI was assessed using the Kaplan-Mayer method with the determination of the difference between the groups using a log-rank criterion. To assess the independent influence of forecast factors on annual mortality, a multidimensional analysis of proportional Coke risks was used. Adjusted relative risks (RR) were calculated with 95% confidence intervals (CI).

Results

Based on the results obtained, it can be assumed that the one-year survival rate is 24.8%, and the median survival rate of 40 days is 95% CI (25.9 - 54.1), which does not differ significantly in survival in developed countries. The factors influencing the annual survival of patients with cerebral strokes in Kazakhstan have been determined. Gender, age, hospitalization time and severity of stroke on the GCS scale are closely related to survival at 12 months.

Conclusions

The factors influencing the annual survival rate of stroke patients in Kazakhstan have been identified. These results can be used to develop treatment and rehabilitation strategies aimed at improving long-term outcomes in stroke patients.

Keywords

stroke; survival; prognostic factors; Cox regression.

INTRODUCTION

Acute cerebrovascular disorders remain one of the leading causes of disability among diseases of the central nervous system [1]. Globally, vascular diseases account for the majority of deaths, and stroke is currently the second most common cause of mortality worldwide [2,3].

In 2015 alone, coronary heart disease and stroke were responsible for approximately 15.2 million deaths. Beyond mortality, the overall burden of stroke is immense: it accounted for an estimated 102 million years of life lost due to disability and premature death, reflecting its profound impact on individuals, families, and healthcare systems [4–6].

Importantly, trends in stroke incidence vary considerably across countries. Over the past two decades, the most significant increases have been observed in low- and middle-income countries, where rapid demographic changes, urbanization, and limited access to preventive healthcare have contributed to the growing burden of disease [7–9].

In Kazakhstan, stroke remains one of the main causes of death. According to statistics, the incidence of cerebrovascular diseases in

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the country increased from 258.4 cases per 100,000 people in 2015 to 433.7 cases per 100,000 people in 2020. At the 2006 Helsinki Conference, international recommendations were developed on the organization of care for stroke patients, which include aspects of acute stroke treatment, preventive measures, rehabilitation, as well as assessment of outcomes and quality of life [10].

However, data on long-term stroke outcomes in Kazakhstan are limited, which makes it difficult to analyze the factors affecting patient survival. The study of long-term outcomes, that is, after a year or more, and the identification of factors influencing these outcomes is important for improving the organization of medical care. Knowing the predictors of late mortality after stroke is key to improving treatment. The outcome of a stroke depends on many factors: age, gender, ethnicity, type of stroke, presence of atrial fibrillation, heart defects, myocardial infarction, overweight, family history, time before hospitalization and severity of stroke. However, in Kazakhstan, the impact of these factors on the long-term survival of patients after stroke remains insufficiently studied.

The aim of the study was to analyze the influence of risk factors on the annual survival of stroke patients in the population of residents of the Aktobe region.

Methods. A continuous cohort study was conducted in the city of Aktobe. The study included 754 patients hospitalized in the stroke department of the Mobile and Regional Medical Center of Aktobe from January 1, 2021 to January 1, 2022. The diagnosis of stroke was confirmed on the basis of ICD-10. Patient outcomes were closely monitored throughout the year. Information on annual mortality was collected both in hospitals and from medical workers of family medical outpatient clinics in the region.

The following parameters were used as independent variables: gender (a dichotomous variable), age, which was divided into four groups (40-49 years old, 50-59 years old, 60-69 years old and 70 years and older), as well as nationality, which was classified into three categories: Kazakhs, Russians and other nationalities. The type of stroke was divided into three groups: ischemic stroke (AI), intracerebral hemorrhage and subarachnoid hemorrhage. The severity of neurological deficits was assessed using the GCS scale. Patients who were under observation up to a certain point in time, but then dropped out as a result of a fatal outcome for another reason or a change of residence, were considered censored.

The survival rate of stroke patients was assessed using the Kaplan-Mayer method, and differences between groups were analyzed using a log-rank criterion. To assess the independent influence of prognostic factors on annual mortality, a multidimensional analysis of proportional Coke risks was used. Adjusted relative risks (RR) were calculated with 95% confidence intervals (CI). All data were statistically processed using the Statistics program (SPSS 25).

The study was conducted in accordance with international standards of Good Clinical Practice,

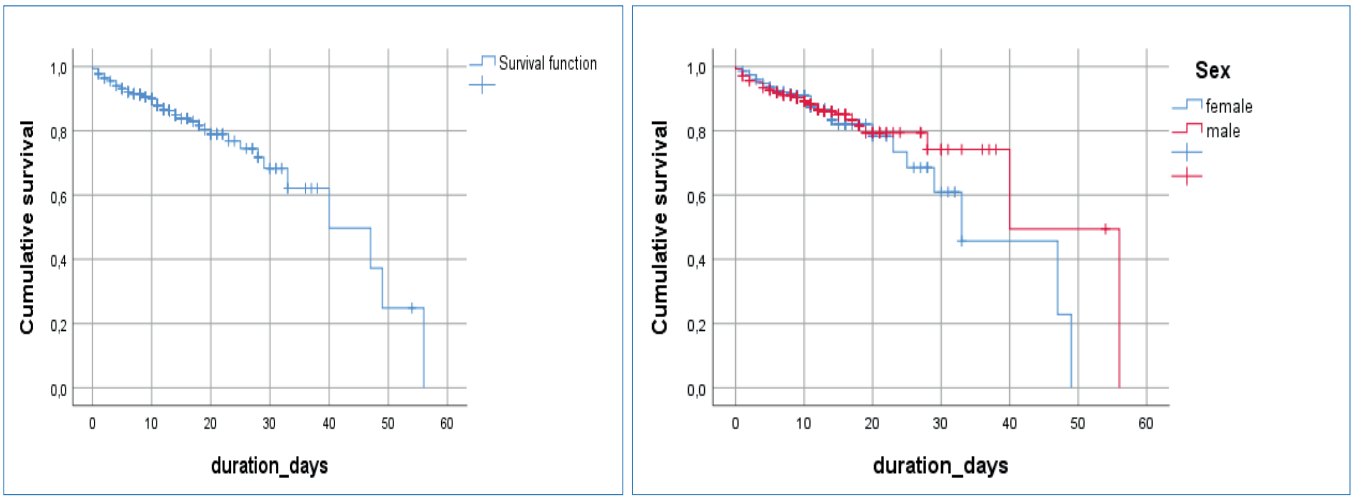


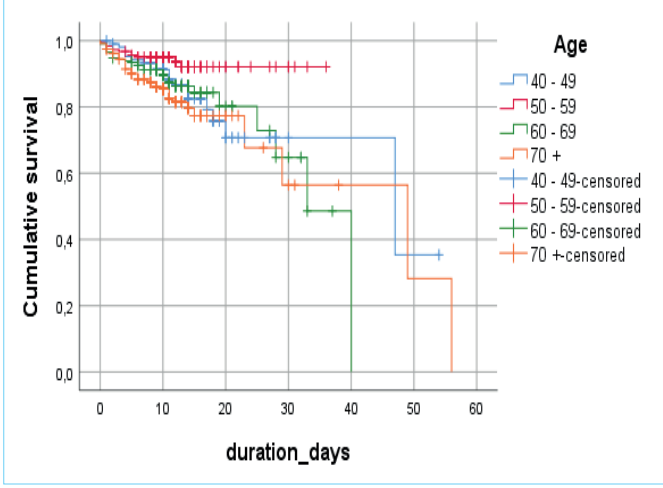
Figure 1.2. Survival rate of patients who suffered brain strokes in Aktobe in 2021-2022. (n=754) and gender differences.

the principles of the Helsinki Declaration and ethical standards approved by the Ethics Commission of the Marat Ospanov West Kazakhstan Medical University (Protocol No. 12 dated January 30, 2018) [11].

MATERIALS AND METHODS

The study included 754 patients. Significant differences were found in the survival rates of patients with cerebral stroke, depending on a number of initial factors. The analysis demonstrated significant differences in the survival rate of patients with cerebral stroke due to differences in baseline characteristics. Next, the Kaplan-Mayer method was analyzed for the following factors: gender, age, nationality, place of residence, and type of stroke. The one-year survival rate was 24.8%, and the median survival rate of 40 days was 95% CI (25.9 - 54.1). (Fig. 1)

Men demonstrated higher survival rates compared with women, but no statistically significant differences were found (log-rank criterion p=0.658) (Fig. 2). Patients under 50 years of age and aged 50-59 years had significantly better survival rates compared with older age groups, with the worst survival observed in patients over 70 years of age. Particularly high survival rates were recorded in patients aged 50-55 years compared with other age groups. The lowest survival rate is observed in patients aged 60-69 years. The median was 33 days 95% CI (27.1 -38.9); (lograng criterion p= 0.006). (Figure 3)



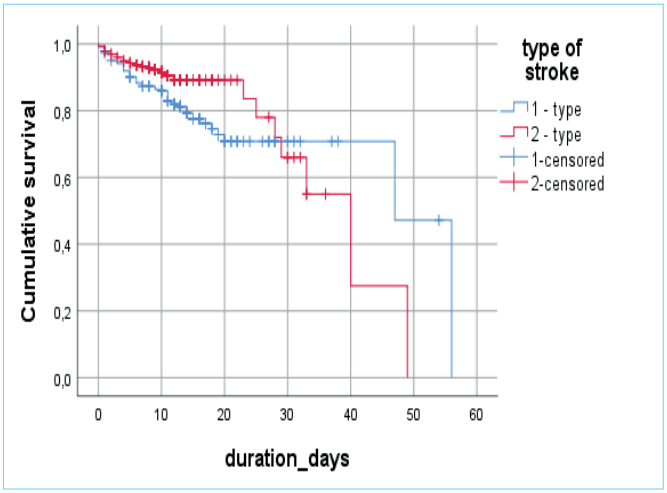


Figure 3.4- Survival of patients depending on age and type of stroke, the survival curve with hemorrhagic stroke was higher than in patients with ischemic stroke (log-rank test p=0.017) Median survival from GI 47 days 95% CI (27.6-66.4) (Fig 4). Patients of Russian nationality had a less favorable prognosis of survival compared to patients of Kazakh nationality (p<0.005).

Table 1. Analysis of prognostic factors of survival in stroke patients: a proportional Cox model for a complete sample. (n=754).

Variables in the equation								
	B	Ст. ош.	Wald	ст.св.	Significance	Exp (B)	95.0% CI for Exp(B)	
							Lower	Bupper
GCS Scale	,144	0,214	,451	1	,050	1,155	,759	„757
diagnosis	-0,713	0,390	3,349	1	,067	,490	,228	„052
hospitalization	,139	302	,212	1	,0645	1,149	,636	„075
Age (70 and above)	,444	296	2,249	1	,0134	1,559	,873	„787
gender	,047	203	,053	1	,0818	1,048	,704	„559
Nationality	-,587	212	7,647	1	,006	,556	,367	„843

A one-dimensional analysis of proportional Cox risks established a link between annual stroke survival and factors such as age, ethnicity, and type of stroke. However, after adjusting for potential interfering factors, the association with a history of stroke lost statistical significance (RR=0.98; 95% CI 0.76-1.27). In the multidimensional model, the most significant predictor of the outcome was the number of points on the GCS scale. Patients with an extremely severe condition (RR=1.15; 95% CI 0.759-0.757) were most likely to have an adverse outcome. In addition, intracerebral and subarachnoid hemorrhages were statistically significantly associated with an unfavorable outcome compared with ischemic stroke (RR=0.49; 95% CI 0.228-0.052). Other significant independent predictors of an adverse outcome were: age over 70 years (RR=1.59; 95% CI 0.873-0.787), russian nationality (RR=0.55; 95% CI 0.367-0.843) and time of hospitalization since the onset of the disease (RR=1.14; 95% CI 0.636-0.75), which It is presented in Table 1. The survival rate of patients from cerebral stroke in Aktobe differed depending on the time of hospitalization. Patients admitted to the hospital before 4.5 hours and from 4.5 hours to 24 hours from the onset of the disease had the highest survival rates in terms of hospitalization time.

The measure of reliability of the model obtained by the criterion of pseudo -2 Log likelihood is 1233.17. These data were used to develop a mathematical model that allows predicting the outcome of the disease. The obtained logistic regression data in the form of a model is presented in Table 2.

Table 2. Universal criteria for the coefficients of the model

-2 Log-likelihood	General (assessment)			Change from the previous step			Change from the previous block		
	Chi-sq.	ст.св.	op	Chi-sq.	ст.св.	p	Chi-sq.	ст.св.	p
1223,177	20,312	7	,005	21,839	7	,003	21,839	7	,003

Ethical clearence

This study was conducted in accordance with ethical standards. Ethical approval was obtained from the appropriate institutional review board, and informed consent was secured from all participants prior to data collection.

DISCUSSION

The present study of risk factors affecting the annual survival rate of Aktobe residents who have suffered a cerebral stroke (MI) is one of the first cohort studies on this topic in Kazakhstan. In developed countries, the annual survival rate varies from 57% to 92%. In our study, this indicator was 24.8%, and the median survival rate was 40 days (95% CI 25.9—54.1), which differs significantly from the data of developed countries. For example, in Germany the survival rate is 76.8% [12,13], in Australia — 57% [14], in Brazil — 69.1% [15], in Belarus — 62.6% [16], in Canada — 76.4% [17], and in Russia — 65.4% [18].

In our study, for the first time, a multidimensional analysis of the proportional risks of Coke was carried out to identify independent factors affecting the mortality of patients with MI within 12 months. The analysis showed that significant predictors of mortality in this period are age over 70 years, Russian nationality, intracerebral or subarachnoid hemorrhage and high scores on the GCS scale. Similar findings have been demonstrated in other studies. For example, in previous studies [19, 20] it was shown that age and GCS scores are statistically significant predictors of one-year survival.

Similar results were obtained in studies by Arboix, A and co-authors, where a link was found between one-year survival after stroke and factors such as gender, myocardial infarction, atrial fibrillation and the degree of neurological deficit [21]. However, these studies only looked at the ischemic type of stroke, whereas our study included all types of strokes.

The results of our study also contradict the data obtained in studies in Europe, Russia and Asia, where an association between diabetes mellitus and an unfavorable outcome was assumed [22, 23, 24]. In our study, the association with diabetes mellitus did not reach statistical significance, which may be due to the small number of diabetic patients in the sample.

According to Nardi K. and co-authors, along with age, important prognostic factors of mortality after MI were a history of stroke and hypertension [25,26]. However, in our study, hypertension did not have a significant effect on the outcome, which probably indicates its greater importance for the risk of stroke, rather than for the outcome, provided timely medical care is provided. Most authors believe that the time from the onset of the disease to the provision of qualified medical care is one of the most important factors determining the outcome of a stroke [27]. Our study highlights a significant time interval between the onset of vascular cerebral catastrophe and hospitalization of patients. The lowest survival rates were observed in patients who were admitted to the hospital more than 24 hours after the onset of the first symptoms of stroke. The likely reason for this is a late request for medical help and a lack of information about the first signs of a stroke. This factor is probably the key to improving the organization of treatment for stroke patients. It is especially worth noting that the GCS scale, despite its simplicity, has shown itself to be a significant predictor of an unfavorable outcome in our study. This makes it a convenient tool for a quick and practical assessment of a neurological condition. Using such a scale allows you to more quickly and accurately choose the tactics and strategy of treatment [28].

The results of our study should be interpreted carefully, taking into account both the advantages and limitations of its design. The strengths include a large sample size, which made it possible to detect even minor differences. The use of modern statistical methods, such as Kaplan-Mayer survival analysis and multidimensional Cox risk analysis, makes this study comparable to similar foreign studies.

Thus, our data allow us to identify groups of patients with a high risk of death after stroke and develop an individual approach to assessing the risk of an adverse outcome. This will help improve long-term treatment outcomes for patients with acute cerebral stroke.

CONCLUSIONS

Based on the results obtained, it can be assumed that the one-year survival rate is 24.8%, and the median survival rate of 40 days is 95% CI (25.9 - 54.1), which does not differ significantly in survival in developed countries. The factors influencing the annual survival of patients with cerebral strokes in Kazakhstan have been determined. Gender, age, hospitalization time and severity of stroke on the GCS scale are closely related to survival at 12 months. We did not identify statistically significant differences in survival between patients with and without a history of hypertension. The results obtained can be used to develop therapeutic measures to improve long-term results after a brain stroke.

Conflict of Interest: The author declare no conflict of interest.

Authors's contribution

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