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ЕЖЕМЕСЯЧНЫЙ НАУЧНЫЙ ЖУРНАЛ

**Медицинские новости Грузии**

საქართველოს სამედიცინო სიახლენი

**GEORGIAN MEDICAL NEWS**

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**GMN: Georgian Medical News** is peer-reviewed, published monthly journal committed to promoting the science and art of medicine and the betterment of public health, published by the GMN Editorial Board since 1994. GMN carries original scientific articles on medicine, biology and pharmacy, which are of experimental, theoretical and practical character; publishes original research, reviews, commentaries, editorials, essays, medical news, and correspondence in English and Russian.

GMN is indexed in MEDLINE, SCOPUS, PubMed and VINITI Russian Academy of Sciences. The full text content is available through EBSCO databases.

**GMN: Медицинские новости Грузии -** ежемесячный рецензируемый научный журнал, издаётся Редакционной коллегией с 1994 года на русском и английском языках в целях поддержки медицинской науки и улучшения здравоохранения. В журнале публикуются оригинальные научные статьи в области медицины, биологии и фармации, статьи обзорного характера, научные сообщения, новости медицины и здравоохранения. Журнал индексируется в MEDLINE, отражён в базе данных SCOPUS, PubMed и ВИНИТИ РАН. Полнотекстовые статьи журнала доступны через БД EBSCO.

**GMN: Georgian Medical News –** საქართველოს სამედიცინო სიახლენი – არის ყოველთვიური სამეცნიერო სამედიცინო რეცენზირებადი ჟურნალი, გამოიცემა 1994 წლიდან, წარმოადგენს სარედაქციო კოლეგიისა და აშშ-ის მეცნიერების, განათლების, ინდუსტრიის, ხელოვნებისა და ბუნებისმეტყველების საერთაშორისო აკადემიის ერთობლივ გამოცემას. GMN-ში რუსულ და ინგლისურ ენებზე ქვეყნდება ექსპერიმენტული, თეორიული და პრაქტიკული ხასიათის ორიგინალური სამეცნიერო სტატიები მედიცინის, ბიოლოგიისა და ფარმაციის სფეროში, მიმოხილვითი ხასიათის სტატიები.

ჟურნალი ინდექსირებულია MEDLINE-ის საერთაშორისო სისტემაში, ასახულია SCOPUS-ის, PubMed-ის და ВИНИТИ РАН-ის მონაცემთა ბაზებში. სტატიების სრული ტექსტი ხელმისაწვდომია EBSCO-ს მონაცემთა ბაზებიდან.

**WEBSITE**

www.geomednews.com

## К СВЕДЕНИЮ АВТОРОВ!

При направлении статьи в редакцию необходимо соблюдать следующие правила:

1. Статья должна быть представлена в двух экземплярах, на русском или английском языках, напечатанная через **полтора интервала на одной стороне стандартного листа с шириной левого поля в три сантиметра**. Используемый компьютерный шрифт для текста на русском и английском языках - **Times New Roman** (**Кириллица**), для текста на грузинском языке следует использовать **AcadNusx.** Размер шрифта - **12**. К рукописи, напечатанной на компьютере, должен быть приложен CD со статьей.

2. Размер статьи должен быть не менее десяти и не более двадцати страниц машинописи, включая указатель литературы и резюме на английском, русском и грузинском языках.

3. В статье должны быть освещены актуальность данного материала, методы и результаты исследования и их обсуждение.

При представлении в печать научных экспериментальных работ авторы должны указывать вид и количество экспериментальных животных, применявшиеся методы обезболивания и усыпления (в ходе острых опытов).

4. К статье должны быть приложены краткое (на полстраницы) резюме на английском, русском и грузинском языках (включающее следующие разделы: цель исследования, материал и методы, результаты и заключение) и список ключевых слов (key words).

5. Таблицы необходимо представлять в печатной форме. Фотокопии не принимаются. **Все цифровые, итоговые и процентные данные в таблицах должны соответствовать таковым в тексте статьи**. Таблицы и графики должны быть озаглавлены.

6. Фотографии должны быть контрастными, фотокопии с рентгенограмм - в позитивном изображении. Рисунки, чертежи и диаграммы следует озаглавить, пронумеровать и вставить в соответствующее место текста **в tiff формате**.

В подписях к микрофотографиям следует указывать степень увеличения через окуляр или объектив и метод окраски или импрегнации срезов.

7. Фамилии отечественных авторов приводятся в оригинальной транскрипции.

8. При оформлении и направлении статей в журнал МНГ просим авторов соблюдать правила, изложенные в «Единых требованиях к рукописям, представляемым в биомедицинские журналы», принятых Международным комитетом редакторов медицинских журналов - http://www.spinesurgery.ru/files/publish.pdf и http://www.nlm.nih.gov/bsd/uniform_requirements.html
В конце каждой оригинальной статьи приводится библиографический список. В список литературы включаются все материалы, на которые имеются ссылки в тексте. Список составляется в алфавитном порядке и нумеруется. Литературный источник приводится на языке оригинала. В списке литературы сначала приводятся работы, написанные знаками грузинского алфавита, затем кириллицей и латиницей. Ссылки на цитируемые работы в тексте статьи даются в квадратных скобках в виде номера, соответствующего номеру данной работы в списке литературы. Большинство цитированных источников должны быть за последние 5-7 лет.

9. Для получения права на публикацию статья должна иметь от руководителя работы или учреждения визу и сопроводительное отношение, написанные или напечатанные на бланке и заверенные подписью и печатью.

10. В конце статьи должны быть подписи всех авторов, полностью приведены их фамилии, имена и отчества, указаны служебный и домашний номера телефонов и адреса или иные координаты. Количество авторов (соавторов) не должно превышать пяти человек.

11. Редакция оставляет за собой право сокращать и исправлять статьи. Корректура авторам не высылается, вся работа и сверка проводится по авторскому оригиналу.

12. Недопустимо направление в редакцию работ, представленных к печати в иных издательствах или опубликованных в других изданиях.

**При нарушении указанных правил статьи не рассматриваются**.

## REQUIREMENTS

Please note, materials submitted to the Editorial Office Staff are supposed to meet the following requirements:

1. Articles must be provided with a double copy, in English or Russian languages and typed or compu-ter-printed on a single side of standard typing paper, with the left margin of **3** centimeters width, and **1.5** spacing between the lines, typeface - **Times New Roman** (**Cyrillic**), print size - **12** (referring to Georgian and Russian materials). With computer-printed texts please enclose a CD carrying the same file titled with Latin symbols.

2. Size of the article, including index and resume in English, Russian and Georgian languages must be at least 10 pages and not exceed the limit of 20 pages of typed or computer-printed text.

3. Submitted material must include a coverage of a topical subject, research methods, results, and review.

Authors of the scientific-research works must indicate the number of experimental biological species drawn in, list the employed methods of anesthetization and soporific means used during acute tests.

4. Articles must have a short (half page) abstract in English, Russian and Georgian (including the following sections: aim of study, material and methods, results and conclusions) and a list of key words.

5. Tables must be presented in an original typed or computer-printed form, instead of a photocopied version. **Numbers, totals, percentile data on the tables must coincide with those in the texts of the articles.** Tables and graphs must be headed.

6. Photographs are required to be contrasted and must be submitted with doubles. Please number each photograph with a pencil on its back, indicate author's name, title of the article (short version), and mark out its top and bottom parts. Drawings must be accurate, drafts and diagrams drawn in Indian ink (or black ink). Photocopies of the X-ray photographs must be presented in a positive image in **tiff format**.

Accurately numbered subtitles for each illustration must be listed on a separate sheet of paper. In the subtitles for the microphotographs please indicate the ocular and objective lens magnification power, method of coloring or impregnation of the microscopic sections (preparations).

7. Please indicate last names, first and middle initials of the native authors, present names and initials of the foreign authors in the transcription of the original language, enclose in parenthesis corresponding number under which the author is listed in the reference materials.

8. Please follow guidance offered to authors by The International Committee of Medical Journal Editors guidance in its Uniform Requirements for Manuscripts Submitted to Biomedical Journals publication available online at: http://www.nlm.nih.gov/bsd/uniform_requirements.html
http://www.icmje.org/urm_full.pdf
In GMN style for each work cited in the text, a bibliographic reference is given, and this is located at the end of the article under the title "References". All references cited in the text must be listed. The list of references should be arranged alphabetically and then numbered. References are numbered in the text [numbers in square brackets] and in the reference list and numbers are repeated throughout the text as needed. The bibliographic description is given in the language of publication (citations in Georgian script are followed by Cyrillic and Latin).

9. To obtain the rights of publication articles must be accompanied by a visa from the project instructor or the establishment, where the work has been performed, and a reference letter, both written or typed on a special signed form, certified by a stamp or a seal.

10. Articles must be signed by all of the authors at the end, and they must be provided with a list of full names, office and home phone numbers and addresses or other non-office locations where the authors could be reached. The number of the authors (co-authors) must not exceed the limit of 5 people.

11. Editorial Staff reserves the rights to cut down in size and correct the articles. Proof-sheets are not sent out to the authors. The entire editorial and collation work is performed according to the author's original text.

12. Sending in the works that have already been assigned to the press by other Editorial Staffs or have been printed by other publishers is not permissible.

**Articles that Fail to Meet the Aforementioned Requirements are not Assigned to be Reviewed.**

## ავტორთა საყურადღებოდ!

რედაქციაში სტატიის წარმოდგენისას საჭიროა დავიცვათ შემდეგი წესები:

1. სტატია უნდა წარმოადგინოთ 2 ცალად, რუსულ ან ინგლისურ ენებზე,დაბეჭდილი სტანდარტული ფურცლის 1 გვერდზე, 3 სმ სიგანის მარცხენა ველისა და სტრიქონებს შორის 1,5 ინტერვალის დაცვით. გამოყენებული კომპიუტერული შრიფტი რუსულ და ინგლისურენოვან ტექსტებში - **Times New Roman (Кириллица)**, ხოლო ქართულენოვან ტექსტში საჭიროა გამოვიყენოთ **AcadNusx.** შრიფტის ზომა – 12. სტატიას თან უნდა ახლდეს CD სტატიით.

2. სტატიის მოცულობა არ უნდა შეადგენდეს 10 გვერდზე ნაკლებს და 20 გვერდზე მეტს ლიტერატურის სიის და რეზიუმეების (ინგლისურ, რუსულ და ქართულ ენებზე) ჩათვლით.

3. სტატიაში საჭიროა გაშუქდეს: საკითხის აქტუალობა; კვლევის მიზანი; საკვლევი მასალა და გამოყენებული მეთოდები; მიღებული შედეგები და მათი განსჯა. ექსპერიმენტული ხასიათის სტატიების წარმოდგენისას ავტორებმა უნდა მიუთითონ საექსპერიმენტო ცხოველების სახეობა და რაოდენობა; გაუტკივარებისა და დაძინების მეთოდები (მწვავე ცდების პირობებში).

4. სტატიას თან უნდა ახლდეს რეზიუმე ინგლისურ, რუსულ და ქართულ ენებზე არანაკლებ ნახევარი გვერდის მოცულობისა (სათაურის, ავტორების, დაწესებულების მითითებით და უნდა შეიცავდეს შემდეგ განყოფილებებს: მიზანი, მასალა და მეთოდები, შედეგები და დასკვნები; ტექსტუალური ნაწილი არ უნდა იყოს 15 სტრიქონზე ნაკლები) და საკვანძო სიტყვების ჩამონათვალი (key words).

5. ცხრილები საჭიროა წარმოადგინოთ ნაბეჭდი სახით. ყველა ციფრული, შემაჯამებელი და პროცენტული მონაცემები უნდა შეესაბამებოდეს ტექსტში მოყვანილს.

6. ფოტოსურათები უნდა იყოს კონტრასტული; სურათები, ნახაზები, დიაგრამები - დასათაურებული, დანომრილი და სათანადო ადგილას ჩასმული. რენტგენოგრამების ფოტოასლები წარმოადგინეთ პოზიტიური გამოსახულებით **tiff** ფორმატში. მიკროფოტოსურათების წარწერებში საჭიროა მიუთითოთ ოკულარის ან ობიექტივის საშუალებით გადიდების ხარისხი, ანათალების შეღებვის ან იმპრეგნაციის მეთოდი და აღნიშნოთ სურათის ზედა და ქვედა ნაწილები.

7. სამამულო ავტორების გვარები სტატიაში აღინიშნება ინიციალების თანდართვით, უცხოურისა – უცხოური ტრანსკრიპციით.

8. სტატიას თან უნდა ახლდეს ავტორის მიერ გამოყენებული სამამულო და უცხოური შრომების ბიბლიოგრაფიული სია (ბოლო 5-8 წლის სიღრმით). ანბანური წყობით წარმოდგენილ ბიბლიოგრაფიულ სიაში მიუთითეთ ჯერ სამამულო, შემდეგ უცხოელი ავტორები (გვარი, ინიციალები, სტატიის სათაური, ჟურნალის დასახელება, გამოცემის ადგილი, წელი, ჟურნალის №, პირველი და ბოლო გვერდები). მონოგრაფიის შემთხვევაში მიუთითეთ გამოცემის წელი, ადგილი და გვერდების საერთო რაოდენობა. ტექსტში კვადრატულ ფჩხილებში უნდა მიუთითოთ ავტორის შესაბამისი N ლიტერატურის სიის მიხედვით. მიზანშეწონილია, რომ ციტირებული წყაროების უმეტესი ნაწილი იყოს 5-6 წლის სიღრმის.

9. სტატიას თან უნდა ახლდეს: ა) დაწესებულების ან სამეცნიერო ხელმძღვანელის წარდგინება, დამოწმებული ხელმოწერითა და ბეჭდით; ბ) დარგის სპეციალისტის დამოწმებული რეცენზია, რომელშიც მითითებული იქნება საკითხის აქტუალობა, მასალის საკმაობა, მეთოდის სანდოობა, შედეგების სამეცნიერო-პრაქტიკული მნიშვნელობა.

10. სტატიის ბოლოს საჭიროა ყველა ავტორის ხელმოწერა, რომელთა რაოდენობა არ უნდა აღემატებოდეს 5-ს.

11. რედაქცია იტოვებს უფლებას შეასწოროს სტატია. ტექსტზე მუშაობა და შეჯერება ხდება საავტორო ორიგინალის მიხედვით.

12. დაუშვებელია რედაქციაში ისეთი სტატიის წარდგენა, რომელიც დასაბეჭდად წარდგენილი იყო სხვა რედაქციაში ან გამოქვეყნებული იყო სხვა გამოცემებში.

აღნიშნული წესების დარღვევის შემთხვევაში სტატიები არ განიხილება.

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*Содержание:*

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# ANALYSIS OF RISK FACTORS FOR ISCHEMIC STROKE IN RURAL RESIDENTS OF THE AKTOBE REGION

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## Abstract.

Stroke continues to be a major global health concern, accounting for the fifth highest death rate and a sizable portion of the world's disability burden. Over 40,000 stroke cases are reported annually in the Republic of Kazakhstan, of which 5,000 people die within the first 10 days and an additional 5,000 within a month after discharge. Even with the establishment of regional stroke centers, a state anti-stroke program, and substantial efforts, rural communities still experience higher rates of stroke-related morbidity and mortality.

The purpose of this research is to examine the complex factors, such as disparities in emergency care and elevated risk factors, that contribute to the variation in the incidence of stroke between rural and urban areas. Rural inhabitants' lesser knowledge of stroke symptoms is a result of educational and socioeconomic differences, which causes systemic delays in care. Just 1% of rural residents live within 60 minutes of a primary stroke center, indicating a lack of access to specialized stroke care. In terms of intravenous thrombolysis performed, urban hospitals perform better than rural ones.

The study shows that the mean age of the patients is 62.2±11.9 years, confirming the presence of an average age in the group. Women make up 40.2%, men - 59.8%. An average BMI of 27.6±4.5 may indicate a predominance of excess weight. The NIHSS score decreases from admission (7.64±4.85) to discharge (5.98±6.02), which may indicate a positive effect of treatment. A decrease in MRS reflects improvement in disability after treatment. Analyzing the dependence on place of residence, it was revealed that the largest number of patients came from districts 5 and 10. Analyzing the NIHSS and MRS indicators, statistically significant differences were identified depending on the presence of diabetes, arrhythmia and atherosclerosis. The rate of stroke severity and disability on admission is significantly higher in patients who die. A model for predicting unfavorable outcome was developed, which showed the statistical significance of the factors of cardiac arrhythmia and NLR.

**Key words.** Stroke, ischemic stroke, rural, urban, risk factors, neurophil to lymphocyte ratio, NLR.

## Introduction.

Stroke continues to be a major global health concern, accounting for the fifth highest death toll and a significant portion of the global disability burden [1]. Stroke claims an estimated 5.5 million lives each year, resulting in 44 million years of disability-adjusted life [2]. Over forty thousand stroke cases are reported annually in the Republic of Kazakhstan, according to official figures from the Ministry of Health. Of those cases, five thousand people die within the first ten days and another five thousand die within a month after being sent home. The incidence rates of cerebral stroke vary across Kazakhstan, with 2.5 to 3.7 incidents per 1,000 people, according to official figures [3]. Kazakhstan implemented a new state anti-stroke program in 2016; it was set to expire in 2020. Level 3 stroke facilities have been operating in Aktobe since July 2012, when the Multidisciplinary Regional Hospital opened, and July 2016, when the Aktobe Medical Center opened. The region has a population of around 938 thousand. The rate of operation for these centers is 30 beds per 250 thousand people. Moreover, level 2 stroke centers were established in the Mugalzhar, Shalkar, and Khromtau districts of the region in less than three years [4].

Stroke morbidity and mortality are higher in rural individuals [5]. It is believed that a variety of factors, such as disparities in emergency care in rural hospitals and higher risk factors for stroke in patients living in rural areas, contribute to the disparities in stroke burden between rural and urban areas [6,7]. It is more likely that rural populations lack the education and financial resources to recognize the warning signs and symptoms of stroke. There are differences in the frequency of stroke between rural and urban locations even in cases where patients from rural areas seek emergency care due to systemic delays in care [8,9]. Because just 1% of persons in rural areas live within 60 minutes of a primary stroke center, residents are frequently far from specialized stroke care [10]. Intravenous thrombolysis is administered in urban hospitals twice as frequently as in rural ones [9].

Due to a lack of monetary and physical resources as well as, sometimes, transportation issues, individuals of rural locations have limited access to medical care for stroke [11].

The rural populace follows guidelines for a healthy lifestyle and modifying cardiovascular risk factors sporadically and is ill-informed about disease risk factors. Even if they are aware of the risk factors for non-communicable diseases, citizens are not driven to actively seek care at medical facilities [12]. Numerous risk factors for stroke have been studied in detail, including smoking, diabetes mellitus, atrial fibrillation, hypertension, atherosclerosis, coronary heart disease, chronic heart failure, and other modifiable risk factors as well as non-modifiable risk factors like age, sex, and race [13,14].

The aim of this research is to examine the risk factors for stroke in rural populations. This will enable the development of strategies to maximize primary and secondary stroke prevention interventions. The foundation for this investigation was all of the aforementioned.

## Materials and Methods.

**Parameter:**

Aktobe region ranks 4th in terms of population in the Republic of Kazakhstan. Population of the region as of December 1, 2023. amounted to 938.7 thousand people, including 702.8 thousand people (74.9%) - urban residents, 235.9 thousand people (25.1%) - rural residents (according to the Bureau of National Statistics of the Republic of Kazakhstan). Residents have universal access to doctors and hospital services, diagnostic tests, and medications according to nosologies.

**Data sources and study sample:**

The study included patients with ischemic stroke living in rural areas over 18 years of age. The cohort was collected in level 3 stroke centers of the Aktobe Medical Center and the Multidisciplinary Regional Hospital. Patient data were collected from the health administration databases of an integrated health information system, which collected information on place of residence, medical and life history, clinical, laboratory tests, prescriptions, and electronic medical records.

**Basic characteristics:**

Information at the individual level on the presence of stroke, as well as the severity of the condition according to NIHSS [15], MRS [16], Glasgow Coma Scale, Barthel Scale. Also, information about the presence of hypertension, diabetes mellitus, atherosclerosis, and atrial fibrillation in patients [17].

**Stroke incidence and outcome:**

We defined stroke incidence as any hospitalization with a primary diagnosis of stroke identified from the Comprehensive Health Information System database, International Classification of Diseases, Tenth Revision code I63. We defined disease outcome as improved, unchanged, worsened, and death. We defined from complex medical information system databases. Results were measured from January to December 2023.

**Ethics:**

The Research Ethics Board of West Kazakhstan Marat Ospanov Medical University provided ethical approval for this study. The study uses existing administrative healthcare databases and did not obtain individual patient consent.

**Analysis:**

All continuous variables were summarized as mean±SD, and categorical variables were summarized as count and percentage. For comparisons between groups, the chi-square test was used for categorical variables. Correlation between variables was assessed using the Spearman correlation coefficient, Mann–Whitney U test, and Wilcoxon T test. To assess the influence of independent factors on a binary variable, binary logistic regression analysis was used by sequential elimination of variables. All statistical analyzes were performed using SPSS 25.

## Results.

The average age of patients is 62.2±11.9 years. This allows us to conclude that the study group includes middle-aged people. Women make up 40.2% and men 59.8%. The average BMI is 27.6±4.5, which may indicate that most patients are overweight. NIHSS 1 (at admission) is 7.64 ± 4.85, and NIHSS 2 (at discharge) is 5.98 ± 6.02. A decrease in this indicator from admission to discharge may indicate a positive effect of treatment. MRS 1 (at admission) is 3.12±1.07, and MRS 2 (at discharge) is 2.37±1.46. A decrease in MRS reflects an improvement in disability after treatment. Bartel Scale 1 (at admission) is 50.0±30.0, and Bartel Scale 2 (at discharge) is 63.0±32.7. An increase in the Bartel Scale indicates an improvement in the functional status of patients. The average NLR is 3.01±2.97. This indicator can be used in assessing the inflammatory response. The average index event from the onset of stroke symptoms to hospitalization is 44.5±29.7 hours. This reflects late hospitalization of the patient outside the therapeutic window (up to 24 hours) (Table 1).

***Table 1.*** *Means of age, gender, BMI, NIHSS1, NIHSS2, MRS1, MRS2, Bartel Scale1, Bartel Scale2, NLR, index event.*

| № | | Means±SD |
|---|---|---|
| 1 | Age | 62,2±11,9 |
| 2 | Gender | W – 40 (40,2%), M – 54 (59,8%). |
| 3 | BMI | 27,6±4,5 |
| 4 | NIHSS 1 | 7,64±4,85 |
| 5 | NIHSS 2 | 5,98±6,02 |
| 6 | MRS 1 | 3,12±1,07 |
| 7 | MRS 2 | 2,37±1,46 |
| 8 | Bartel Scale 1 | 50,0±30,0 |
| 9 | Bartel Scale 2 | 63,0±32,7 |
| 10 | NLR | 3,01±2,97 |
| 11 | Index event | 44,5±29,7 |

Almost 100% of patients had arterial hypertension, indicating a high prevalence of arterial hypertension among the study group. A quarter of the patients suffer from diabetes mellitus, which also indicates the prevalence of the factor under study in this group. Heart rhythm disturbances (HRD) occurred in 11% of patients, being the least common factor in the study group (Table 2).

***Table 2.*** *Presence of risk factors in patients with ischemic stroke.*

| Risk factors | N | % |
|---|---|---|
| Arterial hypertension | 93 | 98,9 |
| Heart rhythm disturbance | 11 | 11,7 |
| Diabetes | 23 | 24,5 |

In the study group of patients, 87.2% of patients had a primary stroke (Table 3).

Cerebral angiography as a diagnostic method was performed in about 30% of cases, and thrombolytic therapy in 2% of cases (Table 4).

***Table 3.*** *Subtypes of strokes.*

| | Primary | Repeated |
|---|---|---|
| Stroke | 82 (87,2%) | 12 (12,8%) |

***Table 4.*** *Number of cerebral angiographies and thrombolysis performed in rural residents.*

| | Conducted | Not carried out |
|---|---|---|
| Cerebral angiography | 17 (28,1%) | 77 (81,9%) |
| | Conducted | Not carried out |
| Thrombolysis | 2 (2,1%) | 92 97,9%) |

When analysing the number of patients depending on their place of residence, the following data were revealed. The largest number of patients were delivered to the hospital from districts 5 and 10. No patients were admitted from settlements 1, 2, 3 during the observed period. Data on discharges and deaths by district provide information on the distribution of cases and their outcomes in different parts of the region (Table 5).

***Table 5.*** *Data on discharged and deceased by region.*

| Districts | Distance from Aktobe, km. | Received | Discharged | Died |
|---|---|---|---|---|
| 1 | 733 | - | - | - |
| 2 | 48 | - | - | - |
| 3 | 248 | - | - | - |
| 4 | 432 | 1 (1,1%) | 1 | - |
| 5 | 99 | 11 (11,7%) | 9 | 2 |
| 6 | 86 | 13 (13,8%) | 9 | 4 |
| 7 | 208 | 15 (16%) | 15 | - |
| 8 | 151 | 13 (13,8%) | 11 | 2 |
| 9 | 261 | 5 (5,3%) | 5 | - |
| 10 | 115 | 16 (17%) | 15 | 1 |
| 11 | 93 | 10 (10,6%) | 7 | 3 |
| 12 | 359 | 10 (10,6%) | 10 | - |
| | | 94 (100%) | 82 (87,2%) | 12 (12,8) |

The mean NIHSS at admission (9.32±5.54) was statistically significantly higher than at discharge (6.07±5.30) in patients without diabetes. This may indicate an improvement in the condition of patients without diabetes mellitus during treatment (p=0.0001). In the presence of diabetes mellitus, the difference in mean NIHSS scores at admission and at discharge was not statistically significant (p=0.065). It is possible that recovery in this group of patients occurs over a longer period.

In the absence of cardiac arrhythmia, the mean NIHSS at admission (9.14±5.31) is higher than at discharge (6.12±5.69), and the difference is statistically significant (p=0.0001). This may indicate a faster recovery of impaired functions in patients without cardiac arrhythmias. In the presence of cardiac arrhythmias, the difference in mean NIHSS scores at admission (8.73±6.74) and at discharge (7.25±7.47) did not reach statistical significance (p=0.785).

In the absence of atherosclerosis, the difference in mean NIHSS scores at admission (6.67±4.50) and at discharge (4.73±3.58) is not statistically significant (p=0.155). In the presence of atherosclerosis, the average NIHSS score at admission (9.38±5.52) was significantly higher than at discharge (6.47±6.11) (p=0.0001) (Table 6).

Analysis of the degree of disability showed that in the absence of diabetes mellitus, the average MRS score at admission (3.31) was statistically significantly higher than at discharge (2.33) (p=0.0001). This may indicate positive dynamics and improvement in the condition of patients without diabetes mellitus during treatment. In the presence of diabetes mellitus, the difference in the average MRS scores at admission and at discharge is also statistically significant (p = 0.027), but the level of significance is lower. This may indicate less pronounced dynamics of changes in patients with diabetes mellitus.

***Table 6.*** *Analysis of the dynamics of the severity of the condition in patients with ischemic stroke depending on the presence of risk factors.*

| NIHSS | On admission (n=94) | Upon discharge (n=82) | p |
|---|---|---|---|
| No diabetes | 9,32±5,54 | 6,07±5,30 | 0,0001 |
| Have diabetes | 8,39±5,21 | 6,68±7,20 | 0,065 |
| No heart rhythm disturbance | 9,14±5,31 | 6,12±5,69 | 0,0001 |
| Have heart rhythm disturbance | 8,73±6,74 | 7,25±7,47 | 0,785 |
| No atherosclerosis | 6,67±4,50 | 4,73±3,58 | 0,155 |
| Have atherosclerosis | 9,38±5,52 | 6,47±6,11 | 0,0001 |

Similarly, in patients without cardiac arrhythmias, the mean MRS at admission (3.28±0.98) was higher than at discharge (2.35±1.43), and the difference was statistically significant (p=0.0001). This may indicate improvement in patients' condition without cardiac arrhythmias during treatment. In the presence of cardiac arrhythmia, the difference in mean MRS scores at admission and at discharge did not reach statistical significance (p=0.713).

In the absence of atherosclerosis, the difference in mean MRS scores at admission and at discharge did not reach statistical significance (p=0.053). In the presence of atherosclerosis, the mean MRS at admission (3.35±1.00) was again statistically significantly higher than at discharge (2.44±1.43) (p=0.0001). This may indicate an improvement in the condition of patients with atherosclerosis during treatment (Table 7).

***Table 7.*** *Analysis of the dynamics of the degree of disability in patients with ischemic stroke depending on the presence of risk factors.*

| MRS | On admission (n=94) | Upon discharge (n=82) | p |
|---|---|---|---|
| No diabetes | 3,31±1,02 | 2,33±1,31 | 0,0001 |
| Have diabetes | 3,30±0,97 | 2,64±1,70 | 0,027 |
| No heart rhythm disturbance | 3,28±0,98 | 2,35±1,43 | 0,0001 |
| Have heart rhythm disturbance | 3,55±1,21 | 3,00±1,30 | 0,713 |
| No atherosclerosis | 3,00±1,04 | 2,27±1,42 | 0,053 |
| Have atherosclerosis | 3,35±1,00 | 2,44±1,43 | 0,0001 |

The mean admission NIHSS for survivors was 8.21, while for those who died it was 15.21. The difference is statistically significant (p=0.0001), indicating a higher level of stroke severity in patients who died.

The mean admission MRS for survivors was 3.21, while for those who died it was 4.00. The difference is statistically significant (p=0.009), indicating a higher level of disability on admission in patients who died.

The mean NLR, SI, age and BMI in our study do not show a statistically significant difference between survivors and deceased (p=0.195, p=0.660, p=0.977 and p=0.506, respectively) (Table 8).

***Table 8.*** *Mann-Whitney U test.*

| **Mann-Whitney U test** | | | |
|---|---|---|---|
| | **Alive (0)** | **Died (1)** | **p** |
| NIHSS 1 | 8,21±4,87 | 15,21±5,60 | 0,0001 |
| NIHSS 2 | 6,24±5,88 | - | 0,741 |
| MRS 1 | 3,21±1,00 | 4,00±0,73 | 0,009 |
| MRS 2 | 2,40±1,42 | - | 0,366 |
| Bartel Scale 1 | 49,3±29,6 | 23,7±25,5 | 0,005 |
| Bartel Scale 2 | 61,8±32,5 | - | 0,805 |
| NLR | 3,14±2,06 | 5,47±5,33 | 0,195 |
| Index event | 45,0±29,3 | 40,5±33,3 | 0,660 |
| Age | 62,5±11,3 | 61,9±13,5 | 0,977 |
| BMI | 27,5±4,51 | 26,6±4,6 | 0,506 |

To assess the influence of independent factors on the binary variable for the development of an unfavourable outcome, binary logistic regression analysis was used by the method of sequential elimination of variables. The criteria for inclusion in the multivariate analysis were the presence of a statistically significant association with the predicted event, determined by univariate analysis. Results are presented as unadjusted and adjusted odds ratios and 95% CIs.

We developed a prognostic model to determine the likelihood of developing an unfavourable outcome depending on stroke risk factors using binary logistic regression. The observed dependence is described by equation (1):

$$P = 1 / (1 + e^{-z}) * 100\%$$

$$z = -3,11 + 1,65^{*}X_{HRD} + 0,22^{*}X_{NLR} \quad (1)$$

where P is the probability of an unfavourable outcome (alive/dead), XHRD – presence of heart rhythm disorder, XNLR – presence of NLR.

The resulting regression model is statistically significant (p=0.007). Based on the value of the Nigelkirk determination coefficient, model (1) determines 18.7% of the variance in the probability of developing an unfavourable outcome (death).

Based on the values of the regression coefficients, the factors HRD and NLR have a direct connection with the likelihood of developing an unfavourable outcome (death) in patients with ischemic stroke. HRD increases the odds of death by 1.65 times (95% CI: 1.16-23.22), an increase in NLR by 1 unit increases the odds of death by 0.22 times (95% CI: 1.03-1.50). Figure 1 compares the values of the adjusted odds ratio with 95% CI for the studied predictors of identifying an unfavourable outcome in ischemic stroke (Figure 1).

## Discussion.

Our findings indicated that middle-aged, overweight men made up the majority of the study group. Men are more likely than women to experience a stroke after the age of 35, and their overall incidence of stroke rises with age [18]. Traditional risk factors like obesity, hypertension, and physical inactivity account for a major portion of this age-related rise in men's stroke risk [19]. Additionally, the results demonstrated that patients' functional status and degree of disability improved during treatment, as indicated by a rise in the Bartel Scale and a decline in MRS scores. In 2021, Ebinger et al. published research on 1563 ischemic stroke patients. According to this study, stroke patients who were younger than 80 years old had low MRS scores of 0 to 1, while those who were older than 80 years old had impairment ratings of more than 2 points [20].

It was feasible to determine which conditions were more prevalent among the study group's participants: diabetes mellitus and arterial hypertension. Less frequently, cardiac arrhythmias are observed. In this demographic, these data may be helpful in determining risk factors, treatment planning, and health management tactics. These days, hypertension affects one billion people globally and is directly linked to almost 10 million fatalities annually [21]. It was deemed a global public health issue by the World Health Organization. 2019 saw the completion of a study by Chinese scientists on 158,929

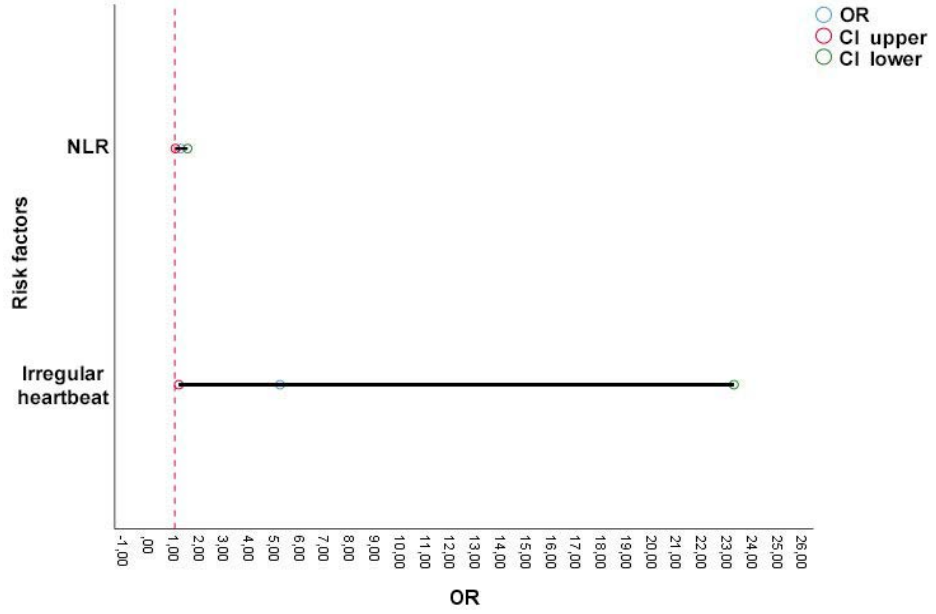


***Figure 1.*** *Odds ratio estimates with 95% CI for the studied predictors of identifying an adverse outcome in ischemic stroke.*

ischemic stroke patients. The most prevalent risk factor for stroke, hypertension, was present in 80% of stroke survivors in the research. Diabetes was the second most prevalent risk factor. Women were more likely than men to have diabetes mellitus and rhythm abnormalities at the same time [22].

87.2% of the patients in the study group experienced a primary stroke. The significance of primary stroke in the disease pattern in this population is shown by these statistics. Enhancing patient outcomes may also be significantly impacted by the management and prevention of recurrent strokes [23].

About 30% of cases underwent cerebral angiography as a diagnostic technique, while 2% underwent thrombolytic treatment. The low number of individuals undergoing cerebral angiography and thrombolytic therapy may point to the population's restricted utilization of these diagnostic and treatment modalities. The availability and application of various stroke treatments in this patient population may be evaluated in part by using these data. Studies indicate that individuals of rural locations face challenges in accessing stroke care due to limited physical and financial resources and, frequently, transportation-related issues [11]. Using more efficient therapies could contribute to better stroke outcomes.

The following information was discovered once the number of patients was broken down by residence. Districts 6 and 10 sent the most patients to the hospital overall. During the monitored period, districts 1, 2, and 3 did not report any patients.

Table 6 shows that the state of patients with different risk factors, including atherosclerosis, diabetes mellitus, and cardiac arrhythmias, can affect changes in NIHSS indicators at admission and discharge as well as the efficacy of treatment [24-27].

Patients with a variety of risk factors, including diabetes mellitus, cardiac arrhythmias, and atherosclerosis, may have different MRS values upon admission and discharge. This information may be crucial for determining the efficacy of treatment and prognosis. Additionally, Maajli's (2014) research demonstrated that even moderate impairments result in a considerable loss of DALYs and a decline in quality of life despite lower mortality. In 6–20% of young stroke patients, poor functional outcomes—defined as mRS scores of 3–6—have been recorded [28].

Both the degree of impairment and the severity of the stroke at admission are statistically significant indicators of a poor prognosis for individuals. Age, BMI, index event, NLR biomarker, and other variables do not significantly differ between these groups. Although older age, female gender, massive infarction, severe stroke, high burden of cardiovascular comorbidities, diabetes mellitus, and poor pre-stroke functional status were related with poor outcomes in earlier investigations of individuals with ischemic stroke [29].

Our prognostic approach enables us to take into account indicators like NLR and cardiac rhythm abnormalities as indicators of poor prognosis in ischemic stroke. The NLR, can reveal more details regarding the immunological activity that occurs during the ischemic stroke etiology. NLR has the ability to predict clinical prognosis in stroke patients, according to prior research [30]. After an ischemic stroke, NLR may also forecast haemorrhagic transition [31]. Moreover, symptomatic internal carotid artery stenosis may be linked to elevated NLR levels [32]. Pneumonia linked to a stroke may be predicted by elevated NLR [33].

## Conclusion.

To sum up, our research illuminates the common risk factors and outcomes linked to stroke in the group under investigation. The results highlight the increased risk of stroke in middle-aged, overweight men, with an age-related rise in the incidence of stroke in men. Traditional risk factors like obesity, arterial hypertension, and physical inactivity are mostly to blame for this age-related risk rise.

Notably, as demonstrated by lower mRS scores and higher Bartel Scale scores, our research shows favorable trends in disability levels and functional status gains after therapy. These findings support the work of Ebinger et al. and highlight the good prognosis of ischemic stroke patients, especially those under 80 years old with low mRS scores.

In the population under study, diabetes and arterial hypertension are the most common risk factors; rhythm problems are less common. The identification of risk factors and the creation of specialized treatment and health management plans for this particular demographic can both benefit greatly from these findings. Our study contributes vital data to the current public health crisis, given the global relevance of hypertension, which affects over a billion people and directly contributes to over 10 million deaths yearly.

Our data also emphasizes the prevalence of primary strokes, underscoring the critical need of controlling and preventing recurrent strokes in order to enhance patient outcomes. The restricted application of cerebral angiography and thrombolytic therapy within this demographic raises the possibility of difficulties in obtaining and putting into practice cutting-edge diagnostic and treatment approaches.

In addition, our research highlights the impact that a number of risk factors, including diabetes, rhythm abnormalities, and atherosclerosis, have on NIHSS and MRS scores, which in turn affects treatment outcomes and prognosis. These results are consistent with earlier studies showing that the quality of life is considerably decreased by even minor stroke sequelae.

In our prognostic model, worse outcomes in ischemic stroke are predicted by markers such as rhythm abnormalities and NLR. NLR is a useful indicator of immune activation during the pathophysiology of ischemic stroke. Past research highlights NLR's potential as a prognostic tool by demonstrating its ability to predict clinical outcomes, hemorrhagic transformation, and related consequences.

To sum up, our thorough investigation offers a detailed picture of the stroke landscape in the studied population, offering crucial information for focused interventions, risk mitigation, and better outcomes for stroke patients.

## Declarations.

**Conflict of Interest:** The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

**Author Contributions:** Conceptualization, Z.U.U., A.A.K.; Data curation, Z.U.U., A.A.K., A.G.I. and M.M.Z.; Formal analysis, Z.U.U., A.A.K. and Z.N.G.; Methodology, Z.U.U., A.A.K. and Z.N.G.; Project administration, A.A.K; Resources, G.B.K., A.P.Y.; Software, Z.U.U., A.A.K., G.B.K., A.P.Y. and Z.N.G.; Supervision, Z.U.U. and A.A.K.; Validation, Z.U.U., A.A.K. and Z.N.G.; Visualization, G.B.K. and A.P.Y.; Writing, original draft, Z.U.U.; Writing, review and editing, Z.U.U., A.A.K., G.B.K., A.P.Y., A.B.U., Z.N.G., M.K.O., A.G.I. and M.M.Z. All authors have read and agreed to the published version of the manuscript.

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**Appendices:** Not applicable

**Data Availability Statement:** All data generated or analyzed in this study can be obtained from the corresponding author upon inquiry.

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