

Register of stroke in the desert-steppe zones of Uzbekistan

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Abstract: Purpose of the study: to conduct a register of stroke in the desert-steppe zones of Uzbekistan on the example of the Khorezm region and to identify the influence of a complex of weather-climatic factors on the course and outcomes of cerebral strokes. To determine the prognosis of cerebral strokes in the near future, a "Register of cerebral strokes" was conducted in the desert-steppe zones of Uzbekistan – using the example of the Khorezm region for 2019. The conducted register of strokes in 2019 in the desert-steppe zones of Uzbekistan revealed 3569 cases of stroke, of which 1967 (55.1%) in men and 1602 (44.9%) in women. The population aged 20 years and older was 1,150,135 people, of which 565,722 men (49.2%) and 584,413 women (50.8%). The mean age of patients with stroke was 63.85 ± 0.2 years, in men - 62.9 ± 0.3 years, in women - 65.1 ± 0.3 years. The incidence of cerebral strokes corresponded to 194.43 cases per 100,000 population. The incidence of cerebral strokes at the age of 20 and older was 310.32 cases per 100,000 population. The main risk factors for stroke are: arterial hypertension (62.3%), atherosclerosis (19.5%), coronary heart disease (7.5%), diabetes mellitus (3.8%). Seasonality of strokes in the region - ischemic and hemorrhagic strokes prevailed in winter (28.1% and 29.7%) and spring (31.7% and 25.0%) months, respectively. Subarachnoid hemorrhages prevailed in summer (36.8%) months. In winter and spring, the "spastic" type of heart is a provoking meteorological risk factor for the development of ischemic and hemorrhagic strokes. In summer - "hypoxic", and in autumn - "unstable weather with the transition from indifferent to" spastic "weather types are provoking meteorological factors for the development of subarachnoid hemorrhages.

1 Introduction

In 2019, there were 12.2 million new cases of stroke worldwide. During this period, there were 101 million stroke patients worldwide, 143 million stroke disabled and 6.55 million stroke lethality. Globally, stroke remained the second leading cause of lethality and the third leading cause of lethality and disability combined in total persons with disabilities in 2019 [1]. The highest age-standardized lethality from stroke were in low-income countries. The fastest growing risk factor for stroke between 1990 and 2019 was a high body mass index.

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Without urgent implementation of effective primary prevention strategies, stroke rates are likely to continue to rise worldwide, especially in low-income countries [2].

Vascular diseases of the brain, despite the progress made in the field of its solution, due to the significant prevalence and severe consequences for the health of the population, remains one of the most important medical and social problems throughout the world, regardless of their geographical location and economic situation [3, 4, 5].

Strokes cause significant damage to people's health, reduce the duration of active life, and caring for the sick entails enormous financial costs for the state and the family [6, 7, 8, 9].

The World Health Organization has developed the Stroke Registry program, which standardizes diagnostic criteria and research methods [10]. This program makes it possible, when using it, to obtain true indicators of morbidity, lethality, and lethality from acute cerebral stroke [11].

Purpose of the study: to conduct a register of stroke in the desert-steppe zones of Uzbekistan on the example of the Khorezm region and to identify the influence of a complex of weather-climatic factors on the course and outcomes of cerebral strokes.

2 Material and methods

To determine the prognosis of cerebral strokes in the near future, a "Register of cerebral strokes" was conducted in the desert-steppe zones of Uzbekistan – using the example of the Khorezm region for 2019.

For the register of cerebral strokes, we used the study of statistical data of the Khorezm Regional Multicenter Medical Center, the Khorezm branch of the Republican Scientific Center for Emergency Medicine, data from the registry office, the State Archives, hospitals and clinics of the Khorezm region.

Demographic characteristics and features of the structure of the population of the Khorezm region, according to the State Statistics Service of the region, the population was 1835690 people as of 01.01.2019.

With the gender distribution of the inhabitants of the Khorezm region, an equal distribution of the female and male population was revealed: 917989 and 917701, respectively. Analyzing the age composition of the inhabitants of the Khorezm region, it should be noted a significant proportion of people under the age of 20, which accounted for 37.3%. The population aged 20 years and older was 1150135 people, of which 565722 men (49.2%), 584413 women (50.8%) (Table 1).

Table 1 The structure of the age and sex composition of the population of the Khorezm region as of 01.01.2019

Indicators	Ischemic	Hemorrhagic	Undifferentiated stroke	All strokes
Number of patients (abs)	2193	714	662	3569
Number of lethalitys (abs)	387	302	662	1351
Incidence	190.7	62.1	57.5	310.3
Mortality	33.6	26.3	57.6	117.5
Number of lethalitys within 28 days	310	284	662	1256
Lethality rate	8.7	8.0	18.5	35.2

3 Results of own researches

Incidence, mortality and letality rate in stroke. The main indicators of the cerebral stroke registry - incidence, mortality and lethality rate in the Khorezm region are given in Table 2, and its average age is given in Table 3.

Table 2. The main indicators of the register of cerebral strokes in the Khorezm region for 2019

age	Men		Women		Both sexes	
	Abs. number	percent	Abs. number	percent	Abs. number	percent
Up to 20 years old	351979	51.3%	333576	48.7%	685555	37.3%
20-29	169391	50.5%	165786	49.5%	335177	18.3%
30-39	153180	49.7%	155193	50.3%	308373	16.8%
40-49	113151	49.6%	114775	50.4%	227926	12.4%
50-59	73781	47.4%	81715	52.6%	155496	8.5%
60-69	38796	46.5%	44718	53.5%	83514	4.5%
70-79	12326	46.0%	14474	54.0%	26800	1.5%
80 and older	5097	39.7%	7752	60.3	12849	0.7%
Total	917701	50.0%	917989	50.0%	1835690	100%

Table 3. Average ages of strokes obtained from the registry

Indicators	Absolute number	Average age
All strokes	3569	63.9±0.2
Ischemic strokes	2193	62.3±0.3
Hemorrhagic strokes	676	61.9±0.5
Subarachnoid hemorrhage	38	33.1±2.4
Undifferentiated strokes	662	72.9±0.5
Died of a stroke	1351	69.2±0.4
Hospitalized due to stroke	2552 (71.5%)	60.7±0.2

The mean age of patients with stroke was 63.85± 0.2 years. The average age of men who had a stroke was 62.9±0.3 years, the average age of women was 65.1±0.3 years.

The incidence of cerebral stroke, calculated for the average annual number of permanent residents of the Khorezm region aged 20 and older, was 310.32 cases per 100,000 population per year. The incidence calculated for the entire population of the Khorezm region corresponded to 194.43 cases per 100 thousand inhabitants per year. The incidence of stroke among men significantly ($p<0.05$) exceeded the incidence among women: 347.69 and 274.12 cases per 100 thousand, respectively. This trend of prevalence of incidence among men was noted in all age groups and the greatest prevalence of incidence was observed in the age group of 50-59 years (Table 4 and Fig. 1).

Table 4. Distribution of the number of stroke cases in the Khorezm region according to the 2019 register, taking into account gender and age

age	Men		Women		Both sexes	
	Abs. number	percent	Abs. number	percent	Abs. number	percent
20-29	19	52.8%	17	47.2%	36	1.0%
30-39	57	60.6%	37	39.4%	94	2.6%
40-49	159	52.0%	147	48.0%	306	8.6%
50-59	569	64.6%	312	35.4%	881	24.7%
60-69	605	54.4%	507	45.6%	1112	31.2%
70-79	364	52.0%	336	48.0%	700	19.6%
80 and older	194	44.1%	246	55.9%	440	12.3%
Total	1967	55.1%	1602	44.9%	3569	100%

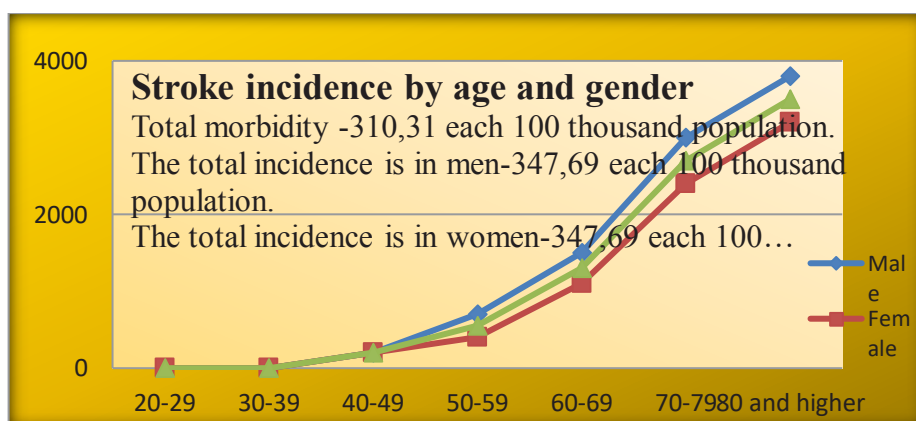


Fig. 1. Stroke incidence by age and gender

The incidence of stroke increased significantly with increasing age. The greatest increase in incidence was observed in the age group of 40-49 years, compared with the age group of 30-39 years. A significant increase in the incidence of stroke occurred starting from the age group of 40-49 years, and the highest incidence is observed in the age group of 80 years and older (Fig. 1).

Mortality rate in cerebral stroke was 73.6 cases per 100,000 population per year. The mortality rate among the adult population (20 years and older) was 117.46 cases per 100 thousand inhabitants per year. The largest, five-fold increase in stroke mortality was observed in the age groups of 40-49 years and 50-59 years, in relation to the previous age groups. A significant increase in this indicator was noted both among all residents of the Khorezm region and among representatives of both sexes, however, in men, a sharp prevalence of mortality begins with the age category of 40-49 and 50-59 years, and in women - 40-49 and 60-69 years (Fig. 2.).

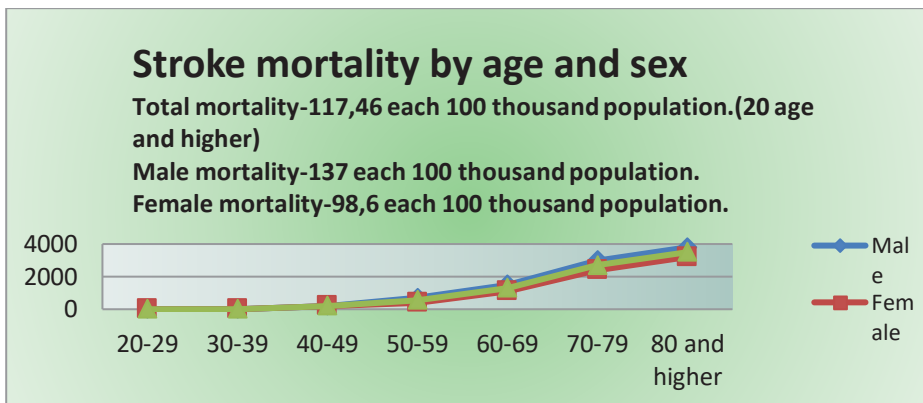


Fig. 2. Stroke mortality by age and sex

Lethality rate in all types of cerebral stroke was 35.2%. There is an unreliable prevalence of lethality among men (36.0%) over women (34.2%). When analyzing lethality rate by age groups, it was found that both sexes have a small peak in mortality in the age group of 20-29 years, with a gradual increase in lethality rate in subsequent age groups, again with a sharp jump in lethality rate from the age group of 70 years and older (Fig. 3).

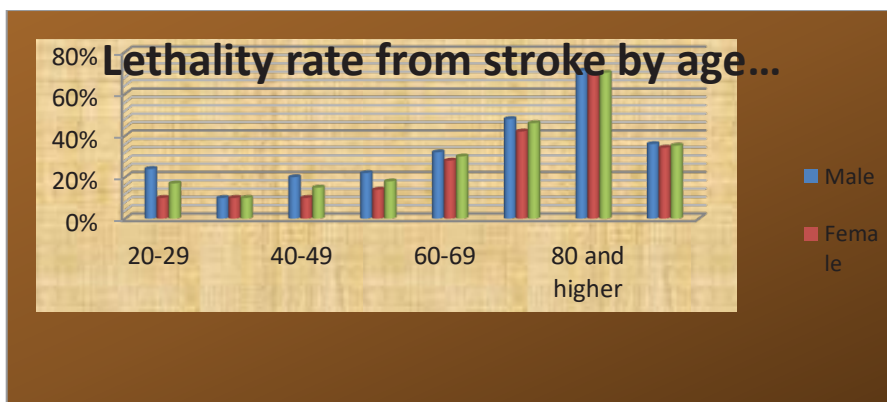


Fig. 3. Lethality rate from stroke by age.

When analyzing the distribution of the timing of lethality from strokes (in the 1st, up to 7, up to 28 days) in patients who received inpatient treatment, it was found that when analyzing both sexes, a large proportion of lethality occurs on terms 2-7 (40.2%) and 8-28 (37.2%) days. When analyzing the timing of lethality by sex, it was found that in men, most of the lethality (47.1%) occurs on days 2-7 and in the age group 50-59 (19.1%) and 60-69 (14%) years, and in women (39.8%) - on days 8-28, with a dome-shaped growth in the age groups from 50 to 79 years with a peak in the age group of 60-69 years - 13.6% (Fig. 4).

When analyzing the distribution of the timing of lethality depending on the type of stroke (in the 1st, up to 7, up to 28 days) in patients who received inpatient treatment, it was found that in the analysis of both sexes, a large proportion of lethality, both ischemic and hemorrhagic, occur on terms 2-7 and 8-28 days. When analyzing the timing of lethality depending on the type of stroke by sex, it was found that in men, most of the lethality, both ischemic and hemorrhagic, occur on days 2-7, and in women, both ischemic and hemorrhagic, on days 8-28 (Fig. 4).

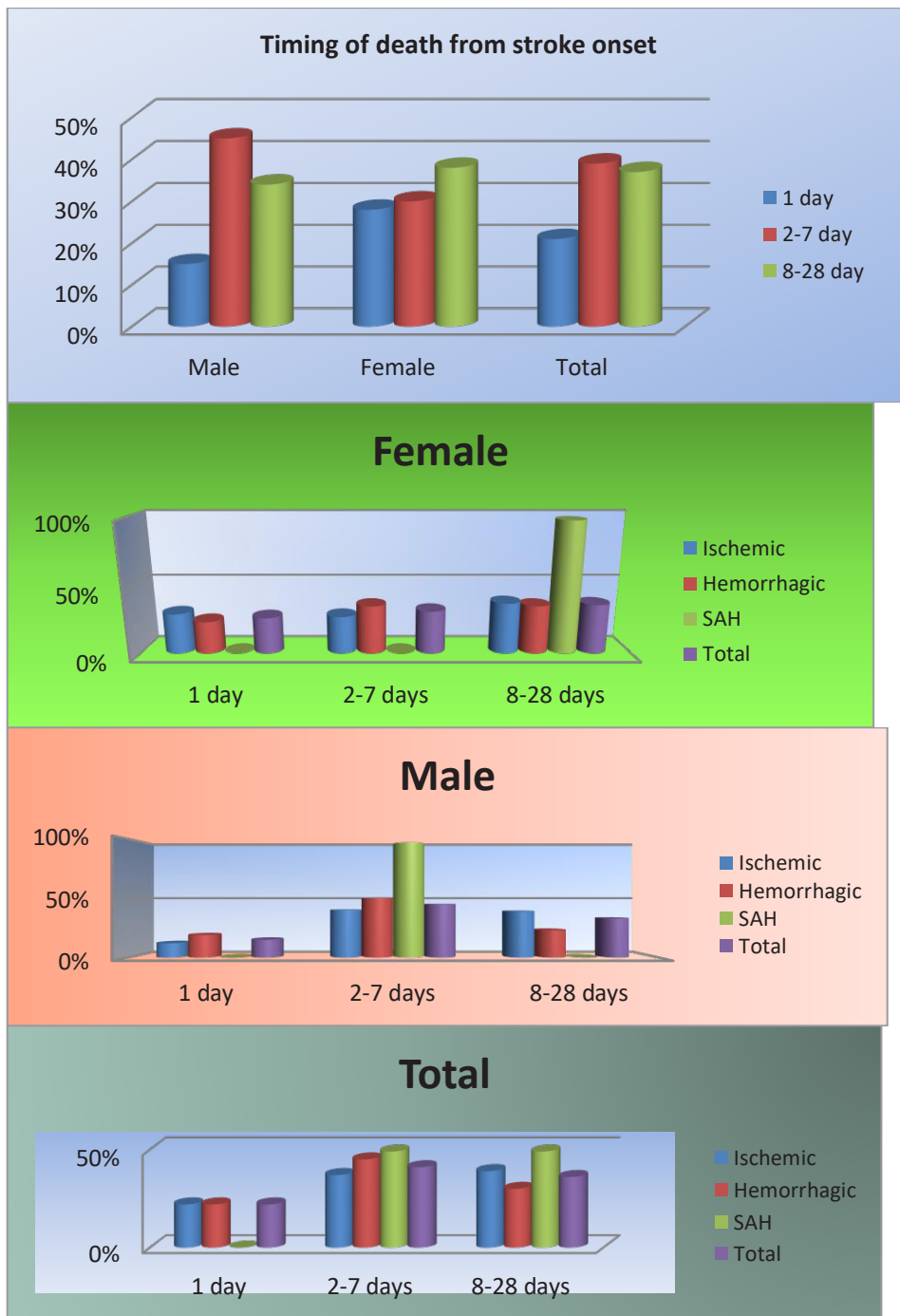


Fig. 4. The analyzing the timing of lethality

In 2019, within the framework of the registry of cerebral strokes, 2552 patients with cerebral strokes were identified, who were in the neurological and therapeutic departments of hospitals in the Khorezm region. Among the inpatients, 1395 men (54.7%) prevailed,

women were 1157 (45.3%). The average age of the patients was 60.7 ± 0.2 years, in men 60.0 ± 0.3 years, in women 61.6 ± 0.4 years. The ratio of ischemic and hemorrhagic strokes in both women and men was 4 : 1 (Table 5).

The largest proportion of strokes, both ischemic and hemorrhagic, both in men and women, occurs in the age group of 50-59 years and 60-69 years. Andsubarachnoid hemorrhage (SAH) in both men and women prevailed in the age groups of 20-29 and 30-39 years.

Significant differences in the structure of stroke among men and women were established with a predominance of intracranial hemorrhages in men (20.9%) and women (19%). The incidence of cerebral infarction in women was slightly higher (81%) than in men (79.1%). Comparison of the structure of strokes did not reveal statistically significant differences among the male and female population of the study region (Table 5).

Table 5. Indicators of the Stroke Register of inpatients

indicators	Men	Women	Both sexes
Average age	60.0±0.3	61.6±0.4	60.7±0.2
Number of strokes	1395 (54.7%)	1157 (45.3%)	2552 (100%)
Ischemic strokes	1103 (79.1%)	937 (81.0%)	2040 (79.9%)
Hemorrhagic strokes	275 (19.7%)	206 (17.8%)	481 (18.8%)
Subarachnoid hemorrhage	17 (1.2%)	14 (1.2%)	31 (1.2%)
Ratio of ischemic to hemorrhagic stroke	3.8:1	4.26:1	4:1
Hospital mortality rate	9.75%	8.9%	9.37%

Hemispheric strokes occurred in 99.4%, and stem strokes in 0.6% of cases; in other cases, the localization of brain damage remained unidentified. Among hemispheric strokes, the localization of the focus in the right hemisphere was found in 47.6%, in the left hemisphere - in 51.8%.

4 Hospital lethality from stroke

Analysis of hospital lethality rate revealed that it is 9.37%. Moreover, the highest hospital lethality rate was with hemorrhagic stroke (HS) - 16.2%, then with SAH - 12.9%, and the smallest - with ischemic stroke (IS) - 7.7%. When analyzing hospital lethality rate by decades, it was found that in ischemic strokes it tended to gradually increase from the age group of 30-39 to 80 years and older. With hemorrhagic strokes, hospital lethality rate in the age groups of 20-29 and 30-39 years was due to SAH, and with hemorrhagic hemorrhages, it tended to gradually increase from the age group of 40-49 to 80 years and older (Table 6).

When considering in-hospital lethality rate in men, its features were revealed according to the type of stroke and in age groups. Thus, in-hospital lethality rate in ischemic strokes in men had an approximately uniform value from the age group of 30-39 years and above, with small peaks in the age groups of 50-59 years and 80 years and above. And with hemorrhagic strokes, hospital lethality rate in the age groups of 20-29 and 30-39 years was due to SAH, and with hemispheric hemorrhages, it tended to gradually increase from the age group of 40-49 to 80 years and older (Table 6).

When considering in-hospital lethality rate in women, its features were revealed according to the type of stroke and in age groups. Thus, in-hospital lethality rate in ischemic strokes in women (as well as in men) had an approximately uniform value from the age group

of 30-39 years and above, but with small peaks in the age groups of 60-69 and 70-79 years. And with hemorrhagic strokes, in-hospital lethality rate in women was similar to men and was detected in the age groups of 20-29 and 30-39 years was due to SAH, and with hemorrhagic hemorrhages it tended to gradually increase from the age group of 40-49 to 80 years and older (Table 6).

Table 6. Hospital mortality rate in patients older than 20 years, taking into account the type of stroke, gender and age in hospitals of the Khorezm region

Age	Ischemic			Hemorrhagic			Sak			All Types Of Strokes		
	Male	Female	Total	Male	Female	Total	Male	Female	Total	Male	Female	Total
20-29	-	-	-	-	-	-	11.1%	11.1%	11.1%	6.7%	6.3%	12.9%
30-39	7.7%	3.8%	6.2%	0%	0%	0%	25.0%	33.3%	28.6%	7.3%	5.7%	6.7%
40-49	9.3%	6.3%	7.6%	11.1%	12.0%	10.8%	-	-	-	9.5%	7.2%	8.4%
50-59	10.2%	3.6%	7.9%	18.0%	13.8%	16.3%	-	-	-	11.6%	5.8%	9.5%
60-69	6.3%	8.4%	7.3%	16.3%	14.6%	15.5%	-	-	-	8.2%	9.7%	8.9%
70-79	7.1%	9.7%	8.5%	16.7%	37.5%	25.9%	-	-	-	8.5%	8.2%	10.8%
80 and older	10%	7.1%	8.3%	33.3%	33.3%	33.3%	-	-	-	13.6%	10.1%	11.6%
All	8.3%	7.0%	7.7%	15.6%	17.0%	16.2%	11.8%	14.3%	12.9%	9.8%	8.9%	9.4%

5 The main risk factors for strokes in the desert-steppe zones of Uzbekistan according to the 2019 register

When analyzing the main risk factors for the development of strokes in the desert-steppe zones of Uzbekistan, according to the data of the 2019 register, it was found that among the risk factors arterial hypertension is 62.3%, atherosclerosis - 19.5%, coronary artery disease - 7.5%, diabetes - 3.8%, combined and other risk factors - 6.9% (Table 7). Such a predominance of hypertension among patients with stroke can be explained by the fact that drinking water in the Khorezm region, which is taken from the Amudarya River and its Shavat canal due to the environmental disaster in the Aral Sea region, has a high mineral content. In the selected water samples, mineralization exceeds the maximum allowable concentration (MAC) by 0.36–0.83 times, sulfates exceed the MAC by 8–10 times [12], which leads to the fact that the population of the region has a very high proportion of gallstones (157.5 per 100,000 population) and urolithiasis (146.2 per 100,000 population), with an increase in kidney diseases among the population (pyelonephritis - 1035, glomerulonephritis - 108.8, diabetic nephropathy - 138.3 per 100,000 population) and, accordingly, hypertension (1610.2 per 100,000 population) [13]. The low proportion of atherosclerosis and diabetes among the population is explained by the culinary tradition of the region, where dietary dishes predominate [14].

In the course of the gender analysis of the main risk factors, it was found that risk factors such as arterial hypertension (65.3%), diabetes (4.1%) and coronary artery disease (7.6%) prevail in men, while atherosclerosis prevails in women (22.2%).

When analyzing risk factors depending on the type of stroke, it was found that such risk factors as arterial hypertension and atherosclerosis predominate in IS and GS, with a slight prevalence in ischemic strokes. And with SAH, the risk factors for the development of stroke are hypertension and cerebral aneurysms (Table 7).

Table 7. Distribution of stroke patients in Khorezm region by risk factors and type of stroke

		Ischemic			Hemorrhagic			Subarachnoid			Unknown			Total		
		Male	Female	Total	Male	Female	Total	Male	Female	Total	Male	Female	Total	Male	Female	Total
Hypertension	n	869	687	1556	276	169	445	5	6	11	135	77	212	1285	939	2224
	%	73,3	68,1	70,9	69,3	60,8	65,8	26,3	31,6	29,0	37,0	25,9	32,0	65,3	58,6	62,3
Atherosclerosis	n	209	246	455	49	44	93	-	1	1	83	64	147	341	355	696
	%	17,6	24,4	20,7	12,3	15,8	13,8	-	5,3	2,6	22,7	21,6	22,2	17,3	22,2	19,5
Diabetes	n	54	36	90	15	9	24	-	-	-	12	9	21	81	54	135
	%	4,6	3,6	4,1	3,8	3,2	3,6	-	-	-	3,3	3,0	3,2	4,1	3,4	3,8
Hard Ischemic Disease	n	48	34	82	29	20	49	1	-	1	71	65	136	149	119	268
	%	4,1	3,4	3,7	7,3	7,2	7,3	5,3	-	2,6	19,	21,	20,	7,6	7,4	7,5
Mix and others	n	5	5	10	29	36	65	13	12	25	64	82	14	11	13	24
	%	0,4	0,5	0,5	7,3	13,0	9,6	68,4	63,1	65,8	17,5	27,6	22,1	5,7	8,4	6,9
Total	n	1185	1008	2193	398	278	676	19	19	38	365	297	662	1967	1602	3569
	%	54,0	46,0	61,4	58,9	41,1	18,9	50,0	50,0	1,1	55,1	44,9	18,6	55,1	44,9	100

Thus, the analysis of risk factors for strokes in the desert-steppe zones of Uzbekistan revealed:

1. The main risk factors for stroke are:arterial hypertension (62.3%), atherosclerosis(19.5%), coronary artery disease (7.5%), diabetes (3.8%).
2. In men, risk factors such as arterial hypertension, diabetes, and coronary artery disease predominate, while in women, atherosclerosis predominates.
3. With both IS and GS, such risk factors as arterial hypertension and atherosclerosis prevail, with a slight prevalence in ischemic strokes. And with SAH, the risk factors for the development of stroke are aneurysms of cerebral vessels and arterial hypertension.

6 Seasonality of strokes in the desert-steppe zones of Uzbekistan

The influence of seasonality factors on the incidence of cerebral stroke is noted in their studies by many authors [15, 16, 17].

To study the seasonality of cerebral strokes, patients were distributed according to the time of occurrence of strokes by seasons of the year. According to our study, cerebral strokes are recorded throughout the year, but the largest number of strokes developed in the winter (28.0%) and spring (28.6%) months. Relatively less often, cerebral strokes are recorded in the summer (21.5%) and autumn (21.9%) months.

When analyzing seasonality by type of stroke, it was found that IS and GS also prevailed in winter (28.1% and 29.7%) and spring (31.7% and 25.0%) months, respectively. Moreover, with IS, men prevailed in winter (29.3%), and in spring - women (35.4%), and with HS, on the contrary, women prevailed in winter (32.4%), and men (26.1%) in spring. SAH prevailed in the summer (36.8%) months, due to its slight prevalence in women (42.1%), and in the autumn (31.6%) months, due to its slight prevalence in men (36.8%).

Apparently, such dynamics is explained by unstable weather in the winter and spring months, when temperature drops and high humidity are most often observed, and these changes can be very sharp. According to the hydrometeorological center of the city of Urgench, during the study period, during one day, there were temperature fluctuations from 6° to 18° on average, which is of no small importance in the development of cerebral strokes.

The studies of recent years, which were carried out by employees of the Department of Propaedeutics of Hygiene, Military and Radiation Hygiene of the National Medical University named after A.A. forecasting meteoropatic reactions [18].

To identify the reasons for the development of seasonality in various types of strokes, we analyzed the frequency of occurrence of various meteoropatic factors by season in the desert-steppe zones of Uzbekistan. To do this, we took some meteorological factors in the weather forecasting bureau of the Khorezmregion, calculated their average values for the seasons of the year. When comparing our data on meteorological factors in the desert-steppe zones of Uzbekistan by season with the medical weather classification according to V.F. Ovcharova, we found that "spastic" and "hypoxic" weather types prevail in winter and spring, "tonifying" in summer, and in autumn - "hypotensive" type.

Thus, the analysis of the dynamics of cerebrovascular diseases by season allowed us to conclude that this pathology has a certain regularity. Most often, this pathology with its complications, in particular, cerebral strokes occur in the winter and spring months. In winter and spring, "spastic" and "hypoxic" type of pod is a provoking meteorological risk factor for the development of IS and GS. In summer - "tonic", and in autumn - "hypotensive" types of weather are provocative meteorological factors for the development of SAH.

With a change in the weather (air temperature, humidity, etc.), there is a deterioration in the condition of patients with cerebrovascular pathology. This suggests that all patients with this pathology are meteolabile, which is confirmed by the data of other researchers [19, 20, 21].

General practitioners, neuropathologists should take into account the significance of weather conditions in the development of cerebral strokes and carry out targeted preventive measures to prevent complications of cerebrovascular diseases and the occurrence of crises and strokes. For this, it is necessary to carry out sanitary and educational work among patients, highlighting the issues of preventing cerebral strokes and other complications of cerebrovascular diseases.

7 Conclusions

The conducted register of strokes in 2019 in the desert-steppe zones of Uzbekistan revealed 3569 cases of stroke, of which 1967 (55.1%) in men and 1602 (44.9%) in women. The average age of patients with stroke was 63.85 ± 0.2 years, in men - 62.9 ± 0.3 years, in women - 65.1 ± 0.3 years. The incidence of cerebral strokes corresponded to 194.43 cases per 100,000 population. The incidence of cerebral strokes at the age of 20 and older was 310.32 cases per 100,000 population. Mortality from cerebral strokes was 73.6 cases per 100,000 population. Mortality among the population 20 years and older was 117.46 cases per 100 thousand population. Lethality rate from cerebral strokes was 35.2%. A large proportion of lethality from cerebral strokes by terms (in the 1st, up to 7, up to 28 days) falls on the terms 2-7 (40.2%) and 8-28 (37.2%) days. The main risk factors for stroke are: arterial hypertension (62.3%), atherosclerosis (19.5%), coronary heart disease (7.5%), diabetes mellitus (3.8%). Seasonality of strokes in the region - ischemic and hemorrhagic strokes prevailed in winter (28.1% and 29.7%) and spring (31.7% and 25.0%) months, respectively. Subarachnoid hemorrhages prevailed in summer (36.8%) months. In winter and spring, the "spastic" and "hypoxic" type of heart is a provoking meteorological risk factor for the development of ischemic and hemorrhagic strokes. In summer - "tonic", and in autumn - "hypotensive" types of weather are provoking meteorological factors for the development of subarachnoid hemorrhages.

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