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One-year Survival and Related Factors in Patients with Ischemic Stroke

Hossein Khosravi[1], Farideh Khosravi[2*], Hossein Salari[3], Ahmad Khosravi[4]

[1] Postgraduate of Medicine, School of Medicine, Shahroud University of Medical Sciences, Shahroud, Iran.
[2] Dept. of Epidemiology, Occupational and Environmental Health Research Center, School of Public Health, Shahroud University of Medical Sciences, Shahroud, Iran.
[3] Dept. of Neurology, Imam Hossein Hospital, Shahroud University of Medical Sciences, Shahroud, Iran.
[4] Dept. of Epidemiology, Center for Health Related Social and Behavioral Sciences Research, Shahroud University of Medical Sciences, Shahroud, Iran.

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Abstract

Background: *Stroke is the second leading cause of death worldwide. Changes in the survival rate could be due to changes in mortality rates and changes in the levels of risk factors. This study aimed to determine the most important risk factors affecting the survival of patients with stroke in Shahroud.*

Methods: *In this retrospective cohort study, 380 patients with ischemic stroke were followed-up for one year after the stroke. Information on patients was collected through hospital records, interviews, and in the case of death, through interviewing the family of the deceased. Then, the data were analyzed using the Kaplan–Meier method and Cox semi-parametric model at the significance level of 0.05 with SPSS 21 and Stata 12.*

Results: *The mean age of patients was 63±6.03. Among the patients, 237 (62.4%) were men. Using the Kaplan–Meier method, survival rates of one month, six months, and one year were, respectively, 98.7, 80.3, and 78.4. Age, number of hospitalizations,(GCS) level of consciousness, hypertension, diabetes, HLP, IHD, HDL, FBS, and smoking show significant correlations with survival ($p<0.001$). Based on the Cox regression model with an age above 70 years, hypertension, diabetes, and an under 13 level of consciousness, the increase in the risk of death, respectively, was 2.85, 2.86, 6.93, and 2.11 times higher in patients with ischemic stroke.*

Conclusions: *Since the risk increases during the months following the stroke, it is necessary to follow up with patients so that they visit their doctors based on appointments.*

Keywords: Survival analysis, Stroke, Proportional hazard cox model, Shahroud.
[*]**Corresponding to:** F.Khosravi, **Email:** Faridehkhosravi50@yahoo.com
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Introduction

Since the risk increases in the months following a stroke, it is important to follow up with patients to encourage them to visit the doctor at their appointments. Stroke is among the diseases affecting those of old age, and with the aging of the population in societies, it gets a higher importance because stroke is the most common nervous system disease; its incidence after the age of 55 years becomes almost twice for each decade.[1,2] Bleeding or obstruction are the two main causes of this disease. Obstruction is caused by thrombosis, so that 75% of strokes are caused by myocardial infarction, 15% by intracerebral hemorrhage, and 10% are caused by other factors.[3] Stroke is the second leading cause of death in the world, and in 2012, about 6,700,000 people in the world died of stroke. The incidence of stroke in western countries is 3–4 people per 1000, and its prevalence is 5–7 people per 1000. In the United States of America from 2007 to 2010, about 6.8 million people aged 20 years and over suffered a stroke, and the prevalence of the disease during this period was 2.8%.[4,5] It is predicted that by 2020, its prevalence will have increased by 20.5% compared to 2012. The largest increase is expected to occur in Spanish men, with mostly elderly people aged 70 years and over as the group who are most prone to a stroke.[4,5] According to a study conducted in Sweden, between the ages of 55–64 years, the incidence of stroke is lower in women than in men, but between the ages of 75–85 years, this relationship is reversed and the incidence of the disease is higher in women.[6,7] According to research conducted in Iran, the incidence of stroke is significantly higher than most Western countries. A study conducted by Azarpazhoh and colleagues in Mashhad indicates that in terms of age, this disease occurs about a decade earlier compared to other Western countries.[8] Numerous other factors such as thromboembolism and bleeding play a role in stroke.[4] Advanced age, sex, race, and genetic susceptibility are the most prominent non-modifiable risk factors, whereas lifestyle risk factors such as diet, exercise, and use of tobacco and alcohol are considered modifiable risk factors.[9] Among manageable risk factors, high blood pressure, hyperlipidemia, smoking, obesity, diabetes, and birth control pills can be pointed to. Among these, high blood pressure is the strongest risk factor, with a spread of 25%–40%. The risk of stroke in patients with known hypertension is four times more than that among people with normal blood pressure and twice as much as among people with borderline blood pressure.[10,11] Diabetes mellitus is a risk factor independent of hypertension, and as research shows, it is associated with a two to six times increase in the risk of stroke.[12,13] Observation studies have shown that higher levels of cholesterol are associated with an increased risk of ischemic stroke, and smoking nearly doubles the risk.[11,14] Due to the increasing prevalence of stroke, a better understanding of risk factors not only helps to prevent the disease, but it also helps to formulate the right plan to increase the survival of patients with ischemic stroke. The aim of this study was to investigate the one-year survival and to determine the risk factors of the survival based on Cox regression model.

Materials and Methods

In this prospective cohort study, 380 patients in Imam Hussein Hospital in Shahrood entered the study since the beginning of 2010 to the end of September 2013. The inclusion criteria were cerebral ischemic stroke, answering the phone, and completeness of patient records. The exclusion criteria were not answering the phone and incomplete patient records.

All patients were studied for one year after an ischemic stroke. Data were collected using a questionnaire that consisted of three parts. The first part included name, gender, and age. The second part included ischemic stroke risk factors, including HTN, FBS, BS, HDL, TG, cholesterol, LDL, and smoking. The third part also included the time of a patient's death, the cause of the death, which was asked from the patient's relatives, and the number of hospitalizations after entering the study. Information on the death of the patient was obtained from relatives using the patient's phone number. In this study, according to the World Health Organization's definition, patient selection criteria for developing HTN (use of antihypertensive drugs, blood pressure >140/90 mmHg), DM [intolerance of glucose (which is defined type 2 diabetes or impaired fasting blood sugar (FBS)] or impaired glucose tolerance (IGT), lipid disorders (TG ≥150, HDL <35 in men and <38 in women), Cholesterol levels ≥220, and a BMI ≥30 were also criteria for inclusion of patients in the study.[15] In the case of incomplete patient information, that person was excluded from the study. Most researchers in the medical field prefer to use the Cox semi-parametric model because it has fewer assumptions than the parametric model. In this study, graphic methods were used to evaluate the assumptions of the appropriateness of risk. After collecting the appropriate data using SPSS 21 and Stata 12 statistical software, they were analyzed at a significance level of 0.05. Using the log-rank test, factors influencing the survival of patients with ischemic stroke were determined, and significant variables were entered into the model along with variables with a p less than 0.3.

Results

Among the patients, 237 (62.4%) were male and 143 (37.6%) were female. During the year, 92 out of 380 patients died, among whom, 82 (88.8%) patients died due to stroke and its complications, and 10 people died because of other reasons.

The mean age of patients was 63±6.03; the mean age of women was 64.64±6.61 and the mean age of men was 65.22±5.65 and no statistically significant difference (P=0.38) was observed between the two groups. All patients entered into the study had neurological disabilities. Among these, the paresis of the right leg, with 89 cases (23.4%), was the neurological disorder with the highest frequency, and paresis of the right hand, with 36 cases (9.4%), was the neurological disorder with the least frequency. Table 1 contains information on some ischemic stroke risk factors related to gender

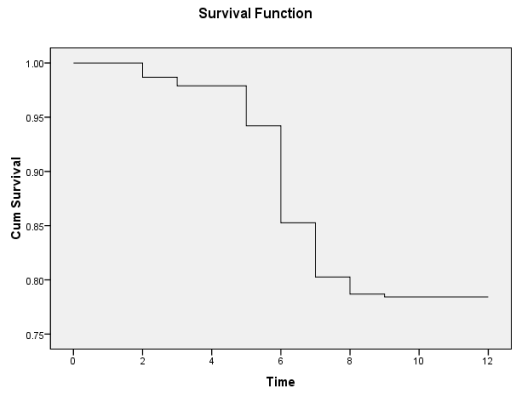

Figure 1. Survival curves in patients with ischemic stroke

The mean survival period was 10.47 months with a confidence interval of 10.16–10.77. Due to the high number of censorship in the study, the software could not calculate median survival time. Using the Kaplan–Meier method, one month, six month, and one year survival rates were, respectively, 98.7, 80.3, and 78.4.

The survival curves show that 5–7 months after a stroke, patients were at high-risk.

The results show that variables such as age, number of hospitalizations, GCS, hypertension, diabetes, HLP, IHD, HDL, FBS, and smoking are significant (P<0.001). Gender (P=0.15) and neurologic signs (P=0.18) were not significant variables.

Table 2 shows the estimates of survival calculated through the nonparametric Kaplan Meier.

The results of the Cox regression model are reported in Table 3.

After fitting the Cox model, its assumptions must be checked. Graphic methods showed that the assumption of appropriateness of risk for all variables had been met.

Table 1. Information on some ischemic stroke risk factors related to gender

Variable		Male Number(%)	Female Number(%)
Age	50-70	121(84.6)	209(88.2)
	70-90	22(15.4)	28(11.8)
Blood pressure	Normal	84(35.4)	51(35.7)
	Abnormal	153(64.6)	92(64.3)
Diabetes	Normal	66(27.8)	63(44.1)
	Abnormal	171(72.2)	80(55.9)
Hyperlipidemia	Normal	63(26.6)	56(39.2)
	Abnormal	174(73.4)	87(60.8)
FBS	Normal	173(73)	81(56.6)
	Abnormal	64(27)	62(43.4)
HDL	Normal	171(71.7)	55(38.5)
	Abnormal	67(28.3)	88(61.5)
TG	Normal	1(0.4)	-
	Abnormal	236(99.6)	143(100)
Smoking	Normal	106(44.7)	9(6.3)
	Abnormal	131(55.3)	134(93.7)

Table 2. Estimates of survival calculated through nonparametric Kaplan Meier

Variable		Mean survival (month)	Standard Deviation	Confidence Interval		Median Survival(month)
				Low	Upper	
Sex	Male	10.65	0.18	10.29	11.01	-
	Female	10.16	0.27	9.63	10.69	-
Age*	50-70	11.31	0.11	11.09	11.53	-
	70-90	4.88	0.29	4.3	5.45	5
number of hospitalizations*	<3	11.24	0.13	10.98	11.5	-
	≥ 3	6.33	0.33	5.69	6.98	5
Hyperlipidemia*	Normal	8.44	0.31	7.84	9.04	8
	Abnormal	11.69	0.1	11.49	11.88	-
Diabetes*	Positive	7.89	0.32	7.26	8.52	6
	Negative	11.79	0.08	11.63	11.95	-
HDL*	Normal	10.86	0.18	10.5	11.21	-
	Abnormal	9.9	0.26	9.38	10.41	-
Smoking*	Normal	9.44	0.32	8.81	10.08	-
	Abnormal	10.91	0.16	10.59	11.23	-
FBS*	Normal	11.82	0.07	11.68	11.96	-
	Abnormal	7.83	0.32	7.2	8.46	6
Hyperlipidemia*	Positive	8.21	0.34	7.54	8.88	7
	Negative	11.49	0.11	11.27	11.72	-
Neurologic signs*	Positive	10.48	0.15	10.18	10.78	-
	Negative	8	2.83	2.46	13.54	4
Glasgow Coma Scale	<13	4.68	0.26	4.17	5.19	-
	13-15	11.22	0.12	10.99	11.46	-
Heart disease*	Positive	9.73	0.25	9.24	10.23	-
	Negative	11.15	0.17	10.82	11.48	-

* significance level of 0.05

Table 3. The Results of Cox regression model

Variable		Risk Ratio	Confidence Interval		P.V
			Low	Upper	
Age*	50-70	-	-	-	<0.001
	70-90	2.85	1.42	4.28	
Hyperlipidemia*	Normal	-	-	-	0.001
	Abnormal	2.86	0.71	5.01	
Diabetes*	positive	6.93	1.03	12.83	<0.001
	Negative	-	-	-	
Hyperlipidemia	Positive	1.86	0.74	2.62	0.07
	Negative	-	-	-	
Glasgow Coma Scale*	<13	2.11	1.06	3.16	0.003
	13-15	-	-	-	

* significance level of 0.05

Discussion

Research shows that unchangeable risk factors for stroke include old age, male gender, non-white race, and a family history of heart disease or stroke.[16] A study by Qureshi and colleagues showed that the survival rate of men is higher than that of African American women.[17] In our study, the mean survival rate is slightly higher for men, but this difference is not significant. Liu XD and colleagues, in a study conducted in China, reported that an older age and lower GSC at the time of admission were among the factors leading to death for patients suffering from Ischemic stroke.[18] Moreover, Chang's study in 2010 showed that the survival rate of patients is associated with age and the severity of Ischemic stroke, which is not consistent with our finding.[19] The results of our study indicate that patients older than 70 years of age are 2.85 times as much of a risk of death from ischemic stroke as other patients. Moreover, patients with a consciousness level lower than 13 are at 2.11 times more of a risk of death as others.

Markaki and colleagues in 2014 concluded in their study that a high cholesterol level has a positive effect on the survival of patients.[20] In this study, patients with hyperlipidemia have lower survival than other patients. The risk ratio of these patients is 1.68, which is not significant (P=0.07).

Amini Sani and colleagues referred to the relationship between patient survival and risk of ischemic heart disease in their study,[21] which is consistent with the current study, and patients with ischemic heart disease have lower survival rates than other patients.

High blood pressure and diabetes are two other risk factors identified in this study, which is consistent with Weimar's finding in Germany in 2002.[22] Patients with high blood pressure are at 2.86 times more risk of death than other patients. Diabetics also have a 6.93 times higher risk compared to non-diabetics. In this study, the highest mortality rate was in the fifth month after ischemic stroke, which seems to be due to a lack of patients' following-up after discharge, finishing medications, or a lack of adequate care 3–4 months after a stroke.

The highest risk was observed in 5–7 months after a stroke, so it is recommended that doctors follow up with their patients. It is suggested that blood pressure and glucose should be

controlled in people with diabetes, and omega-3 supplements need to be used to increase HDL.

Conflict of Interest

The authors declared that they have no conflict of interest.

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