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RESEARCH ARTICLE

Prevalence and risk factors of stroke in Azar cohort-North-West of Iran

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ABSTRACT

Since the prevalence and risk factors of stroke could differ in different geographical areas, analyzing data derived from longitudinal community-based studies with large sample size like cohort studies at the desired geographical region is of importance. Accordingly, the present study aimed at investigating the prevalence and risk factors of stroke in the population covered by the Azar cohort. The Azar cohort data were used in the present case-control study. A total of 357 subjects in two groups with and without a history of stroke were investigated, and their demographic information, medical history, laboratory test results (e g, fasting blood sugar, and lipid profile), anthropometric indices, blood pressure, and fat intake were compared. The collected data were analyzed using independent t test and Chi-square tests to compare demographic characteristics, laboratory test results, and anthropometricindices. Logistic regression was also used to examine the contribution of variables to stroke. The prevalence of stroke in the population covered by the Azar cohort was 7.9 cases per 1000 population. All risk factors for stroke were examined and the results in the present population showed that fatty liver increased the risk of stroke by 3.35 (CI%:2.66-7.31 times. The prevalence of stroke in Azar cohort population was 7.9 cases per 1000 population, which is higher than the average value reported in Iran (1.5 per 1000). Fatty liver can be the risk factors for stroke in the population covered by the Azar cohort. It is suggested that preventive and screening measures be on the agenda of future studies for people prone to stroke.

KEYWORDS:
Stroke, Risk Factor, cohort study.

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INTRODUCTION

Stroke is one of the most important and common cardiovascular diseases worldwide, annually causing significant morbidities and mortalities. Stroke is the cause of 85% of deaths in developed countries and the second cause of death worldwide (1). About 5-8 million deaths are annually from stroke worldwide, more than the total number of death from AIDS, tuberculosis, and malaria (2). Stroke is one of the main debilitating factors in Iran, and according to released statistics, it affects about 100-150 cases per 100'000 population across all age groups (3).

Although the incidence of stroke is decreasing in developed countries, including the United States, it is increasing in developing ones (4). Although in the last four decades the incidence of stroke decreased by 42% in developed countries, its morbidities were more than doubled in developing ones (5). Likewise, 70% of strokes and 87% of deaths and disabilities caused by strokes globally occur in developing countries, which impose a drastic socio-economic burden on the health systems, according to the allocated budget (6).

In Iran, the incidence of stroke varies from 23 to 103 cases per 100,000 population across all age groups, and its associated mortality and disability are higher in the young population compared to Western countries (7). According to Iran's Ministry of Health report, out of 100,000 strokes,

25,000 lead to death; therefore, understanding the associated risk factors helps adopt preventive strategies (8).

A community-based study conducted in Tabriz, Iran, showed the high incidence of stroke (120 cases per 100,000 people) and prevalence of hypertension in the local population compared to other regions of the country (9, 3). Factors such as hypertension, dyslipidemia, Western-style diet, cardiovascular disease, diabetes mellitus, smoking, old age, congestive heart failure, family history of heart attack and stroke, and male gender are associated with stroke (10-12). The incidence and mortality of stroke vary across geographical areas, and most studies in Iran examined the prevalence and risk factors of stroke based on hospital data. Although community-based studies, especially cohorts, are more reliable, to the best of the authors' knowledge, no similar study was performed in this region thus far (13). Understanding the prevalence and risk factors of stroke based on data extracted from a cohort provides the evidence required to design guidelines for the prevention, treatment, and rehabilitation of affected patients in Iran and other developing countries, and health promotion strategies for the prevention and control of the risk factors associated with cerebrovascular diseases, such as stroke, and their early diagnosis and treatment helps to reduce the burden of these diseases in Iran. Therefore, the present study aimed at determining the prevalence and risk factors associated with stroke in Azar cohort population.

METHODS

Study design

The study protocol was confirmed by the Ethics Committee of Tabriz University of Medical Sciences (IR.TBZMED.REC.1399.051). In the present case-control study, the prevalence of stroke was evaluated in all participants of Azar cohort study. The Azar cohort is part of a Prospective Epidemiological Research Studies of Iranian Adults (Persian cohort)(14). The main goal of the project is to find risk factors of common non-communicable diseases. Azar cohort was explained with more details in other published articles (15).

The sample size was determined based on the number of cases with a history of stroke in the population and the double number for the control group with no history of stroke, which was matched by age and gender. The dataof 357 subjects were evaluated, of which 119 were in the case and 238 in the control groups.

Inclusion and exclusion criteria

Inclusion criteria: the age of 35-70 years was the main inclusion criteria. Only Iranian people living at least nine months of the year in the studied area were invited. Exclusion criteria: Unwillingness to cooperate with the study. People who were unable to respond and communicate for various reasons were not included.

Demographic, nutritional, lifestyle, and disease history information were collected using a standardized questionnaire by trained individuals (face-to-face interviews were performed, and information was recorded online). Based on the utilized questionnaire, information about age, gender, education level, smoking habits, alcohol consumption and medical history were collected. Anthropometric indices including height (cm), weight (kg) and waist circumference(cm) were measured. By dividing weight (kg)/height (m)2body mass index (kg /m 2) was measured. Systolic and diastolic blood pressure were also measured in sitting position twice with 10 minute intervals from each arm using a mercury sphygmomanometer (Riester Exacta 1350 Sphygmomanometer, Germany) and their mean was recorded as systolic and diastolic blood pressure(13).

Dietary intake of participants for determining total fat intake, polyunsaturated fatty acid (PUFA), monounsaturated fatty acid (MUFA), and saturated fatty acid (SFA) amounts were analyzed by Nutritionist IV. According to daily energy intake, percentage of fat intake, PUFA, MUFA, and SFA were calculated.

Also, fasting blood samples were taken from all subjects to test fasting blood sugar (FBS),cholesterol, HDL (high-density lipoprotein), LDL (low-density lipoprotein), and TG (triglyceride) using commercially available kits.

Statistical analyzes

Quantitative data were compared between the two groups with independent t test and qualitative data with chisquare test. Moreover, crude and adjusted odds ratios (OR) and their corresponding 95% confidence intervals (95% CI) were assessed.

RESULTS

A total of 150006subjects were evaluated thus far, of whom 119 (0.79%) had a stroke. Evaluation of the demographic information showed no significant differences between the two groups in variables, such as history of diabetes (P=0.13),myocardial infarction (P=0.99), smoking (P=0.61) and alcohol consumption (P = 0.80. But there was a statistically significant difference between the two groups in variables such as a history of hypertension (P=0.001), ischemic heart disease (P=0.001), and fatty liver (P=0.03); so that these variables were significantly higher among those with stroke than controls. The result of demographic information comparisons is shown in Table 1.

Table 1: Comparison of demographic, laboratory, and clinical characteristics between the case and control groups

Variable		Group		P Value
		Control (N=283)	Case (N=119)	
SexN(%)	Male	109(45.8)	55(46.2)	0.94*
	Female	129(54.2)	64(53.8)	
Level of EducationN(%)	illiterate(%)	54(22.7)	76(63.9)	0.001*
	Elementary (%)	84(35.3)	21(21.6)	
	secondary (%)	37(15. 5)	9(7.6)	
	Diploma (%)	43(18. 1)	7(5.9)	
	post-graduate university (%)	11(4.6)	5(4.2)	
	Bachelor(%)	7(2.9)	1(0.8)	
	Masters(%)	1(0.4)	0(0)	
	PhD (%)	1(0.4)	0(0)	
History of diabetes N(%)		35(14.7)	25(21)	0.13*
History of hypertensionN(%)		81(34)	78(65.5)	0.001*
History of ischemic heart disease N(%)		24(10.1)	27(22.7)	0.001*
History of MIN(%)		8(3.4)	4(3.4)	0.99*
Fatty LiverN(%)		4(1.7)	7(5.9)	0.03*
smoking N(%)		66(27.7)	36(30.3)	0.62*
alcohol consumption N(%)		24(10.1)	13(10.9)	0.81*
Age (mean ±SD)		58.57±8.60	58.57±8.60	0.99**
Bad body mass index (kg/m2) (mean ±SD)		28.02±4.69	29.10±5.26	0. 05 **
Waist circumference (cm)(mean ±SD)		96.81± 13.15	95.28± 11.44	0. 26 **
Weight (kg)(mean ±SD)		74.89± 14.73	73.78± 13.59	0. 48 **
diastolic *blood* pressure (mmHg)(mean ±SD)		71.17± 7.94	74.2± 11.23	0. 003 **
Systolic *blood* pressure(mmHg)(mean ±SD)		113.31±15.36	118.40±18.55	0. 006 **
Fasting blood sugar (mg / dl) (mean ±SD)		101.02±39.98	108.52±33.44	0. 06 **
Triglycerides (mg / dL) (mean ±SD)		144.58±79.48	151.69±77.60	0. 42 **
Cholesterol (mg / dL) (mean ±SD)		184.44±42.89	200.71±47.37	0. 002 **
HDL (mg / dL)(mean ±SD)		46.83±11.45	49.34±11.26	0.04 **
LDL(mg/dL)(mean ±SD)		108.72±34.47	121.88±42.26	0. 004 **

**: independent t test *:Chi-Square
MgL: Milligram DL: deciliter kg: Kilogram M: meter - Cm: centimeter

Comparison of the laboratory test results between the two groups showed that the cholesterol (P=0.002), HDL (P=0.049), and LDL (P=0.004) levels were significantly higher in the group with stroke than in the control (Table 1). Comparison of the blood pressure status also showed that diastolic blood pressure (P=0.003) and systolic blood pressure (P=0.006) were significantly different between the two groups (Table 1).

Evaluation of the factors associated with stroke in the participants showed a significant difference between the groups percentage of energy intake fromPUFA (P=0.001)(Table 2).

Table 2: Comparison of percentage of energy intake from fat, fatty acid between case and control groups

Variable	Group		P Value
	Control (N=283)	Case (N=119)	
	Mean ± SD	Mean ± SD	
Total fat % energy	27.93± 5.60	27.71± 5.74	0.73*
SFA % energy	10.80 ± 2.87	10.93± 3.33	0.70*
MUFA % energy	8.16 ± 2.06	7.97 ± 2.14	0.43*
PUFA % energy	5.24 ± 1.78	4.64 ± 1.33	0.001*
Salt	3.59	3.28	0.39*

Total fat % energy			
<30	81	156	0.40**
≥30	35	74	
PUFA % energy			
<10	189	100	0.29**
≥10	41	16	
SFA % energy			
<10	50	102	0.44**
≥10	66	127	
MUFA % energy			
<10	100	189	0.21**
≥10	16	41	
**: Chi-Square *:independent t test			

The results of comparison of FBS(P=0.03), Cholesterol(P=0.03), HDL(P=0.002), LDL(P=0.02) and triglyceride (P=0.04) variables indicated that these variables were significantly different between the two groups (Table 3).

Table 3: comparison of FBS and lipid profile between case and control groups

Variable	Control		Case		P Value
	N	%	N	%	
FBS mg/dl					
<126	197	55.18	108	30.25	0.03**
≥126	41	11.48	11	3.08	
Chol. mg/dl					
<240	195	54.62	105	29.41	0.08**
≥240	43	12	14	3.92	
HDL mg/dl					
<40	55	51.26	40	11.2	0.02**
≥40	183	51.26	79	22.12	
LDL mg/dl					
<110	86	24.08	65	18.20	0.02**
≥110	121	11.29	54	15.12	
TG mg/dl					
<150	137	38.37	80	22.40	0.04**
≥150	101	28.29	39	10.92	
**: Chi-Square MgL: Milligram DL: deciliter					

Table 4: Predictor risk factors of stroke in Azar cohort population

Variable	OR *	95% CI**	P value
Fatty Liver			
Yes	3.35	2.66-7.31	0.04
NO	Reference		
Diabetes			
Yes	0.29	0.02-0.34	0.13
NO	Reference		
TG			
150≤	0.99	0.99-1.00	0.41
150>	Reference		
CHOL			
240≤	0.99	0.98-0.99	0.002

240>	Reference		
HDL			
40≤	0.97	0.95-0.99	0.04
40>	Reference		
LDL			
110≤	0.99	0.98-0.99	0.005
110>	Reference		
Smoking			
Yes	1.13	0.69-1.83	0.61
No	Reference		
BMI			
Underweight	0.607	0.12-3.10	0.55
Overweight	1.150	0.62-2.14	0.65
Obese	1.50	0.80-2.81	0.20
Normal	Reference		
HTN			
Yes	1.02	0.99-1.06	0.14
No	Reference		
Total fat			
<30	1.09	0.67-1.78	0.70
≥30	Reference		
SFA			
<10	0.94	0.60-1.48	0.79
≥10	Reference		
MUFA			
<10	0.73	0.39-1.38	0.34
≥10	Reference		

According to the results shown in Table 4, only fatty liver increased the risk of stroke significantly.(OR=3.35)

DISCUSSION

The prevalence of stroke in Azar cohort population was 7.9 cases per 1000 population ,showing a higher prevalence compared with nationwide studies. Global studies reported the prevalence of stroke as 72 per 100,000 population(16). According a study on Iran's population, the prevalence of stroke was reported 128-149 cases per 100,000 population (17-19). Also, in a study by Farhoudi et al., in Tabriz, the prevalence of stroke was 120 cases per 100,000 population.

The mean age of the study participants was 58 ± 3.41; the majority were females. According to previous studies (15), the prevalence of strokes in the sixth decade of life (age 63) was at its maximum and the highest rate in people aged above 60, which is inconsistent with the present study results, showing that the mean age at a stroke in Azerbaijan region was lower than the normal population. The results of similar studies (20) also show that the prevalence of stroke in females is higher than males, which is consistent with the present study findings.

It seems that lifestyle changes in recent years increased the prevalence of chronic diseases, such as hypertension and heart disease, etc. The higher prevalence of stroke in the study can be attributed to differences in the geographical area, mean age differences and the higher prevalence of risk factors associated with stroke. For example, the prevalence of hypertension in our study was 39.55% compared to 25% in other studies(21).

In the present study, hypertension, ischemic heart disease, fatty liver and obesitywere considered risk factors for stroke, consistent with similar studies results. These risk factors are confirmed in regional, national, and global studies (22-24). It is believed that hypertension is the main factor associated with strokes. Studies show that controlling blood pressure reduces the risk of stroke by 30% to 40%, and it can increase the risk of stroke, the issue observed in the present study (25).

Iranian studies (26) indicate that the prevalence of fatty liver, and cholesterol, HDL, and LDL disorder is higher in Iran than in other countries (27) and, therefore, it can be concluded that with increasing the prevalence of these risk factors, the prevalence of strokes also increases. Obesity and fatty liver are important risk factors for stroke. According to various studies, people with obesity are significantly prone to stroke than those with normal weight. Fatty liver can lead to stroke by damaging cerebral arteries and reducing blood flow by fatty acids (28). The findings are consistent with the present study results.

Following age increase, an increase in cholesterol levels leads to a decrease in vascular resistance. Cerebral arteries are more sensitive to decreased vascular resistance, and therefore the risk of brain lesions increases following an increase in cholesterol levels (29, 30). The results of previous studies indicate the significant effects of higher cholesterol levels on the risk of stroke. The results of the present study showed no significant correlation between serum cholesterol levels and stroke that might be attributed to mean age differences and the effects of other stroke risk factors as a confounding factor, which should be considered in further studies.

The results of studies in Iran show a prevalence of 21.4 cases per 1000 population (31),

The prevalence of diabetes in our study was 14.92 while it is

8.8% in global studies (32). Various studies (33) showed that diabetes could triple the risk of stroke. Diabetes increases the prevalence of stroke, which occurs when the blood supply to the brain is disturbed. People with diabetes have a long history of uncontrolled blood sugar than non-diabetics, especially if it is not well controlled. Our study results showed that diabetes could not play a role in stroke. This difference in the present study compared to previous research might be attributed to differences in the geographical area, mean age differences and the effects of other confounding factors, which should be considered in further studies.

Diet is one of the main causes of neuromuscular disease. A Western-style diet is high in processed foods, added sugars, salts, and hydrogenated fats and is one of the fastest ways to develop heart diseases and stroke. The higher the intake of salt and saturated fats in the diet, the greater the risk of neuromuscular problems and damage, increasing the risk of stroke. The results of the present study didn't show a significant difference between the two groups in fat intake, such as dietary intake of energy from fat, SFA, MUFA, and salt intake. But there was a significant difference between the groups in energy intake from PUFA (3, 6). It seems that the effect of other confounding factors in the population studied is one of the reasons for the difference between the results of the present study and similar research, which requires further investigation.

CONCLUSION

The prevalence of stroke in the population of Azerbaijan is0.79% (7.9 per 1000 population), higher than the average in Iran (0.15%). Fatty liver can be considered the risk factors for stroke and increase the risk of stroke in the Azar cohort. The lack of effect of a history of diabetes mellitus on stroke in the present study could be due to demographic and geographical differences. Most studies in Iran have examined the prevalence and incidence of stroke based on hospital data. The present study was the first research investigating the risk factors of stroke based on data extracted from a longitudinal community-based study with a large sample size.

Our study provides the evidence required to design guidelines for the prevention, treatment, and rehabilitation of affected patients in Iran and other similar countries that can help reduce cerebrovascular diseases burden in Iran.

We performed a case control study on data derived from Azar cohort study that just started. With gathering more data as the study progresses we will be able to obtain more comprehensive results.

On the other hand, the lack of separate evaluation of the risk factors for hemorrhagic and ischemic stroke is one of its weaknesses. Due to the contribution of hypertension, ischemic heart disease, fatty liver disease, fat intake to stroke, the implementation of preventive programs and the screening of people prone to stroke with risk factors are recommended for future studies.

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