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Original Article

Rural-Urban Differences in Stroke Types, Risk Factors, Severity and Prognosis in Babol, Northern Iran

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Introduction: Stroke recognized as the third most common cause of death. Stroke survivors often suffer a large amount of physical and mental disability. Due to assess difference between stroke types, progression and distribution of risk factors according residential status, to get correct information for prevention planning and management, this study was conducted.

Methods: This descriptive cross-sectional study on stroke patient from 2016 to 2017 that admitted to Ayatollah Rohani Hospital of Babol was conducted. Type of stroke, their severity, risk factors, and urban or rural area of residence of patients were recorded in the checklist. The chi-square test was used to compare frequencies of gender, and stroke risk assessment between the urban and rural residents. Binary logistic regression modeling was used to estimate the association of risk factors with living in urban and rural areas. The results were expressed as multivariable-adjusted odds ratios (ORs) and 95 % confidence intervals (95 % CIs). A two-sided $p < 0.05$ was considered statistically significant. All data analyses were performed, using SPSS statistical analysis software.

Results: Of 241 stroke patients, 133 patients (55 %) were female and 213 patients (88.4 %) were ischemic. Also, 140 cases were (58 %) rural. Embolic strokes more in urban population and thrombotic strokes were more in rural populations. Hyperlipidemia was more in urban than rural $p = 0.01$. Severity of stroke in admission time ($p = 0.03$) and at discharge ($p = 0.005$) was more in rural than urban. The mortality was higher in rural 12 (8.6) vs. 2 (2) urban resident,($p = 0.03$).

Conclusion: Rural patients had more severity, thrombotic type and mortality than urban. Suitable policy regard to residential parameter is suggested.

Keywords: Stroke, Risk Factors, Rural, Urban

Introduction

Stroke is one of the most common neurological disorders, recognized as the third most common cause of death after cancer and cardiovascular disease (1).

Stroke patients who survive often suffer a large amount of physical and mental disability that needs special care and long-term rehabilitation cause emotional distress for the families as well as a considerable increase in the financial costs of care and maintenance. Low and middle income countries have the largest burden of stroke, accounting for more than 85

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% of stroke mortality worldwide (2). Two-thirds of all strokes occur in the developing countries in spite of their preventable nature, are increasingly becoming a major health problem (3, 4). The study in Babol, north of Iran shows that the incidence of stroke was 50 per hundred thousand populations (5). Because of the difference in social and economic status of rural and urban societies, probability of stroke incidence, its course and distribution of stroke risk factors such as hypertension (HTN), diabetes mellitus (DM), ischemic heart disease (IHD), hyperlipidemia (HLP), smoking, obesity, and physical inactivity (6) in these societies are different. Knowledge of these differences is very important to get correct information for prevention planning and management of stroke. However, effective stroke prevention needs to be addressed by strategies targeting those at high risk for stroke, which may differ in these two societies (7).

Because of the lack of recognition of these differences in these two societies, acute stroke management practices in rural are suboptimal, which creates an unacceptable health disparity between urban patients with stroke and their rural counterparts. The existing gap between urban and rural stroke care may widen in the future as more urban-tested interventions are incorporated into the treatment of acute stroke, where there is large migration from rural to urban areas.

Given these issues this study was carried out to assess differences in the stroke incidence its course and distribution of stroke-risk factors in rural and urban patients.

Methods

Procedure and sampling

This descriptive, cross-sectional study was conducted on stroke patient from 2016 to 2017 that admitted to Neurology center of Babol University of Medical Sciences (Ayatollah Rouhani Hospital).

Every stroke patient admitted to this hospital in the Babol was registered. Stroke was defined as rapidly developing focal symptoms and signs of cerebral function that correlate with the area of the brain supplied by the affected blood vessel, lasting longer than 24 hours. Stroke was diagnosed by a neurologist, based on the patient's history, neurological examination and neuroimaging studies which were performed for all stroke patients. Diagnosis of stroke and its types was made according to the criteria in epidemiological studies of stroke (8). The criteria for entering this study were every patient with the diagnosis of the first stroke of any type. Cases that had metabolic encephalopathy's and traumatic, or space occupying lesions (with hemi paresis or any other focal neurological symptoms or signs), or stroke mimickers such as seizure, migraine were excluded.

Data collection

Type of stroke, their severity, risk factors such as HTN, IHD, DM, HLP and smoking, and urban or rural area of residence of patients were recorded in the checklist prepared for study. Stroke in this study was divided into ischemic and hemorrhagic types. The ischemic type was divided into thrombotic and embolic. Hemorrhagic stroke was divided into Subarachnoid (SAH) and intracerebral (ICH).

According to the latest census of population and housing in the study area in 2016, of the 531930 Babol population, 305578 people live in the city and the rest are rural population (226351) (5).

In this census, the rural and urban residency of the patients was based on their identity card information (birth certificate), living in areas of at least 5 km from the city is considered as a rural community. Immigration from the city to the village rarely happens in the Babol region, but in the case of recent migration from village to city, the situation of these people has been determined according to their main residence for at least the last 10 years.

Measure

Severity of stroke was determined on the basis of NIH Stroke Scale (NIHSS) criteria (9), score ≤ 8 mild, 9–15 moderate and ≥ 16 severe strokes.

The cut points of risk factors in this study were defined. HTN as systolic blood pressure (SBP) ≥ 140 mm Hg or diastolic blood pressure (DBP) ≥ 90 mm Hg. HLP were include, Low HDL (less than 40 mg/dL in men or 50 mg/dL in women), high LDL (more than 130 mg/dL) and high TG was identified based on triglycerides more than 150 mg/d. DM as FBS more than126mg/dL. (10). In this study, smokers were considered to be smoking at least 5 cigarettes per day at least in last year. It was not possible to intravenous thrombolytic therapy or any interventional procedures at the mentioned center at the time of this study, although these facilities are now available.

Ethical considerations

The study was approved by the ethics committee (code: MUBABOL.REC.95.42631-3384) of Babol University of Medical Sciences. Informed consent was obtained from each participant or the next of kin before any interview or neurologic examination.

Data analysis

Descriptive characteristics of study subjects according to their urban and rural area of residence were reported as percentages for categorical variables and mean ± SD for continuous variables. The chi square test was used to compare frequencies of gender, and stroke risk assessment between the urban and rural residents. Binary logistic regression modeling was used to estimate the association of HTN, DM, HLP, smoking, and other RFs with living in urban and rural areas. The results were expressed as multivariable adjusted odds ratios (ORs) and 95 % confidence intervals (95 % CIs). A two-sided $p < 0.05$ was considered statistically significant. All data analyses were performed, using SPSS statistical analysis software.

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Results

During one year of study (2016-2017) a total of 241 patients with diagnosis of stroke had inclusion criteria for entering the study. 133 cases (55 %) female and 108 (45 %) cases were male, distribution of stroke type were 213(88.4 %) ischemic vs. 28 (11.6) hemorrhagic. Most of ischemic and hemorrhagic were 127 cases (60 %) thrombotic and 21 cases (75 %) were ICH type respectively (Table 1).

Mean age of ischemic patients was 68.31 ± 13.44 and in hemorrhagic 66.60 ± 14.82, (p = 0.53).

Distribution of residential status was 101 cases (42 %) urban vs. 140 cases (58 %) rural (p > 0.05).

Among urban population, 90.1 % of strokes were ischemic and 9.9 % hemorrhagic while 87.1 % of the rural population was ischemic type and 12.9 % hemorrhagic type. In both populations, the frequency of ischemic stroke was greater than that of hemorrhagic.

Hyperlipidemia was higher seen in ischemic patients that was statistically significant (4 (16.7) hemorrhagic vs. 89 (43) ischemic, p = 0.01). Hyperlipidemia was statistically significant with residential status (50 (50 %) urban vs. 43(32.8 %) rural), which was more in urban than rural (p = 0.01).

Difference in the ischemic subtype was statistically significant with diabetes (54 (43.2 %) thrombotic vs 23(27.1 %) embolic, p = 0.02)

IHD as a stroke risk factors had statistically significant with type of stroke (6 (23.1) hemorrhagic vs. 91(44.8) ischemic, p = 0.03).

Difference in Hemorrhagic stroke had statistically significant with admission status and HTN. One case (14.3 %) SAH vs. ICH 15 (71.4 %) that was moderate score in admission (p = 0.006). In HTN patients 6 cases (31.6 %) were ICH vs. 0 (0 %) SAH (p = < 0.001).

Of all the cases of 213 ischemic strokes, 122 cases (57.3 %) rural and 91 cases (42.7 %) were urban. Among all 28 patients, of hemorrhagic in this study, 18 (64.3 %) were rural and 10 (35.7 %) were urban. There was no significant difference between type of stroke and residential status (p = 0.54).

Based on these finding, among the ischemic stroke patients, thrombotic stroke was significantly higher in the rural population and the incidence of embolic stroke was higher in urban populations (p = 0.02).

Severity of stroke in admission (p = 0.03) and discharge (p = 0.005) were statistically significant with residential status. In admission, 65 patients with mild score (64.4 %) were urban vs. 70 cases (50 %) rural. In discharge scale, 77 cases (76.2 %) were urban vs. 81 cases(57.9 %) rural. 16 cases of hemorrhagic patients (57.1 %) had mild discharge vs. 142 ischemic patients (66.7 %), that was statistically significant (p < 0.001).

Nine cases (32.1 %) of hemorrhagic patients had early mortality vs. 5 ischemic patients (2.3 %) (p < 0.001). Mortality was higher in rural 12 (8.6) vs. urban 2 (1.4) (p = 0.03).

Table 1. Parameters that were consider with sub types of stroke in Babol stroke patients

Variable	Category	Ischemic Stroke		Hemorrhagic		Total	
		Thrombotic	Embolic	SAH	ICH	Ischemic	Hemorrhagic
Gender	Male	52 (40.9)	40 (46.5)	3 (42.9)	13 (61.9)	92 (43.2)	16 (57.1)
	Female	75 (59.1)	46 (53.5)	4 (57.1)	8 (38.1)	121 (56.8)	12 (42.9)
	P-value*	0.48		041		0.22	
Admission status	Mild	68 (53.5)	57 (63.3)	6 (85.7)	4 (19)	125 (58.7)	10 (35.7)
	Moderate	53 (41.7)	29 (33.7)	1 (14.3)	15 (71.4)	82 (38.5)	16(57.1)
	Severe	6 (4.7)	0 (0)	0 (0)	2 (9.5)	6 (2.8)	2 (7.1)
	P-value	0.04		0.006		0.05	
Discharge status	Mild	74 (58.3)	68 (79.1)	5 (71.4)	11 (52.4)	142 (66.7)	16 (57.1)
	Moderate	32 (25.2)	17 (19.8)	0 (0)	1 (4.8)	49 (23)	1 (3.6)
	Severe	17 (13.4)	0 (0)	1 (14.3)	1 (4.8)	17 (8)	2 (7.1)
	Death	4 (3.1)	1 (1.2)	1 (14.3)	8 (38.11)	5 (2.3)	9 (32.1)
	P-value	< 0.001		0.52		< 0.001	
Hypertension	Yes	77 (61.1)	39 (46.4)	0 (0)	6 (31.6)	116 (55.2)	18 (64.3)
	No	49 (38.9)	45 (53.6)	7 (100)	13 (68.4)	94 (44.8)	10 (35.7)
	P-value	0.04		0.14		0.42	
Ischemic Heart Disease	Yes	47 (38.5)	44 (54.3)	-	6 (31.6)	91 (44.8)	6 (23.1)
	No	75 (61.5)	37 (45.7)	7 (100)	13 (68.4)	112 (55.2)	20 (76.9)
	P-value	0.03		0.14		0.03	
Diabetes mellitus	Yes	54 (43.2)	23 (27.1)	1 (14.3)	10 (50)	77 (36.7)	11 (40.7)
	No	71 (56.8)	62 (72.9)	6 (85.7)	10 (50)	133 (63.3)	16 (59.3)
	P-value	0.02		0.18		0.67	
Hyperlipidemia	Yes	50 (41)	39 (45.9)	0 (0)	4 (22.2)	89 (43)	4 (16.7)
	No	72 (59)	46 (54.1)	6 (100)	14 (77.8)	118 (57)	20 (83.3)
	P-value	0.56		0.53		0.01	
Smoking	Yes	29 (23.8)	24 (30)	2 (40)	9 (47.4)	53 (26.2)	11 (45.8)
	No	93 (76.2)	56 (70)	3 (60)	10 (52.6)	149 (73.8)	13 (54.2)
	P-value	0.33		0.99		0.05	

*Data was analyzed by chi- square. **Abbreviations: SAH (subarachnoid hemorrhage), ICH (intracerebral hemorrhage)

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Table 2. Gender of patients, subtypes, severity and risk factors of stroke regarding to residential status in urban or rural

Variable	Category		Residential status		P-value
			urban	rural	
Gender	Male		44 (43.6)	64 (45.7)	0.79
	Female		57 (56.4)	76 (54.3)	
Stroke types	Ischemic		91 (42)	122 (57.3	0.54
	Hemorrhagic		10 (35.7	18 (64.3)	
Stroke subtypes	Ischemic	Thrombotic	46 (36.2)	41 (47.7)	0.02
		Embolic	45 (52.3)	81 (63.8)	
	Hemorrhagic	ICH	6 (28.6)	15 (71.4	0.20
		SAH	4 (57.1)	3 (42.9)	
Admission status	Mild		65 (64.4)	70 (50)	0.03
	Moderate		35 (34.7)	63 (45)	
	Severe		1 (1)	7 (5)	
Discharge status	Mild		77 (76.2)	81 (57.9)	0.005
	Moderate		19 (18.8)	31 (22.1)	
	Severe		3 (3)	16 (11.4)	
	Death		2 (2)	12 (8.6)	
Hypertension	Yes		56 (56)	78 (56.5)	0.99
	No		44 (44)	60 (43.5)	
Ischemic heart disease	Yes		40 (41.7)	57 (42.9)	0.89
	No		56 (58.3)	76 (57.1)	
Diabetes mellitus	Yes		36 (36.4)	52 (37.7)	0.89
	No		63 (63.6)	86 (62.3)	
Hyperlipidemia	Yes		50 (50)	43 (32.8)	0.01
	No		50 (50)	88 (67.2)	
smoking	Yes		31 (32.6)	33 (25.2)	0.23
	No		64 (67.4)	98 (74.8)	

*Data was analyzed by chi- square. **Abbreviations: SAH (subarachnoid hemorrhage), ICH (intracerebral hemorrhage)

Discussion

This study aims to assess differences in the stroke type, risk factors, severity and prognosis according residential status.

Current study showed that stroke cases were higher in rural area, while the rural population has been less than urban in studied area. Dadjo et al. study (11), Hashemi et al. study (12) and Lashkaripour et al. study (13) that concluded no statistically significant difference between residential status and stroke incidence.

Opposed to our findings in Mazaheri et al. study showed that the prevalence of stroke in urban population was higher than rural (14), also in many other studies such as Farghaly et al in Egypt (15), Paramdeep Kaur et al. in India (16), the number of stroke cases in urban areas has been reported higher than rural.

The causes of this difference in the results of our study in north of Iran in Mazandaran province with these studies are probably due to little number of health centers in rural areas, which cannot do screening and prophylaxis for stroke risk factors. The reason why these centers are less in these areas, perhaps because these villages are often scattered and small, but within a short distance of cities, and that it is not possible that each of these villages have an independent preventive health centers and it might be the cause of more prevalence of stroke in rural than urban patients. Harwell et al. (17) reported conflicting about the degree of recognition of stroke symptoms in rural areas. Young et al. (18) expressed that resident in rural areas often have their strokes at locations that are many miles from a tertiary health care center.

Another justification for an increase in stroke incidence in rural areas is considering the changing agricultural pattern which is the main occupation of the inhabitants of the rural areas of the region. Due to the industrialization of many agricultural processes, the amount of physical activity has decreased in farmers in this area. It is recommended to take appropriate measures to solve these problems in the villages of this area and other similar areas which may have issues similar to these.

As to all studies conducted in the field of stroke, the incidence of ischemic stroke was greater than that of hemorrhagic in both populations, but compared to previous study in this area (5) there is a decrease in incidence of hemorrhagic stroke cases.

Based on our findings, difference between types of stroke with residential status was not statistically significant, although hemorrhagic cases were more in rural areas. Along with our findings, many studies, Sridharan et al (19) and Mi et al (20) reported that hemorrhagic stroke was seen significantly more in rural as compared to urban regions.

Difference in stroke type's incidence in rural and urban regions can be referred to many factors that are different between countries and cultures. Perhaps one of its most important causes is the lack of adequate control of risk factors (especially HTN) in rural

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communities (21, 22), leading to an increase in hemorrhagic stroke in these communities. Although in this study the most prevalent risk factors for stroke were HTN, which has been more in rural, but this difference was not statistically significant. Raising awareness about high blood pressure complications, encouragement to reduce salt intake can reduce this risk factor in these communities.

Among the ischemic stroke patients, thrombotic stroke was significantly higher in the rural population and embolic stroke was higher in urban populations that need to more attention to life style, regimes and physical activity both in rural and urban.

Mild and moderate severity of stroke was more in urban while severe status of stroke in admission time was more prevalent in rural patients, this difference was present with higher grade at the time of discharge. In the other studies, some causes expressed for difference between severity of stroke in rural and urban stroke areas. Harwell et al. (17) reported conflicting about the degree of recognition of stroke symptoms in rural areas and Young J et al. (18) expressed that resident in rural areas often have their strokes at locations that are many miles from a tertiary health care center.

In our study the early mortality rate was higher in rural than urban cases. Similar to our findings, some studies have reported higher mortality rates of rural areas stroke, include of northern Portugal and China (23-24) that is in line with Kaup et al. (25) study, in 2015, which founded a significant difference between the mortality rate and the residential status. In Howard et al. (26) study, the higher stroke mortality in rural regions seemed to be attributable to higher stroke incidence rather than case fatality in Nishi et al. study (27), stroke mortality has decreased in parallel with the urbanization of rural areas in Japan, so tendency for stroke mortality to be higher in rural areas than in urban areas.

Patra et al. reported that, the rural population had a slower decline in stroke mortality than the urban population (28).

However rural dweller due low health facilities rather urban and distance to health service center need to more attention and increased access to health services. Rural dweller should be more aware about stroke risk factors, stroke symptoms and signs that need to more education, and in the stroke onset, early reference or transport to large health care center in city.

In this study hyperlipidemia was significantly more in urban than rural. Worldwide and also in developing countries, urban dweller had higher rates of overweight and obesity as well as hyperlipidemia in compare to rural participants (29). This difference can be due to difference in job and lifestyle in urban and rural resident.

HTN as a most prevalent risk factors for stroke was more prevalent in rural than urban patients which may be one of the causes of more stroke in rural area and more frequency of hemorrhagic stroke in rural area. In other studies in developing countries such as Nakibuuka et al. (22) study in Uganda, HTN was the most prevalent stroke-risk factors with significant differences in prevalence between rural and urban populations.

IHD significantly was more frequent in ischemic stroke than hemorrhagic type while Dadjo et al. in their study in Iran founded that there was no significant difference between type of stroke and IHD as a stroke risk factor (11). Although, IHD is a classic risk factor of stroke.

In ischemic patients, diabetes was higher seen in thrombotic patients. Although in this study there was no significant relation between DM in rural and urban stroke, in most studies such as Mohan et al. found that frequency of DM in urban populations was more than rural area. In Mohan et al. (30) a total of 34194 subjects were screened and the prevalence of diabetes was 2.1 % in urban subjects and 1.5 % in rural populations. Increased frequency of DM in urban maybe refers to different job and life styles in these different populations.

Smoking as a stroke risk factor had not statistically significant with residential place of our stroke patients, however it frequency was more in urban than rural which must be described as the result of different job and life styles in these different populations.

Small population of the studied patients which make loss of the power statistical analysis and lack of long-term follow-up of cases were the main limitations of this study, lack of evaluation of different variables in the presence of age and sex variables is another limitation.

The strengths of this study are evaluation of the association of residential status of stroke patients with subtypes of stroke and stroke risk factors and stroke severity.

Conclusion

Results of this study show high frequency of stroke in the rural population. Embolic stroke and Hyperlipidemia was higher in urban population and thrombotic stroke in rural populations.

Rural dweller should be aware about unhealthy lifestyles, stroke risk factors, stroke symptoms and sign that need to education, and early reference or transport of stroke cases to comprehensive health care center in city. On other hand urban dweller should be attention to lifestyle, physical activity and decrease high cholesterol food consumption because of high prevalence of embolic stroke and hyperlipidemia. Stroke is a preventable disease, primary prevention and control strategies according residential status suggest, in order to prevent risk factors especially HTN, hyperlipidemia and diabetes. Increase basic health service with trained nurse and rural resident gnarl physician is recommended.

Conflicts of interest

The authors report that they have no conflicts of interest related to our paper.

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Author's contribution

Study design: PS, AAA, AD
Interpretation of data: AAA, MK, RM, SF, FF
Acquisition of data: RM, SF, FF, AD
Revising the article: AAA, SA
Analysis: SK
Final approval: All authors

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