A Stroke Study of an Urban Area of Iran: Risk Factors, Length of Stay, Case Fatality, and Discharge Destination

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Background: The Iranian population is aging rapidly, which causes huge medical concern for health care of this population. This trend will lead to an increase in stroke incidence in the future. The aim of this study was to investigate the epidemiologic patterns, risk factors, length of hospitalization, hospital discharge destination, and case fatality of patients with ischemic stroke from a city of Iran as well as analyses of interaction of these factors. *Methods:* A cross-sectional, multihospital-based study was performed on all consecutively discharged and diagnosed patients with ischemic stroke in the city of Qom, Iran, between March 2006 and September 2008. *Results:* A total of 953 patients, 48.9% men and 51.1% women, were included. The mean age was 68 ± 13.82 years. Hypertension was found in 64% of patients, followed by diabetes mellitus (36%), heart disease (34%), hypercholesterolemia (32%), and smoking (20%). The average length of stay (LOS) was 7.7 days (95% confidence interval 7.2-8.2). Women had a significantly longer LOS compared with men (8.4 *v* 7 days, $P = .0075$) and patients with heart disease had a significantly longer LOS (9 days, 95% confidence interval 7.8-10, $P = .004$). Overall 1-month fatality rate was 15.3%. *Conclusion:* Hypertension and diabetes mellitus are more frequent here than average global findings. One-month case fatality was higher than in European countries but less than in developing countries. The most interesting difference comparing developed countries is the destination, which should be addressed. We strongly recommend establishing a stroke registry, establishing primary prevention, and promoting rehabilitation facilities in Iran. **Key Words:** Iran—stroke—outcomes—risk factors analysis.

The annual incidence of stroke is 15 millions worldwide; one third of these patients will die and one third will experience permanent disability.[1] More than 85% of these deaths will be in people living in low- and middle-income countries.[2] The major type of stroke is ischemic, where the causes, clinical presentations, risk factors, and outcomes are heterogeneous and these factors are essential for initial stroke management.[3] Outcome after stroke varies from country to country, and recent studies have sought to explain the variation in outcome.[4]

There are a number of stroke registries from different countries and continents[5] that provide us with useful knowledge and important information concerning epidemiology, risk factors, mechanism, subtypes, and outcomes. Several studies have found an association between inhospital fatality rate and sex, older age, previous stroke, and some risk factors.[6] However, there are no published comprehensive Iranian hospital-based studies providing us with data in this field.

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The Iranian population is aging rapidly, which causes huge medical concern for health care of this population.[7,8] According to the latest census performed in Iran, the population aged 60 years and older constituted 6.6% of the whole population (71 million), which accounts for more than 4 million people.[7] The increase of the elderly population in Iran during the last decade is partly due to an improvement of health.[9] This trend will lead to an increase in stroke incidence in the future[9] with ischemic stroke as the major subtype, implying a major problem with its consequences to both patients and society, calling for a comprehensive management program of stroke.

Aim

The aim of this study was to investigate the demographics, comorbidity, risk factors, length of hospitalization, hospital discharge destination, and case fatality of patients with ischemic stroke from a city of Iran as well as analyses of interaction of these factors.

Methods

Study Design

A cross-sectional, multihospital-based study was performed on all consecutively discharged and diagnosed patients with ischemic stroke in the city of Qom, Iran, between March 2006 and September 2008. The University of Social Welfare and Rehabilitation Ethics Committee, Tehran, Iran, approved the study.

Study Area and Population

Qom is a city of Iran situated 156 km southwest of Tehran (the capital of Iran) and is the capital of the Qom Province. Five hospitals are located in and near the urban area of Qom with an average of 872 beds. The area covered about 1,046,737 inhabitants in 2006 with a sex proportion of 51.3% male and 48.7% female. The age distribution of the population was at that time 83% aged 0 to 44 years, 12.4% aged 45 to 64 years, and 4.6% older than 65 years.[10]

Case-finding Procedures

We screened for all patients with ischemic stroke by searching all medical documents and the discharge diagnosis register at Qom hospitals. The diagnosis was based on clinical findings by an experienced neurologist, confirmed in each case by computed tomography or magnetic resonance imaging. We performed a screening of all medical records by searching for the classifications of *International Statistical Classification of Diseases, 10th Revision*: G45, G81, G83, I60 to I67, and I69 as well as stroke-related terminologies (cerebrovascular accident, cerebral infarction, and brain infarction). We also used a cross-sectional method for case ascertainment consisting of screening of all patient discharge lists of the emergency and neurology departments at the Qom hospitals. Patients were followed up through ambulatory visits to the hospital. Those who failed to attend the follow-up were contacted and interviewed by telephone and, if not possible, their relatives were contacted. As complementary information they were interviewed face to face or by telephone regarding the presence of risk factors prior to stroke, activities of daily living (ADL) after stroke, and discharge destination from the acute care hospital. Fatality figures after discharge were received from family members, caregivers, or medical records.

We used standard systematic computer coding of data analyzing demographic features, age proportions, sex differences, established cerebrovascular risk factors, history of stroke and length of hospitalization, hospital discharge destination, and fatality rate. ADL was analyzed by Barthel Index (BI) score from all patients with ischemic stroke 4 months after discharge. All data were first coded on a single data sheet and the sheet was reviewed by one of our team members before being entered into the computerized data bank.

Inclusion and Exclusion Criteria

All patients with ischemic stroke fulfilling the World Health Organization definition of ischemic stroke[11] were enrolled during the current study period. Patients with hemorrhagic stroke were excluded, as the study focus was on ischemic stroke being the major part of stroke panorama, thus representing the major health care burden on society. Moreover, only these ischemic stroke patients were later on recruited to participate in an intervention study aiming at reducing neurological dysfunction. Cases with neurologic deficits secondary to previous epilepsy, tumor, infection, craniotomy, or metabolic or traumatic causes were also excluded.

Definition of Variables

Hypertension (HTN) was defined as a history of HTN or reported blood pressure greater than 140 mm Hg (systolic) or 90 mm Hg (diastolic).[12]

Diabetes mellitus (DM) was defined as patient's self-report of DM or persistent fasting hyperglycemia higher than 110 mg/dL after stroke.[13]

Hyperlipidemia (HLP) was defined as history of HLP, taking lipid-lowering drugs, or persistent elevation of total cholesterol higher than 200 mg/dL.[14]

Ischemic heart disease (IHD) was defined as reported angina pectoris, myocardial infarction, previous percutaneous transluminal cardiac stenting, coronary bypass graft, or cardiac arrhythmias.[15]

Smoking was defined as current daily use of cigarettes, cigars, or pipe.[16]

The length of stay (LOS) for a single stroke hospitalization was defined as the time spent in hospital from

admission until death, discharge to home, or discharge to other residential institution.[17]

At-hospital, 30-day, 90-day, and 180-day case fatality was defined as the proportion of strokes where death occurred within these time limits.[18]

Discharge destination was defined as discharge destination from acute care hospital to home, nursing home, rehabilitation unit, or other hospitals.

Statistical Methods

All statistical analyses were conducted with SAS (Statistical Analysis System, Institute Inc., Cary, NC) version 9.1. Comparisons between variables with two levels were analyzed with proc *t* test. In contingency tables data were analyzed using proc freq and Chi-square statistic. Fatality rates were analyzed using logit regression by proc catmod in SAS.

Results

A total of 953 patients, 466 men (48.9%) and 487 women (51.1%), given the diagnosis of ischemic stroke were discharged from the 5 hospitals from March 2006 to September 2008. Patient characteristics and demographics are presented in Table 1. The mean age of patients was 68 ± 13.8 years (range 27-104; 68 ± 14.3 for men and 68 ± 13.4 for women). A total of 47 (4.93%) patients were younger than 45 years and 611 (64.1) patients were older than 65 years. No risk factors were found in 91 patients (9.5%) and 862 (90.5%) had at least one risk factor. Overall, women smoked less than men but had more HTN, DM, IHD, and HLP. Through logistic regression analysis we found HTN to be the risk factor with greatest impact on ischemic stroke (64%) followed by DM (36%), IHD (34%), hypercholesterolemia (32%), and smoking (20%). Median BI score at 4 months was 85 with an interquartile range from 55 to 100. BI was significantly associated with the number of risk factors ($P = .046$). All patients were discharged with secondary ischemic stroke prevention medication: antiplatelet agents in 96% and 4% with warfarin. The antiplatelet regimes were 25% with aspirin at 80 mg/day, 28% with clopidogrel at 75 mg/day, a combination therapy with aspirin at 80 mg/day plus dipyridamole at 76 mg × 3/day in 27%, and clopidogrel at 75 mg/day plus aspirin at 80 mg/day in 16%.

LOS at Hospital

The average LOS for all ischemic stroke-related admissions was 7.7 days (95% confidence interval 7.2-8.2). Women had a significantly longer LOS compared with men (8.4 *v* 7 days, $P = .0075$) and patients with IHD had a significantly longer LOS (8.9 days, 95% confidence interval 8-10, $P = .004$). No significant association between LOS and age groups, recurrent stroke, HTN, DM, HLP, or smoking was observed (Table 2).

Fatality

The overall proportion of stroke fatality rate was 1.8% (17/953) at hospital, 15.3% (146/953) at 1 month, 18.8% (180/953) at 3 months, and 20.5% (196/953) at 6 months after stroke onset. No statistically significant sex differences were found for fatality rate (24.8% for women and 20% for men, $P = .08$). HTN was the most frequent risk factor for fatality, which was followed by IHD, hypercholesterolemia, and DM. The mean number of risk factors per person who died at hospital, 1 month, 3 months, and 6 months after stroke onset were 2.2, 1.8, 1.8, and 1.5, respectively (Table 3).

Discussion

As expected, stroke risk increased sharply with aging, consistent with United Kingdom[19] and international[20] studies. Most patients in the current study developed stroke after the age of 45 years, and the majority were older than 65 years, in agreement with previously published Iranian studies.[21] Our data have not confirmed the general trend of a male-dominant pattern in stroke. In this study, the majority of patients were women, in contrast to the results of a recent statewide study.[5] Although existing evidence suggests women are, on average, older than men at stroke onset,[5] surprisingly the mean age of men and women in our study was similar (68 *v* 67.96). It could be that the women were more likely to have a history of HTN[6,17] and HLP,[22] corroborating the findings from other studies.[23] The reason for this finding is not absolutely certain but it could be implied that women are more prone to have undiscovered or untreated risk factors than men or are prescribed a less effective anti-HTN treatment.[24] Not surprisingly, we also found that men were more likely to smoke.[25]

We did not find statistically significant differences in rate of stroke, medical history of stroke, IHD, or DM in men and women, although other studies have found that men were more likely to have prior stroke and diabetes.[26] Although cardiovascular risk factors seem to have similar effects in different populations,[27] this study aimed at examining the role of known stroke risk factors in Iranian patients with ischemic stroke.

The prevalence of prior stroke was 28.8%, suggesting that history of stroke is also an important risk factor and is higher than the 22.4% reported in a recent study from the Khorasan province of Iran.[24] It could also imply that the medical preventive treatment at discharge is not optimal.

This study found that sex could affect the LOS for patients with ischemic stroke, with female patients staying longer than male patients. This is consistent with other findings that female stroke survivors stayed longer in hospital than male stroke survivors.[24] The longer LOS of female patients has earlier been associated with more severe disability[24,28] or a lack of social and family support.[29]

Table 1. *Characteristics of the 953 patients with ischemic stroke included in analysis stratified by sex*

Characteristic	Total		Female		Male		*P* value*
	N	%	N	%	N	%	
Total patients	953	100	487	51.1	466	48.9	.5
Age (y), mean ± SD	68 ± 13.8		68 ± 13.4		67.9 ± 14.3		
Age group (y)							
<45	47	4.9	20	2.1	27	2.8	.3
45-64	295	31	156	16.4	139	14.6	.3
≥65	611	64.1	311	32.6	300	31.5	.7
Risk factors:							
None	91	10	34	37	57	63	.016
All	9	1	2	22	7	78	.1
HTN	610	64	347	71	263	56	.0005
DM	343	36	198	41	145	32	.085
IHD	324	34	174	36	150	31	.34
HL	305	32	187	38	118	24	.01
Smoking	190	20	44	9	146	32	.001

Abbreviations: DM, diabetes mellitus; HL, hyperlipidemia; HTN, hypertension; IHD, ischemic heart disease.
*From Chi-square test.

Fatality Rate

Stroke fatality rate has been used as a surrogate measure of hospital performance and quality of care to compare hospitals, provinces, and countries.[30] In this study, the overall fatality of the patients with ischemic stroke was 22% in the first 6 months and the 30-day fatality rate was 15.3%. The 30-day fatality rate reported from other major registries ranges from 5.6% to 8.5%.[31] The fatality rate was higher than those reported in Western countries[5] and from Korea[32] but smaller than reported from a previous Iranian study.[33] It may reflect the general trend of declining fatality rate, the inclusion of more patients with smaller lesions detected as a result of increasing the number of computed tomography facilities in hospitals, providing Qom emergency staff with guidelines of detection and treatment of stroke, and increase of the number of neurologists in Qom from 3 in 2001 to 7 in 2008.

In contrast with previous studies that women had a higher overall crude stroke mortality,[34] we did not find that sex was statistically associated with death after stroke. The fatality rate in our study was 20% in men compared with 24.8% in women, which is in line with the reports from other studies. In the Canadian registry, no sex difference in fatality rate was found.[25]

Table 2. *Characteristics of the 953 patients with ischemic stroke included in analysis stratified by length of stay*

Characteristic	LOS	*P* value
Male and female	7.71	.0075
Male	7	
Female	8.4	
Age group (y)		
≤45	6.2	.7
46-64	6.9	
≥65	8.2	
HTN		
Yes	7.7	.88
No	7.8	
DM		
Yes	8.4	.08
No	7.3	
IHD		
Yes	8.9	.005
No	7.1	
HL		
Yes	7.3	.26
No	7.9	
Smoking		
Yes	7.3	.14
No	8.3	

Abbreviations: DM, diabetes mellitus; HL, hyperlipidemia; HTN, hypertension; IHD, ischemic heart disease; LOS, length of stay.

Outcome

ADL was not associated with LOS of patients but was significantly associated with the mean number of risk factors. The figures of BI were in line with the reports from one other study.[35] Unfortunately intravenous thrombolysis has not yet been introduced in the management protocol of acute ischemic stroke in Iran, which probably will affect the ADL outcome after being launched.

Discharge Destination

Almost all patients were likely to go home after hospital discharge and only 2.2% of them were admitted to

Table 3. *Characteristics of fatality*

	All	Hospital stroke fatality		30-d Stroke fatality		90-d Stroke fatality		180-d Stroke fatality	
Characteristic	N	N	%	N	%	N	%	N	%
Male and female	196	17	1.8	146	15.3	180	18.8	196	20.5
Male	86	6	0.6	63	6.6	76	8	86	9
Female	110	11	1.1	84	8.8	104	10.9	110	11.5
Age (y), mean ± SD	73.3 ± 12.9	73.6 ± 10.3		73.2 ± 14.1		75.1 ± 7.9		73.6 ± 13.8	
Age group (y)									
<45	5	0	0	4	2	5	2.5	0	0
46-64	32	3	1.5	25	12.8	28	14.3	32	16.3
≥65	159	14	7.1	117	59.7	147	75	159	81.1
Mean No. of risk factors		2.2		1.8		1.8		1.48	

a nursing home; this is not surprising due to the lack of inpatient and day rehabilitation centers in Qom. Moreover, the Iranian hospital culture, not furnished with stroke units or registers, implies that the vast majority of patients postdischarge are cared for at home by family members with limited support from society or professional caregivers. The medical follow-up is performed by primary care physicians or outpatient visits at the hospitals by internists. Thus we strongly recommend establishing and equipping inpatient and day rehabilitation centers for patients in subacute phase of stroke.

Limitations

There were some limitations in our study. It was not a population-based but multihospital-based study. Case finding was performed through screening of medical records, probably excluding patients with mild stroke, because of their not being admitted to a hospital. Moreover, we did not have data on the severity of stroke and were not able to discriminate between different ischemic stroke subtypes, thereby we were not able to differentiate possible differences in risk factors between these subtypes. The study design was well equipped to consider detailed information on many aspects of acute and subacute stroke care, however, there were only sparse data on clinical information possibly affecting LOS.

We believe our results have high internal validity and are expandable to the whole of Iran. This study is not a broad population-based study, but it will be of great value for further studies determining epidemiologic features, risk factors, and outcome of stroke. This will increase our knowledge of stroke epidemiology and facilitate health care planning, prevention, and management of stroke in Qom. We had some problems with the patient follow-up either by telephone or inviting them to our clinics, the main problem being not having a stroke registry system in Iran at all contributing to the problems with contacting the patients. Moreover, some of the telephone numbers were changed or were disconnected (about 15%) making it problematic to get in contact. Some of the patients also had difficulties in coming to the clinic for follow-up (e.g., transportation difficulties, health problems, long distance). Thus, we are strongly recommending the establishment of a stroke registry system in Qom and, hopefully, the whole of Iran like in Western countries to optimize a well-functioning stroke service to stroke victims.

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