Southern Egypt Stroke Study: Case Fatality Rates in a Hospital-Based Setting

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Southern Egypt Stroke Study: Case Fatality Rates in a Hospital-Based Setting

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Abstract: *Background:* The best approach to reduce the burden of stroke remains prevention. The large majority of epidemiological data available focus only on western countries. A better knowledge of stroke patients characteristics in Middle East and African communities will help to promote tailored campaigns by health care authorities and medical societies.

Objectives: to determine the characteristics of hospitalized stroke patients and case fatality in Upper Egypt governorates areas (Sohag, Quena, Aswan).

Methods: prospective hospital-based study carried out in the Neurology department of Sohag University hospital, involved 467 consecutive stroke patients. Demographic data, stroke-subtypes, risk factors, and stroke outcome, were analyzed. The study population was a consecutive series of patients admitted in the main tertiary health care level hospital of the area.

Results: hemorrhagic strokes reported in 37.5% of cases. Fifty six % were above 60 years and 8.6% were juvenile events. Sixty two % of stroke occurred in autumn-winter. Hemorrhagic stroke was higher in spring-summer (53%). Hypertension was the more frequent risk factor reported in 42% of patients. In the study population smoking was present in 37.7%, ischemic heart diseases in 32.8%, dyslipidaemia in 29.5%, Diabetes (DM) in 21.6%, past history of stroke in 10.5%, obesity in 10.1%, positive family history for stroke in 9.6%, atrial fibrillation in 6%, Rheumatic heart disease (RHD) in 5.6% of patients and alcohol abuse in 1.3%. The 1-month case fatality rate was 27.8%.

Conclusion: In Upper Egypt, we reported higher prevalences of hemorrhagic events, juvenile strokes and RHD compared with other studies.

INTRODUCTION

Stroke now ranks as the second leading cause of death and the first cause of morbidity allover the world. Among all the neurological diseases of adult life, stroke clearly ranks first in frequency and importance, at least 50% of the neurological disorders in a hospitalized patients are of this type [1-3].

Despite advances in medical care of stroke and the advent of treatment of selected patients with acute ischemic stroke, prevention remains the best approach to reduce the burden of stroke. High–risk or stroke-prone individuals can be identified and targeted for specific interventions [4-6]. The prevalence of stroke is heterogeneous and is greater among the elderly and men and is variable from one region to another of the world [7]. Few data are available on Middle East and the developing countries of the African continent.

The aim of this survey was to study the characteristics of hospitalized stroke patients in upper Egypt, with regard to the relative prevalence of different stroke-subtypes, the demographic data and the prevalence of risk factors. A specific pattern of habits and demographic variables between genders is likely to be present in the study population (for religious and socio-economical reasons). The study enrolled all stroke patients admitted to the neurology departement of Sohag University Hospital during the study period.

DEMOGRAPHY IN EGYPT

Egypt is the most populated country in the Middle East and the second-most populous on the African continent, with an estimated 78 million people. Almost all the population is concentrated along the banks of the Nile (notably Cairo and Alexandria), in the Delta and near the Suez Canal. Egyptians can be divided demographically into those who live in the major urban centers and the fellahin or farmers of rural villages. The last 40 years have seen a rapid increase in population due to medical advances and massive increase in agricultural productivity.

Egyptians are by far the largest ethnic group in Egypt at 94% (about 72.5 million) of the total population. Ethnic minorities include the Bedouin Arab tribes living in the eastern deserts and the Sinai Peninsula, the Berber-speaking Siwis (Amazigh) of the Siwa Oasis, and the ancient Nubian communities living in cities in Lower Egypt and in villages clus-

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tered along the Nile in Upper Egypt. There are also tribal communities of Beja concentrated in the south-eastern-most corner of the country, and a number of Dom clans mostly in the Nile Delta and Faiyum who are progressively becoming assimilated as urbanization increases.

Egypt also hosts an unknown number of refugees and asylum seekers, but they are estimated to be between 500,000 and 3 million. There are some 70,000 Palestinian refugees, and about 150,000 recently arrived Iraqi refugees, but the number of the largest group, the Sudanese, is contested.

Egypt is divided into 28 governorates (in Arabic, called muhafazat). The governorates are further divided into regions (markazes). Sohag is the main tertiary health care level among the southern governorates (Sohag, Quena, and Aswan) (Fig. **1**). Located about 72 miles south of Asyut, the City of Sohag is the capital of the Sohag governorate. It is also a major Coptic Christian center for Upper Egypt. Socio-economic indicators show it to be the poorest or the second poorest governorate in Egypt on the basis of population pressure on land, illiteracy and infrastructure. A high proportion of rural households are either landless (42%) or tenants with precarious tenancy contracts (18%). The Governorate's total population reached 3 million in 1995, distributed in 461,600 households. The overall gender balance of the population suggests that out-migration has had little demographic impact, with 51% of the population male and 49% female. The rate of population increase is high at 2.7%, or more than 0.5% higher than the national average. International agencies gives a rate of 2.8% annual increase in 1992, showing a sig-

nificant drop from the late 1980s, as it was 3.6% in 1987 and 3.1% in 1990. Population density in the area is extremely high, with about 1,900 people/km2, the highest being in Akhmeem district, with 2,805 persons/km2 and the lowest in Dar as Salaam district with 1341 persons/km2. The local hospital, is the main tertiary centre of the southern governatorates, having around 50 beds, admitting patients 24hrs a day, 7 days at week. The study population comes from the urban area of the city and rural ones of the above mentioned governatorates.

Health care facilities are limited in the rural areas. In the Governorate there are 149 rural health units, one school health unit, 35 health centers and 9 hospitals (admitting non selected patients). Although the overall number of health facilities in the Governorate is reasonable, existing facilities are primarily in the towns and many of them are insufficiently equipped, as well as lacking most basic supplies for much of the time. This lack of facilities and supplies is in a context of extremely high population density and a very low standard of hygiene, with canal water being used by children for playing and fishing, as well as by livestock and also often by women for laundry and dishwashing. The canal water carries whatever impurities have been dropped in the Nile from Uganda onwards. In this area no emergency transport system exist (*i.e.* 911), paramedical transport services are available but the large majority of patients reaches the medical centre with private means. In the study period the acute stroke unit was not available, and stroke patients were admitted in the large majority of cases in neurology wards. The main destination of patients at discharge was home, a small
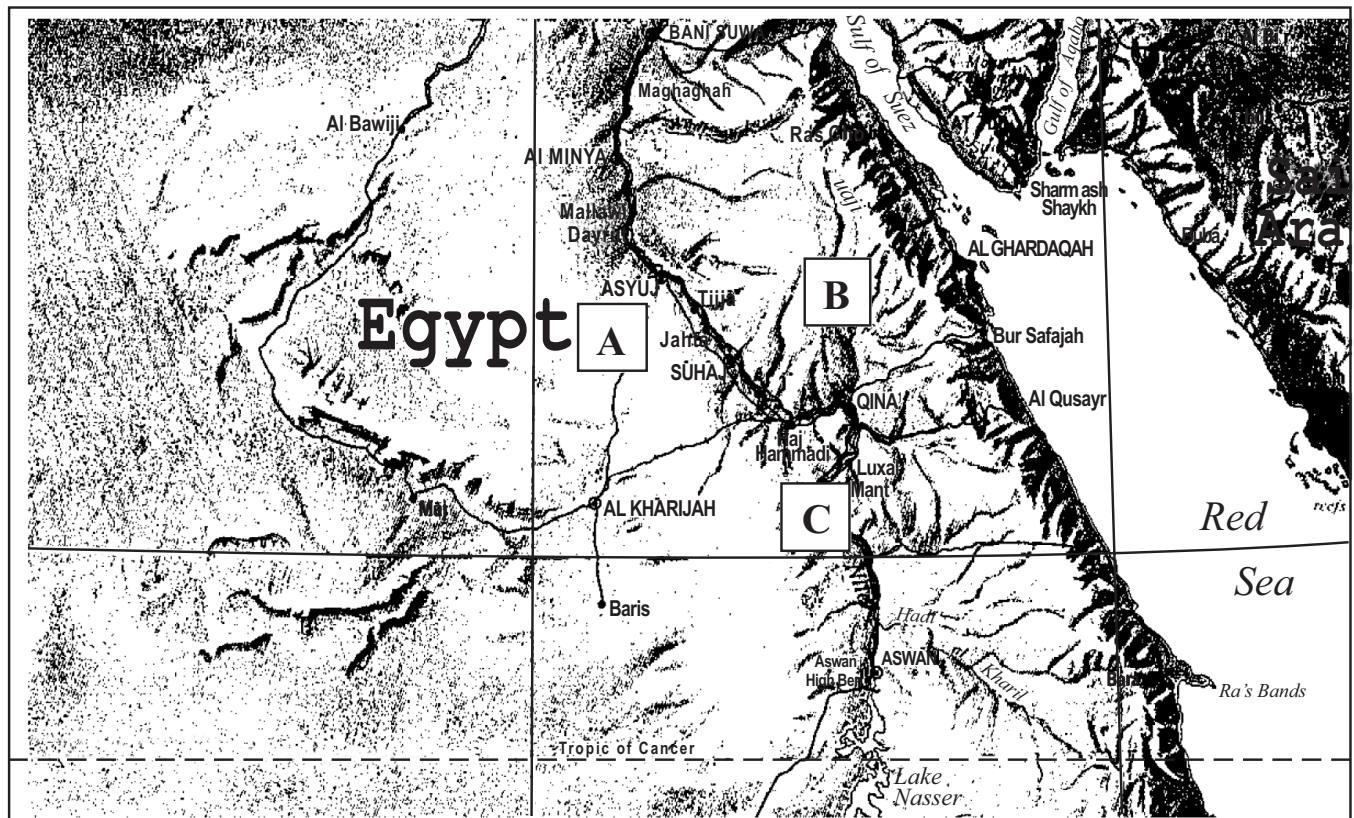

Fig. (1). Upper Egypt area and the 3 governatorates. **A**: Sohag; **B**: Quena; **C**: Aswan.

number of subjects is referred to rehabilitation facilities/programmes. The study was designed to be a prospective hospital based study.

PATIENTS AND METHODS

The study involved 467 stroke-patients consecutively admitted in the Neurology department of Sohag University in the study period.

All patients of the study were subjected to the following:

*Detailed medical history interview

*Thorough general and neurological examinations

*Cranial computed tomography (CT) scanning using CT equipment Siemens, Somatom, HIQS, VB2 with tissue matrix=256x256,one second scanning time and 10 mm slice thickness.

Stroke-subtype was diagnosed, and non-stroke patients were excluded.

*The following investigations were done to define risk factors:

- Electrocardiography & Echocardiography to define relevant cardiac problems, history of myocardial infarction, coronary artery disease, congestive heart failure, arrythmia or valvular heart diseases.

- Blood sugar: Diabetes mellitus (DM), defined as venous plasma level of glucose > 7.0 mmol/l (>126 mg/dl) or under hypoglycemic treatment.

- Complete lipogram: Dyslipidemia defined as venous plasma level of LDL cholesterol > 3.36 mmol/l (> 130 mg/dl) and/or Triglycerides > 1.8 mmol/l (>160 mg/dl).

• The following risk factors were defined:

- Arterial hypertension defined as systolic blood pressure >140 mmHg, diastolic blood pressure > 80 mmHg or antihypertensive treatment.

- Smoking: active smoking or not.

- Alcohol abuse active >300 gr/week.

- Over-weight, obesity: body mass index $\geq 27 kg/m^2$

- Family history of stroke.

- Previous history of stroke or transient ischemic attacks (TIA).

- Education: > 6 years education-yes or no.

- Oral contraceptives use.

Follow-up: one month after stroke to define the vital outcome.

Statistical analysis: data coding and analysis using the SPSS 11.0 version were done, our resuls, were analysed using Odds Ratio, Risk limits, and P value.

RESULTS

Mean age at enrollment in the study populationwas 57.7 years, the median age was 60 years, range: 16 – 90 years. Hemorrhagic stroke prevalence was reported in 37.5% and infarction in 62.5%. Fifty six % were above 60 years and

8.6% were below 46 years. Sixty two % of stroke occurred in autumn-winter. Hemorrhagic stroke was higher in spring-summer (53%). Fifty seven % of stroke involved residents in rural areas. Hypertension reported in 42% of patients, more in males 59%, more in > 40years (97.4%), smoking in 37.7%, ischemic heart diseases in 32.8%, dyslipidaemia in 29.5%, history of TIA in 23.1%, DM in 21.6%, past medical history of stroke in 10.5%, obesity in 10.1%, Positive family history of stroke in 9.6%, atrial fibrillation in 6%, RHD in 5.6% of patients and alcohol abuse in only 1.3% of cases.

At the univariate analysis the prevalence of juvenile events was found higher in the female gender (11.5% vs 6.2%). A peculiar seasonal trend was found: in spring-summer the prevalence of hemorrhagic events reached the highest values with a 47.4% of the total. Regarding the educational level, those below 6 years of school more often suffered of an hemorrhagic event (Table **1**).

Regarding demographics we found how smoking habit was more diffuse in the male gender (84% of smokers were males) while alphabetization was lower in female gender. Males had also more often a positive familiar history for vascular events (86% vs 13.3). At the 1-month follow-up contact 130 subjects were dead, with a case fatality rate of 27.8% (Table **2**).

The vascular risk factors were analyzed for age groups showing how DM was more diffused in older adults (21.6%) like hypertension (42.0%). Twenty-six patients had history of RHD, the 5.6% of the total. (Table **3**).

DISCUSSION

Regarding stroke subtypes, we reported a high prevalence of hemorrhagic stroke (37.5%). This proportion is one of the highest rates compared with other national studies, where in Ain shams (Cairo, Egypt) study [8-12], it was 22% for hemorrhage and 75% infarction, also our result is still higher than most of the international results where in many European studies it was 83% for infarction and 17% for hemorrhage [13-17]. In non European surveys such as Japan it was found at 30.5% for hemorrhage and 69.5% for ischemic [18] also in China it was reported to be 12 up to 48% for cerebral hemorrhage [19]. It is well documented that the pathological patterns of stroke, stroke subtypes and stroke risk factors vary widely between racial groups (blacks, whites, hispanics), also these variations related risks may be related to environmental related risk factors or inherited risk factors [19-24]. The possible reasons for the higher incidence of cerebral hemorrhage in southern Egypt population in our study include the following, firstly, most of the populations in southern Egypt belongs to blacks, who usually carry a higher prevalence of hypertension. High prevalence of hypertension is reported in other studies [24, 25], in our study hypertension was found up to 55% in hemorrhagic stroke patients p<0.001 % O.R.>1.6. Secondly, in southern Egypt, most of the populations are still following the traditional traits of marriage of related family members with potential consequence of inheritance of some of stroke related risk factors including hypertension, vascular malformations. Interestingly in our study we reported higher incidence of positive family history in our stroke patients (9.6%), and 29% of those with positive family history were presented with cerebral hemorrhage and most of those hemorrhagic

Table 1.   **Distribution of Stroke Subtypes and Demographic Differentials**

Item No. Column %	Infarction N = 292 (62.5%)		Hemorrhage N = 175 (37.5%)		Total N = 467 (100%)		P*
	No.	%	No.	%	No.	%	
Gender:							
---Male	161	55.1	98	56.0	259	55.5	NS
-- < 40 y.	11	6.8	5	5.1	16	6.2	
-- ≥ 40 y.	150	93.2	93	94.9	243	93.8	
---Female	131	44.9	77	44.0	208	44.5	NS
-- < 40 y.	15	11.5	9	11.7	24	11.5	
-- ≥ 40 y.	116	88.5	68	88.3	184	88.5	
P** value	NS						
Age at enrollment*:							
---< 40 years	26	8.9	14	8.0	40	8.6	
--- 40 – 60	106	36.3	58	33.1	164	35.1	
---> 60 years	160	54.8	103	58.9	263	56.3	
P value	NS						
Residence:							
---Rural	164	56.2	107	61.1	271	56.9	
---Urban	128	43.8	68	38.9	196	43.1	
P value	NS						
Education:							
---Educated	124	42.5	28	16.0	152	32.5	
---Non-educated	168	57.5	147	84.0	315	67.5	
P value	<0.001						
Seasonal variation:							
---Aut.-winter	197	67.5	92	52.6	289	61.9	
---Spr.-summer	95	32.5	83	47.4	178	38.1	
P value	0.001						

*NS = insignificant statistical difference. **P*** = statistical difference between sub-items, **P**** = statistical difference between items.
Mean age at enrollment = [57.7 ± 12.9] years, the median = 60 years, the infarction started at 16 years old while the hemorrhage started at 21 years of age.

strokes, their CT or MRI showed large lobar and/or intraventricular hemorrhage with great possibility of rupture of underlying vascular malformations. Previous reports stated that the site of hemorrhage shown on CT provides some clue to the cause, where hypertensive hemorrhage tend to occur slightly more in the basal ganglia, thalamus and pons, while lobar hemorrhage tend to be more often due to cerebral amyloid angiopathy, vascular malformations, and hemostatic failure [26, 27]. Also primary ventricular hemorrhage may be due more often to vascular malformation [28, 29]. Intracrainial vascular malformations are properly congenital or familial [30]. A few strokes are clearly familial in the studied population with a simple Mendelian pattern of inheritance of the underlying cause [31, 32].

Thirdly, the effect of the characteristic higher environmental temperature of southern Egypt, in this high temperature climates, central nervous system dysfunction may occur including intracerebral hemorrhage, this dysfunction can be explained by a number of potential pathogenetic mechanisms including disidratation and rehydratation syndromes leading to tissue swelling and brain edema. In many critical weeks of the year the temperature rise over 40°C. Temperature elevation its itself a threat for the central nervous system and to the body in general The excessive amounts of the released exitotoxic glutamets [33] may cause an encephalopathy, including seizures. Hemorrhages may occur in various organs including the brain. This are small lesions related to endothelial damage and disseminated intravascular coagulation. Areas showing maximal damage are cortex, thalamus and striatum.

Mortality rate in our study after one month was 27.8%, this rate is higher than that reported by many other western

Table 2.   Demographic Data and Risk Factors Distribution According to Gender in the Study Population

Item	Total No. of Cases (%)	Male (n = 259)		Female (n = 208)		P
		No. of Cases	Row %	No. of Cases	Row %	
Sociodemographic Data						
Education --Educated --Non- educated	 152 (32.5%) 315 (67.5%)	 138 264	 90.8 83.8	 14 51	 9.2 16.2	 0.04
+ve family history	45 (9.6%)	39	86.7	6	13.3	0.000
Previous attack	49 (10.5%)	32	65.3	17	34.7	NS
Obesity+	47 (10.1%)	16	34.1	31	65.9	.001
Smoking	171 (36.7%)	110	84.3	61	15.7	0.002
Alcohol cons.	6 (1.3%)	6	100	0	0	0.02
Associated Risk Factor						
Hypertension	196 (41.9%)	115	58.7	81	41.3	NS
Ischemic H.D.	153 (32.7%)	84	54.9	68	45.1	NS
Atrial fibril.	28 (5.9%)	11	39.3	17	60.7	NS
Diabetes M.	101 (21.6%)	50	49.5	51	50.5	NS
Rheumatic H.	26 (5.6%)	8	30.8	18	69.2	NS
Outcome of the Cases at Discharge from the Hospital						
Improvement	337 (72.2%)	180	53.4	157	46.6	NS
Death	130 (27.8%)	79	60.8	51	39.2	NS

*P = NS, there were no statistically significant difference between strokers males and females as regard the the specified factor. Mean age of M (59.4 $\pm$ 12.2) was > that of F (55.6 $\pm$ 13.6) years. + Obesity = body mass index (weight, kg / height, m2) > 30.

Table 3.   Age Groups, Risk Factors Distribution and Outcome in the Study Population

Item No. (column %)	Risk Factors											
	DM		Hypertension		IHD		AF		RHD		Outcome	
	- ve	+ ve	- ve	+ ve	- ve	+ ve	- ve	+ ve	- ve	+ ve	Death	Improvement
< 40 years	39	1	31	9	33	7	35	5	26	14	7	33
≥ 40 years	327	100	240	187	281	146	404	23	415	12	123	304
Total % from total	366 78.4	101 21.6	271 58.0	196 42.0	314 67.2	153 32.8	439 94.0	28 6.0	441 94.4	26 5.6	130 27.8	337 72.2
Odds Ratio* Risk limits	11.9 1.7-236.5		2.7 1.2-6.2		2.45 1.0-6.2		0.4 0.1-1.3		0.05 0.02-0.14		0.52 0.21-1.28	
P value	0.002		0.009		0.03		0.06		0.00000		0.52	

studies, where in Malmo, Sweden it was 15% [9] in the Oxford shire Community Stroke Project it was 19% [15] and in Umbria Italy, it was 20.3 % [34], however some other studies reported similar results as in the U.K. it was 31% [16] and in Australian study it was 24 % [35].

These variations may be due to and explained by the followings, our study is a hospital based study which usually includes most of the severe stroke patients not the mild ones. The low awareness in the community, regarding stroke warning signs, and the poor scholarization accounts for big

delays in the arrival of patients in the hospital, when the natural history of the disease may be hardly modifiable. Moreover most of stroke risk factor *e.g*. DM, hypertension, TIAs, were usually unchecked, untreated, and so were more prevalent and intense in most of our non-scholarized stroke patients.

Stroke mortality, as expected, was higher in hemorrhagic strokes 42.3% vs 19.2% in ischemic strokes. Stroke patients with DM carried mortality rate of 34.7%, followed by those with AF 32.1%, then hypertension 31.1%, IHD 28.8% while in those with RHD carried mortality rate of 15.4%, in stroke patients with two or more of the previous risk factors, the mortality rate reached more than 40%. Mortality rate in our stroke patients above 46 years of age was 29%, much higher than that in the juvenile stroke group (17.5%) [36, 37]. Mortality of males was 30.5%, while in females was 24.5% in all age groups also these results agree with literature data [38, 39].

Hyperlipidemia reported more in ischemic strokes but with no definite relationship with stroke subtypes. TIAs were reported more in ischemic strokes, more in older subjects. Alcohol consumption was reported in only the 1.3% of subjects, as expected. Obesity was reported more in females and more in ischemic strokes.

This study was limited to some extent in that it was not undertaken among the general population. However, as more than 80% of patients with acute stroke are hospitalised in this urban area of Sohag, major sampling bias was considered to be unlikely. Other limitations were due to the difficulties faced in a developing country, such as, likely selection bias due to care/deaths at home, referral patterns, case selection, missing data, and information bias due to errors in diagnosis or risk factor information.

The accuracy of diagnosis of stroke type (ischaemic or haemorrhagic) was satisfactory in the present study, since brain CT scan was performed in all individuals. Our hospital-based data probably well represent the situation in the Upper Egypt population in general because all acute medical cases are admitted to tertiary hospitals.

In general, age and hypertension are the most important risk factors for incidence of stroke in the developing world. In the study population, the prevalence of both ischaemic and hemorrhagic stroke rises within the age groups. Other factors such a diabetes mellitus and high lipid levels, was less relevant in this study.

Despite the availability of cost-effective intervention there are significant gaps, in primary prevention of cerebrovascular diseases, in low- and middle- income areas such as southern Egypt. Mostly there is a need to facilitate the access to preventive drug therapy and to promote healthy life-styles. Tailored policies are also required to promote clinical prevention, strengthen infrastructures of health-care facilities and providing continuing medical education for the personnel.

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