

# Profile of stroke in Gizan, Kingdom of Saudi Arabia

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## ABSTRACT

**Objective:** The epidemiological characteristics of stroke at different geographical locations in the Kingdom of Saudi Arabia (KSA) have not been fully investigated. Reports from some areas indicate that stroke is one of the major causes of morbidity and mortality in the population. The present study was carried out to determine the clinical profile of stroke, its subtypes and associated risk factors in Gizan Province, KSA.

**Methods:** Data on consecutive patients with stroke admitted to King Fahd Central Hospital, Gizan, KSA over a 2-year period from January 1997 to December 1998, were retrospectively analyzed. Diagnosis was confirmed by computerized tomography of the brain. Etiologic and risk factors were identified by relevant clinical, laboratory and imaging investigations.

**Results:** Two hundred and forty-one patients (146 males and 95 females; mean age 64.5) were hospitalized during the study period. The subtypes of stroke comprised cerebral infarction (65.6%); intracerebral hemorrhage (30.7%) and sub-arachnoid hemorrhage (3.7%). Coma and convulsions were more frequent among patients with hemorrhagic strokes compared

to the subgroup with cerebral infarction. Major risk factors included hypertension (45.6%), heart diseases with or without atrial fibrillation (31.1%) and diabetes mellitus (22.8%). In 19 (7.9%) patients, no risk factor was found. In-hospital mortality occurred in 20.3% (49 of 241 patients), with no significant difference in the rates in the different subtypes.

**Conclusion:** The crude incidence (estimated as 15.9 per 100,000) in Gizan, KSA, a largely rural area is lower than the reported rates in urban areas of KSA. However, intracerebral hemorrhage had a higher relative frequency, suggesting a geographic variation in the subtypes at different areas. The establishment of rehabilitation centers in the province will reduce the heavy burden on health services and relatives. The incidence and prevalence of stroke must be reduced by appropriate strategy with the objectives of preventing or modifying risk factors such as hypertension, diabetes mellitus and smoking. A national stroke registry should be strengthened to provide further information on the epidemiology of stroke in KSA.

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Stroke is a clinical syndrome of rapidly developing symptoms and signs of focal or global loss of cerebral functions due to causes of vascular origin. It is a major cause of long hospitalization, protracted disability and mortality in many populations. Consequently, stroke imposes an enormous burden on the health care resources and economic well being of the affected persons and their respective families. The syndrome is highly heterogeneous with the etiologic factors influencing its prognosis.<sup>1,2</sup> There are significant difficulties in defining the epidemiology of stroke in any given community or geographic area.<sup>2</sup> However, the

comparison of the stroke incidence and more importantly by subtypes in different ages, racial or ethnic groups and different parts of the world may identify differences that may provide etiologic clues as well as the trend in a community.<sup>3,4</sup> The burden of stroke in a community can be measured from data on mortality, incidence, prevalence, long-term outcome and cost of care.<sup>2</sup> There is no reliable national stroke register in the Kingdom of Saudi Arabia (KSA). A community based survey in the Eastern province of the country had provided some information on the prevalence of stroke in that community.<sup>5</sup> Few studies have described the

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clinical characteristics and some epidemiological aspects among Saudis the majority of whom are residents of urban areas.<sup>6-14</sup> There is little information on the pattern of stroke in the rural populations of KSA. We report the results of a study carried out in the King Fahd Central Hospital, Gizan, KSA to determine the crude incidence, pattern and outcome of stroke in a largely rural population of KSA.

**Methods.** The Gizan province is a relatively small area located on the Red Sea in the southwestern part of KSA. Populated by approximately 700,000 inhabitants who are mainly traders and farmers. Although rapid socio-economic development has continued, the province area is still categorized and considered a rural area, with extensive agriculture and sophisticated traditional irrigation practices.<sup>15</sup> Health care is provided free to the population by a well-organized referral system comprising a network of primary health care centers, 10 general hospitals and the 500-bedded referral regional hospital, the King Fahd Central Hospital (KFCH). The latter has modern diagnostic and therapeutic facilities including computerized axial tomography (CT), magnetic resonance imaging (MRI) and angiography. Therefore, nearly all cases of stroke presenting to the primary health care centers or general hospitals are referred to KFCH for evaluation and management. Consecutive patients with stroke who were admitted to KFCH in a 2-year period from January 1997 to December 1998 were analyzed retrospectively. Investigations in all patients included complete blood count, estimation of serum electrolytes, urea, creatinine, glucose, calcium, albumin, alkaline phosphatase, aminotransferases, cholesterol, triglycerides, uric acid and whole blood prothrombin time, and partial thromboplastin time.

Computed tomography scan and in some cases MRI were obtained in all patients within 24 hours of admission. The CT scan was repeated with or without contrast 48 to 72 hours after admission if the initial test was normal. Echocardiography (ECG) was carried out if clinically indicated. The presence of bloody cerebrospinal fluid (CSF) and the absence of intracerebral infarct or hemorrhage on imaging examination diagnosed sub-arachnoid hemorrhage. Patients with stroke with normal CT or small infarcts were considered to have had lacunar infarction and analyzed with the subgroup of non-hemorrhagic stroke. Patients were treated with supportive measures, aspirin, anticoagulation and physiotherapy as indicated. Deaths occurring during hospitalization were used to calculate the mortality rate. Risk factors that were evaluated included hypertension (systolic blood pressure of >160 mm Hg or diastolic blood pressure of >95 mm Hg or known to be taking anti hypertensive drugs), diabetes mellitus (fasting blood glucose of >7.8 mmol/L or random blood glucose >11.1 mmol/l). Others were hyperlipidemia (namely fasting cholesterol >6.7 or triglyceride >1.8 mmol/l) and, associated heart diseases,

which were diagnosed by history, clinical findings, electrocardiographic and ECG abnormalities. Continuous data was expressed as means with the standard deviation (SD). Discrete variables were stated in proportions. Means were compared by the student t test. The Chi square or Fisher's exact tests were used to compare proportions, using the Epi Info 6.0 computer software. A *p* value of 0.05 was considered significant.

**Results.** Two hundred and forty-one patients (146 males and 95 females) whose ages ranged from 18-96 years (mean  $\pm$  SD of  $64.5 \pm 13.0$ ) were admitted during the 2-year study period. The mean age of females was significantly higher ( $p = 0.0007$ ) than in the males ( $62.7 \pm 13.3$  versus  $67.2 \pm 12.7$ ). Two hundred and seventeen (90%) of the patients were Saudis. Non Saudis ( $n = 24$ , 10%) comprised 18 Yemenis, 4 Egyptians and 2 non-Arabs. The majority of the patients (61.8%) were in the 7th and 8th decades of life, with no gender related difference in the relative frequency rates. Only 12 patients (5%) were aged <40 years. One hundred and fifty-eight (65.6%) of 241 patients had non-hemorrhagic strokes (ischemic cerebral infarction) with thrombotic causes occurring in 49% (118 patients; 68 males and 50 females) and cardio-embolic causes in 16.6% (40 cases; 25 males and 15 males). Among the 83 patients with hemorrhagic stroke, primary intracerebral hemorrhage was found in 30.7% (74 patients; 50 males and 24 females) and sub-arachnoid hemorrhage occurred in 3.7% (9 patients; 3 males and 6 females). Hemorrhagic strokes occurred in non-Saudis (14 of 24) at a significantly higher frequency than in Saudi nationals (69 of 217). The odds ratio (OR) was 3.0 (95% confidence interval (CI) of 1.18-7.772;  $p = 0.01$ ). The relative proportions of cerebral infarction and hemorrhagic stroke in males (93 and 53 cases) and in females (65 and 30 cases) were not significantly different (OR = 0.81, 95%, CI 0.45-1.45;  $p = 0.57$ ).

**Table 1** summarizes the major neurological abnormalities in the patients. The relative frequencies of coma, hemiplegia and hemiparesis and speech disturbance (for example aphasia, dysarthria) in the subgroup with hemorrhagic strokes were significantly higher, compared with patients who had cerebral infarction ( $X^2 = 39.13$ ; 3 degrees of freedom (df);  $p = 0.000$ ). Coma as the only presenting feature occurred in 19 of 27 patients with hemorrhagic stroke. Cerebral infarction was the most frequent CT abnormality, occurring in 138 (57.3%) of 241 cases. The relative frequency rates in males (56.8%; 81 out of 146) and females (62.1%; 57 out of 95) were not significantly different. Fourteen patients (10 males and 4 females) had no identifiable lesion on CT scan and were categorized as lacunar infarction on the basis of the clinical presentation, course and MRI findings, where available. Hypertension and diabetes mellitus, singly or in combination were the risk factors with the highest relative frequency rates (**Table 2**). Heart diseases including rheumatic valvular diseases, post myocardial

Table 1 - Comparison of hemorrhagic and ischemic strokes.

Parameters	Stroke subtype		OR (95% CI)	p value
	Hemorrhagic	Ischemic		
<b>Demography</b>				
Male/Female	53/30	93/65	1.23 (0.69-2.22)	0.4 (ns)
Saudi/Non-Saudi	69/14	148/10	0.33 (0.13-0.85)	0.01
<b>Features n (%)</b>				
Coma	36 (43.4)	17 (10.8)	6.35 (3.12-13.06)	0.00
Hemiplegia	37 (44.6)	105 (26.6)	0.41 (0.23-0.73)	0.001
Hemiparesis	9 (10.8)	42 (26.6)	0.34 (0.14-0.77)	0.005
Speech abnormality*	16 (19.3)	43 (27.2)	0.64 (0.33-1.28)	0.017
Convulsion	8 (9.6)	3 (1.9)	5.51 (1.28-27.06)	0.009
Mortality	19 (22.9)	30 (19)	1.24 (0.63-2.54)	0.5 (ns)

\*aphasia or slurring of speech, OR - odds ratio, CI - confidence interval, ns - non significant

Table 2 - Risk factors in stroke.

Risk factor	Male		Female		All	
	n (%)	n (%)	n (%)	n (%)	n (%)	95% CI
Hypertension	59 (40.4)	51 (43.2)	110 (45.6)	39.23-52.16		
Diabetes mellitus	27 (18.5)	28 (29.5)	55 (22.8)	17.67-28.64		
Heart diseases*	33 (22.6)	21 (22.1)	54 (22.4)	17.3-28.2		
Atrial fibrillation	10 (6.8)	11 (11.6)	21 (8.7)	5.47-13.01		
Smoking	16 (11.0)	-	16 (6.6)	3.84-10.55		
Hyperlipidemia	8 (3.3)	5 (5.3)	13 (5.4)	2.9-9.04		
Drugs	3 (2.1)	1 (1.0)	4 (1.7)	0.45-4.19		
Sickle cell anemia	2 (1.4)	1 (1.0)	3 (1.2)	0.25-3.59		
No risk factors**	11 (7.5)	8 (8.4)	19 (7.9)	4.81-12.03		

\*Organic disease with atrial fibrillation, \*\*No identifiable risk factor, CI - confidence interval

infarction, dilated cardiomyopathy and hypertensive heart diseases were the frequent predisposing factors in a proportion of the patients. Anticoagulant drugs were contributory in 3 patients. In-hospital mortality was 20.3% (49 out of 241 patients) with no significant difference in patients with ischemic (30 out of 158; 19%) and hemorrhagic strokes (19 out of 83; 22.9%).

**Discussion.** The exact incidence of stroke at different geographic locations in KSA is not known.<sup>12</sup> The hospital-based crude annual incidence rate of stroke in Gizan, estimated as 15.1 per 100,000 persons was lower than the rates that were reported from the Eastern province (29.8/100,000) and from Riyadh in the Central province (43.8 per 100,000).<sup>8,9</sup> In an effective and efficient referral system in the Gizan province<sup>16</sup> nearly all patients with stroke are evaluated in the KFCH as the apical hospital in the province with CT and MRI. Therefore, we believe that the patients represented the majority of patients with stroke during the study period. Furthermore, the total number of cases per year in our

series was comparable to those reported from other provinces of the country.<sup>13,14</sup>

The prevalence of stroke in KSA is more difficult to estimate accurately. A prevalence of 178/100,000 was reported in a community based survey from the Eastern region of KSA.<sup>5</sup> Overall, the incidence and prevalence of stroke in KSA appears to be lower than the rates in the Western countries but falls within the range observed among Asian populations.<sup>4,7</sup> Stroke among Gizan patients, was characterized by male preponderance and an incidence that increased with age. With a peak frequency in the 7th and 8th decades of life and a low frequency in the young (<45 years), the pattern was similar to previous observations in other areas of KSA and some western countries.<sup>2,4,8,13</sup>

Identification of the subtypes of strokes is important, and useful in the clinical choice of appropriate treatment.<sup>17,18</sup> In our patients cerebral infarction occurred more frequently (65.6%) than other variants but this relative proportion was lower than the reported (76-87%) in other Saudi surveys.<sup>6,14</sup> A significantly higher relative frequency of thrombotic (ischemic) stroke in an area of high altitude (93.4%) compared with the rate in a region of low altitude (73%), even after adjusting for age, gender and occupation indicated regional variations in stroke subtypes.<sup>12</sup> Erythrocytosis, which is highly prevalent in areas of high altitude, was suggested as one of the possible explanations. Based on this hypothesis, the relatively lower rate of ischemic infarction in the Gizan province may be partly explained by the province's location at sea-level. Conversely, the relative proportion of hemorrhagic stroke (34.4%) in our cases was higher than those reported from Hofuf in the Eastern region of KSA (19%) and from Jeddah in the Western region (15%).<sup>13,14</sup> This difference was due to the relatively higher frequency of intracerebral hemorrhage (30.6%) in our study, compared to a frequency as low as 6.5% reported from Riyadh in the central region.<sup>10</sup> Such wide variations have been noted in other parts of the world, without adequate explanations.<sup>17</sup> Sub-arachnoid hemorrhage had a low frequency and most of the patients with this subtype were non-Saudis. Similar patterns had been reported from other parts of KSA.<sup>9,11,13,14</sup>

The most important consideration in clinical or epidemiological investigations of stroke is the accuracy of the diagnosis. The availability of CT and MRI facilities enhanced the accuracy of diagnosing and subtyping the cases reported here. Such facilities are often not available in general hospitals, especially in the developing world. It has been suggested that clinical features may be useful in distinguishing hemorrhagic strokes from ischemic infarcts, under such circumstances. An evaluation of clinical-based scoring system yielded an accuracy of 90% and a positive predictive value of 100%.<sup>17,18</sup> In the scheme, the presence of coma, vomiting, severe headache, meningism and a systolic blood pressure >220 mm Hg indicated a hemorrhagic stroke.<sup>17</sup> Although the

frequencies of coma and convulsions were significantly higher in the sub-group with hemorrhagic strokes than in patients with cerebral infarction, no clinical feature was specific in predicting the subtype among our patients. Several epidemiological studies have confirmed the impact of host and environmental factors predisposing to stroke. Hypertension, diabetes mellitus, cigarette smoking and atrial fibrillation are widely accepted as major causal factors, world-wide.<sup>19-22</sup> All of these were present with varying frequencies among our patients, with hypertension being the most frequent. In KSA, hypertension and diabetes mellitus have high prevalence and are often poorly controlled.<sup>23</sup> A survey reported that 6% of the sampled population in Gizan had elevated blood pressure and most of them were unaware of the condition.<sup>23</sup> In the United States of America, four-fifths of patients with hypertension were unaware of their disorder, not treated for it or, do not have it under control.<sup>21</sup> Therefore, prevention of stroke poses a major challenge in many populations and, particularly in rural settings. A modification of these risk factors reduces the incidence of stroke. Prevention and control of hypertension may impact on the prevalence of stroke in the Saudi population.

The mortality (20.3%) among patients in Gizan was within the range of 8-31%, in other reports.<sup>7,13,14</sup> We found no difference in the case fatality rates in relation to the subtypes of stroke. In the Gizan experience, the duration of hospitalization in most cases was influenced, in part by social factors. Rehabilitation of the patients with stroke is complex and demanding. It constitutes a major burden on the relatives of the survivors. Consequently, discharges from hospitals are resisted, particularly in rural populations. In Gizan province, separate units for rehabilitation and supervised home care are non-existent. Complications including bedsores, nosocomial infections, and malnutrition resulting from dysphagia, are the most frequent causes of death in those who survive the initial vascular accident. These are preventable complications requiring good nursing and physiotherapeutic care.

It is concluded that stroke in Gizan patients, occurs mainly in older persons and, with an incidence that may be lower than the rates in Saudi urban populations. The difference may be partly explained by the lower prevalence of hypertension in Gizan as compared to other areas.<sup>23</sup> Hypertension and diabetes mellitus were the major risk factors for the development of stroke. Mortality was significantly high, and rehabilitation of survivors was a major burden on the health service system and relatives. The provision of a rehabilitation center in the region is mandatory and will reduce the burden on the relatives who currently provide the care outside of the hospitals. Strategies for the control and prevention of hypertension and other risk factors should be developed and implemented nationally, to reduce the incidence of stroke in KSA.

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