CHARACTERISTICS OF STROKE IN HOFUF, SAUDI ARABIA

Magid M. El Sayed, FRCP (Edin); A. Olumade G. Adeuja, FRCP; Essam El-Nahrawy, MRCP; Mugtaba A.M. Olaish, MRCP

Background: Stroke is a common neurological disorder that is encountered in most hospitals in both developed and developing countries. This two-year study was designed to show the characteristics of the problem at the King Fahad Hospital, Hofuf, Saudi Arabia.

Patients and Method: This was a prospective study of all Saudi stroke patients admitted to the medical wards in the study period. All patients were assessed individually by one of the two available neurologists. Data was collected on pre-designed protocol, and analysis was performed using tables and figures, and EpiInfo® computer software.

Results: The 329 Saudi patients studied fulfilled the criteria for stroke. The male:female ratio of the patients was 1:1, and their ages ranged between 42 and 92 years (mean 62.8±11.1) for males, and between 20 and 100 years (mean 59.6±15.4) for females. The relative frequencies of stroke subtypes were ischemic infarcts (79%), of which 46% were lacunar infarcts, intracerebral hemorrhage (18.8%), and subarachnoid hemorrhage (2.2%). The most common risk factor was concomitant hypertension with diabetes mellitus (40.4%), hypertension alone (24.9%), diabetes alone (11.6%), atrial fibrillation (5.8%), other cardiac factors (5.5%), transient ischemic attack (TIA) and prior stroke (2.1% each), and smoking (1.8%). No risk factor was detected in 5.8% of the patients. The overall in-hospital mortality was 10.0%, with a significant male preponderance.

Conclusion: This study demonstrated that stroke is a common neurological condition in the Al-Hassa region of the Kingdom. The male:female ratio was dissimilar from that observed in other parts of Saudi Arabia. The study also showed that hypertension with diabetes constituted a potent risk factor. Sickle cell anemia was not found to be a risk factor. The case mortality was low and both incidence and mortality showed seasonal preference. We believe that there is a need to establish a Stroke Register at the King Fahad Hospital at Hofuf for the Al-Hassa region.

Key Words: Stroke, risk factors.

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StROKE is a common neurological disorder encountered worldwide. It is the third leading cause of death (after heart disease and cancer), and in many surviving patients, it is the devastating endpoint of cerebrovascular disease. It affects both sexes, with males slightly more affected than females. It is usually more prevalent in persons in their fifties and sixties, and people of African descent seem to be more susceptible than their Caucasian counterparts.

Several publications which are the results of retrospective hospital-based studies have emerged from different parts of Saudi Arabia. In two community-based studies in the Eastern Province of Saudi Arabia, the prevalence rate for stroke was found to be 178/100,000. Recently, Al Rajeh et al. reported the result of a community-based prospective study of stroke from 1989 to 1993. A similar community-based prospective study in Nigeria recorded a prevalence of 58/100,000. The purpose of our two-year prospective study was to describe our own experience with stroke at the King Fahad Hospital, Hofuf (KFHH), in the Al-Hassa region of the Eastern Province of Saudi Arabia.

Patients and Methods

KFHH is a 625-bed hospital which provides both primary and secondary care, and is the main health care institution in Hofuf in the Eastern Province of Saudi Arabia. The catchment area of the hospital includes the city of Hofuf and all adjoining villages. Referrals are received from smaller hospitals and non-governmental hospitals in the area. About 100 of the hospital beds are allocated to the Medicine Department. The Medical Emergency Room, from which almost all cases are admitted to the male and female wards, receives an average of 300 patients daily. There are currently two neurologists in the department, assisted by resident
doctors. All patients with neurological disorders are admitted under the care of the neurologists.

A prospective study of consecutive acute stroke patients admitted between June 1994 and May 1996 was carried out. All the patients were assessed by one of the neurologists who made a clinical diagnosis of stroke. The personal history, clinical findings and the type of stroke were entered on a pre-designed protocol. Plain axial CT of the brain was performed on each patient, and when no abnormality was shown, the test was repeated 24 to 48 hours later. All patients had hematological and full biochemical investigations, including hematocrit, erythrocyte sedimentation rate and sickling test. Electrocardiogram was done on all patients and echocardiogram was done when indicated. A serological test and TPHA for syphilis were done, and lumbar puncture was performed on patients with positive TPHA to screen the cerebrospinal fluid (CSF). Angiogram was done on a selected number of patients. The patients’ progress was reviewed daily and on discharge to assess the degree of disability. Physiotherapy was instituted on all patients from the third day after admission, depending on stroke subtypes, as shown in the brain CT.

For this study, we adopted the WHO definition of stroke\(^6\) and the Framingham study expatiation on the definition.\(^1\) Data collected on the protocol were analyzed in tables. EpiInfo\(^8\) computer software was used for statistical analysis.

### Results

A total of 15,646 patients were admitted to the medical wards of KKUH in the two-year study period. Of these, 356 (2.28%) satisfied the definition of stroke, and 329 of these patients were Saudis. The remaining 27 patients, all males, were expatriates. The 329 Saudi stroke patients were chosen to be analyzed, and consisted of 166 males (50.5%) and 163 females (49.5%), giving a male to female ratio of 1:1. The mean age among males was 62.8±11.1 years (mean±SD) and 59.6±15.3 years among females.

<table>
<thead>
<tr>
<th>Table 1. Age and sex distribution of cases studied.</th>
</tr>
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<tbody>
<tr>
<td>Age group</td>
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<tr>
<td>-----------</td>
</tr>
<tr>
<td>20-29</td>
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<tr>
<td>30-39</td>
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<tr>
<td>40-49</td>
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<td>50-59</td>
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<td>60-69</td>
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<tr>
<td>70-79</td>
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<tr>
<td>80+</td>
</tr>
<tr>
<td>Total</td>
</tr>
<tr>
<td>Admissions</td>
</tr>
<tr>
<td>Mean age (SD)</td>
</tr>
</tbody>
</table>

P-value=0.03 (significant).

The difference was statistically significant \(t=2.145, P=0.03\). The age and sex distribution is demonstrated in Table 1, which also shows a rise in stroke incidence with increasing age, and a sharp decline after the seventh decade. Eighty-three percent of the patients were 50 years and above.

Table 2 shows CT scan findings confirming clinical diagnosis according to the subtypes in both sexes. More females than males had large cerebral ischemic infarcts as well as lacunar infarcts. However, significantly more males than females had cerebral hemorrhage (25.3% vs. 12.3%, ratio 2.1:1). Of the 329 cases, there were 140 large cerebral infarcts (42%), 120 lacunar infarcts (36.5%) (lacunar infarcts constituted 46% of all cerebral infarcts), and 62 hemorrhagic strokes (18.8%). There were only 7 cases of subarachnoid hemorrhage (2.2%), with equal distribution between the sexes. The CT scan was normal in 33 of the patients (10%), and these were included in the lacunar infarct subtype for analysis.

Table 3 shows the risk factors and the stroke subtypes ascribed to them. One hundred and thirty-three (40.4%) patients had hypertension with diabetes, and of these 115 (86.5%) had ischemic infarctions, and 18 (13.5%) had hemorrhages. Eighty-two patients (24.9%) had hypertension alone. Of these, 51 (62.2%) had ischemic infarctions and 31 (37.8%) had hemorrhages. Thirty-eight patients (11.6%) had diabetes mellitus alone and all of them had ischemic infarcts. Non-valvular atrial fibrillation alone accounted for 19 cases (5.8%), all of whom had infarction. Other cardiac lesions consisted of 8 TIA (2.4%) and 7 prior strokes (2.1%), all being ischemic infarcts. Smoking as an independent risk factor accounted for six of the cases (1.82%), of which five (83.3%) were infarcts and one (16.7%) was hemorrhage. In 19 cases (5.8%), there was no recognizable risk factor and they all had cerebral hemorrhage. Cerebral infarction was significantly associated with hypertension concomitant with diabetes, diabetes mellitus, atrial fibrillation and other cardiac causes. Cerebral hemorrhage was significantly associated with hypertension alone and when no risk factor was found.

The overall in-hospital mortality in this study was 10% (33 deaths), made up of 23 males and 10 females \(X^2=5.43, P=0.019\), significant). An almost equal number of the 33 deaths were due to cerebral infarction and hemorrhages.

There were 16 hot months and 8 cold months in the two-year study period (April to November being the hot months, and December to March being the cold months). One hundred and ninety-four patients (59.0%) were admitted in 16 months, i.e., about 12 patients per month, and 135 (41.0%) patients in the 8 cold months, i.e., about 17 patients per month. Twenty-five deaths occurred in the hot months and eight in the cold months. The difference in the number of deaths in the hot and cold months was not, however, statistically significant.
In this hospital-based prospective study of stroke, 329 Saudi patients were admitted in two years. Our sample size was comparable to other published series in Saudi Arabia.8,9 Most studies on stroke indicate a male preponderance with a male:female ratio of about 2:1:1. These contrast with our ratio of 1:1, which we also observed in all stroke subtypes, except for hemorrhagic strokes, where the ratio is 2.1:1. Our case fatality of 10% is lower than the 14% reported by Al Rajeh et al.,10 the 17% reported from Kuwait,11 and the overall mortality of 37% reported by Adeuja and Osuntokun.12 Our study shows a seasonal variation in the incidence of stroke, as more cases per month occurred in the cold months of December to March. There was also a seasonal variation in case fatality rate, with more deaths occurring in the hot months than in the cold months. In Japan, a marked seasonal swing in the cerebrovascular disease death rates has been demonstrated, with the peak in January and February, and the lowest point in July and August. In the USA and in England and Wales, there was a definite seasonal variation from a summer low to a winter high.13 The explanation for the summer high in mortality in our study may be related to the extremes of temperature, which rise to more than 45°C in the hot months, causing excessive sweating and dehydration. Delay in getting patients to hospital may also be responsible, as on average, females were brought to hospital within 35 hours and males within 43 hours. The exponential rise in stroke incidence with age seen in this study has also been observed by others.14-15

The most common pathological stroke subtypes were ischemic infarctions made up of large cerebral infarcts, and lacunar infarcts. The frequency of lacunar infarcts in ischemic infarctions made up of large cerebral infarcts, this study has also been observed by others.14-15 Hemorrhagic strokes accounted for about 19% of cases in this series. The normal CT scans in our stroke patients were not unusual. Although CT remains the single most important first choice examination, it is positive in up to 70% of acute infarcts within 24 hours. However, inconclusive CT scan may require clarification by MRI.16

The major risk factor for stroke in this study was the combined effect of hypertension with diabetes mellitus. This is an important observation which accords with the recent report by Al Rajeh et al.8 Adeuja and Osuntokun12 in Nigeria had observed that diabetes and hypertension together were present in 10% of non-embolic ischemic brain infarctions, and in 8% of those with intracerebral hemorrhage. Zargar et al.17 found concomitant hypertension in 66.6% of diabetic patients with stroke, compared to our finding of 78%. About 62% of our hypertensive stroke patients had concomitant diabetes mellitus. These differences may be due to environmental and sociocultural factors.

Various epidemiological studies have shown that high blood pressure or hypertension is the single most important risk factor for stroke. The risk is a direct function of either systolic or diastolic BP.18-20 All patients in our series were known hypertensives under treatment for a few years before the onset of stroke. Patient compliance with treatment was doubtful in some cases. Diabetes mellitus is another major risk factor. Although it was reported in some series that there may be no overt symptoms of diabetes,12 all our patients were known diabetics and were on medications. Among diabetics, the incidence of stroke has no relationship to treatment or non-treatment or any specific mode of treatment—diet, insulin or oral agents.21 Recently, several large population studies have shown an increase in the prevalence of stroke in the known diabetic population, the undiagnosed diabetic population and those with glucose intolerance.22-23

Evidence in the literature has also shown that age is the biggest risk factor for stroke in the diabetic population, as well as a long duration of the disease.24 Atrial fibrillation (AF) without valvular heart disease constituted an important risk factor in this study, accounting for about 6.0% of our cases. The frequency of non-valvular atrial fibrillation increases with advancing age and the incidence of stroke in AF patients is equally age related.25,26 Elderly stroke patients with AF have been

<table>
<thead>
<tr>
<th>Risk factors</th>
<th>Total Infarction Hemorrhage</th>
<th>X²-value</th>
<th>P-value</th>
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</thead>
<tbody>
<tr>
<td>Hypertension and diabetes mellitus</td>
<td>133 (40.4) 115 (44.2) 18 (26.1)</td>
<td>7.45</td>
<td>0.0063</td>
</tr>
<tr>
<td>Hypertension</td>
<td>82 (24.9) 51 (19.6) 31 (44.9)</td>
<td>18.67</td>
<td>0.000015</td>
</tr>
<tr>
<td>Diabetes mellitus</td>
<td>38 (11.6) 38 (14.6) 0</td>
<td>11.40</td>
<td>0.00073</td>
</tr>
<tr>
<td>Atrial fibrillation</td>
<td>19 (5.8) 19 (7.3)</td>
<td>4.41</td>
<td>0.035</td>
</tr>
<tr>
<td>Other cardiac factors</td>
<td>18 (5.5) 18 (6.9)</td>
<td>4.12</td>
<td>0.042</td>
</tr>
<tr>
<td>Transient ischemic attacks</td>
<td>7 (2.1) 7 (2.7)</td>
<td>1.07</td>
<td>0.307</td>
</tr>
<tr>
<td>Previous stroke</td>
<td>7 (2.1) 7 (2.7)</td>
<td>1.07</td>
<td>0.307</td>
</tr>
<tr>
<td>Smoking</td>
<td>6 (1.8) 5 (1.9) 1 (1.5)</td>
<td>0.06</td>
<td>0.806</td>
</tr>
<tr>
<td>No risk factors</td>
<td>19 (5.8) 0 19 (27.5)</td>
<td>72.28</td>
<td>0.00001</td>
</tr>
<tr>
<td>Total</td>
<td>329 (100) 260 (100) 69 (100)</td>
<td></td>
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</tr>
</tbody>
</table>
shown to have a poor prognosis for recovery.\textsuperscript{27,28} In this study, the mean age was 65±14.1 years for males and 49.3±16.63 for females (\(P=0.03634\), significant). The overall age ranged from 35 to 81 years. The strokes attributable to AF and other cardiac disorders were much lower than those observed by others in Saudi Arabia.\textsuperscript{29}

Cigarette smoking is associated with all forms of stroke in about the same prevalence rate as it is with coronary heart disease.\textsuperscript{29} In this study, cigarette smoking accounted for 1.8\% of all strokes, which were predominantly ischemic infarctions. Other studies\textsuperscript{30,31} have associated increased risk of subarachnoid hemorrhage with smoking. Our figure was lower than the observation of Al Rajeh et al.\textsuperscript{32} The risk of smoking appears to be dose-related. All our patients smoked more than 20 cigarettes per day. Heavy smokers (more than 25 per day) are four times as likely to develop a stroke as nonsmokers.\textsuperscript{30,32}

Transient ischemic attacks (TIAs) are an important risk factor for completed stroke. It has been observed that 10\%-14\% of strokes are preceded by TIAs, and as a risk factor, they confer an independent relative risk of 3.9.\textsuperscript{33} In addition, Mohr et al.\textsuperscript{34} have shown that 35\% of patients with TIAs could expect a stroke within four years. In our series, TIAs accounted for about 2\% of all strokes. We believe that TIA should be singled out as a risk factor for stroke and not classified as stroke.\textsuperscript{8,9} Only one of our patients had carotid bruit and there were no cardiac murmurs. The source of the ischemic attacks may be artery-to-artery thromboembolism, or thrombosis of a penetrating vessel (threatened lacunar infarction).\textsuperscript{35}

A small proportion of our patients had their stroke after a previous stroke, and we regarded the previous one as a risk factor. Previous stroke has been considered a major risk factor for further events.\textsuperscript{36} Indeed, it has been shown that previous strokes accounted for 36.1\% of stroke admissions in all age groups.\textsuperscript{37}

In about 6\% of our strokes, no risk factors were found. In this regard, other risk factors, such as amyloid angiopathy, lupoid anticoagulants, abnormalities of protein C, protein S antithrombin III deficiency, and recombinant tissue plasminogen activator (rtPA), have to be excluded from the study. We did not find stroke among sick cell disease patients in this study, in spite of the high prevalence of the hemoglobinopathy in the Al-Hassa region. The sickle cell anemia encountered in Al-Hassa is milder than that in other endemic parts of the world and in other parts of Saudi Arabia, because of the presence of a large proportion of fetal hemoglobin (HbF), which exerts a protective influence on the patients.\textsuperscript{38,39} Sickle cell disease (SCD) is a recognized risk factor for stroke in Nigeria, particularly among children and young adults, and in pregnant women during or after labor. Cerebrovascular episodes in SCD are usually precipitated by a crisis.\textsuperscript{12}

This prospective hospital-based study shows that cerebrovascular accident or stroke is a common neurological condition in the Al Hassa region of Saudi Arabia, just as in Western countries. The male to female ratio was slightly different from that observed in other parts of the Kingdom, and the incidence of stroke in this series rose exponentially with age, with a peak in the sixth decade and a sharp decline from the seventh decade.

This study also demonstrated that hypertension, in association with diabetes mellitus, constituted a potent risk factor and should be thus classified. Our case fatality was low and both the incidence and mortality showed some seasonal variation. In spite of the high prevalence of sickle cell gene in the region, we did not encounter stroke in adults with the disease.

We believe there is a need to establish a stroke register at KFHH so that the actual incidence and prevalence rates of the disease in the Al-Hassa region can be more accurately measured.

Acknowledgements

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References