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Clinical Profile of Stroke Patients Presenting to the Emergency Department of a Major Stroke Centre in Oman

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Abstract

Objectives: Stroke is a significant public health problem and one of the important preventable non-communicable diseases. Preventive stroke programs are yet to be properly established in Oman, with a better focus on increasing awareness among those who are currently at risk. This study was conducted to describe the characteristics of stroke presenting to a tertiary care hospital in Oman. ***Methods:*** This was a cross-sectional hospital-based study. Included 193 stroke cases which were prospectively recruited from the Emergency Department of a tertiary-level hospital. Data was collected from November 2017 to April 2018. ***Results:*** The total number of patients was 193. 82.9% of strokes were ischemic strokes. 58% were male. The mean age of stroke patients was 61.05 years. Risk factors included hypertension (72.5%) and diabetes mellitus (54.4%). Dyslipidemia, atrial fibrillation and ischemic heart diseases were not particularly prevalent in our population. 24.4% of ischemic strokes had large artery atherosclerosis and 21.9% had small vessel occlusion. Significantly more patients had lower Glasgow Coma Scale

(GCS), required ICU admission and had in-hospital deaths in hemorrhagic stroke compared to ischemic stroke. ***Conclusions:*** This study provides essential stroke characteristics data specific to Oman's population. Most of the information obtained conforms with that described internationally and similar preventive strategies can be implemented. The information can be utilized by health administrators in planning resource allocation. Further research is needed to explore rehabilitation aspects and long-term outcomes.
Keywords: Stroke; Ischemic; Hemorrhagic; Young Stroke; Risk Factors; Thrombolysis; Epidemiology; Oman.

Advances in Knowledge

- This study provides information on characteristics of stroke patients specific to the local population of Oman and compares to benchmark international trends.
- Information on the different risk factors associated with stroke in this population can help guide the development of specific preventive and possibly rehabilitative strategies for stroke.

Application to Patient Care

- This study highlights aspects related to stroke which is one of the main causes of morbidity and mortality in Oman.
- Identifying the main risk factors is important in targeting the patient population at risk and providing them with the necessary means of prevention through better control of their disease.

Introduction

Stroke is a prevalent illness worldwide with associated morbidity, mortality and financial costs to health systems. It is the second most common cause of death and the third most common cause of disability-adjusted life-years (DALYs) lost globally.[1] Stroke is more prevalent in the Middle East when compared to the Western world with an annual incidence of 180 per 100,000 population[2], with ischemic stroke being the commonest subtype. One study revealed that it was the leading cause of death in several middle-income Arab countries.[3] Although the overall average stroke-related DALYs lost percentage is thought to have declined in some Arab

countries[4], the global burden of stroke continues to rise. The financial costs of stroke are multiple and include costs to the health system and economic loss from loss of labor, as well as costs related to the survivors and their caregivers.

Stroke constitutes a significant public health problem being one of the important preventable non-communicable diseases.[5] The majority of risk factors for stroke are modifiable; therefore, preventive strategies are effective in reducing the incidence of new and recurrent stroke. Preventive stroke programs with a better focus on increasing awareness among those who are currently at risk are yet to be properly established in many countries including Oman. Patients at risk of developing stroke have poor awareness of their risks according to one study from a primary healthcare setting in Oman.[6] Other neighboring countries of the Gulf Cooperation Council (GCC) are no different: less than a third of patients at risk in these countries are even familiar with the meaning of stroke.[7]

To our knowledge there has been a single abstract published of a study of ischemic stroke patients in Oman.[8] However, no detailed studies have been conducted in Oman on stroke patients, and this study will be the first to provide such information. The aim of this study was to describe the features of stroke presenting to a stroke center in a tertiary care hospital in Oman. The findings could aid health system planners in decisions for more efficient resource allocation including necessary clinical services and development of preventive strategies.

Methods

This cross-sectional hospital-based study included 193 stroke cases prospectively recruited from the Emergency Department (ED) of Khoula Hospital (KH) from November 2017 to April 2018. KH is one of the main governmental tertiary hospitals with a functioning stroke unit in the capital city of Muscat. In addition, it is the only tertiary stroke center under the Ministry of Health with a stroke unit in Muscat and it also receives referrals from private and remote hospitals.

Patients were included in the study if they had a confirmed acute or sub-acute stroke by computed tomography (CT) and/or magnetic resonance imaging (MRI) and fulfilled the

American Heart Association/American Stroke Association, by which an ischemic stroke is defined as "an episode of neurological dysfunction caused by focal cerebral, spinal, or retinal infarction", and a hemorrhagic stroke is defined as "Rapidly developing clinical signs of neurological dysfunction attributable to a focal collection of blood within the brain parenchyma or ventricular system that is not caused by trauma".[9]

The study was approved by the ethics and research committee under the administration unit of the Directorate General of Muscat region. Informed consent was obtained from each participant or his/her relative before any interview or neurologic examination was conducted.

Omani and non-Omani patients aged 18 years or above with confirmed diagnosis of either intra-cerebral hemorrhage or ischemic stroke were included in the study. Patients with stroke caused by complications arising from trauma were excluded. Subarachnoid hemorrhage (SAH) was not included in the analysis as there were no cases encountered during the study time.

Data were collected in pretested standard forms, including demographic characteristics, type of acute stroke, ischemic stroke subtypes, severity, risk factors, acute management, medical comorbidities, duration of hospital admission, functional assessment and outcomes.

Data was collected from the patients' computerized records as well as from interviews with the patient or a close relative to obtain missing variables in the history. The data on functional assessment obtained by Neurology Unit upon discharge was gathered from the patient's medical record.

Risk factors for stroke that were evaluated included (previous or current diagnosis): hypertension, defined as systolic pressure ≥130 mmHg or a diastolic pressure ≥80 mmHg or use of antihypertensive medication; diabetes mellitus (DM), defined as use of insulin or an oral hypoglycemic agent, or a fasting glucose value ≥126 mg/dL; dyslipidemia, defined as elevated total or low-density lipoprotein (LDL) cholesterol levels, or low levels of high-density lipoprotein (HDL) cholesterol; and cardiac diseases (atrial fibrillation and myocardial infarction).

In addition, history of current or past tobacco and alcohol use was also captured. Furthermore, history of previous stroke and transient ischemic attacks was considered.

Ischemic stroke subtypes were defined according to the TOAST (Trial of Org 10172 in Acute Stroke Treatment) criteria.[10] This is a widely used classification with good reliability and high sensitivity and specificity, based on its etiology of large-artery atherosclerosis (LAA), small-vessel disease or lacunar stroke (LS), cardio-embolic stroke (CE), stroke of other defined etiologies (OD) or stroke of other undetermined etiology (UE).

The severity of cases was assessed using the National Institutes of Health Stroke Scale (NIHSS).[11] The total of the score was interpreted as: very severe neurological impairment (score >25), severe impairment (score 15-24), moderately severe impairment (score 5-14) or mild impairment (score <5). The GCS in which cases are categorized as mild (score >12), moderate (score 8-12) and severe (score <8), was also used.[12] Functional assessment was assessed using the Modified Rankin Scale (MRS).[13] All cases received in the ED had time recorded for triaging, doctor's evaluation, imaging and when management began to evaluate any time delay as a reason for non-thrombolysis.

All the data were analyzed using the Statistical Package for Social Science (SPSS) version 20 (IBM Corp. Chicago, Illinois USA). Statistical inferences were drawn based on two-tailed tests and a *P* value <0.05 was considered statistically significant. For descriptive analysis means, medians, standard deviations and 95% confidence intervals were calculated. Prevalence and frequencies were expressed in terms of percentages. Appropriate tables were designed to describe the study population. Further analysis of ischemic stroke cases (n = 160) was performed.

Results

The total number of confirmed cases of stroke reported was 193 with the majority being ischemic strokes (82.9%, n = 160) and predominantly male (58%) among both Omanis and non-Omanis, with a male to female ratio of 1.38. There was no significant difference between stroke types in terms of gender distribution (P = 0.25) (Table 1). Collected cases showed a mean age of

61.05 (SD: 13.81). More than half of the total cases (63%) were below 65years old with the younger cases found mostly among the hemorrhagic stroke group. Eight out of 10 stroke patients were Omanis reflecting the free medical care offered to Omani nationals compared to non-Omanis.

Hypertension was the most prevalent risk factor, followed by diabetes mellitus, which was more common among ischemic stroke cases. About a quarter of ischemic stroke patients reported hypertension, diabetes, dyslipidemia and 51.3% of them were in the 40-60-year age group. Among the ischemic stroke cases, 16.9% (n = 27) and 6.9% (*n* = 11) reported history of previous stroke and transient ischemic attack, respectively.

Distributions of cases according to severity are demonstrated in Table 3. According to the NIH severity scoring rank, hemorrhagic stroke cases were more severe compared to ischemic stroke cases (*P* = 0.005). The severity correlated with the age group among the ischemic stroke cases with 69.2% of severe cases presenting in patients aged above 60 years but not among the hemorrhagic stroke cases with *P* value of 0.004 and 0.816, respectively. While the age group correlated with outcomes among the hemorrhagic stroke cases, there were five cases of death reported among the hemorrhagic stroke cases, all of them aged below 40 years (*P* = 0.002) and all within the severe to very severe NIH score. There was no significant difference between the two genders in relation to the NIH score (*P* = 0.488) nor outcome (*P* = 0.319).

The average time in minutes spent in different steps of providing care in the ED for patients presenting on the same day of symptoms (*n* = 106) is presented in the Table 4. Among those cases, 25.6% presented directly in the ED while the rest were escorted by ambulance. Among those escorted by ambulance, 96.9% were with a query stroke diagnosis.

Around half of the cases (82) were classified utilizing the TOAST classification system. 45% were large artery atherosclerosis, 40% were small vessel occlusion, 9% were stroke of other undetermined etiology, and 6% cardioembolic. The rest of the cases; however, did not receive any classification. The majority of the cases that were classified were LAA followed by small vessel occlusion.

Around 53.7% of IS cases presented on the same day that symptoms of stroke developed. Around 5.8% of early presenting cases had contraindication for thrombolysis. Only 19 (11.9%) of all IS cases (n = 160) had intravenous thrombolysis and five of those died.

Discussion

To the best of our knowledge, this is the first detailed account of the characteristics of stroke patients as presented in the main National Stroke Center in Oman. In this study, we looked at several aspects related to stroke presenting acutely to a tertiary care hospital. These included demographics, associated risk factors, clinical presentation and their sequelae. The mean age for stroke in our population was similar to the mean age reported for many South Asian countries. For example, the mean age was 59 years in Pakistan and 63 years in India.[14] In the Western world, however, the mean age of incident stroke was higher, for example 68 years in the USA and 71 years in Italy.[15] This finding may be a source of concern considering the relatively young age of stroke onset in both its types of in Oman. However, from our experience, we know that the documentation of age in Oman was inaccurate in the past, especially in generations born prior to the 1970s. During those times, Oman had an underdeveloped system for civil registration of vital statistics including birth recording. Most of the current cohort afflicted by stroke were born at home with no real birth certificates. Furthermore, patients from this generation had a tendency to underestimate their age when asked in medical records at admission. Therefore, the average age of incident stroke cases at onset may actually be closer to that of the Western world than it appears now.

Since stroke is potentially preventable through control of its risk factors, it is important to identify these risk factors and determine their relative prevalence in order to manage them through primary prevention. Hypertension can lead to ischemic stroke through the acceleration of the development of atherosclerosis which results in atherothrombotic events. The relationship between hypertension and hemorrhagic stroke is also well documented with a global consistency. Uncontrolled hypertension is the main cause for primary ICH, and this can be prevented by good blood pressure control and regular medical checkups to pick up diagnose hypertension early. Very often the patient will be diagnosed with hypertension only when they develop a target

organ problem like a hemorrhagic stroke.[16]

Around half of our patient population had diabetes mellitus (DM) with a significantly higher prevalence in the ischemic stroke group. Ischemic stroke is known to be independently associated with DM which increases its risk two to six times. However, with regards to hemorrhagic stroke, the link with diabetes has not been consistent. Atrial fibrillation (AF) is another risk factor associated with ischemic stroke. AF is also associated with a higher risk stroke recurrence, whether it is atrial fibrillation diagnosed after stroke or atrial fibrillation known before stroke.[17] It is interesting to note that the prevalence of AF in our group of ischemic stroke was around 8%, significantly lower than that reported internationally which can reach as high as one third of stroke cases.[18] Whether this represents a general lower incidence of AF in our population or more efficient management of existing AF with anticoagulation leading to a lower incidence of thrombotic complications remains unclear. However, it is important to note that AF can get picked-up later during the patient's hospital course or later during follow-up with Cardiology with Holter monitoring so it is possible that some cases were not identified during the ED course.

Other risk factors known to have an association with stroke were analyzed. These included past history of transient ischemic attacks, dyslipidemia, ischemic heart disease and family history of stroke. These factors were more commonly absent rather than present in our population.
The majority of strokes were of the ischemic type constituting more than 80% of cases with the rest being hemorrhagic. This is consistent with reports from Western countries where ischemic stroke is significantly more common than hemorrhagic stroke.[19] Studies from other Arab countries, including the GCC, reported variable proportions for ischemic stroke ranging from 58% to 87% with the highest reported in Saudi Arabia[20] and the lowest in Bahrain and Sudan where HS comprised a larger percentage.[21,22] The latter is more consistent with the pattern of strokes observed in the Eastern part of the globe, where the incidence of hemorrhagic stroke is reported to be twice that seen in the West.[23] This higher incidence is even seen in East Asians who have immigrated to the West.[24] These differences may be partly related to ethnicity[25], a factor which was not explored in this study. The fact that our findings conform with Western patterns of disease may be a reflection of the change of lifestyles in Oman that has accompanied

the modernization and development of the country witnessed over the past four decades, including the health system. Furthermore, the lower rate of hemorrhagic stroke is likely due to implementation of hypertension screening programs and treatment of the condition, which is a significant factor well known to be related to HS.[26,27]

When comparing the severity of the two subtypes of stroke, hemorrhagic stroke had significantly worse outcomes compared to ischemic stroke with a higher incidence of requiring admission to the intensive care unit and a longer hospital stay. The incidence of death was twice as common in hemorrhagic stroke. This is consistent with findings from many international studies. Intracranial hemorrhage causes more severe strokes and is known to be an independent predictor of poor neurologic outcomes with higher odds of long-term disability. This is a direct result of hemorrhage causing larger anatomic lesions when compared with ischemia-induced strokes.[28] The in-hospital mortality rate of hemorrhagic stroke was relatively low compared to other reports.[29]

This study has certain strengths and limitations. It is the first study from Oman to prospectively collect data from patients during their ED visits. It systematically reviewed the burden of stroke admitted to the National Stroke Center. The findings from this study can be utilized to inform future research in the country and to guide appropriate preventive strategies as well as resource allocation.

One limitation of this study is that it is a single-center study; therefore, the findings may not be considered to be generalizable to the entire population. Furthermore, the sample size was relatively small, which may affect the reliability of the obtained statistical results. Another limitation is that patients were only interviewed during their ED visits which limited the collection of other variables that may have been relevant and could have been collected if the study had included following the patients' in-hospital course. In addition, patients were not followed up with throughout their rehabilitation course which limits the information obtained on their pattern of recovery. For future studies, it will be important to expand the research to include all stroke patients admitted to hospitals in Oman. The adequacy of long-term and rehabilitation facilities for stroke patients is still to be assessed in Oman.

Conclusions

This study provides essential stroke characteristics data which is important in developing effective prevention, management and rehabilitation strategies specific to Oman's population. Most of the information obtained conforms with that described internationally and therefore similar preventive strategies can be implemented. Furthermore, the information can be utilized by health administrators in planning resource allocation. Further research is needed to explore rehabilitation aspects and long-term outcomes.

Conflict of Interest

The authors declare no conflicts of interest.

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Table 1: Sociodemographic characteristics

Variable	**Hemorrhagic stroke n = 33 (17.09%)**	**%**	**Ischemic stroke n = 160 (82.90%)**	**%**	***P* value (95% CI)**
Age	Min 27 Max 100 Mean (SD) 55.79 (16.73)		Min 27 Max 96 Mean (SD) 62.13 (12.93)		0.016
Nationality					
Omani	24	72.7	134	83.7	0.14
Non-Omani	9	27.3	26	16.3	
Gender					
Male	16	48.5	96	60.0	0.25
Female	17	51.5	64	40.0	
Educational status					
Illiterate	9	27.3	38	23.8	0.752
Read/Write	7	21.2	40	25.0	
Elementary education	5	15.2	27	16.9	
Secondary education	6	18.2	38	23.8	
Higher education	6	18.2	17	10.6	
Marital status					
Single	2	6.1	7	4.4	0.934
Married	24	72.7	121	75.6	
Divorced	1	3.0	7	4.4	
Widowed	6	18.2	25	15.6	
Smoking status (current)					

Yes No	2 31	6.1 93.9	13 147	8.1 91.2	0.99
Alcohol consumption (current) Yes No	1 32	3 97	11 149	6.9 93.1	0.69

Table 2: Stroke risk factors

Variable	**Hemorrhagic stroke**		**Ischemic stroke**		***P* value (95% CI)**
	(n = 33)	**%**	**(n = 160)**	**%**	
Hypertension	21	63.6	119	74.4	0.21
Diabetes mellitus	13	39.4	92	57.5	0.06
Dyslipidemia	7	21.2	51	31.9	0.29
Ischemic heart disease	3	9.1	34	21.3	0.16
Atrial fibrillation	4	12.1	11	6.9	0.30
Hypertension + Diabetes + Dyslipidemia	6	18.2	39	24.4	0.44
Past history of stroke	4	12.1	27	16.9	0.40
Family history of stroke	1	3.0	3	1.9	0.53

Table 3: Severity and outcome

Variable	**Hemorrhagic stroke**		**Ischemic stroke**		***P* value (95% CI)**
	(*n* = 33)	**%**	**(*n* = 160)**	**%**	
NIH score: ● Mild ● Moderate ● Severe/very severe	 13 11 9	 39.4 33.3 27.3	 109 38 13	 68.1 23.8 8.1	0.005
GCS: ● Mild ● Moderate ● Severe	 23 4 6	 69.7 12.1 18.2	 150 7 3	 93.8 4.4 1.9	0.001
Complications *	9	28.1	22	14.2	0.07
ICU admission *	16	50	35	22.6	0.004
Hospital stay	Mean (SD) 10.58 (11.89)		Mean (SD) 7.94 (7.31)		0.09
Outcome: ● Died ● Survived ● Signed LAMA	 5 27 1	 15.2 81.8 3.0	 11 144 5	 6.9 90 3.1	0.35
MRS upon discharge: *					

No symptoms	1	3.1	12	7.7	0.26
No significant disability	3	9.4	30	19.4	
Slight disability	4	12.5	32	20.6	
Moderate disability	10	31.3	43	27.7	
Moderately sever disability	6	18.8	21	13.5	
Severe disability	3	9.4	5	3.2	
Died	5	15.6	12	7.7	

NIH = National Institute of Health; GCS = Glasgow coma scale; ICU = intensive care unit; LAMA = left against medical advice; MRS = modified ranking score.
*cases LAMA excluded.

Table 4: Average time in minutes spent in different steps of providing care in the ED for patients presenting on the same day of symptoms

Variable	**Mean in minutes**	**SD**
Time from arrival until triage	6.77	4.5
Time from arrival until doctor evaluation	7.58	0.82
Time from arrival until imaging	28.53	3.08