Original Article

Clinical presentation, risk factors, and outcomes of stroke in Shabwah Governorate, Yemen

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ABSTRACT

Background: There is a lack of reliable information on stroke risk factors, clinical presentation, and mortality. The aim of this study was to describe stroke risk factors, clinical presentations, and in-hospital mortality and to identify the independent predictors of mortality among stroke patients admitted to three hospitals in Shabwa Governorate, Yemen. **Methods**: This retrospective and cross-sectional study was conducted from July 1, 2022, to June 30, 2023, in three hospitals in Shabwah Governorate, namely, Shabwah General Hospital Authority, Al Shifa Specialized Hospital, and Afya Specialized Hospital. **Results**: We involved 124 stroke cases, of whom 92 (74.2%) were males and 32 (25.8%) were females. Their mean age was 64.98±16.22 years, and hypertension was the most common risk factor, accounting for 71.0% (n=88) of cases. Ischemic stroke was detected in 95 (76.6%) cases, intracerebral hemorrhage (ICH) was detected in 25 (20.2%) patients, and subarachnoid hemorrhage (SAH) was detected in 4 (3.2%) cases. The in-hospital mortality was 27(21.8%), and according to bivariate analysis, the in-hospital mortality was significantly associated with hypertension (p=0.015), diabetes mellitus (DM) (p<0.0001), ischemic heart disease (p=0.002), rheumatic heart disease (p<0, 0001), and cardiomyopathy (p=0.004). In addition, in-hospital mortality was significantly associated with coma (p<0.0001), ischemic stroke (p<0.0001), ICH (p=0.013), and SAH (p=0.032). However, in multivariate logistic regression analysis, only coma (adjusted odds ratio [OR]=11.21, 95% confidence interval [CI]=3.42–36.75, p<0.0001) and DM (adjusted OR=5.8, 95% CI=1.79–18.85, p=0.003) were found to be independent risk factors for in-hospital mortality. **Conclusion:** In Shabwah Governorate, Yemen, ischemic strokes were more common than hemorrhagic strokes, with men more likely to have a stroke than women and the majority of cases being elderly. DM and coma were found to be independent risk factors for in-hospital mortality. Therefore, appropriate treatment of DM and other vascular risk factors is recommended to improve stroke outcomes.

Key words: Intracerebral hemorrhage, Ischemic stroke, Risk factors, In-hospital mortality, Shabwah Governorate

Stroke is an important cause of disability, dementia, and mortality worldwide [1]. It is the second leading cause of death, after coronary heart disease, and the third most common cause of disability worldwide [2-4]. Annually, 15 million people worldwide suffer a stroke. Of these, 5 million die, and another 5 million are left permanently disabled, placing a burden on family and community [5]. The burden of stroke in low- and middle-income countries is higher than in high-income countries and this gap is increasing [6,7]. This can be explained by the fact that low- and middle-income countries can only devote limited resources to medical facilities to cope with the burden of stroke. Furthermore, these countries lack reliable information on stroke and its epidemiology due to a lack of research in this field.

In Yemen, there were no population-based surveys on stroke mortality, however, the latest figures from the World Health Organization (WHO) show that Yemen ranked 32nd in the world in stroke-related deaths in 2020, with an age-adjusted death rate of 127.49/100,000 inhabitants [8]. To reduce stroke mortality, stroke care must be improved. This requires reliable data on stroke epidemiology, risk factors, treatment, and outcomes. However, there is a paucity of data on stroke clinical presentations, risk factors, and outcomes, as well as predictors of stroke mortality in Yemen. Only a few studies have addressed some of these aspects [9-13]. The aim of this study was to describe stroke risk factors, clinical presentations, and in-hospital mortality and to identify the independent predictors of mortality among stroke patients admitted to three hospitals in Shabwa Governorate, Yemen.

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PATIENTS AND METHODS

Study Design, Population, and Setting

A retrospective and cross-sectional study was conducted from July 1, 2022, to June 30, 2023, in three hospitals in Ataq City, Shabwah Governorate, namely, Shabwah General Hospital Authority, Al Shifa Specialized Hospital, and Afya Specialized Hospital. This study included all stroke patients admitted to the three hospitals during the study period. Shabwah is the third largest governorate in Yemen by area and is located in the center of the country. This governorate consists of 17 districts covering an area of around 43,000 square kilometers and has the lowest population density in Yemen.

Definition of Stroke, Inclusion and Exclusion Criteria

The American Heart Association/American Stroke Association defines an ischemic stroke as an episode of neurological dysfunction caused by a focal cerebral, spinal, or retinal infarction, and defines a hemorrhagic stroke as rapidly developing clinical signs of neurological dysfunction, which are due to a focal accumulation of blood in the brain parenchyma or ventricular system that was not caused by trauma [14]. Patients with acute stroke confirmed by computed tomography (CT) and/or magnetic resonance imaging (MRI) were included in this study. Patients presented with transient ischemic attacks, subdural or epidural hematomas, and symptoms caused by recent trauma were excluded from the study.

Definition of Risk Factors

We defined the main risk factors as follows. Hypertension was considered positive if the patient was using medication for hypertension or if three consecutive blood pressure estimation readings were ≥140/90 mm Hg [15]. In addition to the WHO diabetes mellitus (DM) diagnostic criteria [16], the patient was considered diabetic if he had a history of DM or was receiving medication for DM. Hyperlipidemia was defined according to standard guidelines [17]. The patient was considered to have heart disease (rheumatic heart disease, ischemic heart disease, atrial fibrillation, and cardiomyopathy) if history, clinical examination, available investigations on admission, or requested investigations during hospitalization confirmed the diagnosis. Smoking and khat chewing were positive if patients were using them daily for more than a year [13].

Data Collection and Source of Data

Patients with stroke (first and/or recurrent) were identified from the medical record departments of the three hospitals. The medical records of these patients were reviewed and the following variables were recorded: Age, sex, and risk factors such as hypertension, DM, smoking, dyslipidemia, smoking, ischemic heart disease, khat chewing, atrial fibrillation, history of previous attack, family history of stroke, and cardiomyopathy. We also recorded the clinical presentation, types of stroke, and stroke outcome. The stroke outcome was reported as survived or dead. The primary outcome of our study was in-hospital mortality.

Sampling and Sample Size Calculation

Purposive sampling was performed and regarding sample size calculation, we executed complete enumeration.

Ethical Approval and Statistical Analysis

The study was approved by the authorities of the three hospitals because there is no research committee in the governorate. Data were reported as mean±standard deviation for quantitative variables, while qualitative variables were described as numbers and percentages. Bivariate analysis was performed to determine the association of various variables with in-hospital mortality. Variables with p<0.5 in the bivariate analysis were entered in the multiple logistic regression to identify the independent risk factors for in-hospital mortality at p<0.05. Data analysis was performed with SPSS software (v 23; IBM Corp, Armonk, NY, USA).

RESULTS

Demographic Characteristics of the Participants

During the period from July 1, 2022, to June 30, 2023, 124 patients with stroke were admitted to the three hospitals involved in this study, accounting for 1.8% of all admissions in these hospitals. Of all, 92 (74.2%) were males and 32 (25.8%) were females with male: Female ratio of 2.9:1. The overall mean age of the patients was 64.98±16.22 years (range: 27–130 years), while the predominantly affected age group was ≥65 years. Illiterates, urban dwellers, and employees accounted for 30.6% (n=38), 58.9% (n=73), and 16.1% (n=20) of all cases, respectively (Table 1).

Table 1: Demographic characteristics of the patients involved in this study

Variable	N (%)/Mean±SD
Age	64.98±16.22 (27–130)
Age groups	
20–44	11 (8.9)
45–54	21 (16.9)
55–64	20 (16.1)
≥65	72 (58.1)
Sex	
Male	92 (74.2)
Female	32 (25.8)
Illiterate	38 (30.6)
Urban	73 (58.9)
Employees	20 (16.1)

Stroke Risk Factors and Clinical Presentation

Systemic hypertension was the most common modifiable risk factor for stroke occurring for 71.0% (n=88) of cases, followed by DM 57 (48.0%), smoking 40 (37.3%), and dyslipidemia 27 (21.8%). Table 2 summarizes the risk factors for stroke among the participants. The most common clinical presentation of stroke was hemiplegia accounting for 82.1% (n=77) of cases, followed by headache 53 (42.7%), speech disorder 50 (40.3%), vertigo 36 (29.0%), and gait instability 35 (28.2%) (Table 2). All patients had an imaging-confirmed stroke, either by brain CT or MRI, with 76.6% (n=95) having an ischemic stroke and 23.4% (n=29) having a hemorrhagic stroke, which involved intracerebral hemorrhage (ICH) 25 (20.2) and subarachnoid hemorrhage (SAH) 4 (3.2) (Table 2).

A Comparison between Male and Female Patients

Table 3 describes the difference between male and female patients in risk factors, clinical presentations, and outcomes. The number of smokers was higher in male patients than in female patients (40 [43.5%] vs. 0 [0%]; p<0.0001), male patients also consumed more khat than female patients (48 [52.2] vs. 1 [3.1%]; p<0.0001].

A Comparison between Survived and Dead Patients

In bivariate analysis, the in-hospital mortality was significantly associated with hypertension (p=0.015), DM (p<0.0001), ischemic heart disease (p=0.002), rheumatic heart disease (p<0.0001), and cardiomyopathy (p=0.004). In addition, in-hospital mortality was significantly associated with coma (p<0.0001), ischemic stroke (p<0.0001), ICH (p=0.013), and SAH (p=0.032). Table 4 summarizes the variables associated with in-hospital mortality in this study.

Stroke Outcome and Independent Predictors of Mortality

In-hospital mortality was 27 (21.8%). Table 2 describes the outcomes of stroke in this study. After adjusting the relationship to include many variables, and using conditional multiple logistic regression analysis, only coma (adjusted odds ratio [OR]=11.21, 95% confidence interval [CI]=3.42–36.75, p<0.0001) and DM

Table 2: Clinical characteristics of the patients involved in this study

Variable	N (%)
Risk factors	
Hypertension	88 (71.0)
Diabetes mellitus	57 (48.0)
Smoking	40 (37.3)
Ischemic heart disease	23 (18.5)
Dyslipidemia	27 (21.8)
Rheumatic heart disease	7 (5.6)
Khat chewing	49 (39.5)
Family history of stroke	23 (18.5)
Atrial fibrillation	13 (10.5)
Cardiomyopathy	15 (12.1)
Clinical presentation	
Hemiplegia	77 (82.1)
Speech disorder	50 (40.3)
Upper motor neuron facial palsy	28 (22.6)
Consciousness disturbance	23 (18.5)
Convulsion	19 (15.3)
Gait instability	35 (28.2)
Headache	53 (42.7)
Vomiting	35 (28.2)
Vertigo	36 (29.0)
Coma	22 (17.7)
Type of stroke	
Ischemic	95 (76.6)
Intracerebral hemorrhage	25 (20.2)
Subarachnoid hemorrhage	4 (3.2)
Stroke outcomes	
Survived	97 (78.2)
Dead	27 (21.8)

Table 3: Clinical characteristics of the patients stratified by sex

Risk factors	Male	Female	p-value
Age	64.84±15.09	65.38±19.38	0.872
Hypertension	68 (73.9)	20 (62.5)	0.221
Diabetes mellitus	44 (47.8)	13 (40.6)	0.481
Smoking	40 (43.5)	0 (0)	<0.0001
Ischemic heart disease	17 (18.5)	6 (18.7)	0.580
Dyslipidemia	21 (22.8)	6 (18.7)	0.417
Rheumatic heart disease	3 (3.3)	4 (12.5)	0.072
Khat chewing	48 (52.2)	1 (3.1)	<0.0001
Family history of stroke	19 (20.7)	4 (12.5)	0.430
History of stroke	28 (30.4)	6 (18.7)	0.254
Atrial fibrillation	11 (11.9)	2 (6.3)	0.295
Cardiomyopathy	10 (10.9)	5 (15.6)	0.335
Clinical presentation			
Hemiplegia	59 (64.1)	18 (56.3)	0.429
Speech disorder	40 (43.5)	10 (31.3)	0.225
Upper motor neuron facial palsy	19 (20.7)	9 (28.1)	0.384
Consciousness disturbance	18 (19.6)	5 (15.6)	0.793
Convulsion	13 (14.1)	6 (18.7)	0.700
Gait instability	26 (28.2)	9 (28.1)	0.234
Headache	41 (44.6)	12 (37.5)	0.487
Vomiting	27 (29.3)	8 (25.0)	0.820
Vertigo	24 (26.1)	12 (37.5)	0.221
Coma	15 (16.3)	7 (21.9)	0.591
Type of stroke			
Ischemic	73 (79.3)	22 (68.7)	0.222
Intracerebral hemorrhage	16 (17.4)	9 (28.1)	0.129
Subarachnoid hemorrhage	3 (3.3)	1 (3.1)	1.00
Stroke outcomes			
Mortality	17 (18.5)	10 (31.3)	0.132

(adjusted OR=5.8, 95% CI=1.79–18.85, p=0.003) were found to be independent risk factors for in-hospital mortality in this study (Table 5).

DISCUSSION

Although stroke is a devastating problem in Yemen, the lack of reliable data on stroke epidemiology, risk factors, treatment, and outcomes makes it difficult to establish a stroke profile for the Yemeni population to improve stroke care. The ongoing conflict in the country has undoubtedly affected the health sector and led to a weak research capacity. In this study, we described the stroke risk factors, clinical presentation, and outcomes in Shabwah Governorate, where stroke care lacks professionalism in terms of

Table 4: Clinical characteristics of patients stratified by outcome

Risk factors	Dead N=27	Survived N=97	p-value
Age	69.70±16.23	63.66±16.06	0.087
Hypertension	24	64	0.015
Diabetes mellitus	21	36	<0.0001
Smoking	10	30	0.548
Ischemic heart disease	11	12	0.002
Dyslipidemia	6	21	0.568
Rheumatic heart disease	6	1	<0.0001
Qat chewing	10	38	0.744
Family history of stroke	6	17	0.582
History of stroke	6	28	0.628
Atrial fibrillation	4	9	0.477
Cardiomyopathy	8	7	0.004
Clinical presentation			
Hemiplegia	18	59	0.658
Speech disorder	9	41	0.507
UMN facial palsy	9	19	0.191
Consciousness disturbance	4	19	0.781
Convulsion	6	13	0.080
Gait instability	10	25	0.463
Headache	8	45	0.119
Vomiting	10	25	0.250
Vertigo	6	30	0.378
Coma	15	7	<0.0001
Type of stroke			
Ischemic	13	79	<0.0001
Intracerebral hemorrhage	10	15	0.013
Subarachnoid hemorrhage	3	1	0.032

Table 5. Results of multivariate analysis of predictors of in-hospital mortality

Variables	Adjusted odds ratio (95% confidence interval)	p-value
Diabetes mellitus	5.8 (1.79–18.85)	0.003
Coma	11.21 (3.42–36.75)	<0.0001

staff and facilities. Most of the treating clinicians were general practitioners or general physicians; in addition, the hospitals lack stroke units, neurology intensive care units, thrombolysis treatment, and rehabilitation facilities. The implication of considerable stroke admissions in the medical wards is that the stroke inpatients may not have received the best critical care needed compared to admissions in a well-equipped stroke unit or neurology intensive care unit.

The actual incidence and prevalence of stroke in Yemen are not yet known due to a lack of stroke databases and stroke registries [13]. However, the results of the present study showed that stroke patients accounted for 1.8% of all hospital admissions during the study period. As shown, the mean age of stroke patients in our study was 64.98±16.22 years, which is similar to the mean age of patients in other studies conducted in Saudi Arabia and India [13,18-20]. The common age group involved in our study was ≥65 years, as in a study conducted in India [20]. This reflects the fact that the elderly population is still the target stroke population that needs special attention to reduce the stroke burden in Shabwah Governorate. There was a male predominance, with male patients accounting for 74.2% of all cases, consistent with the results of many studies conducted worldwide [13, 17-25]. The reason for the global trend towards male dominance is unclear but can be partially explained by the fact that hypertension, DM, smoking, khat chewing, and alcoholism are more common in male patients [13]. Another explanation is that men may have better health care-seeking behavior and therefore be more likely to present to the hospital. In addition, male gender is an established non-modifiable risk factor for stroke [21].

In the present study, the most common clinical presentation was hemiplegia, followed by speech disorders, which closely correlates with the study done by Patne and Chintale [20]. The most common form of stroke in our study was ischemic stroke, accounting for 76.6% of all cases consistent with previous studies conducted in Yemen [9-13], and other countries [18-25]. Hypertension was the leading modifiable risk factor in this study, similar to the findings of earlier studies conducted in hospital settings in our country [9-13] and other countries worldwide [18-25]. The degree of mental stress caused by poverty and instability attributed to the ongoing conflict is likely closely correlated with the frequency of hypertension among the Yemeni population [13]. The correlation between hypertension and ischemic and hemorrhagic stroke is well established, with treatment of hypertension being the cornerstone of stroke prevention, reducing the incidence of stroke by up to 40% [21]. We are unable to assess patient compliance with antihypertensive medications, but we assume that many of our patients have had poor blood pressure management due to noncompliance with treatment due to cost and/or unavailability of medications. DM was the second most common risk factor for stroke in this study, consistent with a previous study conducted in Hadramouth Governorate [13], as well as studies conducted in other countries in the world [18-25]. It has been found that individuals with DM have approximately twice the risk of stroke, particularly ischemic stroke, compared to those without DM

[26]. It has been found that chronic control of hyperglycemia *per se* is not associated with a reduction in stroke risk. However, appropriate management of DM and other vascular risk factors may improve stroke outcomes and reduce the risk of recurrent stroke [27]. We believe that many of our patients had poor glycemic control due to a lack of access to health services, the cost of diabetes diagnosis and treatment, and a lack of research capacity.

The frequency of tobacco smokers among stroke patients varies from study to study ranging between 21% and 40% [9-13]. The present study showed that smoking ranked fourth among stroke risk factors in our study, accounting for 37.3% of all stroke cases, which is within the global range mentioned above. The effect of smoking on stroke was found to be dose-related, regardless of current smoker or passive smoker status, as heavy smokers are more likely to develop a stroke, while the risk of contracting stroke decreases with smoking cessation [28,29].

In our study, dyslipidemia was found in 21.8% of patients similar to a study from Sri Lanka [30], but lower than a study conducted in Hadramout Governorate [13]. Khat chewing was identified in 39.5% of our cases, which is lower than the rate reported by Sallam *et al.* (43.4%) and Nour *et al.* (63%) [9,22]. A study from Yemen showed that khat chewers had a significantly higher risk of cardiogenic shock, stroke, and mortality [31]. Although this study has significant limitations, it highlights the need for larger and more robust studies to confirm the relevance of khat chewing as a risk factor for stroke. Interestingly, alcohol consumption was not reported by our patients, most likely due to sociocultural and religious reasons.

A comparison between male and female patients stratified by clinical presentation, risk factors, and outcome showed no significant differences between males and females except for two risk factors. First, in our study, many male patients smoked significantly more than female patients. Second, male patients were more likely to chew khat than female patients (Table 3). These findings may partially explain the preponderance of male patients in our study.

In-hospital mortality varies from study to study ranging between 2.8% and 46% [9,13,19,22,32]. In-hospital mortality in the present study was 21.8%, which falls within the global range. Independent predictors of in-hospital mortality have been identified by many authors worldwide with varying results. In a previous study by Basamad [13], hemorrhagic stroke and hypertension were found to be independent predictors of in-hospital mortality. Russell *et al.* [33] found the following variables to be independent risk factors for in-hospital mortality: hypertension, previous stroke, Glasgow coma scale <8, clinical diagnosis in the absence of imaging, hemorrhagic stroke, and aspiration pneumonia. Kamabu *et al.* [34] found that hemorrhagic stroke, delay in arrival at the hospital of more than 24 h, poor compliance with antidiabetic treatment, recurrent stroke, poor compliance with antihypertensive treatment, and age advanced > 75 years were independent predictors of in-hospital mortality. Finally, Arabambi *et al.* reported age >65 years, and management

in non-stroke units was considered to be independent risk factors for mortality [21]. In the present study, we found that coma state and DM were the only independent predictors of in-hospital mortality.

This study has several limitations. First, this is a retrospective study based on secondary data where follow-up of patients was not possible. Second, the functional status score at the time of admission and discharge as well as the outcome at 1-year follow-up could not be assessed due to missing data in the patients' medical records. Third, this is a hospital-based study; therefore, this data only represents stroke profiles in Shabwah Governorate and may not be generalizable to the Yemeni context. Finally, ischemic stroke subtypes were not identified due to a lack of data from patients' medical records.

CONCLUSION

In Shabwah Governorate, Yemen, ischemic strokes were more common than hemorrhagic strokes, with men more likely to have a stroke than women and the majority of cases being elderly. Hypertension, DM, smoking, and dyslipidemia were the most commonly identified stroke risk factors. Male patients smoked and chewed khat more than female patients. DM and coma were found to be independent predictors of in-hospital mortality. Therefore, appropriate treatment of DM and other vascular risk factors is recommended to improve stroke outcomes. In addition, the public needs to be educated about the risk factors for stroke, particularly systemic hypertension and DM.

AUTHORS' CONTRIBUTIONS

All authors have made a significant contribution to the work reported, whether in conception, study design, implementation, data collection, data analysis, and interpretation, or all of these areas, they also participated in drafting, revising, or critically reviewing the article and gave final approval to publish the version.

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