Medical Science

pISSN 2321–7359; eISSN 2321–7367

Clinical profile and risk factors for stroke in inpatients admitted in tertiary care center, Saudi Arabia

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To Cite:
Alharbi A. Clinical profile and risk factors for stroke in inpatients admitted in tertiary care center, Saudi Arabia. Medical Science, 2022, 26, ms48e1871.
doi: https://doi.org/10.54905/disssi/v26i120/ms48e1871

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Peer-Review History
Received: 02 November 2021
Reviewed & Revised: 03/November/2021 to 23/January/2022
Accepted: 25 January 2022
Published: 29 January 2022

Peer-review Method
External peer-review was done through double-blind method.

URL: https://www.discoveryjournals.org/medicalscience

ABSTRACT

Objective: The current research examines the clinical profile and associated risk factors for stroke in inpatients admitted to a tertiary care hospital in Saudi Arabia. *Methods:* This retrospective record-based study was conducted in central region of Saudi Arabia from January 2020 to December 2020. The data collected included demographic details, detailed history, examination, and investigations. The stroke patients were classified as mild, moderate, and moderate to severe stroke according to the NHSS stroke scale. Entry of data and analysis were carried outby SPSS Version 25 to know any association between the severity of the stroke and qualitative and quantitative variables. *Results:* The present study was done on 398 stroke patients with 275 (69.1%) males and 123 (30.9%) females. About 45% of patients were in the age group of 61-80 years. With regards to the type of stroke, ischemic stroke was predominant (92.7%) as compare to hemorrhagic stroke. A significant association was found with age, obesity, hospital stay, and dyslipidemia with moderate and moderate to severe stroke. *Conclusion:* Our findings suggest that the prevalence of stroke is on the rise and gets worse with age. The vast majorities of stroke victims were over the age of 60 and were associated with preventable risk factors such as hypertension, diabetes, obesity, and smoking.

Keywords: Stroke, Clinical Profile, Risk Factors, Saudi Arabia

1. INTRODUCTION

Stroke is a significant public health issue that results in 5.5 million fatalities and 44 million disability-adjusted life years lost each year across the globe (Asirvatham and Marwan, 2014). The incidence of stroke, frequency of different types of risk factors, and risk factors vary in different countries (Katan and Luft, 2018). A comprehensive analysis of 56 population-based studies showed that stroke incidence has decreased by 42 percent in high-income nations, whereas it has more than quadrupled in low-income countries in recent years (Alamri et al., 2019). Stroke is developing as a main health problem in the Middle East region, with the mortality going to be doubled by 2030 (Tran et al., 2010). Stroke rates on the Arabian Peninsula are now significantly higher than in many other countries (Al-Senani et al., 2020).

According to research, the Middle East bears increased burden of disease due to declining communicable disease rates and rising non-communicable disease rates (Robert and Zamzami, 2014; Akala and El- Saharty, 2006).

Prevalence rates of strokein rural areas found to vary from 84 to 262 per 100,000. The urban population has a rate of 334 to 424 per 100,000. According to population-based research, incidence rate of 119-145/100,000 people was recorded. Overall morbidity was 795.57 per 100,000 person-years as measured by Disability-Adjusted Life Years (DALYs) (Alahmari and Paul, 2016). According to information is gathered from physiotherapy departments throughout the country that provides stroke victims rehabilitative services, the stroke burden in Saudi Arabia is about 57.64 per 100,000 people (Bakraa et al., 2021). A review by Al Rajeh et al., (2002) which summarized various studies done on stroke in Saudi Arabia, noted the overall distribution of stroke types was quite similar to other communities with the contrasting low incidence of subarachnoid hemorrhage. Relative high frequency of stroke among youth was recorded.

In a study of stroke patients hospitalized at King Abdul Aziz University Hospital, Quri et al., (2000) discovered a significant incidence of thrombotic stroke. In another study done in King Abdulaziz hospital, Saudi discovered that stroke is more common in patients in their 6th decade of life, with a clear male predominance (Akbar and Mushtaq, 2001). According to Almekhlafi's hospital-based study14, the stroke burden in Saudi Arabia is increasing. Stroke and its consequences were responsible for 32% of the deaths among the 548 patients in their study (Almekhalfi, 2016). Considering the wide variability in the profile of stroke patients, this study was carried out in a tertiary care Health centre in Hawtat Sudair, in the central region of Saudi Arabia, with an objective to define the clinical profile and associated risk factors of stroke patients.

2. MATERIALS AND METHODS

This retrospective record-based study was carried out in Department of Neurology, Department of Neurology in King Khalid General Hospital, Majmaah, Hawtat Sudair general hospital, Zulfi general hospital and Kingdome hospital Riyadh, Saudi Arabia from January 2020 to December 2020. All the stroke patients who were above the age of 18 years admitted and diagnosed with ischemic or hemorrhagic stroke by clinical examination and confirmed by appropriate imaging (CT scan/ MRI Brain) during the study duration were encompassed in the study.

All the stroke patients were classified at the time of admission as mild, moderate, and moderate to severe stroke according to the NHSS stroke scale. The patients with a score of 1- 4, 5-15, and 16- 42 were categorized as mild, moderate, and moderate to severe stroke, respectively (Chalos, 2020). Variables such as demographic information such as gender, age, marital status, nationality, associated comorbidities such as diabetes, hypertension, and cardiac diseases were noted in the case records. Other outcome measures such as type of stroke, HGB concentration at admission, blood sugar levels at the time of admission, affected side of the brain and affected part (cerebral, cerebellum, and brain stem) were also recorded.

The type of stroke was classified based on the results of a brain computed tomography (CT) scan performed within one week of the commencement of the stroke. Cerebral infarction was detectedcentered on typical infarct CT scan observations or a normal CT scan when executed within 2 days of the inception of stroke, or the presence of a possible source of cerebral emboli, for example the heart or carotid artery, on the side of the stroke.

Ethical approval was attained from the Deanship of Research, Majmaah University with IRB Log No. 20-288E before the commencement of study and data collection. The identification details mentioned in the case records were kept confidential and anonymous.

Statistical Analysis

The data collected were analyzed using Excel 2007, R2.8.0 Statistical Package for Social Sciences (SPSS) for windows version 25.0 (SPSS Inc.; Chicago, IL, USA). Descriptive & inferential statistics were calculated. Mean and standard deviation was calculated for quantitative variables. Independent t-test, Chi-Square test, and Multinominal logistic regression were applied.

3. RESULTS

The present study carried out included 398 stroke patients during the study period included 275 (69.1%) males and 123 (30.9%) females. Both quantitative and qualitative variables were analyzed based on the severity of stroke. Mean age of stroke patients were noted to be 60.4 ± 15.7 years and were observed to be strongly associated with the severity of stroke. Almost half of the patients had a moderate stroke followed by mild stroke 127 (39.4%), and a few 42 (10.55%) had moderate to severe stroke. The highest number of cases was detected in the 61-80 group (45.0%), and the lowest number was found in the >80 groups (7.8%).

The mean length of hospital staywas 6.6±7.7 days, with the majority of moderate to severe stroke patients staying a bit longer for 12.0 ± 12.0 days compared with 5.3 ± 6.6 days for minor stroke. While observing the type of stroke, ischemic stroke was predominant (92.7%) in comparison to hemorrhagic stroke. Interestingly, it was observed that the baseline hemoglobin (HGB) concentration was normal for the majority (64.6%) of the patients, while only 9 patients had high HGB levels. One-third of the patients rather demonstrated a low HGB level. Similarly, the glucose levels remain normal in more than fifty percent of the patients (55.8%), while 32.7% of them were found to be hyperglycemic. In contrast, hypoglycemic levels have no such reports (Table 1).

Table 1 Characteristics of stroke patients as per the severity

	Minor stroke (n=157)	Moderate stroke (n=199)	Moderate/ severe stroke (n=42)	Total (n=398)	P-value
Comparison of Quantitative measures					
Age	61.1 ± 14.5	58.7 ± 16.4	66.0 ± 15.2	60.4 ± 15.7	0.016
Hospital staying	5.3 ± 6.6	6.4 ± 6.8	12.0 ± 12.0	6.6 ± 7.7	0.000
HGB concentration at admission	13.3 ± 2.5	13.4 ± 2.2	12.0 ± 2.8	13.2 ± 2.4	0.002
Glucose Level at administration :	10.7 ± 23.1	9.1 ± 10.0	11.9 ± 19.1	10.1 ± 17.2	0.539
Gender					
Male	117 (74.5%)	128 (64.3%)	30 (71.4%)	275 (69.1%)	0.111
Female	40 (25.5%)	71 (35.7%)	12 (28.6%)	123 (30.9%)	
Age					
<=40	13 (8.3%)	26 (13.1%)	3 (7.1%)	42 (10.6%)	0.35
41-60	63 (40.1%)	71 (35.7%)	12 (28.6%)	146 (36.7%)	
61-80	69 (43.9%)	89 (44.7%)	21 (50.0%)	179 (45.0%)	
>80	12 (7.6%)	13 (6.5%)	6 (14.3%)	31 (7.8%)	
Type of stroke :					
Hemorrhagic	11 (7.0%)	18 (9.0%)	0 (0.0%)	29 (7.3%)	0.121
Ischemic	146 (93.0%)	181 (91.0%)	42 (100.0%)	369 (92.7%)	
HGB concentration at admission					
Normal	101 (64.3%)	137 (68.8%)	19 (45.2%)	257 (64.6%)	0.064
Low	53 (33.8%)	58 (29.1%)	21 (50.0%)	132 (33.2%)	
High	3 (1.9%)	4 (2.0%)	2 (4.8%)	9 (2.3%)	
Glucose Level at administration :					
Normal	87 (55.4%)	118 (59.3%)	17 (40.5%)	222 (55.8%)	0.112
Low	1 (0.6%)	1 (0.5%)	0 (0.0%)	2 (0.5%)	
Pre-diabetic	22 (14.0%)	19 (9.5%)	3 (7.1%)	44 (11.1%)	
High	47 (29.9%)	61 (30.7%)	22 (52.4%)	130 (32.7%)	

With regards to the affected side and part of the brain in stroke patients, it was observed that all three main regions (cerebral, cerebellum, and brain stem) were affected to various degrees, with most of the patients hospitalised with cerebral involvement followed by cerebellum and brainstem. In the case of the cerebral region, both left and right sides were affected to a similar extent. In contrast to it, in the cerebellum region, it was observed that the right side was more affected than the left side. The affected regions' data just reversed in the case of the brain stem, where the left side was more affected than the right side (Table 2).

Table 2 Affected side of the brain.

	Minor stroke (n=157)	Moderate stroke (n=199)	Moderate/ severe stroke (n=42)	Total (n=398)	P-value
Affected side of brain : [Cerebral]					
Left	51 (32.5%)	78 (39.2%)	18 (42.9%)	147 (36.9%)	0.245
Right	57 (36.3%)	70 (35.2%)	15 (35.7%)	142 (35.7%)	
Both	24 (15.3%)	31 (15.6%)	8 (19.0%)	63 (15.8%)	
No	25 (15.9%)	20 (10.1%)	1 (2.4%)	46 (11.6%)	
The affected side of the brain : [cerebellum]					
Left	4 (2.5%)	4 (2.0%)	2 (4.8%)	10 (2.5%)	0.298
Right	9 (5.7%)	11 (5.5%)	0 (0.0%)	20 (5.0%)	
Both	6 (3.8%)	2 (1.0%)	2 (4.8%)	10 (2.5%)	
No	138 (87.9%)	182 (91.5%)	38 (90.5%)	358 (89.9%)	
Affected side of brain : [Brain stem]					
Left	1 (0.6%)	5 (2.5%)	0 (0.0%)	6 (1.5%)	0.033
Right	3 (1.9%)	1 (0.5%)	0 (0.0%)	4 (1.0%)	
Both	3 (1.9%)	1 (0.5%)	3 (7.1%)	7 (1.8%)	
No	150 (95.5%)	192 (96.5%)	39 (92.9%)	381 (95.7%)	

From the associative comorbidities, it was observed that in >70% of cases, hypertension remained the primary cause, followed by diabetes mellitus (>50% cases) were associated with mild and moderate strokes. Whereas; in moderate to severe stroke, patients about 85% and 76% of cases had hypertension and diabetes mellitus. The influence of smoking and obesity were also imperative factors; however, their influences were restricted to minor levels (Figure 1). It is observed that under all three severities of stroke, the patients bear previous incidences/experiences of hospitalization. About 50% and 40% of patients with moderate to severe stroke had a history of the previous admission to the hospital and previous stroke, respectively (Figure 2).

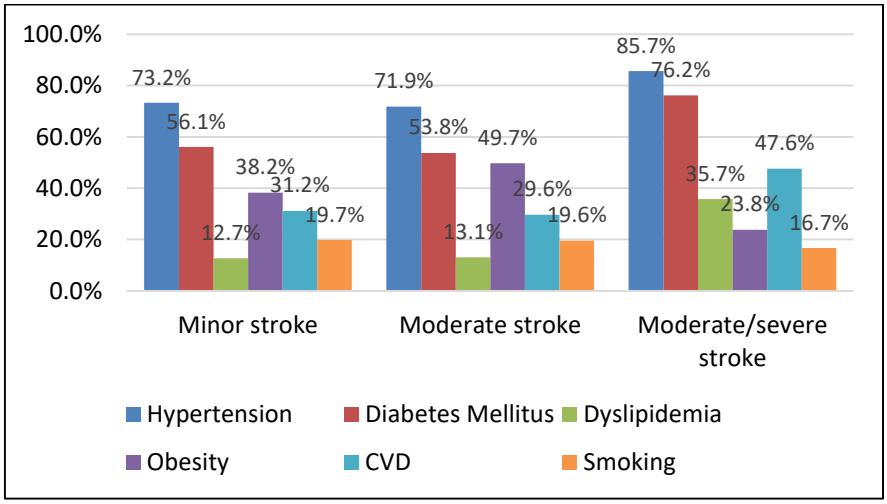

Figure 1 Comorbidities and severity of stroke.

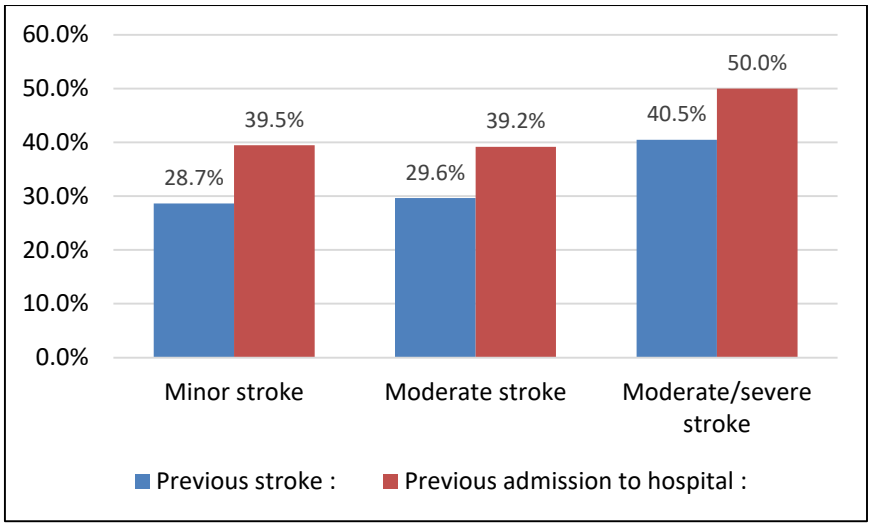

Figure 2 previous histories of stroke and admission to hospital.

The multinomial logistic regressions for the assessment of the risk factors connectedto stroke have been done (Table 3), which concluded the influence of age, dyslipidemia, and obesity on stroke. The reference category is 1-4 minor stroke; Adjusted for factors- Gender, HTN, DM, CVD, Smoking, and HGB levels.

Table 3 Multinomial logistic regression to assess the risk factors associated with stroke

Risk Factors	Moderate stroke			Moderate/Severe stroke		
	B	P-value	OR (95% C.I)	B	P-value	OR (95% C.I)
Age	-0.011	0.136	0.99 (0.98-1.00)	0.035	0.013	1.04 (1.01-1.06)
Hospital stay	0.034	0.096	1.03 (0.99-1.08)	0.091	0.000	1.10 (1.05-1.15)
Dyslipidemia	0.011	0.972	1.01 (0.54-1.91)	1.373	0.001	3.95 (1.72-9.04)
Obesity	0.542	0.014	1.72 (1.12-2.65)	-0.740	0.080	0.48 (0.21-1.09)

4. DISCUSSION

Stroke has a larger impact on women than on males; according to studies, men have greater age-specific stroke rates than women, although women experience more stroke events than men due to their longer life expectancy and considerably higher occurrence at later ages (Reeves et al., 2008). The correlation holds true for this study, where greater age-specific stroke have been found. A study conducted on inpatient stroke patients in the eastern area of Saudi Arabia on 393 patients with an age range of 42 to 92 years found 79% of strokes were ischemic types (El Sayed, 1999). The same finding is corroborated in our study; with a high percentage of patents were in the stroke patients in the age range group of 61-80 years and more than 90% of them having the ischemic type of stroke. In the study, an alarming figure was observed in the 41-60 groups (36.7%), which indicate changing lifestyle. The reports in the group <40 years pointed towards stress, unhealthy lifestyle, and changing psychological phenomena. This age is the highest productivity unit of any nation, and affecting this age group by stroke leads to a huge loss. It has been observed that with the progression of age, the degree or the severity (from minor type to severe type) of stroke escalates proportionately.

Previous research has looked at whether the relationships between concentration of hemoglobin and stroke risk varied by gender, but the findings have been mixed. Increasing hemoglobin concentrations within the stated normal range of hemoglobin has been linked to an augmented risk of stroke. When conventional stroke risk variables were taken into account in multivariate analysis, the relationship remained statistically significant. In Cox regression models that controlled for demographic and clinical factors, there was no link between baseline hemoglobin levels and episode stroke in males, while the lowest (12.4 g/dL) and maximum (>14.0 g/dL) quartiles of hemoglobin were linked to a greater risk of stroke in females (Panwar et al., 2016). In this study, no involvement has been found between baseline hemoglobin levels and incident stroke in both genders. Elevated blood glucose is common in the early phase of stroke. On admission, hyperglycemia, defined as a blood glucose level >6.0 mmol/L, was found in 2/3rdof ischemic stroke subtypes and at least 50% of each types, comprising lacunar strokes. In acute stroke, blood glucose levels are often increased, and increased admission glucose concentration is linked to bigger lesions, higher mortality, and a worse functional prognosis.

Hyperglycemia is linked to an increased risk for hemorrhagic infarct transformation in individuals receiving thrombolysis (Reshi et al., 2017). The relationship holds correct between the hyperglycemic phase and stroke, where individuals with higher glucose levels suffered from a moderate stroke. In a recent meta-analysis, it was shown that being overweight or obese is linked to a higher risk of stroke, which is likely independent of other cardiovascular risk factors. With rising body weight, the dangerous impact becomes more pronounced. Furthermore, there is a link between overweight and obesity with the ischemic stroke risk (Guo et al., 2016). In this study, the role of one of the prime comorbidity, obesity, was found to be interrelated with ischemic stroke.

The evidence connecting smoking to stroke is tremendously convincing. Current smokers have a two-fold to 4 fold higher risk of stroke compared to lifetime non-smokers or those who stopped smoking more than ten years ago, according to studies conducted across different races and demographics. When this group was compared to non-smokers who had never been exposed to ambient tobacco smoke, the risk rose six-fold in one research (*i.e.*, second-hand smoke). In separate research, when cigarette-smoking women with smoking husbands were compared to smoking women with non-smoking spouses, the six-fold increase in risk remained, showing the impact of second-hand smoke on stroke risk (Shah and Cole, 2010). This comorbidity holds fairly correlative with stroke.

Strokes are closely linked to hypertension because hypertension is linked to atheromatous deposits that obstruct or restrict brain arteries, leading to local clot formation (Alreshidi et al., 2020). Above a blood pressure (BP) of around 115/75 mm Hg, the risk of stroke rises constantly. Because the relationship is strong and BP levels are high in most adult populations, non-optimal BP (*i.e.*, >115/75 mm Hg) is responsible for almost two-thirds of the worldwide stroke burden (Wajngarten and Silva, 2019). A similar association has been observed with raised blood pressure and the occurrence of stroke with various degrees of severity. Epidemiological studies have delivered contradictory results regarding the connotation of dyslipidemia and ischemic stroke. Overall, higher LDL-C levels seem to upsurge the risk of ischemic stroke. Low HDL-C levels also seem to be linked to a greater risk, whereas the significance of high triglyceride levels is less clear (Tziomalos et al., 2009). The data attained in this study judiciously correlated with dyslipidemia and sturdily supported its background.

The major cause of death from heart ailment and stroke is the liberal blocking of blood vessels with a build-up of cellular waste (plaques) and fatty substances. Plaque formed in the arteries distributing blood to heart muscle can induce angina or a heart attack (Conforto et al., 2013).

5. CONCLUSION

The young patients' population is escalating, middle-age is more prone to stroke in this decade, and old patients have predominantly high severe cases which are more hazardous in opinion of the productive year lost. Stroke is a most common risk factor in male predominance with hypertension. Dyslipidemia was additional risk factor for stroke. The most frequently encountered stroke was ischemic. Advancing countries like Saudi Arabia are facing an increased burden of non-communicable diseases where the stroke is one of the foremost causes of disability and death.

Acknowledgment

We thank the Deanship of Research, Majmaah University, for continuous support and administrative staff of Hawtat Sudair General Hospital.

Author Contributions

Dr. AbdulrahmanAlharbi has contributed to conceptualization, design, data collection, manuscript drafting, editing, and supervision.

Funding

The study did not receive any external funding.

Conflict of interests

The authors declare that there are no conflicts of interests.

Data and materials availability

All data associated with this study are present in the paper.

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