ABSTRACT

**Background:** The purpose of this study was to explore the stroke types and the risk factors of the first-time stroke in the holy city of Madinah Munawarah.

**Methods:** A prospective hospital-based research study was carried out over the year of 2014. The patients with the diagnosis of the cerebrovascular accident were enrolled in the study. The details of patients’ history, demographic data, stroke type, and risk factors were collected.

**Results:** First-time stroke were determined in 164 patients (91 male and 73 female) during the entire periods of this study with a mean age of 67.52 ± 2.31 years. The prevalence of types of stroke was ischaemic strokes in 133 patients (% 81.1), intercerebral hemorrhage in 24 patients (14.63%), and subarachnoid hemorrhage in one patient (0.6%). The most common risk factors recorded were hypertension (86.6%), diabetes mellitus (63.4%), and ischaemic heart disease (41.5%). There was no significant relationship between the frequency of ischaemic stroke and intercerebral hemorrhage stroke (p > 0.05).

**Conclusion:** The study indicates that hypertension, diabetes, and ischaemic heart disease are critical risk factors for developing stroke and fairly commensurate with the global reported risk factors. Further research is needed to investigate stroke patterns and other possible risk factors concurrently with Saudi national prevention programs.

**Keywords:** Hospital-based study, Risk-factors, ischaemic stroke, intercerebral hemorrhage stroke.

Received 08th June 2019, accepted 03rd August 2019, published 09th August 2019

10.15621/ijphy/2019/v6i4/185413

www.ijphy.org
INTRODUCTION

Stroke is considered as a significant cause of prolonged disability that negatively impacts 16.9 million people every year, and is one of the leading causes of morbidity and mortality in developed and developing countries [1,2]. Stroke is a devastating health problem with a tremendous cost of care with a budget roughly of $34.3 billion spendings annually in the United States of America [3]. Stroke burden is anticipated to be substantially higher, most likely in the developing countries [4]. Risk factors and lifestyle of people differ in those countries which necessitate investigation of stroke risk factors and clinical features in different nations to identify the pattern of the disease in particular population [5-9]. Given that stroke is possibly avoidable, especially when medical information is available, a thorough understanding of risk factors in a specific country becomes fundamental to decrease the incidence of stroke, high costs of rehabilitation, and other negative consequences of stroke.

There is the rarity of data concerning stroke prevalence with its types and risk factors at the holy city named Al-Madina Al-Munawara. The holy city is located at North-Western part of Kingdom of Saudi Arabia [10,11]. We hypothesize that prevalence, types, and risk factors are different than its counterparts in different geographic areas. The purpose of the present study was to explore the types and risk factors associated with first time stroke in the holy city of Al-Madinah Al-Munawarah occurred over the entire year of 2014.

METHODS

A prospective hospital based-study was taken place in governmental and private sector hospitals of Al-Madina Al-Munawara city. Data was collected over the entire year of 2014. Patients were rigorously screened to consider those who meet the inclusion-exclusion criteria set for the present study. Inclusion criteria: patients were included irrespective of age and gender if they experienced stroke for the first time with a physician confirming the diagnosis using computerized tomography of the brain, echocardiography, and magnetic resonance imaging. Exclusion criteria: patients were excluded if they have a recurrent stroke or if they are visitors of Al-Madina Al-Munawara for Umrah/ Hajj. The committee of research ethics of college of medical rehabilitation sciences at Taibah University approved the study (approval no. CMR-PT-2014-08). Also, official letters were obtained from every participating hospital.

A complete history of patients with the first-time stroke was taken concerning hypertension, diabetes, ischaemic heart disease, atrial fibrillation, smoking, and previous history of stroke. For the current study, we will define the medical diagnoses supported by its reference to guide readers for a better understanding of the research work. Patients with the first-time stroke, according to the World Health Organization, defined as “those who are rapidly developing clinical signs of focal or global disturbance of cerebral function, lasting more than 24 hours or leading to death, with no apparent cause other than that of vascular origin [12].” Patients have been diagnosed with high blood pressure, which is called hypertension, if they were under antihypertensive medication program at any time prior the onset of stroke, or had a systolic pressure $\geq 140$ mmHg or diastolic blood pressure $\geq 95$ mmHg throughout the time of hospital stay on two separate occasions [13]. Diabetes mellitus diagnosis was confirmed if patients were on oral hypoglycaemic medications or insulin before the onset of stroke, or if they had a fasting plasma glucose level $\geq 126$ mg/dL (7.0 mmol/L), or a casual plasma glucose $\geq 200$ mg/dL (11.1 mmol/L) in the setting of symptoms as a result of hyperglycemia during the hospital admission period of the patients on more than one occasion [14]. Patients were identified as smokers if they smoked at least a cigarette per day for the earlier three months from the onset of the stroke or more months as chain smokers, or taken a tobacco form in any means.

Statistical analysis

Descriptive statistics were used to estimate demographic characteristics and the prevalence of types and risk factors. Repeated measures of risk factors and types of stroke, comparison between the risk factor and other risk factors of stroke were analyzed by Chi-Square [14]. Frequencies and cross-tabulations were run to compare the risk factors of blood pressure, diabetics, smoking, ischaemic heart disease, and atrial fibrillation with types of stroke. Statistical significance was evaluated at $\alpha = 0.05$. SPSS 22.0 was the software used for all data analysis.

RESULTS

A total of 164 patients (91 male and 73 female) classified as the first-time stroke were recorded over the entire year of 2014 from governmental and private hospitals at Al-Madina Al-Munawara city in Saudi Arabia. The mean age of all of these first stroke patients was 67.52 ± 2.31 years, with a range between 20 and 94.

The sample was stratified at ten years strata starting from the age of 45 years up to the 74 years going to the lower end of 20 years old and the upper end of more than 75 years old. (Table 1).

Table 1: Different types of the first-time stroke

| Age / Stroke types | Ischaemic Stroke | Intercerebral Hemorrhage | Subarachnoid Hemorrhage | Undefined |
|--------------------|-----------------|-------------------------|-------------------------|-----------|
| 20-44              | 5 (3.5%)        | 3 (1.8%)                | 1 (0.6%)                | 1 (0.6%)  |
| 45-54              | 20 (12.2%)      | 1 (0.6%)                | 0 (0.0%)                | 1 (0.6%)  |
| 55-64              | 27 (16.4%)      | 4 (2.4%)                | 0 (0.0%)                | 2 (1.2%)  |
| 65-74              | 35 (21.4%)      | 9 (5.5%)                | 0 (0.0%)                | 0 (0.0%)  |
| 75+                | 46 (28.1%)      | 7 (4.2%)                | 0 (0.0%)                | 2 (1.2%)  |
| Total              | 133 (81.1%)     | 24 (14.6%)              | 1 (0.6%)                | 6 (3.7%)  |

Regarding stroke types, the ischaemic type was the most prevalent with 81% while the subarachnoid hemorrhage was the least prevalent with only 0.6%. (Table 1).

About risk factors, hypertension was the most common risk factor, with 86.6% while arterial fibrillation was the least common risk factor with 12.8%. (Table 2).
It has been noticed that most patients suffered from multiple risk factors with the highest (56.7%) attributed to high blood pressure and diabetes, while the lowest (4.3%) attributed to smoking and arterial fibrillation. (Table 3).

### Table 2: The risk factors of the first-time stroke

| Age/ Risk Factors | Elevated Blood Pressure | Diabetes | Smoking | Ischaemic Heart Disease | Arterial Fibrillation |
|-------------------|-------------------------|----------|---------|-------------------------|----------------------|
| Count (%)         | Count (%)               | Count (%)| Count (%)| Count (%)               | Count (%)            |
| 20-44             | 10 (6.1%)               | 8 (4.9%) | 6 (3.7%)| 5 (3.0%)                | 3 (1.8%)             |
| 45-54             | 15 (9.1%)               | 12 (7.3%)| 5 (3.0%)| 8 (4.9%)                | 4 (2.4%)             |
| 55-64             | 28 (17.1%)              | 20 (12.2%)| 8 (4.9%)| 13 (7.9%)               | 5 (3.0%)             |
| 65-74             | 39 (23.8%)              | 34 (20.7%)| 18 (11.0%)| 18 (11.0%)              | 6 (3.7%)             |
| 75+               | 50 (30.5%)              | 30 (18.3%)| 7 (4.3%)| 24 (14.6%)              | 3 (1.8%)             |
| Total             | 142 (86.6%)             | 104 (63.4%)| 44 (26.8%)| 68 (41.5%)              | 21 (12.8%)           |

A chi-square test of independence was calculated comparing the frequency of ischaemic stroke and intracerebral hemorrhage stroke. No significant relationship was found, p > 0.05. (Table 4).

### Table 3: The risk factors and co-morbid conditions

| Risk Factor            | Diabetes | Ischaemic Heart Disease | Arterial Fibrillation |
|------------------------|----------|-------------------------|-----------------------|
| Count (%)              | Count (%)| Count (%)               | Count (%)             |
| Elevated Blood Pressure| 93 (56.71%)| 67 (40.85%) | 18 (10.98%)          |
| Smoking Habits         | 32 (19.51%)| 20 (12.20%) | 7 (4.27%)            |

**DISCUSSION**

The findings of the current study showed that ischaemic stroke is the most prevalent type with hypertension as the most common risk factor without having any difference between an ischaemic stroke and intracerebral hemorrhage stroke. The study results are in harmony with some studies that were conducted in some regions of Saudi Arabia [15,16] but were different from some other studies [9,17]. Multiple studies were carried out in the Arabic Gulf countries to assess stroke types in Bahrain [18], Kuwait [19,20], and Qatar [21]. These studies revealed that ischaemic stroke was the most common types, ranging from 59 – 80%, whereas intracerebral haemorrhage found in 19–28.4%, subarachnoid haemorrhage in 1 - 1.7%, and undefined in 6.6 – 16%. Similarly, variations were also noted in several studies conducted in the other Arabic countries from Egypt [22,23], Palestine [24], Libya [25], Jordan [26], and Sudan [27]. These studies showed that ischaemic stroke, ranging from 58.3 to 89.2%, whereas intracerebral hemorrhage found in 6-41.6%, subarachnoid hemorrhage in 1.7 - 4.5%. However, a wide variation of the pattern stroke types was also clearly evident in the studies of developed countries [28].

In Europe, several studies were carried out in Italy [29,31], Holland [32], Bosnia [33], and Croatia [34,35]. These studies showed that the ischaemic stroke pattern ranged from 53.9-89.5%, intracerebral hemorrhage 10-20.2%, subarachnoid hemorrhage 4-22.5%, and undefined 2.6-37%. However, this global variation might partly result from different proportions, timing, and intensity of CT and MRI investigations.

The most important of the risk factors associated with stroke is hypertension. It was the most common risk factors existed among patients of stroke (86.6%) in this study, where this proportion is higher than that obtained from other Saudi Studies (24.9 – 61%) [15-17,36,37]. However, relatively higher rates were reported from other Arabic and Arabic Gulf countries than that from previous Saudi Studies (46.9 – 80%) [18,19,25,27,38,39].

Several studies in the West [40-42] and the Middle East [18-20,27,43] countries have also found diabetes mellitus to be a risk factor for stroke. Locally, the present study showed one-hundred, and four-stroke patients (63.4%) had diabetes, which is relatively similar to the finding of a recent study (65%) in Kuwait state [39]. However, diabetes mellitus was less frequently present in the cases of the other Saudi studies (22.8 – 42%) [16,17,36,37] and other Middle East countries (20 – 52.5%) [18-20,27,43].

Hypertension and diabetes are dangerous, and both globally represent possible risk factors of stroke [44]. They are recognized as substantial emerging clinical and public health enigmas in Saudi Arabia and the Middle East [44-46]. Moreover, many patients of this study had co-morbid conditions as more than one of the possible risk factors. The findings showed that hypertension and diabetes (56.71%) were the most frequent conditions. The possible explanations for a high percentage of hypertension and diabetes in stroke patients among Arabs including Saudi Arabia might be related to the high proportions of undiagnosed hypertension and diabetic cases, and also the lack of awareness among people about such probable stroke risk factors [45,46].

The current study also demonstrated that smoking constituted a significant risk factor, accounting for 26.8% of all stroke cases. The strokes attributable to smoking were higher than those reported from other investigators in Saudi Arabia (1.8 – 19%) [15,36,37]. However, it was roughly matched to that stated in a hospital-based study conducted at Jeddah city, Saudi Arabia, that is situated in the western area of Saudi Arabia [16]. The presence of heart diseases such as ischaemic heart disease (41.5%) and atrial fibrillation (12.8%) in this study suggests that cardiac dysfunction probably plays a substantial role in the development of stroke. Previous studies from Saudi Arabia showed less
proportion of stroke patients associated with ischaemic heart disease (8.5 – 17%) [16,37], and atrial fibrillation (4 – 10%) [15-17,37]. However, no genuine diagnosis of heart dysfunction was reported in some studies [17,36]. This study, to the best results of searched literature, was the first piece of work carried out at the city of Al- Madinah Al- Munawarah to investigate the stroke types and risk factors in first-time stroke patients. However, the insufficient number of recent research reports and the dissimilarity of the methodology, adopted in previous studies, had limited the comparison and interpretation.

Findings of the present study indicating that hypertension, diabetes, and ischaemic heart disease, in particular, are in harmony with previous studies being critical risk factors for stroke. It also brought out the necessity for further national studies to investigate the pattern and risk factors of first-time stroke patients in Saudi Arabia. Finally, Saudi community national prevention and educational programs must be addressed for better health planning.

**Conclusion:** The study indicates that hypertension, diabetes, and ischaemic heart disease are critical risk factors for developing stroke and fairly commensurate with the global reported risk factors. Further research is needed to investigate stroke patterns and other possible risk factors concurrently with a Saudi national prevention program.

**Source of funding**
None

**Conflict of interest statement**
There is no conflict of interest to report.

**Acknowledgments**
Thanks for the deanship of scientific research at Taibah University for the support provided. Also, we would like to extend our thanks to all researchers and participants.

**REFERENCES**

[1] Feigin V, Forouzanfar M, Krishnamurthi R, Mensah G. Global burden of stroke: an underestimate – authors’ reply. Lancet 2014; 383(9924): 1205–1206.

[2] Lozano R, Naghavi M, Foreman K, Lim S, Shibuya K, Aboyans V, et al. Global and regional mortality from 235 causes of death for 20 age groups in 1990 and 2010: a systematic analysis for the global burden of disease study 2010. Lancet 2012; 380 (9859): 2095–2128.

[3] Roger V, Go AS, Lloyd-Jones DM, et al. Heart disease and stroke statistics — 2012 update: a report from the American Heart Association. Circulation 2012;125(1):e2-e220.

[4] Tran J, Mirzaei M, Anderson L, Leeder SR. The epidemiology of stroke in the Middle East and North Africa. J NeurolSci2010; 295(1-2):38-40.

[5] Howard VJ, Cushman M, Pulley LGomez CR, Go RC, Prineas RJ, et al. The reasons for geographic and racial differences in stroke study: Objectives and design. Neuroepidemiology 2005;25(3):135-143.

[6] Pandey DK, Gorelick PB. Epidemiology of stroke in African Americans and Hispanic Americans. Med Clin North Am 2005;89(4):739-752.

[7] Stansbury JP, Jia H, Williams LS, et al. Ethnic disparities in stroke: Epidemiology, acute care, and post-acute out-comes. Stroke 2005;36(36): 374-386.

[8] Carter K, Anderson C, Hacket M, et al. Auckland Regional Community Stroke (ARCOS) Study Group. Trends in ethnic disparities in stroke incidence in Auck-land, New Zealand, during 1981 to 2003. Stroke 2006; 37: 56-62.

[9] Al-Rajeh S, Larbi E, Bademosi O, et al. Pattern and ethnic variations in stroke in Saudi Arabia. J Neurosci- ci 1991; 102(1):112-8.

[10] Walker L. The right to health and access to health care in Saudi Arabia with a particular focus on the women and migrants. In The right to health. A multi-country study law, policy and practice. 2014 edition. 2014.

[11] Madina Region Economic Report: Saudi Arabian General Investment Authority, 2014.

[12] Aleksic-Shihabi A: Stroke patients treated at department of neurology, Sibenik-Knin county general hos- pital, 1996–2005. ActaClin Croat 2010; 49(1): 3–9.

[13] Camm JA, Bunce HN. Cardiovascular Disease. In: Kumar P, Clark M, editors. Clinical Medicine. 6th ed; 2005.

[14] Gale EAM, Anderson JV. Diabetes mellitus and other disorders of metabolism. In: Kumar P, Clark M, editors. ClinicalMedicine. 6th ed. 2005.

[15] El Sayed MM, Adeuja AOG, El-Nahrawy E, Olaish MAM. Characteristics of stroke in Hofuf, Saudi Ara- bia. Ann Saudi Med 1999; 19(1): 27–31.

[16] Qari A. Profile of stroke in a teaching university hospital in the western region. Saudi Medical Journal 2000; 21(11):1030-1033.

[17] Ayoola AE, Banzal SS, Elamin AK, Godour MO, El- samman EW, Al-Hazmi MH. Profile of stroke in Gize- han, Kingdom of Saudi Arabia. Neurosciences. 2003; 8(4): 229–32.

[18] Al-Jishi AA, Mohan PK. Profile of stroke in Bahrain. Neurosciences (Riyadh). 2000; 5(1):30–4.

[19] Abdul-Ghaffar NU, El-Sonbaty MR, El-Din Ab- dul-Baky MS, Marafi e AA, Al-Said AM. Stroke in Kuwait: a three-year prospective study. Neuroepide- miology 1997;16(1): 40–7.

[20] Zhang Y, El Bayoumy I, Zhang Y, Yang H, Liu J. Risk factors and predictors of early mortality after acute stroke: hospital based study. Glo. Adv. Res J Med Sci 2014; 3(6):111-116.

[21] Habmad A, Sokrab TE, Momeni S, Mesraoua B, Lingren A. Stroke in Qatar: a one-year, hospital based study. J Stroke Cerebrovasc Dis. 2001; 10(5): 236–41.

[22] Kandil M, El-Tallawy H, Farawez H, Ahmed M, Hamed S, Ali A. Epidemiology of cerebro-vascular stroke and TIA in Upper Egypt (Soahag)- relative frequency of stroke in Assiut University Hospital. Egypt J NeurolPsychiatNeurosurg 2006; 43: 593–602.

[23] El-Tallawy HN, Farghaly WM, Shehata GA, Abu- del-Hakeem NM, Rageh TA, Badry R, et al. Epidemi- ology of non-fatal cerebrovascular stroke and tran- sient ischemic attacks in Al Quseir, Egypt. ClinInterv Aging 2013;8:1547–51.

[24] Sweileh WM, Sawalha AF, Al-Aqad SM, Zyoud SH,
Al-Jabi SW. The epidemiology of stroke in Northern Palestine: a 1-year, hospital-based study. J Stroke-Cerebrovasc Dis 2008; 17: 406–11.

Ashok P, Radhakrishnan K, Sridharan R, El-Mangoush MA. Incidence and pattern of cerebrovascular diseases in Benghazi, Libya. J NeurolNeurosurg Psychiatry 1986; 49(5): 519–23.

Al-Oraibi, S. Demographic characteristics of stroke patients in developing countries: Example from Jordanian government hospitals. J. Public Health Epidemiol 2012; 4(5): 110–116.

Sokrab T, Sid-Ahmed FM, Idris MN. Acute stroke type, risk factors, and early outcome in a developing country: a view from Sudan using a hospital-based sample. J Stroke Cerebrovasc Dis 2002;11(2): 63–5.

Feigin V, Lawes C, Bennett D, Anderson C. Stroke epidemiology: a review of population based studies of incidence, prevalence, and case-fatality in the late 20th century. Lancet Neurol 2003; 2(1): 43–53.

Ricci S, Celani M, La Rosa F, Vitali R, Duca E, Ferraguzzi R, Paolotti M, Seppoloni D, Caputo N, Chiurulla C, Scaroni R, Signorini E. SEPIVAC: a community-based study of stroke incidence in Umbria, Italy. Journal of Neurology, Neurosurgery, and Psychiatry 1991; 54: 695–698.

G. D’Alessandro, Bottacchi E, Di Giovanni M, Martinazzo C, Sironi L, Liu C, Carenni L, Corso G, Gerbazz V, Polillo C, MPesenti Compagnoni. Temporal trends of stroke in Valle d’Aosta, Italy: Incidence and 30-day fatality rates. NeuroSci 2000; 21(1): 13–18.

Marini C, Rocco Totar R, De Santis F, Ciancarelli I, Baldassarre M, Carolei A. Stroke in Young Adults in the Community-Based L’Aquila Registry: Incidence and Prognosis. Stroke2001; 32(1): 52–56.

Hollander M, Koudstaal P, Bots M, Grobbée D, Hofman A, Breteler M. Incidence, risk, and case fatality of first ever stroke in the elderly population. The Rotterdam Study. J NeuroNeurosurg Psychiatry 2003; 74(3): 317–321.

Salihović D, Smajlović D, Sinanović O, MD. Reduction of stroke mortality in the Tuzla region, Bosnia and Herzegovina. Neurosciences 2009; 14(3): 230–233.

Aleksić-Shihabi A. Stroke patients treated at department of neurology, Šibenik-Knin County General-Hospital, 1996-2005. ActaClin Croat 2010; 49(1): 3-9.

Ivanković M, Drobac M, Gverović-Antunica A, De marin V. The incidence of stroke at department of neurology, Dubrovnik General Hospital in 2008. ActaClin Croat 2011; 50(4): 509-512.

Al-Rajeh S, Larbi E, Bademosi O, Awada A, Yousef A, Al-Freihhi H, et al. Stroke register: experience from the eastern province of Saudi Arabia. Cerebrovasc Dis 1998; 8: 86–9.

Awada A, Al Rajeh S. The Saudi Stroke Data Bank. Analysis of the first 1000 cases. ActaNeurol Scand. 1999; 100(4): 265–9.

Khan F, Yasin M, Abu-Khattab M, El Hiday A, Erayes M, Lotf A. Stroke in Qatar: A First Prospective Hospital-based Study of Acute Stroke. Journal of Stroke and Cerebrovascular Diseases. 2008; 17(2): 69-78.

Al-Hashel J, Al-Sabah A, Ahmed S, Al-Enezi M, Al-Tawheid N, Al Mesalekh Z, Eliwa J. Alroughani R. Risk Factors, Subtypes, and Outcome of Ischemic Stroke in Kuwait: A National Study. Journal of Stroke and Cerebrovascular Diseases. 2016; 25(9): 2145-2152.

González-Gómez F, Pérez-Torre P, De-Felipe A, Vera R, Matute C, Cruz-Culebras A, Álvarez-Velasco R, Masjuan J. Stroke in young adults: Incidence rate, risk factors, treatment and prognosis. Rev Clin Esp. 2016; 216(7): 345-351.

Intisoa D, Stampatorea P, Zarrellia M, Guerrab G, Arpaib G, Simonea P, Tonaliab P, Beghica E. Incidence of first-ever ischemic and hemorrhagic stroke in a well-defined community of southern Italy, 1993–1995. European Journal of Neurology 2003, 10: 559–565.

Ihle-Hansen H, Thommessen B, Wyller T, Engedal K, Fure B, MD. Risk factors for and incidence of subtypes of ischemic stroke. Functional Neurology 2012; 27(1): 35-40.

Auais M, Alzyoud J, Sbieh Z, Abdulla F. The risk factors of CVA in Jordan. Physiotherapy Theory and Practice 2012; 28(8): 588–594.

Boutayeb A, Derouchi M, Boutayeb W, M. E. N. Lamli M. Cerebrovascular Diseases and Associated Risk Factors in WHO Eastern Mediterranean Countries. Cardiology and Angiology: An International Journal 2014; 2(1): 62-75.

Bani I, Prevalence, Knowledge, Attitude and Practices of Diabetes Mellitus among Jazan Population, Kingdom of Saudi Arabia (KSA). Journal of Diabetes Mellitus 2015; 5(2): 115-122.

El Bcheraoui C, Memish Z, Tuffaha M, Daoud F, Robinson M, Jaber S, et al. Hypertension and Its Associated Risk Factors in the Kingdom of Saudi Arabia, 2013: A National Survey. International Journal of Hypertension 2014; volume 2014:8 pages.