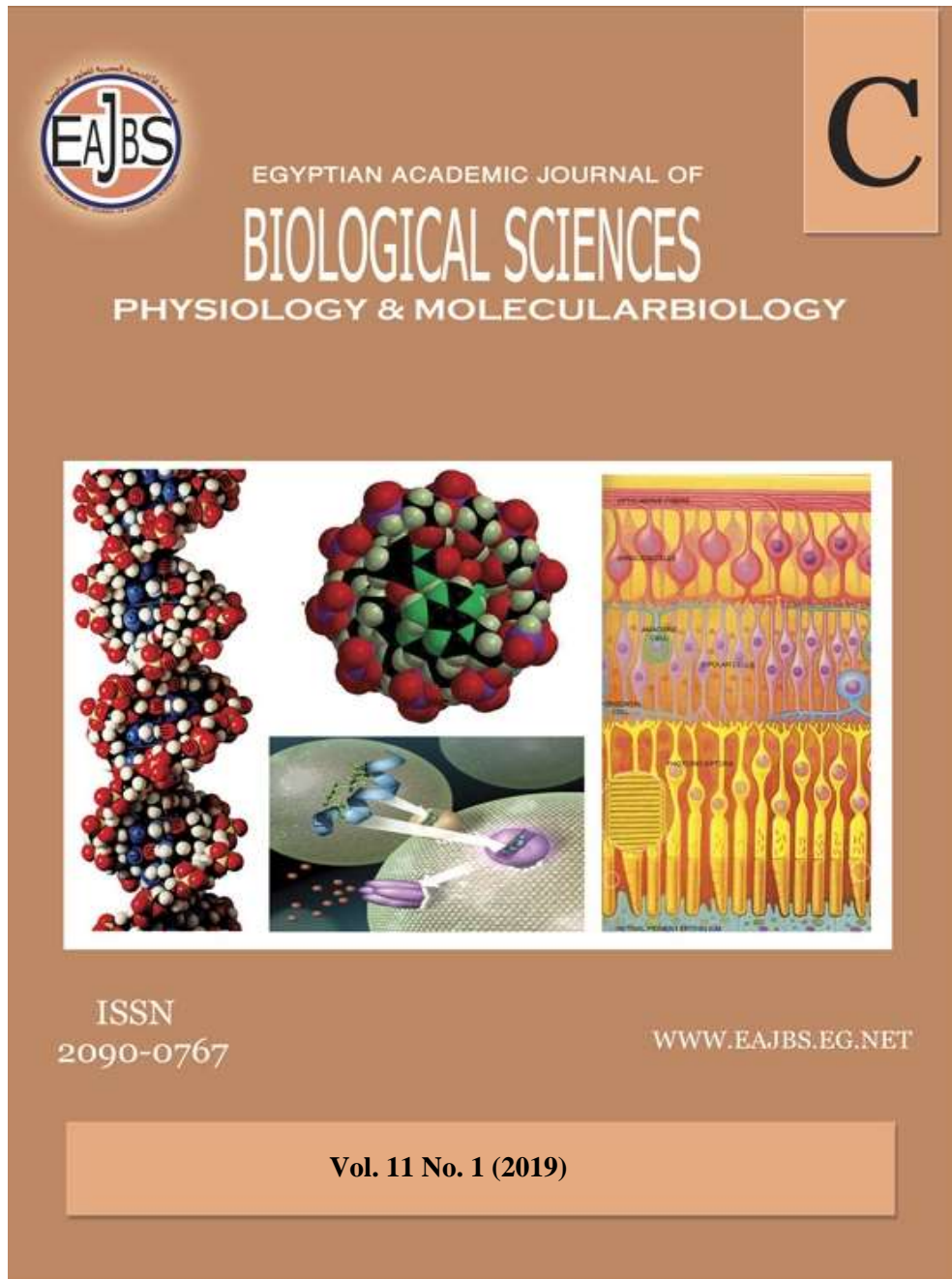


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Prevalence and Prognosis of Cerebrovascular Accidents and its Subtypes: A Cross-Sectional Study in the Hail Region, Saudi Arabia

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ABSTRACT

Cerebrovascular accidents or stroke is an important healthcare concern. Ischemic stroke is an acute neurologic deficit that results from focal cerebral ischemia leading to permanent tissue damage (infarction). The cause is commonly associated with atherothrombotic occlusion of large arteries, cerebral embolism (embolic infarction), nonthrombotic occlusion of small, deep cerebral arteries (lacunar infarction), and proximal arterial stenosis with hypotension that decreases cerebral blood flow in arterial watershed zones (hemodynamic stroke). Stroke is being observed as a rapidly growing problem and an important cause of illness and death in Saudi Arabia. The aims of this cross-sectional study were to establish the prevalence and prognosis of cerebrovascular accidents and its subtypes in the Hail Region, Saudi Arabia. Data were collected on all patients who experienced CVAs between September 2017–January 2018, used the diagnosis coding program in King Khalid Hospital in Hail, Saudi Arabia. Out of 190 patients, 63.7% were male and 36.3% were female. The overall incidence of ischemic stroke after acute myocardial infarction was 85.26%. Hypertension, diabetes mellitus were shown as more risk factors for ischemic stroke type compared with hemorrhagic stroke and embolic stroke. The overall status of stroke patients was shown 92.1% live and 7.9% were dead. The incidence of complicating hospitalizations with cerebrovascular accident continues to grow and is associated with increased mortality and adverse discharge. This highlights the need for early diagnosis, better risk stratification, and preparedness for the need for complex long-term care in this vulnerable population.

INTRODUCTION

Stroke is a major cerebrovascular disease resulting in high mortality and persistent disability in adults across the world. Besides coronary heart disease and cancer, stroke is the commonest cause of death in most industrialized countries (Sims NR, 2010). Cerebrovascular accidents (CVAs) are the fifth leading cause of mortality and the leading cause of serious, long-term disability in the United States. Most strokes (87%) are ischemic, caused by thrombotic or embolic occlusion of a major artery (Shivaraju A, 2014). CVA has traditionally been divided into infarcts (embolic or thrombotic) and hemorrhagic lesions based on the pathologic and radiographic appearance. Infarcts are further subdivided into lacunar and cerebral infarcts. Similarly, hemorrhagic lesions are subdivided into intracerebral hemorrhage and subarachnoid hemorrhage (SAH).

CVA or stroke occurs when blood flow to a part of the brain is prevented due to blockage, or rupture of blood vessels (Korn-Lubetzki I, 2013). Recent statistics on European cardiovascular diseases indicate that stroke is responsible for 4 million deaths, with over 1.9 million deaths recorded in the European Union (Nichols J, 2012). In 75% of the cases, the stroke attack is attributed to the blood clot, i.e. ischemic stroke. The remaining cases are attributed to a ruptured blood vessel in the brain, i.e. hemorrhagic stroke. The established risk factors, including arterial hypertension, diabetes mellitus, cigarette smoking, micro-vascular rupture, hyperlipidemia, age and observed comorbidities such as sickle cell

disease, human immunodeficiency virus/acquired immune deficiency syndrome infection and cerebral malaria are increasingly being encountered in the tropics (Benamer HT, 2009).

Approximately 90% of CVAs were attributed to 10 risk factors that are preventable (hypertension, regular physical inactivity, high apolipoprotein B/A1 ratio, insufficient diet quality, increased waist/hip ratio, psychosocial factors, current smoking, cardiac causes, heavy alcohol consumption, and diabetes mellitus (O'Donnell MJ, 2016). Stroke is being observed as a rapidly growing problem and an important cause of illness and death in Saudi Arabia. Therefore, it becomes one of the most imperative social and economic medical issues in the Kingdom (Al-Jadid MS, 2010). The aims of this cross-sectional study were to establish the prevalence and prognosis of cerebrovascular accidents and its subtypes in the Hail Region, Saudi Arabia.

MATERIAL AND METHODS

Study Design, Study Setting and Subjects:

This study was a cross-sectional study. Defining a CVA as an acute complication of certain chronic diseases with clinical manifestations requiring immediate medical care and hospitalization, we collected data on all patients who experienced CVAs between September 2017–January 2018, we used the diagnosis coding program in King Khalid Hospital in Hail, Saudi Arabia city to look for any patient who had CVA in the last five years, we found more than 300 patients there were diagnosed with CVA and had been admitted to the hospital for full assessment and management. The local institutional ethics committee, College of Medicine, University of Hail, Saudi

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Arabia, approved the research proposal and design (Approval No: EC-0022). We started contacting our patients to have their consent to open their medical records and we received 190 consent. We design a collector form to collect our data, we went through their medical history and some specific lab and radiological investigations. All the data obtained were transferred to an appropriate record form (Fig. 1). No additional investigations were pursued with the patients' families or with physicians.

Statistics Analysis:

All the data from record form were entered in a system in the Microsoft Excel[®] table format then the final file was exported to the

Statistical Package for the Social Sciences V.23 (SPSS) for analysis. The age of patients was represented in mean and standard deviation. The categorical variables were expressed as total numbers and percentages. Frequency tables were used to present the distribution of nominal variables. Descriptive statistics were used to assess the baseline demographics; they were carried out by calculating the frequencies and percentages. Summaries for groups of cases were calculated and represented in the legacy dialogs bars with a level of 95% confidence intervals (CI).

Patient file number:		patient ID:		Data collector name :	
Age					
Nationality					
Gender	<input type="radio"/> Male	<input type="radio"/> Female			
Stroke	<input type="radio"/> Yes	<input type="radio"/> No			
Stroke type	<input type="radio"/> Ischemic	<input type="radio"/> Hemorrhagic	<input type="radio"/> Embolic		
Status	<input type="radio"/> Live	<input type="radio"/> Dead			
Weight		BMI			
Height					
Blood group					
MI	<input type="radio"/> Yes	<input type="radio"/> No			
	<input type="radio"/> stroke → MI	<input type="radio"/> MI → stroke			
Brain lesions Area					
Lipid profile	First reading	Latest reading			
LDL					
HDL					
TG					
Hematocrit		%			
DM	<input type="radio"/> Yes	<input type="radio"/> No			
Type	<input type="radio"/> Type 1	<input type="radio"/> Type 2			
On insulin	<input type="radio"/> Yes	<input type="radio"/> No			
HgA1C					
HTN	<input type="radio"/> Yes	<input type="radio"/> No			
BP reading in EH					
Smoking	<input type="radio"/> Yes	<input type="radio"/> No			
Family history					
DM	<input type="radio"/> Yes	<input type="radio"/> No			
HTN	<input type="radio"/> Yes	<input type="radio"/> No			
Passive smoking	<input type="radio"/> Yes	<input type="radio"/> No			
Stroke	<input type="radio"/> Yes	<input type="radio"/> No			

Fig. 1. The model of record form which was filled the collected patients data

RESULTS

Overall, 190 cerebrovascular accidents or stroke patients were reported and stratified by sex. Out of 190 patients, 121 (63.7%) were male and 69 (36.3%) were female. The average age of patients was 63.68 ± 15.82 years, 62.66 ± 15.99 were male, and 65.48 ± 15.47 were

female. Table 1 represents in a total number of patients in the cross tabulation of gender with the stroke subtype. The ischemic stroke shows more in male compared with female. Comparatively, male CVA patients are almost double compared with female CVA patients.

Table 1. Shows the cross-tabulation of gender with the stroke subtype of patients in the Hail region.

		Stroke Subtype			Total
		Ischemic	Hemorrhagic	Embolic	
Gender	Male	100	11	10	121
	Female	62	3	4	69
Total		162	14	14	190

Data are represented as in numbers of patients with cerebrovascular accidents and its subtypes

Figure 2 showed the nationality wise stroke subtypes of patients with CVA in the Hail region. To compare with other nationality, 80.53 % (47.37% male; 33.16% female) of CVA patients are Saudi. We found 5.27% (both male and female) of CVA patients were Indians. But the other nationalities showed in fewer numbers compared with Saudi. Figure 3 represents the percentage of stroke subtypes of CVA patients in the Hail region. The overall incidence of ischemic stroke within 5 months after acute myocardial

infarction was 85.26% over the period of September 2017 – January 2018. Ischemic stroke was more predominant compared with other subtypes of CVA. But hemorrhagic stroke and embolic stroke were shown an equal percentage (7.37%) of CVA patients.

The prevalence of stroke among gender was shown in figure 4. Findings from these cross-sectional studies suggest male stroke patients were significantly increased compared with female.

Prevalence and Prognosis of Cerebrovascular Accidents and its Subtypes⁹

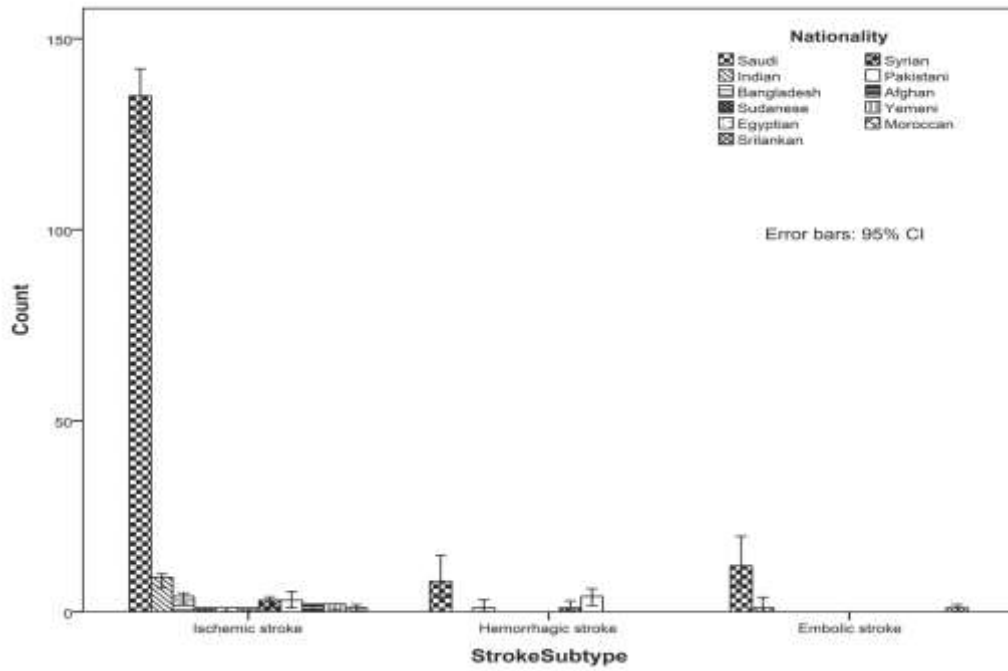


Fig. 2. Shows the stroke subtypes of patients with their nationality in Hail region, Saudi Arabia.

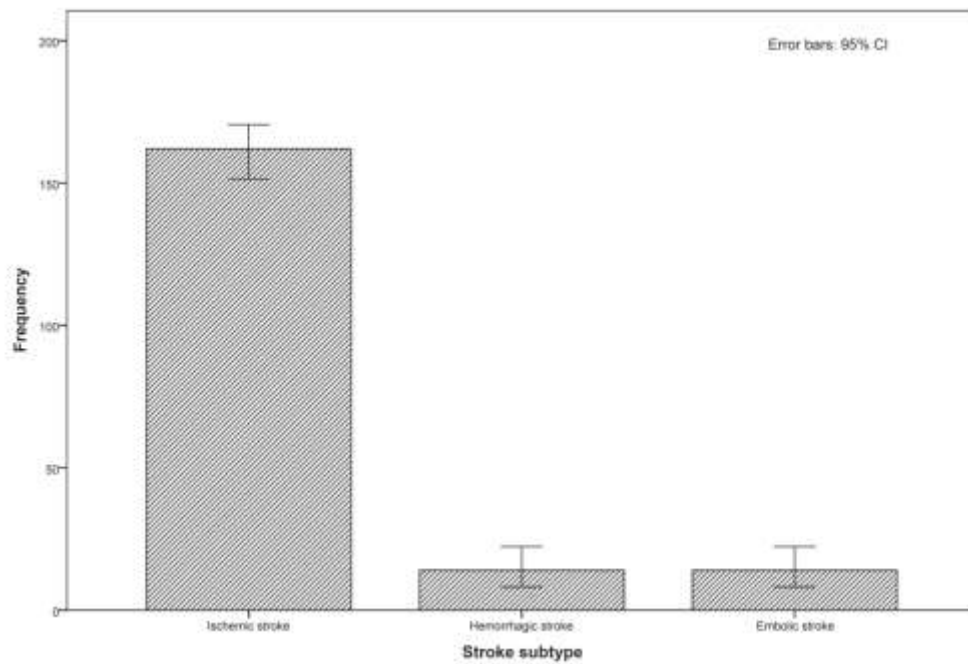


Fig. 3. Represents the percentage of stroke subtypes in 190 patients with cerebrovascular accidents from Hail region between September 2017–January 2018.

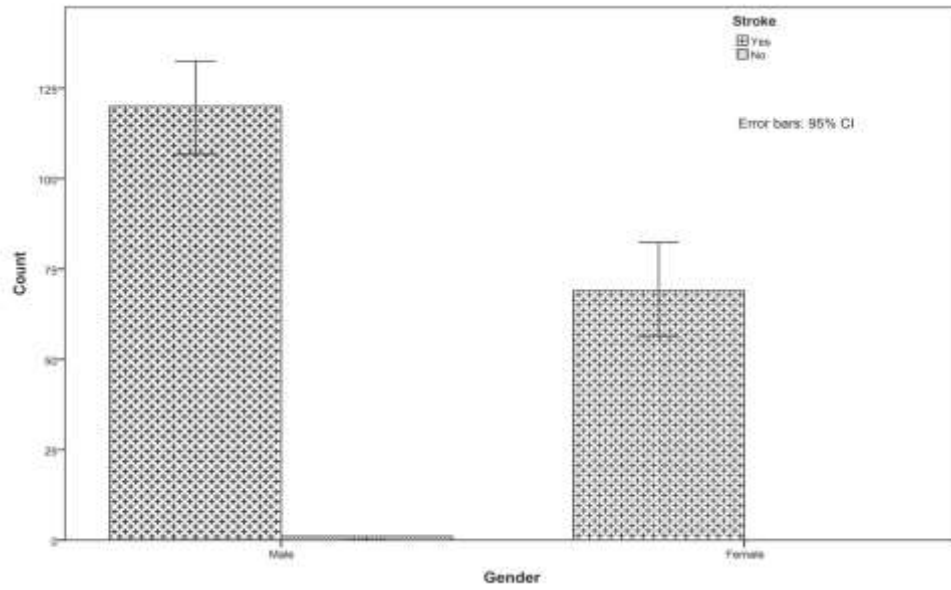


Fig. 4. Prevalence of stroke among gender which shows 99.5% had a stroke in cerebrovascular accidents patients.

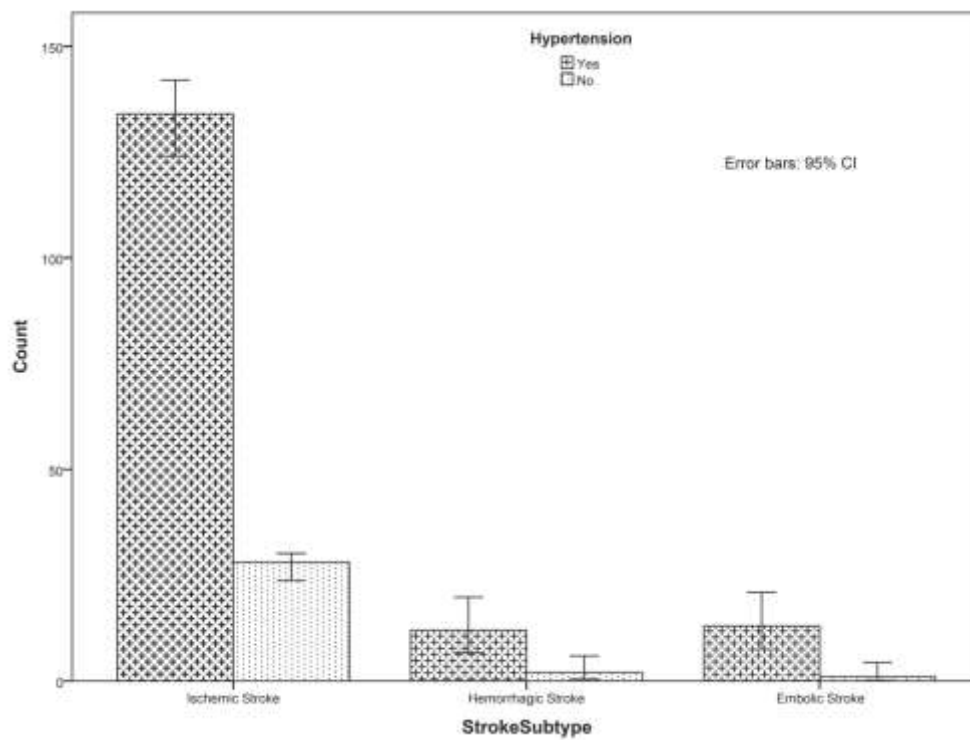


Fig. 5. Prevalence of stroke subtype in relation to hypertension patients with cerebrovascular accidents from Hail region.

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The 99.5% of patients had a stroke, of this 63.16% male and 36.32% female CVA patients. Figure 5, 6 and 7 showed the prevalence of stroke subtypes with the established risk factors, including arterial hypertension, diabetes mellitus, and cigarette smoking. Hypertension, diabetes mellitus were shown as more risk factors for ischemic stroke type compared with hemorrhagic stroke and embolic stroke. But cigarette smoking is not a major risk factor for ischemic stroke. From the legacy dialogs, bars of stroke subtype in relation to hypertension patients showed 70.53% of ischemic stroke had hypertension but 14.74% showed ischemic stroke without hypertension. The other CVA subtypes like hemorrhagic stroke and embolic stroke had 6.32% and 6.84% of hypertension respectively. Its indicates only 1.05% of hemorrhagic stroke and 0.53% of embolic stroke patients had CVA without hypertension.

From figure 6 showed 63.68% of ischemic stroke, 5.26% of

hemorrhagic stroke and 5.26% of embolic stroke patients were not smokers. This indicates smoking is not a major risk factor for stroke. Figure 7 indicates overall 67.37% of CVA patients (all subtypes) had diabetes mellitus which is indicates that the diabetes mellitus is a one of the major risk factor for CVA with stroke.

The association between myocardial infarction and stroke subtype were shown in figure 8 and 9. Stroke with myocardial infarction was more predominant in ischemic stroke compared with other stroke subtypes. Myocardial infarction than stroke was significantly increased in embolic stroke compared with hemorrhagic stroke. The overall 74.74% of CVA patients showed with myocardial infarction, from this 68.09% of ischemic stroke patients, 23.40% of embolic stroke patients and 2.13% of hemorrhagic stroke patients had MI then stroke. It indicates that MI also a major risk factor for CVA patients.

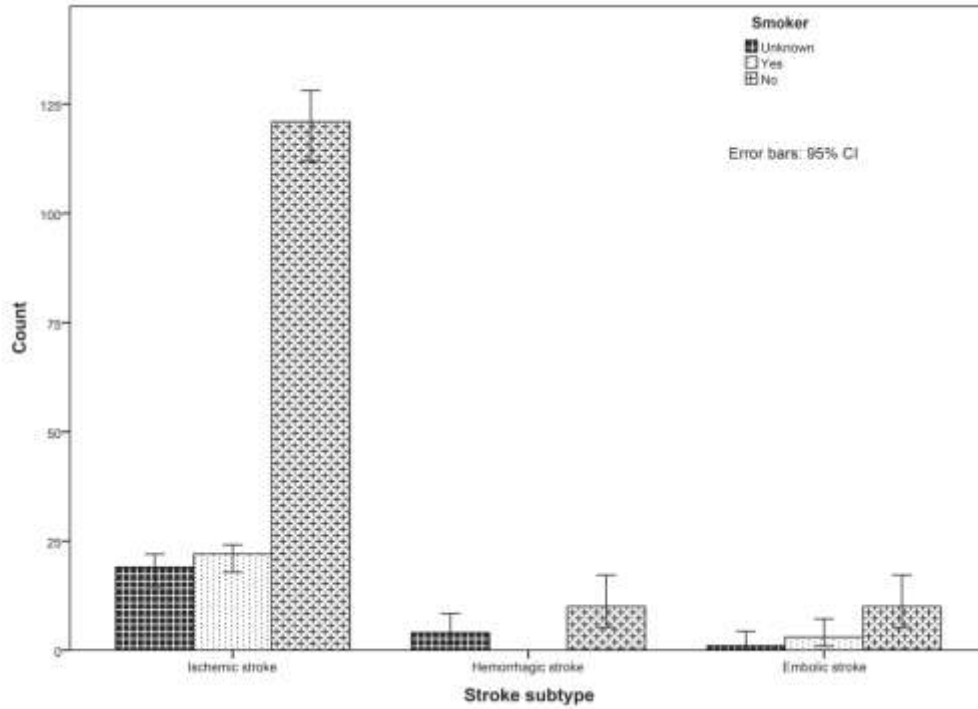


Fig. 6. Prevalence of stroke subtype in relation to smokers hypertension patients with cerebrovascular accidents from Hail region in Saudi Arabia.

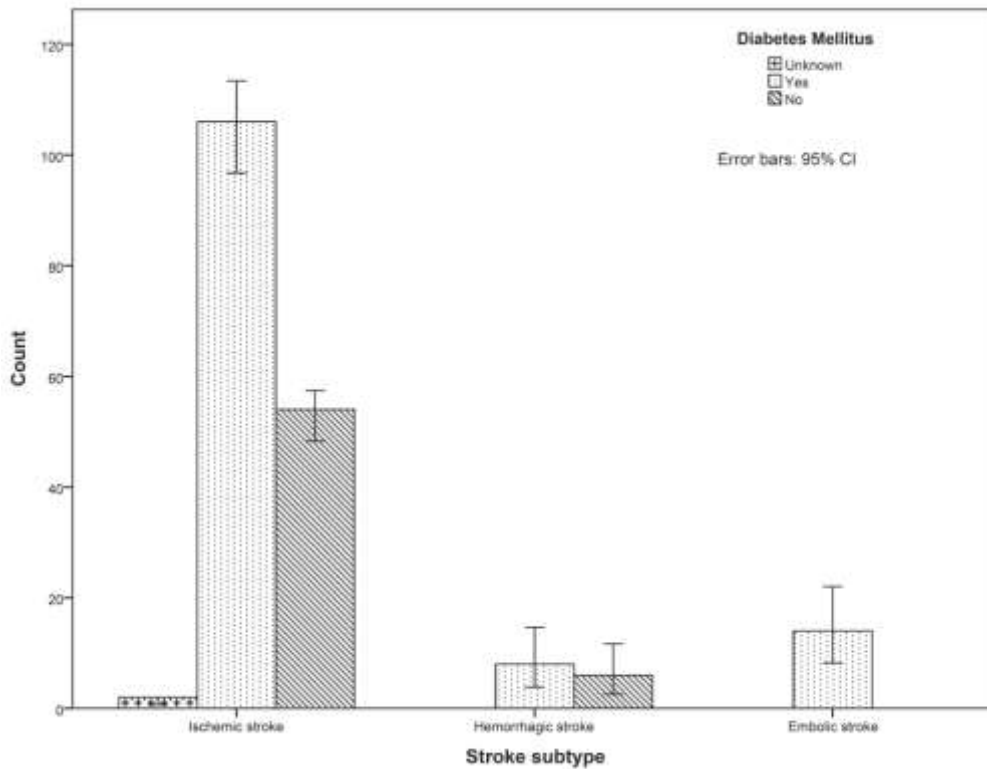


Fig. 7. Association of diabetes mellitus with stroke subtype patients with cerebrovascular accidents from Hail region in Saudi Arabia.[55.79%-ischemic stroke with DM; 4.21% - hemorrhagic stroke with DM and 7.37% - embolic stroke with DM]

Prevalence and Prognosis of Cerebrovascular Accidents and its Subtype³³

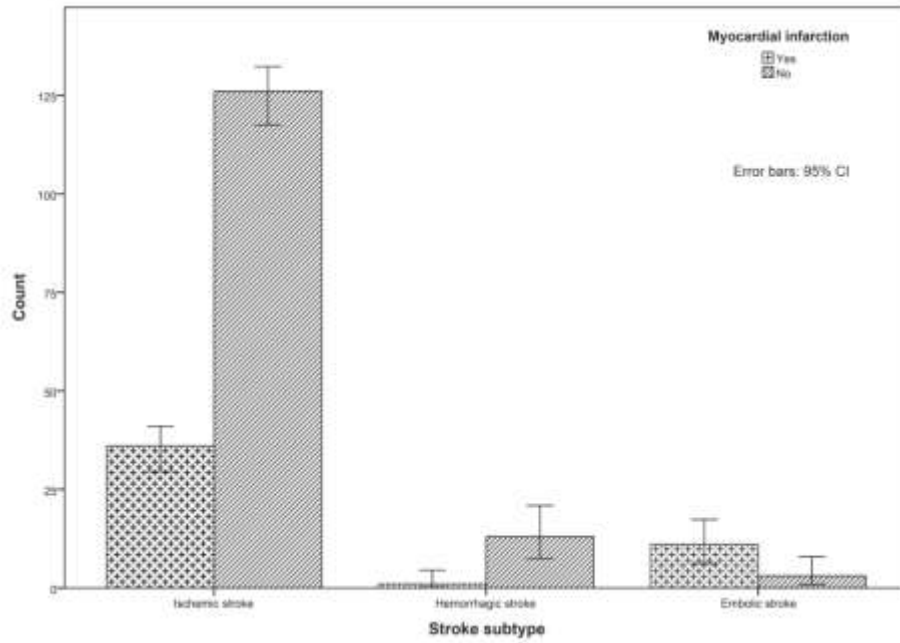


Fig. 8. The prevalence and prognosis of stroke subtypes with myocardial infarction patients with cerebrovascular accidents from Hail region in Saudi Arabia. [18.95% ischemic stroke with MI; 66.32% ischemic stroke without MI; 0.53% hemorrhagic stroke with MI; 6.84% hemorrhagic stroke without MI; 5.79% embolic stroke with MI; 1.58% embolic stroke without MI]

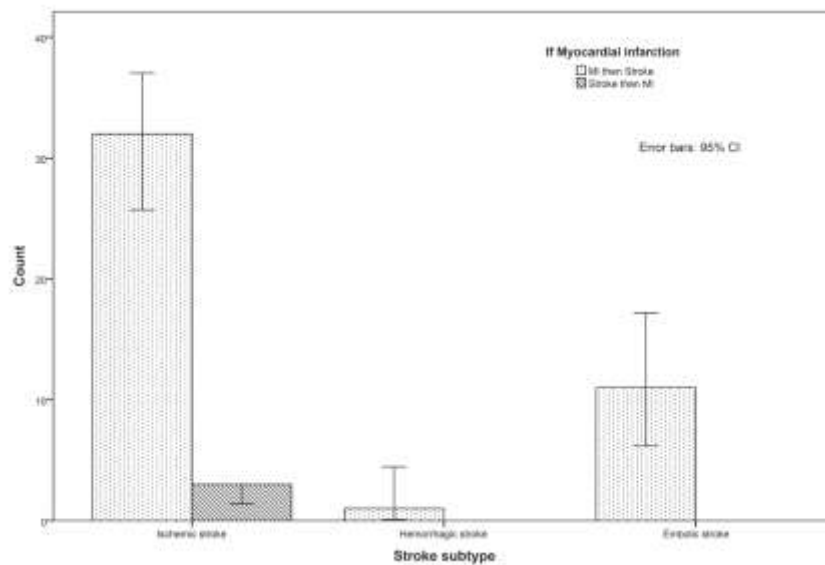


Fig 9. The association between myocardial infarction and stroke subtype patients with cerebrovascular accidents from Hail region in Saudi Arabia.[ischemic stroke: 68.09% MI then stroke and 6.38% stroke then MI; hemorrhagic stroke: 2.19% MI then stroke and No stroke then MI; embolic stroke: 23.40% MI then stroke and No stroke then MI]

Table 2 shows the cross-tabulation on the status of the CVA patients with their stroke subtype. 77.9% of patients with ischemic stroke were live but 7.4% of patients were dead. All the hemorrhagic

stroke patients were live. The overall status of stroke patients was shown 92.1% live and 7.9% were dead approximately during the period of 2016 to 2017.

Table 2 Shows the cross-tabulation on the status of the CVA patients with their stroke subtype

		Status	
		Live	Dead
Stroke subtype	Ischemic stroke	Count	148
		% of Total	77.9%
Stroke subtype	Hemorrhagic stroke	Count	14
		% of Total	7.4%
Stroke subtype	Embolic stroke	Count	13
		% of Total	6.8%
Total	Total	Count	175
		% of Total	92.1%
			15
			7.9%

Data are represented as the status of patients in numbers and percentage with cerebrovascular accidents and its subtypes.

DISCUSSION

Cerebrovascular disorders are common conditions leading to significant morbidity and mortality in the population. The generally recognized importance of cerebrovascular accidents (CVAs) as a cause of death has prompted the World Health Organization to sponsor centers in Europe, Asia, and Africa to study this problem (World Health Organization.1971). Both CVA incidence and the mortality resulting from CVAs exhibit wide geographic variations, even within a single country (Borhani NO.1965; World Health Organization.1971; Richard J,1976; Marquardsen,1978; Aho K,1980), variations that have not yet been satisfactorily explained (Hatano S.1976; Marquardsen, J.1978).

The largest country in the Middle East is Saudi Arabia, occupies nearly four-fifths of the Arabian Peninsula with more than 28

million population. In Saudi Arabia, yearly 22% of deaths occur by CVD (Robert,A.2014). But the current data on stroke in Saudi Arabia is lacking (Khalid Alahmari.....). The prevalence of stroke in Saudi Arabia is more intricate to estimate precisely. A prevalence of 178 out of 100,000 was reported in a community-based survey from the Eastern region of Saudi (Al Rajeh S,2002, Awada A.2011). Compare with Western countries, Saudi Arabia has lower rates in the incidence and prevalence of stroke.

In 2007 reported that a major percentage of the patients had not even heard the term “stroke” in the Gulf Cooperation Council (GCC) countries (Kamran S,2007). Obesity, smoking, sedentary lifestyle, etc are the risk factors for stroke. A study indicates in Saudi Arabia that the prevalence of stroke among men than women (Yaqub BA,1991). In another study showed interviewed

neurologists about their views on stroke, reports that acute stroke care in Saudi Arabia as inadequate (Al Khathaami AM,2011).

In 2012 a study reported an alarming deficit in the level of stroke awareness in the Saudi population (Ahmed Al Aqeel,2012). Stroke was more frequent in the sixth decade of life with male predominance in both Saudis and non-Saudis (Awada A and Rajeh S.1991 ;Akbar, D.,2001). A study conducted in King Abdul Aziz University Hospital, Saudi Arabia found that there was a high incidence of thrombotic stroke (Qari FA.2000).

Across the middle east, in Qatar the incidence rate for all strokes 63/100,000 population. But in Libya, the incidence rates for hemorrhagic stroke were 2.7/100,000. Saudi Arabia showed 1.9/100,000 stroke incidence, and 10.4/100,000 in Iran. (Tran J,2010). The study from Majmaah Province, Saudi Arabia indicates that non-cardioembolic disease was the overwhelming stroke mechanism in this middle-eastern cohort with only 4% of patients have a cardioembolic stroke, in comparison to roughly 20% reported in Western cohorts. Further, 59% of the cohort had the concurrence of hypertension and diabetes mellitus (Abdulrahman Al Harbi,2016). This indicates that the major risk factors for CVA are hypertension and diabetes mellitus showed in our study.

The present study describes several notable findings. We observed that patients with CVA are not at an increased risk of stroke death, as compared to age, and sex. The prevalence of cerebrovascular accident (CVA) or stroke is increasing in frequency amongst the general population due to increased prevalence of diabetes and hypertension (Allen CL,2008).

Stroke poses the risk of immediate mortality and long-term morbidity in the survivors with residual disability. The commonest underlying etiology of the CVA is vascular occlusion leading to infarction of the brain (Stürmer T,2002). Hemorrhagic stroke is less frequent than ischemic stroke and is due to aneurysmal rupture or malignant hypertension (Sundquist K,2006).

In general, elevated sugar , LDL-cholesterol, hypertension , and cigarette smoking are strongly associated with an increased risk of myocardial infarction and CVA. The increasing incidence of hypertension with age had already been described before (Webb G.2005 ; Moltzer E,2010). Hemorrhagic stroke is a rare but serious complication after an acute myocardial infarction (AMI). But the overall incidence of ischemic stroke within 5 months after acute myocardial infarction was 85.26% over the period September 2017-January 2018 in Hail region, Saudi Arabia. Ischemic stroke was more predominant compared with other subtypes. The hemorrhagic stroke and embolic stroke were shown an equal percentage (7.37%) of CVA patients. Patients with hemorrhagic stroke have higher short-term mortality, but ischemic stroke patients have a significant long-term disability and morbidity (Bamford J,1991).

In the present study, the risk of CVA in patients with diabetes mellitus was 55.79% of ischemic stroke, 40% of hemorrhagic stroke and 7.37% of the CVA were an embolic strokes. Although the incidence of CVA was higher in adult patients with ischemic stroke, we did not find a strong prediction from age and sex. We demonstrated that hypertension was the most significant predictor for CVA. Despite a wide variety of risk factors

described for CVAs (Neuman J,1978), hypertension is generally accepted as the principal predisposing factor (Svenius J,1980). From this study, several insights and recommendation for improving care extended to a stroke patient can be derived.

Conclusion

In conclusion, we demonstrated that diabetic and hypertensive patients have higher mortality after incident stroke, but sex and age was not an independent risk factor. The incidence of complicating hospitalizations with cerebrovascular accident continues to grow and is associated with increased mortality and adverse discharge. This highlights the need for early diagnosis, better risk stratification, and preparedness for the need for complex long-term care in this vulnerable population.

Abbreviations

CVA: Cerebrovascular accident; SAH: Subarachnoid hemorrhage

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