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Types and Risk Factors of Cerebrovascular Disease among Adult Patients Admitted in KKUH in Riyadh City: A Case Control Study

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Abstract

Introduction: Stroke is "a rapidly developing signs of focal (or global) disturbance of cerebral function, leading to death or lasting longer than 24 hours, with no apparent cause other than vascular". Stroke is a global health problem, and one of the leading causes of death around the world. Many risk factors for stroke have been described, some of them are biological traits such as age and sex, some of them are physiological or pathological characteristics such as high blood pressure, serum cholesterol, and fibrinogen; some are behavioral such as smoking, diet, alcohol consumption, and physical inactivity; and some are social characteristics such as education, social class and ethnicity. In addition, medical factors including previous TIA or stroke, ischaemic heart disease, atrial fibrillation, and glucose intolerance, all are risk of stroke. The steady increase of stroke's incidence and the limited ways of reducing it in Saudi Arabia prompted us to conduct this research, to evaluate the relationship between stroke and its risk factors, and the associated behavioral factors.

Methodology: This is a case-control study conducted at king khaled university hospital – Riyadh city over a period of six months from April 2016 to September 2016, and it included all patients who were admitted, during the course of study, under diagnosis of stroke based on clinical tests and results of brain imaging. The total number of cases who were hospitalized under diagnosis of stroke were 100 cases. As a control cases the study included another 100 cases hospitalized under another diagnosis. In each case selected infected and non-infected one similar in age and sex.

Results: Ischaemic type is the common type (80%). The most common age group among CeVD patients was (61 - 70 year), followed by (71 - 80 year) and least age group was (above 80 years). There was a male predominance among the patients with CeVD (56%), comparing to (44%) females. Family history of CeVD was positive in 21% cases versus 5% controls. 26% of CeVD cases has a history of heart disease, versus 16% controls with history of heart disease. 31% of CeVD cases has a previous history of TIA (transient ischemic attack). The prevalence of hypertension was high among CeVD patients (51%) compared to controls 39%.¬¬¬ Regarding diabetes, cases and controls were equally affected, 25% with diabetes.

Conclusion: In this study, age was the most significant risk factor of CeVD. The study revealed that people aged between (61 - 70) year are more susceptible to develop CeVD, while the previous history of CeVD, employment and family history of CeVD came in as second, third and fourth important risk factors respectively. The remaining risk factors were Hypertension, heart disease and diabetes. Patients who had a history of modifiable risk factors like smoking are more susceptible to develop CeVD than the others. CeVD tend to occur more in men than women. Finally ischaemic CeVD was more common than hemorrhagic CeVD.

Recommendation: Improving socioeconomic status and higher education have been found to raise awareness of the risk factors and warning symptoms of stroke in both rural and urban populations. A diabetic patient must adhere to treatment because it is one of the most important factor for the occurrence CeVA. Also, heart patients must have a periodic examinations as they are more susceptible to diseases (CeVA) than others.

Keywords: *Stroke; Risk Factors; Case Control Study*

Introduction

Cerebrovascular disease (CeVD) or stroke was defined according to the World Health Organization (WHO) criteria as rapidly developing signs of focal (or global) disturbance of cerebral function, leading to death or lasting longer than 24 hours, with no apparent cause other than vascular [1].

The 1990 Global Burden of Disease (GBD) study provided the first global estimate on the burden of 135 diseases, and cerebrovascular diseases ranked as the second leading cause of death after ischemic heart disease [2]. In 2001 it was estimated that cerebrovascular diseases (stroke) accounted for 5.5 million deaths worldwide, equivalent to 9.6% of all deaths. Two-thirds of these deaths occurred in people living in developing countries and 40% of the subjects were aged less than 70 years [3].

Stroke is a common medical emergency with an annual incidence of between 180 and 300 per 100,000. The incidence rises steeply with age, and in many developing countries, the incidence is rising because of adoption of less healthy lifestyles. About one-fifth of patients with an acute stroke will die within a month of the event, and at least half of those who survive will be left with physical disability [4].

In recent years, there has been increasing economic and demographic development in developing countries resulting in a shift from diseases caused by poverty toward chronic non-communicable lifestyle - related diseases [5]. Traditionally, the term "stroke" has been used to include episodes of focal brain dysfunction due to focal ischaemia or haemorrhage as well as subarachnoid haemorrhage [4].

The pathological background of stroke classify it either to be ischaemic or hemorrhagic disturbances of cerebral blood circulation.

Ischaemic stroke (infarction): Thrombotic cerebral infarction results from the atherosclerotic obstruction of large cervical and cerebral arteries, with ischaemia in all or part of the territory of the occluded artery. This can be due to occlusion at the site of the main atherosclerotic lesion or to embolism from this site to more distal cerebral arteries. Embolic cerebral infarction is due to embolism of a clot in the cerebral arteries coming from other parts of the arterial system. Lacunar cerebral infarctions are small deep infarcts in the territory of small penetrating arteries, due to a local disease of these vessels, mainly related to chronic hypertension. Several other causes of cerebral infarction exist and are of great practical importance for patient management. As they are relatively rare they can be ignored for most epidemiological purposes.

Hemorrhagic stroke: Spontaneous intracerebral haemorrhages (as opposed to traumatic ones) are mainly due to arteriolar hypertensive disease, and more rarely due to coagulation disorders, vascular malformation within the brain, and diet (such as high alcohol consumption, high blood cholesterol concentration, high blood pressure, etc.). Cortical amyloid angiopathy (a consequence of hypertension) is a cause of cortical haemorrhages especially occurring in elderly people and it is becoming increasingly frequent as populations become older.

Subarachnoid haemorrhage: This group of strokes is mainly due to the rupture of aneurysms at the bifurcations of large arteries at the inferior surface of the brain. Often they do not cause direct damage to the brain and some studies of stroke have therefore excluded them. However, patients with subarachnoid haemorrhage may develop symptoms that are in accordance with the stroke definitions and should as such be regarded as a stroke [6].

In Caucasian populations approximately 80% of all strokes are ischaemic, 10% - 15% intracerebral haemorrhage (ICH), 5% subarachnoid haemorrhage (SAH), and the rest is due to other causes of stroke [7]. Studies from Asian countries indicate that the proportion of ICH is higher than in Caucasians with approximately 20% to 30% being hemorrhagic [8-10].

Many risk factors for stroke have been described, some of them are biological traits such as age and sex, some of them are physiological or pathological characteristics that predict future occurrence such as high blood pressure, serum cholesterol, and fibrinogen; some are

behavioral such as smoking, diet, alcohol consumption, and physical inactivity; some are social characteristics such as education, social class and ethnicity; and some are environmental factors that may be physical (temperature, altitude), geographical, or psychosocial. In addition, medical factors including previous TIA or stroke, ischaemic heart disease, atrial fibrillation, and glucose intolerance, all increase the risk of stroke [11]. At a population level, blood pressure and tobacco use are the two most important modifiable risk factors for stroke due to their strong associations, high prevalence and the possibility for intervention [12].

Globally, a study in 2016 (July) by researchers of the Population Health Research Institute (PHRI) of McMaster University. In this study, the investigators looked at the different risk factors, and determined the proportion of strokes which would be cut if the risk factor disappeared [13].

The number of strokes would be practically cut in half (48%) if hypertension was eliminated; trimmed by more than a third (36%) if people were physically active; and shaved by almost one fifth (19%) if they had better diets. In addition, this proportion was cut back by 12% if smoking was eliminated; 9% for cardiac (heart) causes, 4% for diabetes, 6% for alcohol intake, 6% for stress, and 27% for lipids [14].

About high Cholesterol; the use of statins in individuals with a high risk of cardiovascular events reduce the stroke by 25%. In younger people discovered half (52%) of those having stroke under the age of 45 were active smokers [15]. In Saudi Arabia a study reported that stroke occurred most frequently in 61 - 70 years age group. And among 500 Saudi patients with stroke indicated 68.4% were males and 31.6% were females [16].

Another study reported that the risk factors significant for stroke in the Saudi population are systemic hypertension (38%), diabetes mellitus (37%), heart disease such as atrial fibrillation, ischaemic heart disease, valvular disease, cardiomyopathy (27%), smoking (19%) and family history of stroke (14%). Available studies in Lebanon have shown a high prevalence of risk factors as obesity 26%, diabetes 14%, and hypertension 36%.

In general, the prevalence increased with age for both males and females with a prevalence reaching 9.38% in the group aged 80 years and older [17].

Methodology

Study design and area

Observational Case-control study, which was conducted by fifth year medical students in King Khaled university hospital (KKUH), Riyadh city, capital of Saudi Arabia.

Target population

The study targeted all CVA patients aged above 40 years who admitted to king Khaled university hospital, in Riyadh city during the study period from 1st April 2016 to 30th September 2016.

Sample

Cases: All the cases of CVA patients aged above 40 years who admitted in king Khaled university hospital during the study period. The total number of cases was 100 patient.

Controls: Hospital control was gathered prospectively during the period of study, who aged above 40 years and presented to king Khaled university hospital without prior history of CVA. They included patients attending the medical outpatient clinic and patient admitted to medical inpatient ward for disorders other than CVA. The total number of controls was 100 participant. Control were matched to cases for age and sex.

Sample size

Sample size was calculated by using Epi-info formula.

The required minimum sample size in this study is 99. Two-sided confidence level: 95%. Power of study is 80%. Ratio of controls to cases 1:1. Percent of controls exposed 10.2%. Percent of cases exposed 26.6%. Odds ratio: 3.19. Hence a total of 100 cases and equal number of controls were finally included in the study.

Data collection and tools

The data of both cases and hospital controls was collected through a questionnaire filled by the patients themselves or their relatives, the questionnaire included the following information:

1. Personal data (sex, age, occupation, job, education level and place of residence).
2. Did the patient had one of the following;(DM, HTN, CVD, past history of cerebrovascular disease and family history of it).
3. Risk factors: smoking.

Data analysis

The data was checked for completeness, coded then entered into a computer by Statistical Package for Social Sciences (SPSS v 20). Obtained data was analyzed using descriptive statistical tools (frequencies, percentages). Finally the data was presented in tables and graphs using computer applications (Excel and word).

Ethical considerations

An approval of the project was obtained from king khaled university hospital. Objectives of the study were explained to participants. We will ensure that the identities of the participants and their information be kept in the strictest confidence and used only for the benefit of community.

Results

A total of 100 case subjects with cerebrovascular disease aged equal or above 40 years and the same number of control subjects matched by sex and age were identified. During the 6 months study period, 100 patients was admitted to the medical department due to CeVD. Table 1 shows that the majority of the patients had ischaemic type, 80 cases (80.0%), while hemorrhagic strokes were 20 cases (20.0%).

Type	Number	%
Ischemic CV	80	80.0%
Hemorrhagic CVA	20	20.0%
Total	100	100.0%

Table 1: *Distribution of the types of CeVD.*

Table 2 Shows a predominance of male gender 56 (56%) over 44 (44%) females with same numbers as controls. Regarding the age distribution, the most common age group was (61 - 70), followed by (71 - 80) and least age group was (above 80 years). Regarding the residence of the sample, CVA was more common among urban people, 52 cases (52%), comparing to 48 (48%) rural cases, while the controls were 64 (64%) urban and 36 (36%) rural controls. Regarding the education of the sample, CVA was more common among the uneducated people, 78 cases (78%), comparing to 22 (22%) educated cases, while the controls were 67 (67%) uneducated and 33 (33%) educated

controls. Regarding the employment of the sample, CVA was more common among unemployment people, 79 cases (79%), comparing to 21 (21%) employed cases, while the controls were 61 (61%) unemployed and 36 (36%) employed controls.

Gender * Crosstabulation

Gender	Case		Control		Total
	N	%	Case	Control	
Female	44	44%	44	46%	88
Male	56	56%	56	54%	112

Age * Crosstabulation

Age	Case		Control		Total
	N	%	N	%	
40 - 50	15	15%	15	15%	30
51 - 60	15	15%	15	15%	30
61 - 70	29	29%	29	29%	58
71 - 80	27	27%	27	27%	54
> 80	14	14%	14	14%	28

Residence * Crosstabulation

Residency	Case		Control		Total
	N	%	N	%	
Urban	52	52%	64	64%	116
Rural	48	48%	36	36%	84

Educational level * Crosstabulation

Educational level	Case		Control		Total
	N	%	N	%	
Educated	22	22%	33	33%	55
Uneducated	78	78%	67	67%	145

Employment * Crosstabulation

Employment	Case		Control		Total
	N	%	N	%	
Employed	21	21%	39	39%	60
Unemployed	79	79%	61	61%	140

Table 2: *Frequency and distribution of socio-demographic risk factors among CeVD patients and controls.*

Table 3 shows that family history of CeVD was positive in 21% cases versus 5% controls. Also shows that 26% of cases has a history of heart disease, versus 16% controls with history of heart disease. 31% of cases has a previous history of TIA (transient ischemic attack).

Family History of CVA * Crosstabulation

Family History of CVA	Case		Control		Total
	N	%	N	%	
Positive	21	21%	5	5%	26
Negative	79	79%	95	95%	174

History of Heart diseases * Crosstabulation

History of Heart diseases	Case		Control		Total
	N	%	N	%	
Yes	26	26%	16	16%	42
No	74	74%	84	84%	158

Previous History of CVA * Crosstabulation

Previous History of TIA	Case		Control		Total
	N	%	N	%	
Yes	31	31%	0	0%	31
No	69	69%	100	100%	169

Table 3: *Frequency and distribution of previous medical history risk factors among CeVD patients and control.*

Table 4 shows that the prevalence of hypertension was high among CeVD patients (51%) compared to controls 39%. Regarding diabetes, cases and controls were equally affected, 25% with diabetes.

Hypertension * Crosstabulation

Hypertension	Case		Control		Total
	N	%	N	%	
Yes	51	51%	39	39%	90
No	49	49%	61	61%	110

Diabetes * Crosstabulation

Diabetes	Case		Control		Total
	N	%	N	%	
Yes	25	25%	25	25%	50
No	75	75%	75	75%	150

Table 4: *Frequency and distribution of chronic diseases among CeVD patients and controls.*

Table 5 regarding smoking, 24% of CeVD cases were smokers, and 20% of the controls were smokers.

Smoking * Crosstabulation

Smoking	Case		Control		Total
	N	%	N	%	
Yes	24	24%	20	20%	44
No	76	76%	80	80%	156

Table 5: *Frequency and distribution of smoking among CeVD patients and controls.*

Table 6 regarding the age, the crude odds ratio of CeVD was 3.910 among those aged (61 - 70) compared with other ages, which means they have a 3 times more risk to have CVA. The crude odds of CeVD was 5.426 among those who were not employed compared to employed cases, which means they have a 5 times greater risk to have CVA. The crude ratio of CeVD was 0.127 among cases with positive family history of CVA, indicating it's an advantage rather than risk factor. The crude ratio of CVA was 0.117 among cases with previous TIA, indicating it's an advantage rather than risk factor.

Variable	P value	Chi	Odd ratio
Age (61 - 70)	0.000**	21.83	3.910
Gender (male)	0.776	0.81	1.74
Residency	0.086	2.956	1.974
Education	0.082	3.034	1.230
Employment	0.005**	7.714	5.426
Family history	0.001**	11.317	0.127
HTN	0.88	2.909	0.888
DM	1.000	0.000	1.371
Previous TIA	0.000**	20.726	0.117
History of heart disease	0.083	3.614	0.693
Smoking	0.495	0.466	0.361

Table 6: *Analysis of the factors affecting CeVD.*

*** statistically significant*

Discussion

As our study aimed to improve public awareness about risk factors of cerebrovascular disease (CeVD), hopefully to prevent and decrease its incidence. The current study found that the common age group was above 60 year-old (29%), which correlates with a study conducted in India in 2014 at GMERS medical college and Hospital, that found the most common age group was (60 - 70 year-old) [18]. Regarding gender distribution, a study conducted in Kuwait teaching hospital in Sana'a, Yemen, over a four-years period (1999 - 2003), with the result of male predominance (62.6%), which is almost similar to our study that shows a predominance of males (56%) over females (48.9%) [19].

Ischaemic type was the common type, found in 80% of our stroke patients, while the hemorrhagic type was 20%, which correlates with a study conducted in 2014 at Tertiary Care Hospital in India, reported that infarction was seen in 68.5% [18].

In Saudi Arabia, the prevalence of hypertension is 26.1% among all population aged 30 - 70 years, 2007 [20]. Our study demonstrates that hypertension is found in 51% of stroke patients which can be correlated well with a study conducted in 2014 at Tertiary Care Hospital in India, reported that hypertension was seen in 57.1% of cases. The prevalence of DM (52%) in Saudi Arabia is higher than those of Jordan (44%) and Yemen (24.4%). In a study conducted in Jeddah, Saudi Arabia, people aged 50 years or over almost half had DM and another 10 - 15% had prediabetes leaving only a small proportion of people in this age group with normoglycemia [21]. This high rate may be due to the life-style of Saudi people, high obesity rate and the dependence on fast foods. As a risk factor of stroke we found that about 25% of sample were diabetic, which correlated with study conducted in 2014 at tertiary care hospital in India in which DM rate was 22.9%. Regarding history of cardiovascular diseases, we found that 26% of CeDV patients has a history of cardiovascular diseases which correlates with a study conducted in US/Cuba reported that 30.7% of CeVD patients has history of ischaemic heart disease diagnosed by specialist [22].

Smoking as a risk factor was positive in 24%, this is lower than the rate (42%) reported from the study conducted in India. Regarding family history of stroke, we found it has a statically significant relationship with CeVD, (P value = 0.01). this is may be related to inherent biological traits like gender, physical characteristics, and presence of familial risk factors like hypertension, obesity, and non-insulin dependent diabetic mellitus. In comparing to the study conducted in Shri BM Patil Medical College, Hospital and Research Centre in India, family history of stroke seen significant with OR = 2.359 [23]. By looking at analysis of the risk factors in (table 6), we find that the risk factors with statically significant relationship with CeVD are previous history of CeVD, age group between (61 - 90 years), family history of CeVD, and smoking. 31 cases has a previous history of CeVD (P value: 0.000). In a study conducted in Newcastle they found that the preceding cerebrovascular disease has greatest odds of stroke (odds ratio 9.8) [24].

In a study conducted in Thailand, the significant risk factors associated with CeVD were; male gender ($p < 0.001$), occupational class ($p < 0.001$), hypertension ($p < 0.001$) and diabetes mellitus ($p = 0.002$) [25].

Limitations

We faced many limitations while conducting the research, the significant ones were:

1. The study's short time, which limited us from finding all the cases we need.
2. The lack of similar previous researches conducted in Riyadh that we can rely on.
3. The refusal of some female patients to answer certain questions in our questionnaire because of cultural believes.
4. There were some difficulties in taking information where get off to hospital required equivalent day for data collection.
5. We found some difficulties to obtained information at ICU department.
6. Disadvantage of case control study is generally do not allow calculation of incidence.

Conclusion

This study quantifies the contribution of risk factors of cerebrovascular diseases among patients admitted in king Khaled university hospital in Riyadh, capital of Saudi Arabia. It was found that age is the most significant risk factor of CeVD.

The study revealed that people who aged between (61 - 70) are more susceptible to develop CeVD, while the previous history of CeVD, employment and family history of CeVD came in as second, third and fourth important risk factors respectively.

The remaining risk factors are Hypertension, heart disease and diabetes. The patients who had a history of modifiable risk factors like smoking are more susceptible to develop CeVD than the others. CeVD tend to occur more in men than women. Also we found that the ischaemic CeVD is more likely to appear than the hemorrhagic.

Recommendation

- Stroke awareness among the public and general practitioners is directly proportional to improved care and outcome. In Saudi Arabia, level of awareness of risk factors and warning symptoms of stroke among general population is very low. Improving socioeconomic status and higher education have been found to raise awareness of the risk factors and warning symptoms of stroke in both rural and urban populations. Poor recognition of early stroke symptoms and low perception of threat leads to delayed arrival of patients at hospitals. Other influences include distance from the hospital, education, socioeconomic status, family history of stroke, and advice of friends and local doctors.
- A diabetic patient must adhere to treatment because it is one of the most important factor for the occurrence CeVA.
- Also, heart patients must have a periodic examination as they are more susceptible to diseases (CeVA) than others.
- With recent demographic development and adaptations of fast-food, non-communicable lifestyle, a notably steady increase of stroke's cases encountered in Saudi hospitals/Emergency rooms without data bases or researches investigating the magnitude of the problem and the speedy growing burden, we hope this research will provide a base for further multicenter designed researches including different cities, using standardized methodology with specific diagnostic and classification criteria in order to give us more precise epidemiologic data. These studies will provide clarity by enabling comparison of incidence rates and keep a trends over time. Prevention is the primary treatment strategy, as Saudi Committee for Health sciences (SCFHS) aiming to reduce the burden and soon publishing their own recommendations/guideline for increasing awareness, prevention and treatment of stroke in Saudi Arabia, this research is a very small step in that direction, with the objective need for more researches in order to reduce this burden.

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