



## **Risk Factors of Stroke among Patients Admitted to Alkhadra Hospital, Tripoli, Libya (2009-2010)**

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### **Authors' contributions**

*This work was carried out in collaboration between all authors. Author NB wrote the protocol and gathered the initial data. Author ME designed the study, performed the statistical analysis and wrote the first draft of the manuscript. All authors managed the literature searches. All authors read and approved the final manuscript*

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### **ABSTRACT**

**Aims:** To identify the risk factors of stroke among patients admitted to Alkhadra Hospital and to study the association between modifiable risk factors, gender and the type of stroke.

**Study Design:** A cross sectional hospital based study.

**Place and Duration of Study:** This study was carried out at Alkhadra Hospital, during the period from 1<sup>st</sup> of January 2009 to 31<sup>st</sup> of January 2010.

**Methodology:** The study included all medical record of patients with a stroke, relevant socio demographic characteristics and medical data were collected. Data analyzed by SPSS program version 18.

**Results:** There were 294 patients suffering from a stroke during the study period; majority of patients were older than 60 years. Mean age was 71.37± 10.07 years and 55% of study group were male. Ischemic stroke was diagnosed in 88.4% of patients and 11.6% had hemorrhagic stroke.

Hypertension was present in 76.5% of patients, 70% of patients were diabetic and 39% of them

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were smokers. Cholesterol level was high among 8.8% of patients, HDL level was low in 65.3%, Level of LDL was high in 11.9% and Triglyceride level was high in 10.2% of the cases. Frequency of atrial fibrillation was 3.4% among the stroke patients.

**Conclusions:** Ischemic stroke was the most common type. No gender difference in the majority of association with risk factors apart from high level of triglyceride and smoking which were more frequent in males than females; there was no major difference between types of stroke in relation with modifiable risk factor except with hypertension.

*Keywords: Risk factor; cerebro vascular accident; type of stroke; hospital-based.*

## 1. INTRODUCTION

A stroke is a neurological impairment of sudden onset, and lasting more than 24 hours (or leading to death), and of presumed vascular origin [1].

It is a worldwide health problem, leading cause of adult disability and it is responsible for 16.6% of deaths, and 87% of these deaths occurred in low-income and middle-income countries [2]. cerebrovascular diseases have many sequelae, including cognitive impairment and dementia; and these cognitive disturbances account for a decrease in quality of life [3].

Stroke is a major burden to health and social services, as well as to patients and their families. It has an economic load for the family of the patient and the whole society [4,5]. It is a multi factorial disease where a combination of risk factors, include non-modifiable risk factors such as age, sex, low birth weight, race/ethnicity, and genetic predisposition; and modifiable risk factors include hypertension, smoking, diabetes, atrial fibrillation, dyslipidemia, carotid artery stenosis, sickle cell disease, postmenopausal hormone therapy, poor diet, physical inactivity, and obesity [2,5-7].

The incidence of stroke increases with age, older people have a higher absolute risk of stroke compared to younger people, The risk of stroke doubles for each successive decade after age 55 years [5,8].

Hypertension is the most important modifiable risk factor for both cerebral infarction and intracerebral hemorrhage [7,9,10]. Meta-analyses of randomized controlled trials have shown that decrease in blood pressure is associated with a 30% to 40% reduction in risk of stroke [11]. The evidence of the benefits of lower blood pressure and reduced stroke risk is strong, continuous, consistent and independent [10].

Smoking is a strong risk factor for ischemic stroke and has been shown to produce a 10 to

20 folds increase in risk of stroke compared to the risk in normotensive, nonsmoker people. [5,11,12].

Diabetic patients are at 1.5-3 times the risk of stroke compared to general population [7,13]. Dyslipidemia is one of the most important risk factors for coronary artery disease but a less important risk factor for stroke [14]. Results from epidemiological studies have shown that, there was an association between total cholesterol levels (TC), low-density lipoprotein cholesterol (LDL) and an increased risk of ischemic stroke [4,6,11,15]. Some studies revealed a weak and inconsistent associations between ischemic stroke and dyslipidemia. High density lipoprotein (HDL) cholesterol was inversely related to ischemic stroke [6,16,17]. Some prospective studies have found that, high levels of TC may increase total stroke risk, especially ischemic stroke risk; whereas other studies have found a weaker or no association [17-20].

Atrial fibrillation (AF) alone is associated with a 3 to 4 folds increased risk of stroke after adjustment of other vascular risk factors [5]. In the United States, more than 75 000 cases of stroke per year are attributed to AF [11]. An increased knowledge and awareness of stroke risk factors and effective intervention is required to improve primary and secondary preventive strategies, also, to reduce the incidence, recurrence, disability and mortality of stroke [21-24].

The present study was designed to identify the risk factors of stroke among patients admitted to Alkhadra Hospital in Tripoli and to study the association between modifiable risk factors, gender and the type of stroke.

## 2. MATERIALS AND METHODS

A cross sectional hospital based study was conducted in Alkhadra Hospital, at Tripoli, Libya during the period from 1<sup>st</sup> January 2009 to 31<sup>st</sup>

January 2010, all medical records of patients with cerebro-vascular accident (CVA) were included. A case was classified as a stroke, if the following criteria were present: Evidence of new, sudden or rapid onset of neurological deficit, vascular origin that lasted more than 24 hours, no evidence of pathology that could have mimic a stroke, such as brain tumor and subdural hemorrhage. This definition excluded transient ischemic attack (TIA) and recurrent stroke. An electrocardiography (ECG), blood glucose, triglyceride, and total cholesterol, LDL and HDL tests were performed. Brain CT and /or MRI were also performed for all patients.

Clinical information and results from diagnostic tests including brain imaging (CT and MRI) were used to distinguish between ischemic and hemorrhagic stroke.

Data collected using a case sheet filled from the file records of all patients with stroke and including age and sex, presence of risk factors that available in the files (hypertension, diabetes mellitus, smoking, dyslipidemia and atrial fibrillation), and type of stroke.

The following definitions were used in this study: High Total Cholesterol defined as values  $\geq 240$  mg/dl, Low HDL defined as values  $< 40$  mg/dl for men and  $< 50$  mg/dl for women. High LDL as  $\geq 160$  mg/dl and High Triglycerides as values  $> 200$  mg/dl [25].

Statistical package for social sciences (SPSS) program version 18 was used for data analysis, Simple descriptive statistics were used (mean  $\pm$  standard deviation for quantitative variables, and frequency with percentage for categorized variables). Statistical tests used accordingly and the differences were considered to be statistically significant at  $P < 0.05$ .

### 3. RESULTS

There were 310 patients suffering from CVA during the study period; ischemic stroke was recorded in 260 (83.9%) of patients, 34 (11%) had hemorrhagic stroke and 16 (5.1%) had transit ischemic attack. The results includes the stroke patients and exclude TIA cases.

In present study, 294 patients were detected with stroke, the age range was 36 - 94 years, with

mean age  $71.37 \pm 10.07$  years; 162 males (55%) with mean age  $71.22 \pm 9.32$  years and 132 female (45%) with mean age  $71.55 \pm 10.96$  years, and male to female ratio was 1.2: 1.

The results demonstrated that 79.3% of patients were in age group of 65 years and more, patients younger than 45 years were 1.2% and 7.8% of patients were 85 years old or more. Concerning the relationship between the age and gender, the difference did not reach the level of significance ( $P = .09$ ) (Fig.1).

The patients included in this study had different types of stroke, 260 patients (88.4%) had ischemic stroke and 34 patients (11.6%) had hemorrhagic type. There was no significant difference between age and the type of stroke ( $P = .73$ ). Also there was no association between gender and the type of stroke ( $P = .2$ ) (Figs. 2,3).

Most of the patients had more than one risk factor for stroke, The most frequent risk factor among the cases was hypertension (76.5%), followed by diabetes mellitus (70%). The results showed that the cholesterol level among patients was high in 8.8%, 12% of patients had high LDL level and high level of TG was detected in 10.2% of patients with stroke. Regarding HDL level, 65.3% of patients had low level. A significant statistical relationship was found between hypertension and hemorrhagic stroke at  $P = .02$  (Fig. 4).

The results showed that, there was no significant differences between gender and modifiable risk factors except with high level of TG and smoking ( $P = .0001$ ) (Fig. 5).

### 4. DISCUSSION

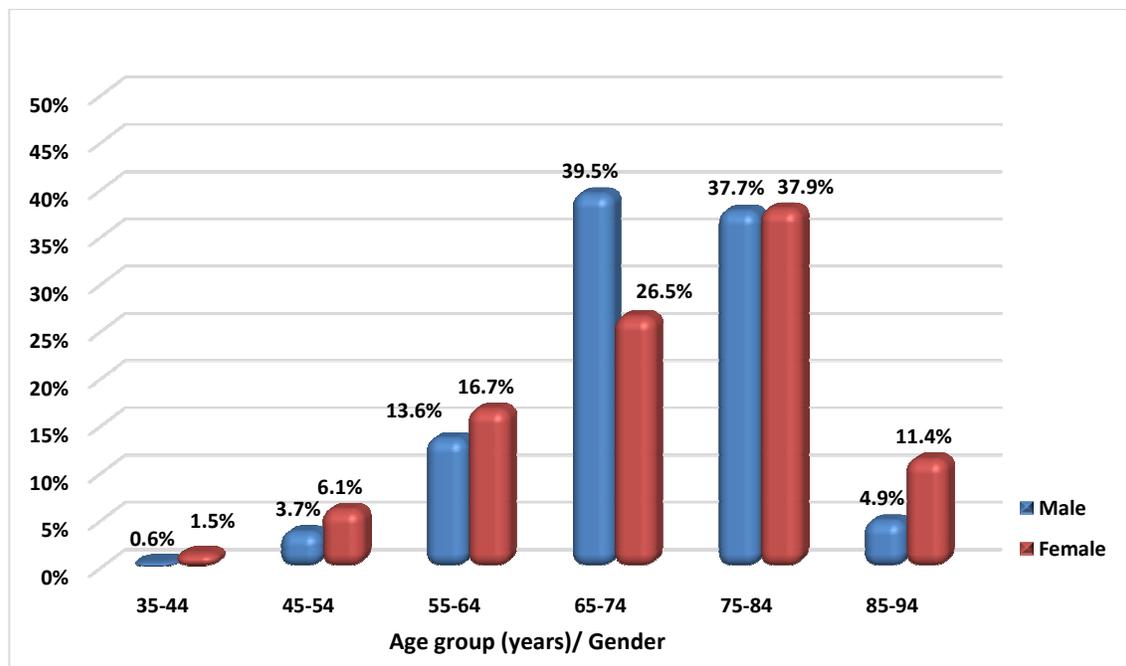
The epidemiology of stroke is changing rapidly all over the world, and it is becoming a major health problem in the Middle East and North Africa. [26,27] Libya is one of these countries where epidemiological studies on the stroke are scarce. Arab countries constitute population with similar life style as physical inactivity, smoking and western diet consumption, which increase stroke risk.

Table 1 illustrates some data about stroke from middle east, north Africa and south Asia countries.

**Table 1. Stroke risk factors characteristics in Middle East, North Africa, South Asian countries**

Study	Country	Mean age	M: F ratio	HT%	DM %	Smoking %	Dyslipidemia %	AF %
Awad et al. [28 ]	Iraq	63.66	1:1.1	69	41	33	-	8
Al-Bana et al. [29]	Bahrain	64.4	1.6:1	75	54	-	34	-
Afridi et al. [30]	Pakistan	63.44±13.8	2.7:1	62	28	47	24	21
Al-Asadi [31]	Iraq	63.8±12.3	1.27:1	66.2	28	28.4	-	9.8
Delbari et al. [32]	Iran	68±13.82	1:1.04	64	36	20	32	-
Al-Mahdawi [33]	Iraq	63.57±8.31	2.4:1	34	28	44	24	6
Sweileh et al. [34]	Palestine	69.09±10.9	1:1.04	69.9	45.2	21	-	14
Divyant et al. [35]	India	58±10.2	2.1:1	57.1	22.9	29.3	27.1	1.4
Sallam et al. [36]	Yemen	95.6	1.7:1	68.3	24.4	42	13.9	-
Yesilot et al. [37]	Turkey	63.6±14.6	1.03: 1	68.7	24.4	36.5	41.6	26
Kulshrestham et al. [38]	India	51.6	1.4:1	65.1	8.9	3.9	5.7	0.6
Al-Hashel et al. [39]	Kuwait	60.2±13.1	1.8:1	80.9	65	34.6	26.8	10.8
Maskey et al. [40]	Nepal	65.98±10.69	1.8:1	61.2	9.3	59.4	23	23
Musa et al. [41]	Sudan	-	1.5:1	43.6	16.5	3.7	-	-
Engels et al. [42]	Morocco	-	1.1:1	43.3	18.1	94.4	-	-
Al suwaidi et al. [43]	Qatar	62±12	3:1	66	43.6	51.8	34.8	7.1
Fawi et al. [44]	Egypt	57.7	1.2:1	42	21.6	37.7	29.5	6

M:F ratio: Male to Female ratio; HT: Hypertension; DM: Diabetes mellitus ; AF: Atrial fibrillation



**Fig. 1. Sex distribution of patients with stroke according to age group (Alkhadra hospital 2009-2010)**

In the present study, there were 294 patients suffering from stroke; most of the patients were more than 60 years old, only 16.7% of patients in age  $\leq 60$  years. The Mean age of stroke in present study was  $71.37 \pm 10.07$  years, which was in agreement with previous Lebanon study ( $71.9 \pm 11.8$ ) [45] as well as with

Italy study ( $74.6 \pm 1.1$ ) [46], However, contradicted finding was demonstrated in Jafar et al. study (mean age was 45 years) [47], in Qatar (57 years) [48], in Egypt ( $59.6 \pm 11$  years) [49] and in Sudan (56.6 years) [50] Also the mean age of stroke onset in the South Asian region is lower than in Western countries [51]. Young ischemic

strokes occurring in patients younger than 45 years old have been considered a relatively rare event, being less than 5% of all cerebral infarctions and the study conducted in Taiwan revealed that the incidence of young stroke was 6.8% of all strokes [52]. Compared with present study it was 1.2%. With increasing life

expectancy, old people will constitute the majority of stroke sufferers. In the current study, the results of stroke patients aged 85 years and older showed a special figure, that is a higher proportion of female sex, male to female ratio was 1:1.9; in accordance with the study of Arbiox et al. [53].

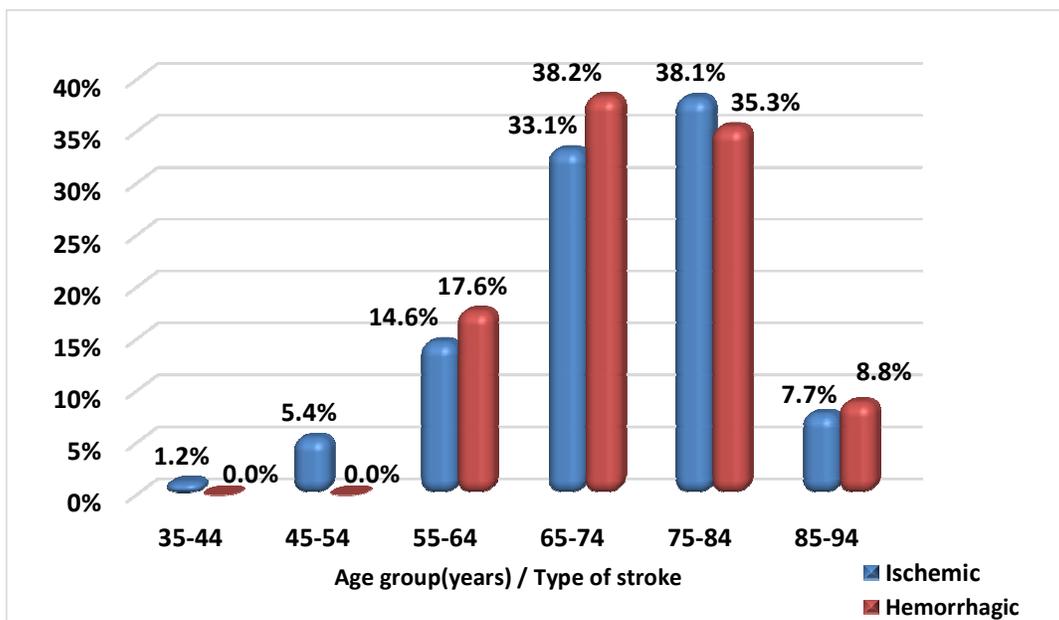


Fig. 2. Distribution of stroke type according to age group (Alkhadra hospital 2009-2010)

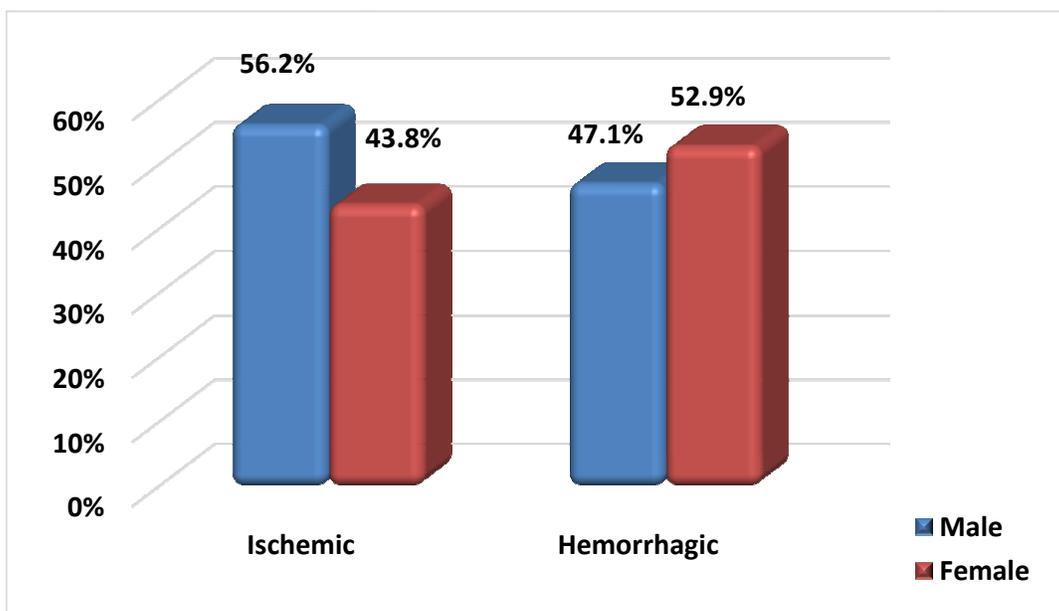


Fig. 3. Distribution of stroke type by gender (Alkhadra hospital 2009-2010)

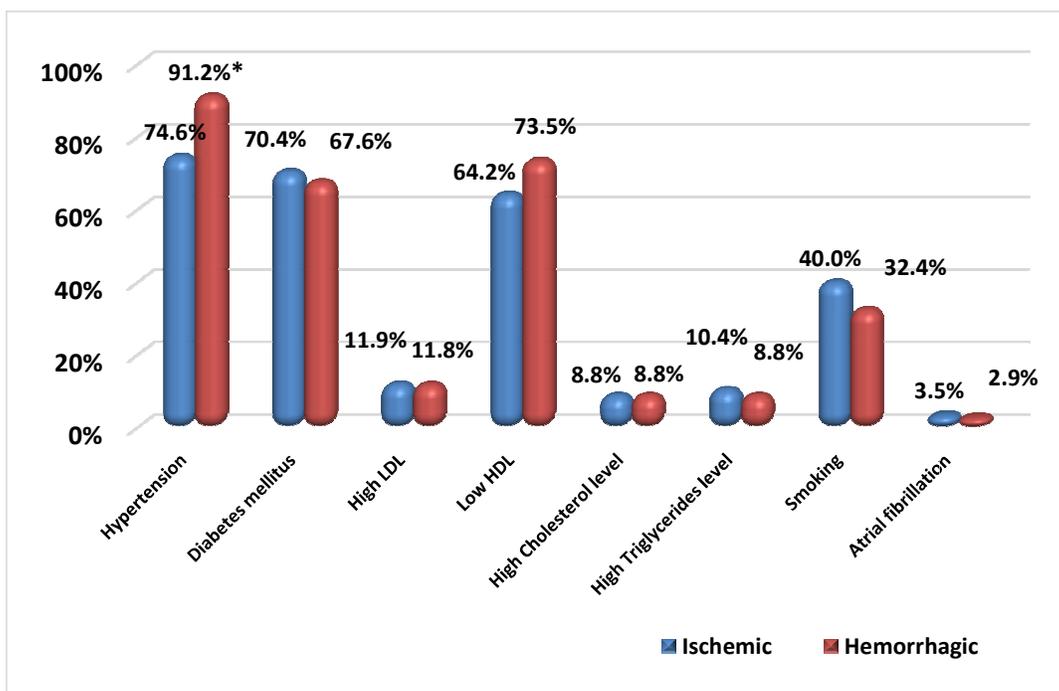


Fig. 4. Distribution of modifiable risk factors according to the type of stroke (Alkhadra hospital 2009-2010)

\* $P < 0.05$

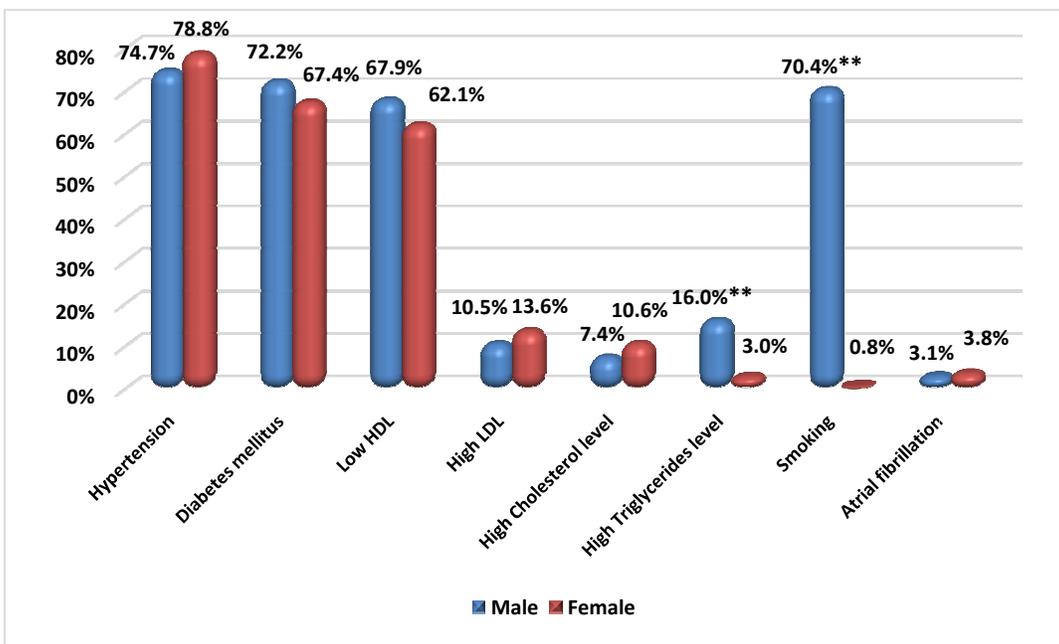


Fig. 5. Distribution of modifiable risk factors by gender among patients with stroke (Alkhadra hospital 2009-2010)

\*\* $P < 0.001$

Fifty five percent of current study group was men, approximately the same findings were indicated by El-Tallawy et al. [54] and Farghaly et al. [55], Appelros et al. reported that stroke incidence was about 30% higher in men than in women [56].

In Pakistan, there is a female preponderance of stroke, and the age of onset of stroke is even younger in females than in males [51]. Ischemic stroke was the most common type of cerebrovascular disease recorded in 88.4% of patients; it was diagnosed in 90% of male and 86.4% of female, while hemorrhagic stroke was diagnosed in 10% of males and 13.6% of females, the results showed that difference was not statistically significant ( $P = .2$ ). This finding is disagree with that of Zafar et al., who indicated that ischemic stroke is significantly more common in male than female [57]. A higher percentage of haemorrhagic stroke (19–46%) has been reported in most of the South Asian studies compared with Western countries. This finding could be related to increased prevalence and poor control of hypertension in South Asia. The prevalence of intracerebral hemorrhage (ICH) is especially high in younger patients (15–45 years of age) with stroke (32–43%) [58]. History of hypertension was present in 76.5% of patients, 74.7% of men and 78.8% of women had high blood pressure, in both gender group no significant difference was observed for hypertension ( $p = .24$ ). These results are in agreement with previous Iraq study [28]. Concerning the relationship between stroke type and hypertension, the current study showed that hypertension was constitutes 91.2% of hemorrhagic stroke and 74.6% of ischemic type and there was a significant difference ( $P = .02$ ). Others was recorded that hypertension is a major risk factor for both cerebral infarction and intra cerebral hemorrhage and the risk of cerebral hemorrhage is 3.9 times higher than non hypertensive individuals; the relationship between hypertension and stroke risk is strong, continuous, graded, consistent, independent, predictive, and etiologically significant [59-61]. Diabetes mellitus was a risk factor for 70.4% of ischemic stroke patients and 67.6% of hemorrhagic type, however this relationship did not reach the level of significance. Diabetic patients have both an increased susceptibility to atherosclerosis and an increased prevalence of proatherogenic risk factors [62]. Diabetes independently increase risk of ischemic stroke with a relative risk ranging from 1.8 fold to nearly 6fold. People with diabetes generally have

additional stroke risk factors, including hypertension, dyslipidemia, obesity, and atrial fibrillation [63].

History of smoking was positive in 39% of the patients, Chronic cigarette smoking is directly linked to reduction of cerebral blood flow, this, in turn, has been demonstrated to occur concomitantly with other known risk factors for stroke, which are well known to predispose to cerebral atherosclerosis and stroke [12]. In the present study 90.4% of smokers were suffering from ischemic stroke and 9.6% of them from hemorrhagic stroke. Smoking is considered as a significant risk factor for ischemic stroke, hemorrhagic stroke and subarachnoid hemorrhage, and the risk increases with the number of cigarettes smoked per day [64].

As observed from present study, 8.8% of studied group had high level of total cholesterol. The evidence of cholesterol as a risk factor is weak or non-existent, the prospective studies collaboration showed no association between total cholesterol and stroke [2]. whereas some studies showed increases in ischemic stroke rates at higher levels of total cholesterol, particularly for levels above 240 and there was a 25% increase in ischemic stroke rates for every 1 mmol/L (38.7 mg/dL) increase in total cholesterol [5,6]. Level of LDL was high in 12% of patients, there was no association between LDL level and stroke type ( $p = .62$ ); Only a few studies have analyzed the relationship between LDL cholesterol and ischemic stroke, with no consistent association has been found [5]. Level of HDL was low among 65.3% of the patients. It was low in 73.5% of hemorrhagic stroke and 64.2% of ischemic type, however, this relationship did not reach the level of significance ( $p = .19$ ). Level of triglyceride was high among 16% of men and 3% of women, this difference was statistically significant ( $P = .0001$ ), but there was no significant difference between TG level and the types of the stroke; While Zang et al. reported that, the highest levels of triglyceride were associated with a 3 and 4 fold risk of ischemic stroke in 4% of men and 1% of women, respectively, in the general population [14].

AF is a significant risk factor for stroke, with an attributable risk of 1.5% for people 50 to 59 years of age and 23.5% for people 80 to 89 years of age [10]. In the current study, 3.7% of patients older than 70 years had AF and a similar results were reported in previously published study in Spain [61].

Another study recorded that the AF is associated with a 4 to 5 folds increased risk of ischemic stroke resulting from embolism of stasis-induced thrombi forming in the left atrial appendage (LAA) even in the absence of cardiac valvular disease [65].

The retrospective nature of this study was a limitation, because not all risk factors were recorded like obesity, sickle cell disease, postmenopausal hormone therapy, use of oral contraceptives, poor diet, drug abuse, and sleep related breathing-disordered.

## 5. CONCLUSIONS

The study concluded that the age is an important risk factor and the risk of stroke increase with age, most of the patients were >60 years. Male gender being affected more than female. Modifiable risk factors such as Hypertension, Diabetes Mellitus, and Smoking were most common risk factors.

Ischemic stroke was the most common type of stroke among hospitalized patients and there was significant association between the hemorrhagic stroke and hypertension.

Also, the study showed no gender difference in the majority of association with risk factor apart from high level of triglyceride and smoking which were more frequent in males than females.

## 6. RECOMMENDATIONS

Health education, Life style modifications and screening as measures for prevention and control of stroke are needed.

The modifiable risk factors should be considered as main targets for primary and secondary prevention of stroke. Further researches are needed to determine the association between these risk factors and ischemic stroke subtypes; to study the emerging vascular risk factors and to assess the stroke outcomes.

## CONSENT

It is not applicable.

## ETHICAL APPROVAL

It is not applicable.

## COMPETING INTERESTS

Authors have declared that no competing interests exist.

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