



Original Research Article

The Pattern and Distribution of Risk Factors of Stroke among Yemeni Patients at USTH and Al-Gumhori Teaching Hospital in Sana'a City, Yemen

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Abstract

Background: Strokes are a heterogeneous group of disorders involving sudden and focal interruption of cerebral blood flow that causes neurologic deficit.

Aim: This study aimed to assess the distribution of risk factors of stroke among Yemeni patients diagnosed at University of Science & Technology Hospital (USTH) & AL-Gumhuri Hospital in Sana'a City, Yemen.

Methodology: This study was descriptive cross-sectional. It include 161 stroke patients in Al-Gumhuri Hospital and USTH, Sana'a, April, 2022. The sample was selected by a simple randomized method. Demographic data included personal data, age, gender, social habits (such as chewing Qat), smoking, medical history, the type of stroke...etc. Data were collected from the participants through interviews of close and open-ended questionnaires. The statistical program (SPSS version 23) was used in data analysis, including frequencies, percentages, arithmetic mean, standard deviation and p-value.

Results: The total number of participants in this study was 161. The findings showed that the stroke type of about three fourths of the participants (73.3%) was Ischemic, 19.9% were of Hemorrhage, and only 2.5% were of TIA. The findings also showed that about two thirds of participants (64.6%) were male and about half of them (47.2%) were between the age of 45 to 64 years. The average of age was 59.08, of which 65.8% have HTN, 37.9% of the patients reported to have Diabetes Miletus, the average of Triglyceride was 128.01(56.97) where 17.4% of them have Triglyceride greater than 150. HDL cholesterol average was (36.21(13.30), LDL cholesterol average was 102.0(33.6), HTN,

as stroke risk factor, gets more prevalent as patients get older and older ($p < 0.05$). DM is more associated with ages above 45 years ($p < 0.05$). The findings revealed that while hypertension and DM are two significant risk factors of Hemorrhagic stroke type, hypertension is significantly associated with risk factors of Ischemic stroke type ($p < 0.05$).

Conclusion: Prevalence of stroke in males was almost twice high than in females. The age-specific prevalence showed a gradual rising trend with increasing age. The most common risk factors observed among stroke patients are Hypertension, then dyslipidemia, tobacco use, diabetes, and ischemic heart disease, respectively.

Key words: Risk Factors, Stroke, Stroke Patients

Introduction

Strokes are a heterogeneous group of disorders involving sudden and focal interruption of cerebral blood flow that causes neurologic deficit [1]

Epidemiology: Globally, ischemia accounts for 62 percent, intracerebral hemorrhage 28 percent, and subarachnoid hemorrhage 10 percent of all incident strokes, reflecting a higher incidence of hemorrhagic stroke in low- and middle-income countries [2,3]. In the United States, the proportion of all strokes due to ischemia, intracerebral hemorrhage, and subarachnoid hemorrhage is 87, 10, and 3 percent, respectively [4].

The lifetime risk of stroke for adult men and women (25 years of age and older) is approximately 25 percent [5]. The highest risk of stroke is found in East Asia, Central Europe, and Eastern Europe. Worldwide, stroke is the second most common cause of mortality and the second most common cause of disability [6].

The annual incidence of new or recurrent stroke in the United States is about 795,000, of which about 610,000 are first-ever strokes and 185,000 are recurrent strokes[4].

Statistics on Stroke Incidence and Mortality

Globally, stroke remains the second-leading cause of death and the third-leading cause of death and disability combined (as expressed by disability-adjusted life-years lost - DALYs) in the world [7].

In the Middle East (ME) region, people suffer from high rates of non-communicable diseases where the prevalence of hypertension is unacceptably high among adults aged 25 years and older, reaching 30% of this population, and diabetes rates attaining 11% of the population [8]. Moreover, the highly prevalent risk factors pattern is similar among the majority of the ME countries as well as the low rate of self-awareness and control of non-communicable diseases [9,10]. Additionally, the ME lacks knowledge for cerebrovascular risk factors, awareness, causes, and symptoms as seen in many studies [11,12], which is a concern, especially in increasing the chances of patients of benefiting from acute intervention including

thrombectomy [13,14], thrombolysis, [15,16] and stroke unit treatment[9].

As for the Republic of Yemen, according to the latest WHO data published in 2020, stroke deaths in Yemen reached 13,570 cases, (8.72%) of total deaths. The adjusted death rate is 127.49 per 100,000 of population, ranking Yemen 32 in the world [17].

Risk Factors

Hypertension is the most predominant risk factor in all stroke types, present in 24.9 – 80% of patients [18,19], followed by diabetes, 5.1– 69.4% [20,21]. Dyslipidemia is reported by 5.4–65.8% [22,23], and smoking by 1.6–47.34% [24,21]. Other risk factors include previous ischemic transient attack (2.1–39%) [18,25]; cardiac diseases (4–50%) [26,27]; obesity (5.3–66%) [24,28]; family history of stroke (5.4–31.6%) [29,30]. No risk factors were reported by 7.9–27.5% of cases [18,22] in the ME.

The mean age of stroke patients in Yemen was 59.6 years, with a 62.6% male-to-female predo aged above 45years. The most common stroke pattern was ischemic in 72%, hemorrhagic in 25 % and was undetermined in 2.5%. The most common age for stroke was the middle age group (15-44 years) as the stroke was seen in 51.7% of them.

The major associated medical conditions were hypertension (HTN) in (68.3%), cardiac diseases that account for (42.4%) and diabetes mellitus (DM) in (24.4%). Hypertension was more common in the hemorrhagic stroke (82.6%) versus 61.6% in the ischemic group. Assessing the known risk factors, smoking history was positive in 42% and hyperlipidemia in (13.9%). QAT chewing habit was positive in (43.4%) of the patients. QAT chewing is known to be

associated with hypertension. The fatality rate was (24.2%), and it was higher in hemorrhagic stroke (28.8%), than in ischemic stroke, (19.7%) [31].

Causes and Risk Factors of Stroke

Hypertension, smoking, dyslipidemia, diabetes insulin resistance, abdominal obesity, Excess alcohol consumption, lack of physical activity, high-risk diet (e.g., high in saturated fats, trans fats, and calories), psychosocial stress (e.g., depression), heart disorders (particularly disorders that predispose to emboli, such as acute MI, infective endocarditis, and atrial fibrillation), hypercoagulability (thrombotic stroke only), intracranial aneurysms (subarachnoid hemorrhage only), use of certain drugs (e.g., cocaine, amphetamines), and vasculitis are modifiable factors that contribute to increased risk of stroke [32].

On the other hand, unmodifiable risk factors include prior stroke, older age, family history of stroke, and genetic factors

Classification of Stroke

Stroke is divided in to two major types: brain ischemia (due to thrombosis, embolism, or systemic hypo perfusion) and brain hemorrhage (due to intracerebral hemorrhage (ICH) or subarachnoid hemorrhage (SAH)) [33]. Moreover, stroke is divided into four subtypes: intracerebral hemorrhage, subarachnoid hemorrhage, ischemic (thrombotic), and ischemic (embolic) [34].

Evaluation of Stroke

Evaluation of stoke aims to establish knowledge for the following aspects of inquiry: whether stroke has occurred, whether stroke is ischemic or hemorrhagic, whether

emergency treatment is required, what are the best strategies for preventing subsequent strokes, and whether and how to pursue rehabilitation. Stroke is suspected in patients with any of the following: sudden neurologic deficits compatible with brain damage in an arterial territory, a particularly sudden severe headache, sudden and unexplained coma, sudden impairment of consciousness, also by brain CT scan, and MRI [35].

Treatment of Stroke

- Stabilization
- Reperfusion for some ischemic strokes
- Supportive measures and treatment of complications
- Strategies to prevent future strokes [36]

Rationale of the Study

1. There are few studies about this subject in Yemen.
2. Multiple risk factors related to stroke in Yemen such as: Qat chewing, smoking.
3. Stroke in general is major health problems worldwide.
4. Increased number of stroke cases in Yemen.
5. Stroke is the second most common cause of mortality and the second most common cause of disability [36].

Research Question

What are the risk factors of stroke among Yemeni patients at USTH and Al-Gumhori Teaching Hospital in Sana'a City, Yemen?

Significance of the Study

This study is significant to identify and estimate the distribution of risk factors of stroke among patients.

Limitations of the Study

1. Most of the cases were discharged of the hospital without making echo. Moreover, the patients who did it, they mostly had normal echo or had signs of IHD, HHD or VHD.
2. All of Al-Gumhori hospital cases didn't do Doppler US, and most of USTH cases who did it, they had normal Doppler US; except few cases who had less than 60 % stenosis and one case had small atheroma.
3. All cases were taken from medical ward, so a few TIA cases were found.

Objectives of the Study

General Objective

This study aimed to estimate the distribution of risk factors of stroke among Yemeni patients at USTH and Al-Gumhori Teaching Hospital.

Specific Objectives

1. To identify the types risk factors of stroke among patients diagnosed.
2. To determine the distribution of risk factors in patients regarding to gender, habits behavior and any medical disease as HTN, DM etc.

Study Hypothesis

There are multiple risk factors of stroke in Yemeni patients that lead to occurrence of stroke.

Methodology

This study is a cross sectional descriptive study which include 161 stroke patients in private and public hospitals in Sana'a (USTH and Al-Gumhori Teaching Hospital). It was carried out within six months. Data were

collected by using an interview and a questionnaire about risk factors. The questionnaire contained open-ended and close-ended questions. The study variables involved patient's personal data, age, gender, occupation, address, habits (such as chewing Qat, smoking, consuming alcohol, nutritional habits), medical history, hereditary predisposing, and type of stroke.

Inclusion and Exclusion Criteria

Inclusion criteria: 161 patients (males & females); (age group >15 years old); (those who already diagnosed with stroke in patient).

Exclusion criteria: (patients who do not have stroke); (stroke cases below age of 15 years).

Analysis of Data: Data were analyzed by SPSS version 23, including frequencies, percentages, arithmetic mean, standard deviation, and *p*-value.

Ethical Consideration:

Ethical approval was obtained from the hospitals from which the study data were collected. Patients were included after obtaining informed verbal consents from them. They were informed of the study objectives and were also confirmed that the methods of data collection would not cause any physical or psychological harm to them. They were also confirmed that all collected data would be handled confidentially and would be used solely for the purpose of the study.

Results

Demographic Characteristics

Table (1) Demographic Characteristics

	N	%	Mean (SD)	
Gender	Male	104	64.6%	
	Female	57	35.4%	
Age	20-45	28	17.4%	
	45-64	76	47.2%	59.08 ±14.32
	65-100	57	35.4%	
Chewing Khat	No	56	34.8%	
	Yes	105	65.2%	
Smoking	No	111	68.9%	
	Yes	50	31.1%	
Ex-Smoker	Yes	46	28.6%	

Table (1) shows that out of 161 patients, about two thirds (64.6%) of them are male and about half of them (47.2%) are at the age group (45-64 years), by which the average age is 59.08 with SD of ± 14.32. It also shows that out of 161 patients, 65.2% are Qat chewers, 31.1% are smokers, and 28.6% are ex-smokers.

History**Table (2):** Type, Duration Neurological Deficit, and History of Stroke

		No.	%
Type of Stroke	Ischemic	118	73.3%
	Hemorrhage	32	19.9%
	Tia	4[total 154]*	2.5%
Duration of the stroke	1-9 days	135	83.9%
	10-19 days	22	13.7%
	>20 days	4	2.5%
Neurological Deficit	Hemiplegia	122	87.1%
	sensory loss	1	0.7%
	Aphasia	42	30.0%
	Dysarthria	64	45.7%
	facial deviation	15	10.7%
	Ataxia	3	2.1%
History		41	25.5%
Times	One time	31	75.6%
	2 times or more	10	24.4%
Type of stroke in	Ischemic*	29	70.7%
	Hemorrhagic	4	9.8%
CKD		4	2.5%
CLD		10	6.2%
Bleeding disorder		1	0.6%
IHD		31	19.3%
Valvular HD		14	8.7%
Anticoagulant		12	7.5%
antiplatelet		69	42.9%
Family History(n=94)	CVA (N=13)	13	23.6%
	hemorrhagic (N=13)	7	53.8%
	Ischemic(N=13)	6	46.2%
	HTN	40	72.7%
	DM	33	60.0%

The results in Table (2) shows that the stroke types were Ischemic in 73.3%, Hemorrhage in 19.9%, and Tia in only 2.5% of the patients involved in this study. The results also show that 83.9% of these strokes lasted for a duration between 1-9 days. Hemiplegia was found in 87.1%, dysarthria in 45.7%, and aphasia in 30% of the

patients, while facial deviation was detected in 10.7% of those having neurological deficits associated with stroke. In addition, only 25.5% of the patients have a history of stroke of which 75.6% have it for one time and 24.4% for two times or more; from which 70.7% of these strokes were Ischemic in type, 9.8% were Hemorrhagic, and 20.5%

were not identified. Moreover, the results reveal that 2.5% of the cases have CKD, 6.2% have CLD, 0.6% have bleeding disorder, 19.3% have IHD, and 8.7% have Valvular HD; from which 7.5% patients take anticoagulant and 42.9% take antiplatelet (Aspirin). Finally, it can be observed that out of 94 patients having first degree family history, 23.6% have a history of CVA of which 53.8% are hemorrhagic and 46.2% are ischemic stroke, 72.7% have family history of HTN, and 60% have DM.

Descriptive Statistics of Stroke Risk Factors

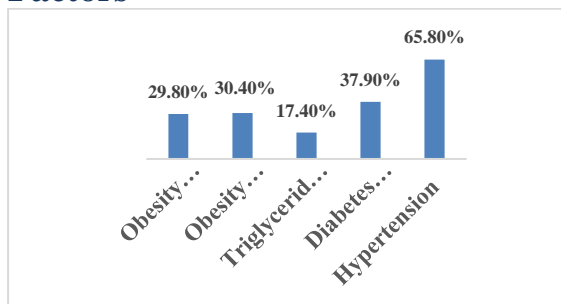


Figure (1) Descriptive Statistics of Stroke Risk Factors*

Figure (1) displays the statistics of Hypertension, in which out of 161 patients (65.8%) have HTN.

Hypertension

Table (3) Stroke Risk Factors

	No.	%	Mean (SD)
Hypertension	106	65.80%	
HTN duration			6.29(5.44)
BP>130/85	52	49.06%	
Anti HTN medications	39	36.79%	
HTN medication duration			7.06(6.45)
COMPLAINT	25	15.50%	
CONTTOLED	24	14.90%	
ACE inhibitors	55	34.20%	
B-BLOKERS	26	16.10%	
CCB	21	13.00%	

Table (3) displays the statistics of Hypertension. It can be seen that out of 161

patients, 65.8% have HTN with an average duration of (6.29) years. It can also be seen that out of 106 patients with HTN, 49.06% have blood pressure greater than (130/85) and 36.79% of them take anti HTN medications with an average duration of (7.06) years. The findings also show that 15.50% of the cases are compliant, 14.90% are controlled, 34.20% are ACE inhibitor, 16.10% are B-blockers, and 13% are CCB.

Diabetes Miletus

Table (4) The statistics of Diabetes Miletus

		N	%	Mean (SD)
Diabetes Miletus		61	37.90%	
Type of DM	Type I	1	1.70%	
	Type II	60	98.30%	
Duration				6.28(5.36)
FBS				160.69(103.86)
>=100		53	86.80%	
Hyperglycemia Medications		57	93.4%	
Oral		42	73.7%	
Insulin		15	26.3%	
HbA1c				8.63(2.14)

Table (4) presents the statistics of Diabetes Miletus. It can be noticed that out of 161 patients with stroke, 37.9% of them reported to have Diabetes Miletus, in which out of 44 patients, majority of them 97.7% have Type II DM. The FBS average is 160.69(±103.86). In addition, it can be seen that out of 61 DM patients, 86.80% of them have FBS >=100 and 93.4% take hyperglycemia medications- of which 73.7% take oral and 26.3% takes insulin. The average of HBA is 8.63(±2.14).

Dyslipidemia

Table (5) The statistics of Triglyceride

	Mean (SD)	N	%
Triglyceride	128.01(56.97)		
Triglyceride >150		28	17.4%
HDL cholesterol	36.21(13.30)		
male <40 N=104		63	60.6%
female <50 (N=57)		41	71.9%
LDL			
LDL>130		36	23.1%
Medications	102.0(33.6)	30	18.6%

Table (5) shows the statistics of Triglyceride. The results show that the average of Triglyceride is 128.01(56.97) where 17.4% of the patients have Triglyceride greater than 150. LDL cholesterol average is 102.0(33.6) where 23.1% of the patients have LDL greater than 130. HDL cholesterol average is (36.21(13.30)). The results also reveal that out of 104 male patients, 60.6% have HDL less than 40 mg, and out of 57 female patients, 71.0% have HDL less than 50. Only 18.6% of the patients take medications.

Obesity

Table (6): Obesity

	Mean (SD)	N	%
Waist circumference	92.55(14.76)		
Male>90		49	30.4%
Female >80		48	29.8%

According to the results in Table (6), the waist circumference average is 92.55(±14.76), in which 30.4% of the male patients have waist circumference >90 cm and 29.8% of female patients have waist circumference >80 cm.

Distribution of Risk Factors According to Gender

Exact Fisher test was run to examine any significant association between Gender and stroke risk factors. As shown in Table (7), there is no statistically significant association between chewing Qat, smoking, HTN, DM and dyslipidemia, as risk factors for stroke, and gender ($p>0.05$). However, ex-smoking was found to be risk factor for male more than female ($p<0.05$) while obesity was found to be risk factor prevalent among female more than male ($P<0.05$).

Table (7) Distribution of risk factors according to Gender

		Gender				X ²	P
		Male		Female			
		N	%	N	%		
Chewing Khat	No	31	55.4%	25	44.6%	3.205	.073
	Yes	73	69.5%	32	30.5%		
Smoking	No	69	62.2%	42	37.8%	.926	.336
	Yes	35	70.0%	15	30.0%		
Ex-Smoker	No	67	58.3%	48	41.7%	7.064	.008
	Yes	37	80.4%	9	19.6%		
Hypertension	No	36	65.5%	19	34.5%	.027	.870
	Yes	68	64.2%	38	35.8%		
Obesity	No	55	85.9%	9	14.1%	21.155	.000*
	Yes	49	50.5%	48	49.5%		
Diabetes Miletus	No	64	64.0%	36	36.0%	.041	.839
	Yes	40	65.6%	21	34.4%		
Triglyceride >150	No	88	66.7%	44	33.3%	1.374	.241
	Yes	16	55.2%	13	44.8%		
LDL>150	No	72	64.9%	39	35.1%	.162	.687
	Yes	24	68.6%	11	31.4%		

Distribution of Risk Factors According to Age Group

Exact Fisher test was run to examine any significant association between Age groups and stroke risk factors. As demonstrated in Table (8), chewing Qat was not associated with age groups as a risk factor of stroke, ($p>0.05$). On the other hand, smoking and ex-smoking were prevalent risk factors among younger age groups ($p<0.05$). In addition, HTN got more prevalent as stroke risk factor as patients get older in age ($p<0.05$). Moreover, DM and dyslipidemia were more associated with ages above 45 years ($p<0.05$).

Table (8) Distribution of risk factors according to age group

		Age groups						P
		20-45		45-64		65-100		
		n	%	n	%	n	%	
Chewing Khat	No	7	25.0%	25	32.9%	24	42.1%	.266
	Yes	21	75.0%	51	67.1%	33	57.9%	
Smoking	No	13	46.4%	48	63.2%	50	87.7%	.000*
	Yes	15	53.6%	28	36.8%	7	12.3%	
Ex-Smoker	No	27	96.4%	57	75.0%	31	54.4%	.000*
	Yes	1	3.6%	19	25.0%	26	45.6%	
Hypertension	No	16	57.1%	25	32.9%	14	24.6%	.011*
	Yes	12	42.9%	51	67.1%	43	75.4%	
Glyceride >150	No	24	85.7%	61	80.3%	47	82.5%	.809
	Yes	4	14.3%	15	19.7%	10	17.5%	
Diabetes Miletus	No	27	96.4%	39	51.3%	34	59.6%	.000
	Yes	1	3.6%	37	48.7%	23	40.4%	
Obesity	No	12	42.9%	26	34.2%	26	45.6%	.386
	Yes	16	57.1%	50	65.8%	31	54.4%	
LDL>130	No	21	18.9%	54	48.6%	36	32.4%	.417
	Yes	4	11.4%	16	45.7%	15	42.9%	

Distribution of Risk Factors According to Type of Stroke

Table (9) Distribution of risk factors according to type of stroke

Risk factor	Type of stroke						P
	Ischemic		Hemorrhage		Tia		
	N	%	N	%	N	%	
Chewing Khat	78	78.80%	19	19.20%	2	2.00%	.786 ^a
Smoking	36	75.00%	11	22.90%	1	2.10%	.726 ^a
Ex-Smoker	34	79.10%	8	18.60%	1	2.30%	.974 ^a
Hypertension	75	74.30%	23	22.80%	3	3.00%	.279 ^a
>150	21	75.00%	7	25.00%	0	0.00%	.465 ^a
Obesity	72	80.90%	14	15.70%	3	3.40%	.348 ^a
Diabetes Miletus	49	83.10%	8	13.60%	2	3.40%	.335 ^a
LDL	24	68.6%	10	28.6%	1	2.9%	.329

Fisher test was also run to examine the cross tabulation between risk factors of stroke and type of stroke. As given in Table (9), there was no statistically significant association between the stroke risk factors (chewing Qat; smoking; ex-smoking; HTN; dyslipidemia; obesity; DM) and the type of stroke ($P>0.05$). However, these risk factors were found to be three-fold among ischemic strokes in comparison with other types. In other words, out of five patients having stroke, four of them can be ischemic and one can be hemorrhagic. TIA type is very rare strokes.

Logistic Regression Findings of Risk Factors of Hemorrhagic and Ischemic Strokes

Table (10) Logistic Regression of Risk Factors of Hemorrhagic and Ischemic Stroke

	B	S.E.	Wald	p	Exp(B)	95% C.I. for EXP(B)	
						Lower	Upper
Risk factors of Hemorrhagic stroke							
HTN	.974	.480	4.124	.042	2.650	1.035	6.786
DM	.954	.460	4.291	.038	2.595	1.053	6.398
Obesity	-.028	.413	.005	.946	.972	.433	2.183
Risk factors of ischemic stroke							
HTN	.909	.431	4.443	.035	2.482	1.066	5.781
DM	-.104	.381	.075	.785	.901	.428	1.900
Obesity	.289	.376	.592	.442	1.336	.639	2.791
Constant	.696	.324	4.621	.032	2.005		

The findings in Table (10) show that hypertension and DM were two significant

risk factors of Hemorrhagic stroke type ($p<0.05$) HTN: (OR=2.650; CI: 1.035-

6.78); DM:(OR=2.595; CI: 1.053-6.398) while other risk factors, such as obesity, were not found to be associated with ischemic stroke type ($P>0.05$). The findings also show that hypertension significantly associated with risk factors of Ischemic stroke type ($p<0.05$, OR=2.482; CI: 1.066-5.781) while other risk factors, such as DM and obesity, were not found to be associated with ischemic stroke type($p>0.05$).

Discussion

Even though risk factors of stroke have been clearly identified in many populations worldwide, which help guiding appropriate prevention and control strategies [37,38], Yemen should determine the impacts of various risk factors on stroke among populations to adapt prevention and control policies that are relevant to the national context especially when resources are limited. Like other studies in Asia, Middle East and North Africa [39,40], hypertension was a major modifiable risk factor of stroke. The prevalence of hypertension among stroke patients was about 3-fold higher than general population. Furthermore, in this case-cohort comparison, hypertension also played a major role in stroke. Approximately 65.80% of stroke in population was related to hypertension, which was even more prominent in middle-aged group of 45-64 years, 67.1%. In Yemen, the estimated prevalence of hypertension for the age group between 30 and 64 is 17.1% and the crude prevalence was 13.5%.[41].

Hypertension prevention and control programs should be seriously promoted, particularly in the middle-aged group. In this study, maleness and increasing age were

important non-modifiable risk factors. Stroke primary prevention should be emphasized and directed to appropriate target populations.

While there was no statistically significant association between smoking and the disease in the overall model, opposite finding was observed in the age group-specific model. Among those aged 20-45 years, smoking carried the highest PAF of stroke, 53.6%. If the concerned authorities in Yemen could implement successful smoking prevention and cessation interventions in young people, annual incidence of stroke in the young generation would be significantly reduced. This study also showed a significant association between diabetes mellitus and stroke. A similar finding was documented in South-East Asia and Western Pacific regions of WHO. [42]. However, in age group-specific multivariable model, PAFs were less than 10% for diabetes mellitus in all groups. Effects of diabetic control could reduce risk of stroke in all age groups. Several risk factors, such as dyslipidemia, DM, and obesity, were not recorded in NHIS properly, so the prevalence and impact of these factors could not be evaluated.

Conclusions

The findings of this study demonstrated the prevalence of stroke common risk factors among the stroke patients. Further, the prevalence of stroke in males was almost twice than in females. The age-specific prevalence showed a gradual rising trend with increasing age. The most common risk factors observed among stroke patients involved in this study were hypertension, dyslipidemia, smoking, diabetes, ischemic,

and heart disease. It is recommended that hypertension control program should be a priority in middle and old age groups.

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