Prevalence of Stroke in Fayoum Governorate, Egypt: A Community-Based Study

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Background: Stroke is a highly prevalent disease with consequent mortality and morbidity. Few community based studies have been conducted only in upper Egypt to estimate prevalence of stroke. *Objectives:* This study was designed to find out the prevalence of stroke in Fayoum Governorate & to study some associated risk factors. *Methods:* through this community based cross-sectional study 4784 participants aged more than or equal to 18 years old were enrolled. A multi-stage random sample technique was followed to choose the study sample. A predesigned interviewer-administered structured questionnaire was used. Suspected stroke case by screening questionnaire was referred to the neurologist. *Results:* The Crude prevalence of stroke was 16 out of 1000 with confidence interval of proportion (12.6%-19.7%). The age adjusted local (Fayoum 2017 census) prevalence rate was 7.97 out of 1000, age adjusted prevalence rate (Egypt population 2017) was 1.05 out of 1000. Age-adjusted World Health Organization standard world population prevalence rate was 1.69 out of 1000. The crude prevalence of ischemic stroke was significantly higher than hemorrhagic stroke 11.9 versus 3.9 out of 1000 population. The most prevalent risk factor was smoking among males, followed by obesity then hypertension. The prevalence of stroke was significantly higher among participants affected with hypertension, diabetes, heart diseases, obesity, and smoking. Logistic regression analysis showed that having hypertension, diabetes, heart diseases, atrial fibrillation, obesity, and smoking were reported risk factors of stroke. *Conclusions:* The prevalence of stroke in Fayoum governorate was 1.6%. Hypertension, diabetes, heart diseases, obesity, and smoking were reported risk factors of stroke.

Key Words: Stroke—prevalence—Fayoum Governorate—risk factors—screening

Introduction

Stroke is a highly prevalent disease. According to the World Health Organization (WHO), around 15 million people, worldwide, suffer from stroke each year. Among those, 5 million die and another 5 million are permanently disabled. Four out of five strokes occur in the low- and middle-income countries.[1] Stroke has been shown to be a major cause of death and disability in all societies irrespective of communities (industrial, agricultural, urban, or rural) which have been studied.[2,3] The incidence of stroke rapidly increases with age, doubling for each decade after age 55.[4] Among adults ages 35-44, the incidence of stroke is 30-120 of 100,000 per year, and for those ages 65-74, the incidence is 670-970 of 100,000 per year.[5]

Approximately 800,000 primary (first-time) or secondary (recurrent) strokes occur each year in the United States, with the majority being primary strokes (roughly

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600,000). Of these strokes, approximately 87% are ischemic infarctions, 10% are primary hemorrhages, and 3% are subarachnoid hemorrhage.[6]

The Prevalence of stroke in European countries and United States ranged from 1.5% in Italy to 3% in the UK and United States.[7] In Asian countries, prevalence of stroke has been reported in the range of 45-471 per 100,000.[8] In Arab countries, Tunisia has reported the lowest figures 42 per 100,000. In Saudi Arabia the reported prevalence was 186 per 100,000.[9,10] Four previous community based studies have been conducted in upper Egypt to estimate prevalence of stroke. The first study was in Assiut Governorate (Nile Valley) where the age-adjusted prevalence rate was 699 of 100,000. The second one was in the Al-Kharga district, New Valley, the crude prevalence rate was 566 per 1000 population. The third one in Al-Quseir district with a crude prevalence rate of 655 of 1000. The fourth was done in Qena Governorate a crude prevalence rate 922 of 100,000, an age-adjusted local prevalence rate of 777 of 100,000, and an age-adjusted prevalence rate of Egyptian population 566.6 of 100,000.[11-14]

Fayoum Governorate, lying in Middle Egypt, about 100 kilometres (62 miles) southwest of Cairo. The total population of Fayoum is 3,170,150 inhabitants in January, 2015 with 22.5 % urban and 77.5 % rural population, according to Central Agency for Public Mobilization and Statistics. Fayoum governorate was divided into 6 districts: (Fayoum, Etsa, Tamiya, Sinnuris, Youssef Sadiek, Abshoay). Each district is composed of groups of villages representing Fayoum rural area. The main capital of governorate is Fayoum city which is considered an urban area.[15] Up to our knowledge, no previous studies had been conducted to look for prevalence of stroke in Fayoum

Previous studies have identified several risk factors for stroke.[16,17] These risk factors are classified as, nonmodifiable or modifiable. Nonmodifiable risk factors serve as markers for high stroke risk, whereas modifiable risk factors are amenable to intervention for lower stroke risk.[16] Recently, a case-control study of 3000 stroke cases, and matched number of controls, demonstrated that roughly 90% of strokes could be explained by 10 risk factors: (1) hypertension, (2) diabetes, (3) cardiac causes, (4) current smoking, (5) abdominal obesity, (6) hyperlipidemia, (7) physical inactivity, (8) alcohol consumption, (9) diet, and (10) psychosocial stress and depression.[17]

This study aimed to find out the stroke prevalence and to estimate age-specific prevalence of stroke in Fayoum Governorate and to study some associated risk factors. Estimation of stroke frequency in Egyptian populations in different governorates may help in providing evidence to formulate a strategy that control stroke in Egypt.

Methods

Study Design and Setting

This was a community-based, cross-sectional descriptive study. It was implemented in Fayoum Governorate.

Ethical Consideration

The study protocol was approved by the ethical committee of Faculty of medicine, Fayoum University. Informed written consent was obtained from each participation in the study.

Sampling Technique

A multistage, stratified systematic random sample was followed to choose the study sample. First 2 districts; Fayoum and Sinoris districts; were randomly selected out of 6 districts of Fayoum Governorate. Fayoum district the main and biggest district. It has characteristics of urban and rural population as it is surrounded by villages. Sinoris district has characteristics of rural population. Second in each district 1 allying village was selected; Benisaleh in Fayoum district and Matrtars village in Senoris, in addition to 2 urban areas in Fayoum city (Keman Fares around Fayoum university hospital and El Hadka) Third; in any of sampling sites the main street was selected then go forward in 1 direction. Fourth, the first house was chosen randomly and then every third house. Eligible study participants were all residents in the selected houses who aged more than equal to 18 years and agreed to participate in the study. If family refused to participate in the survey, we replace it with the family next door.

Sample Size Calculation

To detect a crude stroke prevalence of 922 of 100,000 populations (the average of crude prevalence rate from previous study from Qena Governorate,[14] with 95% confidence, precision of .4, design, effect of 2 and nonresponse of 10%, the minimum required sample size was 4700 individuals. Data collection was done in 12 months from January to December, 2017 by face-to-face interviews conducted by one of the authors' Assistant professor of the Public Health Department, Faculty of Nursing, and 10 Fourth grade nursing students after being trained by Neurology professor. December 31, 2017 was considered the prevalence day, any positive case fulfilling the diagnostic criteria of stroke before that day at any time of their lives was considered as a prevalent case.

Data Collection Tools

A predesigned interviewer-administered structured questionnaire was developed and composed of 2 parts the first part recorded some sociodemographic data (age, sex, and residence) and included some risk factors (smoking habits, medical history of diabetes, hypertension, and

heart diseases including atrial fibrillation[AF]), physical measurements of weight, height, and resting blood pressure. Second part included a stroke screening questionnaire that was developed after review of literature and previous research conducted by Khedr et al[14] This questionnaire was applied to individuals aged more than or equal 18 years old. The participants were interviewed directly, if they were mentally impaired, relatives or their caregivers answered questions. The questionnaire was translated into Arabic by El-Tallawy et al[18] and validated. The sensitivity of the whole questionnaire was 58% and the specificity was 91.2%. The positive predictive value (PPV) of the questionnaire was 86.7%. The questionnaire consists of 8 questions; 5 questions, inquire about cerebral stroke (including weakness, dysesthesia, dysarthria, dysphasia, and deviation of the mouth), 1 question inquires about subarachnoid hemorrhage, 1 question about vertebrobasilar stroke, and the last question about previous history of stroke. Each question had a yes or no answer. The questionnaire was pretested in a pilot group of 15 stroke patients at the neurological outpatient clinic at Fayoum university hospital and age and sex matched health group to assess its validity and also to assess its understandability and making sure that the questions were clear and self-explanatory. The sensitivity and specificity of the questionnaire were set at 85% sensitivity and 98% specificity.

Height and weight were measured according to a standardized protocol and technique, with participants wearing no shoes. Blood pressure was measured using sphygmomanometer, each participant rested for at least 20 minutes before measurements were taken. Participants were measured twice, and the average of the readings was taken.

Variable Definitions

Stroke related risk factors were defined as follows: hypertension was defined as a self-reported history and/or the use of antihypertensive medication in the past 2 weeks, or the average of 2 resting systolic blood pressure readings of more than equal to 140 mm Hg and/or diastolic blood pressure more than equal to 90 mm Hg in the field survey.[19] Diabetes mellitus was defined as the use of insulin and/or oral hypoglycemic medications, or a self-reported history of diabetes. Heart diseases were defined as the use of medication, or self-reported history of heart diseases (angina, infarction, arrhythmia including atrial fibrillation).

Body mass index was calculated as weight (kg) divided by height squared (m^2), and overweight or obesity was defined as body mass index more than equal to 26 kg/m.[19]

Confirmation of Stroke Cases

Stroke was defined according to WHO as rapidly developing clinical signs of focal (or global) disturbance of cerebral function, with symptoms lasting 24 hours or longer with no apparent cause other than of vascular origin.[20] Suspected stroke case by screening questionnaire was referred to the neurologist, author to reapply screening questionnaire, history taking, and neurological examination was done for every suspect. Further laboratory investigation and CT brain imaging were done for all those patients. Strokes were further classified as cerebral infarction or intracerebral hemorrhage based on CT criterion that was available for previously diagnosed cases and done for other suspected cases according to Trial of Acute Stroke treatment criteria.[21] The date of stroke was recorded for all cases and whether if there is any recurrent events.

Data Management and Statistical Analysis

Data were collected, coded, and analyzed using Statistical Package for Social Science (SPSS) software version 16. Simple descriptive analysis in the form of means and standard deviations was calculated for numerical data. The prevalence was expressed in

Table 1. *Evaluation of Questionnaire 8 points in stroke cases*

Questions	Sensitivity	Specificity	PPV	NPP
Deviation of the angle of the mouth with normal eye closure.	82.9%	99.9%	91.3%	99.7%
Heaviness or paralysis or sudden weakness of 1 part or 1 side of the body.	100.0%	86.7%	10.8%	100.0%
Paresthesia or anesthesia of 1 part or 1 side of the body including the face.	100.0%	94.6%	22.9%	100.0%
Dysarthria or difficulty of articulation of speech.	100.0%	99.6%	80.9%	100%
Difficulty in understanding speech or inability to express what he/she wants either in speech or in writing.	100.0%	99.5%	75.2%	100%
Sudden severe headache, continuous vomiting, and lower neck pain.	50.0%	77.7%	3.5%	99.0%
Loss of balance and swaying to 1 or either sides during walking.	100.0%	92.8%	18.3%	100%
Have you ever had a cerebral infarction or hemorrhage.	88.2%	94.9%	21.8%	99.8%

Table 2. *Basal Characteristics study group*

Variables	levels	N = 4784 (%)
Age	<45 years	2818 (58.9)
	≥45	1966 (41.1)
	Mean ± SD	36.98 ± 15.93
Sex	Males	2418 (50.5)
	Females	2366 (49.5)
Residence	Urban	1686 (35.2)
	Rural	3098 (64.8)
Smoking*	Yes	1687 (35.3)
	No	3097 (64.7)
Obesity	Yes	1377 (28.8)
	No	3407 (71.2)
Hypertension	Yes	1013 (21.2)
	No	3771 (78.8)
Diabetes	Yes	865 (18.1)
	No	3919 (81.9)
Heart diseases	AF	59 (1.2)
	Other heart problems (angina, infarction, other arrhythmias)	158 (3.3)
	Free	4567 (95.5)

*Smoking was reported only among male participants.

percentage. Prevalence was age-standardized to the WHO world standard population using the direct method.[22] Nonparametric tests (chi-square) were used to find its association with other factors. Multivariate logistic regression analysis was performed to detect risk factors of stroke. Further evaluation of screening questionnaire was done by calculating sensitivity and specificity of each symptom in predicting stroke case versus 300 healthy age and sex matched family relatives or neighbors (Table 1). The $P \leq .05$ was considered statistically significant.

Results

Through this study 4784 participants of 961 households were enrolled. The mean age of the study group was 36.98 ± 15.93, near 40% of them had age more than equal to 45 years old. Male sex represented 54.1% and females 45.9%. The rural residents represented 64.8%. The percent of smokers was 35.3% and all are males. Obese participants represented 28.8 %. The prevalence of diagnosed hypertension, diabetes, and heart diseases among study group was 21.2%, 18%, and 4.5%, respectively, Table 2. Of those 4784 participants, 82 were identified as positive on the survey questionnaire, out of them 74 cases were identified positive after reassessment by neurologist and neuroimaging (brain CT or MRI). The crude prevalence of stroke among study group was 16 per 1000 with a confidence interval of proportion (12.6-197/1000). The age adjusted local (Fayoum 2017 census) prevalence rate was 7.97/1000, age adjusted Egypt population (census 2017) prevalence rate of 1.05/1000. Age-adjusted world standard world population prevalence rate of 1.69/1000. The age and sex specific prevalence rate of stroke was demonstrated in Table 3. In general, the prevalence rate increased with increasing age with the highest prevalence in the age more than 75 years old (Figure 1). Only 1 case

Table 3. *Crude prevalence rates of CVS with age- and sex-specific groups in Fayoum Governorate*

Age group		Study group N	Prevalent cases	Crude prevalence rate /1000	*P* value
<45 y	Total	**2819**	**1**	**.354**	.359
	Males	1287	0	0	
	Females	1532	1	.652	
45-54 cases	Total	**1474**	**13**	**8.8**	.155
	Males	848	10	11.7	
	Females	626	3	4.8	
55-64	Total	**201**	**26**	**129**	**<.001**
	Males	103	25	243	
	Females	98	1	10	
65-74	Total	**272**	**28**	**103**	**<.001**
	Males	172	9	52	
	Females	100	19	190	
≥75 y	Total	**18**	**8**	**444**	.671
	Males	8	4	500	
	Females	10	4	400	
Total	Total	4784	**76**	**16**	.027
	Males	2418	48	20	
	Females	2366	28	12	

Significant *p* values are in bold.

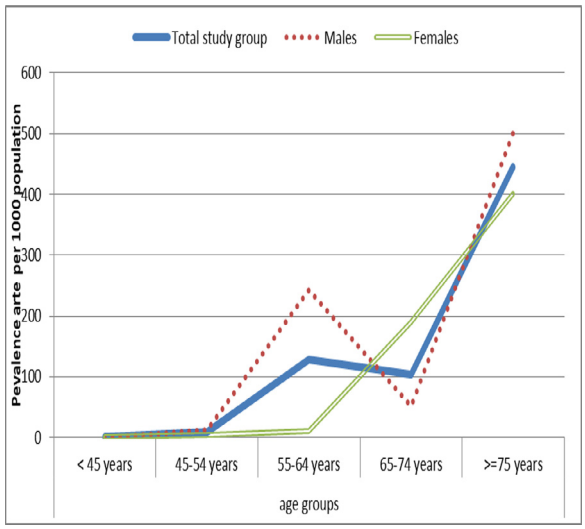

Figure 1. *Prevalence of stroke across age groups in study group.*

was detected below 45 years that is a female patient having diabetes. The prevalence of stroke was significantly higher in males than females (20 out of 1000 versus 12 out of 1000, $P = .027$). But increased stroke prevalence was observed in females than males in the age group 65-74 years old (190 out of 1000 versus 52 out of 1000, $P = <.001$. The crude prevalence of ischemic stroke was significantly higher than hemorrhagic stroke 11.9 versus 3.9 out of 1000 population. No significant difference in the crude prevalence rate of stroke between urban and rural residents ($P > .05$). Regarding association of stroke cases with some studied risk factors, it has been reported that the prevalence of stroke was significantly higher among participants affected with hypertension in comparison with normal subjects (7.1% versus .1%). Also, the prevalence of stroke was significantly higher among diabetic in comparison with normal persons (3.4% versus 1.2%, *P*value <.001). Also, heart diseases, AF, obesity, and smoking were significantly associated stroke cases (*P* values < .001), Table 4. Logistic regression analysis showed that having hypertension, diabetes, heart diseases, AF, obesity, and smoking were reported risk factors of stroke, Table 5. By evaluating the role of questionnaire elements in identifying stroke cases; the potent sensitive elements with 100% sensitivity were Heaviness or paralysis or sudden weakness of 1 part or 1 side of the body, paresthesia or anesthesia of 1 part or 1 side of the body including the face, dysarthria, or difficulty of articulation of speech, difficulty in understanding speech or inability to express what he/she wants either in speech or in writing, and loss of balance and swaying to 1 or either sides during walking. While highest specific elements with specificity 95% were deviation of the angle of the mouth with normal eye closure, dysarthria or difficulty of articulation of speech, loss of balance and swaying to one or either side during walking, Table 1.

Discussion

Stroke is increasingly becoming a major health problem in the Middle East and North Africa countries, with projections that deaths from it will nearly double by 2030. Egypt is one of the Middle East and North Africa countries with population size near 95 million according to recent estimates.[23,24]

The current study revealed the crude prevalence rate of stroke was 16 per 1000 population in the age group above 20 years, this rate is very high in comparison with previous reported studies conducted in the Nile valley governorates: in Sohag, prevalence rate of cerebrovascular stroke (CVS) was estimated to be 5.08 of 1000 in 2006,[25] in Qena 74 were identified as positive cases with a crude prevalence rate 922 of 100,000.[14] Reported prevalence in other Egypt governorates outside the Nile valley (Al-Kharga Valley and Al Qusier governorates), which recorded crude prevalence rates of 566 and 655 of 100,000 respectively.[12,13]

Increased crude prevalence rates of stroke in Fayoum Governorate may be attributed to a recent study work; 3

Table 4. *Associated factors of stroke cases in the study*

		Stroke cases	P value	OR(95% CI)
Hypertension	Yes (1013)	72 (7.1)	<.001	72.06 (26.26-197.72)
	No (3771)	4 (.1)		
Diabetes	Yes (865)	29 (3.4)	<.001	2.86 (1.79-4.57)
	No (3919)	47 (1.2)		
Heart diseases other than AF	Yes (158)	40 (25.3)	<.001	43.2 (26.56-70.26)
	No (4626)	36 (.8)		
AF	Yes (59)	9 (15.3)	<.001	12.5 (5.9-26.5)
	No (4725)	67 (1.4)		
Obesity	Yes (1377)	40 (2.9)	<.001	2.80 (1.78-4.41)
	No (3407)	36 (1.1)		
Smoking	Yes (1686)	29 (1.7)	.006	3.93 (1.37-11.22)
	No (903)	4 (.4)		

Abbreviation: AF, atrial fibrillation.

Table 5. *Predictors of stroke among study participants*

Variables	P value	OR	95%CI
Age	.620	.878	.526-1.446
Sex (male vs female)	.001	23.411	9.317-58.827
Residence (urban vs rural)	.635	1.266	.478-3.335
Hypertension (yes vs no)	<.001	321.01	56.8-1813
Diabetes (yes vs no)	<.001	674.78	132.23-3445
Heart diseases (yes vs no)	<.001	5859	1032-8098
Obesity (yes vs no)	<.001	8.66	2.98-25.15
AF (yes vs no)	<.001	185	132.89-1488
Smoking (yes vs no)	<.001	38.5	6.490-228.02

years from the last published research. Increased prevalence of noncommunicable diseases and stoke by time is likely due aging of the population and increased prevalence of risk factors. It is also important to note that increased prevalence of stroke may not necessarily be due to increasing stroke incidence, but may also be related to better care and survival with a decrease in mortality. Our work represented the first conducted work in Fayoum Governorate, that may have a different disease map with a variation of stroke susceptibility.

Although the current prevalence of stroke is high in this research, the prevalence lies within reported prevalence worldwide. The worldwide prevalence of stroke in all age groups varies between 4 and 20 per 1000 population.[23]

Overall, the prevalence of stroke in Egypt is higher than in other Arabic countries (in Tunisia 68 of 100,000 age adjusted for WHO population and 186 of 100,000 for crude prevalence rate in Saudi Arabia).[9,10]

In this study, out of 76 detected cases, Juvenile stroke below age 45 years old was detected in 1 female patient having diabetes aged 29 years old. This is similar to 2 out of 57 cases found in Assuit study.[11] This however is in contrast to findings among Pashtun population in Karachi, Pakistan where 30% of stroke cases were reported below the age of 45 years.[26]

The current work revealed that stroke prevalence rate increased with increasing age, this is consistent with many previous researches either in Egypt or other countries.[11,14,26,27] Age has been identified as a marker of risk for stroke in both developed and developing countries.[28]

We found overall stroke to be more prevalent among men than women 20 per 1000 in males versus 12 per 1000 in females. The difference was observed strongly in the age group 55-64 years old, but this difference was reversed in the age group 65-74 where the prevalence of stroke was more in females than males (190 per 1000 in females versus 52 per 1000 in males). This may be due to accumulation of risk factors of stroke in those menopausal women. Many previous studies have reported increased stroke prevalence in males than females.[11,26] Others reported no sex difference.[14,29] Females were found to have higher rates of stroke in studies conducted in Kuwait and in South Asia.[30,31] It is possible that many conventional risk factors like hypertension and diabetes are less well managed in women than men, especially in developing countries.

Regarding studied risk factors we concluded that having hypertension, diabetes, Heart diseases, obesity, and smoking were reported risk factors of stroke, these findings were consistent with many previous research.

The strength of the study is the fact that it is a community-based study and likely to be a true representation of stroke burden in Fayoum Governorate as compared with hospital-based study. The limitation of the study is related to small sample size.

Conclusion

The prevalence of stroke in Fayoum governorate was 16 of 1000. The crude prevalence of ischemic stroke was significantly higher than hemorrhagic stroke. Hypertension, diabetes, heart diseases, obesity, and smoking were reported risk factors of stroke.

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Conflict of Interest

None declared.

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