

## ISCHEMIC STROKE REGISTRY IN EGYPT: HOSPITAL BASED STUDY

By

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### ABSTRACT

**Background:** Stroke is defined by the World Health Organization (WHO) as 'a clinical syndrome consisting of rapidly developing clinical signs of focal (or sometimes global) disturbance of cerebral function lasting more than 24 hours or leading to death with no apparent cause other than a vascular origin.

**Objective:** To study the pattern of ischemic stroke subtypes in a sample Egyptian patients, common risk factor profiles and management methods.

**Patients:** A retrospective study was conducted on 321 patients who were admitted to Al-Azhar University Hospitals and Nasser Institute with a main primary diagnosis of acute ischemic stroke during the period from January 2017 until December 2018.

**Results:** Small vessel strokes were the most common accounting for 51.1% of all patients, followed by large vessel getting affected 24% of the cases. Cardio embolic stroke was present in 20.8% of the cases, Hypertension was the most prevalent risk factor among patients accounting for 61.1%, diabetes (49.5%), obesity (38.6%), and smoking (32.1%). A significant difference in stroke severity among stroke patients regarding smoking status was found in univariate analysis and obesity. Multivariate analysis using multiple linear regressions showed that the relationship with obesity was significant.

**Conclusion:** In spite of the high prevalence of stroke risk factors among the study patients, the power wasn't enough to show any association with stroke severity except for smoking and obesity, where smokers and obese patients are more likely to have higher stroke severity.

**Keywords:** Stroke, retrospective, ischemic, Egyptian, vascular.

### INTRODUCTION

Stroke is defined by the World Health Organization as 'a clinical syndrome consisting of rapidly developing clinical signs of focal (or sometimes global) disturbance of cerebral function lasting more than 24 hours or leading to death with no apparent cause other than a vascular origin (Coupland and Thapar, 2017).

There were an estimated 42 million prevalent cases of cerebrovascular disease

worldwide, including an estimated 5.39 million acute first ischemic strokes, and 3.58 million acute first hemorrhagic and other strokes (Feigin *et al.*, 2015). Stroke considered as the second most common cause of deaths (Roth *et al.*, 2017).

The World Health Organization (WHO) estimates that 85% of stroke deaths now occur in low and middle-income countries and that disability-adjusted life years lost to stroke are almost seven times that in high-income countries.

Egypt is the most populated nation in the Middle East and the third most populous on the African continent. Stroke is a major health problem among the Egyptian population, furthermore, although Egypt is the most populous nation in the middle east, there is no active national wide registry for stroke and accurate data on stroke epidemiology are scarce, However, Researches on this topic is essential for planning appropriate management programs, effectively applying primary prevention strategies and improving health resources in Egypt (*Abd-Allah et al., 2014*).

A number of community base studies, particularly investigation conducted in governorates in Upper Egypt between 1992 and 2013 have reported the incidences and prevalence of stroke in Egypt. Arterial hypertension, diabetes mellitus, cigarette smoking, hyperlipidemia, and advancing age have been identified as risk factors for stroke (*Khedr et al., 2014*).

**The present work aimed to** study the pattern of ischemic stroke in Egyptian patients as regard the relative prevalence of ischemic stroke subtypes, the demographic data, common risk factor profiles and management methods, comparing these data with national and international data for more clarification of the situation in Egypt.

## PATIENTS AND METHODS

This was a retrospective study on patients who were admitted to Stroke unit and/or intensive care unit of Al-Azhar University Hospitals and Nasser Institute with a main discharge diagnosis of acute

ischemic stroke during the period from January 2017 until December 2018.

### Exclusion criteria:

Transient Ischemic Attack (TIA), intracerebral hemorrhage, subarachnoidal hemorrhage and cerebral sinus venous thrombosis.

The data encoded in this study was registered in safe implementation of treatment in stroke (SITS international) and was divided into the following categories:

### Demographic data and Risk factors:

1. Hypertension (on antihypertensive medications or established history of Bp > 160/90 mm hg on at least two occasions).
2. Diabetes Mellitus (past history of Diabetes Mellitus, at two independent readings before the stroke or elevated glycated hemoglobin on admission or on anti-diabetic medications).
3. Hyperlipidemia (previous history of hyperlipidemia, on cholesterol lowering drugs or persistent elevation of plasma level of cholesterol, triglycerides, LDL and HDL BMI >30 kg/m<sup>2</sup>).
4. Smoking Classified into two categories: Nonsmokers/former smoker (never smoked regularly or quit regular smoking >5 years) and Smokers (regular daily cigarettes smoking > 5 years).
5. History of TIA, Migraine and family history of strokes.
6. Laboratory.
7. ECG.

8. Carotid duplex.
9. Trans thoracic or trans esophageal Echo if needed.
10. Neuro imaging data.
11. Clinical outcome and complications.

#### Statistical analysis:

Statistical analysis of the study results are presented as the mean, median standard deviation, frequency; chi-square and linear regression model were used to test significance for qualitative data.  $P < 0.05$  was considered significant.

## RESULTS

This stroke registry gathered data from 321 stroke patients in Al-Azhar university hospitals and Nasser institute hospital. Mean age of stroke patients was 59 years and (76.6%) of cases were more than 50 years old, there were 53.3% male and 46.7% females, 61.1% of cases were hypertensive, 49.5% were diabetic, 41.1% of cases had hyperlipidemia, 38.6% were obese while 32.1% were Smokers. 54.5% of cases had no intervention, 40.8% were taken rTPA and only 4.7% had Thrombectomy Intervention. More than half of cases (78.5%) had no history of TIA. The range of systolic blood pressure

at admission was 80.0 – 210.0 and its mean was 146, the range of diastolic blood pressure at admission was 40.0 – 140.0 and its mean was 90, the range of RBS at admission was 85.0 – 450.0 and its mean was 184 and the range of total leucocytes count (TLC) 3.3\_46 and its mean 8.758. 49.8% of cases were arrived in the golden hours (4.5 hours or less), 31.8% of cases came after 4.5 hours but within the first 24 hours and only 18.4% of cases came after 24 hours. 83.4% of cases initially admitted to stroke unit (**Table 1**).

**Table (1): Distribution of the studied cases according to demographic data and baseline clinical factors (n = 321)**

Variables	Patients	Number of patients	Percentage
Sex	Male	171	53.3
	Female	150	46.7
Age	≤50	75	23.4
	>50	246	76.6
Hypertensive	No	125	38.9
	Yes	196	61.1
Diabetic	No	162	50.5
	Yes	159	49.5
Obese	No	197	61.4
	Yes	124	38.6
Smoking	Non-smoker	178	55.4
	Smoker	103	32.1
	X- smoker	40	12.5
TIA history	No	252	78.5
	Yes	69	21.5
Hyperlipidemia	No	189	58.9
	Yes	132	41.1
Onset	≤ 4.5	160	49.8
	4.5 to < 24 hr.	102	31.8
	24 ≥	59	18.4
Intervention	No	175	54.5
	Thrombectomy	15	4.7
	rTPA	131	40.8
Type of admission	Stroke Unit	269	83.8
	Ward	52	14.2
complications	Hemorrhagic transformation	14	4.4
	Pneumonia	22	6.9
	UTI	8	2.5
	Pulmonary embolism	0	0
	DVT	2	.6
Variable		Mean ± SD	Range
Age		58.66± 13.36	17.0 – 89.0
Blood pressure		146.3 ± 27.05	130.0–160.0
Pulse rate		89.60 ± 13.59	80.0 – 100.0
Random blood sugar		183.6 ± 89.08	115.0–235.0
Total leucocytes count		8.758 ± 5.403	3.3_46

Small vessels strokes were the most common accounting for 51.1% of all patients followed by large vessels getting affected in 24%, cardio embolic stroke

was present in 20.8% of the cases. 82.3% of cases had anterior circulation distribution, and 17.1% had posterior circulation distribution (**Table 2**).

**Table (2): Distribution of the stroke-sub types among the study patients**

Variables		Patients	Number of patients	Percentage
Stroke type	Small		164	51.1
	Large		77	24.0
	Embolic		67	20.9
	Un-determined		13	4
Site	Anterior		264	82.3
	Posterior		55	17.1
	Both		2	0.6

Most common infarcts location was in parietal 29%, basal ganglia 24.3% and cerebellar in 8.4% (Table 3).

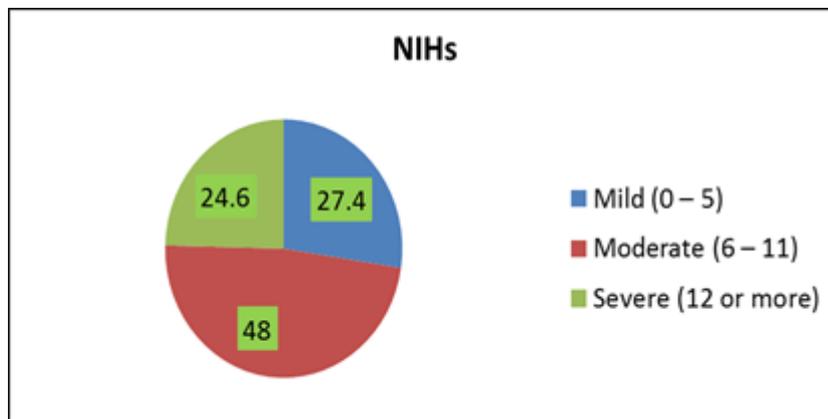
**Table (3): Infarct Location (n=321)**

Location of infarct	n (%)
Frontal	16(5%)
Parietal	93(29%)
Temporal	27(8.4%)
Occipital	5(1.6%)
Basal ganglia	78(24.3%)
Internal capsule	19(5.9%)
Thalamus	14(4.4%)
Cerebellar	27(8.4%)
Mid brain	4(1.2%)
Pontine	8(2.5%)
Medullary	11(3.4%)
More than one site	19(5.9%)

ECG was done for all patients, cardiac co-morbidity was present in 39.9% of cases on ECG, Atrial fibrillation was the most common cardiac abnormality (20.9% of all cases), and ischemic changes in 18.1%.

The hospital stays for the studied cases range from 1 day to 45 days with a mean stay of  $7.31 \pm 6.35$ .

48.0% of cases was Moderate (6 – 11) NIHS, 27.4% Mild (0 – 5), 24.6% Severe (12 or more) NIHS, and Mean  $\pm$  SD. of NIHS is  $8.37 \pm 4.08$  as (Figure 1).



**Figure (1): Bar charts showing Comprise the studied cases as regard NIHSs**

Most of cases (94.7 %) had no Fits on onset (**Table 4**).

**Table (4): Distribution of the studied cases according to present of fits on onset**

Variables	Patients		Number of patients	Percentage
	YES	NO		
Fits on onset	304	17	304	94.7
			17	5.3

Comparison between TLC regarding to age, gender, stroke subtype, circulation and stroke severity, this table shows there was a statistical significant difference

between TLC as a marker of infection as regard Age and gender where old age and female cases were more liable to infection (**Table 5**).

**Table (5): Relation between Total Leucocytic Count and other factors (n=321)**

Factors	TLC		$\chi^2$	P
	Normal TLC (>11)	High TLC ( $\leq$ 11)		
<b>Age</b>				
>50	197	49	25.3549	0.00001
$\leq$ 50	38	37		
<b>Gender</b>				
Males	131	40	10.2765	0.001347
Females	90	60		
<b>Stroke subtype</b>				
Large	58	19	3.1978	0.36212
Small	146	59		
Embolic	20	6		
Undetermined	12	1		
<b>Circulation</b>				
Anterior	190	76	1.0446	0.306762
posterior	43	12		
<b>Severity</b>				
Mild	63	23	0.5447	0.761587
Moderate	110	44		
Sever	60	19		

Tests of significance were conducted using Chi-Square with Monte-Carlo method

There was no statistical significant difference between the grades of NIHSSs as regard Age and that there was a statistical significant difference between NIHSSs as

regard Smoking and obesity, there was no statistical significant difference between NIHSSs as regard hypertension and Diabetes (**Table 6**).

**Table (6): Relation between NIHS and age (n= 321)**

Levels Variables	Mild (0 – 5) (n= 88)		Moderate (6 – 11) (n= 154)		Severe (>12) (n= 79)		x <sup>2</sup>	P
	No.	%	No.	%	No.	%		
≤50	20	22.7	35	22.7	20	25.3	0.223	0.894
>50	68	77.3	119	77.3	59	74.7		
<b>Diabetic</b>							0.704 1	0.70321
No	44	50.0	81	52.6	37	46.8		
Yes	44	50.0	73	47.4	42	53.2		
<b>HTN</b>							3.351 8	0.18714
No	38	43.2	63	40.9	24	30.4		
Yes	50	56.8	91	59.1	55	69.6		
<b>Smoker</b>							11.94 4	0.01777
Non smoker	55	62.5	84	54.5	39	49.40		
Smoker	17	19.3	57	37.0	29	36.7		
X– smoker	16	18.2	13	8.4	11	13.4		
<b>Obesity</b>							10.59 6	0.05001
NO	66	75	91	59.1	40	50.6		
YES	22	25	63	40.9	39	49.4		

\*: P value < 0.05. Tests of significance were conducted using Chi-Square with Monte-Carlo method

The linear regression model showed that males, hypertensive patients or smokers were higher in NIHSs score, although the effects of each of age, gender, DM, HTN, smoking, and TIA history on NIHS score after adjusting for

other variables were not significant. However, obesity had an independent significant effect on NIHS score adjusted for other variables where obese patients were more likely to have 1.83 more NIHS score than non-obese patients (Table 7).

**Table (7): The relationship between NIHS score (dependent variable) and each of gender, age, DM, HTN, smoking, obesity, and history of TIA using linear regression model**

Independent variables	Beta	Std. Error	T	P-value	VIF
(Constant)	8.587	1.192	7.205	0.000	
Female	-0.369	0.732	-0.505	0.614	2.650
Age	-0.013	0.018	-0.709	0.479	1.225
Diabetic	-0.440	0.541	-0.815	0.416	1.451
HTN	0.199	0.566	0.351	0.726	1.516
Smoker or ex-smoker	0.564	0.744	0.758	0.449	2.703
Obese (BMI>30kg/m <sup>2</sup> )	1.828	0.570	3.206	0.001*	1.530
TIA	-0.509	0.559	-.911	0.363	1.053

VIF = variance inflation factor

## DISCUSSION

Epidemiological studies have identified several risk factors for ischemic stroke, including hypertension, smoking, diabetes mellitus and hemostatic factors. However, few prospective studies have characterized risk factors for specific subtypes of ischemic stroke. 2–4 Because the pathogenesis, prognosis, and treatment differ among subtypes, evaluating risk factors for individual subtypes may contribute to more effective primary and secondary prevention of ischemic stroke (*Habibi-koolae and Shahmoradi, 2018*).

Regarding socio demographic data of the studied patients, their age is ranged from 17.0 – 89.0 years with mean of  $58.66 \pm 13.36$  years and (76.6%) more than 50 years, there were 53.3% male and 46.7% females. Mean  $\pm$  SD. of age among male was  $59.49 \pm 12.72$  years old, and was  $57.73 \pm 14.04$  years old among female, 54.7% of male and 52.8% of female were  $\leq 50$  years old.

Our study reported that small vessels strokes were the most common accounting for 51.1% of all patients followed by large vessels getting affected in 24%, cardio embolic stroke was present in 20.8% of the cases which in agreement with Asian studies like *Bum and Jong (2014)* who record high proportion of small artery subtypes in Asian population.

The lower incidence of cardio embolic stroke in our hospital based study which was (20.8%), so it is in contrast to the rates generally noted in stroke registries, which are often above 30% also stroke of undetermined a etiology was (4.1%) of patients which also often around 30% in most studies (*Arboix and Alio, 2010*).

Our results are supported by study of *Khedr et al. (2014)*, as they reported that concerning the demographic and clinical data of studied prevalent cases of stroke, the mean age of our patients was 59.6  $\pm$  11 years (range 28-91). This study conducted on 46 males and 28 females.

Furthermore, *Soliman et al. (2018)* demonstrated that one hundred sixty-seven patients with acute ischemic stroke were included in this cross-sectional descriptive study. Their age ranged from 15 to 90 years, with mean and standard deviation of  $59.3 \pm 13.45$  years. In 90 males (53.9%), 11 patients of them were  $\leq 45$  years old, and in 77 females (46.1%), 13 patients of them were  $\leq 45$  years old.

The current study shows that 49.5 % of cases were diabetic and 61.1% was hypertensive. There was high statistically significant difference between NIHS as regard smoking obesity, while there was no statistically significant difference between NIHS as regard Age, HTN and Diabetes.

Our results are supported by study of *Soliman et al. (2018)* reported that in their study, diabetes mellitus was recorded in 34.7% of patients which is slightly lower than *El Tallawy et al. (2015)* study done in Upper Egypt where diabetes mellitus was recorded in 36.5% of patients, whereas in *Essa et al. (2011)* study in Alexandria, diabetes mellitus was recorded in 66.8% of patients.

Similarly, *Al Baghli et al. (2010)* reported that the significant risk factors for stroke among Saudi population are hypertension followed by diabetes mellitus, heart disease, and smoking. It has been estimated that hypertension causes 54% of stroke in low-income and

middle-income countries, followed by hypercholesterolemia (15%) and tobacco smoking (12%). More recent studies again found elevated blood pressure is by far the most important risk factor for stroke.

The present study shows that 55.5% of cases were nonsmoker, while 32.1% was Smoker. More than half of cases (61.4%) were not obese. 77.6% of cases had abnormal cholesterol, with Mean  $\pm$  SD. is  $184.1 \pm 56.85$ , 72.3% of cases had abnormal TGA with Mean  $\pm$  SD.  $155.7 \pm 85.80$ , and only 12.1% had abnormal LDL with Mean  $\pm$  SD.  $92.18 \pm 45.80$ . There was no statistically significant difference between the Vessels as regard Cholesterol, TGA and there was high statistically significant difference between the Vessels as regard LDL.

Our results are supported by study of *El Tallawy et al.*, (2015), as they reported that Smoking, diabetes, and hyperlipidemia were recorded in higher rates among ischemic strokes, and this is similar to results from a previous study done by *Shah and Cole (2011)* found that smoking was associated with 50% of hemorrhagic and 55% of ischemic stroke cases. He also found that cigarette smokers have an overall 51% increased risk of having a stroke. Patients with diabetes are two to three times more likely to have ischemic stroke when compared with non-diabetic individuals. Diabetes mellitus was associated with 26.25% of ischemic stroke.

Furthermore, *Khedr et al. (2014)* found that 67.57% had 1 or more risk factors of stroke, 37.84% had 2 risks factors and 20.27% had 3 risk factors. Hypertension being the most common risk factor (62.16%), followed by diabetes mellitus

(36.49%). Ischemic heart disease was recorded in 9.46% and a history of transient ischemic attack in 6.76%, whereas rheumatic heart in 5.4%, and systemic lupus erythromatosis in 1.35%. 10.8% had a family history of stroke.

In the present study, more than half of cases (78.5%) had not previous TIA. There was no statistically significant difference between the TIA as regard Duplex. In the study of *El Tallawy et al. (2015)* the prevalence of TIAs in this study was 0.15/1,000 and the incidence was 0.05/1,000. This is lower than the reported crude overall annual incidence of TIA in Northern Portugal per 1,000 populations (0.67; 95% CI 0.45 to 1.04). The lower prevalence rate of this study could be attributed to undervaluation of TIA cases. Thus, the lack of neurologists in Al Quseir, Egypt, can result in such cases being misdiagnosed as syncope attacks or any other medical conditions.

Surprisingly, 49.8% of cases arrived in the golden hours ( 4.5 hours or less ), 31.8% of cases came after 4.5 hours but within the first 24 hours and only 18.4% of cases came after 24 hours ,this high percentage of early arrival could be explained by the restriction of our study on admitted patients and the higher probability of admission in patients viable to interventions rTPA and thrombectomy due to hospitals beds shortage and that is supported by another hospital based study in Egypt done by *Al Serafy et al. (2016)*.

The current study showed that the most common site of infarct was parietal 29%, basal ganglia 24.3% followed by cerebellar 8.4% and temporal 8.4%, The first two locations were similar to previous study done by *Bhowmik and*

*Abbas (2016)* where parietal infarct counted 34.8% and basal ganglia 27.1%. In this study the third most common site was internal capsule 26.2%.

The current study showed that the linear regression model shows that males, hypertensive patients or smokers were higher in NIHSS score, although the effect of each of age, gender, DM, HTN, smoking, and TIA history on NIHSS score after adjusting for other variables was not significant. However, obesity had an independent significant effect on NIHSS score adjusted for other variables where obese patients were more likely to have 1.83 more NIHSS score than non-obese patients. The ordinal logistic regression shows that males, hypertensive patients or smokers were more likely to be in a higher category of severity (adjusted OR = 1.13, 1.08, 1.3 respectively), although their effects were not significant after controlling other variables. However, the effect of obesity on stroke severity was significant where obese patients were 2.34 more likely to be in a higher category of stroke severity (adjusted OR = 2.34) after adjusting for other predictors.

The cumulative risk of stroke recurrence within 5 years after a first episode range was between 15% and 40%. The most relevant predictors of stroke recurrence identified in epidemiological trials include advancing age, hypertension, atrial fibrillation, diabetes mellitus, hyperlipidemia, and previous TIA. In the study of *El Tallawy et al. (2015)* previous stroke was reported in 12.9% of patients and was not correlated to age, sex, or risk factors except for diabetes. Moreover, stroke recurrence was significantly more among patients with ischemic stroke.

*Robert and Zamzami (2014)* found positive family history of stroke in 14% of stroke patients in Saudi Arabia. In the study of *El Tallawy et al. (2015)*, a lower rate (5%) was recorded, which can be attributed to lower level of consanguinity among Egyptians compared to Saudi Arabian population. Number of risk factors was significantly correlated with increasing age. While 20.3% of patients in the age group 40 years to <60 years had one risk factor, 47.1% of patients aged 60+ had four and more risk factors for stroke.

## CONCLUSION

In spite of the high prevalence of stroke risk factors among the study patients, the power was not enough to show any association with stroke severity except for smoking and obesity, where smokers and obese patients are more likely to have higher stroke severity.

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## دراسة مستشفوية عن السكتة الدماغية الاحتشائية فى مصر

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**خلفية البحث:** تعتبر السكتة الدماغية طبقاً لمنظمة الصحة العالمية متلازمة مرضية تتكون من علامات إكلينيكية سريعة التطور موضعية, وفي بعض الأحيان كلية, واضطراب فى وظائف الدماغ تستمر أكثر من 24 ساعة, أو تؤدي إلى الوفاة مع عدم وجود سبب واضح غير الأوعية الدموية.

**الهدف من البحث:** دراسة أشكال السكتة الدماغية الاحتشائية وأنواعها فى مصر وأسبابها وطرق علاجها.

**المرضى وطرق البحث:** تم إجراء دراسة إستيعادية على 321 مريضاً تم إدخالهم إلى مستشفيات جامعة الأزهر ومعهد ناصر مع التشخيص الأساسى الرئيسى للسكتة الدماغية الحادة خلال الفترة من يناير 2017 حتى ديسمبر 2018.

**نتائج البحث:** كانت السكتات الدماغية التى تؤثر على الشرايين الصغيرة هي الأكثر شيوعاً بالنسبة لـ 51.1% من جميع المرضى, تليها إصابة الشرايين الكبيرة بنسبة 24% من الحالات, والجلطة التى مصدرها القلب كانت موجودة فى 20.8% من الحالات, وكان ارتفاع ضغط الدم العامل, الخطر الأكثر إنتشاراً بين المرضى الذين يمثلون 61.1%, والسكري 49.5%, والسمنة 38.6%, والتدخين 32.1%. هناك اختلاف كبير فى شدة السكتة الدماغية بين مرضى السكتة الدماغية فيما يتعلق بحالة التدخين فى تحليل أحادي المتغير والسمنة. أظهر التحليل المتعدد المتغيرات باستخدام الانحدار الخطي المتعدد أن العلاقة مع السمنة كانت ذات دلالية احصائية.

**الاستنتاج:** على الرغم من ارتفاع انتشار عوامل خطر السكتة الدماغية بين المرضى محل الدراسة, فإن الدراسات ليست كافية لإظهار أي ارتباط مع شدة السكتة الدماغية باستثناء التدخين والسمنة, حيث المدخنين والمرضى الذين يعانون من السمنة المفرطة هم أكثر عرضة لجلطات أكثر شدة.