Volume 20 Issue 40
Originally issued as A2



Global Journal of Medical Research: A
Neurology and Nervous System
Volume 20 Issue 2 Version 1.0 Year 2020
Type: Double Blind Peer Reviewed International Research Journal
Publisher: Global Journals
Online ISSN: 2249-4618 & Print ISSN: 0975-5888

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Materials and Methods: 504 consecutive acute cerebral stroke patients were enrolled to a prospective hospital-based study during a period of one year and submitted to clinical evaluation including National institute of health stroke scale (NIHSS), Modified Rankin Scale (MRS),baseline computed tomography (CT) scan, magnetic resonance imaging (MRI) and magnetic resonance angiography (MRA).

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Keywords: *stroke subtypes; stroke risk factors; IC large vessel stenosis.*

GJMR-A Classification: *NLMC Code: WV 180*



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Stroke Subtypes and Intracranial Large Vessel Stenosis Clinical and Radiological Profile

Mohammad Osama Abdulghani [α], Hani Moahamed Aref [σ], Azza Abdulnasser [ρ], Karima Moustafa Maher [ω], Amr Abd El Monaem [¥] & Mohamed Ahmed Shafik [§]

Abstract- Objective: This study aimed at to identify stroke subtypes, clinical picture, outcome, prevalence of stroke-related risk factors and the prevalence of Intracranial(IC) large vessel Stenosis in ischemic stroke Egyptian patients.

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Results: The study revealed that 479 patients (95%) of study cases were ischemic strokes, 25 patients (5%) of study cases were primary Intracerebral Hemorrhage (ICH). Subtypes of acute ischemic stroke were: lacunar stroke 54.4 %. Large artery atherosclerosis 32.0 %. Cardio embolic 4.0 %. Undetermined etiology 8.9 %. Other determined etiology 0.7%. Median NIHSS score on admission was (7), Median NIHSS on discharge was (4). Median MRS score on admission was (3), Median MRS score on three months follow up was (1). The most prevalent risk factor for stroke was Hypertension (HTN) 70.1%, followed by Diabetes mellitus (DM)53%, Heart diseases(HD) 35.4%, with Ischemic Heart diseases (ISHD)22%, Atrial fibrillation (AF) 5.9 %, Myocardial infarction(MI) 1.4%. Past history (PH) of stroke 30.4%. Smoking 25.7%.Hyperlipidemia 8.9%. PH of Transient Ischemic Attacks (TIAs) 8.7%. PH of ICH 2.4%. (35.4%) of cases showed patent IC large vessels by MRA. (27.4%) of cases showed IC large vessel with (<50% stenosis). (22.9%) of cases showed IC large vessel with (>50% stenosis). (14.3%) of cases showed a totally occluded IC large vessel.

Conclusion: Ischemic stroke is the most prevalent type of stroke (95%), Lacunar stroke (54.4%) is the most prevalent ischemic stroke subtype, HTN (70.1%) is the most prevalent risk factor for stroke. IC large vessel stenosis was prevalent among (64.6%) of study cases.

Keywords: stroke subtypes; stroke risk factors; IC large vessel stenosis.

I. Introduction

Stroke is a common neurological disorder, the second commonest overall cause of death, and a major cause of disability in survivors.[1,2] Cerebrovascular disease is globally the sixth commonest cause of an ongoing disease burden, but is expected to move to the fourth place by 2020,Over65% of stroke deaths are reported from developing countries.[3,4]

Stroke is largely preventable, so that knowledge of risk factors is essential to achieve a reduction in the stroke rate and resulting diseaseburden.[5] Examination of stroke incidence, prevalence, subtypes, risk factors and outcome in various countries is therefore an important foundation for evidence-based prevention programs.[5]

Although epidemiologic studies on stroke were carried out in different parts of the world including some neighboring Arab countries, there were no published data from Egypt.[5]

II. Subjects and Methods

A total of 504 patients, admitted to A in Shams University Specialized Hospital stroke unit during the period from January 2011 to March 2012 with a diagnosis of acute cerebral stroke, were subjected to the following:

- Detailed medical history taking.
- Complete neurological examination with NIHSS score and m RS score.
- CT brain without contrast for all study patients within 30 minutes of clinical suspicion of a stroke at the emergency room(ER) to differentiate acute cerebral infraction from anacute cerebral hemorrhage.
- MRI brain Stroke protocol for 456 patients of the study group within 24 hours of patient admission to the hospital. This protocolin cluded T1-weighted image (T1WI), T2-weighted image (T2WI), fluid-attenuated inversion recovery (FLAIR) image, diffusion weighted image (DWI), gradient-echo (T2*) weighted image MRI scans in addition to TOF MRA.
- Noncontrast 3 Dimensional time of flight (TOF) MRA for anterior and posterior circulation with "collapsed image" films were read and evaluated by Neurology-Radiology team for consensus and agreement of our independent observation of the presence of intracranial (IC) large vessel arterial stenosis or occlusion in (2 Internal Carotid Arteries ICAs, 2 Middle Cerebral Arteries MCAs, Basilar artery BA, 2 Posterior Cerebral Arteries PCAs) among 314 patients of the study group.
- TOF MRA Stenotic lesions are sites where flow signal intensity loss commonly occurs. Stenosis was visually

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estimated and calibrated according to the residual lumen diameter measured at the site of maximum narrowing and the diameter of the adjacent normal vessel, from which the percentage stenosis was estimated. Significant stenosis was considered if it was more than 50%.[6,7]

- Based on the above information, ischemic strokes were classified according to Trial of ORG 10172 in Acute Stroke Treatment (TOAST) classification into one of 5 categories based on risk factors as well as clinical and brain imaging features: large artery atherosclerosis, cardio embolic strokes, small vessel occlusion (lacunar strokes), undetermined etiology stroke or other determined etiology stroke.[8]
- The collected data was revised, coded, tabulated and introduced to a PC using Statistical package for Social Science (SPSS 15.0.1 for windows; SPSS Inc, *Chicago, 2001).*
- Data was presented and descriptive statistical analysis was done according to the type of data obtained for each parameter:
  - Mean, Standard deviation (± SD) and range for parametric numerical data.
  - Frequency and percentage of non-numerical data.

III. Results

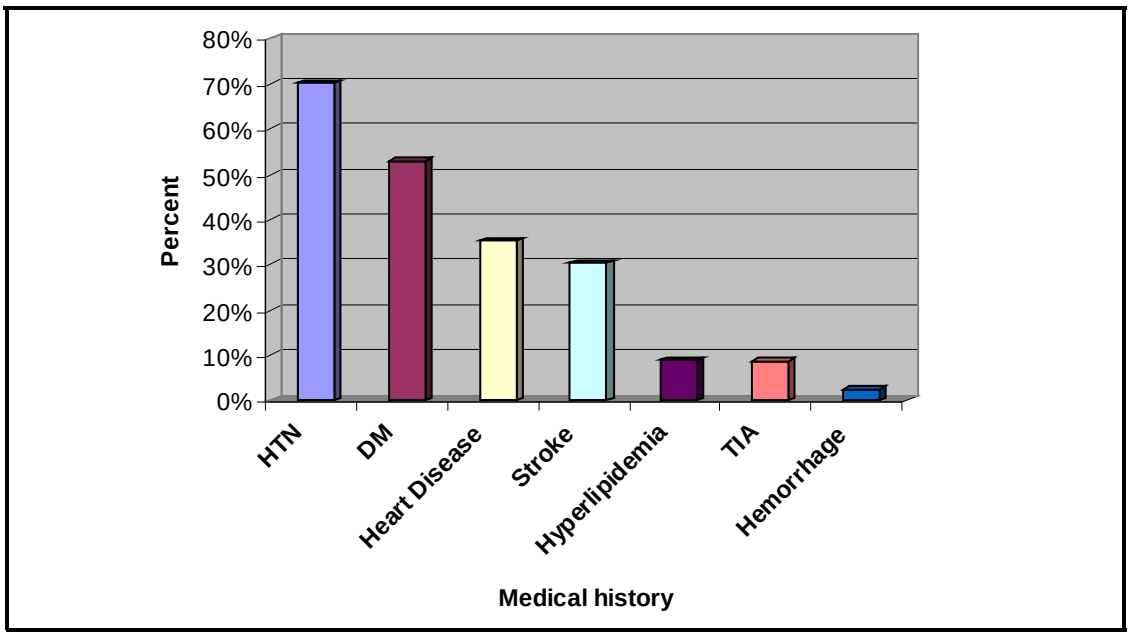
504 stroke patients were enrolled to this hospital-based study with the following results:

Table 1: Description of socio-demographic data and past history of risk factors for stroke among study patients

		N	%
Age (years)	Mean ±SD	63±10.9	
	Range	28-90	
Sex	Male	338	67.1%
	Female	166	32.9%
Alcohol	Yes	2	0.4%
	No	478	99.6%
Smoking	Non smoker	285	59.0%
	Smoker	124	25.7%
	Ex-smoker	74	15.3%
DM	Yes	263	53.0%
	No	233	47.0%
HTN	Yes	349	70.1%
	No	149	29.9%
PH Heart Disease	Yes	174	35.4%
	No	317	64.6%
Type of Heart Disease	No	317	64.6%
	AF	29	5.9%
	ISHD	108	22.0%
	MI	7	1.4%
PH hyperlipidemia	Yes	43	8.9%
	No	441	91.1%
PH stroke	Yes	150	30.4%
	No	344	69.6%
PH TIA	Yes	43	8.7%
	No	451	91.3%
PH Hemorrhage	Yes	12	2.4%
	No	482	97.6%

Table (1) shows that the mean age of study cases was (63±10.9 years). Males represented (67.1%) of study cases. The most prevalent risk factor for stroke among study cases was HTN (70.1%), followed by DM (53%), and Heart diseases (35.4%) with ISHD representing (22%), then AF (5.9%), and MI (1.4%). PH of hyper lipidemi a was present among (8.9%) of study cases. PH of stroke was present among (30.4%) of study cases. Smokers (25.7%). PH of TIAs was found among (8.7%) of study cases. PH of cerebral hemorrhage among (2.4%) of cases. And alcoholics (0.4%) as the least prevalent risk factor (Graph 1).

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Graph 1: Prevalence of PH of Risk Factors for stroke among study cases

Table 2: Description of acute cerebral stroke by C.T brain findings

		N	%
CT brain	Ischemic	479	95.0%
	Hemorrhagic	25	5.0%

Table (2) shows that 479 patients (95%) of the study cases were ischemic strokes by C.T brain findings, while only 25 patients (5%) of study cases were hemorrhagic strokes.

Table 3: Description of stroke cases by clinical NIHSS and MRS scales on admission, discharge and on follow up

	N	Mean	±SD	Minimum	Maximum	Median
NIHSS on admission	476	7.97	4.91	1.00	27.00	7.00
NIHSS on discharge	391	4.87	3.47	.00	18.00	4.00
MRS on admission	465	3.16	1.33	.00	5.00	3.00
MRS on 3 months	340	1.87	1.38	.00	5.00	1.00

Table (3) shows that the mean NIHSS on admission was (7.97±4.91) with median score (7), while the mean NIHSS on discharge was (4.87±3.47) with median score (4). The mean MRS on admission was (3.16±1.33) with median score (3), while the mean MRS on 3 months follow up was (1.87±1.38) with median score (1).

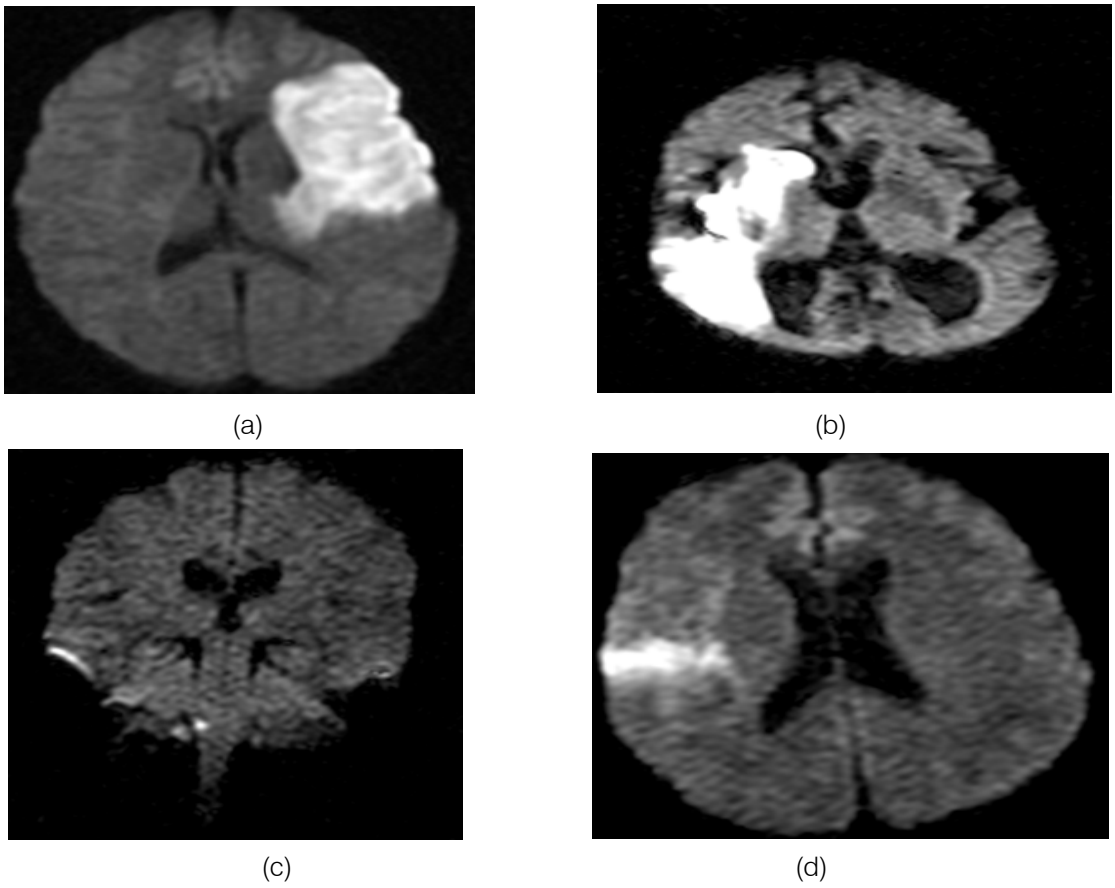
Table 4: Description of ischemic stroke subtypes according to "TOAST" classification of acute ischemic stroke among study cases

		N	%
Stroke subtype	Small vessel occlusion(lacunae)	243	54.4%
	Large artery atherosclerosis	143	32.0%
	Undetermined etiology	40	8.9%
	Cardioembolic	18	4.0%
	other determined etiology	3	.7%

Table (4) shows that subtype of acute ischemic stroke among 447 patients of study cases were classified according to "TOAST" criteria into (Figure 1):

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1) Small vessel disease (lacunar) stroke 54.4 %.
2) Large artery atherosclerosis (thrombosis-embolism) 32.0 %.
3) Cardio embolic stroke 4.0 %.
4) Stroke of undetermined etiology 8.9%.
5) Other determined etiology stroke (vasculitis due to collagen disease) 0.7%.



(a) (b) (c) (d)

a) Cardio embolic stroke
b) Large artery (RT ICA) atherosclerosis
c) lacunar stroke
d) Stroke of undetermined etiology

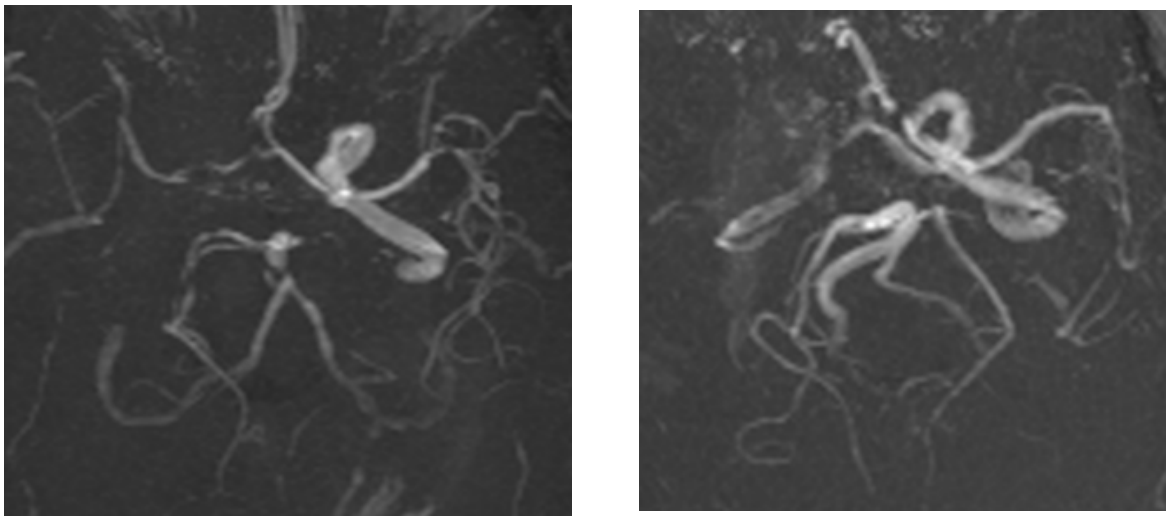
Figure 1: MRI Brain (DWI) showing different subtypes of acute ischemic strokes

Table 5: Description of presence of IC large vessel stenosis by TOF MRA Collapsed image among study cases

		N	%
Collapsed image MRA / Patient	Patent	111	35.4%
	<50% stenosis	86	27.4%
	>50% stenosis	72	22.9%
	Total occlusion	45	14.3%

Table (5) shows that (35.4%) of the study cases showed patent IC large vessels by TOF MRA. (27.4%) of study cases showed IC large vessel with <50% stenosis. (22.9%) of study cases showed IC large vessel with >50% stenosis. And (14.3%) of cases showed totally occluded IC large vessel (Figure 2).

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(A) (B)

A. Totally occluded RT. ICA, <50% stenosis of the RT. MCA and the Basilar A.
B. >50% stenosis of the RT. ICA and totally occluded RT. MCA.

Figure 2: Intracranial large vessel stenosis and occlusion by TOF MRA (Collapsed image) of the Ant. and Post. Circulations

IV. Discussion

Although epidemiologic studies on stroke were carried out in different parts of the world including some neighboring Arab countries, there were no published data from Egypt.[5]

This study revealed that the mean age of study cases was (63±10.9 years). Males represented (67.1%) of study cases. our results were close to thirty one articles reviewed from different Arab countries.[5]

All studies except two found stroke more commonly in males than females (range for males 55.9–75%).[5] One study from Saudi Arabia showed an equal ratio of males to females and another from Kuwait showed a slightly higher female preponderance at 51.7%.[9] The incidence of stroke, as expected, increased with age.[5]

This study revealed that (95%) of the study cases were ischemic strokes, while (5%) of study cases were hemorrhagic strokes (all were intracerebral hemorrhage). Our results showed higher incidence of ischemic strokes in comparison to Arab countries, in which ischemic stroke was the commonest type in all series, ranging from 55–87%, while cerebral hemorrhage occurred in 6.3–41. 3% and subarachnoid hemorrhage in 1–9%.[5]

This study revealed that subtypes of acute ischemic stroke among cases were classified according to "TOAST" criteria into: Small vessel disease (lacunar strokes) (54.4%), Large artery atherosclerosis (32.0%), Cardio embolic strokes (4.0%), strokes of undetermined etiology (8.9%) and strokes of other determined etiology i.e. vasculitis due to collagen disease (0.7%). Regarding Arab countries, Non-lacunar infarction represented 33–65.5% of strokes while lacunar infarction was reported in 10–35% of patients.[5] these results emphasize our finding of the higher preponderance of lacunar infarction among current study cases (54.4%).

This study revealed that the most prevalent risk factor for stroke among cases was HTN (70.1%), followed by DM (53%), and Heart diseases (35.4%) with "ISHD representing (22%), AF (5.9%), and MI (1.4%), PH of stroke was present among (30.4%) of study cases. Smoking (25.7%).

Hyperlipidemia was present among (8.9%) of study cases, while PH of TIAs was found among (8.7%) of study cases, PH of cerebral hemorrhage among (2.4%) of cases, and alcohol consumption (0.4%). Regarding Arab countries, HTN was the most frequent risk factor among stroke patients, being present in 24.9–76% of reported patients, followed by DM which was present in 11.6–69.4%. Hyperlipidemia was reported in 4–61% of patients. And other risk factors were as follows: cardiac disease 5–50%, cigarette smoking 1.6–44%, and previous transient ischemic attack 2.1–46%. [5] these results came in concomitant with our findings of the higher prevalence of HTN and DM.

This study revealed that (35.4%) of the study cases showed patent IC large vessels by TOF MRA collapsed image, while (64.6%) of the study cases showed stenotic and occluded IC large vessels as follows: (27.4%) of study cases showed IC large vessel with <50% stenosis, while (22.9%) of study cases showed IC large vessel with >50% stenosis. And (14.3%) of cases showed totally occluded IC large vessel.

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These results emphasized findings of previous many studies in populations of Asian, African, and Hispanic descent that demonstrate the preponderance of intracranial stenosis compared with extra cranial carotid stenosis.[10] In contrary to the developed world, in which imaging research has largely focused on extra cranial atherosclerosis, with lower incidence of intracranial stenosis in its white population.[11]Asubstantial study of 300 stroke fatalities in Paris showed that intracranial atherosclerotic plaque occurred in 59% of patients and 37.2% of all patients had intracranial plaque that was stenotic.[10,12]

V. Conclusion

Ischemic stroke is the most prevalent type of stroke (95%), Lacunar stroke (54.4%) is the most prevalent ischemic stroke subtype, HTN (70.1%)is the most prevalent risk factor for stroke. IC large vessel stenosis was prevalent among (64.6%) of study cases.

VI. Recommendations

Effective primary and secondary prevention of stroke would not be possible without a thorough understanding of the relevant risk factors and stroke subtype.MRA Brain is an important investigative tool for detection and estimation of intracranial (IC) large vessel stenosis which represents a challenging and important clinical situation in everyday neurology practice especially among stroke specialists.

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