



Original Research Article

A study of clinical & angiographic profile of patients with young stroke in tertiary care center of Southern Rajasthan

Waghalkar M^{1,*}, Barath S², Jukkarwala A¹

¹Dept. of Neurology, Geetanjali Medical College and Hospital, Udaipur, Rajasthan, India

²Dept. of Radiology, Geetanjali Medical College and Hospital, Udaipur, Rajasthan, India



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ABSTRACT

Background: Understanding the exact etiology of stroke in the young has great relevance to its prevention and management. Recent development in the surgical and interventional therapy of extra cranial and intracranial vascular diseases have made it necessary to correctly identify the causative as well as contributory factors of stroke.

Materials and Methods: This cross sectional observational study was done on patients admitted in the stroke unit of Geetanjali Medical College, Udaipur of aged 15 to 50 years with stroke and who have underwent at least one standard vessel imaging procedure within 2 weeks of stroke onset. Out of 310 patients, majority of the strokes occurred in the setting of a rheumatic valvular heart disease (63.6%), with mitral valve disease being the most frequent association. Almost 80% of patients had normal ECG whereas 20% of the patients had an ECG abnormality. 70% of patients had normal ECHO and the most frequent etiologic abnormality detected was valvular heart disease. Scan and MRI was done in 180 patients. The most commonly performed angiographic procedure was CT angiogram. TOF MRA was the next most commonly performed angiographic procedure. The highest yield for picking up abnormalities was noted in the CT Angiography. The yield of CT angiography was 35.4% and 37.7% for extracranial and intracranial vasculature respectively.

Conclusion: Arterial dissections are fairly common in young population and should be considered in appropriate clinical setting and all patients should have a good and timely angiographic assessment to rule out dissections. Thus, this study highlights the importance of risk factor evaluation, and control, complete etiological evaluation including angiographic assessment in the diagnosis, management and planning of secondary prevention strategies in young patients with stroke.

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1. Introduction

A high frequency of strokes in young population has been reported by many authors in India and in other Asian countries as compared to west.¹ Patients from India and South Asia were also younger than the patients with stroke in western countries.² Understanding the exact etiology of stroke in the young has great relevance to its prevention and management. Recent development in the surgical and interventional therapy of extra cranial and intracranial

vascular diseases have made it necessary to correctly identify the causative as well as contributory factors of stroke.

It is well established that incidence of risk factors and etiology in young adults differ notably from older patients. A modification in life style pattern has led to epidemic of traditional risk factors in younger population, and although large vessel extra and intracranial atherosclerotic disease, small-vessel atherosclerosis, and atrial fibrillation have a major role in cases of stroke in older adults, these disorders are comparatively less frequent in young adults.

* Corresponding author.

E-mail address: mandaarw@gmail.com (Waghalkar M).

Though many studies have been done about the association between various vascular risk factors and young stroke, very few studies from India have studied the angiographic profile in patients with young stroke. The study group of acute stroke in young patients in a tertiary care hospital provides an ideal population to comprehensively study the angiographic and clinical profile as they are comprehensively evaluated in stroke care unit.

2. Aims and Objectives

To study the Angiographic & Clinical profile of patients with ischemic stroke in the younger age group.

3. Materials and Methods

This cross sectional observational study was conducted on 310 patients using at least one standard vessel imaging procedure within 2 weeks of stroke onset. Study period Oct 2019 to Mar 2020.

3.1. Inclusion criteria

Age 15-50 year old; Consecutive acute stroke patients; Digital Subtraction Angiography (DSA)/CT Angiography/MR Angiography/ Neck Vessel Doppler completed within 2 weeks of stroke onset.

3.2. Exclusion criteria

Patients who do not meet the inclusion criteria; Hemorrhagic stroke; Subarachnoid hemorrhage; Venous sinus thrombosis.

3.3. Methods

All patients who fulfil the inclusion criteria were included. The clinical and socio-demographical data, National Institutes of Health Stroke Scale scores (NIHSS), and Modified Rankin Scale scores (MRS), as well as data on vascular risk factors and treatment were obtained.

The assessment of imaging data was performed with the assistance of Interventional Neuroradiologist.

A system for categorization of subtypes of ischemic stroke mainly based on etiology has been developed for the Trial of Org 10172 in Acute Stroke Treatment (TOAST) classification into either of the 5 diagnostic subtypes of ischaemic stroke: Large artery; Cardioembolic; Small vessel occlusion (lacunar); Other determined etiology; Undetermined etiology.

3.4. Statistical analysis

A descriptive analysis of the demographic, clinical and angiographic characteristics was performed. Also an inter modality comparison between the various angiographic imaging modalities was carried out. The data was analyzed using statistics software (SPSS Inc., Illinois, Chicago). To

determine whether the angiographic profile is associated with certain clinical features/demographical features, we used tests for statistical significance, like the Chi square test for comparing percentages and the 't' test for comparing mean value.

4. Results

Table 2 Shows clinical features and stroke severity. 18 patients (5.8%) had irregularity in pulse rate at presentation which provided an useful and direct clue to etiology at presentation. No patient presented in hypotension and BP was >140/90mm of Hg in 156 (50.3%) patients on presentation.

32 patients (10.3%) were noted to have a blood glucose level more than 200mg% on admission. No patient had hypoglycaemia on presentation.

Based on the clinical presentation patients were classified as right hemispheric/left hemispheric/ posterior circulation or undetermined territory. (Table 3)

Clinical suspicion of left hemispheric strokes was noted in most of the patients and in about 20% presented with clinical picture suggestive of a posterior circulation involvement.

Cardio embolism was the second most frequent category of determined cause and when causes of cardioembolic strokes were further analyzed, majority of the strokes occurred in the setting of a rheumatic valvular heart disease (63.6%), with mitral valve disease being the most frequent association. Other aetiologies responsible for cardio embolism were paroxysmal AF, PFO and cardiomyopathies.

4.1. Cardiologic work up

All patients underwent basic cardiology work up with Electrocardiography (ECG) and Echo (ECHO) transesophageal echocardiogram (TEE) and Holter study was pursued if clinically indicated. Almost 80% of patients had normal ECG whereas 20% of the patients had an ECG abnormality which helped in detecting the aetiology. 70% of patients had normal ECHO and the most frequent etiologic abnormality detected was valvular heart disease.

More than 80% (n=269) patients underwent CT Scan and MRI was done in 180 patients. 139 patients underwent both CT as well as MRI. MRI as the only parenchymal imaging modality was done in 13.2% patients only (Table 4).

MRI was done in 180 patients and about 55.6 percent patients had multiple DWI restricting lesions on MRI. In patients who had new infarcts on MRI, the territorial distribution of the infarcts was as summarised in following table. MCA was the most commonly involved territory and posterior circulation strokes were noted in 31.1% of the patients, which was as expected much higher than

Table 1: Gender distribution according to age-specific groups (N=310)

Sex	Age ≤35yrs	%	Age >35 yrs	%	Total	%
Male	53	57.0	160	73.7	213	68.7
Female	40	43.0	57	26.3	97	31.3
Total	93	100.0	217	100.0	310	100.0

Table 2: Shows the 16-35 year age group 43% were females whereas in the 36-50 years age group it was 26.3%. Age wise distribution of risk factors

	Age ≤35		Age >35		N	%	Total X ²	P
	N	%	N	%				
Hypertension	7	7.5	78	35.9	85	27.4	26.41	<0.001
Diabetes	4	4.3	49	22.6	53	17.1	15.34	<0.001
Current smoking	12	12.9	61	28.4	73	23.7	8.59	0.003
Valvular heart disease	20	21.5	26	12	46	14.8	4.67	0.031
Hyperlipidemia	2	2.2	21	9.7	23	7.4	5.36	0.020
AF	2	2.2	16	7.4	18	5.8	3.24	0.072
Prior stroke (Y/N)	15	16.2	52	24	67	21.6	2.35	0.125
H/o prior TIA (Y/N)	9	9.7	18	8.3	27	8.7	0.69	0.156

Chi Square test (X²) was applied and p<0.05 was considered significant.

Table 3: Final clinical impression (N=310)

Final impression	Frequency	Percent
Right hemispheric	104	33.5
Left hemispheric	125	40.3
Posterior circulation	65	21
Undetermined	16	5
Total	310	100

Table 4: Cardioembolic specific causes (N=66)

Cardioembolic causes	Frequency	Percentage
Rheumatic heart disease	42	63.6
Mitral valve disease	21	50.0
Aortic valve disease	0	00
Dual valve disease	10	23.8
Prosthetic valve	11	26.2
Congenital heart disease	7	10.6
ASD	1	14.3
PFO	6	85.7
Others	17	25.8
LV thrombus	3	17.6
Paroxysmal AF	2	11.8
Cardiomyopathy	8	47.0
Infective endocarditis	2	11.8
Others	2	11.8
Total	66	100

Table 5: Territorial distribution of the infarcts on CT and MRI Brain (N=240)

CT territory	CT Scan		MRI Scan	
	Frequency	Percentage	Frequency	Percentage
ICA	7	2.9	3	1.6
ACA	5	2.1	5	2.6
MCA	85	35.4	51	27.0
MCA inferior division	16	6.7	11	5.9
MCA superior division	27	11.3	15	7.9
MCA subcortical	46	19.2	30	15.9
Post circulation	38	15.8	59	31.2
Multi territory	16	6.7	15	7.9
Total	240	100	189	100

the posterior circulation strokes picked up on CT Scans (Table 5).

4.2. Angiographic profile

All the patients underwent at least one of the following angiographic tests, CT Angiography, MR Angiography (TOF or CE), DSA or neck vessel Doppler. The most commonly performed angiographic procedure was CT angiogram. TOF MRA was angiographic procedure in our study. The least commonly performed procedure was contrast enhanced MR angiography. Carotid Doppler was done in 9.4% patients but it was never done as a sole angiographic test.

The highest yield for picking up abnormalities was noted in the CT Angiography. The yield of CT angiography was 35.4% and 37.7% for extracranial and intracranial vasculature respectively. Of the 310, 53 patients underwent DSA and it was normal in 20 patients. 33 patients had abnormal DSA, thus the yield of DSA (in carefully selected patients) was more than 60%.

4.3. Final vessel status

The final impression regarding the vessel status at the end of angiographic evaluation was as shown in the table. Of the 310 patients, 42% patients (n=130) had a normal angiography. Stroke of undetermined aetiology was noted to be the most frequent cause in patients with a normal angiography (50.8%). Cardio embolism was the next most frequent cause. (25.4%)

The abnormality most commonly encountered was vessel occlusion in 30.6% of the patients. The next most common abnormality noted was dissection which was seen in 16.8% of the patients. A small percent of the patients i.e. 3.9% had a clinically significant stenosis (>70%).

5. Discussion

While considering the ever increasing burden of stroke and the profound economic and social consequences in young population it is essential that etiological diagnosis

and risk factor evaluation is complete. This helps not only in planning treatment and secondary prevention strategies but also assumes significance for rehabilitation.

The number of patients who were more than 35 years of age constituted almost 70% of the total patients. Also the gender differences were less prominent at younger age groups than in the older age groups. This is consistent with the previous studies some of which have described even higher incidence of stroke in females.^{3,4} Of the commonly studied vascular risk factors hypertension, smoking, diabetes, dyslipidemia and CAD the risk factors most commonly noted were smoking and hypertension.

When the patients of <35 years and that of >35yrs of age were compared, the vascular risk factors revealed statistically significant (using Chi square test) higher occurrence of diabetes mellitus, hypertension, dyslipidemia and smoking in patients >35 years of age (Table 2).

Valvular heart disease was also noted in higher proportion of patients as compared to other studies and this may be because of referral bias as our hospital also serves as a major tertiary referral centre for cardiology services.

Anterior circulation strokes predominated in our study which was consistent with results from other young stroke studies. The proportion of left hemispheric strokes was higher than right as has been previously noted by many authors.^{4,5} This may be because of the difficulty in identifying right hemispheric deficits. The strength of our study is that all patients underwent at least the basic etiologic work up in the form of ECG, ECHO and vessel imaging.

The commonest etiologic subtype according to TOAST etiological classification was stroke due to undetermined causes. The next common cause was stroke due to other determined causes. Similar findings were noted in a recent study by Dashetal⁶ in which 17.4% of their patients had stroke due to other determined causes, arterial dissection being the commonest. Similar trend was observed in our study also in where we noted arterial dissections in 16.7% of our patients. The higher proportion of patients in our study as well as in the study by Dashetal⁶ is probably related to increased and early availability of radiological

Table 6: DSA findings (N=53)

DSA findings	Frequency	Percentage
Atherosclerotic disease	11	20.8
Dissection	8	15.1
Vasculitis	7	13.2
Moya Moya	6	11.3
Takayasu	1	1.9
Normal	20	37.7
Total	53	100

Table 7: Final vessel status (N=310)

Final vessel status	Frequency	Percentage
<50% stenosis	5	1.6
50-69% stenosis	16	5.2
>70% stenosis	12	3.9
Dissection	52	16.8
Occlusion	95	30.6
Normal	130	41.9
Total	310	100

investigations like CT angiogram.

This finding also highlights the importance of early and thorough evaluation of the vascular tree of all young stroke patients. Cardio embolic strokes were the next common cause. Valvular heart was the most common cause of cardio embolic strokes. Lipska et al⁷ have also previously noted cardio embolic strokes as the most common aetiology with valvular rheumatic heart diseases being the commonest cause for cardio embolic strokes. Various studies have previously reported the incidence of cardio embolic young strokes to be between 14-47%.⁸⁻¹⁰ However the common causes of cardio embolic strokes in studies from the west were congenital heart diseases like PFO/ ASD.

All patients underwent ECG and ECHO and this should be considered as one of the strengths of the current study. ECG provided a direct etiologic clue in about 6% of the patients whereas ECHO in about 20% of the patients. Holter was done in selected patients in whom the initial work up (Angiographic evaluation, ECG, ECHO) was negative and clinical suspicion of a cardio embolic aetiology was high. The yield of Holter was about 6 percent. Thus a thorough cardiac evaluation is necessary in all young stroke patients.

CT Brain was the most commonly used parenchymal imaging procedure and more than 40% of the patients underwent MRI as well as CT Brain. This underscores the difficulties in identifying infarcts in acute settings, especially in cases with posterior circulation strokes or acute on chronic infarcts. MRI as expected was more sensitive in detecting the posterior circulation strokes.¹¹

The most commonly performed angiographic procedure was CT angiogram followed by TOF MRA. The least commonly performed procedure was contrast enhanced MR angiography.

These findings highlight the easy availability, speed, good sensitivity and specificity of CT angiogram which has led to its widespread use in stroke setting. Contrast enhanced MRI was sparingly used and this probably reflects the limited resources.

Though DSA^{12,13} Vasculitis Moya disease (especially when planning revascularization procedure), dissections and in acute settings when mechanical thrombectomy is planned.

More than 40% of the patients had normal vessel imaging and the abnormality which was most commonly identified was vessel occlusion. However vessel occlusion might not always provide a clue to the etiology of stroke.

Majority of the events were strokes of minor to moderate severity and of the 310 patients 8 patients expired during the hospital stay and less than 10% of patients had NIHSS >15 at discharge. This is consistent with most of the other young stroke studies from the western as well as the Indian literature.^{6,14,15}

6. Conclusions

The high proportion of patients with past history of stroke/TIA highlights the need for better secondary prevention strategies. The conventional vascular risk factors shifts towards the 'older population' pattern after 35-50years of age and patients who are <35 years of age should be actively evaluated for even the rare causes of stroke in young. Arterial dissections are fairly common in young population and should be considered in appropriate clinical setting and all patients should have a good and timely angiographic assessment to rule out dissections. Thus, this study highlights the importance of risk factor evaluation, and control, complete etiological evaluation including

angiographic assessment in the diagnosis, management and planning of secondary prevention strategies in young patients with stroke.

The main drawback is referral bias due to recruitment of patients from a referral institute. Also being a hospital based study admission bias is also one limitation. The fact that a very limited number of patients underwent a further detailed work up for rarer causes like prothrombotic states can also be considered as a limitation.

7. Source of Funding

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8. Conflicts of Interest

There are no conflicts of interest.

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Author biography

Waghalkar M, DM Resident

Barath S, Assistant Professor

Jukkarwala A, Professor

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