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A study of clinical, aetiological and radiological profile of ischemic stroke in young adults at a tertiary care centre

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ABSTRACT

Introduction: Stroke is one of the most important causes of high morbidity and mortality worldwide. Globally stroke is the third most important cause of mortality and the fourth leading cause of disease burden. Stroke in the younger age group adds to the social burden, these patients merit special attention in diagnostic, therapeutic, and preventive care. Stroke was defined by World Health Organization criteria as rapidly developing clinical signs of focal, at times, global disturbance of cerebral function lasting for more than 24 h or leading to death with no apparent cause other than vascular origin. The incidence of stroke under 45 year of age ranges from 7 to 15 in 1,00,000 people per year for all types of strokes.

Aim: To study the clinical, radiological and etiological profile of stroke in young patients.

Material And Method: It is a Prospective Observational study conducted in Dr D.Y Patil Medical College Hospital and Research Centre, Pimpri, Pune from February 2021 to february2023. Total 50 cases of ischemic arterial stroke between 15-45 years of age meeting inclusion criteria were included in the study.

Results: Stroke is more common in males than females, in our study ratio was 1.27:1, out of 50 patients studied, the most common presenting feature of stroke was motor weakness (66%), followed by headache (28%), followed by cognitive impairment and seizure. In only 5 (10%) cases no obvious risk factors were identified. The most common well-documented risk factor was dyslipidaemia, followed by hyperhomocystenemia, hypertension, diabetes, smoking and obesity. Brain imaging revealed one or more ischemic lesions correlating with current symptoms in 47 (94%) patients. Anterior circulation infarcts were more common among>30year old patients, whereas posterior territory infarcts in those <30, the latter being mostly attributable to cerebellar lesions. On evaluating the etiological factors according to TOAST classification, we found that 36% of patient (18/50) had other determined aetiology ,14% of the patients (7/50) had cardioembolic stroke, followed by atherosclerotic occlusive disease in 12% (6/50). The cause of the infarct was small vessel disease in 4 cases (8%), multiple possible aetiology in 4% (2/50). The aetiology was undetermined in 13 cases

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(26%). Other determined aetiology accounted for most common aetiology included 2 cases of cervical or intra cranial artery dissection, 6 cases of primary angiitis of cns,2 cases of APLA syndrome,2 cases of SLE,1 case of active malignancy,1 case of protein s deficiency ,1 case of CADASIL,1 case of Moya Moya syndrome, 3 case of post infectious stroke.

Conclusion: The most common risk factor for stoke in young was dyslipidaemia followed by hyperhomocystenemia. Other determined aetiology is the most common cause of ischemic stroke in our study followed by cardioembolic stroke and large vessel atherosclerosis.

Key Words: *Ischemic stroke, dyslipidaemia, stroke of other determined aetiology*

INTRODUCTION

Ischemic stroke as an aetiology of morbidity and mortality is well known world over. It often has serious consequences on quality of life and working ability, especially for individuals who have at younger ages. The word stroke means apoplexia in Greek which implies being struck by a deadly blow.(1) WHO define stroke as rapid development of clinical signs of focal or global disturbance of cerebral function lasting more than 24 hours or leading to death, with no apparent cause other than of vascular origin. In 2013 AHA/ASA defined stroke that included WHO definition plus silent infarction (inclusive of cerebral, spinal cord and retinal) and silent haemorrhage(2). The rationale behind such changes was to move towards a radiological demonstration (tissue based) of infarction or haemorrhage.

Globally stroke is the third most important cause of mortality and the fourth leading cause of disease burden(3). Stroke in young age adds to the social and economic burden, these patients warrant special attention in diagnostic, therapeutic, preventive care and rehabilitation. The incidence, risk factors, and aetiology of stroke in young adults differs from those seen in older patients. While the peak age of stroke occurrence is 55–65 years , events occurring at a younger age assume importance in being occurring in a productive age group and having a different set of causes which have to be looked into apart from the conventional ones(4). Data from previous hospital based studies in India indicated a high incidence of stroke in young (first ever stroke onset <45 years of age), with a range of 15 -30% (5) ,however in population based studies in India 8.8% of all cause strokes were noted in young adults, which is similar to western data.(6)

Currently, there is little data on aetiology of stroke in developing countries like India where the burden of risk factors like diabetes and hypertension is quite high in younger population.(7)

Aims And Objective

1-To study the clinical presentation, risk factors, aetiology of ischemic stroke in young adults in tertiary healthcare centre.

2-To study the radiological profile of stroke in young adults using multimodal vascular imaging in tertiary healthcare centre.

A prospective observational study of 50 patients of ischemic stroke who were admitted to the Department of Neurology fulfilling the WHO definition of stroke during study period of February 2021 to February 2023 . Patients who met the inclusion and exclusion criteria were considered.

Subject Inclusion Criteria

Subjects aged 15-45 years attending tertiary neurology centre, fulfilling definition of ischemic stroke with imaging evidence (CT and MRI) suggestive of stroke.

Subject Exclusion Criteria

1- Head injury patients
2- Intracranial Space Occupying Lesions (tumour/SDH/EDH)
3- Demyelinating disorders.
4- Patients with encephalopathy or significant metabolic derangement.

Method Of Study

50 stroke patients between 15-45 years presenting to Emergency department, Neurology OPD, neurology wards of hospital, were evaluated by detailed history and physical examination. A written consent was taken, and

blood samples were drawn for evaluation of biochemical parameters. Further, investigation including cardiac(ECG, 2D echo, Holter monitoring), carotid doppler , neuroimaging (CT and/or MRI) and angiogram(CT/MR) of head and neck vessels from aorta were done in all cases. Specific test like ANA IFA, ANCA, CSF examination, APLA profile, extended thrombophilia profile, Next Generation Sequencing were done on clinical and investigation finding of individual patient. All subjects were treated with conservative management and necessary physiotherapy. Digital Subtraction Angiography (DSA) was done in patients with suspected vascular malformations.

Data Analysis Method

All case report forms were checked. All the forms were entered using Microsoft 2020 Excel worksheet and a master chart was created. The statistical parameters used were the continuous variable such as age was expressed in terms of average ± standard deviation. The statistical significance of an result was determined by calculation of p value using chi-square test or Fisher's exact test as relevant. A p value of <0.05 was taken as statistically significant.

Observations

All cases fulfilling the inclusion criteria were subjected to a detailed clinical and neurological examination as per set protocol. With the help of data which was collected ancillary testing was done to evaluate the cause of stroke in this age group.

Age And Demographic Characterstics

TABLE 1: Age and Sex distribution.

Age Group	Male	Female	Total
<20	1	1	2
21-25	4	6	10
26-30	3	5	8
31-35	5	3	8
36-40	11	4	15
41-45	4	3	7
TOTAL	28	22	50
MEAN AGE+-SD	35.76+-6.42	30.32+-8.12	33.12+-7.44

In the present study a total of 50 patients of ischaemic stroke were studied, The ratio of male to female in study was 1.27:1. The lowest age of stroke in the study was 16years old at the time of presentation. The mean age of ischaemic stroke in male was 35.76 years and female 30.81 years, respectively.

Presenting Feature

TABLE 2: Presenting Features.

Presenting feature	Male	Female	Total
Headache	8	6	14(28%)
Motor paresis	19	14	33(66%)
Seizure	3	2	5(10%)
Cognitive deficits	4	3	7(14%)
Ataxia	2	2	4(8%)
Hemianopia	3	1	4(8%)
Loss of consciousness	2	1	3(6%)
Sensory symptoms	1	2	3(6%)

As depicted in Table 2, out of 50 patients studied, the most common feature of stroke with which patient presented was motor paresis (66%), headache (28%), followed by cognitive

impairment and seizure. Some patient had dual features at presentation.

Risk Factor

TABLE 3: Risk Factor Associated With Stroke.

Risk Factor	Male	female	Total	P value
Dyslipidemia	12	5	17	<0.001
Cigarette smoking	11	2	13	<0.001
Hypertension	9	8	16	<0.001
Obesity	9	4	13	0.05
Cardiovascular disease	9	7	16	<0.001
History of TIA	4	5	9	0.05
Diabetes mellitus	10	4	14	< .001
Hyperhomocystnemia	11	6	17	<0.001
Ocp/hormone replacement	1	5	6	0.01
Heavy drinking	11	2	13	0.05
migraine	2	6	8	0.05
Recent infection	7	5	12	0.01
Active Malignancy	1	2	3	0.5
Illicit drug use	3	0	3	0.5
Prior stroke	6	4	10	<0.001
Family h/o of stroke	12	7	19	0.01
Post Partum or Gravid	-	3	3	0.05

Particularly traditional stroke risk factors were more frequent among males. In only 5 (10%) cases no risk factors were identified. The most common risk factor identified in our study was dyslipidaemia, followed by hyperhomocystenemia, hypertension, diabetes, smoking and obesity. Heavy drinkers was a predominant risk factor in males, whereas migraine was a risk factor more common in females. Migraine as a risk factor was more frequent in the younger age group. The population included 3pregnant females, their age ranging from 20 to 30 years.

Vascular Territory, Imaging Features By Demographic Sub Group

TABLE 4: Table Showing Vascular Territory, Imaging Features By Demographic Subgroup

	Male	Female	Total	P Value	Age 15-30	Age 30-45
Vascular Territory						
Anterior Circulation	16	11	27	0.1	13	14
Posterior Circulation	11	7	18	0.3	5	13
Both	3	2	5	0.2	2	3
Localisation of all visualised ischemic lesion correlating with current symptoms						
Left cerebral hemisphere	14	7	21	0.3	12	9
Right cerebral hemisphere	8	3	11	0.4	7	4
Left cerebellum	3	2	5	0.1	1	4
Right cerebellum	1	1	2	0.2	0	2
Left brain stem	3	3	6	0.3	2	4
Right brain stem	8	2	10	<0.003	3	7

Brain stem undetermined	1	0	1	0.7	1	0
Other imaging features						
Multiple infarct	8	5	13	0.4	4	9
Silent infarcts	1	1	2	0.2	0	2

Imaging of brain (CT/MRI) revealed one or more ischemic areas correlating with current presentation in 47 (94%) patients. Anterior circulation ischemic infarcts including mca and aca territory were more common including among older patients, whereas posterior territory infarcts including pca territory in those <30.In posterior territory ,infarcts were more often in the left cerebral hemisphere (P<0.001). Right side brain stem infarcts were more common among males (P<0.003) and in those <30 (P<0.007). Clinically silent brain infarcts were not frequent (n=2, 4%) and occurred mainly in the older age group. Multiple infarcts were also common (26%), with no differences by age groups. (Table 4).

Stroke Etiology According To Toast Classification

TABLE 5: Etiology By Toast Classification

	Male	**Female**	**Total**	**P value**	**Age 15-30**	**Age 30-45**	**P value**
Large artery atherosclerosis	5	1	6	<0.001	2	4	<0.05
Cardioembolic	4	3	7	<0.001	3	4	0.4
Small vessel disease	2	2	4	0.05	1	3	0.2
Other determined aetiology	10	8	18	<0.001	12	6	<0.001
Multiple possible aetiologies	1	1	2	0.5	1	1	0.2
Undetermined aetiology, extensive evaluation	7	3	10	<0.001	4	6	0.4
Undetermined, incomplete evaluation	2	1	3	0.4	1	2	0.5

Frequencies Of Etiology Of Stroke Of Other Determined Etiology

TABLE 6: Frequencies of aetiology of stroke of other determined aetiology

	N		
Dissection of cervical or intracranial artery	2	11.1%	One patient has vertebral artery dissection, another had carotid artery dissection.
Vasculitis	6	33.3%	5 patient had primary CNS vasculitis ,1 has Wegener granulomatosis.
APLA	2	11.1%	Pregnant female
SLE	2	11.1%	Young females
Active Malignancy	1	5.56%	Patient of ovarian cancer
Throbophilic Disorders	1	5.56%	Case of protein s deficiency
Genetic Polymorphism	1	5.56%	Patient of CADASIL, Notch 3 positive
Moyamoya	1	5.56%	
Infections	3	16.66%	One patient of tubercular meningitis,2 patient of rhinoorbital mucormycosis.

50 young patients of stroke were evaluated. On evaluating the etiological factors according to TOAST classification, we found that 36% of patient (18/50) had other determined aetiology show in table 6,14% of the patients (7/50) had cardioembolic stroke, followed by atherosclerotic occlusive disease in 12% (6/50). The cause of the infarct was small vessel disease in 4 cases (8%), multiple possible aetiology in 4% (2/50). The aetiology was undetermined in 13 cases (26%). Other determined aetiology accounted for 36% of ischemic stroke patients (18/50) and was the most common aetiology included 2 cases of cervical or intra cranial artery dissection, 6 cases of primary angiitis of cns,2 cases of APLA syndrome,2 cases of SLE,1 case of active malignancy,1 case of protein s deficiency ,1 case of CADASIL,1 case of Moya Moya syndrome, 3 case of post infectious stroke.

DISCUSSION

There is increasing evidence for escalation in the prevalence of stroke in young adults in India.(8) In our study, male predominance among the acute ischemic stroke in young patients was observed which may be because of socio-cultural bias in India and also males are more into alcohol and smoking.(9) In this study, dyslipidaemia was noted as the most common risk factor of acute ischemic stroke in young adults.(10) In this study, 48% of the acute ischemic stroke patients had dyslipidaemia which may be related to sedentary lifestyle, smoking, excess alcohol intake, change in dietary pattern and was higher compared to some previous studies. (11) Hyperhomocystenemia was found to be a significant risk factor in our study.(12,13). A family history of any stroke maternal or paternal occurring at <65 years is an independent risk factor for ischemic stroke.(14)

The stroke in young in the northern Manhattan stroke study(15) detected 45% infarcts, with intracranial atherosclerosis in 9%, cardioembolic 6%, cryptogenic 55%, and other causes 6% . Data from several studies reveal that 21%–48% of strokes in young are caused by atherosclerotic large artery disease, cardioembolic 13%–35%, and cryptogenic 7%–40%.(7) Data. from our study are did not show similar treads to the other studies.

In our study, 9.4% of the patients had more than one risk factor. In cases of cerebral infarction, the frequency of such major risk factors as hypertension, smoking, and elevated serum triglycerides was similar to other studies from developed countries (16). The frequency of alcohol and oral contraceptive use was very low as compared to studies from developed countries.

In our study other determined aetiology was the commonest cause of cerebral infarction patients,(17,18) and was more frequent in the younger age group (15–30 years). (19)Among patients with cardioembolic stroke, rheumatic heart disease was most frequent cause, as it is most prevalent cardiac disease in India, while in developed countries endocarditis, mitral valve prolapses, and prosthetic valves are more frequent causes of cerebral infarction.(20)

Most recent studies report ratios of cryptogenic stroke from 24% to 36% is similar(6,16,21) to our series' ranges. We might have not accurately determined the frequency of strokes arising from arterial vasospasm, such as reversible cerebral vasoconstriction syndrome (RCVS), because immediate angiography of cerebral vessels was not done in all patients, and patients who had subarachnoid haemorrhage or infarcts related to surgical procedures were excluded.(22)

Data are sparse in young adults regarding silent infarcts or multiple infarcts. They are associated with subtle deficits on physical and cognitive examination and increase the risk for subsequent stroke and dementia in the general population.(23) In our study, these subclinical/silent brain infarcts were not common even in patients 45 years of age, possibly suggesting that the young might have different underlying pathophysiological mechanisms as compared to elderly.

In comparison to aetiology and risk factors which are predominantly determined by race, genetic factors and individual habits, the outcome is predominantly determined by severity of stroke, quality of care provided, rehabilitative measures and risk factor reduction. Hence the outcome may vary between countries and within the countries. and even within same institute/hospital over the time.

Our study had demonstrated hyper homocystenemia as a very important risk factor, and other determined aetiologies as the most common etiological category according to toast classification (24)warranting a need for

extensive search for aetiology of stroke in young.

CONCLUSION

The findings of this study enhance the understanding of the risk factors, aetiology, and imaging features in young stroke patients of ischemic origin. Traditional risk factors were common in our patient population too, but in the young a meticulous search for each a potential risk factors is of utmost importance for appropriate prevention strategy . Individualised investigation plan should be implemented for each patient. Data from our study suggest that the evolution of aetiology takes place mainly by accumulation of vascular risk factors along with the process of aging . Recognition of genetic factors is important, as genetic studies are not frequently done in stroke patient may explain the higher rates of undetermined causes for stroke . In some young individuals, a combination of several risk factors might play a role to explain the stroke.

LIMITATION OF STUDY

Study was performed at a tertiary care centre receiving mostly referred patient, so referral and admission bias cannot be eliminated Sample size was small so true demonstration of community figures cannot be estimated. We had limitation in performing genetic and specialised tests.

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