



## Clinical Study of Stroke in Young

### KEYWORDS

young stroke, RVHD, CVST

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**ABSTRACT** **AIMS AND OBJECTIVES-** This study was done to study the various etiologies associated with stroke in young, the Neurodeficit on admission and the outcome of the stroke.

**MATERIALS AND METHODS-** A detailed history and risk factor evaluation and neurological examination was done. Total 50 patients of age group 15 – 45 years were studied for 24 months. Exclusion criteria –trauma and SOL. Investigation were done to elicit the possible causes of the stroke.

**Investigations:** Hematological, biochemical and Serological tests like VDRL, RA, HIV ELISA were done. ECG, CXR, CT / MRI, 2D ECHO were done in all patients. MR Angiography, MR venography CSF analysis, Prothrombin time, APLA, ANA, Anti ds DNA Lipid profile, Blood culture and sensitivity, USG abdomen, Bone marrow studies, CT thorax, Colour Doppler, TEE, and DNA were done according to the indications.

**OBSERVATIONS-** Commonest age group 20 - 30 years. Right hemiplegia was the commonest neurodeficit, subtypes were: Thrombotic 28%, Embolic 36%, hemorrhagic 10% and Cortical Venous sinus thrombosis 26%. Female patients predominated in all subtypes of strokes. Ischaemic stroke constituted 64% of total stroke. Cardiogenic embolic stroke constituted 60%, of these and .RVHD and its complication accounted for majority of cases. Other etiologies were tuberculous vasculitis, 1, lupus vasculitis 2,, hyperhomocysteinemia, 1 sickle cell disease 1, postpartum CVST 10,, polycythemia rubra vera 1, protein C & s def 1, AV malformation 1, Moya Moya disease 1, and preeclampsia 1. Cause could not be identified in 8% cases. Mortality was 20% and was common with hemorrhagic stroke (40%) Prognosis was best in CVST and embolic stroke.

**CONCLUSION-** strokes are common in young adults and knowing the right etiology will help in better management.

### Introduction

Stroke ranks first among all nervous system disease<sup>(1,2)</sup>. The total number of stroke cases in India in year 2004 is expected to be 1.64 million<sup>2</sup>. Although stroke is considered to be a disease of the older population, it is not infrequent among adolescents and young adults. There is diversity in the incidence, etiology and prognosis of stroke in young patients in India and Western countries. Young stroke patients' constitute 15 – 30 % of all stroke patients in India, as opposed to 3- 8.5 % in western countries. <sup>12</sup> During the last decade, the age-adjusted prevalence rate of stroke was between 250-350/100,000. <sup>12</sup>.

Hence this study was undertaken in order to study the differences in the etiological profile of young strokes which has implications in epidemiology for eliciting risk factors and etiology of strokes in young compared to the elderly.

### AIMS AND OBJECTIVES

This study was carried out to assess: 1. Symptoms on presentation of young patients with stroke 2. The various etiologies associated with stroke in young 3. The Neurodeficit on admission 4. The Outcome of the stroke.

### MATERIALS AND METHODS

This study was a clinical study with detailed history and risk factors evaluation and neurological examination of each patient. The population studied was in the age group of 15 – 45 years of age who presented as a stroke to our hospital, Sassoon General Hospital. Total number of patient studied were 50. The study was conducted during a total period of 24 months. The inclusion criteria were the clinical diagnosis of stroke in young adults patients in whom trauma was excluded by history and willingness to undergo preliminary investigation together with brain imaging studies, which were mandatory in this study. Patients with space occupying lesion were excluded. Further inves-

tigation were done as indicated and as feasible in order to elicit the possible causes of the stroke. The patients were followed up until discharge and the outcome on discharge recorded. The patients were evaluated according to the proforma attached. The diagnosis of different stroke subtypes was made based on clinical criteria and ancillary investigations. The history was taken in detail as regards the onset, progression, involvement, neurological risk factors and predisposing or past illness. Previous records were scrutinized when available. The patients were subjected to a thorough general examination followed by a full neurological evaluation as well as examination of other system. Clinically the strokes were classified as ischaemic or hemorrhagic with confirmation by imaging by either CT scan or MRI. An accurate history and a careful examination are paramount in the diagnosis of stroke.

### The investigation done were:

Hematology: Hb, PBS, PCV, Total counts, ESR, Biochemical: BSL, BUL, LFT, and RFT Serology: VDRL, RA, HIV ELISA CSF, ECG, CXR, CT / MRI, 2D ECHO, MR Angiography, MR venography. In certain patients other investigations were done such as Prothrombin time, Antiphospholipid antibody, ANA, Anti ds DNA Lipid profile, Blood culture and sensitivity, USG abdomen, Bone marrow studies, CT thorax, Colour Doppler, Transoesophageal echocardiography (TEE), Digital subtraction Angiography according to the indications.

The facilities required for preliminary and most laboratory investigations as well as ECG, CXR, CT scan and Echocardiography were available in SGH. The patients were followed up during the hospital stay and were assessed on discharge as to their functional status

**OBSERVATION**

**TABLE 1 : AGE INCIDENCE IN STROKE**

AGE	Thrombotic	Embolic	Hemorrhagic	CVST	TOTAL
15- 20	4(8%)	0	0	1(2%)	5(10%)
21-25	2(4%)	5(10%)	2(4%)	7(14%)	16(32%)
26-30	1(2%)	7(14%)	1(2%)	4(8%)	13(26%)
31-35	4(8%)	0	1(2%)	1(2%)	6(12%)
36-40	3(6%)	5(10%)	0	0	8(16%)
41-45	0	1(2%)	1(2%)	0	2(4%)
	14(28%)	18(36%)	5(10%)	13(26%)	50

The maximum number of patients of young stroke was in the age group

21-30 years {58%}.2. Ischaemic (thrombotic + embolic) stroke constituted 64 % of total number of strokes.3. Hemorrhagic stroke accounted for total of 10 % of cases.4. Embolic stroke comprised about 36 % of total stroke.

**TABLE 2: SEX INCIDENCE**

SEX	Thrombotic	Embolic	Hemorrhagic	CVST	Total
Male	6(12%)	7(14%)	2(4%)	1(2%)	16(32%)
Female	8(16%)	11(22%)	3(6%)	12(24%)	34(68%)
	14(28%)	18(36%)	5(10%)	13(26%)	50

- Females predominated in all stroke types.
- CVST has maximum female predominance of 92.3%.

**TABLE 3 : NEURODEFICIT INCIDENCE**

Weakness	Ischemic	Hemorrhagic	CVST	Total
Right hemiplegia	21(42%)	3(6%)	7(14%)	31(62%)
Left hemiplegia	9(18%)	2(4%)	3(6%)	14(28%)
Monoplegia	1(2%)	0	1(2%)	2(4%)
Para paresis	0	0	1(2%)	1(2%)
Ataxia	1(2%)	0	0	1(2%)
Quadriparesis	0	0	1(2%)	1(2%)
				50

Right sided weakness was the most common presentation

**TABLE 4: SYMPTOMATOLOGY:**

Symptoms	Ischaemic	Hemorrhagic	CVST	TOTAL
Sensory loss	2	0	1	3
Altered sensorium	12	4	3	19
Giddiness	2	1	1	4
Aphasia	8	2	2	12
Vomiting	11	4	8	23
Convulsion	2	2	6	10
Headache	11	4	11	26
Fever	5	0	1	6

- 50 % of patients with CVST has presented with convulsion.
- Nearly all patients with CVST had headache.
- Nearly all patients with hemorrhagic stroke had headache and altered sensorium.
- 34% of patients with ischaemic stroke had vomiting and headache as the presenting feature.

**TABLE 5 : SIGNS OF ISCHEMIC STROKES (thrombotic +embolic) :**

SIGNS		NO. OF Patients
Unilateral weakness	Rt	22
	Lt	9
Monoparesis		1
Aphasia		8
7th CN weakness		30
Other CN		0

Sensory loss		2
Cerebellar signs		1

Hemiparesis was the commonest presentation(31%)

**TABLE 6: SIGNS OF HEMORRHAGIC STROKE:**

SIGNS		No. Of patients
Unilateral weakness	Rt	3
	Lt	2
Aphasia		2
7th CN weakness		4
Other CN		0
Sensory loss		0
Cerebellar signs		0

Hemiparesis was the commonest presentation

**TABLE 7: SIGNS OF CVST:**

SIGNS		No. Of patients
Unilateral weakness	Rt	7
	Lt	3
Para paresis		1
Monoparesis		1
Quadriparesis		1
Aphasia		2
7th CN weakness		10
Other CN		0
Sensory loss		1
Cerebellar signs		0

Hemiparesis was the commonest presentation.

**TABLE 8: CAUSES OF ISCHEMIC STROKE :**

CAUSES		NO. OF PATIENTS
CARDIOGENIC EMBOLI	a) VALVULAR	17(53.12%)
	b) NON VALVULAR	1(3.2%)
INFECTION	TB VASCULITIS	3(9.3%)
LUPUS VASCULITIS		2(6.25%)
HYPERCOAGULABLE STATE	a) HYPERMOCYST-EINEMIA	3(9.3%)
	b) SICKLE CELL DISEASE	1(3.2%)
	c) ATHEROSCLEROSIS	1(3.2%)
CAUSE NOT FOUND		4(12.5%)
TOTAL		32

1. Maximum patients with cardiogenic embolism had valvular abnormality.
2. In 4 patients' cause could not be found.

**TABLE 9 : CARDIAC DISEASE ASSOCIATED WITH EMBOLIC STROKE**

CAUSES	MALES	FEMALES
RVHD (MS)	1 (5.5%)	3(16.67%)
RVHD (MS+ MR)	1(5.5%)	8(44.4%)
RVHD + IE	1(5.5%)	1(5.5%)
PROSTHETIC VALVES	1(5.5%)	---
MVP+ MR	----	1(5.5%)
CARDIOMYOPATHY	1(5.5%)	---
TOTAL	5	13

1. Maximum number of patients had RVHD (83.33%).

**TABLE 10: CAUSES OF HEMORRHAGIC STROKE:**

CAUSES	NO. OF PATIENTS
AV MALFORMATION	1
MOYA MOYA DISEASE	1
WARFARIN TOXICITY	1
HYPERTENSION	1

PREECLAMPSIA	1
TOTAL	5

**TABLE 11 : CAUSES OF CVST:**

CAUSES	NO OF PATIENTS
POST PARTUM	10
POLYCYTHEMIA RUBRA VERA	1
PROTEIN C& S DEF	1
CAUSE NOT KNOWN	1
TOTAL	13

Maximum number of patients with CVST was post partum.

**TABLE 12: OUTCOME:**

OUT-COME	THROMBOTIC	EMBOLIC	HEMORRHAGIC	CVST	TOTAL
RECOVERY	4(28.5%)	2(11.1%)	0	5(38.46%)	11(22%)
MILD IMPAIRMENT	0	6(33.3%)	1(20%)	3(23.0%)	10(20%)
DISABILITY	7(50%)	6(33.3%)	2(40%)	4(30.7%)	19(38%)
DEATH	3(21.4%)	4(22.2%)	2(40%)	1(7%)	10(20%)
TOTAL	14(100)	18(100)	5(100)	13(100)	50(100)

#### Mortality was maximum in hemorrhagic stroke (40%). And least in cortical venous sinus thrombosis.

- Mild impairment and recovery at discharge were maximum in CVST
- Impairment: symptoms and signs, the manifest abnormalities of function evident to an external observer.
- Disability: Behavioural consequences, activities important to the patient that are disrupted or prevented, altered interaction with the environment.

**TABLE 13. COMPARISON OF INCIDENCE AND ETIOLOGIES**

Etiology	Beevon et al	Rai et al	Panagariya et al	Mehndiratta et al 90	Our series
Ischemic (thrombotic + embolic)	42%	57.8%	73.5%	85.2%	64%
Hemorrhagic	58%	9.6%	2.8%	14.8%	10%
CVST	---	17.7%	22.8%	----	26%
Miscellaneous	---	14.9%	---	----	----

In Rai et al Miscellaneous included trauma and tumours

**Table 14 :Comparison of incidence of symptoms in various studies of CVST**

	Nagara-ja et al N= 78	Srinivasan et al N=135	Cantu et al N= 67	Our study N=13
Headache	72%	----	88%	84%
Seizures	68%	68%	60%	50%
Altered sensorium	93.4%	43%	63%	23%
Focal deficit	65.4%	47.4%	79%	100%

Maximum number of patients with CVST had headache and focal deficit.

#### Discussion

The maximum incidence of young strokes in our study was in the age group 20 –30 years. Rai et al<sup>16</sup> and Mehndiratta et al<sup>11</sup> had maximum patients in the age group 30 –40. Mehndiratta did a study of young stroke in New Delhi and

studied about 127 patients. He found female predominance of stroke, as seen in our study. Our study showed a female predominance of 92% in patient with CVST as was stated Nagaraja et al<sup>13</sup>. Narayan et al had the similar finding of female predominance in the study of 51 patients of CVST.

Beevan<sup>12</sup> in a retrospective study of 113 patients of stroke aged 15 –45 yrs admitted to the Medical center Hospital of Vermont found 42% to be due to cerebral infarction, the majority being due to cardiogenic emboli and premature atherosclerosis.

Mehndiratta<sup>11</sup> did a study of stroke in young in a GB pant hospital in New Delhi. He found the incidence of ischemic stroke of 85.8% and rest being hemorrhagic stroke.

Ischaemic stroke constituted 64% of stroke in our series of patients. Data from large stroke registries indicate that 80-90% of all strokes are ischaemic in origin and upto 23% of these are cardio embolic.

90 % of our patients presented as hemiplegia with commonest cranial nerve involvement being that of the VII nerve. Right hemiplegia was the commoner one, seen in 62% of all patients. It has been reported similarly in many studies except Khan and Rao who found high incidence of left hemiplegia. Monoparesis was seen in 4%, quadriplegia in one patient and one patient had paraparesis. One patient presented with ataxia. Three patients in our study complained of sensory loss.

38 % of patients presented with altered sensorium. 80 % of patients with hemorrhagic stroke had altered sensorium. Headache and vomiting was also the common feature of presentation of hemorrhagic stroke. Headache was common feature of hemorrhagic stroke in Mehndiratta et al<sup>11</sup>.

25% of our patients had aphasia as seen in other stroke studies. Seizures were feature of 6% of ischaemic stroke as compared to 40 % of hemorrhagic stroke. Mehndiratta et al<sup>11</sup> found the similar incidence of seizures in 7.33% of patients with ischemic stroke and 33.33% of patients with hemorrhagic stroke. 5 patients with ischaemic stroke had fever.

CVST patients presented with right hemiplegia in 53.8% while 23 % of patients had left hemiplegia. One patient had quadriplegia. Prominent feature of CVST patients was headache. It was seen in 84% of patients. Vomiting was presenting feature in 62% of patients in our study with CVST.

Other systemic diseases were associated with ischaemic stroke in 78% of cases. Cardiac diseases were most common predisposing condition associated with stroke. Among the cardiac disorders, valvular heart disease was the most common lesions. Mitral stenosis associated with mitral regurgitation was the most common lesion among the valvular lesion amounting to 50% of all cases with embolic stroke. Pure mitral stenosis was responsible for stroke in 22% of patient. Two patients had infective endocarditis. One of the patients had prosthetic valve while one patient had floppy valve. One male patient had dilated cardiomyopathy with apical thrombus, which predisposed to stroke.

Dhanraj et al in a series of 103 patients' ischaemic stroke patients found that cardiac lesion lead to cerebral embolism in 38.8% of patients.<sup>7,8</sup> Rheumatic valvular heart disease is reported to cause 80% of cardiogenic embolic stroke.<sup>8</sup> (83.33% in our study). Cardioembolic strokes accounted for 29.35% of ischemic stroke patients (32/109); rheumatic heart disease contributed to stroke in 16 of these patients (50%), congenital heart disease in 7 cases (21.87%) in mehndiratta et al<sup>11</sup>. Other cardiac conditions contributing to the risk of stroke in study conducted by mehndiratta included endocarditis [3], prosthetic valve [3], paradoxical embolism [3] and atrial myxoma.<sup>11</sup>

The annual incidence of stroke in patients of mitral stenosis not treated with anticoagulation has been estimated at 4% per annum and with atrial fibrillation ranges from 19 to 75%.<sup>15</sup> It is necessary to maintain lifelong anticoagulation in patients with prosthetic valve to reduce the risk of stroke.<sup>15</sup> The risk of embolization for mitral valve prosthesis is 4% per year and for aortic prosthesis 2% per year despite anticoagulation. In our study only one patient had prosthetic mitral valve. Eight of our patients had atrial fibrillation.

Cerebral embolism occurs with a disproportionately high frequency in young people with MVP and seems to occur with equal frequency in those with normal and thickened mitral valve leaflets. There is one Indian report of 13% incidence of MVP in 38 cases of young stroke.<sup>10</sup> Our series had only one patient with MVP. Mitral-valve prolapse is considerably less common than previously reported among young patients with stroke or transient ischemic attack, including unexplained stroke, and no more common than among controls.<sup>10</sup>

Peripartum cardiomyopathy with cerebral embolism is a cause commonly seen. Cerebral ischemia is a relatively common complication in patients with hypertrophic cardiomyopathy and dilated cardiomyopathy of all etiologies. In our series one patient had dilated cardiomyopathy secondary to ischemic heart disease.

Arteritis due to tuberculosis causes ischemic necrosis, which may be found in the distribution of the perforating arteritis. Three of the patients in our study had tuberculous vasculitis leading to stroke. Rai<sup>15</sup> et al have reported that post infective causes including tuberculous meningitis accounted for 14.7% of hemiplegia in young stroke, while panagariya<sup>12</sup> et al found tuberculous arteritis to account for 5.7% of all cases of strokes. Mehindratta<sup>11</sup> et al found total of 4 out of 109 patients of ischemic stroke having tuberculous etiology. One of the patients with tuberculous arteritis was HIV reactive in his study<sup>11</sup>. Several clinical, radiological, and postmortem studies have suggested a greater-than-chance association between HIV and stroke. In our study three patients had tuberculous vasculitis leading to stroke. One of these patient was HIV reactive.

Engstrom, in a study of twenty five patients with AIDS (mean age 38) found that ten patients had non hemorrhagic cerebral infarctions, of which six were due to CNS infections (cryptococcus 4, Tuberculous 1, zoster vasculitis 1), although in many cases the causes of AIDS related cerebral infarction are unknown.

In our series, three patients were found to have elevated homocysteine levels. Modi et al found to have strong correlation of hyperhomocysteinemia with ischaemic stroke in young stroke. The results were consistent with many case control and prospective studies. Cigarette smoking was positively associated with high homocysteine concentration.

In our series one patient had sickle cell disease as the etiology of stroke. Stroke is especially common in children with sickle cell disease, a small subset of whom tends to suffer repeated episode. Stroke is less common in adults and is often hemorrhagic.

In five of our patients no cause could be found. In one of these patients CVST was diagnosed but no risk factors or cause for it could be found even after investigation for collagen disease, cardiac disease and infectious disease. Evaluation of patients classified as " infarcts of undetermined cause" in the Stroke Data Bank revealed certain common factors: they tended not to have had previous TIAs, infarcts, carotid bruits or cardiac risk factors (Marshall, 1993).

In our study 10% of patients had hemorrhagic stroke, one due to AV malformation, one due to Moyamoya disease; one associated with hypertension and one was due to warfarin

toxicity. One patient had hemorrhagic stroke associated with pre eclampsia. In mehindratta et al 4 cases had AV malformation while 2 patients had associated eclampsia.<sup>11</sup> About 50% of patients with spontaneous intracranial hemorrhage may give no past history of hypertension and have no retinal/ cardiac / renal evidence of hypertensive changes, but they usually have elevated blood pressure on arrival to hospital.

Dalal<sup>5,6</sup> et al found the incidence of intracranial hemorrhage to be 9.7% similar to Rai's series. Microangiomas can be the common cause of spontaneous intracerebral hemorrhages in young subjects. Bleeding diathesis are often associated with multiple foci of hemorrhage in the brain and systemic bleeding. Warfarin treatment now accounts for most of these hematoma and has been implicated in about 10% of primary intracranial hemorrhage. One of our patients had similar presentation. It is associated with slowly evolving lobar or cerebellar hematoma and high fatality rates. Despite careful supervision of anticoagulant therapy; there remain a number of cases of "unavoidable" hemorrhage, some of them even in those with perfect laboratory control. Bleeding may be the presenting feature or terminal event of leukemias. Coagulopathies and leukemias are reported as the cause of intracranial hemorrhage in upto 3% of clinical and 20% of autopsy series.

In our series cortical venous thrombosis accounted for 26% of stroke in young. It was more common in female, accounting for about 92% of total CVST. 76% of these patients were postpartum females. One of the patients had protein C & S def. One of the patients was found to have hypercoagulable state, i.e., polycythemia rubra Vera. In one of the patient cause could not be found. Studies have done in India show varied sex distribution for CVST. Wadia<sup>18</sup> et al, Nagaraja<sup>62,63</sup> et al and Narayan et al found to have female predominance.

In young female, CVST occurs more frequently during pregnancy and puerperium in developing countries like India and in the west oral contraceptive plays an important role.<sup>17</sup> In our study 77% of cases were associated with peripartum state. In neonates and children, the etiology is dominated by regional infection, dehydration and congenital heart disease, whereas in elderly inflammatory states and malignancy may be the precipitating cause. Cerebral venous thrombosis is the commonest neurological complication seen during pregnancy and puerperium. The incidence of cortical venous thrombosis has been reported to be from 15%- 22% of young stroke like our study in other studies also.

Compared to older patients, the prognosis of young adults with ischemic stroke is better, nearly 75% of young adults survivors improve or recover completely. In our study total mortality was 20%. Hemorrhagic stroke contributes maximum to the death. 40% of hemorrhagic stroke patient died during the study. Severe neurological deficits at presentation, total anterior circulation stroke, and diabetes mellitus predict unfavorable outcome. Previous TIA are associated with increased risk of recurrence.

Most favorable outcome was seen in CVST with 39% showing complete recovery whereas 23% had only mild impairment. The mortality rate in CVST has fallen down to 4- 15% as shown in various studies.<sup>17</sup> Similarly embolic stroke also has got better prognosis, with 12% showing complete recovery and 23% only mild impairment. So it is important to diagnose these cases at early stage.

Nearly all studies have demonstrated high mortality from intracranial hemorrhage. Despite diagnostic and therapeutic advances in recent years, the mortality of intracerebral hemorrhage remains exceptionally high.<sup>10</sup> Analysis of one-year mortality series revealed that 32.5 percent of deaths were in the age group of less than 40 years. Hypertension, Alcoholism and smoking were the major risk factors associated with stroke mortality to the extent of 32 percent, 12 percent and

11 percent of cases respectively.

Overall stroke related mortality is about 20%, ranging from 15% for supratentorial and brainstem infarcts to 58 % for supratentorial hemorrhage, case fatality from infratentorial hemorrhage being 31%.<sup>33</sup>

Still, the prospects are not that gloomy, as the mortality of young stroke in India appears to be declining in recent years (Dalal et al) 23.

## CONCLUSION

- Maximum number of patients in young stroke were in age group 20 - 30 years.
- Right hemiplegia was the most common neurodeficit in our patients.
- The different subtypes of stroke were as follows: Thrombotic 28%, Embolic 36 % , hemorrhagic 10% and Corti-

cal Venous sinus thrombosis 26%.

- Female patients predominated in all subtypes of strokes.
- Ischaemic stroke constituted 64% of total stroke.
- Cardiogenic embolic stroke constituted 60% of these.
- Rheumatic valvular heart disease and its complication accounted for majority of the cardiogenic causes of embolic strokes.
- Other etiology for stroke in young found were tuberculous vasculitis, lupus vasculitis, hyperhomocysteinemia, sickle cell disease, postpartum CVST, polycythemia rubra vera, protein C & s def, AV malformation, Moya Moya disease, AV malformation, and preeclampsia.
- In 8% of ischemic stroke cause could not be identified even after investigation.
- Mortality was seen in 20% of patients with stroke.
- Mortality was maximum associated with hemorrhagic stroke (40%)

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