



CLINICO-ETIOLOGICAL PROFILE OF STROKE IN CHILDREN PRESENTING TO A TERTIARY CARE HOSPITAL - A PROSPECTIVE OBSERVATIONAL STUDY

Paediatrics

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ABSTRACT

Background: Stroke is one of the leading cause of morbidity and death in children. Commonly considered a disorder of elderly secondary to atherosclerosis. The aim of this study was to find the etiology and risk factors of stroke in children. **Methods:** A prospective observational study was conducted in a tertiary care Hospital in Aurangabad over a period of 2 years. All children from 6 months to 18 years, diagnosed as childhood stroke clinically and by radio-imaging were included in our study. 37 paediatric patients of stroke were enrolled based on clinical examination and radiological findings. **Results:** Out of the 37 stroke patients, the commonest symptom at presentation was Hemiparesis (51.35%), followed by convulsions (27.03%) and giddiness and headache (10.81%). Speech involvement was the presenting complaint in 8.11% children and altered sensorium was the presenting complaint in 2.70% cases. The most common associated etiological factor was infection (16.22%), followed by heart disease and trauma, both being 13.51% of the cases. The association between age and gender was found to be insignificant. **Conclusion:** Intra cranial infections followed by heart disease and trauma were common causes of stroke in pediatric patients in our study. Ischemic stroke was commonest type.

KEYWORDS

Pediatric Stroke; Risk factors; MRI; Prospective studies

INTRODUCTION

The World Health Organization (WHO) defines stroke as “a clinical syndrome of rapidly developing focal or global disturbance of brain function lasting >24 hours or leading to death with no obvious nonvascular cause.”⁽¹⁾ A modern definition is “a clinical syndrome characterized by (1) a neurological deficit related to the perfusion territory of a cerebral artery and (2) neuroradiological evidence of an ischemic lesion.”^(2,3)

Stroke is on the sixth position among the leading causes of death in children^(2,3). The major contributory factor to its high mortality is that it remains undiagnosed in a large number of children. There is a widespread unawareness about stroke in children, due to which there is delayed recognition, adding to the increased burden.

Stroke is commonly a disorder of elderly age group and atherosclerosis is putative mechanism. The reported incidence of paediatric stroke falls between 44 to 843 cases in 100,000 children under the age of 18 years⁽⁴⁾. The varied clinical presentation also forms a major risk factor for it to not be recognized easily. Stroke may be broadly classified as ischaemic or haemorrhagic variants that account for 55% and 45% of all cases in childhood, respectively. 20% of childhood strokes are recurrent. Around 10–25% of children with a stroke die. Recurrence is seen in around 25% of children. 66 % of children may have persistent neurological deficit, seizure, learning or developmental issues⁽⁵⁻⁹⁾.

Previous literature showed that a maximum number of children have arterial ischemic stroke, seizures, and focal deficits, respectively⁽¹⁰⁻¹²⁾. We aimed to know the risk factors of paediatric stroke, common causes of stroke and outcome at discharge.

Methodology

A prospective observational study carried out on children aged 6 months to 18 years at MGM Medical College and Hospital, Aurangabad from October, 2018 to 2020. Informed consent was taken from parents and ethical clearance was taken. Based on prevalence of stroke as 843 per lakh population, sample size of 37 was calculated.

Children between the age group of 6 months to 18 years, with sudden onset (< 24 hours) of focal weakness, visual/speech disturbances, limb in-coordination, altered mental status, Headache, signs of raised intracranial tension and seizures with additional neurological symptom and confirmed case of stroke by Magnetic Resonance Imaging (MRI) and MR Angiography/Venography (MRA/MRV) were included in study and followed up to 6 months following discharge.

After taking consent from the parents, detailed history taking and

clinical neurological examination were conducted. Laboratory investigations like Complete Blood cell counts (CBC), blood clotting tests (Prothrombin time- internationalised normal ratio, Activated Partial Thromboplastin Time), Sickling test and Haemoglobin electrophoresis, MRI (Magnetic resonance imaging), MR angiography/venography (MRA/MRV) were done.

The outcome of these children were also noted, dividing into complete recovery, with neuro-deficit, or death. Discharged patients were followed up to 6 months.

The data was compiled using EXCEL and analysis was done using SPSS software version 21. Descriptive statistical analysis was carried out using frequency and percentage. Inferential statistical analysis was carried out using Chi-square test to show association between risk factors and number of children affected.

RESULTS

A total of 37 patients were included in the study. The mean age of the children was 7.81±5.39.

There were 22 males (59.46%) and 15 females (40.54%) in the study and there was no statistical difference in sex distribution for stroke. 24 out of 33 patients were born to non-consanguineously married parents (64.86%) the most common clinical features of childhood stroke in our study (table 1) were hemiparesis (19 children i.e. 51.35%) followed by convulsions (10 children i.e. 27.03 %) followed by giddiness and headache in 4 children (10.8%), speech involvement in 3 children (8.11 %), altered sensorium in 1 child (2.7 %). 22 out of 37 patients came to the hospital within 24 hours of symptoms (59%). Risk factors were not identified in 20 patients (54 %). Intra cranial infections were diagnosed in 6 (16 %) patients followed by heart disease and trauma in 5 children each (13 %). One child was diagnosed with sickle cell anemia (2.7%). 22 out of 37 patients (72.97%) were consuming mixed diet and 15 were strict vegetarian

Table 1: Distribution of patients according to gender, consanguinity, clinical presentation, onset of symptoms, risk factors, family history and diet.

Variable	Category	No. of children (n)	Percentage (%)
Gender	Male	22	59.46
	Female	15	40.54
Consanguinity	Non-Consanguineous	24	64.86

	3rd Degree Consanguineous	13	35.14
Clinical Presentation	Convulsions	10	27.03
	Speech Involvement	03	8.11
	Hemiparesis	19	51.35
	Change in Mental Status	01	2.70
	Giddiness and Headache	04	10.81
Duration of Onset of symptoms to hospital visit.	< 1 Day	22	59.46
	>1 Day (>1 to <4 days)	07	18.92
	>5 Days	08	21.62
Risk factors	Trauma	05	13.51
	Heart Disease	05	13.51
	Sickle Cell Anaemia	01	2.70
	Presence of Infection (TBM or Mastoiditis)	06	16.22
	No Risk Factor identified.	20	54.05
Diet	Veg	10	27.03
	Non-Veg	27	72.97

Table 2: Association between age and gender of the patients.

Age	Male No.	Female Percentage (%)	No.	Percentage (%)	χ^2 -Value	p-Value
00-04	07	31.82	06	40.00	1.903	0.593
05-09	08	36.36	03	20.00		
10-14	03	13.64	04	26.67		
15-19	04	18.18	02	13.33		
Total	22	100	15	100		

The association between age and gender of the patients was found to be not significant as shown in Table 2. The systolic Blood Pressure and Diastolic Blood Pressure was in the range of 90-120 mm of Hg (106.11 $\pm$ 7.93) and 50-89 mm of Hg (68.38 $\pm$ 9.52) respectively. Most of the patients had Systolic and Diastolic blood pressure at the time of Admission between 50th to 90th percentiles.

It was found that 86.49% patients had no cranial nerve involvement and 64.86% patients had Haemoglobin level of >10 gm%. The Echo findings in 32 children (86.49%) was normal and out 5 children with heart disease, 2 had rheumatic heart disease, 2 had tetralogy of fallots and 1 had cardiomyopathy.

The present study showed that 83.78% patients had Acute infarcts on MRI and 94.59% had Non-Hemorrhagic Infarction sub-type of MRI. About 9 (24.32%) had middle cerebral artery vessel involvement and 6 (16.22%) had vertebrobasilar system involvement, 2 patients had cortical venous thrombosis (5.41%). 20 (54%) had ischemic stroke but MRA or MRV findings were normal. Distribution of MRA/MRV findings are presented in table 3.

Table 3: Distribution of MRA/MRV findings in patients.

MRA/MRV Findings	No. of Patients	Percentage
Cortical Vein Thrombosis	02	5.41
MCA Involvement	09	24.32
PCA Involvement	03	8.11
Hypoplastic Vertebral Artery	03	8.11
NAD	20	54.05
Total	37	100

As described in table 4, 18 patients did not have any neurological deficit at follow up (48.65%), whereas 16 patients (43.24%) had neurological deficit. 3 children (8.11%) had seizure recurrence and there were no deaths recorded in our study

Table 4: Distribution based on Outcome of Patients

Outcome of Patients	No. of Patients	Percentage
Neurological deficit	16	43.24
Seizure Recurrence	03	8.11
Death	00	0.00
No Neurological Deficit	18	48.65
Total	37	100

DISCUSSION

Pediatric stroke is now recognized as an important cause of morbidity and mortality.

In this study 37 children with stroke number of males (22) suffering from stroke were more than females (15), ratio being 1.4:1. The male predisposition was seen in other studies as the male to female ratio being 1.27:1, 2.03:1, and 1.7:1^(10,11). In a study conducted in Nepal, young age (above 18 years) group male to female ratio was 1.47:1 and in elderly it was 1.46:1⁽²²⁾.

Maximum numbers of patients (35.14%) were between the ages of 6 months to 5 years. The mean age in the present study was 93.72 $\pm$ 64.68 months. In a study it was in accordance with the present study, having a maximum number of patients below the age of 5 years⁽¹¹⁾.

In the present study, the common presentation was Hemiparesis (51.35%), followed by convulsions (27.03%), next by giddiness and headache seen in 10.81%. Speech involvement was the presenting complaint in 8.11% children and altered sensorium was the presenting complaint in 2.70% cases, this was found very much similar to other Indian studies^(11,12,13,16). 60% of the patients presenting with convulsions were generalized, the remaining 40% were focal. A study showed that 55% of the convulsions were focal⁽¹¹⁾.

In total, 13.51% children showed cranial nerve involvement, while the most commonly involved cranial nerve was found to be the VIIth nerve. In a study by Patil et al,⁽¹⁶⁾ reported that 42.22% children with stroke were not diagnosed early, having a delay ranging from 15 hours to months from the first presentation⁽¹⁸⁾. Another study conducted in 2002 showed a 28 hour delay in diagnosing stroke from the presentation⁽¹⁴⁾. A 7.2 hour delay was noted in neuroimaging. In our study, the time lag between onsets of symptoms to presentation in the hospital was 1 day in 22 patients (59.46%), was between 1 to 5 days in 7 patients (18.92%), whereas in 8 patients (21.62%) it was more than 5 days. These results are different as the centre of the present study is a tertiary care hospital of this region, hence early referrals. Moreover, these two studies took place more than a decade ago, when stroke in children was even more under-recognized with less access to neuroimaging.

The most common etiology in the cases were infections (45%), followed by cardiac lesions and trauma as a cause, both at 13.51%. The second most common stroke etiology in this study was presence of a heart disease (13.51%), amongst which cyanotic heart disease and RHD being the findings in 40% cases each. Cardiomyopathy is present in 20% cases. A study demonstrated that intracranial infections were the commonest cause of stroke in children, which has been found similar to this study as well⁽¹⁵⁾. Also, studies conducted in North India, Mumbai and Kolkata also reported infections as the most common etiology^(10, 13, 16, 17). Both the studies in Mumbai and Kolkata, Tuberculosis turned out to be the most common infectious etiology, which was also similar in the present study^(13,17). International studies the most common cause found as Vasculopathy, followed by infections, metabolic diseases and then trauma⁽¹²⁾. Trauma (13.51%) was also a significant risk factor found in this study, which was consistent with International studies the most common etiology was cyanotic heart diseases whereas in another study was trauma^(19,20).

In this study, depending upon the neuroimaging diagnosis, acute stroke was seen in 83.78% cases, sub-acute in 5.41% and chronic stroke was seen in 10.81%, also consistent with most studies.

Both the patients with hemorrhagic stroke had blood pressure on the higher side, between 95th to 99th centile, which was secondary to the raised intracranial tension. Both cases had no history of primary hypertension causing haemorrhagic stroke.

Out of the 37 cases enrolled in my study, 94.59% cases had non-Haemorrhagic stroke and 5.41% had Haemorrhagic stroke. In my

study AIS was seen in 89.12% cases, CVST and hemorrhagic in 5.41% each.

Similar findings were seen in Indian studies and international studies^(10,11,12,17). 78.5% patients had AIS, 12.7% intra-cerebral hemorrhage and 8.9% had cerebral venous sinus thrombosis (CVST). Similarly 91.2% cases were ischemic and 8.82% were hemorrhagic⁽¹⁷⁾. The outcome seen in the present study was that neurological deficits were seen in 16 patients (43.24%) whereas seizure recurrence seen in 3 (8.11%), no deaths were reported. In a prospective study on 50 children conducted by in western Rajasthan, India it was found that 66 % (33 out of 50) patients had neurologic deficit at the time of discharge⁽¹¹⁾. Study conducted in Mumbai only 7.3% recovered fully without any residual deficits⁽¹³⁾.

Stroke in children is an under-researched topic, other causes of pro-thrombotic stroke in children are Protein C and S deficiency, MTHFR gene mutation, Vitamin B12 deficiency, factor V Laiden mutation, for identifying rare etiologies, a lot of diagnostic modalities are not readily available yet and also high cost is one of the most prominent constraints.

CONCLUSION

Cardiac, hematological and infectious causes of stroke are common in paediatric age group. Searching for mechanism of stroke and defining aetiology is important. Most cases, if diagnosed earlier and started with treatment, have better outcomes. Some of the infectious causes of stroke are preventable, TB meningitis and tuberculomas being one the most common causes in India, if diagnosed earlier can prevent the debilitating sequelae of stroke. As a collective approach, the cases of stroke should be subjected to neuroimaging earlier, should be started on investigations in all the patients and second line based on availability and affordability. Outcomes in our study were good with almost half with no neurodeficit and few with some neurodeficit and no mortality. treatment earlier and clinicians can approach the management with above.

Limitation

The present study had some limitations like the smaller sample size of 37, though a large study compared to the reported incidence of stroke, but not enough to guide or form protocols for diagnosis or treatment for the general population.

Future scope

A large prospective study be designed for longer period to study etiopathogenesis for paediatric strokes, their difference from strokes in elderly, and primary prevention be applied at national level guidelines to prevent this disabling disease.

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