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Clinical, Etiological and Neuroimaging Profile of Pediatric Stroke at A Tertiary Care Center

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Abstract

Introduction: Stroke, defined as the sudden occlusion or rupture of cerebral arteries or veins resulting in focal cerebral damage or neurological deficits in children, differs in clinical presentation, etiology and neuroimaging from adults.

Materials and methods: This hospital based observational study aimed to assess the clinical etiological patterns and neuroimaging profile of childhood stroke evaluated 75 pediatric stroke patients between the ages of 6 months to 18 years.

Results: Early childhood is the most common period for stroke, males are affected more predominantly. CNS infection was found the most common cause of stroke, CNS T.B being the most common. Hemiplegia was the most common presentation of stroke and AIS being most common type of stroke. Causes of stroke in children are varied and differ from those seen in adults.

Conclusion: Even after many decades of initial studies not much information is available on this aspect in India. Adequate identification and determination of etiology is absolutely necessary as stroke can be prevented in some children and treated in others. With the help of newer diagnostic facilities, probability of finding an etiology of stroke is increased for infectious and non-infectious causes.

Keywords: Pediatric stroke; Neuroimaging; Hemiplegia; Hemorrhagic stroke

Introduction

Stroke, a diagnosis considered commonly in adults and elderly, is now being diagnosed frequently in pediatric patients also [1]. Definition of adult stroke as an acute onset neurological sign or symptom attributable to focal brain infarction or hemorrhage is applicable in children as well [2,3]. Ischemic stroke incidence is estimated 1.0 to 2.0 in 100000 children (non-neonates) annually in developed countries. Incidence differs by age and sex; highest in infants and children <5 years of age and higher in boys than girls. Higher incidence is reported in Black and Asian children than white children [4].

Krishnamurthy et al. evaluated pediatric stroke cases in different geographical regions between 1990 to 2013, and noted significant global increase in the absolute number of prevalent strokes in children of ≈ 35% since 1990. The mortality rate showed significant decline, with boys showing a trend toward higher childhood stroke death rates (95% CI, 1.5 [1.3–1.8] per 100 000) than girls (95% CI, 1.1 [0.9–1.5] per 100 000) globally in 2013. These findings suggest that pediatric strokes are important global public health concern [5].

Accurate and timely diagnosis is often challenging and stroke is correctly diagnosed only in ≈ 60% of children, giving ≈ 40% of cases an incorrect initial diagnosis [6-9]. This suggests a need to develop programs of education to improve knowledge and skills, bedside clinical assessment methods and better imaging techniques for diagnosis of pediatric stroke in children with improved sensitivity and specificity and to identify modifiable stroke risk factors for preventive strategies. There is limited understanding of pathogenesis, and approximately one-quarter to one-third of all childhood strokes remain 'idiopathic' [10]. Also, Risk factors and causes of Pediatric stroke differ as chronic diseases such as atherosclerosis, hypertension, hypercholesteremia/hyperlipidemia, diabetes, and smoking are more common in adults.

Materials and Methods

This hospital based, observational study aimed to assess the socio-clinical and etiological patterns and neuroimaging profiles of childhood stroke was conducted at Jaipur (Rajasthan) from June 2019 to December 2019, after getting requisite clearance from institutional ethics committee. Sample size is calculated at 95% confidence level, alpha error of 0.05, at 10% absolute available error in the above mention clinical manifestation the required sample size was 75 cases. Patients between the age group of 6 months to 18 years admitted with signs and symptoms suggestive of stroke (hemiparesis, fever, seizure, altered consciousness, etc.,) and later diagnosed as stroke by radio-imaging during the study period were included in the study. Those refusing for consent, presenting with paraplegia/ paraparesis, spinal cord/brain trauma and children less than 6 months of age were excluded [10-14].

Results and Discussion

This study evaluated 75 pediatric stroke patients aged between 6 months to 18 years, out of which 65.3% (48) were males and 34.7% (27) were females suggesting male preponderance (M:F=1.89:1). Age group of 6 months to 5 years constituted 52% (39), age group of >5 years to 10 years 34% (26) and age group of >10 to 18 years 13.3% suggesting high prevalence of stroke in early childhood (Figure 1). 42 subjects were from Hindu, 32 from Muslims and 1 from Sikh religious background.

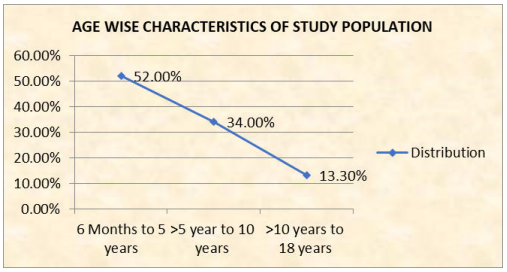

Figure 1: Age wise characteristics of study population.

67% patients were having some co-morbidity. CNS Infections (52%, n=29; M-19, F-10) were the most common co-morbidity with pediatric stroke. Tubercular meningitis was the most common (16%, n=12; M-8, F-4) CNS infection followed by Meningo-encephalitis (12%, n=9; M-6, F-3) and Viral Encephalitis (10.6%, n=8, M-5, F-3).Vascular causes (16%, n=12, M-8, F-4) including Moya-Moya (5.3 %, n=4 M-3, F-1). Vasculitis (6.6%, n=5, M-3, F-2) and Nonspecific vascular malformation (4%, n=3, M-2, F-1) were the second most common cause identified [15].

Figure 2: Classical 'Puff of Smoke' in a child with Moya Moya disease in our study.

Hematological causes (13.3%, n=10, M-6, F-4) including Protein C, S deficiency (8%, n=6, M-3, F-3), Thrombocytopenia (2.6%, n=2, M-1, F-1), Sickle cell disease (2.6 %, n=2, M-2) were the third most common cause identified. Cardiac causes (6.6% n=5, M-3, F-2=Acyanotic CHD 4%, DCM-2.6%) and other causes like homocystenemia (3%), mastoid sinusitis (1%) arteriopathy, ICH (1.3%) (5.3%, n=4; M-2, F-2) were identified associated. In 27.7% (n=15; M-10, F-5) cases, even after intensive diagnostic investigations and efforts no clear etiology was found as shown in **Table 1**.

Table 1: Underlying/co-morbid conditions in patients with stroke.

Condition	n (%)	Hindu(n=42)	Muslim(n=32)	Sikh(n=2)
Infection	29 (52%)	18	10	1
T.B meningitis	12 (16%)	5	7	0
Meningo-encephalitis	9 (12%)	6	3	0
Vascular	12 (16%)	7	5	0
Vasculitis	5 (6.6%)	3	2	0
Moya moya disease	4 (5.3%)	3	1	0
Nonspecific vascular malformation	3 (4%)	1	2	0
Haematological	10 (13.3%)	6	4	0
Cardiac (CHD, RHD, DCM)	5(6.6%)	3	2	0
Others	4 (5.3%)	2	2	0
Idiopathic	15 (27.7%)	8	7	0

The most common clinical presentation of childhood stroke was hemiplegia (81.3%, n=61), followed by seizure (57.3%, n=43), altered consciousness (50.6%, n=38), fever (65%, n=49) and cranial nerve palsy (29.3%, n=22), and aphasia (6.6%, n=5), vomiting (42.6%, n=32) respectively as shown in **Figure 3**.

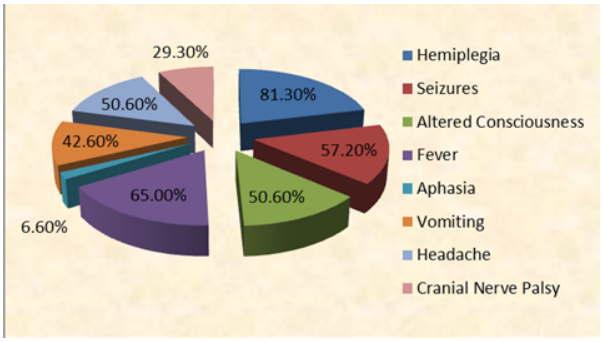

Figure 3: Clinical presentation.

Table 2: Seizure pattern and level of consciousness in patients having stroke.

Parameters	Type of seizures			Level of consciousness	
	Generalized	Focal	No seizures	Impaired	Conscious
AIS (n=54)	16	2	3	6	27(36%)
CSVT (n=9)	12	2	1	1	16(21.33%)
H (n=4)	26	5	0	1	32(42.66%)
Others (n=8)	32	2	4	7	45(60%)
Total (n=75)	22	7	0	1	30(40%)

Seizures were noted in 57.3% (n=43) children, seizure patterns and level of consciousness have been depicted as shown in **Table 2.**

Neuroimaging findings

Out of total 75 stroke patients, 54 (72.2%) cases were diagnosed as acute ischemic stroke and 4 (5.3%) cases as a hemorrhagic stroke. CSVT diagnosed in 9 (12%) patients and others 8 (10.6%) [16]. AIS diagnosed in 32 (42.6%) males and 22 (29.3%) females as shown in **Table 3**.

Table 3: Type of strokes.

Gender	AIS	CSVT	Hemorrhagic	Others
Male(n=48)	32 (42.6%)	8 (10.6%)	03 (4.0%)	05 (6.6%)
Female (n=27)	22(29.3%)	01 (1.3%)	01 (1.3%)	03 (4.0%)
Total (n=75)	54 (72%)	09 (12%)	04 (5.3%)	08 (10.6%)

Middle Cerebral Artery (MCA-52%) was involved most commonly, followed by ICA (21.33%), PCA (12%) MCA+PCA (8%), ACA+MCA+PCA (4%), and ACA+PCA alone (2.67%) as shown in **Table 4** [17].

Table 4: Vascular territory involved.

Age	MCA	PCA	ICA	MCA+PCA	ACA +PCA	ACA+MCA +PCA
6 months to 5 yrs (n=39)	22	6	8	3	1	2
>5-10yrs (n=26)	10	2	5	2	1	1
>10-18yrs (n=10)	7	1	3	1	0	0
Total=75	3(52%)	9 (12%)	16(21.3%)	6 (8%)	2(2.67%)	3(4%)

Conclusion

The current study has provided valuable information about clinico-etiological profile of pediatric stroke. Early childhood is the most common period for stroke, males are affected more predominantly. CNS infection was found the most common cause of stroke, CNS T.B being the most common. Hemiplegia was the most common presentation of stroke and AIS being most common type of stroke. Causes of stroke in children are varied and differ from those seen in adults. One or more risk factors can be identified in up to three fourths of children with ischemic stroke and an even greater percentage in children with hemorrhagic stroke. Even after many decades of initial studies on etiology and outcome of stroke in pediatric population not much information is available on this aspect in India. Adequate identification and determination of etiology is absolutely necessary as stroke can be prevented in some children and treated in others.

Many patients of stroke completely recovered. With the help of newer diagnostic facilities, probability of finding an etiology of stroke is increased for infectious and non-infectious causes. Neuroimaging has the most important role. Newer modalities of treatment increased chances of recovery many folds from previous times. We suggest prompt identification of stroke and early diagnosis and prompt treatment in stroke to prevent long term morbidity and mortality.

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