



ROLE OF MRI IN STUDYING THE OUTCOME OF PAEDIATRIC STROKE.

Radiodiagnosis

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ABSTRACT

OBJECTIVES: The objective of the study was to study the role of MRI in studying the outcome of Paediatric stroke.

MATERIALS AND METHODS: This was an observational study with a prospective design conducted in the department of Radio-diagnosis in a tertiary teaching hospital in Central India on cases of Paediatric stroke sent by the department of Paediatrics for MRI.

RESULTS: A total of 60 cases were studied out of which 40 were males and 20 were females. Mean age of presentation was 5.96 years. Stroke more prevalent in males by 2:1. 50% were arterial ischemic strokes and 25% were hemorrhagic strokes while 17% were non-stroke or stroke mimickers. In the outcome, hemorrhagic stroke was more fatal with maximum death rate of 25% as against 10% in acute ischemic stroke. Rate of disability overall was 67% and recurrence was 18%.

KEYWORDS

Mri, Paediatric Stroke

INTRODUCTION:

A stroke is defined as an abrupt onset of a neurologic deficit due to a sudden alteration of the blood supply to the brain, usually caused by a blocked flow or rupture of an artery to the brain.(1)

Gluseppe Lanni et al in their study on pediatric stroke: clinical findings and radiological approach found that on 41 children of pediatric stroke, MRI was the single best emergency investigation(2).

There is currently no gold standard outcome measure for childhood stroke, and recent reviews have shown a wide variety of measures that have been used across studies. Many of the measures are author derived. Rates of recurrent AIS ranges from 6% to 35%. Population-based data suggest 5-year recurrence rates approach 50%.

The Pediatric Stroke Outcome Measure is the only validated disease-specific measure for the childhood stroke population. The Stroke Recovery and Recurrence questionnaire, derived from the Pediatric Stroke Outcome Measure for use as a telephone questionnaire, also demonstrates good agreement between total scores across both measures in a recent validation study. Hence as there are limited studies, we conducted this study where outcome was categorized as disability, recurrence or death.

METHODOLOGY:

This was an observational study with prospective design including all hemodynamically stable pediatric patients aged 1 month to 12 years of age with clinical diagnosis of stroke without the general contraindications to MRI such as metallic implants or metallic foreign body.

Thus a total of 60 cases were studied from November 2017 to November 2019 i.e. 2 years. MR imaging on a PHILIPS ACHIEVA 1.5 TESLA, MACHINE with a dedicated SENSE HEAD COIL. Every patient went through the brain sequences according to the standard protocol for MRI.

The planning was done to take diffusion weighted imaging as the first sequence followed by FFE. Contrast Administration and post contrast FLAIR and T1_TFE Sag 3D were taken if considered necessary by the reviewer, considering the history of the patient.

Venography was also performed in selected patients only when considered necessary by the reviewer. For analysis, SPSS version 16 was used.

RESULTS:

In our observational study out of 60 patients, 40 were male (66.67%) and 20 were female (33.33%). There appears to be bimodal age distribution with majority of patients in age group of less than 4 years and 9-12 years. Mean age of presentation is 5.96 years. In this study, it was found that stroke is more prevalent in males as compared to

females with male to female ratio of 2:1.

Table 1 Distribution Of Cases According To Age And Sex:

Age (years)	No. of cases in males	No. of cases in females	Total	Percentage (%)
0 to 4	15	10	25	41.67
5 to 8	10	5	15	25
9 to 12	15	5	20	33.33
Total	40	20	60	100

In this study, 17% patients did not have stroke like imaging features and were labelled as stroke mimics. On MRI, out of 60 patients, stroke was diagnosed in 50 patients with no stroke like imaging findings evident in 10 patients. Stroke was classified as three categories: Arterial Ischemic Stroke (AIS), Venous Infarct with or without haemorrhagic transformation (CVST), Haemorrhagic stroke (HS) In this study, 17% patients did not have stroke like imaging features and were labelled as stroke mimics.

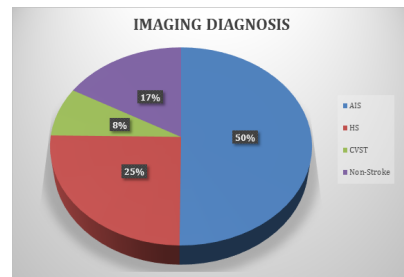


Figure 1: Distribution Of Cases According To Imaging Diagnosis

Recurrence is overall 18% which is uniformly seen in all types of Paediatric Stroke. The Haemorrhagic Stroke is more fatal though with maximum death rate of 25%, as against only 10% in AIS and 14% overall. The Rate of disability across the spectrum is 67%. None of the patients were lost to follow up.

Table 3 Distribution Of Pediatric Stroke Cases Based On Outcome

Outcome	Recurrence		Disability		Death		Normal	
	Number	%	Number	%	Number	%	Number	%
AIS (n=30)	5	16.67	22	73.33	3	10	0	0
CVST (n=5)	1	20	4	80	0	0	0	0
HS(n=16)	3	18.75	8	50	4	25	0	0
TOTAL (n=51)	9	17.65	34	66.67	7	13.75	0	0
NO-STROKE (n=9)	0	0	0	0	2	22.22	7	77.77

DISCUSSION:

The present observational study showed that the majority of patients in this study belonged to age group of less than 4 years and 9-12 years, with mean age of presentation is 5.96 years. In a study carried out by Barnes et al. 2004; Fullerton, Wu, Zhao, & Johnston 2003; Ganesan et al. 2003, it was found that the risk of childhood stroke considerably varies according to age. The majority of the studies report the greatest risk of childhood stroke in children aged less than 1 year.(5, 6) Both Fullerton et al. and Kirkham et al. reported that after the age of 1 year the risk of overall stroke fell significantly between the ages of 5 and 9 years before rising again in adolescence (Fullerton, Wu, Zhao, & Johnston 2003; Kirkham et al. 2003).(6) The observations of above-mentioned studies, corroborates with findings of present study that there is reduced incidence of stroke in between the ages of 5 and 9 years.

There was an increased prevalence of stroke in males as compared to females with male to female ratio of 2:1 in the present study. Several studies like the one by Golomb et al. 2009; Mackay et al. 2011(7,8) also revealed similar findings of increased incidence of stroke in males as compared to females. The International Pediatric Stroke Study Group (IPSS) found a male to female ratio of 1.49 amongst the first 1187 patients enrolled (Mackay et al. 2011)(8, 9) Physical factors like exercise can cause cervical arterial dissection and thus contributing to increased prevalence of stroke in males. Besides, hormonal factors such as estrogen that has vasodilatory and anti-inflammatory effects may offer relative protection from stroke to females. Whereas among boys, elevated testosterone levels have been shown to be independently associated with stroke risk (8,10)

In this study, on MRI, out of 60 patients, stroke was diagnosed in 50 patients with no stroke like imaging findings evident in 10 patients i.e. 17%. Studies by Fullerton, Zimmerman have documented previously that AIS accounts for about half of all strokes in children, in contrast to adults in whom 80–85% of all strokes are ischemic (3,4). The incidence of Haemorrhagic Stroke (HS) is higher in paediatric stroke as compared to adult which is estimated between 0.7 to 2.1/100,000 children/year (7,11,12), to be around 25-50% patients. CVST has an incidence of 0.4 and 0.7/100,000 children/year in childhood, around 5-25% of all strokes. Twenty percent to over half of children presenting urgently with stroke-like symptoms will have stroke mimics.(13) These findings are corroborative of the findings of this study.

In this study, the outcome of the patients was classified as recurrence, disability without recurrence and death. None of the patients were lost to follow up. Fullerton studied pediatric stroke and inferred roughly 10–25% of children with a stroke will die, up to 25% of children will have a recurrence, and up to 66% will have persistent neurological deficits or develop subsequent seizure disorders, learning, or develop mental problems. (3,4) Friedman et al, 2009 and Mirsky et al in 2017 opined that AIS is relapsing in around 6% - 37% of pediatric patients after the first episode and the risk is highest in the six months after the first episode(4). Following childhood AIS, more than 75% of children will suffer long-term neurologic deficits, and 10% of children will die. Recurrence risk after childhood AIS has been estimated at 12% at 1 year(10) and 19% at 5 years(7). Goodman S, and Pavlakis S in the journal Pediatric and newborn stroke have inferred that HS is usually more lethal as compared to the AIS. Poor outcomes were reported in 25% to 52% of children after HS in a retrospective case series.(14) In a multicentric cohort study in the European collaborative paediatric database on cerebral venous thrombosis by Kenet G et al. the recurrence rate for a second CVST is 3%.(15) The findings of these several studies are in unison with the observation of the current study.

CONCLUSION:

MRI is very important noninvasive imaging tool in Pediatric Stroke Management as it has the potential to positively affect the outcome, morbidity in these patients.

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