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TO STUDY THE PROGNOSTICFACTORSIN HEMIPARESIS IN CHILDREN AND CORRELATE NEUROIMAGING ABNORMALITIES TO CLINICAL CHARACTERISTICS: A PROSPECTIVE OBSERVATIONAL STUDY

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ABSTRACT

Background: Acute hemiparesis in children is a common clinical syndrome presenting. Clinical data combined with neuroimaging are important for accurate diagnosis and management. Weakness may or may not improve over time depending on the cause of hemiparesis. Only limited data is available on improvement pattern especially in india so, this prospective observational study was planned to study the factors that affect hemiparetic children's prognosis and correlate anomalies in neuroimaging to their clinical characteristics.

Materials and Methods: A prospective observational study was conducted in Department of Pediatrics, Career institute of medical sciences, Lucknow from September 2020 to August 2023 including children between2 months to 14-year age and presented with complaint of hemiparesis. After prior informed consent, in each eligible child, detailed history, examination and neuroimaging was done. Outcome was noted at discharge which was correlated with their initial presentation and neuroimaging finding.

Results: Among total of 65 children, 45 (69.2%) were of infections etiology while 20 (30.8%) were of non-infective cause. Of65 patients, only 60 patients underwent neuroimaging; CT scan in 35(53.8%) patients and MRI in 39(60%) patients, of them abnormalities were detected in 49 patients (81.6%). Hyperventilation and Pupil size abnormality at presentation were significantly associated with the mortality. Altered sensorium and convulsions at presentation were found to be closely related to the findings suggestive of meningo encephalitis on neuroimaging. This correlation was statistically significant.

Conclusion: Hyperventilation and Pupil size abnormality are significantly associated with the mortality in Hemiparesis. Further multicentric researches are needed.

Keywords: Hemiparesis; muscle power; neuroimaging; prognosis; stroke.

INTRODUCTION

Hemiparesis (hemiplegia = complete loss) means weakness of one vertical side of the body which can involve any side either right or left. It is caused by injury to parts of the brain that control movements of the limbs, trunk, face, etc. Insult to the brain may occur during perinatal period (up to two years of age approximately it is known as hemiplegic cerebral palsy) or later in life (acquired hemiplegia).

The most common cause of acquired hemiplegia is cerebrovascular accident or stroke.

Paediatric stroke is a relatively common condition, affecting up to 1.2 to 13 per 100,000 children under 18 years of age.[1]The reported incidence and prevalence of pediatric stroke has increased over the past two decades. Additionally, more effective treatments have improved survival rates for patients with certain stroke diseases and rare disorders.[2]

The clinical presentation of hemiplegia depends on the age of the patient, duration of the underlying pathology and the area of the central nervous system affected. A prompt and precise diagnosis is required for the timely management. Radiological investigations are most important to find out site of lesion and cause of hemiparesis. In india women choose to deliver at home,which further deprives them of proper health care counselling regarding danger signs of child illness so further delaying diagnosis.[3]

The management of childhood hemiplegia depends on an experienced multidisciplinary pediatric team.

Weakness may or may not improve over time depending on the cause of hemiparesis. In case of vascular insult leading to infarction of part of brain, weakness may persist for lifelong but they may look different over time, partly because the child is growing and developing. As recent studies have shown that breastmilk is protective for children even when applied orally, further relation with hemiparesis need to be studied.[4]

We found that there are only meagre studies available on hemiparesis in children and limited data is available in Indian setup. So, this prospective observational study was planned to studythe factors that affect hemiparetic children's prognosis and correlate anomalies in neuroimaging to their clinical characteristics.

MATERIAL AND METHODS

A prospective observational study was conducted in Department of Pediatrics, Career institute of medical sciences, Lucknow from september 2020 to August 2023 including children between2 months to 14-year age and presented with complaint of hemiparesis.

After prior informed consent, all the eligible children who were hospitalized in the Department of Pediatrics were enrolled for the study. A detailed history and examination was carried out including detailed nervous system examination. All the enrolled children with hemiparesis were subjected to the neuroimaging either a MRI brain or CT scan head according to need, affordability and feasibility.

In case of suspected CNS infection: Complete blood count and CSF examination were conducted in all. On the basis of provisional diagnosis further investigations were carried to confirm the possible viral/pyogenic/ tubercular etiology.

In case of acute ischaemic stroke with no obvious etiology: Following tests were carried out to find out any associated risk factor-

Complete blood counts, prothrombin Time/ APTT,2D Echocardiography, serum protein C, S, antithrombin III levels,Serum homocysteine levels and MR Angiography in suspected cases of arteriopathy. Follow Up-Children were observed daily till discharge. They were treated according to the unit protocol by the physician inchargeof the case. At discharge neurological status of the child was recorded. Improvement in power of the affected side was noted in form of partial, complete or no recovery in power at the time of discharge. Outcome was recorded in form of leave against medical advice (LAMA), discharge, expiry of patient, abscond or transfer.

STATISTICAL CONSIDERATIONS

SAMPLE SIZE:

Since it was a time bound prospective case series study from September 2020 to august 2023, all cases of hemiparesis were included in this study.

Stastitical analysis:

Data was entered in Microsoft Excel Sheet andfor the purpose of analysis Statistical Package for Social Sciences (SPSS) version 21.0 was used. The mean and standard deviation for quantitative data were calculated. For comparison of categorical variables chi square /Fisher exact test was used. For continuous data student t test/Mann Whitney U test was applied.

RESULTS

A total of 65 patients of hemiparesis were enrolled during the study period and data was analysed in all patients.

Out of 65 enrolled patients, 36 (55.38%) were male and 29 (44.61%) patients were female; 14 children were <2years of age, maximum number of patients were in the age group of 2-5 years.

Clinical characteristics of the enrolled children is given in Table 1

Out of 65 enrolled patients, 49 patients (75.3%) had acute onset, 12 (18.5%) had sub-acute and 4 (6.1%) patients had stuttering onset of the disease. Among 65 enrolled cases of hemiparesis, 45 (69.2%)cases were of infections etiology while 20 (30.8%) cases were of non-infective cause

Out of 65 enrolled patients, 37 (56.9%) patients presented with right sided hemiparesis while 28 (43%) patients had left sided hemiparesis.

Among the 65 enrolled patients of 17 (26.2%) had grade 1 power, maximum patients 38 (58.5%) presented in grade 2 power and 10 (15.4%) patients had power of 3 on the affected side of body.Among the 65 enrolled patients, facial neve involvement was present in 11(16.9%) patients. In 2 (3.2%) patients along with facial nerve, oculomotor nerve was also involved.

Out of total 65 patients enrolled,only 60 patients underwent neuroimaging, including CT scan in 35(53.8%) patients and MRI in 39(60%) patient.Of these 60 patients, abnormalities were detected in 49

patients (81.6%) and 11 patients (18.3%) did not show any neuro imaging abnormality.

Out of total 60 patients who underwent neuro-imaging, multiple areas of brain were involved in 22 (36.6%) cases and rest had localised brain involvement. Ventricular abnormality was noticed in 7 (11.6%) cases.Ventricular abnormality consisted of hydrocephalous in enrolled cases of tubercular meningitis.

Among enrolled patients of hemiparesis, cerebral arterial involvement was seen in 6 (50%) patients. Total 5 (84%) patients had middle cerebral artery involvement while 1(8%) patient showed anterior cerebral artery involvement.

Out of total 65 patients enrolled, 8 were lost in form of Left against medical advice, expiry or abscond so outcome could not be assessed in these patients. In remaining 57 patients, there was full recovery of power in 12 patients (21 %), 43 showed partial recovery (75.4%) while 2 patients did not show any improvement in power.

There was improvement in power of enrolled patients at discharge. Mean were compared by paired t test and this difference in power was statistically significant as shown in table 2.

Table 3 depicts the clinical presentation with outcome of these children with hemiparesis. Hyperventilation at presentation was closely associated with the mortality difference between cases of infective and non-infective etiology, that difference was statistically significant. (p value <0.05).Pupil size abnormality at admission was also closely related to the mortality in patients, this correlation also came out to statistically significant. (p value< 0.05).

Weather it is infective or no infective etiology,they were no significant effect of cause of hemiparesis on outcome.

We tried to correlate clinical presentation with neuroimaging abnormalities as shown in table 4. Altered sensorium at presentation was found to be closely related to the findings suggestive of meningo encephalitis on neuroimaging. This correlation was statistically significant with odds ratio of 0.11. (p value<0.05).

Headache was closely related to the space occupying lesion though this correlation was not statistically significant. (p value=0.075).Fever was related to the infarct and meningo encephalitis but this correlation was not statistically significant. Convulsions were also strongly related to the meningoenncephalits and this correlation was statistically significant. (p value <0.001).

Table 1: Clinical characteristics of the enrolled children is given in Table 1

Clinical presentation	Number	Percentage
Fever	42	64.6
Altered sensorium	44	67.7
Headache	28	43.1
Vomiting	28	43.1
Irritability	19	29.2
Lethargy	14	21.5
Weight loss	14	21.5
Seizures	19	29.2
Abnormal breathing	18	27.7
Lymphadenopathy	10	15.4
Cranial nerve involvement	11	16.9
Abnormal pupil size	4	6.2
Signs of meningeal irritation	10	15.4
Hypertonia	29	44.6
Signs of raised ICP	17	26.2
Brisk DTR	21	32.3
Optic atrophy	2	3.1
Aphasia	10	15.4
Cognitive impairment	25	38.5

Table 2: Improvement in power of affected side at discharge

	Power of affected side at Discharge	Power of affected side at Discharge	p Value
Mean	1.89	3.40	0.001
S.D.	0.658	0.564	

Table 3: Correlation of clinical presentation with outcome of enrolled patients

	Discharged	Expired	p Value	Odds Ratio
Fever	35/55 (63.6%)	1/2(50%)	0.697	1.75
Altered sensorium	37/55 (67.3%)	1/2(50%)	0.617	2.05
Headache	24/55(43.6%)	0(0%)	0.331	-
Vomiting	29/55(47.3%)	0(0%)	0.291	-
Irritability	16/55(29.1%)	0(0%)	0.514	-
Lethargy	11/55(92%)	1/2(50%)	0.340	0.25
Weight loss	9/55(16.3%)	1/2(50%)	0.264	0.19
Seizures	16/55(29.1%)	2/2(100%)	0.115	0.083
Abnormal breathing	13/55(23.6%)	2/2(100%)	0.081	0.06

Cranial nerve involvement	8/55(14.5%)	1/2(50%)	0.226	0.17
Pupil size abnormality	2/55(3.6%)	1/2(50%)	0.038	0.03
Hyperventilation	8/55(14.5%)	2/2(100%)	0.036	0.03
Sign of meningeal irritation	9/55(16.3%)	0(0%)	1.00	-
Hypertonia	22/55(40%)	2/2(100%)	0.201	0.13
Hypotonia	10/55(18.2%)	0(0%)	0.928	
Brisk DTR	17/55(30.9%)	2/2(100%)	0.128	0.09
Plantar extensor	18/55(2.7%)	2/2(100%)	0.141	0.09
Lymphadenopathy	9/55(16.3%)	0(0%)	1.10	-
Signs of raised ICP	15/55(27.3%)	1/2(50%)	0.819	0.75
Aphasia	8/55(14.5%)	1/2(50%)	0.226	0.17
Optic atrophy	1/55(1.8%)	0(0%)	0.258	-

Table 4: Correlation of clinical presentation with neuroimaging abnormalities

Clinical feature		Infarct	Hemorrhage	Meningoencephalitis	Atrophy	SOL
Altered sensorium	Number Percentage P value Odds ratio	10/60 16.6 0.366 0.58	3/60 5 0.419 3.45	13/60 21.6 0.048 0.11	5/60 8.3 0.404 2.56	1/60 1.6 0.229 0.21
Fever		9/60 15 0.245 1.95	0/60 0.08 0.1	11/60 18.3 0.226 0.42	3/60 5 0.438 0.51	3/60 5 0.352 4.16
Headache		6/60 10 0.452 0.64	2/60 3.3 0.615 0.90	6/60 3.0 0.388 2.87	2/60 3.3 0.478 0.63	3/60 5 0.075 7.39
Vomiting		8/60 13.3 0.699 1.244	3/60 5 0.79 10.0	6/60 10 0.615 0.98	2/60 3.3 0.478 0.63	3/60 5 0.75 10.2
Seizures		4/60 6.6 0.393 0.67	0 0.447	9/60 15 0.002 7.38	2/60 3.3 0.341 1.23	0 0.456
Sign of meningeal irritation		2/60 3.3 0.482 0.66	0 0.81	4/65 6.6 0.134 3.0	0 0.500	0 0.601
Hypertonia		6/60 10 0.368 0.59	1/60 1.6 0.667 0.58	9/60 15 0.095 2.79	3/60 5 0.558 1.26	0 0.235
Signs of raised ICP		5/60 8.3 0.722 1.25	0 0.389	6/60 10 0.116 2.72	1/60 1.6 0.579 0.53	0 0.291
Brisk DTR		5/60 8.3 0.766 0.83	0 0.296	9/60 15 0.006 5.85	1/60 1.6 0.390 0.39	0 0.303
Plantar extensor		5/60 8.3 0.566 0.83	1/60 1.6 0.704 1.02	8/60 13 0.030 3.89	1/60 1.6 0.362 0.39	0 0.303

DISCUSSION

In our study a total of 65 patients were enrolled who were investigated by doing neuroimaging and CSF examination was done in suspected cases of CNS infection.

In contrast tomany earlier studies which have excluded CNS infections and congenital malformations.[5] This has underestimated the magnitude of the problem.

In our study hemiparesis was more often on right side than on left side. This view is supported uniformly by previous studies.[5]

Clinical profile was the focus of our study and to determine the etiology of hemiplegia. In our study fever (65%) and altered sensorium (67%) were the two most common symptoms. Grau et al case control study highlighted the role of fever as predisposing factor for stroke.[6]

Altered sensorium was present in 33(73%) of infectious etiology and 11 (55%) of non-infectious etiology. Similar results were reported by C.Patra et al (2015) in a study of stroke in childhood population from a tertiary care hospital in Kolkata.[7]

Cranial nerve involvement was seen in 11(16.9%) patients presenting with hemiparesis. The most

common nerve involved was the facial nerve in 11(13.8%) cases and oculomotor was the second in number with involvement in 2 cases (3%).

The investigation panel was carefully chosen depending on the clinical scenario. The limited financial and laboratory resources are major handicaps in our country while investigating these cases.

CSF analysis was done in all cases having suspicion of infective etiology. CSF protein and CSF pleocytosis was seen in cases having suspicion of infective etiology.

An immediate CT scan head following a stroke helps to differentiate infarction from haemorrhage. In our enrolled patients, 35 patients underwent CT scan (53%). MRI scan is useful in identifying brainstem lesion and early infarction .MR angiography (MRA) is a very sensitive non-invasive tool for identifying large vessel disease and to an extent small vessel and medium vessel disease. There was suspicion of vessel involvement so in 18 patients MRA was done. Out of 65 enrolled patients, 39 (60%) underwent MRI. In a total of 60 enrolled patients out of 65, neuroimaging was done

In present study intracranial infections were found to be the most common cause of hemiparesis. In infectious etiology, acute encephalitic syndrome was found to be the commonest etiology of hemiparesis followed by tubercular meningitis similar to Siddiqui et al.[8]

In our study maximum number of patients were of infective etiology so patients were treated with IV antibiotics and supportive treatment. Patients recognized to be the case of tubercular meningitis, were started on anti-tubercular treatment with short course of steroids.Patients having ischaemic stroke, were started on aspirin and few required anti thrombotic drugs in form of heparin and oral warfarin with continuous monitoring for coagulation profile. Patient diagnosed as a case ADEM was treated with steroids.

Outcome of patients has been described in terms of mortality and improvement in motor power at discharge.

Out of 65 enrolled patients, 2 patients left against medical advice, 3 patients absconded and 3 were transferred to neurosurgery department so we could not follow these patients. Our outcome was based on remaining 57 patients.

Out of total 57 patients, 2 patients expired, one case was of acute viral encephalitis and other of acute infarct. Rest other 55 patients were discharged (84.6%). Chou YH & Wang PJ,[9,10] reported 21% mortality in their study of 57 patients with acute Hemiplegia.

Out of 55 discharged patients, 12 patients showed full recovery in the motor power (21%), 43 patients (75.4%) showed partial recovery and 2 patients (3.5%) did not show any improvement in power. There was significant improvement in power of patients at discharge in comparison to power at admission (p value <0.001). Similar pattern of recovery was shown in studies by C. Patra et al,[7] in their study on stroke.

In present study we tried to correlate the clinical presentation with the outcome of the patient. Hyperventilation at presentation was closely associated with the mortality difference between cases of infective and non-infective etiology, that difference was statistically significant. (p value <0.05)Hyperventilation as a poor prognostic presnting feature has not been studied yet but one literature onstrokehavereported prolonged illness following triggers such as hyperventilation.[11]

Pupil size abnormality at admission was also closely related to the mortality in patients, this correlation also came out to statistically significant. (p value< 0.05).Its relation with mortality has not been studied yet,but has been reported as initial presentation only.

We tried to correlate the clinical presentation with neuroimaging abnormality in our enrolled patients. We calculated odds ratio for each clinical presentation with neuroimaging abnormalities in our enrolled patients. Altered sensorium at presentation was found to be closely related to the findings suggestive of meningo encephalitis on neuroimaging.This correlation was statistically significant with odds ratio of 0.11. (p value<0.05).Similar presentation has been reported by previous literatures.[13]

Fever was related to the infarct and meningo encephalitis but this correlation was not statistically significant. Convulsions were also strongly related to the meningoenncephalits and this correlation was statistically significant. (p value <0.001).Similar findings were reported by few reports.[14,15]

Hypertonia and signs of raised ICP were related with meningo encephalitis but statistical significance could not be proven.Similar findings were reported by previous literature.[16]

Brisk DTR and extensor plantar response at presentation were related with the neuro imaging finding of menmingo-encephalitis and this correlation was also statistically significant. (p value<0.05).

CONCLUSION

Strengths of the study

1. This was a prospective observational study and consecutive children with hemiparesis were included in the study. Detailed history and clinical examination was conducted in all.
2. Most of our patients underwent neuroimaging to find out nature of lesion except few in which clinical condition did not allowed for it.
3. MRI and CT scans were read by one person trained in doing SO.

Weakness of the study

1. Study was conducted in tertiary care center which leads to selection bias as patient admitted

were very sick and patient would have received prior antibiotics.
2. Follow up period was limited up to discharge only. So, we could not comment on long term outcome and residual weakness.
3. Pupil size abnormality may be related with anticonvulsants, that could not be.

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