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A Prospective Study Evaluating the Clinical Profile of Pediatric Stroke in Western Rajasthan

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Abstract

Objective: To delineate the profile of pediatric patients with stroke in Western Rajasthan.

Methods: This was a hospital based prospective follow-up study carried out over a period of one year. In the study all admitted patients (6 m-18 years old) fulfilling the both clinical and radiological criteria (CT Scan/MRI) for stroke were enrolled (n=50). Epidemiological profile, clinical parameters and complications of these 50 patients were analyzed.

Results: 50 patients of stroke (as per case definition) were admitted in our institute over a period of one year out of which 64% were males (n= 32) and 36% were females(n=18) with a ratio of 1.78:1. 48% patients were in age group of 6 to 24 months (n=24); with a overall mean age of presentation of 52.8 ± 51.0 months. 74% (n=37) of the patients had Arterial Ischemic stroke (AIS); 8% (n=4) had Cerebral Sinus Venous Thrombosis (CSVT); 6% (n=3) had hemorrhagic stroke; 12% (n=6) had AIS coexisting with CSVT and hemorrhagic stroke. AIS was most commonly seen in age group of 6-24 months of age (45.95%); CSVT was most commonly seen among children of 60-120 months (50%); Combined type of stroke was seen only in patients between age group of 6-60 months. Anterior circulation was most common circulation involved in patients of stroke at all ages (63%), followed in frequency by combination of both anterior and posterior circulation (28.3%) and posterior circulation alone (8.7%). Involvement of both hemispheres of the brain together was slightly more common (36%) than either right side alone (34%) or left side alone (30%). Middle cerebral artery (MCA) territory stroke was the most common territory to be involved at all ages (45.6%). Isolated Posterior cerebral artery (PCA) & Internal carotid artery (ICA) territory stroke were more common (28.6%) in children >120 months. Involvement of more than one vessel territory was seen in children between 6-24 months (20.8%) and 24-60 months (44.4%) of age. Seizures were reported in 80% (n=40) of children amongst which 45% (n=18) had generalized seizures and 55% (n=22) had focal seizures. In patients with AIS, focal seizures were more common (54%) than generalized seizures. Patients who had CSVT type of stroke, only 50% patients had seizures. All hemorrhagic stroke patients presented with generalized seizure. Impairment of consciousness was seen in 50% of stroke patients. Consciousness was most commonly affected in patients of hemorrhagic stroke (100%). Co-morbid conditions were seen in 58% patients and Neurotuberculosis was the most common (22%) co-morbid condition associated with patients of stroke. Hemiparesis was the most common (66%) mode of presentation followed by facial palsy (26%). 26% (n=13) patients of stroke had no neurological deficit at the time of discharge and 36% (n=18) patients had mild to moderate neurological deficit, 30% (n=15) had severe deficit and 8% (n=4) patients expired.

Conclusion: Thus stroke in childhood is an important issue to be addressed as it is not uncommon as previously thought and is an important cause of morbidity and mortality. Despite excellent advances in clinical care and increasing availability of infrastructure, newer medicines and technology, the exact clinic-epidemiologic profile of both adult and pediatric stroke in Western Rajasthan is still not available. The current study has therefore been designed to evaluate the clinic-radiologic profile of pediatric stroke and to see whether stroke profile, mode of presentation and outcome of

Keywords: Stroke; Rajasthan; Ischemia

Introduction

Stroke is defined as the sudden occlusion or rupture of cerebral arteries or veins resulting in focal cerebral damage and clinical neurologic deficits [1]. This can be due to ischemia (lack of blood flow) caused by blockage (thrombosis, arterial embolism), or a hemorrhage (leakage of blood). Stroke is a medical emergency and can cause permanent neurological damage, complications, and death. Stroke represented 1.2% of the total deaths in the country when all ages were included. A prospective cohort study of 163 children who survived ischemic stroke demonstrated that >40% had persistent moderate to severe neurologic deficits [2]. In recent years, the case fatality rate has been estimated at 10% to 20% [3-6]. Stroke ranges among the top 10 causes of death in children [7]. Pediatric stroke is probably more common than once suspected. It has been reported in all racial and ethnic groups.

The reported annual incidence of cerebral infarction in children, all over the world, varies between 1.2 per 100,000 to 13 per 100,000 [8]. There is a paucity of population based published data describing

incidence or prevalence of pediatric stroke in India. In the hospital based studies from India, pediatric strokes have constituted less than 1% of all pediatric admissions [9]. Several risk factors have been consistently reported in large cohort studies of children with stroke. These include sickle cell disease, cardiac structural lesions, chronic systemic disease, cerebral arterial disease, coagulation disorders, head trauma, and sub acute varicella zoster infection [3,6,10-12].

- Classification of stroke

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Received July 03, 2014; Accepted November 01, 2014; Published November 03, 2014

Citation: Parakh M, Arora V, Khilery B (2014) A Prospective Study Evaluating the Clinical Profile of Pediatric Stroke in Western Rajasthan. J Neurol Disord 2: 187. doi:10.4172/2329-6895.1000187

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1. Arterial Ischemic stroke (AIS)
2. Cerebro Sinus Venous Thrombosis (CSVT)
3. Hemorrhagic stroke

Arterial Ischemic strokes are the most common type of pediatric stroke, seen in 85-90% of cases. In developing countries infections is one of the most common causes of childhood stroke [13-15]. A primary problem in pediatric stroke evaluation and management is delayed diagnosis which is due to the many mimics of childhood stroke and the variety of manifesting symptoms. The symptoms depend on the area of the brain affected. More extensive is the area of brain affected the more functions that are likely to be lost. Anterior circulation is most commonly involved [14,16,17] more so in the MCA territory [16,18,19]. Symptoms may include; hemiplegia (most common mode of presentation) [9,20-23] and muscle weakness of the face, numbness, reduction in sensory or vibratory sensation, initial flaccidity (hypotonicity), replaced by spasticity (hypertonicity), hyperreflexia, and obligatory synergies [24], cranial nerve deficits, aphasia etc.

Diagnosis is challenging and pathophysiology and risk factors are poorly understood. The acute onset of a focal neurologic deficit in a child is stroke until proven otherwise. So detailed neurological examination is the key to diagnosis. Neuroimaging investigations CT scans (most often without contrast enhancements) or MRI scans, Doppler ultrasound, and arteriography gives weight to the initial examination. MRI is more sensitive to diagnose ischemic and chronic hemorrhagic stroke.

Thus stroke in childhood is an important cause of morbidity and mortality. People are not aware of the widespread prevalence of stroke in pediatric age group in this part of hemisphere. So the study will give an insight in the various mode of presentation, existing co morbidities, outcome that can be expected depending upon severity of stroke. Moreover, frequent adverse neurologic outcomes suffered by most children who have strokes can be reduced by increasing pediatric physician awareness, facilitating early recognition, diagnosis, and specific treatment.

Aims and Objectives

To delineate the profile of pediatric patients with stroke admitted in our institute.

Materials and Methods

Inclusion criteria

All children aged 6 months to 18 years of age fulfilling the criteria of stroke were included in the study.

Exclusion criteria

Age of child is <6 months or >18 yrs.

In total 50 patients who were diagnosed with stroke were admitted in our institute over a period of 1 year. In all patients detailed clinic-epidemiologic information was collected including age, gender, religion, rural/ urban, detailed present and past history. A thorough systemic and detailed CNS examination was performed in all patients to delineate the neurologic abnormalities and evaluate for focal deficits. All the cases were evaluated radio logically by Computerized tomography scan (CT scan), Magnetic Resonance imaging (MRI) scan and Magnetic resonance angiography (MRA) or venography (MRV) of the cerebral vessels as feasible. All cases were followed up to study further course of disease including future stroke episodes, development

of neurologic sequel and other neurologic morbidity for one year.

Study design

This was a prospective follow up, single-centre study designed to study the clinic-radiological profile of paediatric stroke patients in Western Rajasthan.

Source of data

All children between age group of 6 m-18 years of age attending the Paediatric Department Umaid Hospital who were admitted and satisfying the inclusion criteria were evaluated clinically and necessary investigation were done. The present study was duration based study conducted over 1 year.

Statistical methods

Data was managed on Microsoft® Excel spreadsheet, all the entries were double checked and analysis was performed using SPSS version 16. The statistical analysis was performed by processing data manually. Data were presented as mean \pm SD or in percentage.

Results

50 children with stroke served as cases amongst which 32(64%) were males and 18 (36%) were females.

Maximum 24 (48%) cases were in the age group of 6-24 months (mean-13.5 \pm 6.19 months) followed by 11 (22%) cases in the age group of 24-60 months (mean 43.8 \pm 11.9 months), 8 (16%) in age group of 60-120 months (96 \pm 15.71 months), and 07 (14%) patients in the age group >120 months (mean-152 \pm 12.39 months) at the time of registration. Mean age of cases was 52.84 \pm 50.99 months (Table 1).

Arterial Ischemic stroke (AIS) was the most common type of stroke seen in 37 patients (74%) followed by Cerebral Sinus Venous Thrombosis (CSVT) in 4 patients (8%) and hemorrhagic stroke (H) in 3 patients (6%). AIS coexisting with CSVT and hemorrhagic stroke was seen in 6 patients (12%). Equal number of males and females had AIS and only males with CSVT presented in the current study. AIS in combination with CSVT and Hemorrhagic stroke was more common in females (22.2%) as compared to males (6.25%) (Table 2).

AIS was most commonly seen in children between 6-24 months of age (45.95%) followed by children between 24-60 months of age

Age at time of enrollment	Males N (%) Mean age \pm S.D	Females N (%) Mean age \pm S.D	Total N (%) Mean age \pm S.D
6-24 months	15 (46.9%) 12.7 \pm 5.97	09 (50%) 14.9 \pm 6.7	24 (48%) 13.5 \pm 6.2
24-60 months	07 (21.9%) 45.7 \pm 13.6	04 (22.2%) 40.5 \pm 9	11 (22%) 43.8 \pm 11.9
60-120 months	05 (15.6%) 100.8 \pm 18.2	03 (16.7%) 88 \pm 6.93	08 (16%) 96 \pm 15.71
>120 months	05 (15.6%) 151.2 \pm 13.68	02 (11.1%) 156 \pm 0	07 (14%) 152 \pm 12.39

Table 1: Gender and age distribution of cases.

	Male (n=32) n, %	Female (n=18) n, %	Total (n=50) n, %
AIS	24 (75%)	13 (72.22%)	37 (74%)
CSVT	04 (12.5%)	00 (0%)	04 (8%)
Hemorrhagic	02 (6.25%)	01(5.56%)	03 (6%)
Others	02 (6.25%)	04 (22.2%)	06 (12%)

Table 2: Type of stroke and gender distribution.

Age of patient (in months)	AIS n=37 (n%)	CSVT n=4 (n%)	H n=3 (n%)	Others n=6 (n%)
6-24	17 (45.95%)	01 (25%)	01 (33.33%)	05 (83.3%)
24-60	09 (24.32%)	01 (25%)	00 (0%)	01 (16.7%)
60-120	05 (13.51%)	02 (50%)	01 (33.33%)	00
>120	06 (16.21%)	00 (0%)	01 (33.33%)	00
Mean Age \pm S.D	55.21 \pm 54.61	72 \pm 37.9	97 \pm 73.3	19.3 \pm 16

Table 3: Age distribution of cases with stroke.

Type of circulation	6-24 M N=23	24-60M N=10	60-120M N=06	120-216M N=07	Total (n=46) n, %
Anterior circulation	17 (73.9%)	05 (50%)	03 (50%)	04 (57.1%)	29 (63%)
Posterior circulation	01 (4.35%)	00	01 (16.67%)	02 (28.6%)	04 (8.7%)
Both anterior and posterior	05 (21.7%)	05 (50%)	02 (33.3%)	01 (14.3%)	13 (28.3%)

Table 4: Distribution of cases according to the circulation involved.

Hemisphere of brain involved	6-24 M n=24	24-60M n=11	60-120M n=08	120-216M n=07	Total (n=50) n, %
Right hemisphere	06 (25%)	05 (45.4%)	04 (50%)	02 (28.6%)	17 (34%)
Left hemisphere	08 (33.3%)	03 (27.3%)	02 (25%)	02 (28.6%)	15 (30%)
Both hemispheres	10 (41.7%)	03 (27.3%)	02 (25%)	03 (42.8%)	18 (36%)

Table 5: Hemispheric involvement of cases.

(24.32%), children >120 months (16.21%) and children 60-120 months old (13.51%) (Table 3).

Anterior circulation includes Internal carotid artery and its branches and Posterior circulation includes Vertebral arteries and its branches. Anterior circulation was the most common territory involved at all ages in 29 patients (63%). However, its involvement was most commonly seen in children between 6-24 months of age. Both anterior and posterior circulation was involved in 13 patients (28.3%) and was most commonly seen in children 24-60 months. Only posterior circulation was seen in 4 (8.7%) patients and was most commonly present in patients between 120-216 months (Table 4).

Stroke involving both hemispheres of the brain was slightly more common in present study affecting 18 (36%) patients followed by right side of brain in 17 (34%) patients and left side of brain in 15 (30%) patients. Both hemisphere involvement was seen more commonly in children between 6-24 months of age (41.7%) (Table 5).

Middle cerebral artery (MCA) was the most common territory involved at all ages (45.6%) followed by ICA (19.6%), MCA+ PCA (13%), ACA+MCA+PCA (10.9%), and PCA alone (8.7%). Posterior cerebral artery (PCA) and Internal carotid artery (ICA) territory stroke were more common (28.6%) in children >120 month. Involvement of more than one vessel territory was seen more commonly in children between 6-24 months (20.8%) and 24-60 months (44.4%) of age (Table 6).

Seizures were present in 80% of children. In children having seizures 45% had generalized seizures and 55% had focal seizures. In patients with AIS, focal type of seizures (54%) was most common. However in patients with AIS 19% had no seizures. In patients who had CSVT, 50% did not have seizures. In hemorrhagic stroke all the patients had generalized seizure (Table 7).

50% patients of all forms of stroke presented with impaired level of consciousness. 56.8% of patients with AIS presented with normal sensorium. In hemorrhagic stroke all had impaired level of consciousness. In CSVT 75% of the patients had a normal level of consciousness. In patients having combined stroke, impaired conscious

level was seen in 83.3% patients (Table 7).

Co-morbid conditions were seen in 58% patients and Neurotuberculosis was the most common (22%) co-morbid condition seen in patients with stroke. Other co-morbid conditions seen included Viral Encephalitis in (8%), Moya-Moya (4%), Homocystinemia (6%), Malaria 1 (2%), Dilated Cardiomyopathy, (2%), Acyanotic congenital heart diseases (4%), Mastoid sinusitis (4%), Hodgkin lymphoma (2%), Nutritional tremor syndrome (2%) and HIV 1 (2%) (Table 8).

Territory Involved	6-24 months N=24	24-60 Months N=9	60-120 months N=6	>120 months N=7	Total N=46
MCA	13 (54.2%)	03 (33.3%)	03 (50%)	02 (28.6%)	21 (45.6%)
PCA	01 (4.2%)	00	01 (16.7%)	02 (28.6%)	04 (8.7%)
ICA	05 (20.8%)	02 (22.2%)	00	02 (28.6%)	09 (19.6%)
MCA+PCA	03 (12.5%)	00	02 (33.3%)	01 (14.3%)	06 (13%)
ACA+PCA	00	01 (11.1%)	00	00	01 (2.2%)
ACA+MCA+PCA	02 (8.3%)	03 (33.3%)	00	00	05 (10.9%)

Table 6: Vascular territory involved in patients with AIS.

	AIS N=37	CSVT N=4	H N=3	Others N=6	Total N=50
Type of seizures					
Generalized	10 (27%)	01 (25%)	03 (100%)	04 (66.7%)	18 (36%)
Focal	20 (54%)	01 (25%)	00	01 (16.7%)	22 (44%)
No seizures	07 (19%)	02 (50%)	00	01 (16.7%)	10 (20%)
Level of consciousness					
Impaired	16 (43.2%)	01 (25%)	03 (100%)	05 (83.3%)	25 (50%)
Conscious	21 (56.8%)	03 (75%)	00	01 (16.7%)	25 (50%)

Table 7: Seizure pattern and level of consciousness in patients having stroke.

Condition	Total (n=50) n, %
Neurotuberculosis (Tubercular Meningo-encephalitis)	11 (22%)
Encephalitis	04 (8%)
Moya moya disease	02 (4%)
Homocystinuria	03 (6%)
Malaria	01 (2%)
Dilated Cardiomyopathy	01 (2%)
Congenital heart disease (Tetralogy of Fallot, Atrial Septal defect)	02 (4%)
Mastoid sinusitis	02 (4%)
Hodgkin lymphoma	01 (2%)
NTS	01 (2%)
HIV	01 (2%)

Table 8: Co-morbid conditions in patients with stroke.

Condition	Total (n=50) n (%)
Hemiparesis	33 (66%)
Quadriparesis	12 (24%)
Monoparesis	03 (6%)
Ataxia	02 (4%)
Facial palsy	13 (26%)
Aphasia	06 (12%)
Meningismus	02 (4%)
Dystonia and other abnormal movements	02 (4%)
Slurring of speech	02 (4%)
Cerebellar signs	01 (2%)
Decerebrate posturing	07 (14%)
Pseudobulbar Palsy	02 (4%)
Visual impairment	01 (2%)
Cranial nerve palsies	01 (2%)

Table 9: Neurological deficits seen in patients with stroke.

Outcome	Total (n=50) n, %
No neurological Deficit	13 (26%)
Mild-Moderate Deficit	18 (36%)
Severe Deficit	15 (30%)
Expired	04 (8%)

Table 10: Neurological outcome of stroke patients.

Outcome	AIS	CSV	H	Others
No neurological Deficit	09 (24%)	02 (50%)	01(33%)	01 (17%)
Mild-Moderate Deficit	15(41%)	01 (25%)	00	02 (33%)
Severe Deficit	09 (24%)	01 (25%)	02 (67%)	03 (50%)
Expired	04 (11%)	00	00	00
Total	37 (100%)	04 (100%)	03 (100%)	06 (100%)

Table 11: Neurological outcome in different types of stroke.

Hemiparesis was the most common (66%) presentation followed by facial palsy (26%) (Table 9).

Overall 26% (n=13) patients of stroke had no neurological deficit at the time of discharge and 36% (n=18) patients had mild to moderate neurological deficit, 30% (n=15) had severe deficit and 8% (n=4) patients expired (Table 10).

41% of patients with AIS had mild-moderate neurological deficit, 24% had severe deficit at the time of discharge and 11% of patients of AIS expired.

Amongst the patients with CSV 50% had no deficit and 25% had mil-moderate and 25% had severe deficit at the time of discharge. None of the patient of CSV stroke expired.

Patients with hemorrhagic stroke 33% had no deficit and 67% had severe deficit at the time of discharge (Table 11).

Patients with mixed type of stroke 33% had mild moderate deficit and 50% had severe deficit at the time of discharge.

Conclusion

The current study has provided valuable information into stroke clinic-radiologic profile. In the developing world scenario, neurotuberculosis is an important co-morbidity seen with pediatric stroke. This study further strengthens the observation that AIS is the most common type of stroke in children at all ages, followed by CSV and hemorrhagic variety. Anterior circulation is the most common circulation involved, MCA is the most common territory involved. Thereby presentation of stroke more or less is same in different parts of the world. Survivors have high morbidity and moderate to severe neurologic deficits are common.

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