

Childhood Stroke: A Cross-sectional Study in a Tertiary Level Hospital of Bangladesh

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ABSTRACT

Background & objective: The present study was undertaken to find the prevalence and pattern of childhood stroke and to see its clinical presentation and sub-types.

Materials & Methods: The present cross sectional study was conducted in the Department of Pediatrics, BSMMU, Dhaka over a period of 6 months. A total of 30 children suffering from childhood stroke, provisionally diagnosed on the basis of clinical criteria and confirmed by neuroimaging were the study population. The demographic variables were age, sex, age at onset and age at case taking. The signs and symptoms at presentation, causes, investigations, neuro-imaging findings and final diagnosis were recorded.

Result: Over half (53.4%) of the patients were in the range of 13 – 36 months with mean age of the patients being 39.1 ± 8.2 months. The mean age at onset was 36.2 ± 8.3 months. About 47% of patients were male and 53% female. Paresis of limb was invariably present, unconsciousness at onset (50%), convulsion (33.3%), aphasia (26.7%), raised blood pressure (23.3%), vomiting (13.3%), visual defect (8.7%) and headache (6.7%). Arterial occlusion was the main cause of childhood stroke (36.7%) followed by hypertensive encephalopathy (10%), migraine, hematological disease, cardiomyopathies (each 6.7%). Investigations revealed that over one-third (36.7%) of the patients had leucocytosis and 13.3% abnormal echocardiography. All the children either exhibited ischemia or infarction or hemorrhage on Computed Tomography (CT) and 86.7% on Magnetic Resonance Imaging (MRI). Seventy percent and 36.7% of patients had MRA and MRV abnormality respectively. About 47% of the patients had acute ischemic stroke, 13.3% AIS with left-sided haemiparesis with facial palsy and another 13.3% AIS with right-sided haemiparesia. Acute haemorrhagic stroke (AHS), acute stroke with Hb beta-thalassaemia, acute stroke with right-sided haemiparesis with cardiomyopathy and recurrent haemorrhagic stroke were rare.

Conclusion: The study concluded that childhood stroke occurs most frequently between one to three years of age and equally affects male and female. Paresis of limb and unconsciousness at the onset were the main presenting features and arterial hypertension and hypertensive encephalopathy were the common cause of childhood stroke. Nearly three-quarters of the children present with ischemic stroke and the rest with haemorrhagic stroke.

Key words: Pattern, presentation and sub-types of childhood stroke etc.

INTRODUCTION

Childhood stroke is emerging as a serious and frequent disorder.¹ It is one of the top ten causes of childhood death with high risk of serious morbidity for the survivors in the developed countries.² A retro-prospective (retrospective

from 2003-1995 and a prospective study from 2004-2006) of childhood stroke (arterial ischemic, hemorrhagic, and sinovenous thrombosis) and transient ischemic attack conducted in Estonia demonstrated an incidence of childhood stroke to be 2.73/100,000 person-years for children aged

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30 days to 18 years: 1.61/100,000 for arterial ischemic stroke, 0.87/100,000 for hemorrhagic stroke, 0.25/100,000 for sinovenous thrombosis, and 0.37/100,000 for transient ischemic attack. No arterial ischemic stroke patients died within 30 days, but case-fatality for intracerebral hemorrhage was 46%. Focal signs occurred in 100% of arterial ischemic strokes and 64% of intracerebral hemorrhage cases.³

Research studies reported that in one-third of the cases, even in the best diagnostic centres, the causes of acute stroke remains obscured.⁴ However, occlusive vascular disease (ischemic stroke) comprises 55% and intracranial haemorrhage 45%.⁵ Of the ischemic strokes, congenital cyanotic heart disease may cause cerebrovascular thrombosis before 2 years of age. Acquired heart diseases that may be implicated with ischemic stroke are rheumatic heart disease, endocarditis, cardiomyopathies, arrhythmia and cardiac interventions are commonly reported. Of the vascular problems, infections, migraine, hypertensive encephalopathy and MoyaMoya diseases are more often associated with ischemic stroke.⁶ Haematologic and hypercoagulable states like sickle-cell anemia, polycythemia, thrombosis, leukemia and sickle cell anemia usually associated ischemic stroke. For arterial ischemic stroke, the most common underlying conditions are sickle cell disease (SCD) and congenital or acquired heart disease. The incidence of stroke in sickle cell anemia is as high as 300 per 100000 sickle-cell anemia cases below 15 years of age. Heart disease and chronic anemia (including SCD and β -thalassemia) also are risk factors for cerebral venous sinus thrombosis (CVST). Head trauma appears to be a trigger for arterial stroke and dehydration for venous stroke, whereas infections, including varicella, meningitis, tonsillitis, and otitis media, anemia, leukocytosis, and prothrombotic disorders are probably risk factors for both. It is increasingly evident that many children have multiple risk factors that together determine the risk of stroke or stroke recurrence.⁵ Sinovenous occlusion is suspected if focal deficit, raised intracranial pressure and seizures occur in the setting of chronic sinusitis, otitis or orbital

cellulites, haemoglobinopathies, congestive heart failure etc. Etiologies of haemorrhagic stroke include arterio-venous malformations, aneurysm, arterial hypertension, arteriopathies, cerebral venous occlusive disease & intracranial tumours, trauma and cerebral and systemic infections.⁷

In recent years clinical, basic and population-based studies have resulted in an increased awareness of the frequencies and features of stroke syndromes in children. Advances in neuroimaging and other laboratory testing approaches have resulted in an increased detection of stroke subtypes. A study to find the pattern of clinical presentation of childhood stroke and its subtypes will be useful in clinical decision making about its management and assessing prognosis. The present study was, therefore, undertaken to find the prevalence and pattern of childhood stroke and to see its clinical presentation sub-types.

MATERIALS & METHODS:

This cross-sectional study was conducted in the Department of Pediatrics, Bangabandhu Sheikh Mujib Medical University (BSMMU), Dhaka Bangladesh over a period of 6 months. Children suffering from stroke, provisionally diagnosed on the basis of clinical criteria and confirmed by neuroimaging were the study population. All children of stroke irrespective of sexes were included in the study. However, parents of children refusing to give consent were excluded. A total of 30 children were consecutively included in the study. Prior permission was taken for this study from the Institutional Review Board (IRB) of BSMMU, Dhaka and informed consent was taken from the parents to allow their children to participate in the study.

Data were collected using a structured questionnaire (research instrument) containing all the variables of interest. The demographic variables were age, sex, age at onset and age at case taking. The signs and symptoms at presentation, causes, investigations, neuroimaging findings and final diagnosis were recorded. Data were collected by interview of the children's

parents, clinical examination and laboratory investigations of the children and were processed and analysed using software SPSS (Statistical Package for Social Sciences) version 11.5. The test statistics used to analyse the data were descriptive statistics.

RESULTS:

Over half (53.4%) of the patients were in the range of 13 – 36 months with mean age of the patients being 39.1 ± 8.2 months. The mean age at onset was 36.2 ± 8.3 years. About 47% of patients were male and 53% female (Table I). All of the patients exhibited paresis of limb, followed by unconsciousness at onset (50%), convulsion (33.3%), aphasia (26.7%), raised blood pressure (23.3%), vomiting (13.3%), visual defect (8.7%) and headache (6.7%) (Table II). Arterial occlusion was the main cause of childhood stroke (36.7%) followed by migraine (6.7%), hematological disease (6.7%), hypertensive encephalopathy (10%), cardiomyopathies (6.7%), other cardiac disease (6.7%), arterial hypertension (10%) and others (13.3%) (Table III).

Investigation findings show that over one-third (36.7%) of the patients had leucocytosis and 13.3% abnormal echocardiography. Raised ESR, thrombocytosis, thrombocytopenia, microbocytopenia, protein C deficiency, protein S deficiency, raised TSH and abnormal X-ray chest were present in very few patients (each 6.7%) (Table IV). All the children exhibited ischemia or infarction or hemorrhage on Computed Tomography (CT) and 86.7% on Magnetic Resonance Imaging (MRI). Seventy percent and 36.7% of patients had MRA and MRV abnormality respectively (Table V). About 47% of the patients were diagnosed as having acute ischemic stroke (AIS), 13.3% AIS with left-sided haemiparesis with facial palsy and another 13.3% AIS with right-sided haemiparesis. Acute haemorrhagic stroke (AHS), acute stroke with Hb beta- thalassaemia, acute stroke with right-sided haemiparesis with cardiomyopathy and recurrent haemorrhagic stroke each comprised 6.7% of the cases (Table VI).

TABLE I: Distribution of patients by demographic characteristics (n = 30)

Demographic characteristics	Frequency	Mean \pm SD
Age (months)		
< 6	2(6.7)	39.1 ± 8.2
7 – 12	4(13.3)	
13 – 36	16(53.4)	
37 – 60	4(13.3)	
> 60	4(13.3)	
Age at onset (months)	----	36.2 ± 8.3
Sex		
Male	14(46.7)	----
Female	16(53.3)	----

TABLE II: Distribution of patients by signs & symptoms (n = 30)

Signs & symptoms	Frequency	Percentage
Paresis of limb	30	100.0
Unconscious at onset	15	50.0
Convulsion	10	33.3
Aphasia	08	26.7
Blood pressure (raised)	07	23.3
Vomiting	04	13.3
Visual defect	02	8.7
Headache	02	6.7

TABLE III: Distribution of patients by causes (n = 30)

Causes	Frequency	Percentage
Migraine	02	6.7
Hematological disease	02	6.7
Hypertensive encephalopathy	03	10.0
Cardiomyopathies	02	6.7
Other cardiac disease	02	6.7
Arterial hypertension	03	10.0
Arterial occlusion/narrowing	11	36.7
Others	04	13.3

TABLE IV: Distribution of patients by investigations (n = 30)

Investigations	Frequency	Percentage
ESR raised	02	6.7
Leucocytosis	11	36.7
Thrombocytosis	02	6.7
Thrombocytopenia	02	6.7
Microbocytopenia	02	6.7
Protein C deficiency	02	6.7
Protein S deficiency	02	6.7
Raised TSH	02	6.7
Abnormal X-ray chest	02	6.7
Abnormal echocardiography	04	13.3

TABLE V: Distribution of patients by neuro-imaging findings (n = 30)

Neuro imaging findings	Frequency	Percentage
CT – Ischemia/Infarction/Hemorrhage	30	100.0
MRI-Ischemia/Infarction/Hemorrhage	26	86.7
MRA abnormality	21	70.0
MRS abnormality	11	36.7

TABLE VI: Distribution of patients by final diagnosis/Site of lesion (n = 30)

Final diagnosis/Site of lesion	Frequency	Percentage
Acute ischemic stroke (AIS)	14	46.7
AIS with left sided haemiparesis with facial palsy	04	13.3
AIS with right-sided haemiparesis	04	13.3
Acute haemorrhagic stroke (AHS)	02	6.7
Acute stroke with right-sided haemiparesis with cardiomyopathy	02	6.7
Acute stroke with Hb beta thalassaemia	02	6.7
Recurrent haemorrhagic stroke	02	6.7

DISCUSSION:

Stroke has been increasingly recognized in children in recent years, but diagnosis and management can be difficult because of the diversity of underlying risk factors and the absence of a uniform diagnostic approach. Children and adolescents with stroke have remarkable differences in presentation compared with older patients. Stroke type also varies according to age. Keeping this information in mind, this cross-sectional study was conducted to focus on the prevalence and pattern of childhood stroke attended in a tertiary hospital.

In our study, mean age of the patients at presentation and at onset were 39.1 and 36.2 months respectively. Male female ratio was roughly 1:1. Paresis of limb was invariably present, followed by unconscious (50%), convulsion (33%), aphasia (26.7%), raised blood pressure (23.3%), vomiting (13.3%), visual defect (8.7%) and headache (6.7%). Arterial occlusion and narrowing was the main cause of childhood stroke (36.7%). Second leading causes

were hypertensive encephalopathy (10%) and arterial hypertension (10%). The least common causes were migraine (6.7%), hematological disease (6.7%), cardiomyopathies (6.7%), other cardiac and other diseases (20%). On Computed Tomography (CT) of brain all the children either exhibited ischemia or infarction or hemorrhage, while on Magnetic Resonance Imaging (MRI), 86.7% were diagnosed as having ischemia or infarction or hemorrhage. Seventy percent and 36.7% of patients had MRA and MRV abnormality respectively. About 47% of the patients were diagnosed as having AIS, 13.3% AIS with left-sided haemiparesis with facial palsy and another 13.3% AIS with right-sided haemiparesis. Acute haemorrhagic stroke (AHS), acute stroke with Hb beta-thalassaemia, acute stroke with right-sided haemiparesis with cardiomyopathy and recurrent haemorrhagic stroke were rare. Thus, it is evident from the data that over 70% of the stroke in children are ischemic and the rest are haemorrhagic which is quite consistent with Ganesan et al.⁵ study. In children, 55% of strokes are ischemic, and the remainder is hemorrhagic Hemiplegia, headache, seizure or altered levels of consciousness may all herald a potentially reversible or lethal medical or surgical stroke emergency. In addition to the underlying diagnosis, the time from onset of symptoms to presentation is very useful diagnostically, for example arterial occlusion or narrowing is more likely to present with a stuttering onset,⁸ suggesting the need for imaging to exclude dissection, while “thunderclap” headaches may be indicative of a subarachnoid haemorrhage warranting lumbar puncture even if neuroimaging is normal. Stroke may be benign and require no treatment, but in some cases timely intervention prevents neurological disability or death. Emergency MRI provides information that can guide management in individual children.^{9,10}

Lynch & Han¹¹ in an attempt to focus on the mechanism of stroke established the pathophysiologic process in 78% of the children with stroke. Arteriopathic stroke (31 patients, or 53%) was the most common. The arteriopathies

were either progressive (Moya in 7% patients) or non-progressive (46% patients). The latter form occurred in two patterns: dissection of cervicocephalic arteries (20%) and transient cerebral arteriopathy of unknown origin but probably angiitis (25%). Cardiac or transcatheter embolic stroke occurred in 12% of the series and systemic diseases in 14%. There was a favorable outcome in 70% of patients having stroke due to nonprogressive arterial disease and stroke due to unidentified mechanisms. In contrast, only 26% of patients with embolic stroke, systemic disease, or MoyaMoya had a favorable outcome. Recurrences were more frequent and severe in the latter group. It is therefore, important to determine the mechanism of childhood stroke, because it strongly influences outcome, the recurrence risk, and treatment choice.

Furthermore, deVeber¹² reported almost 58% of their older subjects were in patients at the time of their AIS, and almost 69% had known cardiac risk factors for stroke. This is important because cardiac disease is the most common, previously recognized risk factor. Gabiset al.¹³ demonstrated a large prehospital delay (mean time: 28.5 hours) contributing to the overall delay in stroke diagnosis (mean time: 35.7 hours). One half of the physicians documented a differential diagnosis, and even fewer included stroke in the list of possibilities. In another study, McGlennan & Ganesan¹⁴ demonstrated cranial ultrasonography and CT scanning are not as sensitive as MRI of the brain when used as the initial imaging modality to diagnose AIS.

CONCLUSION:

The study concluded that childhood stroke occurs most frequently between one to three years of age and equally affects male and female. Paresis of limb and unconsciousness at the onset were the predominant clinical features and arterial hypertension and hypertensive encephalopathy were the common cause of childhood stroke. Nearly three-quarters of the children present with ischemic stroke and the rest with haemorrhagic stroke.

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