

Predisposing Factors and Outcome of Stroke in Childhood

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This prospective study was done to determine the predisposing factors and outcome of stroke in Bangladeshi children. It was carried out in Khulna Medical College Hospital from July 2002 to June 2007. Admitted children with acute neurological deficit attributable to a vascular cause were included in the study. Forty two children were finally diagnosed with stroke; 73.8% were male. Apart from paresis/paralysis in 35 (83.3%) cases, headache/vomiting/convulsion was the presenting problem in 28 (66.7%) cases at the onset. Infection in 17 (40.5%) children and trauma in 11 (26.2%) were the important predisposing factors. CT scan revealed ischemia and hemorrhage in 18 (42.8%) and 8 (19.1%) cases, respectively. Twenty two (52.4%) of the children recovered fully and 3 (7.2%) expired.

Keywords: Bangladesh, Hemorrhage, Ischemia, Outcome, Stroke.

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A focal neurological deficit due to cerebrovascular disorder, lasting more than 24 hours is defined as a stroke(1). The reported incidence of childhood stroke (28 days to 18 years of life) is 2.6-3.1 per 100,000 children per year(2). More than half of the stroke is ischemic in origin. Acute and chronic infection appears to be an important trigger for stroke in children and young adults(3). Deterioration in the level of consciousness is common in cerebral hemorrhage(4). MRI is therefore the preliminary investigation of choice but when this is not available, CT to exclude hemorrhage is mandatory(5). The disease is frequently misdiagnosed and managed improperly. In Bangladesh, pediatricians are facing a number of acute neurological deficits in hospital but no study on childhood stroke has been done till now. Therefore, this study was undertaken to determine the predisposing factors and outcome of stroke in Bangladeshi children.

METHODS

This study was carried out for five years in Khulna Medical College Hospital from July 2002 to June 2007. Children admitted in pediatric ward with acute

neurological deficit were primarily enrolled in this study. Stroke was defined as acute neurological syndrome referable to a cerebral arterial territory. Mimicking disorders like migraine, meningoencephalitis, epilepsy and intracranial space occupying lesion were excluded by clinical judgment and investigations(6). Clinically diagnosed cases were included when exclusion was not possible even after full investigation.

A standardized data collection instrument was developed to record the history, gender, age at onset, pre-existing risk factors, nature of neurological event, physical examination finding, results of neuro-imaging, other diagnostic studies, treatment and out-come of the disease. CT scan was done in all sub-jects. Other investigations such as CSF study, blood film, serum urea, glucose, albumin, lipid profile, prothrombin time, electrolytes, ECG, echocardiogram and EEG were done to find out the underlying cause, depending on the merit of individual cases.

Patients with ischemic stroke (IS) were managed with low dose aspirin and neurotropic vitamins. A patient diagnosed as hemorrhagic stroke (HS) was

referred to neurosurgery department. Outcome of the disease was graded on recovery of neurological function at discharge from hospital.

RESULTS

Among the 42 stroke patients, 31(73.8%) were male. Twenty two (52.4%) of the patients belonged to early childhood (<5 yrs) period. Mean age of the children was 4.8±3.7 years. Thirty five (83.3%) of them had objective signs such as paresis/paralysis of one or more limb. Presentation with subjective complaints such as headache/vomiting/convulsion was found in 28 (66.7%) patients. Four patients presented with unconsciousness. Other neurologic sign such as aphasia, ataxia or visual defect was found in 15 (35.7%) patients.

Predisposing factors in relation to nature of stroke shown in **Table I**. Four (9.5%) children with systemic diseases included tetralogy of Fallot, severe protein energy malnutrition, nephrotic syndrome and myocarditis. CT scan findings and its relation with outcome is summarized in **Table II**. Seventeen patients left the hospital with residual neurological lesion such as paresis or paralysis.

DISCUSSION

In the present study, ischemic stroke (IS) mainly presented with headache, vomiting and convulsion, and hemorrhagic stroke (HS) presented with altered consciousness and nuchal rigidity. Exact cause could not be identified but history of infection and head injury was found in 17(40.5%) and 11(26.2%) cases, mostly in relation to ischemic and hemorrhagic stroke, respectively. Dehydration and cyanotic heart

disease were found as important risk factors. CT scan of brain in the present series revealed the lesion in brain in the majority of cases but no abnormality was detected in 30.9% cases. Undetermined cases were included, as it is believed that 10-20% of children with apparent focal ischemic event will not have evidence of vascular disease even with full investigation(1). Mortality was low (7.2%) but neurological sequelae remained in a large number (40.5%) of cases.

The mean age of the studied cases is similar to a previous study(7) but the male female ratio (2.8:1) outweighs their observation (1.5:1).The presenting feature in this study is in conformity with Baumer’s report(8). Association of IS with systemic disease such as cardiac disease and dehydration corroborates with other reports(9,10). Similar to our findings, tonsillitis, dental infection and minor head trauma has also been blamed as precipitating factor by other investigators(11,12). These factors can precipitate IS by disruption of blood flow subsequent to thrombo-embolism and arterial spasm(12). The percentage of negative CT scan in this series is much higher than previously reported (12%) (7). The proportion of IS to HS is little higher than an American study(3) where IS (7.8/100,000) is nearly three times more common than HS (2.9/100,000). Prognosis of HS was worse than IS which is in conformity with other studies(13,14). Data from Canadian pediatric stroke registry on ischemic stroke revealed that 12% were dead by the outcome evaluation period(15). However, the mortality figure was shown to be much higher (18%) by Chung, *et al.*(7).

The primary limitation of this study was the lack of MRI, which is more sensitive than CT scan and could be helpful for diagnosing undetermined cases.

TABLE I PREDISPOSING FACTORS FOR STROKE

Factors	Ischemic stroke	Hemorrhagic stroke	Undetermined stroke	No. (%)
Infection	11	1	5	17 (40.5)
Head injury	2	5	4	11 (26.2)
Dehydration	1	0	1	2 (4.8)
Systemic diseases	2	1	1	4 (9.5)
None	5	1	2	8 (19.0)
Total	21	8	13	42 (100)

TABLE II OUTCOME IN RELATION TO CT SCAN FINDINGS

CT scan findings	Full recovery	Partial recovery	Death	Total (%)
Ischemia	10	7	1	18 (42.8)
Hemorrhage	3	3	2	8 (19.1)
Infarction	2	1	0	3 (7.2)
Normal	7	6	0	13 (30.9)
Total (%)	22 (52.4)	17 (40.4)	3 (7.2)	42 (100)

WHAT THIS STUDY ADDS?

- Infections and trauma are the main risk factors for stroke in Bangladeshi children.

Further investigations like angiogram and screening for prothrombotic disorders (protein S deficiency, raised homocysteine) could not be done to determine the underlying cause. The study is further limited by lack of follow up of partially recovered cases for a prolonged period.

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REFERENCES

1. Kirkham FJ. Stroke in childhood. *Arch Dis Child* 1999; 81: 85-89.
2. Broadman JP, Ganesan V, Rutherford MA, Saunders DE, Mercuri E, Cowan F. Magnetic resonance image correlates of hemiparesis after neonatal and childhood middle cerebral artery stroke. *Pediatrics* 2005; 115: 321-326.
3. Lynch JK, Hirtz DJ, DeVeber G, Nelson K. Report of the National Institute of Neurological Disorder and Stroke Workshop on Perinatal and Childhood Stroke. *Pediatrics* 2002; 109: 116-123.
4. Rosman NP, Wu JK, Caplan LR. Cerebellar infarction in the young. *Stroke* 1992; 23: 763-766.
5. Patrono C, Roth GJ. Aspirin in ischemic cardiovascular disease. How strong is the case for different dosing regimen? *Stroke* 1996; 27: 756-760.
6. Shellhaas RA, Smith SE, Tool EO, Licht DJ, Rebecca N. Mimics of childhood stroke: characteristics of a prospective cohort. *Pediatrics* 2006; 118: 704-709.
7. Chung B, Wong V. Pediatric stroke among Hong Kong Chinese subjects. *Pediatrics* 2004; 114: e 206-212.
8. Baumer JH. Childhood arterial stroke. *Arch Dis Child Ed Prac Ed* 2004; 89: 50-53.
9. deVeber G, Andrew M. Cerebral sinovenous thrombosis in children. *N Eng J Med* 2001; 345: 417-423.
10. Fults D, Kelly DLJ. Natural history of arteriovenous malformation of brain - a clinical study. *Neurosurgery* 1984; 15: 658-662.
11. Grace AJ, Buggle F, Becher H. Recent bacterial and viral infection as a risk factor for cerebrovascular ischemia. *Neurology* 1998; 50: 196-203.
12. Shaffer L, Rid PM, Fold KRE, Ganesan V. Can mild head injury cause ischemic stroke? *Arch Dis Child* 2003; 88: 267-269.
13. Rosenbloom L. Management of stroke in childhood. *BMJ* 2005; 333: 1161-1162.
14. Lauthier S, Carmant L, David M, Larbrisseau A, deVeber G. Stroke in children-the co-existence of multiple risk factors predict poor outcome. *Neurology* 2000; 54: 371-378.
15. Chabrier S, Hussan B, Lasjaunias P, Tardieu M. Stroke in childhood - outcome and recurrence risk by mechanism in 59 patients. *J Child Neurol* 2000; 15: 290-294.