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Clinical Profile and Short-term Outcomes of Childhood Stroke in a Tertiary Care Hospital in Bangladesh

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Abstract

Child development is a particularly exact and important issue of modern pedagogical and pediatric science. Its consideration in the modern dynamic environment is of priority importance. Science is constantly working to build new semantic cycles and their accurate improvement, considering the predisposition of the environment and the new requirements of society. The biological characteristics of children are an integral part of the formation of their self-image and their overall personality. The approach to them is extremely careful and open, tailored to the delicate child's soul. Social perception occurs in the form of social communication, perception, understanding, provoking appropriate behavior. Personal interaction is provided and predetermines specific characterological traits. This report is theoretically conditioned and empirically oriented. It reflects only the point of view and the author's view of the researched issue.

Keywords: Childhood Stroke; Etiology; Neuroimaging; Treatment.

Introduction

Childhood stroke is a relatively rare in adults but critical medical condition that can have severe and lasting consequences on a child's health and quality of life. While stroke predominantly affects adults, it can also occur in pediatric populations, leading to unique challenges in diagnosis, treatment, and long-term management [1]. The stroke prevalence, mortality, and disability-adjusted life years in children and youth aged 0–19 years, data from the Global and Regional Burden of Stroke 2013 revealed that stroke poses a substantial health burden in this age group, with a prominent prevalence rate. The prevalence of stroke in this group in the developing and developed countries were found 2.75 and 14.1 respectively per 100,000 children each year, making it one of the top ten causes of death among children, conversely, the total number of fatalities for stroke across all age categories among under 19 years in underdeveloped countries was approximately over 38 times greater than in rich countries [2]. Most initial strokes occurred within the first 6 years of life (67%), with hemiparesis being the most common presentation (58.3%). Cardiac evaluations, coagulopathy profiles, and genetic analyses were conducted for many patients. Known etiologies for stroke were identified in 58.3% of cases, with metabolic disorders such as MELAS and homocystinuria being the most common [3].

The clinical presentation of childhood stroke can be subtle and nonspecific, often resembling other neurological disorders. Early neuroimaging may even reveal normal findings, further complicating the diagnosis [4]. The most

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common presentation of arterial ischemic stroke (AIS) in children is hemiparesis, with infarcts in the middle cerebral artery territory being the most frequent [5]. Younger children are more likely to present with encephalopathy and a decreased level of consciousness, although a focal neurological deficit is usually present upon detailed examination. Motor deficits are typically most pronounced at presentation [6]. Given the challenges in diagnosing childhood stroke, it is crucial to differentiate it from other conditions that can cause acute hemiparesis in children. Since seizures and headaches commonly accompany childhood stroke, as well as cerebral sinovenous thrombosis, an initial non-contrast CT head scan may not be sufficient to confirm the diagnosis [7]. The treatment and outcomes of childhood stroke are heavily influenced by the underlying cause. Unfortunately, while there have been significant advancements in the treatment of stroke in adults over the past two decades, similar progress has not been observed in childhood stroke. Furthermore, the outcomes of pediatric stroke remain understudied in the current literature. Although it is commonly believed that the outcome of childhood stroke is better than that of stroke in adults, several studies challenge this assumption. More than half of childhood AIS survivors experience long-term physical disabilities and cognitive impairment. In recent years, there has been a growing interest in understanding the clinical profile and short-term outcomes of childhood stroke, especially in regions like Bangladesh, where healthcare resources and access to specialized care are limited. Bangladesh, a densely populated South Asian country, faces its own set of healthcare challenges, including limited healthcare infrastructure, disparities in access to medical care, and a high burden of infectious diseases [8-10]. In this context, childhood stroke represents an underexplored aspect of pediatric healthcare. Understanding the clinical characteristics and immediate outcomes of childhood stroke in a tertiary care hospital in Bangladesh is crucial for several reasons; e.g., providing insights into the prevalence, risk factors, clinical presentation, and short-term outcomes of pediatric stroke cases in a tertiary care setting, timely management is essential to mitigate the potentially devastating effects of stroke in children. This study aimed to bridge the gap by providing insights into the prevalence, risk factors, clinical presentation, and short-term outcomes of pediatric stroke cases in a tertiary care setting in Bangladesh.

Methods

This observational study was conducted at the Department of Pediatric Neurology, National Institute of Neurosciences and Hospital (NINS&H) in Sher-E-Bangla Nagar, Dhaka, and spanning one year from September 2018 to August 2019. The study focused on a cohort of 47 patients aged 1 month to 18 years who had been admitted to the department due to confirmed case of childhood strokes during the specified period. The research utilized consecutive sampling, encompassing all eligible childhood stroke cases. Data collection encompassed various demographic factors such as age, gender, and socioeconomic status, alongside clinical aspects including clinical presentations, stroke type (ischemic or hemorrhagic), etiology, and the location of infarction or hemorrhage. Outcome variables were categorized as good outcome, poor outcome, or death. Ethical considerations were rigorously maintained through the acquisition of both oral and written informed consent from families and approval from the ethical committee of NINS&H. The study procedure involved confirming stroke diagnoses through history, physical examinations, and neuroradiological evidence. Patient data were meticulously recorded in a predefined questionnaire, and assessments were carried out at multiple time points employing the modified Rankin Scale. Statistical analysis was conducted using SPSS version 22.0, with results presented through tables, figures, and diagrams, setting significance at $p < 0.05$. The post-operative patients of cranial surgery, cases of subdural or epidural hematomas or intracerebral hemorrhage resulting from head trauma, patients with cerebral palsy, and those with ICSOL were excluded from the study.

Results

Table 1: Demographic profile of the study subjects (n=47)

Variables	Frequency (n)	Percentage (%)
Age (years)		
<1	4	8.5
01-May	22	46.8
06-Oct	10	21.3
>10	11	23.4
Mean±SD (years)		6.19 ± 4.58
Age range (years)		0.54–17
Sex (M: F)		1.7:1
Male	30	63.8
Female	17	36.2
Socio-economic status		
Poor	25	53.2
Middle class	19	40.4
Affluent	3	6.4

Table 1 provides a demographic profile of the study subjects, comprising a total of 47 individuals. The age distribution shows that the majority of the subjects fall within the age range of 1 to 5 years (46.8%), followed by those aged over 10 years (23.4%). The mean age of the participants was found 6.19±4.58 years, and the age range spans from 0.54 to 17 years. In terms of gender, there is a slight male predominance, with 63.8% being male and 36.2% female,

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resulting in a male-to-female ratio of 1.7:1. Regarding socio-economic status, a significant portion of the subjects come from poor backgrounds (53.2%), while 40.4% belong to the middle class, and a smaller fraction, 6.4%, are classified as affluent. This table provides a comprehensive overview of the demographic characteristics of the study population, which includes age distribution, gender distribution, and socio-economic status, offering valuable insights for understanding the sample composition in the research study.

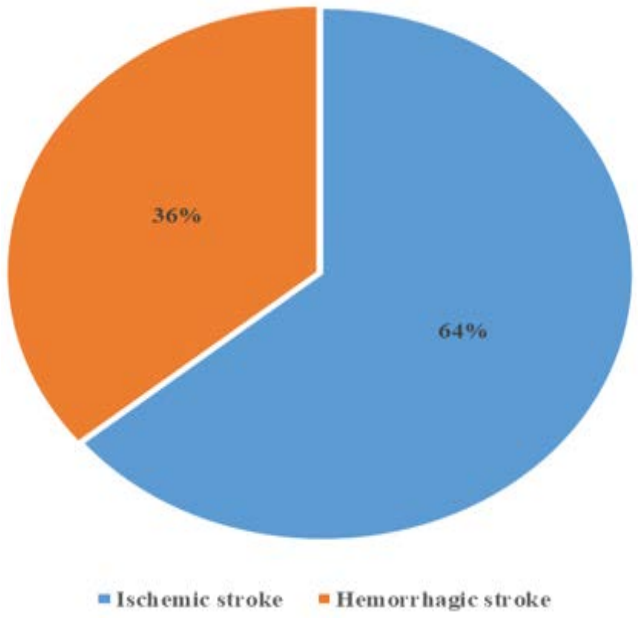

Figure 1: Pattern of stroke among the study cases

Figure 1 shows that ischemic stroke (79%) was found more common than hemorrhagic stroke (21%) in this study.

Table 2: Comparison of Demographic profile between Ischemic and Hemorrhagic stroke (n=47)

Demographic profile	Ischemic stroke (n=37)	Hemorrhagic stroke (n=10)	P value
Age (Mean ± SD) years	5.05 ± 4.29	10.42 ± 2.90	0.001[a]
Sex			
Male	27 (72.97%)	3 (30%)	0.083[b]
Female	10 (27.02%)	7 (70%)	
Socioeconomic status			
Poor	21	4	0.618[b]
Middle	14	5	
Good	2	1	

[a]One-way Anova test, [b]Chi-square test

Table 2 presents a comparison of the demographic profile between individuals with ischemic and hemorrhagic stroke (total n=47). Particularly, the mean age of those with ischemic stroke (5.05 years ± 4.29) was found significantly lower compared to those with hemorrhagic stroke (10.42 ± 2.90 years), with a statistically significant p-value of 0.001, as determined by a one-way Anova test. Regarding gender distribution, males were predominantly affected in the ischemic stroke group (72.97%) compared to the hemorrhagic stroke group (30%), though this difference did not reach statistical significance (p>0.05). Similarly, in terms of socioeconomic status, there were no significant differences (p>0.05) between the two stroke types.

Table 3: Clinical profile on admission among the study cases (N=47)

Clinical profile	Frequency (%)
Acute stroke (1st attack)	40 (85.1%)
Recurrent stroke	7 (14.9%)
Focal neurological features	
Hemiparesis	33 (70.2%)
Right-sided hemiparesis	18 (38.3%)
Left-sided hemiparesis	15 (31.9%)
Quadriparesis	6 (12.76%)
Monopoiesis	1 (2.1%)
Facial palsy	22 (46.8%)
Other cranial nerve palsies	5 (10.6%)
Speech difficulty	12 (25.53%)
Visual disturbance	6 (12.76%)
Global neurological features	
Altered consciousness	26 (55.3%)
Seizure	24 (51.06%)
Focal	13 (27.7%)
Focal - 2 0 GTCS	5(10.6%)
GTCS	6 (12.8%)
Vomiting	18 (38.3%)
Headache	15 (31.9%)
Vertigo	6 (12.8%)
Ataxia	4(8.5%)
Other features	
Fever	9 (19.1%)
Abnormal movement	2 (4.3%)

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Table 3 provides a snapshot of the clinical profile of the study cases (n=47) upon admission. Notably, the majority of cases presented with acute stroke, accounting for 85.1% of the total, while 14.9% were categorized as recurrent stroke. Focal neurological features were prevalent among patients, with hemiparesis being the most common (70.2%), followed by facial palsy (46.8%), and speech difficulty (25.53%). Hemiparesis presented more frequently on the right side (38.3%) than the left side (31.9%). Quadriparesis and monoparesis were observed in 12.76% and 2.1% of cases, respectively. Other cranial nerve palsies were noted in 10.6% of cases. Visual disturbances and global neurological features such as altered consciousness (55.3%) and seizures (51.06%) were also prevalent. Among the seizures, focal seizures accounted for 27.7%, while generalized tonic-clonic seizures (GTCS) were observed in 12.8% of cases. Vomiting and headache were reported in 38.3% and 31.9% of patients, respectively. Additional symptoms included vertigo (12.8%), ataxia (8.5%), fever (19.1%), and abnormal movements (4.3%). This table provides a comprehensive overview of the diverse clinical presentations among the study cases upon admission, shedding light on the varied neurological and other associated features observed in stroke patients.

Table 4: Common etiology among the study cases (N=47)

Etiologies	Frequency (%)
Vasculopathy*	13 (27.65%)
Infection**	8 (17.02%)
Iron deficiency anemia	6 (12.76%)
Cardiac disorders	5 (10.63%)
Trauma	3 (6.38%)
Metabolic (Homocystinuria)	1 (2.1%)
Undetermined causes	11 (23.40%)

Table 4 reveals that the common etiology was vasculopathy 13 (27.65%) followed by infection 8 (17.02%), iron deficiency anemia 6 (12.76%), Cardiac disorders 5 (10.63%), etc. In 11 (23.40%) patients the etiology was unknown.

Table 5: Outcome among the study cases at the time of discharge (n=47)

Immediate total outcome(n=47)	Ischemic stroke (n=37)	Hemorrhagic stroke (n=10)	P value
Hospital 8.1±5.03	7.91±4.68	8.74±6.40	0.652a
Stay (d) (0.4-24)	(1.0-23.0)	(0.40 - 24.00)	
mRS score at discharge			
0 (1) (2.33%)	1(2.94%)	0 (0%)	0.181b
1 (5) (11.62%)	4 (11.76%)	1 (11.11%)	
2 (19) (44.18%)	16(47.05%)	3 (33.33%)	
3 (11) (25.58%)	7(20.58%)	4 (44.44%)	
4 (7) (16.27%)	6(17.64%)	1 (11.11%)	
6 (Dead)			
4 (8.51%)	3(8.1%)	1(10%)	0.715b

[a] One-way ANOVA [b] Chi-square test

Table 5 shows the outcome at the time of discharge. Regarding hospital stay, there was no significant difference between hemorrhagic and ischemic stroke (p=0.652). During discharge 21(61.76%) patients with ischemic stroke had favorable outcomes (mRS 0-2) and 13 (38.23%) patients had poor outcomes (mRS 3-5). In contrast, in the case of hemorrhagic stroke, 4 (44.44%) patients had favorable outcomes (mRS 0-2), and 5 (55.55%) had poor outcomes (mRS 3-5). But statistically, there was no significant difference found between groups (p=0.181). At the time of discharge, 3 (8.1%) patients died in the ischemic stroke group and 1 (10%) died in the hemorrhagic stroke group. But statistically, there was no significant difference found (p=0.751) in between groups regarding mortality.

Table 6: Comparison of mRS score at admission, at discharge, 1 and 3 months after discharge in different types of strokes (n= 47)

mRS	Total (Mean±SD)	Ischemic (Mean±SD)	Hemorrhagic (Mean±SD)	p-value
Admission	3.40 ± 1.17	3.57 ± 1.12	3.80 ± 1.23	0.266
At discharge	2.64 ± 1.39	2.78 ± 1.34	2.88 ± 1.52	0.181
1 m after discharge	1.72 ± 0.93	1.88 ± 0.95	1.31 ± 0.80	0.079
3 m after discharge	1.25 ± 1.29	1.35 ± 1.39	0.89 ± 0.78	0.057
p-value (admission vs 3 m after discharge)	<0.001	<0.001	0.001	

Unpaired t-test was done between groups and paired t-test was done within the group to measure the level of significance

Table 6 reveals that the mean mRS at admission was 3.40 ± 1.17 and at 3 months it was 1.25 ± 1.29 which was statistically significant (p <0.001). In the case of ischemic stroke mean mRS was 3.57 ± 1.12 at admission and 1.35 ± 1.39 at 3 months which was statistically significant (p <0.001). In the case of hemorrhagic stroke mean mRS was 3.80 ± 1.23 at admission and 0.89 ± 0.78 at 3 months which was also statistically significant (p <0.001). There was no significant difference found between ischemic and hemorrhagic stroke with regards to mean mRS at admission, at discharge, and 1 and 3 months after discharge.

Discussion

The study conducted at the Department of Pediatric Neurology, NINS&H, spanned over a one-year period and included a total of 47 patients. The majority of the patients were below 5 years of age, accounting for 55.3% of the sample, with a mean age of 6.19 ± 4.58 years. Similar findings were observed in a study by Rasul et al. [11], where 52.4% of patients were below 5 years with a mean age of 4.8±3.7 years. Parakh et al. [12], Uzunhan et al. [13], and Mallick et

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al. [13] also reported comparable results. In terms of gender distribution, the present study found a higher prevalence of males (63.8%), which aligns with the findings of Patra et al. [4] (61.8% male) and Parakh et al. [12] (64% male) conducted in India. This similarity may be attributed to sociocultural factors and the tendency to prioritize male children in this subcontinent. However, Rasul et al. [11] observed a higher proportion of males (73.8%). It is worth noting that most published literature reports an almost equal male-female ratio [3, 14]. Regarding the types of strokes, the present study found that hemorrhagic stroke was more common in older children compared to ischemic stroke. The mean age for ischemic stroke was 5.05 ± 4.29 years, while for hemorrhagic stroke, it was 10.42 ± 2.9 years. This finding is consistent with the findings of Tham et al. [14] and Uzunhan et al. [13]. Previous literature has generally reported that hemorrhagic stroke accounts for approximately half of childhood strokes.15,16 However, in the present study, ischemic stroke was more prevalent (78.7%) than hemorrhagic stroke (21.3%). This difference may be attributed to a referral bias, with more hemorrhagic stroke cases being admitted to neurosurgery or neuro-intervention departments for intervention, thus bypassing admission to the pediatric neurology department. Another possible explanation is the higher mortality rate among hemorrhagic stroke patients during the acute phase, resulting in death before hospitalization. Similar results were observed by Patra et al. [4], Pergami et al. [17] Matta et al. [18], and Parakh et al. [12]. The present study found a slightly higher rate of recurrent stroke (14.9%) compared to Lehman et al. [15] (8.6%). This difference may be attributed to a lack of definitive treatment based on etiology and a lack of follow-up after the first stroke attack in the country where the study was conducted. In terms of clinical presentation, the most common manifestation of childhood stroke in the present study was hemiparesis (70.2%), followed by altered level of consciousness (55.3%), seizure (51.06%), facial palsy (46.8%), vomiting (38.3%), headache (31.9%), and speech disturbance (25.53%). Altered mental status (55.3%) and seizure (51.06%) were more common in the present study compared to previous studies [19, 20]. This may be attributed to delays in hospitalization, diagnosis, and management. Additionally, facial palsy and visual disturbance were found to be more common in ischemic stroke than hemorrhagic stroke, while headache and vomiting were more common in hemorrhagic stroke than ischemic stroke, which corresponds to another study's findings [21]. The most common etiology of stroke in the present study was vasculopathy (27.65%), followed by infection (17.02%), iron deficiency anemia (12.76%), and cardiac disorders (10.63%). Similar findings were reported by Lee et al. Rasul et al. [11] observed that infection (40.5%) and head injury (26.2%) were common predisposing factors, while Pergami et al. [17] found that cardiac disorders (31%) and hypercoagulability states (13%) were more common. The higher prevalence of vasculopathy as the etiology in the present study may be attributed to referral bias, with more cases of moyamoya disease being referred and the thorough investigation of etiology using MRA angiography in the center where the study was conducted. Financial constraints may have limited the evaluation of bleeding disorders and prothrombotic conditions in most children, resulting in a lower prevalence of hypercoagulability and a higher proportion of undetermined etiology (23.04%) in a quarter of the children. The mean duration of hospital stay in the present study was 8.1±5.03 days, which was shorter than the mean duration reported by Tham et al. [14] (21 days). This difference may be attributed to the policy of early discharge once the acute condition stabilizes, with patients receiving medication and physiotherapy and being advised to follow up in the outpatient department. Death from ischemic stroke accounted for 8.1% of cases, while death from hemorrhagic stroke accounted for 10% of cases. These findings are similar to the studies conducted by Rasul et al. [11] and Uzunhan et al. [13]. Among the survivors, 13.95% had no residual motor disability (mRS 0,1), while 86.04% had mild to moderately severe motor disability (mRS 2-4), with hemiparesis being the most common. Rasul et al. [11] observed full recovery in 52.4% of patients and partial recovery in 40.4% of patients. The present study found slightly higher motor disability at the time of discharge compared to other studies such as Tham et al. [14] and Parakh et al. [12] (64% and 65% respectively). This difference may be attributed to the early discharge of patients after recovery from acute conditions rather than waiting for improvement in disability. Among the survivors of ischemic stroke, 14.70% had no residual motor disability, while 85.29% had mild to moderately severe motor disability, with hemiparesis being the most common. The outcome was favorable (mRS 0-2) for 61.76% of patients and poor (mRS 3-5) for 38.23% of patients. However, the present study found a higher proportion of patients with moderately severe motor

Limitation of the Study

The study encompasses a small sample size, a single-center approach, and a relatively brief follow-up period. So the results may not represent the whole community.

Conclusion

The study found that ischemic strokes were more frequent than hemorrhagic strokes, with the middle cerebral artery region being the most affected. Hemiparesis was the most common symptom. Hemorrhagic strokes had higher rates of headache and vomiting. Mortality was similar for both types, and survivors experienced significant morbidity with mild to moderate motor impairments.

Recommendation

To advance understanding of childhood stroke, research

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Ala Uddin M, et al., J Pediatr Perinatol Child Health 2026
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should expand to involve multiple sites for a more diverse study population. Child health programs should raise awareness about childhood stroke and the need for early intervention. Comprehensive rehabilitation services should be prioritized to improve outcomes and quality of life for trauma survivors. Healthcare programs should be tailored to meet the specific needs of these patients, providing access to specialized care for their long-term well-being.

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