ORIGINAL ARTICLE

# CHILDHOOD STROKES: EPIDEMIOLOGY, CLINICAL FEATURES AND RISK FACTORS

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**Background:** Stroke constitutes a significant health problem in paediatric population. The impact of childhood stroke can easily be realised in terms of economic, social and psychological burden related to disability of the affected children. The objective of study was to outline the epidemiology and clinical features of stroke in a cohort of Pakistani children and also ascertain the causes and potential risk factors in these patients. **Methods:** The study was conducted at the Department of Paediatrics, Ayub Teaching Hospital from January 2008 to October 2010. It was a cross sectional study. A total of 46 patients were included in the study who presented with cerebrovascular disease and were assessed clinically using general physical and systemic examination. The salient epidemiological, clinical, neuro-imaging and laboratory data was retrieved in designed protocol. **Results:** Out of a total of 46 patients, 50% were from either gender. Mean age of presentation was 39 months. Limb weakness was the commonest presenting feature being present in 37 (80.43%) patients. Infectious disorders was the most prevalent risk factor present in 31 (67.39%) patients followed by microcytic hypochromic anaemia in 28 (60.86%) patients. **Conclusion:** A Childhood stroke is a disorder with long term morbidity. Identification of risk factors is important in preventing the disorder by guiding appropriate interventions.

**Keywords:** Childhood stroke, Infectious disorders, risk factors

## INTRODUCTION

Stroke constitutes a significant health problem in paediatric population. The reported incidence of childhood stroke has risen to 2□6/100,000 children per year in the past 10 years.[1] The estimates from North America report an incidence of 2.5 to 2.7 cases per 100,000 children per year[2,3] while in France the incidence is reported to be 13 cases per 100,000 children per year [4].

The impact of childhood stroke can easily be realised in terms of economic, social and psychological burden related to disability of affected children.[5] It is also a focus of interest because of its seriously high morbidity and long term sequelae that includes social and economic consequences as well as neurologic and cognitive disabilities and epileptic disorders.[5□7]

The identification of aetiology and risk factors of childhood stroke is important as many of these are age and population specific. Atherosclerosis, a common risk factor in adults, is not a common aetiology in paediatric strokes.[8] Brain infarcts and brain haemorrhages are significantly less common in patients younger than 20 years of age as compared to adult patients older than 65 years; and their clinical aetiologies also differ markedly from older patients. The risk factors in young stroke patients include congenital heart defects ,cerebral vascular defects and various genetic disorders (haematologic, mitochondrial, and others).[9] The commonest aetiologies in developed countries encompass cerebral arteriopathies, congenital or acquired cardiac disease, and serious systemic infection (meningitis, sepsis).[10] Haematologic disorders such as thrombophilias also constitute a significant risk factor.[11,12]

Stroke is a known complication of acute infections of central nervous system. In such situations, either direct inflammation of blood vessels or haematological disturbances causing hyper-coagulable state cause ischemic injury.[13] The common CNS infections associated with stroke can be categorised into viral, bacterial, parasitic and fungal in origin.[14] Cardiac diseases whether congenital or acquired constitute a significant risk factor for stroke.[15□17] Hypernatremic dehydration and systemic hypotension are also known to cause childhood strokes.[18] A variety of congenital cerebrovascular anomalies like Sturge Weber Syndrome, intracranial aneurysm and arteriovenous malformations are also potential risk factors.[19□21]

Childhood strokes is a disorder bearing poor prognosis as evidenced by the fact that up to 50% patients develop chronic sequelae.[22]

## MATERIAL AND METHODS

This study included children who presented with suspected cerebrovascular disease and were evaluated at the Department of Paediatrics, Ayub Medical College, Abbottabad from January 2008 to October 2010. It was a descriptive cross-sectional study. The patients were recruited from those who presented

with weakness of one or more extremity, sudden unconsciousness, suspected intracranial infections, headaches and seizures. The salient epidemiological, clinical, neuro-imaging and laboratory data was retrieved in designed protocol. This included a detailed general physical and systemic examination. Relevant investigations like peripheral smear, serum electrolytes, CSF examination and neuro-imaging like cranial ultrasound and CT scan were carried out as required.

## RESULTS

During the study period of two years and ten months, 46 children (aged 1 month□13 years) were admitted with clinical diagnosis of stroke. Of these 23 (50%) were males and 23 (50%) were females. Seven (15.2%) were less than 12 months, 28 (60.8%) were aged 12□48 months and 9 (19.5%) were aged 49□84 months. Only 2 (4.34%) were above 85 months of age.

Thirty-seven (80.43%) presented with weakness, 33 (71.73%) had hemiparesis or hemiplegia and 4 (8.69%) had monoplegia. Thirty-one (67.39%) presented with signs and symptoms of raised intracranial pressure. Seizures were a presenting feature in 28 (60.86%). Fever was a presenting feature in 26 (56.52%) while 12 (26.08%) had cranial nerve involvement. Five (10.86%) were aphasic and 10 (21.73%) presented in a comatose state.

Infectious disorders were the most common risk factor. Thirty-one (67.39%) were diagnosed as having intracranial infections with 20 (43.4%) having meningo-encephalitis, 2 (4.34%) having septic meningitis, 3 (6.52%) with tuberculous meningitis, 3 (6.52%) with pertussis encephalopathy, 2 (4.34%) with mumps encephalitis, and 1 (2.17%) had cerebral malaria. Microcytic hypochromic anaemia was a risk factor in 28 (60.86%). Cardiac diseases were identified in 4 (8.69%) followed by hypernatremic dehydration in 3 (6.52%) and congenital cerebrovascular anomalies in 2 (4.34%).

One (2.17%) patient had stroke due to hypertensive encephalopathy secondary to acute glomerulonephritis. No risk factors could be identified in 4 (8.69%) patients due to paucity of laboratory facilities and advanced neuro-imaging techniques for prothrombotic haematological and metabolic disorders.

**Table-1: Gender and age of onset of stroke**

| Age in months | Males | Females | Total | % |
|---|---|---|---|---|
| **<12** | 2 | 5 | 7 | 15.2 |
| **12-48** | 13 | 15 | 28 | 60.8 |
| **49-84** | 6 | 3 | 9 | 19.5 |
| **85 & above** | 2 | 0 | 2 | 4.34 |
| **Total** | 23 | 23 | 46 | 100 |
| **Mean±SD** | 46.48 ±37.295 | 31.48 ±17.776 | 38.98 ±29.866 | |

**Table-2: Symptoms and signs at presentation**

| Signs & symptoms | Cases | % |
|---|---|---|
| **Weakness** | 37 | 80.43 |
| Hemiplegia/hemiparesis | 33 | 71.73 |
| Monoplegia | 4 | 8.69 |
| **Raised Intracranial pressure** | 31 | 67.39 |
| Irritability | 20 | 43.4 |
| Vomiting | 7 | 15.2 |
| Headache | 4 | 8.69 |
| **Seizures** | 28 | 60.86 |
| Generalized tonic clonic | 20 | 43.4 |
| Focal | 8 | 17.39 |
| **Fever** | 26 | 56.52 |
| **Cranial nerve palsies** | 12 | 26.08 |
| **Aphasia** | 5 | 10.86 |
| **Coma** | 10 | 21.73 |

**Table-3: Risk factors of stroke**

| Risk factors | Cases | % |
|---|---|---|
| **Infections and inflammatory disorders** | 31 | 67.39 |
| **Congenital cerebral anomalies** | 2 | 4.34 |
| **Cardiac diseases** | 4 | 8.69 |
| **Hypernatremic dehydration** | 3 | 6.52 |
| **Hypertension** | 1 | 2.17 |
| **Hypochromic microcytic anaemia** | 28 | 60.86 |
| **No risk factors** | 4 | 8.69 |

**Table-4: Infections and inflammatory disorders**

| Infections | No. of cases | %age |
|---|---|---|
| **Meningoencephalitis** | 20 | 43.4 |
| **Tuberculous meningitis** | 3 | 6.52 |
| **Pertussis** | 3 | 6.52 |
| **Septic meningitis** | 2 | 4.34 |
| **Mumps encephalitis** | 2 | 4.34 |
| **Cerebral malaria** | 1 | 2.17 |

## DISCUSSION

Stroke, once thought to be rare in paediatric population, is now becoming increasingly recognised. The present study included 46 children in a period of 2 years and 8 months. In comparison, The Stroke Registry of Dijon, France mentioned 28 stroke patients, studied during 9 years from 1985 to 1993.[4] In the present study, mean age of onset was approximately 3 years which is comparable to a study in Saudi Arabia including 104 children over a period of more than 10 years.[5] In 46 Pakistani children with stroke, limb weakness was a presenting feature in 80.43%, seizures in 60.86%, loss of consciousness in 21.73% and speech disorders in 10.86%. Similar results were observed in Canada where Canadian Paediatric Ischemic Stroke Registry (CPISR) had mentioned hemiparesis in 51%, seizures in 48% and speech disorders in 17%.[23] In another study in Singapore, the presenting symptoms were seizures in 57.7%, hemiparesis in 38.5% and altered level of consciousness in 38.5%.[24] Infectious disorders was the most common risk factor being present in 67.39% followed by hypochromic anaemia in 60.86% and cardiac diseases in 8.69% patients. Anaemia was a significant risk factor in another study over 22 years, where 40% of the patients were found to be anaemic.[25]

The results are also comparable to those obtained from a cohort of 104 Saudi children in a study carried in Riyadh over a period of ten years except that infectious disorders had a much lesser percentage (17.3%) in Saudi patients[5] owing to exclusion of Herpes Simplex encephalitis from that study and much larger prevalence of infectious diseases in our region.

## CONCLUSION

Stroke in paediatric population is now a recognised entity associated with long term morbidity and disability. There is a high prevalence of multiple risk factors. Every child with stroke must be thoroughly assessed using haematologic, biochemical, neuro-imaging and metabolic studies. Identification of risk factors is imperative so as to guide appropriate interventions aimed at preventing the development of childhood strokes.

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