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Speech and Language Impairment after Childhood Arterial Ischemic Stroke

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ABSTRACT

Objective: To investigate potential predictors of dysarthria and dyspraxia of speech and language impairment after childhood stroke.

Study Design: Cross-sectional study

Place and Duration of Study: Department of Pediatric Neurology, Children Hospital & Institute of Child Health, Lahore Pakistan, from Aug 2019 to Aug 2020.

Methodology: Seventy children with radiologically (CT) diagnosed arterial ischemic stroke were selected for the study. Frequency of dyspraxia, dysarthria, and language impairment was measured within two weeks of the stroke. In addition, the side of the stroke (right, left or both) was assessed, and the proportion of language impairment, dysarthria, and dyspraxia was measured in this study.

Results: In this study, the mean age of patients was 8.11±2.14 years. Stroke effects on the left side were noted in 27(38.6%) cases, and stroke effects on the right side were noted in 33(47.1%) cases. In comparison, in 10(14.3%) cases, both Hemispheres were involved, dysarthria was present in 50(71.4%) cases, language impairment was observed in 45(64.3%) cases, and verbal dyspraxia was noted in 12(17.1%) cases.

Conclusion: Cognitive, motor and neurological outcomes result from arterial ischemic stroke. Dysarthria, language impairment and dyspraxia are the main effects of a stroke that depend on the size and place lesion. Rehabilitation cannot be predicted after a childhood stroke.

Keywords: Apraxia, Brain injury, Dysarthria, Language, Stroke, Speech.

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INTRODUCTION

An acute stroke is a sudden demise of cells in the brain as a result of oxygen deficiency in brain cells due to blockage of blood circulation in the brain artery or the rupture of the artery to the brain.[1,2] Initially, about 28% to 55% of paediatric patients with a stroke presented with speech difficulty as the post-stroke symptom. However, language impairment is limited, and few cases were reported compared to speech disturbance in literature or at long-term follow-up.[2] A strong association was found between infarction of the left hemisphere and language impairment and speech disorders like dysarthria and apraxia because of differences in organization, plasticity, location of the stroke, and functional as well as environmental factors between adults and children.[3,4]

Post-stroke complications may include motor impairment contributing to about 50-80% hemiparesis and mild clumsiness.[5] Hemiplegia is another complication contributing to about three-quarters of total victimization in children. After initial management outcome depends upon the location of the stroke. The supratentorial intracranial location gives a very poor prognosis. Long-term effects on language were also observed when the involvement of the left sub-cortical region.[6,7]

There is no gold standard measurement of childhood stroke, but some authors designed scales to measure outcomes.[8] Most commonly used standards were Barthel Index and the modified Rankin Scale, but both apply to adults, not childhood stroke. After a childhood stroke, a functional disability is the main adverse effect which may include intelligence quotient, attention, and memory. Very few children regain functional ability but to some extent, not 100%.[9,10] In this study, we documented the side of stroke and complications after a stroke like dysarthria, verbal dyspraxia and language impairment. There is a need to evaluate the prognosis of children presenting with stroke.

METHODOLOGY

The cross-sectional study was conducted at the Paediatric Neurology Department of Children Hospital & Institute of Child Health, Lahore Pakistan, from August 2019 to August 2020. The study was conducted after taking permission from the Ethical Board of the

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Hospital (IRB#2019-87-CHICH). Infor-med written consent was taken from parents or guardians before the enrolment of a child in the study. The sample size was estimated using the WHO calculator with a 95% confidence level, and a value of post-stroke motor dysfunction as 80% in children.[6]

Inclusion Criteria: Children of age 4 to 17 years, both genders, were included. As confirmed by computed tomography scans, children diagnosed with acute ischemic stroke were included in the study.

Exclusion Criteria: Children with recurrent stroke and cerebral palsy were also excluded.

To recruit the children in the study, a non-probability consecutive sampling technique was applied. A speech and language pathologist and neurologist reviewed and accessed all patients. Language impairment was labelled as present when any language issue was observed by a speech and language pathologist. Difficulty in understanding instructions, response initiation fluency, word finding, sentence production, the grammatical structure of sentences and word association was labelled as language difficulty. If hypernasality, unclear, distorted mumbling or slurred speech was observed, it was labelled as dysarthria. Difficulty in speech consistency, the reputation of sounds or groping, co articulation and speech transposition errors were labelled as apraxia. Elected data like the side of the lesion (right, left or bilateral) territory of circulation like anterior, posterior or both sides were recorded on pre-designed proforma.

Statistical Package for Social Sciences (SPSS) version 23.0 was used for the data analysis. Mean±SD were presented for numerical data, including age and weight, while frequency and percentages were presented for categorical data, including gender, lateral side, dysarthria, language impairment and verbal dyspraxia.

RESULTS

In this study, we enrolled 70 children diagnosed with stroke. The mean age of children was 8.11±2.14 years. There were 35(50%), male children, while 35 (50%) were female. Stroke effects on the left side were noted in 27 (38.6%) cases, stroke effects on the right side were noted in 33(47.1%) cases, while in 10(14.3%) cases, both Hemispheres were involved (Table-I).

Dysarthria was present in 50(71.4%) cases, language impairment was observed in 45(64.3%) cases, and verbal dyspraxia was noted in 12(17.1%) cases (Table-II).

Table-I: Side of Lesion (n=70)

Side of Lesion	n(%)
Left sided Stroke	27(38.6%)
Right Sided Stroke	33(47.1%)
Both Hemispheres	10(14.3%)

Table-II: Potential Predictors after Stroke (n=70)

Predictors	n(%)
Dysarthria	50(71.4%)
Language impairment	45(64.3%)
Verbal dyspraxia	12(17.1%)

DISCUSSION

Childhood arteriopathies are a heterogenous but rare condition. It is difficult to diagnose and classify, specifically by non-experts.[9] Population-based estimates of the annual incidence of childhood stroke ranged from 2-13 per 100,000 person-years. More than fifty percent of children with a stroke diagnosis have prolonged neurological sequelae.[10,11]

Language is essential for every person in daily life and different cultures. Between primates, the tractability and wide range of potential combinations in the human language go beyond the scope of any other system for verbal communication.[12] Dysfunctions of this system are very common in routine neurological practice, typically growing up because of the focal damage to the left side hemisphere and also because of types of discriminating neuronal erosion.[13] Disorders of the custom language are incapacitating and lead to grief and misery in the patients, caregivers and their friends or relatives. The presence of aphasia also causes difficulties in taking the case history, examination, and discussion with the patient about their treatment options or decision-making.[14]

In our study, the mean age of children was 8.11±1.26 years. Liegeois *et al.*[15] conducted a study and reported that the side of stroke lesions a highly associated with apraxia of speech and dysarthria in children. The researchers concluded that regardless of the age of children, they have a high risk of developing communication disorders after acute stroke. In contrast to the adults, stroke in the left hemisphere was not associated with both; speech and language impairment. Apraxia cases were limited as compared to dysarthria. Researchers suggested that there might be bi-hemispheric involvement in language dysfunction. Future studies must be done to observe whether the predictors examined in the study can help to predict long-term outcomes. Another similar study was conducted by Veber *et al.*[16] also reported similar

findings that apraxia of speech and dysarthria are resultant factors of stroke lesion side.

Our study observed that dysarthria was present in 71.4% of patients. In comparison, language impairment was present in 64.3% of patients, which was a large proportion for long-life disabilities and a burden for the family and social life of the children. Another study, conducted by Greenham *et al*. at Murdoch Children's Research Institute, Melbourne, Australia, in association with the National Stroke Foundation of Australia.[17] reported that ischemic stroke is a serious complication (10th top disease causing mortality). In addition, cognitive impairment and motor and neurological disorders after the attack are common. In another study, Edwards *et al*.[5] reported that cognitive, motor and neurological outcomes were the main focus for neurologists after arterial ischemic stroke, especially in children, to save their future.

Eeg-Olofsson and Ringheim.[18] studied this topic and reported that residual sequels are the main after-effects of ischemic stroke observed in 75% of children. Similar findings were observed by Andrew *et al.* [19] in 1997, that ischemic stroke has after-effects of residual sequels. Many affected children suffer from this difficulty after arterial ischemic stroke.

Dysarthria is a disorder of speech in humans. It is described as the dysfunction in the beginning, mechanism and harmonization of the articulatory structures, which are normally involved in the speech output. Dysarthria has been noticed in around 8-30% of patients in many stroke series cohorts. It might be the primary and only clinical indicator of cerebrovascular ischemia. For instance, numerous lacunar syndromes, like "pure motor hemiparesis, ataxic hemiparesis, dysarthria-clumsy hand syndrome and pure dysarthria", include dysarthria in the most defining clinical features. It has been reported that dysarthria was observed in around 25% of patients after acute lacunar stroke while in 30% of patients with the stroke in the internal capsule. However, unluckily, the terms used for the description of dysarthria present in the previous literature are generally imprecise, for example, "slow, slurred and thick speech".[11,19]

CONCLUSION

Cognitive, motor and neurological outcomes are the results of arterial ischemic stroke. Dysarthria, language impairment and dyspraxia are the main effects of stroke. Further studies should be done to confirm these results with a larger sample size. Further studies can be done in multi-centres to improve the authenticity of the findings in future. Further studies can be done as case-control studies to determine if there is any association between these predictors and stroke outcomes.

Conflict of Interest: None.

Authors' Contribution

Following authors have made substantial contributions to the manuscript as under:

MA & MAK: Conception, study design, data acquisition, data analysis, data interpretation, approval of the final version to be published.

NG & TS: Critical review, drafting the manuscript, approval of the final version to be published.

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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