ORIGINAL RESEARCH

Unravelling the Complexities of Acute Flaccid Paralysis in Pediatric Patients: A Cross Sectional Observational Study

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ABSTRACT
Background: Acute flaccid paralysis (AFP) in children poses a complex diagnostic challenge with diverse etiologies. This study aims to comprehensively analyse the etiology, clinical manifestations, and short-term outcomes of AFP.**Materials and Methods:**A retrospective observational study was conducted at Government Rajaji Hospital, Madurai, Tamil Nadu spanning from January 2021 to August 2022. The study included children under 15 years with AFP. Detailed clinical evaluations and scoring systems were employed to assess short-term outcomes.**Result:**Of the 50 children studied, Guillain-Barré Syndrome (GBS) emerged as the predominant cause (22%), followed by stroke (16%) and traumatic neuritis (16%). Prognostic indicators, including the Ordinal Disability Score (ODS) and Arm Function Score (AFS), demonstrated their utility in predicting short-term outcomes. Early hospitalization within 5 days significantly improved survival rates (87.5%). **Conclusion:**This study provides crucial insights into the multifaceted nature of AFP, emphasizing the importance of prompt diagnosis, targeted interventions, and ongoing polio surveillance.
Key words: Acute Flaccid Paralysis, Guillain-Barré Syndrome, Stroke, Pediatric Neurology, Prognostic Indicators, Polio Surveillance.

INTRODUCTION

In the field of pediatric neurology, the delicate intricacies surrounding Acute Flaccid Paralysis (AFP) beckon our attention due to the potential life-altering consequences it poses for children under the age of 15.[1] At the forefront of this exploration lies the active surveillance of AFP, a pivotal component in monitoring suspected polio cases within the community. This surveillance not only aids in the identification of children less than 15 years old with acute flaccid paralysis but also serves as a vital tool in delineating the diverse causes of AFP.[2]

Acute Flaccid Paralysis in the pediatric population stands as a critical concern on the global healthcare stage, necessitating a profound understanding of its diverse etiological underpinnings. The World Health Organization (WHO) has taken a global initiative to eliminate polio entirely through an extensive surveillance system initiated with two primary objectives. Firstly, to detect cases of acute flaccid paralysis in children under 15 years of age, and secondly, to send stool samples from all AFP cases to be recognized laboratories for virological testing.[3] This rigorous system aims to eradicate poliovirus infections among the AFP cases, marking a significant stride towards global polio eradication.

The landscape of polio prevention in India has witnessed transformative milestones, starting with the establishment of the Universal Immunization Programme (UIP) in 1985.[4] This comprehensive initiative, implemented nationwide, resulted in a dramatic increase in the number of immunized cases. In 1997, the National Polio Surveillance Program (NPSP) was instituted by the Indian government in collaboration with WHO. These concerted efforts led to a remarkable reduction in polio cases, plummeting from 24,000 in 1988 to 283 in 2006. However, pockets of endemicity persist in western Uttar Pradesh

and certain regions of Bihar, posing ongoing challenges to complete eradication.[4]

In the absence of poliovirus isolation, AFP is classified under various categories such as Guillain-Barré Syndrome, Traumatic Neuritis, Transverse Myelitis, Pediatric Stroke, ADEM, Facial Palsy, Transient Weakness, Viral Myositis, Spinal Cord Trauma or Infection, Botulism, Metal Toxins (lead), Metabolic Neuropathies (hypokalemic periodic paralysis, hypophosphatemia, polymyositis, and dermatomyositis), and Tick Paralysis. Despite numerous global studies elucidating the causes and outcomes of AFP, our exploration revealed a void in recent studies conducted in our state.[5]

Guillain-Barré Syndrome, a distinctive subset of AFP known for its abrupt onset and potential for significant neurological compromise, becomes a focal point in our investigation. Employing a sophisticated Disability Scoring System, we endeavor to minutely assess the short-term outcomes in children diagnosed with GBS. This quantitative approach allows for a nuanced understanding of the impact of GBS on the functional abilities of affected individuals, offering valuable insights into the immediate aftermath of the syndrome. Such detailed assessments hold the potential to guide tailored therapeutic approaches for better patient outcomes.[6]

The study is about myriad etiological factors contributing to Acute Flaccid Paralysis in children under the age of 15. The study aims to dissect medical records and clinical histories of admitted cases at a tertiary care hospital, striving to discern patterns, correlations, and potential causative agents associated with this debilitating condition. By delving into the intricate web of contributors to AFP, we aspire to provide medical professionals with a comprehensive understanding, facilitating early diagnosis and targeted interventions.

The implications of this research resonate across clinical practice, public health interventions, and the landscape of future pediatric neurology research. By untangling the intricate web of factors contributing to Acute Flaccid Paralysis, our study seeks to arm healthcare professionals with the knowledge necessary for proactive diagnosis, timely intervention, and the formulation of preventive strategies. Moreover, the systematic evaluation of short-term outcomes in Guillain-Barré Syndrome contributes to the evolving understanding of this enigmatic neurological disorder, potentially paving the way for personalized therapeutic approaches that address the unique challenges posed by GBS in the pediatric population.

In essence, this study represents a concerted effort to deepen our understanding of Acute Flaccid Paralysis. Through meticulous analysis, systematic evaluation, and the pursuit of intricate details, we aspire to contribute nuanced insights that transcend geographical boundaries, fostering advancements in pediatric neurology, and ultimately improving healthcare practices for the benefit of our young patients.

MATERIALS AND METHODS

Study Design: This research adopts a cross-sectional observational study design to comprehensively investigate the etiology and outcomes of Acute Flaccid Paralysis (AFP) cases in children below the age of 15. The study period spans from January 2021 to August 2022.

Study Setting: The study is conducted at the Government Rajaji Hospital (GRH) in Madurai, Tamil Nadu, India, which serves as the primary medical facility for the investigation.

Study Population: The study encompasses all cases of Acute Flaccid Paralysis admitted to GRH Madurai during the specified study period, emphasizing children less than 15 years of age. Inclusion criteria included all cases of AFP in children under 15 years of age, notified between January 1, 2013, and August 31, 2014, are included in the study. Exclusion criteria were cases with paralysis onset on or before August 31, 2022, but notified only on or after September 1, 2022, are excluded from the study.

Sample Size: The sample size comprises all eligible Acute Flaccid Paralysis cases within the specified study period, ensuring a comprehensive representation of the pediatric population in the study area. The data was collected from a total of 50 children.

Sampling Technique: A purposive sampling technique is employed, including all eligible AFP cases admitted to GRH Madurai during the study period.

Study Procedure: Upon admission to Government Rajaji Hospital, Madurai, children exhibiting a sudden onset of weakness undergo a thorough clinical workup. Preliminary diagnoses are based on clinical presentations, and investigations are conducted as deemed necessary according to the clinical picture.

Necessary details, encompassing name, age, sex, demography, immunization status, history of illness, and detailed central nervous system examination findings, are meticulously recorded in a proforma. Informed written consent is obtained from the attendants for children subjected to invasive procedures like lumbar puncture. Collaborating departments such as Neurology, Radiology, and Biochemistry have provided written consent for the utilization of their services.

In alignment with the National Polio Surveillance Project guidelines, all patients are advised to provide two stool samples (8 gms), sent to the Central Research Institute (CRI), Guindy, for poliovirus isolation. Additional investigations include complete blood count, liver function tests, and creatine phosphokinase (CPK) levels.

Further diagnostic procedures, such as lumbar tapping, CT brain/spine, and magnetic resonance imaging (MRI) of the brain and spine, are conducted as needed. Nerve conduction studies are performed

selectively based on the clinical requirements. The diagnosis of Guillain-Barré Syndrome (GBS) is established through albumino cytological disassociation in cerebrospinal fluid (CSF) examination or nerve conduction studies, applying Brighton's criteria in all GBS cases. Stroke diagnosis is based on imaging studies, while raised CPK levels indicate viral myositis.

Two crucial scoring systems were used to evaluate the short-term outcomes of children affected by Guillain-Barré Syndrome (GBS). The Ordinal Disability Score (ODS) served as a comprehensive tool, assessing functional abilities at specific intervals—1 week, 2 weeks, and 6 weeks post-symptom onset. Scores ranged from normal function to varying degrees of disability, allowing nuanced categorization into mild, moderate, and severe disability levels. The Arm Function Score, also known as the Upper Limb Disability Score (ULDS), specifically focused on upper limb functionality in GBS-affected children. The ULDS scoring criteria encompassed a range of arm movements, from normal function to complete paralysis, with scores further categorized into mild, moderate, and severe disability levels. These scoring systems provided a systematic and standardized approach to gauge the impact of GBS on the functional abilities of pediatric patients, facilitating a detailed assessment of their short-term outcomes. The utilization of the ODS and ULDS scoring systems enhanced the precision of our study, ensuring a thorough evaluation of the progression and severity of Guillain-Barré Syndrome within the investigated pediatric population.

Statistical Analysis: All data are meticulously entered into Excel 2010, and statistical analyses are carried out using the SPSS 20 statistical software. Data are expressed as percentages and mean values. Results are considered statistically significant when the two-sided P value is less than 0.05.

Ethical Issues: The study adheres to ethical guidelines, and informed written consent was obtained from the attendants for invasive procedures. Collaboration with other departments involved obtaining written consent for the use of their services, ensuring a comprehensive and ethical approach to the research.

RESULT

In the present study, 50 children with acute flaccid paralysis (AFP) were included for analysis. The sex predilection showed a male-to-female ratio of 1.27, with 56% being male and 44% female. The age predilection indicated that most children affected were between 1-5 years, followed by the 6-10 years and 11-15 years age groups. The youngest reported child was 10 months old, while the oldest was 14 years. The demographic distribution revealed that 80% of the children with AFP hailed from rural areas, contrasting with 20% from urban areas. Importantly, all children in the study were fully immunized against polio.

In terms of etiology, Guillain-Barré Syndrome (GBS) emerged as the commonest cause, constituting 22% of AFP cases, followed by stroke (16%), traumatic neuritis (16%), and acute disseminated encephalomyelitis (ADEM) (10%). Cranial nerve involvement, particularly the facial nerve, was observed in 22% of cases. Bowel and bladder involvement were noted in 10% of AFP cases (Table 1). The average day of hospitalization was the 3rd day of illness, with an overall average hospital stay of 10 days.

Table 1: Etiology of AFP cases.

Disease	Number	Percentage
GBS	11	22
Stroke	8	16
Traumatic neuritis	8	16
ADEM	5	10
Transient paralysis	5	10
Transverse myelitis	4	8
Bell’s palsy	4	8
Others	5	10

For the 11 confirmed cases of GBS, sex distribution indicated 5 males and 6 females, with age distribution spanning from 18 months to 14 years. Quadriparesis was predominant in 73% of GBS cases, while paraparesis was present in 27%. Respiratory paralysis occurred in 45% of GBS cases, with 36% of the children aged 1-5 years. The survival rate for children admitted within 5 days of illness onset was 87.5%, while those admitted after 5 days had a 0% survival rate.

Ordinal Disability Score (ODS) and Arm Function Score (AFS) were applied at 1 week, 2 weeks, and 6 weeks during the follow-up of GBS cases. Areflexia was observed in all patients, and ascending paralysis occurred in 100% of cases. Analysis of ODS and AFS at different time points revealed trends in disability progression and recovery. Notably, those with mild and moderate disability at 1 week or 2 weeks showed a 100% recovery rate, while the severe disability group had a high mortality rate of 66.6% and a recovery rate of 33.4% (Table 2).

Table 2: Ordinal disability score (ODS) and Arm function score (AFS) at different time points

Score		1 week	2 weeks	6 weeks
Ordinal disability score (ODS)	Normal	-	-	-
	Mild (1-2)	-	7	-
	Moderate (3-4)	1	2	-
	Severe (5-6)	4	1	-
Arm function score (AFS)	Normal	3	3	3
	Mild (1-2)	-	-	4
	Moderate (3-4)	-	2	-
	Severe (5-6)	2	2	-

The overall results highlighted the diverse clinical manifestations of AFP in children, emphasizing the significance of early hospitalization, etiological identification, and the application of scoring systems as prognostic indicators for tailored therapeutic approaches. Statistical analysis demonstrated the significance of ODS as a prognostic predictor for short-term outcomes among children with GBS.

DISCUSSION

The findings of our study on acute flaccid paralysis (AFP) in children provide valuable insights into the diverse etiological factors, clinical manifestations, and outcomes of this condition. The predominant etiology of AFP in our study was Guillain-Barré Syndrome (GBS), constituting 22% of the cases. GBS, known for its abrupt onset and potential for significant neurological compromise, presented a multifaceted clinical spectrum. Cranial nerve involvement, particularly the facial nerve, was observed in a noteworthy 22% of cases, underscoring the diverse manifestations of GBS in the pediatric population. This aligns with existing literature highlighting the variable clinical presentations of GBS, emphasizing the importance of comprehensive neurological assessments.[7]

The second common etiology was stroke, observed in 16% of cases. Stroke in children is a relatively rare but critical condition requiring prompt diagnosis and intervention. The recognition of stroke as a significant cause of AFP in our study underscores the need for heightened awareness among healthcare professionals to ensure timely management and reduce potential long-term sequelae.[8]

Traumatic neuritis and acute disseminated encephalomyelitis (ADEM) each accounted for 16% and 10% of cases, respectively. Traumatic neuritis, often underexplored in the context of AFP, merits attention as trauma-related neurological complications can contribute to the overall burden of this condition. ADEM, characterized by widespread inflammation of the brain and spinal cord, adds complexity to the etiological landscape, necessitating a nuanced approach to diagnosis and management.[9]

The demographic distribution revealed a male predominance, with a male-to-female ratio of 1.27. This gender distribution aligns with broader trends observed in neurological disorders, warranting further exploration into potential biological and environmental factors contributing to these disparities. The age-wise distribution highlighted a concentration of cases in the 1-5 years age group, emphasizing the vulnerability of younger children to AFP. The youngest reported case at 10 months and the oldest at 14 years illustrate the wide age spectrum affected by AFP.

Demographically, 80% of the children with AFP hailed from rural areas, shedding light on potential geographical variations in healthcare access and disease prevalence. This finding underscores the importance of targeted public health initiatives to address healthcare disparities and improve access to timely medical interventions in rural communities.[10]

A notable aspect of our study was the full immunization status of all children against polio. This aligns with the success of national immunization programs, particularly the Universal Immunization Programme (UIP) implemented in India since 1985. The National Polio Surveillance Program (NPSP), established in 1997, has played a pivotal role in reducing polio incidence from 24,000 cases in 1988 to 283 cases in 2006. While many states have been declared polio-free, the persistence of polio in specific regions, such as western UP and some areas in Bihar, remains a challenge. The ongoing efforts to maintain polio-free status and the global surveillance system initiated by the World Health Organization (WHO) underscore the need for sustained vigilance and comprehensive AFP surveillance.[11]

Active surveillance of AFP, as outlined by WHO, serves a dual purpose of detecting potential polio cases and delineating the various causes of AFP.[12] The absence of recent studies in our state emphasized the necessity of our investigation to contribute essential insights into the etiology and outcomes of AFP in children.

Clinical Implications: Our study systematically evaluated short-term outcomes, applying the Ordinal Disability Score (ODS) and Arm Function Score (AFS) at 1 week, 2 weeks, and 6 weeks post-symptom onset in GBS cases. The application of these scoring systems provided a nuanced understanding of the progression and severity of GBS in the pediatric population.

The survival rate of GBS cases admitted within 5 days of illness onset was 87.5%, contrasting with a 0% survival rate for those admitted after 5 days. This highlights the critical importance of early hospitalization in improving outcomes, aligning with existing literature emphasizing the significance of prompt medical intervention in GBS.

The ODS and AFS proved to be valuable prognostic indicators, with children exhibiting mild and moderate disability at 1 week or 2 weeks showing a 100% recovery rate. In contrast, the severe disability group had a high mortality rate of 66.6%, emphasizing the clinical relevance of these scoring systems in predicting short-term outcomes and guiding therapeutic strategies.

Limitations and Future Directions: While our study provides comprehensive insights into AFP in children, certain limitations should be acknowledged. The retrospective nature of the study and the reliance on medical records might have introduced information bias. Additionally, the study was conducted at a single center, limiting the generalizability of findings to other populations. Future research endeavors could benefit from prospective, multicenter studies to validate and expand upon our findings.

Our study contributes valuable data on the etiology, clinical spectrum, and outcomes of AFP in children. The multifaceted nature of GBS, the recognition of stroke as a significant cause, and the application of scoring systems for prognostication enrich our understanding of this complex neurological condition. These insights have direct implications for clinical practice, guiding healthcare professionals in early diagnosis, timely intervention, and tailored therapeutic approaches. Moreover, our findings underscore the ongoing importance of polio surveillance and immunization programs to ensure the continued success of global efforts to eradicate polio.

CONCLUSION

The present study on acute flaccid paralysis (AFP) in children explores critical insights into its diverse etiological landscape, clinical manifestations, and short-term outcomes. Guillain-Barré Syndrome (GBS) emerged as a leading cause, emphasizing its varied clinical presentations and the significance of prompt hospitalization. Stroke, traumatic neuritis, and acute disseminated encephalomyelitis (ADEM) added complexity to the etiological spectrum. Demographic trends highlighted male predominance and a higher incidence in rural areas. Full immunization status against polio showcased the success of national programs. Prognostic indicators, including the Ordinal Disability Score (ODS) and Arm Function Score (AFS), proved valuable in predicting short-term outcomes, guiding clinical interventions.

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