Original Article
DOI: https://doi.org/10.70749/ijbr.v3i6.3153

INDUS JOURNAL OF BIOSCIENCE RESEARCH
https://ijbr.com.pk
ISSN: 2960-2793/ 2960-2807

Frequency of Aspiration Pneumonia in a Cerebral Palsy Child Presented to a Tertiary Care Hospital

Manahil Shamraiz[1], Shahzad Najeeb[2], Hareem Shahzad Khan[3], Ali Maalik[4], Aleena Ashraf[5], Zoya Fayaz[6]

[1-6]Department of Paediatrics, Ayub Teaching Hospital, Abbottabad, Pakistan

ARTICLE INFO

Keywords: Aspiration pneumonia, child, cerebral palsy, dysphagia, prevalence

Correspondence to: Manahil Shamraiz, Department of Paediatrics, Ayub Teaching Hospital, Abbottabad, Pakistan.
Email: manihalshamraiz01@gmail.com

Declaration
Authors' Contribution: All authors equally contributed to the study and approved the final manuscript.

Conflict of Interest: No conflict of interest.

Funding: No funding received by the authors.

Article History
Received: 05-05-2025 Revised: 17-06-2025
Accepted: 24-06-2025 Published: 30-06-2025

ABSTRACT

Background: Cerebral palsy is one of the most common neurological disorders of childhood and is frequently associated with feeding difficulties, dysphagia and impaired swallowing mechanism. These problems increase the risk of recurrent chest infections and aspiration pneumonia, which is an important cause of morbidity and hospital admissions in such children. Early identification of aspiration pneumonia may help in reducing complications and improving quality of life in cerebral palsy patients. **Objective:** To determine the frequency of aspiration pneumonia in children with cerebral palsy presenting to a tertiary care hospital. **Study Design:** Descriptive cross sectional study. **Duration and Place of Study:** Conducted from 1st January to 1st May 2025 at Department of Paediatrics, Ayub Teaching Hospital, Abbottabad. **Methodology:** Total 103 children aged 1 to 14 years with clinically diagnosed cerebral palsy were included. Clinical assessment and chest findings were used to label aspiration pneumonia based on predefined criteria. Data was analysed using statistical package for social sciences version 26. Mean ± standard deviation was calculated for quantitative variables and frequencies n(%) for categorical variables. Stratification was done and chi square test or Fisher exact test applied, with p≤0.05 taken as significant. **Results:** Mean age was 6.43 ± 4.04 years and mean weight was 20.79 ± 7.30 kg. Males were 63 (61.2%) and females 40 (38.8%). Majority were from rural areas 67 (65.0%). Aspiration pneumonia was found in 31 (30.1%) children while 72 (69.9%) had no pneumonia. Significant association was seen with age, as all cases 31 (37.8%) were in children ≤10 years (p<0.001). All cases also occurred in children with weight ≤20 kg 31 (51.7%) (p<0.001). Higher frequency was seen in children of uneducated parents 21 (51.2%) and rural residents 31 (46.3%) (p<0.001). **Conclusion:** Aspiration pneumonia is common problem in cerebral palsy children, especially in younger age, low weight and socially deprived groups.

INTRODUCTION

Cerebral Palsy refers to a collection of non-progressive brain injury syndromes, which affect body movement and posture, resulting in an individual's inability to perform certain activities.[1] The disorder is characterized by either spasticity or sometimes hypotonicity of muscles together with reduced coordination of actions and delay in achieving developmental milestones.[2] These children commonly have associated conditions such as mental retardation, epilepsy, vision problems, hearing disorders, and dysphagia.[3] The eating process in children with cerebral palsy is unusual because of their lack of proper oral motor skills, weak swallow mechanism, and maladaptive positioning when eating.[4]

Dysphagia has been reported as a common problem among children suffering from cerebral palsy, and is characterized by a condition where there is a problem with swallowing either at oral, pharyngeal, or esophageal levels.[5] These patients have problems coordinating sucking, swallowing, and breathing, thereby leading to a hazardous state of swallowing. The food and liquids will remain in the mouth and pharynx and enter the airway, known as aspiration; however, this process could be asymptomatic with no coughing involved.[6] Furthermore, a weaker coughing reflex and poor airway protection increase the risks involved.

Aspiration pneumonia is an important complication among children who have cerebral palsy due to the inhalation of food particles, liquids, or even saliva into the lungs, causing subsequent infections.[7] Aspiration pneumonia is more likely to occur among children who have severe motor dysfunction and significant dysphagia.[8] Aspiration can result in chronic inflammation of the lungs, which results in frequent admissions to the hospital. Common symptoms associated with aspiration pneumonia include cough, fever, dyspnea, and

occasionally cyanosis.[9] Diagnosis is based primarily on clinical presentation but may be aided with chest X-rays or other diagnostic imaging procedures and swallowing tests.[10]

Aspiration pneumonia is a considerable contributor to morbidity among children with cerebral palsy; nevertheless, the exact prevalence of this condition has not been well studied in many localities. Information concerning the prevalence of dysphagia and respiratory morbidity among children in many localities is insufficient, thus impeding the establishment of useful prevention and treatment strategies. Identification of at-risk patients will be of great benefit in addressing this problem. Therefore, this study is needed to determine the frequency of aspiration pneumonia in cerebral palsy child presented to a tertiary care hospital.

METHODOLOGY

A cross sectional study was carried out in the Department of Paediatrics at Ayub Teaching Hospital Abbottabad from 1st January to 1st May 2025. Approval was obtained from institutional ethical committee as well as from CPSP before starting the data collection, and study was conducted according to ethical standards. The sample size of 103 was calculated by using WHO sample size software with 95% confidence level, 7% margin of error and expected frequency of aspiration pneumonia as 15.4% in children with cerebral palsy.[11]

Inclusion criteria: Children aged 1 to 14 years, both males and females, and diagnosed cases of cerebral palsy on clinical basis were included in the study.

Exclusion criteria: Children having history of other neurological or neurodevelopmental disorders, cystic fibrosis, tuberculosis, recent surgical procedure within last 30 days, or history of steroid therapy were excluded from the study.

Cerebral palsy was taken as permanent disorder of movement and posture starting early in life and identified clinically by presence of motor impairment such as spasticity, dystonia, athetosis or ataxia, along with abnormalities in posture, balance and coordination, delayed motor milestones and may be associated with intellectual disability, epilepsy, visual, hearing, speech or behavioural problems.

After receiving consent from the patients' parents or guardians and ensuring the confidentiality and lack of harm to the patient, the data was collected. The demographic information collected included age, sex, body weight, socioeconomic background, educational background, duration of cerebral palsy and type of residence. A full history and clinical assessment was carried out on all the subjects under study. Symptoms of respiratory system problems such as coughing, sputum production and fever were elicited. Following the general physical examination and systemic examination which included chest auscultation, chest x-rays were taken.

After completion of clinical assessment and investigations, aspiration pneumonia was labelled when acute lung insult occurred following aspiration of gastric contents and at least three findings were present including fever with temperature ≥37.8°C, cough with thick sputum and crepitations on auscultation, increased respiratory rate according to age (up to 40/min for 1–5 years, up to 25/min for 6–10 years and up to 20/min above 10 years), radiological evidence of pulmonary consolidation on chest X-ray, and leukocytosis with WBC count >11,000 cells/μL . All collected data was entered and analysed using SPSS version 26. Quantitative variables like age, weight and duration of cerebral palsy were presented as mean ± standard deviation. Categorical variables such as gender, parent socioeconomic status, education level, residential status and aspiration pneumonia were expressed as frequency and percentages. Stratification was done for age, gender, weight, parent socioeconomic status, education level, duration of cerebral palsy and residential status. Post stratification chi square test or Fisher exact test was applied and p value ≤0.05 was taken as statistically significant.

RESULTS

The mean age of the study participants was 6.43 ± 4.04 years, and the mean weight was 20.79 ± 7.30 kg. Regarding gender distribution, 63 (61.2%) of the children were male and 40 (38.8%) were female. With respect to parental education, 41 (39.8%) parents were uneducated, 22 (21.4%) had primary education, 18 (17.5%) had secondary education, and 22 (21.4%) had higher education. As for residential status, majority of the children, 67 (65.0%), belonged to rural areas, whilst 36 (35.0%) were from urban settings (Table 1).

Table 1

Patient Demographics (N=103)

Demographics		Mean ± SD
Age (years)		6.43 ± 4.04
Weight (kg)		20.79 ± 7.30
Gender	Male n (%)	63 (61.2%)
	Female n (%)	40 (38.8%)
Parent Education Level	Uneducated n (%)	41 (39.8%)
	Primary n (%)	22 (21.4%)
	Secondary n (%)	18 (17.5%)
	Higher n (%)	22 (21.4%)
Residential Status	Rural n (%)	67 (65.0%)
	Urban n (%)	36 (35.0%)

Regarding the frequency of aspiration pneumonia, it was observed that 31 (30.10%) of the cerebral palsy children were diagnosed with aspiration pneumonia, whereas 72 (69.90%) did not had this complication, giving a total sample of 103 children (Table 2).

Table 2

Frequency of Aspiration Pneumonia in a Cerebral Palsy Child (N=103)

Aspiration Pneumonia	Frequency	% age
Yes	31	30.10%
No	72	69.90%
Total	103	100%

With regard to the association of aspiration pneumonia with demographic factors, a statistically significant association were found between aspiration pneumonia and age, wherein all 31 cases of aspiration pneumonia occurred exclusively in children aged ≤10 years, representing 37.8% of that age group, whilst none of the

children aged >10 years were affected (p<0.001). Similarly, a highly significant association were observed between aspiration pneumonia and weight, as all positive cases occurred only in children weighing ≤20 kg, accounting for 51.7% of that weight group, with no cases reported in children weighing >20 kg (p<0.001). Parental education level also showed a statistically significant association, with aspiration pneumonia being present in 21 (51.2%) children of uneducated parents and 10 (45.5%) children of parents with primary education only, whereas no cases were identified amongst children whose parents had secondary or higher education (p<0.001). Furthermore, residential status was significantly associated with aspiration pneumonia, as 31 (46.3%) of rural children were affected compared to none of the urban children (p<0.001) (Table 3).

Table 3
Association of Aspiration Pneumonia with Demographic Factors

Demographic Factors	Subgroup	Aspiration Pneumonia		p-value
		Yes n (%)	No n (%)	
Age (years)	≤10	31 (37.8%)	51 (62.2%)	<0.001**
	>10	0 (0.0%)	21 (100.0%)	
Gender	Male	21 (33.3%)	42 (66.7%)	0.369*
	Female	10 (25.0%)	30 (75.0%)	
Weight (kg)	≤20	31 (51.7%)	29 (48.3%)	<0.001**
	>20	0 (0.0%)	43 (100.0%)	
Parent Education Level	Uneducated	21 (51.2%)	20 (48.8%)	<0.001**
	Primary	10 (45.5%)	12 (54.5%)	
	Secondary	0 (0.0%)	18 (100.0%)	
	Higher	0 (0.0%)	22 (100.0%)	
Residential Status	Rural	31 (46.3%)	36 (53.7%)	<0.001**
	Urban	0 (0.0%)	36 (100.0%)	

*Chi-square Test **Fischer Exact Test

DISCUSSION

The prevalence of aspiration pneumonia among the pediatric population with cerebral palsy was recorded at 31(30.10%). This higher frequency is due to cerebral palsy-related neuro-motor dysfunction in the oropharyngeal muscles leading to impaired swallowing and ineffective airway protection when ingesting meals. The dysfunction makes it more likely for the child to silently aspirate food particles, fluids, and oral secretions into the lungs, ultimately causing pneumonia. Age correlated significantly with aspiration pneumonia (p < 0.001), where all positive cases were recorded among the ≤10-year-old age group, making up 37.8% of the group. Young children with cerebral palsy suffer from underdeveloped and improperly coordinated swallowing functions and incomplete cough reflex and airway defense mechanisms, which make them more susceptible to aspiration events. Weight correlated highly significantly with aspiration pneumonia (p < 0.001), with all 31 (51.7%) cases of aspiration pneumonia being registered among the ≤20kg body mass, without any occurrences among heavier children. Malnutrition, which contributes to low body mass, is prevalent among children with cerebral palsy and causes feeding challenges, thus, indicating oro-motor dysfunction.

The frequency of aspiration pneumonia in the present study was found to be 31 (30.10%), which is consistent with the findings of Hajira B *et al.* [12] who reported pneumonia in 40.9% of cerebral palsy children, indicating that aspiration pneumonia remains a frequent and significant complication in this population. Similarly, Najar BA *et al.* [13] reported aspiration pneumonia in 14.03% of cerebral palsy children, which is somewhat lower than the present findings. This difference may be attributed to variation in sample size, disease severity, and diagnostic criteria used across different settings. The higher frequency observed in present study and that of Hajira B *et al.* [12] may reflects the presence of more severe neuromuscular dysfunction in the studied populations, which predisposes children to oropharyngeal dysphagia and consequent pulmonary aspiration. This is further supported by Marpole R *et al.* [14] and Gibson N *et al.* [15] who both identified respiratory disease as the leading cause of morbidity and mortality in cerebral palsy, with a 14-fold higher risk of death from respiratory causes, confirming the clinical burden of this complication.

Age was found to be significantly associated with aspiration pneumonia (p<0.001), as all 31 (37.8%) positive cases occurred exclusively in children aged ≤10 years. This finding is in agreement with the general observations of Lam P [16] who reported that impaired swallowing, weak cough reflex, and gastro-oesophageal reflux are more pronounced in younger and more severely affected children, making them more vulnerable to aspiration events. Rijal P *et al.* [17] also noted aspiration syndrome as the leading identifiable cause of recurrent pneumonia in children, which further supports the age-related susceptibility observed in the present study. Younger children have less mature airway protective mechanisms and underdeveloped swallowing coordination, which provides a plausible physiological explanation for this significant association.

Weight showed a highly significant association with aspiration pneumonia (p<0.001), with all positive cases occurring only in children weighing ≤20 kg, constituting 51.7% of that weight group. This is comparable to the findings of Abdrakhmanova ST *et al.* [18] who reported that cerebral palsy children with pneumonia had more severe disease and greater nutritional compromise as compared to controls. Malik BA *et al.* [19] also identified nutritional disorders and growth failure as amongst the most common problems associated with cerebral palsy. Low body weight in these children reflects underlying malnutrition and oro-motor feeding difficulties, both of which are closely linked with compromised respiratory muscle strength and impaired immune defence, thereby increasing susceptibility to aspiration pneumonia.

Parental education level was significantly associated with aspiration pneumonia (p<0.001), with highest rates seen in children of uneducated 21 (51.2%) and primary-educated parents 10 (45.5%), whilst no cases were identified in children of parents with secondary or higher education. This finding is well supported by Draz SF *et al.* [20] who demonstrated that educational intervention in mothers of cerebral palsy children with respiratory problems led to statistically significant improvement in maternal knowledge and practices, which consequently reduced recurrent respiratory complications. This confirms that parental awareness regarding safe feeding

techniques, proper positioning, and early recognition of aspiration signs plays a vital role in prevention of aspiration pneumonia.

Residential status was also significantly associated ($p<0.001$), as 31 (46.3%) of rural children were affected compared to none from urban areas. Qureshi D *et al.* [21] reported respiratory illness in 16.4% of cerebral palsy children and highlighted feeding difficulties and oromotor dysfunction as major contributing factors, which are more likely to go unmanaged in rural settings due to limited access to specialised rehabilitation services such as speech and language therapy. Braverman JM[22] further emphasised that impaired airway clearance and recurrent infections are chief causes of morbidity in cerebral palsy, and these are more likely to worsen in rural populations where delayed healthcare seeking and poor health literacy are common. The complete absence of aspiration pneumonia in urban children in the present study strongly suggests that access to healthcare, parental education, and specialised nutritional support are important protective factors against this complication.

However, there are some limitations associated with this study that should be highlighted. Firstly, the research was performed in a single location – in one hospital, which can affect the validity of its conclusions regarding the overall population of children diagnosed with cerebral palsy. Secondly, the number of participants involved in the investigation was rather small, including just 103 children. Moreover, it is likely that this aspect affected the strength of some associations found. Thirdly, the cross-sectional design of the study does not allow concluding about the cause-and-effect relationships between demographic factors and aspiration pneumonia. Finally, some clinical factors, such as the nature of cerebral palsy, type of feeding, vaccinations, and nutrition, were not considered in the study.

CONCLUSION

Aspiration pneumonia is shown to be a common and serious problem in children with cerebral palsy, affecting almost one-third of the participants. In addition, it was revealed that young age, poor body mass, illiteracy of parents, and rural dwelling were related to a higher incidence of aspiration pneumonia among these children.

Disclaimer: No any disclaimer present.

Acknowledgments: The author thankful to the medical staff of department for their continuous support. Their proper maintaining of record and organized handling of patient data play important role in completing this work.

REFERENCES

1. Basoya S, Kumar S, Wanjari A. Cerebral palsy: a narrative review on childhood disorder. *Cureus*. 2023;15(11):e49050. https://doi.org/10.7759/cureus.49050
2. Narayan A, Muhit M, Whitehall J, Jahan I, Islam S, Khandaker G. Associated impairments among children with cerebral palsy in rural Bangladesh-findings from the Bangladesh cerebral palsy register. *Journal of Clinical Medicine*. 2023;12(4):1597. https://doi.org/10.3390/jcm12041597
3. Jonsson U, Eek MN, Sunnerhagen KS, Himmelmann K. Health conditions in adults with cerebral palsy: the association with CP subtype and severity of impairments. *Frontiers in Neurology*. 2021;12:732939. https://doi.org/10.3389/fneur.2021.732939
4. Widman-Valencia ME, Gongora-Meza LF, Rubio-Zapata H, Estrella-Castillo D, Cardenas-Soto L, Gongora-Meza LF. Oral motor treatment efficacy: feeding and swallowing skills in children with cerebral palsy. *Behavioural Neurology*. 2021; 2021:6299462. https://doi.org/10.1155/2021/6299462
5. Schepers FV, van Hulst K, Spek B, Erasmus CE, van den Engel-Hoek L. Dysphagia limit in children with cerebral palsy aged 4 to 12 years. *Developmental Medicine and Child Neurology*. 2022;64(2):253-258. https://doi.org/10.1111/dmcn.15031
6. Ibrahim AF, Elsebahy SY, Aldhahi MI, Khalaf MM, Torad AA, Taha MM, *et al.* Influence of oromotor functions on motor development and feeding outcomes in children with cerebral palsy. *Annals of Medicine*. 2025;57(1):2479587. https://doi.org/10.1080/07853890.2025.2479587
7. Calderone A, Militi D, Cardile D, Corallo F, Calabrò RS, Militi A. Swallowing disorders in cerebral palsy: a systematic review of oropharyngeal dysphagia, nutritional impact, and health risks. *Italian Journal of Pediatrics*. 2025;51(1):57. https://doi.org/10.1186/s13052-025-01903-1
8. Tanaka N, Nohara K, Uota C, Fujii N, Katayama T, Ushio M, *et al.* Relationship between daily swallowing frequency and pneumonia in patients with severe cerebral palsy. *BMC Pediatrics*. 2022;22(1):485. https://doi.org/10.1186/s12887-022-03547-0
9. Mauritz MD, Hasan C, Schmidt P, Simon A, Schmidt M, Kribs A, *et al.* Lower respiratory tract infections in pediatric patients with severe neurological impairments: clinical observations and perspectives in a palliative care unit. *Children (Basel)*. 2022;9(6):852. https://doi.org/10.3390/children9060852
10. Tanaka N, Nohara K, Ueda A, Katayama T, Ushio M, Fujii N, *et al.* Effect of aspiration on the lungs in children: a comparison using chest computed tomography findings. *BMC Pediatrics*. 2019;19(1):162. https://doi.org/10.1186/s12887-019-1531-6
11. Kürtül Çakar M, Cinel G. The respiratory problems of patients with cerebral palsy requiring hospitalization: reasons and solutions. *Pediatr Pulmonol*. 2021;56(6):1626-34
12. Hajira B, Pervez S, Ashraf S, Farid A, Khan AM, Qadeer AA. Frequency and clinical risk factors of pneumonia in CP children. *Pak J Health Sci*. 2025;6(8):134-139. https://doi.org/10.54393/pjhs.v6i8.3422
13. Najar BA, Kachroo A, Gattoo IA, Hussain SQ. Cerebral palsy: risk factors, comorbidities and MRI findings. *Int J Contemp Pediatr*. 2015;2(2):90-95 https://doi.org/10.5455/2349-3291.ijcp20150506
14. Marpole R, Blackmore AM, Gibson N, Cooper MS, Langdon K, Wilson AC. Evaluation and management of respiratory illness in children with cerebral palsy. *Front Pediatr*. 2020;8:333. https://doi.org/10.3389/fped.2020.00333
15. Gibson N, Blackmore AM, Chang AB, Cooper MS, Jaffe A, Kong WR, *et al.* Prevention and management of respiratory disease in CP. *Dev Med Child Neurol*. 2020. https://doi.org/10.1111/dmcn.14640
16. Lam P. Aspiration pneumonitis and aspiration pneumonia in neurologically impaired children. *Hong Kong Med J*. 2008;4(3):1-5
17. Rijal P, Lama L, Shrestha S, Kakshapati P, Nayak R. Study of children with recurrent pneumonia admitted in a tertiary hospital. *Nepal Med Coll J*. 2019;21(1):65-69 https://doi.org/10.3126/nmcj.v21i1.24856

18. Abdrakhmanova ST, Skuchalina LN, Meshcheryakov VV. Features of community-acquired pneumonia in children with cerebral palsy. *Acta Sci Nutr Health*. 2021;5(7):57-63 https://doi.org/10.31080/asnh.2020.05.0892
19. Malik BA, Zafar S, Razzaq A, Butt MA, Khan MS. Frequently associated problems of cerebral palsy. *APMC*. 2007;1(2):14-15 https://doi.org/10.29054/apmc/2007.638
20. Draz SF, Bayoumi OR, El-Nagger NS. Respiratory problems of children with cerebral palsy. *J Am Sci*. 2013;9(7):1-12
21. Qureshi D, Bano S, Idrees H, Iram S. Frequency of respiratory illnesses in CP children. *Prof Med J*. 2020;27(6):1187-1193. https://doi.org/10.29309/TPMJ/2020.27.06.4010
22. Braverman JM. Airway clearance dysfunction associated with cerebral palsy. *J Pulm Med*. 2008;2008:1-5