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Original Research Article

Clinical profile and underlying causes of recurrent pneumonia in young children

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ABSTRACT

Background: Recurrent pneumonia is a significant health concern in children, often associated with underlying medical conditions and substantial morbidity. Identifying risk factors, clinical profiles and underlying causes are essential for timely diagnosis and management.
Methods: This cross-sectional, prospective study was conducted at Bangladesh Shishu Hospital and Institute from January to June 2022, involving 50 children aged 2 months to 5 years with recurrent pneumonia. Data were collected on clinical symptoms, underlying conditions, physical findings, immunization status, radiographic, laboratory and specialized testing findings.
Results: Cough was present in 100% of cases, followed by respiratory distress (78%) and fever (66%). Congenital heart disease was the most common underlying condition (22%), followed by developmental delay (16%) and cystic fibrosis (10%). Respiratory distress was observed in 78% of patients, with crackles (66%) and wheezing (32%) as common auscultatory findings. Bronchopneumonia was the predominant chest x-ray finding (72%), while CT scans revealed consolidation in 48.6% of cases. Sweat chloride testing confirmed cystic fibrosis in 10% of cases and echocardiography identified congenital heart disease in 31.3%.
Conclusions: Recurrent pneumonia in children is frequently associated with congenital heart disease, developmental delay and cystic fibrosis. Radiographic findings, laboratory investigations and specialized testing are crucial for accurate diagnosis and management. Timely identification of risk factors and adherence to immunization schedules are essential to reduce disease burden.

Keywords: Children, Congenital heart disease, Cystic fibrosis, Recurrent pneumonia

INTRODUCTION

Pneumonia is an acute inflammation of the lung parenchyma that develops due to both infectious and non-infectious causes.[1,2] It is a major problem in children especially those younger than 5 years.[3] World Health Organization (WHO) estimated that pneumonia occurred in approximately 156 million children (151 million in developing countries and 5 million in developed countries).[4] The incidence and mortality rate of childhood pneumonia are 10 times higher in developing countries.[5] A subgroup of these children suffers from recurrent

pneumonia.[3] Recurrent pneumonia is defined as at least 2 episodes of pneumonia in 1 year period or more than 3 episodes of pneumonia at any time with radiographic clearance between episodes.[1,2] By this definition, recurrent pneumonia occurs in 6.4%-9% of all children with pneumonia.[6,7] So it become most significant reason for referred to pediatrician and is still a challenging disease.[8] Early recognition and management of the underlying causes are expected to reduce the number of pneumonia related hospital admissions, morbidity and mortality.[1,9] Recurrent pneumonia usually results from deficiencies in the local pulmonary or systemic host defenses or from underlying disorders that modify the lung defense.[1] Factors associated with recurrent pneumonia include repeated aspiration, congenital abnormalities in the upper or lower respiratory tract and cardiovascular system, impaired mucus clearance, immune deficiency disorders, insufficient antibiotic treatment, infection from atypical or drug-resistant organisms, neuromotor disorders accompanied by feeding difficulties, gastroesophageal reflux disease (GERD), asthma and vascular malformations.[3,6]

The challenge for physicians managing recurrent pneumonia lies in distinguishing between children with self-limiting or mild issues that don't need extensive diagnostic evaluation and those with underlying conditions, who require further investigations. Therefore, determining which child should be investigated relies on clinical judgement, that should take into account the patient's history, the clinical course of the episode, any symptoms and/or indicating the presence of an underlying disease.[10] There are limited data on the underlying diseases predisposing to recurrent pneumonia in children.[1] In addition, few studies have addressed this problem in the developing world.[11,12] Studies of epidemiology to recurrent pneumonia will ease preventive and therapeutic approach towards the disease especially in a developing country like Bangladesh. The objective of this study was to address the clinical profile and determine the underlying causes of recurrent pneumonia among children aged 2 months to 5 years. Hence, we can make strategic plan to reduce the morbidity and mortality due to recurrent pneumonia.

METHODS

Study type

This was a cross-sectional prospective study.

Study place

The study was conducted in the Department of Paediatrics at Bangladesh Shishu Hospital and Institute, Dhaka, Bangladesh.

Study duration

The study duration was from January to June 2022.

The study aimed to identify the clinical profile, risk factors and underlying causes of recurrent pneumonia in children aged 2 months to 5 years

Inclusion criteria

Due to time constraints, a total of 50 children meeting the inclusion criteria were included, using a convenient sampling method. The inclusion criteria were children aged 2 months to 5 years, admitted with recurrent pneumonia and radiological evidence of pneumonia.

Exclusion criteria

Exclusion criteria included children with a history of prolonged mechanical ventilation during the neonatal period or known cases of bronchial asthma.

Data collection

Data collection was done using a structured questionnaire, which was pre-tested and finalized. Information's were gathered from legal guardians through interviews, physical examinations and investigation reports.

Radiologic interpretations were performed by a consultant in the department of radiology and imaging. The study focused on identifying risk factors, such as malnutrition, incomplete immunization, overcrowding and passive smoking, as well as underlying illnesses, including congenital heart disease, primary immunodeficiency, cystic fibrosis and GERD.

Ethical approval

Ethical considerations included obtaining informed consent from the parents/guardians, approval from the ethical review committee and maintaining confidentiality of all participant data.

Statistical analysis

Data were analysed using SPSS version 24.0, with frequency and percentage calculations for categorical variables and mean values for continuous variables. This study provides valuable insights into the factors contributing to recurrent pneumonia in young children and highlights the importance of early diagnosis and treatment.

RESULTS

Table I shows that majority 21 (42.0%) patients belonged to age group 7-12 months, the mean age was 19.0±15.7 months. Male patients were predominant 33 (66.0%) whereas female 17 (34.0%), male: female ratio was 1.9:1. In Figure 1 regarding symptoms, cough was presented in all patients, whereas respiratory distress 39 (78.0%), fever 33 (66.0%), reluctant to feed 5 (10.0%), vomiting 4 (8.0%) and lethargy 1 (2.0%).

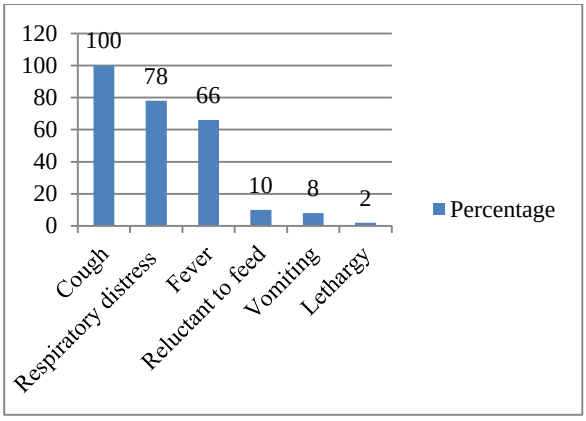

Figure 1: Distribution of the study patients according to symptoms (n=50).

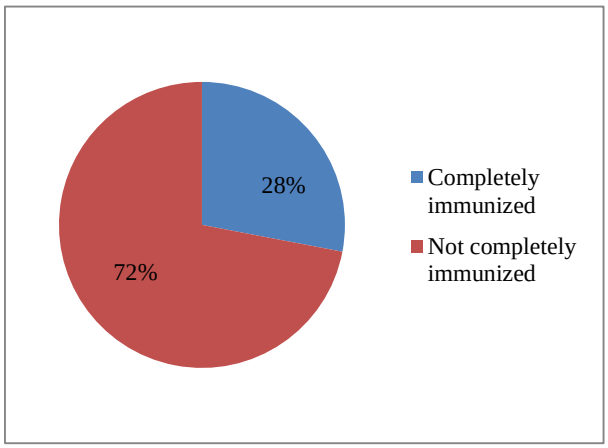

Figure 2: Distribution of the study patients according to immunization (EPI) (n=50).

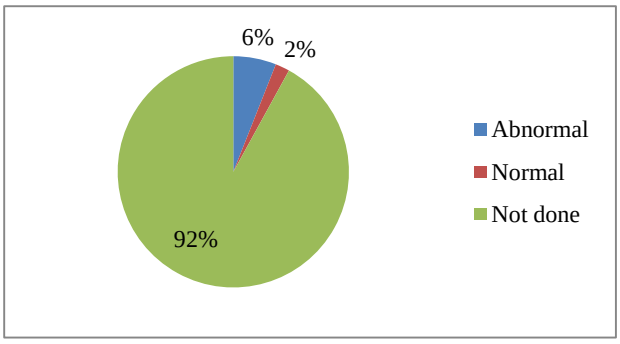

Figure 3: Distribution of the study patients according to CT scan of chest (n=50).

Table 2 shows that congenital heart disease was the most prevalent 11 (22.0%) as underlying causes of recurrent pneumonia patients, then development delay 8 (16.0%), cystic fibrosis 5 (10.0%), primary immunodeficiency 4 (8.0%), malnutrition 4 (8.0%), floppy child 3 (6.0%), cleft lip and cleft palate 3 (6.0%), gastro-esophageal reflux disease (GERD) 2 (4.0%), aspiration pneumonia 2 (4.0%), CP with development delay 2 (4.0%), ILD 1 (2.0%) and unknown cause was 11 (22.0%).

Table 3 shows that almost three fourth (74.0%) patients had chest in-drawing, 31 (62.0%) had BCG mark, 8 (16.0%) had skin-Eczema/Allergy, 6 (12.0%) had cleft lip/palate and 4 (8.0%) had cyanosis.

The mean temperature was 99.6±1.5, mean heart rate 132.3±18.5 beats per minute, mean respiratory rate 54.0±13.1 breaths per minute and mean SpO2 93.1±5.8%.

Figure 2 shows that completely immunized was found in 14 (28.0%) patients.

In Table 4 regarding chest x-ray, bronchopneumonia was found in 36 (72.0%), consolidation 7 (14.0%), aspiration pneumonia 2 (4.0%), collapse 2 (4.0%), collapse and consolidation 1 (2.0%) and hyperinflation 2 (4.0%).

Figure 3 shows that CT scan of chest was done in 4 patients, among them 3 (6.0%) were abnormal, 1 (2.0%) was normal and CT scan was not done in 46 (92.0%) patients.

Table 5 shows that no growth was found in 46 (92.0%) and number of organisms isolated was 4 (8.0%). Among them *Klebsiella pneumoniae* was 2 (4.0%), Pseudomonas 1 (2.0%) and Streptococcus 1 (2.0%).

Table 6 shows that normal sweat chloride level was found in 20 (40.0%), raised 9 (18.0%) and not done in 21 (42.0%).

Table 7 shows that echocardiography was done in 48 patients, among them normal was 33 (68.8%) and abnormal was 15 (31.3%).

Atrial septal defect (ASD) was found 4 (8.3%), ventricular septal defect (VSD) 6 (12.5%), pulmonary HTN 1 (2.1%), patent ductus arteriosus (PDA) 2 (4.2%) and VSD+ASD 1 (2.1%).

Table 1: Distribution of study patients by socio-demographic characteristics (n=50).

Parameters	Frequency	%
Age (months)		
≤6	6	12.0
7-12	21	42.0
13-24	10	20.0
25-36	4	8.0
37-48	5	10.0

Continued.

Parameters	Frequency	%
49-60	4	8.0
Mean±SD	19.0±15.7	
Range (min-max)	3.0-60.0	
Sex		
Male	33	66.0
Female	17	34.0

Table 2: Distribution of the study patients according to underlying illness (n=50*).

Underlying illness	Frequency	%
Congenital heart disease	11	22
Developmental delay	8	16
Cystic fibrosis	5	10
Primary immunodeficiency	4	8
Malnutrition	4	8
Floppy child	3	6
Cleft lip and cleft palate	3	6
Gastro-esophageal reflux disease (GERD)	2	4
Aspiration pneumonia	2	4
CP with development delay	2	4
ILD	1	2
Unknown	11	22

Table 3: Distribution of the study patients according to physical findings (n=50).

Physical findings	Frequency	%
Chest in-drawing	37	74.0
BCG mark	31	62.0
Skin-Eczema/Allergy	8	16.0
Cleft Lip/Palate	6	12.0
Cyanosis	4	8.0
Mean±SD		
Temperature (°F)	99.6	±1.5
Heart rate (beats per minute)	132.3	±18.5
Respiratory rate (breaths per minute)	54.0	±13.1
SpO2 (%)	93.1	±5.8

Table 4: Distribution of the study patients according to chest x-ray (n=50).

Chest X-ray	Frequency	%
Bronchopneumonia	36	72.0
Consolidation	7	14.0
Aspiration pneumonia	2	4.0
Collapse	2	4.0
Collapse & consolidation	1	2.0
Hyperinflation	2	4.0

Table 5: Distribution of the study patients according to blood culture (n=50).

Blood culture	Frequency	%
No growth	46	92.0
Organism isolated	4	8.0
Klebsiella pneumoniae	2	4.0
Pseudomonas	1	2.0
Streptococcus	1	2.0

Table 6: Distribution of the study patients according to sweat chloride level (n=50).

Sweat chloride level	Frequency	%
Normal	20	40.0
Raised	9	18.0
Not done	21	42.0

Table 7: Distribution of the study patients according to echocardiography (n=48).

Echocardiography	Frequency	%
Normal	33	68.8
Abnormal	15	31.3
Atrial septal defect (ASD)	4	8.3
Ventricular septal defect (VSD)	6	12.5
Pulmonary HTN	1	2.1
Patent ductus arteriosus (PDA)	2	4.2
VSD+ASD	1	2.1

DISCUSSION

This study aimed to explore the clinical profile, risk factors and underlying causes of recurrent pneumonia in children aged 2 months to 5 years, admitted to the Pediatric Department of Bangladesh Shishu Hospital and Institute, Dhaka. A total of 50 children were enrolled in this cross-sectional, prospective study conducted from January to June 2022.

The distribution of symptoms among the study participants revealed that the most common symptom was cough, present in all patients, followed by respiratory distress in 78% and fever in 66%. Other symptoms such as reluctant feeding, vomiting and lethargy were less frequent. These findings align with previous studies, including one by Mahmoud and Ahmed, where cough was the most prevalent symptom (99%), followed by wheezing (63%) and fever (60%).[13] The higher prevalence of respiratory distress in our study might reflect the severity of the cases. Similar results were reported in studies by Rijal et al, who found a 98.3% prevalence of cough and Hossain et al, where cough was present in 100% of cases.[1,14]

The study identified several underlying conditions contributing to recurrent pneumonia. Congenital heart disease was the most prevalent, affecting 22% of the patients, followed by developmental delay (16%) and cystic fibrosis (10%).

These findings are comparable to Mahmoud and Ahmed's study, which reported congenital heart diseases in 16% and immune disorders in 22% of patients.[13] Similarly, Capanoglu et al, observed that congenital birth defects (33.9%) and aspiration syndrome (31%) were major contributors.[2] The notable prevalence of congenital heart disease in this study underscores its importance as a risk factor in managing recurrent pneumonia in children.

Physical examination revealed that most children exhibited respiratory distress (78%), with crackles on auscultation being the most common added sound (66%), followed by wheezing (32%). These findings are consistent with those reported by Mahmoud et al and Ahmed et al, where crackles were observed in 86% of cases and wheezing in 60%.[13]

The presence of crackles suggests significant pulmonary involvement, possibly due to inflammation or consolidation. The relatively lower prevalence of wheezing compared to other studies might be attributed to variations in the demographic and clinical characteristics of the study populations.

The immunization status of the study population showed that most children had received their scheduled vaccinations under the expanded program on immunization, with a small proportion of cases exhibiting complete immunization. This finding is consistent with other studies, which suggest that incomplete or delayed immunization increases the risk of pneumonia in children.[15] The cases with incomplete immunization highlight the need for strict adherence to vaccination schedules to prevent recurrent pneumonia.

Radiographic evaluation was crucial in diagnosing and assessing the severity of pneumonia. The most common radiographic finding on chest X-ray was bronchopneumonia, observed in 72% of patients, followed by consolidation in 14% and aspiration pneumonia in 4%. CT scan findings included consolidation in 48.6% of cases, along with bronchiectasis and atelectasis in a subset of patients. These findings are consistent with those of Rijal et al, who reported consolidation as the most common chest X-ray finding (58.1%).[1] The high prevalence of bronchopneumonia and consolidation highlights the importance of imaging in guiding clinical management decisions in children with recurrent pneumonia.

Blood culture results revealed that proportion of patients tested positive for bacterial pathogens, which were identified as the causative agents of pneumonia. This prevalence is comparable to findings by El-Saied et al, who reported a bacterial etiology in a significant proportion of recurrent pneumonia cases.[16] Blood cultures are critical for identifying causative organisms and tailoring appropriate antibiotic therapy, especially in recurrent pneumonia.

Specialized tests identified additional underlying conditions contributing to recurrent pneumonia. Sweat chloride testing, used to diagnose cystic fibrosis, was positive in 10% of cases, consistent with findings by Hossain et al and Rijal et al, who also reported cystic fibrosis as a common underlying condition.[1,14] Echocardiography, performed in 48 patients, revealed congenital heart diseases in 31.3% of cases, including atrial septal defect and ventricular septal defect. These findings align with studies by El-Saied et al and Bolursaz et al, which highlighted a high prevalence of congenital heart disease in children with recurrent pneumonia.[16,17]

The study population was selected from one selected hospital in Dhaka city, so that the results of the study may not reflect the exact picture of the country. Small sample size was also a limitation of the present study. Therefore, in future further study may be under taken with large sample size. Lack of facilities for immunological work-up and an irregular set of investigations for all patients. If the investigations could have been followed up, there would have been fewer patients with undiagnosed causes.

CONCLUSION

This study provides valuable insights into the clinical presentation, risk factors and underlying causes of recurrent pneumonia in children. The results emphasize the importance of identifying and addressing underlying conditions such as congenital heart disease, developmental delay and cystic fibrosis. Radiographic findings, laboratory investigations and specialized tests play a critical role in diagnosis and management. These findings underscore the need for comprehensive evaluation and targeted treatment strategies to reduce morbidity and mortality associated with recurrent pneumonia in this vulnerable population.

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Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

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