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Original Article

Clinical Profile and Predisposing Factors of Recurrent Pneumonia in Children Aged 1 Month to 5 Years: A Cross-sectional Study from a Tertiary Care Hospital

Dr Sowmya Reddy Ch[1], Dr. Udata Nagatulasi[2], Dr. Vasudev Kompally[3], Dr. Subhan Basha Bukkapatnam[4]

[1]Assistant Professor, Department of Pediatrics, Gandhi Medical College, Secunderabad, Telangana, India
[2]Senior Resident, Department of Pediatrics, Gandhi Medical College, Secunderabad, Telangana, India
[3]Professor and Head, Department of Pediatrics, Gandhi Medical College, Secunderabad Telangana, India
[4]Associate Professor, Department of Pediatrics, Kakatiya Medical College Hanamkonda Telangana India

Corresponding Author:

Dr. Subhan Basha Bukkapatnam
Associate Professor, Department of Pediatrics, Kakatiya Medical College Hanamkonda Telangana India

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ABSTRACT

Objectives: To describe the clinical profile and predisposing factors in children aged 1 month to 5 years with recurrent pneumonia.
Methods: This cross-sectional study included 114 children admitted with recurrent pneumonia at a tertiary care hospital during June 2023–December 2024. Recurrent pneumonia was defined as at least two episodes in 1 year or three lifetime episodes with radiographic clearance. Clinical and selected predisposing factors were recorded and analyzed descriptively.
Results: Of 114 children, 45 (39.5%) were aged 1–10 months. Fever and cough occurred in 93.9% and 93.0%, respectively. Malnutrition was present in 86.8%; 49.1% were incompletely immunized or unimmunized. Secondhand smoke exposure, aspiration, congenital heart disease and orofacial anomalies occurred in 33.3%, 18.4%, 14.0% and 11.4%, respectively. Multi-lobar involvement occurred in 62.3%; 96.5% were discharged.
Conclusions: Recurrent pneumonia was concentrated in infancy and frequently accompanied by nutritional and immunization deficits. Structured assessment of modifiable and underlying factors is warranted.

Keywords: *Recurrent pneumonia; Child; Malnutrition; Immunization; Aspiration; Congenital heart disease.*

INTRODUCTION

Recurrent pneumonia is defined by repeated episodes of pneumonia with radiographic clearance between episodes. It is clinically important because recurrence may signal an underlying disorder affecting airway protection, immunity, cardiopulmonary function or lung structure. Previous studies have identified aspiration, immunodeficiency, congenital heart disease and pulmonary abnormalities among the important predisposing conditions in children with recurrent pneumonia. The distribution of these conditions may vary with age and healthcare setting. Data from Indian tertiary care hospitals, particularly in young children, remain limited. We therefore described the clinical profile and predisposing factors among children aged 1 month to 5 years admitted with recurrent pneumonia at a tertiary care teaching hospital.

METHODS

Study design and participants. This cross-sectional study was conducted in the Department of Pediatrics of a tertiary care teaching hospital from June 2023 to December 2024. Children aged 1 month to 5 years admitted with documented recurrent pneumonia were eligible. Recurrent pneumonia was defined as at least two episodes in 1 year or at least three episodes during the lifetime, with intercritical radiographic clearance. Children with a first episode of pneumonia, age below 1 month or above 5 years, and persistent pneumonia were excluded. A total of 114 eligible children were included.
Data collection. After informed consent, information was recorded using a structured case record form. Demographic and clinical data included age, sex, fever, cough, cold and breathing difficulty. History of recurrent pneumonia, immunization, nutritional status, prematurity, tuberculosis contact, secondhand smoke exposure, aspiration,

developmental delay and orofacial anomalies was documented. Previously diagnosed congenital heart disease, congenital lung defects and immunodeficiency were also recorded. Chest radiography was reviewed for single- or multi-lobar involvement. Treatment, length of hospital stay and outcome were documented.

Statistical analysis. Data were entered in Microsoft Excel and analyzed using SPSS. Categorical variables were summarized as frequency and percentage. The chi-square test was used to assess the association between age group and pneumonia severity. A P value <0.05 was considered statistically significant.

Ethics. The study was initiated after institutional ethics approval and written informed consent. The institutional ethics committee name, approval number and date are provided on the title page for insertion from the official approval record before submission.

RESULTS

A total of 114 children aged 1 month to 5 years with recurrent pneumonia were included in the study. The study was conducted at the Department of Pediatrics, Gandhi Hospital, Secunderabad, during the study period from June 2023 to December 2024. Recurrent pneumonia was defined as two or more episodes within 1 year or three or more episodes during the lifetime, with radiological clearance between episodes.

The age distribution of the study population showed a predominance of infants and younger children. The largest proportion of children belonged to the 1–10-month age group, comprising 45 (39.5%) participants. This was followed by 19 (16.7%) children aged 11–20 months and 14 (12.3%) aged 21–30 months. Seven (6.1%) children were aged 31–40 months, 13 (11.4%) were aged 41–50 months and 16 (14.0%) were aged 51–60 months. Thus, nearly two-fifths of the study population were aged below 1 year. The age distribution is shown in Table 1 and Fig. 1.

Table 1. Age distribution of children with recurrent pneumonia (n=114)

Age group (months)	n (%)
1–10	45 (39.5)
11–20	19 (16.7)
21–30	14 (12.3)
31–40	7 (6.1)
41–50	13 (11.4)
51–60	16 (14.0)

Abbreviation: n, number of children.

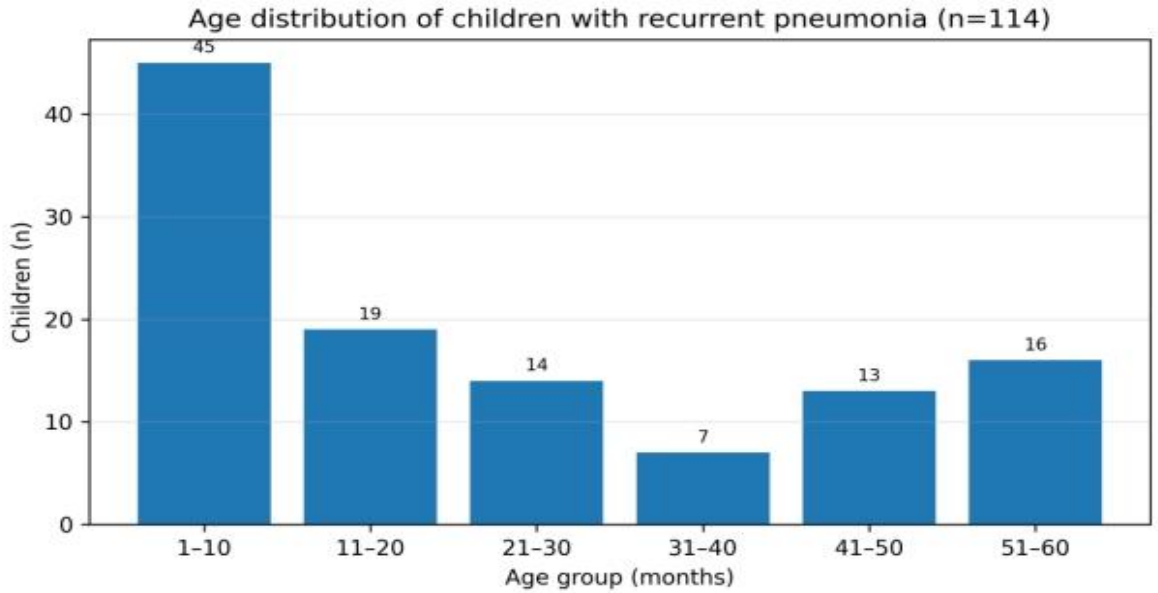

Figure 1. Age distribution of children with recurrent pneumonia (n=114).

Values are shown as number of children.

The sex distribution was almost equal. There were 58 (50.9%) male and 56 (49.1%) female children. Fever was the most frequently documented clinical feature and was present in 107 (93.9%) children, while 7 (6.1%) did not have fever. Cough was present in 106 (93.0%) children and absent in 8 (7.0%). Upper respiratory symptoms described as cold were reported in 94 (82.5%) children. Breathing difficulty was documented in 82 (71.9%) children, while 32 (28.1%) had no reported breathing difficulty. The clinical profile is summarized in Table 2.

Table 2. Clinical profile of children with recurrent pneumonia (n=114)

Clinical characteristic	n (%)
Male sex	58 (50.9)
Female sex	56 (49.1)
Fever	107 (93.9)
Cough	106 (93.0)
Cold	94 (82.5)
Breathing difficulty	82 (71.9)
Multi-lobar involvement on chest radiograph	71 (62.3)
Two previous pneumonia episodes	73 (64.0)
Moderate severity of previous episodes	54 (47.4)

Abbreviation: n, number of children.

The immunization status of the study population showed that 58 (50.9%) children had complete immunization. Immunization was incomplete in 44 (38.6%) children, while 12 (10.5%) children had not received immunization. Therefore, 56 (49.1%) children had either incomplete or absent immunization. Nutritional assessment showed a high proportion of children with malnutrition. Grade I malnutrition was present in 43 (37.7%) children and Grade II malnutrition in 42 (36.8%). Grade III and Grade IV malnutrition were present in 10 (8.8%) and 4 (3.5%) children, respectively. Only 15 (13.2%) children had normal nutritional status. Overall, 99 (86.8%) children had some degree of malnutrition.

Regarding birth history and selected environmental exposures, 18 (15.8%) children were born prematurely, while 96 (84.2%) were born at term. A history of contact with a person with tuberculosis was reported in 14 (12.3%) children. Exposure to secondhand smoke was documented in 38 (33.3%) children, whereas 76 (66.7%) had no reported exposure. Previously diagnosed congenital lung abnormalities were uncommon. No congenital lung defect was documented in 109 (95.6%) children. Congenital lobar emphysema was present in 3 (2.6%) children, while an aberrant bronchus and congenital pulmonary airway malformation were each documented in 1 (0.9%) child.

Congenital heart disease was documented in 16 (14.0%) children. Ventricular septal defect was the most frequent cardiac abnormality, present in 10 (8.8%) children, followed by atrial septal defect in 4 (3.5%). Two (1.8%) children had other congenital cardiac abnormalities. A history of aspiration was present in 21 (18.4%) children. Developmental delay was documented in 12 (10.5%) children. Orofacial anomalies were present in 13 (11.4%) children, including cleft palate in 9 (7.9%) and other orofacial anomalies in 4 (3.5%). The distribution of selected associated factors is shown in Table 3 and Fig. 2.

Table 3. Selected associated factors and underlying conditions (n=114)

Factor or condition	n (%)
Any malnutrition (Grades I–IV)	99 (86.8)
Grade I malnutrition	43 (37.7)
Grade II malnutrition	42 (36.8)
Incomplete immunization	44 (38.6)
Not immunized	12 (10.5)
Secondhand smoke exposure	38 (33.3)
Aspiration history	21 (18.4)
Prematurity	18 (15.8)
Congenital heart disease	16 (14.0)
Orofacial anomaly	13 (11.4)
Developmental delay	12 (10.5)

Abbreviation: n, number of children.

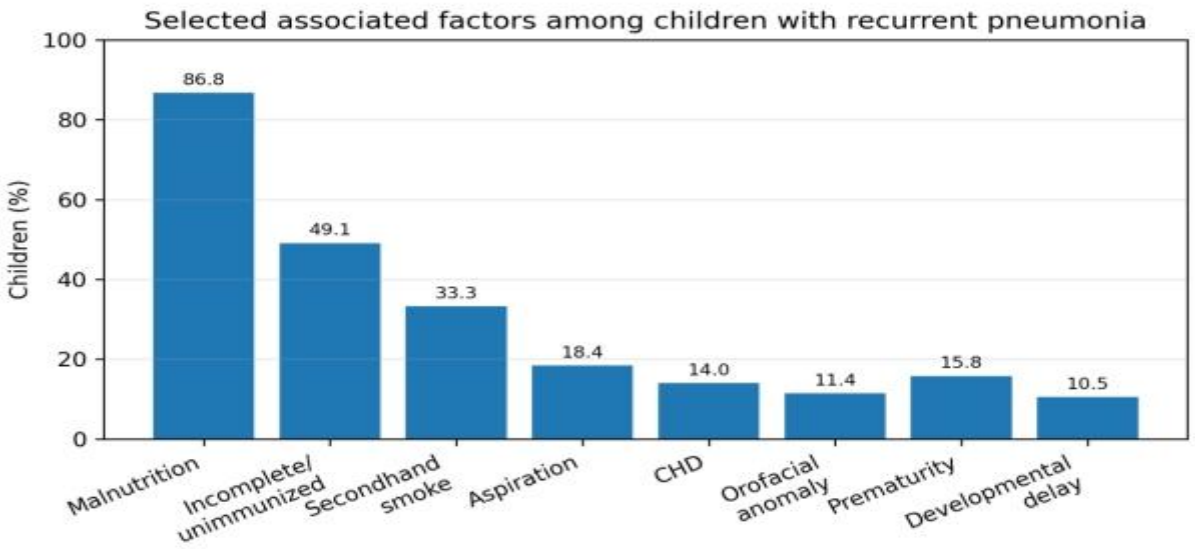

Figure 2. Selected associated factors among children with recurrent pneumonia.

Percentages are based on 114 children.

With regard to the number of previous pneumonia episodes, 73 (64.0%) children had experienced two episodes, 29 (25.4%) had experienced three episodes, 8 (7.0%) had experienced four episodes and 4 (3.5%) had experienced five episodes. The severity of previous pneumonia episodes was classified as mild in 37 (32.5%), moderate in 54 (47.4%) and severe in 23 (20.2%) children. Chest radiography showed multi-lobar involvement in 71 (62.3%) children, while 43 (37.7%) had involvement of a single lobe.

For the current episode, 62 (54.4%) children received oral antibiotics, 23 (20.2%) received intravenous antibiotics and 29 (25.4%) received oxygen along with intravenous antibiotics. Based on the treatment-related severity classification, 32 (28.1%) children were classified as having mild pneumonia, 59 (51.8%) as moderate and 23 (20.2%) as severe pneumonia. The treatment and current episode severity distribution are shown in Table 4.

Table 4. Treatment and current episode severity (n=114)

Treatment or severity category	n (%)
Oral antibiotics	62 (54.4)
Intravenous antibiotics	23 (20.2)
Oxygen + intravenous antibiotics	29 (25.4)
Mild current pneumonia	32 (28.1)
Moderate current pneumonia	59 (51.8)
Severe current pneumonia	23 (20.2)

Abbreviation: n, number of children.

The duration of hospital stay ranged from 1 to 16 days. The most frequent duration of hospitalization was 7 days, observed in 19 (16.7%) children, followed by 5 days in 17 (14.9%) and 6 and 8 days in 13 (11.4%) children each. Four (3.5%) children died during hospitalization, while 110 (96.5%) were discharged. Treatment modalities and hospital outcomes are shown in Fig. 3.

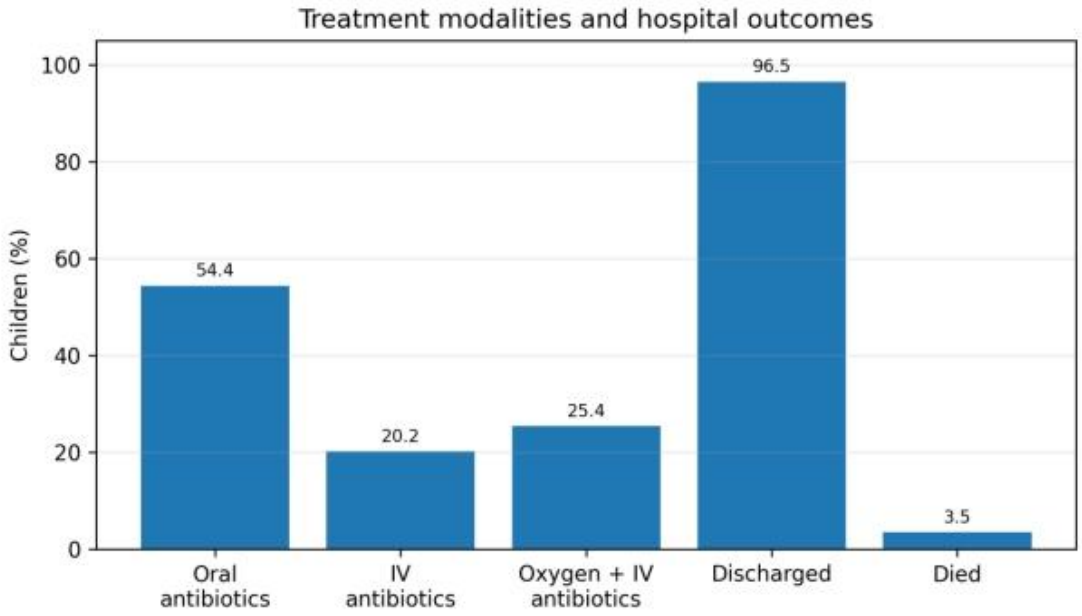

Figure 3. Treatment modalities and hospital outcomes.

Percentages are based on 114 children.

When the age groups of 1–6, 7–12, 13–36 and 37–60 months were compared with pneumonia severity, no statistically significant association was observed. The chi-square value was 3.152, with a P value of 0.7895.

DISCUSSION

This study describes recurrent pneumonia in a young tertiary-care pediatric population and highlights the coexistence of clinical, nutritional, environmental and medical factors. Nearly two-fifths of children were aged 1–10 months. The concentration of cases in infancy is biologically plausible because young children have smaller airways and immature immune defenses. The near-equal sex distribution suggests no clear sex predominance in this cohort.

Fever and cough were present in more than 90% of children, while breathing difficulty was present in approximately three-fourths. The most striking finding was the high burden of malnutrition: 86.8% had Grade I–IV malnutrition. This is clinically relevant because undernutrition can impair host defense and respiratory muscle function. However, as this was a descriptive study without a comparison group, the observed prevalence should not be interpreted as proof that malnutrition caused recurrent pneumonia.

Incomplete or absent immunization was documented in nearly half of the cohort. This finding identifies a potentially modifiable preventive-care gap. The coexistence of malnutrition and incomplete immunization in a substantial proportion of children supports the need for systematic nutritional and immunization assessment during evaluation of recurrent pneumonia.

A variety of underlying conditions were identified. Congenital heart disease was present in 14%, with ventricular septal defect being the most frequent lesion. Aspiration history was present in 18.4%, and orofacial anomalies in 11.4%. These observations are consistent with the broad range of underlying conditions reported in previous studies of recurrent pneumonia, although the relative contribution of individual causes varies between populations. Multi-lobar radiographic involvement was common, suggesting substantial pulmonary involvement at presentation.

The study has limitations. It was conducted at a single tertiary-care hospital and included hospitalized children; therefore, the findings may not be generalizable to community settings or children with less severe illness. The cross-sectional design precludes causal inference. The study did not include a control group and did not use a standardized diagnostic algorithm to systematically investigate all possible underlying causes. These limitations should be considered when interpreting the prevalence of the reported conditions.

In conclusion, recurrent pneumonia in this cohort was predominantly observed in infancy and was accompanied by a high burden of malnutrition and incomplete immunization, with aspiration, congenital heart disease, environmental smoke exposure and orofacial abnormalities also identified. A structured, multidisciplinary evaluation of children with recurrent pneumonia should include assessment of nutrition and immunization and targeted evaluation for underlying cardiopulmonary, aspiration and developmental disorders.

What this Study Adds?

- In this tertiary-care cohort of 114 young children with recurrent pneumonia, malnutrition and incomplete or absent immunization were frequent accompanying findings.
- The findings support a structured evaluation of nutritional, preventive and potential underlying medical factors in children presenting with recurrent pneumonia.

Conflict of interest : None
Source of Funding : None

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