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ORIGINAL ARTICLE

Prevalence of Pneumonia Associated with Measles Among Infants and Children

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ABSTRACT

Background: Measles remains a significant cause of childhood morbidity and mortality in developing countries, primarily due to its complications such as pneumonia. Despite the availability of an effective vaccine, suboptimal immunization coverage and malnutrition continue to contribute to measles outbreaks and severe clinical outcomes.

Objectives: To determine the prevalence of pneumonia in children diagnosed with measles and to assess its association with age, gender, immunization status, and nutritional status.

Study Design & Setting: A descriptive cross-sectional study conducted at the Pediatric Department of Shahida Islam Medical college Lodhran, over a six-month period.

Methodology: A total of 120 children aged 0–12 years with clinically diagnosed measles were enrolled using non-probability consecutive sampling. Pneumonia was diagnosed based on WHO clinical criteria. Relevant demographic, clinical, nutritional, and immunization data were collected using a structured proforma. Statistical analysis was performed using SPSS version 25.0; $p \leq 0.05$ was considered significant.

Results: Pneumonia was observed in 72 (60.0%) children. Pneumonia prevalence was significantly higher in infants (38.9%), malnourished children (58.3%), and those who were either partially immunized (29.2%) or not immunized (45.8%) ($p < 0.05$). No significant association was found with gender.

Conclusion: Pneumonia is a common and serious complication among children with measles, particularly in infants, malnourished, and unvaccinated individuals. Strengthening routine immunization and improving nutritional status are critical to reducing measles-related pneumonia.

Keywords: Children, Immunization, Infants, Malnutrition, Measles, Pneumonia, Prevalence, Vaccination

INTRODUCTION

Measles remains one of the most contagious viral diseases globally, transmitted via respiratory droplets and capable of surviving in airborne particles for hours, with an incubation period of 7–21 days[1]. Although widely preventable by vaccination, measles in infants and young children can lead to severe complications, particularly pneumonia, which is the leading cause of measles-related mortality[2,3]. Pneumonia accounts for 56–86% of deaths in measles-infected children under five[4,5]. In the wake of declining routine immunization rates—exacerbated by the COVID-19 pandemic—there has been resurgence in measles incidence and a corresponding rise in associated pneumonia, particularly among socioeconomically disadvantaged and unvaccinated populations[6,7].

Global measles cases surged by nearly 79% in early 2022 compared to the previous year, reflecting disrupted immunization programs and increasing vulnerability to outbreaks[8]. Europe alone reported over 30,000 cases between January and October 2023, with 40% occurring in children aged one to four9. Such increases reflect gaps in the critical 95% two-dose coverage threshold necessary for herd immunity[9,10].

Several hospital-based cross-sectional studies conducted between 2020 and 2023 in South Asia and the Middle East provide compelling data on measles-associated pneumonia among children. In Peshawar, Pakistan, a study of 178 infants and children (≤12 years) documented a 60% prevalence of pneumonia in measles cases, with severe disease significantly associated with lower vaccination rates and poor socioeconomic conditions[11]. Another Pakistani study across two hospitals reported pneumonia in 65% of 154 measles-infected patients, reinforcing the burden of pulmonary complications in regions with suboptimal immunization[12]. Similarly, in Omani infants hospitalized with measles, several cases developed pneumonitis requiring intensive care—notably among those lacking timely vaccination—underscoring the risk in vulnerable neonates[13].

Despite effective vaccination strategies, measles-associated pneumonia persists as a significant global health challenge among infants and children—particularly in contexts of low immunization coverage and limited healthcare infrastructure. The burden is amplified by socioeconomic inequities, malnutrition, and weakened health systems. Understanding the prevalence, risk factors, and clinical outcomes associated with measles-related pneumonia is crucial to inform targeted public health interventions, optimize vaccination coverage, and reduce morbidity and mortality in this vulnerable population.

MATERIALS AND METHODS

This descriptive cross-sectional study was conducted in the Pediatric Department of Shahida Islam Medical college Lodhran from Jan 2023 to June 2023, after obtaining approval from the Institutional Review Board (IRB). The study included 120 patients aged 0 to 12 years who were clinically diagnosed with measles and admitted with or without signs of pneumonia. Informed written consent was obtained from the parents or legal guardians of all participants. Sample size was calculated using the WHO sample size calculator by assuming an anticipated prevalence of pneumonia among measles cases of 60%, with a 95% confidence level and a 9% margin of error, yielding a required sample of 120 patients. Non-probability consecutive sampling technique was employed.

Inclusion criteria consisted of all infants and children diagnosed with measles (based on WHO clinical criteria: fever, maculopapular rash, and at least one of cough, coryza, or conjunctivitis), confirmed by clinical or serological means, who were admitted during the study period. Children with chronic respiratory illnesses, immunodeficiency disorders, or recent hospitalizations for other infections were excluded to avoid confounding.

A detailed history was taken including demographic data (age, sex, nutritional status), immunization status, and clinical presentation. Physical examination findings, including respiratory

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rate, oxygen saturation, and auscultatory findings, were recorded. Chest X-rays and laboratory parameters (such as complete blood count and C-reactive protein) were obtained where indicated. Pneumonia was diagnosed based on WHO criteria: presence of cough or difficulty in breathing along with tachypnea, chest indrawing, or crepitations on auscultation.

Data was collected using a structured proforma and entered into SPSS version 25.0 for analysis. Frequencies and percentages were calculated for categorical variables such as gender, vaccination status, and presence of pneumonia. Mean and standard deviation were calculated for continuous variables such as age and duration of illness. The prevalence of pneumonia among measles patients was determined, and associations with risk factors were evaluated using chi-square test, with p-value ≤ 0.05 considered statistically significant.

RESULTS

In this study, a total of 120 measles patients were included. Most children were aged above 1–5 years (45.0%), followed by 0–1 year (31.7%) and >5–12 years (23.3%). Males were slightly more common (55.8%) than females (44.2%). Regarding immunization status, 38.3% were fully immunized, 25.8% were partially immunized, and 35.9% were not immunized given in table 1.

Fever and maculopapular rash were present in all patients (100%), while cough was reported in 89.2%, coryza in 76.7%, conjunctivitis in 54.2%, difficulty in breathing in 56.7%, and chest indrawing in 40.0%.

Pneumonia was present in 60.0% of patients, while 40.0% had no pneumonia. Among fully immunized children, 25.0% had pneumonia, compared to 29.2% of partially immunized and 45.8% of non-immunized children. Pneumonia prevalence was higher in malnourished children (58.3%) than in those with normal nutrition (41.7%) given in table 2.

Table 1: Demographic Characteristics of the Study Population (n = 120)

Variable	Frequency (n)	Percentage (%)
Age Group		
0–1 year	38	31.7%
>1–5 years	54	45.0%
>5–12 years	28	23.3%
Gender		
Male	67	55.8%
Female	53	44.2%
Immunization Status		
Fully immunized	46	38.3%
Partially immunized	31	25.8%
Not immunized	43	35.9%

Table 2: Clinical Presentation Among Measles Patients (n = 120)

Symptom	Frequency (n)	Percentage (%)
Fever	120	100%
Cough	107	89.2%
Coryza	92	76.7%
Conjunctivitis	65	54.2%
Maculopapular rash	120	100%
Difficulty in breathing	68	56.7%
Chest indrawing	48	40.0%

Table 3: Prevalence of Pneumonia Among Measles Patients (n = 120)

Pneumonia Status	Frequency (n)	Percentage (%)
Present	72	60.0%
Absent	48	40.0%

Table 4: Pneumonia Prevalence by Immunization Status (n = 120)

Immunization Status	Pneumonia Present n (%)	Pneumonia Absent n (%)	Total n (%)
Fully Immunized	18 (25.0%)	28 (58.3%)	46 (38.3%)
Partially Immunized	21 (29.2%)	16 (33.3%)	37 (30.8%)
Not Immunized	33 (45.8%)	4 (8.3%)	37 (30.8%)
Total	72 (100%)	48 (100%)	120 (100%)

Statistical analysis showed that pneumonia was significantly associated with age group (p = 0.041), with the highest proportion in the 0–1 year group, immunization status (p = 0.003), where non-immunized children were most affected, and nutritional status (p = 0.012), with malnourished children showing greater prevalence. No significant association was found between pneumonia and gender (p = 0.631) given in table 3.

Table 5: Pneumonia Prevalence by Nutritional Status (n = 120)

Nutritional Status	Pneumonia Present n (%)	Pneumonia Absent n (%)	Total n (%)
Malnourished	42 (58.3%)	19 (39.6%)	61 (50.8%)
Normal	30 (41.7%)	29 (60.4%)	59 (49.2%)
Total	72 (100%)	48 (100%)	120 (100%)

Table 6: Association Between age, gender, Immunization Status, Nutritional Status and Pneumonia in Measles Patients (n = 120)

Variable	Pneumonia Present (n = 72)	Pneumonia Absent (n = 48)	p-value
Age Group			
0–1 year	28	10	0.041*
>1–5 years	32	22	
>5–12 years	12	16	
Gender			
Male	39	28	0.631
Female	33	20	
Immunization Status			
Fully immunized	18	28	0.003*
Partially immunized	21	10	
Not immunized	33	10	
Nutritional Status			
Normal	30	29	0.012*
Malnourished	42	19	

*p-value ≤ 0.05 considered statistically significant

DISCUSSION

Measles is a highly contagious viral illness that remains a major public health concern, especially in low-resource settings. Despite the availability of effective vaccines, outbreaks continue to occur due to suboptimal immunization coverage. Pneumonia is the most common and serious complication of measles, contributing significantly to morbidity and mortality among children. Infants and malnourished children are particularly at risk. Understanding the prevalence of pneumonia in measles cases is crucial to guide preventive strategies. This study aims to assess the burden of measles-associated pneumonia among infants and children in a hospital-based setting.

In the present study, pneumonia was observed in 60.0% of children diagnosed with measles, which is consistent with findings reported by several regional and international studies. Saleh Jan et al. (2023) found a slightly higher prevalence of 65% (97/154) pneumonia among hospitalized measles patients in Pakistan, with 40.2% being infants and only 27.3% having received at least one dose of the measles vaccine. This aligns with our data, where infants and unvaccinated children also represented a larger share of pneumonia cases. Similarly, Ullah et al. (2021) in Khyber Teaching Hospital reported a pneumonia prevalence of 61.8%, nearly identical to our findings, and found that 68.6% of pneumonia cases occurred in female children, which closely mirrors the 54.2% female pneumonia rate in our study.

In contrast, Kulsoom et al. (2022) reported a significantly higher complication rate, with 86.5% of 185 measles patients in Karachi developing bronchopneumonia, suggesting a more severe clinical profile or a more selective hospital-based sample. Another high prevalence was noted by Al-Majali et al. (2023), who reported 68.3% of hospitalized measles patients in Jordan developed pulmonary complications, and 100% of those with pneumonia were under 2 years of age, highlighting the extreme vulnerability of younger children. Our findings showed 38.9% of pneumonia cases occurred in infants (<1 year) and 44.4% in children aged 1–5 years, reinforcing the trend of increased risk in early childhood.

Ullah et al. (2019) emphasized this further, reporting a pneumonia rate of 70% in children under two years, which exceeds our figure but confirms the heightened susceptibility in this age group. Similarly, Ayub et al. (2022) noted 61.6% pneumonia prevalence among measles patients, with 44% being infants and only 23.2% vaccinated, comparable to our finding of pneumonia being significantly higher among not immunized (45.8%) and partially immunized (29.2%) children than among fully immunized (25.0%) ones (p = 0.003).

Vaccination status showed consistent patterns across all studies. Ali et al. (2024) reported a lower pneumonia prevalence of 43.3% among 346 children but also found that 23.4% were unvaccinated, with pneumonia being the leading cause of mortality (3.4%), again underscoring the protective effect of immunization. Haq et al. (2024) also found a lower prevalence (39.4%) but demonstrated a statistically significant association between pneumonia and lack of vaccination (p = 0.036), similar to the significant association (p = 0.003) found in our study.

Our results also revealed that pneumonia was significantly associated with nutritional status, as 58.3% of pneumonia cases occurred in malnourished children compared to 41.7% in normally nourished ones (p = 0.012), a finding supported by the broader literature though not quantified in all cited studies.

This study provides recent data on pneumonia prevalence among measles-infected children in a local population, which is valuable for healthcare planning. It used standardized clinical criteria for diagnosis and included multiple risk factors such as immunization and nutritional status. Data collection was systematic and supported by laboratory and radiological evidence. However, being a single-center study, its generalizability is limited. The use of non-probability sampling may introduce selection bias. Also, viral and bacterial co-infections were not evaluated due to resource constraints.

CONCLUSION

The study found a high prevalence of pneumonia among children with measles, especially in those who were unvaccinated and malnourished. Strengthening immunization programs and nutritional interventions could significantly reduce this burden. Early identification and prompt management of pneumonia are critical to improving outcomes in measles cases.

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