Clinical Profile, Radiological Findings, and Risk Factors Associated with Pneumonia among Children Admitted in Dhulikhel Hospital

Pradeep Sharma,[1] Roshan Bhandari,[1] Pranodan Poudel,[1] Ghanashyam Pandey,[2] Richa Paudyal[1]

[1]Department of Pediatrics, Dhulikhel Hospital, Kavre, Nepal, [2] Department of Pediatrics, Institute of Medicine, Kathmandu, Nepal.

ABSTRACT

Background: Pneumonia is the commonest lung disease which is a major cause of mortality and morbidity in young children and is a common acute respiratory infection. The presentation varies among the cases. The study was done to know the risk factors, clinical profile, radiological findings, and short-term outcome of the admitted patients with pneumonia between six months to sixteen years at Dhulikhel Hospital.

Methods: A hospital based observational prospective cross-sectional study done in 65 cases over the period of 17 months in children admitted with pneumonia at Pediatrics department of Dhulikhel Hospital. Socio-demographic variables, clinical profile, radiological profile, diagnosis, and short-term outcome were collected and analyzed using descriptive statistics.

Results: Out of 65 patients, 76.9% cases were children between six months to five years. The most common clinical presentation was fever (98.5%) followed by cough (86.2%). Crepitation (78.5%) and subcostal retraction (29.2%) were common clinical findings. Disseminated intravascular coagulation, thrombocytopenia, sepsis, and right heart failure were associated with mortality. The requirement of mechanical ventilation, oxygenation, and inotrope support was more likely to have fatal outcome.

Conclusions: Fever and cough were the most common clinical presentation and right middle zone consolidation was the most common finding in children admitted with pneumonia.

Keywords: Cough; fever; pneumonia

INTRODUCTION

Acute respiratory infections are major public health concern among children, with pneumonia being the leading cause of death. In developing countries, the frequency of pneumonia is more than 10-fold higher, and the number of childhood pneumonia-related deaths is 2000-fold higher than in developed countries.[1] The prevalence of ARI symptoms among Nepalese children under the age of five was 2% in 2016.[2] Exposure to risk factors related to the host, the environment, and infection causes pneumonia in children. Risk factors include not exclusively breastfeeding, low birth weight, malnutrition, air pollution, crowding, lack of immunization, congenital heart disease and paediatric HIV.[3,4] Dhulikhel hospital is a referral centre and pneumonia is a leading cause of admission in Pediatric ward. Pneumonia incidence was 21% (239/1100) among total admitted cases from July 2018- June 2019. Hence this study was aimed to find out the clinical profile of pneumonia in Dhulikhel hospital.

METHODS

It was a hospital based observational prospective study. The study was conducted in Department of Pediatrics of Dhulikhel hospital, Kathmandu University Hospital. The hospital is referral center of Sindhupalchowk, Dolakha, Sindhuli, Ramechhap, Bhaktapur and other surrounding district. All the cases of pneumonia from 6 months to 16 years admitted in Department of Pediatric, Dhulikhel Hospital. The present study was conducted from May 2020 – October 2021. Total duration of study was 17 months.

Correspondence: Pradeep Sharma Acharya, Department of Pediatrics, Dhulikhel Hospital, Kavre, Nepal. Email: sharmaacharyapradeep@gmail.com, Phone: +9779745603630.

A total of 65 cases fulfilling the inclusion and exclusion criteria were included in the study.

$N° = Z^2 p (1 – p)/C^2$ Z = 1.96, Z = constant   C = 10 % confidence interval

P = 239/1100 P = Prevalence of pneumonia in Dhulikhel Hospital in one year.

Sample size = 65

Inclusion criteria were: Age between 6 months to 16 years admitted with pneumonia in pediatric ward and Parents willing to give consent for the study. Exclusion criteria were: Known cases of bronchial asthma; Congenital Heart Disease and Parents not willing to give consent.

Ethical approval was taken from the Ethical Review Board/Ethical Clearance Committee of Dhulikhel Hospital (Protocol Approval no. 223/19).

Pneumonia was diagnosed as either of following criteria 1 or 2: Criteria one: Children in the age group 6 months to 5 years with pneumonia as defined by the WHO[5], children with the following symptoms: Fever < 1 week; Age specific tachypnea with or without lung signs (wheeze or crepitation's); Respiratory rate ≥50 breaths/min in 2 months to 11 months and ≥40 breaths/min in 12-60 months; Indrawing of chest, Criteria Two: Pneumonia is diagnosed as below with inclusive criteria of Chest X ray finding suggestive of pneumonia[6] :Cough with or without expectorant/shortness of breath/pleuritic chest pain for less than a week; At least one systemic feature (Temperature>37.7 C, Chills or rigor and severe malaise) and Chest finding: bronchial breath sound / crackles, And No other explanation of illness.

All the children with pneumonia fulfilling the inclusion criteria were included in the study after taking written and informed consent and assent as per need. The informants were asked detail on socio-demographic history, clinical presentation, past history, birth history and developmental history and treatment history. All the cases were examined and evaluated. Evaluation of the chest was done by two radiologists. The cases were followed up closely till they were discharged from pediatric ward. The Performa was filled by the researchers. After admission we looked for all possible complications of pneumonia. Intervention like transfusions of platelets concentrate, Fresh frozen plasma and inotropes was done according to need of individual .Outcome of individual was also noted.

Data analysis was performed using SPSS version 23.

All the variable were presented in frequency and percentage .Statistical methods used for analysis of the data was Chi-Square test which was used for comparison of need of extensive medical intervention , outcome and association of low platelets with mortality value of < 0.1 was considered statistically significant.

RESULTS

During the study period of seventeen months, total 547 cases were admitted in pediatric department of Dhulikhel Hospital. Among these, 65 had pneumonia. Thus, incidence of pneumonia in children during the study period was 11.88% Among them, 50 (76.9%) were children less than five years of age, four (6.2%) were between six to ten years of age and, the age of 11 (16.9%) enrolled cases was between 11 and 16 years; 33 (50.8%) were male and 32 (49.2%) were female. Pneumonia was most common in male between 6 months to 5 years. The children admitted with pneumonia had a mean hospital stay of 5.28 (SD ± 4.34) days. Fever (98.5%) was the most common presenting symptom followed by cough (86.2%), vomiting (41.5%), difficulty in breathing (31.5%) and anorexia (24.6%). Chest pain (13.8%) and pain abdomen (13.8%) were found to be less common than shortness of breath (18.5%) or myalgia (15.4%). There were 23.1% (n=15) children who were malnourished.

Analysis of various risk factors leading to development of pneumonia in the pediatric age group demonstrated that the environmental factors such as household crowding (53.8%), exposure to smoke (53.8%) and dust (46.2%), poorly ventilated residence (44.6%) and interaction with domestic animals (58.5%) were mostly encountered. The source of smoke in those with exposure were passive smoking (57.2%) and smoke from firewood (42.8%). Similarly, incomplete immunization (36.9%), prior history of pneumonia (29.2%), nebulization (26.2%) and hospitalization (24.6%), lack of exclusive breastfeeding (27.7%) and malnutrition (23.1%) were also dominant factors to increase the risk of acquiring pneumonia in the children.

Crepitations (78.5%) and subcostal retractions were the most frequently observed respiratory signs (29.2%). Hepatomegaly was found in 38.5% of the patients with the mean liver span among hepatomegaly subset being 10.2 cm. Radiologically, right middle zone (38.5%) was the most affected site followed by left lower zone (32.3%) and right lower zone (23.1%). Bilateral diffuse interstitial pneumonia was found in 24.6%. We found significant association between the complications

such as disseminated intravascular coagulation (p-value 0.00) and cardiac failure (p-value 0.00) with mortality. Similarly, episodes of seizure (p-value 0.04) and sepsis (p- value 0.04) were also associated with mortality. Among the 65 enrolled patients, 87.7% (n=57) cases were discharged while 12.3% (n=8) of the cases expired.

Table 1. Characteristics of children diagnosed with Pneumonia.			
Characteristics	Frequency (n)	Percentage (%)	Mean ± SD
Age (years)			4.21 ± 4.66
0.5-5	50	76.9	
6-10	4	6.2	
11-16	11	16.9	
Sex			
Male	33	50.2	
Female	32	49.8	
Duration of hospital stay (days)			5.28 ± 4.34
1-5	49	75.4	
6-10	10	15.4	
>10	6	9.2	
Nutritional Status			
Well Nourished	50	76.9	
Malnourished	15	23.1	
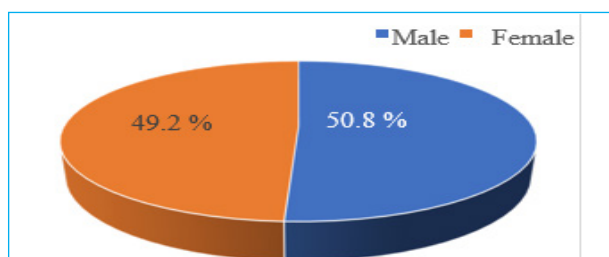
Figure 1. Sex-wise distribution of the cases.
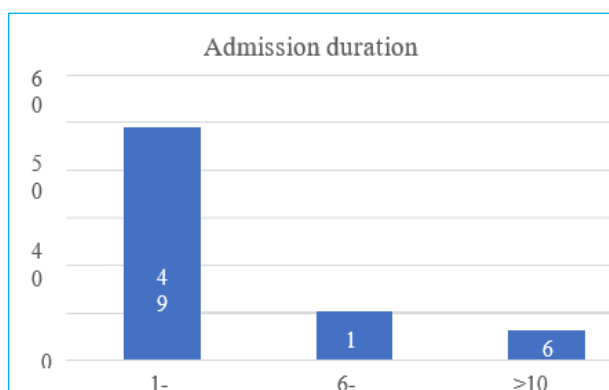
Figure 2. Duration of hospital admission.

Table 2. Risk Factors.		
Factors	Frequency (n)	Percentage (%)
History of pneumonia in past	19	29.2
Prior nebulization	17	26.2
Prior hospitalization	16	24.6
Lack of exclusive Breastfeeding	18	27.7
Household crowding	35	53.8
Poor ventilation	29	44.6
Smoke exposure	35	53.8
Dust exposure	30	46.2
Domestic animals	38	58.5
Malnutrition	15	23.1
Incomplete Immunization	24	36.9

Table 3. Clinical presentation in the patients diagnosed with pneumonia.		
Symptoms	Frequency (n)	Percentage (%)
Fever	64	98.5
Cough	56	86.2
Vomiting	40	61.5
Fast breathing	27	41.5
Noisy Breathing	7	10.8
Pain abdomen	9	13.8
Chest Pain	9	13.8
Shortness of breath (SOB)	12	18.5
Anorexia	16	24.6
Headache	8	12.3
Myalgia	10	15.4

DISCUSSION

This is a descriptive study done in children aged six months to 16 years who were admitted with diagnosis of pneumonia in a Dhulikhel Hospital. During the study period of seventeen months, total of 547 individuals in the age range of six months to sixteen years were admitted, out of which 65 were diagnosed with Pneumonia. The cumulative incidence of pneumonia in hospital admission was 11.88%. Although the exact incidence of pneumonia in this age group has not been studied, according to a study done by Rijal P in Nepal pneumonia accounts for 68.4% of acute respiratory tract infections.[7] We identified a significant burden of pneumonia (76.9%) between six months to five years of age with male to female ratio of 1.03:1.

In our study, fever was the most common clinical presentation accounting for 98.5%. These findings were similar to studies done by Lynch et al (92%).[8] It also agrees with the findings of the studies done by Zukin et al [9] (94%) and Juven et al [10] (96%). On the contrary, a study done by Shamo'on et al [11] showed cough was the most common clinical presentation. This study shows Crepitations as the most important clinical sign which was present in 78.5% cases. Similar findings was demonstrated by study done by Singh et al.[12] Our study demonstrated fast breathing as one of the common clinical presentations of pneumonia which was seen in 41.5% cases. Similar finding was seen in a study done by Juven et al which showed fast breathing in 39% cases.[10] The common radiological findings were lobar consolidation, bronchopneumonia, and diffuse interstitial pneumonia each accounting for 42.6 %, 30.8 % and 24.6 % respectively and all these types were prevalent among under-five children. In our study, the right middle zone (38.5%) was the most affected site followed by the left lower zone (32.3%) and right lower zone (23.1%).

In the present study, risk factors like exposure to smoke is seen in 53.8% of cases and presence of malnutrition in 36.9%, nearly similar to study by Broor et al[13] (40.1%). Savitha et al[14], Broor et al[13] studies showed lack of exclusive breastfeeding was associated with acute respiratory illness in 37.5% & 39.4% which is similar to this study. In our study pneumonia was associated with 27.75% of children who didn't receive exclusive breastfeeding.

During our study period baseline investigations like Total Leukocytes count, Differential count and Hemoglobin were sent. C - reactive protein association could not be done in our study due to inconsistent availability of reagent and unaffordable patients. Blood culture, Sputum culture and Gram stain were only done in a few selected sick cases and during our study period. A single case showed growth of Staphylococcus aureus in blood culture. Blood culture was positive in a fourteen-year female with right lobar pneumonia and investigation was done to rule out pulmonary tuberculosis which was negative. Antibody against a few suspected cases for Multisystem Inflammatory syndrome in Children (MSIC) due to Covid-19 were sent and three cases showed antibody titer positive. In these cases, lobar pneumonia was most common findings. In our study, significant association between the complications such as disseminated intravascular coagulation (p-value 0.00), cardiac failure (p-value 0.00) and sepsis (p-value 0.04) and thrombocytopenia (p- value 0.035) were also associated with mortality.

We demonstrated that the need for medical intervention was also found to be associated with the expected outcome of the cases. The children requiring oxygen support (p-value 0.00), mechanical ventilation (p-value 0.00) and inotropic support (p-value 0.00) were more prone to grave outcome

The limitations of the study were: Study was limited to a single center so it might not have shown the actual incidence of Pneumonia in the country. The small sample size of the study is one of the main limitations affecting the results. Due to Covid-19 Global Pandemic, Lockdown, and social distancing and closing of schools and day care centers actual Incidence might not have been reflected in this study. Due to unavailability of Polymerase chain Reaction and Latex agglutination, various etiological agents of Pneumonia were not diagnosed.

CONCLUSIONS

The study found that the highest prevalence of pneumonia was observed in children between the ages of 6 months to 5 years (76.9%), followed by those aged 11 to 16 years (16.9%), while the lowest prevalence was seen in the age group of 6 to 10 years (6.2%). Presence of fever, cough and fast breathing were most common clinical presentations as equated as clinical evidence of pneumonia among under-five children as per WHO guidelines. But clinicians often use these parameters above the age of 5 years as well. Modifiable risk factors like household crowding, smoke exposure, incomplete immunization, poor ventilation were common risk factors. On clinical examination Crepitations were the most common findings. Radiological findings showed Lobar pneumonia was commonest which occurred more on the right middle zone. Outcome of Pneumonia is favorable if there is no association to the spectrum of multiorgan dysfunction syndrome like disseminated intravascular coagulation, right heart failure and sepsis.

CONFLICT OF INTEREST

The authors declare no conflict of interest

REFERENCES

1. Ramani VK, Pattankar J, Puttahonnappa SK. Acute respiratory infections among under-five age group children at urban slums of gulbarga city: A longitudinal study. Journal of clinical and diagnostic research: 2016 ;10(5):8.[PubMed]
2. Ministry of Health, New ERA, The DHS Program ICF 2017. Nepal Demographic and Health Survey 2016 Kathmandu, Nepal.[Download PDF]
3. Mathew JL, Patwari AK, Gupta P, Shah D, Gera T, Gogia S

et al. Acute respiratory infection and pneumonia in India: A systematic review of literature for advocacy and action: UNICEF-PHFI series on newborn and child health, India. Indian Pediatr 2011; 48: 191.[PubMed]

4. Rudan I, O'brien KL, Nair H, Liu L, Theodoratou E, Qazi S et al. Child Health Epidemiology Reference Group. Epidemiology and etiology of childhood pneumonia in 2010: estimates of incidence, severe morbidity, mortality, underlying risk factors and causative pathogens for 192 countries. Journal of global health. 2013;3(1).[PubMed]

5. World Health Organization. Department of maternal, newborn, child and adolescent health (MCA), highlights 2012-2013: progress report. World Health Organization; 2014.[WebLink]

6. Harris M, Clark J, Coote N, Fletcher P, Harden A, Mckena M et al. British Thoracic Society guidelines for the management of community acquired pneumonia in children: update 2011. Thorax 2011; 66:1–23.[PubMed]

7. Rijal P, Sharma A, Shrestha S, Upadhyaya S. Profile of acute lower respiratory tract infection in children under fourteen years of age at Nepal Medical College Teaching Hospital (NMCTH). Nepal Med Coll J 2011; 13: 58–61. [PubMed]

8. Lynch T, Platt R, Gouin S, Patenaude Y. Can We Predict Which Children With Clinically Suspected Pneumonia Will Have the Presence of Focal Infiltrates on Chest Radiographs? Pediatrics 2004; 113: e186–e189.[PubMed]

9. Zukin DD, Hoffman JR, Cleveland RH, Herman T. Correlation of pulmonary signs and symptoms with chest radiographs in the pediatric age group. Annals of emergency medicine 1986; 15: 792–796.[PubMed]

10. Juvén T, Ruuskanen O, Mertsola J. Symptoms and signs of community-acquired pneumonia in children. Scandinavian Journal of Primary Health Care 2003; 21: 52–56. [PubMed]

11. Shamo'on H, Hawamdah A, Haddadin R, Jmeian S. Detection of pneumonia among children under six years by clinical evaluation. East Mediterr Health J 2004; 10: 482–487. [PubMed]

12. Singh S, Shrestha N, Joshi A. Clinical Profile, Radiological Resolution and Risk Factors Associated with Community Acquired Pneumonia. Journal of Nepal Paediatric Society 2018; 38: 8.[Article]

13. Broor S, Pandey R, Ghosh M, Lodha R, Singhal T, Kabra SK. Indian pediatrics 2001; 38: 1361–1369.[Article]

14. Savitha M, Nandeeshwara S, Kumar MP, Ul-Haque F, Raju CK. Modifiable risk factors for acute lower respiratory tract infections. The Indian Journal of Pediatrics 2007; 74: 477–482.[PubMed]