

Frequency of Positive Radiological Findings in Clinically Diagnosed Cases of Pneumonia in Children

Hajira Umer,¹ Uzma Jabeen,² Sara Saeed Malik¹ and Khalid Perveze¹

¹Ittefaq Hospital Trust, Lahore

²The Children's Hospital & The Institute of Child Health, Lahore.

ABSTRACT

Introduction: Pneumonia and other lower respiratory tract infections are the leading cause of death worldwide. Approximately 150 million new cases of pneumonia occur annually among children younger than 5 years worldwide accounting for 10 to 20 million hospitalizations. Although diagnosis is usually based on radiographic findings in developed countries, the World Health Organization has defined pneumonia on basis of clinical findings. **Objectives:** The objective of this study is to determine the positive radiological findings in clinically diagnosed cases of pneumonia in children. **Methodology:** 230 children who were clinically positive cases of pneumonia, were included in this study by non probability purposive sampling. All cases were subjected to x-ray chest and x-ray chest was interpreted for presence or absence of patchy or lobar infiltrates and pleural effusion. **Result:** X-ray findings were present in 91(39.6%) cases and there were no findings in 139 (60.4%) cases. Of positive radiological findings, patchy infiltrates or bronchopneumonia was present in 69 (75.8%) cases, lobar pneumonia in 22(24.2%) cases and pneumonia was associated with pleural effusion in 10 cases (10.9%) cases. **Conclusion:** As a conclusion, I found pneumonia on x-ray chest was more frequently seen in cases having coarse crackles on chest auscultation (29.1% cases presented with coarse crackles and pneumonia was present on chest x-ray in 83.6% of cases having coarse crackles) and overall frequency of positive radiological findings in clinically diagnosed cases of pneumonia was 39.6%

Key words: Pneumonia , X- ray chest.

INTRODUCTION

Pneumonia the world's most important cause of child death, has attracted remarkably little attention over the past decade.¹ Recent introduction of WHO and UNICEF sponsored integrated management of childhood illness initiative present ideal opportunities for early case detection and appropriate management of acute respiratory infections.² Pneumonia remains a significant cause of pediatric morbidity and mortality despite advances in the identification of causative organisms and availability of antimicrobial agents and vaccinations.³ Pneumonia is the leading cause of death in childhood in developing countries, resulting in an estimated 1.9 million deaths annually.⁴ According to UNICEF and WHO if

pneumonia prevention and treatment interventions were universally delivered then almost 1.3 million child death could be averted every year.⁵ Annual incidence of clinical pneumonia for developed world is 150-151 million new cases among which 11-20 million are severe enough to require hospitalization.⁶

It is more common between 2 months to 17 years of age, occur mostly in fall and winter. Specific risk factors for development of pneumonia include asthma, cystic fibrosis, gastro-oesophageal reflux disease, neurologic disorders, congenital heart disease, pre-maturity, malnutrition, immunodeficiency or haemoglobinopathies.⁷ Pneumonia can be bacterial (60%), viral (45%), mixed (23%), fungal or protozoal in origin.⁸ The etiologic agents vary in different age groups. Bacterial pneumonia is more common in Pakistan.

Streptococcus pneumonia and hemophilus influenza are the commonest causes of pneumonia.⁹ Total number of cases of pneumonia in children under 5 years of age in Pakistan is estimated to be 21316 per year due to hemophilus influenza and 71864 per year due to streptococcal pneumonia.¹⁰

Diagnosis has been based upon clinical presentation and x-ray chest findings. Percentages for different clinical and radiological findings are as follow: (fever 46%, cough with or without sputum 74%, tachypnea with nasal flaring intercostals, subcostal, suprasternal recessions 42%, dyspnea 70%, cyanosis 44%), (abnormal physical examination findings including decreased breath sounds, dullness on percussion, crackles and ronchi in 67.4%), (x-ray findings including lobar consolidation 20%, patchy consolidation 61%, pleural effusion 9%).^{11,12,13} Chest radiograph is considered as a gold standard for diagnosing pneumonia.¹¹ It is the recommended as investigation of choice by Infectious Disease Society of America and American Thoracic Association.¹⁴ Its main role is to determine presence, localization, extent of infection and to detect predisposing factors and complications and in follow up of infection.¹⁵

According to a study done in Japan the overall correlation between clinical features and radiological findings of pneumonia is 30.4%.¹⁶ The current study is being carried out to expedite radiographic diagnosis as it has the potential to improve time to diagnosis, treatment and early dispatch of patients with pneumonia.

METHODOLOGY

Two hundred and thirty (n=230) children who met inclusion and exclusion criteria were selected from indoor department of Ittefaq Hospital Trust after taking informed consent from Parents during period of six months i.e. from January till June 2011. Paediatric patients from two months to five years of age of either gender suffering from pneumonia, diagnosed clinically were included in the study while children having anatomic abnormalities of respiratory tract, Chronic lung diseases, primary or secondary immune deficiencies and children with asthma were excluded from the study. X-ray chest was done in all 230 clinically

positive cases and seen for presence or absence of consolidation (lobar or patchy infiltrates), and pleural effusion. x-ray was interpreted by researcher herself and diagnosis was confirmed on x-ray chest. Site of consolidation (patchy or lobar) and pleural effusion whether on left or right side of thorax was noted. Patient information and x-ray chest findings was recorded on proforma.

Data Analysis

Results were analyzed using SPSS version 10. Mean, Standard deviation (SD), was calculated for quantitative variables like age, temperature, pulse rate, and respiratory rate. Frequency and Percentage was calculated for qualitative variables like gender, nasal flaring, intercostal, subcostal and suprasternal recessions, cough, sputum, cyanosis, dullness on percussion, decreased breath sounds, coarse crackles, patchy or lobar consolidation and pleural effusion. P-value was calculated by applying Pearson chi-square test as test of significance.

RESULTS

Total 230 cases were included in this study. There were 110(47.8%) children in the age range of 2 months-1 year, 120(52.2%) in the age range of 1-5 years. Mean age was 1.7±1.4 years. Of 230 children 132(57.4%) were male and 98(42.6%) were females (Table 1).

Table 1: Age and sex distribution.

| Category | Total n= 230 (100%) |
|--------------------|---------------------|
| Age (Years) | |
| Mean | 1.7±1.4 years |
| < 1 | 110 (47.8%) |
| 1-5 | 120 (52.2%) |
| Sex (M:F) | 1.3:1 |
| Male | 132 (57.4%) |
| Female | 98 (42.6%) |

X-ray findings were present in 91(39.6%) cases and there were no findings on chest x-ray in 139(60.4%) cases. Of positive radiological findings patchy infiltrates or bronchopneumonia was present

in 69(75.8%) cases, lobar pneumonia was present in 22(24.2%) cases and pneumonia was associated with pleural effusion in 10(10.9%) cases. (Table 2).

Table 2: X-ray findings of patients.

| | No. of cases | Percent |
|----------------------------|--------------|---------|
| No pneumonia | 138 | 60.4 |
| Br. Pneumonia | 65 | 28.3 |
| Lobar pneumonia | 16 | 7.0 |
| Br. Pneumonia and effusion | 4 | 1.7 |
| Lobar Pneumonia & effusion | 6 | 2.6 |
| Total | 230 | 100.0 |

Of 230 children, 160(69.6%) children presented with fever. Mean temperature was 101.1±1.0 and pneumonia was present in 74(46.3%) of febrile patients. Tachypnea was present in 106(46.1%) children. Mean respiratory rate was 50.7±3.2 and pneumonia was present in 62(58.5%) of cases having tachypnea (p-value <0.001).

Tachycardia was present in 113(49.1%) children. Mean heart rate was 129.5±3.3 and pneumonia was present in 72(63.7%) of cases having tachycardia (p-value <0.001). Cough was present in 85(80.4%) children. Pneumonia was present in 54(29.2%) cases having cough (p-value <0.001). Regarding the clinical examination recessions were present in 95(41.3%) of children while Pneumonia was present in 58(61.05%) cases having recessions. Dullness on percussion was present in 26(11.3%) cases and lobar pneumonia was present in 16 cases and pneumonia with effusion was present in 10 cases. Decreased breath sounds were present in 22(9.6%) children and pneumonia was present in 3(13.6%) cases having decreased breath sounds. Coarse crackles were present in 67(29.1%) children and pneumonia was present in 56(83.6%) cases having crackles. Ronchi were present in 42(18.3%) children and pneumonia was present in 4(14.3%) cases having ronchi (p-value <0.001). (Table 3)

DISCUSSION

Pneumonia the world's most important cause of child death, has attracted little attention over past decade.¹ Despite advances in the identification of causative organisms and availability of antimicrobial agents and vaccinations, pneumonia

remains a significant cause of pediatric morbidity.³ Pneumonia is the leading cause of death in childhood in developing countries, resulting in an estimated 1.9 million deaths annually.⁴ According to UNICEF and WHO if pneumonia prevention and treatment interventions were universally delivered, nearly 1.3 million child death could be averted every year.⁵

In general, after suspecting a disease based on symptoms and physical findings investigations are conducted to obtain a definitive diagnosis. Similarly pneumonia is suspected in children when they present with features such as fever, cough, sputum, dyspnea or coarse crackles are present on clinical examination and a definitive diagnosis is established following a chest x-ray.¹⁶

Infectious Disease Society of America has recommended the radiography as the initial study of choice in suspected cases of pneumonia. Similarly American Thoracic Association also recommend chest radiograph as an important diagnostic tool as it has potential to improve time to diagnosis, treatment and dispatch of patients with pneumonia.¹¹

In this study, pneumonia was confirmed by chest x-ray in 39.6% of the indoor patients when investigated on clinical suspicion of pneumonia. The frequency of x-ray confirmed pneumonia varies in literature and it has been reported to be present in 15-40% of cases.¹⁶ While it has reported to be 30.4% in a study done by Niro Okimoto et al. published in The Journal of the Japanese Respiratory Society in 2004.¹⁶

In my study 69.6% cases presented with fever, 46.1% with tachypnea, recessions in 41.3%, 49.1% have tachycardia, dullness on percussion in 11.3%, coarse crackles in 29.1%, ronchi in 18.3%, decreased breath sounds in 9.6% cases. These results suggest that in addition to symptoms such as fever, cough, sputum etc presence or absence of coarse crackles is important for diagnosis of pneumonia. In my study 67 /230 patients have coarse crackles and 56/67 cases (83.6%) have pneumonia.. Singal et al also emphasized that presence of coarse crackles is an important predictive factor for diagnosing pneumonia in children.¹⁷ Similarly physical findings such as hearing coarse crackles are important for diagnosis of pneumonia according to Niaro et al.¹⁶

Table 3: X-ray findings.

| | No pneumonia | Broncho-pneumonia | Lobar-pneumonia | Broncho-pneumonia with effusion | Lobar pneumonia with effusion | p-value |
|-----------------------------|--------------|-------------------|-----------------|---------------------------------|-------------------------------|---------|
| Respiratory rate | | | | | | |
| >40/min | 44(41.5%) | 48(45.3%) | 8(7.5%) | 4(3.8%) | 2(1.9%) | <0.001 |
| <40/min | 95(76.6%) | 17(13.7%) | 8(6.5%) | | 4(3.2%) | |
| Heart rate | | | | | | |
| <100/min | 98(38.8%) | 17(14.5%) | 1(0.9%) | 1(0.9%) | | <0.001 |
| >100/min | 41(36.3%) | 48(42.5%) | 15(13.3%) | 3(2.71%) | 6(5.3%) | |
| Cough | | | | | | |
| Yes | 131(70.8%) | 39(21.1%) | 9(4.9%) | 2(1.1%) | 4(2.2%) | <0.001 |
| No | 8(17.8%) | 26(57.8%) | 7(15.6%) | 2(4.4%) | 2(4.4%) | |
| Examination findings | | | | | | |
| Recession Yes | 37(38.9%) | 46(48.4%) | 6(6.3%) | 4(4.2%) | 2(2.1%) | <0.001 |
| Recession No | 102(75.6%) | 19(14.1%) | 10(14.5%) | ----- | 4(3.0%) | |
| Decreased breath sounds | 19(86.4%) | 3(13.6%) | ----- | ----- | ----- | |
| Dullness on percussion | ----- | ----- | 16(61.5%) | 4(15.4%) | 6(23.1%) | |
| Coarse crackles | 11(16.4%) | 56(83.6%) | ----- | ----- | ----- | |
| Ronchi | 36(85.7%) | 6(14.3%) | ----- | ----- | ----- | |

CONCLUSION

Pneumonia on x-ray chest was more frequent in cases having coarse crackles on chest auscultation (29.1% cases presented with coarse crackles and pneumonia was present on chest x-ray in 83.6% of cases having coarse crackles) and Overall Frequency of positive radiological findings in clinically diagnosed cases of pneumonia was 39.6%.

REFERENCES

- Greenwood B, Weher M, Holland KM. Childhood pneumonia. Bull World Health Organ 2007; 85: 501-68.
- Khan TA, Madni SA, Zaidi AK. Acute respiratory infections in Pakistan: have we made any progress. J Coll Physicians Surg Pak 2004; 14: 440-8.
- Grafakou O, Moustaki M, Tsolia M, Kavazarakis E, Malhiovidakis J, Fretzayas A, et al. Can chest x-ray predict pneumonia severity? *Pediatr Pulmonol* 2004; 38: 465-9.
- Cherian T, Mulholland EK, Carlin JB, Ostensen H, Aonin R, Decampo M et al. Standardized interpretation of pediatric chest radiograph for diagnosis of pneumonia in epidemiological studies. *Bull. World Health Organ* 2005; 83: 353-9.
- UNICEF/WHO. United Nation's Children Fund/World Health Organization. *Pneumonia / The forgotten killer of children* 2006.
- Rudan I, Tomaskov L, Boshi Pinto C, Campbell H. Global estimate of incidence of clinical pneumonia among children under 5 years of age. *Bull World Health Organ* 2004; 82: 891-970.
- Stapchok M, Roberts D, Haddy R. Community acquired pneumonia in infants and children. *Am Fam Physicians* 2004; 70: 899-908.
- Greenberg D, Leibovitz E. Community acquired pneumonia in children from diagnosis to treatment. *Chang Gung Med J* 2005; 28: 746-52.
- Tanwani AK, Hussain S, Qazi SA, Khan MA. Prevalence of anti microbial resistance of streptococcal pneumonia and hemophilus influenza in children with pneumonia. *Ann Pak Inst Med Sci* 2005; 1: 105-9.

10. Nizami SG, Bhutta ZA, Hasan R. Incidence of acute respiratory infections in children 2 months to 5 years of age in periurban communities in Karachi Pakistan. *J Pak Med Assoc* 2006; 56: 163-7.
11. Khalil A, Kalen G, Rothman RE. A simple screening tool for identification of community acquired pneumonia in an inner city emergency department. *Emerg Med J* 2007; 24: 336-8.
12. William T, Brien O, Daniel A, Grant E. Clinical indicators of radiographic findings in patients with suspected community acquired pneumonia. *J Am Coll Radiol* 2006; 3: 703-6.
13. Clark JE, Hammal D, Spencer D, Hampton F. Children with pneumonia: how do they present and how are they managed? *Arch Dis Child* 2007; 92: 394-8.
14. Wilkins TR, Wilkins RL. Clinical and radiographic evidence of pneumonia. *Radiol Technol* 2005; 77: 106-10.
15. VanMicghum IM, Dewever WF, Verscharen JA. Lung infection in radiology: a summary of frequency depicted sign. *JBR BTR* 2005; 88:66-71.
16. O Niro, Y Kenji, K Takeyuki, H Yoshiro, O Kohichi, A Naoko et al. Clinical predictors for the detection of community acquired pneumonia in adults as a guide to ordering chest radiograph. *Respirology* 2006; 11:322-4.
17. Singleton RJ, et al. Invasive pneumococcal disease caused by nonvaccine serotypes among alaska native children with high levels of 7-valent pneumococcal conjugate vaccine coverage. *JAMA*.2007. 297:1784-1792.

The Authors:

Hajira Umer
Ittefaq Hospital Trust,
Lahore

Uzma Jabeen
Assistant Professor,
Paediatric Medicine
The Children's Hospital &
The Institute of Child Health,
Lahore.

Sara Saeed Malik
Ittefaq Hospital Trust,
Lahore

Khalid Perveze
Consultant Paediatrician
Ittefaq Hospital Trust,
Lahore

Correspondence Address:

Dr. Uzma Jabeen
H/No. 31, Bismillah street, Allama Iqbal town
Lahore, Pakistan.
Mob. no. 0333-5242224
E-mail: ujabeen1.uj@gmail.com