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Original Research Article

Diagnosis of pneumonia in paediatric age group by comparing two modalities chest x-ray versus ultrasonography at tertiary care hospital

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ABSTRACT

Introduction: Up to 20 million cases of pneumonia in children ages 0 to 5 years require hospitalization each year, from total 150 million cases of pneumonia. The most common cause of death in children worldwide is pneumonia. Due to the general non-specificity of the signs and symptoms, clinical history and physical examination cannot reliably distinguish between the causes of respiratory cases. As a result, accurate diagnosis frequently requires medical imaging, but two-thirds of the world's population lack access to diagnostic imaging, which lead to increasing the consequences of respiratory illnesses.
Aim & Objective: To know the characteristic of pneumonia in x-ray and ultrasonography. To compare X-ray chest and USG for early diagnosis.
Materials and Methods: A Prospective observational study was conducted among 100 paediatric patients diagnosed with pneumonia and admitted in paediatric ward, at New Civil Hospital, Surat.
Result: Out of total, 52.7% and 47.3% patients were Males and Females, respectively. 87.2% cases were fully immunized, while remaining were partially immunized. Sensitivity and specificity of chest X-ray is 83.4 % and 86.8 % respectively. Sensitivity and specificity of USG thorax is 96.8 % and 90.5 % respectively. Young children are at least four times more susceptible to radiation damage than adults.
Conclusion: In comparison to chest radiography, lung ultrasound has the potential advantages of being more sensitive and specific, radiation-free, subject to less regulatory constraints, relatively less expensive so it can be used in diagnosis in patients with pneumonia.

1. Introduction

According to data from the World Health Organization (WHO), Pneumonia accounts for 14% of all deaths of children under 5 years old, killing 740 180 children in 2019.[1,2] Up to 20 million cases of pneumonia in children ages 0 to 5 years require hospitalization each year, from total 150 million cases of pneumonia.[3] The most common cause of death in children worldwide is pneumonia.[4] The earliest symptoms of pediatric pneumonia can include fever, coughing, and tachypnoea. These symptoms may not, however, consistently indicate bacterial pneumonia because they are also frequently present in respiratory conditions.[5] Other clinical examination results, such as auscultation-based findings, have also shown to be unreliable.[6–8] The World Health Organization (WHO) created a case management strategy for the treatment of pneumonia in low resource settings when competent doctors are not frequently available. In order to diagnose, treat, and refer patients, it was necessary to train community health workers to recognize respiratory signs and symptoms, including cough, breathing trouble, respiratory rate, and danger indications. Although by using this approach significantly reduced

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mortality once, other investigations have since revealed that it lacks specificity. Children with acute bronchospasm may actually need bronchodilators instead of antibiotics, but a high false positive rate has led to incorrect treatment and overuse of antibiotics.[9–13] Due to the general non-specificity of the signs and symptoms (such as fever and cough), clinical history and physical examination cannot reliably distinguish between the causes of respiratory cases. As a result, accurate diagnosis frequently requires medical imaging, but two-thirds of the world's population lack access to diagnostic imaging, which lead to increasing the consequences of respiratory illnesses.[14–16] Numerous studies demonstrate that lung ultrasonography (LUS), which may someday replace x-rays for diagnosis, correctly identifies the majority of cases of pneumonia in children and young people. In comparison to chest radiography, lung ultrasound has the potential advantages of being radiation-free, subject to less regulatory constraints, relatively less expensive. Lung ultrasonography is a non-invasive and straightforward approach for the detection of probable pneumonia in children, according to a study by Cui Yan et al. comparing it to chest X-ray in children with the condition.[17] Hence the present study was conducted to diagnose pneumonia in paediatric age group by comparing two modalities chest X-ray verses ultrasonography at tertiary care hospital.

2. Aim & Objectives

To know the characteristic of pneumonia in x-ray and ultrasonography. To determine use of x-ray and USG in diagnosis of pneumonia. To compare X-ray chest and USG for early diagnosis.

3. Materials and Methods

A Prospective observational study was conducted among 100 pediatric patient diagnosed with pneumonia and admitted in paediatric ward, at New Civil Hospital, Surat.

3.1. Inclusion criteria

All children admitted in our hospital with symptoms and signs pneumonia between 1month to12 years of age were included. Parents of the children who gave valid informed written consent were included.

3.2. Exclusion criteria

Children having symptoms and signs of pneumonia but was not showing findings in X-ray chest or USG chest were excluded. Children with Major Congenital malformation along with pneumonia were excluded.

Careful history taking was done and proforma was filled. Temperature, heart rate, respiratory rate, blood pressure, SPo2 were taken. Respiratory system examination including upper and lower respiratory tract examinations was done in detail. This study was approved by Institutional Ethical Committee of this institute. Written informed consent was taken prior to the study of each participant. Data collection and analysis: Data was collected by case record form and entered into MS excel 2016. Data analysis was done in SPSS Software version 26. Qualitative data were represented as frequency and percentages, while Quantitative data were described as a Mean and Standard deviation. The validity was described in terms of sensitivity, specificity, NPV and PPV.

4. Results

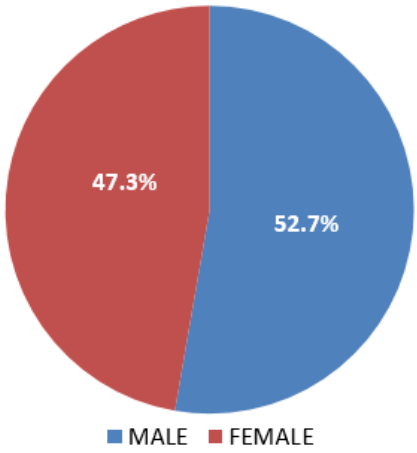

Figure 1: Gender wise distribution of study paricipants

Out of total, 52.7 were males and 47.3% were females. [Figure 1]

Table 1: Symptoms observed among study participants

Symptoms	Present	Absent
Fever	109	1
Cough	103	7
Breathlessness (breathing difficulty)	104	6
Fast Breathing	110	0
Runny nose	37	73

Among the cases, in 109 there was presence of Fever, while in 103 patients presence of Cough found. There was presence of breathlessness and Fast breathing among 104 and 110 patients, respectively. [Table 1]

In the study, 87.27% patients had immunization up to their particular age, while remaining 12.73% cases were partially immunized. [Figure 2]

Out of total, 4.55% patients had fast breathing in 2 months to 12 months of age group. Total 35 patients from 12 months to 5 year age group had fast breathing and in

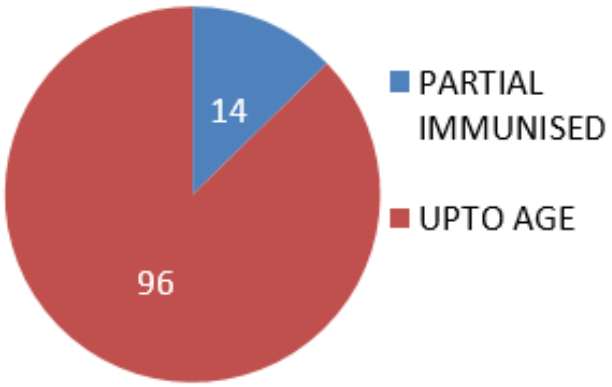

Figure 2: Immunization history study among patient

Table 2: Respiratory rate among study participants

Age group	Fast Breathing	
	Present	Absent
2 months to 12 months	5 (4.55)	0 (0)
12 months to 5 year	35 (31.82)	0 (0)
> 5 year	70 (63.64)	0 (0)

more than 5 years age group 70 patients had fast breathing. [Table 2]

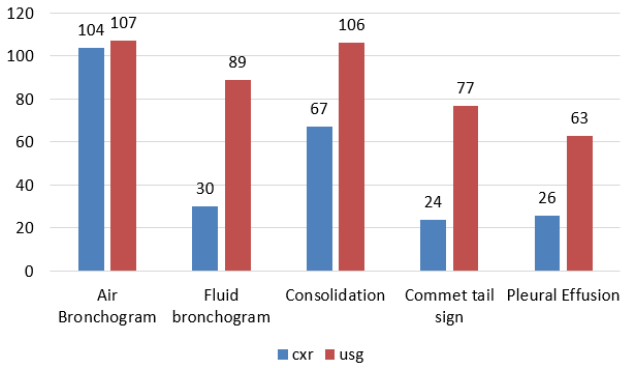

Figure 3: Presence of diffrent variable among study participants

Air bronchogram was present in 104 patient in chest X-ray and in 107 patient in usg, while fluid bronchogram was present in only 30 patient in chest X-ray but 89 patient showed fluid bronchogram on usg. Consolidation present in 67 and 106 patient on chest X-ray and usg respectively. Pleural effusion seen in 57.2% in usg. [Figure 3]

Table 3: Outcomes among study participants

Outcome	Frequency (%)
Discharged	108 (98.2)
Death	2 (1.8)

Of total, 98.2% patients were discharged and 2 deaths were noted. [Table 3]

Table 4: Sensitivity and specificity of chest X-ray (cxr) and usg thorax

validity	cxr	Usg
Sensitivity	83.4 %	96.8 %
Specificity	86.8 %	90.5 %

Sensitivity and specificity of chest Xray is 83.4 % and 86.8 % respectively. Sensitivity and specificity of usg thorax is 96.8 % and 90.5 % respectively. Sensitivity and specificity is more in usg thorax. [Table 4]

5. Discussion

Community acquired Pneumonia in children usually presents with fever, cough, and respiratory distress If proper treatment on appropriate time not given then it can lead to complications like pleural effusion and empyema, pneumatocele, lung abscess or necrotizing pneumonia.[18] Many studies show that lung ultrasonography (LUS) accurately diagnoses most cases of pneumonia in children and young adults and it may eventually replace x-rays for diagnosis.[19–21] In present study total 110 patients were included which are belonged to age group of 2 months to 12 year of which 52.7% were male and 47.3% female. In the study by sharif Met al[22] 69% were male and 31 % were female and in study of Heng Liao et al[23] 66% were male, which is comparable to our study. Fast breathing was used as an important indicator for classification of pneumonia. In present study 100% patient was found to having fast breathing, in the study done by Dipti Gupta et al[24] sensitivity of fast breathing was found to be an 83% and in study of Rees CA et al[25] found to be an 92%. In present study it is high because of we used fast breathing as one of the inclusion criteria. In present study sensitivity of chest indrawing was found to be 74.5% which is comparable to 74% sensitivity of study of Rees CA et al.[25] while in study of Dipti Gupta et al[24] sensitivity of chest indrawing was 62%. Air bronchogram was used as important indicator as findings of usg thorax in present study. Total 97.2% patient had air bronchogram in usg thorax in present study; in the study done by Meng-Chieh Ho a et al[26] total 93.7% patient had an air bronchogram positive in usg thorax. In study of Emilia Urbankowska a et al[27] air bronchogram was present in 76.5% of patients. Fluid bronchogram was present in 80.9% of patients in usg thorax while in study of Meng-Chieh Ho a et al[26] only 20.1 % had a fluid bronchogram was positive which may be because of as we participants in our study were from tertiary care hospital and most of the cases in our study was referred for further treatment, which leads to delayed treatment and as child‘s airway is narrow more exudates blocking airway can lead to more findings of fluid bronchogram in ultrasonography. In present study sensitivity of usg thorax was 96.8%, which is comparable to study done by Emilia Urbankowska a et al[27] and Susanna

Esposito1 et al[28] in which sensitivity of usg thorax was 98.4% and 97.9% respectively. In present study specificity of usg thorax was 90.5%, while in study done by Susanna Esposito1 et al[28] it was 94.5% which is comparable to our study. In the study done by Emilia Urbankowska a et al[27] it was 100%. In present study sensitivity of chest Xray was 83.4% while in study done by Reali F et al,[29] Shah VP et al[19] and sharif Met al[22] it was 82%, 80 % and 81.9% respectively. While in study done by Biagi C et al[30] it was 96% which maybe because as in this study patient of bronchiolitis with concomitant pneumonia were included which may be affect the results. In present study specificity of chest Xray was 86.8%. In study done by Reali F et al,[29] Shah VP et al[19] and Biagi C et al[30] it was 94%, 94% and 81.1% which is comparable to our study.

6. Conclusion

USG thorax is having more sensitivity and specificity for diagnosis of pneumonia and picked up consolidation in early stage according to our study. Other advantages are that it is radiation free, easily accessible, subject to less regulatory constraints, no effect of posture and tiny lesion can also be detected in early phases of disease process. So, it can be used for screening, diagnosis and follow up, which can be further confirmed by study on large number of patients. Fast breathing is an important sign to perform further imaging for confirmation of pneumonia.

7. Source of Funding

None.

8. Conflict of Interest

None.

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