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ADMISSION CHEST RADIOGRAPHS AS PREDICTOR OF SEVERITY FOR PNEUMONIA IN CHILDREN: HOSPITAL BASED STUDY

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Abstract
Background: To Study chest radiographic finding among hospitalized children less than 5 years of age. To study whether radiographic findings as predictor of severity and outcome among hospitalized. **Materials and Methods:** This prospective study included children under 5 years of age admitted with clinical and radiological evidence of pneumonia. Admission chest radiographs were taken and categorized as single lobar, unilateral or bilateral multilobar, or interstitial. Pleural effusions were classified as absent, small, or moderate/large. Severity was assessed on basis of need for supplemental oxygen, intensive care, and mechanical ventilation, as well as hospital length of stay and duration of supplemental oxygen. **Result:** There were 620 children (median age, 3 years) with M:F ratio of 1.3:1.Single lobar infiltrate was the most common radiographic pattern (53.2%) followed by multilobar bilateral (21%), multilobar unilateral (12.9%), interstitial (12.9%). Pleural effusion was present in 12% of children and was more common associated with lobar infiltrates, particularly multilobar disease. Only 1 child with interstitial infiltrate had a pleural effusion. Overall, 71% of children required supplemental oxygen, 11% required ICU admission, and 2.6% required invasive mechanical ventilation. Mean length of stay was 109 hours and mean oxygen duration was 63.9 hours. There was 1 death with multilobar bilateral involvement with pleural effusion. Percentage of oxygen supplementation, mean hours of oxygen duration, percentage of ICU admission, need for invasive mechanical ventilation and mean hours of duration of hospital stay were highest for multilobar bilateral followed by interstitial and multilobar unilateral, while only 2 patients of single lobar involvement required ICU admission. Among all pleural effusions, children with moderate to large effusion have higher percentage of oxygen supplementation, longer duration of oxygen supplementation, ICU admission, invasive mechanical ventilation and length of hospital stay. **Conclusion:** Admission chest radiograph can provide important clues regarding clinical course in hospitalized children and thus help clinicians to anticipate various outcomes helping in planning treatment in a better way.

INTRODUCTION

Community-acquired pneumonia (CAP) is the leading causes of death among children younger than 5 years accounting for around 1.2 millions death annually worldwide (18% of total).[1] The 2011 Pediatric Infectious Diseases Society and Infectious Diseases Society of America (PIDS/IDSA) guidelines for management of pediatric community-acquired pneumonia (CAP) recommend that admission chest radiographs be obtained in all children hospitalized with CAP to document the presence and extent of infiltrates and to identify complications.[2] There is evidence supporting the fact that radiographic findings did not correlate to any etiology.[3] and chest radiography findings are not considered among the criteria for defining CAP severity. In adults with CAP, clinical prediction tools use radiographic findings to inform triage decisions, guide management strategies, and predict outcomes. However, as there few published data concerning the relationship between the two, the aim of this study was to assess radiographic findings in children with CAP and assess whether they predict severity and outcome in children with CAP.

947

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MATERIALS AND METHODS

Design and Setting: This was a prospective study done in SMGS hospital pediatrics department.

Inclusion Criteria
All children who met criteria for clinical and radiographic pneumonia defined as:
1. Abnormal temperature.
2. Signs and symptoms of acute respiratory illness (e.g. cough, tachypnea, crepts).
3. Chest radiograph indicating pneumonia.

Exclusion Criteria
Patients suffering from severe chronic underlying diseases, such as cystic fibrosis, bronchodysplasia, primary ciliary dyskinesia, swallowing dysfunction, immunodeficiency, congenital heart defects, neurological diseases or malformations were excluded. All patients enrolled had chest radiograph done at admission which were evaluated by an independent expert radiologist. Chest radiographs were categorized as single lobar, unilateral or bilateral multilobar, or interstitial. Pleural effusions were classified as absent, small, or moderate/large. Severity was assessed on basis of need for supplemental oxygen, duration of supplemental oxygen, intensive care need, mechanical ventilation and length of hospital stay. Various variables obtained were analyzed using standard statistical tests.

RESULTS

The median age of the 620 children with clinical and radiographic CAP was 3 years with M: F ratio of 1.3:1. Single lobar infiltrate was the most common radiographic pattern (53.2%) followed by multipolar bilateral (21%), multilobar unilateral (12.9%), interstitial (12.9%). Pleural effusion was present in 12% of children and was more common associated with lobar infiltrates, particularly multilobar disease. Only 1 child with interstitial infiltrate had a pleural effusion [TABLE 1].

Table 1: Characteristics of Patients in terms of Admission Radiographic Findings

Variables	Single Lobar	Multilobar Unilateral	Multilobar Bilateral	Interstitial
Number	330 (53.2)	80 (12.9)	130 (21)	80 (12.9)
Median Age(Years)	3	2	3	1.5
Sex(Male)	185	44	78	41
No Pleural Effusion	299 (90.6)	64 (80)	103 (79.2)	79 (98.8)
Small Pleural Efuusion	20 (6.1)	11 (13.7)	21 (16.2)	1 (1.2)
Moderate/ Large Pleural Effusion	11 (3.3)	4 (5)	7 (5.4)	-

Overall, 71% of children required supplemental oxygen, 11% required ICU admission, and 2.6% required invasive mechanical ventilation. Mean length of stay was 109 hours and mean oxygen duration was 63.9 hours. There was 1 death with multilobar bilateral involvement with pleural effusion. Percentage of oxygen supplementation, mean hours of oxygen duration, percentage of ICU admission, need for invasive mechanical ventilation and mean hours of duration of hospital stay were highest for multilobar bilateral followed by interstitial and multilobar unilateral, while only 2 patients of single lobar involvement required ICU admission. [TABLE 2].

Table 2: Outcomes of Patients in Term of Chest Radiographic Findings

Outcomes	Single Lobar	Multilobar Unilateral	Multilobar Bilateral	Interstitial
O2 Supplementation	214 (64.8)	54 (67.5)	108 (83)	64 (80)
O2 Duration (Hours)	46	63	94	90
Icu Admission	2 (.6)	15 (18.7)	35 (26.9)	16 (20)
Mechanical Ventilation	-	2 (2.5)	11 (8.5)	3 (3.8)
Length Of Hospital Stay (Hours)	96.5	98.5	138.5	124

Among all pleural effusion, children with moderate to large effusion have higher percentage of oxygen supplementation, longer duration of oxygen supplementation, ICU admission, invasive mechanical ventilation and length of hospital stay [TABLE 3].

Table 3: Outcomes of Patients in Terms of Presence and Size of Pleural Effusion

Outcomes	No Pleural Effusion	Small Pleural Effusion	Moderate/ Large Pleural Effusion
O2 Supplementation	380 (69.7)	41 (77.3)	19 (82.6)
Icu Admission	40 (7.3)	16 (30)	12 (54.5)
Mechanical Ventilation	10 (1.8)	2 (3.8)	4 (18.2)
O2 Duration (Hours)	56	88	119
Length Of Hospital Stay (Hours	104	129	182

DISCUSSION

In this study we studied 620 patients with aim to assess whether radiographic findings predict outcomes among children hospitalized with pneumonia. In our study we found most common radiologic finding to be single lobar infiltrate followed by multilobar and interstitial infiltrates. Similar result were being reported by Maria Francesia Patria et al.[4] wastudy on association of radiologic findings and severity of pneumonia in children as 63% focal infiltrate and 36.7% multifocal consolidation. In our study we found pleural effusion in 12% of children with pneumonia similar to Patria et al study where 9.8% of study patients had pleural effusion. In our study we found bilateral multilobar infiltrate are associated with severe outcome. Patria et al and McClain et al.[5] studies too found similar result with bilateral multilobar infiltrate associated with severe disease and outcome. Size of consolidation and it's location can be used as predictor of pneumonia severity with left sided pneumonia running a more severe course possibly due to increased risk of pleurisy.[6] In our study we found interstitial infiltrates are associated with increase severity and hence increase oxygen requirement, ICU care, mechanical ventilation and hospital stay then single lobar infiltrates. We also found only 1.25% of interstitial infiltrate patients develop pleural effusion as compared to 13.7% of lobar infiltrates. McClain et al study also found interstitial infiltrates were associated with increase severity however in contrast to our study they found no difference in terms of length of stay and duration of oxygen requirement between interstitial and single lobar infiltrates. In our study we found moderate/large pleural effusion is associated with severe pneumonia and is associated with increase requirement of oxygen, ICU care, mechanical ventilation, and hospital stay. In McClain et al study also they found strongest association between severe pneumonia outcome and moderate/severe pleural effusion. Other factors constituting the risk for severity of illness in community acquired pneumonia are congenial heart disease, respiratory distress, high WBC counts, C reactive protein.[7] and vaccination status.[8]

CONCLUSION

In the present study we found admission chest radiograph can provide important clues regarding clinical course in hospitalized children and thus help clinicians to anticipate various outcomes helping in planning treatment in better way. This also helps clinician to explain prognosis in a better way to the family of children. Also our study supports and provides extra benefits of 2011 PIDS/IDSA guideline for admission chest radiograph.

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