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Original Research Article

A Study on Role of Chest Radiograph in Diagnosis of Etiology of Tachypnea in Children Less Than Five Years of Age

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Abstract

Introduction: Respiratory diseases are the commonest cause of death in children under 5 year. Pneumonia is the leading killer of children worldwide. In developing countries childhood pneumonias are diagnosed using clinical parameters, usually based on presence of cough and increased respiratory rate. Although this is cheap, sensitive and maximizes the number of children identified and treated empirically, it is also nonspecific and highly dependent on the context in which it is being applied. So the simple chest radiograph has been an important investigative tool in the diagnoses of diseases, since the discovery of X-rays in late nineteenth century. Chest radiograph is frequently used in the management of acute lower respiratory infection in children and still considered to be the gold standard for diagnosing respiratory infection and pneumonia. ***Objectives:*** To study the role of chest radiographs in diagnosing the etiology of tachypnea in children less than five years of age and to correlate findings of chest radiographs with etiology of tachypnea. ***Materials and Methods:*** A case control study was conducted in the Department of Pediatric Medicine, CNMC, Kolkata on tachypneic children aged between 2 months to 59 months during October 2017 to September 2018, presenting to Pediatric OPD, CNMC (Calcutta National Medical College) with clinical features of tachypnea. Chest Radiographs were done and evaluated. Analysis was done by SPSS 20 software. ***Results:*** In this present study, Among 300 patients Brochiolitis was diagnosed in 30% cases, Pneumonia in 26% cases, Asthma in 15% cases, Bronchopneumonia in 8% cases; Pleural effusion and Pneumothorax in 4% cases each; Bronchiectasis, Foreign body impaction, Milliary Tuberculosis(TB), Space occupying lesion were diagnosed in 2% cases each. The comparisons between Chest x-ray findings with Final diagnosis and Patient outcomes were significant (p value <0.001). ***Conclusions:*** In this study I have seen that chest X-ray can give useful information about the presence of pneumonia more commonly in patients who complain of cough and tachypnea for 3 days and more. So physicians should have to select patients who need x-rays to avoid unnecessary exposure to radiation and wastage of time and money for all patients with pneumonia

Keywords: Chest Radiograph, Tachypnea, Children less than five years of age.

INTRODUCTION

Respiratory diseases are the commonest cause of death in children under 5 year. Pneumonia is the leading killer of children worldwide. It kills more children than any other illness i.e AIDS, malaria and measles–accounting for 29 per cent of all under-five deaths. It is estimated that more than 150 million episodes of pneumonia occur every year among children under five in developing countries, accounting for more than 95 per cent of all new cases worldwide. Between 11 million and 20 million children with pneumonia will require hospitalization and accounts more than 3 million or an estimated 29% of all deaths, among children younger than 5 year worldwide. In India under-five mortality is 49 deaths per 1,000 live births, and the plan is to decrease to 42 deaths per 1000 live births by 2015 according to Millennium Development Goals and pneumonia is leading cause of death in this age group.

In developing countries childhood pneumonias are diagnosed using clinical parameters, usually based on presence of cough and raised respiratory rate. Although this is cheap, sensitive and maximizes the number of children identified and treated empirically, it is also nonspecific and highly dependent on the context in which it is being applied. So the simple chest radiograph has been an important investigative tool in the diagnoses of diseases, since the discovery of X-rays in late nineteenth century. Chest radiograph is frequently used in the management of acute lower respiratory infection in children and still considered to

be the gold standard for diagnosing respiratory infection and pneumonia.

The use of chest radiography in the initial assessment of acute lower respiratory infection rests on the assumptions that; (i) clinical assessment plus radiography results in a more accurate diagnosis than clinical assessment alone; (ii) this leads to changes in clinical management; and (iii) the changes benefit the patient.

The standard test for diagnosis of patients is a 2 view plain chest radiograph. To provide an objective end point WHO established standard categorization for radiological case definition of pneumonia, classified as:

1) Alveolar pneumonia: i.e. end point consolidation, which may be fluffy or part of whole lobe or entire lung often containing air bronchogram and or with plural effusion.

2) Non alveolar (i.e. other consolidation or infiltrate). The presence of other infiltrates as defined above in the absence of plural effusion as well as other non-end point (i.e. linear, interstitial, pre-bronchial thickening, multiple areas of atelectasis). When more than one radiological signs were present, the condition is designed as severe radiological pneumonia.

There are studies which show the importance of chest x-ray findings in patients with severe pneumonia. One study reports 53.2% of patients with severe pneumonia have chest X ray findings [1] and also other study shows 50% of chest X-rays were positive [2]. Other two reports were 42.4% [3] and 34% [4].There is some variation but not significant.

Several studies have found the pattern of radiologic features could not accurately distinguish a bacterial etiology from a viral etiology, although unilateral and or lobar infiltrates are often seen in bacterial pneumonia and some chest x ray findings shows diseases severity. One study shows that radiological findings such as multifocal bilateral distribution, the simultaneous involvement of at least three sites and right hilar consolidation are associated with severe CAP in otherwise healthy children, and could be considered markers of disease severity [5].

The studies regarding incidence of chest x ray findings of patients with severe pneumonia in Eastern India are scarce. In CNMCH pediatric emergency department, tachypnea is the commonest cause of admission. In order to diagnose pneumonia we are using clinical parameters according to WHO classification and also chest x-ray which is the gold standard and most commonly utilized tool for pediatricians in diagnosing pneumonia and other respiratory conditions. Patients can have chest x ray before admission or after stabilization of the patient as much as possible in the same day of admission and interpreted by radiology residents under supervision of senior radiologist. But there are few studies which shows role of chest x ray to diagnose the etiology of tachypnea in children less than five years of age. Hence, this study evaluates the role of chest x ray findings in diagnosing the etiology of. Tachypnea in children less than five years of age.

AIMS AND OBJECTIVES

Primary objective

- To study the role of chest radiographs in diagnosing the etiology of tachypnea in children less than five years of age.

Secondary objectives

- To study the utility of chest radiographs in diagnosing the etiology of tachypnea in children.
- To correlate findings of chest radiographs and etiology of tachypnea.
- To study the reliability of chest radiographs in finding out the outcome in tachypneic children.
- To study the socio-economic status of the patient.
- To study the outcome of the patient.

REVIEW OF LITERATURE

Radiography has been an important tool in the investigation of chest infection since its invention in the late 19th century. Plain radiographs remain the most commonly used radiological tool [1]. Pediatric respiratory disease remains an important cause of morbidity in both developed and developing countries. Chest radiograph is frequently used in the management of acute lower respiratory infection in children and still considered to be the gold standard for diagnosing respiratory infection and pneumonia. Chest x ray positivity ranging from as low 34% to as high as 53.2%.

Ali Salih KEM, *et al*. studied 156 patients aged between 2 month and 5 year, the chest X-ray finding of pneumonia were present in 83 (53.2%) children with alveolar pneumonia accounting for 47 (30.12%), and non-alveolar pneumonia for 36 (23.10%) cases, while X-ray showed normal findings in 46.8%. It was observed that 29 (34.9%) chest X-ray showed severe radiological pneumonia. All children with severe pneumonia presented with fever (100%), followed by shortness of breath (88.5%), cough (81.4%) and running nose (78.2%), while grunting in two third of the cases [1].

Njeze *et al*. studied 100 children aged 0-16years out of these Thirty seven (37%) of the radiographs were in agreement with clinical diagnosis of pneumonia while 63 %radiographs had no evidence of pneumonia. The commonest finding was lobar consolidation [2].

Mulholland *et al*. reported 34% patients with pneumonia had chest x ray findings, in 248 children age between 1 month to 5 yrs who are admitted with diagnosis of LRTI, but chest x ray was found for only 174 patients. Case fatality rate was 2.8% in LRTI and higher in chest x ray confirmed pneumonia which was 6.8% [3].

Salwa Ahmed Al-Najjar studied 356 children aged between 2 month to 10 year to determine the relationship between clinical and chest X-ray findings of pediatric patients. All children had signs and symptoms of respiratory infections for instance, fever (87.4%), shortness of breath (99.5 %),cough (98%), tachypnea (73.5%), wheezes (93.3%), chest retraction (80%), crepitations (82%) and**,** *42.4% of* chest X-rays showed focal infiltrations. Three clinical parameters related to pneumonia diagnosed by chest X-ray these were, chest retraction with sensitivity of 80%, and specificity of 88.29%), tachypnea with sensitivity of 73.5% and specificity of 56.59% fever with sensitivity of 87.42% and specificity of 60.98% [4].

Patria *et al*. (Italian Journal of Paediatrics 2013, 39:56) prospectively studied on 335 children to assess radiographic findings in children with CAP of different severity in order to evaluate whether some parameters are associated with severe CAP .Of these children 22% were sever pneumonia patients. The most frequent radiological presentation was focally distributed parenchyma densities (212, 63.3%), whereas 123 patients (36.7%) showed multifocal consolidations, predominantly bilaterally (85/123, 69.1%). Atelectasis and pleural effusions.

Were detected in respectively 30 (8.9%) and 33 patients (9.8%), and only five radiographs (1.5%) showed interstitial changes. Parenchyma densities were more prevalent in the right than the left lung (263 vs 179), and consolidations were more frequent in the middle lung than in the lower and upper areas (247 vs 176 and 19). The most frequently affected locations were the right lower lobe (75, 22.4%), the right para cardiac field (65, 19.4%), the left lower lobe (63, 18.8%), and the right hilum (61, 18.2%). From the above findings multifocal bilateral distribution, the simultaneous involvement of at least three sites and right hilar consolidation are associated with severe CAP [5].

KEY, *et al*. reported chest x-ray findings on 301 children who were admitted and research was done prospectively. Among them pulmonary infiltrate and consolidation were described in 161(54%) and 119(40%) cases, respectively. Chest x-ray was normal for 140 cases. Overall, the median age was 17 months (mean 20±14, range 12 days to 59 months). Pulmonary infiltrate was less frequently described among patients aged less than 1 year (41.3% vs 59.9%) and hyperinflation was significantly more frequent in this group [6].

Grafakou *et al.* investigated whether chest radiographic findings could be used as predictors of severity of childhood pneumonia on 167 children, aged more than 12 months who were hospitalized with unilateral lobar or segmental pneumonia. The result was consolidation was right-sided in 109 cases and left sided in 58. The majority of children with left sided pneumonia more commonly had the lower lobe affected (lower lobe, 45/58, 77.5%; upper lobe, 11/58, 19.1%;upper and lower lobe, 2/58, 3.4%), while in right-sided pneumonia, the upper lobe was more commonly affected (upper lobe, 54/109, 49.5%; lower lobe, 35/109, 32.1%;middle lobe, 16/109, 14.7%; and more than one lobe, 4/109, 3.6%)and other finding was pleural effusion which was lower in patients with right-sided pneumonia (12/109, 11%) compared to those with left-sided (23/58, 39.6%) (P<0.001), mainly found in lower lobe pneumonia, as it was identified in 21/47 (45%) patients with the left lower lobe affected compared to 2/11 (18.1%) of those with pneumonia of the left upper lobe. Finally he demonstrates that right lung pneumonia is more common, with the upper lobe more frequently affected, while in left-sided pneumonia the lower lobe is preferably involved. It was also found that left-sided pneumonia was more severe compared to right sided, as indicated by the increased risk for the development of complications and delayed response to treatment [7].

Puumalainen *et al*. analysed 821 children (60%) boys) who were hospitalised at the Bohol Regional Hospital. According to the WHO pneumonia severity classification algorithm, 290 episodes (24%) were non severe pneumonia, 785 (66%) were severe pneumonia, 120 (10%) were very severe pneumonia. A blood culture was obtained in 90% of episodes. They detected 13 (1.1% of episodes) invasive bacterial infections. The most common bacterial pathogens included *Staphylococcus aureus, Streptococcus pneumoniae* and *Salmonella typhi.* According to the retrospective review of clinical, laboratory and radiographic data, 402 episodes (33.6%) had radiographically confirmed pneumonia as the major cause of hospitalisation. Bacteriologically confirmed bacterial pneumonia or probable bacterial pneumonia was the diagnosis in 8.6%, 11.5% and 15.9% of episodes in non severe, severe and very severe WHO pneumonia categories, respectively [8].

M Sheng *et al.* assessed the radiological presentation of 210 confirmed cases of viral pneumonia in children and reported that most common cause of viral pneumonia was influenza a infection (81 out of a total of 210 patients). Remaining 129 patients were RSV (n=38), PIFV (n=28), adenovirus (n=27), influenza B (n=18) and PIFV (n=18). Findings in chest

radiograph were bilateral patchy areas of consolidation in 133 patients, interstitial lung disease in 33 patients, diffuse areas of air space consolidation in 29 patients and lobar consolidation in 15 patients. Lower lobes were the most common site for abnormal radiographic abnormalities and were bilaterally involved in 195 patients and unilaterally involved in the remaining 15 cases [9].

A. G. Falade *et al*. evaluated 487 malnourished children aged 2 months to 5 years in developing countries and 255 well nourished children who presented with a cough or breathing difficulty. Among these radiological pneumonia was present in 145 cases (30%) of the malnourished children and 68 cases (26%) of well-nourished children [10].

Xavier-Souza *et al*. conducted a prospective study to assess the inter-observer agreement in the interpretation of several radiographic features in the chest radiographs (CXR) of 773 children aged 2–59 months with non-severe acute lower respiratory tract infection (ALRI). The overall agreement was 78.7% (normal CXR [n =385, 60.9%], pneumonia [n =222, 35.1%], other radiological diagnosis [n = 22, 3.5%], inappropriate for reading [n = 3, 0.5%]). The most frequent symptoms and findings were cough (97.4%), fever (92.0%), rales (64.9%), difficult breathing (62.3%), vomiting (44.7%) and tachypnea (44.5%), crackles (44.1%). The most frequent findings were atelectasis; peri bronchial thickening, hyperinflation.But abscess, pneumatocele, and pneumothorax were not described [11].

Koya Ariyoshi (Central Vietnam, April 2007-March 2010) determined the incidence of radiologically-confirmed pneumonia (RCP) prospectively, among children < 5 years of age, hospitalized with acute respiratory infection. The overall incidence of RCP for children < 5 years of age was 3.3 (2.3-3.8) per 1000 children, and the highest incidence, 8.3 (3.8-10.5) per 1000 children, was observed in the 12- to 23-month age group. This incidence is lower than those in the previous studies from other developing countries. A 5-6 times higher annual RCP incidence was reported in Brazil (1-35 months: 36.2/1000 children) 15 and the Northern Territory Indigenous (1 month-5years; 26.6 per 1000, 1-11 months: 57.5/1000, 12-23 months: 38.3/1000 children).16 Studies from the Philippines and Indonesia also had reported higher annual RCP incidences of 13.5/1000 and 8.9/1000 per children (1.5-23months) respectively [17, 18]. A slightly higher annual RCP incidence of 4.3/1000 children (1-59 months) also was reported in Fiji. Several factors might be responsible for the lower RCP incidence in Vietnam, which include availability of free health care for children <6 years of age, implementation of Integrated Management of Childhood Illnesses guidelines for treatment of pneumonia in primary health care level, widespread use of antibiotics, improving social-economic status, and better access to medical care in Vietnam [12].

M. Javadi *et al*. reported 166 (86%) patients with pneumonia had chest x ray finding which was done on the 192 radiographs from patients with clinical pneumonia and found radiological abnormalities in 166(86%) patients. Seventy-eight (47%) of the pneumonias had alveolar consolidation and 80(48%) had Interstitial pattern only and the rest have other evidence of pneumonia even though not specified [13].

Northeast Brazil, researched on 472 children, aged 6-59 months, with clinically-diagnosed pneumonia who were either admitted to or treated as out patients and he found out that confirmatory infiltrate on the chest X-ray was present in 389 (86.1%) of 452 patients and in 228(92.7%) of 246 admitted to the hospital. An alveolar non-lobar infiltrate (non-perihilar) was the most common radiological finding in 221 cases (56.8%). Lung complications were present in 56 cases (11.9%), Pleural effusion in 34 cases (8.7%). He also reported the causes of pneumonia i.e bacteria were identified in 26.7% of the cases, while viruses and mixed infections accounted for 8.4% and 2.7% respectively. *Haemophilus influenzae* (18.9%), *Streptococcus pneumonia* (6.4%), and respiratory syncytial virus (5.0%) were most often identified [15].

MATERIALS AND METHODS

a) **Study design/experiment design**: This is an institution based observational study

b) **Study settings & timelines**: The study will be conducted in the Department of Pediatric Medicine, CNMC, Kolkata on tachypneic children aged between 2 months to 59 months.

c) Place of study: Department of Pediatric Medicine, Calcutta National Medical College and Hospital, Kolkata

d) **Period of study**: Cases will be recorded over a period of one year (October 2017 to September 2018).

e) **Study population**: Patients aged between 2 months to 59 months presenting to Pediatric OPD, CNMC with clinical features of tachypnea.

f) **Sample size/design**: All patients attending the Pediatric Emergency of CNMCH, Kolkata during the study period fulfilling the inclusion and exclusion criteria. According to the prevalence of Acute Respiratory Tract infections in children aged between 2 months to 5 years, the sample size should be 800. This will not be feasible for me, so I am taking 300 samples.

g) **Control required or not:** Not required

h) Inclusion criteria

1. Patients aged between 2 months to 59 months, presenting with clinical features of tachypnea due to respiratory causes and willing to participate in the study through a written informed consent (annexure 1).

WHO Age- Dependent Criteria for diagnosing tachypnea in children

<2months ------- >60 breaths/min

2-11 months ------ >50 breaths/min

12-59 months ------ >40 breaths/min

i) EXCLUSION CRITERIA

- Patients less than 2 months and more than 59 months will be excluded from the study.
- Tachypnea due to non-respiratory causes (eg.Cardiac causes, Neurological causes, metabolic causes, Traumatic causes) will be excluded from the study.
- Tachypnea due to upper respiratory tract infections will be excluded from the study.

j) Study variables: Demographics, Clinical features and chest radiograph findings of tachypnea.

k) Data collection: Patients aged between 2 months to 59 months attending Pediatric OPD suspected with clinical features of tachypnea due to respiratory cause will be included for investigation once consented to participate in the study.

l) Laboratory investigations & parameters

- Routine Laboratory Investigations including complete blood count, liver function test, urea and creatinine, serum electrolytes, capillary blood sugar, Urine for routine examination and microscopical examination, blood culture(if needed), blood serology(if needed).
- Chest radiographs
- Ultrasonography(if needed)
- CT scan of chest(if needed)

Outcome definition and parameters and procedures

- Patients aged between 2 months to 59 months attending Pediatric OPD with tachypnea due to respiratory cause will be included in the study.
- Written informed consent will be taken from the patient.
- History and clinical examination findings will be recorded in a case record form.
- Routine laboratory investigations and appropriate special investigations will be done.
- Chest radiographs will be done for each patient.

Definition of the outcomes: Not applicable as this is an observational study.

n) Additional resources: This study will be conducted by support of department of radiology, CNMCH, Kolkata.

6) Statistical analysis plan: Data will be analyzed by appropriate statistical tests using statistical software SSPE version 20(sample size= $4pq/ L^2$).

STATISTICAL METHODS

Categorical variables are expressed as Number of patients and percentage of patients and compared across the groups using Pearson's Chi Square test for Independence of Attributes/ Fisher's Exact Test as appropriate. The statistical software SPSS version 20 has been used for the analysis. An alpha level of 5% has been taken, i.e. if any p value is less than 0.05 it has been considered as significant.

Photographs

CXR SHOWING PNEUMONIA

RESULTS AND ANALYSIS

This study was conducted from October 2017 to September 2018. A total 960 children with signs and symptoms of respiratory tract involvement were seen at the pediatric emergency ward of Calcutta National Medical College and Hospital. Of these Chest radiographs were obtained in 300 patients, presented with tachypnea and the radiographs were subsequently reviewed by pediatric radiologist.

Table-1: Distribution by Age

Age	Frequency	Percent
< 1 Year	180	60.0
1-2 Years	78	26.0
2-5 Years	42	14.0
Total	300	100.0

In this present study, among 300 patients, 60% are infants, 26% are between 1-2 yrs of age and 14% are between 2-5 yrs of age.

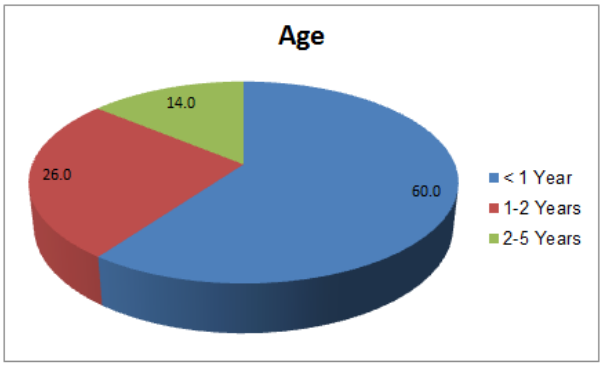


Table-2: Distribution by Sex

Sex	Frequency	Percent
Male	156	52.0
Female	144	48.0
Total	300	100.0

In this present study, among 300 patients, 52% are male and 48% are female.

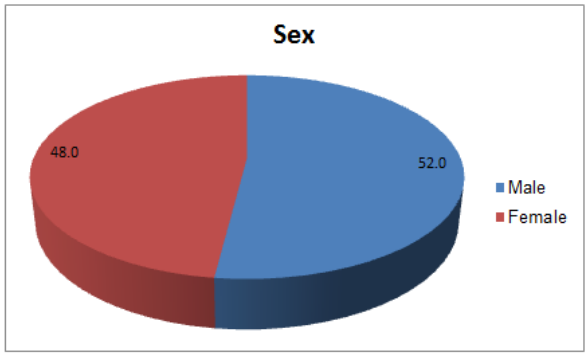


Table 3: Distribution by Socio-economic status

SES	Frequency	Percent
LOWER	195	65.0
MIDDLE	75	25.0
UPPER	30	10.0
Total	300	100.0

In this present study, among 300 patients, 65% from lower, 25% from middle, 10% from upper socio-economic classes.

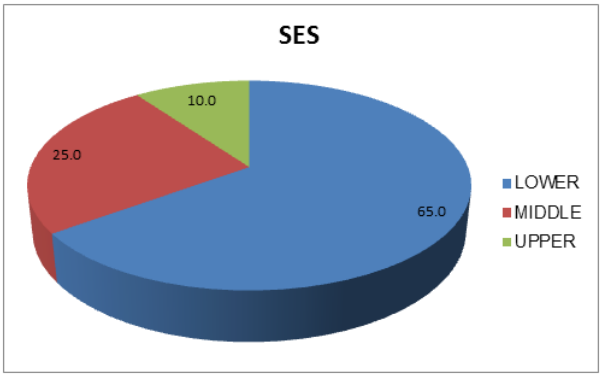


Table-4: Fever with cough as Chief complaints (CC)

fever and Cough	Frequency	Percent
No	174	58.0
Yes	126	42.0
Total	300	100.0

In this present study, Fever with cough was present in 42% cases.

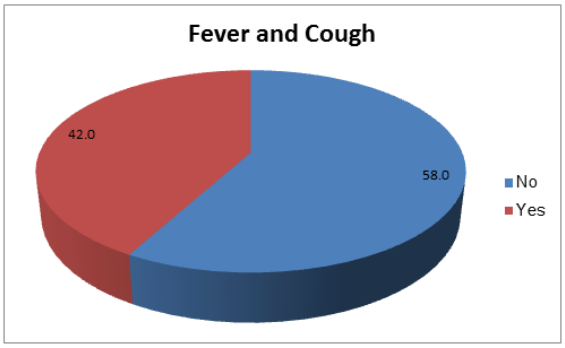


Table-5: Only Fever as Chief complaint

fever and IRB	Frequency	Percent
No	273	91.0
Yes	27	9.0
Total	300	100.0

In this present study, Only Fever was present in 9% cases.

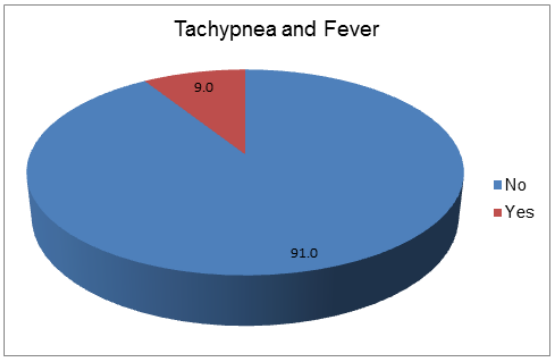


Table 6: Only Cough as Chief complaint

IRB and Cough	Frequency	Percent
No	234	78.0
Yes	66	22.0
Total	300	100.0

In this present study, only Cough was present in 22% cases.

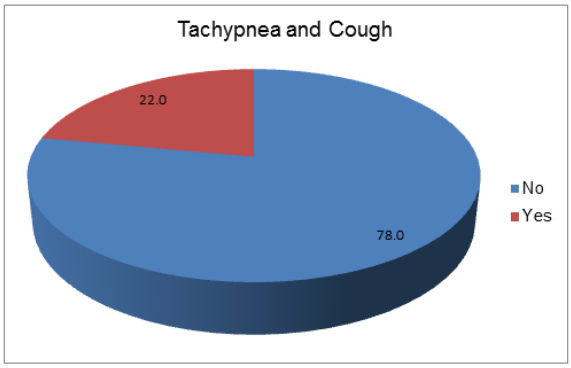


Table-7: Only Grunting as Chief complaint

fever and grunting	Frequency	Percent
No	291	97.0
Yes	9	3.0
Total	300	100.0

In this present study, only Grunting was present in 3% cases.

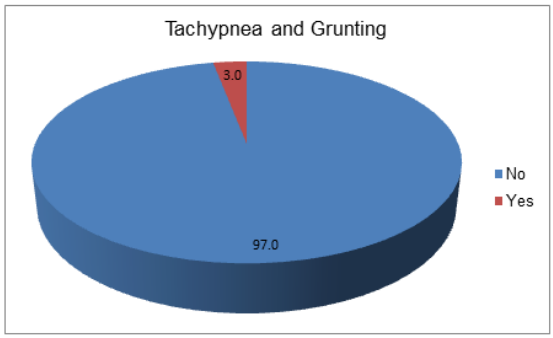


Table-8: Cough and Grunting as chief complaints

Cough and grunting	Frequency	Percent
No	297	99.0
Yes	3	1.0
Total	300	100.0

In this present study, Cough with grunting was present in 1% cases.

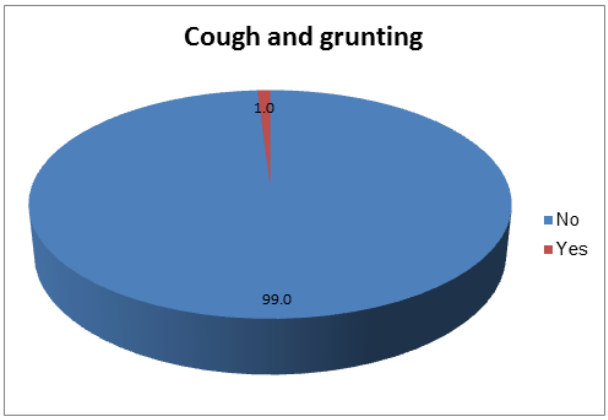


Table-9: Fever with cough and grunting as chief complaints

Fever and Cough and grunting	Frequency	Percent
No	297	99.0
Yes	3	1.0
Total	300	100.0

In this present study, Fever with cough and grunting was present 1% cases.

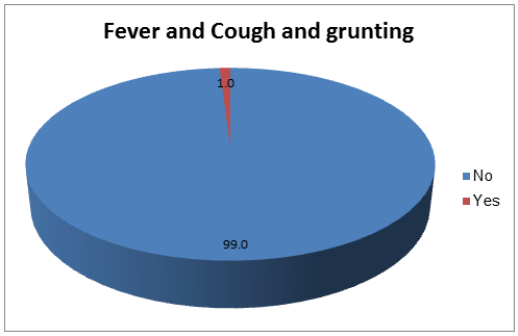


Table 10: Difficulty in Breathing (Dyspnea)

DIB	Frequency	Percent
No	15	5.0
Yes	285	95.0
Total	300	100.0

In this present study, Difficulty in breathing (dyspnea) was present in 95% cases.

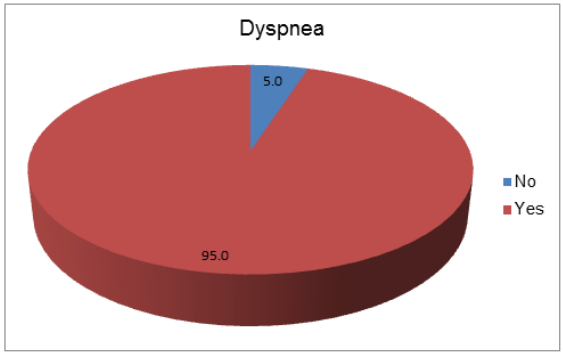


Table 11: Distribution by Similar illness in the past

Similar History in the past	Frequency	Percent
No	183	61.0
Yes	117	39.0
Total	300	100.0

In this present study, past history of similar illness was present in 39% cases.

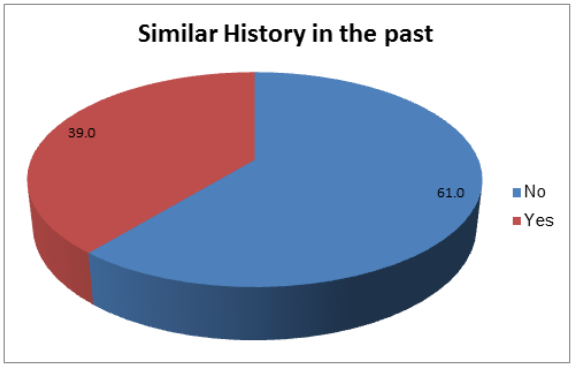


Table 12: Distribution by Frequency of past history of similar illness

Frequency of H/O past illness	Frequency	Percent
Once	24	20.5
Twice	33	28.2
3 Times	45	38.5
4 Times	15	12.8
Total	117	100.0

In this present study, past history of similar illness was 3 times in 38.5% cases, twice in 28.2% cases, once in 20.5% cases, 4 times in 12.85 cases.

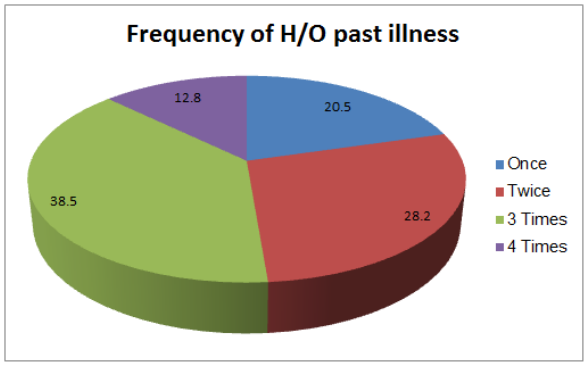


Table-13: Distribution by Auscultatory chest findings

Auscultatory chest findings	Frequency	Percent
wheeze(p) and crepitation	75	25.0
no finding	57	19.0
wheeze only	54	18.0
crepitation only	30	10.0
both crepitation(p) and wheeze	27	9.0
diminished VBS	27	9.0
BBS(p) and crepitation	15	5.0
BBS(p), crepitation and wheeze	9	3.0
diminished VBS, wheeze	6	2.0
Total	300	100.0

In my study; Predominantly wheeze with crepitation was present in 25% cases, no finding seen in 19% cases, only wheeze 18% cases, only crepitation in 10% cases, predominantly crepitation with wheeze in 9% cases, diminished Vesicular breath sound (VBS) in 9% cases, Predominantly Bronchial breath sound (BBS) with crepitation and wheeze in 3% cases, diminished Vesicular breath sound with wheeze in 2% were present.

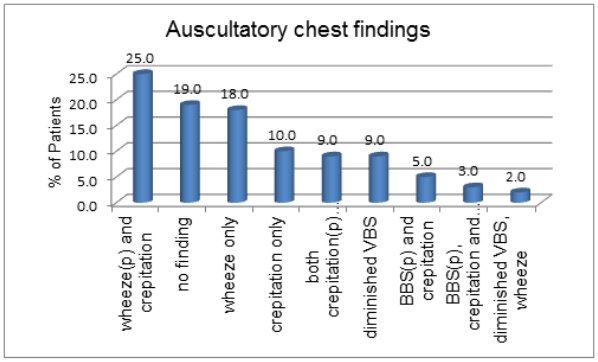


Table-14: Distribution by Site of Auscultatory chest finding

Site of chest finding	Frequency	Percent
B/L	147	49.0
Left	33	11.0
Right	69	23.0
No Finding	51	17.0
Total	300	100.0

In this present study, Auscultatory chest findings were present bilaterally in 49% cases, in right lung 23% cases, in left lung 11% cases.

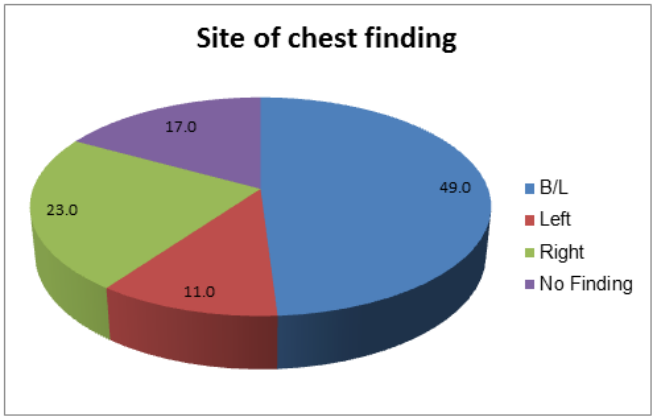


Table-15: Distribution by Chest x-ray findings

CXR	Frequency	Percent
Hyper Inflation with parahilar opacity and increased bronchovascular markings	90	30.0
Consolidation	72	24.0
Hyperinflation	51	17.0
Bronchopneumonia	24	8.0
Interstitial Pneumonia	15	5.0
Pleural Effusion	12	4.0
Hyperlucent lung field with collapsed lung border	12	4.0
Atelectasis	6	2.0
Unspecified	6	2.0
Rounded homogenous opacity	6	2.0
Honeycomb lesion	6	2.0
Total	300	100.0

In Chest x-ray findings of this present study, Hyperinflation with parahilar opacity and increased bronchovascular markings was present in 30% cases, Consolidation in 24% cases, Hyperinflation in 17% cases, Bronchopneumonia in 8% cases, Interstitial pneumonia in 5% cases, Pleural effusion in 4% cases;Atelectasis, Rounded homogenous opacity, Honeycomb lesion and Unspecified findings were seen in 2% cases each.

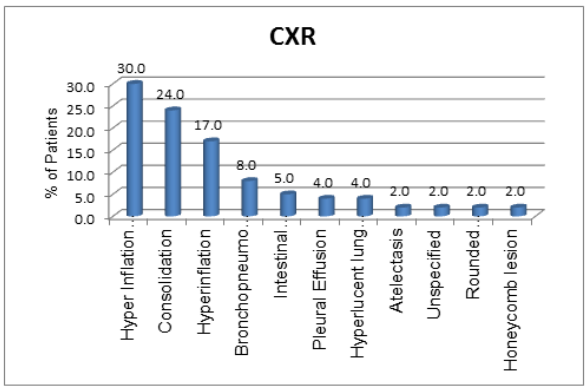


Table-16: Distribution by Lobe involvement (Chest X-ray finding)

Lobe involvement	Frequency	Percent
B/L	189	64.3
Left lung	15	5.1
LLL	9	3.1
LUL	9	3.1
Right lung	9	3.1
RLL	15	5.1
RML	15	5.1
RUL	33	11.2
Total	294	100.0

In CXR findings of this present study, Bilateral lobe(B/L) involvement was seen in 64.3% cases, Right upper lobe(RUL) involved in 11.2% cases; Right middle lobe(RML), Right lower lobe(RLL) and whole left lung involved in 5.1% cases each; Left upper lobe(LUL), Left lower lobe(LUL) and whole Right lung involved in 3.1% cases each.

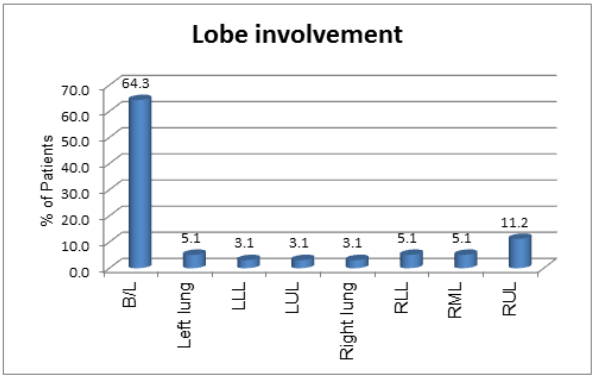


Table-17: Distribution by Final Diagnosis

Final Diagnosis	Frequency	Percent
Bronchiolitis	90	30.0
Pneumonia	78	26.0
Asthma	45	15.0
Bronchopneumonia	24	8.0
Interstitial pneumonia	15	5.0
Pleural effusion	12	4.0
Pneumothorax	12	4.0
Bronchiectasis	6	2.0
Foreign body impaction	6	2.0
milliary TB	6	2.0
Space occupying lesion	6	2.0
Total	300	100.0

In this present study, Among 300 patients Brochiolitis was diagnosed in 30% cases, Pneumonia in 26% cases, Asthma in 15% cases, Bronchopneumonia in 8% cases; Pleural effusion and Pneumothorax in 4% cases each; Bronchiectasis, Foreign body impaction, Millary Tuberculosis(TB), Space occupying lesion were diagnosed in 2% cases each.

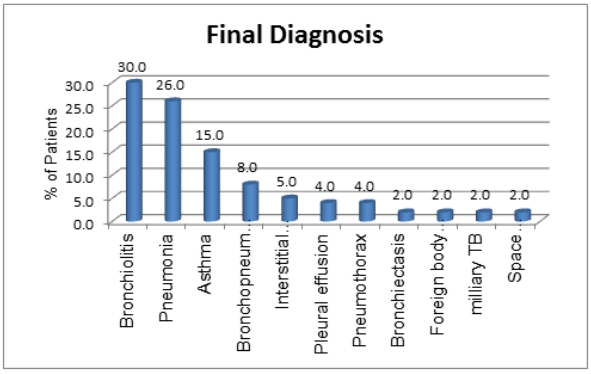


Table 18: Distribution by Duration of Hospital stay

Duration of H/S(days)	Frequency	Percent
<4 days	60	20.0
4 to 7 days	150	50.0
>7 days	90	30.0
Total	300	100.0

In this present study 50% cases stayed in hospital for 4-7 days, 30% cases for >7 days and 20% case <4 days.

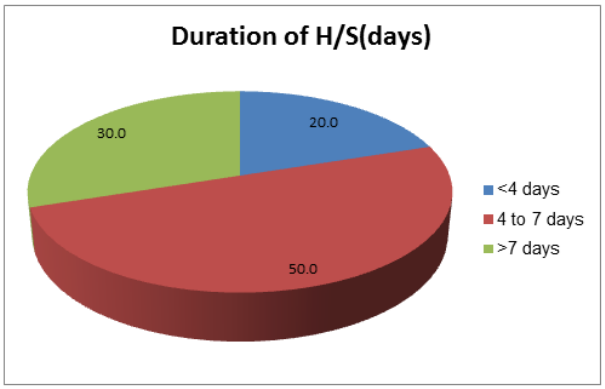


Table-19: Distribution by Outcome

Outcome	Frequency	Percent
Discharged	270	90.0
Death	30	10.0
Total	300	100.0

In this present study, 90% patients were discharged after clinical improvement.

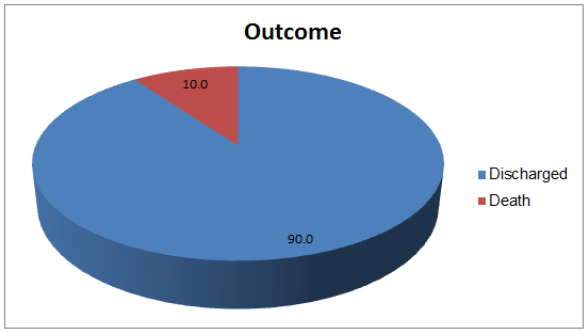


Table-20: Compasion between CXR findings and Lobe involvement

		Lobe involvement						Total	p Value	Significance
		B/L	LLL	LUL	RLL	RML	RUL			
CXR	Consolidation	30(15.87)	6(66.67)	9(100)	0(0)	9(60)	18(54.55)	72(26.67)	<0.001	Significant
	Bronchopneumonia	12(6.35)	0(0)	0(0)	6(40)	6(40)	0(0)	24(8.89)		
	Interstitial Pneumonia	6(3.17)	0(0)	0(0)	0(0)	0(0)	9(27.27)	15(5.56)		
	Hyper Inflation with parahilar opacity and increased bronchovascular markings	90(47.62)	0(0)	0(0)	0(0)	0(0)	0(0)	90(33.33)		
	Atelectasis	0(0)	3(33.33)	0(0)	3(20)	0(0)	0(0)	6(2.22)		
	Unspecified	6(3.17)	0(0)	0(0)	0(0)	0(0)	0(0)	6(2.22)		
	Hyperinflation	45(23.81)	0(0)	0(0)	0(0)	0(0)	0(0)	45(16.67)		
	Rounded homogenous opacity	0(0)	0(0)	0(0)	0(0)	0(0)	6(18.18)	6(2.22)		
	Honeycomb lesion	0(0)	0(0)	0(0)	6(40)	0(0)	0(0)	6(2.22)		
Total		189(100)	9(100)	9(100)	15(100)	15(100)	33(100)	270(100)		

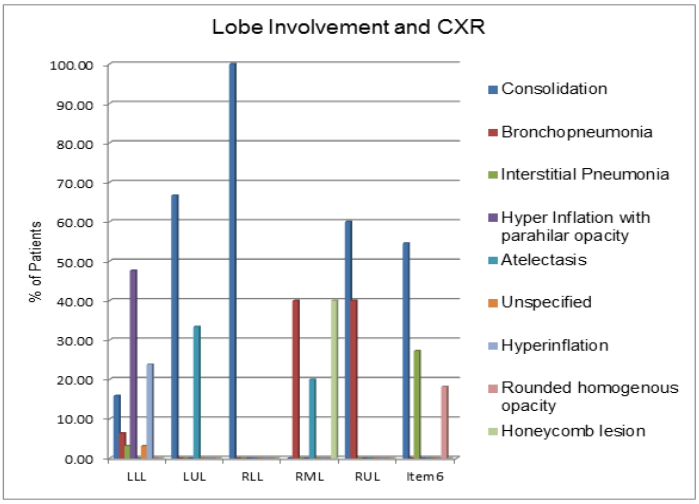


Table-21: Comparison between CXR findings and Duration of illness

		Duration of illness(days)			Total	p Value	Significance
		Within 3 days	4 to 7 days	>7 days			
CXR	Consolidation	45(62.5)	24(33.33)	3(4.17)	72(100)	<0.001	Significant
	Bronchopneumonia	9(37.5)	15(62.5)	0(0)	24(100)		
	Interstitial Pneumonia	12(80)	3(20)	0(0)	15(100)		
	Pleural Effusion	0(0)	0(0)	12(100)	12(100)		
	Hyper Inflation with parahilar opacity and increased bronchovascular markings	54(60)	33(36.67)	3(3.33)	90(100)		
	Atelectasis	3(50)	3(50)	0(0)	6(100)		
	Unspecified	3(50)	3(50)	0(0)	6(100)		
	Hyperinflation	15(29.41)	24(47.06)	12(23.53)	51(100)		
	Hyperlucent lung field with collapsed lung border	6(50)	6(50)	0(0)	12(100)		
	Rounded homogenous opacity	3(50)	3(50)	0(0)	6(100)		
	Honeycomb lesion	6(100)	0(0)	0(0)	6(100)		
Total		156(52)	114(38)	30(10)	300(100)		

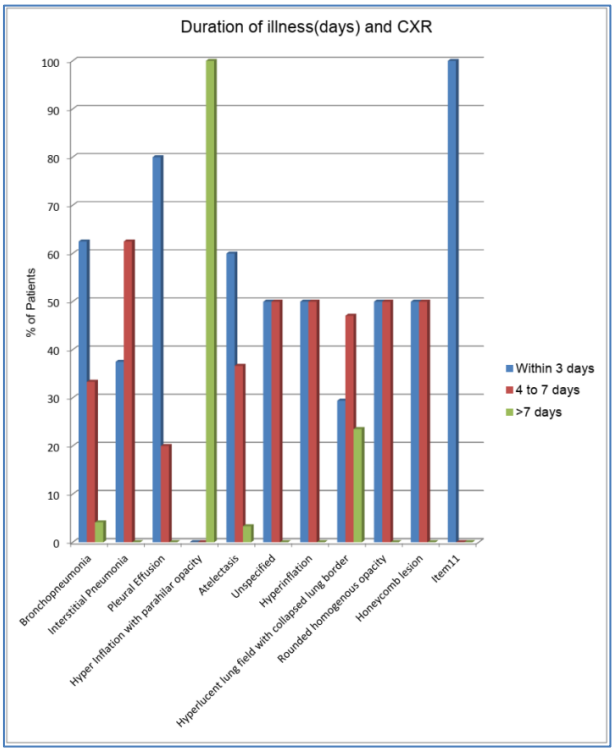


Table-22: Comparison between CXR findings and Duration of Hospital stays (H/S)

		Duration of H/S(days)			Total	p Value	Significance
		<4 days	4 to 7 days	>7 days			
CXR	Consolidation	15(20.83)	39(54.17)	18(25)	72(100)	<0.001	Significant
	Bronchopneumonia	0(0)	18(75)	6(25)	24(100)		
	Interstitial Pneumonia	3(20)	12(80)	0(0)	15(100)		
	Pleural Effusion	0(0)	0(0)	12(100)	12(100)		
	Hyper Inflation with parahilar opacity and increased bronchovascular markings	27(30)	39(43.33)	24(26.67)	90(100)		
	Atelectasis	0(0)	3(50)	3(50)	6(100)		
	Unspecified	0(0)	3(50)	3(50)	6(100)		
	Hyperinflation	12(23.53)	21(41.18)	18(35.29)	51(100)		
	Hyperlucent lung field with collapsed lung border	0(0)	6(50)	6(50)	12(100)		
	Rounded homogenous opacity	0(0)	6(100)	0(0)	6(100)		
	Honeycomb lesion	3(50)	3(50)	0(0)	6(100)		
Total		60(20)	150(50)	90(30)	300(100)		

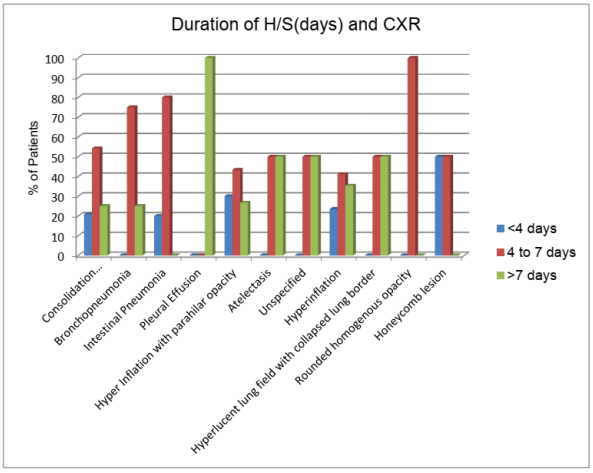


Table-23: Comparison between CXR findings and Outcome

		Outcome		Total	p Value	Significance
		Discharged	Death			
CXR	Consolidation	63(87.5)	9(12.5)	72(100)	<0.001	Significant
	Bronchopneumonia	24(100)	0(0)	24(100)		
	Interstitial Pneumonia	9(60)	6(40)	15(100)		
	Pleural Effusion	9(75)	3(25)	12(100)		
	Hyper Inflation with parahilar opacity and increased bronchovascular markings	81(90)	9(10)	90(100)		
	Atelectasis	3(50)	3(50)	6(100)		
	Unspecified	6(100)	0(0)	6(100)		
	Hyperinflation	51(100)	0(0)	51(100)		
	Hyperlucent lung field with collapsed lung border	12(100)	0(0)	12(100)		
	Rounded homogenous opacity	6(100)	0(0)	6(100)		
	Honeycomb lesion	6(100)	0(0)	6(100)		
Total		270(90)	30(10)	300(100)		

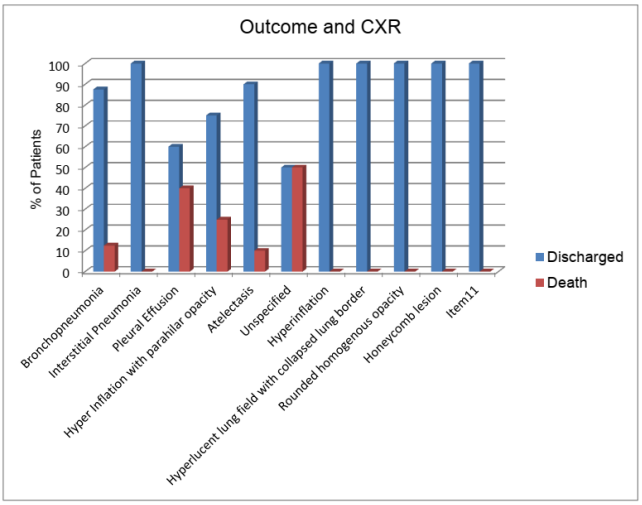
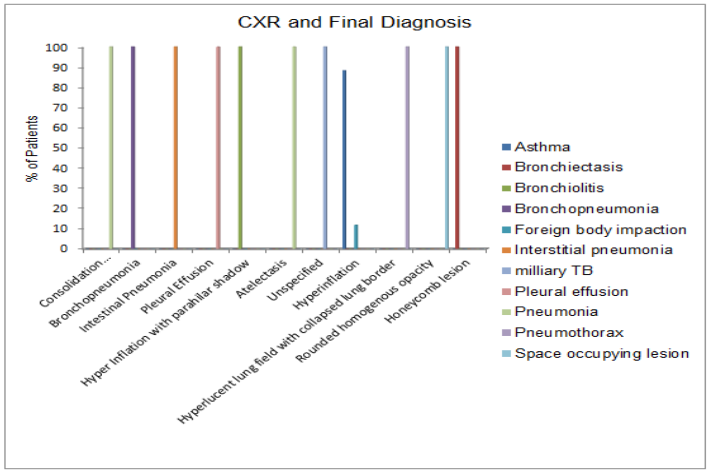


Table-24: Comparison between CXR findings and Final diagnosis

		Final Diagnosis											Total	p Value	Significance
		Asthma	Bronchiectasis	Bronchiolitis	Bronchopneumonia	Foreign body impaction	Interstitial pneumonia	miliary TB	Pleural effusion	Pneumonia	Pneumothorax	Space occupying lesion			
CXR	Consolidation	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	72(100)	0(0)	0(0)	72(100)	<0.001	Significant
	Bronchopneumonia	0(0)	0(0)	0(0)	24 (100)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	24(100)		
	Interstitial Pneumonia	0(0)	0(0)	0(0)	0(0)	0(0)	15 (100)	0(0)	0(0)	0(0)	0(0)	0(0)	15(100)		
	Pleural Effusion	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	12 (100)	0(0)	0(0)	0(0)	12(100)		
	Hyper Inflation with parahilar opacity and increased bronchovascular markings	0(0)	0(0)	90 (100)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	90(100)		
	Atelectasis	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	6(100)	0(0)	0(0)	6(100)		
	Unspecified	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	6(100)	0(0)	0(0)	0(0)	0(0)	6(100)		
	Hyperinflation	45 (88.24)	0(0)	0(0)	0(0)	6 (11.76)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	51(100)		
	Hyperlucent lung field with collapsed lung border	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	12(100)	0(0)	12(100)		
	Rounded homogenous opacity	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	6(100)	6(100)		
	Honeycomb lesion	0(0)	6(100)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	0(0)	6(100)		
Total		45(15)	6(2)	90 (30)	24(8)	6(2)	15(5)	6(2)	12(4)	78(26)	12(4)	6(2)	300(100)		



DISCUSSION

This study has been done at Calcutta National Medical College and Hospital from October 2017 to September 2018 to know the role of chest x ray findings in diagnosing etiology of tachypnea in children less than 5 years of age.

In this present study a total of 300 patients has been enrolled and 156(56%) were male and 144(48%) were female. The commonest age at presentation was less than 12 months. Most of this patients presented with fever with cough followed by fast breathing and cough; then fever with fast breathing and few cases presented with grunting {126 (42%), 66 (22%), 27 (9%), 9 (3%) respectively}. This finding is consistent with the study done by Salwa Ahmad Al-Najjar *et al*. The commonest auscultator finding is predominantly wheeze and crepitation (30%) which is comparable to Salwa Ahmad Al-Najjar *et al*. study (82%); followed by no finding seen in 19% cases, only wheeze 18% cases, only crepitation in 10% cases, predominantly crepitation with wheeze in 9% cases, diminished Vesicular breath sound (VBS) in 9% cases, Predominantly Bronchial breath sound (BBS) with crepitation and wheeze in 3% cases, diminished Vesicular breath sound with wheeze in 2% cases were present. In my study, Auscultatory chest findings were present bilaterally in 49% cases, in right lung 23% cases, in left lung 11% cases [4].

In this study of three hundred patients; 294(98%) were having abnormal chest x-ray and this finding is comparable with Ali Salih KEM, *et al*. study (52.3%), but it is greater than Salwa Ahmad Al-Najjar *et al*. study **(**42.4%), Njeze *et al*. study (37%) and Mulholland *et al*. study(34%). All of the above study was done on patients who have pneumonia but my study was conducted on patients only who have Tachypnea, so we can explain the difference [1, 3, 4].

In this study most of chest x-ray findings were seen on bilaterally in 147(49%) cases, in right lung 69(23%) cases, in left lung 33(11%) cases. In Chest x-ray findings of my study, commonest finding was Hyperinflation with parahilar opacity; present in 90(30%) cases, Consolidation in 72(24%) cases, Hyperinflation in 51(17%) cases, Bronchopneumonia in 24(8%) cases, Interstitial pneumonia in 15(5%) cases, Pleural effusion in 12(4%) cases; Atelectasis, Rounded homogenous opacity, Honeycomb lesion and Unspecified findings were seen in 6(2%) cases each.

This study is similar with Patria *et al*. study, which showed that Parenchymal densities were more prevalent in the right than the left lung (263 vs 179) and the most frequent radiological presentation was focally distributed parenchymal densities in 212 patients (63.3%), whereas 123 patients (36.7%) showed multifocal consolidations; of these 123 patients predominantly bilateral consolidation seen in 85 cases (85/123, 69.1%) and only five radiographs (1.5%) showed interstitial changes. This study also consistent with Brazilian study which showed pulmonary infiltrate and consolidation in 161 cases (54%) and 119(40%) respectively. In this study Interstitial pneumonia was seen in 15 cases (5%) but Salwa Ahmad Al-Najjar *et al*. study showed that it is as common as that of consolidation [4-6].

In CXR findings of my study; Bilateral lobe(B/L) involvement was seen in 64.3% cases, Right upper lobe(RUL) most commonly involved (11.2% cases) than Right middle lobe(RML) and Right lower lobe(RLL); which were involved in 5.1% cases each; Left upper lobe(LUL) and Left lower lobe(LUL) were involved in 3.1% cases each. These findings are similar with Grafakou *et al*. study (Greece) showed that from 169 chest x-rays, consolidation was right sided 109 cases and left sided in 58 cases. The majority of children with left sided pneumonia, more commonly had the lower lobe affection (lower lobe, 45/58, 77.5%; upper lobe, 11/58, 19.1%;upper and lower lobe, 2/58, 3.4%), while in right-sided pneumonia, the upper lobe was more commonly affected(upper lobe, 54/109, 49.5%; lower lobe, 35/109, 32.1%;middle lobe, 16/109, 14.7%; and more than one lobe, 4/109, 3.6%)[7].

We have seen that there is an association between chest x-ray finding with patients who presented with >7 days of compliant (p<0.001), patients who have previous admission with similar illness (p<0.001). Patients who have crepitation and diminished Vesicular breath sound on auscultation have an association with chest x –ray findings (p<0.001) and patients who stayed in the hospital more than 7 days also have association with chest x ray finding (p<0.001). This is similar with Ali Salih KEM *et al*. (Sudan) study which showed that chest X-ray findings of the disease has significant association with many factors e.g. hospital stay more than 4 days (p<0.001), presence of severe malnutrition (P <0.001), presence of other diseases (p<0.01)[1].

The mortality rate of patients in this study is 10%, which is greater than Mulholland *et al*. study (2.8%)[3].

SUMMARY

- In this present study, among 300 patients, 60% are infants, 26% are between 1-2 years of age and 14% are between 2-5 years of age.
- In this present study, among 300 patients, 52% are male and 48% are female.
- In this present study, among 300 patients, 65% from lower, 25% from middle, 10% from upper socio-economic classes.
- In this present study, Fever with cough was present in 42% cases followed by Fast breathing with cough in 22% cases, Fever with Fast breathing in 9% cases and Grunting in 3% cases.
- In this present study, past history of similar illness was present 3 times in 38.5% cases, twice in 28.2% cases, once in 20.5% cases, 4 times in 12.85 cases.
- In this present study; Predominantly wheeze with crepitation was present in 25% cases, no finding seen in 19% cases, only wheeze 18% cases, only crepitation in 10% cases, predominantly crepitation with wheeze in 9% cases, diminished Vesicular breath sound (VBS) in 9% cases, Predominantly Bronchial breath sound (BBS) with crepitation and wheeze in 3% cases, diminished Vesicular breath sound with wheeze in 2% were present.
- In this present study, Auscultatory chest findings were present bilaterally in 49% cases, in right lung 23% cases, in left lung 11% cases.
- In Chest x-ray findings of this present study, Hyperinflation with parahilar opacity was present in 30% cases, Consolidation in 24% cases, Hyperinflation in 17% cases, Bronchopneumonia in 8% cases, Interstitial pneumonia in 5% cases, Pleural effusion in 4% cases; Atelectasis, Rounded homogenous opacity, Honeycomb lesion and Unspecified findings were seen in 2% cases each.
- In CXR findings of this present study, Bilateral lobe(B/L) involvement was seen in 64.3% cases, Right upper lobe(RUL) involved in 11.2% cases; Right middle lobe(RML), Right lower lobe(RLL) and whole left lung involved in 5.1% cases each; Left upper lobe(LUL), Left lower lobe(LUL) and whole Right lung involved in 3.1% cases each.
- In this present study, Among 300 patients Brochiolitis was diagnosed in 30% cases, Pneumonia in 26% cases, Asthma in 15% cases, Bronchopneumonia in 8% cases; Pleural effusion and Pneumothorax in 4% cases each; Bronchiectasis, Foreign body impaction, Millary Tuberculosis(TB), Space occupying lesion were diagnosed in 2% cases each.
- In this present study 50% cases stayed in hospital for 4-7 days, 30% cases for >7 days and 20% case <4 days.
- In this present study, 90% patients were discharged after clinical improvement and death occurred in 10% cases.

CONCLUSION

In this study we have seen that chest X-ray can give useful information about the presence of pneumonia more commonly in patients who complain of cough and tachypnea for 3 days and more. So physicians should have to select patients who need x-rays to avoid unnecessary exposure to radiation and wastage of time and money for all patients with pneumonia.

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