

Original Research Article

How good are the examination findings in predicting the chest radiographic abnormalities amongst children with LRTI?

Ishank Goel*, Anjali Kher, Jayant Vagha

Department of Pediatrics, Jawaharlal Nehru Medical College, Sawangi (Meghe), Wardha, Maharashtra, India

Received: 21 October 2016

Accepted: 18 November 2016

***Correspondence:**

Dr. Ishank Goel,

E-mail: goel.ishank@gmail.com

Copyright: © the author(s), publisher and licensee Medip Academy. This is an open-access article distributed under the terms of the Creative Commons Attribution Non-Commercial License, which permits unrestricted non-commercial use, distribution, and reproduction in any medium, provided the original work is properly cited.

ABSTRACT

Background: Acute lower respiratory tract infections are an important cause of mortality and morbidity in children below five years of age. Plain chest radiograph remains the most accessible and commonly used radiological tool. The present study is thus designed to clinically evaluate children with pneumonia, to identify the risk factors and correlate them with the X-ray findings.

Methods: Our study was an observational and Analytical study. A total of 250 patients from the age group of 2 months to 5 years, admitted in paediatrics wards with respiratory complaints suggestive of involvement of lower respiratory tract whose X-rays were done were included in our study. All the patients were examined by the clinical experts every day and the findings were being confirmed by at least two experts. Radiologists/residents in the department made the first assessment during their daily practice through online database. The radiologist, who was not informed about the results of the first assessment, re-examined the radiographs. X-ray findings were then compared with clinical features.

Results: Out of 250 children, 137 patients had normal radiographs and 113 had abnormal radiographs. Pallor, intercostal retractions, subcostal retractions, grunt, nasal flaring, decreased breath sounds and crepts had a sensitivity of 80.53%, 84.07%, 76.99%, 70.80%, 76.99%, 73.45%, 62.83% and specificity of 30.66%, 35.77%, 67.88%, 82.48%, 36.50%, 88.32%, 49.64% respectively, in predicting the chest X-ray abnormalities in LRTI.

Conclusions: Tachypnea, pallor, retractions, grunt, nasal flaring, decreased breath sounds and crepitations were the main indicators of ALRI confirmed by X-ray. Inspection and Auscultation were two more important pillars of Respiratory system examination in children, where we could predict abnormal X-ray findings.

Keywords: Acute lower respiratory tract infections, Decreased breathe sounds, Retractions, Tachypnea, X-ray

INTRODUCTION

Acute lower respiratory tract infections are an important cause of mortality and morbidity in children below five years of age. In the developing countries pneumonia alone kills 3 million children every year. It is responsible for 19% of all deaths in children below five years of age. Of these, 90 to 95% are in the developing countries.^{1,2}

The interpretation of the radiograph depends upon several factors such as quality of the film and competence of the

interpreter.^{3,4} The quality of film largely depends on the machine that is being used, milliamperage, kilo voltage peak, exposure time and, in paediatrics, the cooperation of the patient.

The standard management thereafter of acute respiratory infections (ARI) in children less than five years of age has been recommended under Integrated Management of Childhood Illnesses (IMNCI) protocol developed by WHO. Unnecessary intervention results in wasting of financial resources of poor patients both in obtaining the

radiograph and subsequent management. The present study is thus designed to clinically evaluate children with pneumonia, to identify the risk factors and correlate them with the X-ray findings.

METHODS

Our study was an Observational and Analytical study that was conducted in Department of Paediatrics, AVBRH, Sawangi (Meghe), Wardha, for a period of 2 years. A total of 250 patients from the age group of 2 months to 5 years both sexes were included in the study.

All patients between 2 months to 5 years admitted in Paediatric wards with respiratory complaints suggestive of involvement of lower respiratory tract whose X-rays were done in our study after obtaining the informed consent. All the relevant information was gathered in the predesigned proforma. All the patients who formed the subjects of the study were examined by the clinical experts on every day morning rounds and the findings were being confirmed by at least two experts to avoid subjective variations.

General examination of the patients was done in detail. Following were noted;

- Vital parameters like heart rate, respiratory rate, blood pressure and oxygen saturation
- Abnormalities like pallor, oedema, icterus, cyanosis, clubbing and significant lymphadenopathy
- Detailed head to toe examination was done.

Systemic examination was done in detail and abnormalities like use of accessory muscles of respiration (intercostal and subcostal recession); presence of any stridor, audible wheeze, grunt and nasal flaring; respiratory rate; Tactile vocal fremitus during crying; Percussion of all areas: Normal (resonant), hyper-resonant, dull, stony dull; air entry on both sides, vesicular (normal), absent breath sounds and bronchial; added sounds: Rhonchi/crepts, inspiratory or expiratory, crackles (fine versus coarse), pleural friction rub; Vocal resonance were recorded. Other systems were also examined in detail and abnormalities were noted. Clinical impression was made on the basis of these details and only relevant findings were recorded.

Chest radiographs of patients for LRTI were collected. In accordance with the study protocol, the chest radiographs (postero-anterior wherever possible) were performed immediately after the patients were included in the study. Radiologists/ Residents in the department made the first assessment during their daily practice through online database on picture archiving and communication system (PACS).

The radiologist, who was not informed about the results of the first assessment, re-examined the radiographs systematically afterwards. In cases of a disagreement

amongst the two assessments, a third radiologist was asked to review. The aim was to reach consensus.

The radiological criteria for the diagnosis of pneumonia were used.^{5,6} Based on the description of the radiographic findings, five groups of radiographic diagnoses were evaluated:

- Bronchopneumonia (more widespread or ill-defined consolidation)/lobar pneumonia (consolidation confined to segmental boundaries)
- Airways disease (peri-bronchial wall thickening without a consolidation) (WALRI)
- Bronchiolitis (hyperinflation with atelectasis).
- Others like pleural effusion (Obliteration of Costophrenic angle), noninfectious pulmonary features like pulmonary oedema
- Normal (none of the above-mentioned findings present).

Above four points were labelled as abnormal or positive X-ray findings. These X-ray findings were then compared with clinical features.

RESULTS

Out of 250 children, 137 patients had normal radiographs with a frequency of 54.80% and 113 patients had abnormal radiographs with a frequency of 45.20% (Figure 1).

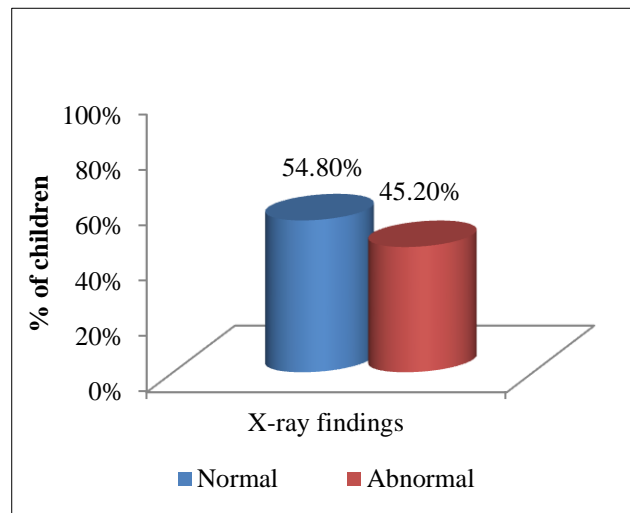


Figure 1: Distribution of X-ray findings among patients.

On general physical examination, 193 (77.20%) had tachycardia and 57 (22.80%) had no tachycardia. These groups had no statistically significance with the X-ray findings ($p = 0.113$, NS). 234 (93.60%) patients had tachypnoea with 113 (100%) abnormal radiographs and 16 (6.40%) had normal respiratory rate with 16 (11.68%) patients having normal radiographs which was statistically significant ($p < 0.0001$, S). 186 (74.40%)

patients had pallor and 64 (25.60%) had no visible pallor. The radiographs were more abnormal 91 (80.53%) when associated with pallor which was statistically significant (p= 0.044, S). Out of all the children, 21 (8.40%) patients had abnormal blood pressure; 1 (0.40%) patient had

oedema; 2 (0.80%) had lymphadenopathy and 6 (2.40%) had cyanosis on examination. These groups had no significant correlation with the X-ray findings with the p-value of 0.27 (NS), 0.89 (NS) and 0.81 (NS) respectively (Table 1).

Table 1: Correlation between general physical examination and X-ray findings.

General physical examination		X-ray findings		Total (n = 250)	χ ² -value	p-value
		Normal (n = 137)	Abnormal (n = 113)			
Heart rate	Tachycardia	111 (81.02%)	82 (72.57%)	193 (77.20%)	2.51	0.113,NS
	No tachycardia	26 (18.98%)	31 (27.43%)	57 (22.80%)		
Tachypnoea	Present	121 (88.32%)	113 (100%)	234 (93.60%)	14.09	0.0001,S
	Absent	16 (11.68%)	0 (0%)	16 (6.40%)		
Blood pressure	Normal	125 (91.24%)	104 (92.04%)	229 (91.60%)	0.05	0.82,NS
	Abnormal	12 (8.76%)	9 (7.96%)	21 (8.40%)		
Pallor	Present	95 (69.34%)	91 (80.53%)	186 (74.40%)	4.07	0.044,S
	Absent	42 (30.66%)	22 (19.47%)	64 (25.60%)		
Oedema	Present	0 (0%)	1 (0.88%)	1 (0.40%)	1.21	0.27,NS
	Absent	137 (100%)	112 (99.12%)	249 (99.60%)		
Lymphadenopathy	Present	1 (0.73%)	1 (0.88%)	2 (0.80%)	0.01	0.89,NS
	Absent	136 (99.27%)	112 (99.12%)	248 (99.20%)		
Cyanosis	Present	3 (2.19%)	3 (2.65%)	6 (2.40%)	0.05	0.81,NS
	Absent	134 (97.81%)	110 (97.35%)	244 (97.60%)		

On inspection, 183 (73.20%) patients had subcostal retractions with more number of abnormal X-rays 95 (84.07%) and 67 (26.80%) did not have subcostal retractions with more number of X-rays with no findings 49 (35.77%) which was statistically significant (p< 0.0001, S) (Figure 2).

131 (52.40%) patients had intercostal retractions with significant increase in the number of abnormal X-rays 87 (76.99%) and 119 (47.60%) had no intercostal retractions with more number of normal X-rays 93 (67.88%), which was statistically significant (p< 0.0001, S) (Figure 3).

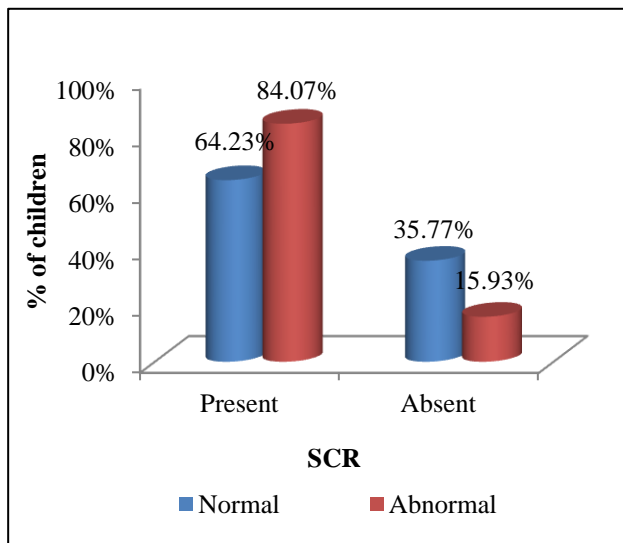


Figure 2: Correlation between subcostal retractions and X-ray findings.

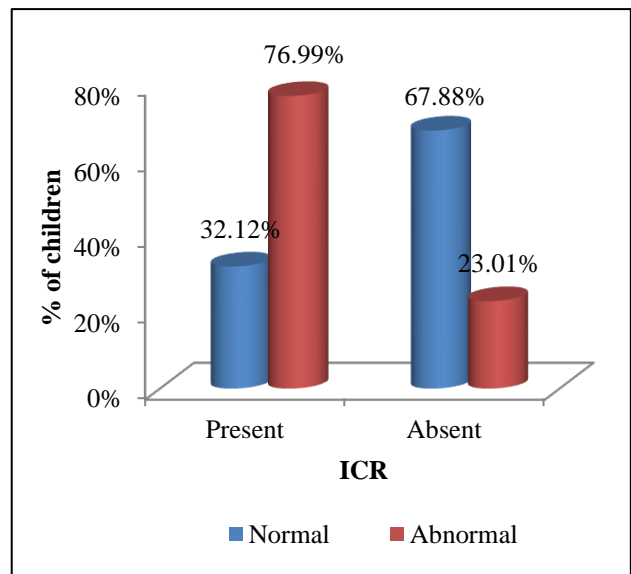


Figure 3: Correlation between intercostal retractions and X-ray findings.

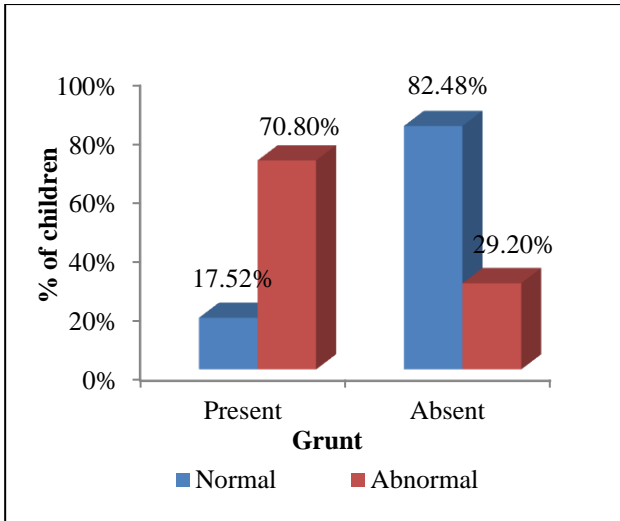


Figure 4: Correlation between grunt and X-ray findings.

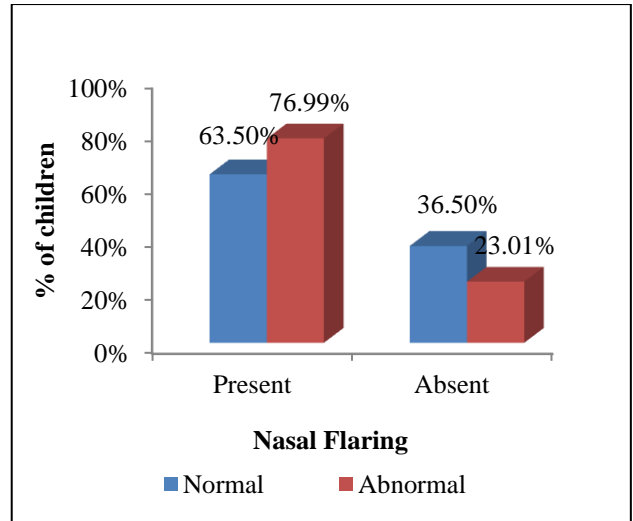


Figure 5: Correlation between Nasal flaring and X-ray findings.

Table 2: Correlation between auscultatory findings and X-ray findings.

Auscultatory findings	X-ray findings		Total (n = 250)	χ ² -value	p-value
	Normal (n = 137)	Abnormal (n = 113)			
Crepts	69 (50.36%)	71 (62.83%)	140 (56%)	6.02	0.049, S
Rhonchi	64 (46.72%)	36 (31.86%)	100 (40%)		
Normal	4 (2.92%)	6 (5.31%)	10 (4%)		
Total	137 (100%)	113 (100%)	250 (100%)		

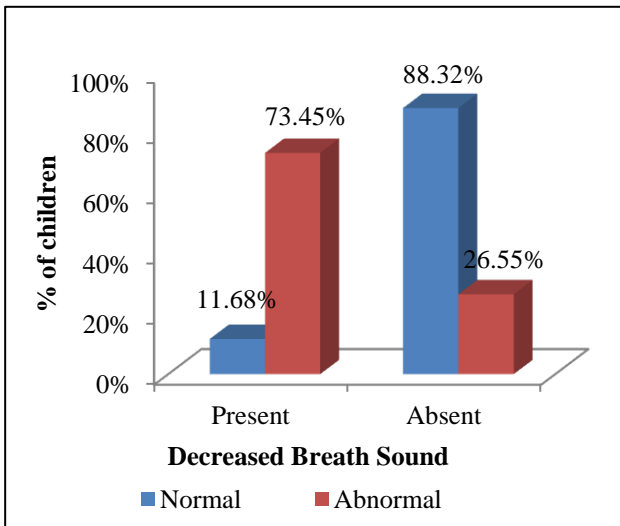


Figure 6: Correlation between decreased breath sounds and X-ray findings.

104 (41.60%) patients had grunt with more radiographic abnormalities 80 (70.80%) and 146 (58.40%) did not have grunt with less radiographic abnormalities 33 (29.20%) which was statistically significant with a p-

value of < 0.0001 (S) (Figure 4). 174 (69.60%) patients had nasal flaring with 87 (76.99%) having abnormal radiographs and 76 (30.40%) had no signs of nasal flaring with more number of normal radiographs 50 (36.50%) which was statistically significant (p = 0.021, S) (Figure 5).

On palpation, 221 (88.40%) patients had normal findings and 29 (11.60%) had abnormal findings. These groups had no correlation with the X-ray findings (p= 0.052, NS). On percussion, 242 (96.80%) patients had normal findings and 8 (3.20%) had abnormal findings. These groups had no correlation with the X-ray findings (p = 0.656, NS).

On auscultation, 140 (56%) patients had crepts followed by 100 (40%) with rhonchi and 10 (4%) patients had no finding. Radiographs were more affected in the patients with crepts 76 (62.83%). Patients with rhonchi had less abnormality in the radiographs 36 (31.86%). These values were statistically significant with a p-value of 0.049 (S) (Table 2). 99 (39.60%) had decreased breath sounds with radiographic abnormalities in 83 (73.45%) patients and 151 (60.40%) had normal air entry bilaterally with more number of normal radiographs 121

(88.32%) which was statistically significant ($p < 0.0001$, S) (Figure 6).

Out of all the clinical variables, pallor had a sensitivity of 80.53%, specificity of 30.66%, and positive predictive value of 48.92% and a negative predictive value of 65.62%. Subcostal retractions had a sensitivity of 84.07%, specificity of 35.77%, and positive predictive value of 51.91% and a negative predictive value of 73.13%. Intercostal retractions had a sensitivity of 76.99%, specificity of 67.88%, and positive predictive value of 66.41% and a negative predictive value of 78.15%. Grunt had a sensitivity of 70.80%, specificity of 82.48%, and positive predictive value of 76.92% and a negative predictive value of 77.40%. Nasal flaring had a sensitivity of 76.99%, specificity of 36.50%, and positive predictive value of 50% and a negative predictive value of 65.79%. Decreased breath sounds had a sensitivity of 73.45%, specificity of 88.32%, and positive predictive value of 83.84% and a negative predictive value of 80.13%. Crepts had a sensitivity of 62.83%, specificity of 49.64%, and positive predictive value of 50.71% and a negative predictive value of 61.82% in predicting the chest X-ray abnormalities in LRTI (Table 3).

78.15%. Grunt had a sensitivity of 70.80%, specificity of 82.48%, and positive predictive value of 76.92% and a negative predictive value of 77.40%. Nasal flaring had a sensitivity of 76.99%, specificity of 36.50%, and positive predictive value of 50% and a negative predictive value of 65.79%. Decreased breath sounds had a sensitivity of 73.45%, specificity of 88.32%, and positive predictive value of 83.84% and a negative predictive value of 80.13%. Crepts had a sensitivity of 62.83%, specificity of 49.64%, and positive predictive value of 50.71% and a negative predictive value of 61.82% in predicting the chest X-ray abnormalities in LRTI (Table 3).

Table 3: Binary classification of significant clinical variables.

Variable	Sensitivity (%)	Specificity (%)	Positive predictive value PPV (%)	Negative predictive value NPV (%)
Pallor	80.53	30.66	48.92	65.62
Subcostal retractions	84.07	35.77	51.91	73.13
Intercostal retractions	76.99	67.88	66.41	78.15
Grunt	70.80	82.48	76.92	77.40
Nasal flaring	76.99	36.50	50	65.79
Decreased breath sounds	73.45	88.32	83.84	80.13
Crepts	62.83	49.64	50.71	61.82

DISCUSSION

Acute respiratory infection (ARI) is one of the most common causes of mortality in children in the developing countries. Out of all the ARIs, Pneumonia is the most common illness prevailing in the developing countries. Early diagnosis and treatment can help in preventing the disease mortality. Chest radiography is the most common investigation done to diagnose these cases.

Silayach J et al showed that the prevalence of radiographic pneumonia in their study subjects were 26.7% (40/150) with maximum number of cases among the youngest age group of 2 months to 11 months [40% (12/30)] and concluded that presence of radiographic pneumonia were predicted by clinical presence of decreased breath sounds and crepitations.⁷

Njeze et al showed that 37% cases had radiological correlation with the clinical findings and 63% did not have any correlation concluding that chest radiographs have a role in the diagnosis of pneumonia.⁸ The World Health Organization does not recommend chest radiography in the management of acute lower respiratory tract infections in children in developing countries.⁹

Lynch T et al showed that tachycardia was present in 51% cases with CXR positive and 40% cases with CXR negative with a p-value of 0.02 which was significant.¹⁰ Tachycardia might be associated with multiple reasons

like anaemia, fever etc. which are not associated with LRI. Singhi S et al showed that respiratory rate was the best discriminator of radiological evidence of pneumonia.¹¹ Shah S et al showed that mean triage respiratory rate (RR) among children with pneumonia (RR = 39/min) did not differ from children without pneumonia (RR = 38/min).¹² Twenty percent of children with tachypnea as defined by WHO age-specific cut-points had pneumonia, compared with 12% of children without tachypnea ($P < 0.001$). In a study of children in Pakistan by Hazir et al, diagnosed with non-severe pneumonia on the basis of tachypnea alone, no difference was found in baseline clinical characteristics between children with and without radiological evidence of pneumonia (WHO-criteria).¹³ Tachypnea as a sign of pneumonia has been used by WHO in resource limited countries.

Salih A et al showed that there was a strong correlation between anaemia and radiological findings of ARI with a p-value of 0.039.¹⁴ In comparison to the few other studies done on anaemia and LRTI, Ramakrishnan et al found, in a study of 200 infants and children between 9 months to 16 years, that 74% of cases and 33 % of controls were anaemic (with 80% and 82 % IDA, respectively).¹⁵ Boys were more anaemic than girls, and the anaemic subjects were 5.7 times more susceptible to LRTI. Malla et al, in a study done on a total of 280 infants and children aged 1 Months to 5 years, recorded 68.6% of anaemic cases and 21.4% of anaemic controls with mean Hb level of 9.8 g/dl and 12 g/dl, 82% and 60% of IDA, respectively. Eighty

three percent of the anaemic group had a picture of pneumonia on chest radiograph. Anaemia due to mainly IDA was a risk factor for LRTI with an odds ratio of 3.2(2). H.C. Magree et al also found that 52% cases had CXR confirmed pneumonia and 25% cases had CXR negative pneumonia which was statistically significant ($p < 0.01$).¹⁶ We have a very high prevalence of anaemia in our region and that might be a contributing factor.

Domecq et al showed that when subcostal retractions were analyzed in CAP patients, a positive Likelihood ratio of 2.49 (95% CI 1.41-4.37) and a negative Likelihood ratio of 0.59 (95% CI 0.4-0.87) were obtained.¹⁷ Miguel Palafox et al showed that chest indrawing was present in 50.9% cases and it had a significant correlation with chest radiographs with a p-value of 0.004. In a study by Lynch T et al, retractions had significant correlation with the chest radiographs with a p-value of 0.047.¹⁰ Silayach J et al showed that intercostal retractions had no significant correlation with chest radiographs with a p-value of 0.089.⁷ Patients with retractions are said to have severe Pneumonia according to the ARI control program.¹⁹

In accordance to this study, Silayach J et al showed that grunt had a strong correlation with the chest findings with a p-value of < 0.001 .⁷ Lynch T et al also showed the same results with chest radiographs with a p-value of 0.038.¹⁰

Silayach J et al showed that nasal flaring had a good correlation with chest radiographs in accordance to our study with a p-value of 0.038.⁷ Pepin J et al stated that 'Grunting and/or nasal flaring' had a sensitivity of 72% and a specificity of 66% in predicting death in Pneumonia, and might be easier to use by primary health care personnel than other combinations.²⁰

Lynch T et al showed that decreased breath sounds had a correlation the chest radiographs with a p-value of 0.034.¹⁰ J. Silayach et al showed that on testing the validity of clinical variables, they observed that decreased breath sounds has a sensitivity of 92% with a specificity of 84% and a negative predictive value of 97%.⁷ So, by these values they interpreted that radiographic pneumonia can be ruled out in the absence of decreased breath sounds and also had a high chance of "CXR positive pneumonia" in its presence. It was a significant ($p < 0.001$) independent predictor among all the clinical variables.

The above study has shown strong correlation between the decreased breath sounds and CXR confirmed pneumonia which is in accordance to the present study.

In a study by Zukin DD et al, a subgroup with either normal breath sounds, or findings limited to wheezing, prolonged expiration, rhonchi on chest examination proved to be at low risk for any major chest radiographic abnormality.²¹

Emmanuelle Dugelay et al stated that presence of crackles were independent clinical predictors of chest radiography prescription in Bronchiolitis ($p = 0.003$), while these variables did not appear to predict a greater risk of radiographic abnormalities.²² Lynch T et al showed that crackles/crepts had a significant correlation with the chest radiography findings with the p-value of 0.001.¹⁰ Crackles/creptations on auscultation (in the absence of wheeze) have been found to be strongly associated with, or highly sensitive for, radiologically diagnosed pneumonia were stated in two other studies.^{23,24} Whereas, Silayach J et al showed that creptations as a clinical sign of pneumonia is not always associated with radiographic pneumonia.⁷ Creptations can be present prior to consolidation or asymmetric infiltrates on CXR. In their study, creptations had a sensitivity of 85%, poor specificity of 43% but a negative predictive value of 89%.

Silayach J et al have found the variables to be as grunt to have a sensitivity of 60%, specificity of 72%, positive predictive value of 44% and a negative predictive value of 83%.⁷ Nasal flaring to have a sensitivity of 72%, specificity of 46%, positive predictive value of 33% and a negative predictive value of 82%. Decreased breath sound to have a sensitivity of 92%, specificity of 84%, positive predictive value of 67% and a negative predictive value of 97%. Crepts to have a sensitivity of 85%, specificity of 43%, positive predictive value of 35% and a negative predictive value of 89%. Wheeze to have a sensitivity of 32%, specificity of 25%, positive predictive value of 14% and a negative predictive value of 50%. These findings are similar to our study.

CONCLUSION

To conclude the renal involvement starts below 5 years and increases with age. Males out number females in renal involvement may be due to more crises. Homozygous children specially in crises are affected more. Renal involvement is more in children with moderate and severe anaemia. Hence increasing age, male sex, homozygous state and severe anaemia appear to be risk factors for renal involvement.

Funding: No funding sources

Conflict of interest: None declared

Ethical approval: The study was initiated only after obtaining permission from the Institutional Ethics Committee (Reference no- DMIMS (DU)/IEC/2014-15/839), Acharya Vinoba Bhave Rural Hospital, Jawaharlal Nehru Medical College, Sawangi (Meghe), Wardha, Maharashtra, India.

REFERENCES

1. Kabra SK, Lodha R, Broor S, Chaudhary R, Ghosh M, Maitreyi RS. Etiology of acute lower respiratory tract infection. *Indian J Pediatr.* 2003;70(1):33-6.

2. Mourad S, Rajab M, Alameddine A, Fares M, Ziade F, Merhi BA. Hemoglobin level as a risk factor for lower respiratory tract infections in Lebanese children. *North Am J Med Sci.* 2010;2(10):461-6.
3. Child health epidemiology reference group (CHERG). First meeting, 6-7 February 2002, La Mainaz, Gex. Available at <http://www.popline.org/node/259255>. Accessed on 29 September 2016.
4. Albaum MN, Hill LC, Murphy M, Li YH, Fuhrman CR, Britton CA, et al. Interobserver reliability of the chest radiograph in community-acquired pneumonia. *PORT Investigators Chest.* 1996;110(2):343-50.
5. Katz DS, Leung AN. Radiology of pneumonia. *Clin Chest Med.* 1999;20(3):549-62.
6. Graffelman AW, Willemsen FE, Zonderland HM, Neven AK, Kroes AC, van den Broek PJ. Limited value of chest radiography in predicting aetiology of lower respiratory tract infection in general practice. *Br J Gen Pract.* 2008;58(547):93-7.
7. Clinicoradiological correlation of children between 2 months-5 years with clinical features of pneumonia in emergency settings. Available at <http://www.ijser.org/paper/Clinicoradiological-correlation-of-children-between-2-months.html>. Accessed on 2 October 2016.
8. Ngozi R, Okwor C, Nzegwu M. A correlation between clinical and chest radiograph. *Advances in Bioresearch.* 2011;2(2):18-21.
9. The management of acute respiratory infections in children. Available at http://apps.who.int/iris/bitstream/10665/41803/1/9241544775_eng.pdf.
10. Lynch T, Platt R, Gouin S, Larson C, Patenaude Y. Can we predict which children with clinically suspected pneumonia will have the presence of focal infiltrates on chest radiographs? *Pediatr.* 2004;113(3 Pt 1):e186-9.
11. Singhi S, Dhawan A, Kataria S, Walia BN. Validity of clinical signs for the identification of pneumonia in children. *Ann Trop Paediatr.* 1994;14(1):53-8.
12. Shah S, Bachur R, Kim D, Neuman MI. Lack of predictive value of tachypnea in the diagnosis of pneumonia in children. *Pediatr Infect Dis J.* 2010;29(5):406-9.
13. Hazir T, Nisar YB, Qazi SA, Khan SF, Raza M, Zameer S, et al. Chest radiography in children aged 2-59 months diagnosed with non-severe pneumonia as defined by World Health Organization: descriptive multicentre study in Pakistan. *BMJ.* 2006;333(7569):629.
14. Radiological findings in severe pneumonia in children 1-59 months in a children's hospital, Khartoum, Sudan. Available at <http://connection.ebscohost.com/c/articles/86390796/radiological-findings-severe-pneumonia-children-1-59-months-childrens-hospital-khartoum-sudan>. Accessed on 2 October 2016.
15. Ramakrishnan K, Harish PS. Hemoglobin level as a risk factor for lower respiratory tract infections. *Indian J Pediatr.* 2006;73(10):881-3.
16. Magree HC, Russell FM, Sa'aga R, Greenwood P, Tikoduadua L, Pryor J, et al. Chest X-ray-confirmed pneumonia in children in Fiji. *Bull World Health Organ.* 2005;83(6):427-33.
17. Domecq JP, Prutsky G, Lazo M de LÁ, Salazar C, Montori V, Prevost Y, et al. Identification of tachypnea and subcostal retractions as clinical signs for the diagnosis of community-acquired pneumonia among children: systematic review and meta-analysis. *Rev Peru Med Exp Salud Pública.* 2012;29(3):337-44.
18. Palafox M, Guiscafré H, Reyes H, Munoz O, Martínez H. Diagnostic value of tachypnoea in pneumonia defined radiologically. *Arch Dis Child.* 2000;82(1):41-5.
19. Ghai OP, Jain V. ARI control program. In: Ghai OP, Paul VK, Bagga A editors. *Ghai essential pediatrics*, 7th ed. New Delhi: CBS Publishers; 2009:356.
20. Pépin J, Demers AM, Mberyo-Yaah F, Jaffar S, Blais C, Somsé P, et al. Acute lower respiratory infections among children hospitalized in Bangui, Central African Republic: toward a new case-management algorithm. *Trans R Soc Trop Med Hyg.* 2001;95(4):410-7.
21. Zukin DD, Hoffman JR, Cleveland RH, Kushner DC, Herman TE. Correlation of pulmonary signs and symptoms with chest radiographs in the pediatric age group. *Ann Emerg Med.* 1986;15(7):792-6.
22. Ecochard-Dugelay E, Beliah M, Perreux F, de Laveaucoupet J, Bouyer J, Epaud R, et al. Clinical predictors of radiographic abnormalities among infants with bronchiolitis in a paediatric emergency department. *BMC Pediatr.* 2014;14:143.
23. Enwere G, Cheung YB, Zaman SMA, Akano A, Oluwalana C, Brown O, et al. Epidemiology and clinical features of pneumonia according to radiographic findings in Gambian children. *Trop Med Int Health TM IH.* 2007;12(11):1377-85.
24. Gupta D, Mishra S, Chaturvedi P. Fast breathing in the diagnosis of pneumonia: a reassessment. *J Trop Pediatr.* 1996;42(4):196-9.

Cite this article as: Goel I, Kher A, Vagha J. How good are the examination findings in predicting the chest radiographic abnormalities amongst children with LRTI? *Int J Contemp Pediatr* 2017;4:167-73.