

**Diagnostic value of the chest radiograph in neonates having respiratory distress****Najah Ismail Kunju<sup>1</sup>, Jerish Joseph<sup>2\*</sup>**<sup>1</sup>Assistant Professor, Department Of Radiodiagnosis , KMCT Medial College Manassery Kozhikode Kerala,India<sup>2</sup>Assistant Professor, Department Of Radiodiagnosis, KMCT Medial College Manassery Kozhikode Kerala,India

Received: 19-10-2021 / Revised: 10-11-2021 / Accepted: 24-12-2021

**Abstract**

**Introduction:** Chest radiography is one of the most typical diagnostic instruments for respiratory distress. The rationale of the study was to assess the specificity, sensitivity, and clinical value of chest radiography of neonates with respiratory distress. **Objective:** To find out Effectiveness of Chest X-rays in Neonatal Respiratory Distress. **Methods:** A descriptive- analytical study was conducted on 100 neonate's patients that were in Dept. of Radiodiagnosis KMCT Medical College Manassery Calicut , from July 2019 to June 2020. After confirming the neonate's respiratory distress and taking CXR, the radiography was described by a radiologist and final diagnosis was confirmed. **Results:** Most of the neonates (64%) were born with caesarian section and were premature (78%) in this study. Respiratory distress syndrome (RDS) was the most common reason for respiratory distress (54%). Chest radiography had the most sensitivity and specificity in pneumothorax and diaphragmatic hernia (100%). For pneumosepsis, radiography had 73% sensitivity and 87% specificity, for RDS the sensitivity and specificity were 35% and 82% respectively, for congenital heart disease sensitivity of zero and specificity of 98% and for Transient tachypnea of neonates (TTN) sensitivity of zero and specificity of 100%. **Conclusion:** Chest radiography is used as one of the most predictable and available diagnostic tools in respiratory distress syndrome, but inaccurate specificity and sensitivity in some disease must be judged, especially in neonates.

**Keywords:** chest x-ray, neonate, respiratory distress, sensitivity, specificity, sepsis.

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**Introduction**

Two third of the neonatal mortality is connected to neonates who weight lower than 2500 gr at the time of birth however very low birth weight infants contain less than 1% of all births, 50% of neonatal mortality is connected to this group.[1,2] The most common causes of pre-term neonatal mortality are bronchopulmonary dysplasia and Respiratory distress syndrome (RDS). Bronchopulmonary dysplasia (BPD) is a chronic lung disease that is seen most frequently in severely premature babies who developed RDS. Respiratory distress syndrome is a life-threatening lung disorder in which a baby's lungs are not fully Functional . This condition primarily affects premature babies.[3,4] Pneumothorax, congenital diaphragmatic hernia, pneumonia, sepsis, temporary tachypnea and respiratory distress syndrome (RDS) have been proposed as the main causes of respiratory distress. RDS is one of the most common causes of death in premature infants[5] which is caused by developmental insufficiency of surfactant production and structural immaturity in the lungs. Chest X-rays (CXR) have shown promising results regarding the early diagnosis of respiratory distress.[6] Also, it has been declared that normal radiographic patterns 6 hours after labour exclude any chance of RDS.[7,8,9] The rationale behind the study was since there are no conclusive studies regarding the specificity and sensitivity of radiographs in detecting respiratory distress causes, the present study was designed to determine the sensitivity, specificity, and clinical value of chest radiography of neonates with respiratory distress.

**Materials and Methods**

This was a descriptive-analytic study which was held in the Dept. of Radiology in tertiary care hospital during July 2019 to June 2020. 100 neonates who were admitted in NICU. with respiratory distress diagnosis were included in the present study. When respiratory distress was verified and following information (maternal age, history of mother disease, history of drug use birth weight, height, gender, delivery mode, date of delivery, Apgar score at birth, symptoms at time of referring, etc.), were recorded in the study tool. RDS was diagnosed by a neonatal specialist based on clinical symptoms and course and Arterial blood gas (ABG) and infection rule out and chest X-ray, then chest X-ray was given to a radiologist without awareness of the above diagnosis and then the results were statistically collected. Different interpretations included lung collapses, pneumothorax, congenital, heart disease, mediastinal mass, pulmonary vessels, diaphragm condition, and the presence of any cavity, mass and unusual opacity were diagnosed and recorded in the questionnaire. After specific clinical and para-clinical procedures the definite diagnosis was made and recorded in the questionnaire. Finally, final diagnosis has been confirmed by another neonatologist.

**Statistical Analysis-** We assessed the prevalence of these parameters and performed the statistical analysis by SPSS version 22. Chi-square test and exact fisher test were used. The statistical significance was at ( $P < 0.05$ ) and the confidence interval was 95% for all these tests in our study.

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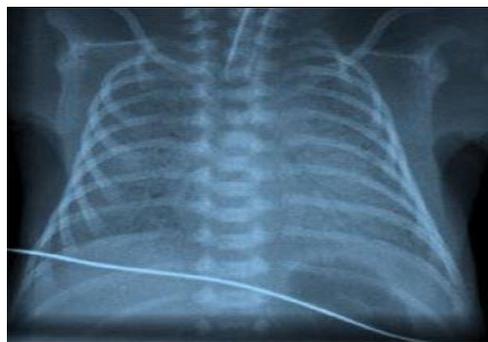
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**Results**

**Table 1: Radiographic observations and Abnormal Xray findings**

Radiographic observation	Frequency (%)
Haziness	73(73)
Air Broncho gram	51(51)
Collapse	9 (9)
Pneumothorax	4 (4)
Pulmonary lucencies	33 (33)
<b>Abnormal Xray findings</b>	
Heart size & shape	21(21)
Lung hills	18 (18)
Pulmonary vessels	14(14)
Mediastina condition	11(11)
Diaphragm	8 (8)

Table 1 demonstrates the frequency of radiographic observations in chest X-rays. It can be concluded that chest X-ray haziness and bronchogram were the most common radiographic signs. Also, presence of the pneumothorax was the least common sign in X-rays. After the signs of pneumothorax intensified, missed cases were revised and definitive diagnosis was assigned after consulting with the radiologist.



**Fig 1: Chest Xray of Respiratory Distress Syndrome (RDS)**

Figure 1 shows a neonatal chest xray depicting respiratory distress syndrome as per radiologist.

**Table 2: Final Clinical and Radiographic diagnosis of patients (N=100)**

Disease	Final clinical diagnosis (N)	Final radiographs diagnosis (N)	Percent of accurate Diagnosis by radiographs (%)
RDS	37	20	54
Transient tachypnea of neonates	17	0	0
Pneumothorax	4	4	100.0
Pneumonia	15	4	26.6
Congenital heart diseases	7	1	14.2
Asphyxia	19	0	0
Hernia	1	1	100.0
Total	100	30	30

According to Table 2 it can be said that totally 79% of clinical diagnosis were confirmed by radiographs and in 20% of cases there was no coordination between clinical and radiological observations. It was seen that RDS had the highest rate of frequency following by Transient tachypnea of the newborn (TTN). Also, diaphragmatic hernia showed the least rate of frequency. It was observed that RDS, pneumonia and bronchopneumonia had the highest rate of frequency. And it was significant ( $p < 0.05$ )

**Table 3: Sensitivity and Specificity of Radiographs in diseases.**

Disease	Sensitivity	Specificity
RDS	80	85
Pneumothorax	100	100
Pneumonia	74	87
Congenital heart diseases	100	94

Table 3 represents the sensitivity and specificity radiological and clinical observations for different radiologic diagnosis. The specificity (the percentage of healthy people who are correctly identified as not having the condition) and sensitivity (the percentage of sick people who are correctly identified as having the condition) of the radiographic test was 82.5 and 35.8% respectively.

**Discussion**

Chest X-ray is one of the key steps in respiratory distress diagnostic procedure, consequently it is necessary to investigate the value of radiography role in this disease. Marini 1997 describe the sensitivity and specificity of chest x-ray in neonates were 89.1% and 86.9% respectively in detecting respiratory distress.[10] In the present study

it was concluded that chest X-ray haziness and bronchogram were the most common radiographic signs. In the present study, boys consisted 56.9% of patients who were admitted to dept of Radiodiagnosis. This finding is in agreement with Hashemizadeh's study which declared that 61% of patients suffering from respiratory distress were boys.[11] In Berg's study respiratory distress was said to be one of the major complications of cesarean.[12] This finding was also confirmed in the present study as just 35.3% of neonates had natural delivery. While in the Kurl's study clinical and radiographic diagnosis matched properly in 95% of cases. The specificity and sensitivity of the test in diagnosing Pneumothorax were 100%. In Marini study there were 5 patients suffering from pneumothorax and all of them were

diagnosed. Also Kurl indicated that the consistency of radiographic and clinical diagnosis is 78%.<sup>8</sup>The sensitivity and specificity of the radiographic tests was 73% and 87% respectively in the present study. In Mathur study in 2002, chest X-rays were normal in 15% of patients suffering from pneumonia (sensitivity 15%).<sup>9</sup>16.6% and 98% sensitivity and specificity were reported for radiographic tests respectively in the present study. Also it was revealed that chest x-rays do not change the trend of treatment and diagnosis of patients with congenital heart diseases.[13] In the present study the sensitivity and specificity of radiographic tests were 100%. The sensitivity and specificity of radiographic tests were 0 and 100% respectively. In Kurl study just 48% of clinical and radiographic diagnosis matched properly. In the present study none of the neonates who were suffering from TTN were diagnosed by radiographs. Also, Ponhold revealed that the diagnosis of TTN is mainly based on clinical signs and symptoms.[14] Finally in the present study 79.4% of clinically diagnosed cases were confirmed by radiographs. Also, in Kurl's study, 66.6% of clinical and radiographic diagnosis matched properly.

#### Conclusion

Although chest radiography is used as one of the most usual and accessible diagnostic tools in respiratory distress syndrome but diagnostic value of RDS based on radiologist opinion were about two-third of all cases and has high sensitivity.

#### References

1. Lavoie PM, Pham C, Jang KL. Heritability of Bronchopulmonary dysplasia, defined according to the consensus statement of the National Institutes of Health. *Pediatrics*. 2018; 122:479–85.
2. Ehrenkranz RA, Walsh MC, Vohr BR, Jobe AH, Wright LL, Fanaroff AA, et al. Validation of the National Institutes of Health consensus definition of bronchopulmonary dysplasia. *Pediatrics*. 2015; 116(6):1353–60.
3. Sánchez Luna M, et al. Bronchopulmonary dysplasia: definitions and classifications. *AnPediatri (Barc)*. 2019; 79(4):262.e1-6.
4. Bhandari A, McGrath-Morrow S. Long-term pulmonary outcomes of patients with bronchopulmonary dysplasia. *Semen Perinatal* 2018; 37(2):132-7.
5. Kliegman R, Marcdante K. *Nelson Essentials of pediatrics*. 4th ed. Philadelphia: Elsevier Saunders, 2016, 271-337.
6. Armstrong P, Wastie M, Rockall A. *Diagnosing imaging*. 4th ed. United State of America: Black well, 2014, 17-99.
7. Sutton D. *Textbooks of radiology and imaging*. 17th ed. Iandam: Churchill living stone, 2003, 256-257.
8. Kurl S, Heinonen KM, Kiekara O. The First chest Radiography in neonates exhibiting respiratory distress at birth. *Clinpediatr (phila)*. 2017; 36(5):285-90.
9. Mathur NB, Kumar S. Respiratory distress in neonates with special reference to Pneumonia. *Indian pediatr*. 2012; 39(6):529.
10. Marini C, Bulleri A, Cambi L, et al. The Neonatal Respiratory insufficiency syndrome: The Role of the chest Radiogram. *Radiol Med*. 2017; 94(5):4637.
11. Hashemzadeh A. Evaluation of respiratory distress in 6 months-5 years old children. *J Med Univer Ardabil*. 2019; 5(2):175-179.
12. van den Berg A, van Elburg RM, van Geijn HP, Fetter WP. Neonatal respiratory morbidity following elective cesarean section in term infants. A 5 year retrospective study and a review of the literature. *Eur J obstet Gynecol Reprod Biol*. 2020; 98(1):9-13.
13. Oeppen RS, Fair Hurst JJ, Argent JD. Diagnostic value of the chest radiograph in asymptomatic neonate with a cardiac murmur. *Clin Radial*. 2017; 57(8):736-40.
14. Ponhold W. Most frequent causes, complications, and differential diagnosis of neonatal respiratory distress in chest X-Ray. *Padiatrpado*. 2018; 17(4):715-40.

**Conflict of Interest: Nil Source of support: Nil**