Section: Pediatrics

Original Research Article

COMPARATIVE STUDY BETWEEN CHEST X-RAY AND LUNG ULTRASOUND IN NEONATES PRESENTING WITH RESPIRATORY DISTRESS IN A RESOURCE-LIMITED SETTING

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Corresponding Author:
Dr. Amit Kumar Tripathy,
Email: amittripathy810@gmail.com

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B. Maheswar Rao[1], Jyoti Ranjan Behera[2], Manisha Patro[3], Amit Kumar Tripathy[4]

[1]Associate Professor, Department of Pediatrics, MKCG Medical College & Hospital, Berhampur, Ganjam
[2]Assistant Professor, Department of Paediatrics, MKCG Medical College & Hospital
[3]Assistant Professor, Department of Pediatrics, MKCG Medical College & Hospital Berhampur, Ganjam
[4]Senior Resident, Department of Paediatrics, F.M. Medical College & Hospital, Balasore

ABSTRACT

Background: The study is to evaluate the diagnostic utility of lung ultrasound (LUS) in comparison to chest X-ray (CXR) in neonates presenting with respiratory distress. The study seeks to determine whether LUS can serve as a reliable alternative or adjunct to CXR in the diagnosis and management of neonatal respiratory distress. **Materials and Methods:** This study was conducted by using quantitative, analytical cross-sectional design in order to assess the the usefulness of Lung ultrasound in comparison to chest x-ray in neonates with respiratory distress syndrome. This study was carried out using participants who were admitted in the Special newborn care unit (SNCU), in the Department of Paediatrics of MKCG Medical College and Hospital, Berhampur. **Result:** Neonatal respiratory distress is a critical condition requiring prompt diagnosis and intervention. This study evaluated the role of Chest X-ray and Lung Ultrasound in diagnosing various neonatal respiratory disorders. A total of 112 neonates presenting with respiratory distress were assessed to determine their birth characteristics, maternal risk factors, clinical features, radiological findings, and the diagnostic performance of Chest X-ray and Lung Ultrasound compared to the final clinical diagnosis. **Conclusion:** In conclusion, this study demonstrates that LUS is a highly effective diagnostic tool for neonatal respiratory distress, with superior sensitivity and specificity compared to CXR for many conditions. Its ability to provide rapid, bedside diagnosis without radiation exposure makes it an invaluable tool in neonatal care, particularly in resource- limited settings. However, the limitations of LUS in distinguishing between conditions with overlapping imaging features highlight the importance of using LUS in conjunction with clinical findings and other diagnostic modalities.

INTRODUCTION

In addition to being the primary cause of early morbidity and mortality during the first week of life, respiratory issues are the most frequent reason why babies are brought to the neonatal intensive care unit (NICU). Neonatal respiratory disorders are diagnosed mostly by clinical signs and conventional chest X-rays (CXR). These techniques have drawbacks, too, since CXRs by themselves could not always yield a conclusive diagnosis and clinical symptoms might not always be sensitive or specific. Uncertainty and delays in handling crucial situations may result from this. Since its introduction in the 1960s, neonatal ultrasonography has become increasingly popular during the past ten years. When evaluating critically unwell neonates, the European Society of Paediatric and Neonatal Intensive Care (ESPNIC) highlights the importance of point-of-care ultrasound (POCUS), especially lung ultrasound (LUS).[1]

In the last ten years, LUS has become a viable substitute for CXR in the diagnosis of lung disorders in newborns. Despite being done indirectly, LUS is a useful imaging technique because of the tiny chest size and thin chest walls of neonates. LUS is a safer choice since it removes exposure to ionising radiation, which is one of its main advantages. It is also less complicated technically than other imaging methods and very simple to master.[2,3]

The most common reason for admission to the neonatal intensive care unit (NICU) is respiratory distress. It is a significant clinical sign of a number of conditions, both cardiopulmonary and non-cardiopulmonary.[4] Overall, 7% of neonates experience respiratory distress. It accounts for between 30 and 40 percent of admissions to special care neonatal units. Respiratory distress is the most prevalent cause of admission to the neonatal intensive care unit (NICU), accounting for 15% of term and 29% of preterm newborns.[5,6]

Early newborn mortality is primarily caused by respiratory problems. Respiratory distress is defined by one of the two characteristics listed in the National Neonatal and Perinatal Database of India (NNPD).[1] RR (respiratory rate) greater than 60 breaths per minute,[2] Intercostal and subcostal recessions,[3] Grunting or groaning when breathing. In addition to the aforementioned characteristics, respiratory distress is also indicated by the presence of nasal flaring, suprasternal retractions, and decreased air intake during chest auscultation.[7] The typical reasons observed in a variety of In addition to other less frequent reasons, investigations included pneumonia (sepsis), respiratory distress syndrome (RDS), meconium aspiration syndrome (MAS), congenital heart disease (CHD), congenital diaphragmatic hernia (CDH), transient tachypnea of newborns (TTN), pneumothorax, and pulmonary haemorrhage.[8,9] The best course of action will be guided by the ability to quickly identify respiratory distress in the infant and comprehend the physiologic anomalies linked to each of the many causes. which will reduce mortality as well as short-term and long-term complications.[5]

A meta-analysis by Razak and Faden analysed six studies involving 480 neonates to evaluate the diagnostic accuracy of lung ultrasound (LUS) in detecting neonatal respiratory distress syndrome (NRDS). The study found that LUS had a pooled sensitivity of 97% and specificity of 91% for identifying and ruling out NRDS.[10-15] Similarly, a meta-analysis by Shao et al., which included nine studies with a total of 703 infants, reported a pooled sensitivity of 99% and specificity of 95% for diagnosing NRDS. These findings further support the high accuracy of LUS in detecting neonatal lung conditions, highlighting its potential as a safer alternative to chest X-ray (CXR) by reducing exposure to ionizing radiation.[16] In both studies, the p-value was statistically significant (<0.001), reinforcing the reliability of LUS in clinical practice. This study aims to compare the sensitivity and specificity of LUS and CXR in diagnosing NRDS and other neonatal respiratory conditions by analysing data from multiple studies. Furthermore, research is needed to better understand the learning curve associated with LUS and to determine the most effective training programs for healthcare providers.

MATERIALS AND METHODS

This study was conducted by using quantitative, analytical cross-sectional design in order to assess the the usefulness of Lung ultrasound in comparison to chest x-ray in neonates with respiratory distress syndrome. This study was carried out using participants who were admitted in the Special newborn care unit (SNCU), in the Department of Paediatrics of MKCG Medical College and Hospital, Berhampur.

Study Duration: The total study duration was 18 months (May 2023 – November 2024). Participants were recruited and followed up simultaneously during the period of this study.

Study Population: All neonates admitted to the SNCU with features of respiratory distress arising out of any etiology during the study period.

Inclusion Criteria

The Participants Of This Study Were Selected From

- Neonates presenting with clinical symptoms and sign of moderate respiratory distress were diagnosed using a combination of clinical indicators (presentation, vital signs and auscultation) as per Silverman Anderson score96 and Downe’s score97

Exclusion Criteria

- Neonates presented with severe respiratory distress and mild respiratory distress.
- Respiratory distress due to extrapulmonary cause e.g. congenital heart disease (CHD), renal failure etc.

Methodology

Before commencing the study, the parents or guardians of the children were thoroughly briefed about the study's objectives, procedures, potential risks, and benefits. This explanation was provided in a clear and understandable manner to ensure that they were fully informed. Written informed consent was then obtained from the parents or guardians using a standardized consent form. This form was designed to comply with ethical guidelines and ensure that the participants' rights and confidentiality were protected.

RESULTS

Table 1: Gender Distribution Of Neonates With Respiratory Distress (N=112)

Gender	Frequency (N)	Percentage (%)
Male	68	60.7%
Female	44	39.3%

The table shows the gender distribution of 112 neonates with respiratory distress. There were 68 males (60.7%) and 44 females (39.3%). Males represent a higher proportion of neonates with respiratory distress compared to females, aligning with known trends of increased respiratory distress in male neonates. The male-to- female ratio is approximately 1.54:1, reflecting a moderate gender imbalance in the sample.

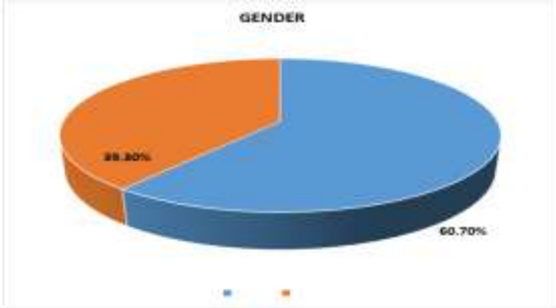

Table 2: Birth Weight Of Neonates With Respiratory Distress (N=112)

Birth Weight (Kgs)	Frequency (N)	Percentage (%)
<1.5	13	11.6%
1.5 – 2.5	30	26.7%
2.5 – 4.0	64	57.1%
>4	5	4.5%

[Table 2] summarizes the birth weight distribution of neonates with respiratory distress. A total of 112 neonates were included in the analysis. The birth weight distribution is as follows:

- 13 neonates (11.6%) had a birth weight of less than 1.5 kg, indicating very low birth weight.
- 30 neonates (26.7%) had a birth weight between 1.5 kg and 2.5 kg, falling within the low-birth-weight category.
- The majority, 64 neonates (57.1%), had a birth weight between 2.5 kg and 4.0 kg, which is considered within the normal birth weight range.
- 5 neonates (4.5%) had a birth weight greater than 4 kg, indicating macrosomia or high birth weight.

This distribution shows that more than half of the neonates had a birth weight within the normal range, while approximately 38.3% had low or very low birth weight, which could contribute to increased susceptibility

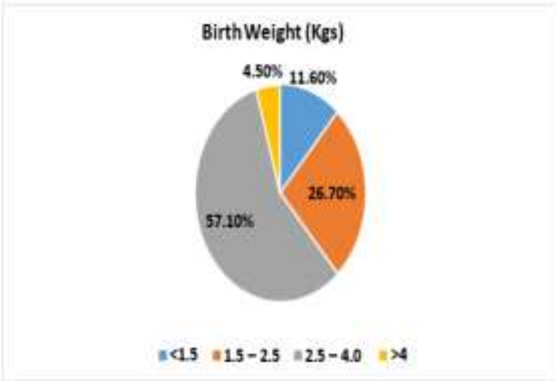

Table 3: Gestational Age Of Neonates At Birth (N=112)

Period Of Gestation	Frequency (N)	Percentage (%)
Preterm (<37 weeks)	46	41.1%
Term (37 – 42 weeks)	62	55.4%
Post-term (>42 weeks)	4	3.5%

[Table 3] presents the gestational age distribution of neonates at birth. A total of 112 neonates were included in the analysis. The distribution is as follows:

- 46 neonates (41.1%) were born preterm (before 37 weeks of gestation). Preterm birth is a known risk factor for respiratory distress.
- 62 neonates (55.4%) were born at term (between 37 and 42 weeks), which represents the majority of the sample.
- 4 neonates (3.5%) were born post-term (after 42 weeks), which is less common but may still contribute to respiratory complications. This data shows that while most neonates were born at term, a significant proportion (41.1%) were preterm, indicating that prematurity may be a contributing factor to respiratory distress in this cohort.

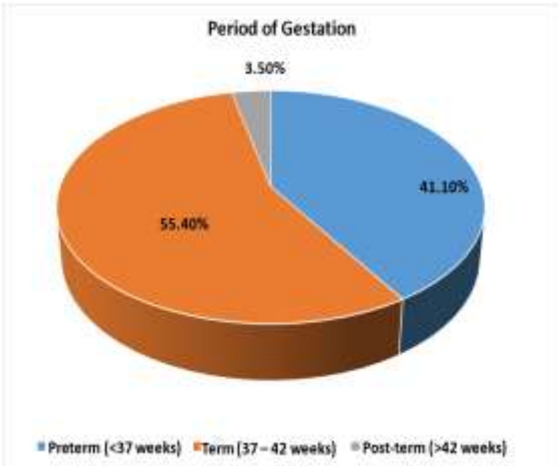

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Table 4: Mode of Delivery of Neonates At Birth (N=112)

Mode Of Delivery	Frequency (N)	Percentage (%)
Caesarean	50	44.6%
Normal Vaginal	62	55.4%

[Table 4] summarizes the mode of delivery of neonates at birth among the 112 neonates included in the study. The distribution is as follows:

- 50 neonates (44.6%) were delivered by caesarean section. Caesarean delivery is often performed for medical indications but may also increase the risk of neonatal respiratory issues.
- 62 neonates (55.4%) were delivered through normal vaginal delivery, which represents the majority of the cases.

This data indicates that vaginal delivery was more common than caesarean delivery among the neonates with respiratory distress.

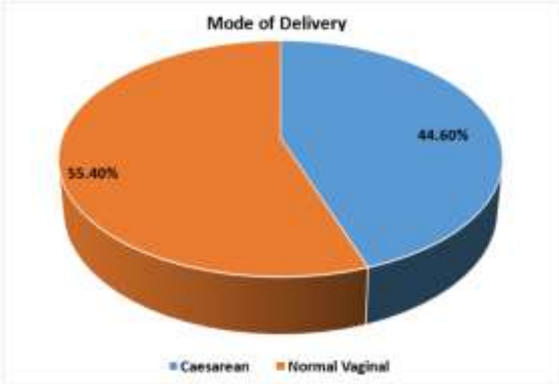

Table 5: History of Premature Rupture of Membrane (N=112)

Premature rupture of membrane	Frequency (N)	Percentage (%)
Yes	23	20.5%
No	89	79.5%

[Table 5] presents the history of premature rupture of membranes (PROM) among the 112 neonates included in the study. The distribution is as follows:

- 23 neonates (20.5%) had a history of premature rupture of membranes. PROM can increase the risk of neonatal respiratory distress and other complications.
- 89 neonates (79.5%) did not have a history of PROM.This indicates that the majority of neonates did not have a history of PROM.

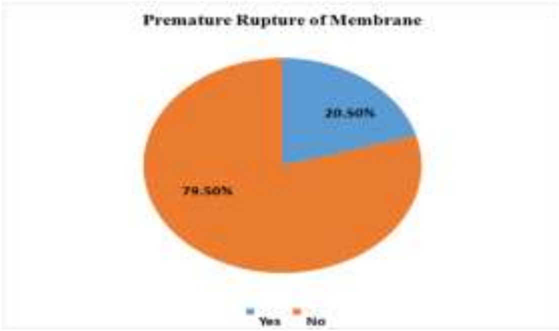

Table 6: History of Consanguinity (N=112)

Consanguinity	Frequency (N)	Percentage (%)
Yes	20	17.9%
No	92	82.1%

[Table 6] presents the history of consanguinity among the 112 neonates included in the study. The distribution is as follows:

- 20 neonates (17.9%) had a history of consanguinity (parents being related by blood). Consanguinity is known to increase the risk of genetic disorders and certain neonatal complications.
- 92 neonates (82.1%) did not have a history of consanguinity.

This indicates that the majority of neonates were born to non-consanguineous parents, but the 17.9% with a history of consanguinity may represent a group with higher genetic risk factors.

DISCUSSION

Respiratory distress in newborns is a serious illness that needs to be diagnosed and treated right away. This study assessed the use of lung ultrasonography and chest X-rays in the diagnosis of different infant respiratory conditions. In order to ascertain the birth characteristics, maternal risk factors, clinical features, radiological findings, and the diagnostic performance of lung ultrasound and chest X-ray in comparison to the final clinical diagnosis, 112 newborns who presented with respiratory distress were evaluated. Using Cohen's Kappa coefficient, agreement between various imaging modalities was also examined.[17-19]

Radiological Findings: Chest X-ray vs. Lung Ultrasound Chest X-ray, traditionally considered the gold standard for evaluating neonatal respiratory distress, revealed a spectrum of abnormalities. The most common findings included haziness (57%), which is a nonspecific indicator of pulmonary pathology, reticulation (26%), typically associated with RDS, bilateral lung opacification (39%), often seen in severe RDS or pneumonia, and pleural effusion (14%).[20-22]

Lung Ultrasound findings demonstrated strong correlation with Chest X-ray results. Key ultrasonographic abnormalities included pleural line abnormalities (93%), absent A-lines (92%), lung

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consolidation (86%), and B-lines (59%). Importantly, Lung Ultrasound was particularly useful in detecting conditions such as pneumothorax (2%) and pleural effusion (2%), where characteristic signs like the barcode sign and lung point sign provided definitive diagnostic value.[23]

Comparative Diagnostic Performance of Chest X-ray and Lung Ultrasound to assess the diagnostic accuracy of Chest X-ray and Lung Ultrasound, their sensitivity and specificity were analysed against the final clinical diagnosis. For RDS, Lung Ultrasound demonstrated a slightly higher sensitivity (87.5%) than Chest X-ray (84.38%), with both modalities showing high specificity (93.75% and 92.5%, respectively). For MAS, both modalities showed moderate sensitivity, with Lung Ultrasound at 65.0% compared to Chest X-ray at 60.0%, while specificity remained high (94.57% and 96.74%, respectively).[24] For pneumonia, Chest X-ray had a sensitivity of 89.74% and specificity of 94.52%, whereas Lung Ultrasound had slightly lower sensitivity (80.56%) and specificity (86.84%), indicating some limitations in distinguishing pneumonia from other conditions. For TTN, Lung Ultrasound outperformed Chest X-ray in sensitivity (82.35% vs. 70.59%) and specificity (95.79% vs. 94.74%). For pneumothorax and pleural effusion, both modalities achieved perfect sensitivity and specificity, reinforcing their reliability in detecting these conditions. These findings confirm that Lung Ultrasound is a highly sensitive and specific diagnostic tool for neonatal respiratory conditions, with particular advantages over Chest X-ray in detecting RDS, MAS, and TTN.[25]

Agreement Between Chest X-ray and Lung Ultrasound Cohen's Kappa coefficient was used to evaluate inter-modality agreement between Chest X-ray and Lung Ultrasound. Agreement was highest for RDS (κ = 0.788) and TTN (κ = 0.700), indicating substantial agreement. Pneumonia and MAS showed moderate agreement (κ = 0.606 and κ = 0.574, respectively), while pneumothorax and pleural effusion exhibited fair agreement (κ = 0.657). The observed agreement (Po) ranged from 82.1% for pneumonia to 98.2% for pneumothorax and pleural effusion, whereas expected agreement (Pe) varied from 54.6% to 94.7%. The relatively high Kappa values for RDS and TTN suggest that Lung Ultrasound can effectively complement or even replace Chest X-ray in these conditions. The lower agreement in pneumonia and MAS may be due to the overlapping imaging features between these conditions and the challenges in differentiating bacterial from viral pneumonia using ultrasound alone.[26]

Neonatal respiratory distress (NRD) is a life-threatening condition that necessitates rapid and accurate diagnosis to guide appropriate clinical management. This study aimed to evaluate the diagnostic performance of Chest X-ray (CXR) and Lung Ultrasound (LUS) in identifying the underlying causes of NRD, comparing their sensitivity, specificity, and agreement with the final clinical diagnosis. The findings of this study, when compared to existing literature, provide valuable insights into the strengths and limitations of these imaging modalities in neonatal care. This discussion will elaborate on the study findings, compare them with other studies, and explore the clinical implications of these results.

Radiological Findings: Chest X-ray vs. Lung Ultrasound CXR revealed common abnormalities such as haziness (57%), reticulation (26%), and bilateral lung opacification (39%), which are nonspecific but often associated with RDS and pneumonia. These findings are consistent with those of Elham Zarei and Vahid Alizadeh (2018), who reported haziness and consolidation as the most frequent CXR findings in neonates with NRD. However, LUS demonstrated superior diagnostic capabilities, particularly in detecting pleural line abnormalities (93%), absent A-lines (92%), and lung consolidation (86%). These findings are supported by Wu et al. (2020), who highlighted the high sensitivity of LUS in identifying RDS and its complications. LUS was particularly effective in diagnosing pneumothorax and pleural effusion, with characteristic signs such as the barcode sign and lung point sign providing definitive diagnostic value. This aligns with the findings of Raimondi et al. (2016), who reported 100% sensitivity and specificity of LUS in diagnosing pneumothorax. The ability of LUS to detect these conditions rapidly and accurately has significant clinical implications, as it allows for timely intervention and reduces the need for repeated radiation exposure. For example, in cases of pneumothorax, the "lung point" sign on LUS is pathognomonic and can be identified within minutes, enabling immediate treatment.

Comparative Diagnostic Performance of Chest X-ray and Lung Ultrasound in our study, LUS demonstrated higher sensitivity than CXR for RDS (87.5% vs. 84.38%) and TTN (82.35% vs. 70.59%), while maintaining high specificity. These findings are consistent with those of Shivani et al. (2023)103, who reported a sensitivity of 95.9% and specificity of 90.3% for LUS in diagnosing NRD. Similarly, Ismail et al. (2022)107 found LUS to have high sensitivity and specificity for RDS, pneumonia, and MAS, supporting its utility as a primary diagnostic tool. Respiratory Distress Syndrome (RDS): LUS demonstrated a slightly higher sensitivity (87.5%) compared to CXR (84.38%) for diagnosing RDS, with both modalities showing high specificity (93.75% for LUS and 92.5% for CXR). This finding is consistent with several studies, including Liu et al. (2022)100, who reported a diagnostic coincidence rate of 95% for LUS in identifying RDS, compared to only 48.7% for CXR. The higher sensitivity of LUS can be attributed to its ability to detect subtle changes in lung aeration, such as pleural line abnormalities and subpleural consolidations, which are early signs of RDS. In contrast, CXR relies on findings such as reticulo-granular patterns and ground-glass opacities, which may not be as apparent

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in the early stages of the disease. The high specificity of both modalities indicates that they are reliable for confirming the diagnosis of RDS, but LUS has the added advantage of being a bedside tool that avoids radiation exposure. Meconium Aspiration Syndrome (MAS): For MAS, both LUS and CXR showed moderate sensitivity, with LUS at 65.0% and CXR at 60.0%. However, specificity remained high for both modalities (94.57% for LUS and 96.74% for CXR). The moderate sensitivity of both imaging techniques in diagnosing MAS may be due to the overlapping imaging features of MAS with other conditions, such as pneumonia or TTN. For example, LUS findings in MAS, such as lung consolidation and B-lines, can also be seen in pneumonia, making it challenging to differentiate between the two conditions based on imaging alone. This is consistent with the findings of Pal and Ahmed (2024)99, who reported that pleural line abnormalities and subpleural consolidations, which are common in MAS, can also be seen in other conditions such as TTN and pneumonia. Despite these challenges, the high specificity of both LUS and CXR suggests that they are useful for ruling out other conditions and confirming the diagnosis of MAS when clinical findings are supportive.

Pneumonia: CXR had a higher sensitivity (89.74%) compared to LUS (80.56%) for diagnosing pneumonia, while specificity was also slightly higher for CXR (94.52%) compared to LUS (86.84%). The lower sensitivity of LUS in diagnosing pneumonia may be due to the difficulty in distinguishing bacterial pneumonia from other conditions, such as viral pneumonia or TTN, based on ultrasound findings alone. This is consistent with the findings of Elham Zarei and Vahid Alizadeh (2018)105, who noted that while LUS is highly sensitive for detecting lung abnormalities, it may have limitations in differentiating between different aetiologies of pneumonia. In contrast, CXR findings such as focal consolidations and air bronchograms are more specific for bacterial pneumonia, making CXR a more reliable tool for this condition. However, LUS remains valuable as a complementary tool, particularly in cases where CXR findings are inconclusive or when repeated imaging is required to monitor disease progression.

Transient Tachypnoea of the Newborn (TTN): LUS outperformed CXR in diagnosing TTN, with a sensitivity of 82.35% compared to 70.59% for CXR, and specificity of 95.79% compared to 94.74% for CXR. The higher sensitivity of LUS in diagnosing TTN can be attributed to its ability to detect subtle changes in lung fluid dynamics, such as the presence of B-lines and spared areas, which are characteristic of TTN. In contrast, CXR findings in TTN, such as perihilar streaking and fluid in the fissures, may be less specific and can overlap with other conditions such as RDS or pneumonia. This is supported by the findings of Vergine et al. (2014), who reported that LUS had a sensitivity of 93.3% and specificity of 96.5% for diagnosing TTN, making it a highly reliable tool for this condition.

Pneumothorax and Pleural Effusion: Both LUS and CXR achieved perfect sensitivity and specificity (100%) for diagnosing pneumothorax and pleural effusion. This finding is consistent with the results of Raimondi et al. (2016),[12] who reported that LUS had 100% sensitivity and specificity for diagnosing pneumothorax in critically ill neonates. The ability of LUS to detect pneumothorax rapidly, using characteristic signs such as the "lung point" and "barcode sign," makes it an invaluable tool in emergency situations. Similarly, LUS can accurately diagnose pleural effusion by identifying anechoic fluid collections in the pleural space. The high diagnostic accuracy of both modalities for these conditions underscores their reliability, but LUS has the added advantage of being a bedside tool that provides immediate results without radiation exposure.

The comparative diagnostic performance of LUS and CXR has several important clinical implications. First, the high sensitivity and specificity of LUS for conditions such as RDS, TTN, and pneumothorax make it an excellent first-line diagnostic tool, particularly in settings where rapid diagnosis is critical. For example, in cases of suspected pneumothorax, LUS can provide immediate confirmation, allowing for prompt intervention and potentially life-saving treatment.

Second, the moderate sensitivity of LUS for conditions such as MAS and pneumonia highlights the importance of using LUS in conjunction with clinical findings and other diagnostic modalities. While LUS is highly effective for ruling out certain conditions and confirming others, it may not always provide a definitive diagnosis on its own. In such cases, CXR remains an important complementary tool, particularly for conditions such as pneumonia, where CXR findings are more specific. Broader Implications of the Study Findings The findings of this study have significant implications for neonatal care, particularly in the context of improving diagnostic accuracy, reducing radiation exposure, and enhancing patient outcomes. The ability of LUS to provide rapid, bedside diagnosis without the need for ionizing radiation is a major advantage, especially in the neonatal population, where minimizing radiation exposure is critical. This is particularly relevant for preterm infants, who are more vulnerable to the long-term effects of radiation, including an increased risk of malignancies later in life (Hiles et al., 2017). The use of LUS as a first-line diagnostic tool can significantly reduce the cumulative radiation dose in neonates, particularly those requiring repeated imaging for monitoring disease progression or response to treatment. Moreover, the high sensitivity and specificity of LUS for conditions such as RDS, TTN, and pneumothorax make it an invaluable tool in resource-limited settings, where access to advanced imaging modalities may be limited. For instance, in rural or low-resource healthcare settings, LUS can be performed by trained clinicians using portable ultrasound machines,

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providing immediate diagnostic information without the need for specialized radiology services. This can lead to earlier initiation of appropriate treatment, potentially reducing morbidity and mortality associated with neonatal respiratory distress.

The findings of this study are consistent with a growing body of literature supporting the use of LUS in neonatal respiratory care. For example, Liu et al. (2022) reported a diagnostic coincidence rate of 95% for LUS in identifying RDS, compared to only 48.7% for CXR. Similarly, Shivani et al. (2023) found that LUS had a sensitivity of 95.9% and specificity of 90.3% for diagnosing respiratory distress, with a positive predictive value of 94% and a negative predictive value of 93.3%. These findings align closely with the results of our study, which demonstrated high sensitivity and specificity for LUS in diagnosing RDS, TTN, and pneumothorax. However, our study also highlights some limitations of LUS, particularly in distinguishing pneumonia from other conditions. This is consistent with the findings of Elham Zarei and Vahid Alizadeh (2018), who noted that while LUS is highly sensitive, it may have limitations in differentiating bacterial from viral pneumonia. Similarly, Pal and Ahmed (2024) reported that pleural line abnormalities and subpleural consolidation, which are common findings in LUS, can also be seen in conditions such as TTN and MAS, making it challenging to definitively diagnose pneumonia based on LUS findings alone. These limitations underscore the importance.

CONCLUSION

In conclusion, this study demonstrates that LUS is a highly effective diagnostic tool for neonatal respiratory distress, with superior sensitivity and specificity compared to CXR for many conditions. Its ability to provide rapid, bedside diagnosis without radiation exposure makes it an invaluable tool in neonatal care, particularly in resource- limited settings. However, the limitations of LUS in distinguishing between conditions with overlapping imaging features highlight the importance of using LUS in conjunction with clinical findings and other diagnostic modalities. Neonatal respiratory distress (NRD) is a serious illness that requires quick and precise diagnosis in order to provide prompt and efficient treatment. This study assessed the diagnostic efficacy of lung ultrasound (LUS) and chest X-ray (CXR) in determining the underlying causes of NRD, offering insightful information on the advantages and disadvantages of each technique. The results demonstrate both the ongoing use of CXR in particular clinical situations and the promise of LUS as a revolutionary tool in neonatal care.

The study showed that LUS is an extremely sensitive and specific diagnostic tool for a variety of neonatal respiratory disorders, such as pleural effusion, pneumothorax, respiratory distress syndrome (RDS), and transient tachypnea of the newborn (TTN). It is a desirable substitute for CXR due to its capacity to give quick, bedside diagnosis without radiation exposure, especially in locations with low resources including neonatal intensive care units (NICUs). For instance, LUS was especially successful in identifying pneumothorax, a potentially fatal illness that had to be treated right once. The distinctive "lung point" and "barcode sign" on LUS provide quick confirmation of pneumothorax, allowing medical professionals to start treatment right once. In a similar vein, LUS provided real-time information that helps direct treatment choices and was quite accurate in identifying pleural effusion. The ability of LUS to lower radiation exposure in neonates—a population that is especially susceptible to the long-term effects of ionising radiation—is one of its most important benefits. Even at modest levels, repeated radiation exposure has been linked to a higher chance of developing cancer in later life. LUS may enhance long-term results for newborns experiencing respiratory distress by reducing the need for repeated CXRs. This is particularly crucial for premature babies, who frequently need numerous imaging tests while in the NICU.

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