International Journal of Contemporary Pediatrics
Maguluri A et al. Int J Contemp Pediatr. 2026 Jun;13(6):936-942
https://www.ijpediatrics.com
pISSN 2349-3283 | eISSN 2349-3291

DOI: https://dx.doi.org/10.18203/2349-3291.ijcp20261538

Original Research Article

Beyond B lines: role of pleural line thickness in a novel thoracic ultrasound score for predicting surfactant requirement in preterm neonates

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Received: 24 March 2026
Accepted: 13 May 2026

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ABSTRACT

Background: Lung ultrasound is a valuable tool for assessing neonatal respiratory distress. Standard lung ultrasound scores (LUS) quantify B-lines, but the role of pleural line thickness, a potential marker of pulmonary edema and inflammation, is less explored. Objective was to assess the diagnostic accuracy of a novel thoracic ultrasound score (TUS), which includes pleural line thickness, in evaluating oxygenation and predicting surfactant need in preterm neonates, compared to the standard LUS.
Methods: This prospective study included 80 preterm neonates. After stabilization, infants underwent lung ultrasound (based on Brat et al) and thoracic ultrasound within 3 hours of life. Both the TUS and the standard LUS were calculated.
Results: Surfactant was administered to 25 infants (31.25%). These infants had lower gestational age (30.80±3.19 versus 33.56±2.35 weeks, p<0.001), higher FiO_2 requirements, and worse oxygenation indices (S/F ratio: 199.96±26.00 versus 376.18±62.95, p<0.001). TUS and LUS were both significantly higher in the surfactant group (8.60±1.61 versus 3.71±1.42, p<0.001 and 10.80±1.68 versus 6.80±1.99, p<0.001, respectively). Pleural line thickness was greater in the surfactant group (1.42±0.15 mm versus 0.99±0.30 mm, p<0.001). For predicting surfactant need, the optimal TUS cut-off was 5 (sensitivity 96%, specificity 92.73%) and LUS cut-off was 9 (sensitivity 92%, specificity 94.55%). In infants >34 weeks, TUS showed sensitivity (100%) and NPV (100%). Both scores demonstrated strong correlations with OSI (TUS: r=0.77; LUS: r=0.71, p<0.001) and S/F ratio (TUS: r=-0.76; LUS: r=-0.72, p<0.001).
Conclusions: The thoracic ultrasound score, incorporating pleural line thickness, is feasible and accurate tool for early prediction of surfactant need and correlates strongly with oxygenation status in preterm neonates. It performs exceptionally well, particularly in near-term infants.

Keywords: Lung ultrasound, Pleural line thickness, Preterm neonates, Thoracic ultrasound score

INTRODUCTION

Respiratory distress is a pervasive challenge in the management of preterm neonates, with respiratory distress syndrome (RDS) being a primary driver of morbidity and mortality. The pathophysiology of RDS is rooted in surfactant deficiency, leading to diffuse atelectasis, ventilation-perfusion mismatch, and hypoxemia. Timely identification of infants who will progress to severe respiratory failure and require surfactant administration is crucial for optimizing outcomes, minimizing lung injury, and preventing complications such as bronchopulmonary dysplasia. Traditional methods for guiding this decision, including clinical assessment, blood gas analysis, and chest radiography, have well-documented limitations, including

subjectivity, lag time, and radiation exposure. This has driven a growing interest in point-of-care lung ultrasound (LUS) as a rapid, bedside, and non-ionizing alternative for real-time assessment of lung aeration.[1,2] The standard lung ultrasound score (LUS), as described by Brat et al, has been extensively validated for its ability to quantify lung aeration loss by scoring the extent of B-lines and consolidations across lung zones. A strong correlation exists between higher LUS and the severity of oxygenation impairment, making it a powerful predictor for surfactant replacement therapy.[3] However, the standard LUS primarily focuses on artifacts (B-lines) arising from the pleural line. The pleural line itself, visualized as a hyperechoic line on ultrasound, represents the visceral and parietal pleura. Its thickness may increase in pathological states due to pulmonary edema, inflammation, and fluid accumulation in the subpleural space all hallmarks of severe RDS and evolving lung injury.[4,5]

Therefore, this study hypothesized that incorporating a quantitative measurement of pleural line thickness into a novel scoring system could enhance the predictive capability of lung ultrasound. This concept has been recently explored in a multicenter study by Forcellini et al, who developed a refined "thoracic ultrasound score" (TUS) that combines traditional B-line assessment with evaluation of the pleural line and subpleural consolidations.[6] Their work demonstrated that this refined score predicted surfactant need with high accuracy. Building upon this foundation, our study was designed to assess the feasibility and diagnostic accuracy of a similar novel TUS, with a specific focus on quantifying pleural line thickness, in evaluating oxygenation and predicting the need for surfactant administration in a cohort of preterm neonates, and to compare its performance against the standard LUS.[6]

METHODS

This prospective observational study was conducted in the neonatal intensive care unit (NICU) of a tertiary care teaching hospital over a period of 6 months. The study protocol was approved by the institutional ethics committee, and written informed consent was obtained from the parents or legal guardians of all participating infants.

Inclusion criteria

All preterm neonates with GA between 24 + 0 and 36 + 6 weeks who were admitted for respiratory distress admitted to NICU in Rajarajeswari medical college and hospital.

Exclusion criteria

Need for tracheal intubation and mechanical ventilation during stabilization in the delivery room because of administration of surfactant in the delivery room, major congenital malformations, chromosomal abnormalities, early onset sepsis, septic shock, neonatal hypotension, meconium aspiration syndrome.

Sample size calculation

The sample size was calculated based on the primary objective of assessing the diagnostic accuracy of the thoracic ultrasound score (TUS) for predicting surfactant administration. According to the findings of the landmark study by Brat et al, the standard lung ultrasound score (LUS) demonstrated an area under the curve (AUC) of 0.93 for predicting surfactant need in preterm infants with a gestational age less than 34 weeks.[3] Assuming a similar or superior diagnostic performance for the novel TUS, with an expected AUC of 0.90,a two-sided 5% significance level (α=0.05), and a power of 80% (β=0.20), a minimum sample size of 70 infants was estimated. To account for potential dropouts, incomplete data, or uninterpretable ultrasound examinations, a total of 80 preterm neonates were enrolled in this study.

Data collection

Baseline demographic and clinical characteristics were recorded for all infants, including gestational age, birth weight, gender, mode of delivery, Apgar scores, and antenatal steroid exposure. At the time of the ultrasound, clinical parameters including the type of respiratory support, FiO_2, SpO_2, positive end-expiratory pressure (PEEP), and Silverman Andersen Score (SAS) were documented. Oxygenation indices were calculated: SpO_2/FiO_2 (S/F) ratio and oxygen saturation index (OSI) = (FiO_2 × mean airway pressure × 100) / SpO_2.

Methodology

All enrolled infants were initially stabilized in the delivery room following the latest NRP guidelines. Upon admission to the NICU, they were managed according to a standardized "golden hour" protocol. The decision to administer surfactant was made based on clinical criteria (FiO_2 requirement >0.30-0.40 on CPAP of at least 6 cmH_2O to maintain SpO^2 in target range) and was independent of the study ultrasound findings.

Ultrasound assessment

Within the first 3 hours of life, trained professionals, blinded to the infant's clinical details and the eventual need for surfactant, performed a bedside thoracic ultrasound, reviewed by radiologist. A high-frequency linear array transducer (12 MHz) was used with a standardized machine (Philips CX 50) with settings (depth 3-4 cm, focus on the pleural line).

Lung ultrasound score

Infants were screened for 6 zones (right-upper anterior, lower anterior and lateral and left-upper anterior, lower anterior and lateral). In each zone, the standard lung

ultrasound score (LUS) by Brat et al was assigned: 0 = A-lines; 1 = ≥3 isolated B-lines; 2 = crowded and coalescent B-lines; 3 = extended consolidation (Figure 1). The total LUS was the sum of the six zones (range 0-18).[3]

Thoracic ultrasound score

Infants were screened in 3 regions (right-upper anterior and lower anterior and left-upper anterior). Pleural line thickness was measured in millimeters at a point without a rib artifact. Total thoracic ultrasound score (TUS) was the sum of three zones (range 0-12). In TUS following three parameters were evaluated:

Lung aeration

0- "black lung" characterized by the presence of only A-lines or a number of B-lines <3/field. 1- "black and white lung" defined by the presence of both isolated A- and B-lines ≥3/field or by the presence of lung areas with A-lines and lung areas with merging B-lines. 2- "white lung" distinguished by the only presence of merging B-lines.

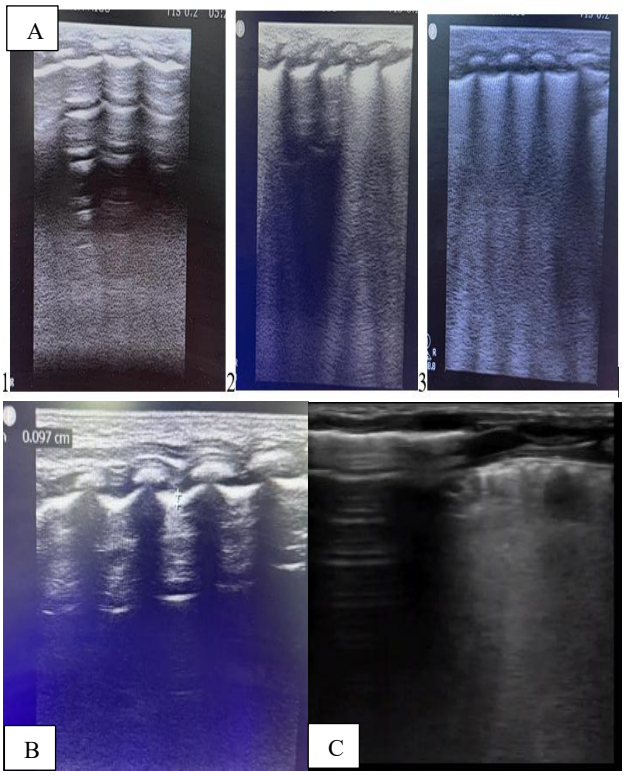

Figure 1: A) Images showing A lines and B lines; B) pleural line thickness; C) consolidations.

A-(Images showing: 1) 0 = A-lines; 2) 1 = ≥3 isolated B-lines; 3) 2 = crowded and coalescent B-lines.

Thickness of the pleural line

0- normal pleural line <1 mm. 1 point- thickened pleural line ≥1mm.

Presence of alveolar consolidations

0- absence of atelectasis or consolidation. 1- point was given if subpleural atelectasis or consolidations were detected. Total score- 0 to 12.

Statistical analysis

Data were analyzed using SPSS software (version 26.0). Continuous variables were compared using the student's t-test or Mann-Whitney U test, and categorical variables using the Chi-square test. Pearson's correlation was used to assess the relationship between ultrasound scores and oxygenation indices. Receiver operating characteristic (ROC) curve analysis was performed to determine the optimal cut-off values of TUS and LUS for predicting surfactant administration, and the area under the curve (AUC) was calculated. A p value of <0.05 was considered statistically significant.

RESULTS

The gender distribution was relatively similar, with males comprising 52.0% of the surfactant group and 61.8% of the no-surfactant group (p=0.408). However, the groups differed markedly in their maturity at birth; infants in the surfactant group had a significantly lower mean gestational age of 30.80±3.19 weeks compared to 33.56±2.35 weeks in the no-surfactant group (p<0.001), and a correspondingly lower mean birth weight of 1.47±0.57 kg versus 2.06±0.59 kg (p<0.001). Clinically, the surfactant group demonstrated significantly poorer condition at birth, with lower median Apgar scores at 1 minute [6 (IQR 4-7) versus 8 (IQR 7-8)], 5 minutes [8 (IQR 6-8) versus 9 (IQR 8-9)], and 10 minutes [9 (IQR 8-9) versus 9 (IQR 9-9)] (all p<0.001)

Crucially, the two groups exhibited profound disparities in their respiratory status at the time of first evaluation. Infants who received surfactant had a much higher severity of illness, indicated by a significantly higher mean Silverman-Andersen Severity (SAS) score (6.76±1.27 versus 4.53±1.37, p<0.001) and a higher mean required fraction of inspired oxygen (FiO_2) (43.12±7.79% versus 25.47±5.31%, p<0.001). Consequently, their oxygenation indices were markedly worse, as reflected by a lower mean SpO_2/FiO_2 (S/F) ratio (199.96±26.00 versus 376.18±62.95, p<0.001) and a higher mean oxygen saturation index (OSI) (3.15±0.77 versus 1.38±0.34, p<0.001). This severe respiratory compromise was further corroborated by lung ultrasound findings, with the surfactant group exhibiting significantly thicker pleural lines (1.42±0.15 mm versus 0.99±0.30 mm, p<0.001) and substantially higher total lung ultrasound scores for both the thoracic (TUS) (8.60±1.61 versus 3.71±1.42, p<0.001) and standard lung (LUS) (10.80±1.68 versus 6.80±1.99, p<0.001) protocols (Table 1).

Table 1: Basic characteristics of the subjects compared between surfactant administered with and not administered study subjects.

Basic characteristics	Surfactant administration		No surfactant administration		P value
	N (25)	%	N (55)	%	
Gender					
Male	13	52.0	34	61.8	0.408
Female	12	48.0	21	38.2	
Mean gestational Age±SD (weeks)	30.80±3.19		33.56±2.35		<0.001
Birth weight (gm), Mean±SD	1.47±0.57		2.06±0.59		<0.001
Twin pregnancy					
Single	21	84.0	44	80.0	0.671
Twin pregnancy	4	16.0	11	20.0	
Mode of delivery					
LSCS	18	72.0	43	78.2	0.547
Normal vaginal delivery	7	28.0	12	21.8	
Antenatal steroid					
1 Dose	4	16.0	16	29.1	0.417
2 Doses	8	32.0	17	30.9	
Not received	13	52.0	22	40.0	
Apgar score at 1 minutes, Median (IQR)	6 (4-7)		8 (7-8)		<0.001
Apgar score at 5 minutes, Median (IQR)	8 (6-8)		9 (8-9)		<0.001
Apgar Score at 10 mins, Median (IQR)	9 (8-9)		9 (9-9)		0.001
Pregnancy pathologies					
Pre-eclampsia	16	64.00	25	45.50	0.124
Pre term labour	9	36.00	28	50.90	0.215
PROM	6	24.00	17	30.90	0.527
Gestational diabetes mellitus	0	0	4	7.30	0.167
IUGR	7	28.00	12	21.80	0.547
Maternal Infections	6	24.00	5	9.10	0.073
Fetal flow alterations	16	64.00	12	21.80	0.001
Placenta Previa	0	0	2	3.60	0.334
TTTS	0	0	1	1.80	0.497
Isoimmunization	0	0	0	0	-
Oligo/Polyhydramnios	0	0	2	4	0.334
Birth weight, Mean±SD	1.47±0.57		2.06±0.60		<0.001
SAS, Mean±SD	6.76±1.27		4.53±1.37		<0.001
FIO_2 requirement, Mean±SD	43.12±7.79		25.47±5.31		<0.001
Peep at first evaluation, Mean±SD	6.08±0.76		5.00±0.00		<0.001
SpO_2, Mean±SD	90.52±2.84		92.85±1.35		0.001
S/F ratio, Mean±SD	199.96±26.00		376.18±62.95		<0.001
OSI, Mean±SD	3.15±0.77		1.38±0.34		<0.001
Pleural line thickness-RUA, Mean±SD	1.42±0.15		0.99±0.30		<0.001
Gestational age in weeks, Mean±SD	30.80±3.19		33.56±2.36		<0.001
TUS-total score, Mean±SD	8.60±1.61		3.71±1.42		<0.001
LUS total score, Mean±SD	10.80±1.68		6.80±1.99		<0.001

(Prom- premature rupture of membranes; IUGR- Intra uterine growth restriction, TTTS- Twin to twin transfusion syndrome)

The optimal cut-off value for the TUS was 5. At this threshold, the TUS demonstrated a sensitivity of 96% and a specificity of 92.73% for predicting surfactant need. Its positive predictive value (PPV) was 85.71%, and its negative predictive value (NPV) was 98.08%. The LUS, with an optimal cut-off of 9, showed slightly higher specificity but slightly lower sensitivity. It had a sensitivity of 92%, a specificity of 94.55%, a PPV of 88.46%, and an NPV of 96.3%.

When analyzing infants with a gestational age of less than 34 weeks, both scoring systems performed similarly in terms of sensitivity. At a cut-off of 5, the TUS had a sensitivity of 95% and a specificity of 86.96%, yielding a

PPV of 86.36% and an NPV of 95.24%. The LUS, at a cut-off of 9, achieved a sensitivity of 95% and a notably higher specificity of 95.65%, resulting in a superior PPV of 95% and an NPV of 95.35%. In the subgroup of infants with a gestational age greater than 34 weeks, the TUS at a cut-off of 5 was exceptionally sensitive, achieving 100% sensitivity and 96.88% specificity. While its PPV was 83.33%, its NPV was perfect at 100%. Conversely, the LUS at a cut-off of 9 in this older gestational age group showed a drop in sensitivity to 80%, though it maintained high specificity at 93.75%. Its PPV was 66.67%, and its NPV remained excellent at 96.77% (Table 2).

Table 2: Sensitivity, specificity, positive predictive value, and negative predictive value at the optimal cut-off value.

GA weeks	Best cut off	Sensitivity %	Specificity %	PPV %	NPV%
All	TUS 5	96	92.73	85.71	98.08
	LUS 9	92	94.55	88.46	96.3
<34 (n=43)	TUS 5	95	86.96	86.36	95.24
	LUS 9	95	95.65	95	95.35
>34 (n=37)	TUS 5	100	96.88	83.33	100
	LUS 9	80	93.75	66.67	96.77

Table 3: Pearson's correlations between TUS, LUS, and indexes of oxygenation.

	TUS		LUS	
	Pearson correlation	**P value**	**Pearson correlation**	**P value**
TUS	1	-	0.86	<0.001
LUS	0.86	<0.001	1	-
OSI	0.77	<0.001	0.71	<0.001
S/F ratio	-0.76	<0.001	-0.72	<0.001

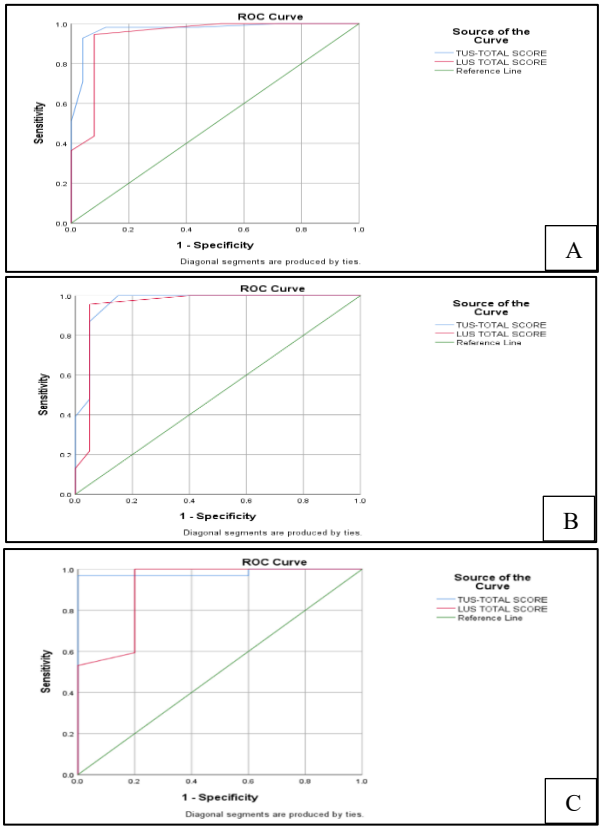

Figure 2: ROC curve for TUS prediction of surfactant requirement in preterm infants at: A) all GA; B) at GA <34 weeks; and C) at GA ≥34 weeks.

Based on the Pearson correlation analysis, there was a very strong, positive, and statistically significant relationship between the two-lung ultrasound scoring systems themselves, with a correlation coefficient of 0.86 ($p<0.001$).

Regarding their association with oxygenation indices, both ultrasound scores demonstrated strong and statistically significant correlations with the severity of respiratory compromise. There was a strong positive correlation between the TUS and the oxygen saturation index (OSI), with a coefficient of 0.77 ($p<0.001$). Similarly, the LUS showed a strong positive correlation with OSI at 0.71 ($p<0.001$). This suggests that higher (worse) lung ultrasound scores are strongly associated with higher (worse) OSI values. Conversely, both ultrasound scores exhibited strong negative correlations with the SpO_2/FiO_2 (S/F) ratio. The TUS had a correlation coefficient of -0.76 ($p<0.001$) with the S/F ratio, while the LUS had a coefficient of -0.72 ($p<0.001$). This inverse relationship indicates that as the lung ultrasound scores increase (indicating worse aeration), the S/F ratio decreases (indicating poorer oxygenation status) (Table 3).

In the overall study population, the TUS had an outstanding area under the curve (AUC) of 0.972 (95% CI: 0.935-1.000, $p<0.001$), while the standard LUS yielded an AUC of 0.940 (95% CI: 0.874-1.000, $p<0.001$). The coordinates of the curve confirm that a TUS cut-off of 5, provides sensitivity of 92.7% with high

specificity (96%), while an LUS cut-off of 9 achieves 94.5% sensitivity with 92% specificity. For infants with a gestational age less than 34 weeks, the TUS maintained an AUC of 0.965 (95% CI: 0.908-1.000, p<0.001), and the LUS showed an AUC of 0.951 (95% CI: 0.870-1.000, p<0.001). At a TUS cut-off of 5.50, sensitivity was 87% with 95% specificity, while LUS cut-off of 9 demonstrated 95.7% sensitivity and 95% specificity. In the greater than 34 weeks gestational age group, the TUS achieved AUC of 0.981 (95% CI: 0.940-1.000, p=0.001), outperforming the LUS which had an AUC of 0.913 (95% CI: 0.752-1.000, p=0.003). Notably, at a TUS cut-off of 4.50, sensitivity reached 87.5% with 100% specificity, and at a cut-off of 6.50, sensitivity increased to 96.9% while maintaining 100% specificity. The LUS at a cut-off of 9.50 in this subgroup showed 93.8% sensitivity with 80% specificity (Figure 2).

DISCUSSION

The findings of this study demonstrate that a novel thoracic ultrasound score (TUS), which incorporates pleural line thickness, is a highly accurate tool for the early prediction of surfactant need in preterm neonates. The study results show that both the TUS and the standard LUS correlate strongly with the severity of respiratory distress, as evidenced by their significant associations with FiO_2 requirement, SAS score, and the objective oxygenation indices, S/F ratio and OSI. This reinforces the fundamental principle that lung ultrasound is not merely an imaging modality but a robust physiological monitor of lung aeration.[7] The strong negative correlation of both scores with the S/F ratio (TUS: r=-0.76; LUS: r=-0.72) and strong positive correlation with OSI (TUS: r=0.77; LUS: r=0.71) quantitatively confirms that as the lung loses aeration (higher score), oxygenation efficiency declines. This aligns perfectly with the pathophysiological cascade of RDS, where surfactant deficiency leads to atelectasis, intrapulmonary shunting, and hypoxemia.

A key novel aspect of our study is the evaluation of pleural line thickness. We observed that infants who received surfactant had a significantly thicker pleural line (1.42±0.15 mm) compared to those who did not (0.99±0.30 mm, p<0.001). This suggests that pleural thickening is a clinically relevant marker of disease severity. In the context of RDS, this thickening may represent subpleural interstitial edema, inflammation, or early hyaline membrane formation.[4,5] By integrating this quantitative measure into the TUS, we aimed to capture a direct structural abnormality, moving beyond the artifact-based assessment of B-lines. The excellent diagnostic performance of the TUS (AUC 0.972 in the overall cohort) supports the value of this addition, suggesting it provides complementary information to the standard LUS. This concept aligns with the recent multicenter work by Forcellini et al, who demonstrated that their refined thoracic ultrasound score, which also evaluated pleural line abnormalities, achieved an AUC of 0.91 for predicting surfactant need, further validating the clinical utility of this approach.[6]

The comparative performance of the TUS and LUS across different gestational age subgroups provides intriguing insights. In infants <34 weeks, both scores performed exceptionally well, with the LUS showing marginally higher specificity (95.65% versus 86.96%) and PPV (95% versus 86.36%) at their respective cut-offs. This may be because extremely preterm infants have a more uniform and severe surfactant deficiency, making the standard B-line pattern a very reliable indicator. However, in the >34 weeks gestation group, the TUS demonstrated a distinct advantage with a perfect sensitivity of 100% and an AUC of 0.981, compared to the LUS which showed a drop in sensitivity to 80%. Near-term infants with RDS can sometimes have a more heterogeneous disease pattern. In this context, the presence of a thickened pleura might be a more consistent and reliable sign of significant lung pathology requiring surfactant than the B-line score alone, which could be influenced by transient tachypnea or retained fetal lung fluid. This finding echoes the observations of Forcellini et al, who noted that their refined score was particularly useful in reducing diagnostic uncertainty across all gestational age subgroups.[6]

There are some limitations. First, it was conducted at a single center with a relatively modest sample size, particularly in the subgroup analyses. Multi-center validation with a larger, more diverse population is essential before widespread clinical adoption, building upon the foundational work of multicenter studies like that of Forcellini et al.[6] Second, the TUS cut-off for pleural thickness (>1 mm) was derived from our own study population, which may introduce bias. Very few studies were done on the pleural line and the thickness. External validation studies are needed to confirm this threshold. Third, the ultrasound operator, while blinded to the surfactant decision, was not blinded to the clinical status of the infant at the time of the scan, which could introduce subtle bias Future studies could explore inter-observer variability for measuring pleural thickness to ensure reproducibility Fourth, we only assessed infants within the first 3 hours; serial measurements could provide insights into the evolution of these scores with treatment and their potential to predict longer-term outcomes like CPAP failure or BPD.[9]

Strengths are: it introduces and validates a novel easily measurable parameter pleural line thickness that enhances the predictive power of lung ultrasound, especially in a specific subgroup. The strong correlations with objective oxygenation indices (OSI, S/F ratio) ground the ultrasound findings in quantifiable physiology, strengthening the validity of our conclusions.[10] The use of a standardized protocol minimized variability. By demonstrating the feasibility and high diagnostic accuracy of the TUS, our study provides a strong foundation for future research.[11] As highlighted by

Forcellini et al, the integration of pleural parameters into lung ultrasound scoring represents a significant step forward in neonatal respiratory care, offering the potential for more precise and individualized treatment decisions.[6]

CONCLUSION

This study validates the thoracic ultrasound score (TUS), incorporating pleural line thickness, as a feasible and highly accurate bedside tool for early respiratory assessment in preterm neonates. The TUS demonstrated outstanding diagnostic performance for predicting surfactant need. Notably, pleural line thickness was significantly greater in infants requiring surfactant (1.42±0.15 mm versus 0.99±0.30 mm, $p<0.001$), confirming its value as a novel structural marker of disease severity. The TUS correlated strongly with objective oxygenation indices (grounding the ultrasound findings in quantifiable physiology. In infants >34 weeks gestation, the TUS achieved perfect sensitivity (100%) and negative predictive value (100%), demonstrating particular utility in this diagnostically challenging subgroup. By moving beyond traditional artifact-based scoring to include direct pleural assessment, the TUS provides a more comprehensive evaluation of lung pathology. This refined score offers clinicians a practical, reliable tool for timely surfactant administration and improved respiratory management in preterm neonates.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

REFERENCES

1. Raimondi F, Yousef N, Migliaro F, Capasso L, De Luca D. Point-of-care lung ultrasound in neonatology: classification into descriptive and functional applications. Pediatr Res. 2021;90(3):524-31.
2. Kurepa D, Zaghloul N, Watkins L, Liu J. Neonatal lung ultrasound exam guidelines. J Perinatol. 2018;38(1):11-22.
3. Brat R, Yousef N, Klifa R, Reynaud S, Shankar Aguilera S, De Luca D. Lung ultrasonography score to evaluate oxygenation and surfactant need in neonates treated with continuous positive airway pressure. JAMA Pediatr. 2015;169(8):e151797.
4. Copetti R, Cattarossi L. The ‘double lung point’: an ultrasound sign diagnostic of transient tachypnea of the newborn. Neonatology. 2007;91(3):203-9.
5. Liu J, Chen SW, Liu F, Li QP, Kong XY, Feng ZC. The diagnosis of neonatal pulmonary atelectasis using lung ultrasonography. Chest. 2015;147(4):1013-9.
6. Forcellini CA, Rossignoli S, Ficial B, Cenci G, Santoro L, Bonadies L, et al. A Refined score, namely thoracic ultrasound score, to predict the need for surfactant in preterm neonates: a prospective, multicenter, observational study. Pediatr Pulmonol. 2025;60(2):e71001.
7. De Luca D, Van Kaam AH, Tingay DG, Courtney SE, Danhaive O, Carnielli VP, et al. The Montreux definition of neonatal ARDS: biological and clinical background behind the description of a new entity. Lancet Respir Med. 2017;5(8):657-66.
8. Sweet DG, Carnielli V, Greisen G, Hallman M, Ozek E, Te Pas A, et al. European consensus guidelines on the management of respiratory distress syndrome-2019 update. Neonatology. 2019;115(4):432-50.
9. Rodriguez-Fanjul J, Balcells C, Aldecoa-Bilbao V, Moreno J, Iriondo M. Lung ultrasound as a predictor of mechanical ventilation in neonates older than 32 weeks. Neonatology. 2016;110(3):198-203.
10. Yang H, Gao LJ, Lei J, Li Q, Cui L, Li XH, et al. Relationship between neonatal respiratory distress syndrome pulmonary ultrasonography and respiratory distress score, oxygenation index, and chest radiography grading. World J Clin Cases. 2024 Jul 16;12(20):4154-65.
11. Perri A, Sbordone A, Patti ML, Nobile S, Tirone C, Giordano L, et al. Early lung ultrasound score to predict noninvasive ventilation needing in neonates from 33 weeks of gestational age: A multicentric study. Pediatr Pulmonol. 2022;57(9):2227-36.

Cite this article as: Maguluri A, Murthy VDV, Sahana G, Rajanish KV. Beyond B lines: role of pleural line thickness in a novel thoracic ultrasound score for predicting surfactant requirement in preterm neonates. Int J Contemp Pediatr 2026;13:936-42.