

The utility of lung ultrasound score as a predictor for extubation success in ventilated neonates

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Abstract

Background

Weaning from mechanical ventilation is a challenging decision to avoid complications of weaning failure. Because of its non-invasive, convenient, and real-time features, ultrasound has a great potential for bedside assessment of critically ill ventilated patients.

Aim of the work:

The aim of our study is to evaluate accuracy of Lung Ultrasound Severity Score (LUSS) as a predictor of extubation outcome in ventilated newborns.

Study Design:

A prospective observational cohort study was conducted at the NICU of Kafrelsheikh University Hospital. Neonates who are mechanically ventilated for more than 48 hours and ready for weaning, were included in the study. Lung US was done 1 hour prior to extubation to evaluate extubation readiness and 48 hours after. The included infants were then categorized into two groups: success group and failure group based on extubation outcome.

Results

A total of 60 newborns were included, of whom 53 (88.3%) were successfully extubated and 7 (11.7%) failed. According to LUSS score, the success group had lower lung ultrasound score compared to failure group. The area under the curve was 0.906 ($p \leq 0.001$) for LUSS, the cut-off value was ≤ 4 , sensitivity and specificity were (90.57, 57.14) % in detecting extubation success. The combined LUSS score, OI and S/F ratio had an AUC of 0.97 with increased sensitivity and specificity (98.1, 85.7) % in predicting extubation success.

Conclusion

Lung Ultrasound Severity Score has significant role in predicting extubation outcomes, with increased sensitivity and specificity by combination of LUSS, OI and S/F ratio.

Introduction

Despite advances in non-invasive ventilation modes, mechanical ventilation (MV) is still frequently applied in the Neonatal Intensive Care Unit (NICU) (1). Prolonged MV may lead to many complications as

atelectasis, pneumonia, pneumothorax, bronchopulmonary dysplasia, pulmonary hemorrhage, tracheal edema and tracheal stenosis (2)(3)

The process of weaning and extubation from mechanical ventilation is still a challenge and remains an inexact science (4). Thus, every attempt is made to extubate as soon as possible. Unfortunately, there is still no clear scientific basis for assessing extubation readiness; instead, doctors rely on their own judgment and clinical experience to decide. However, making the wrong choice might have devastating outcome. There are currently no standard guidelines to guide clinical weaning of infants with MV(5), (6), therefore weaning timing is primarily determined by the attending physician based on clinical evaluation, ventilator parameters, and blood gas results (7).

To address these limitations, point-of-care lung ultrasound has emerged as a valuable and validated diagnostic and interventional tool in neonatal intensive care. It is non-invasive, radiation-free, easily repeatable, and can be performed at the bedside, making it particularly suitable for neonates. It allows visualization of lung aeration patterns, detection of interstitial syndrome, pulmonary edema, consolidation, and pleural abnormalities. The development of neonatal lung ultrasound scoring systems has enabled semi-quantitative assessment of lung aeration and has shown promising results in the diagnosis and management of neonatal respiratory problems, including respiratory distress syndrome, transient tachypnea of the newborn, ventilator associated pneumonia and bronchopulmonary dysplasia (8)(9),(10)

Additionally, many studies have implemented this tool in assessment of readiness of weaning in mechanically ventilated neonates and found that lung ultrasound scores had great potential in aiding the process of weaning (1, 11).

Recently, there is an ongoing need to evaluate the predictive value of Lung Ultrasound Severity Score (LUSS) in diverse neonatal cohorts to validate its routine integration into evidence-based weaning protocols. Therefore, our study aimed to evaluate the diagnostic accuracy of lung ultrasound score, both alone and in combination with oxygenation parameters (oxygenation index and S/F ratio) for predicting extubation success in ventilated newborns.

Patients and methods

Study design and patient population

This prospective observational cohort study was conducted at the NICU of Kafrelsheikh University Hospital. The study was carried out between March 2024 and December 2025.

Inclusion criteria

Neonates who were born at 35 weeks gestational age (GA) or more and were mechanically ventilated for more than 48 hours and ready for extubation were included in the study. While no formal universal guidelines were utilized, extubation readiness was typically assessed using the following ventilatory parameters:

- 1- Mean airway pressure ≤ 12 cmH₂O
- 2- FiO₂ from 0.3 to 0.4
- 3- Blood gases: PH ≥ 7.25 , pCO₂ ≤ 55 –60 mmHg.

Exclusion criteria

1. Preterm infants born at < 35 weeks GA.
2. Infants with major congenital or chromosomal anomalies.
3. Infants intubated for non-respiratory causes (e.g., surgical procedures or primary neurological issues).
4. Infants receiving muscle relaxants.

Sample size

The sample size calculation was performed using Epi-Info software statistical package designed by the Centers for Disease Control and Prevention (12). Based on a previous study by *Soliman et al.* (9), the sensitivity of lung ultrasound to predict the extubation success was 91% $\pm$ 8% confidence limit. With a 95% confidence level and an 8% margin of error (precision), the required sample size was determined using the following formula:

$$n = Z^2 p (1 - p) / d^2$$

Where:

- • n = required sample size
- • Z = Z statistic for the desired confidence level (95%, Z = 1.96)
- • p = expected proportion (sensitivity) = 0.91 (91%)
- • d = desired precision (margin of error) = 0.08 ($\pm$ 8%).

The initial calculation yielded 50 cases. Ten additional cases were included to account for potential dropouts, resulting in a total recruitment of 60 neonates.

Data collection

Each included infant was subjected to a full medical history and a thorough clinical examination at time of inclusion and the following data was recorded:

- Demographic data (sex, postnatal age, gestational age, birth weight, appropriateness for gestational age, type of delivery).
- Ventilatory parameters: Average FiO_2 and MAP recorded within the 12 hours preceding extubation.
- Respiratory severity score (RSS), Calculated as $RSS = \text{FiO}_2 \times \text{MAP}$ (13).
- Oxygenation Indices: Average $\text{SpO}_2/\text{FiO}_2$ (S/F) ratio and Oxygenation Index (OI) within 12 hours before extubation.

Ethical Considerations

This study was approved by Kafrelsheikh University Scientific Research Ethics Committee (No: KFSIRB200). A written informed consent was obtained from the parents who agreed to participate in the study prior to study enrollment. All parents were informed that they could withdraw from the study at any time. All methods and clinical procedures were performed in strict accordance with the relevant guidelines, institutional regulations, and the ethical tenets of the Declaration of Helsinki.

Lung ultrasound scanning

Newborns meeting the enrollment criteria were subjected to an initial lung ultrasound scan within 1 hour before extubation and 48 hours after extubation. Examination was performed by two well trained neonatologists using a CHISON ECO 3 Portable Ultrasound with a linear probe (L7M-A) (**CHISON Medical Technologies, Jiangsu, China**).

- Infants were examined in supine position and on their sides, the scanning proceeded from top to bottom and from left to right. The probe was placed perpendicular to the ribs, scanning along the intercostal space. Each area was then scored with the most severe ultrasound signs according to *Bart et al.* (14).
- A total of six lung zones were scanned, 3 on the right lung and 3 on the left lung. Four patterns of lung findings were described with graded severity score. The lowest score is zero and the highest is 3 for each zone. Therefore, the cumulative score ranged from 0 to 18 (3 zones 2 lungs max score of 3).
- All scans were recorded and stored as uncompressed video files and images on an external storage device for subsequent evaluation of interrater agreement.

Study groups

Participants were classified into two groups based on the 48-hour post-extubation outcome:

- 1- Success Group (Group A): Infants who remained off mechanical ventilation for hours.
- 2- Failure Group (Group B): Infants requiring re-intubation within 48 hours of the initial extubation.

Study outcome

- Primary outcome: To determine the diagnostic accuracy of LUS in predicting successful extubation.
- Secondary outcome: To assess the diagnostic accuracy of combining LUS with oxygenation parameters (OI and S/F ratio) to predict extubation success.

Statistical analysis

Statistical analyses were performed utilizing SPSS software, version 26 (IBM Inc., Chicago, IL, USA). Categorical and qualitative variables were expressed as frequencies and percentages. To assess the normality of data distribution, the Kolmogorov-Smirnov test was applied. Accordingly, quantitative data were expressed as the mean, standard deviation, median, interquartile range (IQR), and full range (minimum to maximum values). For all statistical evaluations, significance was established at a threshold of $p \leq 0.05$ (5% level).

Results

Out of 108 cases eligible for the study who were on MV for ≥ 48 hours in Kafrelsheikh NICU, 60 cases were included in this study after excluding infants with congenital heart diseases ($n = 11$), infants intubated for non-respiratory causes ($n = 13$), hemodynamic disorders ($n = 6$) and incomplete data ($n = 18$). Based on extubation outcomes, participants were categorized into Group A (success; $n = 53$) and Group B (failure; $n = 7$).

Table 1. Demographic data of the studied groups

	Success (n =53)	Failure (n =7)	<i>p-value</i>
Sex			
Male	32 (60.4%)	3 (42.9%)	0.436
Female	21 (39.6%)	4 (57.1%)	
Postnatal age (days)			
Min. – Max.	3.0 – 195.0	4.0 – 75.0	0.946
Mean ± SD.	23.45 ± 29.80	23.14 ± 24.71	
Median (IQR)	15.0 (9.0 – 30.0)	17.0 (7.0 – 26.0)	
Gestational age (weeks)			
Min. – Max.	35.0 – 40.0	35.0 – 38.0	0.469
Mean ± SD.	37.21 ± 1.21	36.71 ± 1.25	
Median (IQR)	37 (36 – 38)	37 (36 – 37.5)	
Birth Weight (kg)			
Min. – Max.	1.20 – 5.0	1.40 – 4.0	0.246
Mean ± SD.	2.59 ± 0.82	2.20 ± 0.96	
Median (IQR)	2.60 (2.0 – 3.0)	2.10 (1.45 – 2.50)	
Appropriateness for gestational age			
AGA	48 (90.6%)	6 (85.7%)	0.634
SGA	5 (9.4%)	1 (14.3%)	
Mode of delivery			
Normal labor	13 (24.5%)	2 (28.6%)	1.000
C.S	40 (75.5%)	5 (71.4%)	

*IQR : Interquartile range, SD : Standard deviation, AGA : Appropriate for gestational age, SGA : Small for gestational age, C.S : Caesarean section

* p - value ≤ 0.05 is considered significant.

Regarding the demographic data of the included infants, there were no significant differences in both studied groups as seen in (Table 1).

Table 2
Ventilatory parameters of both studied groups

Rate (b/min)	Success (n = 53)	Failure (n = 7)	p-value
Min. – Max.	30.0–60.0	40.0–60.0	0.210
Mean ± SD.	42.28 ± 7.27	45.71 ± 6.73	
Median (IQR)	40.0 (37.0–45.0)	45.0 (42.50–45.0)	
PIP			
Min. – Max.	7.0–14.0	10.0–13.0	0.157
Mean ± SD.	10.11 ± 1.56	11.0 ± 1.29	
Median (IQR)	10.0 (9.0–11.0)	10.0 (10.0–12.0)	
PEEP			
Min. – Max.	4.50–6.50	4.50–5.0	0.484
Mean ± SD.	5.12 ± 0.49	4.93 ± 0.19	
Median (IQR)	5.0 (5.0–5.0)	5.0 (5.0–5.0)	
FiO2			
Min. – Max.	21.0–55.0	21.0–70.0	0.020*
Mean ± SD.	28.51 ± 8.18	44.43 ± 18.14	
Median (IQR)	25.0 (21.0–30.0)	50.0 (30.0–55.0)	
Ti			
Min. – Max.	0.34–0.50	0.36–0.50	0.501
Mean ± SD.	0.39 ± 0.03	0.40 ± 0.05	
Median (IQR)	0.38 (0.38–0.40)	0.38 (0.38–0.40)	

*IQR : Inter quartile range, SD : Standard deviation, PIP : Peak inspiratory pressure, PEEP : Positive end-expiratory pressure, FiO₂ : Fraction of inspired oxygen, Ti : Inspiratory time.

* *p*-value ≤ 0.05 is considered significant.

The ventilatory parameters of both studied groups were comparable as regard the rate, PIP, PEEP and Ti, while there was statistically significant increase in FiO₂ in failure group compared to success group

(Table 2).

Table 3
MAP and oxygenation parameters of both studied groups prior to extubation

MAP	Success (n = 53)	Failure (n = 7)	p-value
Min. – Max.	5.01–8.70	5.71–7.25	0.193
Mean ± SD.	6.34 ± 0.89	6.80 ± 0.59	
Median (IQR)	6.27 (5.70–6.83)	7.16 (6.51–7.22)	
RSS			
Min. – Max.	1.0–4.0	1.0–5.0	0.036*
Mean ± SD.	1.87 ± 0.76	3.0 ± 1.41	
Median (IQR)	2.0 (1.0–2.0)	3.0 (2.0–4.0)	
Oxygenation index			
Min. – Max.	1.03–4.12	1.47–5.44	0.028*
Mean ± SD.	2.00 ± 0.78	3.05 ± 1.40	
Median (IQR)	1.80 (1.40–2.30)	2.33 (2.17–3.89)	
S/F ratio	175.0–476.0	140.0–265.0	< 0.001*
Min. – Max.	358.0 ± 91.90	189.4 ± 52.48	
Mean ± SD.	333.0 (300.0–461.0)	180.0 (150.50–220.0)	
Median (IQR)			
*MAP: mean airway pressure, RSS: respiratory severity score, S/F ratio: SpO ₂ /FiO ₂			

* p- value ≤ 0.05 is considered significant.

Table 3 shows that while Mean Airway Pressure (MAP) was comparable between the success and failure groups (6.34 ± 0.89 vs. 6.80 ± 0.59 cm H₂O; $p = 0.193$), functional oxygenation indices differed significantly. The success group demonstrated significantly lower Respiratory Severity Scores (RSS) ($p = 0.036$) and Oxygenation Indices (OI) ($p = 0.028$), alongside a markedly higher S/F ratio (358.0 ± 91.90 vs. 189.4 ± 52.48; $p < 0.001$) as illustrated in figures (1,2,3) respectively.

Table 4
LUSS of both studied groups 1 hour prior to extubation and 48 hours after extubation

Lung ultrasound score	Success (n = 53)	Failure (n = 7)	p-value
1 hour before extubation			
Min. – Max.	0.0–7.0	3.0–7.0	< 0.001*
Mean ± SD.	2.19 ± 1.57	5.0 ± 1.41	
Median (IQR)	2.0 (1.0–3.0)	5.0 (4.0–6.0)	
48 hours after extubation			
Min. – Max.	0.0–3.0	3.0–6.0	< 0.001*
Mean ± SD.	1.51 ± 1.14	4.14 ± 1.07	
Median (IQR)	1.0 (1.0–3.0)	4.0 (3.50–4.50)	
p- value	< 0.001*	0.221	

* p - value ≤ 0.05 is considered significant.

Group A showed significantly lower Lung Ultrasound Severity Score (LUSS) both 1 hour before and 48 hours after extubation compared to group B. Moreover, a significant reduction in LUSS was observed 48 hours after extubation in the success group, while no significant change was noted in failure group as shown in Table 4 and Figs. 2–4.

Table 5
Predictive accuracy of LUSS and oxygenation parameters

LUS 1 hour before extubation	AUC	p-value	95% CI	Cut off	Sensitivity	Specificity	PPV	NPV
	0.906	< 0.001*	0.822–0.989	≤ 4	90.57	57.14	94.1	44.4
Oxygen Index	0.755	0.030*	0.565–0.945	≤ 2.3	77.36	71.43	95.3	29.4
S/F ratio	0.945	< 0.001*	0.879–1.0	> 180	96.23	71.43	96.2	71.4
LUS + OI 1 hour before extubation	0.938	< 0.001*	0.873–1.0		92.45	85.71	98.0	60.0
LUS + OI + S/F ratio 1 hour before extubation	0.973	< 0.001*	0.932–1.0		98.11	85.71	98.1	95.7

*AUC : Area under the curve, CI : Confidence interval, NPV : Negative predictive value, PPV: Positive predictive value.

* p -value ≤ 0.05 is considered significant.

The predictive accuracy of LUSS alone and combined with the oxygenation parameters is shown in Table 5. The LUSS assessed 1 hour before extubation was of high sensitivity and moderate specificity while combining LUSS with oxygenation parameters had significantly improved the sensitivity and specificity of extubation outcomes. Figure 5 confirms the high predictive accuracy of these parameters, with ROC curve showing AUC for (LUSS, OI and S/F ratio) was (0.906, 0.755, 0.945) respectively with a sharp cut off value ≤ 4 .

Discussion

Despite advances in non-invasive respiratory support, endotracheal intubation and mechanical ventilation remains widely utilized in NICUs (1). Nevertheless, prolonged mechanical ventilation is associated with significant short- and long-term complications, particularly in preterm infants. Thus, extubation should be performed as soon as possible if the baby is ready for extubation (4)(15). This study aimed to evaluate the utility of lung ultrasound score as a predictor of extubation outcome. In our study, a total of 60 cases were included, with 53 cases underwent successful extubation while 7 cases failed extubation from MV and needed to be re-intubated within 48 hours.

This study demonstrated no significant association between demographic data and extubation outcomes. These findings align with those reported by *Song et al.*, who conducted a cohort study on

preterm infants born before 32 weeks of gestation (16). Their study similarly concluded that demographic characteristics, including gestational age and birth weight, were not significant predictors of extubation outcomes. This consistency suggests that factors beyond baseline demographic variables may play a more critical role in determining extubation outcomes.

Regarding ventilatory parameters, no significant difference was observed between both studied groups except for FiO_2 , which was significantly higher in group B compared to group A. This finding suggests that increased FiO_2 requirements are associated with extubation failure, indicating that oxygenation status may serve as sensitive and a clinically relevant marker of extubation readiness. These findings are in agreement with the results of a systematic review and meta-analysis conducted by *Fu et al.* which evaluated 34 studies involving mechanically ventilated newborns, and identified pre-extubation FiO_2 as a definite predictor for extubation outcome (5).

In our study, MAP was not significantly associated with extubation outcomes, this comes in line with *Mohsen et al.* who evaluated 45 preterm neonates with GA < 28 weeks receiving MV for more than 12 hours prior to inclusion in the study and reported no significant difference in MAP between success and failure groups. This can be explained by the fact that MAP is influenced by ventilator settings rather than actual lung aeration (8).

Additionally, the respiratory severity score (RSS) was significantly higher in (Group B), compared to (Group A) suggesting that neonates requiring higher ventilatory support are more likely having underlying lung pathology with increased risk of re-intubation. This comes in agreement with outcomes of a study published by *Mhanna et al.* which included 42 ventilated preterm infant with GA < 32 weeks and concluded that higher RSS was associated with extubation failure and it can be used as a screening tool for extubation readiness (17). As regard oxygenation index (OI), the present study showed that lower OI values have been linked with favorable outcomes, aligning with previous studies using oxygenation parameters to indicate extubation readiness. These findings are consistent with *Saragih et al.* who demonstrated that neonates with lower OI values had significantly higher extubation success rates, whereas higher OI values were predictive of extubation failure in a cohort of 50 mechanically ventilated infants (18). Furthermore, our results also concur with those of *Li et al.* who emphasized the predictive role of OI prior to weaning (19). Similarly, the findings of *Zong et al.* support our results by confirming a strong association between the OI and extubation outcomes, further highlighting its clinical utility as a reliable predictor (1).

Moreover, S/F ratio which is a simple index for oxygenation efficacy and lung function, was significantly higher in success group compared to failure group, which suggests improved lung condition before extubation and its association with extubation success. However, *Trachsel et al.* reported no significant differences in S/F ratio regarding extubation outcomes, which may be attributed to different timing of evaluation and that their study was conducted on pediatric age group (20).

Interestingly, lung ultrasound severity score (LUSS) differed markedly between success group and failure group. Infants who were successfully extubated had lower LUSS both 1 hour before and 48 hours after extubation compared to those who failed extubation, suggesting that lower LUSS is associated with a higher likelihood of extubation success. Moreover, a significant improvement in LUSS was observed 48 hours post extubation in the success group (Group A), whereas no significant change was noted in failure group (Group B), indicating that post extubation improvement may serve as an important indicator of lung recovery and respiratory function. These findings support the utility of LUSS as a predictive tool for extubation outcomes.

The findings of the study strongly support previous evidence on the predictive value of LUS in neonatal extubation as it comes in agreement with previous studies by *Liang et al.* and *Soliman et al.* and *Mohsen et al.* demonstrating that lower pre-extubation LUSS together with marked post extubation improvement are a strong predictor for extubation (8, 9, 21).

Our results also confirmed the predictive value of LUSS for neonatal extubation; a score of ≤ 4 demonstrated a sensitivity of 90.57% and a specificity of 57.14%. Similar results were reported by *El Amrousy et al.* who evaluated the role of lung ultrasound in predicting extubation outcomes in a cohort of 80 mechanically ventilated neonates with gestational ages ranging from 28 to 36 weeks (22). They assessed lung ultrasound scores pre-extubation and 6 hours post-extubation, identifying a LUSS cutoff value of ≤ 4 as significantly associated with extubation success. This agreement supports the reliability of lung ultrasound and underscores the importance of both pre- and post-extubation LUS assessments in guiding clinical decisions. Moreover, in a systematic review and meta-analysis included eight observational studies involving 564 neonates, the sensitivity and specificity for LUS in predicting extubation failure in neonates were 0.82 (95% CI: 0.75 – 0.88) and 0.83 (95% CI: 0.78 – 0.86), respectively, The AUC for LUS predicting extubation failure was 0.87 (95% CI: 0.80 – 0.95), this is in line with our study confirming that LUS is a good predictor of extubation outcomes (11).

Notably, combining LUSS with oxygenation parameters, including OI and S/F ratio, significantly improved the diagnostic accuracy. These findings underscore the importance of integrating LUSS with oxygenation indices to provide a more reliable and comprehensive evaluation of extubation.

Oxygenation Index (OI) showed moderate sensitivity and specificity (77.36, 71.43) with 95% C. I (0.565–0.945), while S/F ratio which was of higher sensitivity and specificity than OI (96.23, 71.43) with 95% CI (0.879–1), supporting its usefulness as a predictor for extubation. S/F ratio offers a simple, non-invasive measure of oxygenation that can predict extubation outcome, our results showed that higher S/F ratio is associated with extubation success, AUC (0.945), 95% C.I was (0.879–1.0), cut off value was > 180 , with sensitivity and specificity (96.23, 71.43) respectively.

Combined LUS and OI provide complementary information about structural lung changes assessed by LUS and functional oxygenation status identified by OI. Our analysis indicates that patients with lower lung US score and lower OI were associated with favorable outcomes. This combined approach enhances predictive accuracy compared to using each parameter alone, supporting its use to guide

extubation. This is consistent with *Zong et al.* who reported improvement of predictive accuracy of extubation outcome by oxygenation index and LUS combination (1).

Integrating the S/F ratio with other assessment elements such as LUS and OI increase the predictive value for assessing extubation readiness. By analysis of combined LUS, OI and S/F ratio, AUC was (0.973), 95% C.I (0.932–1.0), with sensitivity and specificity (98.11, 85.71) respectively, thus adding to the advantage of using LUS solely. Our study showed that a neonate with well aerated lung, lower lung score, low OI, and high S/F ratio most likely to succeed extubation, this integrated approach enhances decision making and may reduce re-intubation in NICUs.

While most existing research focuses on lung ultrasound or oxygenation indices individually, few studies have assessed their combined utility. By integrating both methods, we demonstrated a marked increase in the accuracy of neonatal extubation predictions.

Conclusion

Lower Lung Ultrasound Severity Score is indicative of better lung aeration and is strongly associated with a higher likelihood of extubation success. Furthermore, the integration of LUSS with oxygenation parameters enhances diagnostic accuracy by providing complementary information on lung aeration and gas exchange, improving the prediction of extubation success.

Limitations of the study

This study has some limitations. First, the relatively small sample size may limit the generalizability of the findings. Second, the study was conducted at a single center. Finally, we did not assess the respiratory muscle strength of the neonates as a factor for extubation readiness.

Declarations

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Author Contributions: M.E., O.E., and A.S. conceptualized and designed the study. M.E. and E.K. conducted data collection and prepared the initial draft. M.E., O.E., A.S., and E.K. contributed to data interpretation, manuscript drafting, and critical revisions. All authors reviewed and approved the final manuscript.

Ethics statement: This study was approved by Kafrelsheikh University Scientific Research Ethics Committee (No: KFSIRB200).

Informed consent statement: A written informed consent was obtained from the parents who agreed to participate in the study in accordance with the Declaration of Helsinki prior to study enrollment. All parents were informed that they could withdraw from the study at any time.

Consent for publication: All the participating authors give consent for publication.

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Figures

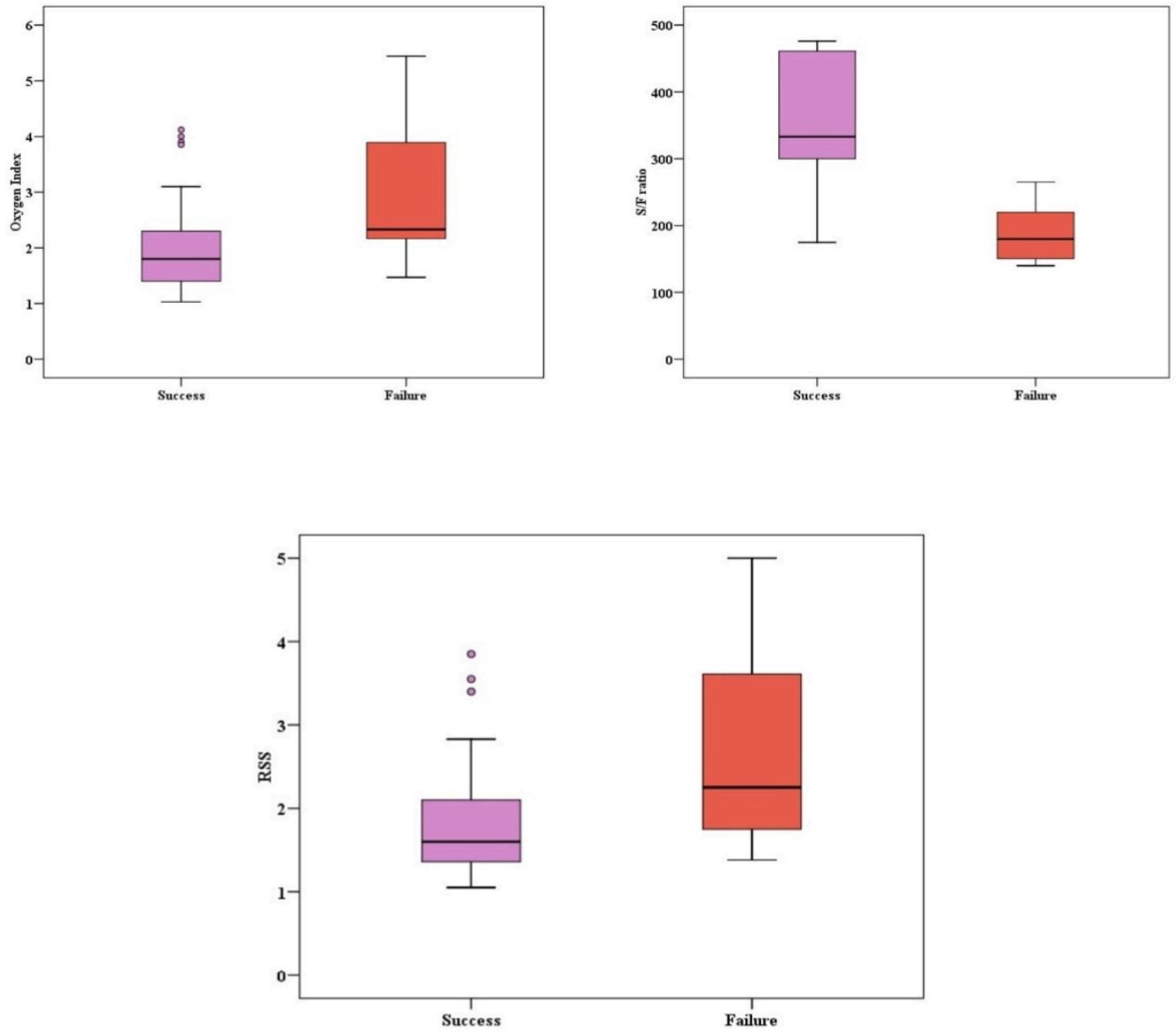


Figure 1

Oxygenation index, S/F ratio and RSS of both studied groups.

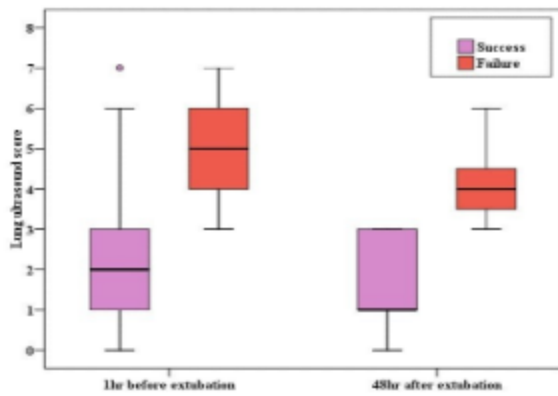


Figure 2

Comparison between both studied groups according to lung ultrasound score.

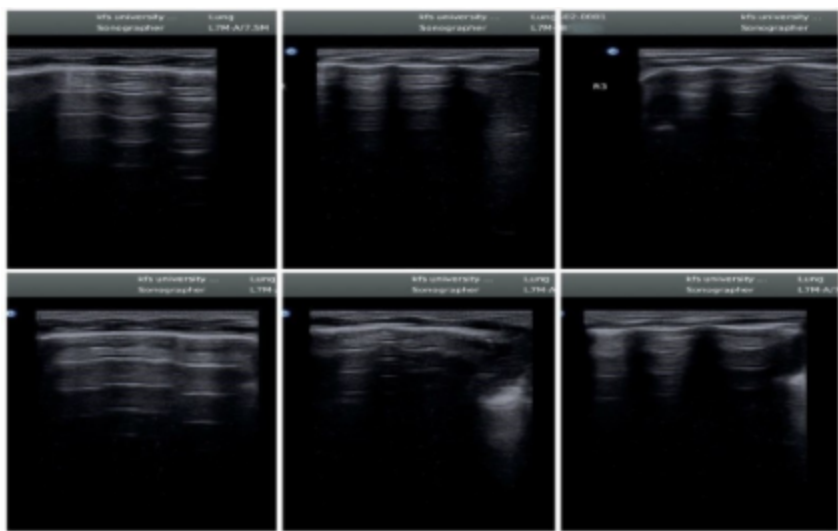


Figure 3

Lung ultrasound assessment of bilateral lung fields performed 1 hour prior to extubation in group (A). The ultrasound examination demonstrated a predominant A-line pattern with preserved lung sliding, indicating good lung aeration. Overall, these findings correspond to a low lung ultrasound score (score = 0) in all lung areas.

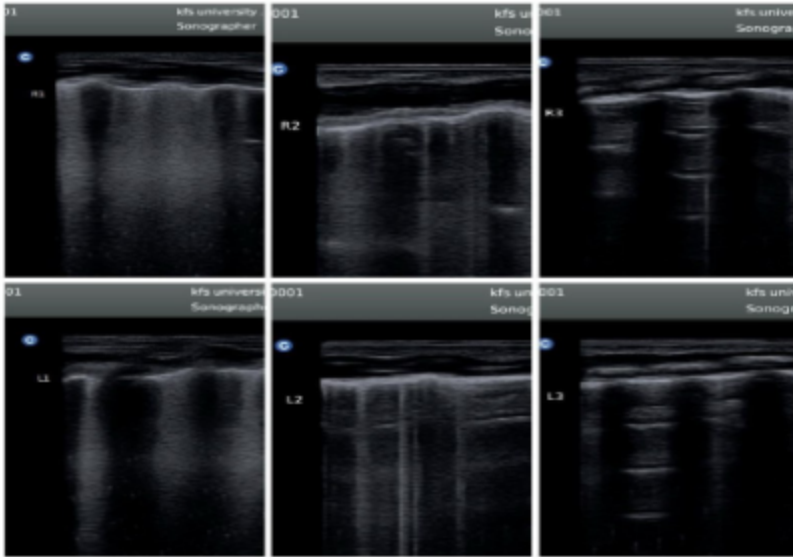


Figure 4

Lung ultrasound assessment of bilateral lung fields performed 1 hour prior to extubation in group (B). Ultrasound examination demonstrated a continuous and thickened pleural line with no evidence of lung consolidation and preserved lung sliding. Confluent B-lines are observed in R1 & L1 erasing A-lines (given a score of 2 for each). Multiple, discrete, well-spaced vertical B-lines arising from the pleural line and extending to the bottom of the screen are seen in R2 & L2 (given a score of 1 for each). Both R3 & L3 demonstrated a predominant A-line pattern with occasional single B-line artefact (given a score of 0 for each). Collectively the total lung score was 6.

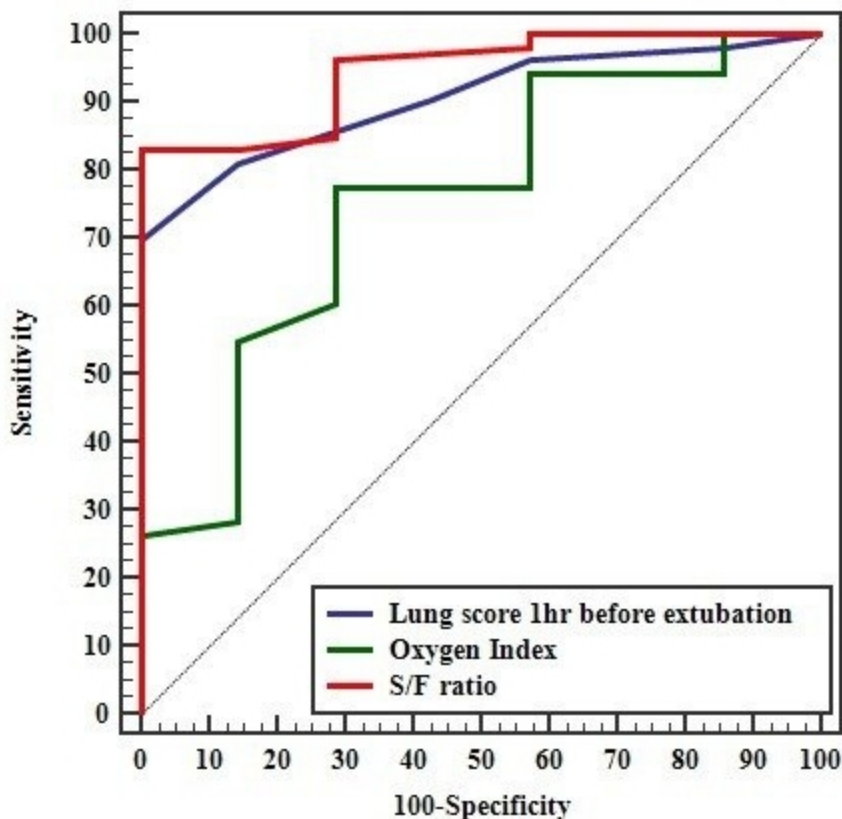


Figure 5

ROC curve for predicting extubation success.

