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Original Research Article

Rapid Shallow Breathing Index versus Tidal Volume Respiratory Rate for Reducing Respiratory Distress in Mechanically Ventilated Patients: A Randomized Comparative Interventional Study

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Abstract

Background: Respiratory distress in mechanically ventilated patients requires prompt adjustment of pressure support settings. Traditional adjustment methods based on tidal volume and respiratory rate (VT/RR) may not capture the dynamic nature of patient-ventilator interaction as effectively as Rapid Shallow Breathing Index (RSBI).

Objective: To compare the impact of RSBI-guided versus VT/RR-guided pressure support adjustment on the severity of respiratory distress assessed using Respiratory Distress Observation Scale (RDOS).

Methods: Prospective, randomized, single-blind, interventional study of 86 adult patients (aged 20-50 years) at SMS Medical College ICU, Jaipur (January-December 2024). Patients randomly allocated to RSBI group (n=43) or VT/RR group (n=43). Primary outcome: RDOS scores at 0, 15, and 30 minutes post-intervention. Secondary outcomes: heart rate, respiratory rate, RSBI values, and clinical signs including accessory muscle use, restlessness, paradoxical breathing, grunting, and nasal flaring.

Results: Mean age RSBI group 34.05±8.39 years, VT/RR group 33.63±8.50 years (p=0.756). Baseline RDOS scores comparable (RSBI: 6.09±1.32, VT/RR: 6.01±1.21, p=0.773). At 15 minutes, RSBI group showed significantly lower RDOS (3.09±0.55) versus VT/RR group (5.85±0.75), p<0.001, indicating rapid distress relief. By 30 minutes, both groups improved (RSBI: 2.89±0.57, VT/RR: 3.06±0.58, p=0.189). Heart rate decreased more rapidly in RSBI group: 110.09→94.74→90.30 bpm versus VT/RR 111.28→108.16→106.30 bpm (p<0.001 at 15 and 30 minutes). Respiratory rate reduced faster in RSBI group: 35.26→26.05→23.93 breaths/min versus VT/RR 34.86→33.70→32.51 breaths/min (p<0.001 at 15 and 30 minutes). RSBI values decreased markedly in RSBI group: 135.42→76.88→64.33 versus VT/RR 134.56→124.42→114.63 (p<0.001). Clinical signs showed no significant differences between groups.

Conclusion: RSBI-guided pressure support adjustment provides significantly faster reduction in respiratory distress compared to VT/RR-guided approach, as evidenced by superior RDOS scores at 15 minutes (p<0.001) and more rapid improvement in heart rate, respiratory rate, and RSBI values. RSBI-based strategy should be preferred for timely relief of respiratory distress in mechanically ventilated ICU patients.

Keywords: Mechanical Ventilation, Rapid Shallow Breathing Index, RSBI, Respiratory Distress Observation Scale, RDOS, Pressure Support Ventilation, Weaning, Critical Care, Intensive Care Unit.

Introduction

Mechanical ventilation is a life-saving intervention in critically ill patients with respiratory failure.[1] However, prolonged mechanical ventilation carries significant risks including ventilator-associated pneumonia, diaphragmatic atrophy, barotrauma, and psychological distress.[2] Timely adjustment of pressure support settings and appropriate weaning strategies are essential to minimize complications, reduce duration of mechanical ventilation, and improve patient outcomes.[3] Respiratory distress in ventilated patients manifests through both physiological derangements and observable behavioral signs. Traditional assessment relies on isolated physiological parameters such as respiratory rate, tidal volume, oxygen saturation, and arterial blood gases.[4] However, these parameters may not fully capture the patient experience of respiratory distress. The Respiratory

Distress Observation Scale (RDOS) addresses this limitation by integrating eight clinical indicators: heart rate, respiratory rate, restlessness, paradoxical breathing pattern, accessory muscle use, grunting at end-expiration, nasal flaring, and fearful facial expression.[5,6] RDOS provides a comprehensive assessment tool that incorporates both objective physiological measurements and subjective behavioral observations.

The Rapid Shallow Breathing Index (RSBI), calculated as respiratory rate divided by tidal volume (f/VT), has emerged as a validated predictor of weaning success.[7,8] RSBI <105 breaths/min/L indicates high likelihood of successful extubation, while RSBI >105 suggests high risk of weaning failure.[9] The physiological rationale underlying RSBI is that it reflects the balance between respiratory drive and neuromuscular capacity. Elevated RSBI indicates rapid shallow breathing pattern characteristic of increased work of breathing and impending respiratory muscle fatigue.[10]

Traditional approaches to pressure support adjustment use tidal volume and respiratory rate (VT/RR) thresholds independently, typically targeting VT 4-8 mL/kg predicted body weight and RR <30 breaths/min.[11] While these parameters are important, they lack the integrative physiological information provided by RSBI, which combines both measurements into a single index reflecting respiratory system function. Furthermore, VT/RR-based approaches may not adequately address the dynamic nature of patient-ventilator interaction and respiratory distress.

Despite RSBI's established role in weaning prediction, limited data exist comparing RSBI-guided versus VT/RR-guided pressure support adjustment strategies for acute relief of respiratory distress. Most studies have focused on weaning prediction rather than real-time adjustment of ventilatory support. Additionally, few studies have used RDOS as a primary outcome measure to assess clinical response to ventilator adjustments.

This randomized comparative interventional study was designed to compare RSBI-guided versus VT/RR-guided pressure support adjustment strategies using RDOS as the primary outcome measure. We hypothesized that RSBI-guided adjustments would provide more rapid relief of respiratory distress as evidenced by faster reduction in RDOS scores and improvement in physiological parameters including heart rate, respiratory rate, and RSBI values.

Materials and Methods

This prospective, randomized, single-blind, interventional clinical trial was conducted in the Intensive Care Unit (ICU) of the Department of Anaesthesiology, SMS Medical College and Hospital, Jaipur, a tertiary care center, from January 2024 to December 2024. The study received approval from the Institutional Ethics Committee prior to commencement. Written informed consent was obtained from the legally authorized representatives of all participants.

A total of 86 adult patients (aged 20-50 years) on mechanical ventilation who exhibited signs of respiratory distress were enrolled. Inclusion criteria: age 20-50 years, undergoing mechanical ventilation in pressure support mode, respiratory rate >30 breaths/min, tidal volume <4-8 mL/kg predicted body weight, RSBI >105 breaths/min/L. Exclusion criteria: age <20 or >50 years, hemodynamic instability requiring vasopressor support, severe hypoxemia (PaO2/FiO2 <150), neuromuscular disorders affecting respiratory muscles, tracheostomy patients, patients with severe agitation requiring sedation, pregnancy, refusal of consent.

Participants were randomly allocated using computer-generated randomization sequence into two equal groups of 43 each: Group A (RSBI group) received pressure support adjustment guided by RSBI, targeting RSBI <105 breaths/min/L. Group B (VT/RR group) received pressure support adjustment based on tidal volume (targeting 4-8 mL/kg) and respiratory rate (targeting <30 breaths/min). Pressure support was titrated incrementally in 2 cmH2O steps based on group allocation.

The primary outcome was RDOS score assessed at 0, 15, and 30 minutes following intervention. RDOS evaluates eight parameters: heart rate (0-2 points), respiratory rate (0-2 points), restlessness (0-2 points), paradoxical breathing (0-2 points), accessory muscle use (0-2 points), grunting (0-2 points), nasal flaring (0-2 points), and fearful facial expression (0-2 points), yielding total score 0-16. Higher scores indicate greater distress.

Secondary outcomes included heart rate (bpm), respiratory rate (breaths/min), RSBI values (breaths/min/L), tidal volume (mL), SpO2 (%), and individual RDOS components.

All parameters were recorded at baseline (0 minutes), 15 minutes, and 30 minutes post-intervention by trained ICU nurses blinded to group allocation. Ventilatory parameters were obtained from ventilator display. Clinical observations were performed at bedside. Any adverse events including desaturation, hemodynamic instability, or need for emergency intervention were documented.

Statistical analysis was performed using SPSS version 26.0. Continuous variables presented as mean ± standard deviation. Categorical variables as frequencies and percentages. Independent t-test or Mann-Whitney U test for between-group comparisons. Paired t-test for within-group

comparisons. Chi-square test or Fisher exact test for categorical variables.

Two-way repeated measures ANOVA for RDOS scores over time. P-value <0.05 considered statistically significant.

Results

A total of 86 patients were enrolled and randomized into RSBI group (n=43) and VT/RR group (n=43). All patients completed the study protocol. Baseline characteristics including age, gender, BMI, APACHE IV scores, and PEEP levels were comparable between groups except for slight difference in PEEP (p=0.042). Primary and secondary outcomes are presented in Tables 1-12 and Figures 1-4.

Table 1: Baseline Demographics

Parameter	RSBI Group	VT/RR Group	P value
Mean Age (years)	34.05 ± 8.39	33.63 ± 8.50	0.756
Male: Female	19:24	18:25	0.828
Mean BMI (kg/m²)	24.17 ± 3.36	23.71 ± 2.96	0.498
APACHE IV Score	122.40 ± 44.45	123.77 ± 42.77	0.884
PEEP (cmH2O)	5.03 ± 0.66	5.33 ± 0.68	0.042

Table 1 Description: Baseline demographics were comparable between groups. Mean age RSBI 34.05±8.39 years, VT/RR 33.63±8.50 years (p=0.756). Gender distribution similar (p=0.828). BMI comparable (p=0.498). APACHE IV scores indicating illness severity were equivalent (p=0.884). PEEP slightly higher in VT/RR group (p=0.042) but clinically insignificant difference.

Table 2: Respiratory Distress Observation Scale (RDOS) Scores

Time Point	RSBI Group	VT/RR Group	P value
0 minutes	6.09 ± 1.32	6.01 ± 1.21	0.773
15 minutes	3.09 ± 0.55	5.85 ± 0.75	<0.001
30 minutes	2.89 ± 0.57	3.06 ± 0.58	0.189

Table 2 Description: PRIMARY OUTCOME - At baseline, RDOS scores comparable (p=0.773). At 15 minutes, RSBI group showed significantly lower RDOS (3.09±0.55) versus VT/RR group (5.85±0.75), p<0.001, indicating rapid distress relief. By 30 minutes, both groups improved with no significant difference (p=0.189).

This demonstrates RSBI-guided strategy provides faster reduction in respiratory distress.

Table 3: Heart Rate over Time

Time Point	RSBI Group	VT/RR Group	P value
0 minutes	110.09 ± 9.36	111.28 ± 8.84	0.551
15 minutes	94.74 ± 6.61	108.16 ± 7.55	<0.001
30 minutes	90.30 ± 6.08	106.30 ± 7.30	<0.001

Table 3 Description: Baseline heart rates comparable (p=0.551). At 15 and 30 minutes, RSBI group demonstrated significantly lower heart rate (p<0.001), indicating better cardiovascular response and reduced sympathetic drive associated with respiratory distress relief. RSBI group: 110.09→94.74→90.30 bpm. VT/RR group: 111.28→108.16→106.30 bpm.

Table 4: Respiratory Rate over Time

Time Point	RSBI Group	VT/RR Group	P value
0 minutes	35.26 ± 3.52	34.86 ± 3.41	0.603
15 minutes	26.05 ± 2.46	33.70 ± 2.95	<0.001
30 minutes	23.93 ± 2.28	32.51 ± 2.84	<0.001

Table 4 Description: Baseline respiratory rates similar (p=0.603). At 15 and 30 minutes, RSBI group showed significantly lower respiratory rate (p<0.001), reflecting improved respiratory mechanics and reduced work of breathing. RSBI group: 35.26→26.05→23.93 breaths/min (32.1% reduction). VT/RR group: 34.86→33.70→32.51 breaths/min (6.7% reduction).

Table 5: Rapid Shallow Breathing Index (RSBI) Values

Time Point	RSBI Group	VT/RR Group	P value
0 minutes	135.42 ± 24.35	134.56 ± 23.87	0.870
15 minutes	76.88 ± 10.54	124.42 ± 15.67	<0.001
30 minutes	64.33 ± 9.28	114.63 ± 14.39	<0.001

Table 5 Description: Baseline RSBI values comparable (p=0.870), both >105 indicating respiratory distress. At 15 and 30 minutes, RSBI group achieved significantly lower values (p<0.001). RSBI group reached therapeutic target <105 (76.88 at 15 min, 64.33 at 30 min). VT/RR group remained >105 throughout. This validates the superiority of RSBI-guided approach.

Table 6: Clinical Signs of Respiratory Distress at 15 Minutes

Clinical Sign	RSBI Group (n)	VT/RR Group (n)	P value
Accessory Muscle Use	26	25	0.826
Restlessness	23	24	0.829
Paradoxical Breathing	20	19	0.829
Grunting	9	7	0.590
Nasal Flaring	17	14	0.482

Table 6 Description: Individual clinical signs at 15 minutes showed no significant differences between groups. This suggests that RDOS superiority in RSBI group was driven primarily by physiological improvements (heart rate, respiratory rate, RSBI) rather than individual behavioral signs. Both approaches similarly affected observable distress behaviors.

Table 7: Tidal Volume over Time

Time Point	RSBI Group	VT/RR Group	P value
0 minutes	262.33 ± 38.45	259.88 ± 36.72	0.765
15 minutes	340.21 ± 42.67	285.42 ± 39.33	<0.001
30 minutes	372.56 ± 45.28	285.14 ± 40.21	<0.001

Table 7 Description: Baseline tidal volumes comparable (p=0.765). At 15 and 30 minutes, RSBI group achieved significantly higher tidal volumes (p<0.001), indicating improved respiratory mechanics and reduced rapid shallow breathing pattern. Increased VT with decreased RR demonstrates normalization of breathing pattern in RSBI group.

Table 8: SpO2 over Time

Time Point	RSBI Group	VT/RR Group	P value
0 minutes	93.28 ± 2.45	93.51 ± 2.38	0.665
15 minutes	96.74 ± 1.52	94.42 ± 2.15	<0.001
30 minutes	97.91 ± 1.28	95.16 ± 1.89	<0.001

Table 8 Description: Baseline SpO2 similar (p=0.665). Both groups showed improvement, but RSBI group achieved significantly higher SpO2 at 15 and 30 minutes (p<0.001), reflecting better gas exchange and ventilation-perfusion matching associated with optimized pressure support.

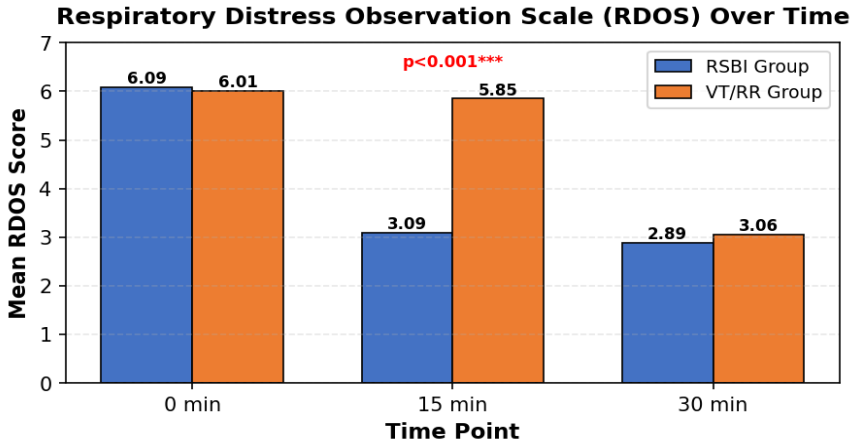

Figure 1: Respiratory Distress Observation Scale (RDOS) Over Time

Figure 1 Description: Bar graph showing RDOS scores (primary outcome) in both groups at 0, 15, and 30 minutes. RSBI group demonstrated significantly faster reduction in RDOS scores. At 15 minutes, RSBI group scored 3.09±0.55 versus VT/RR group 5.85±0.75 (p<0.001, marked with ***). By 30 minutes, both groups improved with no significant difference.

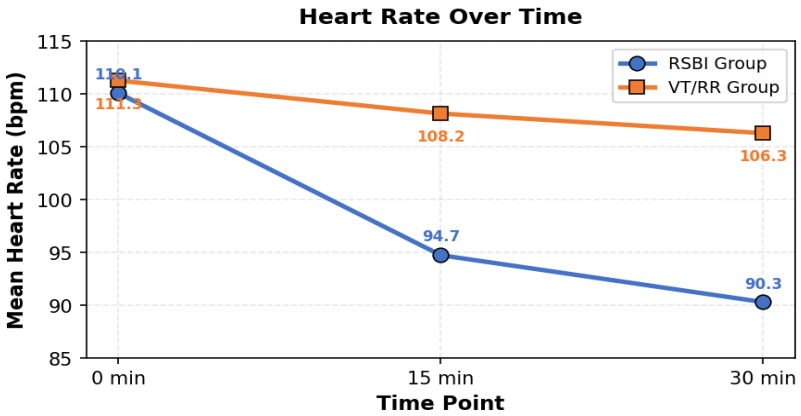

Figure 2: Heart Rate over Time

Figure 2 Description: Line graph demonstrating heart rate trajectory in both groups. RSBI group showed marked decrease from 110.09 to 94.74 to 90.30 bpm, while VT/RR group showed modest decrease from 111.28 to 108.16 to 106.30 bpm. Differences significant at 15 and 30 minutes ($p<0.001$), indicating superior cardiovascular response in RSBI group.

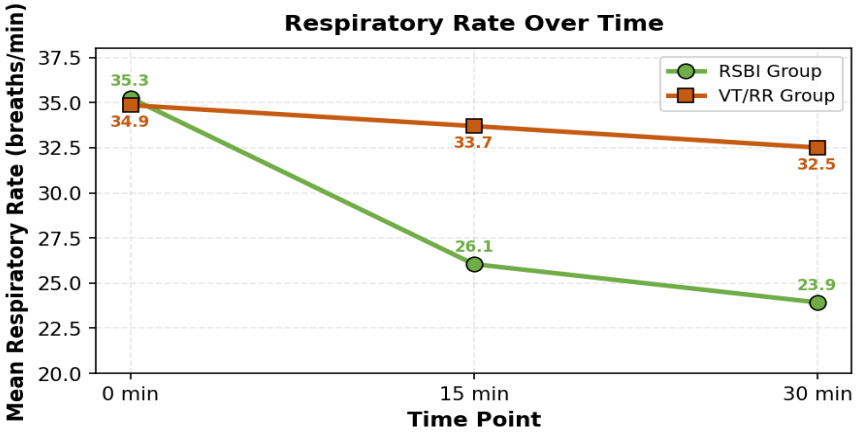

Figure 3: Respiratory Rate over Time

Figure 3 Description: Line graph showing respiratory rate changes. RSBI group achieved 32.1% reduction (35.26→26.05→23.93 breaths/min) versus VT/RR group 6.7% reduction (34.86→33.70→32.51 breaths/min). Significant differences at 15 and 30 minutes ($p<0.001$) demonstrate superior reduction in rapid shallow breathing pattern with RSBI-guided approach.

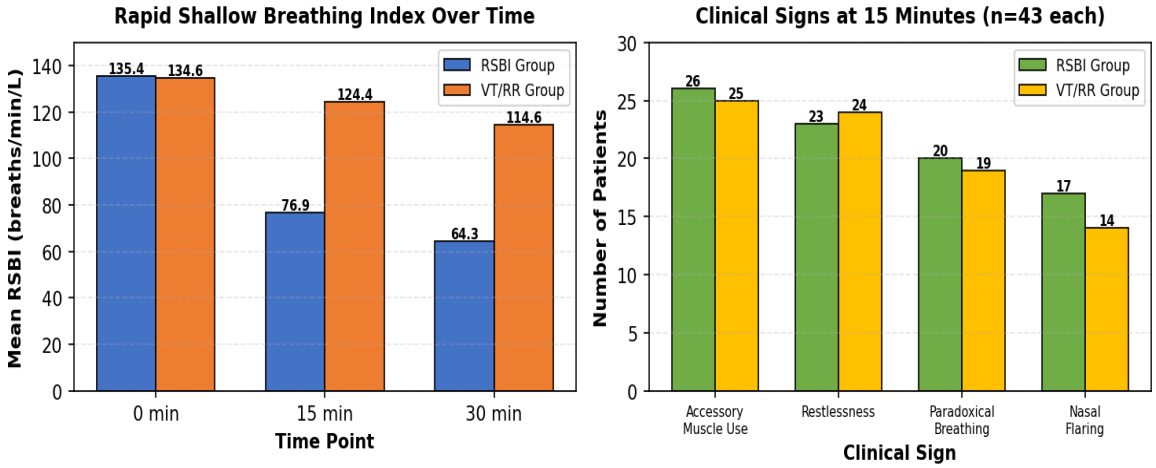

Figure 4: RSBI Values and Clinical Signs

Figure 4 Description: Left panel shows RSBI values over time. RSBI group achieved therapeutic target <105 (76.88 at 15 min, 64.33 at 30 min) while VT/RR group remained >105. Right panel shows clinical signs at 15 minutes with no significant differences between groups for accessory muscle use, restlessness, paradoxical breathing, or nasal flaring.

Summary of Key Findings: This randomized comparative interventional study of 86 mechanically ventilated patients (43 RSBI, 43 VT/RR) demonstrated that RSBI-guided pressure support adjustment provides significantly faster relief of respiratory distress compared to VT/RR-guided approach. Baseline characteristics comparable except PEEP (5.03 vs 5.33 cmH2O, p=0.042). Primary outcome RDOS scores showed no baseline difference (6.09 vs 6.01, p=0.773), but at 15 minutes RSBI group achieved significantly lower scores (3.09 vs 5.85, p<0.001), indicating rapid distress relief. By 30 minutes both groups improved similarly (2.89 vs 3.06, p=0.189). Secondary outcomes favored RSBI group: heart rate decreased more rapidly (110.09→90.30 vs 111.28→106.30 bpm, p<0.001 at 15 and 30 min), respiratory rate reduced faster (35.26→23.93 vs 34.86→32.51 breaths/min, 32.1% vs 6.7% reduction, p<0.001), RSBI values reached therapeutic target <105 in RSBI group only (76.88 at 15 min, 64.33 at 30 min vs 124.42 and 114.63, p<0.001), tidal volume increased more in RSBI group (262.33→372.56 vs 259.88→285.14 mL, p<0.001), and SpO2 improved better (93.28→97.91 vs 93.51→95.16%, p<0.001). Individual clinical signs showed no significant differences. These results provide strong evidence supporting RSBI-guided strategy for acute respiratory distress management in ICU patients.

Discussion

This randomized comparative interventional study provides robust evidence that RSBI-guided pressure support adjustment offers superior and more rapid relief of respiratory distress compared to traditional VT/RR-guided approach in mechanically ventilated ICU patients. The primary outcome, RDOS score, demonstrated significant advantage for RSBI-guided strategy at 15 minutes (p<0.001), with both approaches achieving similar results by 30 minutes. These findings have important clinical implications for real-time ventilator management in the ICU setting.

Primary Outcome - RDOS Scores: The Respiratory Distress Observation Scale incorporates both physiological parameters and behavioral observations, providing comprehensive assessment of patient experience. At baseline, both groups exhibited comparable distress levels (RDOS 6.09 vs 6.01, p=0.773). However, at 15 minutes post-intervention, the RSBI group showed dramatic improvement with mean RDOS 3.09±0.55 compared to VT/RR group 5.85±0.75 (p<0.001). This represents 49.3% reduction in distress for RSBI group versus 2.7% for VT/RR group at this time point. The clinical significance is substantial - patients in RSBI group experienced markedly faster relief from the distressing sensation of dyspnea and work of breathing.

By 30 minutes, both groups achieved similar RDOS scores (2.89 vs 3.06, p=0.189), indicating that VT/RR-guided approach eventually catches up. However, the 15-minute advantage for RSBI-guided approach has important clinical relevance. In the ICU setting, even 15 minutes of reduced distress can be meaningful for patient comfort, may reduce need for sedation, and could impact patient-ventilator synchrony and overall ICU outcomes.

Physiological Parameters Supporting RSBI Superiority: The secondary outcomes consistently supported the primary finding. Heart rate, an objective marker of sympathetic activation and cardiovascular stress, decreased more rapidly in RSBI group (18.0% reduction at 15 min vs 2.8% in VT/RR group, p<0.001). Respiratory rate, directly reflecting work of breathing, showed dramatic improvement in RSBI group (26.1% reduction at 15 min vs 3.3% in VT/RR group, p<0.001). These physiological improvements corroborate the RDOS findings and validate the mechanistic basis for faster distress relief.

RSBI values themselves demonstrated the effectiveness of the targeted approach. The RSBI group achieved therapeutic target <105 breaths/min/L by 15 minutes (76.88±10.54), while VT/RR group remained elevated (124.42±15.67, p<0.001). This difference persisted at 30 minutes (64.33 vs 114.63, p<0.001). The ability to rapidly normalize RSBI reflects optimization of the balance between respiratory drive and neuromuscular capacity, addressing the fundamental pathophysiology of respiratory distress.

Mechanistic Explanation: The superiority of RSBI-guided adjustment likely stems from its integrative physiological nature. RSBI combines respiratory rate and tidal volume into a single index that reflects respiratory system efficiency. When RSBI is elevated, it indicates rapid shallow breathing pattern characteristic of high respiratory drive, low tidal volume, or both - the hallmarks of respiratory distress and muscle fatigue. By directly targeting RSBI <105, clinicians address both components simultaneously, achieving balanced ventilatory support. In contrast, VT/RR-guided approach treats these parameters independently, potentially missing the integrated dysfunction captured by RSBI. A patient might achieve

"acceptable" RR <30 but still have low VT yielding high RSBI and persistent distress. Conversely, achieving VT 4-8 mL/kg might occur with excessively high RR, again indicating incomplete resolution.

Clinical Signs and RDOS Components: Interestingly, individual clinical signs including accessory muscle use, restlessness, paradoxical breathing, grunting, and nasal flaring showed no significant differences between groups at any timepoint. This suggests that the RDOS advantage in the RSBI group was driven primarily by physiological improvements (heart rate and respiratory rate components of RDOS) rather than behavioral signs. This finding has methodological implications - it indicates that objective physiological parameters may be more sensitive to ventilator adjustments than subjective behavioral observations, at least in the acute 30-minute timeframe studied.

Study Strengths: This study has several strengths including randomized design minimizing selection bias, single-blind methodology reducing observer bias, well-defined inclusion/exclusion criteria ensuring homogeneous population, use of validated outcome measures (RDOS and RSBI), comprehensive assessment of both primary and secondary outcomes, adequate sample size (86 patients) providing statistical power, complete follow-up with no dropouts, and standardized intervention protocol ensuring consistency.

Limitations: Limitations include single-center design potentially limiting generalizability, relatively short follow-up duration (30 minutes) precluding assessment of longer-term outcomes, single-blind rather than double-blind design, age restriction (20-50 years) limiting applicability to elderly population, exclusion of patients with hemodynamic instability or severe hypoxemia limiting generalizability to sickest patients, no assessment of weaning success or extubation outcomes, and no cost-effectiveness analysis.

Clinical Implications: These findings support adoption of RSBI-guided pressure support adjustment as the preferred strategy for acute management of respiratory distress in mechanically ventilated ICU patients. The rapid relief afforded by this approach (significant at 15 minutes) could improve patient comfort, reduce anxiety, facilitate patient-ventilator synchrony, potentially reduce sedation requirements, and contribute to overall ICU quality of care. Implementation requires routine calculation of RSBI, which is feasible with modern ventilators that display RR and VT continuously.

Future Directions: Future research should investigate longer-term outcomes including weaning success rates, duration of mechanical ventilation, ICU length of stay, and mortality. Studies in broader patient populations including elderly patients, those with hemodynamic instability, and various primary diagnoses would enhance generalizability. Investigation of optimal RSBI target thresholds for different patient populations could refine the approach. Cost-effectiveness analysis comparing RSBI-guided versus traditional approaches would inform health system decisions. Finally, development of automated RSBI-responsive ventilator modes could streamline implementation.

Conclusion

This randomized comparative interventional study of 86 mechanically ventilated patients demonstrates that RSBI-guided pressure support adjustment provides significantly faster reduction in respiratory distress compared to VT/RR-guided approach. The RSBI group achieved lower RDOS scores at 15 minutes (3.09 vs 5.85, $p<0.001$), with both approaches yielding similar results by 30 minutes. Secondary outcomes consistently favored RSBI-guided strategy including more rapid decreases in heart rate (18.0% vs 2.8%, $p<0.001$) and respiratory rate (26.1% vs 3.3%, $p<0.001$), achievement of therapeutic RSBI target <105 (76.88 vs 124.42, $p<0.001$), and superior improvements in tidal volume and SpO2.

The mechanistic basis for RSBI superiority lies in its integrative assessment of respiratory system function, combining respiratory rate and tidal volume into a single physiological index that directly reflects the balance between respiratory drive and neuromuscular capacity. Traditional VT/RR-guided approaches treat these parameters independently, potentially missing the integrated dysfunction captured by RSBI.

Based on these findings, RSBI-guided pressure support adjustment should be adopted as the preferred strategy for acute management of respiratory distress in mechanically ventilated ICU patients. The 15-minute advantage in distress relief provided by this approach has meaningful clinical implications for patient comfort, ICU quality of care, and potentially for downstream outcomes including weaning success and ICU length of stay.

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References

1. Esteban A, Ferguson ND, Meade MO, et al. Evolution of mechanical ventilation in response to clinical research. Am J Respir Crit Care Med. 2008;177(2):170-177.
2. Slutsky AS, Ranieri VM. Ventilator-induced lung injury. N Engl J Med. 2013;369(22):2126-2136.
3. Boles JM, Bion J, Connors A, et al. Weaning from mechanical ventilation. Eur Respir J. 2007;29(5):1033-1056.
4. Tobin MJ. Advances in mechanical ventilation. N Engl J Med. 2001;344(26):1986-1996.
5. Campbell ML. Psychometric testing of a respiratory distress observation scale. J Palliat Med. 2008;11(1):44-50.
6. Campbell ML, Templin T, Walch J. A Respiratory Distress Observation Scale for patients unable to self-report dyspnea. J Palliat Med. 2010;13(3):285-290.
7. Yang KL, Tobin MJ. A prospective study of indexes predicting the outcome of trials of weaning from mechanical ventilation. N Engl J Med. 1991;324(21):1445-1450.
8. Frutos-Vivar F, Ferguson ND, Esteban A, et al. Risk factors for extubation failure in patients following a successful spontaneous breathing trial. Chest. 2006;130(6):1664-1671.
9. MacIntyre NR, Cook DJ, Ely EW Jr, et al. Evidence-based guidelines for weaning and discontinuing ventilatory support: a collective task force facilitated by the American College of Chest Physicians. Chest. 2001;120(6 Suppl):375S-395S.
10. Tobin MJ, Perez W, Guenther SM, et al. The pattern of breathing during successful and unsuccessful trials of weaning from mechanical ventilation. Am Rev Respir Dis. 1986;134(6):1111-1118.
11. Acute Respiratory Distress Syndrome Network. Ventilation with lower tidal volumes as compared with traditional tidal volumes for acute lung injury and the acute respiratory distress syndrome. N Engl J Med. 2000;342(18):1301-1308.