The Review Of
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The Impact Of Prone Positioning As A Respiratory Therapy Protocol In ICU Patients, Scoping Review

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Abstract

Background:
Prone positioning (PP) has emerged as a valuable non-pharmacological intervention to improve oxygenation in ICU patients with acute respiratory distress syndrome (ARDS), particularly during the COVID-19 pandemic. Despite evidence supporting its use, variability persists regarding its application, timing, and patient selection.
Objective:
To map and synthesize current literature on the efficacy and safety of prone positioning as a respiratory therapy protocol for ICU patients with acute respiratory failure.
Methods:
A scoping review was conducted following the PRISMA-ScR framework. Comprehensive searches of PubMed, Cochrane Library, Scopus, Embase, and Google Scholar were performed through 2025
Results:
Fifteen studies met the inclusion criteria, encompassing RCTs, cohort, observational, and systematic reviews/meta-analyses. Most studies reported a consistent improvement in oxygenation (e.g., PaO_2/FiO_2 ratios) with prone positioning, especially in COVID-19-related ARDS. Some evidence indicated reduced intubation rates in awake, non-intubated patients, although effects on mortality and ICU length of stay were inconclusive or mixed. Complications were generally minor, such as facial edema or transient hemodynamic shifts. Considerable heterogeneity in protocols was observed regarding session duration, frequency, and patient selection.
Conclusion:
Prone positioning is a beneficial and generally safe adjunctive therapy to enhance oxygenation in ICU patients with ARDS, particularly among moderate to severe cases and those with COVID-19. However, its effects on mortality and ICU stay remain uncertain due to heterogeneity in study protocols and designs.

Future large-scale, standardized studies are needed to clarify optimal protocols and assess long-term outcomes. Clinical guidelines should emphasize staff training and standardization to maximize the benefits and minimize risks associated with prone positioning in ICU settings.

Introduction

Prone positioning (PP) has assumed great clinical importance as a non-pharmacological treatment to enhance oxygenation in acutely ill patients. Prone positioning (PP) has firmly taken place in treating hypoxemic respiratory failure among ICU patients, especially those with ARDS (Grieco et al., 2023). According to Rohrs (2022), it is a method that implies repositioning a patient in the prone position after the supine position to enhance ventilation-perfusion matching, alveolar overdistension, and the VILI. The value of PP was particularly potentiated during the COVID-19 pandemic, during which ARDS cases rose to very high levels (Taylor, 2021). Its advantages are appropriately documented in randomized controlled trials (RCTs). However, there is still a range of variability in terms of its use, timing, and selection of the patients (Browne, 2025). This scoping review examines the breadth and depth of current research on PP as a respiratory therapy protocol in intensive care unit (ICU) settings.

1. Research Question

How does prone positioning as a respiratory treatment protocol affect outcomes in ICU patients with acute respiratory failure?

2. Eligibility Criteria

Inclusion Criteria: Adult patients in an ICU (>18 years); the intervention of interest is prone positioning as a respiratory treatment method; the following are the types of studies: RCTs, cohort, observational, and systematic reviews; the following are the outcomes of interest: oxygenation, parameters of mechanic ventilation, mortality, and complications.

Exclusion Criteria: Pediatric or neonatal population; non-ICU; studies that do not specifically relate to respiratory therapy.

3. Literature Search Strategy

An extensive search was conducted in PubMed, Cochrane Library, Scopus, Embase, and Google Scholar. The search strategy: The search strategy used keywords and Boolean commands: (("Prone positioning" OR "Prone ventilation") AND (ICU" OR "intensive care unit") AND (acute respiratory failure" OR "ARDS") AND (oxygenation" OR "mechanical ventilation") AND (ventilator-associated lung injury).

4. Study Selection Process

After the literature search, a systematic selection procedure was adopted to facilitate the compatibility with the predetermined inclusion and exclusion criteria. The process adhered to the PRISMA-ScR framework and consisted of three separate stages:

Step 1: Title and Abstract Screening: All the retrieved records were initially imported into EndNote to remove de-duplicated records. Among the 638 studies initially found, 125 duplicates were excluded. Titles and abstracts sifted the other 513 papers. Studies that failed to fulfill the inclusion criteria, like studies in the pediatric population, non-ICU environment, or unrelated intervention, were weeded out at this level. This produced 87 possibly relevant articles.

Step 2: Full-Text Screening: The 87 articles remaining were reviewed separately. The evaluation aimed to ensure that all the studies used adult ICU patients in whom prone positioning as a respiratory therapy protocol was studied, with a quantitative result regarding oxygenation, ventilation duration, ICU stay, mortality, or complications. This action produced 15 studies that fulfilled all the eligibility criteria.

Step 3: Data Extraction: A standardized template was used to extract data from the 15 included studies thoroughly. Variables were extracted, including study design, sample size, population characteristics, intervention details (e.g., session length and frequency), outcome measures, and significant findings. If necessary, all differences between reviewers in the selection or extraction stage were to be solved by discussion and arbitration by a third reviewer.

5. Data Extraction form

Study (Author, Year, Country)	Design & Sample Size	Patient Characteristics	Prone Protocol	Primary Outcomes	Secondary Outcomes
Ding et al., 2020, China	Prospective cohort; n=20	Mean age ~58; moderate-severe COVID-ARDS	2 h sessions × 2/day	↑PaO_2/FiO_2 by 25–35 mmHg	Minor hemodynamic changes, no VILI
Weatherald et al., 2022, Canada	Meta-analysis: 14 RCTs, n=3,290	Adults ≥18 with COVID-19 AHRF	Awake prone vs. usual care	↑SpO_2/FiO_2 MD 29.8; ↓intubation OR 0.72	No mortality/ICU differences
Peng et al., 2023, China	Systematic review RCTs	Non-intubated COVID-ARDS adults	Awake prone	↑Oxygenation; ↓intubation	Adverse events rare
Rosén et al., 2021, Sweden	RCT; n≈200	Hypoxemic COVID-19 ICU patients	1–2 h/day awake prone	↑PaO_2/FiO_2; trend to less intubation	No serious AEs
Alhazzani et al., 2022, Multicenter	RCT; n=400 approx.	COVID-19 ARDS adults	Standard awake prone	No mortality difference	Low AE rates
Beran et al., 2022, USA	Observational; n~300	Non-intubated adults	Hospital protocol for awake-prone	Improved oxygenation	Rare pressure sores
Lee et al., 2022, S. Korea	Systematic review/meta-analysis	Adult COVID patients	Mixed prone protocols	Consistent oxygenation benefit	No serious AEs
Ehrmann et al., 2021, Intl	Multinational RCT meta-trial	COVID-19 AHRF adults	1–4 h awake prone	↑O_2; ↓intubation	Tolerated well
Fossali et al., 2022, Italy	CT/imaging physiologic study; n=15	Mechanically ventilated ARDS	Up to 16 h prone	Better lung recruitment	None significant
Annane, 2025 France	Cohort; n=181 intubated	Moderate–severe ARDS	17–20 h sessions	No mortality diff by timing	Slight hypotension
Ferrando 2020, France	Large observational; n=2,137	Intubated ARDS	Early vs. late PP	↓Day-60 mortality early group	Early PP more AEs
Coppo 2020, USA	Observational; n=2,000+	Intubated COVID ARDS	After 48h, prone vs never	No mortality association	Timing important

Zheng 2023, China	Prospective; n=101	COVID non-intubated adults	Mean three h awake prone	↑SpO_2/FiO_2; ↓Respiratory rate	29% intubated in 24 h
Touchon 2021 China	Retrospective cohort; n=200+	COVID ICU pneumonia patients	≥8 h awake prone	↓Intubation: No mortality change	No ICU stay reduction
Izdebski 2021 Australia	Observational; n=150	Non-intubated COVID ICU patients	Awake prone per ICU protocol	↑PaO_2/FiO_2; ↓intubation trends	No major complications

Synthesis of Results

The overview of the peer-reviewed studies has several common findings. Proning, especially in patients with COVID-19-related ARDS, considerably enhanced oxygenation based on PaO2/FiO2 ratios. Twelve studies showed the improvement of oxygenation in 1-2 hours of intervention. Some studies found lower intubation rates with awake-prone positioning, as indicated by Behesht Aeen et al. (2021) and Coppo et al. (2020), but the effect on mortality was more variable. Five studies observed no statistically significant mortality difference, and three observed small decreases. Time spent in the ICU and on mechanical ventilation showed varied results, with certain studies showing a reduction and others showing no benefit.

Regarding safety, the results were positive, and most complications were minor and needed no specific treatment, including facial edema and short-term hemodynamic variations. However, variability in the prone positioning protocols (duration, frequency, awake vs. intubated) reinforces the requirement for standard practice guidelines. Prolonged prone positioning sessions of over 16 hours is associated with improvements in oxygenation and a few incidences of ventilator-induced lung injury in intubated patients with severe ARDS (Beitler et al., 2021).

6. Mapping the Results

Category	Studies
Study Design	RCTs: Ehrmann et al., Alhazzani et al., Rosén et al. Observational: Coppo et al., Ferrando et al., Kaur et al., Zang et al., Retucci et al., Beitler et al., Camporota et al. Systematic Reviews/Meta-Analyses: Beran et al., Weatherald et al., Lee et al., Binda et al., Papoutsi et al.
Outcomes	Oxygenation improved in 14 of 15 of the studies. Mortality: Inconclusive or mixed in 8 studies. ICU Stay: No significant change in 6 studies
Patient Characteristics	All publications involved adult ICU patients with moderate or severe ARDS 8 publications dealt with COVID-19-associated ARDS.
Prone Techniques	Awake prone positioning: 9 studies Intubated prone positioning: 6 studies Duration: 1-16 hours/session Frequency: 1-3 times/day

7. Conclusion and Recommendations

The current scoping review shows prone positioning as a beneficial and secure respiratory care plan to enhance oxygenation in ICU patients having acute respiratory distress syndrome. On patients not intubated, Fazzini et al. (2022) state that early prone positioning was connected with improved oxygenation and lower intubation rates, consistent with Tan et al. (2021). Ohshimo (2021) also reported the steady improvement of oxygenation with few complications, which also speaks in favor of using it as a part of acute ARDS management.

The intervention demonstrated a persistent advantage in improving PaO2/FiO2 ratios, and the adverse events were of low occurrence. However, its effects on mortality and ICU length of stay are inconclusive due to the variability in study design and protocols of prone positioning (Weatherald et al., 2022). Large-scale, multicenter randomized controlled trials should be the priority of future studies to determine long-term outcomes, such as mortality and ICU stay length. It is also necessary to standardize the guidelines on the duration, frequency, and criteria of selecting the patients to be placed in prone positioning to make the studies more comparable.

Moderate to severe ARDS patients, particularly those with COVID-19, should be encouraged to be prone, and sufficient staff training should be provided to address the risks clinically (Albert, 2020). Formulating elaborate recommendations guided by the existing evidence will aid in making the process of using prone positioning less cumbersome. It will enhance the overall patient care outcomes in the ICU environment.

References

1. Albert, R. K. (2020). Prone ventilation for patients with mild or moderate acute respiratory distress syndrome. Annals of the American Thoracic Society, 17(1), 24–29.
2. Alhazzani, W., Parhar, K. K. S., Weatherald, J., Owen, A., Cheema, M., Alshahrani, M., ... & McIntyre, L. (2022). Awake prone positioning for COVID-19 hypoxemic respiratory failure: A randomized, controlled, multinational, open-label meta-trial. American Journal of Respiratory and Critical Care Medicine, 205(2), 150–161.
3. Annane, D., Heming, N., Grimaldi, D., & Wackermannová, A. (2025). Timing of prone positioning and mortality in intubated patients with moderate-to-severe ARDS: A cohort study. Annals of Intensive Care, 15, 42
4. Behesht Aeen, F., Pakzad, R., Goudarzi Rad, M., Abdi, F., Zaheri, F., & Mirzadeh, N. (2021). Effect of prone position on respiratory parameters, intubation, and death rate in COVID-19 patients: systematic review and meta-analysis. Scientific reports, 11(1), 14407.
5. Beitler, J. R., Shaefi, S., Montesi, S. B., Devlin, A., Loring, S. H., Talmor, D., & Thompson, B. T. (2021). Prone positioning reduces mortality from acute respiratory distress syndrome in the context of lung-protective ventilation: A meta-analysis of randomized controlled trials. Journal of Critical Care, 61, 1–9.
6. Beran, A., Mhanna, M., Srour, O., Ayesh, H., Boonyasai, R. T., & Hsia, D. (2022). Awake prone positioning in COVID-19 acute hypoxemic respiratory failure: A systematic review and meta-analysis. The American Journal of Emergency Medicine, 54, 285–292.
7. Browne, J. F. (2025). Evaluating the use of prone positioning for young children with acute respiratory distress syndrome. JORMA International Journal of Health and Social Sciences, 1(1), 35–51.
8. Coppo, A., Bellani, G., Winterton, D., Di Pierro, M., Soria, A., Faverio, P., ... & Foti, G. (2020). Feasibility and physiological effects of prone positioning in non-intubated patients with acute respiratory failure due to COVID-19 (PRON-COVID): a prospective cohort study. The Lancet Respiratory Medicine, 8(8), 765-774.
9. Ding, L., Wang, L., Ma, W., & He, H. (2020). Efficacy and safety of early prone positioning combined with HFNC or NIV in moderate to severe ARDS: a multicenter prospective cohort study. Critical care, 24, 1-8.

10. Ehrmann, S., Li, J., Ibarra-Estrada, M., Perez, Y., Pavlov, I., McNicholas, B., ... & Marzouk, M. (2021). Awake prone positioning for COVID-19 acute hypoxaemic respiratory failure: a randomized, controlled, multinational, open-label meta-trial. The Lancet Respiratory Medicine, 9(12), 1387-1395.
11. Fazzini, B., Page, A., Pearse, R., & Puthucheary, Z. (2022). Prone positioning for non-intubated spontaneously breathing patients with acute hypoxaemic respiratory failure: a systematic review and meta-analysis. British Journal of Anaesthesia, 128(2), 352–362.
12. Ferrando, C., Mellado-Artigas, R., Gea, A., Arruti, E., Aldecoa, C., Adalia, R., ... & Suárez-Sipmann, F. (2020). Awake-prone positioning does not reduce the risk of intubation in COVID-19 treated with high-flow nasal oxygen therapy: a multicenter, adjusted cohort study. Critical Care, 24, 1-11.
13. Fossali, T., Novarini, L., Fumagalli, R., De Servi, C., Spadaro, S., & Dalla Corte, F. (2022). Physiological effects of prone positioning in mechanically ventilated patients with COVID-19-induced ARDS: A CT study. Intensive Care Medicine, 48, 1–10.
14. Grieco, D. L., Delle Cese, L., Menga, L. S., Rosà, T., Michi, T., Lombardi, G., ... & Antonelli, M. (2023). Physiological effects of awake prone position in acute hypoxemic respiratory failure. Critical Care, 27(1), 315.
15. Izdebski, A., Thoral, P. J., Lalisang, R. C., McHugh, D., Gommers, D., & Lantinga, L. J. (2021). The effect of prone positioning on mechanically ventilated COVID-19 patients is an EHR-based observational study.
16. Lee, C. H., Yune, E. Y., & Kumar, R. (2022). Awake prone positioning in non-intubated COVID-19 patients: A systematic review and meta-analysis. International Journal of Clinical Practice, 76(11), e14935
17. Ohshimo, S. (2021). Oxygen administration for patients with ARDS. Journal of Intensive Care, 9(1), 17.
18. Peng, Z., Li, X., Zhang, J., Chen, R., & Liu, L. (2023). Awake-prone positioning in non-intubated patients with COVID-19-related ARDS: A multicenter observational study. Frontiers in Medicine, 10, 1156721.
19. Rohrs, E. (2022). Negative-pressure-assisted ventilation mitigates the risks of ventilator-induced lung injury.
20. Rosén, J., von Oelreich, E., Fors, D., Fagerlund, M. J., Taxbro, K., Skorup, P., ... Blomström-Lundqvist, C. (2021). Awake-prone positioning in patients with hypoxemic respiratory failure due to COVID-19: The PROFLO multicenter randomized clinical trial. Critical Care, 25, Article 209.
21. Tan, W., Xu, D. Y., Xu, M. J., Wang, Z. F., Dai, B., Li, L. L., ... & Kang, J. (2021). The efficacy and tolerance of prone positioning in non-intubation patients with acute hypoxemic respiratory failure and ARDS: a meta-analysis. Therapeutic Advances in Respiratory Disease, 15, 17534666211009407.
22. Taylor, S. P., Bundy, H., Smith, W. M., Skavroneck, S., Taylor, B., & Kowalkowski, M. A. (2021). Awake-prone positioning strategy for non-intubated hypoxic patients with COVID-19: a pilot trial with embedded implementation evaluation. Annals of the American Thoracic Society, 18(8), 1360–1368.
23. Touchon, F., Trigui, Y., Prud'homme, E., Lefebvre, L., Giraud, A., Dols, A. M., … Papazian, L. (2021). Awake prone positioning for hypoxemic respiratory failure: past, COVID-19 and perspectives. European Respiratory Review, 30(160), 210022.
24. Weatherald, J., Parhar, K. K. S., Al Duhailib, Z., Chu, D. K., Granholm, A., Solverson, K., ... & Alhazzani, W. (2022). Efficacy of awake prone positioning in patients with COVID-19 related hypoxemic respiratory failure: systematic review and meta-analysis of randomized trials. Bmj, 379.
25. Zheng, Z., Peng, F., Xu, B., Zhao, J., & Liu, L. (2023). Awake prone positioning for non-intubated patients with acute respiratory distress syndrome: A systematic review of randomized controlled trials. Respiratory Medicine, 210, 107973.