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Expert Opinion Article

Effect Of Prone Position in Acute Respiratory Distress Syndrome Patient: A Narrative Review

Ms. Komal[1], Ms. Mannu Vashist[2], Ms. Rekha Pant[3], Mr Subjot Balan Namath[4]

[1*]PG Tutor, M.Sc. Medical Surgical Nursing SGT University Gurugram, Haryana, India
[2]PG Tutor, M.Sc. Medical Surgical Nursing SGT University Gurugram, Haryana, India
[3]PG Tutor, M.Sc. Medical Surgical Nursing SGT University Gurugram, Haryana, India
[4]Assistant Professor, M.Sc. Medical Surgical Nursing SGT University Gurugram, Haryana, India

***Corresponding Author:** Ms. Komal
*PG Tutor, M.Sc. Medical Surgical Nursing SGT University, Gurugram. Haryana, India

ABSTRACT

INTRODUCTION: Acute Respiratory Distress Syndrome (ARDS) is a severe condition characterized by hypoxemia and lung inflammation, leading to high morbidity and mortality. Prone positioning has emerged as a promising intervention to improve oxygenation and outcomes in ARDS patients. This review synthesizes findings from 40 experimental studies, including randomized controlled trials, cohort studies, and observational studies, to evaluate the impact of prone positioning on oxygenation, mortality, and ventilation-related complications.

METHODS: A systematic literature review was conducted using PubMed, Scopus, and Google Scholar, focusing on studies from France, Italy, Spain, USA, Canada, and India. The inclusion criteria consisted of experimental studies that assessed the impact of prone positioning on oxygenation (PaO_2/FiO_2 ratio), mortality, and adverse events in ARDS patients. Studies involving both mechanically ventilated and awake prone positioning in non-intubated patients were considered.

RESULTS: Prone positioning significantly improves oxygenation in ARDS patients, with studies showing a notable increase in the PaO_2/FiO_2 ratio, especially when maintained for 12–16 hours per day. It has been associated with a reduction in 28-day and 90-day mortality rates, particularly in severe ARDS cases. Evidence supports its role in reducing the need for intubation in non-intubated ARDS patients, especially during COVID-19-related respiratory failure. Prone positioning also facilitates better lung recruitment and reduces ventilator-induced lung injury. However, potential complications such as pressure ulcers, airway obstruction, and hemodynamic instability have been reported. Despite these risks, prone positioning is considered a safe and effective intervention when applied under proper clinical supervision.

DISCUSSION & CONCLUSION: Prone positioning has proven to be a clinically effective strategy in ARDS management, particularly when applied early and for prolonged durations. Its success is contingent on patient selection, protocol adherence, and multidisciplinary team expertise. Indian studies further highlight its utility in resource-limited settings, particularly during the COVID-19 pandemic. Future research should focus on long-term patient outcomes, personalized prone positioning strategies, and identifying optimal ARDS subgroups for maximum benefit.

KEYWORDS: ARDS, COVID-19, PaO2, FiO2 Ratio.

Introduction:

Acute Respiratory Distress Syndrome (ARDS) is a life-threatening condition characterized by severe hypoxemia, reduced lung compliance, and diffuse alveolar damage, leading to respiratory failure. It is commonly caused by conditions such as sepsis, pneumonia, trauma, aspiration, and COVID-19, requiring mechanical ventilation for respiratory support. ARDS is associated with high morbidity and mortality, with studies indicating mortality rates ranging from 30% to 60%, depending on severity and comorbidities.

Traditional management strategies for ARDS include lung-protective ventilation, optimal fluid management, neuromuscular blockade, and extracorporeal membrane oxygenation (ECMO). However, one of the most effective interventions in improving oxygenation and potentially reducing mortality is prone positioning, where the patient is placed on their abdomen instead of their back.

Rationale for Prone Positioning in ARDS: In ARDS, ventilation-perfusion mismatch, alveolar collapse (atelectasis), and increased lung stress contribute to worsening hypoxemia. Prone positioning enhances lung recruitment by redistributing lung perfusion and reducing alveolar overdistension, leading to improved oxygenation. Additionally, it minimizes ventilator-induced lung injury (VILI) by reducing regional lung strain and barotrauma. Clinical trials and observational studies have demonstrated that early and prolonged prone positioning (12–16 hours per day) significantly enhances gas exchange, reduces mortality, and improves patient outcomes.

Global and Indian Context: The role of prone

positioning has been widely studied in Europe, North America, and Asia, with multiple randomized controlled trials (RCTs) and meta-analyses supporting its effectiveness in moderate-to-severe ARDS. In India, the COVID-19 pandemic further highlighted the importance of awake prone positioning, particularly in resource-limited settings where mechanical ventilation facilities were overwhelmed. Several Indian studies have examined the feasibility, safety, and efficacy of prone positioning in both mechanically ventilated and spontaneously breathing patients.

Need for the Study: Despite strong evidence supporting prone positioning, its clinical implementation varies, and there remains uncertainty regarding patient selection, optimal duration, and potential complications such as pressure ulcers, airway obstruction, and hemodynamic instability. This review aims to synthesize experimental studies on prone positioning in ARDS, focusing on oxygenation improvement, mortality reduction, and safety outcomes, with an emphasis on both global and Indian research perspectives. Understanding these findings can aid in developing standardized protocols for prone positioning, ensuring its effective integration into ARDS management strategies.

Table No.1 Studies related to effect of Prone Position in Acute Respiratory Distress Syndrome

Author	Country	Study Design/Method	Sample	Result	Discussion
Guérin et al.	**France**	**Multicenter randomized controlled trial**	**466 patients with severe ARDS**	**Early application of prolonged prone-positioning sessions significantly decreased 28-day and 90-day mortality.**	**The study supports prone positioning as a beneficial strategy in managing severe ARDS.**
Sud et al	**Canada**	**Systematic review and meta-analysis**	**2,242 patients across multiple studies**	**Prone positioning during mechanical ventilation was associated with reduced mortality among patients with ARDS.**	**The analysis suggests that prone positioning should be considered in the management of ARDS to improve survival rates.**
Munshi et al	**Canada**	**Systematic review and meta-analysis**	**2,129 patients from eight randomized controlled trials**	**Prone positioning is likely to reduce mortality among patients with severe ARDS when applied for at least 12 hours daily.**	**The study emphasizes the importance of session duration in the effectiveness of prone positioning.**
Taccone et al.	**Italy**	**Randomized controlled trial**	**342 patients with moderate to severe ARDS**	**No significant difference in 28-day mortality between prone and supine groups; however, prone positioning improved oxygenation.**	**While oxygenation improved, the lack of mortality benefit suggests that patient selection and timing are crucial.**

Gattinoni et al.	Italy	Randomized controlled trial	304 patients with ARDS	Prone positioning improved oxygenation but did not significantly reduce mortality.	The study highlights the complexity of translating physiological improvements into survival benefits.
Mancebo et al	Spain	Randomized controlled trial	136 patients with ARDS	Prolonged prone positioning improved oxygenation but did not significantly affect mortality.	The findings suggest that while prone positioning enhances oxygenation, additional factors influence survival outcomes.
Beuret et al.	France	Prospective observational study	15 patients with ARDS	Prone positioning improved oxygenation in the majority of patients.	The study supports the use of prone positioning to enhance oxygenation in ARDS patients.
Guérin et al.	France	Randomized controlled trial	791 patients with hypoxemic acute respiratory failure	Prone positioning improved oxygenation but did not significantly reduce mortality.	The study suggests that while prone positioning enhances oxygenation, it may not translate into a mortality benefit.
Papazian et al.	France	Randomized controlled trial	340 patients with ARDS	Neuromuscular blockers improved outcomes in ARDS patients, with prone positioning as a co-intervention.	The study indicates that combining neuromuscular blockade with prone positioning may enhance patient outcomes.
Gattinoni et al.	Italy	Prospective clinical study	50 patients with ARDS	Prone positioning improved oxygenation in a majority of patients.	Early evidence supporting the use of prone positioning to enhance oxygenation in ARDS.
Kumar et al.	India	Case report	Single patient with H1N1 pneumonia-induced	The patient, after initial management with invasive mechanical	This case highlights the effectiveness of prone positioning

			severe ARDS	ventilation, was placed in the prone position for four consecutive days. Post-extubation, prone positioning was continued alongside high-flow nasal cannula (HFNC), leading to significant improvement in oxygenation.	combined with HFNC in managing severe ARDS, suggesting its utility at various stages of ARDS management.
Galiatsou et al.	Greece (Study conducted with Indian collaboration)	Prospective observational study	20 patients with early and late ARDS	Prone positioning led to significant alveolar recruitment and improved oxygenation, especially in patients with early ARDS.	The study suggests that early application of prone positioning can be beneficial in ARDS management, emphasizing the importance of timing in intervention.
Mehta et al.	India	Prospective cohort study	50 COVID-19 patients with ARDS	Awake prone positioning improved oxygenation parameters and reduced the need for intubation in a significant number of patients.	The findings support the use of awake prone positioning as a feasible and beneficial intervention in COVID-19-related ARDS, potentially reducing the burden on intensive care resources
Choudhury et al.	India	Randomized controlled trial	74 patients with moderate to severe ARDS	Patients in the prone group showed significant improvement in oxygenation and a trend towards reduced mortality compared to the supine group.	The study reinforces the efficacy of prone positioning in improving clinical outcomes in ARDS patients and advocates for its inclusion in standard care protocols.
Singh et al.	India	Retrospective	60 patients	Prone	The analysis

		analysis	**with ARDS of various etiologies**	**positioning was associated with improved oxygenation and was well-tolerated, with minimal complications**	**suggests that prone positioning is a safe and effective strategy in the management of ARDS, with potential benefits outweighing the risks.**

CONCLUSION:

Prone positioning is a proven, effective intervention in moderate-to-severe ARDS, significantly improving oxygenation and reducing mortality when applied early and for at least 12–16 hours per day. It enhances lung recruitment, reduces ventilator-induced lung injury (VILI), and optimizes gas exchange, leading to better patient outcomes.

Despite its benefits, challenges such as pressure ulcers, airway obstruction, and hemodynamic instability require careful monitoring and skilled management. The COVID-19 pandemic highlighted the success of awake prone positioning, particularly in resource-limited settings, demonstrating its feasibility beyond mechanically ventilated patients.

To maximize its effectiveness, standardized protocols, proper patient selection, and staff training are essential. Future research should focus on long-term outcomes and individualized approaches to optimize prone positioning in ARDS management.

Conflicts of Interest

The author declares that they have no conflicts of interest

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