

## In COVID positive ARDS (C-ARDS) patients, what is the effect of prone positioning on respiratory outcomes during hospitalizations?

### Background & Significance

- The U.S. COVID case count as of March 2023 is 103,802,702 (JH Coronavirus Resource Center, 2023)
- COVID-NET (2023) reported 16.4% of COVID-positive cases require ICU level care
- Symptoms of COVID include SpO<sub>2</sub><94, PF ratio below 300 mmHg, increased respiratory rate, and lung infiltrates
- Clinical presentation of COVID is similar to "Classic ARDS"
- Proning is considered beneficial in care of "Classic ARDS"
  - Increased surface area to redistribute stress
  - Improved lung shape (Guerin et al., 2020)
  - Decreased rate of intubation and mortality rate
  - Improved PF ratio (Tan et al., 2021)

During the COVID-19 pandemic, studies began analyzing if prone positioning could be an effective tool for COVID-19 patients, due to the similarity of severe hypoxemia, pulmonary edema, and inflammation (Krynyska et al., 2021).

Prone positioning consists of placing a patient on their abdomen for more than 12 hours (Guerin et al., 2020, pg. 2386)

### Literature Review

- CINAHL: (prone position OR proning OR patient position) AND (covid OR covid-19 OR coronavirus) AND (ards OR respiratory distress) with 180 results
  - Limit to peer reviewed + research article = 63 results
- PUBMED: (prone position OR proning OR patient position) AND (covid OR covid-19 OR coronavirus) with 2854 results
  - Limit to clinical trial + RCT = 59 results

Articles were excluded if there were multiple interventions studied or if the comparison was not the normal standard of care. Seven were investigated further for the purpose of this project review.

Inclusion criteria for each study was similar and generally consisted of patients 18 years and older, suspected or confirmed COVID-19 infection, receiving supplemental oxygen or ventilated and/or had a diagnosis of ARDS or pneumonia.

### Figures

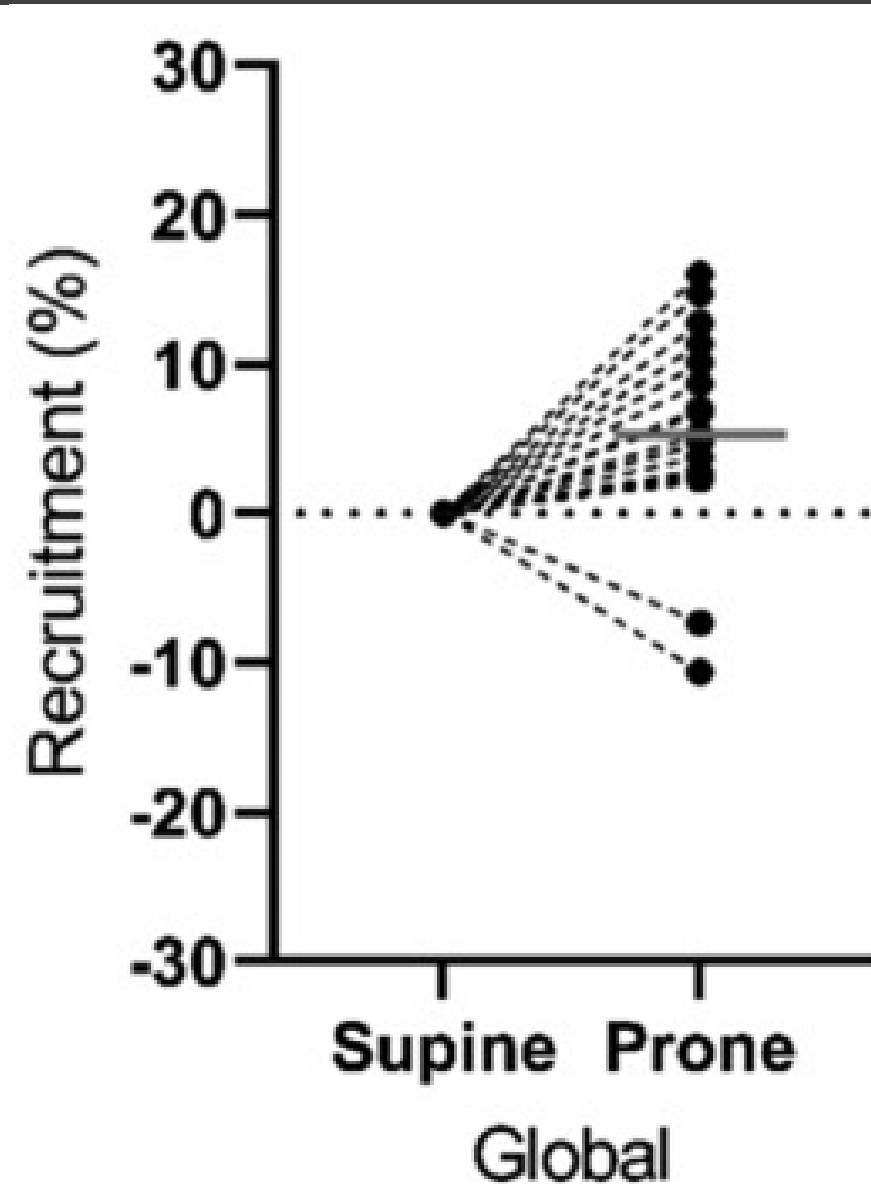


Figure 1. Fossali et al. (2022) graph showing global lung recruitment and derecruitment in prone position.

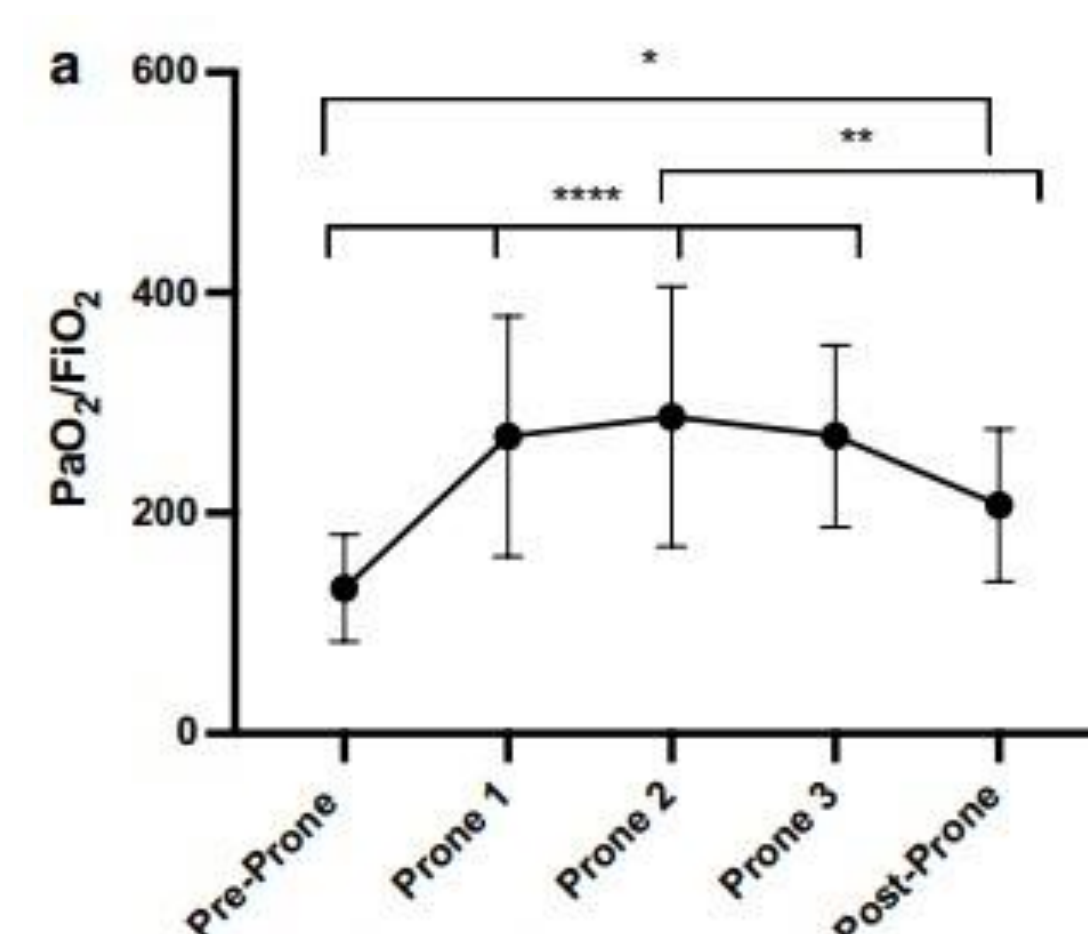


Figure 2. Clarke et al. (2021) graph showing change in PF ratio in relation to position and time.

### Results

Author(s) and year	Research Question	Study Design (JHNEBP Score)	Main Results
Alhazzani, W., Parhar, K. S., Weatherald, J., Al Duhailib, Z., Alshahrani, M., Al-Fares, A., et al., 2022.	Does awake prone positioning reduce endotracheal intubation when compared to usual care in COVID patients with hypoxic respiratory failure?	• RCT • n=400, ICUs across 21 hospitals • Prone goal of 8-10H (I B)	The study found the rate of intubation at 30 days with prone positioning to be 34.1% and with usual care to be 40.5%, with p=0.2.
Clarke, J., Geoghegan, P., McEvoy, N., Boylan, M., Ní Choileáin, O., Mulligan, M., et al., 2021.	What are the effects of prone position on respiratory mechanics and oxygenation in ventilated C-ARDS patients?	• Single center cohort observational • n=21, ICU • Data from EHRs • Proning as part of care (III A)	The average PF ratio during prone position was 286 mmHg (132 mmHg improvement). The majority saw a >20% increase from baseline.
Coppo, A., Bellani, G., Winterton, D., Di Pierro, M., Soria, A., Faverio, P., et al., 2020.	What is the effect of prone positioning on gas exchange in awake, non-intubated patients with COVID-19 pneumonia?	• Single-center cohort • n=56 • minimum goal of 3H prone (II B)	The patients in the prone position had a PaO <sub>2</sub> /FiO <sub>2</sub> ratio of 285.5 mm Hg compared to 180.5 mm Hg, p value was reported at <0.0001.
Ehrmann, S., Li, J., Ibarra-Estrada, M., Perez, Y., Pavlov, I., McNicholas, et al., 2021.	What is the effect of prone positioning in awake patients with Covid-19 associated hypoxemia and respiratory failure on the need for intubation?	• RCT, open-label meta-trial • n=1121, multinational • APP vs. high-flow nasal cannula (I A)	The primary outcome, treatment failure at day 28 was reported at 40% for the prone group and 46% for the standard care. The relative risk was 0.86 with a confidence interval of 0.75-0.98.
Fossali, T., Pavlovsky, B., Ottolina, D., Colombo, R., Basile, M. C., Castelli, A., et al., 2022.	Use CT scan and EIT to understand the physiological mechanisms of improved oxygenation resulting from prone positioning in patients with C-ARDS.	• quasi experimental • n=21, intubated in COVID ICU • CT & EIT scans to compare prone and supine (II B)	Recruitment in the dorsal part of the lungs was reported at 12.5% ± 8.0%, p<0.001. This suggests that proning had a statistically significant impact on lung recruitment. Additionally, the dead-space/shunt ratio decreased 5.1, p=0.035.
Rosén, J., von Oelreich, E., Fors, D., Jonsson Fagerlund, M., Taxbro, K., Skorup, P., et al., 2021	What is the effect of prone positioning in awake patients with Covid-19 associated hypoxemia and respiratory failure?	• RCT • n=75, across 2 hospitals • goal of 16H prone/day (I A)	After 30 days of treatment, 33% of patients in both groups were intubated. The intervention did not reduce the rate of intubation.
Ibarra-Estrada, M., Li, J., Pavlov, I., Perez, Y., Roca, O., Tavernier, E., et al., 2022.	Does awake prone positioning reduce the need for intubation and invasive ventilation of patients with COVID-19-induced acute hypoxemic respiratory failure (AHRF)?	• RCT, multi-center • n=430, across 2 hospitals • APP (I B)	The APP group had more treatment success (59% vs 48%) and a shorter hospital length of stay (11 vs 13 days), compared to standard care. P reported at 0.006.

### Nursing Considerations

- Adverse events can also occur (Rodríguez-Huerta et al., 2022):
  - The accidental loss or displacement of vascular accesses, drains, or catheters
  - Accidental extubation, or endotracheal tube obstruction
  - Corneal and lingual injuries
  - Vomiting or intolerance of nutrition
  - Increased risk of pressure ulcer development
- Considerations for practice:
  - Shift the patient's head every two hours and repositioning the head every four hours (Morata et al., 2023).
  - Apply prophylactic soft silicone foam dressings
  - Stop tube feedings 1 hour before to prevent aspiration, vomiting, enteral intolerance
  - Utilize at least 5 caregivers when proning a vented patient to prioritize safety of the patient and caregivers
- Potential nurse led/managed intervention for critically ill or at risk patients

### Recommendations

Based on evidence, it seems the respiratory benefits outweigh the risks and prone positioning is recommended for C-ARDS patients.

Further research on the effect of APP on intubation incidence is needed since studies had difficulty with adherence to proning goal.

Further research on amount of time needed to maximize respiratory benefits warranted.

### References & Resources



Scan me for information and a complete list of references!

### Synthesis of Findings

- Inconclusive results if awake prone positioning is statistically significant at reducing intubation
  - Alhazzani et al. (2022) suggest it is clinically significant
  - Coppo et al. (2020) found improved PF ratio but it was not sustained
  - Ehrmann et al. (2021), a large RCT, and Ibarra-Estrada et al. (2022) found statistically significant improvement
  - In all studies on APP, there were poor adherence to recommended intervention
- CT and EIT showed lung recruitment, improved dead-space shunt ratio, and decreased atelectrauma- all are markers of improved oxygenation
- Suggested that prone position benefits are dose dependent- studies recommend longer periods of time prone for max benefits
- A number of studies found improved PF ratio, some >20% increase from baseline
- Mixed data about the effects of proning on length of stay and mortality
- Low incidence of adverse events such as skin breakdown and vomiting associated with prone position

