

Semi Recumbent Ventilation and Traditional Supine Vs Prone Ventilation in Reducing Mortality in ARDS Adult Patients Needed Invasive Conventional Artificial Ventilation; Systematic Review

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Abstract

Study aim: The purpose of this study was to determine whether prone ventilation, as opposed to semi-recumbent ventilation or conventional supine, gives a mortality advantage in patients who need conventional invasive ventilation due to ARF.

Method: The Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guideline was followed in the conduct of this study. We searched electronic databases (PubMed, Google Scholar, and Embase) for relevant literature. Included were observational studies or randomized controlled trials that compared MV in the PP with conventional techniques in the supine or semi-recumbent posture for patients with ARF and were published between 2006 and 2014.

Result and conclusion: Five studies—four randomized controlled trials and one observational study—were considered in this evaluation. Participants in the study include patients with refractory ARDS on MV, adults with ARDS on MV and endotracheal intubation for ARDS shorter than 36 hours, and severe ARDS. The prognosis of ARDS patients is improved by early sustained prone posture. According to one study, prone posture has no discernible positive impact on mortality for ARDS patients or subgroups of patients with hypoxemia. The PRONE treatment was a safe and effective way to increase oxygenation in patients with severe CAP and ARDS. Prone also affected the expression of IL-6 in patients with severe CAP.

Keywords: Semi recumbent ventilation, traditional supine, prone ventilation, acute respiratory distress syndrome, invasive conventional artificial ventilation.

Introduction

Acute respiratory failure (ARF) is a frequent cause of hospitalization and can result from a variety of illnesses or disease processes. Intensive care units may be recommended for patients with severe gas

exchange abnormalities who do not respond to ward-based interventions. Patients with pneumonia, are among those whose issues are primarily associated with oxygenation. A significant portion of hypoxemia patients in the ICU have been documented to have acute lung damage and acute respiratory distress syndrome (1,2). ARDS can result from a wide range of disparate pulmonary and extra-pulmonary disease processes (3). Similar to acute lung injury, which is less physiologically severe, ARDS is only a syndrome and not a single disease process. Numerous distinct pulmonary and extra-pulmonary illness processes may cause it (3). ALI is now referred to as "mild ARDS" because ARDS has been redefined since the majority of research were developed or published. The mortality rates for the new mild, moderate, and severe ARDS criteria are 27%, 32%, and 45%, respectively(4).

According to Thomas and colleagues, children's underlying etiology vary greatly; their responses to therapy varied and were frequently better; and the severity of the lung injury seemed to have less of an impact on the outcome than underlying etiology (5). Regarding ventilator-induced lung damage, it is challenging to directly extrapolate clinical practice from adults to children due to the physiological and biological distinctions between infants, children, and adults' respiratory systems (6).

It can be very difficult for carers to manage both the hypoxaemia and the underlying process or processes in patients with hypoxaemia. Hypoxaemia has detrimental impacts even though it is frequently not thought of as the primary cause of death for these patients (7). One of the objectives of supportive therapy in ICU is to prevent severe hypoxemia, and many strategies are used to reduce hypoxemia. Inverse ratio ventilation, alveolar recruitment techniques, restrictive fluid administration methods, inhaled pulmonary vasodilators like prostacyclin and nitric oxide, neuromuscular blockers, and corticosteroids positive end-expiratory pressure, and mechanical ventilation in the prone position (PP) are a few examples (8).

The purpose of this study was to determine whether prone ventilation, as opposed to semi-recumbent ventilation or conventional supine, gives a mortality advantage in patients who need invasive ventilation due to ARF.

Method

This study was conducted according to the Preferred Reporting Items for Systematic reviews and Meta-Analyses (PRISMA) statement. We conducted a literature search through electronic databases (PubMed, Google scholar, and Embase). Randomized controlled trials or observational studies that contrasted MV in the PP with traditional methods in the supine or semi-recumbent posture for individuals experiencing ARF, and published in the period from 2006 to 2014 were included. Studies on critically ill patients in intensive care units who needed traditional MV for acute severe respiratory failure were included. Our outcome of interest was the mortality either short term or long term.

All citations were checked and categorized by two writers independently as possible primary studies, review papers, or other sources for inclusion. After looking over every possible primary study, two review writers determined if it should be included in the review. All of our disagreements were settled through dialogue. Each study's procedures and results were independently retrieved in duplicate by two authors.

Result and discussion

In this review we included 5 researches, 4 randomized controlled trials and one observational study. Participants of the studies include; MV and endotracheal intubation for ARDS less than 36 hours and Severe ARDS (9); CAP(10); patients on MV who have early, refractory ARDS(11); ARDS (12); adults with ARDS on MV(13) (Table 1).

Three of the included studies(9,12,13) claim that there is no discernible survival benefit to using PPs for extended periods of time. In contrast to the initial Prone-Supine investigation(14), a particular protocol was created for the Taccone et al.(12) trial to direct ongoing adjustments in the MV settings. Prone stance may actually support the lung-protective breathing method, according to the reasoning behind the approach (15). In fact, doctors may be able to lower potentially hazardous amounts of oxygen in inspired air, tidal volumes, and positive end-expiratory pressures by utilizing the possible improvement in oxygenation and respiratory compliance linked to PPing(15). However, Taccone et al.(12) findings indicate that only FIO₂ was considerably lower in the PP as compared to the supine position.

A research by Guérin et al.(9) found that the prone group had a considerably greater survival rate following severe ARDS than the supine group. Furthermore, even though the supine group's mortality was lower than expected, the impact magnitude was still quite high. Despite the fact that earlier randomized studies have not demonstrated a survival benefit with PPing, their results are in line with earlier meta-analyses (16,17) and an observational study (18). PPing appears to improve outcomes for the subset of patients with severe hypoxemia, according to meta-analyses of ARDS trials (16,17).

These findings could be explained by a number of factors. First, oxygenation, PEEP, and Fio₂ levels were used to select patients with severe ARDS. Second, patients were included once the ARDS criteria had been verified, which took 12 to 24 hours. This time frame might have played a role in choosing patients with more severe ARDS¹⁹ who would benefit from the PPing's benefits, which include preventing ventilator-induced lung injury and relieving severe hypoxemia. According to a prior study, PPing significantly lessens the overinflated lung regions while encouraging alveolar recruitment as compared to supine orientation. By uniformizing the distribution of stress and strain throughout the lungs, these effects (reduction of overdistention and recruitment augmentation) may aid in preventing ventilator-induced lung injury.

Guérin et al.(9) study doesn't evaluated alveolar recruitment explicitly. Nonetheless, research has demonstrated that the degree of hypoxemia is correlated with lung recruitability(4,17)and that the trans pulmonary pressure along the ventral-to-dorsal axis is more uniformly distributed in the PP as opposed to the supine position (19). We propose that prone stance reduced pulmonary stress and strain in patients with ARDS.

Table 1: method, main findings and conclusion of the included studies

Citation	Method	Main findings	Conclusion
Taccone et al., 2009 (12)	A randomized controlled study that is multicenter and unblinded. Enrolled between 2004 and 2008, the 342 persons with ARDS on mechanical breathing were prospectively divided into subgroups with moderate and severe hypoxemia.	Although the prone group experienced considerably greater rates of complications, the 28-day and 6-month death rates for prone and supine individuals from the whole research population were comparable. At 28 days and 6 months, the results for patients with mild hypoxemia in the prone and supine groups were likewise comparable. In patients with severe hypoxemia, the 6-month death rates were 52.7% and 63.2%, respectively, while the 28-day mortality rates were 37.8% in the prone group and 46.1% in the supine group.	Patients with ARDS or subgroups of patients with moderate to severe hypoxemia do not significantly benefit from prone posture in terms of survival.
Fernandez et al., 2008 (11)	Randomized controlled study in intensive care units. Forty supine patients on MV who had early and refractory ARDS despite protective ventilation. Until they recovered or passed away, patients were randomly assigned to either stay in the supine position or be transferred to the early and continuous PP.	After six hours, prone patients tended to have greater PaO ₂ /FIO ₂ than supine patients; on day three, this difference became statistically significant. Side effects from proneness were mild and curable. In prone patients, sixty-day survival achieved the desired 15% absolute gain, but because of the limited sample size, it was not significant.	This study supported the idea that early sustained PPing improves ARDS patients' chances of survival.
Guérin et al., 2013(9)	The authors of this randomized controlled study randomized 466 patients with severe acute respiratory distress syndrome to either be placed in the supine position or undergo prone-positioning procedures lasting at least 16 hours. Severe ARDS was described as having a tidal volume of nearly 6 ml per kilogram of anticipated body weight, a positive end-expiratory	In all, 229 patients were placed in the supine group and 237 patients in the prone group. In the prone group, the 28-day death rate was 16.0%, but in the supine group, it was 32.8%. With prone placement, the death hazard ratio was 0.39. With a hazard ratio of 0.44, the prone group's unadjusted 90-day mortality was 23.6%, whereas the supine group's was 41.0%. With the exception of cardiac arrests, which were more common in the supine group, there was no discernible	Early use of extended prone-positioning sessions dramatically reduced 28-day and 90-day mortality in patients with severe ARDS.

	pressure of at least 5 cm of water, a FiO ₂ of at least 0.6, and a partial pressure of arterial oxygen to FiO ₂ of less than 150 mm Hg. The percentage of patients who passed away within 28 days of being included was the main outcome.	difference in the incidence of complications between the groups.	
Mancebo et al., 2006 (13)	136 patients with severe ARDS were enrolled by the authors within 48 hours of tracheal intubation; 60 were randomly assigned to supine ventilation, and 76 to prone ventilation. Weaning procedures and ventilator settings were standardized. The goal was to provide the prone group continuous prone ventilation treatment for 20 hours every day.	The death rate in the intensive care unit was 43% for patients ventilated prone and 58% for individuals ventilated supine. When they were included, the latter had a higher simplified acute physiology score of II. Simplified acute physiology score II at inclusion, the number of days between ARDS diagnosis and inclusion, and randomization to supine position were all identified by multivariate analysis as independent risk factors for death. For a mean of 10 days, 718 turning procedures were performed, and the PP was used for an average of 17 hours each day.	When started early and used for the majority of the day, prone ventilation is safe, practicable, and may lower mortality in patients with severe acute respiratory distress syndrome.

Chan et al., 2007 (10)	In a respiratory intensive care unit, a prospective observational clinical study was carried out. There were twenty-two individuals with severe ARDS and CAP. If they fit the criteria for ARDS, they were treated with PRONE or conventional supine breathing. For a minimum of 72 hours, patients in the PRONE group were continuously ventilated while in the PP. At baseline, 24 hours, and 72 hours following enrollment, plasma cytokines were gathered and examined. Complications and serial PaO ₂ /FiO ₂ were assessed.	PRONE-related complications were mild and self-limiting. At 48 hours following enrollment, PRONE's PaO ₂ /FiO ₂ ratio was higher than SUPINE's. Over time, the PRONE group's plasma IL-6 concentration levels dramatically decreased. The 14th day mortality of every patient was also predicted by the plasma IL-6 concentration levels at enrollment, 24 hours after enrollment, and 72 hours after enrollment.	Patients with severe CAP and ARDS were able to improve their oxygenation with the safe and efficient PRONE procedure. In patients with severe CAP, PRONE also had an impact on IL-6 expression.
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Conclusion

Early sustained PPing improves ARDS patients' chances of survival. One study found that ARDS Patients or subgroups of patients with moderate to severe hypoxemia do not significantly benefit from prone posture in terms of survival. Patients with severe CAP and ARDS were able to improve their oxygenation with the safe and efficient PRONE procedure. In patients with severe CAP, PRONE also had an impact on IL-6 expression.

List of abbreviations:

FiO₂, Fraction of inspired oxygen

ARDS, Acute respiratory distress syndrome

CAP, community-acquired pneumonia

MV, mechanical ventilation

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