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**Prone position in respiratory failure**

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## Overview

Much of the information on the use of proning in ARDS or respiratory failure is unspecific to the age of the population. The research suggests that mortality in the elderly is due to the number of morbidities being experienced.

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## A. National and International Guidance

#### Faculty of Intensive Care Medicine (FICM)

**Guidelines on the management of acute respiratory distress syndrome** (2018)

[Available online at this link](https://www.knowledgeshare.nhs.uk/index.php?PageID=link_resolver&link=af5591001643fc6cbcbc25c0c54fc4d8)

p36 prone positioning p.38 Treatment Harms Overall the pooled risk of any adverse event with prone positioning was significantly increased (RR 1.10; 95%CI 1.01-1.12). Where a more detailed analysis of adverse events was conducted, endotracheal tube displacement (RR 1.33; 95%CI 1.02-1.74), the incidence of pressure sores (1.23; 95%CI 1.07-1.41) and loss of venous access 39 (RR 1.98; 95%CI 1.11-3.55) were significantly increased. However, this evidence was down-graded based on the risk of bias and imprecision in the trials evaluated. GRADE Recommendation Statement We do not recommend the use of prone positioning for all patients with ARDS. We recommend the use of prone positioning for at least 12hours per day in patients with moderate/severe ARDS (P/F ratio <20kPa: GRADE recommendation: strongly in favour)

## B. Synopses or Summaries

#### BMJ Best Practice

**Acute respiratory distress syndrome** (2019)

[Available online at this link](https://www.knowledgeshare.nhs.uk/index.php?PageID=link_resolver&link=3337bbae13c34737f5aef1da66bd7bb9)

Approach: Prone positioning: Prone positioning can improve oxygenation in patients with ARDS and has been shown to reduce mortality in patients with severe ARDS (PaO₂/FiO₂ <150). One systematic review found that reduced mortality was contingent upon patients remaining prone for at least 12 hours daily. Given the potential complications of prone positioning, including facial oedema, pressure sores, and dislodgement of catheters and endotracheal tubes, prone positioning should only be considered in patients with severe ARDS (PaO₂/FiO₂ <150).

#### UPToDate

**Acute respiratory distress syndrome: Supportive care and oxygenation in adults** (2020)

[Available online at this link](https://www.knowledgeshare.nhs.uk/index.php?PageID=link_resolver&link=9a9e72946bbfd6711a8f76ee9311fdd4)

Prone positioning improves oxygenation in the majority of patients with ARDS. Small uncontrolled studies, subpopulation meta-analyses and one large multicenter randomized trial suggest a survival advantage among patients with severe ARDS

#### UpToDate

**Prone ventilation for adult patients with acute respiratory distress syndrome** (2020)

[Available online at this link](https://www.knowledgeshare.nhs.uk/index.php?PageID=link_resolver&link=109bfdce4e3290faba9e9f34e7b63887)

Prone positioning increases the risk of certain complications...

## C. Systematic Reviews

#### Medicina intensiva

**The effects of prone position ventilation in patients with acute respiratory distress syndrome. A systematic review and meta-analysis.** (2015)

Mora-Arteaga JA, Bernal-Ramírez OJ, Rodríguez SJ

INTRODUCTION: Prone position ventilation has been shown to improve oxygenation and ventilatory mechanics in patients with acute respiratory distress syndrome. We evaluated whether prone ventilation reduces the risk of mortality in adult patients with acute respiratory distress syndrome versus supine ventilation. METHODOLOGY: A meta-analysis of randomized controlled trials comparing patients in supine versus prone position was performed. A search was conducted of the Pubmed, Embase, Cochrane Library, and LILACS databases. Mortality, hospital length of stay, days of mechanical ventilation and adverse effects were evaluated. RESULTS: Seven randomized controlled trials (2,119 patients) were included in the analysis. The prone position showed a nonsignificant tendency to reduce mortality (OR: 0.76; 95%CI: 0.54 to 1.06; P=.11, I(2) 63%). When stratified by subgroups, a significant decrease was seen in the risk of mortality in patients ventilated with low tidal volume (OR: 0.58; 95%CI: 0.38 to 0.87; P=.009, I(2) 33%), prolonged pronation (OR: 0.6; 95%CI: 0.43 to 0.83; p=.002, I(2) 27%), start within the first 48hours of disease evolution (OR 0.49; 95%CI 0.35 to 0.68; P=.0001, I(2) 0%) and severe hypoxemia (OR: 0.51: 95%CI: 0.36 to 1.25; P=.0001, I(2) 0%). Adverse effects associated with pronation were the development of pressure ulcers and endotracheal tube obstruction. CONCLUSIONS: Prone position ventilation is a safe strategy and reduces mortality in patients with severely impaired oxygenation. It should be started early, for prolonged periods, and should be associated to a protective ventilation strategy.

#### Respiratory Care

**A Comprehensive Review of Prone Position in ARDS** (2015)

Kallet RH

[Available online at this link](https://www.knowledgeshare.nhs.uk/index.php?PageID=link_resolver&link=b23def78797b64d9493d108972b48f3a)

Prone position (PP) has been used since the 1970s to treat severe hypoxemia in patients with ARDS because of its effectiveness at improving gas exchange. Compared with the supine position (SP), placing patients in PP effects a more even tidal volume distribution, in part, by reversing the vertical pleural pressure gradient, which becomes more negative in the dorsal regions. PP also improves resting lung volume in the dorsocaudal regions by reducing the superimposed pressure of both the heart and the abdomen. In contrast, pulmonary perfusion remains preferentially distributed to the dorsal lung regions, thus improving overall alveolar ventilation/perfusion relationships. Moreover, the larger tissue mass suspended from a wider dorsal chest wall effects a more homogeneous distribution of pleural pressures throughout the lung that reduces abnormal strain and stress development. This is believed to ameliorate the severity or development of ventilator-induced lung injury and may partly explain why PP reduces mortality in severe ARDS. Over 40 years of clinical trials have consistently reported improved oxygenation in approximately 70% of subjects with ARDS. Early initiation of PP is more likely to improve oxygenation than initiation during the subacute phase. Maximal oxygenation improvement occurs over a wide time frame ranging from several hours to several days. Meta-analyses of randomized controlled trials suggest that PP provides a survival advantage only in patients with relatively severe ARDS (PaO2/FIO2<150 mm Hg).Moreover, survival is enhanced when patients are managed with a smaller tidal volume (<8 mL/kg), higher PEEP (10–13 cm H2O), and longer duration of PP sessions (>10–12 h/session). Combining adjunctive therapies (high PEEP, recruitment maneuvers, and inhaled vasodilators) with PP has an additive effect in improving oxygenation and may be particularly helpful in stabilizing gas exchange in very severe ARDS.

#### The Cochrane Database of Systematic Reviews

**Prone position for acute respiratory failure in adults.** (2015)

Bloomfield R., Noble DW, Sudlow A.

BACKGROUND: Acute hypoxaemia de novo or on a background of chronic hypoxaemia is a common reason for admission to intensive care and for provision of mechanical ventilation. Various refinements of mechanical ventilation or adjuncts are employed to improve patient outcomes. Mortality from acute respiratory distress syndrome, one of the main contributors to the need for mechanical ventilation for hypoxaemia, remains approximately 40%. Ventilation in the prone position may improve lung mechanics and gas exchange and could improve outcomes. OBJECTIVES: The objectives of this review are (1) to ascertain whether prone ventilation offers a mortality advantage when compared with traditional supine or semi recumbent ventilation in patients with severe acute respiratory failure requiring conventional invasive artificial ventilation, and (2) to supplement previous systematic reviews on prone ventilation for hypoxaemic respiratory failure in an adult population. SEARCH METHODS: We searched the Cochrane Central Register of Controlled Trials (CENTRAL; 2014, Issue 1), Ovid MEDLINE (1950 to 31 January 2014), EMBASE (1980 to 31 January 2014), the Cumulative Index to Nursing and Allied Health Literature (CINAHL) (1982 to 31 January 2014) and Latin American Caribbean Health Sciences Literature (LILACS) (1992 to 31 January 2014) in Ovid MEDLINE for eligible randomized controlled trials. We also searched for studies by handsearching reference lists of relevant articles, by contacting colleagues and by handsearching published proceedings of relevant journals. We applied no language constraints, and we reran the searches in CENTRAL, MEDLINE, EMBASE, CINAHL and LILACS in June 2015. We added five new studies of potential interest to the list of "Studies awaiting classification" and will incorporate them into formal review findings during the review update. SELECTION CRITERIA: We included randomized controlled trials (RCTs) that examined the effects of prone position versus supine/semi recumbent position during conventional mechanical ventilation in adult participants with acute hypoxaemia. DATA COLLECTION AND ANALYSIS: Two review authors independently reviewed all trials identified by the search and assessed them for suitability, methods and quality. Two review authors extracted data, and three review authors reviewed the data extracted. We analysed data using Review Manager software and pooled included studies to determine the risk ratio (RR) for mortality and the risk ratio or mean difference (MD) for secondary outcomes; we also performed subgroup analyses and sensitivity analyses. MAIN RESULTS: We identified nine relevant RCTs, which enrolled a total of 2165 participants (10 publications). All recruited participants suffered from disorders of lung function causing moderate to severe hypoxaemia and requiring mechanical ventilation, so they were fairly comparable, given the heterogeneity of specific disease diagnoses in intensive care. Risk of bias, although acceptable in the view of the review authors, was inevitable: Blinding of participants and carers to treatment allocation was not possible (face-up vs face-down).Primary analyses of short- and longer-term mortality pooled from six trials demonstrated an RR of 0.84 to 0.86 in favour of the prone position (PP), but findings were not statistically significant: In the short term, mortality for those ventilated prone was 33.4% (363/1086) and supine 38.3% (395/1031). This resulted in an RR of 0.84 (95% confidence interval (CI) 0.69 to 1.02) marginally in favour of PP. For longer-term mortality, results showed 41.7% (462/1107) for prone and 47.1% (490/1041) for supine positions, with an RR of 0.86 (95% CI 0.72 to 1.03). The quality of the evidence for both outcomes was rated as low as a result of important potential bias and serious inconsistency. Subgroup analyses for mortality identified three groups consistently favouring PP: those recruited within 48 hours of meeting entry criteria (five trials; 1024 participants showed an RR of 0.75 (95% CI 0.59 to 94)); those treated in the PP for 16 or more hours per day (five trials; 1005 participants showed an RR of 0.77 (95% CI 0.61 to 0.99)); and participants with more severe hypoxaemia at trial entry (six trials; 1108 participants showed an RR of 0.77 (95% CI 0.65 to 0.92)). The quality of the evidence for these outcomes was rated as moderate as a result of potentially important bias. Prone positioning appeared to influence adverse effects: Pressure sores (three trials; 366 participants) with an RR of 1.37 (95% CI 1.05 to 1.79) and tracheal tube obstruction with an RR of 1.78 (95% CI 1.22 to 2.60) were increased with prone ventilation. Reporting of arrhythmias was reduced with PP, with an RR of 0.64 (95% CI 0.47 to 0.87). AUTHORS' CONCLUSIONS: We found no convincing evidence of benefit nor harm from universal application of PP in adults with hypoxaemia mechanically ventilated in intensive care units (ICUs). Three subgroups (early implementation of PP, prolonged adoption of PP and severe hypoxaemia at study entry) suggested that prone positioning may confer a statistically significant mortality advantage. Additional adequately powered studies would be required to confirm or refute these possibilities of subgroup benefit but are unlikely, given results of the most recent study and recommendations derived from several published subgroup analyses. Meta-analysis of individual patient data could be useful for further data exploration in this regard. Complications such as tracheal obstruction are increased with use of prone ventilation. Long-term mortality data (12 months and beyond), as well as functional, neuro-psychological and quality of life data, are required if future studies are to better inform the role of PP in the management of hypoxaemic respiratory failure in the ICU.

## D. Original Research

1. **Mechanical Ventilation Management during Extracorporeal Membrane Oxygenation for Acute Respiratory Distress Syndrome. An International Multicenter Prospective Cohort.**  
   Schmidt Matthieu American journal of respiratory and critical care medicine 2019;200(8):1002-1012.

Rationale: Current practices regarding mechanical ventilation in patients treated with extracorporeal membrane oxygenation (ECMO) for acute respiratory distress syndrome are unknown. Objectives: To report current practices regarding mechanical ventilation in patients treated with ECMO for severe acute respiratory distress syndrome (ARDS) and their association with 6-month outcomes. Methods: This was an international, multicenter, prospective cohort study of patients undergoing ECMO for ARDS during a 1-year period in 23 international ICUs. Measurements and Main Results: We collected demographics, daily pre- and per-ECMO mechanical ventilation settings and use of adjunctive therapies, ICU, and 6-month outcome data for 350 patients (mean ± SD pre-ECMO PaO2/FiO2 71 ± 34 mm Hg). Pre-ECMO use of prone positioning and neuromuscular blockers were 26% and 62%, respectively. Vt (6.4 ± 2.0 vs. 3.7 ± 2.0 ml/kg), plateau pressure (32 ± 7 vs. 24 ± 7 cm H2O), driving pressure (20 ± 7 vs. 14 ± 4 cm H2O), respiratory rate (26 ± 8 vs. 14 ± 6 breaths/min), and mechanical power (26.1 ± 12.7 vs. 6.6 ± 4.8 J/min) were markedly reduced after ECMO initiation. Six-month survival was 61%. No association was found between ventilator settings during the first 2 days of ECMO and survival in multivariable analysis. A time-varying Cox model retained older age, higher fluid balance, higher lactate, and more need for renal-replacement therapy along the ECMO course as being independently associated with 6-month mortality. A higher Vt and lower driving pressure (likely markers of static compliance improvement) across the ECMO course were also associated with better outcomes. Conclusions: Ultraprotective lung ventilation on ECMO was largely adopted across medium- to high-case volume ECMO centers. In contrast with previous observations, mechanical ventilation settings during ECMO did not impact patients' prognosis in this context.

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1. **Personalised mechanical ventilation tailored to lung morphology versus low positive end-expiratory pressure for patients with acute respiratory distress syndrome in France (the LIVE study): a multicentre, single-blind, randomised controlled trial**  
   Jean-Michel Constantin et al The Lancet Respiratory Medicine 2019;(October):870-880.

Background The effect of personalised mechanical ventilation on clinical outcomes in patients with acute respiratory distress syndrome (ARDS) remains uncertain and needs to be evaluated. We aimed to test whether a mechanical ventilation strategy that was personalised to individual patients’ lung morphology would improve the survival of patients with ARDS when compared with standard of care. Methods We designed a multicentre, single-blind, stratified, parallel-group, randomised controlled trial enrolling patients with moderate-to-severe ARDS in 20 university or non-university intensive care units in France. Patients older than 18 years with early ARDS for less than 12 h were randomly assigned (1:1) to either the control group or the personalised group using a minimisation algorithm and stratified according to the study site, lung morphology, and duration of mechanical ventilation. Only the patients were masked to allocation. In the control group, patients received a tidal volume of 6 mL/kg per predicted bodyweight and positive end-expiratory pressure (PEEP) was selected according to a low PEEP and fraction of inspired oxygen table, and early prone position was encouraged. In the personalised group, the treatment approach was based on lung morphology; patients with focal ARDS received a tidal volume of 8 mL/kg, low PEEP, and prone position. Patients with non-focal ARDS received a tidal volume of 6 mL/kg, along with recruitment manoeuvres and high PEEP. The primary outcome was 90-day mortality as established by intention-to-treat analysis. This study is registered online with ClinicalTrials.gov, NCT02149589. Findings From June 12, 2014, to Feb 2, 2017, 420 patients were randomly assigned to treatment. 11 patients were excluded in the personalised group and nine patients were excluded in the control group; 196 patients in the personalised group and 204 in the control group were included in the analysis. In a multivariate analysis, there was no difference in 90-day mortality between the group treated with personalised ventilation and the control group in the intention-to-treat analysis (hazard ratio [HR] 1·01; 95% CI 0·61–1·66; p=0·98). However, misclassification of patients as having focal or non-focal ARDS by the investigators was observed in 85 (21%) of 400 patients. We found a significant interaction between misclassification and randomised group allocation with respect to the primary outcome (p<0·001). In the subgroup analysis, the 90-day mortality of the misclassified patients was higher in the personalised group (26 [65%] of 40 patients) than in the control group (18 [32%] of 57 patients; HR 2·8; 95% CI 1·5–5·1; p=0·012. Interpretation Personalisation of mechanical ventilation did not decrease mortality in patients with ARDS, possibly because of the misclassification of 21% of patients. A ventilator strategy misaligned with lung morphology substantially increases mortality. Whether improvement in ARDS phenotyping can decrease mortality should be assessed in a future clinical trial

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1. **Acute Respiratory Distress Syndrome and Prone Positioning.**  
   Mitchell DA AACN advanced critical care 2018;29(4):415-425.

Acute respiratory distress syndrome continues to have high morbidity and mortality despite more than 50 years of research. The Berlin definition in 2012 established risk stratification based on degree of hypoxemia and the use of positive end-expiratory pressure. The use of prone positioning as a treatment modality has been studied for more than 40 years, with recent studies showing an improvement in oxygenation and decreased mortality. The studies also provide evidence to support the methodology and length of treatment time. Recent guidelines include several ventilator strategies for acute respiratory distress syndrome, including prone positioning. Protocols and procedures discussed in this article ensure successful prone repositioning and prevention of complications related to the procedure itself.

1. **Successful management of prolonged venovenous extracorporeal membrane oxygenation in an octogenarian**  
   Takagaki Masami Journal of Artificial Organs 2017;20(4):377-380.

Venovenous extracorporeal membrane oxygenation is now an established treatment for acute respiratory distress syndrome. However, this treatment remains rare in octogenarians and is associated with poor outcomes. An 81-year-old man with a history of chronic obstructive pulmonary disease and heavy smoking underwent mitral and tricuspid valve repair and the Maze procedure for mitral and tricuspid regurgitation and paroxysmal atrial fibrillation. Although he was extubated the following day, his postoperative course was complicated with pneumonia followed by acute respiratory distress syndrome. He was reintubated on day 7. Ratio of partial pressure of arterial oxygen to fraction of inspired oxygen continuously dropped to less than 100 mmHg, and venovenous extracorporeal membrane oxygenation support was induced on day 18. His lung condition showed slow and steady recovery, and he was successfully weaned from mechanical support on day 44 (total support, 27 days). Bleeding complication from tracheotomy (day 31) due to disseminated intravascular coagulation was successfully managed using recombinant human soluble thrombomodulin. He was ambulatory and discharged to a nursing facility without tracheotomy on day 172. Proper extracorporeal membrane oxygenation management, while challenging to keep the elderly patient away from further complications, saved an 81-year-old patient.

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1. **A Comparative Effectiveness Study of Rescue Strategies in 1,000 Subjects With Severe Hypoxemic Respiratory Failure.**  
   Moreno Franco P. Respiratory care 2016;61(2):127-33.

BACKGROUND: Subjects with severe hypoxemic respiratory failure have shown a high mortality in previous studies. METHODS: All adult ICU patients requiring mechanical ventilation from 2005 to 2010 at Mayo Clinic were screened for severe hypoxemia (Murray lung injury score of ≥ 3). Extracorporeal membrane oxygenation, prone positioning, high-frequency oscillatory ventilation (HFOV), and inhaled vasodilators were considered as rescue strategies. A propensity-based scoring was created for the indication or predilection to use each strategy. A model was created to evaluate the association of each rescue strategy with hospital mortality. RESULTS: Among 1,032 subjects with severe hypoxemia, 239 subjects received some form of rescue strategy (59 received a combination of therapies, and 180 received individual therapies). Inhaled vasodilators were the most common, followed by HFOV. Rescue strategies were used in younger subjects with severe oxygenation deficits. Subjects receiving rescue strategies had higher mortality and longer ICU stays. None of the strategies individually or in combination showed a significant association with hospital mortality after adjusting covariates by propensity scoring. Adjusted Odds ratios and respective 95% CI were as follows: HFOV 0.67 (0.35-1.27), extracorporeal membrane oxygenation 0.63 (0.18-1.92), prone position 1.07 (0.49-2.28), and inhaled vasodilators 1.17 (0.78-1.77). CONCLUSIONS: In this retrospective comparative effectiveness study, there was no association of rescue strategies with hospital mortality in subjects with severe hypoxemia.

1. **Lung ultrasound can be used to predict the potential of prone positioning and assess prognosis in patients with acute respiratory distress syndrome.**  
   Wang Xiao-Ting Critical care (London, England) 2016;20(1):385.

BACKGROUND It is very important to assess the effectiveness of prone positioning (PP) in patients with severe acute respiratory distress syndrome (ARDS). However, it is difficult to identify patients who may benefit from PP. The purpose of this study was to investigate whether prone positioning potential (PPP) can be predicted by lung ultrasound in patients with ARDS. METHODS In this prospective study, 45 patients with ARDS were included for the assessment of PPP. A PP lung ultrasound examination (PLUE) protocol was performed in the dorsal regions of the lung in 16 areas at H0, H3, and H6 (0, 3, and 6 h after PP). The ultrasonography videos were blindly evaluated by two expert clinicians to classify the lung regions as normal pattern (N), moderate loss of lung aeration (B1), severe loss of lung aeration (B2), and consolidation (C). The aeration scores were collected at H0, H3, and H6. According to the ratio of partial pressure of arterial oxygen to fraction of inspired oxygen (P/F ratio) at 7 days, patients were classified into PPP-positive (P/F ratio >300) and PPP-negative groups; also, the patients were classified into survival and nonsurvival groups according to 28-day mortality. RESULTS Aeration scores was compared at H0, H3, and H6. The scores were significantly reduced between H3 and H0, but there was no difference between H3 and H6. The aeration score variation (ASV) of the PPP-positive group between H3 and H0 was significantly higher than that in the PPP-negative group, and the sensitivity and specificity of ASV ≥5.5 for the PPP-positive group were 73.9% and 86.4%, respectively. The area under the receiver operating characteristic curve (AUROC) was 0.852 for the ASV. The ASV between H3 and H0 in the survival group was significantly higher than in the nonsurvival group. The sensitivity and specificity of ASV ≥7 for survival were 51.5% and 75%, respectively. The AUROC was 0.702 for the ASV. CONCLUSIONS The PLUE protocol can be used to predict PPP and assess prognosis in patients with ARDS.

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1. **Prone positioning improves oxygenation in spontaneously breathing nonintubated patients with hypoxemic acute respiratory failure: A retrospective study.**  
   Scaravilli Vittorio Journal of critical care 2015;30(6):1390-1394.

PURPOSE Prone positioning (PP) improves oxygenation and outcome of patients with acute respiratory distress syndrome undergoing invasive ventilation. We evaluated feasibility and efficacy of PP in awake, non-intubated, spontaneously breathing patients with hypoxemic acute respiratory failure (ARF). MATERIAL AND METHODS We retrospectively studied non-intubated subjects with hypoxemic ARF treated with PP from January 2009 to December 2014. Data were extracted from medical records. Arterial blood gas analyses, respiratory rate, and hemodynamics were retrieved 1 to 2 hours before pronation (step PRE), during PP (step PRONE), and 6 to 8 hours after resupination (step POST). RESULTS Fifteen non-intubated ARF patients underwent 43 PP procedures. Nine subjects were immunocompromised. Twelve subjects were discharged from hospital, while 3 died. Only 2 maneuvers were interrupted, owing to patient intolerance. No complications were documented. PP did not alter respiratory rate or hemodynamics. In the subset of procedures during which the same positive end expiratory pressure and Fio2 were utilized throughout the pronation cycle (n=18), PP improved oxygenation (Pao2/Fio2 124±50 mmHg, 187±72 mmHg, and 140±61 mmHg, during PRE, PRONE, and POST steps, respectively, P<.001), while pH and Paco2 were unchanged. CONCLUSIONS PP was feasible and improved oxygenation in non-intubated, spontaneously breathing patients with ARF.

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1. **The PRESERVE mortality risk score and analysis of long-term outcomes after extracorporeal membrane oxygenation for severe acute respiratory distress syndrome.**  
   Schmidt M. Intensive Care Medicine 2013;39(10):1704-13.

Abstract PURPOSE: This study was designed to identify factors associated with death by 6 months post-intensive care unit (ICU) discharge and to develop a practical mortality risk score for extracorporeal membrane oxygenation (ECMO)-treated acute respiratory distress syndrome (ARDS) patients. We also assessed long-term survivors' health-related quality of life (HRQL), respiratory symptoms, and anxiety, depression and post-traumatic stress disorder (PTSD) frequencies. METHODS: Data from 140 ECMO-treated ARDS patients admitted to three French ICUs (2008-2012) were analyzed. ICU survivors contacted >6 months post-ICU discharge were assessed for HRQL, psychological and PTSD status. RESULTS: Main ARDS etiologies were bacterial (45%), influenza A[H₁N₁] (26%) and post-operative (17%) pneumonias. Six months post-ICU discharge, 84 (60%) patients were still alive. Based on multivariable logistic regression analysis, the PRESERVE (PRedicting dEath for SEvere ARDS on VV-ECMO) score (0-14 points) was constructed with eight pre-ECMO parameters, i.e. age, body mass index, immunocompromised status, prone positioning, days of mechanical ventilation, sepsis-related organ failure assessment, plateau pressure and positive end-expiratory pressure. Six-month post-ECMO initiation cumulative probabilities of survival were 97, 79, 54 and 16% for PRESERVE classes 0-2, 3-4, 5-6 and ≥7 (p < 0.001), respectively. HRQL evaluation in 80% of the 6-month survivors revealed satisfactory mental health but persistent physical and emotional-related difficulties, with anxiety, depression or PTSD symptoms reported, by 34, 25 or 16%, respectively. CONCLUSIONS: The PRESERVE score might help ICU physicians select appropriate candidates for ECMO among severe ARDS patients. Future studies should also focus on physical and psychosocial rehabilitation that could lead to improved HRQL in this population. TRIAL REGISTRATION: ClinicalTrials.gov NCT01470703.

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1. **Effects of systematic prone positioning in hypoxemic acute respiratory failure: a randomized controlled trial.**  
   Guerin C. JAMA 2004;292(19):2379-87.

CONTEXT: A recent trial showed that placing patients with acute lung injury in the prone position did not increase survival; however, whether those results hold true for patients with hypoxemic acute respiratory failure (ARF) is unclear. OBJECTIVE: To determine whether prone positioning improves mortality in ARF patients. DESIGN, SETTING, AND PATIENTS: Prospective, unblinded, multicenter controlled trial of 791 ARF patients in 21 general intensive care units in France using concealed randomization conducted from December 14, 1998, through December 31, 2002. To be included, patients had to be at least 18 years, hemodynamically stable, receiving mechanical ventilation, and intubated and had to have a partial pressure of arterial oxygen (PaO2) to fraction of inspired oxygen (FIO2) ratio of 300 or less and no contraindications to lying prone. INTERVENTIONS: Patients were randomly assigned to prone position placement (n = 413), applied as early as possible for at least 8 hours per day on standard beds, or to supine position placement (n = 378). MAIN OUTCOME MEASURES: The primary end point was 28-day mortality; secondary end points were 90-day mortality, duration of mechanical ventilation, incidence of ventilator-associated pneumonia (VAP), and oxygenation. RESULTS: The 2 groups were comparable at randomization. The 28-day mortality rate was 32.4% for the prone group and 31.5% for the supine group (relative risk [RR], 0.97; 95% confidence interval [CI], 0.79-1.19; P = .77). Ninety-day mortality for the prone group was 43.3% vs 42.2% for the supine group (RR, 0.98; 95% CI, 0.84-1.13; P = .74). The mean (SD) duration of mechanical ventilation was 13.7 (7.8) days for the prone group vs 14.1 (8.6) days for the supine group (P = .93) and the VAP incidence was 1.66 vs 2.14 episodes per 100-patients days of intubation, respectively (P = .045). The PaO2/FIO2 ratio was significantly higher in the prone group during the 28-day follow-up. However, pressure sores, selective intubation, and endotracheal tube obstruction incidences were higher in the prone group. CONCLUSIONS: This trial demonstrated no beneficial outcomes and some safety concerns associated with prone positioning. For patients with hypoxemic ARF, prone position placement may lower the incidence of VAP.

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Links are provided to the full text of each document. Relevant extracts have been copied and pasted into these results. Rather than browse through lengthy documents, you can search for specific words as follows:

**Portable Document Format / pdf / Adobe**  
Click on the Search button (illustrated with binoculars). This will open up a search window. Type in the term you need to find and links to all of the references to that term within the document will be displayed in the window. You can jump to each reference by clicking it.

**Word documents**  
Select Edit from the menu, the Find and type in your term in the search box which is presented. The search function will locate the first use of the term in the document. By pressing 'next' you will jump to further references.

## Search History

Sources searched include: BMJ Best Practice, Cochrane Database of Systematic Reviews, Health Research Premium Collection, NICE, PubMed, Respiratory Care, TRIP PRO, UpToDate

**Date range used** (5 years, 10 years):   
**Limits used** (gender, article/study type, etc.):

**Search terms and notes**: proning prone\* position\*ARDS “respiratory distress” “respiratory failure” ventilator ventilated elderly aged

**PubMed search strategy**: ((ARDS) OR (((failure) OR (distress)) AND (respiratory))) AND (((position) AND (prone)) OR (proning))

Filters applied: Ages 65+ years, 80 and over 80+ years = 155 results

**HDAS**

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| --- | --- | --- | --- |
| **#** | **Database** | **Search term** | **Results** |
| 1 | EMBASE | exp "RESPIRATORY DISTRESS SYNDROME"/ | 72188 |
| 2 | EMBASE | (respiratory ADJ3 (distress OR failure)).ti,ab | 102642 |
| 3 | EMBASE | (ARDS).ti,ab | 19487 |
| 4 | EMBASE | ("prone\* position\*").ti,ab | 9195 |
| 5 | EMBASE | (proning).ti,ab | 141 |
| 6 | EMBASE | (1 OR 2 OR 3) | 143342 |
| 7 | EMBASE | (4 OR 5) | 9263 |
| 8 | EMBASE | (6 AND 7) | 1502 |
| 9 | EMBASE | 8 [English language] [Human age groups Aged 65+ years] | 156 |
| 10 | Medline | exp "RESPIRATORY DISTRESS SYNDROME, ADULT"/ | 18996 |
| 11 | Medline | (respiratory ADJ3 (distress OR failure)).ti,ab | 67190 |
| 12 | Medline | (ARDS).ti,ab | 11419 |
| 13 | Medline | ("prone\* position\*").ti,ab | 5808 |
| 14 | Medline | (proning).ti,ab | 43 |
| 15 | Medline | (10 OR 11 OR 12) | 75964 |
| 16 | Medline | (13 OR 14) | 5825 |
| 17 | Medline | (15 AND 16) | 899 |
| 18 | Medline | 17 [Human age groups Aged OR Aged,80 and over] [Languages English] | 124 |
| 19 | CINAHL | exp "RESPIRATORY DISTRESS SYNDROME, ACUTE"/ | 7732 |
| 20 | CINAHL | (respiratory ADJ3 (distress OR failure)).ti,ab | 18273 |
| 21 | CINAHL | (ARDS).ti,ab | 3998 |
| 22 | CINAHL | ("prone\* position\*").ti,ab | 1931 |
| 23 | CINAHL | (proning).ti,ab | 39 |
| 24 | CINAHL | (19 OR 20 OR 21) | 22297 |
| 25 | CINAHL | (22 OR 23) | 1949 |
| 26 | CINAHL | (24 AND 25) | 517 |
| 27 | CINAHL | 26 [Human age groups Aged: 65+ years OR aged~ 80 & over] [Languages eng] | 57 |

**Date of request:** 6th April, 2020  
**Date of completion:** 9th April, 2020

**Audience/Context:** Chief of Medicine in relation to the use/or not of proning in elderly patients

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