Case Report

Early prone ventilation in the emergency department for severe refractory hypoxaemia

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Abstract

Background: Prone ventilation is an established intervention in severe ARDS but is rarely initiated in the Emergency Department (ED). We report a case of an intubated woman with profound refractory hypoxaemia unresponsive to mechanical ventilation and urgent haemodialysis who demonstrated rapid oxygenation improvement following early prone positioning in the ED. The case highlights the feasibility, safety, and physiological rationale for ED proning when lung consolidation is evident.

Key words: Emergency Department (ED); Hypoxaemia; Tachypnoeic

1. Introduction

Prone positioning reduces mortality in severe ARDS by improving ventilation–perfusion matching, recruiting dependent lung units, and reducing ventilator-induced lung injury. Although standard in ICU practice, its implementation in the ED is uncommon. This case demonstrates successful application of proning in ED for refractory hypoxaemia.

2. Case Presentation

A 47-year-old woman with chronic kidney disease (conservative management), type 2 diabetes mellitus, and hypertension presented with acute onset breathlessness and vomiting. She was tachypnoeic and hypoxaemic on arrival, with an oxygen saturation of 54% on 15 lits O2 via bag–mask ventilation. Her blood pressure was 200/100 mm Hg, and the heart rate was 144 beats per minute.

She remained alert but showed signs of impending respiratory failure. Point-of-care ultrasonography revealed moderately reduced left ventricular systolic function with no pericardial effusion or right ventricular dilatation. Pocus of the lung demonstrated bilateral lateral and posterior consolidations with coalescent B-lines. The inferior vena cava measured 1.8 cm.

Because of worsening work of breathing and persistent hypoxaemia, she underwent endotracheal intubation and mechanical ventilation with FiO_2 1.0. Emergency hemodialy-

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sis was performed to address metabolic derangement and suspected pulmonary congestion, but oxygenation did not improve. The estimated PaO_2 remained approximately 45 mm Hg (PaO_2/FiO_2 ratio 45).

In view of severe refractory hypoxaemia, prone positioning was initiated in the ED. Following proning, oxygen saturation rose rapidly to 97%, and FiO_2 was reduced to 0.40. The corresponding PaO_2 improved to approximately 85–90 mm Hg (PaO_2/FiO_2 ratio ≈212). She remained prone for 29 hours and hemodynamically stable throughout.

She subsequently underwent five hemodialysis sessions, was extubated on day 4, and discharged on day 10.

Clinical and Ventilator Parameters Before and After Proning

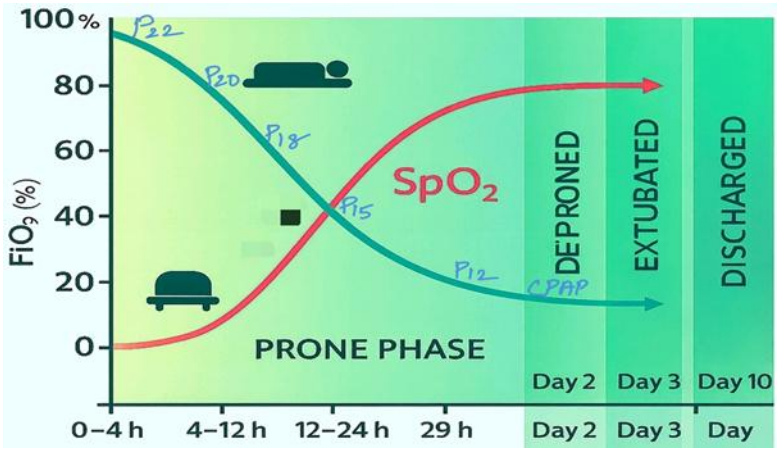
Parameter	Pre-Proning (Supine)	Post-Proning (30 min)
SpO_2	54%	97%
FiO_2	1.0	0.4
Estimated PaO_2	~45 mm Hg	~85–90 mm Hg
PaO_2/FiO_2 Ratio	45	212
Haemodynamics	Unstable	Stable
Lung Ultrasound	Bilateral Consolidation	Improved aeration

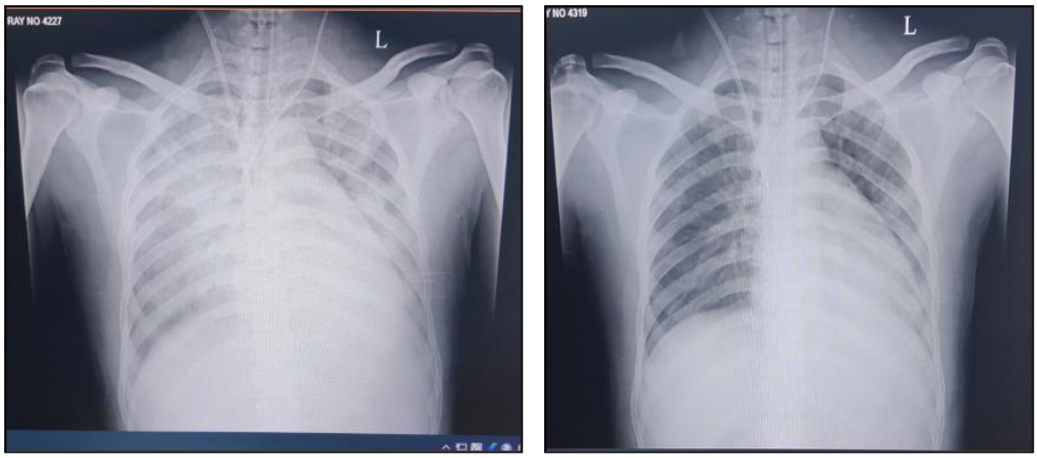
3. Differential Diagnosis

Acute pulmonary oedema from hypertensive crisis, Pneumonia or aspiration with severe hypoxaemia, Metabolic acidosis–driven dyspnea, Pulmonary embolism (less likely: no RV strain).

4. Outcome and Follow-Up

After proning, oxygenation improved profoundly. The patient was successfully extubated on day 4 and discharged home on day 10 with full recovery of respiratory function.





5. Discussion

Prone ventilation is a cornerstone intervention in severe ARDS, producing rapid improvements in oxygenation by altering regional lung mechanics and reducing shunt physiology. Although commonly initiated in the ICU, this case demonstrates its feasibility and effectiveness when applied early in the ED.

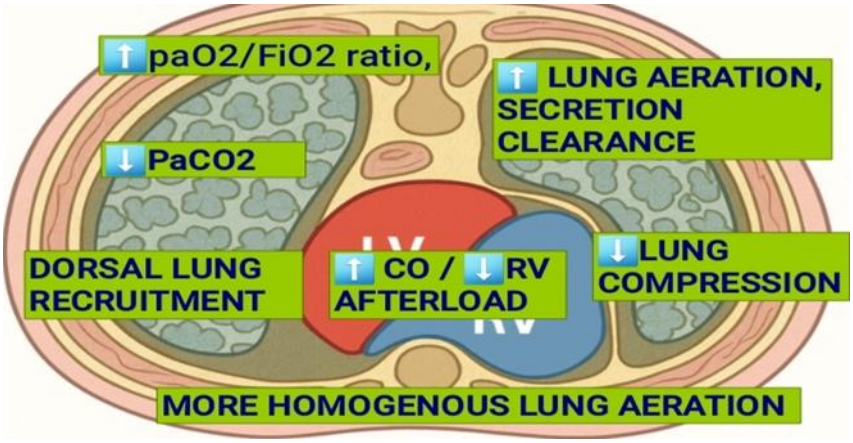
6. Physiological Basis of Prone Ventilation

In the supine position, dorsal lung regions—receiving most of the pulmonary blood flow—collapse early under the weight of the heart, mediastinum, and elevated diaphragm. This results in perfused but non-ventilated lungs, generating substantial intrapulmonary shunts and profound hypoxaemia.

Prone positioning recruits these dependent alveoli by shifting the heart anteriorly, reducing dorsal compression, and redistributing ventilation toward lung regions that continue to receive preferential blood flow. Ventilation–perfusion matching improves almost immediately. Functional residual capacity increases, and end-expiratory alveolar stability is enhanced.

The prone position also equalises transpulmonary pressures, reducing regional overdistension in ventral lungs and minimizing cyclic alveolar collapse in dependent zones. This creates a more homogeneous mechanical environment and reduces ventilator-induced lung injury. Improved secretion drainage and more favourable diaphragmatic mechanics further support alveolar recruitment.

The dramatic improvement in this patient's oxygenation—from a PaO_2/FiO_2 ratio of 45 to more than 200—reflected classical ARDS physiology. Her sonographic findings of dorsal consolidation and the immediate response to proning confirmed that shunt physiology and dependent collapse were the primary contributors to refractory hypoxaemia rather than fluid overload or cardiac dysfunction.



7. Learning Points

- Prone ventilation can be safely initiated in the Emergency Department when severe ARDS physiology is identified.
- Bedside ultrasonography is instrumental in supporting diagnosis, excluding cardiac pathology, and guiding the decision to prone.
- Early proning leads to immediate physiological improvement and may stabilise patients when ICU transfer is delayed.