

Knowledge Update

Prone ventilation : The essential facts

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In the era of Covid-19, mechanical ventilation has become the buzzword of the medical community. Also, among the various modalities of mechanical ventilation, prone ventilation has become a popular treatment method. At this juncture, it may be necessary for every physician to have a basic knowledge of this ventilator technique. This short article will try to highlight the essential characteristics of prone ventilation.

Indications :

- Severe ARDS, when there is refractory hypoxia
 - Wounds or burns in the back which make supine position impossible
- But there are certain **contraindications** to prone positioning:
- Extreme obesity
 - Ascites
 - Hemodynamic instability etc..

So, the basic premise of prone ventilation is that the patient will be put in prone position for long hours (typically 12-16 hours per day) while on mechanical ventilation. This daily change of position requires a highly trained team of staff (at least 3-4, working in unison). The patient in prone position must have eye protection, pressure ulcer care and airway care.

Usually these patients are on continuous deep sedation with or without neuromuscular blockade.

Physiology of prone positioning :

In supine position, the weight of the mediastinal structures and also some upper abdominal viscera increases the dorsal pleural pressure (for example, the heart contributes approx. 3-5 cm of water pressure on the dorsal lungs). This reduces the transpulmonary pressure (the pressure which is responsible for alveolar ventilation) in the dorsal areas of the lung and increases the chances for atelectasis. In normal persons, this is of minimal significance. But in ARDS, when the lung is already edematous, this physiology severely compromises ventilation in dependent dorsal lung regions. Placing the patient in prone position reduces the pleural pressure and helps improve alveolar air-flow. It has been observed that there is significant improvement in oxygenation after prone positioning in ARDS.

The second advantage of prone ventilation is prevention of ventilator induced lung injury (VILI). Prone position makes lung density, alveolar ventilation and transpulmonary pressure homogeneous throughout the lungs. This reduces

the chances of atelectrauma. Alveolar recruitment is increased and hyperinflation or volutrauma is reduced.

Prone positioning also allows better pulmonary secretion drainage and change in mechanics of the chest wall allows the lungs to inflate at lower pressures.

Trials :

The PROSEVA trial (2013) (published in NEJM) was the first to show clear benefit of prone ventilation in ARDS. It showed that there was a clear mortality benefit up to 90 days after prone positioning. But prone ventilation in isolation does not benefit the patient. It must be used in conjunction with other ventilator strategies like low tidal volume, high PEEP or the use of pressure controlled mode.

Complications:

1. Reduced enteral feeding
2. Displacement of airway tubes
3. Facial edema
4. Difficulty in performing procedures like catheter insertion etc.....

Self-proning/auto-proning :

This method has become popular after the covid-19 pandemic. In covid-19 infections with hypoxia, many western hospitals have initiated the technique of making the awake patients lie in prone position early in the hospital course. This is done improve oxygenation and delay the need for mechanical ventilation. A small observational study has shown that self proning can improve oxygen saturation quickly but whether this will really help in long term management is still a matter of debate.

Conclusion :

Prone positioning is a good method of treatment of severe ARDS, especially in acutely developing ARDS like Covid-19 infection. But this is a highly labour intensive procedure and requires dedicated healthcare staff round the clock. This may not be feasible in most hospitals of India.

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