Medical and Research Publications
International Open Access

Case Report **Journal of MAR Pulmonology (Volume 3 Issue 4)**

Prone ventilation combination with supplemental oxygen therapy in the Non – intubated Patient in a COVID 19 Unit. Lessons from The Past and Future Applications, Review of the Literature.

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Received Date: August 18, 2021

Published date: September 01, 2021

Patient: Male, 42-year-Old

Final Diagnoses: Hypoxemic Respiratory Failure due to COVID 19 Pneumonia in early ARDS.

Symptoms: Dyspnea and increase Aa Gradient, hypoxemia

Medication: None

Clinical Procedure: Prone Ventilation using Supplemental Oxygen

Specialty: Critical Care

Objective: Unusual clinical course

Background:

Large metanalyses has been performed in the use of prone ventilation on severe hypoxemic respiratory failure. Proning has been adjuvant therapy to ventilated patients as use on paO2/FiO2 fraction of <100 mmHG compare with moderate hypoxemias. COVID19 is a new virus that enters through the respiratory tract and causes fever, dyspnea, and acute respiratory symptoms that can lead to ARDS. Multiple trials have shown improved oxygenation and survival of patients with severe hypoxic respiratory failure. In this era of a pandemic where we are concerned about exhausting capital resources such as mechanical ventilators. Any protective strategy to increase oxygenation and prevent mechanical intubation can decrease cost and allow clinicians to effectively treat more patients with hypoxic respiratory failure. The main physiological aims of prone ventilation are to improve oxygenation, to improve respiratory mechanics, to homogenize the pleural gradient, the alveolar inflation, and the ventilation distribution. Prone ventilation will also increase lung volume and reduce of the number of atelectatic regions, facilitate the drainage of secretions and reduce ventilatory lung injury.

Prone ventilation in the non-intubated patient has been shown to improve oxygenation, it does not change minute volume ventilation, ventilatory components. The gravitational distribution of the ventilation-perfusion on the ratio is more uniform in prone than supine posture in the normal lung. The lungs are the major organs of the respiratory system and responsible for gas exchange. Ventilation-perfusion matching, such that regions of the lung that receive fresh gas also receive deoxygenated capillary blood, this is the essential mechanism determining gas exchange. Such a passive mechanism includes vascular branching structure and the effect of gravity on ventilation and perfusion.

Over the past 30 years, with the advent of Bilevel ventilation, continuous positive pressure, we have increased controlled modalities to ventilate patients which can be done without the use of invasive ventilation. These modes of ventilation are done by using a device that provides positive pressure through a mask, and providing, ventilation and oxygenation without the necessity of performing endotracheal intubation. Proning in a non-intubated patient is an adjunctive tool in improving oxygenation and improving paO2/Fio2 ratios that can efficiently be done without being in the intensive care unit. In ARDS, the homogeneity of the lung is lost when alveoli capillary units become full of proteinaceous material. Prone ventilation causes a redistribution of alveoli, which in turn improves the oxygenation and the V/Q mismatch. Also using high flow oxygen system or continuous positive pressure can add the effect of PEEP in adding recruitment of new alveoli improving lung compliance and oxygenation.

Case Report:

40-year-old male presented to the emergency room complaining of cough, fever for the past five days. Patient with no prior medical history, nonsmoker. Cat scan of the Chest showed bilateral ground-glass opacities with no evidence of pulmonary embolus or effusions. On physical exam, the patient had a BMI of 42; vitals were normal except for saturation of 80% in room air. The patient was started on Plaquenil 200 mg PO BID and Azithromycin 500 mg PO day, and supplemental oxygen 8 liters/min. He was instructed to wear supplemental oxygen and was titrated to keep sat of 92%. The patient was compliant, and after one hour of instruction, he was started on a 16-hour cycle of pronation. The patient did have breaks to eat and go to the bathroom. Patient-reported over the next three days to feel better, feel less shortness of breath, and we were able to wean his oxygen requirements. The patient did use some BIPAP for 6 hours the first night, and then successfully weaned off over the next three days. Patient saturation improved, and the pa02/fio2 ration went from 150 to about 275 over the next three days. He did not require intubation. Furthermore, he was able to do his self proning after one-hour instruction, did not required any further assistance, his oxygenation improved and remained stable upon discharge after a course of antibiotics.

Discussion

COVID19 enters the lungs and causes a massive inflammatory response to viral replication and Pro-inflammatory th1 cytokine release. Viral replication leads to acute lung injury-causing hypoxemia, hypoxic respiratory failure leading to ARDS. The prevalence of ARDS in COVID patients has been reported in up to 17% of patients with respiratory failure. The use of proning improves oxygenation and decrease the possibilities of mechanical intubation. In a pandemic where we have had over 500,000 deaths in the United States and over 5.0 million have been infected. Reducing the incidence of mortality and increasing oxygenation in moderate to severe ARDS without any active medications except for oxygen by improving the homogeneity of the lung and ventilatory perfusion mismatch is a powerful tool that can save lives at an extremely low cost and allow resources to be redistributed in patients that have a higher SOFA score or worsening of their ARDS. The mechanism of this oxygenation includes a more uniform pleural pressure gradient, a smaller volume of lung compressed by the heart, and more uniform and better-matched ventilation and perfusion. The use of prone ventilation was recommended when patients had severe ARDS with PaO2/Fio2 of less than 100 mmHg. Prone position can be used in the management of COVID 19 before intensive care unit (ICU) admission on the non- intubated patient.

Furthermore, in regions of the world where medical equipment, medications, and even oxygen may be limited, a simple maneuver as proning may be an alternative to mild cases that can potentially be treated

at home. We support the use of this technique as first-line therapy in combinations with other modalities of therapy and recommend this to our facility.

Conclusion:

Prone Positioning was proposed over 30 years ago as a means to improve gas exchange in hypoxic respiratory failure. There is enough physiological evidence to show that with a combination of positive pressure in a noninvasive set up. Proning causes improvement of oxygenation, changes the distribution of pulmonary blood flow, improving VQ mismatch. Prone ventilation improves recruitment in dorsal lung regions, increases end-expiratory lung volume, increase chest wall elastase, decreasing alveolar shunt, and improved tidal volume. It is a cost-effective therapy and should be used as the first line of therapy on COVID19 patients in the Pre-ICU floor. Instructing hypoxic patients to self-prone can alleviated the dyspnea, improve oxygenation but more important buy time for patient's clinical condition to improved and hopefully improve a clinical presentation.