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Letter to Editor

Airway Pressure Release Ventilation as an Open Lung Strategy in SARS-Cov2 Patients Under Mechanical Ventilation

Ali Jabbari[1]*, Shabnam Tabasi[2] and Atabak Najafi[3]

[1]Assistant Professor, Ischemic Disorders Research Center and Department of Anesthesiology and Critical Care Medicine, Golestan University of Medical Sciences, Gorgan, Iran

[2]Assistant Professor, Department of Internal medicine, Hematology and oncology branch, Golestan University of Medical Sciences, Gorgan, Iran

[3]Professor, Department of Anesthesiology and Critical Care Medicine, Tehran University of Medical Sciences, Tehran, Iran

***Corresponding Author**: Ali Jabbari, Assistant Professor, Ischemic Disorders Research Center and Department of Anesthesiology and Critical Care Medicine, Golestan University of Medical Sciences, Gorgan, Iran.

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With the advent of human corona virus 2019 (Covid-19) disease, which fatally destroys patients' lungs and causes respiratory failure; artificial ventilation strategies in patients with Covid-19-induced respiratory failure received more attention [1]. Management of respiratory failure and refractory hypoxemia due to Covid-19 infection propounds significant clinical challenges. Despite the large number of patients whom get infected by Covid-19, data on effective treatment strategies with artificial ventilation are limited and the optimal adjustment of mechanical ventilator modes and parameters remains controversial. It seems the heterogeneity, difference in severity of illness and diversity of the nature of severe acute respiratory syndrome corona virus 2 (SARS- CoV2) is the main reasons for this differences [1,2].

Data in mechanically ventilated patients with Covid-19 indicate that the respiratory mechanics and ventilation parameters are similar to those reported for classical acute respiratory distress syndrome (ARDS) however; when conventional mechanical ventilation methods do not succeed in achieving the goals of oxygen supply and adequate ventilation, alternative ventilation methods should be used [1-3].

We evaluated physiological changes in patients with severe secondary acute respiratory distress syndrome due to Covid-19 and developed a method for refractory hypoxemia management based on mechanical ventilation using airway pressure release ventilation mode (APRV).

Lung ventilation with a medium tidal volume (6 - 8 ml/kg) is currently considered the standard of care in mechanical ventilation and traditionally volume control with a pressure-limiting mood has been used to treat ARDS, but clinical experiences have been show that pressure control modes and other advanced modes in mechanical ventilation can be used to treat ARDS and have similar results [3,4].

Lung protection method includes low tidal volume and PEEP to minimize alveolar sheering stress and cyclic atelectrauma used in patients who suffer from conventional ARDS. Open lung strategy is a special approach in artificial ventilation that can be applied in several modes of mechanical ventilation. For the open lung strategy, we use the recruitment maneuver, which is a deliberate process to transiently increase pulmonary pressure above the values used during conventional mechanical ventilation, whose primary purpose is to open unstable distal airways and collapse alveoli. we replace lung protection strategy with an open lung strategy that applies low driving pressure to ensure low tidal volume base on patient effort, recruitment maneuver, inspiration to expiration time inverse ratio and high PEEP when use Airway pressure release ventilation (APRV) mode in the management of SARS CoV 2 ventilation [3,5,6].

The cause of hypoxemia in SARS- CoV 2 is not fully understood. Several mechanisms have been suggested, including intravascular thrombosis, increased dead space ventilation, hypoxic pulmonary vasoconstriction, massive alveolar collapse, intrapulmonary shunting

and perfusion-ventilation mismatch. The formation of microvascular thrombosis and Pulmonary alveolar filling with cytokines, inflammatory mediators, and lymphocytes; appears to play an important role in the pathogenesis of SARS-CoV 2 [6,7].

In patients with SARS- CoV 2, cyclic alveolar closure and excessive dilatation during mechanical ventilation may induced alveolar shearer stress which lead to perpetuate alveolar injury and restructuring. Open lung strategy is used to prevent alveolar shearer stress, which is the minimum tidal volume base on patient effort on high airway pressure that provides alveolar ventilation appropriate to the body's metabolism. It is based on maintaining low inspiratory driving pressures according to patient effort, with lower tidal volumes versus and preferential use of limited airway pressure over regulation, with the simultaneous circumvention of alveolar collapse through the use of appropriate positive end-expiratory pressures (PEEP) above the lower inflection point on the static pressure–volume curve of the respiratory system [3,5,6].

There is a tendency in the SARS- CoV 2 for alveolar collapse, so these avioles must be re-opened and somehow kept open. Ventilation spaces in SARS-CoV 2 are filling and closing by inflammatory mediators and the physician must reuse these inflamed and infiltrated alveolar spaces for re-ventilation, which is called a recruitment maneuver. Experimental data suggest that atelectrauma is prominent in SARS- CoV 2 and atelectrauma may be mitigated by recruitment maneuvers. We refer to recruitment maneuvers as Open lung strategy (OLS) [5-7].

PEEP is an essential component of SARS- CoV 2 management. The effective level of PEEP ultimately reflects the balance between regions with excessive traction and regional unemployment. Using PEEP in open lung strategy keeps the open alveoli open. It improves hypoxemia and reduces intrapulmonary shunting, and these effects have been the basis for determining PEEP in clinical practice [5-7].

APRV has many attractive features applicable of SARS Cov 2 treatment, such as minimizing ventilator-induced lung injury (VILI) using lung protective strategies and alveolar recruitment as open lung strategy. It is an open lung mode of invasive mechanical ventilation mode in which spontaneous breathing is encouraged [4-6]. APRV uses a longer inhalation time. This leads to an increase in mean airway pressure aimed at reusing the collapsing alveoli, which improves oxygen delivery. The key is a dynamic exhalation valve in the circuit that allowed it to breathe spontaneously in large volumes and regulated pressure of the lungs. Hypoventilation and hypercapnia are known consequences of APRV [5,6].

We conducted a retrospective observational statistical descriptive study over 16 months. We applied APRV as an open lung strategy in critically ill SARS-Cov2 patients under mechanical ventilation from May 2020 to September 2021 on 64 patients admitted in Intensive care unit. Our mechanical ventilator parameter was an elevated bilevel (Ins/Expiratory) pressure with timed pressure releases (instead of PEEP), patients spontaneous breathing which supported by pressure (Provides respiratory tidal volume with lung protection strategy), inverse in to expiration ratio. This ventilator mode was used intermittently with the P/V SIMV mode. Our hospital mortality rate (48 patients, 75%) was slightly higher than other reports [8]. Age and diabetes were identified as independent risk factors for in-hospital mortality. The duration of symptoms until medication was effective in the outcome of the patients. The number of days before ICU admission, mental disorder, thyroid and kidney disease were assessed as potential risk factors for subsequent complications like similar reports [8]. Our main complication was subcutaneous emphysema.

Based on our performance, we believe that APRV mechanical ventilation as an open lung strategy can be considered as an acceptable management in SARS-CoV 2 ventilation.

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Declaration of Conflicting Interests

The authors declared no potential conflicts of interest with respect to the research, authorship and publication of this article.

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