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## Prolonged use of non-invasive ventilation in patients with COVID 19: a case report.

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## ABSTRACT

One of the most commonly affected organ systems by SARS-CoV-2 virus is the respiratory system. Major challenge with coronavirus disease is managing the pulmonary complications. Role of non-invasive ventilation in patients of coronavirus disease 2019 (COVID 19) has been questioned in spite of evidence showing its use in acute hypoxemic respiratory failure. Patient selection is very important when using non-invasive ventilation for management of respiratory failure due to COVID 19. Here we report a case of COVID 19 with respiratory failure that was managed successfully with prolonged use of non-invasive ventilation.

**KEY WORDS:** Case report, COVID 19, non-invasive ventilation, respiratory failure.

## INTRODUCTION

Coronavirus disease (COVID 19) which first appeared in Wuhan, China in December 2019 is now a serious global challenge. One of the most commonly affected organ systems by SARS-CoV-2 virus is the respiratory system [1]. Many patients during the clinical course of disease develop mild to moderate pneumonia and few may get severe acute respiratory distress syndrome [2]. Major challenge with coronavirus disease is managing the pulmonary complications. There is high mortality in patients who are intubated and mechanically ventilated [3]. Avoiding intubation and providing respiratory support through non-invasive methods might improve the outcome. Role of non-invasive ventilation (NIV) in covid-19 patients has been questioned in spite of evidence showing its use in acute hypoxemic respiratory failure [4]. Here we report a case of COVID 19 with respiratory failure that was managed successfully with prolonged use of non-invasive ventilation.

## CASE REPORT

**Patient information** – a 75 year old male presented in our hospital with chief complaints of fever and cough for 4 days and breathlessness since 1day. He also had a history of hypertension since 10 years and was taking medicine regularly. **Clinical findings** – at the time of admission his temperature was 101°F, blood pressure 150/85 mm Hg, heart rate of 108 beat/min, respiratory rate of 28 per minute, and oxygen saturation (Spo<sub>2</sub>) of 88% on room air. **Diagnostic testing** – nasopharyngeal swab sample was sent for reverse-transcription-polymerase-chain-reaction (RT-PCR) assay for COVID 19 which turned out to be positive. A chest radiograph showed multiple bilateral infiltrates in the lower zones. His routine blood test results were not remarkable. He received oxygen supplementation with 5L/min through a simple face mask to maintain oxygen saturation (Spo<sub>2</sub>) of 92-96%. Patient was also started on medication with remdesivir, azithromycin, dexamethasone and low molecular weight heparin. His clinical condition worsened on the second day with an increase in respiratory distress, PaO<sub>2</sub>/FiO<sub>2</sub> ratio (P/F ratio) decreased to 150 mmHg. **Therapeutic intervention** – patient was shifted to ICU, non-invasive ventilation was started through the non-vented face mask interface with ICU ventilator and dual limb circuit. Initial continuous positive airway pressure (CPAP) mode of ventilation was used with setting CPAP 10 cmH<sub>2</sub>O and FiO<sub>2</sub> 60%. Vitals were continuously monitored and ABG was done every 6 hour. Appropriate dressing was done at pressure areas to prevent pressure sores. When required, NIV Pressure Support mode was also used with pressure support (PS) of 5-10 cmH<sub>2</sub>O adjusted to target a tidal volume of 6ml/kg predicted body weight, PEEP and FiO<sub>2</sub> was regulated to maintain SpO<sub>2</sub> > 90%. With non-invasive ventilation patients work of breathing significantly decreased and respiratory rate fell down to 25/min also there was improvement in blood gases. On day 10 as the clinical condition of the patient started deteriorating again with rising inflammatory markers, a decision was taken to start tocilizumab. On day 11th the first dose of tocilizumab was given (8mg/kg), and the second dose was repeated after 24hrs, along with IL-6 monitoring. **Follow-up and outcomes** – the patient remained on NIV between day 2 to 14 with either CPAP or NIV-PS mode. Continued NIV support was given to the patient for 12 days. Over the time there was a gradual improvement in the clinical condition and P/F ratio also increased to 350 mmHg.

There was marked improvement in respiratory symptoms with significant resolution of radiological changes in CT chest. For another 6 days the patient was kept on intermittent NIV support. The patient was discharged from the hospital on the 22th day without the need of supplemental oxygen.

## DISCUSSION

In patients with COVID 19 pneumonia, non-invasive ventilation may improve the gaseous exchange in those who are difficult to oxygenate by conventional oxygen therapy. Recommendations by the World Health Organization and National Health Service (United Kingdom) also support the use of NIV in management of respiratory failure due to COVID 19 [5,6]. Our case report emphasizes the fact that by wisely selecting the patient and with the rational use of NIV, intubation and invasive mechanical ventilation can be avoided in many COVID 19 patients admitted in ICU. The patient remained on an NIV for a prolonged period of time and survived because of the early respiratory support and timely medical management. Due to high mortality of patients on invasive mechanical ventilation, use of NIV becomes a logical choice. Major advantage with a NIV is it may help in overcoming mechanical and infectious complications associated with invasive mechanical ventilation. With limited resources in the ongoing pandemic, NIV could be a better option for managing patients with mild to moderate ARDS in COVID 19 patients [7]. Risk of airborne transmission with use of NIV is still debatable [8]. Negative airflow isolation bed system may provide a cost-effective protective cover to the COVID 19 patients requiring management with Mask-NIV [9]. This risk can be reduced with use of PPE kit in ICU, tightly fitted non-vented masks and viral filters. There is certainly a possibility of NIV failure in ARDS secondary to COVID 19. The use of NIV in severe COVID 19 pneumonia also carries the risk of complications like generation of high tidal volumes, delayed tracheal intubation and aspiration of gastric contents. Thus the patients who develop severe ARDS or do not improve with NIV support, intubation and invasive mechanical ventilation should not be delayed.

## CONCLUSIONS

The role of NIV in acute hypoxemic respiratory failure is still controversial and more studies are required to explore the use of NIV in ARDS related to COVID 19. However in mild-to-moderate ARDS secondary to COVID 19, prolonged use of NIV may reduce complication related to unnecessary intubation and invasive mechanical ventilation in patients.

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**Informed Consent Statement:** *Informed consent was obtained from all subjects involved in the study.*

**Data Availability Statement:** *The datasets generated and analyzed during the current study are available from the corresponding author on reasonable request.*

**Conflicts of Interest:** *The authors declare no conflicts of interest.*

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