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Safety of prolonged prone ventilation in critically ill COVID-19 patients: A short report

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ABSTRACT

To share our observations regarding the safety of prolonged prone ventilation admitted to our intensive care unit with critical COVID-19 pneumonia and required prone ventilation because of severe ARDS. Since our observations were limited to assessing the safety of prolonged prone ventilation in critical COVID-19 patients and not to analyze any mortality benefit, we did not compare prolonged prone ventilation with standard invasive ventilation or standard duration of prone ventilation.

Introduction

Prone ventilation is a proven technique to improve oxygenation in patients with severe ARDS with a P/F ratio of less than 150 mmHg and its use is associated with reduced mortality [1]. Mostly, the sustained improvement in oxygenation can only be achieved with several cycles of pronation [2]. Improvement in oxygenation after initial prone positioning is a significant predictor of ICU survival and the duration of the prone position may be an important determinant of its efficacy [3,4]. The standard pronation involves a prone position for the duration of at least 16 h [1].

Ventilation in the prone position is a labor-intensive technique and involves multiple caregivers to turn patients and it has inherently increased risks of inadvertent tracheal extubation, endotracheal tube obstruction, facial tissue injury and tracheal stenosis [5]. The enormous number of patients required intensive care during the peak of the COVID-19 pandemic, and it created difficulties in following standard pronation cycles of 16–18 h due to the limited number of healthcare workers compared to the number of patients in the intensive care unit. There is limited literature available on the feasibility, safety & efficacy of prolonged prone ventilation.

Summary

A 32-year-old man, a case of critical COVID-19 pneumonia with ARDS on the mechanical ventilator was placed on prone ventilation because of PaO2/FiO2 ratio less than 100 mmHg. After the standard duration of prone ventilation for 16–18 h, he was made supine. Given the sudden increase in the airway pressure and increasing oxygen requirement, once he was placed back to the supine position, he was made prone again within half an hour of the supine position. Thereafter, we kept him in the prone position for the next 72 h. With ongoing management, he was made supine for one day and again placed back in the prone position for another period of 72 h. After two periods of 72 h of prone ventilation interspersed with 24 h supine ventilation, we were able to wean him successfully and he was discharged from the hospital after a total duration of around 5 weeks.

We emulated the same pattern of prone ventilation with 9 more patients to primarily assess the safety of prolonged prone ventilation (Ranging from 48 to 72 h at once and a total of 1–2 times) in critically ill COVID patients on an invasive mechanical ventilator where PaO2/ FiO2 ratio was less than 100 mmHg. [Table-1].

We observed the safety of prolonged prone ventilation, ranging from 48 to 72 h at once and a maximum of 2 times, for our patients. We observed for only those patients who were on invasive mechanical ventilation, when their PaO2/ FiO2 values were less than 100 mmHg, and when it was done within 24 h of initiation of invasive mechanical ventilation. This idea of prolonged prone ventilation was originated after our first successful prolonged prone ventilation and shortage of adequately trained manpower for the given number of patients.

We did prolong prone ventilation for a total of only 10 patients including the initial one. We could not recruit more patients as COVID-19 patients' inflow to our facility was improved significantly and there were no more patients to recruit. Our all

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Table 1
Characteristic of prone ventilation and adverse effects.

Patient serial number	PaO2/FiO2 (mmHg) before prone ventilation	Standard duration of prone ventilation done	Average duration of prolonged prone ventilation	Number of times prolonged prone ventilation done	Adverse effects	Outcome
1	Less than 100	18 h	72 h	2	None	Survived
2	Less than 100	–	66 h	2	None	Survived
3	Less than 100	–	68 h	2	Minor skin abrasion on chest	Survived
4	Less than 100	–	59 h	2	None	Survived
5	Less than 100	–	66 h	2	None	Survived
6	Less than 100	–	58 h	2	None	Survived
7	Less than 100	–	70 h	2	None	Survived
8	Less than 100	–	60 h	2	None	Survived
9	Less than 100	–	72 h	1	None	Survived
10	Less than 100	–	66 h	2	Gastric regurgitation	Survived

patients were COVID-19 positive with bilateral lung involvement, on invasive mechanical ventilation with a P/F ratio less than 100 mm Hg. In all our patients, prone ventilation was done within 24 h of intubation and ventilatory support. Six out of the total ten patients were diabetic, 4 were hypertensives, 4 were hypertensives & diabetics both and none of them was chronic kidney disease, chronic obstructive or cardiac disease, or suffering from any other immunosuppressive disease or on immunosuppressant. There was no evidence of any bacterial infection in all patients on ICU arrival. All our patients were young males with an average age of 38 years (32 years to 52 years). The average duration of prone ventilation was 65 h and out of 10 patients, 9 of them were kept in prone position twice. None of the patients was kept in the prone position more than two times or more than 72 h during any single session. All of them were initially placed on 100% oxygen with a median PEEP of 10 with lung-protective ventilation before initiating prone ventilation. We set the tidal volume 6 ml per kg predicted body weight or less, respiratory rate 35 or less per minute, plateau pressure less than 30–35 cm H2O while ensuring driving pressure to remain 17 cm H2O or less. We did not find any complications related to the ventilator whether it is an infection or any evidence of barotrauma in our patients. All our patients were given remifentanil and cis-atracurium as infusion while the lung-protective ventilation was practiced. Total six patients underwent tracheostomy which was closed before discharge from the hospital in all patients. As there was no ECMO facility at our center, none of them was placed on it. Though we requested two patients out of ten for transfer to another facility with ECMO, it could not be materialized. The average duration of mechanical ventilation was 15 days, ICU stays 23 days and hospital stay 30 days. None of our patients developed any major problem attributed to prolonged prone position except a few minor observations as one of our patients did not accept feed initially after making him prone. One of the patients developed skin peeling over the chest. Ten out of 10 of our patients survived.

These findings have several implications. Firstly, it paves the way for conducting larger studies to see whether prolonged prone ventilation has any outcome benefit over the standard duration of prone ventilation as this much duration of prone ventilation appears to be safe at least in this subgroup of COVID-19 patients. Though all our patients survived, this prospective observation was not intended to analyze this effect. At his point, we are rather more comfortable in concluding that prolonged prone ventilation is a safe technique for critically ill COVID-19 patients. Secondly, as it was common at most of the healthcare facilities, due to a sheer increase in the number of intensive care unit COVID patients, it was not feasible to provide the standard duration of prone ventilation. This strategy of prolonged prone ventilation might reduce the number of pronation cycles per patient.

Though we did not encounter any major adverse effects in our patients, it does not undermine the importance of a highly trained healthcare team who is well-versed with all the aspects of care in such patients and possible side effects of prolonged ventilation in the prone position. Our data, though relevant still must be read in the light of caution because of the small number of patients in a single center and its observational nature. Our study has several other limitations as all our patients were young men without any chronic end-organ dysfunction and history of any immunosuppression illness or medications. Moreover, none of them was in sepsis due to bacterial infection. Further studies can be done to provide more information and decide on whether it is justifiable to continue with it or not in terms of its safety profile and outcome benefits.

To the best of our knowledge, the study of prolonged prone ventilation on COVID-19 for this much-prolonged duration as in our series was never done before. In a study done by Andrea Carsetti et al. on prolonged prone position ventilation for SARS-CoV-2 patients, they concluded that prone position up to 36 h is feasible, safe and may offer potential clinical and organizational advantages. [2] In another study by Elizabeth M. Parker et al. on the efficiency of prolonged prone positioning for mechanically ventilated patients with COVID-19, they mentioned that single turn prone for more than 39 h is efficacious and saves the burden of multiple prone turns. [5].

In conclusion, our data showed that prolonged prone ventilation up to 72 h is safe in critically ill COVID-19 patients who require prone ventilation.

Authors' contributions

All authors contributed equally in drafting this manuscript.

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Conflict of interest statements

We have read and understood the policy on declaration of interests and declare that We do not have conflicting interest of any kind.

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