A Retrospective Analysis of the effect of Self Proning on Disease Progression in COVID-19 Patients

MED CENTER HEALTH

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Introduction:

Prone positioning has been a well-documented method to improve oxygenation and reduce mortality in severe acute respiratory distress syndrome (ARDS) patients. (1) Prone positioning has traditionally been described for intubated patients; however, it has been used in spontaneously breathing patient as well (2). With the aim of improving oxygenation and preventing progression to mechanical ventilation, we began a protocol of self-proning on any patient with documented COVID 19 infection who met the criteria for ARDS using the Kigali modification of the Berlin criteria(3).

The rapid decline in respiratory status among COVID-19 patients usually began with dyspnea, on average 5 days into the disease, with progression to full ARDS generally by day 8 (3). The management of ARDS with COVID-19 infection is controversial, with some authorities recommending early intubation to prevent patient self-inflicted injury(P-SILI) (4), while others recommending a more conservative strategy (5)

With worsening of oxygenation, we attempted both high flow nasal cannula(HFNC) and noninvasive positive pressure ventilation(NIPPV) prior to attempting intubation and mechanical vent. If both HFNC and NIPPV fail, then ventilation with use of proning for moderate to severe ARDS was used. After review of the current literature and present practices, our group began the use of self proning in attempt to prevent progression to mechanical ventilation.

Methods:

Charts were reviewed from March 2020 to May 2020 for all patients found to be COVID-19 positive and admitted to our COVID-19 unit. During the management of these patients, all were encouraged to self-prone in an attempt to prevent progression to mechanical ventilation. The patients were then categorized into two cohorts based on the ability to self-prone. Within each group, data was gathered based on time to mechanical ventilation in days, amount of respiratory support required, time at this maximal therapy in days, and number of deaths. Amount of respiratory support was determined based on respiratory support devices required by the patient. These were stratified into no oxygen requirement, nasal canula, HFNC, NIPPV, and mechanical ventilation.

All statistical analyses were conducted using SYSTAT, version 13. Differences between proning and non-proning groups with respect to continuously-distributed variables were tested normality using the Shapiro-Wilks test and for significance via independent samples t-tests, assuming separate variances; three variables (BMI, days to ventilation, days at maximum oxygen therapy) were log-transformed prior to analysis. Discrete variables were tested for significant differences between groups using chi-square tests of association.

Table 1. Summary of patient characteristics and clinical outcomes for patients in the proning and non-proning groups (n = 117).

Variable	Proning Group (n = 26)	Non-Proning Group (n = 91)	p-value
Patient Characteristics			
Age (years) – mean ± SE	56.8 ± 3.0	64.3 ± 1.7	0.033
Female – no. (%)	12 (46.2)	42 (46.2)	1.000
BMI – mean ± SE	32.5 ± 1.7	31.3 ± 0.9	0.406
Diabetic – no. (%)	8 (30.8)	34 (37.4)	0.537
Smoker – no. (%)	8 (30.8)	30 (33.0)	0.833
COPD – no. (%)	7 (26.9)	22 (24.2)	0.775
Initial oxygen requirement			0.017
Nasal canula – no. (%)	19 (73.1)	81 (89.0)	
High-flow – no. (%)	6 (23.1)	4 (4.4)	
Bipap – no. (%)	1 (3.8)	2 (2.2)	
Mechanical ventilation – no. (%)	0 (0.0)	4 (4.4)	
Clinical Outomes			
Maximal oxygen therapy			<0.001
Nasal canula – no. (%)	10 (38.5)	56 (61.5)	
High-flow – no. (%)	12 (46.2)	10 (11.0)	
Bipap – no. (%)	1 (3.8)	7 (7.7)	
Mechanical ventilation – no. (%)	3 (11.5)	18 (19.8)	
Progressed to mechanical ventilation – no. (%)	3 (11.5)	14 (16.1)[1]	0.572
Survived – no (%)	25 (96.2)	78 (85.8)	0.148

[1] n = 87

Results:

Twenty-five of 142 COVID-19 patients (17.6%) admitted during the study period required no oxygen therapy upon admission. These patients were thus not encouraged to self-prone. The remaining 117 patients were encouraged to self-prone; of these, 26 (22.2%) did so, while 91 (77.8 %) did not.

There was a significant difference in the initial oxygen requirement of patients in the two groups ($p = 0.017$, Table 1). Nineteen (19) of 26 patients in the proning group (73.1%) required only a nasal canula, while 81 of 91 (89.0%) of patients in the non-proning group required only this level of support. By contrast, a higher proportion of patients in the self-proning group (6 of 26, 23.1%) than in the non-proning group (4 of 91, 4.4%) required high-flow oxygen support upon admission. The proportion of patients requiring Bipap (2 vs. 1, 3.8% vs. 2.2%) or mechanical ventilation (0 vs. 4, 0.0% vs. 4.4%) was small and similar between the two groups. These data are summarized in Table 1.

There was also a significant difference in the maximum level of oxygen therapy required between the proning and non-proning groups ($p < 0.001$, Table 1). However, this largely reflects the difference in initial oxygen requirements of the two groups; there was a significant positive correlation between initial oxygen requirement and maximum oxygen therapy (Spearman $r = 0.39$, $p < 0.001$).

There was no significant difference between patients in the proning vs. non-proning groups with respect to survival ($x2 = 2.09$, $df = 1$, $p = 0.148$, Table 1).

Discussion:

Proning has been a valuable tool used for many years and in the management of severe ARDS and now COVID-19 patients. (1) Based on the Journal of American Medical Association (JAMA) article which describes the use of awake proning in COVID-19 patients and its positive effects on oxygenation, (7) our group of physicians began encouraging awake proning in the management process of our COVID-19 patients. We felt that using this may be a tool that could prevent the progression of the respiratory disease to the need for mechanical ventilation.

In our retrospective analysis of the effects of self proning, our data showed no difference in progression to mechanical ventilation or survival. It should be noted that the setting is a small community hospital and the number of patients we were able to convince to self-prone was much smaller than the number that did not self-prone. There are a few confounders here as well. Early in duration of this pandemic we were engaged in prompt intubation of patients. This may have caused a small inflation in the number of non self proning patients that progressed to need for mechanical ventilation as we were not attempting other means to slow the respiratory decline.

Another large confounder in this study is the variability in which each patient was managed. Most of our patients were given 1mg/kg methylprednisolone, 2 doses of tocilizumab, and daily furosemide based upon daily lung ultrasound findings. This formula for management occurred most often in those that progressed to high flow nasal canula or beyond. Not all patients that were admitted to our facility would receive this treatment regimen. The variability in the treatment of our patients likely plays a large role in the progression to mechanical ventilation. However, we feel that our data raises an interesting query about the role for proning earlier in respiratory failure and even more so in the COVID-19 induced respiratory failure.

As previously mentioned, we noticed that many of the patients in the non self proning group were encouraged to prone but either refused or were unable to tolerate positioning. In Kentucky, obesity is a major morbidity factor which presents a challenge for the patient to tolerate the prone positioning. It bears noting that, because of the large number of obese patients, proning may be the more beneficial by removing the weight on the chest wall and reducing the work of breathing. Also, we were unable to determine the amount of time, on average, a patient would prone. This likely played a large role in the progression of the respiratory decline if some patients were proning longer than others. However, despite this inability to record the average amount of time spent proned only 3 of the self proning patients progressed beyond need for high flow nasal canula.

Conclusion:

Ultimately, our study is a small sample size across both the self proning and non self proning groups. Unfortinuately, we were not able to show a difference in need for mechanical ventilation, level of oxygen support, or survival. We feel that the variability in management across all patients likely played a significant role as well as patients' ability to tolerate proning. Proning was previously viewed as a salvage therapy in attempt to improve oxygenation in severe ARDS. We feel that there is a significant place in the treatment regimen to initiate early proning, even before a patient requires intubation. We still believe that early proning has its place and can provide benefit. We feel that a larger scale less confounding study will show this and feel further investigation is still warranted.

References:

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