Original article

Prone position as a therapeutic strategy for elderly patients with COVID-19 under mechanical ventilation

Posição prona como estratégia terapêutica para pacientes idosos com COVID-19 sob ventilação mecânica

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ABSTRACT | OBJECTIVE: To evaluate the use of the prone position (PP) as a therapeutic strategy for elderly patients diagnosed with COVID-19 undergoing invasive mechanical ventilation (IMV). **METHODOLOGY:** A cross-sectional descriptive retrospective study was carried out through the analysis of 166 medical records related to the patients' hospitalization in a COVID intensive care unit from April to August 2021 at a large hospital in the Federal District. Data collection included sociodemographic, clinical, and healthcare information, as well as health outcomes. Descriptive statistics were used to characterize the sample, and the Wilcoxon test was used to assess differences before and after the adoption of the PP. **RESULTS:** A total of 66 elderly patients were hospitalized with a diagnosis of COVID-19 and required IMV. The majority were male (51.5%), had comorbidities such as systemic arterial hypertension (56.1%) and diabetes mellitus (25.8%), and 80.3% of cases were already admitted intubated. The mean duration of IMV use was 10 days (±11.05). PP was used in 10.6% of patients. The most frequent outcome was death (72.7%). Patients undergoing PP showed no statistically significant differences in pulmonary mechanics and oxygenation index before and after PP adoption. **CONCLUSION:** The use of PP in elderly patients with COVID-19 undergoing IMV was uncommon and showed no significant impact on pulmonary mechanics or improved oxygenation.

KEYWORDS: Elderly. COVID-19. Mechanical Ventilation. Death.

RESUMO | OBJETIVO: Avaliar o uso da posição prona (PP) como estratégia terapêutica para pacientes idosos com diagnóstico de COVID-19 submetidos a Ventilação Mecânica Invasiva (VMI). **METODOLOGIA:** Estudo transversal descritivo retrospectivo, realizado mediante análise de 166 prontuários referentes à internação dos pacientes em uma unidade de terapia intensiva de COVID no período de abril a agosto de 2021 de um hospital de grande porte do Distrito Federal. A coleta contemplou informações sociodemográficas, clínicas, assistenciais e desfecho de saúde. Foi utilizada estatística descritiva para caracterização da amostra e o teste de Wilcoxon para verificar as diferenças antes e após a adoção da PP. **RESULTADOS:** Um total de 66 pacientes idosos foi internado com diagnóstico de COVID-19 e necessitou de VMI. A maioria era do sexo masculino (51,5%), apresentava comorbidades como hipertensão arterial sistêmica (56,1%) e diabetes mellitus (25,8%) e 80,3% dos casos já foram admitidos intubados. O tempo médio de uso da VMI foi de 10 dias (±11,05). A PP foi utilizada em 10,6% dos pacientes. O desfecho mais frequente foi o óbito (72,7%). Os pacientes submetidos à PP não apresentaram diferença estatisticamente significante na mecânica pulmonar e relação do índice de oxigenação antes e após a adoção da PP. **CONCLUSÃO:** A utilização da PP em idosos com COVID-19 submetidos à VMI foi pouco frequente e não demonstrou impacto significativo na mecânica pulmonar nem na melhora da oxigenação.

PALAVRAS-CHAVE: Idoso. COVID-19. Ventilação Mecânica. Óbito.

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1. Introduction

COVID-19 causes Acute Respiratory Failure (ARF) in its carriers, with many patients requiring Invasive Mechanical Ventilation (IMV) and hospitalization in Intensive Care Units (ICUs) due to the development of acute respiratory distress syndrome (ARDS)[1]. According to the authors cited, ARDS resulting from ARF due to COVID-19 causes diffuse inflammation of the alveolar-capillary membrane as a result of lung injury. The same authors also state that the presence of pulmonary infiltrates leads to a reduction in lung compliance, with repercussions on gas exchange, triggering hypoxemia.

Elderly people stand out among the groups at risk for complications from COVID-19, as they are more likely to have comorbidities that can aggravate their clinical condition[2]. The elderly are vulnerable due to chronic conditions they may have, such as systemic arterial hypertension (SAH), diabetes mellitus (DM), cardiovascular or pulmonary diseases. Among these, the ones with cardiovascular diagnoses were associated with the worst outcome when affected by COVID-19 and are the patients who progress to the need for orotracheal intubation and IMV[3].

Among the factors most associated with death from COVID-19 in the elderly, the most notable are advanced age, male gender, diagnosis of DM, obesity, or other morbidities, as well as having used ventilatory support during hospitalization[4]. This fact calls attention to the adoption of therapeutic measures aimed at minimizing the chances of elderly patients with COVID-19 having a prolonged hospitalization or dying, as well as reducing the damage that IMV can cause to these patients[5]. In this regard, the prone position (PP) was widely used during this period, as it is responsible for generating a redistribution of pulmonary ventilation and perfusion, as well as reducing the gravitational gradient of pleural pressure. In this way, the prone position improves arterial oxygenation and must be adopted when patients have an oxygenation index, P/F ratio, <150[6].

The adoption of the PP in elderly patients in the ICU requires the attention of all team members. Nurses, for example, must be attentive to the positive response to therapy. This means less time in the PP and less exposure to the risks that this position can cause, such as accidental extubation, skin lesions, loss of devices, among others[7]. Successful adoption of the PP results in shorter IMV time, less use of sedatives and neuromuscular blockers (NMBs), and a reduction in the use of vasoactive drugs, length of hospital stays, and greater chances of extubation and hospital discharge[8].

Knowledge of the clinical characteristics of elderly patients with COVID-19 undergoing IMV and PP can guide multidisciplinary teams in developing strategies that reduce the adverse effects of these interventions and promote faster and more effective weaning and extubation[9]. Thus, the objective of this study was to evaluate the use of the prone position as a therapeutic strategy for elderly patients diagnosed with COVID-19 undergoing invasive mechanical ventilation.

2. Methods

This was a cross-sectional, retrospective, descriptive, quantitative study conducted by analyzing the medical records of patients diagnosed with COVID-19 who required IMV support and underwent PP in the COVID ICU of the Hospital de Base do Distrito Federal (HBDF).

Data collection occurred between October and December 2022 in the Medical and Statistical Archiving System (SAME), in which electronic medical records were listed, located, and examined. For data collection, the researchers developed a script containing information about sociodemographic variables, such as age, sex; clinical variables, such as comorbidities, associated clinical conditions; care variables, such as reason for intubation, total time on IMV, therapy administered before intubation or after extubation (Non-Invasive Ventilation – NIV, or oxygen therapy), adoption of PP, time to adoption of PP after intubation, number of PP cycles the patient underwent, pulmonary mechanics; and outcome variables, including health outcomes (death, extubation, among others). The researchers, who had been trained beforehand, took turns collecting data and standardized the method to ensure consistency.

The inclusion criteria were the medical records of elderly patients (≥60 years) who were admitted to the COVID ICU at HBDF in the period from April to August 2021 with a diagnosis of COVID-19, who evolved to ARF and were intubated, requiring IMV support, as well as those patients already admitted under IMV who were transferred from other institutions and underwent PP. The following exclusion criteria were adopted: patient records containing incomplete information, in addition to those that were not suitable for research, such as those that were lost, blocked, or impossible to access, or that could not be located during data collection. Patient data were transcribed into coded spreadsheets, without the possibility of identifying the source patient, in accordance with confidentiality criteria.

Sampling is non-probabilistic, of the simple random intentional type. After collection, the data were tabulated in a Microsoft Excel spreadsheet to create the database. They were then exported to SPSS software version 24. Descriptive statistics were used for analysis, numerical variables were expressed as mean and standard deviation, while categorical variables were expressed as frequency and proportions. Data normality was assessed using the Kolmogorov-Smirnov test, and differences in pulmonary mechanics and P/F ratio before and after the adoption of PP were verified using the Wilcoxon test, adopting a significance level of $p<0.05$. The study was approved by the Research Ethics Committee (CEP) of the Gestão Estratégica em Saúde do Distrito Federal - IGESDF (Federal District Strategic Health Management Institute) (under protocol no. 5.652.606 (CAAE 60311222.8.0000.8153), in compliance with resolutions 466/2012 and 510/2016, which regulate the use of information contained in patient records for scientific research purposes.

3. Results

A total of 166 patients were admitted to the COVID ICU and required IMV. Of these, 39.75% (*n*=66) were elderly, with a mean age of 70.86 (± 6.86) years, and the majority were male 51.5% (*n*=34). With the main comorbidities being cardiovascular and metabolic, the information is shown in table 1.

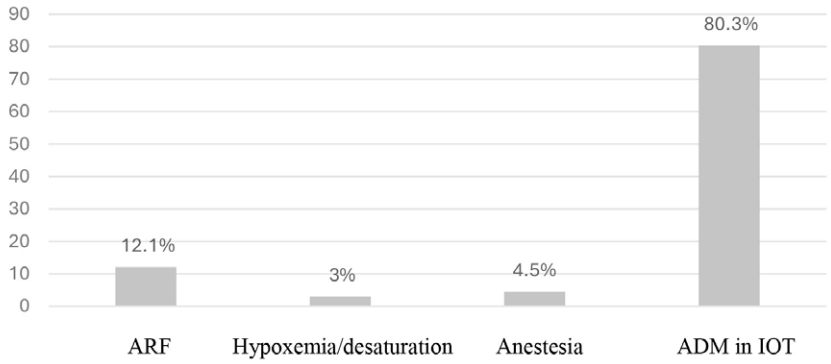
Table 1. Comorbidities and associated clinical conditions in elderly patients hospitalized for COVID-19 at the Hospital de Base do Distrito Federal in 2021. (*n*=66)

Variables	*n* (%)
Comorbities	
Systemic Arterial Hypertension	37 (56.1%)
Diabetes Mellitus	17 (25.8%)
Dyslipidemia	6 (9.1%)
Associated medical conditions	
Heart disease	21 (31.8%)
Pulmonary disease	5 (7.6%)
Oncologic disease	9 (13.6%)
Vascular disease	12 (18.2%)
Musculoskeletal disorder	2 (3.0%)
Kidney disease	12 (18.2%)

Source: the authors (2025).

Graph 1 contains information on the reason why patients were intubated and required IMV. Among the 66 elderly patients with COVID-19 who required IMV, the main reason for intubation was admission to hospital already intubated, representing 80.3% (*n*=53) of cases, with ARF being the second main reason in 12.1% (*n*=8) of patients.

Graph 1. Reasons for intubation in elderly patients diagnosed with COVID-19 at the Hospital de Base do Distrito Federal in 2021 (*n*=66)



Source: the authors (2025).
ARF: Acute Respiratory Failure; ADM: Admission; IOT: intubation.

As for the total duration of IMV, the patients had an average of 10 (±11.05) days. As for the therapy adopted before intubation, 4.54% (*n*=3) were on oxygen therapy with a non-rebreather mask, while 7.57% (*n*=5) were on NIV support. After extubation, 1.51% (*n*=1) used NIV, 6.06% (*n*=4) used a non-rebreather mask, 1.51% (*n*=1) used a Venturi mask and 6.04% (*n*=4) used oxygen therapy under a nasal cannula.

Regarding the application of the PP, it was adopted only in part of the patients in the study (*n*=7), which represents 10.6% of the sample. Of these, 3 (42.85%) were pronated immediately after orotracheal intubation. As for the number of cycles, 3 patients (42.85%) underwent only one to two cycles and only one (14.28%) underwent six cycles. Regarding the time spent in the prone position, 3 (42.85%) patients remained prone for 18 hours, one (14.28%) patient remained prone for 22 hours, and the other remained prone for 24 hours. The data are shown in table 2.

Table 2. Characteristics of the adoption of the prone position in elderly patients hospitalized for COVID-19 at the Hospital de Base do Distrito Federal in 2021. (*n*=7)

Variables	*n* (%)
Application of the prone position	
Immediately after IOT	3 (42.85)
> 24 hours after IOT	2 (28.57)
5 days after IOT	1 (14.28)
9 days after IOT	1 (14.28)
Number of Prone position cycles	
1 prone cycle	3 (42.85)
2 prone cycles	3 (42.85)
6 prone cycles	1 (14.28)
Time in prone position	
18 hours	3 (42.85)
20 hours	2 (28.57)
22 hours	1 (14.28)
24 hours	1 (14.28)

Source: the authors (2025).
OTI: orotracheal intubation.

Regarding pulmonary mechanics, it was found that a total of 65.2% (*n*=43) of patients had data on pulmonary mechanics assessment recorded in their medical records, while 34.8% (*n*=23) did not have such records. The patients who underwent PP (*n*=7) did not show a statistically significant difference in pulmonary mechanics and P/F ratio before and after adopting PP. The relevant data are shown in table 3.

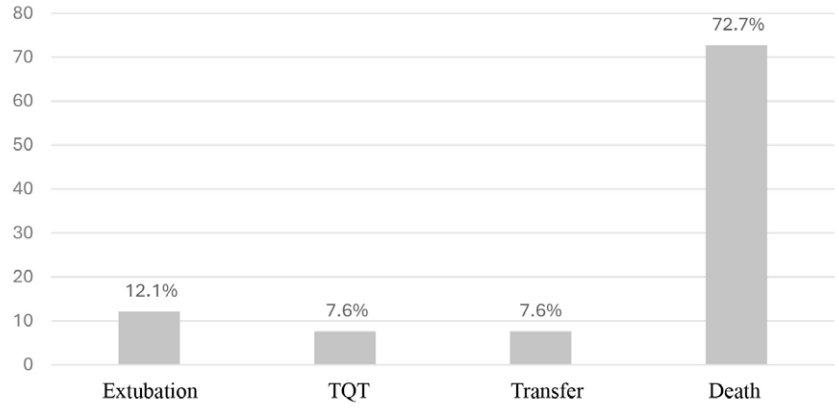
Table 3. Pulmonary mechanics (Cest and DP) and P/F ratio before and after adopting the prone position in elderly patients hospitalized for COVID-19 at the Hospital de Base do Distrito Federal in 2021. (*n*=7)

	Pre (median/ min and max)	Post (median/ min and max)	*p*
Cest	33 (17 - 55)	27 (17 - 66)	0.753
DP	14 (5 - 22)	15 (6 - 20)	0.833
P/F	88 (68 - 169)	130 (101 - 163)	0.176

Fonte: os autores (2025).
Cest: complacência estática; DP: Driving pressure; P/F: índice de oxigenação.

Regarding the health outcomes of the hospitalizations of elderly patients in the study, most progressed to death (72.7%, *n*=48), a total of 12.1% (*n*=8) were extubated, and 7.6% (*n*=5) were either tracheostomized or transferred to other services. The data is shown in graph 2.

Graph 2. Percentage of health outcomes for elderly patientes hospitalized for COVID-19 at the Hospital de Base do Distrito Federal in 2021. (*n*=66)



Source: the authors (2025).
TQT: tracheostomy.

4. Discussion

This article aimed to evaluate the effect of PP as a therapeutic strategy in elderly patients diagnosed with COVID-19 who required IMV support and other characteristics during this process, including health outcomes. A retrospective, single-center study that profiled patients diagnosed with COVID-19 found that most patients had a mean age of 58.66 (±11.77) years, were male, and that the second wave of COVID-19 infection in 2021 changed the age profile of those affected[10]. According to the aforementioned authors, due to the prioritization of the elderly population with vaccines, adults were among the most infected, contributing to a high hospitalization rate and a close relationship between hospitalization and progression to death. In the present study, which is also a single-center retrospective study, the majority of the sample was male.

A study that assessed the profile of elderly patients diagnosed with COVID-19 in the state of Ceará from January 2020 to July 2022 found that 15% of confirmed cases accounted for people aged 60 or older, the majority of whom were female (55.5%)[11]. The study concluded that the elderly population was the most impacted, especially those aged 80 or older, demonstrating that the elderly are one of the main risk groups for COVID-19. Elderly patients generally have more comorbidities than adult and young patients, and this can contribute to frailty[12]. In our study, cardiac and metabolic diseases were present in a considerable portion of the sample.

A study conducted in southwestern Bahia identified that elderly patients diagnosed with COVID-19 had age-related comorbidities, such as SAH, DM, and joint diseases, where elderly patients with chronic pathologies and immunosuppression were those with the highest risk factor for COVID-19[13]. A study that evaluated the clinical profile and factors associated with death in COVID-19 patients in the first months of the pandemic observed that the presence of comorbidities was associated with death, with elderly patients with cardiovascular comorbidities associated with worse outcomes[3].

The data from this study showed that most patients had already been admitted to the unit intubated under IMV. As this was a reference and backup hospital during the pandemic in the Federal District, many patients were transferred to the unit to continue their treatment. IMV is a resource used in severe conditions of ARF where spontaneous ventilation fails. The infection caused by COVID-19 was responsible for generating severe hypoxemia that was refractory to noninvasive measures, requiring intubation and IMV[14]. The average total time of IMV in the patients in the sample of this study was 10 (±11.05) days, which is considered relatively short among patients who were extubated.

IMV is responsible for reducing autonomic ventilatory capacity the longer it is used and for other probable complications, such as Ventilator-Associated Pneumonia (VAP), loss and/or reduction of the swallowing reflex, longer periods of immobility in bed, among others[15]. Thus, correct management of mechanical ventilation in patients on IMV to promote the earliest possible removal of the mechanical ventilation is of paramount importance, so that the patient can spend less time on invasive mechanical ventilation[16].

PP is a proven effective intervention for treating ARDS, and ARDS resulting from COVID-19 caused a reduction in compliance and oxygenation index, where PP generates significant effects for improving the clinical condition, by promoting improved compliance, redistribution of the V/Q ratio, with a consequent improvement in the oxygenation index[6]. In the present study, PP was adopted in 10% of volunteers, the majority (42.85%) being prone immediately after intubation and undergoing 1 to 2 (42.85%) cycles of PP, with 42.85% of patients remaining prone for at least 18 hours. Unlike our results, a multicenter cohort study[17] conducted with patients diagnosed with COVID-19 showed that the time in days taken to adopt PP was two days in those patients judged to be responders to PP, and the average length in hours of stay was 18.6 hours. As for the prone cycles adopted, two cycles were adopted, in line with the findings of this study.

When comparing data on pulmonary mechanics (static compliance and Driving pressure) and P/F ratio in patients undergoing PP, no statistically significant differences were observed after the adoption of PP, with only an increase in the oxygenation index, but with no statistical difference. Different data ha been found in other studies that demonstrate the effectiveness of adopting PP in the context of ARDS due to COVID-19[18-20]. A scoping review that analyzed 12 studies pointed out that PP is a common procedure in ICUs, but it requires care to ensure safety and effectiveness in its adoption[21]. The same review also noted that when PP was used in the care of patients with COVID-19, the average duration was 12 to 16 hours, and the P/F ratio was among the main indications for the adoption of PP. The authors also consider the identification of some complications resulting from the use of the PP, such as accidental extubation, pressure injury, and facial edema, and the positive outcomes of its use, which outweigh the possible complications.

A study evaluated the effects of PP in 40 patients diagnosed with COVID-19 who were mechanically ventilated, with a mean age of 64.5 years, most of whom were male (55%), and among the comorbidities observed, SAH and DM were prominent[22]. The authors showed that PP had positive effects on pulmonary stress and oxygenation index immediately after its adoption; however, when the patients were supinated after 16 hours, the effects were quickly reduced but remained higher than the values before PP.

This demonstrates the benefit of adopting PP to reduce pulmonary stress and prevent lung damage induced by IMV.

An important aspect to consider is the outcome of patients diagnosed with COVID-19 on IMV. The goal is always to fully restore spontaneous ventilation; however, the severity of the condition, pulmonary involvement, and the use of sedation and NMBs may delay the safe removal of the ventilatory prosthesis[23]. Given the clinical condition of many patients, such as age, pulmonar involvement, and comorbidities, they could progress to tracheostomy. In this study, 7.6% underwent tracheostomy, while 12.1% were extubated. A total of 72.7% of elderly patients in the sample died. The type of study does not allow us to establish a cause-and-effect relationship for this finding, but we can infer that the fact that they were elderly patients with multiple comorbidities may have contributed to the high number of deaths in the sample.

A study conducted in Rio Grande do Sul showed that of the total of 110 patients diagnosed with COVID-19, 15.4% used IMV and 10% died[24]. Unlike our data, the study included all patients, whether they were on spontaneous ventilation or IMV, as well as all age groups. A retrospective cohort study conducted at a single center showed that patients who required IMV had higher hospital mortality, elderly patients had the highest death rates, and the most prevalent comorbidities were oncological, cardiovascular, and renal among those who evolved to death[25].

The use of PP in patients on IMV diagnosed with COVID-19 may be beneficial when properly indicated and conducted[5,16]. However, a study conducted in São Paulo found no association between the use of PP and intubation time, hospital admission, and mortality. The sample consisted mainly of elderly male patients with at least one comorbidity. Among the patients who were prone, the highest rates of comorbidities were found, such as hypertension, diabetes mellitus, and obesity[26].

Nurses are usually involved in the care of patients who use PP, but being attentive to issues such as pulmonary mechanics and response to PP means less time is needed to adopt it and there is less chance of harm. Nurses should be aware of the implications and complications of keeping patients in this position[27]. Assessing the patient in conjunction with the multidisciplinary team, including ventilation mechanics, is among the scope of duties that nursing professionals must manage When caring for elderly patients diagnosed with COVID-19 on IMV undergoing PP[28].

The study's limitations include the fact that it is an analysis of medical records, which does not allow for the establishment of cause-and-effect relationships, as well as missing information in the records that could have enriched the analyses.

5. Conclusion

The adoption of the prone position in elderly patients diagnosed with COVID-19 on IMV did not result in statistically significant differences in pulmonary mechanics, static compliance, and Driving pressure. The P/F ratio improved after the adoption of the PP, but with no statistically significant difference. The clinical profile of the patients was characterized by being male, with cardiovascular and metabolic comorbidities. Most patients had already been admitted to the unit on IMV, transferred from other institutions. The average length of stay in the ICU was relatively short, and death was the most common outcome in the sample. The study does not suggest that PP should be avoided in elderly patients diagnosed with COVID-19 receiving IMV, as it is a retrospective study with a small sample, but it does emphasize the characteristics of the sample that may have contributed to these findings.

Authors' contributions

The authors declared that they had made substantial contributions to the work in terms of the conception or design of the research; the acquisition, analysis, or interpretation of data for the work; and the writing or critical revision of relevant intellectual content. All authors have approved the final version to be published and have agreed to take public responsibility for all aspects of the study.

Competing interest

No financial, legal, or political conflicts involving third parties (government, private companies and foundations, etc.) were declared for any aspect of the submitted work (including, but not limited to, grants and funding, participation in advisory boards, study design, manuscript preparation, statistical analysis, etc.).

Indexers

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