

A REVIEW OF THE PRONE POSITION IN ACUTE RESPIRATORY FAILURE DUE TO COVID-19

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Abstract: To improve oxygenation, the prone position is indicated in acute respiratory distress syndrome, being used in critically ill patients. The use of prone position improves the hypoxemic level and reduces mortality when used early. The objective is to identify the indication and main benefits and complications of the prone position in patients admitted to the Intensive Care Unit under mechanical ventilation due to acute respiratory failure due to Covid-19. This is a narrative review of the literature carried out in August 2022, in the Scielo, PubMed and ``Portal de Periódicos Capes`` databases on the clinical indication, benefits and complications of the prone position in patients under mechanical ventilation due to acute respiratory failure due to Covid-19. 19, admitted to the Intensive Care Unit. The Health Sciences descriptors used were “Intensive Care Unit”, “Covid-19” and “Prone” (prone position), using the Boolean operator “AND”. The original publications were established as inclusion criteria, available in full in Portuguese, English and Spanish, published from 2020 to 2022. As it is a literature review, the study did not require approval from the ethics committee. They resulted in 14 scientific articles, eight from Capes and six from PubMed. Benefits were reported by seven articles, complications by two, and five dealt with the two themes (benefits and complications). Although this review did not make it possible to define the indications for the use of the prone position, some benefits pointed out were the improvement in the PaO₂/FiO₂ ratio, oxygenation, reduction in length of stay and mortality, and better lung compliance. With regard to complications, pressure injuries and accidental removal of medical devices such as an endotracheal tube and peripheral and central venous accesses occur. Finally, prone positioning was used in intubated and non-intubated patients, with significant PaO₂/

FiO₂ improvements in prone patients during the Covid-19 pandemic. The limitation in this review is that there is heterogeneity in the studies regarding the pronation criteria, its definition, use, benefits and complications, with cohort methods, cross-sectional studies and with casuistic interventions. Although the pandemic has already ended, retrospective studies are suggested to better investigate the conduct of pronation in patients with Covid-19 in intensive care.

Keywords: COVID-19. Ventral Decubitus. Intensive Care Units. Nursing.

INTRODUCTION

According to Souza et al. (2019), Intensive Care Units (ICUs) are environments designed to provide specialized assistance to patients in critical health conditions, with strict control of their vital parameters. Therefore, this unit, within the scope of the Unified Health System (SUS), requires a qualified and committed multidisciplinary team, which performs care functions with technical, technological and scientific knowledge, performing from simple to more complex procedures (OUCHI et al, 2018; ROBINSON, et al., 2018; PURIN; PURIN; DELLINGER, 2009). This multidisciplinary team, a priori, is made up of doctors, nurses and nursing technicians. However, there are other professionals involved as a support team, such as nutritionists, psychologists, speech therapists, pharmacists and social workers who offer comprehensive and high-quality care for those who are seriously compromised (BRASIL, 2010; ROSE, 2011).

Stressors that threaten the “stable” atmosphere of the ICU are the constant emergencies and unpredictable events that require clinical thinking and rapid decision-making from professionals and learning cycles for new skills, in addition to patients being monitored 24 hours a day, with reading and interpretation of various imaging and

laboratory tests (OUCHI et al., 2018; INOUE et al., 2013; LEITE; VILA, 2005).

In the context of a new pandemic scenario that occurred at the end of 2019, in the city of Wuhan, China, these intensive care professionals had to be trained in a new therapeutic management of Covid-19 symptoms. SARS-CoV-2 (a type of virus from the coronavirus family 2), which causes Covid-19, is highly transmissible, causing serious respiratory diseases, such as Severe Acute Respiratory Syndrome (SARS), in which death can occur in a few minutes. days (BRASIL, 2020a).

From the first images obtained from China, with hospitals being built quickly (almost overnight) and soon the news arriving from Europe, the message transmitted to the world was the overload of health services and the inability to attend to all high patient flows in a timely manner. And over the days and months, what was heard and experienced were the numbers of new or confirmed cases of Covid-19, lethality rates, numbers of new deaths, recovered people, strict measures adopted by social isolation, flattening curves of contagion, mitigation measures such as mandatory use of masks, ICU occupancy rates, use and purchase of more respirators and ventilators (PEREIRA, 2021), a scenario that required additional beds to meet the high demand for hospitalization (BALDWIN; DI-MAURO, 2020). The transmission rate of this virus has overwhelmed health systems with a serious global health crisis, leaving many infected patients with little or no treatment for the serious respiratory problems caused (GOURINCHAS, 2020).

According to Rodrigues e Silva (2020), the pandemic in Brazil started in February 2020 and, in March, there were more than 22 cases in which care was carried out continuously, with notification and referrals to the State Health Secretariats. In the meantime, the

Ministry of Health (MS) instituted protocols and authorized the opening of wards and ICUs specialized in the treatment and recovery of patients with Covid-19 (BRASIL, 2020a).

While most infected patients do not have severe clinical complications, approximately 14% progress to a more severe condition that requires intensive care admissions, multiple central accesses, prolonged mechanical ventilation, prone position and use of corticosteroids (ZHOU et al., 2020). Characteristics of the complications of this condition were sepsis, acute renal failure, acute cardiac dysfunction and Acute Respiratory Distress Syndrome (ARDS) (YANG et al., 2020; ZHOU et al., 2020). Clinical signs of ARDS are respiratory failure unrelated to hypervolemia or ventricular failure, with bilateral pulmonary opacity on X-ray and a drop in the ratio of Partial Arterial Oxygen Pressure (PaO₂) and Fraction Inspired (FiO₂) less than 300 (FAN et al. al., 2017).

To improve oxygenation or ventilation, the prone or prone position is indicated in ARDS. In favor of gravity, there is a repositioning of the heart in the thorax for recruitment of pulmonary alveoli, in which a gravitational gradient of pleural pressure is reduced, transpulmonary pressures are more uniform and alveolar recruitment can be achieved in atelectatic regions, improving the ventilation ratio /perfusion, arterial oxygenation, and mortality of this non-COVID-19 syndrome (ANANIAS, CAMBRAIA, CALDERARO, 2017; CASTELL *et al.*, 2016; COPPO *et al.*, 2020).

The effects of using the prone position early (maintaining it for 16 hours, which can reach up to 20 hours, before returning to the dorsal position) (GUÉRIN et al., 2013), in critically ill patients with Covid-19, are the improvement of hypoxemic level assessed by oxygen saturation and reduction in mortality (ZANG et al., 2020). It must be indicated

to patients who have severe changes in gas exchange, with a PaO₂/FiO₂ of less than 150 mmHg (GUÉRIN et al., 2013).

It is worth mentioning that professionals from the most diverse areas have acted together to combat and reduce the consequences that the pandemic has brought, with the nursing team and, more specifically, the nurse being responsible for managing intensive care both in the ICU and in the nursing wards. Covid-19 (AGOSTINHO et al., 2021). Therefore, it is noticeable how the quality of patient safety within the ICU aims to provide quality care, ensuring comprehensiveness and humanization allied to good professionals working within the interdisciplinary team who will ensure quality in care (BARROS, 2019).

Based on this introductory statement, the objective was, based on a bibliographic review, to identify the clinical indication and the main benefits and complications of the prone position in patients under mechanical ventilation due to acute respiratory failure due to Covid-19, admitted to the Intensive Care Unit?

METHOD

It is a narrative review of the literature, used to describe and discuss the development of a given subject, from a theoretical or contextual point of view, constituting an analysis of the literature published in books, articles in printed and/or electronic magazines in the interpretation and critical analysis, which allows the reader to acquire and update knowledge about a specific topic in a short period of time (ROTHER, 2007).

Qualitative research occupies a recognized place among the various possibilities of studying phenomena, and can be better understood in the context in which it occurs and of which it is part, and must be analyzed from an integrated perspective. Several types

of data are collected and analyzed in order to understand the dynamics of this phenomenon (GODOY, 1995).

For the eligibility of the studies, the following inclusion criteria were used: original publications in full scientific article format, electronically available, free of charge, in Portuguese, English or Spanish, respecting the pre-established time limit from 2020 to 2022, who answered the research question.

For the exclusion criteria, duplicated articles were considered, association of the prone and supine position, publications in the form of course conclusion works, monographs, theses, dissertations, chapters of books and books, minutes, abstracts of congresses, research reports, letters, editorials, reviews, bibliographic reviews and publications outside the selected period or that did not address the proposed content. The search and selection of articles was carried out by two researchers involved in this research.

The search was carried out on August 20, 2022 in the SciELO (Scientific Electronic Library Online), PubMed (National Library of Medicine) and Capes (Coordination for the Improvement of Higher Education Personnel) journal portal databases. The selection of keywords for the search terms was consulted in the vocabulary of the DeCS (Health Sciences Descriptors) database, namely: "Intensive Care Unit", "Covid-19" and "Prone" (referring to prone position, in English). The Boolean operator used was "AND". The advanced search used the final search term 'Intensive Care Unit AND Covid-19 AND Prone'.

The analysis of the results took place with reading, translation and interpretation of the articles found. The identification took place with an Arabic numeral, in addition to the title, authors, method, objectives and main results. Data such as language of the article and country of publication were also collected. The results were divided into two thematic

axes, namely: benefits of prone positioning (PP) and complications of PP.

RESULTS

There was a total of 14 articles, eight from Capes and six from *PubMed*, available only in English, with publications in the United States of America (USA), Italy, United Kingdom, Ireland, Switzerland, France and Japan. The selection of articles that took place in August 2022 is described in Figure 1.

The identification and classification data of the selected articles can be seen in Table 1, containing title, authors, method used, objectives and main results.

DISCUSSION

Studies have shown that placing the patient in the prone position (PP) reduces mortality in situations of severe stress. This technique has been widely used since the beginning of the pandemic, even in spontaneously breathing patients. Although its effectiveness is a source of debate in intubated patients due to lack of proof of effectiveness and consensus among researchers, it was more used in the second period of the pandemic in an attempt to reduce the need for intubation (COPPO et al., 2020; TABOADA et al., 2021).

Among the benefits related to the use of PP in patients with Covid-19, most articles mentioned a significant improvement in the PaO₂/FiO₂ ratio (SHELHAMER et al.; LANGER et al.; WEISS et al.; CLARKE et al., 2021; WALTER et al.; DELLANNA et al.; CAMPOROTA et al.; DI MASCIO et al.; KAWAKAMI et al., 2022). Studies by Duggal and colleagues (2021) reported that patients with acute respiratory distress syndrome (ARDS) have been shown to benefit from early prone position if hypoxemia is severe and refractory through an increase in the inspired fraction of oxygen (FiO₂ greater than 60%) and higher positive end-expiratory

pressure (PEEP).

Other benefits found in other articles were the significant and sustained decrease in the alveolar-arterial oxygen gradient (CLARKE et al., 2021), reduction in the length of stay in the ICU (STILMA et al., 2021), significant increase in oxygenation (WALTER et al.; DELLANNA et al.; CAMPOROTA et al., 2022; PARKER et al., 2021;), decreased pulmonary shunt and improved compliance of the respiratory system (DELLANNA et al., 2022).

Thus, the prone position demonstrated improvements in blood oxygenation by homogenizing the distribution of lung ventilation/perfusion ratios, thus preventing ventilator-induced lung injury. This strategy also homogenizes the tension to the lung tissue associated with mechanical ventilation in inflamed alveoli, preserving systemic hemodynamics, particularly right ventricular function. However, the clear response to the prone position remained elusive (GUÉRIN et al., 2020).

In a large cohort of intubated patients with Covid-19, Langer et al. (2021) showed that prone positioning was associated with immediate improvement in oxygenation without any increase in respiratory system compliance. These results show a trend of worsening oxygenation after resupination. The lack of improvement in static compliance contrasts with non-COVID-19 ARDS due to a reduction in driving pressure and plateau pressure when placed in the prone position, suggesting better static compliance (GUÉRIN et al., 2020).

Before the Covid-19 pandemic, a study by Guérin and collaborators (2013), demonstrated an improvement in survival from the prone position (PP) used as cycles of more than 16 consecutive hours in selected patients with ARDS, that is, those with PaO₂/FIO₂ ratio < 150 mmHg after 12h to 24h of stabilization. Although experts recommend

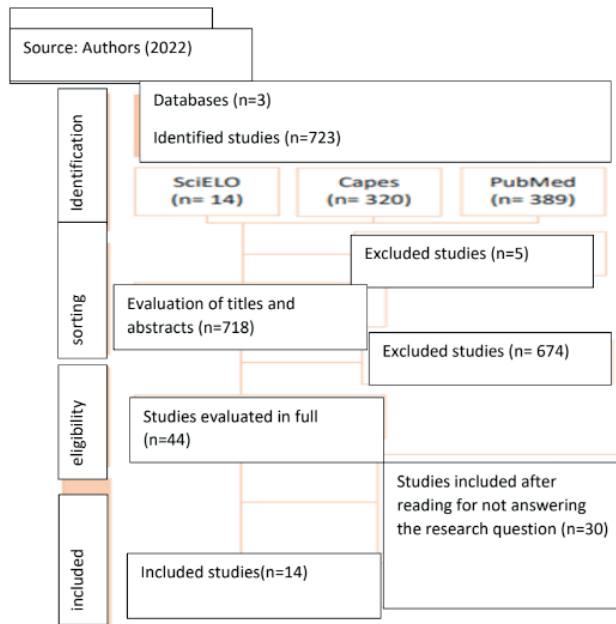


Figure 1. Flowchart of selection of articles in the Scielo, PubMed and Capes databases, Chapecó, 2022.

	Title	Authors	Method	Objective	Main results
1	Prone positioning in acute respiratory distress syndrome due to Covid-19: a cohort study and physiology analysis*	SHELHAMER, M. C., <i>et al.</i>	cohort study	To determine the benefit of prone positioning in mechanically ventilated patients with ARDS due to Covid-19.	Using linear mixed-effects models to assess the impact of positioning maneuvers on physiological parameters, the oxygenation-saturation index improved significantly during days 1 to 3 ($P < 0.01$), whereas the oxygenation-saturation index, index of oxygenation and partial pressure of oxygen and fractional inspired oxygen were significantly improved during days 4 to 7 ($P < 0.05$ for control and intervention groups).
2	Complications of prone positioning in patients with Covid-19: a cross-sectional study*	BINDA, F., <i>et al.</i>	Cross-sectional study	To determine the prevalence of complications in patients with Covid-19 submitted to the prone position, focusing on the development of pressure ulcers.	The main complications recorded in 63 patients were: pressure ulcers related to pronation (30.2%), bleeding (25.4%) and medical device displacement (12.7%). Only 15 cycles of prone positioning (6.8%) were interrupted, requiring the team to return the patient to the supine position.
3	Prone position in intubated and mechanically ventilated patients with COVID-19: a multicenter study of more than 1000 patients*	LANGER, T., <i>et al.</i>	Retrospective, multicenter national cohort study.	To describe the frequency of use of the prone position and the clinical characteristics and outcomes of patients undergoing the prone position in a large cohort of critically ill, mechanically ventilated patients with Covid-19.	The prone position was applied in 61% of the 1057 patients. Those placed in the prone position where the diagnosis of the disease was more severe still died, significantly more (45% vs. 33%, $p < 0.001$). In general, the prone position induced a significant increase in the PaO ₂ /FiO ₂ ratio. Non-responders had more severe respiratory failure and died in the ICU ($p = 0.047$). 47% of patients were defined as carbon dioxide responders, being older and having more comorbidities. However, no difference in terms of ICU mortality was observed.

4	Prone positioning for patients intubated for severe acute respiratory distress syndrome (ARDS) secondary to Covid-19: a retrospective observational cohort study*	WEISS, T.T., <i>et al.</i>	Retrospective cohort study.	To investigate the effect of prone positioning for patients with ARDS secondary to COVID-19 who required invasive mechanical ventilation	In this study, 42 individuals were eligible for analysis. Nine individuals were placed in the prone position only once, and 25 of them required the prone position on three or more occasions. After the first prone positioning session, the PaO ₂ /FiO ₂ ratio increased from 17.9 kPa to 28.2 kPa (p<0.01). After the initial prone session, individuals who were discharged from the hospital were more likely to have a 20% improvement in PaO ₂ /FiO ₂ compared to those who required ECMO or who died.
5	Prone positioning and survival in mechanically ventilated patients with respiratory failure associated with coronavirus disease 2019*	MATHEWS, K.S., <i>et al.</i>	Multicenter cohort study.	To estimate the effect of early initiation of pronation on survival in patients with respiratory failure associated with coronavirus disease 2019.	Of 2,338 eligible patients, 702 (30.0%) were prone within the first two days of ICU admission. A total of 1017 (43.5%) of the 2338 patients were discharged alive, 1101 (47.1%) died, and 220 (9.4%) were still hospitalized at the last follow-up. Prone-lying patients within the first two days of ICU admission had a lower adjusted risk of death compared with non-prone patients (hazard ratio, 0.84; 95% CI, 0.73-0.97).
6	Prone positioning improves oxygenation and lung mechanics in patients with SARS-CoV-2 acute respiratory distress syndrome: a single-center cohort study of 20 consecutive patients*	CLARKE, J., <i>et al.</i>	Prospective cohort study	To characterize the effects of prone positioning on respiratory mechanics and oxygenation in invasively ventilated patients with ARDS due to SARS-CoV-2.	The main outcome was the effect of the prone position on gas exchange and respiratory mechanics. There was a median improvement in PaO ₂ /FiO ₂ of 132 in the prone position compared to the supine position. There was no significant difference in the static compliance of the respiratory system with the prone position. Prone positioning was effective in improving oxygenation in SARS-CoV-2 ARDS. Prone positioning must be considered in patients with SARS-CoV-2 ARDS.
7	Incidence and practice of early prone positioning in invasively ventilated patients with Covid-19: information from the PRoVENT-COVID observational study*	STILMA, W., <i>et al.</i>	National observational study, multicentric.	To describe the incidence and practice of prone positioning and to determine the association of the use of prone positioning with outcomes in invasively ventilated patients with ARDS due to Covid-19	Of 734 patients, prone positioning was indicated in 60%. The patients were left in the prone position for a period of 15 hours, the ventilator parameters and the PaO ₂ and FiO ₂ ratio were not different from the 4 groups mentioned, but the FiO ₂ reached the highest indication for patients to receive the prone position.
8	Prolonged duration of prone positioning for COVID-19-related ARDS: benefits and drawbacks*	WALTER, T., <i>et al.</i>	A retrospective study	To report the benefits and disadvantages of an extended duration of prone position use for COVID-19-related ARDS.	For the 81 patients included in the study, the mean duration of prone position use was 39 hours. The cumulative incidence of stage II pressure injuries was 26% [95% CI 17–37] and 2.5% [95% CI 0.3–8.8] for stage III/IV pressure injuries. Patients were placed in the prone position during the day between 9 am and 6 pm. This increased duration was associated with a further increase in oxygenation after 16 hours, with a PaO ₂ /FiO ₂ ratio increasing from 150 mmHg to 162 mmHg before returning to the supine position (p = 0.017).

9	Hemodynamic response to positive end-expiratory pressure and prone position in COVID-19 ARDS*	DELLANNA, A.M., <i>et al.</i>	Cross-sectional study	To evaluate the hemodynamic effects of PEEP and prone positioning during respiratory failure due to Covid-19.	Relative to the supine position with low PEEP, the prone position significantly decreased the pulmonary shunt fraction (p=0.03), but increased PaO ₂ /FiO ₂ (p=0.03) and mixed venous oxygen saturation (p =0.016), without affecting cardiac output. PaO ₂ /FiO ₂ was also improved by prone position when compared to high PEEP (p=0.03).
10	Efficiency of prolonged prone positioning for mechanically ventilated patients infected with Covid-19*	PARKER, E.M., <i>et al.</i>	Retrospective study	To examine the impact of duration and factors associated with prone positioning and return of the patient to the supine position, with the aim of determining the most efficient positioning regimen to increase oxygenation and decrease the potential for complications.	Prone position for more than 39 hours maintained PaO ₂ /FiO ₂ (P/F) ratios when supine; the P/F decrease at 7 h was not significant in relation to baseline values when supine. Patients in the prone position a second time, when again in the supine position at 7 am, had a significant decrease in P/F. When PP started for an initial P/F ≤ 150 versus P/F > 150, P/F increased throughout PP and on return to bench press. Our results show that a single prone turn for > 39 h is effective and saves the burden of multiple prone turns, and there is no significant advantage in initiating PP when P/F > 150 compared to P/F ≤ 150
11	Prone Positioning in COVID-19 and COVID-19 Acute Respiratory Distress Syndrome: an International Multicenter Observational Comparative Study*	CAMPOROTA, L., <i>et al.</i>	Retrospective, observational, multicenter, international cohort study.	To quantify the prone position response, describe the differences between coronavirus disease 2019 acute respiratory distress syndrome and acute respiratory distress syndrome, and explore variables associated with survival.	Patients with COVID-19 ARDS had a longer mean time from intubation to prone position. The prone position less than 24 hours after intubation achieved greater improvement in oxygenation (11 kPa [interquartile range, 4-21 kPa] vs 7 kPa [interquartile range, 2-13 kPa]; p = 0.002).
12	Prone positioning for mechanically ventilated patients with coronavirus disease 2019: the experience of an intensive care unit at an Irish regional hospital*	DI MASCIO, N., <i>et al.</i>	Retrospective and observational cohort study.	To verify whether prone positioning significantly improves oxygenation in mechanically ventilated patients with severe COVID-19 ARDS and to describe the feasibility of frequent prone positioning in an intensive care unit (ICU) of an Irish regional hospital with limited prior experience.	The PaO ₂ /FiO ₂ ratio improved from 11.6 kPa (9.80–13.8) to 15.80 kPa (13.1–19.6) in the prone position, p<0.0001.

13	Early prone positioning in COVID-19-related acute respiratory distress syndrome: a multicenter cohort COVID-ICU network propensity score analysis - the ProneCOVID study*	TERRIER, C. L.	Prospective multicenter cohort study	To evaluate the use and impact of early PP on clinical outcomes in intubated patients admitted to intensive care units (ICUs) due to COVID-19	Among 2137 intubated patients, 1504 (70.4%) were placed in the prone position (PP) during the ICU stay and 491 (23%) during the first 24h after ICU admission. One hundred and eighty-one patients (36.9%) in the early PP group had a PaO ₂ /FiO ₂ ratio >150 mmHg when prone positioning was initiated. Among patients in the non-early PP group, 1013 (47.4%) patients were finally placed on PP within a median delay of 3 days after ICU admission. Sixtieth day mortality in the non-early PP group was 34.2% versus 39.3% in the early PP group (p=0.038). After adjusting for the propensity score, no significant difference in Day-60 survival was found between the two study groups (HR 1.34 [0.96–1.68], p=0.09 and HR 1.19 [0.998–1.412], p=0.053 in full case analysis or multiple imputation analysis, respectively).
14	PaO ₂ /FiO ₂ ratio to prone positioning in intubated patients with severe COVID-19: a retrospective observational study*	KAWAKAMI, A., <i>et al.</i>	Retrospective and observational cohort study	To investigate trends in PaO ₂ /FiO ₂ values in prone patients to identify a predictive factor for early detection of patients requiring advanced therapeutic intervention, such as extracorporeal membrane oxygenation (ECMO).	Three <i>clusters</i> were generated according to trends in PaO ₂ / FiO ₂ ratios during prone positioning (group A, n = 16; group B, n = 24; group C, n = 14). Cluster A (no increase in PaO ₂ /FiO ₂ during prone positioning) had a significantly higher proportion of patients placed on ECMO or who died (6/16, 37.5%). The number of patients with ECMO who died in the hospital was significantly different between the three groups (p = 0.017)

Table 1. Identification of articles according to title, authors, method, objective and main results, Chapecó, 2022.

PP in this pandemic setting, the rate of PP use was lower than expected when prone (PAPAZIAN et al., 2019).

Finally, patients on invasive ventilation with ARDS due to COVID-19 are usually indicated for prone positioning because they have severe hypoxemia. Furthermore, consolidation can behave like focal lesions, which is another reason to apply prone positioning early after starting invasive ventilation. Hypoxemia can also be a consequence of pulmonary embolism, for which a higher PEEP is not helpful. Several scientific reports have highlighted the frequent use of the prone position in patients with Covid-19, but with notable variation in incidence and practice (SCHULTZ, 2020; GRASSELLI et al., 2021).

Some complications in the selected articles were associated with the use of PP, such as accidental removal of intravenous devices, endotracheal tube (SHELHAMER et al., 2021), upper airway bleeding (BINDA et al., 2021), occurrence of pressure injury (BINDA et al., 2021; WALTER et al.; DI MASCIO et al., 2022), brachial plexus injury (WALTER et al., 2022), occurrence of facial edema and endotracheal tube leakage (DI MASCIO et al., 2022) and higher occurrence of shock on the first day of ICU (MATHEWS et al., 2021).

The prone position is not a totally successful intervention, as adverse events have been associated with it, such as loss of endotracheal tubes, displacement of central lines and development of pressure injuries (DIAMOND et al., 2022).

During the coronavirus disease 2019 (COVID-19) pandemic, prone positioning was used in intubated and non-intubated patients, realizing from clinical practice that there were significant improvements in PaO₂/FiO₂ when the patient was prone. Although this review did not make it possible to define the indications for the use of the prone position, some benefits and complications

of its use were found. Among the benefits pointed out, the improvement in the PaO₂/FiO₂ ratio, in oxygenation, in the reduction of hospitalization time and mortality and better lung compliance stand out. With regard to complications, pressure injuries and accidental removal of medical devices such as an endotracheal tube and peripheral and central venous accesses occur.

It must also be noted that the nurse working in the Covid-19 ICU will assess and plan care to reduce risks, especially the development of pressure injuries caused by pronation. He will be responsible for assessing possible injuries and prescribing appropriate care according to an assessment in nursing diagnoses (PEREIRA et al., 2021).

FINAL CONSIDERATIONS

The limitation in this review is that there is heterogeneity in the studies regarding the pronation criteria, its definition, use, benefits and complications, with cohort, cross-sectional methods and with casuistic interventions. Despite the fact that the pandemic has already ended, retrospective studies are suggested, in addition to this review, to better investigate the pronation management, in which the impact of early pronation remains uncertain in patients with Covid-19 in the ICU.

REFERENCES

- AGOSTINHO, C. S. de; et al. O papel da equipe de enfermagem na segurança do paciente no contexto da pandemia pela COVID-19: um relato de experiência. **Editora Científica digital**, p. 344-351, 2021.
- ANANIAS, M. A. N. B.; CAMBRAIA, A. A.; CALDERARO, D. C. Efeito da posição prona na mecânica respiratória e nas trocas gasosas em pacientes com SDRA grave. **Revista Médica de Minas Gerais**, Minas Gerais, v.28, n.5, 2017.
- ARAÚJO, M. S. et al. Posição prona como ferramenta emergente na assistência ao paciente acometido por COVID-19: scoping review. **Rev Latino-Am. Enfermagem**, v.29, 2021.
- BALDWIN, R.; DI-MAURO, B. W. Mitigating the COVID economic crisis: Act fast and do whatever it takes. **CEPR Press**, Londres, 2020.
- BARROS, F. R. B. et al. Adesão ao bundle de prevenção de pneumonia associada à ventilação mecânica. **Revista Cuidarte**, Colombia, v.10, n.2, 2019.
- BIGARAN, L. T. et al. Benefícios da posição de prona em pacientes com COVID-19 não-intubados. **Research, Society and Development**, v.10, n.6, 2021.
- BINDA, F.; GALAZZI, A.; MARELLI, F.; GAMBAZZA, S.; VILLA, L.; et al. Complications of prone positioning in patients with COVID-19: A cross-sectional study. **Intensive & Critical Care Nursing**, v. 67, n. 103088, p. 1-7. 2021. Disponível em: <https://pubmed.ncbi.nlm.nih.gov/34244027/>. Acesso em: 04 out. 2022.
- BORGES, D. L.; RAPELLO, G. V. G.; ANDRADE, F. M. D. Posição prona no tratamento da insuficiência respiratória aguda na COVID-19. **ASSOBRAFIR Ciência**, São Paulo, v.11, n.1, p.111-120, 2020.
- BRASIL. Ministério da Saúde. Agência Nacional de Vigilância Sanitária. **Resolução nº7, de 24 de fevereiro de 2010**. Dispõe sobre os requisitos mínimos para o funcionamento de Unidades de Terapia Intensiva e dá outras providências. Brasília: ANVISA, 2010.
- BRASIL. Ministério da Saúde. **Protocolo de Manejo Clínico da COVID-19 na atenção especializada**. Brasília, DF: Ministério da Saúde, 2020b.
- BRASIL. Ministério da Saúde. **Protocolo de Manejo Clínico para o novo Coronavírus (2019-nCov)**. Brasília, DF: Ministério da Saúde, 2020a.
- CAETANO, E.P.S. **Risco para lesões do posicionamento cirúrgico decorrentes da posição supina**. 2018. 122 f. Dissertação (Mestrado). Universidade Federal de Minas Gerais, Escola de Enfermagem. Belo Horizonte. 2018. Disponível em: <https://docplayer.com.br/118936320-Universidade-federal-de-minas-gerais-escola-de-enfermagem-erica-patricia-souza-caetano.html>. Acesso em: 12 out. 2022.
- CAMPOROTA, L.; SANDERSON, B.; CHIUMELLO, D.; TERZI, N.; ARGAUD, L.; et al. Prone Position in COVID-19 and COVID-19 Acute Respiratory Distress Syndrome: An International Multicenter Observational Comparative Study. **Society of Critical Care Medicine and Wolters Kluwer Health**, v. 50, n. 4, p. 633-643. 2022. Disponível em: <https://pubmed.ncbi.nlm.nih.gov/34582426/>. Acesso em: 04 out. 2022.
- CARVALHO, C. R. R. de.; JUNIOR, C. T.; FRANCA, S. A. Ventilação mecânica: princípios, análise gráfica e modalidades ventilatórias. **J Bras Pneumol**, v.33, n.2, 2007.
- CASTELL, C. D. et al. Insuficiência respiratória aguda. **Acta Colomb Cuid Intensivo**, Colômbia, v.16, n.1, p.1-24, 2016.
- CLARKE, J.; GEOGHEGAN, P.; MCEVOY, N.; BOYLAN, M.; CHOILEÁIN, O.N.; et al. Prone positioning improves oxygenation and lung recruitment in patients with SARS-CoV-2 acute respiratory distress syndrome; a single centre cohort study of 20 consecutive patients. **BMC Research Notes**, v. 14, n. 1, p. 14-20. 2021. Disponível em: <https://pubmed.ncbi.nlm.nih.gov/33422143/>. Acesso em: 04 out. 2022.
- COPPO, A.; BELLANI, G.; WINTERTON, D.; DI PIERRO, M.; SORIA, A.; FAVERIO, P.; et al. Feasibility and physiological effects of prone positioning in non-intubated patients with acute respiratory failure due to COVID-19 (PRON-COVID): a prospective cohort study. **Lancet Respir Med**, v.8, n. 8, p. 765-74. 2020. Disponível em: [https://www.thelancet.com/journals/lanres/article/PIIS2213-2600\(20\)30268-X/fulltext](https://www.thelancet.com/journals/lanres/article/PIIS2213-2600(20)30268-X/fulltext). Acesso em: 28 ago. 2022.

COSTA, R. et al. O legado de Florence Nightingale: uma viagem no tempo. **Texto Contexto Enferm**, Florianópolis, v.18, n.4, p.661-669, 2009.

DAMASCENO, M. P. C. D. et al. Ventilação Mecânica no Brasil. Aspectos Epidemiológicos. **Revista Brasileira de Terapia Intensiva**, São Paulo, v.18, n.3, 2006.

DELL'ANNA, A.M.; CARELLI, S.; CICETTINI M.; STELLA, C.; BONGIOVANNI, F.; et al. Hemodynamic response to positive end-expiratory pressure and prone position in COVID-19 ARDS. **Respiratory Physiology & Neurobiology**, v. 298, n. 4, p. 103844. 2022. Disponível em: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8759096/>. Acesso em: 04 out. 2022.

DI MASCO, N.; CLARKE, S.; LOUGHRY, G.; ALTAF, W. Prone positioning for mechanically ventilated patients with coronavirus disease 2019: the experience of an Irish regional hospital intensive care unit. **Irish Journal of Medical Science**, p. 1-6. 2022. Disponível em: <https://pubmed.ncbi.nlm.nih.gov/35819744/>. Acesso em: 05 out. 2022.

DIAMOND, M.; PENISTON, H.L.; SANGHAVI, D.; MAHAPATRA, S. **Acute respiratory distress syndrome (ARDS)**. StatPearls. 2022. Disponível em: <https://www.ncbi.nlm.nih.gov/books/NBK436002/>. Acesso em: 28 ago. 2022.

DUGGAL, A.; REZOAGLI, E.; PHAM, T.; MCNICHOLAS, B.A.; FAN, E.; BELLANI, G.; et al. Patterns of Use of Adjunctive Therapies in Patients with Early Moderate to Severe ARDS: Insights from the LUNG SAFE Study. **Chest**, v. 157, n. 6, p. 1497-1505. 2020. Disponível em: <https://pubmed.ncbi.nlm.nih.gov/32088180/>. Acesso em: 28 ago. 2022.

ELHARRAR, X.; TRIGUI, Y.; DOLS, A.M.; TOUCHON, F.; MARTINEZ, S.; PRUD'HOMME, E.; et al. Use of prone positioning in nonintubated patients with COVID-19 and hypoxemic acute respiratory failure. **JAMA Network**, v. 323, n. 22, p. 2336-8. 2020. Disponível em: <https://jamanetwork.com/journals/jama/fullarticle/2766292>. Acesso em: 28 ago. 2022.

FAN, E. et al. An official american thoracic society/european society of intensive care medicine/society of critical care medicine clinical practice guideline: mechanical ventilation in adult patients with acute respiratory distress syndrome. **American Journal of Respiratory and Critical Care Medicine**, Nova York, v.195, n.9, p.1253-1256, 2017.

FERRANDO, C.; MELLADO-ARTIGAS, R.; GEA, A.; ARRUTI, E.; ALDECOA C.; BORDELL A.; et al. Patient characteristics, clinical course and factors associated to ICU mortality in critically ill patients infected with SARS-CoV-2 in Spain: a prospective, cohort, multicentre study. **Rev Esp Anestesiol Reanim**, v. 67, n. 8, p. 425-37. 2020. Disponível em: <http://dx.doi.org/10.1016/j.redar.2020.07.003>. Acesso em: 28 ago. 2022.

FILGUEIRA, R. F. de B. et al. Manejo da posição prona em pacientes com COVID-19: revisão integrativa. **Revista de Ciências da Saúde Nova Esperança**, João Pessoa, v.18, n.2, p.135-142, 2020.

FLOR, M. A.; OLIVEIRA, K. D. L.; OLIVEIRA, A. F. Efeitos da posição prona em pacientes com COVID-19. **Brazilian Journal of Health Review**, Curitiba, v.5, n.1, p.3342-3349, 2022.

GONÇALVES, J. et al. Detecção de RNA SARS-CoV-2 em águas residuais hospitalares de uma área de baixa prevalência da doença COVID-19. **Science os The Total Environment**, v.755, n.2, 2021.

GOURINCHAS, P. O. Flattening the pandemic and recession curves. **CEPR Press**, Londres, 2020.

GRASSELLI, G.; CATTANEO, E.; FLORIO, G.; IPPOLITO, M.; ZANELLA A.; CORTEGIANI, A.; et al. Mechanical ventilation parameters in critically ill COVID-19 patients: a scoping review. **Crit Care**, v. 25, n. 115, p. 1-11. 2021. Disponível em: <https://ccforum.biomedcentral.com/articles/10.1186/s13054-021-03536-2>. Acesso em: 28 ago. 2022.

GUÉRIN, C.; ALBERT, R.K.; BEITLER, J.; GATTINONI, L.; JABER, S.; MARINI, J.J.; et al. Prone position in ARDS patients: why, when, how and for whom. **Intensive Care Med**, v. 46, n. 12, p. 2385-96. 2020. Disponível em: <https://pubmed.ncbi.nlm.nih.gov/33169218/>. Acesso em: 28 ago. 2022.

GUÉRIN, C.; REIGNIER, J.; RICHARD, J.C.; BEURET, P.; GACOUIN, A.; BOULAIN, T., et al. Prone positioning in severe acute respiratory distress syndrome. **N Engl J Med**, v. 368, n. 23, p. 2159-68. 2013. Disponível em: <https://pubmed.ncbi.nlm.nih.gov/23688302/>. Acesso em: 28 ago. 2022.

GUIRRA, P. S. B., et al. Manejo do paciente com COVID-19 em pronação e prevenção de lesão por pressão. **Health Residencies Journal**, v.1, n.2, p.71-87, 2020.

- INOUE, K. C. et al. Estresse ocupacional em enfermeiros intensivistas que prestam cuidados diretos ao paciente crítico. **Rev Bras Enferm**, Brasília, v.66, n.5, p. 722-729, 2013.
- JESUS, I. das G. de. et al. Protocolo de atendimento básico na ventilação mecânica. **Revista Gestão em foco**, n.10, p.514-534, 2018.
- JOUFFROY, R. et al. Impacto da posição prona em pacientes com respiração espontânea não intubados admitidos na UTI por insuficiência respiratória aguda grave por COVID-19. **Journal of Critical Care**, v.64, p. 199-204, 2021.
- JUNIOR, C. T.; CARVALHO, C. R. R. de. Ventiladores Mecânicos. **J Bras Pneumol**, v.33, n.2, 2007.
- KAWAKAMI, A.; YAMAKAWA, K.; NISHIOKA, D.; OTA, K.; KUSAKA Y.; et al. PaO₂ / FiO₂ ratio responsiveness to prone positioning in intubated patients with severe COVID-19: a retrospective observational study. **Acute Medicine & Surgery**, v. 9, n. 1, p. 1-6. 2022. Disponível em: <https://pubmed.ncbi.nlm.nih.gov/35677680/>. Acesso em: 04 out. 2022.
- LANGER, T.; BRIONI, M.; GUZZARDELLA, A.; CARLESSO, E.; CABRINI, L.; CASTELLI, G.; et al. Prone position in intubated, mechanically ventilated patients with COVID-19: a multi-centric study of more than 1000 patients. **Crit Care**, v. 25, n. 128, p. 1-11. 2021. Disponível em: <https://pubmed.ncbi.nlm.nih.gov/33823862/>. Acesso em: 28 ago. 2022.
- LAW, A.C.; FORBATH, N.; O'DONOGHUE, S.; STEVENS, J.P.; WALKEY, A.J. Hospital-level availability of prone positioning in Massachusetts ICUs. **Am J Respir Crit Care Med**, v. 201, n. 8, p. 1006-8. 2020. Disponível em: <https://www.atsjournals.org/doi/full/10.1164/rccm.201910-2097LE>. Acesso em: 28 ago. 2022.
- LEITE, M. A.; VILA, V. da S. C. Dificuldades vivenciadas pela equipe multiprofissional na unidade de terapia intensiva. **Rev Latino-Am. Enfermagem**, v.13, n.2, p.145-150, 2005.
- MATHEWS, K.S.; SOH, H.; SHAEFI, S.; WANG, W.; BOSE, S.; et al. Prone positioning and survival in mechanically ventilated patients with coronavirus disease 2019 – related respiratory failure. **Society of Critical Care Medicine and Wolters Kluwer Health**, v. 49, n. 7, p. 1026-1037. 2021. Disponível em: <https://pubmed.ncbi.nlm.nih.gov/33595960/>. Acesso em: 04 out. 2022.
- MATTOS, V. N. F.; VIVEIROS, C. P.; DAMÁZIO, L. C. M. Os efeitos do posicionamento em prono na mecânica respiratória de pacientes com COVID-19 no Centro de Terapia Intensiva: uma revisão sistêmica. **Research, Society and Development**, v.10, n.13, 2021.
- MENDES, K. D. S.; SILVEIRA, R. C. de C. P.; GALVÃO, C. M. Revisão integrativa: método de pesquisa para a incorporação de evidências na saúde e na enfermagem. **Texto e Contexto – Enfermagem**, v.17, n.4, 2008.
- NARAIN, S.; STEFANOV, D.G.; CHAU, A.S.; WEBER, A.G.; MARDER, G.; KAPLAN, B.; et al. Comparative survival analysis of immunomodulatory therapy for coronavirus disease 2019 cytokine storm. **Chest J**, v. 159, n. 3, p. 933-48. 2021. Disponível em: <http://dx.doi.org/10.1016/j.chest.2020.09.275>. Acesso em: 28 ago. 2022.
- OLIVEIRA, V. M. et al. Checklist da prona segura: construção e implementação de uma ferramenta para realização da manobra de prona. **Revista Brasileira de Terapia Intensiva**, v.29, p.131-141, 2017.
- OUCHI, J. D., et al. O papel do enfermeiro na unidade de terapia intensiva diante de novas tecnologias em saúde. **Revista Saúde em Foco**, Teresina, n.10, p.412-428, 2018.
- PAPAZIAN, L.; AUBRON, C.; BROCHARD, L.; CHICHE, J.D.; COMBES, A.; DREYFUSS, D.; et al. Formal guidelines: management of acute respiratory distress syndrome. **Ann Intensive Care**, v. 9, n.69, p. 1-18. 2019. Disponível em: <https://annalsofintensivecare.springeropen.com/articles/10.1186/s13613-019-0540-9>. Acesso em: 28 ago. 2022.
- PARKER, E.M.; BITTNER, E.A.; BERRA, L.; PINO, R.M. Efficiency of Prolonged Prone Positioning for Mechanically Ventilated Patients Infected with COVID-19. **Journal of Clinical Medicine**, v. 10, n. 13, p. 1-11. 2021. Disponível em: <https://www.mdpi.com/2077-0383/10/13/2969>. Acesso em: 04 out. 2022.
- PEREIRA, A. da S., et al. A importância do conhecimento do enfermeiro na prevenção das lesões por pressão em pacientes submetidos à posição prona. **Global Academic Nursing Journal**, v. 2, n. 2, 2021.
- PEREIRA, E. F. A pandemia de COVID-19 na UTI. **Horiz Antropol**, Porto Alegre, v.27, n.59, p.49-70, 2021.

- PIZZANI, L. et al. Um Estudo Bibliométrico da Produção Científica: A Interface entre a Educação Especial e a Fonoaudiologia nas Bases de Dados da Biblioteca Virtual em Saúde (BVS). **Distúrbios da Comunicação**, São Paulo, v. 20, n. 2, p.205-218, 2008.
- PURIN, N.; PURIN, V.; DELLINGER, R.P. History of technology in the intensive care unit. **Crit Care Clin**, v.25, n.1, p.185-200, 2009.
- ROBINSON, C. C., et al. Qualidade de vida pós-unidades de terapia intensiva: protocolo de estudos de coorte multicêntrico para avaliação de desfechos em longo prazo em sobreviventes de internação em unidades de terapia intensiva brasileiras. **Rev Bras Ter Intensiva**, São Paulo, v.30, n.4, p.405-413, 2018.
- RODRIGUES, N. H.; SILVA, L. G. A. Gestão da pandemia Coronavírus em um hospital: relato de experiência profissional. **J. nurs. Health.**, v.10, 2020.
- RODRIGUEZ-HUERTA, M.D.; DIEZ-FERNANDEZ, A.; RODRIGUEZ-ALONSO, M.J.; ROBLES-GONZALEZ, M.; MARTIN-RODRIGUEZ M., GONZALEZ-GARCIA, A. Nursing care and prevalence of adverse events in prone position: Characteristics of mechanically ventilated patients with severe SARS-CoV-2 pulmonary infection. **Nurs Crit Care**, v. 27, n. 4, p. 493-500. 2021. Disponível em: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC8251070/>. Acesso em: 28 ago. 2022.
- ROSE, L. Interprofessional collaboration in the ICU: how to define? **Nurs Crit Care**, v.16, v.1, p.5-10, 2011.
- SANTO, F. H. do E.; PORTO, I. S. De Florence Nightingale às perspectivas atuais sobre o cuidado de enfermagem: a evolução de um saber/fazer. **Esc Anna Nery**, Rio de Janeiro, v.10, n.3, 2006.
- SANTOS, M. da C. dos. Evolução tecnológica dos ventiladores pulmonares: análise dos registros de falhas e manutenção dos ventiladores pulmonares atendidos pela força tarefa de enfrentamento à pandemia da COVID-19 nos estados da Bahia e Ceará. **Revista Fatec de Tecnologia e Ciências**, Bahia, v.6, n.1, 2021.
- SCARAMUZZO, G.; GAMBERINI, L.; TONETTI, T.; ZANI, G.; OTTAVIANI, I.; MAZZOLI, C.A.; et al. Sustained oxygenation improvement after first prone positioning is associated with liberation from mechanical ventilation and mortality in critically ill COVID-19 patients: a cohort study. **Ann Intensive Care**, v. 11, n. 63, p. 1-10. 2021. Disponível em: <https://annalsofintensivecare.springeropen.com/articles/10.1186/s13613-021-00853-1>. Acesso em: 28 ago. 2022.
- SCHULTZ, M.J. High versus low PEEP in non-recruitable collapsed lung tissue: Possible implications for patients with COVID-19. **Lancet Respir Med**, v. 8, n. 6, p. e44. Disponível em: [https://www.thelancet.com/journals/lanres/article/PIIS2213-2600\(20\)30180-6/fulltext](https://www.thelancet.com/journals/lanres/article/PIIS2213-2600(20)30180-6/fulltext). Acesso em: 28 ago. 2022.
- SHELHAMER, M.C.; WESSON, P.D.; SOLARI, I.L.; JENSEN, D.L.; STEELE, W.A.; et al. Prone positioning in moderate to severe acute respiratory distress syndrome due to COVID-19: A cohort study and analysis of physiology. **Journal of Intensive Care Medicine**, v. 36, n. 2, p. 241-252. 2021. Disponível em: <https://pubmed.ncbi.nlm.nih.gov/33380236/>. Acesso em: 04 out. 2022.
- SIMÃO, I. R. et al. Assistência de Enfermagem ao paciente com COVID-19: com foco na posição prona. **Única Cadernos Acadêmicos**, v.3, n.1, 2021.
- SOUZA, C. S. de, et al. Cultura de segurança em Unidades de Terapia Intensiva: perspectiva dos profissionais de saúde. **Rev Gaúcha Enferm**, Rio Grande, v.40, 2019.
- STILMA, W.; MEENEN, D.M.P.; VALK, C.M.A.; BRUIN, H.; PAULUS, F.; et al. Incidence and Practice of Early Prone Positioning in Invasively Ventilated COVID-19 Patients—Insights from the PRoVENT-COVID Observational Study. **Journal of Clinical Medicine**, v. 10, n. 20, p. 4783-4797. 2021. Disponível em: <https://pubmed.ncbi.nlm.nih.gov/34682907/>. Acesso em: 04 out. 2022.
- TABOADA, M.; GONZÁLEZ, M.; ÁLVAREZ, A.; GONZÁLEZ, I.; GARCÍA, J.; EIRAS, M.; et al. Effectiveness of prone positioning in nonintubated intensive care unit patients with moderate to severe acute respiratory distress syndrome by coronavirus disease 2019. **Anesth Analg**, v. 132, n. 1, p. 25-30. 2021. Disponível em: https://journals.lww.com/anesthesia-analgesia/Fulltext/2021/01000/Effectiveness_of_Prone_Positioning_in_Nonintubated.4.aspx. Acesso em: 28 ago. 2022.
- TERRIER, C.L.; SIGAUD, F.; LEBBAH, S.; DESMEDT, L.; HAJAGE, D.; et al. Early prone positioning in acute respiratory distress syndrome related to COVID-19: a propensity score analysis from the multicentric cohort COVID-ICU network - the ProneCOVID study. **Critical care**, v. 26, n. 1, p. 71-84. 2022. Disponível em: <https://pubmed.ncbi.nlm.nih.gov/35331332/>. Acesso em: 04 out. 2022.

WALTER, T.; ZUCMAN, N.; MULLAERT, J.; THIRY, I.; GERNEZ, C.; et al. Extended prone positioning duration for COVID-19-related ARDS: benefits and detriments. **Critical Care**, v. 26, n. 1, p. 208- 218. 2022. Disponível em: <https://pubmed.ncbi.nlm.nih.gov/35804453/>. Acesso em: 04 out. 2022.

WEISS, T.T.; CERDA, F.; SCOTT, J.B.; KAUR, R.; SUNGURLU, S.; et al. Prone positioning for patients intubated for severe acute respiratory distress syndrome (ARDS) secondary to COVID-19: a retrospective observational cohort study. **British Journal of Anaesthesia**, v. 126, n. 1, p. 48-55. 2021. Disponível em: <https://pubmed.ncbi.nlm.nih.gov/33158500/>. Acesso em: 04 out. 2022.

YANG, X. et al. Clinical course and outcomes of critically ill patients with SARS-CoV-2 pneumonia in Wuhan, China: a single-centered, retrospective, observational study. **Lancet Respir Med**, Reino Unido, v.8, n.5, p.475-481, 2020.

ZANG, X. et al. Efficacy of early prone position for COVID-19 patients with severe hypoxia: a single-center prospective cohort study. **Intensive Care Med**, Estados Unidos da América, v.46, p.1927-1929, 2020.

ZHOU, F. et al. Clinical course and risk factors for mortality of adult inpatients with COVID-19 in Wuhan, China: a retrospective cohort study. **Lancet Respir Med**, Reino Unido, v.395, n.10229, p.1054-1064, 2020.