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Trends in Anaesthesia and Critical Care 45 (2022) 37–41

Contents lists available at ScienceDirect

Trends in Anaesthesia and Critical Care

journal homepage: www.elsevier.com/locate/tacc

Short Communication

Optimizing nursing workload in the intensive care unit during the COVID-19 pandemic: Planning prone positioning

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ARTICLE INFO

Article history:
Received 16 February 2022
Received in revised form
14 April 2022
Accepted 14 May 2022

Keywords:
Intensive care unit
Prone position
Workload
COVID-19
Staffing

ABSTRACT

Background: Prone positioning is a complex, time-consuming task, involving significant intensive care unit staff. The increased workload during the COVID-19 pandemic and the reduced staffing boosted the burden of intensive care unit nurses, which might have a negative impact on patients' safety and outcomes.
Methods: Retrospective chart review, analysing the hourly distribution of pronation and supination procedures in mechanically ventilated critically ill patients during the first and the second wave of the COVID-19 pandemic (March 2020–May 2021).
Results: 303 procedures were analysed: 77 pronation manoeuvres out of 156 (49.3%) and 82 supination out of 147 (55.8%) were performed in dedicated time slots in the afternoon (15.30–19.00) and in the morning (9.30–12.30) shifts, when the nursing staff was increased. At least five healthcare providers performed pronation manoeuvres. Six device displacements were registered.
Conclusions: Planning complex activities such as prone positioning needs an effective strategy to optimize nursing staff workload in the intensive care unit. This organization allowed to perform pronation cycles with a duration of at least 16 h, according to current clinical recommendations.
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1. Background

The COVID-19 pandemic highlighted the role of the prone position as an adjunctive possibly life-saving intervention during mechanical ventilation under sedation and neuromuscular blockade that improved gas exchange and lung mechanics [1]. The prone position was applied in a greater percentage of patients with COVID-19 pneumonia, if compared to the pre-COVID-19 era (61% vs 8%) [2,3].

Since the beginning of the COVID-19 pandemic, the great number of critically ill patients with severe respiratory failure significantly impacted on the intensive care unit (ICU) nursing workload. In addition to the surge in hospital and intensive care admissions, critical patients with severe COVID-19 illness presented an increased level of clinical complexity, with a reported rise in the Nursing Activities Score, and a contextual reduction of the nurse-to-patient ratio [4–6]. Despite a wide number of studies evaluating clinical outcomes and complications, the impact of prone position on the ICU nursing workload remains scarcely addressed.

The purpose of this short communication was to describe, analyse and discuss the scheduling of prone position manoeuvres in a COVID-19 metropolitan hub set of ICUs with the aim to optimize the ICU staff workload in relation to the nurse staffing during a 24-h service.

2. Methods

This retrospective chart review searched the available data on the electronic health records of five ICU modules (10–14 beds each) at Maggiore Hospital Carlo Alberto Pizzardi, in Bologna (Italy), to

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https://doi.org/10.1016/j.tacc.2022.05.002
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analyse the hourly distribution of pronation and supination procedures in critically ill patients undergoing mechanical ventilation, during the first and the second wave of the COVID-19 pandemic (March 2020–May 2021). In consideration of the heavily increased workload and the need to optimize the nurse staffing, pronation and supination manoeuvres were scheduled in dedicated time slots: pronations in the afternoon (15.30–19.00) and supinations in the morning (9.30–12.30). These time slots were identified in accordance with the medical and the nursing staff to not overlap positioning procedures with shift changes and to allow other activities, such as therapy administration and hygiene care.

The prone position protocol currently adopted at our ICUs includes two possible approaches. A manual technique, which requires at least five health care providers: one responsible for securing the airway device (typically an intensivist) and two on each side of the bed; the patient is laterally repositioned, rotated and lowered with the use of friction-reducing sliders and sheets. The other proning method uses a ceiling-mounted lifting system, which assists all movements and supports most of the patient's weight. The lift-assisted approach reduces risks and relieves operator fatigue but, on the other hand, requires longer times for the procedure. Before any pronation procedure, regardless of the chosen technique, all patients were carefully prepared (oral and eye care, securement of medical devices, assessment and prevention of pressure injuries, using dressings and gel pads).

Patients spontaneously breathing (treated with non-invasive ventilation, high-flow nasal oxygenation or other oxygen supports) were excluded from this analysis. Patient data is reported as numbers and percentages and median and interquartile range for continuous variables. The data set of this brief report was extracted from an unpublished, ongoing research on prone position, authorised by the local Ethical Committee (CE AVEC N° 379-2020-OSS-AUSLBO, 08/04/2020).

3. Results

This report describes the daily distribution of 156 pronation and 147 supination procedures (total 303 manoeuvres) performed on 96 patients whose characteristics are detailed in Table 1. The majority of pronation (49.3%, n.77) and supination procedures (55.8%, n.82) were performed in the dedicated time slots in the middle of the morning and afternoon shifts, as shown in Fig. 1. In response to the increased number of ICU admissions, from April 2020 the nursing staff was increased by one or two nurses per shift in each ICU module, and particularly during the morning and the afternoon. Table 2 describes the nurse staffing of each 10-bed ICU module, during the three daily shifts considering different roles and activities. Notably, two support nurses were added to the standard staffing, dedicated to providing equipment and infusions, and relieving colleagues caring for patients in the isolation area [7].

Both pronation and supination manoeuvres were carried out by a team of at least five health care providers (pronation 57.7% with five providers, 35.6% with six; supination 75.7% with five, 20.6% with six). All pronations were performed manually, except ten (6.5%), carried out with the lift-assisted method; despite the clear advantages on safety for both staff and patients, the ceiling track lifting system was used only for ten severe obese patients, probably because of the longer times required.

When possible, the nursing staff, planned by the head nurse, scheduled and coordinated these activities in accordance with intensivists, allowing to avoid an overlap of prone positioning procedures with nurses' shift changes at 7.00, 13.00, and 20.00. Moreover, when patients were proned in the afternoon, they stayed in the prone position during the night (when nursing staff was generally reduced) and repositioning was performed in the morning. That granted a median proning cycle time of 21:08 h (IQR 18:23–24:10), which is in line with current clinical recommendations (≥16 h) [8,9]. Six prone position-related adverse events were observed: four nasogastric tubes partial displacements, one airway device and one centrally inserted venous catheter complete displacement which required repositioning. In none of these cases patients reported clinical consequences. None of the health care providers reported musculoskeletal injuries.

4. Discussion

The main finding of this descriptive report is that despite the clinical complexity of COVID-19 patients, it was possible to plan and organise half of the pronation and supination procedures in dedicated time slots (3 and 3.5-h, respectively), optimizing the activities and the workload of the ICU nursing staff.

Despite the general consideration that the prone position is a low-cost procedure, positioning and repositioning of critically ill patients is a complex and time-consuming task, requiring a significant amount of health care staff [10,11]. Several reports describe that prone positioning involves a dedicated team of five to seven trained providers [12–14]. Moving a patient from supine to prone and back, should always guarantee an adequate safety level, for both patients and the acting health care providers. Possible risks are musculoskeletal injuries and contamination [13,15]. Moreover, proning a patient while wearing full personal protective equipment represents a considerable stressor and burden. Interestingly, these infection precautions are not considered by any nursing workload assessment tool [15,16]. The increased workload while caring for patients with an infectious disease and the need to wear personal protective equipment during a physically demanding procedure considerably increase the risk of contamination of the staff and harm to the patient.

The accurate preparation of a patient before a pronation includes several nursing activities such as oral and eye care including protection measures, airway device and vascular catheters' securement, skin assessment and application of protective dressings, gastric residual volume assessment and evacuation, and preparation of the ICU bedside (e.g., bed, drip tubes, monitoring and cables) [16,17]. These tasks may require up to 1 h and two dedicated nurses and one health care assistant. Typically, a pronation manoeuvre involves one intensive care physician, responsible for securing the airway, and at least four ICU nurses for 20 to 40 min, corresponding to a significant quote of nursing staff in a medium-size ICU. Performing prone position manoeuvres on one or more patients gathers the majority of the nursing staff and represents a considerable disruption to workflow, leaving only one or two nurses available to attend the other patients and may constitute a serious concern in case of deteriorating patients requiring immediate assistance or emergency treatments [13]. Notably, higher levels of clinical complexity (chest drainages, continuous renal replacement therapies, extracorporeal membrane oxygenation) require supplemental personnel to safely rotate a patient [18].

The increased attention on prone positioning during the last two years boosted the number of publications discussing this procedure and its safety performance. Some authors reported as a feasible strategy the creation of dedicated pronation teams, which are a group of trained health care providers like critical care or operating theatre nurses, physical therapists, intensivists and even medical students [11,19,20]. The main goals of such pronation teams are to collaborate with the ICU staff, reducing their burden, positioning critically ill patients through a standardised procedure and reducing turning-related adverse events [14,20]. Pronation teams are generally composed of three to five providers and should be

Table 1
Patient characteristics.

	Patients (n. 96)
Sex - number (%)	
Male	78 (81%)
Female	18 (18%)
Age - median [IQR]	67 [60–74]
BMI - median [IQR]	28.9 [25.9–32.7]
SOFA - median [IQR]	7 [5–8]
SAPS II - median [IQR]	42 [37–45]
Outcome – number (%)	
Discharged to another ICU	
Same hospital	5 (5.2%)
Other hospital	12 (12.5%)
Discharged to High Dependancy Unit	
Same hospital	2 (2.1%)
Other hospital	1 (1%)
Discharged to a general ward	
Same hospital	16 (16.7%)
Other hospital	1 (1%)
Deceased	59 (61.5%)
Number of pronation cycles per patient	Number of pronations (n.156)
1 - no (%)	58 (59.8%)
2 - no (%)	26 (26.8%)
3 - no (%)	8 (8.3%)
4 - no (%)	3 (3.1%)
5 - no (%)	2 (2.1%)
Median duration of prone positioning cycle - hh:mm [IQR]	21:08 [18:23–24:10]

Abbreviations: BMI, body mass index; IQR, interquartile range; SAPS II, Simplified Acute Physiology Score; SOFA, Sequential Organ Failure Assessment score.

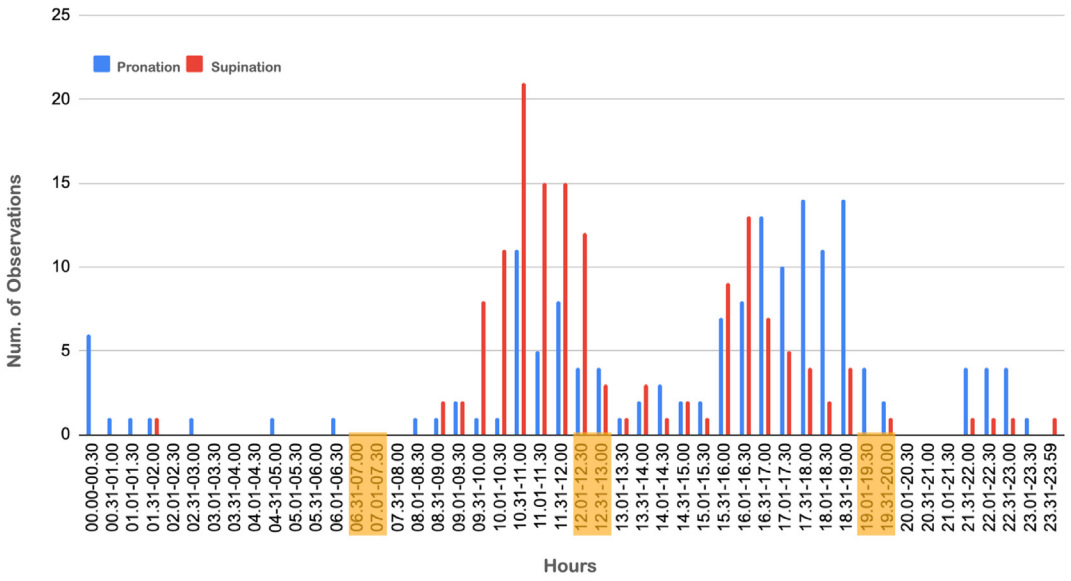

Fig. 1. Distribution of pronation (n. 156) and supination (n. 147) procedures over the 24 h. The highlighted boxes in the timeline indicate the shift changes of the nursing staff (7:00–13:00–20:00).

available 24/7. For example, Miguel et al. described their experience in a large research hospital, reporting the activity of up to five prone teams every day (three to four providers each) during the peak of the first wave of the pandemic [14]. It should be considered that implementing one or more pronation teams involves a significant amount of human resources and might be difficult for smaller hospitals or in case of staff shortage.

5. Conclusion

The scheduling of dedicated time slots allowed to perform a significant number of positioning procedures with very few adverse events. That strategy was able to optimize the nursing workload in a COVID-19 ICU and enabled pronation cycles in accordance with current clinical recommendations.

Table 2
Nurse staffing in a 10-bed ICU module during the different shifts.

Number of nurses and roles	Morning 7.00–13.00[a]	Afternoon 13.00–20.00[a]	Night 20.00–7.00[a]
Direct care nurse (Nurse-to-patient ratio 1:2)	5	5	5
Support nurse (drug/device preparation and changes)	3	2	2
Emergency and transport nurse	1	1	1
Management and administrative task nurse	1	1	
Total	10	9	8

Note: Support nurses work outside the patient area and provide devices and ready-to-use drugs or drips to the Direct care nurses; the Emergency & transport nurse is shared within all the ICU modules and is not always available to support for proning manoeuvres; the nurse dedicated to management and administrative tasks is not dedicated to direct care.
[a] Start and end of shifts.

Source of funding or grants

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Funding

This research did not receive any specific grant from public funding agencies, commercial, or not-for-profit sectors.

Data availability statement

The dataset from the current study is not publicly available, but is available from the corresponding author on reasonable request.

CRediT authorship contribution statement

Guglielmo Imbriaco: Conceptualization, Investigation, Writing – original draft, Writing – review & editing. **Alessandro Monesi:** Conceptualization, Investigation, Resources, Data curation. **Carlo Alberto Mazzoli:** Conceptualization, Resources, Writing – review & editing. **Lorenzo Gamberini:** Data curation, Writing – review & editing. **Patrizia Ferrari:** Conceptualization, Resources, Supervision.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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