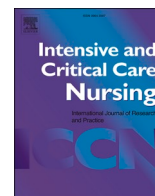




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Current Insights In Intensive &amp; Critical Care Nursing



## Prevention of Hospital-Acquired Pressure Injury in COVID-19 Patients in the Prone Position

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Prone, also referred as face-down, position is frequently used as adjuvant therapy to improve lung mechanics and gas exchange in patients with acute respiratory distress syndrome (ARDS) admitted to an intensive care unit (ICU) and ventilated mechanically. Findings of the recently updated Cochrane review (Bloomfield et al., 2015) indicated there is weak evidence of the benefit for application of ventilation in the prone position to all patients with hypoxaemia recruited in randomised controlled trials; although stronger evidence of benefit is reported for the subgroups of patients with severe hypoxaemia, who started treatment earlier and stayed in ICU longer. The use of prone positioning in the ICU has re-emerged with Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) infected patients with ARDS. Prone positioning is widely used in the management of the ARDS syndrome, both in non-intubated and mechanically ventilated COVID-19 patients (Behesht Aeen et al., 2021), although the effectiveness of prone positioning is debatable.

Hospital acquired pressure injury (HAPI) is the most common complication related to prone positioning reported by researchers in pre-pandemic period (Bloomfield et al., 2015) and during the COVID-19 pandemic (Binda et al., 2021; Ibarra et al., 2020). In general, the risk profile for HAPI acquisition is strongly related with ICU admission. In a recent study that involved 1117 ICUs in 90 countries, ICU-acquired prevalence of pressure injury was 16.2% (95% CI 15.6–16.8) (Labeau et al., 2021). The general risk factors for HAPI development in the ICU are difficult to identify because the ICU population groups are not homogenous (Deschepper et al., 2021). In addition to the ICU case-mix, organizational and workforce factors, including staffing levels, HAPI prevention protocols, use of preventive measures, and quality of care may contribute to the differences in ICU-acquired HAPI prevalence across countries (Deschepper et al., 2021). Clinical HAPI predictors have been identified using data from the electronic health records of critically ill patients in ICU (Sala et al., 2021).

The main risk factors for HAPI development in the prone-positioned COVID-19 patients were the number of days of mechanical ventilation and the length of time in the prone position (Binda et al., 2021). COVID-19 patients with ARDS may remain in prone position up to 16 h before returning to supine, which constitutes a pronation cycle. Although the

recommended repositioning regime is usually two hours, COVID-19 patients require a number of prolonged pronation cycles; and this prolonged time frame without pressure relief predisposes patients to HAPI development (Binda et al., 2021). The most commonly reported HAPI site in the prone-positioned COVID-19 patients was the face (Binda et al., 2021; Ibarra et al., 2020); and stage II (partial thickness skin loss) the most frequent stage (Ibarra et al., 2020).

The International guideline (National Pressure Injury Advisory Panel et al., 2019) provides essential and specific components of HAPI prevention for both supine- and prone-positioned patients. In critical care nursing, these strategies include risk assessment, using reliable risk assessment scales (Zhang et al., 2021); regular two-hourly skin checks; the use of off-loading devices and mattresses and protective dressings (Peko et al., 2020); patient repositioning, taking into consideration turning effectiveness (Powers et al., 2020); nutrition assessment and correction (Bruni et al., 2020), and promoting early mobility. However, HAPI prevention in prone-positioned COVID-19 patients is complex and requires specific preventive strategies to be applied prior to prone positioning, once prone positioned, and after repositioning patients to supine position. We have summarised these basic and specific HAPI prevention strategies in prone positioned COVID-19 patients with ARDS in Table 1.

The main pressure points in prone position that need to be protected and inspected regularly are forehead, chin, cheeks, shoulder (anterior), elbow, chest (breasts), genitalia (particularly male), anterior pelvic bones (iliac crests and ischium), knees (patella) dorsal feet and toes, nose (if positioned incorrectly) (National Pressure Injury Advisory Panel et al., 2019, p.139). Specific attention should be paid to eye care because frequent pronation cycles and increased time spent in prone position may contribute to ocular injury (Pirret, 2021). However, frequent skin and eye inspections in prone positioned COVID-19 patients are challenging due to hospital infection control measures during a pandemic, including the availability and use of protective gear aimed to reduce the risk for health professionals working in ICU. Repositioning an intubated COVID-19 patient is complicated, and may require up to seven people to be involved in this process. The delivery of complex care has been impacted by reduced nurse-to-patient ratio, the involvement of non-specialist nurses in ICU care, and the lack of protective equipment

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**Table 1**

HAPI prevention in prone positioned SARS-CoV-2 infected patients with Acute Respiratory Distress Syndrome.\*

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Pressure injury prevention prior to prone positioning
Conduct skin check
Use pressure redistribution devices to off-load pressure from the bony prominences
Select an appropriate mattress or an overlay
Ensure the endotracheal tube securing device is removed and the tube taped into position
Use a liquid film-forming protective dressing applied at the forehead and chin and
Lubricate the eyes and tape them closed
Pressure injury prevention in prone positioned patients
Use the swimmer's position
Check for uneven pressure redistribution
Where feasible reposition patient every two hours
Keep the skin clean and conduct regular skin checks
Ensure patients have adequate nutrition and hydration
Pressure injury prevention when patients repositioned back to supine position
Assess the pressure points
Document a comprehensive skin assessment at all stages
Promote early mobilization
Summary of risk mitigation strategies for health professionals
Follow recommended intensive contact and droplet precautions
Follow recommended airborne precautions for aerosol-generating procedures
Provide adequate training and monitor health professionals' compliance

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\*Adapted from the National Pressure Injury Advisory Panel et al. (2019) and Team et al. (2021a).

in some health care services (Team et al., 2021a).

Many ICUs have updated their protocols for HAPI prevention in prone-positioned patients, reflecting necessary changes related to care for COVID-19 patients. In addition to changes related to direct patient care of COVID-19 patients with ARDS, health services have focused on capacity building approach to HAPI prevention and care (Team et al., 2021b). Other organisational changes include the introduction of the functional teams that assist with repositioning the prone-positioned patients and virtual consultations with the wound clinical nurse consultants HAPI are identified. Some health services developed online learning resources, including the infographics, learning modules, and webinars on how to prevent HAPI in the prone-positioned COVID-19 patients with ARDS (Team et al., 2021b). Knowledge and skills development will allow health professionals to optimise the quality of care for the prone-positioned ICU patients and to reduce the risk of HAPI in these patients.

In summary, prone position is frequently used as adjuvant therapy in management of ARDS in COVID-19 patients. A prone position-time and a number of days of mechanical ventilation are known risk factors for the development of HAPI. Health professionals' knowledge and skills on how to prevent HAPI can optimise the quality of care for the prone-positioned ICU patients and decrease adverse events. The cyclical nature of COVID-19 outbreaks and the frequency of SARS-CoV-2 mutations coupled with the insufficient vaccination coverage highlight the need to speed up quality improvement in this field.

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#### Conflict of interests

The authors declare no conflict of interests.

#### CRediT authorship contribution statement

**Victoria Team:** Conceptualization, Methodology, Writing – original draft, Writing - review & editing. **Angela Jones:** Conceptualization, Writing - review & editing. **Carolina D. Weller:** Conceptualization, Writing - review & editing.

#### References

- Behesht Aeen, F., Pakzad, R., Goudarzi Rad, M., Abdi, F., Zaheri, F., Mirzadeh, N., 2021. Effect of prone position on respiratory parameters, intubation and death rate in COVID-19 patients: systematic review and meta-analysis. *Sci. Rep.* 11 (1), 14407.
- Binda, F., Galazzi, A., Marelli, F., Gambazza, S., Villa, L., Vinci, E., et al., 2021. Complications of prone positioning in patients with COVID-19: A cross-sectional study. *Intensive Crit. Care Nurs.* 103088.
- Bloomfield, R., Noble, D.W., Sudlow, A., 2015. Prone position for acute respiratory failure in adults. *Cochrane Database Syst. Rev.* 11, CD008095.
- Bruni, A., Garofalo, E., Grande, L., Auletta, G., Cubello, D., Greco, M., et al., 2020. Nursing issues in enteral nutrition during prone position in critically ill patients: a systematic review of the literature. *Intensive Crit. Care Nurs.* 60, 102899.
- Deschepper, M., Labeau, S.O., Waegeman, W., Blot, S.I., 2021. Heterogeneity hampers the identification of general pressure injury risk factors in intensive care populations: a predictive modelling analysis. *Intensive Crit. Care Nurs.* 103117.
- National Pressure Injury Advisory Panel, European Pressure Ulcer Advisory Panel, and Pan Pacific Pressure Injury Alliance. Prevention and treatment of pressure ulcers/injuries: Clinical practice guideline. Emily Haesler ed. 2019. Osborne Park, Australia: Cambridge Media.
- Ibarra, G., Rivera, A., Fernandez-Ibarburu, B., Lorca-García, C., García-Ruano, A., 2020. Prone position pressure sores in the COVID-19 pandemic: The Madrid experience. *J. Plast. Reconstr. Aesthet. Surg.* S1748-6815(20)30732-4.
- Labeau, S.O., Afonso, E., Benbenishty, J., Blackwood, B., Boulanger, C., Brett, S.J., et al., 2021. Prevalence, associated factors and outcomes of pressure injuries in adult intensive care unit patients: the DecubiCUs study. *Intensive Care Med.* 47 (2), 160–169.
- Peko, L., Barakat-Johnson, M., Gefen, A., 2020. Protecting prone positioned patients from facial pressure ulcers using prophylactic dressings: a timely biomechanical analysis in the context of the COVID-19 pandemic. *Int. Wound J.* 17 (6), 1595–1606.
- Pirret, A., 2021. Optimising COVID-19 survivorship after ICU - Don't forget eye care. *Intensive Crit. Care Nurs.* 64, 103018 <https://doi.org/10.1016/j.iccn.2021.103018>.
- Powers, J., Beaubien, R., Brunner, T., Girardot, K., Rechter, J., Richardson, J., 2020. Comparing a patient positioning system to an overhead LIFT with pillows for impact on turning effectiveness. *Intensive Crit. Care Nurs.* 59, 102847.
- Sala, J.J., Mayampurath, A., Solmos, S., Vonderheid, S.C., Banas, M., D'Souza, A., LaFond, C., 2021. Predictors of pressure injury development in critically ill adults: a retrospective cohort study. *Intensive Crit. Care Nurs.* 62, 102924.
- Team, V., Jones, A., Teede, H., Weller, C.D., 2021a. Pressure injury surveillance and prevention in Australia: Monash Partners Capacity Building Framework. *OSF Preprints*. <https://doi.org/10.31219/osf.io/63tgp>.
- Team, V., Team, L., Jones, A., Teede, H., Weller, C.D., 2021b. Pressure injury prevention in COVID-19 patients with acute respiratory distress syndrome. *Front. Med.* 7, 558696.
- Zhang, Y., Zhuang, Y., Shen, J., Chen, X., Wen, Q., Jiang, Q., Lao, Y., 2021. Value of pressure injury assessment scales for patients in the intensive care unit: systematic review and diagnostic test accuracy meta-analysis. *Intensive Crit. Care Nurs.* 64, 103009.