

Pressure injury management in critically ill patients with COVID-19 in a makeshift hospital in Indonesia: A report of two cases

ABSTRACT

Patients who are critically ill with COVID-19 need ventilation support in the ICU. However, ICU patients are at higher risk of developing a pressure injury (PI). Unfortunately, PI prevention is not optimally implemented in Indonesia, especially in the makeshift hospitals created during the COVID-19 pandemic.

Here, the authors report two cases of critically ill COVID-19 patients who developed large sacral PIs during hospitalisation in a makeshift hospital in Indonesia. The first patient developed a grade III, 7 cm × 7 cm sacral PI on the 14th day of hospitalisation. The second patient developed a grade IV, 12 cm × 8 cm sacral PI on the 16th day of hospitalisation. Both patients had elevated D-dimer levels and used a noninvasive ventilator for one week.

The wounds were treated with surgical debridement, silver hydrogel dressing, and hydrocolloid dressing, and complemented with static air mattress overlay.

The authors recommend that in situations where there is a shortage of healthcare workers, the government should provide pressure-redistribution devices and silicone foam dressings for all critically ill patients to prevent PI development and lighten the workload of healthcare workers.

Keywords Case report, COVID-19, ICU, Indonesia, pressure injury

For referencing Eveline K et al. Pressure injury management in critically ill patients with COVID-19 in a makeshift hospital in Indonesia: A report of two cases. *WCET® Journal* 2022;42(3):23-29

DOI <https://doi.org/10.33235/wcet.42.3.23-29>

Submitted 9 January 2022, Accepted 15 March 2022

Copyright Advances in Skin & Wound Care and the World Council of Enterostomal Therapists®.

Kezia Eveline MD

Plastic Reconstructive and Aesthetic Surgery Resident, Faculty of Medicine Universitas Airlangga, Dr Soetomo General Academic Hospital, Surabaya, Indonesia

Hemma W Indirayani MD

Internist, Menur Mental Hospital, Surabaya, Indonesia

Rachmaniar Pramanasari MD

Plastic Reconstructive and Aesthetic Surgeon, Airlangga University Hospital, Surabaya, Indonesia

Firas F Alkaff* MD

Lecturer, Division of Pharmacology and Therapy, Department of Anatomy, Histology and Pharmacology, Faculty of Medicine Universitas Airlangga

PhD Researcher, Division of Nephrology, Department of Internal Medicine, University Medical Centre, Groningen, The Netherlands

**Corresponding author*

Kezia Eveline, MD is Plastic Reconstructive and Aesthetic Surgery Resident at Faculty of Medicine Universitas Airlangga, Dr. Soetomo General Academic Hospital, Surabaya, Indonesia. Hemma W. Indriyani,

MD is Internist at Menur Mental Hospital, Surabaya. Rachmaniar Pramanasari, MD, is Plastic Reconstructive and Aesthetic Surgeon at Airlangga University Hospital, Surabaya. Firas F. Alkaff, MD is Lecturer at Division of Pharmacology and Therapy, Department of Anatomy, Histology, and Pharmacology, Faculty of Medicine Universitas Airlangga and PhD Researcher at Division of Nephrology, Department of Internal Medicine, University Medical Center Groningen, Groningen, The Netherlands

INTRODUCTION

COVID-19 has a wide clinical spectrum.¹ Although the majority of those infected with COVID-19 are asymptomatic or have only mild symptoms, older adults and those with comorbidities are more likely to become critically ill.² Among patients who are critically ill with COVID-19, the majority develop acute respiratory distress syndrome (ARDS), a life-threatening form of respiratory failure with a high mortality rate.^{3,4} Patients who develop ARDS require ventilation support in the ICU. However,

patients in the ICU are also at higher risk of pressure injury (PI) development due to prolonged immobilisation.⁵

Unfortunately, PI prevention measures are not optimally implemented in Indonesia,⁸ especially in the makeshift hospitals created during the COVID-19 pandemic. Here, the authors report two cases of critically ill COVID-19 patients who developed large PIs during hospitalisation in a makeshift hospital in one of the largest cities in Indonesia. Written informed consent was provided by the legal guardian (for case 1) and by the subject of the case (for case 2) to publish the case details and associated images. The authors highlight challenges in PI management during the COVID-19 pandemic and propose several suggestions to aid PI prevention.

CASE REPORT

Case 1

A 40-year-old man with a medical history of schizophrenia and intellectual disability presented to the ER with the chief complaints of irritability, fever, dry cough, and shortness of breath. Three days before admission, the patient developed a fever of 38° C at home. On physical examination at the ER, the patient's temperature was 37.8° C, BP was 120/80 mmHg, heart rate was 102 beats per minute, respiratory rate was 24 breaths per minute, and oxygen saturation was 85% without any oxygen support. Lung auscultation revealed rales in the left lung and chest X-ray revealed pulmonary infiltrates in the left lung (Figure 1). Laboratory evaluation showed elevated D-dimers (>20,000 ng/mL FEU) and hypoalbuminemia (2.2 mg/dl). Based on the initial evaluation, COVID-19 infection was suspected. A nasopharynx specimen was taken for COVID-19 reverse transcriptase-polymerase chain reaction evaluation to confirm the COVID-19 diagnosis.

While waiting for the test result, the patient was given 15 liters per minute oxygen via nonrebreathing mask and treated with intravenous moxifloxacin 400 mg daily, intravenous

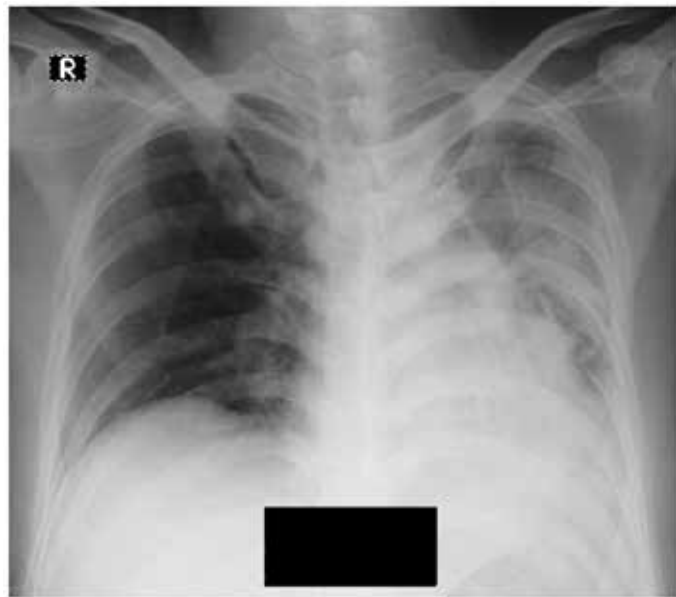


Figure 1. Chest x-ray in case 1, X-ray showing infiltrate in left lung.

acetylcysteine 500 mg daily, intravenous albumin 50 grams daily, and 40 mg subcutaneous enoxaparin twice daily. To treat the symptoms of schizophrenia, the patient was given oral clozapine 50 mg twice daily, oral quetiapine 200 mg twice daily, and oral trihexyphenidyl 2mg twice daily. Because the patient was uncooperative, the patient was restrained on the bed after his legal guardian provided written consent. A foley catheter was then inserted and a diaper was used. The following day, the patient's COVID-19 test result came back positive. The patient was then given additional treatment of intravenous oseltamivir 75 mg twice daily.

During hospitalisation, the patient's oxygen saturation was not improving. On day 10, blood gas analysis showed uncompensated respiratory acidosis (pH 7.28, PO₂ 122 mmHg, PCO₂ 51.8 mmHg, and HCO₃ 24.9 mEq/L) with Jackson Reese circuit oxygen support. The patient also developed ARDS (PaO₂/FiO₂ ratio 122). Because this makeshift hospital lacked mechanical ventilators, a noninvasive ventilator was used. The patient had mean arterial pressure of 60 mmHg and Glasgow Coma Scale of 8, indicating ongoing septic shock. Thus, intravenous norepinephrine (0.1 mcg/kg/min) was administered continuously using syringe pump. Because the patient was immobilised, 30 minutes right-oblique and 30 minutes left-oblique passive mobilisation was undertaken every 8 hours. The restraints were released prior to mobilisation and retied after mobilisation to the new position. To maintain nutrition intake, a nasogastric feeding tube was inserted. The required nutrition was calculated by the dietitian and given as milk feeding.

Due to the limited number of healthcare workers (HCWs) available every shift and their high workloads, PI risk assessment was not performed. However, the patient's skin was inspected every 8 hours during diaper changes. On day 14, a 7 cm × 7 cm bilateral sacral wound was noted with epithelial surface and superficial wound bed (Figure 2a). The wound was cleansed using normal saline and wound irrigation solution and a silver hydrogel dressing was applied to the wound bed. A hydrocolloid foam dressing was placed on top of the silver hydrogel dressing and extended 2 cm around the wound to protect the peri-wound skin from maceration. To prevent urine or fecal contamination, nonsterile gauze was placed above the hydrocolloid foam dressing and fixed with retention tape. In addition, a static air mattress overlay was placed on the bed as a pressure-redistribution device (PRD). The wound dressing was changed every 3 days, or earlier if contaminated with urine or feces.

On day 18, the sacral wound enlarged to 15 cm × 10 cm with slough and suspicion of "deeper ulceration" (Figure 2b). Surgical debridement was then performed by the nurses at the bedside. After surgical debridement, fascia was seen as the wound bed (Figure 2c). According to the 2016 National Pressure Ulcer Advisory Panel (NPUAP) staging system,¹⁰ the wound was classified as grade III. Because of the deep cavity wound, sterile gauze was placed in the cavity to fill the space after applying a silver hydrogel dressing onto the wound



Figure 2. Sacral ulcer in case 1

A) Sacral ulcer with epithelial wound bed measuring 7 cm × 7 cm on day 14. B) Covered by slough and suspicion of “deeper ulcer,” measuring 15 cm × 10 cm on day 18. C) Minimal slough and fascia in the wound bed after surgical debridement and wound dressing, 15 cm x 10 cm with depth of 6 cm on day 22. D) Granulation tissue on day 26, measuring 10 cm × 6 cm.

bed. The wound dressing was changed every 2 days instead of every 3 days, or earlier if contaminated with urine or feces. When needed, surgical debridement was performed again. On day 26, granulation began to appear from the wound (Figure 2d). The patient was discharged on day 39. Nurses followed up with weekly home visits until the wound was completely closed to evaluate the wound-healing process, perform surgical debridement if needed, change the wound dressing, and teach family members how to change the wound dressing in between home visits.

Case 2

A 59-year-old man with a medical history of type 2 diabetes mellitus, hypertension, and cerebrovascular accident (CVA) presented to the ER with the chief complaints of fever, cough, and shortness of breath. Five days earlier, the patient had developed a cough and fever of 38.5° C at home. The patient tested positive for COVID-19 3 days before presenting to



Figure 3. Chest x-ray in case 2

X-ray showing infiltrate in both lungs and cardiomegaly with cardio-thoracic ratio of 60%.

the ER. On physical examination at the ER, the temperature was 37.5° C, BP was 140/90 mmHg, heart rate was 110 beats per minute, respiratory rate was 24 breaths per minute, and oxygen saturation was 75% without any oxygen support. The patient had left-side hemiplegia due to the CVA. Lung auscultation revealed rales in both lungs. Chest X-ray revealed bilateral pulmonary opacities and cardiomegaly (Figure 3). Laboratory evaluation showed elevated D-dimers (2.100 ng/mL FEU), elevated interleukin-6 level (120 pg/mL), and hypoalbuminemia (2.8 mg/dl). Based on the initial evaluation, the patient was diagnosed with COVID-19 and recent CVA.

The patient was given 15 liters per minute oxygen via Jackson Rees circuit and treated with intravenous moxifloxacin 400 mg daily, intravenous acetylcysteine 500 mg daily, intravenous albumin 50 grams daily, subcutaneous heparin 5000 International Unit (IU), intravenous dexamethasone 6 mg daily, 400 mg intravenous Tocilizumab single dose, and oral oseltamivir 75 mg twice daily. To treat the hypertension, the patient was given oral amlodipine 10 mg once daily and oral candesartan 16 mg once daily. The patient also received subcutaneous long acting insulin 20 IU once daily and rapid acting insulin 16 IU thrice daily to treat the diabetes mellitus.

During hospitalisation, the patient's oxygen saturation was not improving. On day 7, blood gas analysis showed uncompensated respiratory acidosis (pH 7.3, PO₂ 150 mmHg, PCO₂ 50.2 mmHg, and HCO₃ 23.5 mEq/L) with Jackson Reese circuit oxygen support. The patient developed ARDS (PaO₂/FiO₂ ratio 150) and was given a noninvasive ventilator due to the lack of mechanical ventilators. Because the patient was immobilised, 30 minutes right-oblique and 30 minutes left-oblique passive mobilisation was undertaken every 8 hours. To maintain nutritional intake, a nasogastric feeding tube was inserted; milk feeding was calculated by a dietician.

Due to the limited number of HCWs every shift and their high workloads, PI risk assessment was not performed. However, the patient's skin was inspected every 8 hours during diaper changes. On day 16, a 12 cm × 8 cm sacral wound with suspicion of "deeper ulceration" was found on both sides of the sacrum (Figure 4a). On day 18, central necrotic tissue was present (Figure 4b). Nurses performed surgical debridement at the bedside (Figure 4c) and the wound was cleansed using normal saline and wound irrigation solution. A silver hydrogel dressing was applied on the wound bed and a hydrocolloid foam dressing was placed on top of the silver hydrogel dressing and extended 2 cm around the wound to protect the peri-wound skin from maceration. To prevent urine or fecal contamination, nonsterile gauze was placed above the hydrocolloid foam dressing and fixed with retention tape. Further, a static air mattress overlay was placed on the bed as a PRD. The wound dressing was changed every 3 days, or earlier if contaminated with urine or feces. When needed, surgical debridement was performed again.

Two days after treatment, the wound bed was more profound than the initial wound with bone and tendon exposure (Figure

4d). According to the 2016 NPUAP staging system,¹⁰ the wound was grade IV. Because of the deep cavity wound, the cavity was filled with sterile gauze after applying a silver hydrogel dressing onto the wound bed. The wound dressing was changed every 2 days instead of every 3 days, or earlier if contaminated with urine or feces. On day 25, granulation tissue presented on the ulcer (Figure 4e) and by day 30, the ulcer had narrowed (Figure 4f). The patient was discharged on day 35. Nurses followed up with weekly home visits until the wound was completely closed to evaluate the wound-healing process, perform surgical debridement if needed, change the wound dressing, and teach family members how to change the wound dressing in between the scheduled home visits.

DISCUSSION

As reflected in the latest NPUAP definition of PI, the main factors influencing PI development are pressure, shear, and soft tissue tolerance.¹⁰ Pressure refers to sustained pressure on a local point, whereas shearing force occurs when two opposing surfaces slide in opposite directions. When pressure and shear disrupt blood flow and local tissue hypoxia lasts for a critical period of time, tissue damage results. However, at what intensity and duration of force tissue damage occurs depends on the tissue tolerance.¹² Pressure injuries usually occur in bony areas such as the sacrum.¹³

Researchers have identified a number of PI risk factors, including immobility, being confined to bed, malnutrition, dehydration, infection, urinary and bowel incontinence, diabetes, vascular disease, and vasopressor use.¹⁴⁻¹⁶ Sedated patients are particularly prone to PI because they do not perceive painful stimuli from intense and prolonged pressure and are not able to actively change their position in bed.^{7,17,18} Recently, it has been reported that patients who are critically ill with COVID-19 are also at higher risk of PI.¹⁹ These patients have reduced perfusion and are more likely to develop systemic coagulopathy, which leads to decreased tissue tolerance.¹⁹ In the first case, the patient was critically ill with COVID-19 and required a vasopressor. This patient had impaired mental health as a comorbidity. People with severe mental health impairment such as schizophrenia tend to have poor diet and may neglect their personal hygiene, causing similar conditions to having urinary and bowel incontinence.¹³ In the second case, the patient was also critically ill with COVID-19 and had CVA and diabetes mellitus as comorbidities.

Pressure injury is associated with prolonged hospitalisation.²⁰⁻²² The length of stay was 39 days for the first case report patient and 35 days for the second patient. The first patient could have been discharged 9 days earlier if there were no PI present; the second patient could have been discharged 5 days earlier. In a previous case series of three severely ill patients with COVID-19, PIs were first noted between 7 and 19 days after hospitalisation.¹⁹ For the patients described herein, PI was noted on day 14 of hospitalisation for the first patient, and on day 16 for the second patient.

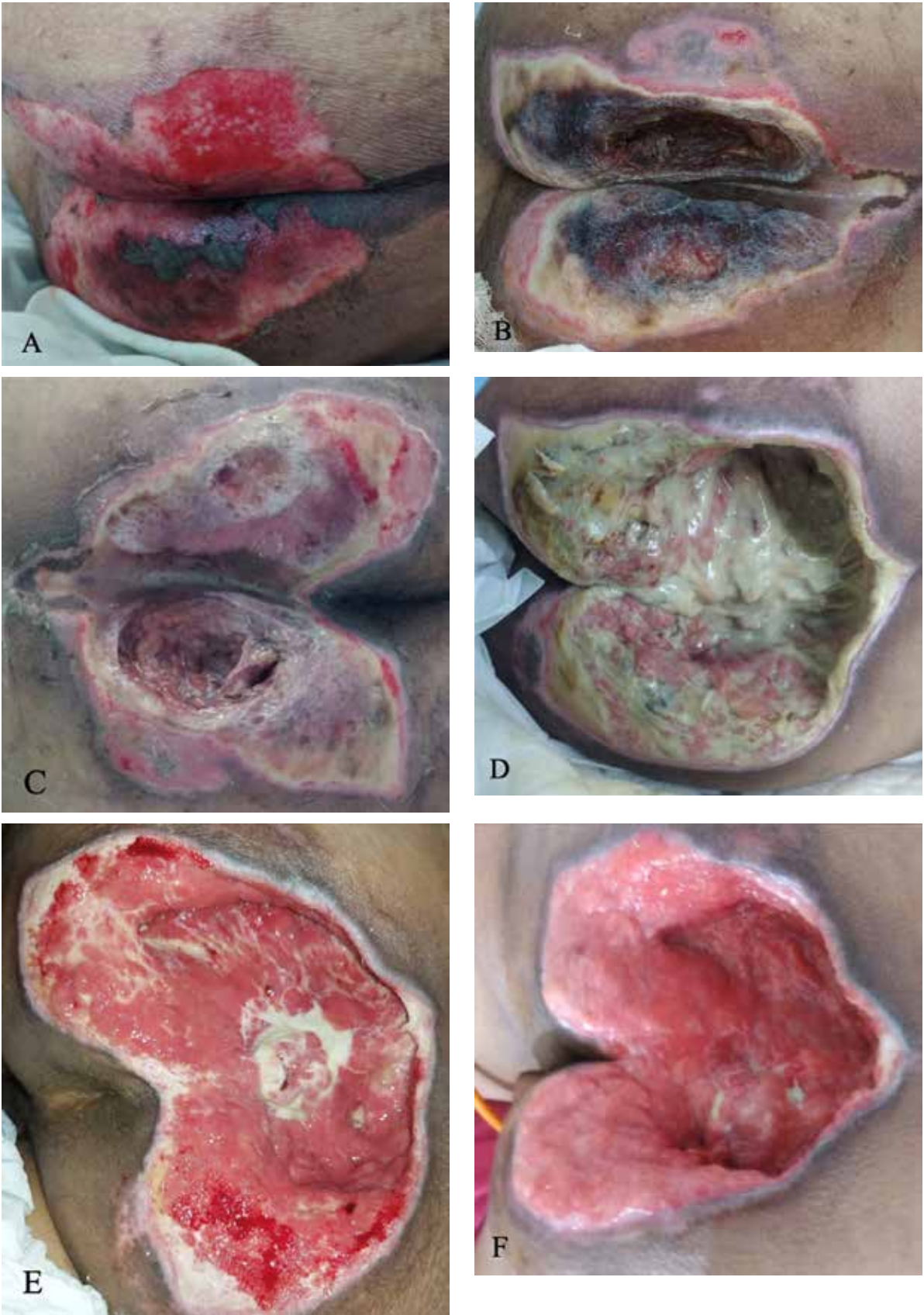


Figure 4. Sacral ulcer in case 2

A) Sacral ulcer on both side of buttocks with epithelial wound bed and necrotic tissue on central side, measuring 12 cm x 8 cm on day 16. B) Covered with both slough and necrotic tissue, measuring 12 cm x 10 cm on day 18. C) After surgical debridement on day 18. D) Covered with massive slough, depth of 7 cm on day 20. E) Granulation tissue and minimal slough on day 25. F) Granulation tissue on day 30.

According to the latest guidelines, comprehensive PI risk assessment, preventive skin care, and early mobilisation and repositioning are some of the PI management strategies that should be considered.²³ In terms of patients who are critically ill with COVID-19, Tang et al²⁴ found that PIs can be managed by improving the underlying contributing factors, providing PRD with proper positioning, improving mobility, minimising excessive moisture, correcting malnutrition, and performing close daily monitoring of the PI including the dressing, surrounding skin, and any possible complications.

However, proper PI management translates to an extra workload for nurses. Unfortunately, due to significant staffing shortages, HCWs' workload during the COVID-19 pandemic in Indonesia is already high.⁹ In this makeshift hospital, there are only one doctor and three nurses on every shift, resulting in a HCW-to-patient ratio of 1:5. In addition, most of the patients with COVID-19 were critically ill. With a very unbalanced HCW-to-patient ratio and resultant high workload for the HCWs, it is not possible to follow the guidelines for proper PI management. As a result, PI risk assessment was not performed when patients arrived at the makeshift hospital; mobilisation and skin assessment were performed every 8 hours (once per HCW's working shift) instead of being individualised according to risk assessment.

With regard to PRDs, a recent study found that PRD use was associated with an 88% reduced risk of PI development in high risk ICU patients.²⁵ Similarly, a previous systematic review also concluded that PRD should be provided to patients who are at high risk of PI development.²⁶ Pressure-redistribution devices help prevent PIs by decreasing the magnitude and duration of pressure as well as reducing the shear and friction between the patient and the bed surface.^{10,25} Thus, providing PRDs for all critically ill patients with COVID-19 would be a beneficial strategy for PI prevention. However, in the makeshift hospital, only two PRDs are available, and thus are allocated for PI treatment and not for PI prevention.

Based on the difficulties experienced during the COVID-19 pandemic, the authors recommend several PI prevention strategies for hospitals with HCW shortages:^{23,28}

Re-educate HCWs about PI management

Conduct skin assessments as often as possible

Ensure patients have adequate nutrition and hydration

Use PRDs for all patients who are critically ill with COVID-19

Apply silicone foam dressings over the bony prominences that serve as the main pressure points in all critically ill patients with COVID-19.

CONCLUSIONS

Patients who are critically ill with COVID-19 are also at greater risk of PI development during hospitalisation. In a situation where there is a shortage of HCWs, governments should compensate by providing additional PRDs and silicone foam

dressings for all critically ill patients to prevent PI development and lighten the workload of HCWs.

CONFLICT OF INTEREST

The authors declare no conflicts of interest.

FUNDING

The authors received no funding for this study.

REFERENCES

1. Ramos-Casals M, Brito-Zeron P, Mariette X. Systemic and organ-specific immune-related manifestations of COVID-19. *Nat Rev Rheumatol* 2021;17:315-32.
2. Gao YD, Ding M, Dong X, et al. Risk factors for severe and critically ill COVID-19 patients: a review. *Allergy* 2021;76:428-55.
3. Xu W, Sun NN, Gao HN, et al. Risk factors analysis of COVID-19 patients with ARDS and prediction based on machine learning. *Sci Rep* 2021;11:2933.
4. Yang X, Yu Y, Xu J, 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* 2020;8:475-81.
5. Challoner T, Vesel T, Dosanjh A, Kok K. The risk of pressure ulcers in a prone COVID population. *Surgeon* 2021;S1479-666X(21)00121-9.
6. He M, Tang A, Ge X, Zheng J. Pressure ulcers in the intensive care unit: an analysis of skin barrier risk factors. *Adv Skin Wound Care* 2016;29:493-8.
7. Keller BP, Wille J, van Ramshorst B, van der Werken C. Pressure ulcers in intensive care patients: a review of risks and prevention. *Intensive Care Med* 2002;28:1379-88.
8. Amir Y, Lohrmann C, Halfens RJ, Schols JM. Pressure ulcers in four Indonesian hospitals: prevalence, patient characteristics, ulcer characteristics, prevention and treatment. *Int Wound J* 2017;14:184-93.
9. Mahendradhata Y, Andayani N, Hasri ET, et al. The capacity of the Indonesian healthcare system to respond to COVID-19. *Front Public Health* 2021;9:649819.
10. Edsberg LE, Black JM, Goldberg M, McNichol L, Moore L, Sieggreen M. Revised National Pressure Ulcer Advisory Panel pressure injury staging system: revised pressure injury staging system. *J Wound Ostomy Continence Nurs* 2016;43:585-97.
11. Defloor T. The risk of pressure sores: a conceptual scheme. *J Clin Nurs* 1999;8:206-16.
12. Mervis JS, Phillips TJ. Pressure ulcers: Pathophysiology, epidemiology, risk factors, and presentation. *J Am Acad Dermatol* 2019;81:881-90.
13. Bhattacharya S, Mishra RK. Pressure ulcers: current understanding and newer modalities of treatment. *Indian J Plast Surg* 2015;48(1):4-16.
14. Cox J, Roche S. Vasopressors and development of pressure ulcers in adult critical care patients. *Am J Crit Care* 2015;24:501-10.
15. Ahn H, Cowan L, Garvan C, Lyon D, Stechmiller J. Risk factors for pressure ulcers including suspected deep tissue injury in nursing home facility residents: analysis of national minimum data set 3.0. *Adv Skin Wound Care* 2016;29:178-90; quiz E1.
16. Mawhirt SL, Frankel D, Diaz AM. Cutaneous manifestations in adult patients with COVID-19 and dermatologic conditions related to the COVID-19 pandemic in health care workers. *Curr Allergy Asthma Rep* 2020;20(12):75.

17. Nedergaard HK, Haberlandt T, Toft P, Jensen HI. Pressure ulcers in critically ill patients - preventable by non-sedation? A substudy of the NONSEDA-trial. *Intensive Crit Care Nurs* 2018;44:31-5.
18. Sasabe Y, Niitani M, Teramoto C, et al. Deep sedation predicts pressure injury in patients admitted to intensive care units. *Nurs Crit Care* 2022;DOI: 10.1111/nicc.12753.
19. Young S, Narang J, Kumar S, et al. Large sacral/buttocks ulcerations in the setting of coagulopathy: a case series establishing the skin as a target organ of significant damage and potential morbidity in patients with severe COVID-19. *Int Wound J* 2020;17:2033-7.
20. Triantafyllou C, Chorianopoulou E, Kourkouni E, Zaoutis TE, Kourlaba G. Prevalence, incidence, length of stay and cost of healthcare-acquired pressure ulcers in pediatric populations: a systematic review and meta-analysis. *Int J Nurs Stud* 2021;115:103843.
21. Gupta P, Shiju S, Chacko G, et al. A quality improvement programme to reduce hospital-acquired pressure injuries. *BMJ Open Qual* 2020;9(3):e000905.
22. Allman RM, Goode PS, Burst N, Bartolucci AA, Thomas DR. Pressure ulcers, hospital complications, and disease severity: impact on hospital costs and length of stay. *Adv Wound Care* 1999;12:22-30.
23. European Pressure Ulcer Advisory Panel, National Pressure Injury Advisory Panel, Pan Pacific Pressure Injury Alliance. Prevention and Treatment of Pressure Ulcers/Injuries: Clinical Practice Guideline. The International Guideline. EPUAP/NPIAP/PPPIA; 2019.
24. Tang J, Li B, Gong J, Li W, Yang J. Challenges in the management of critical ill COVID-19 patients with pressure ulcer. *Int Wound J* 2020;17:1523-4.
25. Bai DL, Liu TW, Chou HL, Hsu YL. Relationship between a pressure redistributing foam mattress and pressure injuries: an observational prospective cohort study. *PLoS One* 2020;15(11):e0241276.
26. McInnes E, Jammali-Blasi A, Bell-Syer SE, Dumville JC, Middleton V, Cullum N. Support surfaces for pressure ulcer prevention. *Cochrane Database Syst Rev* 2015;9:CD001735.
27. Shi C, Dumville JC, Cullum N. Support surfaces for pressure ulcer prevention: a network meta-analysis. *PLoS One* 2018;13(2):e0192707.
28. Team V, Team L, Jones A, Teede H and Weller CD (2021) Pressure Injury Prevention in COVID-19 Patients With Acute Respiratory Distress Syndrome. *Front. Med.* 7:558696. doi: 10.3389/fmed.2020.558696