CASE REPORT

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Zinc oxide–chitosan dressing for grade IV pressure ulcers post-debridement with complications: A case report

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ABSTRACT

Background: Pressure ulcers require appropriate management to prevent complications and reduce mortality. Several factors can delay wound healing, including diabetes mellitus, malignancies, inadequate nutrition, hypoalbuminemia, anemia, and immobility. Therefore, selecting the appropriate wound dressing is crucial. Zinc oxide and chitosan dressings have been shown to enhance wound healing and promote tissue epithelialization.
Objective: To evaluate the outcomes of zinc oxide and chitosan dressing application in a patient with a grade IV pressure ulcer following surgical debridement and presenting with multiple complicating factors.
Case: This case study involved the application of zinc oxide and chitosan dressings in a patient with a grade IV pressure ulcer post-surgical debridement. During the first month, the treatment was combined with antimicrobial dressings. Dressings were changed every 2 to 3 days. Ulcer severity was assessed using the National Pressure Ulcer Advisory Panel criteria, and healing progress was measured with the Pressure Ulcer Scale for Healing.
Conclusion: The pressure ulcer showed progressive improvement over 8 months. However, complete healing was not achieved due to several complicating factors that delayed the healing process, including comorbidities, immobility, inadequate nutrition, urinary catheter use, the severity of the ulcer, anemia, and hypoalbuminemia.

Keywords: chitosan; modern dressing; pressure ulcer; wound care; zinc oxide

INTRODUCTION

Pressure ulcers occur when the normal anatomical structure and function of the skin are compromised due to prolonged external pressure on bony prominences (Zhang et al., 2021). The most commonly affected areas include the sacrum (30–49%), trochanter (6–11%), ischium (6–16%), heel (19–36%), elbow (5–9%), malleolus (7–8%), iliac crest (4%), and knee (3–4%) (Mamoto & Gessal, 2018). According to the National Pressure Ulcer Advisory Panel (NPUAP, 2020), the incidence of pressure ulcers varies significantly across healthcare settings,

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- *This case study can serve as a reference for hospital and home care nurses in implementing wound care interventions for patients with pressure ulcers.*
- *Primary treatment for pressure ulcers includes selecting appropriate dressings, regular monitoring, debridement, infection control, and nutritional optimization.*
- *Zinc oxide and chitosan dressings may be effective in enhancing wound healing and stimulating tissue epithelialization in grade IV pressure ulcers following surgical debridement.*

ranging from 0.4% to 38% in acute care units, 2.2% to 23.9% in long-term care units, and 0% to 7% in home care settings. In Indonesia, the incidence reaches 33.3%, which is relatively high compared to Southeast Asia, where the rates range from 2.1% to 31.3% (Kemenkes RI, 2023). Pressure ulcers are a common complication in hospitalized patients due to prolonged bed rest or immobility. Conditions frequently associated with prolonged immobility include stroke, fractures, spinal cord injuries, pneumonia, degenerative diseases, and malignancies (Mulianto & Rosmarwati, 2023).

Untreated pressure ulcers can lead to serious complications. Grade III and IV ulcers are commonly associated with infections, septicemia, anemia, hypoalbuminemia, and bone and joint infections such as periostitis, osteitis, osteomyelitis, and septic arthritis. In severe cases, these complications may result in death, with a reported mortality rate of up to 48% (Damioli et al., 2023; Jona et al., 2022). Several factors can delay the healing process even with adequate wound care. These include local factors (e.g., oxygenation, wound infection, vascular insufficiency, wound size, depth, edema, local tension, and pressure), systemic factors (e.g., age and gender), and external influences such as stress, ischemia, chronic illnesses, obesity, medication use, alcoholism, smoking, immune suppression, and poor nutrition (Liu et al., 2018; Zhao et al., 2016).

The management of pressure ulcers depends on their severity. Primary treatments include debridement, infection control, nutritional optimization, proper dressing selection, and regular monitoring (Mulianto & Rosmarwati, 2023). Modern dressing choices are continually evolving and are guided by the principle of balanced moisture to promote optimal healing (Shi et al., 2020). Zinc oxide and chitosan dressings are among the types that help maintain wound moisture, support autolysis, stimulate tissue regeneration, and are considered both safe and effective (Sukmawati et al., 2022). Given their therapeutic benefits, these dressings offer great potential for improving outcomes in pressure ulcer care. However, the presence of complicating factors can still hinder the healing process. In this case, the patient experienced multiple complications that contributed to delayed healing of a grade IV pressure ulcer. Therefore, this study aims to examine the healing progression using zinc oxide and chitosan dressings in a patient with a grade IV pressure ulcer following surgical debridement and the presence of various complications.

Nurses play a critical role in the prevention, assessment, and management of pressure ulcers. Their responsibilities include conducting thorough skin assessments, identifying patients at risk, implementing preventive measures such as repositioning and pressure redistribution, and providing appropriate wound care. In cases involving advanced pressure ulcers, nurses are instrumental in coordinating multidisciplinary care, monitoring wound progression using tools like the PUSH Tool, and educating patients and families on home care practices. Furthermore, nurses ensure adherence to infection control protocols and support nutritional interventions to promote healing. Their clinical judgment and consistent monitoring are essential in facilitating recovery, preventing complications, and improving the overall quality of patient care in both hospital and home care settings.

CASE PRESENTATION

This study was conducted over a period of eight months, from September 12, 2023, to May 14, 2024, using data collected through physical examination, observation, interviews, and secondary data obtained from medical records. The severity of the pressure ulcer was assessed using the National Pressure Ulcer Advisory Panel (NPUAP) criteria, which categorize ulcers into grades I, II, III, IV, and

Table 1. Clinical laboratory results

Test	Results	Units	Reference
Leukocytes	33.200	/µL	4.000 – 10.000
Hematocrit	20.6	%	L: 40 - 50 / P: 35 - 45
Hemoglobin	6.8	g/dl	L: 14 - 18 / P: 12 - 16
Albumin	1.9	g/dl	3.4 – 4.8
Fasting blood glucose	123	mg/dl	60-100

Tabel 2. Monitoring of wound healing scores and grade of pressure ulcers (8 months)

Monitoring the wound healing scores using the PUSH Tool						
Date	13/09/2023	16/09/2023	14/10/2023	14/12/2023	14/03/2024	14/05/2024
	POD-1	POD-3	1st month	3rd month	6th month	8th month
Length x Width	10	10	10	10	10	9
Amount of exudate	3	3	1	0	0	0
Type of tissue	4	3	2	1	1	1
Total score	17	16	13	11	11	10
Monitoring Pressure Ulcer Grade based on NPUAP criteria						
Date	13/09/2023	16/09/2023	14/10/2023	14/12/2023	14/03/2024	14/05/2024
	POD-1	POD-3	1st month	3rd month	6th month	8th month
Grade	IV	IV	IV	III	III	III

NPUAP: National Pressure Ulcer Advisory Panel; PUSH: Pressure Ulcer Scale For Healing, POD: Post-operation Day

unstageable. The Pressure Ulcer Scale for Healing (PUSH Tool) was used to evaluate the healing progress, assessing three dimensions: wound size (length × width), amount of exudate, and wound appearance. The wound size was scored on a scale from 0 (0 cm^2) to 10 (>24 cm^2); exudate amount ranged from 0 (none) to 3 (heavy); and wound appearance was rated from 0 (closed) to 4 (necrotic tissue). The total PUSH score ranges from 0 to 17, with higher scores indicating more severe wounds.

The subject of this case study was a female patient, Mrs. P, who presented with a grade IV pressure ulcer and underwent surgical debridement on September 12, 2023. Laboratory examination revealed elevated leukocytes (33,200/µL), reduced hematocrit (20.6%), low hemoglobin (6.8 g/dL), hypoalbuminemia (1.9 g/dL), and slightly elevated fasting blood glucose (123 mg/dL) (Table 1). Wound care using zinc oxide and chitosan dressings was initiated in the hospital on September 13 and 16, 2023, and continued at home, with follow-up visits at the 1st, 3rd, 6th, and 8th months. Dressings were changed every 2 to 3 days or when saturated with exudate or contaminated by urine or feces. During the first month, wound care included the use of antimicrobial dressings in combination with Conservative Sharp Wound Debridement (CSWD).

On September 13, 2023, a post-surgical debridement assessment was performed, followed by the first wound care intervention involving the application of zinc oxide and chitosan dressings combined with antimicrobial dressing and mechanical CSWD. Based on the assessment, the nursing diagnosis was impaired tissue integrity due to pressure on bony prominences, with a suspected grade IV pressure ulcer (post-debridement). The wound measured 14 cm × 10 cm with a depth of 5 cm, the presence of necrotic tissue (+), and exudate (+) (Figure 1b). The second intervention, performed on September 16, 2023, involved the removal of necrotic tissue and slough using mechanical CSWD in the surgical inpatient unit. The wound assessment showed exudate (+), slough tissue (+), undermining (+), visible coccygeal bone, wound size 14 cm × 10 cm,

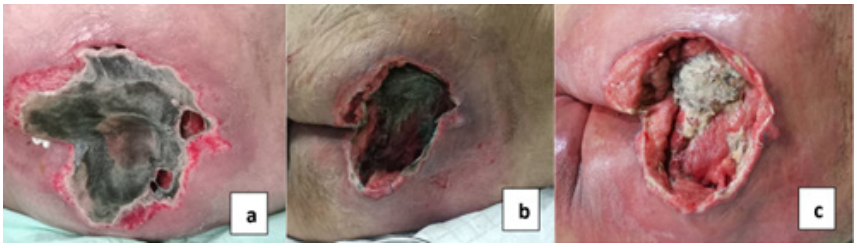

Figure 1. (a) Wound at initial assessment (pre-surgical debridement); (b) Wound post-surgical debridement; (c) Wound post-mechanical Conservative Sharp Wound Debridement (CSWD) (September 16, 2023)

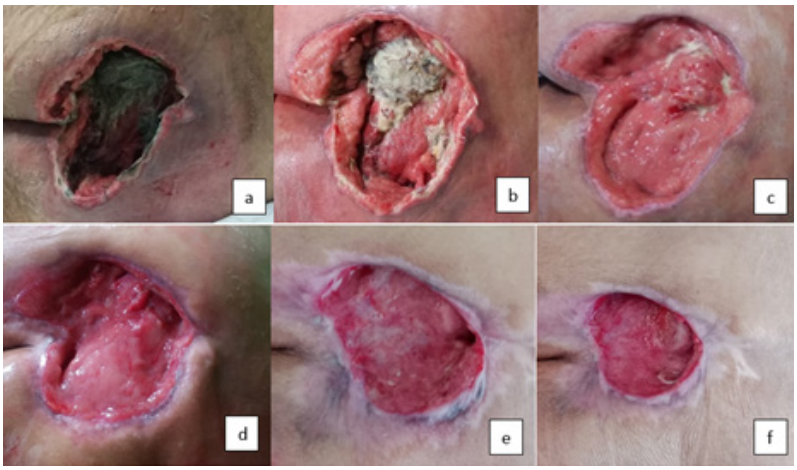

Figure 2. (a) Wound pre-mechanical Conservative Sharp Wound Debridement (CSWD); (b) Wound post-mechanical Conservative Sharp Wound Debridement (CSWD); (c) Wound care 1st month; (d) Wound care 3rd month; (e) Wound care 6th month; (f) Wound care 8th month

and a depth of 5 cm (Figure 1c). The wound care followed the 3M approach: washing the wound, removing dead tissue, and selecting the appropriate dressing. Red Fruit Oil Soap (Pandanus conoideus) was used for cleansing; necrotic tissue and slough were removed with CSWD, and zinc oxide and chitosan dressings were applied. During the first month, antimicrobial agents such as cadexomer iodine and sorbach were used along with foam dressings and gauze. Subsequent care was continued at home with scheduled follow-up assessments. All procedures were performed after obtaining informed consent from the patient and her family, who also agreed to the inclusion of this case in the study and its publication.

DISCUSSION

One patient was included in this study: a woman with a grade IV pressure ulcer following surgical debridement and a medical history of ovarian adenocarcinoma, stroke, diabetes mellitus, hypoalbuminemia, and anemia. Wound care interventions demonstrated a reduction in the pressure ulcer grade based on the National Pressure Ulcer Advisory Panel (NPUAP) criteria, and a decrease in severity as measured by the Pressure Ulcer Scale for Healing (PUSH Tool) (Table 2). As shown in Table 2 and Figure 2, the initial PUSH score was 17, with the wound filled with necrotic tissue. Following the application of zinc oxide and chitosan dressings, combined with mechanical Conservative Sharp Wound Debridement (CSWD), the score decreased to 16 on postoperative day 1 (POD-1). At this time, the wound measured 14 cm × 10 cm, had a depth of 5 cm, and presented with necrotic tissue and exudate.

On POD-3, the wound base was primarily composed of slough (yellow devitalized tissue), still measuring 14 cm × 10 cm with a depth of 5 cm and abundant exudate. The PUSH score reduction from POD-1 to POD-3 was attributed

to the mechanical CSWD method. Salsabila et al. (2024) noted that CSWD is effective for debriding necrotic tissue of varying severity, thereby accelerating the wound healing process. This is consistent with findings from Cahyono et al. (2021), who emphasized that debridement facilitates healing by removing devitalized tissue and reducing infection risk. After one month of combined treatment with zinc oxide, chitosan, and antimicrobial dressings (cadexomer iodine and sorbach), the wound size was reduced to 10 cm × 10 cm, with a depth of 2 cm and granulation tissue present, and the PUSH score had improved to 13. This improvement reflected reductions in wound size and depth, decreased exudate, and granulation filling the wound bed. Contributing factors to this progress included effective infection control, consistent wound care, and regulated blood glucose levels. Hidayat et al. (2023) supported the use of modern antimicrobial dressings in managing wounds with chronic exudate and slough. Zinc oxide, known for its antimicrobial properties, also prevents bacterial invasion, thereby promoting healing (Damsir et al., 2018).

By the third month, the wound area had reduced to 6 cm × 6 cm, with a depth of 1 cm, absence of exudate, signs of epithelialization, and a PUSH score of 11. The pressure ulcer was downgraded to grade III, as the coccygeal bone was no longer visible. At the six-month follow-up, the PUSH score remained at 11, but the wound had further decreased to 5 cm × 5 cm with a depth of 0.5 cm and a wound bed filled with epithelial tissue. These improvements were influenced by proper wound cleansing using Red Fruit Oil Soap (Pandanus conoideus) and the use of pressure-relieving devices. Masunaga et al. (2021) reported that effective cleansing prevents biofilm formation, which otherwise hinders healing. Similarly, Mariyana and Naziyah (2023) found that pressure-relieving devices protect wounds from excessive mechanical stress and promote healing. By the eighth month, the wound size had further reduced to 5 cm × 4 cm, with no exudate and complete epithelialization of the wound bed. Although significant progress was observed, complete healing was not achieved. Nevertheless, the PUSH score improved by 7 points from baseline. These findings were consistent with the study by Mariyana and Naziyah (2023), who reported that zinc oxide and chitosan dressings effectively stimulate epithelialization and reduce wound dimensions. However, this contrasts with Guest et al. (2018), who noted that the average healing time for grade IV pressure ulcers is approximately eight months.

Despite improvement, complete healing was not observed by the end of the eighth month. Several factors likely contributed to the delayed healing process. These include chronic comorbidities such as diabetes mellitus, ovarian adenocarcinoma, and stroke; immobility; high ulcer severity; malnutrition indicated by a low body mass index (BMI); anemia; and hypoalbuminemia. Dalisson and Barralet (2019) explained that diabetes reduces blood flow to wounds, thereby limiting oxygen and nutrient delivery essential for healing. Arai et al. (2020) reported that patients with malignancies such as ovarian cancer often suffer from poor appetite and nutritional deficits, further hindering wound recovery. Malnutrition also reduces tissue tolerance to pressure and contributes to protein deficiencies such as hypoalbuminemia, which compromises tissue oxygenation (Ahn et al., 2016). As noted by Neloska et al. (2016), patients with poor nutritional status are more prone to anemia and hypoalbuminemia—both associated with delayed wound healing due to the role of albumin in tissue regeneration.

Further evidence from Karahan et al. (2018) highlighted that grade IV ulcers have a lower likelihood of healing than less severe ulcers. Low hemoglobin levels impair oxygen delivery to tissues, while immobility further compromises healing. Alimansur and Santoso (2019) also emphasized that reduced hemoglobin levels impair tissue metabolism and recovery. In this case, the patient remained bedridden and was unable to mobilize independently for eight months. Mitchell (2018) explained that prolonged immobility increases the risk of shear and friction injuries, thereby delaying healing. The NPUAP (2014) recommends early repositioning and mobilization to manage pressure ulcers effectively. This includes adopting a 30° tilt in the side-lying position and limiting bed elevation and seated time to reduce sacral and coccygeal pressure.

Additionally, the pressure ulcer was located in the sacral region, and the patient used a urinary catheter continuously for eight months. Sacral ulcers are especially vulnerable to contamination from urine and feces, increasing the risk of skin irritation and infection. Therefore, dressings must be changed regularly and immediately upon contamination. Exposure to moisture can rapidly deteriorate

the skin, leading to epidermal breakdown and infection, ultimately prolonging wound healing. Browning et al. (2018) stressed that timely dressing changes and skin protection are critical to minimizing contamination-related complications and improving outcomes in patients with sacral pressure ulcers.

CONCLUSION

The intervention using zinc oxide and chitosan dressing can reduce the PUSH score and decrease the grade of pressure ulcers. The grade of the pressure ulcer decreased in the third month from grade IV to grade III because the coccygeal bone was no longer visible. Additionally, the decrease in the PUSH score can be seen from 17 to 16 after mechanical CSWD. After 1 month of wound care, the PUSH score decreased to 13. Then, after 3 and 6 months, the PUSH score decreased to 11. By the eighth month, the PUSH score decreased to 10. The decrease in the PUSH score can be observed from the reduction in wound area, amount of exudate, and tissue type transitioning to granulation and beginning epithelialization. In this case, several factors influenced the improvement of pressure ulcers, including wound care with exudate management and appropriate dressing selection, wound cleansing process, controlled infection, controlled blood sugar levels, debridement procedures, and the use of pressure-relieving mattresses. Additionally, there were several factors that delayed the wound healing process, preventing complete healing by the eighth month, including chronic diseases (Diabetes Mellitus, ovarian adenocarcinoma, and stroke), limited patient mobility, urinary catheter use, inadequate nutrition indicated by underweight category as well as low hemoglobin and albumin levels, and high grade of pressure ulcers.

Declaration of Interest

The authors declare that no conflicts of interest exist.

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Data Availability

The datasets generated during and/or analyzed during the current study are available from the corresponding author on reasonable request.

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