INTERNATIONAL **CASE REPORT**

WOUNDS | INTERNATIONAL

Pressure injury prevention and management in the Asia-Pacific Region

Use of Polyhexamethylene Biguanide and Betaine Surfactant (PHMB-B) for wound bed preparation

2026



Published by
Wounds International
A division of OmniaMed Communications Ltd
108 Cannon Street
London EC4N 6EU, UK
Tel: +44 (0)20 3735 8244

www.woundsinternational.com

© Wounds International, 2026

Suggested citation
Wounds International (2026) *Retrospective case series: Pressure injury prevention and management in the Asia-Pacific Region. Use of Polyhexamethylene Biguanide and Betaine Surfactant (PHMB-B) for wound bed preparation.* Wounds International, London, UK

Free download available at:
www.woundsinternational.com

All rights reserved ©2026. No reproduction, copy or transmission of this publication may be made without written permission.

No paragraph of this publication may be reproduced, copied or transmitted save with written permission or in accordance with the provisions of the Copyright, Designs and Patents Act 1988 or under the terms of any license permitting limited copying issued by the Copyright Licensing Agency, 90 Tottenham Court Road, London, W1P 0LP.

The views expressed in this publication are those of the authors and do not necessarily reflect those of B. Braun.

EXPERT PANEL

Honorary Chairman:

Prof. Emeritus Dato' Dr. Harikrishna K.R. Nair, MD, MSc, FRCPI, FRCPE, PhD (ULSIT), PhD in Medical Sciences, President, World Union of Wound Healing Societies (WUWHS)

Prof. Keryln Carville, RN, PhD, STN, Fellow, Wounds Australia, Professor of Primary Health Care and Community Nursing, Silver Chain Group Inc. and Curtin University, Perth, Australia

Dr. Yuwadee Kestsumpun, PhD, APN, T-WOCN, President of Enterostomal Therapy Nurses Association, Thailand

Prof. Dr. Zhang Long, MD, Department of Wound Healing Center, Peking University Third Hospital, Beijing, China

EDITOR AND PROJECT LEAD

Sumita Poopalalingam, RN, BHSc (Nurs), CCWC, PGWM, Senior Manager, Regional Clinical and Education Partner APAC, B. Braun Medical Industries, Penang, Malaysia

AUTHOR DETAILS

Lt. Col. Jaraspas Wongviseskarn, MNS, APN, T-CWOCN, Head of Advanced Wound Care Clinic, Rehabilitation Department, Phramongkutklao Hospital, Bangkok, Thailand

Maj. Ananyaran Tiengtham, ET Nurse, Advanced Wound Care Clinic, Rehabilitation Department, Phramongkutklao Hospital, Bangkok, Thailand

Capt. Niyada Boonsom, ET Nurse, Advanced Wound Care Clinic, Rehabilitation Department, Phramongkutklao Hospital, Bangkok, Thailand

Lt. Natnicha Muangmoon, ET Nurse, Advanced Wound Care Clinic, Rehabilitation Department, Phramongkutklao Hospital, Bangkok, Thailand

Jirakan Kamket, PN, Advanced Wound Care Clinic, Rehabilitation Department, Phramongkutklao Hospital, Bangkok, Thailand

Rene Armzed Cantuba, MSN, RN, IIWCC, Wound Care Manager, Dr. Marcelo M. Chan Memorial Hospital, Pangasinan, Philippines

Rachill Clavecillas, RN, Wound Care Nurse, Dr. Marcelo M. Chan Memorial Hospital, Pangasinan, Philippines

Arlene Pavo, Consultant General Surgeon, Head of Wound Care Center, Dr. Marcelo M. Chan Memorial Hospital, Pangasinan, Philippines

Mohd Shahrul Suondoh, MD, MS (Plastic Surgery), MBA, Plastic, Burn and Reconstructive Surgeon, Department of Plastic and Reconstructive Surgery, Kuala Lumpur Hospital, Kuala Lumpur, Malaysia

Salmi Mohamed Sukur, MBBS, MS (Plastic Surgery), Plastic, Burn and Reconstructive Surgeon, Department of Plastic and Reconstructive Surgery, Kuala Lumpur Hospital, Kuala Lumpur, Malaysia

Juntima Sinmaneerat, RN, T-CWOCN, Wound Care Center, Vachira Phuket Hospital, Phuket, Thailand

Tharnthip Bunprom, RN, ET, Wound Care Center, Vachira Phuket Hospital, Phuket, Thailand

Enoka Wijeratne, Registered Enterostomal Therapy Nurse, Wound Care Nurse Practitioner, Care and Cure Wound Management Center, Sri Lanka

Wei Cheng, RN, Senior Nurse, Enterostomal Therapist, Anqing Bingfeng Hospital, Daguan District, Anqing City, Anhui Province, China

Youping Wang, MBBS, Attending Physician, Anqing Bingfeng Hospital, Daguan District, Anqing City, Anhui Province, China

Fen Liu, RN, Associate Chief Nurse, Wound and Ostomy Care Nurse, Anqing Bingfeng Hospital, Daguan District, Anqing City, Anhui Province, China

Muriel Toledo, Medical Officer III, Plastic, Reconstructive and Aesthetic Surgery Fellow-in-Training, Philippines

Tao Li, Associate Chief Physician, Department of Plastic and Reconstructive Surgery, Peking University Shougang Hospital, Beijing, China

Jing Yu Hu, Attending Physician, Department of Plastic and Reconstructive Surgery, Peking University Shougang Hospital, Beijing, China

Haiyang Lin, Attending Physician, Department of Plastic and Reconstructive Surgery, Peking University Shougang Hospital, Beijing, China

Dr. Nguyen Xuan Thien, Department of Burns, Plastic and Aesthetic Surgery, Trung Vuong Hospital, Ho Chi Minh City, Vietnam

Li Yunfeng, MD, Department of Wound Healing Center, Peking University Third Hospital, Beijing, China

Cai Meng, MSc, Department of Wound Healing Center, Peking University Third Hospital, Beijing, China

Wang Qian, MSc, Department of Wound Healing Center, Peking University Third Hospital, Beijing, China

Prof. Dr. Zhang Long, MD, Department of Wound Healing Center, Peking University Third Hospital, Beijing, China

Hannah Grace P. Lumongsod, RN, MD, Southern Philippines Medical Center, Davao, Philippines

Kathrina Victoria Baluyut-Angeles, FPAPRAS, FPCS, Southern Philippines Medical Center, Davao, Philippines

Rungrat Koetsawat, Head Nurse, Treatment Unit, ET Nurse, Ramathibodi Hospital, Mahidol University, Bangkok, Thailand

Paweena Kachanthuek, RN, Observation Ward, ET Nurse, Ramathibodi Hospital, Mahidol University, Bangkok, Thailand

The authors are listed in the order in which their respective case reports are presented.

Foreword

A pressure injury is localised damage to the skin and/or underlying tissue, usually occurring over a bony prominence or in association with a medical or other device. It results from sustained pressure, or pressure in combination with shear (National Pressure Injury Advisory Panel [NPIAP], European Pressure Ulcer Advisory Panel [EPUAP] and Pan Pacific Pressure Injury Alliance [PPPIA], 2026). Pressure injuries, also called pressure ulcers or bedsores, are a leading hospital adverse event, yet are mostly preventable. Anyone with reduced mobility, impaired sensation, poor perfusion or nutritional compromise is at risk, and the burden is expected to grow as populations age.

Across the Asia-Pacific region, pressure injuries affect patients in a range of care settings, from acute hospitals and rehabilitation services to long-term care and community settings, and reported prevalence varies widely by population and setting. A multi-centre survey covering 52 hospitals in China and 14,675 older patients showed that the prevalence of pressure injuries was 3.3% (Jiang et al, 2022). Rehabilitation settings have reported 5.9% in Sri Lanka and up to 29.9% in South India (Zakrasek et al, 2015). In Australia and New Zealand, a systematic review found an overall prevalence of 12.9% in acute-care hospitals, with a hospital-acquired prevalence of 7.9% (Rodgers et al, 2019). Southeast Asian data are more limited and outdated. A community study of 790 people with chronic spinal cord injury in Malaysia, Indonesia and Thailand found that 35% had pressure injury problems (Kammuang-Lue et al, 2024). Although these figures are unable to be directly compared because of differences in populations and care settings, they illustrate the continuing burden of pressure injuries across the Asia-Pacific region, and the need for more consistent regional data.

The challenge does not end when a pressure injury heals. Recurrence is common, with reported rates ranging from 21% to 60% after surgical reconstruction (Lin-Yin et al, 2023). This reinforces the importance of identifying and addressing the factors that contribute to pressure injury development, rather than focusing solely on wound closure. Prevention therefore needs to remain an integral part of care throughout the patient journey.

For those affected, the consequences can be significant. Pressure injuries may cause pain, limit mobility, disrupt sleep and negatively affect quality of life. Patients and caregivers may also experience anxiety and worry, alongside loss of privacy, dignity, control and personal autonomy (Burston et al, 2023). More severe injuries can contribute to significant morbidity and mortality, while also prolonging hospital stays and increasing the complexity of care (Sullivan, 2013; Jackson et al, 2018; Song et al, 2019; Graves et al, 2023).

Pressure injuries also place considerable demands on healthcare resources. Nursing care accounts for approximately 41% of the total cost associated with hospital-acquired pressure injury care, reflecting the time required for prevention, assessment, treatment and ongoing monitoring (Posnett et al, 2009). In intensive care settings, the cost of a single hospital-acquired pressure injury has been estimated to reach US$32,000 per patient (Wassel et al, 2020). In Australia, pressure injuries were estimated to cost public hospitals AU$9.11 billion in 2020, of which AU$5.50 billion was attributed to hospital-acquired injuries (Nghiem et al, 2022). Comprehensive and comparable economic data are not available across all Asia-Pacific countries, but these figures illustrate the wider resource implications for healthcare services.

This supplement presents real-world evidence from clinicians working across diverse settings. It features 12 cases from the 2025 Excellence Case Sharing Award abstract submissions, highlighting best practices in care across adult populations in both inpatient and community settings. Together they show how structured assessment, therapeutic wound cleansing, wound bed preparation with polyhexamethylene biguanide and betaine (PHMB-B), appropriate dressings and multidisciplinary, person-centred care can support even complex, infected pressure injuries towards healing.

We thank the healthcare professionals who generously shared their cases, the patients and caregivers whose care they describe and everyone who contributed to bringing this publication together. We hope it supports clinicians across the Asia-Pacific region in delivering better outcomes for the people they care for.

Prof. Emeritus Dato' Dr. Harikrishna K.R. Nair, Prof. Keryln Carville, Dr. Yuwadee Kestsumpun & Prof. Dr. Zhang Long

Glossary

Antimicrobial stewardship: The supervised and organised use of antimicrobials in order to decrease the spread of infections that are caused by multidrug-resistant organisms and to improve clinical outcomes by encouraging appropriate and optimised use of antimicrobials (International Wound Infection Institute [IWII], 2026).

Antiseptic: A topically administered agent with broad-spectrum activity that inhibits multiplication of, or sometimes kills, microorganisms. Depending upon its concentration, an antiseptic may have a toxic effect on human cells. Development of resistance to antiseptics is uncommon (IWII, 2026).

Bates-Jensen Wound Assessment Tool (BWAT): A 13-item objective measure including tissue characteristics, exudate, necrotic burden and healing progression, designed to assess wound status and track healing (Bates-Jensen et al, 2019).

Betaine: A gentle yet effective surfactant that penetrates, disturbs, cleans and removes biofilm and wound debris.

Biofilm: Aggregate of microorganisms that have unique characteristics and enhanced tolerance to treatment and the host defences. Wound biofilms are associated with impaired wound healing and signs and symptoms of chronic inflammation (IWII, 2026).

Braden Scale score: Scale that measures the risk of developing pressure injuries. The scale consists of six subscales that reflect determinants of pressure (sensory perception, activity and mobility) and factors influencing tissue tolerance (moisture, nutrition, friction and shear). Five of the six subscales are rated from 1 (least favourable) to 4 (most favourable); the friction and shear subscale is rated from 1 to 3. A low total score indicates a high risk of developing pressure injuries (Bergstrom et al, 1987; Burston et al, 2025).

Chronic/hard-to-heal wound: A wound that makes slow progression through the healing phases or displays delayed, interrupted or stalled healing. Inhibited healing may be due to intrinsic and extrinsic factors that impact on the person, their wound and their healing environment. When a wound fails to heal within an expected timeframe or within 4–6 weeks it is usually considered to be chronic/hard-to-heal (IWII, 2026).

Cytotoxic: Refers to a substance that has a toxic effect on an important cellular function. In the context of wounds, cytotoxicity generally refers to the potential adverse effect of destroying cells that are involved in tissue healing, including keratinocytes, fibroblasts, macrophages and neutrophils. CT_{50} refers to the concentration of an antimicrobial agent that causes 50% cytotoxicity to mammalian cells (IWII, 2026).

Debridement: The removal of devitalised (non-viable) tissue from or adjacent to a wound. Debridement also removes foreign matter, exudate and microorganisms from the wound bed and promotes a stimulatory environment (IWII, 2026).

Epibole: Wound edges that are rolled, raised, rounded and harder, and may appear lighter in colour than the periwound skin (IWII, 2025).

Hypoalbuminaemia: A condition in which the level of albumin, a protein in the blood, falls below the normal range. It is common in hospitalised and critically ill patients (Gounden et al, 2026).

Maceration: Wrinkled, soggy and/or soft periwound skin occurring due to exposure to moisture. Macerated periwound skin usually presents as white/pale and is at increased risk of breakdown. In dark skin tones maceration can appear as shiny, grey, purple, or darker discolouration (IWII, 2026).

Medical adhesive-related skin injury (MARSI): Skin damage caused by the use of products containing a medical adhesive – e.g. tapes, dressings, electrodes, medication patches and wound closure strips (Fumarola et al, 2020).

Necrotic tissue/necrosis: Dead (devitalised) tissue that is dark in colour and comprised of dead tissue cells. Necrotic tissue acts as a barrier to healing by preventing complete tissue repair and promoting microbial colonisation. It is usually managed with debridement, but only after a comprehensive assessment of the individual and their wound (IWII, 2026).

Negative pressure wound therapy (NPWT): A wound treatment that applies controlled

negative pressure to remove exudate, promote wound drainage, stabilise the wound bed, draw wound edges together and stimulate granulation tissue formation. NPWT can also be combined with automated instillation of topical wound solutions (Wounds UK, 2026).

Polyhexamethylene biguanide (PHMB): A broad-spectrum antiseptic effective against Gram-positive and Gram-negative bacteria. It has low toxicity and good clinical safety, and may help reduce bacterial burden and wound-related pain while promoting wound healing (Kramer and Rudolph, 2002; Scientific Committee on Consumer Safety, 2017; Rippon et al, 2023).

Pressure injury: Localised damage to the skin and/or underlying tissue, usually over a bony prominence or related to a medical or other device, resulting from prolonged pressure or pressure in combination with shear (EPUAP/NPIAP/PPPIA, 2026).

Prontosan® Wound Irrigation Solution: Irrigation solution designed for cleansing, moistening and decontamination of acute and chronic wounds, including burn injuries.

Prontosan® Wound Gel: Gel that provides long-lasting cleansing, moistening and decontamination of acute and chronic wounds, including burn injuries. Supports the creation of an optimal moist environment for wound healing.

Prontosan® Wound Gel X: Highly viscous gel for acute and chronic wounds including burns that provides long-lasting cleansing, moistening and decontamination. Supports the creation of an optimal moist environment for wound healing and may be preferred for large surface areas and burns.

Surfactant: A hydrophobic/lipophilic agent that reduces the surface tension between liquid and debris, slough and/or biofilm in a wound. The reduction in surface tension better disperses the liquid, improving the cleansing effect (IWII, 2026).

Therapeutic wound cleansing: Active removal of surface contaminants, loose debris, non-attached non-viable tissue, microorganisms and/or remnants of previous dressings (IWII, 2026).

Introduction

Scan the QR code to access the 2026 fourth edition of the Prevention and Treatment of Pressure Ulcers/Injuries: Clinical Practice Guideline, an international collaboration by the National Pressure Injury Advisory Panel (NPIAP), European Pressure Ulcer Advisory Panel (EPUAP) and Pan Pacific Pressure Injury Alliance (PPPIA).

Pressure injuries (PIs) are areas of localised damage to the skin and/or underlying tissue, usually over bony prominences or related to a medical or other device, resulting from prolonged pressure or pressure in combination with shear (NPIAP/EPUAP/PPPIA, 2026). This combination of forces drives tissue and cell deformation, as well as ischaemia, lymphatic flow blockage and reperfusion damage (Santamaria et al, 2018; Wilson et al, 2019; Gefen et al, 2022). The severity of a PI is proportional to the magnitude and duration of this deformation, and injury can, in some cases, occur very rapidly.

Which patients are at risk?

A PI develops when the load on the tissue (how much pressure or shear, and for how long) is greater than that person's skin and underlying tissue can tolerate. Risk factors therefore fall into two groups: those that increase the load, such as being unable to move or having a device pressing on the skin, and those that reduce tissue tolerance, such as poor circulation or poor nutrition. Patients at highest risk usually have several risk factors at once (NPIAP/EPUAP/PPPIA, 2026).

At first contact, look for these three risks. If any is present, treat the patient as at risk and move on to a full risk assessment, regardless of age or care setting (NPIAP/EPUAP/PPPIA, 2026):

- **Reduced mobility or activity**: the patient is unable to reposition themselves independently, for example because they are bedbound or chairbound, or need help to move.
- **A medical device in contact with the skin or mucosa**: examples include oxygen tubing, masks, catheters and splints. Risk starts as soon as the device is applied and increases the longer it stays on and the more devices are in use (Jia et al, 2024).
- **An existing PI, or a history of one**: this includes scarring from a previous injury.

Then assess the remaining risk factor domains in full, such as sensory perception limitations (e.g. stroke, spinal cord injury, peripheral neuropathy, reduced level of consciousness), perfusion, circulation and oxygenation (e.g. diabetes mellitus, peripheral vascular disease, vasopressors, oedema) and moisture (e.g. urinary, faecal or dual incontinence; NPIAP/EPUAP/PPPIA, 2026). Persistently moist skin can also progress to moisture-associated skin damage.

Pressure injury stages

While all PIs are serious, their severity varies in clinical impact and treatment difficulty, ranging from patches of discoloured skin that may heal without incident to deep, open ulcers that expose underlying bone or muscle and are very challenging to treat (NPIAP/EPUAP/PPPIA, 2026).

PI classification is based on visual inspection and palpation to identify which tissues are involved, including skin, subcutaneous fat, muscle, bone, tendon and ligament (NPIAP/EPUAP/PPPIA, 2026). PIs are classified into six categories: Stages 1 to 4, unstageable and suspected deep tissue injury/deep tissue pressure injury (sDTI/DTPI). Higher numbers indicate deeper tissue loss, but they do not describe a progression. Stage 1 PIs may progress to a Stage 2, 3 or 4 PI; however, a healing Stage 3 or 4 PI is not "downstaged" but reported as a healing Stage 3 or 4 PI (NPIAP/EPUAP/PPPIA, 2026).

An sDTI/DTPI can be difficult to classify because it evolves. It may appear as purple or maroon discolouration of intact skin or a blood-filled blister over a pressure-loading surface. It may then develop a thin blister over a dark wound bed or thin eschar, or in some cases heal without any loss of the dermis or epidermis. Any sDTI/DTPI that progresses, or is debrided to reveal deeper tissue injury, should be reclassified as a Stage 3 or 4 PI.

Skin tones

Early signs of pressure damage can present differently in medium to dark skin tones compared with light skin tones (Pramod et al, 2024). As a result, identifying the early changes that signal a Stage 1 PI or sDTI/DTPI in medium to dark skin tones can be more difficult (Black and Simende, 2020). Early damage may therefore be identified later, which could contribute to the higher rates of full-thickness PIs and mortality reported in people with dark skin tones (Bauer et al, 2016). The problem is compounded by the continued dominance of light skin tone examples in undergraduate and postgraduate PI education for nurses (Gunowa et al, 2021).

Assessment therefore needs to go beyond looking for redness. Persistent erythema may be seen in light skin tones, but in medium to dark skin tones early damage more often appears as a change from the person's usual skin tone, typically localised darkening. Visual inspection should be combined with palpation to assess warmth, localised oedema and changes in tissue consistency, such as increased hardness compared with the surrounding skin. The patient should also be asked about localised pain at bony prominences/pressure points (NPIAP/EPUAP/PPPIA, 2026). Using tangential (side) lighting or lightly moistening the skin can make early damage easier to see. Where available, advanced assessment technologies can support detection, while the person or their carer can often identify what is normal for the skin and recognise any changes. The same checks should be used when determining the extent of tissues involved in Stage 2 to 4 PIs; ethnicity or race should never be used as a stand-in for skin tone (NPIAP/EPUAP/PPPIA, 2026). Other skin conditions, including maceration, intertrigo and fungal rashes, may present differently in darker skin tones, making them more difficult to distinguish from a PI.

Multidisciplinary management and structured assessment

Managing PIs effectively demands more than local wound care alone: it requires a coordinated, multidisciplinary approach spanning pressure relief, nutritional optimisation, infection control, and patient and caregiver education. Two elements of that approach, structured risk assessment and structured wound assessment, underpin everything that follows in this case series.

Structured assessment: Braden Scale and BWAT

Two tools anchor the assessment work in the cases that follow: one for predicting risk before a PI develops, the other for tracking an existing wound's progress.

Scan the QR code to access an editable/ printable Braden Scale sheet.

For risk prediction, the NPIAP/EPUAP/PPPIA (2026) guideline recommends regular and comprehensive skin and tissue assessment. Around 40 PI risk assessment tools exist (Moore and Patton, 2019), yet none has been established as the "gold standard" (Hultin et al, 2022; Balzer et al, 2025). Among the available assessment tools, the Braden Scale [**Table 1**, page 8] is the most widely used across a variety of clinical settings (Lovegrove et al, 2023). It has also been the most extensively studied in terms of its psychometric properties, reflecting its ease of use and inclusion of a wider range of risk factors, such as moisture and sensory perception, compared with many alternative tools (NPIAP/EPUAP/PPPIA, 2026). It comprises six subscales: activity, friction and shear, mobility, moisture, nutrition and sensory perception, each scored from 1 to 4 (friction and shear from 1 to 3), with lower scores indicating greater risk (Bergstrom et al, 1987).

Scan the QR code to access an editable/ printable Bates-Jensen Wound Assessment Tool sheet.

For tracking an existing wound, the Bates-Jensen Wound Assessment Tool (BWAT; **Table 2**, page 9) offers the same consistency that the Braden Scale brings to risk prediction. Wound assessment has traditionally depended on individual clinicians' observations, resulting in inconsistent use of assessment tools. Standardised instruments, such as the BWAT, address this variability by supporting consistent monitoring of wound healing and improving communication across care teams (NPIAP/EPUAP/PPPIA, 2026). The BWAT rates 13 wound characteristics including size, depth, wound edges, undermining and tunnelling, necrotic tissue, exudate type and amount, periwound skin condition, and granulation and epithelialisation (Bates-Jensen et al, 2019). Each characteristic is rated on a 5-point Likert scale, in which a score of 1 indicates the healthiest state and a score of 5 reflects the worst condition. The 13 scores are then summed, with a total score ranging from 13 (best) to 65 (worst; Bates-Jensen et al, 2019).

Biofilm, therapeutic cleansing and Prontosan®

Once a wound has been assessed, the focus shifts to local wound bed management, with biofilm representing one of the key barriers to healing. A 2017 meta-analysis found that 78.2% of the wounds sampled contained biofilm, leading the authors to conclude that biofilms are ubiquitous in chronic wounds (Malone et al, 2017). Biofilms are aggregates of microorganisms encased in a self-produced matrix of extracellular polysaccharides, proteins and DNA (Lichtenberg et al, 2024; Bjarnsholt et al, 2026). They can promote persistent inflammation, delayed healing, reduced antimicrobial susceptibility and an increased risk of infection (IWII, 2026).

Table 1. Braden Scale for Predicting Pressure Sore Risk (Bergstrom et al, 1987).
Scores of 15 or higher indicate low risk; 13–14 indicate moderate risk; 10–12 indicate high risk; and scores 9 or below indicate severe risk.

Theme	Value				Score
Sensory perception (Ability to respond meaningfully to pressure-related discomfort)	**1. Completely Limited** Unresponsive (does not moan, flinch, or grasp) to painful stimuli, due to diminished level of consciousness or sedation **OR** Limited ability to feel pain over most of the body.	**2. Very Limited** Responds only to painful stimuli. Cannot communicate discomfort except by moaning or restlessness **OR** Has a sensory impairment which limits the ability to feel pain or discomfort over 1/2 of the body.	**3. Slightly Limited** Responds to verbal commands but cannot always communicate discomfort or need to be turned **OR** Has some sensory impairment which limits ability to feel pain or discomfort in 1 or 2 extremities.	**4. No Impairment** Responds to verbal commands, has no sensory deficit which would limit ability to feel or voice pain or discomfort.	
Moisture (Degree to which skin is exposed to moisture)	**1. Constantly Moist** Skin is kept moist almost constantly (e.g. perspiration, urine). Dampness is detected every time patient is moved or turned.	**2. Very Moist** Skin is often but not always moist. Linen/ continent briefs must be changed once a shift.	**3. Occasionally Moist** Skin is occasionally moist, requiring an extra linen/ continent briefs change approximately once a day.	**4. Rarely Moist** Skin is usually dry; linen only requires changing at routine intervals.	
Activity (Degree of physical activity)	**1. Bedfast** Confined to bed.	**2. Chairfast** Ability to walk severely limited or non-existent. Cannot bear own weight and/or must be assisted into chair or wheelchair.	**3. Walks Occasionally** Walks occasionally during the day, but for very short distances, with or without assistance. Spends majority of each shift in bed or chair.	**4. Walks Frequently** Walks outside room at least twice a day and inside room at least once every two hours during waking hours.	
Mobility (Ability to change and control body position)	**1. Completely Immobile** Does not make even slight changes in body or extremity position without assistance.	**2. Very Limited** Makes occasional slight changes in body or extremity position but unable to make frequent or significant changes independently.	**3. Slightly Limited** Makes frequent though slight changes in body or extremity position independently.	**4. No Limitations** Makes major and frequent changes in position without assistance.	
Nutrition (Usual food intake pattern)	**1. Very Poor** Never eats a complete meal. Rarely eats more than 1/3 of any food offered. Eats 2 servings or less of protein-rich foods (meat or dairy products) per day. Takes fluids poorly. Does not take a liquid dietary supplement **OR** Is nothing by mouth and/or maintained on clear liquids or IVs for more than 5 days.	**2. Probably Inadequate** Rarely eats a complete meal and generally eats only about 1/2 of any food offered. Protein intake includes only 3 servings of protein-rich foods (meat or dairy products) per day. Occasionally will take dietary supplement **OR** Receives less than optimum amount of liquid diet or tube feeding.	**3. Adequate** Eats over half of most meals. Eats a total of 4 servings of protein-rich foods (meat or dairy products) each day. Occasionally will refuse a meal, but will usually take a supplement when offered **OR** Is on a tube feeding or total parenteral nutrition regimen, which probably meets most of nutritional needs.	**4. Excellent** Eats most of every meal. Never refuses a meal. Usually eats a total of 4 or more servings of protein-rich foods (meat or dairy products). Occasionally eats between meals. Does not require supplementation.	
Friction and Shear	**1. Problem** Requires moderate to maximum assistance in moving. Complete lifting without sliding against sheets is impossible. Frequently slides down in bed or chair, requiring frequent repositioning with maximum assistance. Spasticity, contractures, or agitation leads to almost constant friction.	**2. Potential Problem** Moves feebly or requires minimum assistance. During a move skin probably slides to some extent against sheets, chair, restraints or other devices. Maintains relatively good position in chair or bed most of the time but occasionally slides down.	**3. No Apparent Problem** Moves in bed and in chair independently and has sufficient muscle strength to lift up completely during move. Maintains good position in bed or chair.		
The lower the score, the greater the risk.					

Table 2. Bates-Jensen wound assessment tool (BWAT; Bates-Jensen et al, 2019).
Scores of 13–20 indicate minimal severity; 21–30 indicate mild severity; 31–40 indicate moderate severity; and 41–65 indicate critical severity.

Item	Assessment	Score	Item	Assessment	Score
1. Size	1 = Length × width <4cm^2 2 = Length × width 4–<16cm^2 3 = Length × width 16.1–<36cm^2 4 = Length × width 36.1–<80cm^2 5 = Length × width >80cm^2.		**2. Depth**	1 = Non-blanchable erythema on intact skin 2 = Partial thickness skin loss involving epidermis and/or dermis 3 = Full thickness skin loss involving damage or necrosis of subcutaneous tissue; may extend down to but not through underlying fascia; and/or mixed partial and full thickness and/or tissue layers obscured by granulation tissue 4 = Obscured by necrosis 5 = Full thickness skin loss with extensive destruction, tissue necrosis or damage to muscle, bone or supporting structures.	
3. Edges	1 = Indistinct, diffuse, none clearly visible 2 = Distinct, outline clearly visible, attached, even with wound base 3 = Well-defined, not attached to wound base 4 = Well-defined, not attached to base, rolled under, thickened 5 = Well-defined, fibrotic, scarred or hyperkeratotic.		**4. Undermining**	1 = None present 2 = Undermining <2cm in any area 3 = Undermining 2–4cm involving <50% wound margins 4 = Undermining 2–4cm involving >50% wound margins 5 = Undermining >4cm or tunnelling in any area.	
5. Necrotic Tissue Type	1 = None visible 2 = White/grey non-viable tissue and/or non-adherent yellow slough 3 = Loosely adherent yellow slough 4 = Adherent, soft, black eschar 5 = Firmly adherent, hard, black eschar.		**6. Necrotic Tissue Amount**	1 = None visible 2 = <25% of wound bed covered 3 = 25% to 50% of wound covered 4 = >50% and <75% of wound covered 5 = 75% to 100% of wound covered.	
7. Exudate Type	1 = None 2 = Bloody 3 = Serosanguineous: thin, watery, pale red/pink 4 = Serous: thin, watery, clear 5 = Purulent: thin or thick, opaque, tan/yellow, with or without odour.		**8. Exudate Amount**	1 = None, dry wound 2 = Scant, wound moist but no observable exudate 3 = Small 4 = Moderate 5 = Large.	
9. Skin Colour Surrounding Wound	1 = Pink or normal for ethnic group 2 = Bright red and/or blanches to touch 3 = White or grey pallor or hypopigmented 4 = Dark red or purple and/or non-blanchable 5 = Black or hyperpigmented.		**10. Peripheral Tissue Oedema**	1 = No swelling or oedema 2 = Non-pitting oedema extends <4cm around wound 3 = Non-pitting oedema extends ≥4cm around wound 4 = Pitting oedema extends <4cm around wound 5 = Crepitus and/or pitting oedema extends ≥4cm around wound.	
11. Peripheral Tissue Induration	1 = None present 2 = Induration, <2cm around wound 3 = Induration 2–4cm extending <50% around wound 4 = Induration 2–4cm extending >50% around wound 5 = Induration >4cm in any area around wound.		**12. Granulation Tissue**	1 = Skin intact or partial thickness wound 2 = Bright, beefy red; 75% to 100% of wound filled and/or tissue overgrowth 3 = Bright, beefy red; <75% and >25% of wound filled 4 = Pink, and/or dull, dusky red and/or fills <25% of wound 5 = No granulation tissue present.	
13. Epithelialisation	1 = 100% wound covered, surface intact 2 = 75% to <100% wound covered and/or epithelial tissue extends >0.5cm into wound bed 3 = 50% to <75% wound covered and/or epithelial tissue extends to <0.5cm into wound bed 4 = 25% to <50% wound covered 5 = <25% wound covered.		Severity score classification: - 13–20: Minimal severity - 21–30: Mild severity - 31–40: Moderate severity - 41–65: Critical severity.		
The higher the score, the greater the wound severity.					

Microorganisms within biofilms or other persistent communities may exhibit increased tolerance to topical and systemic antimicrobials; therefore, wound infection management should not rely on antimicrobial therapy alone. Instead, antimicrobials should be used alongside host optimisation, therapeutic wound cleansing, debridement, exudate management, and registered products and devices with an antimicrobial effect. Debridement is a fundamental component of wound bed preparation in chronic/hard-to-heal wounds. It removes slough, debris, necrotic tissue and other material that may harbour microorganisms, and it reduces inflammatory mediators and host-derived matrix components. In doing so, it lowers microbial burden, disrupts microbial aggregates and biofilm-like structures, and improves the local wound environment (IWII, 2026).

The IWII has formalised therapeutic cleansing across three consensus documents. Its 2022 consensus document, updated in 2026, defined therapeutic wound cleansing and debridement as the rigorous cleansing of chronic or hard-to-heal wounds to disrupt biofilm, prevent its reformation and facilitate removal of necrotic, non-viable or infected tissue, thereby optimising visualisation and enabling reliable assessment (IWII, 2022; 2026). Its 2025 document, *Therapeutic Wound and Skin Cleansing: Clinical Evidence and Recommendations,* introduced a three-zone model (wound bed, wound edge/periwound and surrounding skin), with cleansing required at every dressing change (IWII, 2025). It also sets out evidence-based recommendations on frequency, technique and solution selection. Together, these documents establish therapeutic cleansing as a defined clinical intervention in its own right, to be performed diligently, and at times vigorously, using an appropriately chosen solution.

Prontosan® Wound Irrigation Solution, Prontosan® Wound Gel and Prontosan® Wound Gel X align with this framework. All three contain a combination of polyhexamethylene biguanide (PHMB) and the surfactant betaine, referred to in this document as PHMB-B:

- **Betaine:** a gentle yet effective surfactant that penetrates, disturbs, cleans and removes biofilm and wound debris.
- **Polyhexamethylene biguanide (PHMB):** a highly effective broad-spectrum antiseptic active against Gram-negative bacteria (e.g. *Pseudomonas aeruginosa*) and Gram-positive bacteria (e.g. methicillin-resistant *Staphylococcus aureus* [MRSA] and vancomycin-resistant enterococci; Kaehn, 2010). PHMB has been in use for many years and exhibits good clinical safety, low toxicity and no evidence of bacterial resistance (Rippon et al, 2023). PHMB exhibits low to no absorption by human cells and tissues; therefore, interference with the metabolism of the body is negligible (Kramer and Rudolph, 2002; Scientific Committee on Consumer Safety, 2017). Existing evidence shows that topical PHMB may promote the healing of chronic wounds, reduce bacterial burden and wound-related pain and eliminate MRSA (To et al, 2016; Atkin et al, 2020; Bhatt, 2024).

Excellence Case Sharing Award (ECSA): Highlighting best practice in Pressure Injury Prevention and Management

In response to the growing challenge of PIs, B. Braun launched the Excellence Case Sharing Award in 2025, inviting independent healthcare professionals across the Asia-Pacific region to share their expertise in PI management. The theme for the award, "Prevention and Management of Pressure Injuries Among Adults and Children", sought to highlight innovative, person-centred approaches and cost-effective practices aimed at improving wound outcomes, with a particular emphasis on infection control, wound bed preparation and sustainable care across both inpatient and community settings.

A distinguished panel of independent experts comprising Prof. Emeritus Dato' Dr. Harikrishna K.R. Nair (MY), Prof. Keryln Carville (AU), Dr. Yuwadee Kestsumpun (TH) and Prof. Dr. Zhang Long (CN) reviewed the submitted abstracts and selected the finalists and winners. Their decisions were made independently, without affiliation to B. Braun, ensuring an unbiased evaluation process.

This case series presents 12 cases [**Table 3**] drawn from the abstracts submitted by healthcare professionals across the Asia-Pacific region. Together, the cases show what a structured wound management approach looks like in practice, with Prontosan® used for wound bed preparation and/or prevention of infection, forming one part of a comprehensive plan that also included appropriate dressing selection, debridement, offloading, nutrition and multidisciplinary care. Since patients received several concurrent interventions, the individual contribution of PHMB-B to the outcomes cannot be separated from the other elements of care. The cases should therefore be read as illustrations of practice rather than as evidence of the effect of any single product.

Table 3. Summary of case studies.

Case	Clinician(s)	Country	Case Title	Pages
1	• Lt. Col. Jaraspas Wongviseskarn • Maj. Ananyaran Tiengtham • Capt. Niyada Boonsom • Lt. Natnicha Muangmoon • Jirakan Kamket	Thailand	Stage 4 pressure injury following spinal cord injury	12–13
2	• Rene Armzed Cantuba • Rachill Clavecillas • Arlene Pavo	Philippines	Stage 4 sacral pressure injury in a patient with dementia	14–15
3	• Mohd Shahrul Suondoh • Salmi Mohamed Sukur	Malaysia	Concurrent pressure injuries and an infected burn in a patient with multiple sclerosis	16–17
4	• Juntima Sinmaneerat • Tharnthip Bunprom	Thailand	Stage 4 spinal pressure injury following spinal board immobilisation	18–19
5	• Enoka Wijeratne	Sri Lanka	Stage 4 sacral pressure injury following hip fracture surgery	20–21
6	• Wei Cheng • Youping Wang • Fen Liu	China	Stage 4 sacrococcygeal pressure injury complicated by multidrug-resistant infection	22–23
7	• Muriel Toledo	Philippines	Stage 4 sacral pressure injury following cardiac surgery	24–25
8	• Tao Li • Jing Yu Hu • Haiyang Lin	China	Stage 4 ischial tuberosity pressure injury complicated by pelvic pyogenic infection	26–27
9	• Dr. Nguyen Xuan Thien	Vietnam	Stage 3–4 sacral and buttock pressure injuries following major trauma	28–29
10	• Li Yunfeng • Cai Meng • Wang Qian • Prof. Dr. Zhang Long	China	Stage 4 sacrococcygeal pressure injury following prolonged bed rest	30–31
11	• Hannah Grace P. Lumongsod • Kathrina Victoria Baluyut-Angeles	Philippines	Stage 4 sacral pressure injury following pelvic exenteration	32–33
12	• Rungrat Koetsawat • Paweena Kachanthuek	Thailand	Stage 4 sacral pressure injury in a patient on haemodialysis	34–35

CASE 1: Stage 4 pressure injury following spinal cord injury

Author details: **Lt. Col. Jaraspas Wongviseskarn,** MNS, APN, T-CWOCN, Head of Advanced Wound Care Clinic; **Maj. Ananyaran Tiengtham**, ET Nurse; **Capt. Niyada Boonsom**, ET Nurse; **Lt. Natnicha Muangmoon**, ET Nurse; **Jirakan Kamket**, PN, Advanced Wound Care Clinic, Rehabilitation Department, Phramongkutklao Hospital, Bangkok, Thailand

Patient presentation and history

- **Age/sex:** 80-year-old male
- **Relevant history:** Pathological fracture T10–T12, treated with percutaneous pedicle-screw fixation T10–L2, resulting in spinal cord injury and spastic paraplegia. Neurogenic bladder, osteoporosis and recurrent urinary tract infections. Required substantial assistance with activities of daily living
- **Wound history:** Stage 4 sacral pressure injury present on admission. Wound location at the sacral/gluteal cleft impeded dressing seal and predisposed negative pressure wound therapy (NPWT) to leakage.

Wound presentation

- **Staging and location:** Stage 4 sacral/gluteal cleft pressure injury
- **Wound size:** 18.04cm^2
- **Wound bed:** 50% granulation tissue and 30% slough; heavy brown exudate; intact periwound skin
- **Braden Scale score:** 12/23 (high risk)
- **BWAT score:** 32/65 (moderate severity)
- **Infection status:** Cultures identified carbapenem-resistant *Acinetobacter baumannii* and *Enterococcus faecalis*, with mixed flora (4–5 organisms). Intermittent nitrite positivity and pyuria indicated a high risk of contamination from urinary and bowel sources.

Management plan

Wound cleansing and antimicrobial management: Wound irrigation was performed twice a week with normal saline solution, followed by 10 minutes of soaking with Prontosan® Wound Irrigation Solution as the primary antimicrobial strategy. An enzyme alginogel and foam, charcoal and superabsorbent dressings were chosen according to wound condition and exudate level.

Debridement: Enzymatic and ultrasonic debridement with Prontosan® Wound Irrigation Solution was used to facilitate removal of slough and optimise wound bed preparation.

NPWT: NPWT at –120mmHg was used when clinically feasible. Maintaining an effective dressing seal with an iodophor-impregnated drape was challenging due to the wound's location in the sacral and gluteal cleft, often resulting in leakage and subsequent urinary and faecal contamination of the wound.

Additional interventions: A Foley catheter and structured bowel training, including scheduled enemas, were implemented to minimise contamination and improve NPWT effectiveness. Occupational therapy focused on reducing shear and repeated trauma. Sliding transfers were stopped and replaced with supported sitting and walker-assisted standing.

Clinical outcomes

Within 39 days, wound area reduced from 18.04cm^2 to 7.10cm^2 (reduction of >60%). The wound bed progressed from 50% granulation and 30% slough to predominantly healthy red granulation tissue, approaching complete granulation and epithelialisation by Day 148. Slough and necrotic tissue resolved, exudate normalised and the surrounding skin remained intact. The wound did not progress to invasive infection despite multidrug-resistant colonisation.

Given the relative stability of BWAT scores, changes in wound area appeared to be a more reliable indicator of healing progress.

BWAT score (range: 13–65); higher scores indicate greater wound severity				
Day 0	**Day 7**	**Day 14**	**Day 21**	**Day 28**
32	32	31	34	33

The increase in the BWAT score observed on Day 21 was attributed to NPWT leakage during an episode of diarrhoea, resulting in faecal contamination of the wound and compromised NPWT effectiveness.

The Braden Scale score improved from 12 to 17 in the first month of treatment, reflecting lower pressure injury risk.

Resource utilisation and conclusion

The multidisciplinary approach was associated with favourable early outcomes, with ongoing wound improvement achieved through coordinated inpatient care, advanced wound management and rehabilitation. Resource utilisation was primarily driven by hospitalisation and room and board, reflecting the complexity of care required.

Prontosan® Wound Irrigation Solution formed part of the advanced wound care regimen, supporting wound cleansing and wound bed preparation. Wound care specialists, occupational therapists and physicians provided coordinated care, supported by laboratory monitoring.

Although initial treatment required substantial healthcare

resources, the structured approach supported clinical progress and may have reduced the risk of complications and further healthcare utilisation. This case highlights the potential value of coordinated wound care in improving patient outcomes and promoting efficient use of healthcare resources.



Figure 1A. Day 0. Initial assessment of a Stage 4 sacral pressure injury showing a wound bed containing approximately 50% granulation tissue and 30% slough, with heavy exudate.



Figure 1B. Day 13. Improved wound bed condition with increased granulation tissue, reduced slough and controlled exudate.

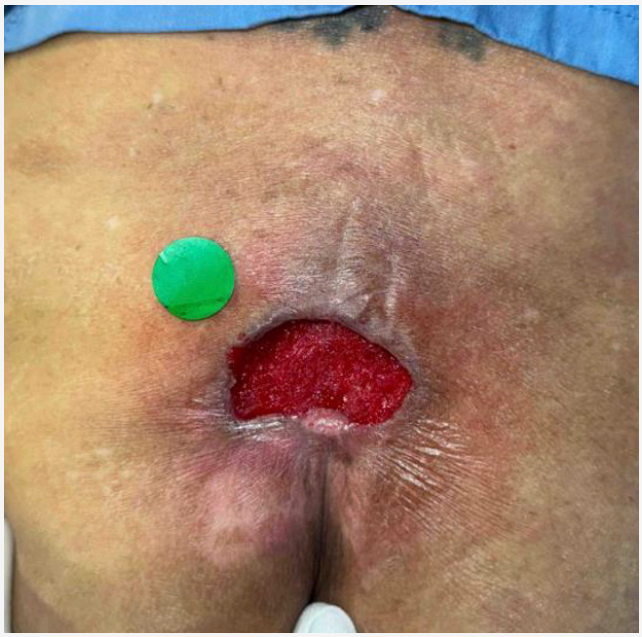


Figure 1C. Day 39. Significant wound progression characterised by near-complete granulation tissue coverage, wound contraction and resolution of non-viable tissue.

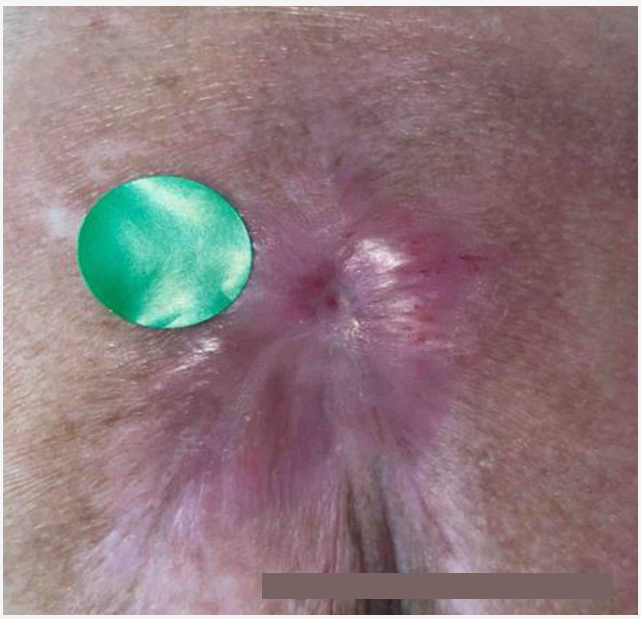


Figure 1D. Day 148. Long-term follow-up demonstrating sustained healing progression with advanced epithelialisation and substantial reduction in wound size.

CASE 2: Stage 4 sacral pressure injury in a patient with dementia

Author details: **Rene Armzed Cantuba**, MSN, RN, IIWCC, Wound Care Manager; **Rachill Clavecillas**, RN, Wound Care Nurse; **Arlene Pavo**, Consultant General Surgeon, Head of Wound Care Center, Dr. Marcelo M. Chan Memorial Hospital, Pangasinan, Philippines

Patient presentation and history

- **Age/sex:** 77-year-old female
- **Relevant history**: Advanced dementia, chronic hypotension, hypocalcaemia secondary to poor oral intake, peripheral arterial occlusive disease
- **Wound history:** Presented to the emergency department with a sacral wound causing significant distress. Due to her advanced dementia, the patient was unable to cooperate with wound care.

Wound presentation

- **Staging and location:** Sacral pressure injury, unstageable at first presentation. Following debridement, it was reclassified as Stage 4, with exposed supraspinous ligaments
- **Wound size:** 18cm × 16cm with 3cm undermining at the 5, 7 and 11 o'clock positions
- **Wound bed:** Non-adherent necrotic tissue, epibole (rolled wound edges) and heavy, malodorous exudate
- **BWAT score:** 37/65 (moderate severity)
- **Infection status:** Clinical wound infection at presentation. Culture confirmed extended-spectrum beta-lactamase (ESBL)-producing *Klebsiella pneumoniae*.

Management plan

Wound cleansing: Due to financial constraints, the wound was initially managed with povidone-iodine-soaked gauze. Prontosan® Wound Irrigation Solution was subsequently introduced as the preferred antibiofilm cleansing agent and used during each wound cleansing episode to soften fibrin and facilitate debridement.

Debridement: Sharp debridement under local anaesthesia.

NPWT: A few days after necrotic tissue removal, the patient's family was involved in the care plan, and treatment was transitioned to a locally manufactured NPWT system set at –125mmHg, using silver foam as the wound contact layer.

Clinical outcomes

Serial BWAT scores demonstrated progressive improvement over 4 weeks:

BWAT score (range: 13–65); higher scores indicate greater wound severity				
Day 0	Day 7	Day 14	Day 21	Day 28
37	33	28	27	27

By Week 3 (Week 2 of NPWT), wound dimensions had reduced to 17cm × 15.2cm and the BWAT score had decreased to 27, with significant granulation tissue formation observed. During treatment, nursing staff noticed marked pallor of the face and limbs, and medical adhesive-related skin injury (MARSI) in the periwound skin. Blood tests confirmed acute anaemia and hypoalbuminaemia, and she was admitted for a blood transfusion. Outpatient wound management resumed once she was stable.

At 16-week follow-up, wound dimensions had reduced further to 15.5cm × 10.5cm, undermining had fully resolved, and the BWAT score remained stable at 27. The infection was treated with antibiotics during the first 4 weeks and had resolved by the end of that period.

Resource utilisation and conclusion

The incorporation of Prontosan® Wound Irrigation Solution as part of the wound management strategy supported effective wound cleansing and preparation of the wound bed, while NPWT facilitated exudate management and progression of healing. Together, these interventions were associated with favourable clinical outcomes and enabled ongoing management using advanced wound therapy.

A locally sourced NPWT device provided on loan substantially reduced treatment costs, with expenditure largely limited to consumable supplies. Combined with outpatient reimbursement support, this approach improved access to NPWT for a patient who may otherwise have been unable to afford conventional therapy. Additionally, active involvement of the patient and family in the care plan, including adherence to wound care recommendations and contamination prevention measures, further supported treatment success. The positive wound healing progress achieved reduced the need for more extensive interventions and supported continuation of care outside the acute setting.

Overall, this case demonstrates how the integration of Prontosan® Wound Irrigation Solution and affordable NPWT technology, supported by multidisciplinary care and family engagement, can optimise resource utilisation, improve accessibility to advanced wound care and support favourable patient outcomes in a cost-conscious manner.



Figure 2A. Day 0. Initial presentation of a complex sacral pressure injury, pre-debridement.



Figure 2B. Day 0. Same wound during debridement, showing extensive necrotic tissue, heavy exudate and significant wound burden.



Figure 2C. Day 7. Early healing response with development of granulation tissue, reduction in non-viable tissue and improved wound bed condition.



Figure 2D. Day 21. Continued wound improvement with increasing granulation tissue coverage and progressive reduction in wound dimensions.



Figure 2E. Day 58. Continued wound improvement with increasing granulation tissue coverage.



Figure 2F. Week 16 follow-up. Substantial wound reduction with resolution of undermining and a healthy granulating wound bed supporting ongoing healing.

CASE 3: Concurrent pressure injuries and an infected burn in a patient with multiple sclerosis

Author details: **Mohd Shahrul Suondoh,** MD, MS (Plastic Surgery), MBA, Plastic, Burn and Reconstructive Surgeon; **Salmi Mohamed Sukur**, MBBS, MS (Plastic Surgery), Plastic, Burn and Reconstructive Surgeon, Department of Plastic and Reconstructive Surgery, Kuala Lumpur Hospital, Kuala Lumpur, Malaysia

Patient presentation and history

- **Age/sex:** 82-year-old female
- **Relevant history**: Multiple sclerosis with progressive paralysis; hypertension
- **Wound history:** Neglected infected contact burn to the right thigh from a scald injury five days earlier. Chronic pressure injuries over the sacrum and right heel had also developed secondary to prolonged immobility.

Wound presentation

Wound 1: Right thigh burn

- **Type, location and extent:** Contact (scald) burn to the right thigh, sustained five days before admission, 2% total body surface area
- **Infection status:** Infected, with surrounding cellulitis. Mixed bacterial growth on culture.

Wound 2: Sacral pressure injury

- **Staging and location:** Stage 3 sacral pressure injury
- **Wound size:** 2cm × 2cm
- **Braden Scale score:** 6/23 (severe risk)
- **BWAT score:** 37/65 (moderate severity)
- **Infection status:** Mixed bacterial growth on culture.

Wound 3: Right heel pressure injury

- **Staging and location:** Stage 2 right heel pressure injury
- **Wound size:** 1cm × 2cm
- **Braden Scale score:** 9/23 (severe risk)
- **BWAT score:** 27/65 (mild severity)
- **Infection status:** Mixed bacterial growth on culture.

Management plan

Wound preparation: All three wounds were managed conservatively. Prontosan® Wound Irrigation Solution was used for cleansing and biofilm management at each dressing change, followed by Prontosan® Wound Gel X. The antimicrobial and surfactant action disrupts biofilm and reduces bacterial burden while maintaining an optimal healing environment. Non-adherent, low-adherent absorbent dressings were applied as the secondary layer. Dressings were changed twice daily during admission, and the regimen was continued by family caregivers after discharge. Zinc oxide barrier cream protected the surrounding skin from maceration.

Antibiotics: A 10-day course of intravenous antibiotics treated the mixed infection.

Additional interventions: Nutritional support corrected hypoalbuminaemia and poor oral intake. Offloading of pressure was used to reduce further friction and shear.

Clinical outcomes

The burn wound healed completely, and both pressure injuries were prevented from deteriorating despite the patient's very high-risk profile. Infection was present in the wound beds at baseline and had resolved by Week 4, with culture status changing from positive to negative.

Serial BWAT scores for the sacral pressure injury remained unchanged:

BWAT score for wound 2 sacral pressure injury (range: 13–65); higher scores indicate greater wound severity				
Day 0	**Day 7**	**Day 14**	**Day 21**	**Day 28**
37	37	37	37	37

By Day 28, the heel pressure injury BWAT score had improved from 27 to 21 (a reduction of 6 points). It continued to improve at outpatient follow-up, reaching 14 by Week 5. Although the sacral score did not fall, there was no progression, enlargement or new complication, which is an encouraging result in such a severely compromised patient. No surgery was required.

BWAT score for wound 3 right heel pressure injury (range: 13–65); higher scores indicate greater wound severity				
Day 0	**Day 7**	**Day 14**	**Day 21**	**Day 28**
27	27	23	23	21

Resource utilisation and conclusion

Prontosan® Wound Irrigation Solution and Prontosan® Wound Gel X supported wound cleansing, biofilm management and wound healing as part of a conservative management approach, which was associated with progressive wound improvement without surgery.

Regular dressing changes, continued by family caregivers after discharge, supported continuity of care at home and reduced reliance on healthcare resources. Conservative management avoided surgery and was associated with minimal complications, limiting additional healthcare utilisation. This case highlights the potential value of incorporating Prontosan® Wound Irrigation Solution and Prontosan® Wound Gel X into local wound care to support healing, encourage caregiver involvement and promote efficient resource utilisation in the management of complex wounds.



Figure 3A. Day 0. Initial wound size assessment, right thigh burn.



Figure 3B. Day 0. Initial wound size assessment, sacral pressure injury.



Figure 3C. Day 0. Initial wound size assessment, right heel pressure injury.



Figure 3D. Day 28. Wound reassessment, right thigh burn.



Figure 3E. Day 28. Sacral pressure injury, with no progression, enlargement or new complication.



Figure 3F. Day 28. Right heel pressure injury, with the BWAT score improved from 27 to 21 (a 6-point reduction).



Figure 3G. Week 5. Outpatient follow-up, right thigh burn.



Figure 3H. Week 5. Sacral pressure injury, remaining stable with no deterioration.



Figure 3I. Week 5. Right heel pressure injury, with the BWAT score further improved to 14. No surgical intervention was required.

CASE 4: Stage 4 spinal pressure injury following spinal board immobilisation

Author details: **Juntima Sinmaneerat,** RN, T-CWOCN; **Tharnthip Bunprom,** RN, ET, Wound Care Center, Vachira Phuket Hospital, Phuket, Thailand

Patient presentation and history

- **Age/sex:** 82-year-old female
- **Relevant history**: Asthma, diabetes mellitus, hypertension, dyslipidaemia, previous cerebrovascular accident with left hemiparesis, tracheostomy with CO_2 retention, scoliosis
- **Wound history:** Pressure injury developed while the patient was immobilised on a spinal board during emergency transport for severe hypoxaemia and reduced consciousness. The board was used for safe immobilisation during transfer; there was no traumatic spinal injury. Surgical debridement was performed before wound management began.

Wound presentation

- **Staging and location:** Stage 4 pressure injury over the spine, assessed after debridement
- **Wound size:** 16.7cm × 7.9cm × 1.0cm
- **Wound bed:** 23% red granulation tissue, 54% slough, 23% necrotic tissue; large-volume, thick, malodorous exudate; wound edges not attached; erythematous periwound skin
- **Pain:** 8/10 (higher scores indicate greater pain)
- **Braden Scale score:** 12/23 (high risk)
- **BWAT score:** 38/65 (moderate severity)
- **Infection status:** Wound swabs identified carbapenem-resistant *Acinetobacter baumannii* complex and *Klebsiella pneumoniae* complex.

Management plan

Wound cleansing: Dressings were changed twice daily. Each change began with normal saline to remove debris, followed by thorough irrigation with Prontosan® Wound Irrigation Solution. Gauze soaked with Prontosan® Wound Irrigation Solution was then applied to the wound bed for 15 minutes to reduce bacterial burden and disrupt biofilm.

NPWT: After cleansing, NPWT was applied at –125mmHg in continuous mode, with black polyurethane ether foam as the wound filler to promote granulation tissue, manage heavy exudate and provide a closed wound environment to minimise bacterial contamination.

Pain management: Analgesics were administered before each dressing change, and pain was monitored regularly.

Additional interventions: A 2-hourly repositioning schedule was implemented, with documentation by caregivers.

Alternating-pressure support surfaces and pressure-relieving devices were used to minimise pressure, shear and friction. Skin was assessed daily to catch new pressure damage early. Nutritional management included a high-protein diet supplemented with vitamin C and zinc under dietetic supervision. Family members were actively involved in wound care education and provided emotional support throughout the treatment period.

Clinical outcomes

Progressive wound healing was documented over 4 weeks. Serial BWAT scores demonstrated improvement:

BWAT score (range: 13–65); higher scores indicate greater wound severity				
Day 0	Day 7	Day 14	Day 21	Day 28
38	35	35	35	31

By Day 28, the BWAT score had decreased from 38 to 31 (reduction of 7 points). Wound volume decreased to 30.5cm^3, while granulation tissue increased from 23% to more than 75% of the wound bed. Pain levels decreased from 8/10 to 3/10, and wound odour and exudate were well controlled. Despite the multidrug-resistant organisms, no systemic infection developed. The patient's emotional wellbeing and cooperation with treatment improved with family involvement and better nutrition.

Resource utilisation and conclusion

NPWT accounted for approximately 94% of treatment-related costs over the 4-week period, reflecting the investment required for advanced wound therapy. Despite this, the introduction of NPWT reduced dressing frequency from twice daily to twice weekly, leading to lower wound care consumable use, decreased nursing time and reduced caregiver burden.

The combined use of Prontosan® Wound Irrigation Solution and NPWT supported effective infection control, biofilm management and exudate reduction, contributing to improved patient comfort and wound healing progression. Fewer dressing changes also simplified ongoing care and enhanced treatment efficiency.

Overall, this treatment approach optimised healthcare resource utilisation by reducing the burden on healthcare providers and caregivers while supporting favourable wound

healing outcomes. The avoidance of additional wound-related complications and interventions further highlights the value of combining advanced wound cleansing and NPWT as an effective and resource-conscious strategy for managing complex wounds in high-risk older patients.



Figure 4A. Day 0. Initial presentation of a Stage 4 spinal pressure injury with a mixed wound bed comprising necrotic tissue, slough and thick malodorous exudate.



Figure 4B. Day 4. Early wound improvement following cleansing with Prontosan® Wound Irrigation Solution and NPWT.



Figure 4C. Day 11. Progressive granulation tissue formation with reduction in devitalised tissue, improved wound bed quality and better exudate control.



Figure 4D. Day 32. End-of-treatment assessment showing substantial granulation tissue coverage, reduced wound volume and marked improvement in wound bed condition.

CASE 5: Stage 4 sacral pressure injury following hip fracture surgery

Author details: **Enoka Wijeratne**, Registered Enterostomal Therapy Nurse, Wound Care Nurse Practitioner, Care and Cure Wound Management Center, Sri Lanka

Patient presentation and history

- **Age/sex:** 66-year-old female
- **Relevant history**: Type 2 diabetes mellitus
- **Wound history:** Sacral pressure injury developed following five days of immobility after surgical repair of a neck-of-femur (hip) fracture. The wound deteriorated while the patient was living in a care home, before referral for specialist wound management. Povidone-iodine was applied every other day in the care home.

Wound presentation

- **Staging and location:** Sacral pressure injury, initially classified as unstageable and reclassified as Stage 4 following debridement
- **Wound size:** 7.0cm × 6.0cm × 1.8cm
- **Wound bed:** Black and yellow necrotic tissue with slough and malodour
- **Pain:** 5/5 (higher scores indicate greater pain)
- **Braden Scale score:** 12/23 (high risk)
- **BWAT score:** 45/65 (critical severity)
- **Infection status:** Wound swab positive for MRSA.

Management plan

Wound cleansing and debridement: The wound was cleansed with Prontosan® Wound Irrigation Solution before each dressing application. Necrotic eschar was debrided on Day 1, and a skin barrier cream was applied to the surrounding skin after each cleansing.

Dressings: An antimicrobial foam dressing was applied initially and later transitioned to a hydrogel dressing as the wound bed improved, with gauze as the secondary dressing. Dressings were changed every other day during the first week and subsequently every third day for the remainder of the four-week treatment period.

Additional interventions: Repositioning techniques were introduced alongside the use of an air mattress. Physiotherapy was initiated twice weekly to address fear of mobilisation and improve functional status. The patient and caregivers received education regarding pressure-relief positioning, appropriate nutritional intake and blood glucose monitoring.

Clinical outcomes

Progressive wound healing was documented over 4 weeks. Serial BWAT scores demonstrated improvement:

BWAT score (range: 13–65); higher scores indicate greater wound severity				
Day 0	**Day 7**	**Day 14**	**Day 21**	**Day 28**
45	38	32	27	18

By Day 28, the BWAT score had decreased from 45 to 18 (reduction of 27 points). The Braden Scale score improved from 12 (high risk) to 17 (low risk). Wound margins had contracted, healthy granulation tissue covered the wound bed and exudate had decreased substantially.

Despite documented MRSA colonisation at initial presentation, no clinical evidence of infection developed during the observation period, and antibiotic therapy was not required.

Resource utilisation and conclusion

Over the 28-day treatment period, effective wound management was achieved with relatively modest wound-specific product costs, including the use of only two bottles of Prontosan® Wound Irrigation Solution. The treatment approach supported ongoing wound cleansing and biofilm management while avoiding the need for systemic antibiotics, thereby eliminating associated medication costs and reducing the risks linked to systemic antimicrobial therapy.

As the wound improved clinically, dressing frequency was successfully reduced from every other day to every third day, resulting in lower dressing material consumption, reduced nursing time, and more efficient use of care-home resources. Importantly, these efficiencies were achieved while maintaining positive healing outcomes, demonstrating sustained patient progress throughout treatment.

The absence of hospitalisation, intravenous antibiotics and specialist consultation requirements further reflects the effectiveness of the management strategy in controlling the wound within the community setting. Overall, the incorporation of Prontosan® Wound Irrigation Solution as part of the wound care regimen supported favourable patient outcomes, streamlined resource utilisation, and reduced treatment burden, highlighting the value of a proactive, community-based approach to wound management.



Figure 5A. Day 0. Initial presentation of an unstageable sacral pressure injury with extensive black necrotic tissue, slough and malodour.



Figure 5B. Day 6. Early response to treatment with reduced tissue burden, emerging granulation tissue and improved wound bed appearance.



Figure 5C. Day 9. Continued wound bed improvement characterised by reduced tissue burden and increasing granulation tissue.



Figure 5D. Day 18. Continued wound bed improvement characterised by progressive granulation tissue formation, reduction in slough and decreasing exudate levels.



Figure 5E. Day 24. Continued wound bed improvement characterised by granulation tissue formation and reduced tissue burden.



Figure 5F. Day 27. Marked healing progression with a healthy granulating wound bed, contracting wound margins and reduced exudate.

CASE 6: Stage 4 sacrococcygeal pressure injury complicated by multidrug-resistant infection

Author details: **Wei Cheng**, RN, Senior Nurse, Enterostomal Therapist; **Youping Wang**, MBBS, Attending Physician; **Fen Liu**, RN, Associate Chief Nurse, Wound and Ostomy Care Nurse, Anqing Bingfeng Hospital, Daguan District, Anqing City, Anhui Province, China

Patient presentation and history

- **Age/sex:** 85-year-old female
- **Relevant history**: Cerebral infarction, hypertension, right femoral neck fracture, Alzheimer's disease, malnutrition.

Wound presentation

- **Staging and location:** Stage 4 sacrococcygeal pressure injury
- **Wound size:** 6.5cm × 5.0cm
- **Wound bed:** Exposed fascia with necrotic tissue
- **Pain:** 3/10 (higher scores indicate greater pain)
- **Braden Scale score:** 11/23 (high risk)
- **BWAT score:** 39/65 (moderate severity)
- **Infection status:** Wound culture identified multidrug-resistant *Enterococcus faecium*.

Management plan

Wound cleansing and debridement: Necrotic tissue was removed by conservative sharp debridement on the day of admission. Debridement was then performed three times during the first week as necrotic tissue was identified. Thereafter, the wound was reassessed regularly to guide either conservative sharp or autolytic debridement. Prontosan® Wound Irrigation Solution and sterile saline were used for routine wound cleansing. Wound exudate was collected for microbiological culture to guide antimicrobial management, and aseptic technique was maintained at every dressing change.

Dressings: Alginate dressings were applied during high-exudate phases, hydrocolloid dressings during drier phases, as well as an antimicrobial dressing. Dressing changes were initially daily and were reduced to 3–4 times per week from Day 4 onward.

Antibiotics: Intravenous antibiotics were given for 13 days to treat the infection.

NPWT: NPWT was applied at -125mmHg in continuous mode, using a black polyurethane open-cell foam dressing designed for NPWT. NPWT was applied on Day 6 and again on Day 17.

Additional interventions: Analgesia was given as prescribed, with pain levels monitored throughout treatment; pain had reduced to 0/10 by the end of treatment. Repositioning every two hours was supported by pressure-relieving devices, including air mattresses, positioning pillows and foam cushions. Nutritional support, comprising a high-protein diet and supplementation, addressed malnutrition and supported tissue repair. Family members were educated in positioning techniques and pressure injury prevention.

Clinical outcomes

Progressive wound healing was documented over 4 weeks. Serial BWAT scores demonstrated improvement:

BWAT score (range: 13–65); higher scores indicate greater wound severity				
Day 0	**Day 7**	**Day 14**	**Day 21**	**Day 28**
39	33	22	18	13

By Day 28, the BWAT score had improved from 39 to 13 (a reduction of 26 points). Wound dimensions had reduced from 6.5cm × 5.0cm to 4.5cm × 2.0cm. The previously exposed fascia was fully covered by healthy granulation tissue, and necrotic tissue was no longer present. Infection was present at the start of wound management and had resolved by the end of the four-week period. At follow-up assessment on Day 69, wound closure progression with mature tissue formation and sustained healing outcomes was demonstrated.

Resource utilisation and conclusion

The treatment approach was associated with favourable wound healing outcomes while utilising healthcare resources in a structured and targeted manner. Although hospitalisation accounted for the largest proportion of treatment costs during the one-month period, the comprehensive management strategy supported effective infection control, wound progression and ongoing clinical improvement.

Prontosan® Wound Irrigation Solution formed part of the wound care regimen, supporting wound cleansing and wound bed management alongside appropriate dressings, intravenous antibiotic therapy and nursing care. This coordinated approach facilitated a favourable healing trajectory and may have contributed to reducing the risk of wound-related complications.

While advanced wound management can be associated with higher initial resource requirements, achieving timely wound improvement has the potential to reduce ongoing treatment needs, decrease nursing burden and minimise future healthcare utilisation. This case highlights how investment in effective wound management strategies can support positive patient outcomes while promoting efficient use of healthcare resources.



Figure 6A. Day 0. Initial presentation of a Stage 4 sacrococcygeal pressure injury with exposed fascia, necrotic tissue and evidence of multidrug-resistant wound infection.



Figure 6B. Day 14. Reduction in wound size following debridement, infection control measures and NPWT. Increasing granulation tissue formation was observed.



Figure 6C. Day 28. Advanced healing stage characterised by near-complete granulation tissue coverage, absence of necrotic tissue and continued wound contraction.



Figure 6D. Day 69. Follow-up assessment demonstrating wound closure progression with mature tissue formation and sustained healing outcomes.

CASE 7: Stage 4 sacral pressure injury following cardiac surgery

Author details: **Muriel Toledo,** Medical Officer III, Plastic, Reconstructive and Aesthetic Surgery Fellow-in-Training, Philippines

Patient presentation and history

- **Age/sex:** 63-year-old male
- **Relevant history**: Aortic valve and ascending aortic replacement, followed by mediastinal exploration for a pericardial haematoma
- **Wound history:** Sacral pressure injury developed during a prolonged cardiac ICU admission after open-heart surgery.

Wound presentation

- **Staging and location:** Sacral pressure injury, initially Stage 2; progressed to Stage 4 by the time of referral
- **Wound size:** 18cm × 15cm
- **Wound bed:** Thick, firmly adherent eschar, malodour, extensive necrotic tissue and exposed coccygeal bone. The surrounding skin was red-grey and persistently contaminated with faeces
- **BWAT score:** 58/65 (critical severity)
- **Infection status:** Tissue cultures positive for multidrug-resistant *Escherichia coli* and multidrug-resistant *Klebsiella pneumoniae*.

Management plan

The treatment was staged and depended on the patient's cardiac condition.

Wound cleansing and debridement: Anticoagulation therapy precluded early surgical debridement, so Prontosan® Wound Gel X was used for autolytic debridement for the first week (Days 1–7), with cleansing using Prontosan® Wound Irrigation Solution. Two staged surgical debridements followed on Days 8 and 14, once anticoagulation had been managed. Daily cleansing with Prontosan® Wound Irrigation Solution continued throughout treatment.

Faecal management and NPWT: NPWT was attempted early but repeatedly failed due to faecal contamination. A diverting colostomy on Day 22 reduced faecal contamination, and NPWT was then initiated the same day and reapplied on Day 27.

Surgical reconstruction: Definitive closure was achieved on Day 30 with a gluteal V-Y myocutaneous advancement flap, performed in a lateral decubitus position to protect the patient's unstable cardiac status.

Antimicrobial therapy: Targeted intravenous antibiotics, meropenem for 14 days and amikacin for 7 days, were given based on culture results.

Additional interventions: Nutritional optimisation, pressure offloading and regular microbiological monitoring continued throughout.

Clinical outcomes

Progressive wound healing was documented over four weeks. Serial BWAT scores demonstrated improvement:

BWAT score (range: 13–65); higher scores indicate greater wound severity				
Day 0	**Day 7**	**Day 14**	**Day 21**	**Day 28**
58	54	39	32	28

By Day 28, the BWAT score had decreased from 58 to 28 (a reduction of 30 points). Necrotic tissue decreased progressively as healthy granulation tissue developed and, following faecal diversion, NPWT could be applied successfully. The infection resolved and both resistant organisms were cleared from the wound bed. The flap survived with no infection, haematoma, dehiscence or failure. At discharge on Day 45 the wound was fully covered by an intact, viable flap.

Resource utilisation and conclusion

Despite the patient's complex clinical presentation and the need for multiple interventions, the staged treatment approach was associated with successful wound closure within the one-month treatment period. Prontosan® Wound Irrigation Solution and Prontosan® Wound Gel X were incorporated into the local wound management approach to support wound cleansing, moisture balance and autolytic debridement during a period when immediate extensive surgical intervention was not feasible. Their use may have contributed to wound bed preparation and supported progression to subsequent treatment phases.

Importantly, all treatment costs were covered through national healthcare support programmes, allowing the patient to access advanced wound care without financial burden. Overall, this case demonstrates how coordinated local wound care and surgical interventions can support positive outcomes and efficient resource utilisation in the management of complex wounds.



Figure 7A. Day 0. Referral photo showing the sacral pressure injury prior to treatment.



Figure 7B. Day 7. Wound bed after one week of autolytic debridement with Prontosan® Wound Gel X.



Figure 7C. Day 30. Wound bed immediately before flap reconstruction, following NPWT and pre-operative marking.



Figure 7D. Day 45. Post-operative monitoring. Flap viable and intact through to discharge.

CASE 8: Stage 4 ischial tuberosity pressure injury complicated by pelvic pyogenic infection

Author details: **Tao Li,** Associate Chief Physician; **Jing Yu Hu,** Attending Physician; **Haiyang Lin**, Attending Physician, Department of Plastic and Reconstructive Surgery, Peking University Shougang Hospital, Beijing, China

Patient presentation and history

- **Age/sex:** 51-year-old male
- **Relevant history:** Paraplegia secondary to lumbar spine injury (7 years); type 2 diabetes (>10 years) with poor glycaemic control
- **Wound history:** A small pressure injury present for over a year, enlarged from approximately 1cm × 1cm to 10cm × 4cm with self-administered dressings and with no specialist input.

Wound presentation

- **Staging and location:** Stage 4 pressure injury, right ischial tuberosity
- **Wound size:** Approximately 10cm × 4cm; deep ulcer with a sinus tract extending to the ischial tuberosity bone
- **Wound bed:** Extensive necrotic fascia with grey-yellow purulent exudate and marked malodour. Marked swelling and inflammation and heavy perianal contamination around the surrounding skin
- **BWAT score:** 17/65 (minimal severity)
- **Infection status:** Severe local infection extending into the pelvic cavity (pelvic pyogenic infection).

Management plan

Wound cleansing and debridement: Repeated surgical debridement with an ultrasonic water-knife system cleared necrotic tissue from both the pressure injury and the infected pelvic cavity. Prontosan® Wound Irrigation Solution and Prontosan® Wound Gel were used throughout for cleansing, biofilm management and wound bed preparation.

Infection control: Pelvic cavity drainage, NPWT and antibiotic-loaded bone cement were combined to control infection.

Antibiotics: Intravenous antibiotics were given for 23 days, followed by oral antibiotics for 27 days.

Faecal diversion: Given the wound's proximity to the anus, a sigmoid colostomy was performed to stop ongoing contamination and support healing.

Surgical reconstruction: Once infection was controlled and the wound bed was ready, reconstruction was carried out on Day 35 using a gluteus maximus muscle flap combined with an inferior gluteal artery perforator flap.

Post-operative care: The patient was nursed on a suspension bed to protect the flap and support healing.

Clinical outcomes

By Day 28, the BWAT score had improved from 17 to 13 (a reduction of 4 points).

BWAT score (range: 13–65); higher scores indicate greater wound severity				
Day 0	**Day 7**	**Day 14**	**Day 21**	**Day 28**
17	15	13	13	13

Infection was present at the start of treatment and had fully resolved by the end. The pelvic infection cleared, purulent drainage stopped, and the wound bed became healthy enough to support reconstruction. The flap survived and the wound closed completely, with a healthy post-operative recovery. Complete healing was confirmed at follow-up on Day 96.

Resource utilisation and conclusion

Although resource utilisation was greatest during the initial infection-control and reconstruction phases, costs decreased as the pelvic infection resolved and wound healing progressed. Prontosan® Wound Irrigation Solution and Prontosan® Wound Gel formed part of the wound management strategy, supporting wound cleansing and wound bed preparation during a critical stage of care. Their use may have contributed to achieving local wound care objectives and supporting progression to definitive surgical reconstruction.

While flap reconstruction accounted for a substantial proportion of treatment expenditure, successful wound healing helped avoid further wound-related procedures and additional healthcare utilisation. This case highlights how a comprehensive treatment approach incorporating effective wound bed management, infection control and timely surgical intervention can support favourable patient outcomes and make efficient use of healthcare resources when managing complex wounds.

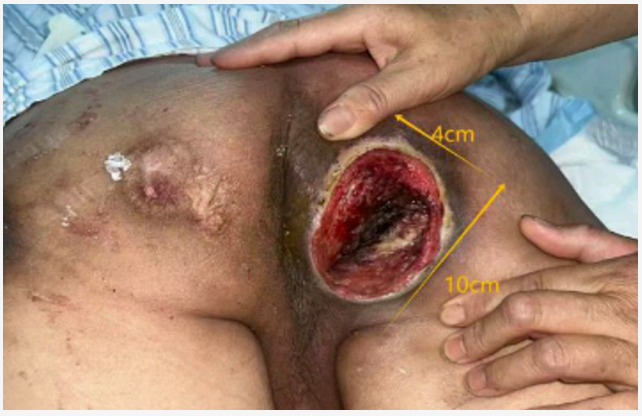


Figure 8A. Day 0. Initial presentation of a Stage 4 right ischial tuberosity pressure injury with extensive necrotic fascia, purulent exudate and periwound inflammation.



Figure 8B. Day 5. Wound bed after cleansing and irrigation with Prontosan® Wound Irrigation Solution.



Figure 8C. Day 21. Wound before irrigation.



Figure 8D. Day 21. Wound after irrigation with Prontosan® Wound Irrigation Solution and NPWT.



Figure 8E. Day 35. Reconstruction with a gluteus maximus muscle flap combined with an inferior gluteal artery perforator flap.



Figure 8F. Day 49. Surgical wound healing well, with the flap intact.



Figure 8G. Day 96. Follow-up showing complete healing.

CASE 9: Stage 3–4 sacral and buttock pressure injuries following major trauma

Author details: **Dr. Nguyen Xuan Thien,** Department of Burns, Plastic and Aesthetic Surgery, Trung Vuong Hospital, Ho Chi Minh City, Vietnam

Patient presentation and history

- **Age/sex:** Female, age not reported
- **Relevant history**: Major trauma with traumatic brain injury, cerebral contusion and right femoral fracture
- **Wound history:** Severe pressure injuries developed during prolonged immobility from her neurological impairment and orthopaedic injury. Both appeared at the same time, one month after surgery, and were attributed to prolonged positioning in bed.

Wound presentation

- **Staging, location and wound size:** Two Stage 3–4 pressure injuries; ulcer 1, sacral: 12cm × 7cm; ulcer 2, right buttock: 8cm × 4cm
- **Wound bed:** Extensive necrotic tissue and slough, purulent exudate, and exposed spinal ligaments
- **Braden Scale score:** 13/23 (moderate risk)
- **BWAT score:** 40/65 (moderate severity)
- **Infection status:** Clinical infection at baseline, with raised white cell count.

Management plan

Wound cleansing and debridement: The wounds were cleansed with Prontosan® Wound Irrigation Solution, which was left in contact for 5 minutes before thorough cleansing to help disrupt the biofilm. Prontosan® Wound Gel X supported autolytic debridement. Necrotic tissue was softened and removed.

NPWT: From Day 11 to Day 24, NPWT was applied twice to further prepare the wound bed. Prontosan® Wound Irrigation Solution was also used for post-operative wound cleansing.

Surgical reconstruction: Definitive closure was achieved using a superior gluteal artery perforator flap, providing durable soft tissue coverage.

Clinical outcomes

Progressive wound healing was documented over four weeks. Serial BWAT scores demonstrated improvement:

BWAT score (range: 13–65); higher scores indicate greater wound severity				
Day 0	**Day 7**	**Day 14**	**Day 21**	**Day 28**
40	35	25	20	13

By Day 28, the BWAT score had decreased from 40 to 13 (a reduction of 27 points). Necrotic tissue and slough were removed progressively through bedside debridement supported by Prontosan® Wound Irrigation Solution and Prontosan® Wound Gel X, and no deterioration or spreading infection was observed.

Following wound bed preparation, NPWT was applied twice over 14 days, and healthy granulation tissue developed with the wound bed remaining clean. The infection resolved by the end of the four-week period. The wound was fully covered after superior gluteal artery perforator flap surgery, and at 10-day post-operative follow-up it was stable with no recurrence or infection.

Resource utilisation and conclusion

The use of Prontosan® Wound Irrigation Solution and Prontosan® Wound Gel X accounted for a small proportion of overall treatment costs while supporting local wound cleansing, wound bed preparation and infection management as part of a comprehensive treatment strategy. Combined with NPWT, targeted antimicrobial therapy and surgical reconstruction, this approach was associated with effective infection control and successful wound closure.

Although NPWT and flap reconstruction required additional resources, these interventions supported progression towards definitive healing and may have reduced the need for prolonged wound care and repeated dressing changes. The favourable clinical outcome achieved within one month highlights the potential value of early, structured wound management in optimising resource utilisation, reducing treatment burden and supporting timely recovery in patients with complex wounds.



Figure 9A. Day 0. Initial presentation. Two Stage 3–4 sacral and buttock pressure injuries with necrotic tissue, slough, purulent exudate and exposed spinal ligaments.



Figure 9B. Day 10. Reduced slough and necrotic burden, with a cleaner wound bed ready for NPWT.



Figure 9C. Day 23. Wound bed conditioning with NPWT (started Day 11) and cleansing using Prontosan® Wound Irrigation Solution at each dressing change. Improved granulation and wound bed quality ahead of surgical closure.



Figure 9D. Day 35. Follow-up showing continued improvement after staged wound bed preparation, surgical debridement and superior gluteal artery perforator flap reconstruction, with stable soft tissue coverage and no signs of infection.

CASE 10: Stage 4 sacrococcygeal pressure injury following prolonged bed rest

Author details: **Li Yunfeng,** MD**; Cai Meng,** MSc**; Wang Qian,** MSc**; Prof. Dr. Zhang Long,** MD, Department of Wound Healing Center, Peking University Third Hospital, Beijing, China

Patient presentation and history

- **Age/sex:** 61-year-old male
- **Relevant history**: Schizophrenia, medically controlled for 18 years
- **Wound history:** Sacrococcygeal pressure injury developed during prolonged bed rest for pneumonia and a flare-up of psychiatric symptoms.

Wound presentation

- **Staging and location:** Stage 4 sacrococcygeal pressure injury
- **Wound size:** 8.5cm × 5.0cm × 1.5cm
- **Wound bed:** >75% slough, <25% granulation tissue, with exposed fascia and heavy purulent exudate; undermining of the wound edges from the 1 o'clock to 3 o'clock position, with a 1cm tunnel. The surrounding skin was red, hyperpigmented and warm
- **BWAT score:** 24/65 (mild severity).

Management plan

Wound cleansing and debridement: Daily cleansing with Prontosan® Wound Irrigation Solution continued throughout the treatment period, supporting moisture balance management alongside debridement. In the first two weeks, surgical debridement removed non-viable tissue as the first priority for infection control. From weeks 2–10, weekly sharp and enzymatic (collagenase) debridement cleared what remained.

Wound dressings: Hydrocolloid dressings were used from Week 2 to Week 10 as non-viable tissue was cleared. As granulation took hold from Week 10, dressings were selected to maintain moisture balance and support wound edge advancement. In the final phase, silicone foam dressings carried the wound through to closure.

Pressure redistribution: Pressure redistribution was prioritised as granulation progressed, supported throughout by a low-air-loss mattress.

Additional interventions: Family counselling secured caregiver support, and protein supplementation (1.8g/kg/day) supported healing throughout the treatment period.

Antibiotics: A 7-day course of oral antibiotics.

Clinical outcomes

Progressive wound healing was documented over 16 weeks. Serial BWAT scores demonstrated improvement:

BWAT score (range: 13–65); higher scores indicate greater wound severity				
Day 0	**Day 7**	**Day 14**	**Day 21**	**Day 28**
24	23	22	20	17

By Day 28, the BWAT score had decreased from 24 to 17 (a reduction of 7 points). CRP fell from 82mg/L to 18mg/L by Week 2, confirming infection control. Slough had cleared and granulation was covering the wound bed by Day 69. Complete epithelialisation was achieved by Week 16 (Day 112), with no recurrence at 6-month follow-up.

Resource utilisation and conclusion

The incorporation of Prontosan® Wound Irrigation Solution into the wound care regimen supported ongoing wound cleansing and local wound management throughout the treatment period. Used alongside regular dressing changes, nursing care and antimicrobial therapy, the overall approach was associated with continued wound improvement and allowed care to remain within the outpatient setting.

Although dressing-related activities accounted for a substantial proportion of resource utilisation, the structured treatment plan enabled consistent wound monitoring and management without the need to escalate to more resource-intensive interventions. The favourable clinical progress observed suggests that effective local wound management, including the use of Prontosan® Wound Irrigation Solution, may support wound healing while promoting efficient use of healthcare resources and continuity of care.



Figure 10A. Day 0. Initial wound sizing.



Figure 10B. Day 2. Wound bed after cleansing with Prontosan® Wound Irrigation Solution.



Figure 10C. Day 69. Wound progression, with slough cleared and granulation tissue covering the wound bed.



Figure 10D. Day 112. Wound progression during the granulation promotion phase.

CASE 11: Stage 4 sacral pressure injury following pelvic exenteration

Author details: **Hannah Grace P. Lumongsod,** RN, MD; **Kathrina Victoria Baluyut-Angeles,** FPAPRAS, FPCS, Southern Philippines Medical Center, Davao, Philippines

Patient presentation and history

- **Age/sex:** 55-year-old male
- **Relevant history**: Malignant sigmoid mass, following total pelvic exenteration with ileal conduit and sigmoid loop colostomy, persistent bilateral leg weakness (bedbound), overweight
- **Wound history:** Developed a sacral pressure injury approximately seven months post-pelvic exenteration secondary to prolonged immobility from persistent bilateral leg weakness
- **Previous treatment**: Prior to referral to Plastic and Reconstructive Surgery, General Surgery performed two debridements, resulting in a large soft tissue defect with exposed sacral bone.

Wound presentation

- **Staging and location:** Stage 4 sacral pressure injury
- **Wound size:** 12cm × 8cm
- **Wound bed:** Granulating wound with fibrinopurulent tissue, rolled wound edges, exposed gluteus maximus muscle and exposed sacral bone
- **Braden Scale score:** 14/23 (moderate risk)
- **BWAT score:** 41/65 (critical severity)
- **Infection status:** Initially light growth of *Escherichia coli*; no growth on repeat cultures after debridement.

Management plan

Wound cleansing: Prontosan® Wound Irrigation Solution was used for cleansing and biofilm management at each dressing change, twice daily. Zinc oxide barrier cream protected the surrounding skin from maceration.

Antibiotics: Fourteen days of intravenous antibiotics were given to address the residual infection risk.

Additional interventions: Offloading of bony prominences with a pneumatic mattress and neck pillow, frequent repositioning, moisture control, skin barrier application with zinc oxide, nutritional support to achieve ideal body weight and rehabilitation medicine referral supported recovery.

Surgical reconstruction: The flap operation combined surgical debridement, peripheral ostectomy and a right gluteal V-Y advancement myocutaneous flap. This approach was selected to provide durable tissue coverage, adequate padding over the sacrum and dead-space obliteration, while helping to reduce the risk of recurrence in this high-risk area.

Clinical outcomes

Progressive wound healing was documented over the four-week preparation period. Serial BWAT scores demonstrated improvement:

BWAT score (range: 13–65); higher scores indicate greater wound severity				
Day 0	**Day 7**	**Day 14**	**Day 21**	**Day 28**
41	39	34	32	29

By Day 28, the BWAT score had improved from 41 to 29 (a reduction of 12 points). Infection was present in the wound bed at the start of wound management and was no longer present by the end of the 4-week wound management period.

Following optimisation of both the wound bed and the patient's overall medical condition, the patient underwent gluteal V-Y advancement myocutaneous flap reconstruction on Day 68, with the flap healing well by Day 75.

Resource utilisation and conclusion

During the one-month pre-operative optimisation period, Prontosan® Wound Irrigation Solution was used at each dressing change to support wound cleansing, biofilm management and wound bed preparation. As part of a comprehensive treatment strategy, its use may have helped maintain a favourable wound environment and support progression towards surgical reconstruction.

Regular wound care, targeted intravenous antibiotic therapy and inpatient monitoring were associated with clinical improvement and readiness for surgery, allowing the planned reconstructive intervention to proceed. Although hospitalisation and antimicrobial therapy accounted for a substantial proportion of resource utilisation, this investment in pre-operative optimisation may have helped reduce factors that could compromise reconstructive success or delay definitive wound closure.

This case highlights the potential value of incorporating Prontosan® Wound Irrigation Solution into a structured wound management pathway to support wound bed optimisation and surgical readiness, while contributing to favourable patient outcomes and efficient use of healthcare resources.



Figure 11A. Day 0. Initial wound sizing assessment.



Figure 11B. Day 29. Wound bed after cleansing with Prontosan® Wound Irrigation Solution.



Figure 11C. Day 68. Intraoperative view following gluteal V-Y advancement myocutaneous flap elevation and inset.



Figure 11D. Day 75. Post-operative wound appearance, showing the flap healing well.

CASE 12: Stage 4 sacral pressure injury in a patient on haemodialysis

Author details: **Rungrat Koetsawat**, Head Nurse, Treatment Unit, ET Nurse; **Paweena Kachanthuek**, RN, Observation Ward, ET Nurse, Ramathibodi Hospital, Mahidol University, Bangkok, Thailand

Patient presentation and history

- **Age/sex:** 76-year-old male
- **Relevant history**: Diabetes mellitus, end-stage renal disease on haemodialysis, cirrhosis, spinal cord stenosis
- **Wound history:** Sacral pressure injury present for 2 months. Spinal cord stenosis had caused neurological decline, with urinary and faecal incontinence. He was admitted after acute deterioration with fever, respiratory symptoms and purulent wound discharge.

Wound presentation

- **Staging and location:** Stage 4 sacral pressure injury
- **Wound size:** 15cm × 14cm × 5cm, with 4cm of undermining extending upwards as a tract to a smaller secondary wound
- **Wound bed:** 70% yellow slough and 30% unhealthy granulation tissue; heavy, purulent, malodorous exudate
- **Pain:** 5/10 during dressing changes (higher scores indicate greater pain)
- **Braden Scale score:** 12/23 (high risk)
- **BWAT score:** 55/65 (critical severity)
- **Infection status:** Clinical signs of wound infection at admission. Cultures identified *Escherichia coli*, *Klebsiella pneumoniae* and *Candida* species.

Management plan

Wound cleansing and debridement: The wound and surrounding skin were cleansed with normal saline, then necrotic tissue was removed by sharp debridement. Prontosan® Wound Irrigation Solution was used to irrigate the wound at every dressing change (twice weekly) to disrupt biofilm and reduce bacterial load. After cleansing, gauze soaked with Prontosan® Wound Irrigation Solution was packed into the wound bed.

NPWT: In hospital, the NPWT dressing was changed twice weekly. A modified vacuum dressing was made from a nasogastric tube and connected to the hospital's central suction system at a continuous negative pressure of -100mmHg, to manage exudate and help control infection. Prior to discharge, wall suction therapy was discontinued so the patient could move to wet-dressing care at home.

Antibiotics: Short course of oral antibiotics and intravenous antibiotics during the acute phase.

Discharge and home-care transition: The patient was hospitalised for 57 days and discharged when clinically stable. Caregiver education supported continuity of care beyond the acute setting, promoting ongoing wound healing in the community.

Clinical outcomes

Progressive wound healing was documented over 4 weeks. Serial BWAT scores demonstrated improvement:

BWAT score (range: 13–65); higher scores indicate greater wound severity				
Day 0	Day 7	Day 14	Day 21	Day 28
55	48	45	42	39

By Day 28, the BWAT score had decreased from 55 to 39 (reduction of 16 points). The wound contracted in size from 15cm × 14cm × 5cm at baseline to 13cm × 13cm × 4.2cm, with undermining decreasing from 4cm to approximately 2cm. Clinical signs of infection resolved, slough decreased and granulation tissue increased across the wound bed.

The patient was successfully discharged with his caregiver managing the wound at home. No wound-related complications or hospital readmission were reported during the documented follow-up period.

Resource utilisation and conclusion

The management of this Stage 4 pressure injury required coordinated inpatient and community-based care; however, the treatment strategy was associated with favourable clinical and resource outcomes. Prontosan® Wound Irrigation Solution supported wound cleansing and local wound management throughout the treatment period, forming an integral component of the wound care regimen alongside appropriate dressings, antimicrobial therapy and multidisciplinary care.

The comprehensive approach resulted in resolution of infection, notable improvement in wound condition, successful discharge to the home environment and avoidance of wound-related readmission. Continued care within the community setting further supported efficient utilisation of healthcare resources while maintaining positive clinical progress.

This case highlights how the incorporation of Prontosan® Wound Irrigation Solution within a structured treatment pathway may support effective wound bed management and contribute to favourable patient outcomes.

The achievement of infection resolution and avoidance of readmission suggests that early, coordinated wound care can optimise resource utilisation while promoting successful recovery in patients with complex pressure injuries.



Figure 12A. Day 0. Initial assessment of a Stage 4 sacral pressure injury with slough, malodorous purulent exudate and granulation tissue. The two wounds are connected via a subcutaneous tract.

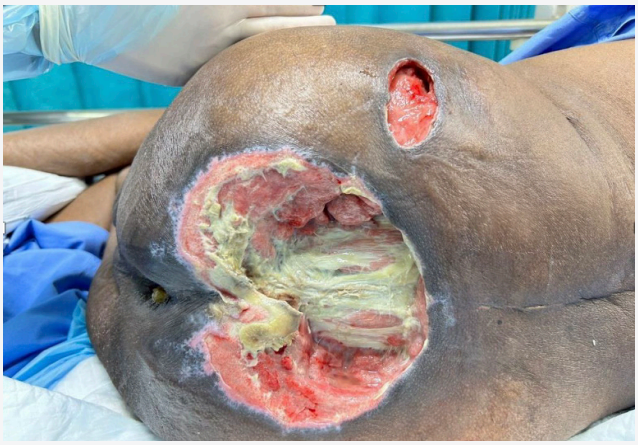


Figure 12B. Day 14. Reduction in slough and wound bioburden following debridement, cleansing with Prontosan® Wound Irrigation Solution and NPWT, with increasing granulation tissue.



Figure 12C. Day 28. Improved wound bed quality with healthy granulation tissue, reduced wound dimensions and resolution of overt infection.

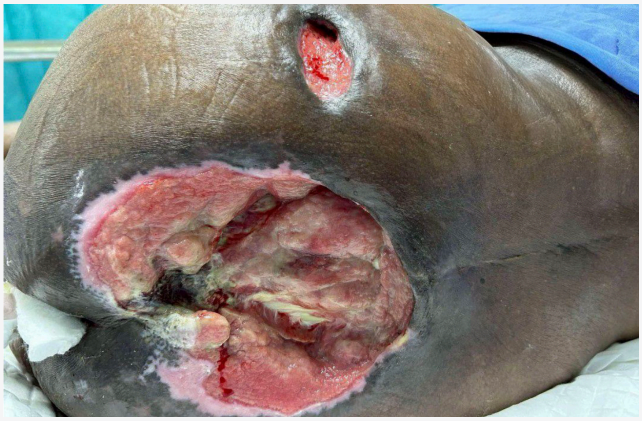


Figure 12D. Day 45. Ongoing wound contraction and depth reduction with sustained granulation tissue development and continued progression towards healing.



Figure 12E. Day 59. Ongoing wound contraction and depth reduction.

Conclusion

This retrospective series describes 12 patients with Stage 3–4 PIs managed in hospital, care home and community settings in Thailand, the Philippines, Sri Lanka, China, Vietnam and Malaysia. Where age was reported, patients were aged 51–85 years, and their clinical backgrounds were complex, including spinal cord injury, dementia, haemodialysis, cardiac surgery, pelvic exenteration, major trauma and multiple sclerosis. Many wounds were complicated by multidrug-resistant organisms, exposed bone or fascia, pelvic infection or faecal contamination. In every case, Prontosan® was used to support wound bed preparation through therapeutic cleansing, biofilm management and infection prevention, as part of a broader care plan that included debridement, appropriate dressing selection, NPWT, pressure redistribution, nutritional support and caregiver education. The cases therefore show what structured, multidisciplinary care looks like in practice.

Wound progress (BWAT) scores

Serial BWAT scores [**Table 4**] fell in 10 of the 12 cases, by 4 to 30 points (mean 16.6, median 14), a mean relative reduction of about 40% from baseline. The largest falls were in **Case 7** (30 points), **Cases 5 and 9** (both 27 points) and **Case 6** (26 points). All four wounds that started in the critical band (**Cases 5, 7, 11 and 12**) had moved down at least one band by Day 28. **Case 5** moved three bands, from critical to minimal, and **Cases 7 and 11** moved from critical to mild. Wounds with moderate baseline scores also improved, including those in **Cases 2, 4, 6 and 9**.

The two cases without a fall show why BWAT should be read alongside other measures. In **Case 1**, the score remained broadly stable (32 to 33). The rise on Day 21 was attributed to NPWT leakage during an episode of diarrhoea, which contaminated the wound with faeces. Wound area nevertheless fell by more than 60% (18.04cm^2 to 7.10cm^2) within 39 days, and the wound was approaching complete granulation and epithelialisation by Day 148. In **Case 3**, the sacral injury held a BWAT score of 37 throughout, while the heel injury improved from 27 to 21 by Day 28 and reached 14 by Week 5, and the burn healed completely. The sacral wound did not progress, enlarge or develop complications in a patient with progressive paralysis and a Braden score of 6. Taken together, these cases suggest that BWAT is most informative when read alongside wound dimensions, tissue type, exudate, infection status and clinical context.

Table 4. Changes in BWAT severity scores and corresponding severity bands between Day 0 and Day 28 for 12 cases.

Case	Day 0 (score out of 65)	Day 28 (score out of 65)	Change (Negative values indicate a reduction in severity score)	Severity band
1	32	33	+1	Moderate → moderate
2	37	27	-10	Moderate → mild
3	Sacral: 37 Heel: 27	Sacral: 37 Heel: 21	Sacral: 0 Heel: -6	Sacral: Moderate → moderate Heel: Mild → mild
4	38	31	-7	Moderate → moderate
5	45	18	-27	Critical → minimal
6	39	13	-26	Moderate → minimal
7	58	28	-30	Critical → mild
8	17	13	-4	Minimal → minimal
9	40	13	-27	Moderate → minimal
10	24	17	-7	Mild → minimal
11	41	29	-12	Critical → mild
12	55	39	-16	Critical → moderate

Beyond the scores, the clinical pattern was consistent across the case series. Slough and necrotic tissue cleared, granulation tissue increased, and exudate and malodour came under control. Pain fell in the two cases with follow-up pain scores, from 8/10 to 3/10 in **Case 4** and from 3/10 to 0/10 in **Case 6**. In several cases, healing continued beyond the 4-week assessment period. Closure progression with mature tissue was seen by Day 69 in **Case 6**, complete healing was confirmed by Day 96 in **Case 8**, and complete epithelialisation was achieved by Week 16 in **Case 10**, with no recurrence at 6 months.

Care pathways: NPWT, faecal management and surgical closure

Wound bed preparation was often a bridge to the next stage of care. NPWT was used in eight cases (**Cases 1, 2, 4, 6, 7, 8, 9 and 12**), sometimes only after practical barriers to treatment had been solved. In **Case 1**, the sacral/gluteal cleft location caused repeated leakage and contamination, which was managed with catheterisation, structured bowel training and a change in transfer technique. In **Cases 7 and 8**, faecal diversion was needed to stop ongoing contamination, and in **Case 7** NPWT became effective only after the colostomy.

Surgical reconstruction followed wound bed preparation in four patients (**Cases 7, 8, 9 and 11**). The flaps used were gluteal V-Y advancement flaps, a combined gluteus maximus and inferior gluteal artery perforator flap and a superior gluteal artery perforator flap. Cleansing and debridement did not replace surgery; instead, they supported it by controlling infection and preparing a wound bed that could take a flap. In **Case 7**, autolytic debridement also bridged a period when anticoagulation precluded surgical debridement. The flap survived in **Cases 7 and 8**, was stable at follow-up in **Case 9** and was healing well in **Case 11**. Conservative management was sufficient in the remaining cases, including all three wounds in **Case 3**.

Infection control and antimicrobial stewardship

Infection or heavy colonisation was documented at baseline in most cases, including carbapenem-resistant *Acinetobacter baumannii*, MRSA, ESBL-producing *Klebsiella pneumoniae*, multidrug-resistant *Enterococcus faecium* and multidrug-resistant *Escherichia coli*. Where infection was present at baseline, it had resolved by the end of the reported period, and no wound progressed to invasive infection during treatment. In **Case 5**, MRSA colonisation did not progress to clinical infection and no antibiotics were required. Where antibiotics were used, courses were relatively short and, where reported, culture-guided. They ranged from 7 days of oral therapy in **Case 10** to 23 days of intravenous plus 27 days of oral therapy in **Case 8**, where infection extended into the pelvic cavity. These findings are consistent with the principle that antimicrobials should be used only when clinically indicated, alongside accurate diagnosis, source control and optimisation of host factors and the wound environment through measures such as cleansing, debridement and exudate management (IWII, 2026).

Resource utilisation

Resource use was described narratively rather than costed to a common standard, and settings, payers and price levels differ between countries. Absolute costs are therefore not reported in the cases and should not be compared across cases. Instead, the cases highlight patterns in cost drivers, product use, opportunities to reduce resource use and access to care.

PIs are costly to manage. In Sichuan province, China, patients admitted primarily for a PI had the longest hospital stays of any complex wound (median 20 days) and a median inpatient cost of CNY 8,039 (approximately US$1,212) per admission, around 2.4 times that of all-cause admissions (Jiang et al, 2020). Across this series, including the three cases from China (**Cases 6, 8 and 10**), a structured, multidisciplinary approach was associated with more efficient use of resources, through fewer dressing changes, resolution of infection and care outside hospital, although costs were not quantified.

Across the case series, inpatient care and procedures were the main cost drivers. Hospitalisation and room and board accounted for nearly 70% of total expenditure in **Case 1**, and hospitalisation was the largest or a major component in **Cases 2, 6 and 11**. Reconstructive surgery accounted for a substantial share in **Case 8**, and NPWT for approximately 94% of treatment-related costs in **Case 4**. In the outpatient setting of **Case 10**, dressing-related activity was the main resource use. By contrast, cleansing products were a small part of overall resource use. In **Case 9**, Prontosan® Wound Irrigation Solution and Prontosan® Wound Gel X accounted for a small proportion of treatment costs, and in **Case 5**, only two bottles of solution were used over 28 days. The economic question is therefore less about the price of the cleansing solution and more about whether effective wound bed preparation shortens stays, avoids antibiotics, reduces dressing frequency and enables earlier closure.

Gansen

Several cases documented exactly these opportunities. **Case 5** was managed in a care home without hospital admission or systemic antibiotics. Dressing frequency fell as healing progressed:

- From twice daily to twice weekly after NPWT in **Case 4**, where this was linked to lower consumable use, less nursing time and a reduced caregiver burden

- From every other day to every third day in **Case 5**
- From daily to 3–4 times weekly in **Case 6**.

Conservative management avoided surgery in **Case 3**. Care remained in the outpatient setting in **Case 10** and caregiver-led home care without readmission followed discharge in **Case 12**. The authors of **Cases 6, 9 and 11** also suggested that higher upfront investment in advanced therapy, surgery or pre-operative optimisation may be offset by faster closure and fewer later interventions, although these savings were not quantified.

These patterns are consistent with previous evidence. PHMB-B products have been used as an adjunct in chronic wounds of varied aetiology in clinical series and retrospective analyses (Horrocks, 2006; Andriessen and Eberlein, 2008; Möller and Kaehn, 2008; Bradbury and Fletcher, 2011; Moore et al, 2016; Naude, 2018). They are therefore typically used alongside, rather than instead of, other components of wound management. PHMB-B has also been associated with lower costs than saline across different wound types and countries. In venous leg ulcers, cost-utility analyses estimated savings of £867.87 per patient over 1 year in the UK (Cooper et al, 2023) and AU$295.23 per patient in Australia (Ghosh et al, 2026). In chronic wounds, PHMB-B was cost-saving in Brazil (Mehl et al, 2013) and reduced the total cost of healing by 63.6% in Korea (Suh and Ghosh, 2020). Projections from RCT data also suggested faster wound bed preparation than with saline (28.9 vs 78.9 days; Ghosh, 2023). A UK real-world study of hard-to-heal lower limb ulcers found fewer hospital admissions, outpatient attendances and primary care consultations with PHMB-B, and a mean all-cause cost £605 lower per patient, although this difference was not statistically significant (Gansen et al, 2026). The resource patterns in this series, including avoided antibiotics, fewer dressing changes and care outside hospital, concur with these findings.

Access to treatment and funding arrangements also influenced the resources available. In **Case 2**, initial care with povidone-iodine-soaked gauze reflected financial constraints, and a locally manufactured NPWT device on loan, together with outpatient reimbursement support, made advanced therapy accessible. In **Case 7**, all costs were covered through national healthcare support programmes. These examples highlight the influence of reimbursement, device availability and care setting on resource use. The findings should therefore be interpreted in the context of each case and not generalised across healthcare systems.

Clinical pearl summary

Across 12 complex, high-risk and often infected PIs, structured assessment, therapeutic cleansing and wound bed preparation with PHMB-B, appropriate dressings and multidisciplinary care were associated with wound improvement, infection resolution and, in several cases, closure. Resource use was driven by hospitalisation, procedures, NPWT and care setting rather than by the cleansing solution. The potential savings came from avoiding antibiotics, reducing dressing frequency, preventing readmission and enabling earlier closure.

Clinical pearls: prevention and management of PIs

1. **Assess risk and wound status with structured tools.** Use the Braden Scale to identify risk and serial BWAT scoring to track the wound, and interpret BWAT score alongside wound area, tissue type and infection status.
2. **Prevent while you treat.** Pressure redistribution, 2-hourly repositioning, daily skin checks, moisture management, nutrition and reduced shear need to continue alongside wound care.
3. **Cleanse at every dressing change and prepare the wound bed.** Combine therapeutic cleansing and biofilm management using Prontosan® with debridement suited to the patient's clinical status. Prontosan® contact times of 5–15 minutes were used in three cases. Wound bed preparation can also be a bridge to NPWT or flap closure.
4. **Solve the barriers to healing, not just the wound.** Faecal and urinary contamination, shear, nutrition and pain control determined whether NPWT and dressings could work (**Cases 1, 4, 7 and 8**).
5. **Use antimicrobials as part of a package.** Relatively short, culture-guided courses used alongside cleansing, debridement and exudate management support stewardship. Antibiotics were not needed in **Case 5** despite MRSA colonisation.
6. **Involve the patient, family and wider team, and plan for discharge.** Caregiver training, occupational therapy, physiotherapy and dietetic input supported continuity of care at home and in the community.

REFERENCES

Andriessen AE, Eberlein T (2008) Assessment of a wound cleansing solution in the treatment of problem wounds. *Wounds* 20(6): 171–5

Atkin L, Stephenson J, Cooper DM (2020) Wound bed preparation: a case series using polyhexanide and betaine solution and gel, a UK perspective. *J Wound Care* 29(7): 380-86

Balzer K, Carville K, Ayello EA et al (2025) From Screening to Full Risk Assessment in Pressure Injury Prevention: Targeting the Right Care to the Right Patients. *Adv Skin Wound Care* 38(10): 511–18

Bates-Jensen BM, McCreath HE, Harputlu D, Patlan A (2019) Reliability of the Bates-Jensen wound assessment tool for pressure injury assessment: The pressure ulcer detection study. *Wound Repair Regen* 27(4): 386–95

Bauer K, Rock K, Nazzal M et al (2016) Pressure ulcers in the United States' inpatient population from 2008 to 2012: results of a retrospective nationwide study. *Ostomy Wound Manage* 62(11): 30–8

Bergstrom N, Braden BJ, Laguzza A, Holman V (1987) The Braden Scale for predicting pressure sore risk. *Nurs Res* 36(4): 205–10

Bhatt P (2024) Quality of life case series review: wound bed preparation from a UK perspective. *Br J Community Nurs* 29(6): 8–14

Bjarnsholt T, Lex C, Stewart P et al (2026) The biofilm paradigm: A milestone, not the destination. *Cell Rep* 45(3): 117014

Black J, Simende A (2020) Ten top tips: assessing darkly pigmented skin. *Wounds International* 11(3): 8–11

Bradbury S, Fletcher J (2011) Prontosan Made Easy. *Wounds International* 2(2)

Burston A, Butterworth J, Mehicic A, Fulbrook P (2025) The Psychometric Properties of the Braden Scale to Assess Pressure Injury Risk in Acute Care: A Systematic Review. *J Clin Nurs* 34(10): 4055–73

Burston A, Miles SJ, Fulbrook P (2023) Patient and carer experience of living with a pressure injury: A meta-synthesis of qualitative studies. *J Clin Nurs* 32: 3233–47

Cooper DM, Bojke C, Ghosh P (2023) Cost-effectiveness of PHMB & betaine wound bed preparation compared with standard care in venous leg ulcers: a cost-utility analysis in the United Kingdom. *J Tissue Viability* 32(2): 262–9

Fumarola S, Allaway R, Callaghan R et al (2020) Overlooked and underestimated: medical adhesive-related skin injuries. *J Wound Care* 29(3): 1–24

Gansen F, Hepworth C, Richardson S et al (2026) A comparative analysis of Prontosan versus saline in hard-to-heal lower limb ulcers using real-world data. *J Wound Care* 35(6): 470–7

Gefen A, Brienza DM, Cuddigan J et al (2022) Our contemporary understanding of the aetiology of pressure ulcers/pressure injuries. *Int Wound J* 19(3): 692–704

Ghosh P (2023) Health economics in wound management. EWMA Conference report. *Wounds International* 14(3): 1–6

Ghosh P, Vallejo A, Poopalalingam S (2026) Cost-effectiveness and budget impact of topical antimicrobial polyhexamethylene biguanide with a surfactant betaine on wound bed preparation in venous leg ulcers: an analysis in Australia from a community perspective. *Wounds International* 17(1): 12–18

Gounden V, Easton-Carr R, Jialal I (2026) Hypoalbuminemia. In: StatPearls [Internet]. Treasure Island (FL): StatPearls Publishing; 2026 Jan-. Available at: https://www.ncbi.nlm.nih.gov/books/NBK526080/

Graves N, Maiti R, Aloweni FAB et al (2023) Retrospective matched cohort study of incidence rates and excess length of hospital stay owing to pressure injuries in an Asian setting. *Health Care Sci* 2(2): 82–93

Gunowa NO, Hutchinson M, Brooke J et al (2021) Pressure injuries and skin tone diversity in undergraduate nurse education: Qualitative perspectives from a mixed methods study. *J Adv Nurs* 77(11): 4511–24

Horrocks A (2006) Prontosan wound irrigation and gel: management of chronic wounds. *Br J Nurs* 15(22): 1224-8

Hultin L, Gunningberg L, Coleman S, Karlsson AC (2022) Pressure ulcer risk assessment—registered nurses experiences of using PURPOSE T: a focus group study. *J Clin Nurs* 31(1-2): 231–9

International Wound Infection Institute (2022) Wound Infection in Clinical Practice consensus document: 2022 update. *Wounds International*

International Wound Infection Institute (2025) Therapeutic Wound and Skin Cleansing: Clinical Evidence and Recommendations. *Wounds International*

International Wound Infection Institute (2026) Wound Infection in Clinical Practice, 4th ed. *Wounds International*

Jackson DE, Durrant LA, Hutchinson M et al (2018) Living with multiple losses: Insights from patients living with pressure injury. *Collegian* 25(4): 409–14

Jia L, Deng Y, Xu Y et al (2024) Development and validation of a nomogram for oral mucosal membrane pressure injuries in ICU patients: A prospective cohort study. *J Clin Nurs* 33(10): 4112–23

Jiang Q, Dumville JC, Cullum N et al (2020) Epidemiology and disease burden of complex wounds for inpatients in China: an observational study from Sichuan province. *BMJ Open* 10(11): e039894

Jiang QX, Xie YJ, Bai YX et al (2022) Prevalence and Epidemiologic Features of Skin Injuries in Chinese Older Adults: a Multicenter Cross-sectional Study. *Chin Gen Pract* 25(21): 2569–76

Kaehn K (2010) Polihexanide: a safe and highly effective biocide. *Skin Pharmacol Physiol* 23: 7–16

Kammuang-Lue P, Pattanakuhar S, Engkasan JP et al (2024) Association Between Health Service Systems and Pressure Injury Problems of Individuals With Chronic Spinal Cord Injury in Malaysia, Indonesia, and Thailand: A Cross-sectional Study. *Am J Phys Med Rehabil* 103(10): 867–74

Kramer A, Rudolph P (2002) Efficacy and tolerance of selected antiseptic substances in respect of suitability for use on the eye. *Dev Ophthalmol* 33: 117-44

Lichtenberg M, Kirketerp-Møller K, Kvich LA et al (2024) Single cells and bacterial biofilm populations in chronic wound infections. *APMIS* 132(12): 1071-7

Lin-Yin W, Chia-Ming L, Lin HL et al (2023) Risk factors for recurrent pressure ulcers after reconstructive surgery: A retrospective study in a single medical centre. *Int Wound J* 20(7): 2511–7

Lovegrove J, Ven S, Miles SJ, Fulbrook P (2023) Comparison of Pressure Injury Risk Assessment Outcomes Using a Structured Assessment Tool Versus Clinical Judgement: A Systematic Review. *J Clin Nurs* 32(9–10): 1674–90

Malone M, Bjarnsholt T, McBain AJ et al (2017) The prevalence of biofilms in chronic wounds: a systematic review and meta-analysis of published data. *J Wound Care* 26(1): 20–5

Mehl AA, Mensor LL, Bastos DF et al (2013) Cost-effectiveness of polyhexamethylene biguanide 0,1% and betaine 0,1% solution (Prontosan®) versus saline for cleansing of chronic wounds under the Brazilian private health system perspective. *J Bras Econ Saúde* 5(3): 135–46 [in Portuguese]

Möller AN, Kaehn K (2008) Experiences with the use of polyhexanide-containing wound products in the management of chronic wounds: results of a methodical and retrospective analysis of 953 patients. *Wund Management*

Moore M, Dobson N, Cetnarowski W (2016) 0.1% polyhexanide-betaine solution as an adjuvant in a case-series of chronic wounds. *Surg Technol Int* 29: 85-9

Moore ZE, Patton D (2019) Risk Assessment Tools for the Prevention of Pressure Ulcers. *Cochrane Database of Systematic Reviews* 1(1): CD006471

National Pressure Injury Advisory Panel, European Pressure Ulcer Advisory Panel and Pan Pacific Pressure Injury Alliance (2026) Prevention and Treatment of Pressure Ulcers/Injuries: Quick Reference Guide. The International Guideline: Fourth Edition. Available at: https://internationalguideline.com

Naude L (2018) The use of Prontosan in combination with Askina Calgitrol: an independent case series. *Wounds International* 9(1): 44–8

Nghiem S, Campbell J, Walker RM et al (2022) Pressure injuries in Australian public hospitals: A cost of illness study. *Int J Nurs Stud* 130: 104191

Posnett J, Gottrup F, Lundgren H, Saal G (2009) The resource impact of wounds on health-care providers in Europe. *J Wound Care* 18(4): 154–6

Pramod S, Mayes J, Bowling K et al (2024) Implementation of skin tone assessment in pressure ulcer prevention. *Wounds International* 15(1): 10–7

Rippon MG, Rogers AA, Ousey K (2023) Polyhexamethylene biguanide and its antimicrobial role in wound healing: a narrative review. *J Wound Care* 32(1): 5-20

Rodgers K, Sim J, Clifton R (2019) Pressure injury prevalence in Australian and New Zealand hospitals: Systematic review protocol. *Collegian* 27

Santamaria N, Gerdtz M, Kapp S et al (2018) A randomised controlled trial of the clinical effectiveness of multilayer silicone foam dressings in the prevention of pressure injuries in high risk aged care residents: the Border III Trial. *Int Wound J* 15(3): 482–90

Scientific Committee on Consumer Safety (2017) Opinion on polyaminopropyl biguanide (PHMB) – submission III. European Commission, Scientific Committee on Consumer Safety. Available at: https://health.ec.europa.eu/publications/polyaminopropyl-biguanide-phmb-submission-iii_en

Song YP, Shen HW, Cai JY et al (2019) The relationship between pressure injury complication and mortality risk of older patients in follow-up: A systematic review and meta-analysis. *Int Wound J* 16(6): 1533–44

Suh J, Ghosh P (2020) Analysis of potential cost-savings after introduction of 0.1% polihexanide/betaine solution for chronic wounds in reimbursement healthcare system of Korea. *Value Health Regional Iss* 22: S49

Sullivan R (2013) A two-year retrospective review of suspected deep tissue injury evolution in adult acute care patients. *Ostomy Wound Manage* 59(9): 30-9

To E, Dyck R, Gerber S et al (2016) The Effectiveness of Topical Polyhexamethylene Biguanide (PHMB) Agents for the Treatment of Chronic Wounds: A Systematic Review. *Surg Technol Int* 29: 45–51

Wassel CL, Delhougne G, Gayle JA (2020) Risk of readmissions, mortality and hospital-acquired conditions across hospital-acquired pressure injury (HAPI) stages in a US National Hospital Discharge database. *Int Wound J* 17(6): 1924–34

Wilson L, Kapp S, Santamaria N (2019) The direct cost of pressure injuries in an Australian residential aged care setting. *Int Wound J* 16(1): 64–70

Wounds UK (2026) Veraflo™ Therapy with Smart Instill™ Feature. *Wounds UK*

Zakrasek EC, Creasey G, Crew JD (2015) Pressure ulcers in people with spinal cord injury in developing countries. *Spinal Cord* 53(1): 7–13