JERN Journal of Education and Research in Nursing

Invited Review
DOI:10.14744/jern.2024.79158
*J Educ Res Nurs.* 2024;21(4):350-356

# Best Practices in Medical Device-Related Pressure Injuries

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**Abstract**

Medical device-related pressure injuries (MDRPIs), a subclass of pressure injuries, represent a significant health concern impacting patient safety on a global scale. Efforts to prevent MDRPIs have gained importance due to their occurrence across all areas of care and their potential to negatively affect both patients and healthcare systems. In the prevention and treatment of MDRPIs, adherence to and implementation of current best practices is essential for promoting clinical quality and ensuring patient safety. Additionally, there is a need for evidence-based development of these best practices to improve the quality of care provided. This article presents the latest best practice recommendations based on research findings, consensus reports, and practice guidelines for the prevention and management of MDRPIs.

*Keywords: Best practices, medical device-related pressure injuries, prevention, wound management*

## Introduction

Protecting and maintaining skin integrity is an important aspect of health promotion and quality improvement.[1,2] In this context, healthcare professionals require practical information and recommendations grounded in current scientific knowledge.[3] Nurses play an integral role in providing comprehensive, evidence-based care.[4] Medical device-related pressure injuries (MDRPIs) are among the skin integrity issues that have garnered significant attention in recent years and are recognized as a global health concern.[5,6] MDRPIs have become increasingly prevalent across various care settings[7-9] and have notable implications for the quality of care provided.[6] Moreover, the growing awareness of healthcare-related complications and patient safety has led to a strong commitment from policymakers, educators, and healthcare administrators to promote and implement optimal practices. This has, therefore, placed greater importance on the prevention of MDRPIs.[5,10]

Although the prevalence and incidence of MDRPIs have been studied across different care settings,[7-9] there is a limited number of studies with strong evidence on their negative impact on patient outcomes, healthcare costs, prevention, and treatment.[6,11] Therefore, best practice recommendations are needed to improve clinical care in the prevention and management of MDRPIs.[6,12,13] A systematic review by Parvizi et al.,[14] which analyzed five publications, found that nurses' knowledge of MDRPIs was rated at moderate to acceptable levels in three studies, while two studies reported nurses' knowledge as insufficient.[14] Healthcare professionals are advised to be knowledgeable about the pathophysiology, etiology, and risk factors of MDRPIs[6,13,15] by following a rational and systematic approach to achieve optimal patient outcomes. This approach should be supported by a service philosophy that emphasizes information flow led by an expert healthcare team and aims for continuous improvement.[3] In this review, best practices for the prevention and management of MDRPIs are discussed based on current research findings, consensus reports, and practice guidelines.

### Pressure Injuries

The European Pressure Ulcer Advisory Panel (EPUAP), the National Pressure Injury Advisory Panel (NPIAP), and the Pan Pacific Pressure Injury Alliance (PPPIA) define a pressure injury (PI) as localized damage to the skin and/or underlying tissue, caused by pressure or a combination of pressure and shear. This broad definition encompasses a

**Cite this article as:** Çakar V, Karadağ A. Best practices in medical device-related pressure injuries. *J Educ Res Nurs.* 2024;21(4):350-356.

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Received: September 11, 2024
Accepted: November 5, 2024
Publication Date: December 1, 2024

range of causal factors.[6] Injury or damage usually occurs over bony prominences or in areas where medical devices and other objects make contact with the body.[5,16] Multiple factors contribute to the formation of PIs.[16] PIs primarily develop due to the forces exerted by a patient's body weight, the forces applied by a medical device or object, or a combination of these forces. Soft tissue tolerance to sustained deformation varies depending on the level of tissue involvement. Factors such as microclimate, perfusion, age, health status, comorbidities, and the condition of the soft tissue also influence PI development.[5,6,15] PIs are classified into several categories by the National Pressure Injury Advisory Panel (NPIAP): Stage 1 PI, Stage 2 PI, Stage 3 PI, Stage 4 PI, Unstageable PI, Deep Tissue PI, Medical-Device Related PI (MDRPI), and Mucous Membrane PI.[5,17] These injuries are not limited to the skin and surrounding tissues but may also affect mucous membranes. Medical devices often cause these injuries by stabilizing equipment that exerts constant pressure, friction, and shear stresses on delicate mucosal and underlying tissues.[5,6,15]

PIs represent a significant global health concern due to their serious consequences, including increased mortality and morbidity, elevated healthcare costs, prolonged hospital stays, and reduced quality of life for patients and their families.[1,5] As such, the prevalence and incidence of PIs across different care settings are of critical importance.[5,18,19] In a meta-analysis of observational, cross-sectional, and prospective studies involving adult patients in acute care settings (n = 42), the overall PI prevalence was reported as 12.8%, with a nosocomial prevalence of 8.4% and an incidence of 5.4 per 10,000 patient days.[18] An international prevalence study involving adult intensive care unit patients (n = 13,254) across 90 countries found an overall PI rate of 26.6% in intensive care units.[20] A meta-analysis of neonates (n = 30) that included various study designs reported an incidence of 15.1%.[21] In the largest national point prevalence study on acute care in Türkiye in 2019, which included 5,088 patients from 13 hospitals, the overall PI prevalence was found to be 9.5%.[22]

## Medical Device-Related Pressure Injuries

MDRPIs, a subclass of PIs, generally arise from the use of medical equipment for diagnostic or therapeutic purposes. MDRPIs can also occur when non-medical devices and objects come into contact with the patient's skin. The term "device-related PI" is commonly used in the literature to describe this damage, as the injury typically conforms to the shape or design of the device, and the materials in the care environment also contribute.[5] In the recent International Consensus Document on this topic by Gefen et al.,[6] it was proposed to define MDRPIs as "PI due to a device involving interaction with a device or object in direct contact with the skin or transdermally implanted subcutaneously, causing focal and localized forces that deform superficial and deep underlying tissues".[6] MDRPIs should be staged using a recognized classification system to assess the type and depth of tissue affected.[5,17]

The primary factors contributing to MDRPI formation include the perpendicular (pressure) and parallel forces (friction and shearing) exerted by the device in the contact area, as well as moisture accumulation on the skin and specific microclimate characteristics.[6,12,13,15] The features of the devices used—such as their material, size, shape, and duration of application—as well as individual patient factors, including site of device use, reduced tissue tolerance, sensitive skin, and chronic health conditions, play important roles in the development od MDRPIs.[7] Devices known to cause MDRPIs include respiratory equipment, orthopedic devices, urinary and fecal collection systems, patient positioning systems, immobilization products, nasogastric catheters and other feeding tubes, surgical drains, intravenous catheters, sutures, sphygmomanometer cuffs, intra-aortic balloon pumps, fluid sets, intermittent pneumatic compression device bandages and their accessories, compression stockings, restraint materials, and various non-medical objects left in beds or sitting areas.[5,6,11,23]

MDRPIs are a particularly significant concern for patients in intensive care, pediatric patients, and neonates.[7-9,23,24] In a multicentre survey study conducted in Canada and the USA by Kayser et al.[25] (n = 102,865), 75% of MDRPIs were found to be facility-acquired. The most commonly associated devices were nasal oxygen tubes (26%), casts/splints (12%), non-invasive oxygen masks (9%), among others (19%).[25] In a multicenter descriptive study in Türkiye by Baykara et al.[22] (n = 5,088), a total of 1,044 PIs were identified, 112 of which (10.7%) were MDRPIs. The most frequently involved devices in these MDRPIs were compression stockings (28.6%), endotracheal tube connectors (10.7%), and oxygen masks (9.8%).[22] In a systematic review and meta-analysis by Simsek et al.,[9] which included seven studies on pediatric patients, the pooled prevalence and cumulative incidence of MDRPIs were reported as 7% and 5%, respectively. Medical devices most frequently associated with MDRPIs include external monitoring devices (24.5%), respiratory devices (22.8%), and securing devices (14.9%).[9] In a prospective, descriptive study by Hanönü and Karadağ (2016)[23] involving five adult intensive care units (n = 175), 70 patients (40%) developed hospital-acquired MDRPIs.[23]

MDRPIs are considered key quality indicators in healthcare services. These injuries negatively impact patient quality of life, extend hospital stays, increase the nursing workload, and lead to additional costs due to extra care supplies and treatment needs.[6,26] Although there are no cost studies specific to MDRPIs,[6] numerous studies on PIs indicate the financial burden they impose. A systematic review by Demarré et al.,[26] which included 17 publications, reported that the cost per patient per day for PI treatment ranged from €1.7 to €470.5, while prevention costs ranged from €2.6 to €87.6.[26] During the SARS-CoV-2-induced (Severe Acute Respiratory Syndrome Coronavirus 2-induced) Coronavirus Disease 2019 (COVID-19) pandemic, prolonged and intensive use of personal protective equipment caused various skin injuries (42.8-88%), including PIs in the facial area of healthcare workers (30-92.8%).[27] This period highlighted that MDRPIs are not only a patient concern but also an issue impacting staff, underscoring the importance of addressing these injuries to ensure both patient and staff safety.[6,12,28]

## Prevention of Medical-Device Related Pressure Injuries

With increasing awareness of healthcare-associated issues and patient safety, policymakers, educators, and healthcare managers have promoted and implemented best practices to prevent MDRPIs.[5,10] Preventing MDRPIs requires a high level of awareness and strict adherence to clinical practices that minimize risk. Healthcare providers must assess all factors contributing to MDRPI formation, including the device's clinical purpose, design, anatomical placement, and the type of tissue involved. Additionally, there is a need for institutional implementation of protocols, ongoing quality improvement, and training to raise awareness.[5,6] Prevention interventions should aim to reduce the mechanical load exerted by medical devices and enhance tissue tolerance.[5,16] It is essential that these interventions be planned according to the recommendations of current, evidence-based

guidelines. This approach should prioritize best practices by systematically evaluating relevant literature, incorporating clinical expertise, and addressing the diverse needs of patient.[6,16,19] Best practices for MDRPI prevention can be organized under key areas: MDRPI risk and skin assessment, reduction of mechanical load from devices, enhancement of tissue tolerance, staff training, and quality improvement initiatives.[5,6,10,13,16]

## Risk Assessment

Assessing the risk of MDRPI development is the most critical step in prevention. This assessment should include general PI risk factors as well as specific risks posed by the devices used with the patient. This risk assessment process is an integral part of daily care routines.[5,29] Risk factors for MDRPIs can be divided into intrinsic and extrinsic categories. Intrinsic risk factors are patient-oriented and include age (especially prematurity and advanced age), severity of the underlying illness, comorbidities, tissue perfusion status, skin condition, presence of a medical device, and previous PIs or other injuries at the device site. Extrinsic risk factors include the pressure, friction, and shear forces (mechanical loads) exerted by the medical device, the humidity and microclimate of the skin in the area of device contact, and the duration of device use.[6,15]

It is advisable to use valid and reliable measurement tools with established psychometric properties for risk assessment.[30] The various assessment tools used for assessing the risk of classical PIs do not adequately address the specific risks associated with MDRPIs.[6] A review of the relevant literature[31] highlights the need to develop risk assessment tools specifically tailored for MDRPIs as a priority.[32] To date, only one assessment tool for MDRPI risk, developed in 2023, addresses MDRPI risk factors across 12 items.[33] Additionally, the 2018 revision of the Braden QD scale introduced a "Medical Devices" sub-dimension, allowing for the assessment of "Number of Medical Devices" and "Repositionability/Skin Protection".[34]

Awareness of individual and additional risk factors is important for accurate MDRPI risk assessment. Developing forms that enable risk assessment and documentation when high-risk medical devices are in use can support the assessment process and increase awareness. This approach also provides a foundation for assessing the skin surface in contact with medical devices. In this context, the risk assessment should include a comprehensive patient evaluation, taking into account the necessity of the device in use.[5,6]

Assessing an individual's MDRPI risk should be part of routine care. The frequency of risk assessment should be based on the individual's overall health status and the specific characteristics of the medical device in use. Consistent with a critical thinking approach, patients should be assessed daily from the time of hospital admission and reassessed whenever there is a change in clinical status. Additionally, skin and mucous membrane assessment intervals may provide guidance for risk assessment. For this purpose, a list of medical devices specific to various care units can be prepared, and device-specific risk assessment protocols and frequencies can be determined.[6] Table 1 provides a list of equipment commonly used in healthcare settings and known to cause MDRPIs.[5]

**Table 1.** Equipment Commonly Causing Medical Device-Related Pressure Injuries

| Type of equipment | Examples |
|---|---|
| Respiratory equipment | Tracheostomy faceplates<br>Masks used to deliver non-invasive mechanical ventilation (e.g., biphasic positive airway pressure, continuous positive airway pressure)<br>Endotracheal (ET) and nasotracheal tubes<br>Oximeter probes<br>Oxygen masks<br>Nasal cannulas |
| Orthopedic devices | Cervical collars<br>Halo devices<br>Helmets<br>External fixators<br>Immobilizers<br>Braces<br>Plaster casts |
| Urine and feces collection supplies | Indwelling urinary catheters<br>Fecal containment devices<br>Bedpans and bottles |
| Patient support and positioning devices | Heel lifts<br>Slings and transfer boards |
| Vascular instruments and accessories | Central venous and dialysis catheters<br>Intravenous catheters and components<br>Arterial catheter lines<br>Extra-corporeal membrane oxygenation cannulas<br>Intra-aortic balloon pumps |
| Tubes and drains | Nasogastric and feeding tubes<br>Chest tubes<br>Surgical drains |
| Securements materials | Restraints<br>Retention sutures<br>ET tube fixation tapes<br>Tracheostomy securement devices<br>Other stabilization tapes/materials |
| Cuffs, bandages, and cables | Blood pressure cuffs<br>Intermittent pneumatic compression device sleeves<br>Compression stockings<br>Compression bandaging systems<br>Medical device or equipment cables |
| Devices and objects without a medical function left in the bed or wheelchair | Mobile phones<br>Personal care items<br>Clothes button or zipper<br>Miscellaneous non-medical objects |
| Personal protective equipment | Surgical masks<br>Respiratory masks<br>Face shields<br>Safety goggles |

## Skin Assessment

For all patients using a medical device, the skin in contact with and surrounding the device should be carefully assessed. Frequent assessment of skin and mucous membranes is recommended as a best practice. Regular examination of the skin under and around medical devices can detect pressure-related injuries and enable pressure redistribution and microclimate control.[6,13] Skin assessment should include evaluation of discoloration (such as redness and bruising),

moisture and dampness, edema, turgor, warmth and coldness, scaling, dryness, rash, and any irritation, including within skin folds. The individual's normal skin color is an important factor when assessing discoloration. In individuals with dark skin, the damaged area should be compared to unaffected areas to assess color changes, while in individuals with lighter skin, non-blanching redness can be used as a reference for pressure-related injury.[5]

Although there is no high-quality scientific evidence establishing clear guidelines on the frequency of skin assessments, it is recommended that observation and examination of the skin under medical devices be conducted at least twice daily as part of routine care.[6] However, the frequency of assessment should be determined based on professional judgment, considering the patient's clinical data and the specifics of the device being used. Patients who are sensitive to fluid changes and/or show signs of localized or generalized edema should have their skin under and around the medical device assessed more than twice daily.[5]

### Reducing Mechanical Loads

A thorough understanding of the factors contributing to the formation of MDRPIs is crucial for planning effective prevention and management strategies.[5,6,16] The most basic etiological factors can be grouped into two main categories: "mechanical loads" and "susceptibility and tissue tolerance of the individual". These factors, individually or in combination, initiate a series of damaging reactions that perpetuate each other, resulting in the development of PI due to the body's natural internal response to mechanical loads.[5] Mechanical loads refer to any force exerted on soft tissues through contact between the skin and a solid surface (external load, such as pressure and friction) and the force created by body weight transferred through bony structures (internal load, primarily pressure).[5,15] Consequently, continuous and repetitive exposure to mechanical loads generates tension and stress in the skin and deeper subcutaneous tissues. Excessive strain and stress within tissues can damage cellular structures and impair tissue perfusion, thereby triggering an inflammatory response. This response can lead to inflammatory edema, tissue ischemia, and cell death. Thus, prolonged exposure to mechanical loads can lead to MDRPIs.[6,13]

Pressure is one of the most critical factors in the development of MDRPIs and is defined as "the force applied perpendicularly per unit of surface area." Smaller surface areas increase pressure, while larger areas decrease it. Additionally, external pressure intensifies as it moves from the skin surface to the subcutaneous tissues. When the pressure exerted on a body region exceeds the average functional capillary pressure, capillary collapse and tissue anoxia can occur. Pressure occurs when a medical device remains in the same position for an extended period.[5]

Friction includes all surface conditions and interactions between surfaces moving in the same or opposite directions. Both surfaces may come into contact, either with both surfaces moving (dynamic) or with only one surface moving (static). During this contact, resistance occurs between the surfaces. Particularly during dynamic friction, the resistance generated as the surfaces slide in opposite directions creates a parallel force per unit of surface area. These forces include frictional force and shearing (or tearing) force.[5,15] The frictional force results from static friction between the patient's skin and medical materials or other objects. Static friction generally follows a "top-down" damage mechanism, affecting only the epidermis and dermis layers of the skin. Although these types of damage are not classified as PIs, they create a predisposition for PI development. Shearing force refers to the deformation of tissue by two parallel forces moving in opposite directions.[15,35]

The frictional force and dynamic shearing force exerted by medical devices, objects that create pressure, and equipment such as bed surfaces on the skin as external loads usually cause MDRPIs.[7,13] The degree of these forces is influenced by the coefficient of friction, which varies based on the properties of the contacting surfaces and leads to structural and functional deterioration of deep tissues. Rough and damp surfaces increase the coefficient of friction.[12] When a medical device comes into contact with bony protrusions on the patient's body, internal loads (body weight) further contribute to the formation of MDRPIs. Deformation, mechanical stress, and microclimate changes often result from the production of many medical devices, as well as bands or straps used for fixation, made from traditional hard materials.[6,35] Therefore, the correct use and management of medical devices are essential to reduce mechanical loads. Accordingly, care principles should be established to minimize the pressure, friction, and shearing forces created by medical devices and securing materials.[28,36] In this context, the recommendations from recent implementation guidelines and consensus documents are summarized below:[5,6,13]

- Medical devices should be selected in an appropriate size for the individual and secured gently and safely. The securing should be adjusted to ensure that it does not impede circulation or risk dislodging, friction, or shearing.
- The tightness of securing materials should be checked at regular intervals according to organizational policies.
- Medical devices should be positioned to avoid being under the individual's body weight or exposed to external pressure.
- If not contraindicated, the medical device should be rotated or loosened at regular intervals to reduce interface pressure between the tissue and the device. Given that many medical devices are used across a variety of patients, the rotation or loosening interval should be determined by the treatment team based on the device's placement, shape, intended use, and the patient's condition or clinical needs.
- Thin protective dressings should be applied to areas where the medical device contacts the skin. Various wound dressings, such as transparent films, hydrocolloids, silicone dressings, and foam dressings, can be used for this purpose. However, as the properties of these dressings may vary, they should be used according to the manufacturer's instructions.
- The skin beneath the medical device should always be kept clean and dry to prevent moisture accumulation.
- Protective products with barrier properties, such as barrier creams or film sprays, are recommended on the skin surface in contact with the medical device to prevent moisture-related irritation.
- For patients receiving oxygen therapy, it is advised to alternate oxygen delivery devices (e.g., masks and nasal cannulas) if appropriate and safe.
- Foreign objects should not be left in the patient's bed.
- The use of pajamas with zippers or buttons, as well as hairpins made of hard materials, should be avoided.
- In addition to the above basic recommendations, for patients receiving treatment in the prone position, the use of pressure-distributing

support surfaces, securing the endotracheal tube with gentle adhesive tapes, and managing salivary secretion should be ensured.

### Increasing Tissue Tolerance

Beyond intense and prolonged pressure, decreased tissue tolerance–defined as the tissue's capacity to distribute pressure when influenced by extrinsic factors like shear force, friction, and moisture, as well as intrinsic factors related to the patient's health status–increases the risk of MDRPIs.[5] Key determinants in the development of PI include the intensity and duration of pressure, along with the skin and subcutaneous structures' ability to withstand it (tissue tolerance). Reduced tissue tolerance heightens the risk of prolonged and intense pressure exposure, leading to injury.[5,15] Given the impact of mechanical loads on the formation of MDRPIs, decreased tissue tolerance in skin that is continually exposed to such loads due to medical device use is a significant factor in MDRPI development.[37] Interventions to improve tissue tolerance are, therefore, essential for preventing MDRPIs. Strategies include reducing mechanical loads (pressure, friction, and shearing forces), cleaning and drying the skin with a pH-balanced cleanser, using protective and pressure-reducing dressings, applying barrier sprays or creams, ensuring proper nutrition, and effectively managing underlying health conditions.[5,11,36]

### Training and Cooperation

Preventing MDRPIs is not solely the responsibility of nurses, wound care specialists, or other health professionals. For prevention efforts to be effective, all professionals involved in procuring, applying, using, maintaining, and managing medical devices, as well as those involved in disease management, along with patients and their families, should be aware of the adverse effects of MDRPIs and understand prevention strategies.[6,11,19] It is critical to establish well-structured and ongoing training programs to foster this awareness.[6] It is recommended that training programs include the mechanism of MDRPI formation, risk factors and risk assessment, properties of medical devices and their effect on MDRPI development, interventions to increase tissue tolerance, basic preventive care practices, and MDRPI assessment.[11,13] To keep healthcare professionals' knowledge and practices regarding MDRPI current, regular monitoring and updates based on the latest scientific knowledge are essential. This approach ensures the relevance and continuity of training activities.[11,14] Furthermore, involving patients' relatives, who play an active role in patient care, in prevention processes supports the success of prevention efforts and promotes person-centered care. In this regard, training sessions and materials should be provided to increase the awareness of patients' relatives about MDRPI prevention.[19,38]

Beyond training activities, medical device manufacturers and healthcare professionals should maintain continuous communication and collaboration. Partnership between biomedical engineers and industry is crucial for developing and implementing effective preventive measures. Many medical devices continue to be used with the same design and material as when they were first introduced in the 19$^{th}$ century. This has resulted in the unpredictability of unintended effects of medical devices.[6] It is important to support the production of functional and responsive materials by enabling healthcare professionals to actively participate in the design of medical devices. Procurement managers and healthcare professionals should collaborate closely in selecting medical devices for healthcare settings. Decision-making should consider both the evaluation criteria for medical devices and the insights of healthcare experts. With a better understanding of the role medical devices play in the etiology of MDRPIs, manufacturers now have the opportunity to redesign existing devices to reduce the risk of MDRPIs. This may include developing gender-specific devices in various sizes for all patients and adapting designs to accommodate all age groups and anatomical structures.[6,36] Additionally, in selecting medical devices, factors such as production material, surface properties, appropriate size and shape suitable for the individual, and the ability to be precisely and securely fixed should be considered.[13]

### Care Protocols

Healthcare workers require ongoing information and practical support in their daily care practices. Developing care protocols based on current scientific evidence can guide the implementation of prevention strategies. The use of care protocols has been shown to positively impact the prevention of PIs,[19,32] and it is evident that they will contribute to MDRPI prevention and management efforts across different care settings. The basic components of a care protocol should include the training of healthcare professionals, regular risk assessments, a list of commonly used medical devices and their areas of application, recommended device replacement frequencies, strategies to reduce and/or prevent mechanical loads specific to each device (such as protective dressing properties and usage guidelines, intermittent loosening and rotation protocols), care checklists, specifications for securing medical devices, and basic product evaluation criteria for device procurement. As a general rule, all medical devices should be used correctly according to the manufacturer's instructions and should be removed or discontinued as soon as they are no longer necessary. In consultation with specialized healthcare professionals, safe usage recommendations should include opting for soft cervical collars instead of hard ones and applying intermittent loosening and rotation protocols for medical devices with different intended uses and features.[6]

### Quality Improvement

Establishing a quality improvement program within any healthcare organization and supporting it with an evidence-based information system (including policies, procedures, protocols, information, and documentation systems) strengthens best practices.[6] Additionally, conducting cause-and-effect analyses by monitoring the prevalence and incidence of PI at the institutional level improves PI prevention and wound management practices.[5] These follow-ups help improve the quality of care by identifying the current situation and specific care needs. Making these processes interdisciplinary will further strengthen institutional quality.[39] It is recommended, therefore, to include practices related to MDRPIs in quality improvement programs. Care algorithms, decision support systems, and care protocols integrated into quality improvement initiatives support quality across healthcare settings by guiding the selection of effective strategies for the prevention and management of MDRPIs.[10]

### Wound Management in Medical Device-Related Pressure Injuries

In cases where MDRPIs develop, the fundamentals of case management align with the principles of wound management. These principles include regular risk assessments to reduce the risk of new MDRPIs, comprehensive wound assessments for accurate diagnosis, and appropriate wound care practices.[3,6]

A comprehensive wound assessment forms the foundation of effective wound management practices. This process requires expertise, clinical experience, and a detailed assessment of the patient along with a local wound evaluation using a valid, reliable assessment tool and thorough documentation.[40] Various objective and subjective methods are employed for local wound assessment. While many assessment tools focus primarily on the wound condition and surrounding, some also address patient-related factors and healing-related risk factors, including quality of life. Although there is no single universally accepted method or tool, using a wound assessment tool that has been validated for reliability provides clinicians with a systematic framework for both preventive and therapeutic care.[3,40] These wound assessment tools allow for comprehensive observation and analysis across several domains, including wound size, depth, presence of tunnels and undermining, wound edges, tissue types in the wound bed, exudate amount, condition of the surrounding skin, and pain levels, along with monitoring and documentation of wound healing.[3] Assessment tools suitable for this purpose include the Bates-Jensen Wound Assessment Tool, Pressure Ulcer Scale for Healing, T.I.M.E. Wound Assessment Tool, T.I.M.E. Clinical Decision Support Tool, and Sussman Wound Healing Tool.[41]

The most important step in wound assessment is to thoroughly understand the etiology of the wound and accurately distinguish it from other wound types by applying the appropriate wound-specific diagnostic criteria.[5] Therefore, correctly identifying MDRPIs and differentiating them from other skin issues, such as skin tears and moisture-associated irritations, is essential for selecting suitable wound care methods.[6] The use of a standardized classification system, such as the NPIAP system, is recommended for the diagnosis of MDRPIs. The NPIAP established the most current classification system for PI in 2016, which is now recognized as the global standard diagnostic criteria.[17]

In the NPIAP classification system, the affected tissues (including the epidermis, dermis, adipose tissue, muscle tissue, bone, and supporting structures), wound depth, and the degree of visible tissue loss are evaluated.[5,17] Accordingly, MDRPIs are classified as Stage 1 PI, Stage 2 PI, Stage 3 PI, Stage 4 PI, Unstageable PI, Deep Tissue PI, and Mucosal Membrane PI.[5,6] In addition to diagnosing MDRPIs based on the NPIAP system, it is critical to continuously assess the wound bed, considering the signs and symptoms associated with the stages of chronic wound healing (hemostasis, inflammation, proliferation, and maturation) and the tissue types specific to these stages (such as granulation tissue, epithelial tissue, slough, and eschar).[42]

One of the aims of wound management is to determine the appropriate treatment methods. The fundamental approach to wound treatment is to establish optimal conditions for the natural completion of the wound healing process, which begins as a response to tissue damage through various cellular interactions, and to prevent complications. In this context, creating and sustaining an environment that maintains moisture balance, facilitating the migration of cells that play key roles in wound healing within the wound bed, is recommended as a method that supports natural healing and increases the effectiveness of wound treatment interventions.[43] The T.I.M.E. (tissue, infection/inflammation, moisture balance, and edge of wound) framework, developed by Schultz et al.,[44] provides a systematic, up-to-date approach for wound care practices.[3,43,44] Modern wound care products, including dressings, wound-cleansing solutions, debridement products, and specialized devices, are continually advancing to support this framework. With the use of advanced wound dressings, necrotic tissue can be removed, the wound bed and edges protected, wound exudate absorbed, and an optimal moist wound environment achieved alongside effective infection control. However, no single product performs all these functions simultaneously. Thus, healthcare professionals should stay informed about modern wound care products, understand their specific indications and contraindications, and thoroughly evaluate both the patient and the wound when selecting and applying products.[45]

## Conclusion

MDRPIs, prevalent across all care settings, have taken on greater significance in today's technology-based healthcare. As with classical PIs, prioritizing prevention due to potential adverse effects remains the primary focus of clinical care. Prevention and management of MDRPIs, guided by best practices and current knowledge, are essential to advancing clinical quality improvement and quality of care. In this context, best practices for MDRPIs can be strengthened through continuous improvement efforts supported by interdisciplinary collaboration and care protocols. Moreover, it is critical to develop and shape best practices based on evidence from well-structured research. This article clearly demonstrates the need for strong, evidence-based care recommendations for the prevention and treatment of MDRPIs.

Peer-review: Externally peer-reviewed.

Author Contributions: Concept – V.Ç., A.K.; Design – V.Ç., A.K.; Supervision – A.K.; Literature Review – V.Ç.; Writing – V.Ç., A.K.; Critical Review – V.Ç., A.K.

Conflict of Interests: The authors have no conflict of interest to declare.

Funding: The authors declared that this study has received no financial support.

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