

# Pressure injury related to medical devices: prevention and associated risk factors

**RESUMO** | Introdução: A lesão por pressão é encontrada na pele ou tecido subjacente, geralmente sobre uma proeminência óssea, resultante da exposição à pressão ou forças de cisalhamento, possuindo fatores intrínsecos e extrínsecos: imobilidade, inconsciência, perda da continência urinária e fecal, deficiência nutricional, doenças crônicas degenerativas, peso e relacionados a dispositivos médicos. Objetivo: Descrever a prevenção e fatores de risco para Lesão por pressão relacionadas a dispositivos médicos. Método: Revisão integrativa de literatura, entre 2010 a 2020 nas bases de dados LILACS, PubMed, Bdenf e site de busca Scielo. Resultados: Foram incluídos nove estudos, sendo: quatro (44,4%) publicações que descrevem os principais dispositivos relacionados a estas lesões. Conclusão: Foi descrito os fatores associados ao desenvolvimento de Lesões por Pressão Relacionadas a Dispositivos Médicos e como preveni-las, identificando quais os dispositivos de risco, e medidas de prevenção e tratamento, cuidados específicos e eficazes por meio dos profissionais de enfermagem na prevenção e tratamento.

**Descritores:** Lesão por Pressão; Equipamentos e provisões; Enfermagem.

**ABSTRACT** | Introduction: Pressure injury is found in the skin or underlying tissue, usually over a bony prominence, resulting from exposure to pressure or shear forces, having intrinsic and extrinsic factors: immobility, unconsciousness, loss of urinary and fecal continence, nutritional deficiency, chronic degenerative diseases, weight and related to medical devices. Objective: To describe the prevention and risk factors for Pressure Injury related to medical devices. Method: Integrative literature review, between 2010 and 2020 in LILACS, PubMed, Bdenf and Scielo search engine databases. Results: Nine studies were included: four (44,4%) publications describing the main devices related to these injuries. Conclusion: The factors associated with the development of Pressure Injuries Related to Medical Devices and how to prevent them were described, identifying which are the risk devices, and prevention and treatment measures, specific and effective care through nursing professionals in prevention and treatment.

**Keywords:** Pressure injury; Equipment and supplies; Nursing.

**RESUMEN** | Introducción: La lesión por presión se encuentra en la piel o tejido subyacente, generalmente sobre una prominencia ósea, como resultado de la exposición a fuerzas de presión o cizallamiento, teniendo factores intrínsecos y extrínsecos: inmovilidad, inconsciencia, pérdida de continencia urinaria y fecal, deficiencia nutricional, crónico degenerativo. enfermedades, peso y relacionados con dispositivos médicos. Objetivo: Describir la prevención y los factores de riesgo de las lesiones por presión relacionadas con los dispositivos médicos. Método: Revisión integrativa de la literatura, entre 2010 y 2020 en las bases de datos de los motores de búsqueda LILACS, PubMed, Bdenf y Scielo. Resultados: Se incluyeron nueve estudios: cuatro (44,4%) publicaciones que describen los principales dispositivos relacionados con estas lesiones. Conclusión: Se describieron los factores asociados al desarrollo de Lesiones por Presión Relacionadas con Dispositivos Médicos y cómo prevenirlas, identificando cuáles son los dispositivos de riesgo, y las medidas de prevención y tratamiento, atención específica y efectiva a través de profesionales de enfermería en prevención y tratamiento.

**Palabras claves:** Lesión por presión; Equipo y suministros; Enfermería.

## Carla Nascimento Souza Santos

Student of the Undergraduate Nursing Course at Faculdades Integradas de Três Lagoas – AEMS.

ORCID: 0000-0002-3991-8527.

## Gabriela Maia de Oliveira

Student of the Undergraduate Nursing Course at Faculdades Integradas de Três Lagoas – AEMS.

ORCID: 0000-0003-1163-1249.

## Flávia Carla Takaki Cavichioli

Nurse. Master in Science, Technology and Management Applied to Tissue Regeneration by UNIFESP.

ORCID-ID: 0000-0003-2277-9548.

## Hélio Martins do Nascimento Filho

Nurse. Master in Science, Technology and

Management Applied to Tissue Regeneration by Unifesp. Nurse at the Family Health Unit / USF in Conselheiro Lafaiete – MG. Professor at the Postgraduate Course in Dermatological Nursing with Emphasis on Wound Treatment at FAIPE Faculty (Cuiabá-MT).

ORCID-ID: 0000-0003-3700-3910.

## Fabiola Arantes Ferreira

Nurse. Master in Nursing in Intensive Care, graduated in Nursing from UEMG.

ORCID: 0000-0001-7360-820X.

## Daniela Tinti Moreira Borges

Nurse. Professional Master in Science from UNIFESP/SP; Stomal therapist, by FAMERP/SP (2019). Professor of Undergraduate Nursing at AEMS (Integrated Faculties of Três Lagoas/MS).

ORCID: 0000-0001-8890-8918.

**Received:** 26/07/2021

**Approved:** 06/08/2021

## INTRODUCTION

Pressure injuries (PI) are aggravating to public health, and indicate the effectiveness of health care. The appearance of injuries causes an imbalance for affected people and also for caregivers, therefore, it alters the well-being of everyone involved, it is a relevant problem and can lead to death. Knowing the evolution process of LP is a fundamental factor so that lesions do not develop. About 95% of injuries can be avoided by previously discovering the severity of the severity, performing quality care, a factor that greatly contributes to prevention. <sup>(1)</sup>

The PIs have intensified in recent years due to the population's increa-

sed life expectancy, resulting from the evolution in health care, which made the survival of patients with serious and previously lethal diseases, transformed into chronic and slowly debilitating diseases, plausible. This change in profile allowed in practice a gradual number of people with skin lesions, basically PI.<sup>(2)</sup>

A relevant aspect in nursing care is the preservation of skin integrity, with the use of preventive actions being essential to achieve this goal. A pressure injury is understood as that which is found in the skin or underlying tissue, usually over a bony prominence, resulting from exposure to pressure or shear forces, having intrinsic and extrinsic factors, such as immobility, unconsciousness, loss of urinary and fecal continence, nutritional deficiency, chronic degenerative diseases, weight and other factors. These injuries represent a failure in public health, and end up prolonging the length of hospital stay, thus generating negative impacts on the financial expenses of health institutions.<sup>(3)</sup>

The National Pressure Injury Advisory Panel (NPIAP)<sup>(4)</sup> redefined the test system for LP to encompass Medical Device-Related Pressure Injuries (MDRPI) established as resulting from the use of devices programmed and executed for diagnostic or therapeutic purposes.<sup>(5)</sup>

Medical devices are commonly used in hospital environments. With the water content and heating between the skin and the device, the skin's microclimate changes. For a proper seal, it is often necessary to firmly fix these devices, creating pressure in unusual areas, instead of bony prominences, ie, the device itself creates pressure. The tapes, straps and other materials used to fix the devices make it difficult to inspect the underlying skin below them, increasing the risk of pressure injuries.<sup>(6)</sup>

Some medical devices such as

The PIs have intensified in recent years due to the population's increased life expectancy, resulting from the evolution in health care, which made the survival of patients with serious and previously lethal diseases, transformed into chronic and slowly debilitating diseases, plausible.

(endotracheal tubes, oxygen masks, urinary catheters, cervical collars, tracheostomy tubes/slings, compression stockings, and the nasogastric tube) are found among care organizations. Pressure injuries (PIs) formed from the use of medical devices are a clinical event that requires attention from health professionals, as they are part of the care provided to people in all health services.<sup>(7)</sup>

The prevention of PI characterizes an essential care and requires a lot of attention, as the non-appearance of the lesion and its development requires less teamwork compared to the time and expenses that are essential to resolve the implications of its onset. The scarcity of preventive interventions results with the progress of PI. Based on this veracity, it is crucial to develop an imminent and effective care plan capable of reducing the harmful effects of the injury, thus contributing to a faster efficient recovery of the patient.<sup>(8)</sup>

The objective of the present work is to describe prevention and factors associated with the development of Pressure Injuries Related to Medical Devices.

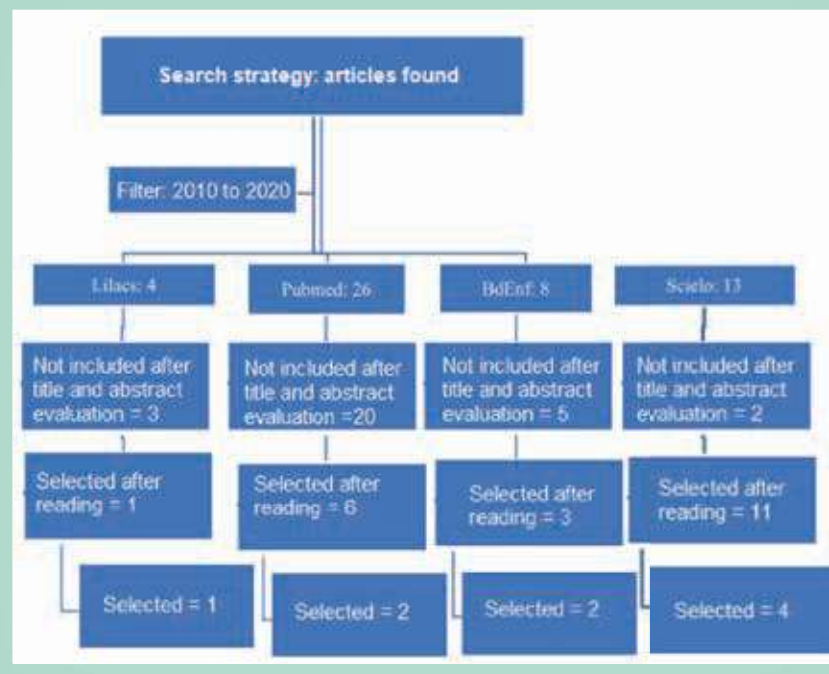
## METHODS

This is an integrative literature review, carried out following the six steps recommended for this type of study: elaboration of the guiding question "What are the factors associated with the development of LP related to medical devices and what is their clinical management"? Literature search, data collection, critical analysis of included studies, discussion and results and presentation of the integrative review.

The bibliographic search took place from March to May 2020 in the MedLine, Lilacs, Bdenf, PubMed and Scielo search engine databases. The following Health Sciences Descriptors were used: Pressure Injury; Equipment and supplies; Nursing.

The inclusion criteria adopted were

Figura 1. Estratégia de busca e seleção de artigos



Source: The authors, 2020

articles published between 2010 and 2020; available in full, in Portuguese, English and Spanish; articles with appropriate content for the purpose of this research. Duplicates, those not consistent with the research theme and those that do not comprise the determined registration period were excluded, thus not consistent with the objectives of the present work.

According to the established criteria, nine articles were included, one in Lilacs, two in Bdenf, four in Scielo, two in Pubmed and a document prepared by the Ministry of Health (Figure 1).

RESULTS

Nine studies were selected, so that four (44,4%) articles describe the medi-

cal devices that most frequently cause injuries, and the orotracheal tube is the device related to the highest incidence of MDRPI, especially behind the ears. Two (22,2%) portray preventive measures; one (11,1%) publication brings the update of concepts in pressure injuries, one (11,1%) study verified the knowledge of professionals about the prevention and treatment of these wounds and one (11,1%) describes the conditions of the associated with the development of MDRPI. The articles included in this study can be seen in Table 1.

It is important to highlight that prevention actions reduce the occurrence of MDRPI. Team training is essential for prevention and treatment care actions, as studies have shown that 90% of the participating team have difficulties in the normative classification of pressure injuries, directly interfering in the assessment and development of more effective coping strategies. Studies describe that the longer the hospital stay, the greater the risk of developing injuries. Regarding the medical devices most likely to develop a pressure injury are the non-invasive ventilation masks, endotracheal tube, venous catheter and cervical collar, which increase the chances of developing pressure injuries by 2 to 4 times. The most affected areas are: the nose, lips, hands and occipital

Quadro 1 - Artigos incluídos no estudo

Database	Authors and Year of publication	Title of the article	Main results
LILACS	Correia e Santos, 2019(8)	Pressure Injury: Therapeutic Measures Used by Nursing Professionals	Analyzing the care with PL, they highlighted preventive actions, aiming to avoid the aggravation of injuries and prevent the emergence of new PLs, with actions to clean the wound and topical therapy.

Bdenf	Moraes et al. 2016(2)	Pressure Injury Concept and Classification: National Pressure Ulcer Advisory Panel Update	As established by the NPIAP, the concept of PPL is localized damage to the skin and/or underlying soft tissue usually over bony prominence or may be related to medical equipment or other type of device. The correct use of the concept and terminology in LPP allows professionals to evaluate and develop coping strategies more effectively.
-------	-----------------------	---	---

Bdenf	Santin Júnior et al., 2019(3)	Continuing Education: Pressure Injury Care Improvement Tool	90% of the team participating in the study had a lower than expected average in terms of knowledge regarding the normative classification of pressure injuries, reinforcing the need for continuing education of the health team.
PubMed	Black et al., 2010(6)	Medical device related pressure ulcers in hospitalized patients	Patients with medical devices were significantly more likely to develop a pressure ulcer. When using the device, patients were 2 to 4 times more likely to develop a pressure injury. Pressure injuries occurred more frequently in the labia, hands and occipital region, related to the following medical devices: endotracheal tube, venous catheter and cervical collar.
PubMed	Kayser et al., 2018(7)	Prevalence and Analysis of Medical Device-Related Pressure Injuries: Results from the International Pressure Ulcer Prevalence Survey	The prevalence of MDRPI was higher in long-term intensive care hospitals than in low-intensity treatment settings with shorter hospital stays.
Scielo	Galleto et al., 2018(9)	Pressure Injuries Related to Medical Devices: an integrative literature review	The posterior cervical region and the nose are the sites most frequently affected by MDRPI. Eleven risk devices for the development of injuries were identified, with the Non-Invasive Ventilation masks and the orotracheal tube standing out, as they cause injuries in six different places of the body. With regard to measures for preventing and treating injuries, there are general and specific measures for the type of device used, most of which are simple to perform and mainly based on periodic evaluation of the skin under the devices.
Scielo	Souza e Prado, 2016(10)	The use of the Braden Scale in the ICU for pressure ulcer prevention.	The number of publications found presents a continuous trajectory over the years. The prevention of LP is an old and current concern, confirming the high incidence of this complication, especially in critically ill patients.
Scielo	Cavalcanti 2018(5)	Pressure injury related to medical devices: frequency and associated factors.	The device that most developed MDRPI was the orotracheal tube, with 63,76%, and the ears were the main location, with 32,60%. The main risk factors were the presence of pressure injuries on admission, with a significant association with the formation of MDRPI, and patients who progressed to the outcome of death, with an association with the formation of MDRPI; there was no significant association between risk factor, length of stay and location of MDRPI.



Scielo Torres 2016(1) Incidence of Pressure Ulcers Associated with Medical Devices

The factors that influence the incidence of these injuries are related to the clinical condition of the person in critical condition. Nurses play an important role in preventing pressure injuries and pressure ulcers associated with medical devices and also within the multi-disciplinary team in the care of the person. Elderly people are more susceptible to developing such wounds.

Source: The Authors

and cervical regions.

## DISCUSSION

The main risk factors for the development of MDRPI are: hypotension, hemodynamic instability, comorbidities, history of pressure injuries, generalized edema, history of smoking.<sup>(11,12)</sup>

The physical attributes of medical devices, such as their material characteristics and physical structure, can induce the occurrence of MDRPI. The less elastic or harder the device, the greater the risk. The ease of having friction and pressure exerted on the tissue is greater when the device is hard and also if the physical structure of the device facilitates direct pressure on the patient's skin, as it was also observed that the length of stay, critical patients or those that require the need for any type of DM, all of these are more likely to have these injuries. Several medical devices are linked to injuries, considering that the most prominent are: non-invasive ventilation masks, orotracheal tube, tracheostomy devices, nasogastric catheter, gastrostomy catheter, cervical collar, indwelling bladder catheter, catheter installed in the radial artery and immobilizing splint.<sup>(12,13)</sup>

To develop quality care with MDRPI, it is necessary to have some principles for the effectiveness of this care, as well as skin inspection, relocation of devices and that the entire multidisciplinary team has knowledge about the lesions since their development and their causes. Thus, medical devices

cannot be classified as harmless as they participate in the development of PPL, especially if it is a full-thickness lesion. However, medical and fixation devices are fundamental, the care of the nursing team must be paramount, the proper adjustment, the need for permanence, the safety of these medical devices,

**The main risk factors for the development of MDRPI are: hypotension, hemodynamic instability, comorbidities, history of pressure injuries, generalized edema, history of smoking.**

and the appropriate implementation of prevention strategies must be analyzed.

Relevant recommendations for the prevention of (LPs) are highlighted, risk

assessment and preventive care of the skin and tissues, therapies that result in the prevention of these injuries, nutrition, repositioning and mobilization in bed, support surfaces and care with devices for health care. The use of scales to identify the risk and predisposition of patients affected by LP is among the most important preventive measures. These measures contribute to the development of a favorable care plan, preventing or minimizing the growth of lesions.<sup>(14)</sup>

Speaking of care, the nurse is the professional who is closest to the patients, as the preservation of the wholeness of the skin is inserted in the nursing care strategy, which, in turn, needs to identify the risk of the appearance and growth of lesions, to work on the care and prevention in the integrity of the affected skin. The probability of the patient developing pressure injury is analyzed through the risk assessment scale, which generates scores for this purpose; the classification method changes between the scales. Actions and measures that will be used after the patient's risk classification need to be precise so that the entire team is able to deal with situations of high and low risk for the onset of pressure injuries, aiming at prevention in a manner prior and effective.<sup>(14)</sup> The studies analyzed propose as the main preventive precautions for the appearance of lesions: avoid positioning on reddish body areas identified as being at high risk, constant preservation of clean and dry skin by means of products with a stab-

le pH such as those of the skin; do not rub in areas with redness; for patients with incontinence problems, cleaning should be performed momentarily at each occurrence and the skin needs to be protected from exposure to moisture, reducing damage, the use of moisturizer helps to reduce this damage, it is necessary to create an individual care plan.<sup>(14)</sup>

Analyzing this context, it can be observed that these behaviors are adopted in patient care, but they can also be directed to health professionals who use respiratory masks and other PPE, in order to protect the skin of these professionals who are exposed to various bodily fluids. Measures such as protecting the skin, with preventive coverage as an interface between the skin and the mask's fixation area, especially if the use is prolonged such as thin polyurethane foam, silicone, transparent film or extra-fine hydrocolloid plates; Trace moments of relief, removal of the mask every two hours; constantly watch the skin for signs of pain, discomfort, redness and lesions; In areas already injured with redness, eczema, refrain from putting on masks and PPE, it is necessary to take topical care first.<sup>(15)</sup>

The combination of clinical judgment along with LP risk assessment sca-

les help to assist practitioners in instituting the most appropriate intervention for the patient. The evaluation of patients should take place as soon as they are admitted to the ICU, the frequency should be repeated as soon as appropriate, and when changes are present, and/or if the patient's health condition worsens. One of the most used scales worldwide is the Braden Scale, approved in Brazil for the Portuguese language, and its use has been published in contexts, practice and research.<sup>(16)</sup>

Attention to these scales is essential, as it enables the progress of a structured, individualized and systematized approach to solve the difficulties found and expand the simplifying aspects related to nursing care aimed at the prevention of pressure injuries, since the effectiveness nursing care is deeply related to a lower incidence of injuries in institutions that provide health care.<sup>(14)</sup>

#### CONCLUSION

The main risk factors for the patient for the development of MDRPI are: hypotension, hemodynamic instability, comorbidities, history of pressure injuries, generalized edema, history of smoking. Regarding the physical attri-

butes of medical devices, there is the material and flexibility of the device, which the harder, the greater the risk. The medical devices that cause the majority of MDRPI are: non-invasive ventilation masks, endotracheal tube, cervical collar, venous catheter. The measures that must be adopted for prevention are: pressure relief, the proper choice of materials and their proper fixation. It is essential that nursing professionals have knowledge about the proper use of these devices so that they can carry out the proper risk assessment with the use of scales and preventive care for the skin and tissues, therapies that result in the prevention of these injuries, nutrition, repositioning and mobilization in bed, support surfaces and care devices for health care.

This study is an excerpt from the Course Conclusion Work, where the literature search took place from March to May 2020. With the advent of the Coronavirus Pandemic, the authors believe that future studies have presented more medical devices related to the development of pressure injuries both in patients affected by COVID-19 due to the long period of hospitalization and in health professionals who wear PPE for long periods to provide care to these patients. 🐦

## References

1. Torres RS. Incidência de úlcera por pressão associada a dispositivos médicos. Viana do Castelo: Instituto politécnico de Viana do Castelo- Escola superior de Saúde; 2016.
2. Moraes JT, Borges EL, Lisboa CR, Cordeiro DCO, Rosa EG, Rocha NA. Conceito e classificação de lesão por pressão: Atualização do national pressure ulcer advisory panel. *Rev Enferm Cent Oeste Mineiro (RECOM)*. 2016;6(2):2292-306.
3. Santin Júnior LJ, Carrara GLR, Possidônio PB, Larêdo SMP, Nogueira LDP. Educação permanente: ferramenta de aprimoramento assistencial às lesões por pressão. *Rev Enferm UFPE*. 2019;13(5):1115- 23.
4. National Pressure ulcer advisory panel. Washington: Pressure ulcer stages revised; 2016.
5. Cavalcanti EO. Lesão por pressão relacionada a dispositivos médicos: Frequência e Fatores Associados. Brasília: Universidade de Brasília; 2018.
6. Black JM, Cuddigan JE, Walko MA, Didier LA, Lander MJ, Kelpe MR. Medical device related pressure ulcers in hospitalized patients. *Int Wound J*. 2010;7(5):358-65.
7. Kaiser SA, VanGilder CA, Ayello EA, Lachenbruch C. Prevalence and analysis of medical device-related pressure injuries: results from the international pressure ulcer prevalence survey. *J Wound care*. 2018;31(6):276-85.
8. Correia ASB, Santos IBC. Lesão por pressão: medidas terapêuticas utilizadas por profissionais de enfermagem. *Rev Bras Cienc da Saúde*. 2019;23(01):33-42.
9. Galetto SGS, Nascimento ERP, Hermida PMV, Malfussi LBH. Lesões por pressão relacionadas a dispositivos médicos: Revisão integrativa de literatura. *Rev Bras Enferm*. 2018;72(2):528-36.
10. Souza CT, Prado RT. A utilização da escala De Braden na UTI para prevenção de úlcera por pressão. *Rev Educ*. 2016;3(1):31-50.
11. Mcnichol L, Mackey D, Watts C, Zuecca N. Choosing a support surface for pressure injury prevention and treatment. *Nursing*. 2020;50(2):41-4.
12. Cavalcanti EO, Kamada I. Protagonism. Lesão por pressão relacionada a dispositivo médico em adultos. *Texto e Contexto Enferm*. 2020;29(n. esp.):1-14.
13. Chen L. The risk management of medical device-related pressure ulcers based on the Australian/New Zealand Standart. *J Int Med Res*. 2018; 46(10):4129-39.
14. Almeida ILS, et al. Pressure injury prevention scales in intensive care units: an integrative review. *Rev Rene*. 2020;21(n. esp.):1-10.
15. Ramalho AO, Freitas PSS, Nogueira PC. Lesão por pressão relacionada a dispositivo médico nos profissionais de saúde em época de pandemia. *Estima, Braz J Enterostomal Ther*. 2020;18(n. esp.):1-3.
16. Vasconcelos JMB, Caliri MHL. Ações de enfermagem antes e após um protocolo de prevenção de lesões por pressão em terapia intensiva. *Esc Anna Nery*. 2107;21(1):1-9.