

## Pressure ulcers in individuals with spinal cord injury: risk factors in neurological rehabilitation\*

Lesão por pressão em indivíduos com lesão medular: fatores de risco na reabilitação neurológica

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### Special Call 2 - Stomatherapy Nursing

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### ABSTRACT

**Objective:** to identify risk factors for the occurrence of pressure ulcers in adult individuals with spinal cord injuries in neurological rehabilitation. **Methods:** integrative review of studies published in the bases Medical Literature Analysis and Retrieval System Online, Cumulative Index to Nursing and Allied Health Literature and Latin American and Caribbean Literature in Health Sciences. **Results:** 308 studies were found, with six articles selected, based on pre-established inclusion criteria. The number of risk factors found was similar during and after neurological rehabilitation. **Conclusion:** the risk factors found for the occurrence of pressure ulcers during and after neurological rehabilitation, were related to sociodemographic conditions, the spinal cord injury itself, associated with clinical condition and behavior. With the exception of complete injury and a history of pressure ulcers, risk factors varied during and after rehabilitation stages.

**Descriptors:** Risk Factors; Spinal Cord Injuries; Pressure Ulcer; Neurological Rehabilitation; Review.

### RESUMO

**Objetivo:** identificar fatores de risco para ocorrência de lesão por pressão, em indivíduos adultos com lesão medular, na reabilitação neurológica. **Métodos:** revisão integrativa de estudos publicados nas bases *Medical Literature Analysis and Retrieval System Online*, *Cumulative Index to Nursing and Allied Health Literature* e Literatura Latino-Americana e do Caribe em Ciências da Saúde. **Resultados:** encontrados 308 estudos, sendo selecionados seis artigos, a partir de critérios de inclusão preestabelecidos. O número de fatores de riscos encontrados foi semelhante para as etapas, durante e após a reabilitação neurológica. **Conclusão:** os fatores de risco encontrados para ocorrência de lesão por pressão, durante e após a reabilitação neurológica, estiveram relacionados às condições sociodemográficas, à própria lesão medular, associados à condição clínica e ao comportamento. Com exceção da lesão completa e história de lesão por pressão, os fatores de risco variaram durante e após a reabilitação.

**Descritores:** Fatores de Risco; Traumatismos da Medula Espinal; Lesão por Pressão; Reabilitação Neurológica; Revisão.

## Introduction

Spinal cord injury is defined as any damage to the structures of the spinal cord, resulting from trauma or disease/degeneration. It is estimated that, worldwide, 250,000 to 500,000 people suffer from spinal cord injury per year, and 90.0% of these injuries are the result of trauma<sup>(1)</sup>.

The symptoms of spinal cord injury vary according to the affected spinal cord segment and the severity of the injury. Spinal cord injury is classified into quadriplegia (cervical segment) or paraplegia (thoracic segment) and its severity is determined by the classification from the American Spinal Injury Association (ASIA). It can be a complete injury (ASIA A) or an incomplete one (ASIA B-D)<sup>(1-2)</sup>.

Several secondary complications result from spinal cord injury, and pressure ulcers are the second most frequent<sup>(3)</sup>. These are damages caused to the skin and/or adjacent soft tissues, derived from the response of the skin tissue to intense and/or prolonged pressure, associated with shear. These injuries usually occur on bony prominences or are associated with the use of medical devices or other artifacts<sup>(4)</sup>.

Spinal cord injury causes autonomic, sensory, and motor changes that result in intrinsic and extrinsic alterations that favor the occurrence of pressure ulcers. Intrinsically, spinal cord injury causes reduced vascularity, cutaneous hypoxia, altered sensitivity and decreased tissue resistance to external pressure; extrinsically, it causes changes in temperature, microclimate, and predisposes the to moisture and shear<sup>(5)</sup>.

The risk for pressure ulcers in individuals with spinal cord injury begins in the acute phase and persists after the individual's reintegration into the community (chronic phase)<sup>(6)</sup>. Evidence shows that 85.0% of individuals develop at least one pressure ulcer during any stage of spinal cord injury and 70.0% of individuals with chronic spinal cord injury have recurrent pressure ulcers<sup>(5-6)</sup>. The neurological rehabilitation of

individuals with spinal cord injury is paramount and aims to prevent secondary complications, stimulate the person's neurorecovery, autonomy and independence, in addition to favor their reintegration into the community<sup>(7)</sup>.

The incidence of pressure ulcers during neurological rehabilitation is high, varying between 10.0% and 48.0%<sup>(6)</sup>. The occurrence of pressure ulcers in individuals with spinal cord injury implies in a reduction in achieving the objectives proposed for neurological rehabilitation, as well as in an increase in hospitalization time and use of the health system, and an increase in readmission and mortality rates<sup>(3,6)</sup>.

In this context, systematic reviews were carried out in order to identify risk factors associated with the occurrence/recurrence of pressure ulcers in individuals with spinal cord injuries<sup>(8-11)</sup>. In two publications from a single study, the risks for pressure ulcers were identified according to the stages of spinal cord injury. There were different risk factors for pressure ulcers during the acute and chronic phases; however, it was not possible to determine risks for the neurological rehabilitation stage, due to the lack of evidence<sup>(8-9)</sup>.

Recognizing different risk factors for the occurrence of pressure ulcers, during and after neurological rehabilitation, based on evidence available in scientific literature, will allow nursing professionals to establish reliable strategies centered on the individual, in order to avoid or minimize the risk for pressure ulcers during neurological rehabilitation. This area of knowledge represents a gap in the field of stoma therapy Nursing.

When considering the high incidence of pressure ulcers in individuals with spinal cord injury, their negative implications for the results of rehabilitation and quality of life of the individuals and the gap of knowledge about the theme, this study aimed to identify risk factors for the occurrence of pressure ulcers in adult individuals with spinal cord injury in neurological rehabilitation.

## Methods

The integrative review is a method that seeks to systematically synthesize the results of researches, in order to produce knowledge to be applied in clinical practice. To carry out this integrative review, the steps considered were: 1) formulation of the guiding question; 2) definition of inclusion and exclusion criteria and search in databases; 3) selection of articles; 4) categorization and analysis of selected studies; 5) interpretation of results; and 6) presentation of the review<sup>(12)</sup>.

The guiding question was defined based on the PEO search strategy [P (population): adult individuals with spinal cord injury during or after neurological rehabilitation; E (exposure): risk factors; O (outcomes): pressure ulcers]. Thus, the research question was: what are the risk factors for the occurrence of pressure ulcers in adult individuals with spinal cord injuries, during or after neurological rehabilitation?

The search for articles was carried out by a researcher in the electronic databases Medical Literature Analysis and Retrieval System Online (MEDLINE), via the PubMed portal, Cumulative Index to Nursing and Allied Health Literature (CINAHL) and Latin American and Caribbean Literature in Health Sciences (LILACS).

Original articles, published in Portuguese, English or Spanish, from December 1, 2009, to June 13, 2020, were selected. The initial period of time established for the selection of articles was based on the existence of a previous review on the subject, published in two publications addressed in this integrative review<sup>(8-9)</sup>, and the end date was up to the most recent publications.

The established exclusion criteria were: articles whose main objective was not to identify the risk factors for pressure ulcers exclusively in individuals with spinal cord injuries; who addressed the risks of pressure ulcers only in the acute phase, without addressing the risks for rehabilitation; articles made with methodological design that did not allow the

identification of risk relationships (cross-sectional and qualitative studies, for example); which included children in the sample; which were not performed on humans; expert opinions, dissertations, theses, abstracts and research protocols.

For the search, the DeCS and MeSH controlled descriptors, keywords and synonyms were used, combined by the Boolean operators AND and OR. The search on the LILACS platform was carried out using the following descriptors: “traumatismos da medula espinal” OR “traumatismo da medula espinhal” OR “traumas da medula espinal” OR “traumas medula espinhal” OR “traumas medulares” OR “traumatismos medulares” OR “lesões da medula espinal” OR “lesões da medula espinhal” OR “doenças da medula espinal” OR “doenças da medula espinhal” AND “reabilitação” OR “reabilitação neurológica” AND “fatores de risco” OR “risco” OR “risco relativo” OR “causalidade” AND “lesão por pressão”. The searches in the MEDLINE and CINAHL databases were performed with the keywords: “spinal cord injuries” OR “spinal cord injury” OR “spinal cord diseases” OR “spinal cord trauma” OR “spinal cord disorders” AND “rehabilitation” OR “neurological rehabilitation” OR “neuromedical rehabilitation” OR “rehabilitation neurological” OR “neurologic rehabilitation” AND “risk” OR “risks” OR “relative risk” OR “relative risks” OR “factors associated” OR “risk factors” OR “risk factor” OR “causality” AND “pressure ulcers” OR “pressure ulcer” OR “bedsore” OR “bedsores” OR “pressure sore” OR “pressure sores” OR “decubitus ulcer” OR “decubitus ulcers”. The search in the CINAHL database was carried out using their specific titles.

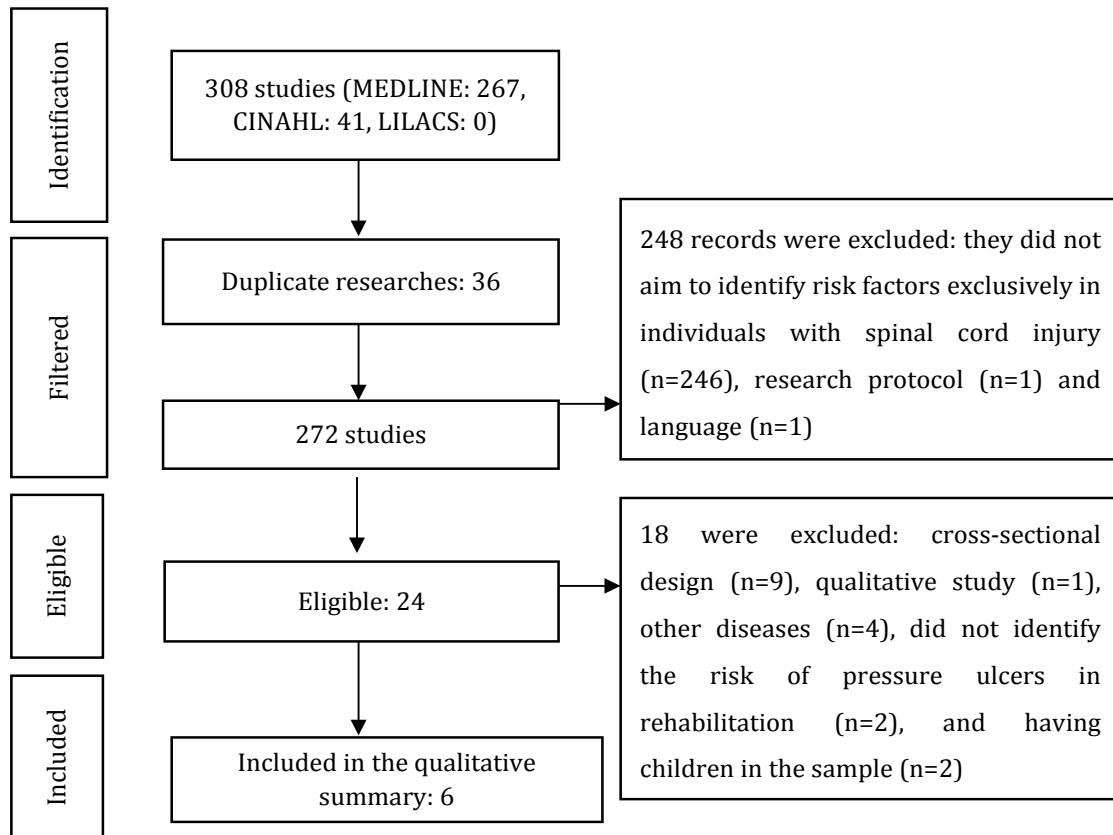
The selection of articles followed the recommendations of the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA)<sup>(13)</sup>. The studies were selected by two researchers, independently, after reading the title and summary. Then, the eligible studies were read in full, and the disagreements were resolved by consensus between the two researchers.

The data from the eligible studies was extrac-

ted using a validated instrument, containing the items: author, title, place of study, design, purpose, sample, sampling technique, identification of independent variables, methodological analysis, results and interpretation<sup>(14)</sup>.

308 studies were identified in the MEDLINE

and CINAHL databases, and there was no research found in the LILACS database. Among the studies identified, 36 duplicate studies were eliminated and the titles and abstracts of the remaining 272 articles were read. 24 articles were read in full, six of which were selected for a final analysis (Figure 1).



**Figure 1** – Flowchart of article selection, according to the PRISMA recommendation<sup>(13)</sup>. Brasília, DF, Brazil, 2020

## Results

The studies selected for this integrative literature review were published in English and conducted in the following countries: one in the Netherlands<sup>(15)</sup>, three in the United States of America (USA)<sup>(16-18)</sup>, one in Japan<sup>(19)</sup> and one in France<sup>(20)</sup>. The sample size of the studies ranged from 61 to 4.866 adult individuals, predominantly male and with spinal cord injuries of traumatic etiology. Among the studies, four evaluated risk factors during neurological rehabilitation<sup>(15-18)</sup> and two studies<sup>(19-20)</sup> analyzed the risk after neurological rehabilitations.

The studies that assessed the risk of pressure ulcers during neurological rehabilitation were observational cohort studies<sup>(15-18)</sup>. Among the studies, two verified risk factors for pressure ulcers, during neurological rehabilitation<sup>(15-16)</sup>, and two others analyzed the risk of pressure ulcers during neurological rehabilitation in the acute phase of spinal cord injury; the risk factors found in the studies were similar for both situations<sup>(17-18)</sup>.

The risk factors found during neurological rehabilitation were: quadriplegia<sup>(15)</sup>, complete inju-

ries<sup>(15,17-18)</sup>, low score on the Functional Independence Measure Scale, history of pressure ulcer<sup>(15-16)</sup>, pressure ulcer on admission, smoking<sup>(16)</sup>, pneumonia, lung pathologies, and mechanical ventilation<sup>(15,17-18)</sup>. Complete injuries, pneumonia, lung pathology and mechanical ventilation were risk factors found in three studies analyzed.

Two studies verified the risk of pressure ulcers after neurological rehabilitations, one being an observational case-control type<sup>(19)</sup> and the other an observational cohort study<sup>(20)</sup>. The researches evaluated the risk of pressure ulcers in individuals with spinal cord

injury of patients already back in the community.

The risk factors found after neurological rehabilitation were: advanced age, time of spinal cord injury<sup>(19)</sup>, history of pressure ulcer<sup>(19-20)</sup>, number of pads changed according to the time of injury, average permanence time in the wheelchair<sup>(19)</sup>, tracheostomy, complete injuries, unemployment, absence of a support network and altered perception of well-being<sup>(20)</sup>. The only common risk factor between the two studies was the story of pressure ulcers.

The characteristics of the studies analyzed, and the risk factors found are described in Figures 2 and 3.

Authors/year	Local	Study design	Risk factors for pressure ulcers during neurological rehabilitation
Verschueren JHM/2010 <sup>(15)</sup>	The Netherlands	Cohort study	Factors related to spinal cord injury: complete injuries, quadriplegia, low score on the Functional Independence Measure Scale. Factors related to the clinical condition: history of pressure ulcers, pneumonia and/or lung disease.
Dejong G/2014 <sup>(16)</sup>	The USA	Cohort study	Factors related to spinal cord injury: score less than 3.5, in the transfer item of the Functional Independence Measure Scale. Factors related to clinical condition: history of pressure ulcers. Factor related to the individual's behavior: smoking.
Krishnan S/2017 <sup>(17)</sup>	The USA	Cohort study	Factors related to spinal cord injury: complete injuries. Factors related to clinical condition: pneumonia, use of mechanical ventilation.
Brienza D/2017 <sup>(18)</sup>	The USA	Cohort study	Factors related to spinal cord injury: complete injuries. Factor related to clinical condition: pneumonia.

**Figure 2** – Articles that describe the risk factors during neurological rehabilitation. Brasília, DF, Brazil, 2020

Authors/year	Local	Study design	Risk factors for pressure ulcers after neurological rehabilitation
Morita T/2015 <sup>(19)</sup>	Japan	Case control study	Sociodemographic risk factor: age. Factors related to spinal cord injury: time of spinal cord injury. Factors related to clinical condition: history of pressure ulcers. Factors related to the individual's behavior: number of pads exchanged, according to the injury time and the average time spent in the wheelchair.
Le Fort M/2017 <sup>(20)</sup>	France	Cohort study	Sociodemographic risk factor: unemployment. Factors related to spinal cord injury: complete injuries. Factors related to clinical condition: tracheostomy, history of pressure ulcers. Factors related to the individual's behavior: absence of a support network and altered perception of wellbeing.

**Figure 3** – Articles that describe the risk factors after neurological rehabilitation. Brasília, DF, Brazil, 2020

## Discussion

The main limitation of this research was the number of databases researched, which may contribute to the non-identification of other evidence available in the literature. Few studies were identified that met the established inclusion criteria. Furthermore, a selected study was an observational case-control, a type of methodological design that limits the identification of risk relationships.

This study has implications for the practice of nursing, since the identification of risk factors for pressure ulcers in adult individuals with spinal cord injuries, during and after neurological rehabilitation, will make an individualized care planning for the prevention of pressure ulcers possible. It can also help in the implementation of preventive strategies, based on individuals at high risk of developing pressure ulcers.

From the risk factors identified in the literature review, the aspects associated with the occurrence of pressure ulcers were categorized into: sociodemographic risk factors, factors related to spinal cord injury, factors related to clinical condition and factors related to the individual's behavior. This categorization was performed based on the classification proposed by a previous study in the literature<sup>(9)</sup>. The sociodemographic risk factors for the occurrence of pressure ulcers after neurological rehabilitation, were high age and unemployment.

High age<sup>(19)</sup> is related to systemic changes, decreased mobility and muscle strength, thus, representing a risk factor for the occurrence of pressure ulcers, both in individuals with or without spinal cord injury<sup>(21)</sup>. After reintegration into the community, individuals with spinal cord injuries have high unemployment rates<sup>(20)</sup>, which contributes to low socioeconomic status<sup>(1)</sup>. The literature shows that low socioeconomic status is associated with a high risk of pressure ulcers in individuals with spinal cord injuries<sup>(22)</sup>.

The following risk factors related to the spinal cord injuries itself were found during and after neurological rehabilitation: time since the occurrence of

a spinal cord injury<sup>(19)</sup>, complete injury<sup>(15,17-18,20)</sup>, and low motor evaluation score on the Functional Independence Measure Scale<sup>(15-16)</sup>.

The time since the occurrence of spinal cord injury<sup>(19)</sup> is associated with the worsening of the neurological system and, consequently, with the increase in complications. The risk of developing pressure ulcers increases by 15.0%, after the first year of the spinal cord injury, remains stable in the first ten years of the injury, and tends to increase again after this period, reaching approximately 30.0% after 20 years of spinal cord injury<sup>(23)</sup>.

Complete injuries were determined as a risk factor during<sup>(15,17-18)</sup> and after neurological rehabilitation<sup>(20)</sup>. Individuals with complete injuries have severe mobility limitations and changes in the perception of pressure and shear forces in bony prominences, which increases the risk of pressure ulcers<sup>(18)</sup>. Complete injury is an important factor for several complications for patients with spinal cord injury and contributes to a high incidence of pressure ulcers<sup>(24)</sup>.

The Functional Independence Measure Scale assesses the individuals' functional capacity and independence. Low motor score<sup>(15-16)</sup>, a risk factor measured by the Scale, is associated with greater dependence and limited mobility<sup>(25)</sup>. Individuals with greater dependence and limited mobility have a high potential for friction and shear and are at constant risk for pressure ulcers<sup>(26)</sup>.

The risk factors related to the clinical condition can be modified, based on preventive strategies, during the stages of spinal cord injury. The risk factors found during this review were history of pressure ulcers, pneumonia, lung disease, and use of mechanical ventilation.

History of pressure ulcers<sup>(15-16,19-20)</sup> is a risk factor for new pressure ulcers, during and after neurological rehabilitation. A study showed that the deformation of tissues in the pelvic region of individuals with spinal cord injury with a history of pressure ulcers is greater, even with low pressure (40-60mmHg)<sup>(27)</sup>. One of the main risk factors for the occurrence of pressure



re ulcers is the deformation of tissues in response to external pressure<sup>(5)</sup>, therefore, these data suggest that individuals with spinal cord injury and a history of pressure ulcers are at constant risk for the occurrence of new wounds due to pressure.

Pneumonia, lung disease and the use of mechanical ventilation<sup>(15,17-18,20)</sup> are among the modifiable risk factors for the occurrence of pressure ulcers during neurological rehabilitation. The decrease in oxygenation, due to pulmonary complications, increases the risk of pressure ulcers<sup>(17)</sup>.

In the analysis of the selected articles, few studies addressed risk factors for the occurrence of pressure ulcers related to the behavior of patients. The behavior risk factors found during and after neurological rehabilitation were: smoking, pressure relief, time spent in the wheelchair, number of pillows used, absence of support networks, and altered perception of well-being.

Smoking was the only modifiable risk factor, related to behavior, during neurological rehabilitation<sup>(16)</sup>. It causes vasoconstriction and cutaneous hypoxia, increasing the risk for pressure ulcers. Smokers with spinal cord injuries are three times more likely to develop pressure ulcers than non-smokers<sup>(28)</sup>. Pressure relief actions, length of stay in the wheelchair, number of pillows used<sup>(19)</sup>, absence of a support network, and altered perception of well-being<sup>(20)</sup> are behavior risk factors for pressure ulcers after the neurological rehabilitation stage.

Adherence to preventive behaviors by adult individuals with spinal cord injury is inadequate. This situation led to a problem where 29.0% of pressure ulcers injuries in this population, according to the patients, are due to the absence of preventive behavior<sup>(23)</sup>. This integrative literature review identified risk factors for the occurrence of pressure ulcers in adult individuals with spinal cord injuries, during the stage of neurological rehabilitation, which was not possible in a previous study<sup>(8)</sup>. The risk factors found, related to the occurrence of pressure ulcers, during and after rehabilitation, converge with the systematic

reviews carried out previously<sup>(8-11)</sup>.

A study carried out with the objective of evaluating the risk factors for the occurrence of pressure ulcers in individuals with sequelae of several diseases (stroke, traumatic brain injury, amputation of lower limbs, spinal cord injury, among others), showed that rehabilitation individuals with spinal cord injuries and amputees are at high risk for the occurrence of pressure ulcers and for low scores on the Functional Independence Measure Scale, another significant risk factor for the occurrence of pressure ulcers injuries during rehabilitation<sup>(29)</sup>. This finding is in agreement with the results of this review, in which two studies showed this risk factor for the occurrence of pressure ulcers, during the stage of neurological rehabilitation<sup>(15-16)</sup>.

The prevention of pressure ulcers in individuals with spinal cord injuries is a challenge in the area of stoma therapy, due to the complexity of the factors associated with its occurrence. Thus, it is necessary to constantly seek to identify risks for the occurrence of pressure ulcers, in addition to others known risks, such as moisture, immobility, nutritional status, Diabetes Mellitus, among others, although these were not evidenced in this review. The identification of risk factors for pressure ulcers injuries will allow stoma-therapy nurses to develop guidelines for an assistance focused on the prevention of pressure ulcers in adult patients with spinal cord injuries.

## Conclusion

The risk factors found for the occurrence of pressure ulcers, during neurological rehabilitation and after, are related to sociodemographic conditions (only for one stage after rehabilitation), to the spinal cord injury itself, and associated with the clinical conditions and behavior of the patient. With the exception of complete spinal injuries and a history of pressure ulcers, risk factors varied during and after rehabilitation stages.

The analysis of the risk factors found showed

that they are multifactorial and complex, and only the factors related to clinical condition and behavior can be modified through the implementation of preventive strategies.

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## Collaborations

Silva JB and Rodrigues MCS contributed to the design, analysis and interpretation of data, writing of the article, relevant critical review of the intellectual content and final approval of the version to be published.

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