

Federal University of Rio de Janeiro State

Journal of Research  
Fundamental Care OnlineISSN 2175-5361  
DOI: 10.9789/2175-5361

## RESEARCH

## Úlceras por pressão em pacientes com lesão medular traumática: subsídios na identificação microbiológica

Pressure ulcers in patients with traumatic spinal cord injury: subsidies in microbiological identification

Úlceras por presión en pacientes con lesión traumática médula espinal: subvenciones en identificación microbiológica

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## ABSTRACT

**Objective:** To determine the prevalence of bacterial species in pressure ulcers (PU) in patients with spinal cord injury treated by a Physically Handicapped Association. **Method:** A descriptive, cross-sectional, quantitative study, conducted in a northeastern city from 2009 to 2010. The sample was consecutive, not probabilistic and comprised 20 individuals with spinal cord injury and PU being treated in the Association and without antibiotic therapy. Samples were collected from exudates of PU, using sterile swabs, plated on Blood Agar plates and incubated at 35°C for 24 hours. For identification of microorganisms were employed biochemical tests. Descriptive statistics were used for data analysis. **Results:** The six microorganisms were: *S. aureus*, *S. epidermidis*, *S. saprophyticus*, *Proteus spp.*, *Escherichia coli* and *Enterobacter spp.* **Conclusion:** Additional prospective microbiological investigations are needed to assess the prevalence of pathogens in patients with PU injured thus instituting, nutritional, therapeutic and educational programs that reduce bacterial colonization and infection. **Descriptors:** Pressure ulcer, Microbiology, Spinal cord injuries.

## RESUMO

**Objetivo:** Determinar a prevalência de espécies bacterianas em úlceras por pressão (UP) de pacientes com lesão raquimedular assistidos por uma associação de deficientes físicos. **Método:** Estudo descritivo, transversal, quantitativo, conduzido em uma cidade nordestina de 2009 a 2010. A amostra foi consecutiva não probabilística e compreendeu 20 indivíduos com lesão raquimedular e UP, em acompanhamento na associação e sem uso de antibioticoterapia. Coletaram-se amostras de exsudatos das UP, utilizando suabes estéreis, semeadas em ágar sangue e incubadas a 35°C por 24 horas. Para identificação dos microrganismos, foram empregadas provas bioquímicas. Utilizou-se estatística descritiva para análise dos dados. **Resultados:** Os seis microrganismos encontrados foram: *S. aureus*, *S. epidermidis*, *S. saprophyticus*, *Proteus spp.*, *Escherichia coli* e *Enterobacter spp.* **Conclusão:** Investigações microbiológicas prospectivas adicionais são necessárias para avaliar a prevalência dos agentes patogênicos de UP em pacientes lesionados, a fim de instituir programas educacionais, nutricionais e terapêuticos que reduzam a colonização e infecção bacteriana. **Descritores:** Úlcera por pressão, Microbiologia, Traumatismos da medula espinal.

## RESUMEN

**Objetivo:** Determinar la prevalencia de especies bacterianas en las úlceras por presión (UPP) en pacientes con lesión medular espinal (LME) tratada por una Asociación de Discapacitados Físicos. **Método:** Estudio descriptivo-transversal, cuantitativo, realizado en una ciudad del noreste en 2009-2010. La muestra fue no probabilística, secuencial y comprende 20 individuos con LME y UPP y sin tratamiento antibiótico. Se recogieron muestras de exudados de la UPP, utilizando torundas estériles, sembradas en placas de Agar Sangre y se incubaron a 35°C durante 24 horas. Los microorganismos fueron identificados por pruebas bioquímicas. Se utilizó estadística descriptiva para el análisis de datos. **Resultados:** Los seis microorganismos fueron: *S. aureus*, *S. epidermidis*, *S. saprophyticus*, *Proteus spp.*, *Escherichia coli* y *Enterobacter spp.* **Conclusión:** Se necesitan investigaciones microbiológicas prospectivas para evaluar la prevalencia de patógenos en LME con UPP instituyendo así, los programas nutricionales, terapéuticos y educativos para reducir la colonización bacteriana y la infección. **Descriptor:** Úlcera por presión, Microbiología, Traumatismos de la médula espinal.

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## INTRODUCTION

**T**he spinal cord injury can affect neural structures such as bone marrow, the conus medullaris and the cauda equina. This type of injury is considered a serious affliction to human beings and studies with high physical and psychosocial burden.<sup>1-2</sup> It is characterized by a neurological spinal cord aggression that, medically, can result in loss of voluntary movements and/or sensitivity at levels below the body segment where the injury occurred.<sup>2</sup>

Brazil presents the second highest incidence of spinal cord injury (SCI) in the world. There are about six to eight thousand new cases per year, among which 80% are represented by male victims aged between 10 to 30 years old.<sup>3</sup> However, studies indicate that the Brazilian coefficient of incidence of traumatic spinal cord injury lacks accuracy, since there is no accurate data for incidence and prevalence due to underreporting of data.<sup>3-4</sup>

The SCIs can attend with the onset of complications and overhead compromises, such as autonomic dysreflexia, postural hypotension, Heterotopic ossification, contractures, deep vein thrombosis, pain syndromes (pain, pain in traumatic nerve root, among others), osteoporosis, kidney stones and, mainly, decubitus ulcers or pressure ulcers (UP)<sup>5</sup>.

The *National Pressure Ulcer Advisory Panel* (NPUAP) sets UP as an area of cell death that occurs contact compression of soft tissue, between a bony prominence and a hard surface, for an extended period of time. Friction, the decrease in sensitivity, the immobility and nutritional status are highlighted as potential risk factors for the development of UP, as well as skin exposure to excessive humidity, caused mainly by urinary incontinence and perspiration.<sup>6-7</sup>

Pressure ulcers (UP) are a growing concern in clinical practice. NPUAP data indicate a prevalence of 15% and 7% incidence of UPs in North American hospitals, 60 thousand patients die each year due to complications of this injury.<sup>8-9</sup> Although there are few Brazilian data, a study in a university hospital showed an incidence of 41.02%.<sup>10</sup> However, after implementation of protocols for risk assessment and prevention of pressure ulcer in the institution the index dropped to 23.1%.<sup>11</sup> It is worth mentioning that the incidence rates and prevalence are due to the characteristics of patients and the type of assistance provided, that is, long-stay care or acute and home care.

Involving skin and adjacent tissues, UP causes a poor blood circulation which culminates in necrosis, ulceration of the skin and other tissues and chronic secondary infection. These changes make it favorable to the development of microorganisms due to exudative material, serous, crusted or hemorrhagic present on the surface of the UP.<sup>12</sup> In this context, bacterial contamination of chronic ulcers, especially those UPs is a universal and inevitable occurrence.<sup>13</sup>

To do so, the decision trees or algorithm propose a sequence of events related to the management and integral care of individual with UP. This includes nutritional data at

overload monitoring of tissues with pressure reduction and, especially, control of bacterial colonization and infection.<sup>13</sup>

It should be noted that in addition to the stigma of rehab, the reduction in the quality of life is driven by ignorance of this injury, which carries a deficiency in these patients self-care.<sup>14-15</sup> To assess the rehabilitation process of these subjects, a study used a psychosocial approach that, in addition to including variables, pain management, prevention of UP, skin care skin integrity and control of bladder emptying, provided a means of social reintegration.<sup>15</sup> This approach should involve multidisciplinary care psychosocial simultaneously and integrated with patients injured in order to promote proper social rehabilitation, greater survival and better quality of life during and after the therapy instituted.<sup>1-16</sup> In addition to the assessment of contaminant microbiota or transient UPs cannot be justified, therefore, only in the face of increased patient survival and greater accuracy in the treatment of them but, above all, in terms of quality of life during and after treatment.

The objective of this study was to determine the prevalence of bacterial species on pressure ulcers to patients with spinal medullar injury, assisted by an association of disabled people.

## METHOD

This study presents descriptive cross-sectional delineation and quantitative approach. It was held in an association of disabled people located in a capital city of the northeastern region, with the outcome variables processed in the laboratory of Microbiology, Faculty of Biological Sciences and Health (FCBS) CESMAC University Center. The period of investigation was from August 2009 to July 2010.

Prioritizing ethical integrity seeking subjects involved in research and, in accordance with the guidelines established in the resolution 196/96, the National Health Council, the present study has obtained approval by the Research Ethics Committee of the University Center CESMAC Faculty of Biological Sciences and Health, process under number 440/08.

The inclusion criteria set in the investigation were individuals with spinal medullar injury and with pressure ulcer and without use of antibiotic therapy. The sample was non-probability type in succession, and for convenience, and understood 20 subjects, who have agreed to participate voluntarily by clarifications concerning the research study and after signing the informed consent (TFCC).

Pressure ulcers (UP) have been classified in accordance with the guideline of the National Pressure Ulcer Advisory Panel (NPUAP), in Portuguese language, developed to assist health care professionals in decision making in relation to the resources and circumstances available in specific clinical situations. This recommendation brings the proposed classification of UPs in: Level I - injuries limited to epidermis and superficial Dermis; Level II - involving skin and subcutaneous tissue; Level III - extending to the muscles; Level IV - injured tissues and involvement of bones and joints.<sup>6</sup>

The UPs have been measured according to the parameters of length versus width by specific rule. For Level III and IV ulcers, the depth criterion was conducted by one swab sterile. In addition the largest dimensions for irregular wounds were standardized.<sup>17-18</sup>

For collection of biological material, exudate samples were used from the surface of the UPs via one swab with sterile cotton and kept in blood agar medium at room temperature, and then incubated at 37° C for 24 to 48 hours. In case of possible presence of necrotic material, exudate was disposed and collected by the edges and depth of the lesion.

In order to determine the prevalence and identify microorganisms in biological samples of the subjects of the research, we conducted a bibliographic survey, based on current scientific literature, which legitimized through biochemical tests, the following bacterial species: *Staphylococcus aureus*, *Staphylococcus epidermidis*, *Staphylococcus saprophyticus*, *Escherichia coli* and *Proteus SSP*.<sup>19-20</sup> The colonies were identified by the method of Gram and thus the gram-negative bacteria were peaked in MacConckey Agar and the Müller-Hinton agar positive (MH). For isolation and identification of species, it the biochemical tests were used: testing catalase, oxidase, motility, DNase, urease, H<sub>2</sub>O, indole; sucrose, citrate, lysine and lactose.

The analysis of the data collected was done through *Data Analysis and Statistical Software program* (STATA) version 9.0. We proceeded to the descriptive statistics (relative frequency (Fr), absolute frequency (%), average, median, standard deviation, minimum and maximum value) to characterize the sample of the study, as well as to determine the prevalence of bacterial species in the UPs. The normal distribution of the data was checked by the *Kolmogorov-Smirnov* test with  $\alpha$  fixed at 5%, CI 95%.

## RESULTS AND DISCUSSION

Among the 73 patients who presented some type of spinal cord injury at the time of the survey, only 20 (27%) showed UP, such patients composed the final sample of the study. Clinical and demographic characteristics are represented in table 1.

Table 1. Clinical characteristics of patients with SCI assisted by an Association of disabled people located in a capital city of the northeastern region (n = 20)

Characteristics	n	%	X(±SD)	MD	Min.	Máx.
<b>Gender</b>						
Male	17	86				
Female	3	14				
<b>Age (years old)</b>			24(±7)	21	15	42
15-25	13	65				
26-35	6	30				
≥36	1	5				
<b>Mechanism of spinal cord injury</b>						
Firearm	14	70				
Car Accident	5	25				

Home Accident	1	5				
<b>Type of spinal cord injury</b>						
Paraplegia	12	60				
Tetraplegia	5	25				
Hemiplegia	3	15				
<b>Treatment of pressure ulcer</b>						
AGE e S.F. 0.9%	8	40				
Collagenase without antibiotic associated	5	25				
Papain without antibiotic associated	3	15				
Others	4	20				
<b>Location of pressure ulcer</b>						
Trochanter	10	50				
Ischium	4	20				
Sacrum	4	20				
Gluteus	1	5				
Prominence of the tibia	1	5				
Malleolus	0	0				
<b>Dimension of pressure ulcer</b>						
			10(±3)	10	3	15.5
< 1cm <sup>2</sup>	0	0				
between 1cm <sup>2</sup> - 9cm <sup>2</sup>	8	40				
≥ 10cm <sup>2</sup>	12	60				
<b>Classification of pressure ulcer</b>						
I	4	20				
II	4	20				
III	12	60				
IV	0	0				

There was a predominance of the male 86% (n = 17) with spinal cord injury, corroborating findings from other studies that showed a prevalence of young males and whose spinal injuries in 70% of cases affecting young people aged 17 to 25 years old.<sup>4, 9, 21</sup> A study conducted recently with 295 patients showed that their average age was 49.1 years old, with a standard deviation of approximately 18.6 years old, and minimum ages 18 years old and a maximum of 87 years old. As for sex, the same study pointed out that 55% (n = 162) were male.<sup>22</sup>

The prevalence of patients with spinal medullar trauma accompanied by UPs was considered low when considered the total number of patients with SCI (n = 73), i.e. only 27%. This finding contrasts the data of some scholars who identified 70% UP on patients assisted in rehabilitation centers.<sup>23</sup> In a survey in the General Hospital of Maceió, with 232 patients, it was found a high prevalence of UPs (65.1%) and an extended period of hospitalization (20.9 days).<sup>21</sup>

The constant monitoring of patients by the staff of the institution studied physiotherapy may have minimized the possibility of recurrence of UPs, given that 73% (n = 53) of patients with spinal cord injury, not developed this complication. Physiotherapy has a substantial role in the treatment of spinal cord injuries, as it provides an adequate mobility and sensitivity through the change of decubitus on bone protrusions, as well as the

management of neuromotor stimulus manoeuvres of muscle blocks of spinal cord injury and ulcers.<sup>24</sup>

It should be noted that some variables interfere in risk reduction, development of UPs and infection of the UPs. Among these variables, we highlight the focus on interdisciplinarity, personalized care and the level of knowledge and decisions of the patient and his family.<sup>12</sup> Contiguous efforts of professionals and family members, both within and outside the health care institution, promotes the improvement and/or rehabilitation of diminished or lost functions that are indispensable for the survival and quality of life of injured Medullary.<sup>11,12</sup>

The firearm injury is highlighted among the mechanisms of spinal cord injury, a fact which is also reported by other studies.<sup>21,25</sup> SCI cases by firearm are generally in virtue of urban violence, which makes the service more frequent hospital centres and has a burden to society.<sup>25</sup> The path that the projectile follows can injure numerous other structures such as abdominal and thoracic viscera, neural, vascular structures and cardio-pulmonary lesions of thoracic viscera.<sup>26</sup> sit-ups are devoid of sensitivity, which can complicate the diagnosis.<sup>27</sup> Thus, the surgical indications are controversial, and there is a scientific consensus of conservative therapy, in most cases.<sup>27-28</sup> On the type of spinal cord injury, paraplegia 60% (n = 12) stood out as the most prevalent lesion type, followed by the tetraplegia 29% (n = 5) presenting, so similarities to some studies.<sup>21-22</sup> In paraplegia, spinal level more injured is the thoracic-lumbar, causing a neural deficit in this area. 4.21

Regarding UPs therapy, saline and essential fatty acids (AGE) 40% (n = 8) were the most widely used. These solutions are distributed for free by the institution where the research was conducted. It is known that the AGE promotes chemotaxis, angiogenesis and accelerates tissular granulation process. Although this substance is widely used in Brazil, there are few studies that discuss its use on wounds, and there is a dearth of randomized controlled clinical trials.<sup>29-30</sup> The AGE recommendation, for different types of injuries, since UPs until surgical wounds, is indicated when associated with other substances.<sup>30</sup>

Patients in this study reported the use of AGE and concomitant saline solution the use of herbal remedies as sambacaitá (*Hyptis pectinata*) and stone hume. The species *Hyptis pectinata* is popularly known as sambacaitá, used in the States of Sergipe and Alagoas, for therapy of inflammations, bacterial infection and pain. The stone hume is an inorganic salt, potassium sulphate-aluminic, employed as blood coagulator of minor cuts.<sup>31</sup> However, it should be noted that there is no scientific evidence available that legitimate the effectiveness of herbal medicines in the treatment of UPs or other ulcers. The need for a therapeutic UP arises when prevention measures are inadequate.<sup>32</sup> A Chilean hospital proposed in the 90, a program for the prevention of UPs, where among the measures deployed have excelled those based on periodic visits, health education of caregivers at home and regular examinations.<sup>33</sup>

The guidelines for the prevention of UPs suggest to patients, caregivers and healthcare professionals, to assess risks, regularly inspect the skin, relieve pressure on the affected area, to establish adequate hydration and nutrition, in addition to continuing education.<sup>8</sup> In this sense, the UP is associated with reduced quality of life in the psychosocial aspect, although the injury is preventable. However, prevention measures are still precarious.<sup>13</sup>

A current scientific research reported that only 19% of patients medullary injured had appropriate precautions measures of UPs.<sup>9</sup> Patients at intensive care units may have the skin care overshadowed at the expense of demands on the respiratory system, breathing and circulation.<sup>34</sup>

The areas most affected by UPs were the areas trochanter, 50% (n = 10), sacral and Ischia 20% (n = 4). Together, these areas accounted for 90% of the local development of UPs in individuals. Those numbers of UPs were estimated, as we see in some studies<sup>9,34</sup> because most vulnerable bone protrusions are: ischium (24%), Sacral (23%), trochanters (15%), heels (8%), malleolus (7%), knee (6%), iliac crest (4%), region of the elbow (3%), prominence of the tibia (2%), spinous process occiput (1%), Chin (0.5%) and scapula (0.5%).

Calcaneal region 49% (n = 23) was demonstrated as the most affected in recent study.<sup>9</sup> Even though other researchers have reported 12 other frequent locations of UPs as the ischial tuberosity (24%), sacrococcygeal (23%), 15%), a calcaneal trochanteric 8 (%), lateral malleoli (7%), elbows (3%), occipital region (1%) and scapular region (1%).

The predominance of UPs in those regions is characterized by functionality of the bony structures of the patient support, either sitting or lying supine or side, as well as the interface of these long bones with numerous muscles.<sup>35</sup> In addition, there is a stabilization and body support, in the position of Fowler, semi-Fowler and orthostatic.

Several clinical factors are associated with the development of UP. It is highlighted that the nutritional status of patients with UP is often related to the development and progression of UP. Variables such as diameter and depth are considered for a proper evaluation of correlation with the concomitant and nutritional status of the affected subjects. Wound healing is a complex process, well regulated, which consists of three distinct phases (inflammatory phase, proliferative phase and reparative phase). At each stage of wound healing the macronutrients are needed. In addition, animal studies have established a specific role for some nutrients, such as arginine, vitamins A, B, and C and the elements selenium, manganese, zinc and copper.<sup>35-36</sup>

Nutritional parameters have been correlated with the development and healing of chronic UPs, leading to suggestions that the improvement of nutritional status can prevent or treat UP. In a study whose objective was to evaluate the effectiveness of the Racol<sup>®</sup> formula for 12 weeks, the analysis indicated notable reductions in the size of the UP and the rates of improvement of waist circumference and cutaneous fold supra-iliac in the intervention group. Covariance structure analysis showed that nutritional intervention has a direct effect on reducing the size of the ulcer. The results suggest that aggressive nutritional intervention accelerated the pressure ulcer healing process of the wound and had a direct effect on reducing the size of the ulcer (p < 0.001).<sup>37</sup>

Samples collected from exudate of UPs revealed five species of microorganisms (table 1).

Table 1. Microorganisms prevalent in pressure ulcers to patients with traumatic spinal medullar injury, 2010.

Identified microorganisms	N	%
<i>Staphylococcus aureus</i>	17	85
<i>Staphylococcus epidermidis</i>	16	80
<i>Staphylococcus saprophyticus</i>	13	65
<i>Escherichia coli</i>	12	60
<i>Enterobacter spp.</i>	10	50
<i>Proteus spp.</i>	9	45

*Staphylococcus aureus* was identified in 85% of patients with infected skin ulcerations, thus corroborating findings of other research.<sup>21,38</sup> The microorganism is prevalent in UP and can be identified on the skin of healthy individuals (40%).<sup>21,39</sup> Coagulase-negative are colonizers of skin microbiota and recognized as causative agents of hospital acquired infections.<sup>40</sup>

High frequency of *s. aureus*, *Pseudomonas aeruginosa* and entero-bacteria was detected in similar injuries by scholars in the field.<sup>21</sup> Other studies have recorded the presence of *Staphylococcus aureus*, *Streptococcus* sp, *p. mirabilis*, *e. colli*, *p. aeruginosa*, *Klebsiellasp*, and anaerobes like *b. fragilis* in UP, warning that these microorganisms prevail in pressure ulcers.<sup>38-40</sup>

A sample of 145 patients with UP to level II presented colonization and/or infection by *s. aureus* (20.7%) and Gram-negative bacilli (32.5%). Among these microorganisms, 64.8% showed multidrug resistance to instituted antibiotics.<sup>38</sup> Findings like these take on character of alert to bearers of SCI and UP, about the use of antibiotics.

Results of the same study showed cases of bacteremia in 56 patients (50.5%), being a likely microbial source ulcers in 53.6% of the episodes. Thus, it is suggested to rigour in prevention of UPs, because these constitute an important means of microbial resistance, exposing patients to potential risk of bacteremia.<sup>38</sup>

The presence of *Escheria coli* and *Staphylococcus saprophyticus* draws attention, for 67% of the patients showed UP in the coccygeal, favouring the colonization of bacterial species, commonly associated with urinary tract infections, complication usually found in patients with injury spinal medullar.<sup>41</sup>

The *Staphylococcus epidermidis*, in the study, was prevalent in 80% of the sample, causing part of the endogenous microbiota. The microorganism is considered a living skin eater and mucous membranes, causing hospital-acquired infections through catheters, probes and prostheses.<sup>21,39</sup>

The use of probes for patients with spinal cord injury below T12, eventually in the lumbar region, sacral and coccygeal observed in 60% (n = 12) of the study sample, typically occurs due to episodes of urinary retention, frequent in this interlocutory appeal group of individuals. After spinal cord injury, the muscles lose their ability to bladder contractility and this causes large amount of urine to be retained inside the bladder by muscle flaccidity, being necessary the use of vesical probe.<sup>41</sup>



The presence of *E. coli* and *Enterobacter spp.*, in the sample in question, is corroborated by a study that claims that the frequency of ulcer patients colonized was elevated (67%), and 80% of these patients presented colonization by *S. aureus* and 67% for Gram-negative bacilli: *E. coli* (15.8%), *Enterobacter spp.* (15.8%) and *Pseudomonas spp.* (26.3%)<sup>38</sup>.

## CONCLUSION

The objective of this study was to determine the prevalence of microorganisms in UPs Medullary injury. The results demonstrated in the survey are indicative of relevance for programmes for the prevention and control of infection through an active epidemiological monitoring challenges of microbial resistance and outpatient hospital.

An appropriate microbiological investigation should be instituted in antibiotic therapy protocols of the UPs of injured spinal cord patients, since the identification and determination of bacterial profile direct reduction of microbial resistance and lead to therapeutic success. Studies like this will provide inputs for future investigations to improve clinical practice.

This work contributes to boost the need to seek new methods of identifying microorganisms in UPs, because the use of molecular techniques for typing of these pathogens can expand the possibilities of classification, identification and diagnosis. Phenotypic methods (microscopic, physiological and biological analysis) and genotypic (polymorphisms at the level of the nucleic acids or allelic variation at the level of enzymes) can be used as supplementary analysis to biochemical tests.

The results as of this study should be reported to the multidisciplinary team, will assist in health education and individualized and intensive care of patients, moreover, need to be discussed factors that can influence the evolution of colonization and infection of microorganisms in UPs in patients injured spinal cord. Microbiological investigations are necessary to assess prospective the prevalence of pathogens and as much as to establish interdisciplinary committees aimed at developing educational programs, nutritional and therapeutic. These measures are essential for the reduction of Bacterial colonization and infection, as well as to improve the outcomes and results handled by healthcare professionals.

## REFERENCES

1. Brasil. Ministério da Saúde. Secretaria de Atenção à Saúde. Departamento de Ações Programáticas Estratégicas. Diretrizes de Atenção à Pessoa com Lesão Medular / Ministério da Saúde, Secretaria de Atenção à Saúde, Departamento de Ações Programáticas Estratégicas e Departamento de Atenção Especializada. - Brasília: Ministério da Saúde, 2012. Acesso em 24 set 2013. Disponível em: [http://bvsm.sau.gov.br/bvs/publicacoes/diretrizes\\_atencao\\_pessoa\\_lesao\\_medular.pdf](http://bvsm.sau.gov.br/bvs/publicacoes/diretrizes_atencao_pessoa_lesao_medular.pdf).
2. Takami MP, Figliolia CS, Tsukimoto GR, Moreira MCS, Ferraz S, Barbosa SBB, et al. Lesão medular: reabilitação. *Acta Fisiatr.* 2012;19(2):90-8.
3. Fawcett JW, Curt A, Steeves JD, Coleman WP, Tuszynski MH, Lammertse D et al. Guidelines for the conduct of clinical trials for spinal cord injury as developed by the ICCP panel: spontaneous recovery after spinal cord injury and statistical power needed for therapeutic clinical trials. *Spinal Cord.* 2007 mar.;45(3):190-205.
4. De Campos MF, Ribeiro AT, Listik S, Pereira CADB, Sobrinho JA, Rapoport A. Epidemiologia do traumatismo da coluna vertebral. *Rev. Col. Bras. Cir.* 2008;35(2):88-93. Access in 30 sep. 2013. Available from: [http://www.scielo.br/scielo.php?script=sci\\_arttext&pid=S0100-69912008000200005&lng=en](http://www.scielo.br/scielo.php?script=sci_arttext&pid=S0100-69912008000200005&lng=en).
5. Schmitz, TJ. Lesão Medular Traumática. In: O'Sullivan SB, Schmitz TJ, editores. *Fisioterapia Avaliação e Tratamento.* São Paulo (SP): Manole; 2004. p. 874-87.
6. European Pressure Ulcer Advisory Panel and Pressure Ulcer Advisory Panel. Prevention and treatment of pressure ulcers: quick reference guide. Washington DC: National Pressure Ulcer Advisory Panel; 2009. Disponível em: [http://www.epuap.org/guidelines/QRG\\_Prevention\\_in\\_Portuguese.pdf](http://www.epuap.org/guidelines/QRG_Prevention_in_Portuguese.pdf). Acesso em: 03 set 2013.
7. National Pressure Ulcer Advisory Panel. Pressure Ulcer prevalence, cost and risk assessment consensus development conference statement. *Decubitus* 1989 may.; 2(2): 24-8.
8. Moore ZE, Cowman S. Risk assessment tools for the prevention of pressure ulcers. *Cochrane Database of Syst Rev.* 2008 jul.;16(3):CD006471.
9. Tubaishat A, Aljezawi M. The prevalence of pressure ulceration among Jordanian hospitalised patients. *J Wound Care.* 2013 jun.;22(6):305-11.
10. Rogenski NMB, Santos VLCG. Estudo sobre a incidência de úlceras por pressão em um hospital universitário. *Rev Latino-am Enfermagem.* 2005 julho-agosto; 13(4):474-80. [serial on the Internet]. Available from: [http://www.scielo.br/scielo.php?script=sci\\_arttext&pid=S0104-11692005000400003&lng=en](http://www.scielo.br/scielo.php?script=sci_arttext&pid=S0104-11692005000400003&lng=en).
11. Rogenski NMB, Kurcgant P. Incidência de úlceras por pressão após a implementação de um protocolo de prevenção. *Rev Latino-Am Enfermagem [Internet].* 2012 mar.-abr.;20(2):[07 telas]. Disponível em: [http://www.scielo.br/pdf/rlae/v20n2/pt\\_16.pdf](http://www.scielo.br/pdf/rlae/v20n2/pt_16.pdf)
12. Rocha JA, Miranda MJ, Andrade MJ. Abordagem terapêutica das úlceras de pressão - intervenções baseadas na evidência. *Acta Med Port.* 2006;19: 29-38.

13. Jones D. Pressure ulcer prevention in the community setting. *Nurs Stand*. 2013 sep.;28(3):47-55.
14. Thietje R, Giese R, Pouw M, Kaphengst C, Hosman A, Kienast B, et al. How does knowledge about spinal cord injury-related complications develop in subjects with spinal cord injury? A descriptive analysis in 214 patients. *Spinal Cord*. 2011;49(1):43-8.
15. Bailey J, Dijkers MP, Gassaway J, Thomas J, Lingfelt P, Kreider SED, et al. Relationship of nursing education and care management in patient rehabilitation interventions and patient characteristics to outcomes following spinal cord injury: The SCIRehab Project. *The Journal of Spinal Cord Medicine*. 2012;35(6):593-610.
16. Renovato RD, Bagnato MHS. Mudanças na vida das pessoas com lesão medular adquirida. *Rev Eletr Enf*. 2012 jan-mar.;14(1):95-103. Acesso em 30 set. 2013. Disponível em: [http://www.fen.ufg.br/fen\\_revista/v14/n1/pdf/v14n1a11.pdf](http://www.fen.ufg.br/fen_revista/v14/n1/pdf/v14n1a11.pdf).
17. Bryant RA, Bar BW, Beshara M, Broussard CI, Cooper DM, Doughty DB, et al. *Acute and chronic wounds: nursing management*. 2nd ed. St. Louis, Mo.: Mosby, Inc.;2000.
18. Bergstrom N, Allman RM, Alvarez OM, Bennet MA, Carlson CE, Frantz RA, et al. Treatment of pressure ulcer. Clinical practice guideline. n.15. 1994; Rockville: Public Health Service, Agency for Health Care Policy and Research. 1004 (AHCPR publication, n.95-0653).
19. Fernandes LM. Úlcera de pressão em pacientes críticos hospitalizados. Uma revisão integrativa da literatura. [dissertação]. São Paulo (SP): Universidade de São Paulo; 2000.
20. Fernandes LF, Pimenta FC, Fernandes FF. Isolamento e perfil de suscetibilidade de bactérias de pé diabético e úlcera de estase venosa de pacientes admitidos no pronto-socorro do principal hospital universitário do estado de Goiás, Brasil. *J Vasc Bras*. 2007;6(3):211-7.
21. Costa RC; Caliri MHL; Costa LS; Gamba MA. Fatores associados a ocorrência de úlcera por pressão em lesados medulares. *Rev Neurocienc* 2013;21(1):60-68.
22. Tubaishat A, Aljezawi M, Al Qadire M. Nurses' attitudes and perceived barriers to pressure ulcer prevention in Jordan. *J Wound Care*. 2013 sep.;22(9):490-7.
23. Leite VBE, Faro ACM. Identificação de fatores associados às úlceras por pressão em indivíduos paraplégicos relacionados às atividades de lazer. *Acta Fisiátr*. 2006;13(1):21-5.
24. Merino DF, Chiarion BMA, Pizzelli PB. Estudo do papel do fisioterapeuta nas principais complicações do traumatismo raquimedular na fase hospitalar: relato de caso clínico. In: 6ª Amostra Acadêmica Unimep. 2008:1-5. Disponível em: <http://www.unimep.br/phpg/mostraacademica/anais/6mostra/4/207.pdf>
25. Gonçalves AMT, Rosa LN, Savordelli CL, Bonin GL. Aspectos epidemiológicos da lesão medular traumática na área de referência do Hospital Estadual Mário Covas. *Arq Med ABC*. 2007;32(2):64-6.
26. Medzon R, Rothenhaus T, Bono C, Grindlinger G, Rathlev NK. Stability of cervical spine after gunshot wound to the head and neck. *Spine*. 2005;30(20):2274-9.
27. Araújo Júnior FA, Heinrich CB, Vieira CML, Verísimoli DCA, Rehder R, Scharf PCA et al. Traumatismo raquimedular por ferimento de projétil de arma de fogo: avaliação epidemiológica. *Coluna/Columna*. 2011;10(4):290-292. Available from: [http://www.scielo.br/scielo.php?script=sci\\_arttext&pid=S1808-18512011000400008&lng=en](http://www.scielo.br/scielo.php?script=sci_arttext&pid=S1808-18512011000400008&lng=en).

28. Cheryl A, Muszynsky KN. Surgical management of penetrating injuries to the spine. In: Schimidek Operative neurosurgical techniques. 3rd. Philadelphia: Saunders, 1995:1971-80.
29. Brasil. Ministério da Saúde. Instituto Nacional de Câncer. Tratamento e controle de feridas tumorais e úlceras por pressão no câncer avançado. Série Cuidados Paliativos 2009. Disponível em: [http://bvsmms.saude.gov.br/bvs/publicacoes/inca/Feridas\\_Tumorais.pdf](http://bvsmms.saude.gov.br/bvs/publicacoes/inca/Feridas_Tumorais.pdf) Acesso em: 02 out 2013.
30. Manhezil, A.C.; Bachionl, M. M.; Pereirall, A.C. Utilização de ácidos graxos essenciais no tratamento de feridas. Rev Bras Enferm. 2008 set-out.;61(5):620-9. Disponível em: <http://www.scielo.br/pdf/reben/v61n5/a15v61n5.pdf>.
31. Ortêncio W.B. Medicina popular do Centro-Oeste. 2. ed. Brasília: Theasaurus, 1997. 464p.
32. Medeiros ABF, Lopes CHAF, Jorge MSB. Análise da prevenção e tratamento das úlceras por pressão propostos por enfermeiros. Rev Esc Enferm USP. 2009;43(1):223-8. Disponível em: [http://www.scielo.br/scielo.php?pid=S0080-62342009000100029&script=sci\\_arttext](http://www.scielo.br/scielo.php?pid=S0080-62342009000100029&script=sci_arttext).
33. Correa G, Finkestein J, Fuentes M, Gonzalez X, Parada L, Piñeros JL, et al. Manejo de úlceras por presión: mejoracalidad de vida de lesionados medulares. Bol Cient Asoc Chil Segur. 1999;1(2):36-9.
34. Flike K. Pressure ulcer prevention in the intensive care unit: a case study. Crit Care Nurs Q. 2013 oct-dec.;36(4):415-20.
35. Mathus-Vliegen EM. Old age, malnutrition, and pressure sores: an ill-fated alliance. J Gerontol A Biol Sci Med Sci. 2004 Apr;59(4):355-60.
36. Iizaka S, Sanada H, Minematsu T, Oba M, Nakagami G, Koyanagi H, et al. Do nutritional markers in wound fluid reflect pressure ulcer status? Wound Repair Regen. 2010 jan-feb.;18(1):31-7.
37. Ohura T, Nakajo T, Okada S, Omura K, Adachi K, Oishi S. Effects of nutrition intervention for pressure ulcer patients-Healing rate and speed of wound size and nutrition. Nihon Ronen Igakkai Zasshi. 2013;50(3):377-83.
38. Braga IA, Pirett CC, Ribas RM, Gontijo Filho PP, Diogo Filho A. Bacterial colonization of pressure ulcers: assessment of risk for bloodstream infection and impact on patient outcomes. J Hosp Infect. 2013 apr.;83(4):314-20.
39. Heym B, Rimareix F, Lortat-Jacob A, Nicolas-Chanoine M-H. Bacteriological investigation of infected pressure ulcers in spinal cord-injured patients and impact on antibiotictherapy. Spinal Cord. 2004;42:230-4.
40. Soldera J, Nedel WL, Cardoso PRC, d'Azevedo PA. Bacteremia due to *Staphylococcus cohnii* ssp. *urealyticus* caused by infected pressure ulcer: case report and review of the literature. Sao Paulo Med. J. 2013; 131(1):59-61.
41. Sartori NR, Melo MRAC. Necessidades no cuidado hospitalar do lesado medular. Medicina, Ribeirão Preto. 2002; 35:151-159.

Received on: 19/11/2013  
Required for review: No  
Approved on: 06/01/2014  
Published on: 01/04/2014

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