

ANALYSIS OF THE MICROBIOTA OF PATIENTS WITH PRESSURE INJURIES IN A TEACHING HOSPITAL



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ABSTRACT

Introduction: The chronicity of diseases and the development of chronic lesions trigger an increase in the incidence of patients with multidrug-resistant bacteria (MDR). **Objective:** To describe the microbiological profile of patients with pressure ulcers admitted to a teaching hospital. **Method:** This is a cross-sectional study with retrospective analysis of the results of safety cultures of 74 patients with chronic lesions, stages 3, 4 and unclassifiable, admitted to a medical, surgical, ICU and Onco-Hematology clinic at the University Hospital of Aracaju/SE, from January 2018 to December 2022. **Results:** Among the 74 patients selected for the study, 27 (36.5%) were female and 47 (63.5%) were male. Among the positive samples, 6 different microorganisms were identified, all of which were Gram-negative bacteria, identified as: *Pseudomonas aeruginosa* 4 (5.4%), *Klebsiella pneumoniae* 7 (9.5%), *Enterobacter* 2 (2.7%), *Acinetobacter baumannii* 2 (2.7%), *Serratia marcescens* 1 (1.4%) and *Burkholderia* sp 2 (2.7%). **Conclusion:** There is a clear need to investigate the presence of microorganisms in chronic pressure ulcers, since these agents are frequently identified in these patients, both in the short and long term, which can lead to complications and even death.

Keywords: Skin Lesions, Pressure Injury, Stomatherapy, Microbiota, Lesions, Microbial Resistance.

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INTRODUCTION

Pressure injuries are a health problem, resulting from prolonged pressure, friction or shear on bony prominences or medical devices, which can result in tissue death, directly affecting the patient's quality of life and safety. These lesions are identified mainly in a hospital environment, and are often the result of ineffective health care. Patients with LPs suffer from pain and reduced quality of life, making it one of the biggest problems for the elderly and individuals with prolonged immobilization (Correia *et al*, 2019).

In Brazil, it is estimated that about 22% of patients admitted to internal medicine units develop pressure injuries after hospitalization (Shibata *et al*, 2021). It is emphasized that pressure injuries are classified as a potentially preventable adverse event (De Oliveira *et al*, 2022), that is, they represent a negative indicator of the quality of health services and a challenge for the multiprofessional team.

According to the *National Pressure Ulcer Advisory Panel* (NPUAP), pressure ulcers are classified into 4 stages, the first of which is characterized by intact skin with non-bleachable erythema; the second, loss of skin in its partial thickness with exposure of the dermis; the third, there is loss of skin in its total thickness; finally, in the fourth stage, the loss of the skin in its full thickness associated with tissue loss is observed (Ramalho *et al*, 2020)

Among the various types and classifications of injuries, chronic and complex wounds stand out. These are characterized as degradation of the skin layer, to a small or large extent, which presents a prolonged healing process, being longer than six weeks. In addition, they can be associated with chronic diseases such as diabetes mellitus and hypertension, vascular diseases, obesity, neoplasms, and immobility for a long time (Anvisa, 2023).

The chronicity of diseases and the development of chronic lesions end up triggering another worrying factor, the increase in the incidence of patients carrying multidrug-resistant bacteria (MDR), that is, resistant to three or more classes of antimicrobials. The occurrence of infection in the lesion is associated with prolonged healing time and, consequently, a longer hospitalization period, which generates higher costs of care and treatment, in addition to the risk of complications (Oliveira *et al*, 2019)

According to the Brazilian Society of Microbiology, about 700 thousand deaths are registered annually, caused by infections by multidrug-resistant bacteria and it is estimated that by 2050 this number will be 10 million deaths per year. Among the care sectors, the

intensive care unit (ICU) is a favorable environment for the presence of pathogens, accounting for 30% of MDR infections (Oliveira *et al*, 2019); (Anvisa, 2023).

Among the main causative agents of infection, we can highlight the gram-positive and gram-negative microorganisms, the first are predominant in the early stages of the chronic wound, with greater evidence of *S. aureus*, and the second are present in the last stages, evidenced in deeper layers of the skin, causing more important damage, especially the bacteria *Escherichia coli*, *Pseudomonas aeruginosa* and *Acinetobacter baumannii* (De Lucena *et al*, 2017).

When analyzing the incidence of microorganisms isolated in the hospital environment, gram-positive bacteria are the majority, representing 52.6% among patients with skin lesions (Arcanjo; Oliveira, 2017).

The motivation for this study arose after the care and assistance of several patients with chronic injuries, in whom wound infections and the use of antibiotic therapy were evidenced. In addition, there is a scarcity of studies in the literature on the subject, thus demonstrating the importance of knowledge of the microbiological profile for clinical and scientific practice, contributing to the appropriate targeting of planned interventions, especially in the quality of care.

The present study aims to characterize and describe the microbiological profile of patients with pressure injuries at the University Hospital of Aracaju/SE.

METHOD

This is a cross-sectional study with retrospective analysis of the results of safety cultures of 74 patients with chronic lesions, stages 3, 4 and non-classifiable, hospitalized in the units of Internal Medicine 1 and 2, Surgical Clinic 1 and 2, ICU and Onco-Hematology of the University Hospital of Aracaju/SE (HU-UFS), an institution managed by the Brazilian Company of Hospital Services (EBSERH), from January 2018 to December 2022.

The safety cultures analyzed in this study are performed on material collected via rectal swab at the time of the patient's admission to the institution. The criteria used to perform the test were established by the Hospital Infection Control Commission (CCIH), namely: patients from other hospital institutions (extra-hospital transfer) with hospitalization time equal to or greater than 05 days, hospitalization greater than 07 days in the last 03 months and patients who had a positive culture for some pathogen in the last 03 months.

The following were included in the study: people over 18 years of age, regardless of gender, place of birth, or pre-existing comorbidities, who had stage 3, 4, and/or unclassifiable pressure injuries during hospitalization. The exclusion criteria were: patients with incomplete data that make it impossible to characterize the microorganism.

In view of the aforementioned criteria, secondary data were collected from the Electronic Patient Record, and information from the CCIH monitoring spreadsheets and the institution's Skin Care Care Service (SACP) spreadsheet. The data were grouped through a specific collection instrument, produced by the authors of this study, in Microsoft Office Excel® 2016 spreadsheet format.

The simple statistical and descriptive analysis considered the association of the following information collected: medical record number, age, gender, year and sector of hospitalization, type of skin lesion, staging, diagnostic group, comorbidities, presence and result of safety culture performed by the hospital institution, and positive result of microorganisms. Pressure ulcers were grouped according to their nature (pre-existing or acquired), quantity (single or multiple lesions), location, and staging.

The research project was evaluated by the Research Ethics Committee and approved under CAAE opinion and approved by the Research Ethics Committee, under CAAE No. 70239323.3.0000.5546 and because it used only the analysis of secondary data, it was waived from the Informed Consent Form, according to Resolution No. 466/12.

RESULTS

Among the 74 patients selected for the study, 27 (36.5%) were female and 47 (63.5%) were male, 33 (44.6%) were between 18 and 59 years old, 29 (39.2%) were 60 to 79 years old, and 12 (16.2%) were 80 years old or older.

Regarding the level of education, 5 (6.8%) had completed 1st grade, 27 (36.5%) had incomplete 1st grade, 11 (14.9%) had completed 2nd grade and 3 (4.1%) had incomplete 2nd grade. 3 (4.1%) had completed higher education and 9 (12.2%) had no schooling. For the other 16 (21.6%), no teaching data were recorded.

Regarding the underlying diseases of the patients, the information was organized into diagnostic groups, being 3 (4.1%) cardiovascular diseases, 3 (4.1%) skin or subcutaneous tissue diseases, 2 (2.7%) diseases of the digestive system, 6 (8.1%) diseases of the genitourinary system, 5 (6.8%) diseases of the respiratory system, 15

(20.3%) diseases of the nervous system, 2 (2.7%) endocrine diseases, nutritional or metabolic, 32 (43.2%) infectious and parasitic diseases and 6 (8.1%) neoplasms.

Among the main comorbidities, 25 (33.8%) were hypertensive, 18 (24.3%) were diabetic, and 7 (9.5%) had some type of anemia.

Regarding the number of pressure injuries (PF) per patient, 38 (51.4%) had multiple injuries, while 36 (48.6%) had a single injury, with the body regions most affected by the wounds: sacral 59 (79.7%), trochanter 11 (14.9%), ischia 13 (17.6%) and lower limbs 18 (24.3%). The distribution of PF according to their classification was: stage 3 (24.3%), stage 4 (37.8%) and unclassifiable (37.8%). The lesions were mostly pre-existing (85.5%) and (27%) were infected.

Regarding the safety cultures performed by the hospital institution at admission, the number of patients who underwent rectal swab collection was 36 (48.6%). Of these, 18 cultures were positive for some microorganism.

Among the positive samples, 6 different microorganisms were identified. All of them were Gram-negative bacteria, identified as: *Pseudomonas aeruginosa* 4 (5.4%), *Klebsiella pneumoniae* 7 (9.5%), *Enterobacter* 2 (2.7%), *Acinetobacter baumannii* 2 (2.7%), *Serratia marcescens* 1 (1.4%) and *Burkholderia sp* 2 (2.7%).

Table 1. Characteristics of the patients included in the study. n (74). Sergipe, 2024.

Variables	(n)	%
Gender		
Female	27	36,5%
Male	47	63,5%
Age		
19-58	33	44,6%
59-78	29	39,2%
79-98	12	16,2%
Schooling		
1st Grau complete	5	6,8%
1st Grau incomplete	27	36,5%
2nd Grau Complete	11	14,9%
2nd Grau incomplete	3	4,1%
Not informed	16	21,6%
None	9	12,2%
Complete Superior	3	4,1%
Diagnostic Group		
Cardiovascular Diseases	3	4,1%
Skin or subcutaneous tissue diseases	3	4,1%
Diseases of the digestive system	2	2,7%
Genitourinary system disorders	6	8,1%
Diseases of the respiratory system	5	6,8%
Nervous system disorders	15	20,3%
Endocrine, nutritional or metabolic diseases	2	2,7%
Infectious and Parasitic Diseases	32	43,2%

Neoplasms	6	8,1%
Hypertension		
No	49	66,2%
Yes	25	33,8%
Diabetes Melitus		
No	56	75,7%
Yes	18	24,3%
Anemia		
No	67	90,5%
Yes	7	9,5%
Number of Injuries		
Multiple	38	51,4%
Unique	36	48,6%
Sacred		
No	15	20,2%
Yes	59	79,7%
Trochanter		
No	63	85,1%
Yes	11	14,9%
Ischium		
No	61	82,4%
Yes	13	17,6%
Lower limbs		
No	56	75,7%
Yes	18	24,3%
Other locations		
No	64	86,5%
Yes	10	13,5%
Staging		
3	18	24,3%
4	28	37,8%
NC	28	37,8%
Origin		
Acquired	10	14,4%
Existing	59	85,5%
Lesion infection		
No	54	73,0%
Yes	20	27,0%
Culture of vigilance		
No	38	51,4%
Yes	36	48,6%
Microorganisms		
<i>Acinetobacter baumannii</i>	2	2,7%
<i>Burkholderia sp</i>	2	2,7%
<i>Enterobacteria</i>	2	2,7%
<i>Klebsiella pneumoniae</i>	7	9,5%
<i>Pseudomonas aeruginosa</i>	4	5,4%
<i>Serratia marcescens</i>	1	1,4%
Not applicable	39	52,7%
Refusal	17	23,0%

Source: Authors.

DISCUSSION

Pressure injuries (LP) represent a complex challenge in the clinical setting, resulting from prolonged compression in specific areas of the body. This phenomenon requires a

careful analysis of factors such as age, gender, and educational level, which play crucial roles in its incidence. The uniqueness of each individual, combined with social complexities, makes up a challenging scenario.

The age factor was relevant when analyzing these results. In a survey, 35 adults over the age of 18 were analyzed, and the prevalence of patients over 50 years of age was observed, with a mean of 57.4 years. Another individual factor was the patient's gender, with a higher incidence of patients with lesions among men (74%), (Menezes *et al*, 2021)

Regarding the level of education, a cross-sectional study showed that 64% of the patients had a low level of education, characterized by incomplete elementary education (Russel; Tsang; Sutherland, 2020). This data highlights that individuals with a lower level of education may face challenges in accessing information about preventive measures and self-care, resulting in a lack of awareness about the risks and appropriate practices to avoid pressure injuries.

In addition to the aspects mentioned, wounds have a considerable impact on the individual's life, interfering with their biopsychosocial aspects. The literature shows that prolonged immobility, lack of local sensitivity, malnutrition, advanced age, and underlying medical conditions, such as diabetes, are the main risk factors associated with the development of pressure injuries (Oliveira *et al*, 2019)

In a survey conducted with 339 adults, 40 had chronic wounds, with a prevalence of 11.8%. Of these, 35% had more than one lesion. The regions most affected by wounds were the sacral, plantar region, and distal third of the leg, as confirmed in the literature (Lima *et al*, 2023). In the present study, it was found that in addition to these sites, the trochanter and ischial regions also stand out.

In addition, the main causes of hospitalization of these individuals were related to diseases of the circulatory system (37.1%), followed by diseases of the respiratory system (20.1%) and diseases of the digestive system, as found in a cohort study on factors associated with the incidence of pressure injuries in critically ill patients (Vieira; Araújo, 2018). In addition to these reasons mentioned above, this study evidenced infectious and contagious diseases, which reinforces the importance of considering not only chronic diseases as a predisposing factor for pressure ulcers, but also emerging ones, such as infectious diseases.

Another significant aspect concerns comorbidities. In a survey of quality of life and related factors in individuals with chronic wounds, it was found that 41% of patients with

pressure injuries had concomitant medical conditions, such as diabetes and hypertension. The presence of these underlying conditions often compromises blood circulation, decreases the capacity for cell regeneration, and modifies skin sensitivity, increasing the skin's vulnerability to damage resulting from prolonged pressure (Russell; Tsang; Sutherland, 2020).

The existence of multidrug-resistant microorganisms in these situations adds complexity to the clinical picture, requiring a comprehensive approach to prevention and treatment. In a study whose objective was to characterize the microbiota of complex wounds and the antimicrobial resistance of the identified microorganisms, it was observed that 58.1% of patients with complex lesions had at least one type of microorganism in the culture results (Teixeira *et al*, 2022).

Regarding the microorganisms identified, recent studies confirm the prevalence of Gram-negative pathogens, notably *Pseudomonas aeruginosa*, *Acinetobacter baumannii* and *Escherichia coli*. Recognized for their antibiotic resistance and potential to cause serious infections, the colonization of these bacteria in pressure injuries increases the risk of complications, extending the healing process and intensifying the morbidity of patients (De Oliveira *et al*, 2021).

The ability of these bacteria to cause serious infections is well recognized, and their colonization in pressure injuries emerges as a significant factor in increasing the risk of complications. The presence of *Pseudomonas aeruginosa* and *Acinetobacter baumannii* in chronic wounds can interfere with the healing process due to their antibiotic resistance, compromising tissue regeneration, increasing the risk of more persistent infections, and aggravating the injury (De Oliveira *et al*, 2021); (Brave; Teixeira; De Paula, 2023).

Although its association is more common with urinary tract infections, the presence of *Escherichia coli* in pressure lesions, especially in the sacral region, may be due to fecal contamination. Lack of proper care and hygiene can create an environment conducive to the entry of bacteria, exacerbating the situation due to *E. coli*'s remarkable ability to trigger disseminated infections. If this bacterium manages to reach deeper layers in the lesion, the risk of systemic complications, such as sepsis, increases (De Oliveira; De Paula, 2021).

The findings of this investigation highlight significant contributions, especially by highlighting the relevance of identifying the microbiota present in pressure injuries. It is important to highlight the need to understand the diversity of these microorganisms for a

more effective approach to the prevention and treatment of these lesions. ((De Oliveira; De Paula, 2021).

Thus, the results highlight the importance of preventive strategies, promoting a comprehensive approach to the care of patients with wounds, aiming not only at immediate resolution, but also at improving the biopsychosocial aspects impacted by these health conditions (Menezes et al, 2021); (Dana; Bauwan, 2015).

The pandemic period is ratified as limitations for this research, causing the spreadsheets used as a source of data not to be continuously updated, taking into account the increase in professional demands from the Hospital Infection Control Commission (CCIH) and the Skin Care Service (SACP). Periods in which the institution did not provide the necessary material to carry out safety cultures. Finally, the difficulty in releasing data from the patient's medical records by the institution to carry out the present study, even with the approval of the Research Ethics Committee.

These limitations underline the importance of conducting further studies that can overcome these challenges, enabling a more comprehensive and up-to-date analysis of the microbiological profile of patients with pressure ulcers. This approach would not only improve the quality of the data collected, but would also significantly enrich the global understanding of the topic, highlighting specific areas in need of attention and strategies for improvement.

CONCLUSION

There is an urgent need to investigate the presence of microorganisms in chronic pressure ulcers, since these agents are frequently identified in these patients, both in the short and long term.

In view of this scenario, it is essential that the multidisciplinary team devote even more careful attention to the investigation of multidrug-resistant microorganisms in pressure injuries, as pointed out in the present study.

The findings of this research provide a solid basis for the practice of health care in the treatment of wounds, evidencing the importance of more focused attention on the part of these professionals in relation to the colonization and infection of lesions. We suggest conducting similar studies to expand the understanding of microbiota patterns in wounds, covering different contexts and locations.

REFERENCES

1. ANVISA. (2023). Technical note GVIMS/GGTES: Patient safety practices in health services: Prevention of pressure injuries [Internet]. Available at: <https://www.gov.br/anvisa/pt-br/centraisdeconteudo/publicacoes/servicosdesaude/notas-tecnicas/notas-tecnicas-vigentes/nota-tecnica-gvims-ggtes-anvisa-no-05-2023-praticas-de-seguranca-do-paciente-em-servicos-de-saude-prevencao-de-lesao-por-pressao>.
2. Arcanjo, R., & Oliveira, A. (2017). Factors associated with axillary colonization by resistant microorganisms in intensive care unit patients. *Revista de Atenção à Saúde*, 15(51), 11-17.
3. Correia, A. de S. B., et al. (2019). Pressure injuries: Therapeutic measures used by nursing professionals. *Revista Brasileira de Ciências da Saúde*, 23(1), 33-42.
4. Dana, A. N., & Bauman, W. A. (2015). Bacteriology of pressure ulcers in individuals with spinal cord injury: What we know and what we should know. *The Journal of Spinal Cord Medicine*, 38(2), 147-160.
5. De Lucena, B. J. D., et al. (2023). Bacterial resistance associated with chronic wounds in adult patients. *Research, Society and Development*, 12(5), e22012541688.
6. De Oliveira, F. T., et al. (2021). Microorganisms and antimicrobial resistance in complex wounds. *Research, Society and Development*, 10(2), e10110212161.
7. De Oliveira, J. W. A., & De Paula, C. (2021). Multidrug-resistant gram-negative bacteria: A review of challenges and discussions. *Caderno de Publicações Univag*, 11.
8. De Oliveira Silva, L. L., et al. (2022). Prevalence and incidence of pressure injuries in patients admitted to medical clinics. *Revista Brasileira de Desenvolvimento*, 8(3), 16138-16149.
9. Lima, C. C., et al. (2023). Risk factors for the development of pressure injuries in intensive care unit patients. *Research, Society and Development*, 12(2), e17912240097.
10. Menezes, L. K., et al. (2021). Incidence of multidrug-resistant microorganisms in skin lesions of hospitalized patients. *Brazilian Journal of Development*, 7(3), 31839-31855.
11. Oliveira, A. C., et al. (2019). Quality of life of people with chronic wounds. *Acta Paulista de Enfermagem*, 32, 194-201.
12. Ramalho, A. O., et al. (2020). Reflections on recommendations for preventing pressure injuries during the COVID-19 pandemic. *Estima – Brazilian Journal of Enterostomal Therapy*, 18.

13. Russell, C. D., Tsang, S. T. J., & Sutherland, R. K. (2020). Outcomes, microbiology, and antimicrobial usage in pressure ulcer-related pelvic osteomyelitis: Messages for clinical practice. *Journal of Bone and Joint Infection*, 5(2), 67-75.
14. Shibata, K., et al. (2021). Skin physiology and its microbiome as factors associated with the recurrence of pressure injuries. *Biological Research for Nursing*, 23(1), 75-81.
15. Teixeira, A. de O., et al. (2022). Factors associated with the incidence of pressure injuries in critically ill patients: A cohort study. *Revista Brasileira de Enfermagem*, 75, e20210267.
16. Valente, G. L. C., Teixeira, F. L., & De Paula, G. R. (2023). Correlation between skin microbiota and its metabolome with the healing of chronic wounds. *VITTALLE – Revista de Ciências da Saúde*, 35(1), 73-87.
17. Vieira, C. P. de B., & Araújo, T. M. E. de. (2018). Prevalence and factors associated with chronic wounds in older adults in primary care. *Revista da Escola de Enfermagem da USP*, 52, e03415.