v. 2, n. 2, 2022

International Journal of Health Science

INTEGRATIVE REVIEW: MOST FOUND MICROORGANISMS IN BURNS

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Abstract: The skin is the largest organ in the human body, it covers the entire body and is our first barrier against external pathogens, breaking this barrier can cause an imbalance in body homeostasis. Burns are injuries of thermal origin that affect the physiology of the body by causing the skin to break, can cause inflammation along with its classic symptoms, tissue necrosis and promote an ideal environment for the proliferation of opportunistic microorganisms OMS recognizes burns as a serious public health problem, especially in developing countries, in Brazil there are one million burns per year of these two thousand five hundred will die. Most of these deaths are due to infections and sepsis resulting from burns. In this context, the present study aimed to evaluate the most common microorganisms found in burn victims. For this, an integrative review was prepared where the methodology was based primarily on the search for key terms (BURNS INFECTION, BACTERIOLOGY OF BURNS e BACTERIAL COLONIZATION IN BURNS) in databases (SCIELO, LILACS, PUBMED), following inclusion criteria, when this step was applied, 42 articles were pre-selected and only 7 fit all the prerequisites, being then the review sampling. For this research, works produced between 2012 and 2020 were evaluated, the elaboration of the work in all its stages from research and writing to submission were carried out in the period from December 1, 2021 to January 10, 2022. In conclusion, it was possible to observe that men continue to constitute the main group affected by burns and the following microorganisms *Pseudomonas aeruginosa, Acinetobacter Sp. Staphylococcus sp., Klebsiellapneumoniae* were the most present among bacteria and candida, not *albicans* how much *albicans* were the most present organisms among the fungi.
Keywords: Infections in burns, microorganisms in burns, bacteria in burns, fungi in burns.

INTRODUCTION

The skin is the largest organ of the human body, together with its attachments (hair and nails) form the integumentary system, it covers the entire human body and among its various functions, which help in the maintenance of body homeostasis, constitutes the first barrier of the body. organism against external pathogens. (THIODEAU and PATTON, 2015; JUNQUEIRA and CARNEIRO, 2017).

The skin is composed of three layers, the outermost layer is called the epidermis, the hypodermis is the innermost layer formed by loose connective tissue connecting the skin to internal organs and reserving energy in the form of lipids, and the middle layer called the dermis, formed by connective tissue. and serving as a link between the epi and hypodermis (JUNQUEIRA and CARNEIRO, 2017). Several causes can lead to skin discontinuity, the most frequent being chemical, physical and mechanical. Burns are injuries of thermal origin and can range from mild local redness, from total destruction of the layers of the skin to death. (MOSER et al., 2015; NORBURY et al., 2016; SCHAEFER e SZYMANSKI, 2020).

In 2008, the OMS estimated that from 200 to 300 thousand deaths occur due to burns and their aggravations, low and middle-income countries are the main affected, accumulating, according to the organization, 95% of deaths resulting from burns, generating a major problem public health in these countries (OMS. 2008; SCHAEFER and SZYMANSKI, 2020).

In Brazil, the OMS together with government institutions, has worked to reduce the gap and consolidate the epidemiological data on these diseases. Brazilian accidents are commonly in victims' homes and mostly affect children and low-income people, the main causes are scalding, electric shocks and direct contact with fire. Brazil has around 1 million

burn victims, about 100,000 seek hospital care and of these approximately 2,500 will die. (GOMES et al., 2001; CRUZ et al., 2012; MINISTÉRIO DA SAÚDE, 2018; SCHAEFER and SZYMANSKI, 2020).

From 2016 to 2017, the SUS spent approximately 49,340 million on the treatment of small, medium and large burns. According to the data indexed on the DATASUS platform for the CID-10 (burns and corrosion), in the 10-year period (2008 – 2018) 258,638 hospitalizations were found, the medical stay was 10 days, of the total 86,837 were from the Southeast region and the men were the most affected (162,699) (MINISTRY OF HEALTH, 2018).

Burns affect the metabolism and physiology of the skin, there are three main factors for classification in burn patients depth, degree (1, 2 and 3 degrees) and/or extent (rule of Wallace and Pulaski). The injuries and inflammation caused by burns make the affected area an ideal environment for reproduction and microorganisms, leading to opportunistic infections and, in more severe cases, sepsis. (OLIVEIRA and SERRA, 2011; MOSER et al., 2015; KARTAL and ANTUNEL 2018; JESCHKE, 2020).

Although there are advances in therapeutic treatments for burn patients and the mitigation of infectious processes, microorganisms and underlying infections remain one of the biggest obstacles to the recovery of burn patients, about 75% of deaths in burn patients are a direct result. infections, especially those associated with pneumonia and sepsis (OLIVEIRA and SERRA, 2011; FALEIROS 2018).

The pathophysiology of burn injuries contributes to the establishment of the sepsis process, the inflammatory state can become chronic, there is a rupture of the mechanical barrier, in addition to colonization by pathogens and the risk of local infections spreading via the lymphatic and circulatory systems (OLIVEIRA and SERRA, 2011; HENRIQUE et al., 2013; FALEIROS 2018).

METHODOLOGY

The article is categorized as a bibliographic research, in which the main objective was to discuss and answer the following guiding question: "Main microorganisms found and reported in the literature on burn patients?"; for this purpose, searches were carried out in databases, namely, Latin American and Caribbean literature on Health Sciences (LILACS), scientificelectroniclibrary online (SCIELO) and PUBMED. The keywords used in the searches were "BURNS INFECTION", "BACTERIOLOGY OF BURNS" and "BACTERIAL COLONIZATION IN BURNS".

As inclusion criteria, only works published between 2012 and 2020 were selected, only works carried out with research in humans and that were part of the scope of the theme proposed by the guiding question. With the inclusion criteria established, a first reading of the abstracts of the works was performed as a screening step to choose the articles that would compose the work sample. Initially, 42 articles were pre-selected after reading the abstracts, applying the criteria and excluding divergences and duplicates, the final sample consisted of 7 articles.

RESULTS

As can be seen in table 1, of the selected works, four were developed in Brazil, two in Argentina and one in India, among the databases that offered the most results was LILACS (4), followed by SCIELO (2) and from PUBMED was selected only 1.

The number of hospitalizations was quite high, 552 in the largest study in terms of number of hospitalizations, the smallest being 101, it must be taken into account that the studies are prospective observational, which

International Journal of Health Science ISSN 2764-0159 DOI 10.22533/at.ed.159222217019

Base / Country	Authors / Year	Kind of study	Hospitalizations	Isolated microorganisms	Bacteria	Fungi
SCIELO/ Argentina	ROSANOVA, M. T. et al. / 2014	Observational prospective	110 (65% men), average age (31,5)	128 in 84 patients	*Pseudomonas aeruginosa (52), Acinetobacter sp. (27), staphylococcus aureus (20), Bacillus sp. (9), Klebsiellapneumoniae (7), Enterococcus sp. (8), Enterobacteraglomerans (4), Stenotrophomonasmaltophilia (4), Escherichia coli (3), Serratia sp. (3), Corynebacterium sp. (2), Streptococcus pyogenes (3), outros (6)*	*Candida no albicans (19), Candidaalbicans (14), Fusarium (5), Filamentoso sem tipificação (5), Aspergillusfumigates (5), Alternaria sp. (3), Trichosporumasahi (2), Mucor (2), others (4)*
SCIELO/ Brasil	MILLAN, L. S. et al. / 2012	Observational prospective	178 (73.59% men), average age (29.2)	80 of which 66 with multidrug-resistant bacteria	*Staphylococcus sp. (48), Pseudomonas sp.(19), Acinetobacterbaumanii (11), Enterobacter sp. (10)*	*Não analisados*
LILACS/ Argentina	BASILICO, H. et al./ 2021	Cases and Controls	230 (61% men), average age (2.6)	29 out of 16 patients	Pseudomonas sp. (7), Staphylococcus sp. (7), Acinetobacterbaumanii (5), Enterobacter sp. (10), Enterococo (2), Klebsiellasp.(2), Serratia (2), Stenotrophomona (2), Providencia (1)	*Candidaalbicans (1)*
LILACS/ Brasil	ARAÚJO, A.F., TACLA, E. M./ 2020	Observational prospective	250 from children to seniors	495	*Staphylococcus sp. (130), Pseudomonas aeruginosa (102), Klebsiellapneumoniae (61), Acinetobacter sp. (57), Enterobacter sp. (27), Escherichia coli (19), Enterococcus sp. (12), Serratia sp. (5), Stenotrophomonas sp. (3), Corynebacterium sp. (2), Streptococcus sp (2), outros (12)*	*Candida sp. (58), Trichosporon sp. (4)*
LILACS/ Brasil	SODRÉ, C. N. S., et al./ 2015	Observational prospective	552	203	*Acinetobacterbaumanii (58), Pseudomonas aeruginosa (31), Enterococcus sp. (24), Staphylococcus aureus (22), Escherichia coli (14), S. epidermidis (13), Klebsiellapneumoniae (7), Proteusmirabilis (4), outros (3).*	*Candidaalbicans (3)*
LILACS/ Brasil	GRAGNANI, A., et al. / 2014	Observational prospective	101 (66.7% men), average age (33,7)	55 isolados em 159 culturas	*Staphylococcus coagulase - (18), Pseudomonas aeruginosa (13), Acinetobacter sp. (22), Klebsiellapneumoniae (3), S. aureus (2), Enterobacter sp. (2), Enterococcussp.(2), outros (3)*	*Not analyzed*
PUBMED/ Índia	SANJANA, S., et al. / 2020	Observational prospective	124	320 isolados em 102 pacientes	*Pseudomonas aeruginosa (85), Acinetobacter sp. (85), Klebsiella sp. (55), Staphylococcus aureus (36), Enterococcus sp. (15), Staphylococcus coagulase - (13), Citrobacter sp. (16), Proteusvulgaris (8), Escherichia colli (7)*	*Not analyzed*

Table 1: Selected studies and their results.

Source: Prepared by the author.

denotes follow-up for periods of time, in some of these studies it can reach years.

The number of episodes of infections with clinical isolates was also high, ranging from 55 isolates to 320 in the largest study, it should be noted that some patients have more than one episode of infection over time, as well as the culture samples can be taken from different sites in addition to the presence of infections with multiple strains.

Among fungi, the variety was not as high as that observed in bacteria, and Candida sp. most responsible for fungal infections. The studies showed a high amount of bacterial strains, which in fact was already expected, both due to the presence in the skin microbiota as well as the hospital environment that several times presents itself as co-responsible with an exuberant flora of pathogenic organisms, it can be noticed both the presence of bacteria Gram + (*S. Aureus, Enterococcus sp., Bacillus sp.)* how much Gram - (*P. Aeruginosa, Entrobacter sp., Acinetobacter sp., K. pneumoniae, E. colli*).

When observing the isolates of all studies, the specimens that appeared the most in absolute numbers were the Pseudomonas aeruginosa (283), *Acinetobacter sp.* (191) and specifically the *A. baumanii* appeared 74 times, elevated isolates of *S. aureus and K. pneumoniae* respectively 78 and 75, it is also worth mentioning the *Enterococcus sp.* (67) and *Enterobacter sp*. (49).

DISCUSSION

The data corroborate the official statistics from Brazil and the world according to the OSM, where men are the most affected by accidents involving burns, this is due to the fact that men historically tend to undergo more dangerous situations in addition to the greater presence male in occupations commonly associated with the risk of burns. Another important and well evidenced data in the literature is the presence of children, mostly in early childhood, commonly involved in domestic accidents with risk of burns. (OMS, 2008; M MINISTÉRIO DA SAÚDE, 2018; LADHANI et al., 2020).

Gram bacteria - usually appear in the first week, are quite common in patients with a severe infectious condition, are also closely associated with an increase of up to 50% in the possibility of death in patients who present them in a state of bacteremia (OLIVEIRA e SERRA, 2011; SIMÕES, 2011).

Epidemiological data for burns are usually outdated and research tends to focus on patients with medium-severe conditions in the UTI, in which the isolation of Gram – (*P. aeruginosa, Enterobacter sp., K. pneumoniae)* is more prevalent, as was also observed in the review, another worrying factor is the presence of antibiotic resistance in Gram strains - which can worsen the patient's general condition, A. Baumanii has recently been associated with cases of resistance and is very found in bacteremia (HODLE et al., 2006; OLIVEIRA and SERRA, 2011; VICKERS et al., 2017).

A *P. aeruginosa* presents a characteristic infection, starts superficially with the presence of itching and sweet odor, the risk is the deepening of the infection that can lead to sepsis. The advent of penicillin in the 20th century changed the spectrum of bacteria present in burns, before its appearance Streptococcus pyogenes was the most frequent bacterium in burn sepsis, after penicillin the *S. aureos and the P. aeruginosa* stood out as the most isolated microorganisms in burns. S. aureos, usually the most common a Gram + and is usually the first to colonize burn injuries, are usually part of the flora of up to one third of patients who have infection and are highly associated with mortality in patients with major burns (HODLE et al., 2006; OLIVEIRA e SERRA, 2011).

The decrease of bacteria as well as the use of antibiotics affecting the native

microbiota, can result in fungal colonization, fungi tend to appear two weeks after burns, Candidaalbicansa being more prevalent in these infections, other non-albicans Candidas are also usually associated with burn patients (OLIVEIRA and SERRA, 2011; SIMÕES, 2011; CHAVEZ, 2013).

CONCLUSION

The spectrum of microorganisms can vary depending on the location, epidemiology of patients, resistant species, among other factors, therefore, constant control is essential as well as the promotion of research always evaluating the most common species in different patients and situations.

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