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RESEARCH ARTICLE

PROGNOSTIC FACTORS ASSOCIATED WITH INTRA-HOSPITAL INFECTION IN ADULT BURN PATIENTS

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ABSTRACT

The experience accumulated over the last three decades in the early treatment of burns patients has radically changed the cause of death. It is now estimated that about 75% of mortality after burns is related to infections. The study aim was to identify the prognostic factors associated with intra-hospital infection in adult burn patients in Santiago de Cuba provincial plastic surgery and burn department. It was a prospective case-control and analytic study from September 2011 to August 2013 including all hospitalized patients. We found 58 cases of infection in 200 burns patients; the probability of infection was high from 46 years old and increasing the risk at 1.02 times per year from this age. 71% of our patients with infection had hypodermic burns and the flame was the most common causative agent. The risk of infection increased by 1.16 times per day of hospitalization, hypodermic burns increased the risk of infection by 2.15 fold. Age, day of hospitalization and depth of burns; especially those of the hypodermic type have been the prognostic factors of infection of greater influence in burns patient.

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INTRODUCTION

The rate of infection reported in the burn units varies considerably, because of different criteria used to make their diagnosis. In Africa, in a study conducted by Siah and his collaborators in Morocco, the intra-hospital infection was 32% in the study population (Siah et al, 2009), and another author in Mali reports that 5.7% of their cases had an infection, 33.3% of which was due to sepsis (Bagayoko, 2007). In America Latina, infection causes 50 to 60% of the deaths of burn patients (Rosanova, 2013). Morales in his work in Colombia reports an incidence of 12.9% (Morales et al., 2010). León de Havana reported that sepsis morbidity was 24.3% in the entire sample and sepsis mortality was 72% (Léon, 2010).
The experience accumulated over the last three decades in the early treatment of patients with burns has radically changed the cause of death.

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It is now estimated that about 75% of mortality after burns is related to infections, instead of osmotic shock and hypovolemia (Lessa et al.2009) .The objective of our study was to identify prognostic factors associated with intra-hospital infection in adult burns in the Provincial Burning Department of Santiago de Cuba, Cuba

MATERIALS AND METHODS

This was a prospective case-control and control study in the Provincial Burns Department of Santiago de Cuba between September 2011 and August 2013; including all hospitalized patients are 200 during the period mentioned. Data entry and analysis was performed on Excel version 8.0 and SPSS version 20 software. The main variables used to measure the response were: diagnosed intra-hospital infection (dependent variable); age, sex, geographical location of the accident site, etiological agent of burn, body superficie area of burn, Burn depth, invasive procedures, days of hospitalisation and signs of

infection (independent variables). The data were summarized through mean and standard deviation for quantitative variables and percentage for qualitative variables. To establish statistical differences between groups and explanatory variables, the Chi 2 test of independence and homogeneity was applied taking into account a significance level of 5%. For the identification and determination of the intensity of the prognostic factors associated with the infection, the multi-varied logistic regression technique was used. This one showed the odds ratio (OR) and the confidence interval (CI) equal to 95%; according to which prognostic factor was considered any explanatory variable whose OR was greater than 1 and not included in the confidence interval.

RESULTS

Table 1. Patients by age

Group	Statistical Parameters		
	Medium	S-D	IC
infected	46	20,55	40,77-51,58
Not infected	40	16,51	39,76-45,25

Table 2. Patients by depth of burns

Depth of burns	Infected		Not infected	
	Number	Percentage	Number	Percentage
Dermal A	2	3	23	16
Dermal AB	15	26	83	59
Hypodermic B	41	71	36	25
Total	58	**100**	**142**	**100**

p = 0,000

Table 3. Patient by Etiological Agent

Etiologic agent	Infected		Not infected	
	Number	Percentage	Number	Percentage
Hot liquid	8	14	50	35
Flame	50	86	85	60
Chemical agent	0	0	3	2
electricity	0	0	4	3
Total	58	100	142	100

p = 0,003

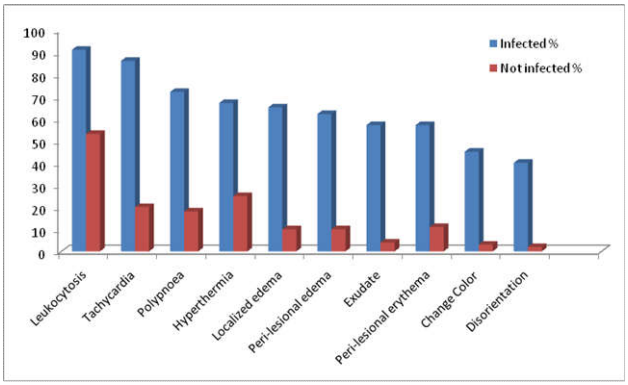

Figure 1. Signs of infection present in the burn patients studied

Table 4. Burned body area and hospital stay

Parameters	Infected		Not infected	
	Medium	S-D	Medium	S-D
Burned body area	28,29	20,83	11,37	15,41
Day of hospitalization	25,19	16,11	9,6	6,61

S-D: standard deviation

Table 5. Infection Risk Factors and Intensities

Variables	OR	CI (95%)
Age (year)	1,02	1,01; 1,46
Hypodermic B (Burn wound depth)	2,15	1,43; 3,23
Day of hospitalization	1,16	1,10; 1,22

OR = Odds Rattio
CI = confidence interval

We found 58 cases of infection in 200 patients with burns, i.e. 29% of cases; in which the sex ratio was 1.04. The probability of infection was high from 46 years on average (1.02 times per year) with a standard deviation of 20.55 and a confidence interval of 40.77 to 51.58 (Table 1). There was no relationship between the area of provenance and the probability of infection (p = 0.37). 71% of our patients with infection had hypodermic burns (Table 2). Flame was the most common etiologic agent 86% of infected patients and 60% of uninfected patients (Table 3). Central catheterization was related to infection in the first phase of our analysis (p = 0.003) although later this was not the case. Signs of major influence were 91% leukocytosis, 86% tachycardia, and 72% polypnea (Figure 1). There was a significant statistical relationship between these signs and infection with p = 0.000. An average of 28.29% burned body area was found with a standard deviation of 20.83 and no apparent relationship to infection. The hospital stay was 52.19 days with a standard deviation of 16.11. For infected patients an average body area burned of 28.29% was found with a standard deviation of 20.83 (Table 4). The risk of infection increased by 1.16 times per day of hospitalization. The presence of hypodermic burns increased the risk of infection by 2.15 times more (Table 5).

DISCUSSION

Internationally, over the past decade, there has been a significant increase in the incidence of bacteraemia, sepsis and septic shock, which is one of the leading causes of hospital mortality (Contreras et al, 2009). Differences in susceptibility to infection between the sexes possibly related to gonad, hypothalamic and pituitary hormones have been demonstrated, showing that a decrease in the immune response is increased with testosterone; conversely, the increase in estrogens and prolactin levels reinforces this response (Vargas et al, 2009).
In this study, 58 (29%) patients presented infections, and there was a similar behaviour between the both sexes, although there was a slight predominance of women compared to men (1.04: 1). Similarly, a greater number of infected female patients were observed (55%) for a p = 0.451, that does not reveal any sex relation with the infection in this study. Our results are similar to data presented by Ulloa in 2012, after a similar study in Chile, with a distribution of 48.6% of the male sex (Ulloa et al 2012), as well as the work of Samaké and his collaborators in Mali , the female sex was 61.8% against 38.2% of the opposite sex (Samaké et al.2013). ForVargas and his collaborators in Costa Rica in 2009, there was no benefit in associating one or the other sex with intrahospital infection as in this work (Vargas et al., 2009).

Rosanova and his collaborators found the male sex presented a higher risk of infection, with a distribution of 66% (Rosanova, 2013). Similarly, this behaviour is observed in Colombia, where the burn relationship among men: women was 2.4: 1 in 2010, according to Morales and collaborator's data. Also Robson and Berrocal agree with these results, showing a predominance of men among burn patients from 1.44: 1 to 2.55: 1 (Morales et al, 2010). Septic complications in burns patients occur more frequently in the extreme ages of life; in children because of the weak development of their immune system fundamentally and in adults towards the senior age because of the decrease of body defensive mechanisms (Duran, 2009). It was observed in this study that the probability of infection of these patients is higher from 46 years old with an average of years of 20.55 and confidence of

interval of 40.77-51.58; data that would coincide with those of Manach if we take account the upper limit (66 years). This author reveals that adulthood, especially after the age of 60; it is most common to develop infectious complications, due to immunological conditions at this age (Manach, 2007). In Colombia and the United States of America, the highest incidence of this complication is reported in patients with a predominance of more than 60 years in 23.2% of cases (Malagon and Hernandez, 2010), (Hugonnet et al, 2009).

According to Morales et al in 2010 in Colombia, the age group concerned was between 15 and 49 years old with 38.9% of cases in a total of 255 patients followed by the group (Morales et al. 2010). In Mali, according to Samaké, the most affected age group was from 15-24 age group (Samaké et al.2013) included in the previous range. However, according to Ulloa in 2012 as other authors, they have found that the age of patients does not influence the risk of infection (Ulloa et al, 2012) .Rosanova has a result similar to this one with p = 0.07 (Rosanova, 2013). In our study, there was no association between the area of origin and the probability of having an infection. We cannot compare it to other studies by lack of study found in the literature. Although it has a p = 0.003 showing an associative influence of the cause of the burn with the infection, it cannot be ruled out that this relationship is not influenced by other factors. Rosanova et al in 2013 in Argentina, did not find an association between etiologic agent and infection with p = 0.216 according to their study (Rosanova, 2013).

The depth of the burns is related to a greater tendency to infection, which could be explained by the greater number of invasive surgical procedures that are required for these cases, and with a longer period of waiting for stabilization of view of the necessary surgery. It should be noted that the depth of burns statistically has an excellent relationship with infection where at greater depth a greater possibility of infection for a p = 0.000. In Morales et al work's in 2010 (Morales et al.2010) they performed in Colombia, the frequency of infections in deep second degree burns was higher (53.2%). In Chile, Ulloa in 2012 reported a 77.5% of infection for patients of similar depth (Ulloa et al, 2012). By other way, in a study conducted in Argentina, the presence of an infection was significantly associated with 43% of hypodermic burns versus only 4% without infection (Rosanova, 2013).

In 2013 in Rosanova's work in Argentina, the presence of catheters was an independent risk factor for infection at 71% (Rosanova, 2013). In this study there was an influence on the onset of infection in patients burned in uni-varied analysis in the first phase of analysis with a value of p = 0.003. This value is so much in favour of the central catheterization in which 62% of the infected patients had this condition against 15% of non-infected of the same group. The infection of the burn wound is difficult to interpret, so any changes that may reflect the infection should be monitored. It can be noted that the most influential signs were leukocytosis in 91% of the infected subjects compared to 53% of uninfected subjects and thus respectively the percentages of infected versus uninfected subjects with tachycardia (86/20) and polypnea (72/12). . In any case, from a statistical point of view, there was a great relationship of signs with the infection with p = 0.000. The signs of infection observed may be nonspecific and most of them are present in infected and uninfected patients, even if it will be in different degrees.

This may mean that they are not sufficient for the diagnosis of infections because, as it's known, these signs are also present in entities such as non-infectious or traumatic systemic inflammatory response syndrome. Burn patients who had most day of hospitalisation get infection on 2.6 (mean ratio) times higher than patients who did not. These results are similar to those of Vargas, where the average length of stay in infected patients was 3.8 times higher than in uninfected patients (Vargas et al. 2009). The incidence of infection in burns patients varies greatly from some units to others, and is clearly associated with the percentage of body surface area burned, as well as in burns patients when the injury affect more than 30-40% of body superficies area, infection is the norm (Mc Manus et al, 1981). Others authors report as more as large is the body area affected there is a greater the possibility of infection (Morales et al.2010).

This variable had no influence on the presentation of the infection in this study although it is widely described as a major factor associated with the occurrence of the infection.
The result obtained in this work is similar to that of Rosanova in 2013 in Argentina, although with an average of 34% within the range described above (Rosanova, 2013). Without doubt, the age, the depth of the burns and the number of days of hospitalisation are factors associated with the appearance of the infection in the burn patient; however, information on the extent of this influence is not yet available. We found that the risk of infection increases by 1.02 times by year from about 46 years old, while the risk of infection caused by hospital stay increases by 1.16 times per day of admission. Also, the presence of hypodermic burns generates a risk of infection at 2.15 times higher for each percentage (1%) increased in hypodermic burn.

Conclusion

Age, days of hospitalisation and depth of burns, particularly those of hypodermic type B, are the prognostic factors that have the greatest influence on the development of burn infection at the provincial department of plastic surgery and burns at the General "Dr. Juan Bruno Zayas» teaching hospital of Santiago de Cuba, Cuba.

Conflict of interest: the authors do not declare a conflict of interest

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