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Original Article

Importance of early debridement and sterilization in burn: Inspection of infections observed in our burn unit

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Abstract

Aim: In this study, we aimed to investigate the infections that developed in our burn-unit between 2014-2018 and to retrospectively evaluate the patients who have developed in all wound cultures.

Materials and Methods: The files of the patients who received inpatient treatment between 2014 and 2018 were evaluated at the Burn Treatment Unit. Nineteen patients who were reproductive in their culture were included in the study. Patients whose files could not be accessed or no records were excluded from the study.

Results: The mean age of 19 patients with recorded reproduction by our infection control committee was 15.16 ± 14.63 years and 63.2% were male. All 19 patients have had reproduction. The most common causative agent was *Staphylococcus aureus*. Reproduction was not detected in any of the blood cultures. When we examined the burn scores of the patients 3 (15.8%) patients had first degree burn, 13 (68.4%) patients had second degree burn, and 3 (15.8%) patients had third degree burn. When we examined the types of Burns, 2 patients had electrical burns (10.5%), 16 patients had hot water burns (84.2%) and 1 patient had hot oil burns (5.3%)

Conclusion: As a result of our study, we found the rate of infection, especially the wound infections, in our burn unit to be lower in other (blood, urine and catheter) infections. We consider early surgical excision of patients hospitalized in our department and extreme sensitivity to environmental sterilization and environmental cleanliness of our department may be the cause.

Keywords: Burn; infection; reproduction type

INTRODUCTION

Burn has the risk of developing many complications, and therefore, it is a difficult-to-manage trauma for both patients and physicians. One of the most important functions of the skin is to protect against microorganisms of the external environment. When a burn injury occurs, the integrity of the skin disappears. Thereby, this situation facilitates the penetration of microorganisms from the injury. Moreover, necrotic tissues caused by burns facilitate the reproduction of microorganisms. Burn injuries have a suppressive effect on the immune system. Therefore, the tendency to develop endogenous and exogenous infections increases in such patients. In the event of infection development, this causes a prolonged hospital stay, and more importantly, the risk of mortality increases (1).

Depending on the type and size of the burn, the number and depth of the colonized microorganism may vary. This is very important in terms of the infection that may occur later. Gram-positive bacteria, especially Staphylococcus, colonize on the burn surface within the first 48 hours (2). Gram-negative microorganisms are important as they have high mobility, ability to develop resistance to many antibiotics, and ability to penetrate and reproduce under eschar due to some enzymes, such as collagenase, protease, lipase and elastase (3).

Specific site infections, such as blood circulation system infection, pneumonia, burn infection and urinary tract infection, are the most severe types of infections in burn patients. Surveillance studies are carried out for these infection foci. Surveillance monitoring and taking infection control measures are important in order to reduce the risk of infection development, especially in patients with a large burn area, and to prevent the transmission of responsible microorganisms to other patients (4).

The aim of our study was to examine the infections that developed in patients who were hospitalized in our burn unit between 2014 and 2018, to evaluate patients with

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growth in wound cultures, and to contribute to the literature by emphasizing the importance of early debridement of necrotic tissues in burn wounds and sterilization.

MATERIALS and METHODS

Archive files of patients who received inpatient treatment in the burn treatment unit between January 2014 and March 2018 were evaluated after obtaining the 117 numbered and 07/06/2018 dated ethical committee decision. In the study, 19 patients with growth in their culture and infection diagnosis were included. Patients whose files could not be accessed or had no record were excluded.

Wound, blood and urine cultures are routinely taken right after the hospitalization after admission to the emergency department of our hospital, and from patients whose transport to our clinic was accepted following hospitalization in an outer center. As a patient arrived at our unit, the dressing was renewed and the new culture was taken immediately. Blood and urine cultures were collected once a week from burn patients who were under follow-up in General Intensive Care and who cannot be administered to the burn unit. Wound cultures were taken during the dressing periods on the first day and after. In the patient group other than intensive care, if there was a decline in the clinical course of the patient (decrease in effort capacity, temperament changes, incompatibility, loss of appetite, etc.) or if the laboratory values referred (thrombocytopenia, leukopenia, leukocytosis, etc.), the indication for taking culture was established by the infection committee and our pediatrician. Advanced debridement and dressings of our patients are performed under sedoanalgesia after complete sterilization in operating room conditions. Alloplastic skin equivalents are performed to our patients when necessary and in the time deemed appropriate. Wound swab cultures after dressing of patients included in the study were evaluated.

Statistical analysis

All statistical analyses were performed with SPSS v17.0 for Windows software package. In the evaluation of the data, in addition to descriptive statistical methods (mean, standard deviation, median, interquartile width), Pearson's Chi-square test was used to compare inter-parameters qualitative data. The results were evaluated with a significance level of $p<0.05$ and a confidence interval of 95%.

RESULTS

In this study, a total of 19 patients who had growth in their cultures, who were recorded by our infection control committee and received inpatient treatment between January 2014 and March 2018 were analyzed retrospectively. The mean age of patients was 15.16 ± 14.63 and 63.2% were males. Reproduction was observed in nineteen patients. The most common factor was *Staphylococcus aureus*. Other factors were shown in Table 1. No growth was detected in any of the blood cultures. The factors isolated in the wound, catheter, respiratory and urine cultures were summarized in Table 1.

The antibiotic type administered to patients with growth positive was given in Table 2.

Table 1. Distribution of active microorganisms

Microorganism	n	%	Place of Reproduction
Acinetobacter baumannii	2	10.5	Urinary Tract Respiratory Tract
Acinetobacter spp	1	5.3	Burn wound
Enterococcus feacalis	1	5.3	Burn wound
Klebsiella Pneumoniae	1	5.3	Burn wound
MRStaphylococcus haemolyticus	2	10.5	2 Burn wounds
MR Staphylococcus hominins	1	5.3	Burn wound
Pseudomonas aeruginosa	2	10.5	2 Burn wounds
Staphylococcus aureus	6	31.6	1 catheter drain site 5 Burn wounds
Staphylococcus epidermidis	1	5.3	Burn wound
Staphylococcus haemolyticus	2	10.5	1 catheter drain site 1 Burn wound
Total	19	100	19 Place of Reproduction

Values were presented as numbers and percent (%). P value<0.05 was statistically significant. SD: standard deviation

Table 2. Antibiotics used in the treatment

Antibiotic Type	n	%
Daptomycin	2	10.5
Meropenem	3	15.8
Meropenem+Linezolid	1	5.3
Ciprofloxacin + Amoxicillin-Clavulanic acid	1	5.3
Ciprofloxacin + Amoxicillin-Clavulanic acid	1	5.3
Clindamycin + Ceftriaxone	1	5.3
Ceftriaxone	2	10.5
Colystimethate sodium + amikacin	1	5.3
Linezolid	2	10.5
Cefazolin sodium + Ceftriaxone + Amikacin	1	5.3
Ceftriaxone + imipenem	1	5.3
sulbactam / cefoperazone	1	5.3
Teicoplanin + imipenem	1	5.3
Vancomycin + ceftriaxone	1	5.3
Total	19	100

When we analyzed the degree of burns of patients, the number of patients with 1st-degree burn was 3 (15.8%), the number of patients with 2nd-degree burn was 13 (68.4%), and the number of 3rd-degree burn patients was 3 (15.8%) (Table 3). The comparison of culture results in these 3 patient groups is summarized in Table 4. When we examined the types of burns, 2 patients had electrical burns (10.5%), 16 patients had hot water burns (84.2%), and 1 patient had hot oil burns (5.3%). Hot water burn was the most common burn type (Table 5).

Table 3. Degrees of burn

Degree of Burn	n	%
1	3	15.8
2	13	68.4
3	3	15.8
Total	19	100

Table 4. Comparison of the factors by the degree of burn

Reproducing Factor	Degree of Burn			Total
	1st Degree	2nd Degree	3rd Degree	
Acinetobacter baumannii	1	0	1	2
Acinetobacter spp	0	1	0	1
Enteroccus Feacalis	1	0	0	1
Klebsiella Pneumoniae	1	0	0	1
MR Staphylococcus Haemolyticus	0	2	0	2
MR Staphylococcus Hominis	0	1	0	1
Pseudomonas Aeruginosa	0	1	1	2
Staphylococcus Aureus	0	5	1	6
Staphylococcus Epidermidis	0	1	0	1
Staphylococcus Haemolyticus	0	2	0	2
Total	3	13	3	19

Table 5. Types of Burns

Type of Burn	n	%
Electricity	2	10.5
Hot Water	16	84.2
Hot Oil	1	5.3
Total	19	100

DISCUSSION

In our study, *Staphylococcus aureus* was found to be the most frequently isolated infection factor at the wound site, in addition to gram-negative factors that rarely grow in a burn wound, such as *Pseudomonas aeruginosa, Acinetobacter spp*, and *Enterococcus feacalis*. It is similar to the most frequently isolated factors in studies conducted in the world and Turkey (4). Bacteria quickly colonize on open skin wounds after a burn injury. Microorganisms in the burn wound may be composed of microorganisms of the skin, gastrointestinal and respiratory flora of the patient, moreover, it can also be caused by contaminated external environmental surfaces, water, air, and dirty hands of health workers. Immediately after injury, gram-positive bacteria colonize on the patient's burn wound (5).

In the first few days after the injury, gram-negative bacteria from the patient's gastrointestinal flora also quickly colonize on the burn wound surface. In wound colonization, fungi usually arise due to the use of broad-spectrum antibiotic therapy (5).

In our study, approximately 32% of the burn wound infection factors were composed of *Staphylococcus aureus*. There was no growth in any of the blood cultures. *Pseudomonas aeruginosa* infection, which is common in some centers and is caused by the patient's gastrointestinal flora or environmental factors, was observed to be low as 10% in our study. We consider that this difference is important in terms of showing that the microbial colonization of each burn unit is idiocretic. We believe that the detection of this pattern may have positive results on morbidity and mortality by allowing early management in terms of empirical antibiotic use before microbiological culture results. In our study, reproduction occurred in 19 (5.01%) of 379 patients who were hospitalized and followed-up. We think that the reason for the low rate of these infections is due to the good control of infection in our unit, providing early treatment and rehabilitation of patients.

Mortality increases as the degree and percentage of burns increase. Gunay et al. (6) have grouped the cases as <20% minor burns (60%), > 20% major burns (40%) according to the burned surface area and have stated that mortality increased significantly in major burns. In some studies, it has been reported that mortality is 51%, 70.6% and 82.6% in burns with a burn surface area of 70-79%, 80-89% and >90% (7-9). In the study conducted by Behçet et al. (10), the burn surface area was ≤10% in 50.2% of the patients. Mortality was higher in patients with high burn percentage and depth. In this study, 68.4% of those who developed infections were composed of patients with 2nd-degree burns. There was a positive correlation between the burn degree and burn percentage and infection. In our study, it was thought that the majority of patients who developed infection were patients with a 2nd-degree burn due to the low number of 3rd-degree burns in our hospital. More than one factor was detected in 38% of patients with reproduction on wound sites. Considering the burn type of patients with reproduction, it was determined that 84% of them had scalding burns due to boiling water exposure, as correlated with the highness of the scalding rate among all burn patients. The mean age of 19 patients with growth in their culture was 15 and 63.2% were males. In studies conducted in our country, the difference between the mean age and gender was found to be similar (4,10). In our region, it is thought that more burns are observed

in children, especially since the child population density is high and it is a population opens to chemical and physical trauma.

CONCLUSION

As a result of our study, we found the rate of infection in our burn unit to be lower in other (blood, urine, and catheter) regions, especially the wound infection. We think that the reason for this is that all patients hospitalized in our clinic have early surgical debridement and that our clinic pays attention to the infection control rules.

Competing interests: The authors declare that they have no competing interest.

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