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Predictive Role of Bacteriology in the Outcome of Pediatric Burn Injuries

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Abstract

Aim: To study the outcome of pediatric burn injuries in relation to bacteriology of the burn wound. **Methodology:**A retrospective study on microbiological data of 14 pediatric patients admitted with burns in the Department of Plastic and Reconstructive Surgery was conducted over a period of 3 years (2020 -2022). Thepatients were evaluated for age, sex, burn etiology, burned body surface area (BSA), the presence of inhalationinjury, sepsis, positive cultures, the micro-organisms cultured samples, and septic focus. A total of 38 swabs were cultured and antibiotic sensitivities to the isolated organisms were determined. **Results:**The total number of pediatricpatients studied were 14.Among these patients,05-09 years (62.81%), 10 – 12 years (37.19%) age groups were reported. 10 patients were male children (71.43%) and 4patients were female children (28.57%). The wound culture report of eight patients showed the highest bacterial counts of Staphylococcus aureus. Four patients showed Pseudomonas aeruginosa and two patients had Klebsiella pneumoniae in their wound. **Conclusion:** Pediatric burn patients are at greater riskfor infection and sepsis secondary to the injury and resultantimmunosuppression.Burn wound management requires the study ofchanging bacterial flora and the antibiotic sensitivity reports.

Key words: Pediatric burns, Bacteriology, Burn wound sepsis.

Introduction: Burn injuries are a leading cause of death and disability among children globally[1-4]. (The World Health Organization (WHO) estimates that burn injuries account for 180,000 deaths annually and are the fifth most common cause of non-fatal childhood injuries[5]. The burden of child mortality due to burn injuries reflects the inequity of risk factors and care capacity, as rates of child deaths from burns are over seven times higher in low- and middle-income countries when compared to high-income countries[5].

The maincause of morbidity and mortality in children with major burnsis due to burn wound sepsis. The correctmethod of pus sampling technique plays a major role in establishing the type of wound infection. Quantitative bacteriology is a better option than surface swabbing in patientswith sepsis.

Methods:A retrospective study on microbiological data of 14 paediatric patients admitted with burns in the Department of Plastic and Reconstructive Surgery was conducted over a period of 3 years (2020 -2022). Among these patients 62.81% were05-09 years and 37.19% were10 – 12 years of age. 10 patients were male children (71.43%) and 4patients were female children (28.57%). The most common age group affected was 05-09 years (62.81%), followed by the age group 10 – 12 years (37.19%). Tenpatients were male children (71.43 %) and four patientswere female children (28.57%). Eight patients had 20% to 30% superficial burns, three patients had 40% burns of varying depth, two patients had 10% to 20% scalds and one patient had electrical burns [Table 1, Figure 1,Figure 2].

The wounds wereswabbedat the time of admission, on the third orfourth day, twice weekly according to clinical signsand threedays before any proposed grafting procedure.A total of 38 swabs were cultured and antibiotic sensitivities to the isolated organisms were determined.

The care of the burns included the following steps: cleaning of the wound with normal saline and excision, escharotomy, occlusive dressing with chlorhexidine-soaked gauze, and sterile bandage. The dressings were changed every two days. Skin grafting was done for non-healing wounds.

Results: Highest bacterial counts of Staphylococcus aureus were isolated in eight patients.Two of these patients who had 40% burns with highStaphylococcus aureus counts succumbed due to sepsis. Pseudomonas aeruginosa was isolated in four patients and Klebsiella pneumoniae was isolated in two patients. One patient with Pseudomonas aeruginosa had skin graft rejection.

S. aureus was sensitive to Sparfloxacin (90.4%), Cefpirome (70.2%), Piperacillin and Tazobactam (88.4%), Netilmicin (65.6%), Imipenem (71%) and Erythromycin (48.5%).

Pseudomonas was sensitive to Cefoperazone and Sulbactam (73.9%), Piperacillin and Tazobactam (68.5%), Amikacin (70.4%), Azithromycin (54.6%), Meropenem (49.5%) and Gatifloxacin (61.4%). Klebsiella was sensitive to Gatifloxacin (73.6%), Cefoperazone and Sulbactam (79.4%), Piperacillin and Tazobactam (76.7%), Meropenem (67.5%), Amikacin (54.4%) and Azithromycin (58.9%).

Discussion: Burninjury destroys the skin barrier and allows microbial colonization of the wounds. Most burns in children are caused by carelessness and appear to be preventable[6]. Severe thermal injury induces an immunosuppressed state that predisposes children to subsequent sepsis and multiple organ failure, which are the major causes of morbidity and mortality in pediatric burn patients[7].The immunological response to thermal injury is a depression in both the first and the second lines of defence. The epidermis of the skin becomes damaged, allowing microbial invasion as the coagulated skin and exudate of the patient create an ideal environment for microbial growth[8].The type and number of microorganisms on and in the injured tissue influence wound healing, the frequency of invasive infection and the clinical characteristics of such infections as wellas the risk of dissemination[9]. Thus, knowledge of the burn wound microbial flora and the currentantibiotic sensitivities at any time is important for the clinician treating burn sepsis.

When patients are brought to the hospital with exposed burntareas, the initial swabs reveal no growth. After applying a closed dressing, repeat swabs fromthe same patient reveal presence of microorganisms. Admittedly, burn biopsy is a better tool todetermine microbiological colonization and invasion and for quantitative evaluation. It is alsoless fallacious[10].

In this study, we found that the most frequent isolates were Staphylococcus aureusfollowed byPseudomonas aeruginosa andKlebsiella pneumoniae. Compared to several earlier reports on burn wound colonization andinvasive infection, one of the most striking differences is the frequency of Klebsiella in thisstudy, which is contrary to findings in other studies in which Klebsiella formed a small numberof total isolates.

Conclusion: Pediatric burn patients are at greater riskfor infection and sepsis secondary to the injury and resultantimmunosuppression. The burn wound morphology plays a major role in predicting the outcome of pediatric burn injuries. Quantitative bacteriology is essential to identify and manage sepsis.

Ethical Clearance: Ethical clearance was obtained from the institutional ethical committee.

Conflict of Interest: Nil

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Table 1. Observation of demographic and other evaluation parameters of patients

Parameters		Frequency
Age group	05 – 09 years	62.81 %
	10 – 12 years	37.19 %
Gender	Male	71.43 %
	Female	28.57 %
Scalds	10% -20 %	2 patients
Superficial burns	20 % - 30 %	8 patients
Deep burns	40 %	3 patients
Electrical burns	40 %	1 patient
Micro-organisms cultured	Staphylococcus aureus	8 patients
	Pseudomonas aeruginosa	4 patients
	Klebsiella pneumoniae	2 patients
Sensitive Drugs	**Staphylococcus aureus**	
	Sparfloxacin	90.4%
	Cefpirome	70.2 %
	Piperacillin and Tazobactam	88.4 %
	Netilmicin	65.6 %
	Imipenem	71.0 %
	Erythromycin	48.5 %
	Pseudomonas aeruginosa	
	Cefoperazone and Sulbactam	73.9 %
	Piperacillin andTazobactam	68.5 %
	Amikacin	70.4 %
	Azithromycin	54.6 %
	Meropenem	49.5 %
	Gatifloxacin	61.4 %
	Klebsiella pneumoniae	
	Gatifloxacin	73.6 %
	Cefoperazone and Sulbactam	79.4 %
	Piperacillin and Tazobactam	76.7 %
	Meropenem	67.5 %
	Amikacin	54.4 %
	Azithromycin	58.9 %

Figure 1. A child with superficial burns due to scalds

Figure 2. A child with electrical burns with eschar