Bacteriological profiles in burn patients within first twenty-four hours of injury

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Abstract

Background: Infection and sepsis are the main confounders of mortality and morbidity of burn injury. Burn wound surface thought to be sterile for few hours immediately after injury. Eventually microorganisms from skin surface area or hospital environment colonize the wound. The aim of this study is to observe the bacteria profile (i.e. form the first day of burn) and their subsequent changes.

Materials and Methods: Fifty patients attending Burn emergency care Department with history of burn injury within 24hours was enrolled in this study. To observe the microbial profile at the site, three swabs (1st on 0 day i.e. the day of admission, 2nd after 24-48hours, and 3rd after 72-96 hours) were collected from the burn wound. Once collected, they were immediately transferred to a sterile test tube and transported to the Department of Microbiology for further processing and identification of bacterial flora.

Results: Eighty percent of samples collected on day 0 were observed sterile. *Staphylococcus aureus* found to be commonest isolate among the isolates in the day 0 in comparison to gram-negative bacteria in 2nd and 3rd sample.

Discussion and conclusion: Burn wound remains sterile for first few hours after injury. It subsequently colonized with the multidrug resistant microorganisms transmitted from the hospital environment or from the hospitalized patients in the same set up. Prompt effective treatment and regular hospital surveillance is necessary to reduce the infection of burn wound.

Key words: Burn wound, Sterile, Bacterial flora

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Introduction

Human skin is the largest anatomical organ serving a plethora of physiologic functions that include proprioception, thermoregulation, body fluid homeostasis and protection from external agents etc. Conditions lead to loss of skin integrity; especially burns are usually met with numerous consequences. Burn wounds represent a state of immense immunocompromised and heightened susceptibility to infections. The disruption of the epidermal barrier and down regulation of both local and systemic immune response makes burn patients an ideal breeding ground for infection.[1] The microbes implicated in such patients are endogenous (derived from skin, gastrointestinal and respiratory flora) or exogenous (transferred from the external environment or from the hands of health care workers).[2,3] The microorganisms acquired from nosocomial settings are more resistant to antimicrobials than those arising from patient's flora. Burn wounds are classified into various degrees depending upon the layers and surface area of the skin involved. Though the patients are sterile immediately following thermal injury, the microbial flora eventually colonizes the wound and establishes an infection. The knowledge of indigenous flora helps in predicting and preventing an impending infection. Many literatures were published exhibiting the change in the pattern of bacterial flora in the burn injury in relation to different days of hospital stay, but none of them had emphasized their pattern immediately after thermal injury. This study was designed to ascertain the microbial etiology of acute burn injury right from first 24 hours and subsequent changes in the bacterial flora.

Materials and Methods

This prospective study was conducted in Department of Microbiology and Department of Burns, Plastic and Maxillofacial Surgery in a tertiary care hospital from March 2013 to September 2013. Fifty patients admitted to burn emergency care with a history of burn injury within 24hours of reporting were enrolled in the study. The study is aimed to determine the bacteriological flora on 'day 0' i.e. day of admission and subsequent changes in the bacterial flora at the wound site. A detailed data including the age, gender, cause/mode of burns, distribution, and total body surface area (TBSA) was collected. Total 3 swabs from the injury area were collected from each patient on three occasions i.e. first sample at the time of admission (day 0), 2nd sample after 24-48 hours of admission to the ward (day 1-2) and 3rd sample after 72-96 hours of admission (day 3-4). These are the days when routine dressings of burn wounds are carried out in routine. The swabs were immediately transferred to the microbiological laboratory for further processing.Each

swab was cultured on blood agar and Mac Conkey agar plate and isolates were identified by various biochemical and enzymatic tests. Bacterial colonies were identified as per standard microbiological techniques.

Results

A total of 50 patients were included in this study. Seventeen out of fifty patients (34%) suffered 35-50% TBSA burn injury (Table 1). There was no growth in majority of the samples on the first sample i.e. 'day 0' irrespective of the percentage of TBSA (Table 1). Majority of burn injury were due to thermal burns (44%), followed by scald (24%), electric burns (18%), chemical burns (8%) and flash burn (6%)[Table 1]. However, the growth on 0day was found almost same irrespective of the type of burn injury. Majority of burn injury were found in the perineum, groin and axilla areas. Maximum number of burn injury affecting perineum showed growth on 0day in comparison to the other areas [Table 1]. There was no case of upper airways burn injury. But male patients were manifested more bacterial growth on day 0 than females [Table 2]. During the study period, a total of sixty-three different isolates were obtained from the samples processed on 'day 0', 'day 1-2' and on 'day 3-4'. Only 7 isolates (11.11%) were from the first samples in comparison to 44 (69.84%) and 12 (19%) isolates 2nd and 3rd samples respectively [Table 3]. Sample collected from 'day 0' exhibited *Staphylococcus aureus* to be the most common organism in 14%. Eighty percent (40/50) of samples collected on 'day 0'were found sterile. Gram-negative bacilli were predominantly isolated in the 2nd samples. Majority (13/27) samples were showed insignificant growth in the 3rd sample. All the patients were treated with the standard protocol depending on the percentage of TBSA of burn injury and changed to other antibiotics depending on the antibiotic susceptibility testing result. Seven out of 15 patients having burn injury more than 50 percent develop septicaemia due to *Acinetobacter spp.* and *Psedomonas aeruginosa*. All of them were resistant to all antibiotics except Colistin.

Table 1: Potential risk factors for acquisition of nosocomial infections in burn patients

Factors	Infected patient on 0day	non-infected patient on 0day
TBSA		
0-15%	2	9
>15%-35%	0	7
>35%-50%	4	13
>50%	4	11
Age in yrs	26.2	28.6
Burn type		
Thermal	2	20
Scald	3	9
Electricity	2	7
Chemical	2	2
Flash	1	2
Site of burn		
Axilla	3	5
Perineum	5	10
Groin	1	18
Others	1	7
Body Parts		
Mobile	4	10
Immobile	6	28

Table 2: Age-wise distribution of burn patients

Age group	Males (n=27)	Females (n=23)
0-5yr	3 (11.11%)	3 (13.04%)
5-13yr	1 (3.70%)	5 (21.75%)
>13-30yr	14 (51.85%)	10 (43.47%)
>30yr	9 (33.33%)	5 (21.73%)

Table 3: Bacteriological profile isolated on different days of burn injury

Isolates	0 day/1st sample (n=50)	After 24-48 hours/2nd sample (n=50)	After 72-96 hours/3rd sample (n=27)
No growth	40 (80%)	7 (13.7%)	0
Staphylococcus aureus	7 (14%)	7 (13.7%)	0
Acinetobacter spp.	0	13 (25.4%)	3 (6%)
Proteus spp	0	7 (13.7%)	0
Klebsiella pneumoniae	0	9 (17.6%)	4 (8%)
Pseudomonas aeruginosa	0	8 (15.6%)	5 (10%)
Insignificant / mixed growth	2 (4%)	0	13 (26%)
Aerobic spore bearers	1 (2%)	0	2 (4%)

Discussion

Burn wound infection and the subsequent systemic infections are the principal determinants of morbidity, mortality, and prognosis of patients. Management of burn patients follow a multi-faceted approach. Fluid resuscitation, reconstruction of damaged skin including escharatomy, fasciotomy, graft excision and closure of wound are essential steps in this regard.[4,5] Prevention of infection in burn patients should receive strict attention. Factors like age of the patient, the extent of body surface area and the microbial flora will decide the prognosis.[6,7] As the flora can be endogenous or exogenous, the bacterial profile within first 24 hours may influence the outcome. This study demonstrated that, 80% of the collected showed no growth on 'day 0 'in comparison to 14% on 'day 1-2', respectively. Irrespective of TBSA, majority of samples on 'day 0' showed no growth; which signifies that the burn wound remains sterile for first few hours after injury. Interventions such as dressing with an antimicrobial agents, topical application of antibacterial compounds and prompt excision and skin grafting of the burn wound should be advised early to minimize the infection rate in successive days of hospital stay.[8] The eschar at the burn site provides optimal conditions for bacterial growth and proliferation.[9] The distribution of organisms changes over time in the individual patient.[10,11]The dominant flora of burn wounds during hospitalization changes from gram-positive bacteria such as *Staphylococcus aureus* to various gram negative bacterias.[12,13] Patients with prolonged hospitalization may harbour nosocomial multidrug resistant pathogens in their wounds.[12,13] Our study result depicts similar kind result with isolation of *Staphylococcus aureus* on 'day 0' sample followed by *Acinetobacter spp., Ps. aeruginosa, Kleb.pneumoniae*, and *Proteus spp.* etc. on subsequent days. *Acinetobacter spp.* accounting for the most commonly isolated bacteria from burn wound sepsis followed by other gram negative bacill ion 'day 1-2'. This indirectly highlights the increased chances of acquisition of nosocomial pathogens with increased duration of hospital stay. Nosocomial transmission of microorganisms to the burn wound has been well documented in various literatures, which may be the reason of infections in the above cases. Strict isolation techniques and infection control surveillance programs in the burn wards should be routinely carried out to minimize the occurrence of such burn wound infections.

Conclusion

The study highlights the fact that burn wound remains sterile within first 24 hours. This is independent of the degree of burn injury or the surface area of affection. Also the likelihood of increase in frequency of *Acinetobacter spp*, *Pseudomonas aeruginosa* infection increases with the duration of patients stay in the hospital meaning thereby that these strains may have been acquired from the hospital environment. The strains also become more resistant with the increased stay in the hospital. In developing countries like India, this often result in profound morbidity and mortality in the burn patients. An effective infection control policy is very much required. The infection control program for burn centre requires strict compliance with a number of control measure that include strictly enforced hand washing and the universal use of personal protective equipment.

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