Section: Plastic Surgery

Original Research Article

ASSESMENT OF EARLY SEPSIS IN BURN WOUNDS IN A TERITIARY CARE CENTRE

M. Vijaya Chandra Mouli[1], P S Raja Ravi Kumar[2], D. Sindhu Priyanka[3], K. V. Nagendraprasad[4], M. Manjula Bai[5], Tathapudi Greeshma[6]

[1]*Assistant Professor, Department of Plastic Surgery, Kurnool Medical College, Kurnool, Andhra Pradesh, India*
[2]*Associate Professor, Department of Plastic Surgery, Kurnool Medical College, Kurnool, Andhra Pradesh, India*
[3]*Assistant Professor, Department of Plastic Surgery, Kurnool Medical College, Kurnool, Andhra Pradesh, India*
[4]*Associate Professor, Department of Plastic Surgery, Guntur Medical College, Guntur, Andhra Pradesh, India.*
[5]*Professor & HOD, Department of Plastic Surgery, Kurnool Medical College, Kurnool, Andhra Pradesh, India*
[6]*Intern MBBS, Kurnool Medical College, Kurnool, Andhra Pradesh, India.*

Received *: 12/10/2023*
Received in revised form *: 26/11/2023*
Accepted *: 10/12/2023*

Corresponding Author:
Dr. M. Vijaya Chandra Mouli
Assistant Professor, Department of Plastic Surgery, Kurnool Medical College, Kurnool, Andhra Pradesh, India.
Email: vcmmeruva@gmail.com

DOI: 10.5530/ijmedph.2023.4.8

Source of Support: Nil,
Conflict of Interest: None declared

Int J Med Pub Health
2023; 13 (4); 38-42

ABSTRACT

Background: Burns rank among the most prevalent and severe types of injuries. Severe thermal damage patients need to receive expert care right away in order to reduce their risk of morbidity and death. Despite rigorous treatment with topical and parenteral antibiotics, sepsis and burn wound infection cause 50% to 60% of fatalities in burn patients. **Aim:** To investigate the burn wound bacteriological pattern in patients who come to a tertiary care facility.
Materials and Methods: A total of 112 swab culture samples and 56 blood culture samples were obtained for this prospective observational study, which included 56 patients admitted to the burns ward at Government General Hospital. The samples were processed at the laboratory of the institution, government general hospital.
Results: 15 samples (28.3%) and 38 samples (71.7%) of the 56 swab culture isolates were gram positive and gram negative, respectively. The major organism identified from 16 (28.50%) of the study's second-week culture samples was the gram-negative bacterium Klebsiella.
Conclusion: This study focuses on the microbiological etiology, and microbial analysis of burn wounds, with a particular emphasis on the methodologies for culturing and surveillance of burn wound infections.
Keywords: Burn wound, infection, colonization, septicemia, swab.

INTRODUCTION

Burn injuries have long been treated historically, and burn care has developed into a sensible therapeutic approach [1]. Treating burn patients presents its own set of challenges since burn wounds are highly susceptible to bacterial colonization and infection. At first, it is assumed that the charred region is free of microbial contamination. Burn wound infections are caused by coagulative elements, massive skin loss, and burn injuries. It is believed that early burn wounds are free of microbiological infection.

Major burn wounds typically get infected three to five days after being admitted, primarily due to the patient's own bacterial flora rather than external factors. The resident and transitory flora of the patient are the source of colonization.[3–7] Sepsis is linked to around 75% of patient deaths in cases with burn injuries, particularly in developing nations.[1] Septicemia is brought on by microbial invasion of the bloodstream when the concentration of bacterial growth above 10^6 or 10^7.

Particularly, immunological suppression brought on by compromised neutrophil function, cellular immunity, and humoral immunity might promote the growth and colonization of many bacteria in burn sites.[8] Bacteremia may be linked to burn wound infection, which hinders the adoption of skin transplants.[6] The burn wound infection continues to be a factor in 50–75% of fatalities even with successful topical treatment.[7] The range of bacterial isolates varies over time and across locations.[9] Therefore, the primary objective of any plan for treating burn wounds should be to achieve successful infection management.

This calls for regular evaluation of the burn wounds bacterial pattern and antibiogram, which serves as the foundation for adjusting the antibiotic regimen. In light of this, the current study's objective is to identify the burn unit's bacterial profile and resistance pattern.[9] The surface wound swabs that are currently being used in many Indian centers do not always provide an accurate count of the organisms involved in burn wound sepsis.[10,11] Surface swab culture has been the main technique employed at our institution to evaluate burn injuries thus far. Leucocyte count, blood culture, and surface swab culture are highlighted in this study as more precise methods of diagnosing sepsis from burn wounds.

Aims and Objectives

To study the bacteriological profile of burn wound infections.

To study the importance of swab culture, blood cultures and leucocyte count in burn wound sepsis.

MATERIAL AND METHODS

The research was carried out in the plastic surgery department during the 2020–2021 academic year.

As the study design, a prospective observational study was adopted. The ethical committee clearance was previously approved by the institutional ethical committee. Each patient provided informed consent for this study. Samples are gathered and sent for blood culture, swab culture, and leucocyte count. The samples were processed by the institutional laboratory.

After being admitted to the plastic surgery department, 56 burn patients had their blood culture sample and 112 swab culture samples taken. Participants in the current study included patients of all ages and genders with burn wounds ranging from 15% to 70%.

Children with burns <5% TBSA, Adults<15%TBSA, and burns above 70% TBSA and facial/hands and feet/perineal burns are excluded.

Specimen Collection

Samples were collected according to the above mentioned criteria. Samples from the burn wounds were collected by surface swab culture, blood culture for bacterial isolation and blood samples for leucocyte count.

Surface Swab

The burn surface was first cleaned with a gauze soaked in sterile saline in order to obtain specific culture of the burn. Either deep swabbing or blister aspiration was the collection technique used. Two sterile swab sticks were then used to collect the sample. The swab was moistened with saline for dry wounds. Swabs were taken straight away to the lab for additional processing after collection.

Blood sample Collection

Patients who were suspected of having sepsis had their blood drawn, ideally prior to the start of antibiotic treatment. Under strict aseptic precautions, 5–10 ml of blood from adult patients and 2 ml from pediatric patients were drawn from a peripheral vein. The sample were taken and sent straight away to the lab for additional processing in blood culture bottles.

Blood Culture

The inoculated blood culture bottles are incubated aerobically at 37^0 C overnight before being subcultures on days 2, 3, 4, and finally 7 of the incubation period. Blood agar, Chocolate agar, and Mac-Conkey agar were used for subcultures.

Following are the typical laboratory techniques that were used to specifically identify an aerobic bacterial pathogen based on microscopic morphology, staining characteristics, cultural features, and biochemical characteristics.

The colonies on the Blood/Chocolate and Mac-Conkey agar were processed using Gram stain.

RESULTS

The distribution of age and sex in the population was examined with regard to burn wound infections. Out of the 56 cases, the age group affected most frequently was 21–30 years old (39%), followed by <10 years old (25%). The age group of over 60 years old had the fewest cases (1.7%).

Table 1 shows 16 -30 % of the TBSA is the maximum per-centage of burns cases 41.7% least being 5.3% involving>60% TBSA. [Table 1]

Table 2 shows Among isolates of swab cultures during 1st week- poly microbial growth shown maximum prevalence 37.5%, followed by Gram positive bacteria- staph aureus 19.6%, Gram negative bacteria-Klebsiella, E. coli 3.5%. No growth 17.8%. Second week common organism isolated are Gram negative bacteria Klebsiella 28.5% followed by Escherichia coli 12.5% and Pseudomonas aeruginosa 10.7%. Among Gram positive Staphylococcus aureus shown least prevalence - 5.3%. No growth 23.20%. [Table 2]

Table 3 shows Among positive swab culture during 1st week 70% were gram positive bacteria 30% were gram negative. During 2nd week 8.34% were gram positive bacteria with 91.67% were gram negative. [Table 3]

Table 4: Organisms commonly isolated in blood culture was Staphylococcus aureus 10.71%, polymicrobial growth 3.57% followed by Staphylococcus aureus, CONS, MR CONS, MRSA with each 1.79% and no growth bacterial growth seen in 78.57. [Table 4]

Table 5 shows among swab cultures Staphylococcus aureus and Klebsiella pneumonia were the common bacteria isolated with each 12.5% and in blood cultures Staphylococcus aureus is the commonest bacteria 10% followed by Escherichia coli 8.03%, Citrobacter freundiiand Klebsiella oxytoca 3.5% in swab cultures and Pseudomonas aeruginosa, MRSA, CONS, MR CONS were next common bacteria isolated with each 1.7%. [Table 5]

Table 6 shows Among patients with sepsis Swab cultures 47.3% showed positive culture, Blood cultures showed 17.8%positive results, Leucocyte count were significant in 28.57%. [Table 6]

Table 1: Percentage of Burns

% TBSA	No of cases	Percentage
<15	6	10.71%
16 - 30	23	41.07%
31 - 45	11	19.64%
46 - 60	13	23.21%
> 60	3	5.35%

Table 2: Swab Culture Isolates

Isolates	1st Week	1st Week %	2nd Week	2nd Week%
Staphylococcus aureus	11	19.60%	3	5.30%
Klebsiella pneumonia	2	3.50%	16	28.50%
Escherichia coli	2	3.50%	7	12.50%
Pseudomonas aeruginosa	1	1.70%	6	10.70%
Strepto coccus	1	1.70%	0	0
Citrobacter freundii	0	0	4	7.14%
Polymicrobial	21	37.50%	4	7.14%
Contaminants	8	14.20%	3	5.30%
Nobacterial growth	10	17.80%	13	23.20%

Table 3: Weekly Swab Cultures

Specimen	1st week	Percentage	2nd week	Percentage
Positive	12	70.00%	3	8.34%
Negative	5	30%	33	91.67%

Table 4: Blood Cultures

Isolates	No of Isolates	Percentage
Staphylococcus aureus	6	10.71%
Pseudomonas aeruginosa	1	1.79%
CONS	1	1.79%
MR CONS	1	1.79%
MRSA	1	1.79%
POLYMICROBIAL	2	3.57%
Nobacterial growth	44	78.57%

Table 5: Organism Swab Culture

Organisms	Swab culture (n=112)	Swab culture %	Blood Culture (n=56)	Blood Culture %
Staphylococcus aureus	14	12.5	6	10.7
Klebsiella pneumonia	14	12.5	0	0
Escherichia coli	9	8.03	0	0
Pseudomonas aeruginosa	7	6.25	1	1.7
Klebsiella oxytoca	4	3.5	0	0
Citrobacter freundii	4	3.5	0	0
Strepto coccus non BH	1	O.89	0	0
MRSA	0	0	1	1.7
CoNS	0	0	1	1.7
MR CoNS	0	0	1	1.7
No Growth	60	53.57	46	82.14

Table 6: Comparison of Swab Culture/ Blood Culture/CBP Count

Type of Investig ation	No. of Samples	No of Positive Culture/ CBP	Percentage
Swab Culture	112	53	47.3
Blood Culture	56	10	17.8
CBP Count	112	32	28.57

DISCUSSION

Patients admitted to the hospital with severe thermal burns continue to be most at risk for morbidity and mortality due to infection in the burn wound.[12] Because of the persistently rich sources of nourishment for the microorganisms, the wider regions of involvement, and the lengthier stays of the patients in the hospital, burns offer a favourable environment for bacterial growth.[13] In order to manage burn wounds, surface swab culture is performed as part of routine research to identify bacterial isolates and their susceptibility to antibiotics.[14] Another inquiry to identify the organism causing sepsis in burn wounds is blood culture.[15]

Burn patients who develop sepsis face significant risks of morbidity and mortality. In the treatment of burn wounds, changing patterns of isolates and rising

rates of antibiotic resistance are of concern because they can contribute to sepsis.[16–19] Therefore, it is crucial to continuously examine and update the sepsis epidemiology.

Conducting repeated surface swab cultures, cbp and blood cultures in patients with sepsis symptoms to examine the bacteriological profile and antibiotic susceptibility pattern of the burn wound pathogen in patients with burns. To predict sepsis and provide the patients with the best care, a complete blood picture and cbp were performed concurrently.

In this study a total of 112 Surface swabs, 112 Blood samples for Leucocyte count and56 Blood culture samples were collected from 56patients with burns and were admitted in burns ward with symptoms of suspected sepsis. This study was done to know the aerobic bacterial profile of clinically suspected sepsis in burns and role of blood culture, swab culture and leucocyte counts. Results obtained in this study were analyzed and compared with other studies.

Burn wound infections were common in the age groups between 21-30 years. This age group had sustained mixed thermal burns who were about 39%. The next age group between 0-10 years sustained scald injuries they accounting up to 20%. Females were common because they sustained deep thermal burns.

Leucopenia and severe leucocytosis were seen in 5.3% and 28.5% of patients, respectively, making a total of 33.6% in the first week. 66.4% of patients had normal counts despite having suspected sepsis symptoms. While 76.8% of the samples during the second week had normal leucocyte counts despite experiencing fever spikes, 23.2% of them displayed leucocytosis. When combined with swab cultures, complete blood picture counts were a reliable way to identify sepsis during the first week. A study by Clinton Murray et al.[20] found that 32% of the patients had normal counts while experiencing fever spikes, while 68% of the patients had leucocytosis and leucopenia.

Studies conducted by Krejci NC et al.[21] failed to find a link between CBP and either its gram-negative or gram-positive infections. According to a study conducted by L Edlman Saffle et al. and Keen A. Knodock,[22] the mean WBC on the day of culture was the same for both positive and negative blood culture events. Leucocyte count alone or the complete blood picture (CBP) are unreliable indicators of burn wound sepsis. had more reliable in predicting sepsis. CBP count + swab culture =4.5% raise in culture positivity. CBP count+Blood culture =3.5% raise in culture positivity.

CONCLUSION

The age group with the highest prevalence of burn wound sepsis symptoms was between 21 and 30 years old. There was a noticeable female predominance, and more than 15% of TBSA was involved with deeper levels of burns. Staphylococcus aureus was the most often isolated microorganism throughout the first week. Swab cultures from the second week revealed that Klebsiella was the predominant isolate of Gram negative bacteria. Complete blood picture counts were reliable to diagnose sepsis during the first week when done alongside with swab culture. In this study, swab culture outperformed blood culture as a more reliable method for managing sepsis during the second week.

Conflict of Interest: None.

Funding: None

REFERENCES

1. Arturson MG. The pathophysiology of severe thermal injury. J Burn Care Rehabil. 1985;129-34.
2. Fernandez RJ. The historical evolution of Burn Surgery, Howard A. Granay Competition for Undergraduate writing in the historyof Surgery, 2010.
3. Teplitz C. The pathology of burn and fundamentals of burn wound sepsis. In: Artz CP, Moncreif JA, Pruitt BA, Jr., eds. Burns: A team approach. Philadelphia: WB. Saunders Co, 1979:45-49.
4. Teplitz C, Davis D, Mason AD, Moncrief JA. Pseudomonas burnwound sepsis.I. Pathogenesis of experimental pseudomonas burnwound sepsis. J Surg Res. 1964; 4:200-216.
5. Heggars JP, Robson MC, Ko F, et al. Transient and resident microflora of burn unit personnel and its influence on burn wound sepsis. Infect Control. 1982; 3:471-474.
6. Pruitt BA, Jr, McManus AT. (1984). Opportunistic infections in severly burned patients. Am J Med. 1984; 76:146-153.
7. Robson MC. Bacterial control in the burn wound. Clin Plast Surg. 1979; 6(4):515-522.
8. Ravage B. Burn unit: saving lives after the flames. Da Capo Press: Cambridge, MA, 2004.
9. Krizek TJ, Robson MC. Evaluation of quantitative bacteriology in wound management. Am J Surg. 1975; 130:579-84.
10. Georgiade NG, Lucas MC, Fallon WM. A comparison of methodsfor the quantitation of bacteria in burn wounds. II Clinical evaluation. Am J Clin Path. 1970; 53:40-46.
11. Munford RS. Severe Sepsis and Septic Shock. In: Longo, Fauci, Kasper, Hauser, Jameson and Loscalzo, editors. Harrison's TM. Principles of Internal Medicine, 18th edition, The McGraw-Hillcompanies, 2012:2223-31.
12. Seifert H and Wisplinghoff H. Blood Stream Infections and Endocarditis. In: Topley and Wilson's Microbiology and Microbial infections. 10th edition, Edward Arnold Ltd, 2006:509.
13. Dai T, Huang YY, Sharma SK, Hashmi JT, Kurup DB, Hamblin MR. Topical antimicrobials for burn wound infections. Recent Pat Antiinfect Drug Discov. 2010 Jun;5(2):124-51. doi: 10.2174/157489110791233522. PMID: 20429870; PMCID: PMC2935806.
14. Bessa LJ, Fazii P, Di Giulio M, Cellini L. Bacterial isolates from infected wounds and their antibiotic susceptibility pattern: some remarks about wound infection. Int Wound J. 2015 Feb;12(1):47-52. doi: 10.1111/iwj.12049. Epub 2013 Feb 24. PMID: 23433007; PMCID: PMC7950398.
15. Shahrokhi S. Infections in Burns. Burn Care and Treatment. 2013 Feb 9:43–55. doi: 10.1007/978-3-7091-1133-8_4. PMCID: PMC7120884.
16. WinnJr W, Allen S, Janda W, Koneman E, Procop G, Schrekenbeger Petal. Guidelines for the Collection, Transport, Processing, Analysis, and Reporting of cultures from specific Specimen Sources. In: Koneman's Color Atlas and Textbook of Diagnostic Microbiology, 6th edition, Lippincott Williams and Wilkins, 2006; 97-105.
17. Forbes BA, Sahn DF, Weissfeld AS. Bloodstream Infections. In: Bailey and Scott's Diagnostic Microbiology: A Textbook for isolation and identification of pathogenic microorganisms. 12th edition. Mosby Company, St. Louis. 2007:778-97.

18. Forbes BA, Sahn DF, Weissfeld AS. Bloodstream Infections. In: Bailey and Scott's Diagnostic Microbiology: A Textbook for isolation and identification of pathogenic microorganisms. 12th edition. Mosby Company, St. Louis. 2007:778-97.
19. Levine NS, Lindberg RB, Mason AD, Jr, and Pruitt BA Jr (1976). The quantitative swab culture and smear: a quick, simple methodfor determining the number of viable aerobic bacteria on open wounds. J Trauma. 1976; 16:89-94.
20. Murray CK. Infections in burns. J Trauma. 2007; 62(6 Suppl): S73.
21. Krejci NC, McGuire J. Treatment of burns with skin substitute. J Dermatol Sci. 1992;4(3):149-55.
22. Lu, Jing et al. Antibiotics for treating infected burn wounds. TheCochrane Database Systemat Rev. 2017:7 CD012084.