



STUDY OF SWAB CULTURE VS TISSUE BIOPSY CULTURE IN LOWER LIMB ULCERS

General Surgery

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ABSTRACT

Background: An ulcer is defined as a discontinuity of the covering epithelium, skin, or mucous membrane. Infection is a dreaded complication of lower limb ulcers and leads to major causes of morbidity and mortality. So, the culture of the wound is necessary to identify the microbial flora. The reliability of the two microbiological sampling techniques—swabbing and tissue biopsy—for the routine identification of pathogens is compared. **Aims and objectives:** This study was conducted to compare the effectiveness of wound swabs and tissue biopsies in treating lower limb ulcers. **Materials and methods:** The present study was carried out in 50 patients with lower limb ulcers admitted to the department of general surgery at KGMCH from January 2019 to December 2022. **Results:** The study was conducted among 50 patients, with the majority of patients in the age group between 41 and 60 years of age. Male predominance was reported in this study, with the majority of patients in the age group between 41 and 60 years of age. Male predominance was reported in this study. 31 patients out of 50 (62%) were male. 66% of patients included in the study were diabetic, and 40% of the patients had grade 2 ulcers. Swab culture isolated more organisms in grade 3. The same organisms were isolated from 72% of the patients. *Pseudomonas aeruginosa* was the most common organism isolated. **Conclusion:** Both swab culture and tissue biopsy are equally beneficial in identifying the microbial flora. Swab cultures are reliable for guiding antibiotic treatment for patients with grades 1, 2, and 3, while grade 4 and 5 ulcers require a deep tissue biopsy. Gram negative organisms are most commonly isolated.

KEYWORDS

Ulcer, Swab Culture, Tissue Biopsy,

INTRODUCTION:

An ulcer is a break in the continuity of the covering epithelium, skin, or mucous membrane. The wounds are graded depending on the Wagner grading¹ based on the depth involved and associated infection on the deeper structures. Infection is a frequent and costly complication of lower limb ulcers and represents a major cause of morbidity and mortality.² A wound is said to be infected when the microbial growth in the wound is greater than 105 colony forming units (CFUs) per gram of tissue or milliliter of wound fluid.

Causative organisms need to be reliably diagnosed to start antibiotic therapy. The techniques used for sampling for subsequent microbiological analysis will affect the quality of evaluations of the microbiota in lower limb ulcers. The Infectious Diseases Society of America recommends that an appropriate specimen for culture be obtained from the wounds to guide antibiotic therapy.³

For the identification of pathogens, the International Working Group on Diabetic Foot (IWGDF) has proposed that clinicians obtain cultures from tissue specimens rather than from swabs^{4,5}. Swabs are often contaminated with normal skin flora or colonizers, and their use may fail to identify deep tissue pathogens⁶. However, superficial wound swabbing is more widely applied in clinical practice because it is easy to perform and noninvasive. This study is intended to understand the reliability of superficial swabbing and tissue biopsy for the culturing of lower limb wounds with infections of varying severity. We prospectively compared superficial swabbing and deep tissue biopsy used for sampling and its efficacy.

MATERIALS AND METHODS:

The study was done as a prospective, non-randomized study. The study was conducted on 50 patients with lower limb ulcers admitted to the surgical wards of Kanyakumari Government Medical College Hospital between January 2019 and December 2022. Swabs and tissue cultures were taken from the same wound of these patients.

Inclusion:

All the diabetic and nondiabetic ulcers involving the lower limb are included in the study.

Exclusion:

Wounds with gangrene, very ill patients, and patients unwilling to participate in the study are excluded.

Specimen Collection and Microbiological Culturing

Two specimens were collected from the wound after it had been cleansed using sterile saline and gauze and debrided. No antimicrobial agent like alcohol, iodine, or antiseptic was applied to the wound before specimen collection. Each wound was swabbed using the Levine technique⁷, which involves rotating a wound swab over a 1 cm² area of the wound for 5 seconds, using sufficient pressure to extract fluid from the inner part of the wound.

A deep tissue specimen of 4mm in diameter was obtained from the base of the ulcer via Allis forceps or artery forceps. After collecting the swab or tissue, it is inserted into a sterile container or sent to the lab immediately (within one hour). The cultures were processed following the same standard procedures as swabs and tissue biopsy samples.



Figure 1: swab culture

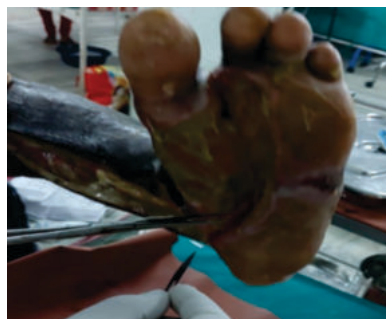


Figure 2: Deep tissue biopsy



Figure 3: Collection of specimen

RESULTS:

Age distribution: 54 % of our population were between 41-60 years of age.

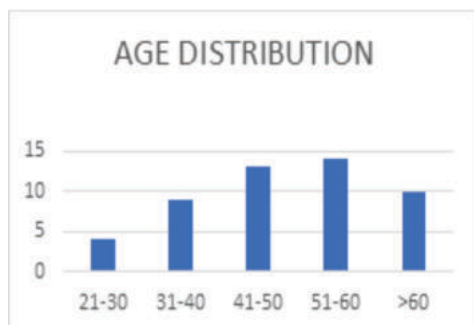


Table 1: Age distribution

Sex distribution:

31 patients in our study were male, while 19 patients were female



Table 2: Sex distribution

Diabetic status of the patients:

33 patients included in our study were diabetic and 17 were non diabetic.

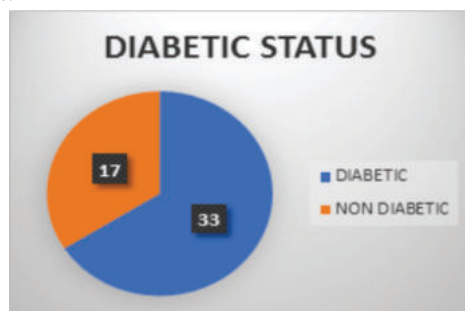


Table 3: Diabetic status

Grade of the ulcer:

The Diabetic wound are graded depending upon the Wagner grading¹ based on the depth involved and associated infection on the deeper structures.

Wagner Grading System

Grade 1: Superficial Diabetic Ulcer.

Grade 2: Ulcer extension-Involves ligament, tendon, joint capsule or fascia without abscess or osteomyelitis.

Grade 3: Deep ulcer with abscess or Osteomyelitis.

Grade 4: Gangrene localized in a portion of forefoot.

Grade 5: Extensive gangrene of foot.

20 patients included in our study is of grade 2, while 14 patients had grade 3 ulcers.

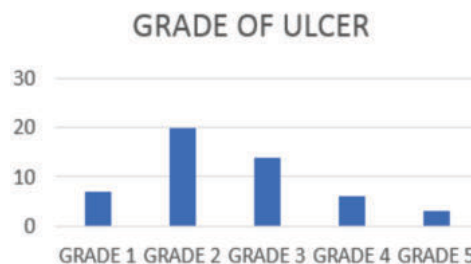


Table 4: Grade of the ulcer

Positive swab culture vs positive tissue culture based on grade of the ulcer:

Table 5: positive cultures based on grade of the ulcer

Grade of ulcer	Number of patients	Positive swab c/s	Positive tissue c/s
Grade 1	7	6	3
Grade 2	20	18	16
Grade 3	14	13	13
Grade 4	6	3	5
Grade 5	3	2	3
Total	50	42	40

Swab culture isolated more organisms in grade 1, 2 & 3 ulcer s; while more organisms were isolated in tissue culture in grade 4&5 ulcers.

Microbial growth:

Table 6: microbial growth

	No. of patients
No growth in both culture	5
No growth in swab c/s; growth in tissue c/s	3
Growth in swab c/s; No growth in tissue c/s	5
Same organism in both culture	36
Different organism in both culture	1
Total	50

72% of the patients showed the same organism in the both culture technique, while 2% (1 patient) showed different organism in the both culture; 10% showed no growth in both culture; 6% showed growth in tissue culture with no growth in swab culture; 10% showed swab culture with no growth in tissue culture.

Concordance of swab versus tissue culture:

Table 7: concordance of swab vs tissue cultures

ORGANISM	SWAB C/S	TISSUE C/S
No growth	8	10
Escherichia coli	6	5
Proteus mirabilis	7	5
Klebsiella species	8	7
Pseudomonas aeruginosa	11	10
Citrobacter species	2	3
Acinetobacter species	-	2
Staphylococcus aureus	6	5
Coagulase negative staphylococcus aureus	1	1
Enterococcus	1	2
Total	50	50

Pseudomonas species were the most common organisms isolated in both swab culture and tissue cultures. (22% of swab cultures and 20% of tissue cultures from the patients had pseudomonas species growth); Klebsiella species were the second most common organism isolated, with 16% in swab culture and 14% in tissue culture; Staphylococcus aureus is the most common gram-positive organism isolated (12% of the swab culture and 10% of the tissue culture); Acinetobacter species were isolated only in tissue culture and not in swab culture.

DISCUSSION:

Pathogens that infect the wounds through colonisation will be identified only by appropriate sampling techniques. Many studies infer that biopsy is the best method for the identification of pathogens in lower limb ulcers because deep biopsy is not prone to superficial contamination. In the **Demetriou et al.**⁸ and **Kessler et al.**⁹ studies, the number of pathogens isolated by swabbing was significantly higher than those isolated by tissue biopsy. The usual mistake made during the collection of samples for the culture—not cleansing and debridement of the wounds before taking the culture fluid or pus may be the reason for this discrepancy in the study mentioned above. However, in our study, we used the Levine swabbing technique after cleansing the wound. Levine's technique involves using the swab to exert pressure on the surface of the ulcer, thereby enhancing the oozing of fluid from the inner part of the wound. Levine's method nullifies the chance of superficial infectivity and reduces the error of missing out on the deep organism.

In this study, anaerobic culturing was not done and couldn't be compared with other studies, and our sample size is small. 54 percent of our population was between the ages of 41 and 60. 31 patients in our study were male, while 19 patients were female. 33 of the patients included in our study were diabetic, and 17 were non-diabetic.

Twenty patients included in our study are of grade 2, while 14 patients have grade 3 ulcers; Swab culture isolated more organisms in grades 1, 2, and 3, while more organisms were isolated in tissue culture in grades 4 and 5. 72% of the patients showed the same organism in both culture techniques, while 2% (1 patient) showed different organisms in both cultures; 10% showed no growth in both cultures; 6% showed growth in tissue culture with no growth in swab culture; 10% showed swab culture with no growth in tissue culture; *Pseudomonas* species were the most common organisms isolated in both swab culture and tissue culture. (22% of swab cultures and 20% of tissue cultures from the patients had *pseudomonas* species growth); *Klebsiella* species were the second most common organism isolated, with 16% in swab culture and 14% in tissue culture; *staphylococcus aureus* is the most common gram-positive organism isolated (12% of the swab culture and 10% of the tissue culture); *Acinetobacter* species were isolated only in tissue culture and not in swab culture. Many studies reported by researchers consider that tissue biopsy is the best method for the identification of pathogens in chronic wounds, especially diabetic foot ulcers, because deep biopsy is not prone to superficial contamination. In **J. A. Jayalal et al.**'s (2010) studies¹⁰, it is evident that both swab and deep tissue biopsy techniques have the same results in providing the wound flora in grade 2 and grade 3 ulcers. *Pseudomonas* is the most common organism isolated, followed by *Klebsiella*. **K. Gjodsbøl et al.**¹¹ have reported based on their study that there is no need for biopsy, as in their study there were no significant differences in the bacterial organisms isolated between swab and tissue samples; and *Staphylococcus aureus* is the most commonly isolated; In **Bansal et al.**'s¹² study, *pseudomonas aeruginosa* was the most common organism isolated among the gram-negatives, and *Staphylococcus aureus* was the most common organism isolated among the gram-positives. **T. J. Bill et al.**'s¹³ assessment of infection does not differ whether culture is done by swab or biopsy; In **R. A. Slater et al.** study,¹⁴ Swab culture is useful when the bone is not involved and when debridement is contraindicated. When a bone is not involved, swab culture is useful, and tissue biopsy is useful when osteomyelitis is involved, according to **Bozkurt et al.**¹⁵.

CONCLUSION:

Both swab culture and tissue biopsy are equally beneficial in identifying microbial flora. Swab cultures are reliable for guiding antibiotic treatment for patients with grades 1, 2, and 3; while grade 4 and 5 ulcers require a deep tissue biopsy. Gram-negative organisms are most commonly isolated.

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