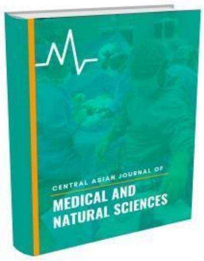

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Article

Study of the Contemporary Microbial Landscape of Wounds of Various Localization

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Abstract: The aim was to investigate the modern picture of micorbiocenosis in wounds of different localization and origin on the basis of microbiological control results over wound exudation for a long time period in patients with surgical pathology from comparison groups.A microbiological audit was undertaken over 5 years with a review of all cases involving 953 surgical patients. Wounds' microflora was qualitatively and quantitatively estimated by the use of routine bacteriological culture methods with bacteria cultivation on blood agar and selective media. The microbial contamination level was assessed by the Ryabinsky–Rodoman scale. The findings showed that an important diversity of wound microflora was observed according to wound location, origin and clinical context (eg: elective vs. emergency surgery). Gram-positive bacteria were implicated in most wound types as Staphylococcus aureus was the most prevalent pathogen. Enterobacteriaceae gram-negative bacteria were more prevalent in wounds with perineal location, diabetic foot and gangrenous process. A great number of wounds were sterile bacteriologically. The research represents the updated information on epidemiology in wound microflora and documentates a stubborn predominance of conditionally pathogenic microorganisms, as well shows the leading significance of Staphylococcus aureus for purulent- inflammatory processes. The findings emphasize the necessity of routine microbiological monitoring of wound infections to guide rational antimicrobial therapy and improve surgical outcomes. The study did not include molecular diagnostic techniques or antimicrobial resistance profiling, which should be addressed in future research.

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1. Introduction

Wound infection remains one of the most challenging problems in modern surgery, significantly affecting the duration of treatment, the risk of complications, and overall patient outcomes. Despite advances in aseptic techniques, antimicrobial therapy, and wound care technologies, surgical site infections and chronic wound infections continue to pose a substantial clinical burden[1].

Although the presence of microorganisms in wounds is common, not all contaminated wounds progress to infection. Microbial load and host defense mechanisms play an important role in successful wound healing [2-3]. Perturbation of this balance results in bacterial overgrowth, local tissue destruction, impaired healing, and potentially systemic inflammation and sepsis.

Culture test of the wound exudates are essential for the identification of the infecting organisms and their likely pathogenicity[4]. The majority of microorganisms isolated in wounds are opportunistic flora, comprising aerobic, microaerophilic and anaerobic species. Commonly, encountered genera are Staphylococcus, Streptococcus, Pseudomonas Escherichia Proteus Klebsiella Enterobacter and Clostridium etc. These microorganisms can act as monocultures or mixed cultures and make the treatment more difficult[5-6-7].

The role of biofilms in wound infections has gained increasing attention. Microorganisms embedded in biofilms exhibit enhanced resistance to antibiotics, ultraviolet radiation, and host immune responses[8]. This significantly reduces the effectiveness of conventional antimicrobial therapy and necessitates the development of new treatment strategies.

Staphylococcus aureus deserves particular attention due to its high prevalence among healthy carriers and its ability to cause a wide spectrum of diseases, ranging from superficial skin infections to life-threatening systemic conditions. It remains one of the leading causes of postoperative wound infections and healthcare-associated infections worldwide[9].

In this context, continuous surveillance of wound microflora is essential for understanding current epidemiological trends and optimizing therapeutic approaches. The present study aims to provide a comprehensive analysis of the contemporary microbial landscape of wounds with different localization and etiology based on long-term microbiological data.

2. Materials and Methods

This study included 953 surgical patients treated over a five-year period. Patients represented various age groups and had wounds of different localization and origin, including postoperative wounds, chronic non-healing wounds, purulent-inflammatory skin lesions, diabetic foot ulcers, and gangrenous wounds[10-11].

Microbiological examination of wound exudate was performed using standard bacteriological methods. Primary inoculation of clinical material was carried out using a 2 mm loop onto 5% blood agar and selective media, including Endo agar, mannitol salt agar, and Sabouraud agar. Cultures were incubated under appropriate aerobic and anaerobic conditions.

Qualitative identification of microorganisms was conducted based on morphological, cultural, and biochemical characteristics. Quantitative assessment of microbial contamination was performed using the Ryabinsky–Rodoman table.

All procedures were carried out in accordance with institutional laboratory standards. The study design was retrospective and observational.

3. Results

Before presenting the numerical findings, it is important to note that the microbial composition of wounds demonstrated considerable variability depending on clinical context.

Table 1 presents the distribution of microorganisms isolated from elective postoperative wounds.

Table 1. Microbial composition of elective postoperative wounds (n = 152).

Microorganism	Number of isolates (n)	Percentage (%)
Staphylococcus aureus	26	16.9
Enterobacteriaceae spp.	32	21.0
Enterococcus spp.	10	6.7
Coagulase-negative staphylococci	7	4.7
Pseudomonas aeruginosa	5	3.4
Streptococcus pyogenes	4	2.7
Sterile wounds	68	47.0

In elective postoperative wounds (n = 152), bacteria of the Enterobacteriaceae family accounted for 21%, *Staphylococcus aureus* for 16.9%, *Enterococcus spp.* for 6.7%, coagulase-negative staphylococci for 4.7%, *Pseudomonas aeruginosa* for 3.4%, and *Streptococcus pyogenes* for 2.7%. Sterile wounds constituted 47%.

Table 2. Microbial spectrum of emergency postoperative wounds (n = 132).

Microorganism	Number of isolates (n)	Percentage (%)
Staphylococcus aureus	39	29.5
Enterobacteriaceae spp.	20	15.1
Coagulase-negative staphylococci	10	7.8
Enterococcus spp.	7	5.2
Pseudomonas aeruginosa	3	2.6
Streptococcus pyogenes	2	1.5
Candida spp.	1	0.3
Clostridium perfringens	1	0.1
Microbial associations	9	6.6
Sterile wounds	41	31.3

In emergency postoperative wounds (n = 132), *Staphylococcus aureus* predominated (29.5%), followed by sterile wounds (31.3%), Enterobacteriaceae (15.1%), coagulase-negative staphylococci (7.8%), and other microorganisms.

Table 3. Microbial profile of chronic non-healing wounds and trophic ulcers (n = 169).

Microorganism	Number of isolates (n)	Percentage (%)
Staphylococcus aureus	54	31.7
Enterobacteriaceae spp.	30	17.6
Coagulase-negative staphylococci	22	13.0
Enterococcus spp.	12	7.0

Microorganism	Number of isolates (n)	Percentage (%)
Pseudomonas aeruginosa	9	5.5
Streptococcus pyogenes	3	1.5
Candida spp.	2	1.0
Sterile wounds	41	24.0

Chronic non-healing wounds (n = 169) were most frequently colonized by *Staphylococcus aureus* (31.7%), Enterobacteriaceae (17.6%), and coagulase-negative staphylococci (13.0%)[8-9].

In furunculosis and carbuncle cases (n = 116), *Staphylococcus aureus* was isolated in 80% of wounds.

Diabetic patients with purulent wounds (n = 102) demonstrated predominance of staphylococci (53%), while Gram-negative pathogens accounted for 23%.

4. Discussion

The findings confirm the persistent dominance of Gram-positive microorganisms in wound infections, particularly *Staphylococcus aureus[12-13-14]*. The variation in microbial composition across different wound types reflects the influence of anatomical localization, tissue perfusion, and underlying systemic conditions such as diabetes mellitus.

The relatively large percentage of sterile wounds, especially for post-operative and gangrenous type cases, could be attributed to the use of antibiotics and early surgical intervention. Chronic wounds and perineal infections were associated with more Gram-negative flora, which can be explained by their anatomical and physiological properties[15-16].

These findings correlate with former reports and emphasize the need for a personalised investigation of microbiology for successful wound care.

5. Conclusion

The contemporary microbial landscape of wounds is characterized by significant diversity and variability. The spectrum of isolated microorganisms depends on wound localization, etiology, and clinical context.

Gram-positive bacteria predominate in most wound types, with *Staphylococcus aureus* remaining the leading causative agent of purulent-inflammatory processes. Gram-negative pathogens play an important role in chronic, diabetic, and perineal wounds.

Routine microbiological monitoring of wound infections is essential for guiding targeted antimicrobial therapy and improving surgical outcomes.

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