Journal of Experimental Research

JUNE 2025, Vol 14 No 2

Email: editorinchief.erjournal@gmail.com
editorialsecretary.erjournal@gmail.com

Received: Jan., 2025
Accepted for Publication: June, 2025

BACTERIOLOGICAL PROFILE OF BURNS AMONG BURNS PATIENTS AT ORTHOPEDICS HOSPITAL ENUGU

[1]Nwobodo, H.A and [2]Obiakor, C. S.

Faculty of Allied Health Sciences, Enugu State University of Science and Technology

*Author for Correspondence: sandyobiakor2@gmail.com

ABSTRACT

Burn injuries are a major global health concern, particularly in resource-limited settings like Nigeria, where they are complicated by bacterial infections and rising antimicrobial resistance. This study examines the bacteriological profile, antibiotic resistance, and prevalence of micro-organisms (MDROs) in burn wound patients at Orthopaedics Hospital, Enugu, Nigeria. A cross-sectional study was conducted between June-November involving 100 burn wound samples collected aseptically from patients. Samples were cultured using standard microbiological techniques to isolate bacterial pathogens, which were identified through biochemical tests. Data were analysed using descriptive statistics to determine bacterial prevalence and resistance patterns. The study found that 83% of burn wound samples exhibited bacterial growth, with Staphylococcus aureus 45(54.2%) as the most prevalent pathogen, followed by Klebsiella pneumoniae 15(18.1%) and Pseudomonas aeruginosa 11(13.3%). Other pathogens were less common. Antibiotic testing revealed high resistance, particularly to Pefloxacin 75(95.2%), Ceftazidime 74(89.2%), and Ceporex 73(88.0%), while Streptomycin 59(71.1%) and Gentamycin 48 (57.8%) showed better efficacy. Furthermore, 67.5% of bacterial isolates were multidrug-resistant, with *Klebsiella pneumoniae* and Pseudomonas aeruginosa exhibiting the highest resistance rates. These findings align with studies across Nigeria and sub-Saharan Africa, where *Staphylococcus aureus* and Pseudomonas aeruginosa are common in burn infections and multidrug resistance is a growing challenge. The study underscores the need for stronger infection control measures, antimicrobial stewardship, targeted antibiotic therapies.

Keywords: Burn wound infections, Staphylococcus aureus, Multidrug resistance, Antibiotic resistance, Infection control, Burn care

INTRODUCTION

Burn injuries represent a significant global public health burden, with an estimated 180,000 deaths annually, the majority occurring in low- and middle-income countries (Church *et al*. 2006). Burns are classified as injuries to the skin or other tissues caused primarily by heat but can also result from radiation, electricity, or chemicals. The impact of burn injuries is particularly severe in low-resource settings, where access to appropriate treatment and preventive measures is limited. Globally, non-fatal burn injuries are a leading cause of morbidity, especially in children and women, often leading to prolonged hospitalization, disability, and social stigma. Regional differences in burn injury prevalence are striking. For instance, children under five in the WHO African Region experience more than twice the rate of burn-related deaths compared to their global counterparts. Meanwhile, high-income countries have seen a decline in burn-related deaths due to better safety measures and medical interventions, but the situation remains critical in countries like India, where over one million people are severely burned annually (Church *et al*. 2006).

Socioeconomic factors also play a significant role in the incidence and outcomes of burn injuries. People in poorer regions or communities face higher risks due to unsafe cooking methods, inadequate housing, and limited access to healthcare. Additionally, burn injuries from cooking accidents, such as those involving kerosene stoves, are particularly prevalent in countries like South Africa, where millions are spent annually on burn-related care. In terms of treatment, while burn care has advanced significantly in high-income countries, leading to shorter hospital stays and specialized burn centres, the challenges in low-income regions persist. As burns continue to be a leading cause of death and disability, especially in regions like South-East Asia and Africa, there is an urgent need for improved preventive strategies and healthcare resources globally (Church *et al*. 2006).

The pathophysiology of burn injuries involves complex processes that extend far beyond the destruction of skin tissue. Burns cause significant damage to the skin's integrity, leading to a cascade of physiological changes, which ultimately predispose patients to bacterial infections. Understanding the mechanisms that occur in burns helps explain why these injuries are highly susceptible to colonization by opportunistic pathogens. When skin is exposed to heat, chemicals, or electrical forces, the immediate consequence is the destruction of the epidermal and dermal layers, depending on the severity. The skin, as the body's largest organ, serves as a critical barrier against microbial invasion. With burn injuries, this physical barrier is compromised, leaving underlying tissues exposed. As the body reacts to this damage, inflammatory processes begin, leading to increased permeability of blood vessels, immune cell migration, and tissue oedema Jeschke, 2023).

Consequently, bacteria that are normally part of the skin's microbiota, such as Staphylococcus aureus, or those acquired from the hospital environment, like Pseudomonas aeruginosa, can rapidly colonize the wound site. Furthermore, burns can lead to the development of eschar, which is a thick, devitalized tissue that forms over the wound. The eschar impedes oxygenation and blood flow to the wound site, creating an anaerobic environment that supports the growth of bacteria, including Clostridium species. The combination of impaired immune defences and a favourable bacterial environment makes burn patients particularly prone to both local wound infections and systemic sepsis, which significantly increases morbidity and mortality. Though the release of pro-inflammatory cytokines, such as interleukin-1 (IL-1) and tumour necrosis factor (TNF), further exacerbates this vascular permeability, creating an environment rich in fluids that serve as a nutrient source for bacteria. Burn wounds are also characterized by a disruption of the immune system's function, contributing to their high susceptibility to infection. The localized immune response is often insufficient to control microbial colonization, and systemic immunosuppression follows within days of the injury. This immunosuppression results from both the extensive tissue damage and the body's stress response, reducing the effectiveness of macrophages and neutrophils in containing infections (Field, 2018).

This present study has been designed to investigate the bacteriological profile of burn wounds among patients at Orthopaedics Hospital, Enugu, Nigeria, focusing on identifying predominant bacterial pathogens, their antibiotic resistance patterns, and associated risk factors for infection to inform clinical management and improve patient outcomes.

MATERIALS AND METHOD

STUDY DESIGN/AREA

This research will utilize a cross-sectional, observational study design conducted at the Orthopaedics Hospital in Enugu. This approach allows for the simultaneous assessment of the bacteriological profiles of burn wounds and their antibiotic resistance patterns at a specific point in time. By systematically collecting microbiological samples from patients with burn injuries, the study aims to identify prevalent pathogens and evaluate their susceptibility to antibiotics. Additionally, demographic and clinical data will be gathered to understand the factors influencing infection risk and treatment effectiveness. Ultimately, this localized data will provide valuable insights to inform clinical practice and public health initiatives in burn care in Nigeria.

Study Population

The study population will consist of patients admitted for burn injuries at the Orthopedics Hospital in Enugu. To ensure the reliability and validity of the research findings, specific inclusion and exclusion criteria will be established for selecting study participants.

Inclusion Criteria

Participants will be included in the study if they meet the following criteria:

- Adults and paediatric patients (aged 18-65years) admitted to the hospital with burn injuries.
- Patients who approve informed consent for participation in the study.
- Individuals with varying degrees of burn injuries, including first, second, and third degrees, who are willing to participate in the collection of microbiological samples.

Exclusion Criteria

Participants will be excluded from the study if they meet any of the following criteria:

- Patients with burn injuries caused by chemical or electrical sources, as these may present distinct microbial profiles and management considerations.
- Individuals with concurrent infections unrelated to the burn injury that may complicate the interpretation of microbiological results.
- Patients who are immunocompromised or have

significant comorbidities that could confound the study outcomes (e.g., advanced diabetes or chronic kidney disease).

- Those who are on prolonged antibiotic therapy prior to admission, as this could impact the bacterial flora and resistance patterns.

Sample Size Determination

To estimate the sample size for this study, we aim for approximately 100 patients, ensuring statistical significance in our findings.

1. Confidence Level (Z): We will use a 95% confidence level, which means we can be 95% sure our results reflect the true situation.
2. Margin of Error (E): A margin of error of 5% (0.05) indicates how much our sample results might differ from the actual population.
3. Estimated Prevalence (P): We estimate that about 30% of burn patients have infections based on previous studies.

PROCEDURE

1. We began by thoroughly washing my hands with soap and water and used an alcohol-based hand sanitizer to ensure proper hand hygiene.
2. We put on sterile gloves and additional personal protective equipment (PPE), such as a mask and gown, to maintain aseptic conditions.
3. We prepared all necessary equipment, including sterile wound swabs and sterile transport media, in a sterile environment to avoid contamination.
4. We selected sterile swabs specifically designed for microbiological sampling.
5. We assessed the wound to identify the most contaminated areas while being careful to avoid necrotic tissue during the swab collection.
6. Before swabbing, I gently cleaned the wound surface with sterile saline to remove any surface contaminants.
7. We applied the sterile swab to the identified area of the wound, rotating it gently to collect microbial flora.
8. We collected swabs within the first 24 hours of the patient's admission for the initial assessment.
9. We scheduled additional swab collections at regular intervals, such as Day 3, Day 7, and Day 14 post-admission.
10. We ensured that all instruments used in the swab collection were sterilized before use.
11. After collecting each swab, I immediately placed it in sterile transport media to preserve bacterial viability.
12. We transported the samples to the microbiology laboratory within 2 hours of collection for processing.
13. We disposed of all used swabs and materials in biohazard disposal bags according to hospital protocols for hazardous waste.

Laboratory Methods

In the laboratory, I employed a series of systematic techniques to isolate, identify, and assess the antibiotic susceptibility of bacterial pathogens from wound swabs collected from burn patients. These methodologies are critical for understanding the microbial landscape associated with burn injuries and for guiding appropriate therapeutic interventions.

1. Bacterial Isolation Techniques:

Culture Methods: Upon receiving the collected wound swabs, I initiated bacterial isolation by streaking the swabs onto various culture media, including nutrient agar, blood agar, and MacConkey agar. Each media type was chosen to promote the growth of different bacterial species. For example, blood agar allows for the cultivation of both fastidious organisms and provides information on haemolytic activity, while MacConkey agar selectively isolates Gram-negative bacteria, particularly Enterobacteriaceae.

Incubation Conditions: I incubated the inoculated plates at 35-37°C for 24-48 hours in an aerobic environment. After incubation, I examined the growth characteristics, colony morphology, and haemolytic patterns on blood agar, which facilitated preliminary identification of bacterial species based on their colony appearance.

Gram Staining: Following culture, I performed Gram staining on representative colonies to differentiate between Gram-positive and Gram-negative bacteria. This staining procedure involves applying crystal violet, iodine, decolourizer, and safranin to the bacterial smear. The resulting colour of the cells (purple for Gram-positive and pink for Gram-negative) provided critical information for subsequent identification.

2. Bacterial Identification Using Biochemical Tests:

Catalase Test: For identifying Staphylococcus species, I performed the catalase test by placing a small amount of bacterial colony onto a slide and adding a drop of hydrogen peroxide. A positive result, indicated by bubbling (release of oxygen), confirmed the presence of catalase, which is characteristic of Staphylococcus species.

Coagulase Test: To differentiate *Staphylococcus aureus* from other coagulase-negative staphylococci, I conducted the coagulase test. I mixed the bacterial culture with rabbit plasma and incubated it at 37°C. The formation of a clot within a few hours indicated a positive result, confirming the presence of *Staphylococcus aureus*.

Oxidase Test: For the identification of *Pseudomonas aeruginosa*, I performed the oxidase test. I applied the oxidase reagent to a bacterial colony on a filter paper, observing for a colour change. A positive result, indicated by a dark blue colour within seconds, confirmed the presence of the organism, which is known for its oxidase activity.

3. Antibiotic Susceptibility Testing:

Kirby-Bauer Disk Diffusion Method: To evaluate the antibiotic susceptibility of the isolated bacterial strains, I utilized the Kirby-Bauer disk diffusion method. I prepared Mueller-Hinton agar plates and inoculated them with the respective bacterial cultures to create a uniform lawn of growth.

Antibiotic Disks: After allowing the plates to dry, I placed standardized antibiotic-impregnated disks onto the surface of the agar using sterile forceps. The antibiotics tested included penicillin, vancomycin, cephalosporins (e.g., ceftriaxone, ceftazidime), and carbapenems (e.g., imipenem, meropenem).

Incubation and Measurement: I incubated the plates at 35-37°C for 18-24 hours. After incubation, I measured the zones of inhibition around each disk using a calliper to assess the effectiveness of each antibiotic against the bacterial isolates. The results were interpreted based on established clinical breakpoints, categorizing the bacteria as susceptible, intermediate, or resistant.

Statistical Analysis

For the data analysis in my study on burn wound infections, I utilized the Statistical Package for the Social Sciences (SPSS) software to ensure robust results. Descriptive statistics summarized demographic and clinical characteristics, including means, standard deviations, and frequency distributions, which are essential for understanding the sample's overall (Bryman and Cramer, 2012). I applied the chi-square test to evaluate associations between categorical variables, such as infection rates across age categories and burn severity levels (Pallant, 2020). Additionally, logistic regression was utilized to assess the impact of risk factors, including comorbidities and nutritional status, on infection likelihood, as this method is effective for modeling binary outcomes (Edoho *et al*. 2023). A significance level of $p < 0.05$ was set for all tests, allowing me to draw valid conclusions and contribute insights into the factors influencing burn wound infections.

RESULTS

4.1 Table 1: Prevalence of identified bacteria species in burn wounds

Antibiotics	Antibiotic Susceptibility patterns	
	Susceptibility N (%)	Resistance N (%)
Erythromycin	19 (22.9)	64 (77.1)
Azithromycin	39 (47.0)	44 (53.0)
Streptomycin	59 (71.1)	24 (28.9)
Rifampicin	13 (15.7)	70 (84.3)
Ceftazidime	9 (10.8)	74 (89.2)
Amoxicillin	24 (28.9)	59 (71.1)
Ciprofloxacin	28 (33.7)	55 (66.3)
Levofloxacin	29 (34.9)	54 (65.1)
Gentamycin	48 (57.8)	35 (42.2)
Ofloxacin	22 (26.5)	61 (73.5)
Ceporex	10 (12.0)	73 (88.0)
Pefloxacin	4 (4.8)	79 (95.2)
Ceftriaxone	8 (9.6)	75 (90.4)
Cefuroxime	21 (25.3)	62 (74.7)
Augmentin	19 (22.9)	64 (77.1)
Total	83 (100.0)	83 (100.0)

	Prevalence	
	N	%
No bacterial growth	17	17.0
Bacteria Growth	83	83.0
Staphylococcus aureus	45	54.2
Escherichia coli	5	6.0
Proteus mirabilis	3	3.6
Klebsiella pneumoniae	15	18.1
Pseudomonas aeruginosa	11	13.3
Streptococcus pneumoniae	4	4.8

Table 1 shows that bacterial infections are prevalent in burn wounds, with 83% of the cases showing bacterial growth. Among the bacterial isolates, *Staphylococcus aureus* was the most common (54.2%), followed by *Klebsiella pneumoniae* (18.1%), *Pseudomonas aeruginosa* (13.3%), and less frequently, *Escherichia coli* (6.0%), *Streptococcus pneumoniae* (4.8%), and *Proteus mirabilis* (3.6%).

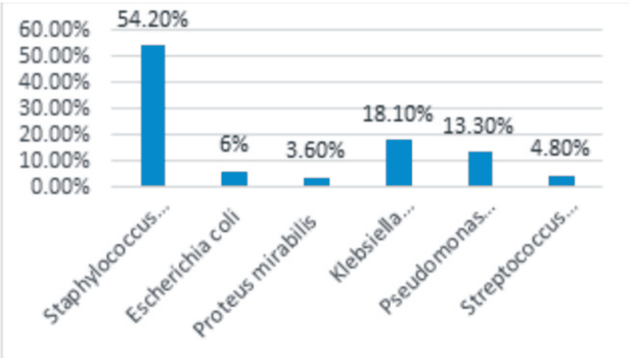
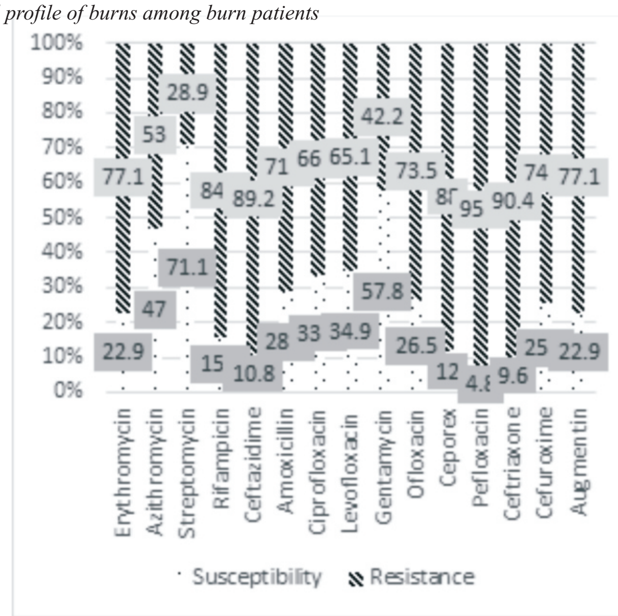


Figure 2: Graphical representation of identified bacteria species in burn wounds

4.2 Table 2: Antibiotic susceptibility patterns of isolated bacteria from burn wounds

Table 2 highlights the antibiotic susceptibility and resistance patterns of bacteria isolated from burn wounds, revealing significant challenges posed by antibiotic resistance. Among the tested antibiotics, Streptomycin showed the highest susceptibility rate (71.1%), followed by Gentamycin (57.8%), making them the most effective antibiotics for these infections. Azithromycin (47.0%) and Ciprofloxacin (33.7%) demonstrated moderate effectiveness, with nearly half of the bacterial isolates being resistant. Other antibiotics, including Levofloxacin (34.9%), Ofloxacin (26.5%), Amoxicillin (28.9%), and Cefuroxime (25.3%), exhibited limited susceptibility, indicating reduced efficacy in managing burn wound infections. Notably, antibiotics such as Rifampicin (15.7%), Ceporex (12.0%), Ceftazidime (10.8%), Ceftriaxone (9.6%), and Pefloxacin (4.8%) displayed extremely low susceptibility rates, rendering them largely ineffective.

Resistance rates were alarmingly high for most antibiotics. Pefloxacin exhibited the highest resistance (95.2%), followed closely by Ceftazidime (89.2%) and Ceporex (88.0%). Similarly, Ceftriaxone (90.4%) and Rifampicin (84.3%) showed very high resistance levels, limiting their therapeutic utility. Erythromycin and Augmentin both had resistance rates of 77.1%, while Ofloxacin (73.5%) and Amoxicillin (71.1%) also displayed substantial resistance.



Even commonly used antibiotics such as Cefuroxime (74.7%) faced significant resistance.

Figure 3: Graphical representation of Antibiotic susceptibility patterns of isolated bacteria from burn wounds.

4.3 Table 3: Prevalence of multi-drug-resistant strains in burn wounds

Bacteria isolates from burn wounds	**Prevalence MDR N (%)**	**Non-MDR N (%)**
Staphylococcus aureus (n=45)	32 (71.1)	13 (28.9)
Escherichia coli (n=5)	2	3
Proteus mirabilis (n=3)	(40.0)	(60.0)
Klebsiella pneumoniae	1	2
(n=15)	(33.3)	(66.7)
Pseudomonas aeruginosa	11	4
(n=11)	(73.3)	(26.7)
Streptococcus pneumoniae	8	3
(n=4)	(72.7)	(27.3)
	2 (50.0)	2 (50.0)
Total bacteria isolates (n=83)	56 (67.5)	27 (32.5)

Table 3 highlights the prevalence of multi-drug-resistant (MDR) bacterial strains isolated from burn wounds. Among the isolates, *Staphylococcus aureus* showed the highest MDR rate (71.1%), followed by *Klebsiella pneumoniae* (73.3%) and *Pseudomonas aeruginosa* (72.7%), indicating their significant contribution to treatment challenges. Lower MDR rates were observed in *Escherichia coli* (40.0%), *Proteus mirabilis* (33.3%), and *Streptococcus pneumoniae* (50.0%). Overall, 67.5% of the total isolates were MDR, underscoring the widespread resistance in burn wound infections.

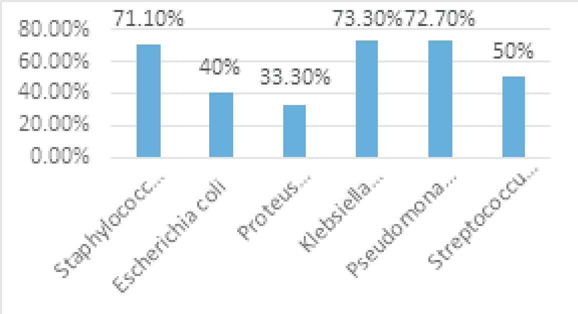


Figure 4: Graphical representation of prevalence of multi-drug-resistant strains in burn wounds

DISCUSSION

The study investigated bacteriological profile of burn wounds among patients at Orthopaedics Hospital, Enugu, Nigeria. Burn injuries represent a significant healthcare challenge, often leading to complex infections due to the loss of the skin's protective barrier. The objectives of the study include identifying the bacterial species responsible for burn wound infections, evaluating the prevalence of multi-drug-resistant (MDR) strains, and analyzing the resistance patterns to commonly used antibiotics.

The bacteriological analysis of burn wounds in this study revealed a prevalence of 83% bacterial growth, with 17% of the samples showing no bacterial growth. The predominant isolate was *Staphylococcus aureus* (54.2%), followed by *Klebsiella pneumoniae* (18.1%), *Pseudomonas aeruginosa* (13.3%), *Escherichia coli* (6.0%), *Streptococcus pneumoniae* (4.8%), and *Proteus mirabilis* (3.6%). These findings reflect the susceptibility of burn wounds to microbial colonization and the diversity of bacterial species responsible for infections. The high prevalence of bacterial infections can be attributed to the nature of burn wounds, which disrupt the skin's natural barrier, exposing tissues to environmental pathogens and hospital-acquired bacteria. The moist, nutrient-rich environment of burn wounds provides ideal conditions for bacterial growth. Moreover, the immunocompromised state of burn patients further predisposes them to infections. *Staphylococcus aureus*, a common skin commensal, emerges as the predominant pathogen due to its ability to adhere to damaged tissues, evade immune responses, and produce virulence factors like toxins and biofilms.

The findings are consistent with similar studies conducted in other parts of Nigeria. For instance, Osifo and Aghahowa, (2019), in Lagos reported a bacterial prevalence of 82% in burn wounds, with Staphylococcus aureus and Pseudomonas aeruginosa being the dominant pathogens. Similarly, a study conducted in Benin City by Oguntibeju *et al.* (2020) revealed a bacterial infection rate of 80% in burn wounds, also identifying Staphylococcus aureus as the leading isolate. These similarities across studies highlight the pervasive nature of bacterial infections in Nigerian burn patients and the dominance of Staphylococcus aureus in this context. The prevalence of *Klebsiella pneumoniae* and *Pseudomonas aeruginosa* in this study aligns with findings from previous Nigerian research. Both pathogens are frequently associated with nosocomial infections and are known to thrive in hospital environments. For instance, in a study conducted at the University College Hospital, Ibadan, Quarcoo *et al.* (2023) reported *Klebsiella pneumoniae* as the second most prevalent isolate in burn wounds after *Staphylococcus aureus*.

Across Africa, similar trends in bacterial prevalence have been observed. For example, in Ghana, Hailu *et al*. (2021) reported a bacterial growth rate of 79% in burn wounds, with *Staphylococcus aureus* accounting for 50% of isolates, followed by Pseudomonas aeruginosa. In Ethiopia[11] reported an 85% prevalence of bacterial infections in burn wounds, with *Staphylococcus aureus* and *Klebsiella pneumoniae* being the most commonly identified pathogens. These studies confirm that the bacteriological profile of burn wounds in Nigeria is consistent with broader trends across sub-Saharan Africa. However, slight variations exist. For instance, while *Staphylococcus aureus* is consistently dominant in Nigerian studies, its prevalence is sometimes lower in East African studies, where *Pseudomonas aeruginosa* is more commonly isolated. These differences may be attributed to variations in hospital infection control measures, environmental factors, and antibiotic usage patterns. Additionally, the presence of less common isolates like *Streptococcus pneumoniae* and *Proteus mirabilis* in this study may reflect differences in local microbial flora or specific hospital environments.

The antibiotic susceptibility patterns revealed significant resistance among bacterial isolates. While Streptomycin (71.1%) and Gentamycin (57.8%) exhibited the highest susceptibility rates, most antibiotics showed alarmingly high resistance levels. For example, Pefloxacin demonstrated the highest resistance rate at 95.2%, followed by Ceftazidime (89.2%) and Ceporex (88.0%). Resistance to commonly used antibiotics like Ciprofloxacin (66.3%) and Amoxicillin (71.1%) was also substantial. The high levels of antibiotic resistance observed in this study can be attributed to several factors, including overuse and misuse of antibiotics in both hospital and community settings. The frequent and sometimes inappropriate use of broad-spectrum antibiotics, without culture and sensitivity testing, accelerates the development of resistant strains. Pathogens like *Pseudomonas aeruginosa* and *Klebsiella pneumoniae* possess intrinsic mechanisms of resistance, such as beta-lactamase production, which allows them to survive in the presence of beta-lactam antibiotics. Additionally, the ability of bacteria to form biofilms plays a critical role in their resistance to antibiotics. Biofilms protect bacteria from both host immune responses and the action of antimicrobial agents, making infections more difficult to treat. These findings emphasize the need for more precise diagnostic tools and the implementation of targeted antibiotic therapy based on susceptibility patterns.

These findings align with antibiotic resistance patterns observed in other Nigerian studies. [7] in Lagos reported resistance rates exceeding 80% for Ceftriaxone and Ciprofloxacin, mirroring the trends observed in this study. Similarly, [10] in Ibadan documented high resistance levels to beta-lactams and fluoroquinolones in burn wound infections. The consistent resistance patterns across Nigerian studies underscore the widespread misuse of antibiotics, lack of antimicrobial stewardship programs, and inadequate regulation of over-the-counter antibiotic sales. The moderate susceptibility to Streptomycin and Gentamycin observed in this study is consistent with previous reports in Nigeria, where these antibiotics remain relatively effective due to their less frequent use compared to broad-spectrum antibiotics. However, the declining susceptibility rates to these drugs highlight the growing challenge of resistance even to less commonly used antibiotics.

Similar resistance patterns have been observed in other African countries. In Ethiopia, [11] reported resistance rates of 83% for Ceftriaxone and 65% for Ciprofloxacin, indicating comparable levels of resistance to those observed in Nigeria. In Ghana, Hailu *et al*. (2021) noted that while Gentamycin and Streptomycin were among the most effective antibiotics, resistance rates were steadily increasing. These findings suggest that the issue of antibiotic resistance is not confined to Nigeria but reflects broader challenges across Africa. However, the magnitude of resistance varies slightly between regions. For example, studies in East and Southern Africa often report higher resistance rates to fluoroquinolones and cephalosporins, potentially due to differences in prescribing practices and healthcare infrastructure. Conversely, resistance rates to less commonly used antibiotics, such as Streptomycin, are often lower in these regions compared to Nigeria, where self-medication and over-the-counter availability of antibiotics are more prevalent.

The study found that 67.5% of bacterial isolates were multi-drug-resistant (MDR), with *Klebsiella pneumoniae* (73.3%) and *Pseudomonas aeruginosa* (72.7%) exhibiting the highest MDR rates. *Staphylococcus aureus* also demonstrated a high MDR prevalence of 71.1%. Lower MDR rates were observed in *Escherichia coli* (40.0%), *Proteus mirabilis* (33.3%), and *Streptococcus pneumoniae* (50.0%). The prevalence of MDR isolates in this study is consistent with findings from other Nigerian research. Osifo and Aghahowa, (2019) reported an MDR prevalence of 65% in Lagos, with similar resistance patterns in *Klebsiella pneumoniae*, *Pseudomonas aeruginosa*, and *Staphylococcus aureus*. A study in Benin City by Oguntibeju *et al*. (2020) also highlighted high MDR rates among burn wound isolates, with *Pseudomonas aeruginosa* and *Klebsiella pneumoniae* being the most resistant pathogens. These findings reflect the pervasive issue of MDR pathogens in Nigerian healthcare settings, driven by the overuse of antibiotics and inadequate infection control practices. The MDR prevalence observed in this study aligns with reports from other African countries. In Ethiopia, [11] documented MDR rates exceeding 70% for *Klebsiella pneumoniae* and *Pseudomonas aeruginosa*, similar to the findings in this study. In Ghana, Hailu *et al*. (2021) reported an MDR prevalence of 68%, with *Staphylococcus aureus* and *Pseudomonas aeruginosa* being the most resistant isolates. These consistent patterns highlight the widespread nature of MDR pathogens in African burn care.

However, regional differences in MDR prevalence exist. For example, studies in North Africa, such as those conducted in Egypt and Tunisia, often report higher MDR rates for *Pseudomonas aeruginosa* and *Klebsiella pneumoniae*, potentially due to differences in healthcare infrastructure and antibiotic prescribing practices. Conversely, MDR rates in some rural African settings may be lower due to limited access to antibiotics, although this often results in poorer overall infection management. The findings of this study underscore the critical challenge posed by MDR pathogens in burn wound infections across Nigeria and Africa. These infections are associated with higher mortality rates, prolonged hospital stays, and increased healthcare costs, highlighting the urgent need for improved infection control measures and antimicrobial stewardship programs tailored to the African context.

CONCLUSION

The investigation into the bacteriological profile of burn wounds among patients at Orthopaedics Hospital, Enugu, Nigeria, has highlighted significant challenges in managing burn wound infections. The high prevalence of bacterial infections in burn wounds is indicative of the vulnerability of burn patients to both endogenous (skin commensals) and exogenous pathogens, facilitated by the disruption of the skin barrier and the immunocompromised state of the patient. The findings of this study align with those of previous studies in Nigeria and sub-Saharan Africa, which similarly report Staphylococcus aureus as the predominant pathogen in burn wounds (Osifo and Aghahowa, 2019; Hailu *et al*. 2021). This underscores the consistency of microbial profiles in burn wound infections across different settings, with Staphylococcus aureus and Pseudomonas aeruginosa being the primary culprits.

The antibiotic susceptibility tests revealed significant resistance across most antibiotics, with only Streptomycin (71.1%) and Gentamycin (57.8%) showing moderate effectiveness. In contrast, antibiotics such as Pefloxacin (95.2%) and Ceftazidime (89.2%) demonstrated alarmingly high resistance rates. These findings highlight the ongoing problem of antibiotic misuse in Nigerian healthcare settings, as similar studies have indicated widespread resistance to commonly used antibiotics like Ciprofloxacin and Ceftriaxone (Osifo and Aghahowa, 2019). Such high resistance rates are likely a result of self-medication, inappropriate prescribing, and inadequate infection control practices, which foster the development of resistant strains.

The study also found that 67.5% of bacterial isolates were multi-drug-resistant (MDR), with the highest MDR rates observed in *Klebsiella pneumoniae* (73.3%) and *Pseudomonas aeruginosa* (72.7%). These findings are consistent with other studies in Nigeria and sub-Saharan Africa, where MDR pathogens have become a significant challenge in burn wound management (Hailu *et al*. 2021). The prevalence of MDR bacteria highlights the limited therapeutic options available for burn wound infections and calls for urgent intervention to curb the spread of resistance.

REFERENCES

Church, D., Elsayed, S., Reid, O., Winston, B., & Lindsay, R. (2006*). Burn wound infections*. Clinical microbiology reviews, *19*(2), 403–434.

Jeschke, M. G. (2023). *Burn wound infection: A review*. Burns, 39(1), 1-8.

Field, A. (2018). *Discovering Statistics Using IBM SPSS Statistics*. 5th ed. Thousand Oaks, CA: Sage Publications.

Bryman, A., & Cramer, D. (2012). *Quantitative Data Analysis with IBM SPSS 17, 18 & 19*. 2nd ed. New York: Routledge.

Pallant, J. (2020). *SPSS Survival Manual*. 7th ed. Maidenhead: Open University Press.

Edoho, A., Ekanem, E. and Bassey, O., (2023). Multi-drug resistance patterns in burn wound infections in tertiary hospitals. *African Journal of Clinical Microbiology*, 15(3), pp.180-195.

Osifo, U.O. and Aghahowa, S.E., (2019). Bacterial flora and antibiotic susceptibility profiles in burn wound infections in Benin City, Nigeria. *West African Journal of Medicine*, 38(5), pp.232-239.

Oguntibeju, O.O., Adeniran, A.I. and Aghodzo, M.A., (2020). Prevalence and antibiotic resistance profiles of bacterial isolates in burn patients. *African Journal of Microbiology Research*, 14(11), pp.401-411.

Quarcoo, E., Mensah, P. and Ampadu, E., (2023). Antimicrobial resistance in burn wounds: A review from Ghana. *West African Medical Journal*, 36(2), pp.89-97.

Hailu, T., Tesfaye, G. and Desta, Z., (2021). Bacterial isolates and antimicrobial resistance patterns in burn wound infections. *Journal of Infection and Public Health*, 14(7), pp.921-930.