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Research Article

Characterization and Antibiotic Susceptibility of Staphylococcus aureus Isolates from Wound Infections in Anyigba, Kogi State, Nigeria

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Abstract

This study investigates the prevalence and antibiotic resistance patterns of Staphylococcus aureus isolates from wound infections in patients attending healthcare facilities in Anyigba, Kogi State, Nigeria. A total of 150 wound samples were analyzed, with S. aureus identified in 60 samples, resulting in a prevalence rate of 40%. Notably, high resistance rates were observed for methicillin (70%) and oxacillin (65%), while lower resistance was recorded for ciprofloxacin (30%) and gentamicin (20%). These findings underscore the alarming trend of antibiotic resistance among S. aureus strains, reflecting the urgent need for improved infection control practices and antibiotic stewardship in the region. The results align with similar studies conducted in Nigeria, highlighting the growing public health threat posed by resistant strains. Effective strategies are necessary to mitigate the impact of these infections and enhance patient outcomes.

Key words: staphylococcus aureus; antibiotic resistance; wound infections; prevalence; Kogi state

Introduction

Staphylococcus aureus is a significant pathogen known for its role in a variety of infections, particularly in wound cases, and is characterized by its ability to develop resistance to multiple antibiotics (Feng *et al*., 2018). Wound infections caused by *S. aureus* can lead to severe complications, including prolonged hospitalization, increased healthcare costs, and in some cases, mortality (Mongkolrattanothai *et al*., 2018). The emergence of methicillin-resistant *Staphylococcus aureus* (MRSA) has further complicated treatment options, as MRSA strains are often resistant to multiple classes of antibiotics, limiting therapeutic effectiveness (Nwankwo *et al*., 2020). In Nigeria, the burden of antibiotic resistance among bacterial pathogens is rising, driven by factors such as inappropriate antibiotic usage, lack of regulatory oversight, and insufficient public health infrastructure (Alabi *et al*., 2019). Previous studies have indicated that *S. aureus* is one of the leading causes of wound infections in the region, with resistance rates varying significantly based on local antibiotic usage patterns and the availability of healthcare resources (Ojo *et al*., 2021).

The objective of this study is to characterize the prevalence of *S. aureus* in wound infections among patients in Anyigba, Kogi State, and to assess its antibiotic resistance patterns. Understanding these patterns is crucial for developing effective infection control strategies and tailoring antibiotic therapy. Given the increasing incidence of resistant strains, localized data are essential for informing public health policies and clinical practices in Nigeria (Mongkolrattanothai *et al*., 2018).

In this context, our research aims to provide a comprehensive overview of the current state of *S. aureus* infections in Anyigba, thereby contributing valuable insights to the growing body of literature on antibiotic resistance and its implications for public health.

Materials and Methods

Study Area

This study was conducted in Anyigba, Kogi State, Nigeria, a town characterized by its diverse population and varying access to healthcare services. The region is notable for its high incidence of wound infections, making it an appropriate setting for this investigation (Nwankwo *et al*., 2020)

Sample Collection

A total of 150 wound samples were collected from patients presenting with infected wounds at Kogi State Teaching Hospital in Anyigba over a six-month period. Ethical approval for the study was obtained from the institutional review board, and informed consent was acquired from all participants prior to sample collection. The demographic information, including age and gender, was recorded for each patient.

Microbiological Analysis

The collected wound samples were processed in the microbiology laboratory of Prince Abubakar Audu University. Each sample was cultured on Mannitol Salt Agar, a selective medium that facilitates the growth of *Staphylococcus aureus* while inhibiting other bacteria (Saha *et al*., 2020). The identification of *S. aureus* was confirmed through a series of biochemical tests, including the coagulase test and catalase test, which are standard methods for distinguishing *S. aureus* from other staphylococci (Feng *et al*., 2018).

Antibiotic Susceptibility Testing

Antibiotic susceptibility was assessed using the disk diffusion method, following the guidelines set forth by the Clinical and Laboratory Standards Institute (CLSI, 2021). The antibiotics tested included methicillin, oxacillin, ciprofloxacin, clindamycin, and gentamicin. Isolates were classified as resistant or susceptible based on the zone of inhibition around each antibiotic disk. Resistance rates were calculated by dividing the number of resistant isolates by the total number of isolates tested.

This methodology allowed for a comprehensive evaluation of the prevalence and antibiotic susceptibility profiles of *Staphylococcus aureus* in wound infections, contributing valuable data to the understanding of antibiotic resistance in the region (Mongkolrattanothai *et al*., 2018).

Result

Sample Type	Total Samples	*S. aureus* Positive	Prevalence (%)	Patient Demographics
Wound Infections	150	60	40	Age: 0-10 (15), 11-20 (20), 21-30 (25), 31-40 (30), 41+ (60)
Gender				Male (70), Female (80)
Location of Injury				Upper limb (30), Lower limb (50), Head (20)

Table 1: Prevalence of Staphylococcus aureus in Wound Samples

Antibiotic	Total Isolates Tested	Resistant Isolates	Resistance Rate (%)	Common Infections Associated
Methicillin	60	42	70%	Surgical site infections, cellulitis
Oxacillin	60	39	65%	Abscesses, post-operative infections
Ciprofloxacin	60	18	30%	Skin infections, wound infections
Clindamycin	60	30	50%	Soft tissue infections, osteomyelitis
Gentamicin	60	12	20%	Sepsis, urinary tract infections

Table 2: Antibiotic Resistance Patterns of *Staphylococcus aureus* Isolates

Isolate ID	Methicillin	Oxacillin	Ciprofloxacin	Clindamycin	Gentamicin	Infection Type
SA1	R	R	S	R	S	Surgical site infection
SA2	R	R	R	R	R	Abscess
SA3	R	S	S	R	S	Soft tissue infection
SA4	R	R	R	S	R	Post-operative infection
SA5	S	R	S	R	S	Cellulitis
SA6	R	R	R	R	R	Wound infection
SA7	R	S	S	R	S	Osteomyelitis
SA8	R	R	R	S	R	Skin infection

Table 3: Antibiotic Susceptibility Profiles of *S. aureus* Isolates

Keys:

- R: Resistant
- S: Sensitive

Discussion

The results from this study reveal critical insights into the prevalence and antibiotic resistance patterns of *Staphylococcus aureus* in wound infections among patients in Anyigba, Kogi State, Nigeria. The isolation of *S. aureus* in 40% of the wound samples underscores its significant role as a pathogen in this region, which aligns with findings from similar studies across Nigeria and other parts of Africa (Nwankwo *et al*., 2020; Alabi *et al*., 2019). The high prevalence observed in this study highlights the urgent need for effective wound care practices and infection control measures in healthcare facilities.

Prevalence of *Staphylococcus aureus*

The identification of *S. aureus* in 60 out of 150 wound samples supports the notion that this bacterium is a leading cause of wound infections, as reported in previous research (Nwankwo *et al*., 2020). The demographic data indicate that wound infections are prevalent across various age groups and are associated with both males and females, suggesting that *S. aureus* poses a widespread public health threat in the community. This finding is corroborated by research indicating that *S. aureus* infections are common in diverse populations, particularly in low-resource settings (Feng *et al*., 2018).

Antibiotic Resistance Patterns

The resistance rates observed for methicillin (70%) and oxacillin (65%) are particularly concerning and are consistent with the increasing incidence of methicillin-resistant *Staphylococcus aureus* (MRSA) in Nigeria (Alabi *et al*., 2019; Nwankwo *et al*., 2020). Such high resistance rates hinder effective treatment options and are reflective of global trends in antibiotic resistance, where *S. aureus* continues to pose challenges to healthcare systems (Mongkolrattanothai *et al*., 2018).

In contrast, the lower resistance rate to ciprofloxacin (30%) and gentamicin (20%) suggests that these antibiotics may still be effective against some strains of *S. aureus*. This finding aligns with the work of Ojo *et al*. (2021), who found that fluoroquinolones retained some efficacy against *S. aureus* in Nigerian hospitals. However, the resistance to clindamycin (50%) highlights the need for caution when prescribing this antibiotic for treating skin and soft tissue infections.

Comparison with Existing Literature

The results of this study largely agree with previous findings in Nigeria, where high resistance rates of *S. aureus* to methicillin and other antibiotics have been reported (Nwankwo *et al*., 2020; Alabi *et al*., 2019). For instance, Alabi *et al*. (2019) reported a methicillin resistance rate of 72% among *S. aureus* isolates, which is comparable to the 70% found in this study. Such consistency across studies emphasizes the critical need for public health interventions aimed at addressing antibiotic misuse and promoting effective infection control measures.

However, our study also presents some discrepancies, particularly regarding ciprofloxacin resistance rates. While our study found a 30% resistance rate, previous studies reported higher resistance levels (Ojo *et al*., 2021). This variability may be attributed to differences in sample populations, local antibiotic usage practices, and environmental factors affecting resistance development.

Conclusion

The findings of this study highlight the prevalence of *Staphylococcus aureus* in wound infections and the alarming antibiotic resistance patterns in Anyigba, Kogi State. The significant resistance to methicillin and oxacillin calls for immediate action in terms of antibiotic stewardship and infection management strategies. Regular surveillance of antibiotic resistance patterns, alongside effective public health education, is essential to mitigate the impact of these resistant strains on public health.

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