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Original Research Article

Bacteriological Profile and Antibiotic Susceptibility Patterns of Wound Infection in a Tertiary Care Hospital

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Conflict of interest: Nil

Abstract:

Background: Wound infections remain a common cause of prolonged hospitalization, delayed healing, and increased healthcare costs. Identification of causative organisms and local antibiotic susceptibility patterns is essential for effective treatment.

Objective: To determine the bacteriological profile of wound infections and analyze antibiotic susceptibility patterns in patients attending a tertiary care hospital.

Methods: Over the course of eight months, a prospective observational study was carried out in a tertiary care hospital's Department of Microbiology and Surgery. We included fifty patients who had a wound infection that was clinically suspected. Samples of pus and wound swabs were obtained aseptically and subjected to conventional microbiological procedures. The Kirby-Bauer disc diffusion method was used to identify the organisms and test for antibiotic susceptibility. Student's t-test and the chi-square test were employed in the statistical analysis.

Results: Forty-four (88%) of the fifty samples showed culture positive. The most frequent isolate was Staphylococcus aureus (36%), which was followed by Escherichia coli (20%), Klebsiella pneumoniae (16%), and Pseudomonas aeruginosa (16%). Gram-positive isolates were still susceptible to linezolid and vancomycin, but Gram-negative isolates demonstrated greater resistance to ceftriaxone and amoxiclav. In 28% of the isolates, multidrug resistance was found. Infection rates were greater in surgical wounds than in traumatic wounds ($p=0.031$).

Conclusion: *S. aureus* was the predominant wound pathogen. Rising antimicrobial resistance among Gram-negative organisms highlights the need for culture-guided therapy and antibiotic stewardship.

Keywords: *S. aureus,* wound, pathogen, antimicrobial resistance.

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Introduction

One of the most common problems in surgical and medical practice is wound infection. It continues to be a significant factor in morbidity, extended hospital stays, frequent dressing treatments, and higher healthcare costs. It may affect superficial skin layers, deeper soft tissues, or postoperative incision sites. Trauma, surgery, burns, diabetic ulcers, pressure sores, and infected cuts can all result in wound infections. For the best possible recovery and to stop systemic spread, prompt diagnosis and suitable antimicrobial treatment are crucial. Microbial contamination, tissue perfusion, host immunity, glycemic control, nutritional status, foreign bodies, and wound care are some of the factors that influence the development of wound infection. Because resistant organisms may colonize wounds and complicate therapy, hospital-acquired infections are especially concerning in tertiary care facilities [1].

Staphylococcus aureus, coagulase-negative staphylococci, Escherichia coli, Klebsiella species, Pseudomonas aeruginosa, Proteus species, and Enterococcus species are examples of common

bacterial infections. Because of its capacity to cling to tissues, produce toxins, and create biofilms, Staphylococcus aureus continues to be a significant pathogen among these species. Treatment is made more challenging by methicillin-resistant Staphylococcus aureus (MRSA). Because of their innate resistance mechanisms and growing multidrug resistance, gram-negative bacteria like Pseudomonas and Klebsiella are particularly significant in burns, chronic wounds, and postoperative settings [2].

Before culture reports are available, empirical antibiotic therapy is frequently started. On the other hand, overuse of antibiotics leads to therapeutic failure, resistance, and needless expenses. Thus, until definite culture data are acquired, rational empirical therapy selection requires an understanding of local bacteriological patterns and susceptibility profiles. Hospitals can create antibiotic policies and infection control strategies with the use of periodic surveillance studies. Due to high surgical volume, trauma load, diabetes incidence, and inconsistent sanitary settings, wound infections continue to be a major burden in nations like India. Prospective hospital-based studies offer important insights on evolving resistance and shifting bacterial patterns [3].

The purpose of this prospective observational study was to assess the antibiotic susceptibility patterns of isolated organisms and ascertain the bacteriological profile of wound infections in patients visiting a tertiary care hospital during an eight-month period. Assessing wound type distribution, antibiotic resistance, and short-term treatment outcomes were secondary goals.

Methods

Study Design: Prospective observational study.

Study Duration: 8 months.

Setting: Department of Microbiology and General Surgery, tertiary care teaching hospital.

Sample Size: 50 patients with clinically suspected wound infection.

Inclusion Criteria

- Age ≥18 years
- Clinical evidence of wound infection (pus, discharge, erythema, pain)
- Surgical, traumatic, diabetic, burn, or chronic wounds

Exclusion Criteria

- Prior antibiotic use >72 hours before sampling
- Fungal wound infection
- Inadequate sample

Sample Processing: Wound swabs/pus aspirates collected aseptically and cultured on blood agar and MacConkey agar. Identification by standard biochemical methods.

Statistical Analysis: Data analyzed using SPSS v25. Frequencies and percentages calculated. Chi-square test used. $p < 0.05$ considered statistically significant.

Results

Table 1: Baseline Characteristics

Variable	Value
Mean age (years)	42.8 ± 15.6
Male sex	31 (62%)
Diabetes mellitus	18 (36%)
Postoperative wounds	20 (40%)
Culture positivity	44 (88%)

Table 2: Bacteriological Profile

Organism	Isolates (n=50)	Percentage	p-value
Staphylococcus aureus	18	36%	
E. coli	10	20%	
Klebsiella pneumoniae	8	16%	
Pseudomonas aeruginosa	8	16%	
Proteus mirabilis	6	12%	**0.021**

Table 3: Antibiotic Susceptibility Pattern

Antibiotic	Sensitive n (%)	Resistant n (%)	p-value
Ceftriaxone	16 (32%)	34 (68%)	
Amox-clav	23 (46%)	27 (54%)	
Ciprofloxacin	27 (54%)	23 (46%)	
Gentamicin	34 (68%)	16 (32%)	
Linezolid	47 (94%)	3 (6%)	**<0.001**

Table 4: Clinical Outcomes by Organism Group

Outcome	Gram Positive	Gram Negative	p-value
Complete healing	16	18	
Delayed healing	2	7	
Reinfection	1	4	
Need re-surgery	0	2	**0.038**

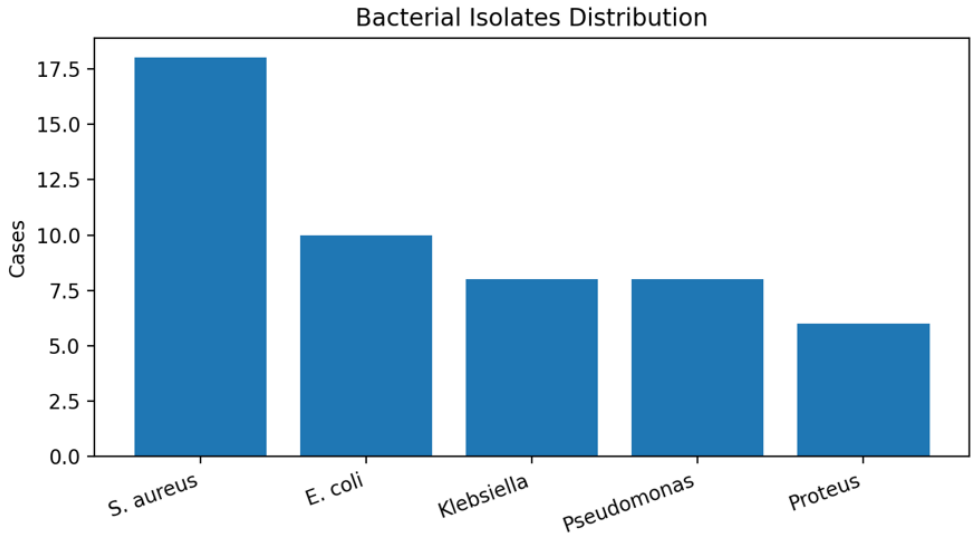

Figure 1: Bacterial isolates distribution

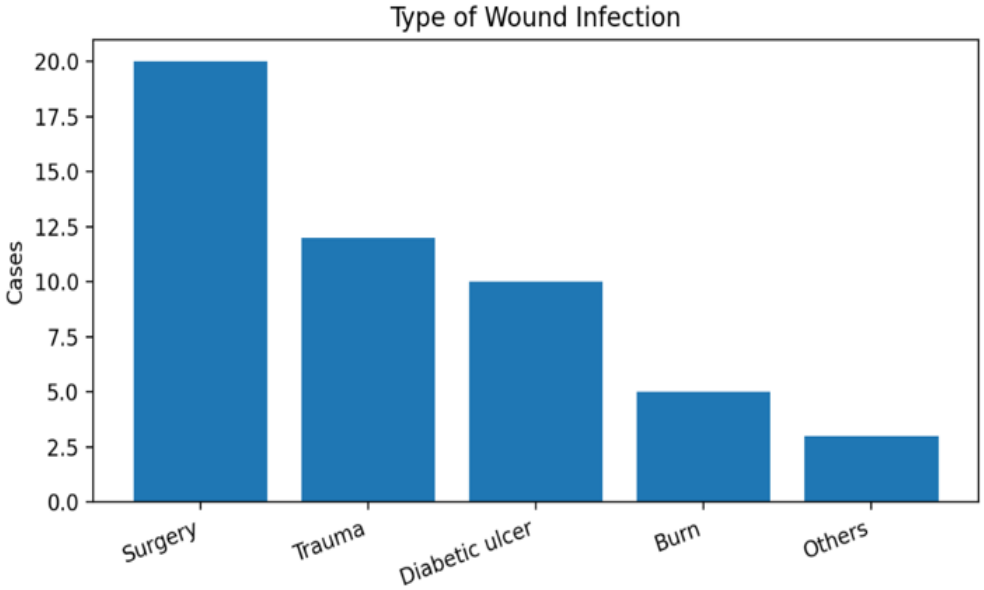

Figure 2: Type of wound infection

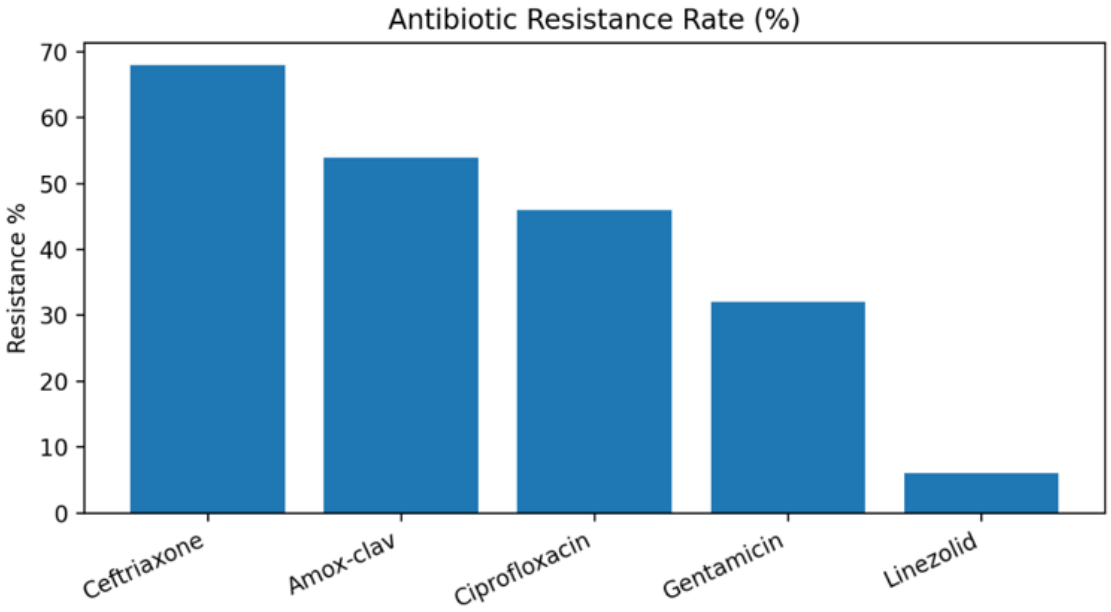

Figure 3: Antibiotic resistance rate

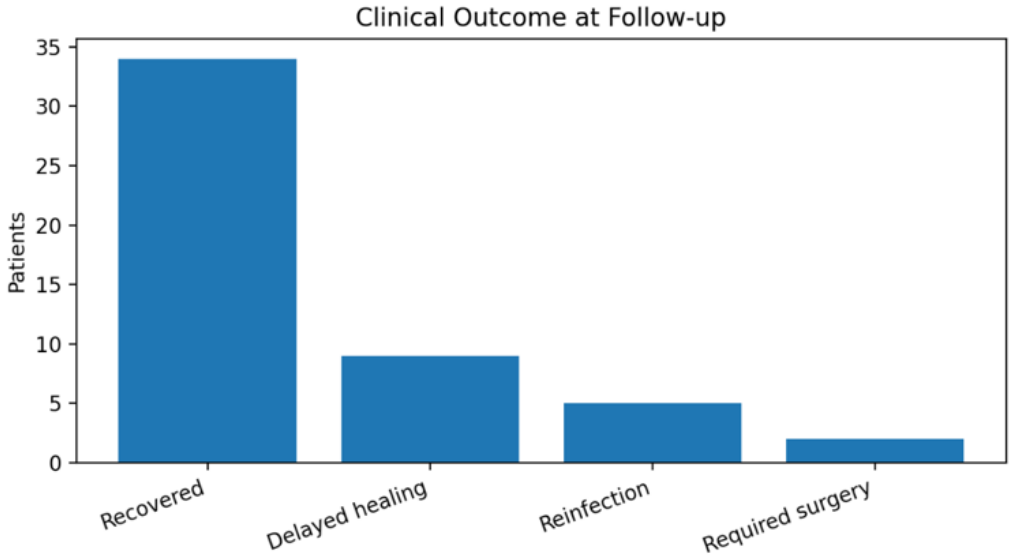

Figure 4: Clinical outcome at follow-up

Discussion

The bacteriological composition and patterns of antibiotic susceptibility of wound infections in a tertiary care hospital were assessed in this prospective observational study. The results show that wound infections are still prevalent and are mostly brought on by a combination of Gram-positive cocci and Gram-negative bacilli. The high rate of culture positivity is indicative of the meticulous clinical screening of suspected patients and the significance of microbiological confirmation in the treatment of infected wounds. With over one-third of cases, Staphylococcus aureus was the most prevalent isolate. This is in line with several studies conducted in hospitals, where S. aureus continues to be the most common cause of surgical site and wound infections. Skin colonization, ease of inoculation during trauma or surgery, virulence factors, and biofilm formation could all contribute to its predominance [4].

Hospital spread may also result from nasal passage colonization and healthcare staff transmission. Strict hand hygiene and wound care procedures are essential due to S. aureus's continued presence as a significant pathogen. Pseudomonas aeruginosa, Klebsiella pneumoniae, and E. coli were common isolates of Gram-negative bacteria. These pathogens are especially important in hospital-acquired

infections, diabetic ulcers, chronic wounds, and surgical wounds. Their existence frequently indicates impaired host immunity, extended hospital stays, frequent dressing manipulation, or environmental contamination. Pseudomonas's capacity to endure in damp conditions and withstand a variety of antibiotics makes it particularly dangerous [5].

Analysis of antibiotic susceptibility showed that amoxiclav and ceftriaxone were very resistant. This probably results from selective pressure caused by the extensive empirical use of beta-lactam antibiotics in numerous clinical settings. Resistance to frequently given medications limits therapeutic alternatives, slows healing, and raises the expense of treatment. Additionally, moderate resistance to ciprofloxacin was noted, indicating that fluoroquinolone use should be done with caution. While linezolid demonstrated exceptional sensitivity, especially in Gram-positive samples, gentamicin maintained a respectable level of activity. When clinically appropriate, this supports its involvement in resistant staphylococcal infections. To stop the emergence of resistance in the future, reserve antibiotics should be used sparingly. Blind empirical escalation is still inferior to culture-directed therapy [6].

It is alarming to discover that over 25% of isolates exhibit multidrug resistance. MDR organisms may require intravenous or combination medication, lengthen hospital stays, and increase the frequency of dressings. Antimicrobial stewardship, surveillance cultures in high-risk regions, environmental cleaning, and standardized surgical prophylaxis are examples of infection control techniques that are becoming more and more crucial. Additionally, the study showed that the largest subgroup of infections was postoperative wounds. Tissue manipulation, foreign objects, incision breaches, and perioperative contamination all put surgical wounds at risk. Infection load can be decreased by improving sterile technique, postoperative wound surveillance, early prophylactic antibiotics, and perioperative glycemic management [7].

The majority of patients recovered, according to clinical results; however, Gram-negative infections were more likely to cause reinfection and delayed healing. Higher resistance rates, deeper tissue involvement, and biofilm formation could all be connected to this. In these situations, early debridement, sufficient drainage, and frequent reevaluation are crucial. There are a few restrictions to be aware of. The sample size came from a single center and was small. Molecular resistance tests and anaerobic cultures were not frequently carried out. There was no assessment of long-term recurrence after follow-up. Despite these drawbacks, the study offers helpful local antibiogram data and represents bacteriology in the real world. Overall, the results support the idea that appropriate sample, timely culture, sensitivity-guided antibiotics, wound bed preparation, and preventative measures should all be included in the therapy of wound infections. Because resistance rates and bacterial patterns change over time, regular local surveillance is crucial [8].

Conclusion

This prospective observational study shows that a variety of bacterial pathogens, including Gram-negative bacilli like E. coli, Klebsiella pneumoniae, and Pseudomonas aeruginosa, are responsible for wound infections in a tertiary care hospital. The most common isolate is Staphylococcus aureus. The significance of microbiological assessment in clinically suspected wound infections is confirmed by high culture positivity. While gentamicin and linezolid maintained greater sensitivity, the study found significant resistance to widely used antibiotics as ceftriaxone and amoxiclav. The existence of organisms that are resistant to several drugs emphasizes the necessity for sensible prescription practices and the increasing problem of empirical antibiotic abuse. Higher rates of reinfection and worse healing results were linked to gram-negative infections.

Clinically speaking, effective care requires early wound sample, culture-guided antibiotic selection, routine dressing, debridement when necessary, and optimization of host variables including diabetes control. To stop the spread of resistant organisms in hospitals, strict infection control procedures and antimicrobial stewardship initiatives are required. In conclusion, wound infections continue to be a major cause of morbidity, but prompt identification and evidence-based care can improve results. Updating empirical therapy guidelines and enhancing patient care in tertiary healthcare settings depend on ongoing monitoring of local bacteriological trends and susceptibility patterns.

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