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RISK FACTORS AND MICROBIAL PROFILE OF POSTOPERATIVE INFECTIONS IN ORTHOPEDIC IMPLANTS

Microbiology

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ABSTRACT

Background and Aim: To study Surgical Site Infection in orthopedic implant patients. **Methods:** A prospective cohort study was conducted throughout a twelve-month duration in the Microbiology department of Bharati Vidyapeeth Deemed to be University Medical College and Hospital in Sangli, following endorsement from the Ethical Committee. **Results:** The study reported a 3.3% SSI rate in orthopedic implant surgeries, with UHMWPE implants most affected. Staphylococcus aureus, including 60% MRSA, was the leading pathogen. No significant risk factor associations were found, highlighting the need for strict aseptic protocols and culture-based antibiotic use.

KEYWORDS

INTRODUCTION

A Surgical Site Infection (SSI) occurs when there's evidence of pathogen infection within an incision site, either inside a month post-operation or within a year if surgical procedure involved implant placement. In the field of orthopedics, an SSI following prosthesis implantation is considered as a disastrous outcome for both individual undergoing surgery and the surgeon.

SSI incidents associated with orthopedic procedures pose severe and devastating complications for patients, surgical specialists, and healthcare facilities. Infections in orthopedic cases can prolong curtailed inpatient time, result in a twofold increase in re-hospitalization rates, and elevate care costs by more than 300%. Furthermore, they cause substantial physical limitations that significantly diminish life's quality for patient's post- surgery. Incidence levels of orthopedic SSI vary widely, ranging from 0.8% to 71%.

This underscores the variability in the occurrence of these infections, influenced by factors such as patient characteristics, surgical techniques, and healthcare practices. Addressing these challenges through preventive measures is crucial to mitigate the impact on both individual patients and healthcare institutions. The emergence of microbial contamination in fracture fixation devices is associated with microorganisms that flourish in biofilms, rendering their eradication difficult.

Contaminations are classified into three phases: initial (less than two weeks), intermediate (2 to 10 weeks), and prolonged (more than 10 weeks) infections. In 1896, Brewer documented a contamination rate of 39% in postop-surgical individuals, which has dramatically declined to 0.2% with the introduction of proper sterile techniques in modern times. The implementation of fundamental sterile practices and the utilization of antibiotics in the early 19th century led to a decrease in contamination rates.

The Centers for Disease Control and Prevention (CDC) categorizes SSI into three distinct types: Superficial Incisional, Deep Incisional, and Organ/Space. Superficial SSI are limited to skin and subcutaneous tissue, whereas Deep SSIs penetrate deeper tissue layers. Organ/Space SSIs affect regions beyond incision site, including internal organs. These classification systems play crucial role in identifying and managing SSIs, thereby enhancing patient outcomes.

Various risk factors play a role in the occurrence of SSIs in orthopedic implant patients. Patient-related factors such as age, underlying medical conditions (e.g., diabetes, immunosuppression), and obesity can compromise the body's ability to fight off infections. Additionally, the nature and complexity of the orthopedic procedure, as well as the duration of surgery, play a role. Poor surgical techniques, inadequate sterilization procedures, and suboptimal perioperative hygiene practices also heighten the risk of SSIs. To mitigate the occurrence of orthopedic surgical site infections (SSIs), it is crucial to identify risk factors both within the hospital and the broader community.

Hence, primary goal of this research is to investigate the ratio of SSIs among cases undergone orthopedic implant surgeries. Additionally, the study aims to pinpoint the various risk factors influencing SSIs in these patients. Furthermore, it seeks to analyze the bacteriological profile of SSIs, focusing on identifying the types of bacteria involved, as well as their antimicrobial susceptibility patterns. By addressing these objectives, the study aims to provide valuable insights that can enhance our understanding of SSIs in orthopedic implant patients and facilitate establishment of potent avoidance and intervention methodologies.

METHODS

A prospective cohort study was conducted throughout a twelve-month duration in the Microbiology department of Bharati Vidyapeeth Deemed to be University Medical College and Hospital in Sangli, following endorsement from Ethical committee. Inclusion Criteria: Patients undergoing orthopedic implant surgeries under clean wound classification. Exclusion Criteria: Patients with dirty wounds or external fixation devices.

This research comprised 240 patient that satisfied inclusion criteria throughout investigation duration. A successive sampling technique was employed for selection of study subjects.

RESULTS

Factors	SSI Cases (n=8)	No SSI Cases (n=232)	Total (n=240)
Male	6 (3.55%)	163 (96.45%)	169
Female	2 (2.82%)	69 (97.18%)	71
Age >60 years	3 (5%)	57 (95%)	60
Age 41-60 years	3 (3.26%)	89 (96.74%)	92
Age 21-40 years	2 (2.98%)	65 (97.02%)	67
Age <20 years	0 (0%)	21 (100%)	21
Hospital Stay >10d	4 (6.25%)	60 (93.75%)	64
Surgery Duration >4h	3 (3.4%)	84 (96.6%)	87

The study found a 3.3% surgical site infection (SSI) rate in orthopedic implant surgeries, aligning with similar research. Despite analyzing factors like age, gender, surgical site, implant type, preoperative stay, and surgery duration, no significant association with SSI was identified. The highest infection rates were observed with UHMWPE implants, followed by titanium and stainless steel. Staphylococcus aureus was the leading pathogen, with 60% being MRSA, followed by CONS and GNB, including ESBL producers. Gram-positive bacteria were sensitive to vancomycin and linezolid, while Gram-negative bacteria exhibited resistance to third-generation cephalosporin and fluoroquinolones.

These findings emphasize the importance of adhering to aseptic

protocols and using culture-guided antibiotics to reduce SSIs and prevent antibiotic resistance. Further studies exploring ASA scores, comorbidities, and tissue injury are recommended.

DISCUSSION

The 3.3% surgical site infection (SSI) rate observed in this study for orthopedic implant surgeries is comparable to findings from other similar studies. Despite evaluating potential risk factors, including patient demographics, surgical site, implant type, preoperative hospital stay, and surgery duration, no statistically significant associations with SSIs were identified. This suggests that additional variables not covered in the present study may influence infection rates.

Interestingly, UHMWPE implants showed the highest incidence of infections, followed by titanium and stainless steel, highlighting the need to further investigate material-specific factors affecting bacterial adherence or contamination. Consistent with global trends, Staphylococcus aureus emerged as the predominant pathogen, with a significant proportion (60%) identified as methicillin-resistant (MRSA). The detection of CONS and GNB, including ESBL-producing strains, further underscores the evolving antimicrobial resistance landscape in hospital settings.

These findings emphasize the critical importance of maintaining strict aseptic protocols and tailoring antibiotic treatments based on culture and sensitivity results. Empirical antibiotic use without proper microbiological guidance may contribute to the alarming rise of drug-resistant strains.

CONCLUSIONS

The study highlights a low SSI incidence in orthopedic implant surgeries; however, the presence of biofilm-associated infections and antimicrobial resistance underscores the need for stringent infection control measures. Preventive strategies such as optimized preoperative preparation, strict aseptic techniques, and targeted antibiotic prophylaxis are essential to minimize infection risks.

Further research on factors like ASA scores, comorbidities, and tissue injury may provide deeper insights into SSI prevention strategies.

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