ORIGINAL RESEARCH PAPER
Volume - 13 | Issue - 03 | March - 2024 | PRINT ISSN No. 2277 - 8179 | DOI : 10.36106/ijsr
INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH

STUDY OF THE INCIDENCE OF POSTOPERATIVE WOUND INFECTIONS IN ORTHOPEDIC SURGERIES

Orthopaedics

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ABSTRACT

Background: Surgical site infections (SSIs) present a significant challenge in orthopedic surgeries, leading to adverse outcomes and increased healthcare costs. Despite infection control advancements, SSIs remain problematic, especially in orthopedic wards. Unique factors, such as low inocula for implant-related infections and the pathogenicity of skin commensals, contribute to their occurrence. This study aims to determine the incidence of Post-operative Wound Infections (POWI)/Surgical Site Infections (SSI) within a year of orthopedic surgeries and identify associated risk factors. The findings can help improve patient safety and reduce the burden of SSIs in orthopedic surgeries. **Methods:** The study was a prospective, single-center, observational study conducted in a tertiary care center with 101 cases of SSI identified out of 1076 eligible orthopedic patients. Data on patient characteristics, comorbidities, length of pre-operative stay, timing of SSI detection, microbiological profile, NNIS scoring, and management strategies were collected. **Results:** The study examined 101 patients with surgical site infections (SSIs). Patients were primarily aged 30-50 years (39.6%), with a higher proportion of males (73.27%). Wound locations varied, with 45.54% on the Right Lower Limb and 32.67% on the Left Lower Limb. SSIs were detected early (22.77%), delayed (43.56%), or late (33.66%), predominantly as superficial infections (58.42%). Staphylococcus aureus (44.55%) was the most common microorganism. NNIS scoring indicated diverse severity, with 0 (50.50%) and 1 (48.51%) score being most prevalent. Management involved antibiotics (22.77%), debridement (45.54%), and implant removal surgery (31.68%). **Conclusion:** The study highlights the importance of proper risk assessment and management of orthopedic patients to prevent SSIs. It also emphasizes the need for early detection and intervention, judicious use of antibiotics, and follow-up care to improve patient outcomes and reduce the financial burden of infections. Implementing proactive measures based on the identified risk factors can lead to improved patient outcomes and a reduction in the incidence of SSIs in orthopedic settings.

KEYWORDS

Surgical site infection, orthopedic surgeries, Staphylococcus aureus, Methicillin Resistant Staphylococcus aureus (MRSA), debridement surgery, antibiotic prophylaxis.

INTRODUCTION:

Infection is one of the most dreaded complications in orthopedic surgeries, posing a significant threat to patient recovery and overall outcomes.[1,2] Surgical site infections (SSIs) are a subset of Nosocomial infections (NI) or Hospital-Acquired Infections (HAIs) that occur at the site of surgery within a defined time frame. These infections not only lead to prolonged hospital stays and increased morbidity but also result in a substantial economic burden on both patients and healthcare infrastructure.[3]

Orthopedic SSIs differ from infections in other surgical wards due to various factors, such as the use of implants and the pathogenicity of skin commensals. These infections are often caused by endogenous flora, and their risk is influenced by patient-related factors, surgical techniques, and the healthcare environment.[4] In India, the rise in trauma cases, coupled with inadequate sterilization in orthopedic wards and delays between fractures and surgery, has contributed to a higher incidence of SSIs.[5] Additionally, elderly patients are particularly vulnerable to postoperative complications, including SSIs, due to comorbid conditions and reduced immunity. Preventing SSIs is a critical priority for healthcare institutions.[6] Strategies for reducing the risk of these infections involve preoperative patient optimization, perioperative protocols, sterilization and preparation in the operation theatre, as well as controlling factors like patient-related conditions and surgical techniques.[2] While efforts have been made to minimize the risk of SSIs, the evidence surrounding their prevention is not entirely undisputed. Even with ultra-clean theatres and prophylactic antibiotics, the risk of developing SSI can never be completely ruled out.[7]

The management of SSIs can be financially burdensome and emotionally taxing for patients, leading to increased healthcare resource utilization and a lower quality of life. Identifying independent risk factors for SSIs is crucial for implementing targeted interventions to prevent this type of HAI effectively.[8] However, despite its significance, there is limited research on orthopedic SSIs in developing countries, including India. This study seeks to assess the extent of postoperative surgical site infections and pinpoint the underlying risk factors among patients with skeletal injuries treated at a tertiary care center.

By understanding the complexities of wound infection and the interplay of various biological pathways, this research seeks to contribute valuable insights to enhance preventive measures and ultimately improve patient outcomes in orthopedic surgeries.

METHODOLOGY:

The study was conducted at a tertiary care center that integrated medical treatment, teaching, and research facilities. The center has over 800 hospital beds, with approximately 120 beds allocated to orthopedic patients. This research employed a prospective, single-center, observational study design, focusing exclusively on patients undergoing orthopedic surgeries. All patients admitted and operated on in the Orthopedic Department of the institute between December 2019 to December 2021, with preoperatively intact surgery sites (closed fractures), regardless of age, gender, or the type of surgery (both elective and emergency cases), were included in the present study. Patients with infections after one year, compound fractures, incomplete data, and unwillingness to participate were excluded.

Data Collection and Case Finding:

All eligible post-operative patients during the study period were interviewed and observed daily throughout their hospitalization by surgical team members. Post-operative wound examinations were typically conducted on POD3 and POD5, unless signs of soakage or infection were detected. Patients suspected of having wound infection underwent further investigations, including radiological assessment, hematological analysis, bacteriological culture, and antibiogram, to determine the presence of infection.

Ethical Considerations:

The study obtained ethical clearances from the Ethical Clearances

 PRINT ISSN No. 2277 - 8179 | DOI : 10.36106/ijsr

Committee, as well as approvals from the Dean and Head of the Department of Orthopaedics. Prior to interviews, informed consent was obtained from the patients, ensuring privacy and confidentiality of their information.

Microbiological Analysis:
Pus samples were collected using sterile disposable cotton swabs, with one swab used for smear preparation for detecting pus cells and microorganisms. The other swab was inoculated onto Blood agar and MacConkey agar media and incubated at 37 degrees Celsius for 24 hours. After incubation, bacteria were identified using standard microbiological techniques, including Gram staining and biochemical reactions. Antibiotic sensitivity testing of all isolates was performed according to CLSI guidelines.

Data Analysis:
All data collected, including patient demographics, pre-morbidities, surgical details, antibiotic prophylaxis, wound conditions, and treatment outcomes, were analyzed using descriptive statistics.

RESULT:
In this study, a total of 101 patients were evaluated. The average age of the patients was determined to be 45.88 years. The majority of patients fell within the age range of 30 to 50 years, constituting 39.6% of the total sample. Subsequently, the age groups of 50 to 70 years, less than 30 years, and 70 to 90 years comprised 24.7%, 22.7%, and 12.8% of the patient population respectively.

Table-1: Gender distribution

Gender	No. of patients	Percentage
Male	74	73.27%
Female	27	26.73%
Total	101	100.00%

The male patient population, encompassing a total of 74 individuals, forms a substantial majority, accounting for 73.27% of the entire cohort. Conversely, the female patient group comprises 27 individuals, representing a distinct yet slightly smaller proportion of 26.73%.

Table-2: Location of wound in patients

Location of wound	No. of patients	Percentage
Rt U/L	8	7.92%
Lt U/L	11	10.89%
Rt L/L	46	45.54%
Lt L/L	33	32.67%
Spine	3	2.97%
Total	101	100.00%

The distribution of wound locations is detailed as follows: Among the patients, 8 cases (7.92% of the total) exhibit wounds on the Right Upper Limb (Rt U/L), while 11 cases (10.89%) present wounds on the Left Upper Limb (Lt U/L). Notably, a considerable portion of the dataset is characterized by wounds on the Right Lower Limb (Rt L/L), with 46 cases (45.54%) falling into this category. Similarly, the Left Lower Limb (Lt L/L) accounts for wounds in 33 instances (32.67% of the total). Additionally, a smaller subset of patients displays wounds on the Spine, amounting to 3 cases (2.97%).

Table-3: classification of Timing of SSI detection and Level of Surgical Site Infection.

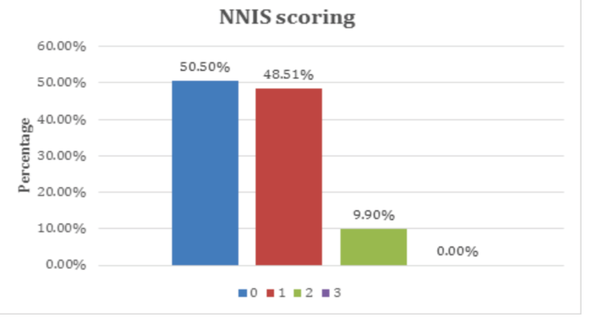
Timing of SSI detection	No. of patients	Percentage
Early	23	22.77%
Delayed	44	43.56%
Late	34	33.66%
Total	101	100.00%
Level of Surgical Site Infection		
Superficial	59	58.42%
Deep	42	41.58%

The identification of Surgical Site Infections (SSI) instances is presented with a focus on detection timing and infection level. In terms of timing, early detection (within 2 weeks) is noted in 23 cases (22.77%), delayed detection (within 2-10 weeks) in 44 cases (43.56%), and late detection (after 10 weeks) in 34 cases (33.66%). Concerning infection level, superficial infections are found in 59 cases (58.42%), while deep infections are detected in 42 cases (41.58%). This comprehensive analysis, encompassing 101 cases, provides a nuanced understanding of SSI occurrences, both in terms of when they were detected and their severity.

Table-4: Microorganism isolated

Microorganism isolated	No. of patients	Percentage
S. aureus	45	44.55%
CONS	8	7.92%
Pseudomonas spp.	18	17.82%
klebsiella spp.	11	10.89%
E. colli	13	12.87%
Proteus spp.	4	3.96%
Acinetobacter spp.	2	1.98%
Total	101	100.00%

The presence of isolated microorganisms is elucidated as follows: Among the analyzed cases, *Staphylococcus aureus* (*S. aureus*) was identified in 45 patients, accounting for 44.55% of the total occurrences. Coagulase-Negative *Staphylococci* (CONS) were observed in 8 cases, representing 7.92%. *Pseudomonas spp.* were isolated in 18 cases, constituting 17.82%, while *Klebsiella spp.* were found in 11 cases, contributing to 10.89%. *Escherichia coli (E. coli)* was detected in 13 cases, making up 12.87%, and *Proteus species (spp.)* were present in 4 cases, equivalent to 3.96%. Furthermore, *Acinetobacter spp.* were identified in 2 cases, accounting for 1.98%.



Graph-1: classification of NNIS scoring in patients.

The distribution of NNIS scoring is outlined as follows: Among the patients evaluated, a score of 0 was observed in 51 cases, constituting 50.50% of the total. A score of 1 was attributed to 49 cases, accounting for 48.51%. Notably, a score of 2 was assigned to 10 cases, representing 9.90%. Conversely, no instances were assigned a score of 3.

Table-5: management of cases

Management	No. of patients	Percentage
Antibiotics	23	22.77%
Debridement	46	45.54%
Implant removal	32	31.68%
Total	101	100.00%

Within the cohort under investigation, 23 patients (22.77% of the aggregate cases) required antibiotic administration only, while debridement, a surgical procedure for cleansing, was required in 46 cases (45.54%). Furthermore, implant removal had to be done in 32 instances (31.68%). In totality, this all-encompassing scrutiny, encompassing a total of 101 cases.

DISCUSSION:
In our study, we investigated the prevalence and factors associated with post-operative wound infections (POWI) or surgical site infections (SSI) in orthopedic patients. Our findings revealed a notable incidence rate of 9.38%, significantly higher than the accepted standard of less than 1%. This elevated incidence of SSI aligns with similar observations in other studies conducted in developing countries, such as those by **Ravi Kant Jain et al.,**[9] **N Rajkumari et al.,**[10] **Muhammad Shoaib Khan et al.,**[11] and **Ibtesam K Afifi et al.**[12]

Comparing our results with previous studies, our SSI rate was notably higher than rates reported in developed countries, yet consistent with the prevalence observed in developing countries, which typically ranged from 4.2% to 22.7%. e.g. **Birendra K Jain et al** [3] at 22.58%; **A Kisibo et al** [13] at 25% etc. T This pattern underscores the role of regional healthcare infrastructure and practices in influencing SSI risk.

Regarding patient demographics, we observed that older age groups, specifically those aged 30-70 years, exhibited a higher likelihood of infection development. This finding resonates with existing literature, including studies by **Lorena Soleto et al.,**[14] which indicated an association between advancing age and increased SSI risk. Notably, patients aged over 70 years demonstrated a decline in SSI rates, possibly due to hardy survivor effect; wherein it is hypothesized that the elderly population has already survived long and may have a physiological advantage over the younger population, reduced trauma-related admissions, or study-specific biases.

Our study's analysis of gender distribution indicated a male predominance (73.2%) among SSI patients, aligning with global trends reported in studies such as those by **Guo-qing Li et al.**[15] and **R Coello et al.**[16] Males generally exhibit higher rates of traumatic injuries and risk-taking behaviors, contributing to an elevated susceptibility to infection following orthopedic procedures.

Regarding the affected anatomical region, lower limb injuries (78.2%) were more commonly linked to SSI compared to upper limb injuries (18.8%). This trend is consistent with injury patterns observed in road traffic accidents and falls, where lower limbs are more vulnerable. Furthermore, injuries on the right side (53.4%) were more prevalent, potentially linked to right-side dominance and driving practices in the study population.

In terms of the causative organism, our study found *Staphylococcus aureus* (45.7%) to be the most common, often methicillin-resistant (MRSA), in line with research by **Amaradeep G et al., (54.54%),**[17] **Sanjay Kumar et al. (39%),**[18] **Anil K. Bhat et al. (24%),**[19] and others. This emphasizes the importance of preoperative screening, appropriate antibiotic prophylaxis, and infection control strategies to address the challenge of multidrug-resistant pathogens.

Regarding treatment, a considerable proportion of SSI patients (77.1%) required surgical management, including implant removal and debridement. Only 22.8% were managed solely with antibiotics, underscoring the necessity of combined antibiotic therapy and surgical intervention for effective SSI treatment.

Overall, our study underscores the intricate relationship between patient characteristics, surgical procedures, and healthcare practices in shaping the prevalence and outcomes of postoperative wound infections in orthopedic patients. The findings highlight the critical importance of stringent infection control measures, prudent patient selection, and improved surgical protocols to mitigate SSI risk.

CONCLUSION:

Orthopedic implants have significantly improved the treatment of bone fractures and joint arthritis. However, surgical site infections remain a potential complication despite strict aseptic precautions. The increasing rate of orthopedic surgeries worldwide underscores the importance of implementing strategies to minimize the risk of infections. Our study conducted at a tertiary care center revealed an infection rate of 9.38%, exceeding the accepted norm of <1%. Surgical site infections were found to prolong hospital stays, increase morbidity and mortality, and impose a significant financial burden on both patients and hospitals. Prompt management and decreased length of hospital stay, along with dedicated infection control units and active surveillance, are crucial in minimizing infection risks. *Staphylococcus aureus*, including MRSA, was the predominant pathogen, underscoring the importance of judicious antibiotic use based on culture reports.

To achieve decreased incidence of SSIs, interventions to reduce personnel during surgery, improve wound treatment, and minimized time between site shaving and surgery, among many others, are required. The study's prospective design, well-defined eligibility criteria, and large sample size strengthen its findings. However, the single-center setting and observational design limit causal inferences, and future studies should explore other potential risk factors for orthopedic SSIs to improve preventive measures.

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