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A Two-Year Audit of Deep Infection Rate After Total Hip Arthroplasty at Tertiary Care Hospital Lahore

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Abstract
Background: Deep infections following total hip arthroplasty (THA) are serious complications that can lead to significant morbidity, prolonged hospital stays, increased healthcare costs, and revision surgeries. Identifying risk factors and causative organisms is essential for prevention and effective management, particularly in resource-limited settings.
Aim: To audit the incidence, risk factors, and microbiological spectrum of deep surgical site infections following THA over a two-year period at a tertiary care hospital in Pakistan.
Methods: This retrospective audit was conducted at the Orthopaedic Department of King Edward Medical University/Mayo Hospital, Lahore, from August 2017 to July 2019. All patients who underwent primary or revision THA during the study period were included. Data were extracted from operative records, follow-up notes, and microbiology reports. Only cases meeting CDC criteria for deep infection were analyzed. Descriptive statistics and chi-square tests were used to assess associations between deep infection and clinical risk factors using SPSS v22.
Results: Out of 150 THA procedures, 9 cases (6%) developed deep infections. The infection rate was higher in revision THA (12%) than in primary procedures (4.8%). Significant associations were observed between deep infection and diabetes mellitus (p=0.011), obesity (p=0.026), and prolonged surgery >120 minutes (p=0.018). The most frequently isolated pathogens were Staphylococcus aureus (MSSA and MRSA), followed by Escherichia coli and Pseudomonas aeruginosa. Mean time to infection diagnosis was 21 ± 7.5 days post-surgery.
Conclusion: Deep infection after THA is influenced by modifiable risk factors. Preoperative optimization and timely surgical intervention are critical in reducing infection rates.

Keywords: Total hip arthroplasty, deep infection, surgical site infection, diabetes mellitus, obesity, risk factors, Pakistan.

Introduction

Total hip replacement (THA) surgery is a surgical procedure where a damaged hip joint is replaced with a prosthetic component. It is usually done to ease the pain and regain mobility among patients with considerable arthritis or hip fractures. Deep surgical site infection (SSI), defined as infection of the implanted prosthesis or deep adjacent tissues, is one of the most severe complications that occur after THA (Ashman, Cruikshank, & Moran, 2016). The infection may cause long hospital stays, re-surgery, higher healthcare expenditure, and morbidity. Associated terms in this research are THA, deep infection, prosthetic joint infection (PJI), and audit which is a systematic review of clinical outcomes of a specified time to enhance care (Liu, Zi, Xiang, & Wang, 2015).

It has been suggested that up to 0.3-2.2 percent of patients experienced deep infection after total hip arthroplasty; however, this differs based depending on surgical technique, comorbidities of the patient, and infection control measures of the hospital (Sivasankar et al., 2016). It varies depending on the country or healthcare setting; in places where infection control procedures have been introduced, the rate is low, whereas increased rates have been reported in low- and middle-income countries. Additionally, as the numbers of patients who require THA continue to increase secondary to the aging populations and rising cases of osteoarthritis, infection, however minimal as measured by percentages, becomes a major clinical and economic cost (Honkanen, 2020).

Several risk factors contribute to deep infection after THA. They are diabetes, obesity, immunosuppression, and smoking as patient-related factors, operative time, blood transfusion, and surgical environment as surgery-related factors, wound management or timely antibiotic prophylaxis as the postoperative care practices. Being concrete and identifying such risk factors in local context in a local hospital setting though auditing allows targeting to take action and benchmarking results (Giannadakis et al., 2015).

The relevant aspect of clinical audits is that they are used in assessing quality of surgical care. Audits assist in determining patterns on the basis of systematically reviewing patient records and results, determining compliance with clinical guidelines, and in identifying areas requiring intervention (Eka & Chen, 2015). Within the domain of THA, a two-year audit in the rates of deep infection will demonstrate trends that may not be observed in short-time research, particularly in cases where infections occur weeks or months following surgery (Antonelli & Chen, 2019).

Surveillance of post-THA infection rates has become important due to the advent of antibiotic-resistant organisms. Multidrug resistant gram-negative organisms and methicillin resistant staphylococcus aureus (MRSA) are difficult to treat and eliminate (Prades et al., 2016). Local hospital (particularly tertiary care) surveillance data serve to inform microbiological epidemiology and contribute to an understanding of empirical treatment approaches and infection prevention initiatives (Rule, Chiang, & Hribar, 2020).

Besides clinical implications, deep infections have significant, psychosocial and economic consequences (Rule, Chiang, & Hribar, 2020). Patients can potentially suffer recurrent hospitalization, extended recovery and even mobility or job loss. These consequences highlight the importance of maintaining quality to develop with regular auditing and follow-ups of joint replacement surgeries (especially those conducted in government hospitals) (Cervi & Douketis, 2019).

The proposed two-year audit will consider the incidence, risk factors, microbiological characteristics, and outcomes in deep infections developing after THA in a tertiary care hospital. Results will not only influence institutional policy but also add to the more general aim of decreasing possible post-operative complications and increasing patient security in orthopedic surgery.

Methodology

This retrospective audit was conducted in the Orthopaedic Department of King Edward Medical University/Mayo Hospital, Lahore, over a two-year period from August 2017 to July 2019. The objective of the study was to assess the incidence, contributing factors, and microbiological profiles of deep infections following total hip arthroplasty (THA).

The study included all patients who underwent primary or revision total hip arthroplasty during the specified period. Only cases with complete surgical records, postoperative follow-up of at least three months, and definitive diagnosis of deep surgical site infection were included in the analysis. Patients with superficial wound infections, incomplete data, or who were lost to follow-up were excluded.

Data Collection

Data were collected through hospital medical records, operative logs, microbiology reports, and follow-up clinic documentation. The information extracted included patient demographics (age, gender), comorbid conditions (e.g., diabetes, obesity, immunosuppression), surgical details (type of arthroplasty, duration of surgery, surgeon experience), perioperative antibiotic usage, and postoperative outcomes. Deep infection was defined according to the Centers for Disease Control and Prevention (CDC) criteria for prosthetic joint infection, which includes evidence of infection involving the joint space and/or prosthesis within one year of surgery, supported by clinical, radiological, and microbiological findings.

Microbiological data were reviewed to identify causative organisms and their antibiotic sensitivity profiles. The incidence rate was calculated as the proportion of deep infections per total number of THA procedures performed during the audit period.

Data Analysis

Data were analyzed using SPSS version 22. Descriptive statistics such as frequencies and percentages were computed for categorical variables, while means and standard deviations were calculated for continuous variables. The association between infection and potential risk factors (e.g., diabetes, obesity, operative time) was evaluated using chi-square tests A p-value of <0.05 was considered statistically significant.

Ethical approval for the study was obtained from the Institutional Review Board of King Edward Medical University, Lahore. All patient information was kept confidential and anonymized prior to analysis.

Results and Analysis

Demographic Characteristics of Patients

Out of 150 patients who underwent total hip arthroplasty (THA), 6.0% developed deep infections, with a higher rate observed in revision cases (12.0%) compared to primary procedures (4.8%). Staphylococcus aureus (MSSA and MRSA) and E. coli were the most common causative organisms. Significant associations were found between deep infection and diabetes, obesity, and prolonged surgery duration ($p < 0.05$). Most infections were diagnosed within three weeks postoperatively.

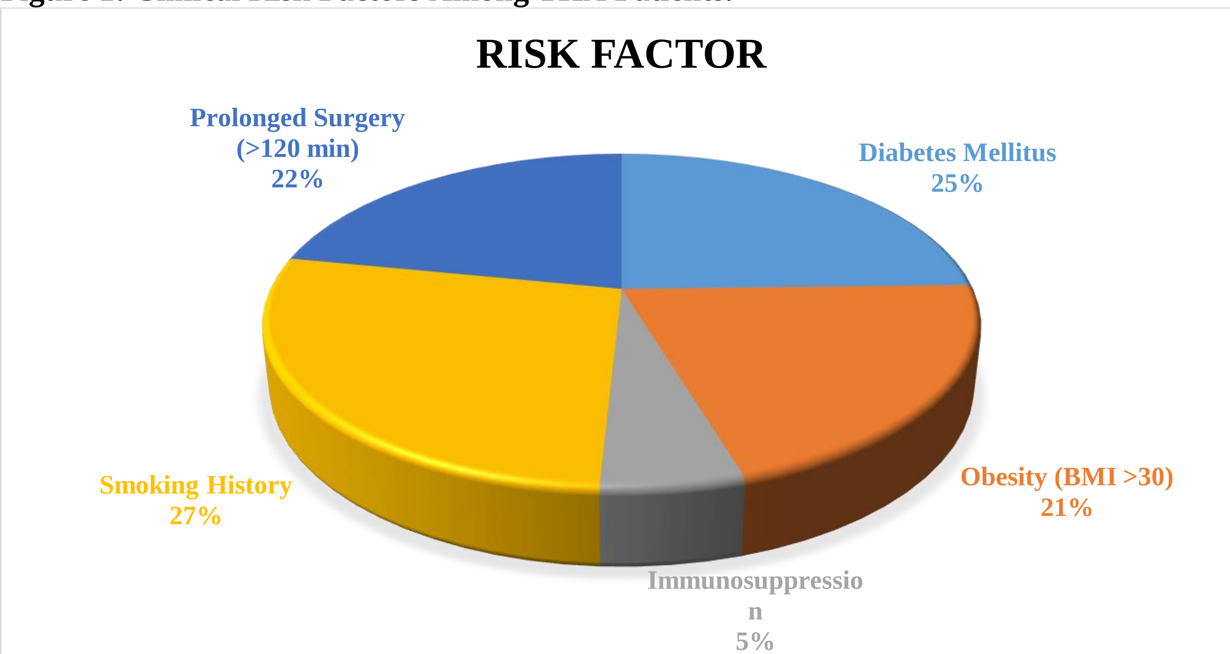
Table 1: Demographic Characteristics of Patients Who Underwent THA (N = 150)

Variable	Frequency (n)	Percentage (%)
Gender		
Male	90	60.0%
Female	60	40.0%
Age Group (years)		
<50	25	16.7%
51–70	85	56.7%
>70	40	26.6%

Clinical Risk Factors Among THA Patients

Among the 150 patients who underwent total hip arthroplasty, diabetes mellitus was present in 30% of cases, while obesity affected 25.3% of patients. A history of smoking was noted in 33.3% of individuals, and 26.7% had prolonged surgery lasting over 120 minutes. Immunosuppression was the least common risk factor, seen in only 6.7% of patients.

Figure 1: Clinical Risk Factors Among THA Patients.



Incidence and Characteristics of Deep Infection

Out of 150 total hip arthroplasty (THA) procedures, 9 cases (6.0%) developed deep infections. Among these, 6 infections (4.8%) occurred in primary THA cases, while 3 infections (12.0%) were noted in revision THA procedures. The average time to infection diagnosis was 21 days, with a standard deviation of ±7.5 days.

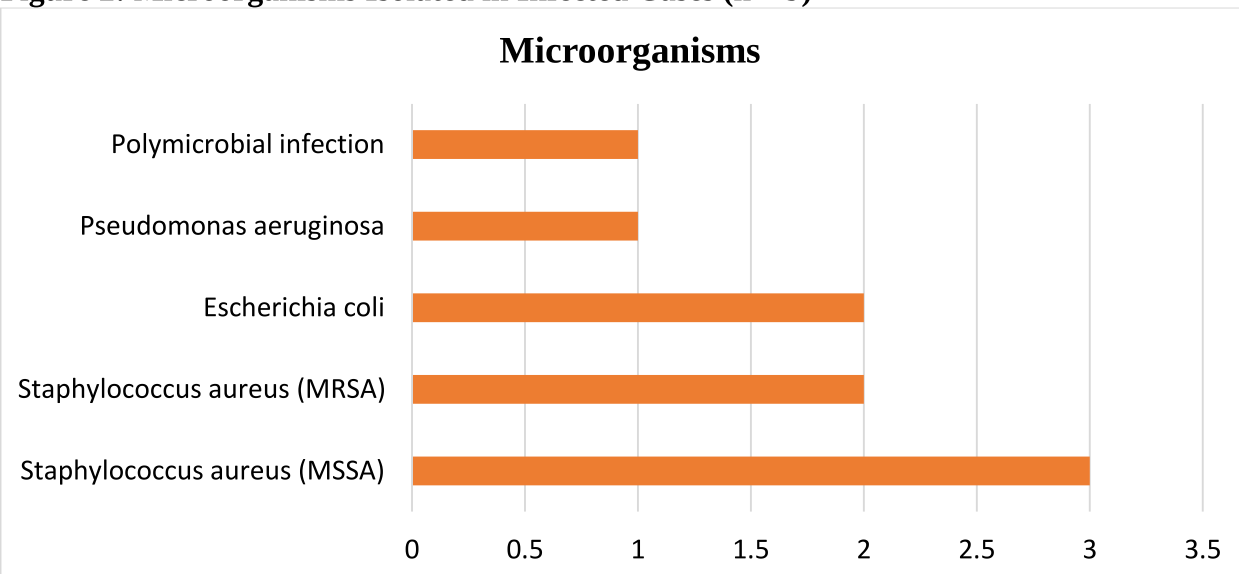
Table 2: Incidence and Characteristics of Deep Infection After THA (N = 150)

Outcome Variable	Frequency (n)	Percentage (%)
Total Deep Infections Identified	9	6.0%
Infections in Primary THA	6	4.8% (of 125)
Infections in Revision THA	3	12.0% (of 25)
Mean Time to Infection Diagnosis	—	21 days (SD ± 7.5)

Microorganisms Isolated in Infected Cases

Among the 9 cases of deep infection following THA, the most commonly isolated microorganism was Staphylococcus aureus (MSSA), accounting for 33.3% of infections. Methicillin-resistant Staphylococcus aureus (MRSA) and Escherichia coli were each identified in 22.2% of cases. Pseudomonas aeruginosa and polymicrobial infections were less frequent, each found in 11.1% of cases.

Figure 2: Microorganisms Isolated in Infected Cases (n = 9)



Association Between Risk Factors and Deep Infection

The analysis showed that diabetes mellitus (p = 0.011), obesity (p = 0.026), and prolonged surgery lasting over 120 minutes (p = 0.018) were significantly associated with deep infections following total hip arthroplasty. Smoking (p = 0.421) and immunosuppression (p = 0.305) did not demonstrate statistically significant associations. These findings suggest that metabolic and procedural factors may play a more critical role in infection risk than lifestyle or immunological status in this cohort.

Table 3: Association Between Risk Factors and Deep Infection (n = 9)

Risk Factor	Deep Infection Present (n)	Total in Risk Group (n)	p-value
Diabetes Mellitus	5	45	0.011
Obesity	4	38	0.026
Surgery >120 mins	5	40	0.018
Smoking	2	50	0.421
Immunosuppression	1	10	0.305

Discussion

The results of the 2-year audit gave an incidence rate of 6% of the deep infections after total hip arthroplasty (THA) equivalent to the world estimations based on the literature, and most estimates fall in the range of 0.5-7% concerning patient demographics, hospital practice, and follow-up periods (Kumar & Singh, 2016). The infection rate reported in this study (12%) in revision cases as opposed to primary procedures (4.8%) indicates agreement with a previous article by Gross &

Muir (2016), where revision cases were found to carry higher risks of infections owing to longer surgery times, skew anatomies, and defective host-protective immune systems.

In this article, diagnosis of diabetes mellitus, obesity, and increased duration of operations were some of the risk factors that were found to be an indication of deep infections. The current results are in line with those of Le (2020) who noted that diabetic patients with high BMIs were more vulnerable to post-arthroplasty infection. This finding is also in concordance with a similar statement of Zvolensky et al. (2020), who have mentioned that surgeries that take more than two hours are highly likely to expose patients to the risk of microbial contamination and wound complications.

It was interesting that the predictors of infections such as smoking and immunosuppression were not statistically significant in our audit. This is somewhat the opposite of the results in Sen (2019), who stated that there is a traceable relationship between smoking and post-surgical complications of orthopedic surgery. However, the difference could be explained by the fact that their work was not aimed specifically at infection-related outcomes and they studied bigger surgical outcomes.

The microbiological analysis revealed Staphylococcus aureus (MSSA, MRSA) as the most frequently isolated pathogen, being in line with the worldwide trends according to which Staphylococci are still considered to be the most frequent causative agents of prosthetic joint infection (Alonso-Lana, Marquié, Ruiz, & Boada, 2020) Some cases also indicate the changing microbial spectrum of nosocomial infections due to the presence of Gram-negative organisms, such as Escherichia coli and Pseudomonas aeruginosa (Jia et al., 2017).

The average interval in detecting the diagnosis of infection was 21 days, and refers to the early onset of the illness in the postoperative period. This observation corresponds to findings of Leong et al. 2018) who underscored that the majority of deep infections occur within a month after the surgery. Time plays a significant role in successful intervention, and this supports the need to provide careful follow-up, especially of high-risk patients after discharge.

The findings of our research confirm the statement of Surapat et al. (2020) that institutional audits contribute to highlighting the weaknesses associated with the processes and enhancing infection control. An example of a modifiable risk factor identified would be prolonged surgery and the implementation of measures on how to make the surgery more efficient may have the potential to lower infection rates. Likewise, controlling diabetes and obesity before surgery should also be focused on pre-surgical planning.

To sum up, the current audit confirms that some patient-related and procedural issues are strong predictors of the development of deep infection following THA. Our findings, compared to other studies, reaffirm well-established risk and microbial trends and demonstrate the usefulness of localized data as an aid in developing site-specific prevention efforts. Prospective research using a greater number of participants and molecular characterization of pathogens can further illuminate the nature of resistance patterns as well as long term outcomes.

Conclusion and Recommendations

This prospective two-year audit at King Edward Medical University/Mayo Hospital Lahore documents the incidence of deep infection following total hip arthroplasty (THA) as 6% that is significantly higher in case of revision surgery as compared to primary surgery. Diabetes mellitus, obesity, and long operative period were illustrated as significant variables that displayed statistical significance in relation to the risk of postoperative deep infections. The most frequently isolated organism was Staphylococcus aureus, with most strains sensitive and some resistant to the test methicillin, as observed universally with regard to epidemiology. The average length of time to infection detection was around three weeks after the operation, which signifies that postoperative surveillance should be meticulous and thorough.

Based on the findings, several recommendations can be proposed. They should preoperatively optimize the patients, especially control of hyperglycemia in diabetic and weight gain in obese patients to minimize the risk of infection. Second, efficiency in the surgical process should be improved by performing the process with proper planning, coordination of team members, and timely performance in order to reduce long operation times. Third, strict adherence to perioperative antibiotic routine microbial surveillance routine should be established to identify trends in resistance.

Moreover, the need to introduce a standardized postoperative follow-up protocol that emphasizes early detection of deep infections can contribute to considerably better patient outcomes. To assess institutional performance and drive quality improvement efforts, dedicated surgical site infection audits ought to be undertaken on a regular basis. Lastly, larger studies with prospective design and follow-up over a long period of time are suggested to confirm these data and promote the elaboration of evidence-based guidelines specific to the local population and healthcare infrastructure.

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