International Journal of Frontiers in
Medicine and Surgery Research
Journal homepage: https://frontiersrj.com/journals/ijfmsr/
ISSN: 2783-0489 (Online)

(RESEARCH ARTICLE)

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Prosthetic joint infections following a total knee arthroplasty: A retrospective analysis

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International Journal of Frontiers in Medicine and Surgery Research, 2023, 03(02), 070–073

Publication history: Received on 05 June 2023; revised on 20 August 2023; accepted on 23 August 2023

Article DOI: https://doi.org/10.53294/ijfmsr.2023.3.2.0068

Abstract

Background: Total knee arthroplasty, especially, has been a resort for many individuals plagued with deforming joint pathologies, alleviating pain, and improving joint mobility, but is not without complications. Prosthetic joint infection (PJI) is the most commonly occurring early and late complication of total knee arthroplasty. In one study, they observed that even though the rate of PJI after TKA is 0.6-0.9%, the financial burden is enormous. Therefore, it is imperative for surgeons to find the ideal management strategies, both non-surgical and surgical, to tackle PJI. Here, we conducted this study to demonstrate the occurrence of PJI following an uneventful arthroplasty, and the management strategies in a tertiary care hospital.

Methods and materials: This was a retrospective study performed in the Department of Orthopaedics, Kanachur Institute of Medical sciences, between January 2021 to January 2023. The case records of all patients with culture proven prosthetic joint infection was identified. Demographic details, surgery performed, type of implant, duration of surgery, ICU stay, intra-operative and post-operative complications were recorded in a semi-structured pro forma. The data was analysed using SPSS v20. A p value < 0.05 was considered statistically significant.

Results: The most common presenting complaint in the patients was pain and fever > 38 degrees C (67.5%), followed by discharge from wound site (34.23%). Four patients required ICU admission due to features of sepsis, and 2 patients died following the revision surgery. Most common organism isolated was Staphylococcus aureus in the synovial fluid cultures. We found that there was a statistically significant difference in the operative time between single staged and two staged procedure, but there was no correlation between that and the re-infection rates.

Conclusion: PJI following TKA is a dreadful complication, which requires swift diagnosis and prompt management. Most patients present with pain initially, which should alert the treating physician towards an ongoing inflammatory process in the joint. Appropriate antibiotics, single stage/two-staged surgical correction and adequate limb movement restriction can aid in reducing risk of morbidity while maintaining functionality in the operated joint.

Keywords: Arthroplasty; Prosthesis; Joint infection; Arthritis

1. Introduction

Arthroplasty in India has gained popularity in recent times as it has been identified as a lifestyle enhancement procedure, especially for those middle aged and elderly people suffering from this debilitation (1). Total knee replacement has been a resort for many individuals affected with deforming joint pathologies, alleviating pain, and improving joint mobility. While it is shown to be a relatively safe procedure, it is not without its complications. Septic complications, otherwise referred to as Prosthetic Joint Infection (PJI) are not uncommon, owing to the presence of an

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implant (2,3) It is important to realise that PJI does not only reflect an infection of the prosthetic interface, but also an infection of the surrounding bone and soft tissues (4).

Pathogenesis of PJI begins with bacterial adhesion to the implant. (5,6) During bacterial adhesion to the surface of the implant, two distinct phases of reversible (non-specific) and irreversible (specific) attachments take place. (6) The non-specific physical and chemical properties of the bacterium are the basis for how the reversible attachment functions. The biomaterial and surrounding joint fluid both contribute to the bacteria's reversible adherence to the implant. Reversible adhesion, however, is dependent on receptors and structures that are more particular. (6) Biofilms are crucial to the pathophysiology of PJI. (7)

Pain is the most important clinical presentation of patients with early PJI, and a high index of suspicion is required to tackle such patients. There has been a lot of recent research into diagnosis and treatment options. However, there have been not many studies to research the changing trends in organisms causing PJI and the resulting outcome of the same. Early PJI can usually managed with single stage, while late PJI (more than 30 days) is usually managed with two-stage procedure. Several studies have show no difference in infection rates and outcomes between the two procedures (9,10)

Hence, this study was aimed at evaluating the aetiopathogenesis and outcomes of patients suffering with culture positive infections following total knee arthroplasty.

2. Material and methods

This study was conducted in the department of Orthopaedics, Kanachur Institute of Medical sciences, between January 2021 to January 2023. Patients with culture proven prosthetic joint infection were identified with the data obtained from the Department of Microbiology.

Data was retrospectively collected from case records; details of demographic data, duration of hospitalization, type of disease, operative time, culture reports and other complications, and recorded in a semi-structured pro forma. The relevant information was then entered in a MS Excel spreadsheet.

The data was then analysed using SPSS software v22. Categorical variables were represented as mean and median where appropriate. Ordinal variables were represented as proportions and ratios where deemed necessary. A p value of <0.05 was considered to be statistically significant.

3. Results

After a thorough record search, we identified 22 cases of prosthetic joint infection after an uneventful total knee arthroplasty. Out of the 22 patients assessed, 14 were male and the remaining 8 were female patients with ages ranging from 50 years to 72 years. The mean age was 54.36 with a median age of 56 and a standard deviation of 11.238. Patients were included from all three units of Orthopaedics in the institution.

18 out of 22 patients had their index surgery in our institute whereas the remaining 4 had their index surgery elsewhere. The mean number of admissions to the hospital was 2.23 and the duration of admission varied from 8-92 days with a mean duration of 31.82 days and median of 23.5 days with a standard deviation of 19.74 days. 12 out of the 22 patients presented within 30 days of the index surgery, while the remaining 10 patients presented late (after 30 days of index surgery)

The most common presenting complaint in the patients was fever > 38 degrees C (67.5%), followed by discharge from wound site (34.23%). Biochemical investigations aid in the diagnosis of patients with suspicious PJI, and we that total leucocyte count was > 12,000 cells/ mm^3 in 87.7% of the study population. Four patients required ICU admission due to features of sepsis, and 2 patients died following the revision surgery.

Table 1 Laboratory parameters in PJI

Lab parameters	Early PJI	Late PJI
CRP POSITIVE	6	4
ESR > 20 MM/HR	10	7

All the patients were started on antibiotics empirically on admission (based on the institute's policy- cephalosporins are initiated with gentamicin), and then antibiotics escalated depending on the blood and pus culture reports. When the culture reports were analysed, it revealed that of the infections, 8 were Staphylococcus aureus, 4 were Gram Negative Bacilli (GNB), 5 were Coagulase Negative Staphylococcus aureus, 4 were Enterococcus and 1 was β hemolytic streptococcus. All patients received systemic antibiotics for a minimum duration of 10 days based on the culture reports.

There was a predisposition for infections by Staphylococcus aureus and GNB in males and there was a definite increase in the number of infections caused by Staphylococcus aureus overall in the study population. This was found to be statistically significant (p 0.045). This finding helps in guiding the empirical antibiotic treatment. In the 22 patients who underwent arthroplasty of the knee, 14 underwent early revision arthroplasty with debridement and implant retention while the remaining 8 underwent a staged revision (here, an antibiotic spacer was used). Mean operating time was 122.34 +/- 36.44 minutes for the single stage debridement, while it was 185.91 +/- 46.86 minutes, this difference was statistically significant ($p < 0.05$).

Functional outcomes were also considered following revision surgery with the New oxford knee score. It was found that 10 patients had a score between 0-19 (poor), while 6 had a score between 40-48 (excellent). Among the 20 patients that survived the revision surgery, 4 didn't recover and underwent debridement. When we compared the difference between the single stage and two stage revision procedures, we found that there was no statistically significant deterioration with addition of a spacer. (The chi-square statistic is 1.6893. The p-value is .639318. The result is not significant at $p < .05$.)

Table 2 New Oxford knee score and comparison of staging of surgery

New oxford knee score	Single stage	Two stage
POOR	4 (5.09) [0.23]	4 (2.91) [0.41]
FAIR	2 (1.91) [0.00]	1 (1.09) [0.01]
GOOD	3 (3.18) [0.01]	2 (1.82) [0.02]
EXCELLENT	5 (3.82) [0.37]	1 (2.18) [0.64]

In this study, in the 4 patients that had repeated PJI, all 4 had an isolate of Staphylococcus aureus. This is statistically significant, and hence is important to initiate aggressive eradicative strategies.

4. Discussion

Periprosthetic joint infection is a devastating complication following a joint arthroplasty. Though, there are a lot of studies that have explored various diagnostic modalities and organisms implicated, there was a lacuna in the current knowledge on the outcomes of patients following PJI.

In the study, we noticed that there was no difference between the age groups affected in terms of organism causing infection and also outcome. However, there was a significant increase in the duration and number of admissions in people who suffered PJI due to either Staphylococcus aureus and GNB had a longer median duration of admission with a median of 45 compared to 37 for Staphylococcus aureus, however, this difference was not found to be statistically significant.

The patients who had implant survival predominantly had infections caused by organisms of low virulence like CONS and Enterococcus (67.8%). Only 33.7% of patients who had implant survival were affected by organisms of higher virulence. However, these 2 patients (2 infections were caused by Staphylococcus aureus and one by GNB) were sensitive to the first line of antibiotics and responded well to treatment with specific antibiotics. In a study done Berberi EF et al (11) and Rao et al (12), S. aureus and coagulase-negative staphylococci, which contribute to between 50 and 60% of PJIs, while streptococci and enterococci together account for only approximately 10% of cases.

In our study, majority of the patients underwent a single stage procedure with debridement. In those patients that underwent two-staged procedure, we observed that 2 patients had a recurrence of infection. In a study by Jenrue et al (13), they found no significant difference in the infection rates in patients that received a spacer, implying that two-staged procedure is non-inferior. The study revealed that PJI due to ESBL had a rather grim prognosis with more failures and more salvage procedures being performed to eradicate infection. From the results we can observe that infections

caused by ESBL had the worst prognosis and also had a poorer outcome in patients who underwent revision arthroplasty.

5. Conclusion

PJI is a uncommon, but life-threatening complication of TKA, and we need to keep in mind the consequences of the same while evaluating patients for surgeries. Pre-operative optimization, intra-operative technique and post-operative antibiotic coverage are key in preventing such events.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

Statement of ethical approval

Retrospective study, hence consent taken on admission

Statement of informed consent

Informed consent was obtained from all individual participants included in the study.

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