



Original Research Article

LONG-TERM VS SHORT TERM ANTIBIOTIC PROPHYLAXIS IN POST-OPERATIVE ORTHOPAEDIC PATIENTS: A SINGLE CENTRE STUDY

Sumedh Kumar¹, Ankush Ratanpal², Tushar Sachdev³, Anuj Kumar Ekka⁴, Vivek Parsurampuriya⁵, Arun Chaturvedi⁶

¹Assistant Professor, Department of Orthopaedics, Government Institute of Medical Sciences, Greater Noida, Uttar Pradesh, India.

²Senior Resident, Department of Orthopaedics, NDMC Medical college and Hindu Rao Hospital, New Delhi, India.

³Senior Resident, Department of Orthopaedics, NDMC Medical college and Hindu Rao Hospital, New Delhi, India.

⁴DNB Resident, Department of Orthopaedics, NDMC Medical college and Hindu Rao Hospital, New Delhi, India.

⁵Consultant, Department of Orthopaedics, Primus Hospital, New Delhi, India.

⁶DNB Resident, Department of Orthopaedics, NDMC Medical college and Hindu Rao Hospital, New Delhi, India.

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Corresponding Author:

Dr. Sumedh Kumar,
Assistant Professor, Department of
Orthopaedics, Government Institute of
Medical Sciences, Greater Noida, Uttar
Pradesh, India.
Email: sumedh.4.kumar@gmail.com

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ABSTRACT

Background: Surgical site infection (SSI) after an orthopaedic surgery is devastating for both the patient and surgeon. Use of strict aseptic measures and administration of prophylactic intravenous antibiotics to the patient prior to the surgery and in the post-operative period are the most common measure taken by surgeons to prevent SSI. However, there is no clarity regarding the optimal duration of the antibiotic prophylaxis required. In order to err on the side of caution, surgeons keep patients on a long duration of antibiotic prophylaxis which is prudent but leads to increased cost of treatment and poor patient compliance. That is why, in our study, we compared the short-term vs long-term antibiotic prophylaxis for prevention of SSI.

Materials and Methods: Patients with age > 13 years undergoing orthopaedic surgery were randomly divided in to 2 groups. Both groups received IV antibiotics 30 minutes before the time of incision followed by two further prophylactic IV antibiotic dose. The 2nd group received additional oral antibiotics 12 hourly over the next 4 days.

Results: Among the 113 patients enrolled, 59 patients received antibiotic prophylaxis for short term while 54 patients got long-term prophylaxis. Comparison between the two groups was done by calculating SH score. Among 59 patients who received 3 prophylactic IV antibiotics only 2 patients developed SSI at a rate of 3.4 % while 54 patients who receive additional oral antibiotics got infected with a rate of 3.7 %. The rate of infection was similar for both the groups.

Conclusion: The study shows that there is no significant difference in rate of infection at the post-operative surgical site with short term antibiotic prophylaxis as compared to long-term prophylaxis. Hence, short term prophylaxis can be preferred over long-term prophylaxis as it results in reduced risk of Antibiotic resistance, increased patient compliance and cost effectiveness.

Keywords: Surgical site infections, Orthopaedic surgery, Traumatology

INTRODUCTION

A surgical site infection (SSI) is defined as an infection that occurs at or near a surgical incision within 30 days of surgery or within 1 year of implant surgery. The Centre for Disease Control and

Prevention (CDC) broadens the classification of SSI to encompass both incisional SSI and organ/space SSI. Organ/space SSI specifically refers to an infection occurring anywhere within the operative field, excluding the area where the body wall tissues were incised.^[1]

Several factors contribute to the development of SSI, which can be categorized as either exogenous or endogenous, or primary and secondary. Primary infections occur when the wound is colonized by bacteria during surgery, while secondary infections occur postoperatively, often at suture sites or through drains, among other factors. The sources of wound infection can be direct, such as through the hands of the surgeon, dressing, apron, equipment, and the patient's skin, or indirect, potentially stemming from inadequate ventilation.

Surgical site infections have severe implications for patients, leading to inferior outcomes and imposing a substantial economic burden. The consequences of SSI extend beyond the immediate postoperative period and highlight the importance of preventive measures in surgical settings.

SSI proportions are reported to be 1–5% in patients undergoing major surgery.^[2,3] *Staphylococcus aureus* is the most important organism as it remains most common pathogen associated with SSI followed by *Pseudomonas*, *Streptococci*, *Escherichia coli*, *Klebsiella* and *Enterobacter*. Up to 55% of SSI are estimated to be preventable with the use of evidence based strategies, including appropriate use of surgical antibiotic prophylaxis (SAP).^[4] Although SAP is an effective prevention measure, a safe use of SAP is needed to prevent potential resistances and adverse effects of antibiotics.^[5,6]

Discontinuing SAP within 24 h after operation (Bratzler et al, 2013; WHO Guidelines Approved by the Guidelines Review Committee, 2018). Besides that, the 2017 U.S. Centers for Disease Control and Prevention (CDC) guideline even recommend against administration of SAP after closure of the operation site in all clean or clean-contaminated procedures.^[7] A retrospective cohort study found patients with total hip or knee arthroplasties (THA/TKA) to be 4–5 times more likely to develop a periprosthetic joint infection (PJI) if they were not administered extended oral SAP.^[8] The goal of antimicrobial prophylaxis is to achieve serum and tissue drug levels that exceed, for the duration of the operation, the minimum inhibitory concentration (MIC) for the organisms likely to be encountered during the operation. The idea is not to sterilize tissues but to reduce the microbial burden of intra-operative contamination to a level that cannot overwhelm host defences.

There is no consensus with regard to the optimal duration of prophylaxis. The standard practice is to administer prophylactic intravenous antibiotics only on the day of surgery in Western countries.^[9] Advanced age, poor nutritional status, obesity, smoking, diabetes and remote infection from the operative site are patient risk factors believed to increase the chance of SSI. Antibiotic prophylaxis may carry more hazards than benefits that may include allergic response, adverse effects, drug interactions and emergence of resistant organisms. The chosen antibiotic must be active against bacteria

that frequently results in post-operative infection. The pharmacokinetics and pharmacodynamics of medicine should be considered. The final consideration should be the cost associated with the use of the antibiotic, which should include the costs of drug monitoring, administration, repeat doses, adverse effects, and failure of prophylaxis (i.e., wound infection sequelae).^[10] According to reports, guidelines are not being implemented and followed enough and non-compliance may even increase the proportion of SSI cases. The goal of the current investigation was to compare the efficacy of short term versus long-term antibiotics prophylaxis in preventing surgical site infection after an orthopaedic surgery.

MATERIAL AND METHODS

A prospective observational study was conducted in tertiary care hospital in New Delhi, India from September 2021 to September 2023 comparing short term and long-term antibiotic prophylaxis in prevention of surgical site infection after orthopaedic surgery. We have included 113 patients between age of 13 to 65 years with hemoglobin more than 10 g/dl and serum albumin >3.5g /dl who underwent an orthopaedic surgery. Follow up was taken for 1 year. Ethical approval to conduct this observational follow up study was obtained. We have excluded the patients with open fractures, had comorbidities such as Diabetes mellitus, HIV, TB, positive for HCV, HBV; history of steroid intake; having remote infections and pregnancy. After written consent patients were divided randomly in to 2 groups.

Both groups viz group A and group B received preoperative dose of antibiotic 30 minutes prior to surgery and an intra-operative dose, if surgery extends beyond four hours. Both groups received post-operative antibiotics 6 hours after surgery & every 12 hours thereafter. We used a broad-spectrum antibiotic viz. Cefuroxime axetil 50-100mg/kg IV and 250-500 mg ORAL dose in all the patients for antibiotic prophylactic dose. Now we had given only IV antibiotic to Group A and additional ORAL antibiotics every 12 hourly to Group B after 3rd IV antibiotic dose.

Post-operative examination of surgical site was done while dressing the wound on regular basis thereafter at 2 weeks, i.e., suture removal, after 4 weeks from surgery and thereafter every month till 1 year.

Comparison of incidence of surgical site infection between two groups was done. They were examined for surgical site infection on the basis of signs and symptoms, if present. Further, laboratory tests were ordered on the basis of clinical suspicion of infection. CRP, CBC, ESR, and pus culture sensitivity.

We have included South Hampton Score for assessment of wound after surgery.

Grade 0	Normal healing
Grade 1	Normal healing with mild bruising and hematoma
Grade 2	Erythema plus other sign of inflammation
Grade 3	Clear or hemo-serous discharge
Grade 4	Pus discharge
Grade 5	Deep or severe wound infection with or without tissue breakdown

Bailey IS, Karran SE, Toyn K, et al. Community surveillance of complications after hernia surgery. *BMJ* 1992; 304:469–71

Statistical Analysis

We have used chi square test for comparison between the group of short term and long-term prophylaxis antibiotics. All the data were 2 tailed using $p=0.05$ as a threshold for significance.

RESULTS

This study enrolled 113 patients. we have not lost any of the patient during follow up and had 59 patients received short term prophylaxis antibiotics (52.2%) and 54 received long-term prophylaxis antibiotics (47.8%). Out of 113 only 4 patients got infected (3.5%). In both the short term and long-term antibiotic prophylactic patients 2 from each

group got infected post-surgery (Figure 1). SH score of each patient came >2 . Findings suggestive of infection were slightly higher in long-term prophylaxis (3.7%) than short term (3.4%). There was no significant ($p>0.05$) difference in finding with time of prophylaxis. [Table 1]

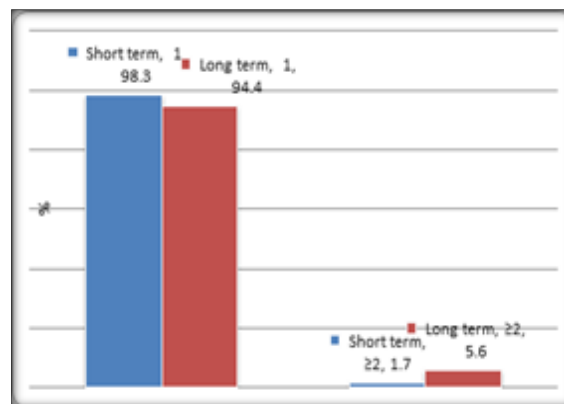


Figure 1: Comparison of SH score between short term and long-term prophylaxis

Table 1: Comparison of SH score between short term and long-term prophylaxis

SH score	Short term(n=59)		Long-term(n=54)		p-value 1
	No.	%	No.	%	
1	58	98.3	51	94.4	0.26
≥2	1	1.7	3	5.6	

DISCUSSION

The occurrence of surgical site infections (SSI) not only imposes a significant financial burden but also has detrimental effects on patients and can be a distressing challenge for surgeons. SSIs are documented to manifest in 1–5% of individuals undergoing major surgical procedures. It is noteworthy that up to 55% of these infections are believed to be preventable through the implementation of evidence-based strategies, with a key emphasis on the judicious utilization of surgical antibiotic prophylaxis (SAP), as highlighted in the findings of Umscheid et al. in 2011.^[4]

Although SAP is an effective prevention measure, a safe use of SAP is needed to prevent potential resistances and adverse effects of antibiotics. Heterogeneous guidelines reflect the ongoing discussion about the optimal duration of SAP. Several recommend discontinuing SAP within 24 hours after operation (WHO Guidelines Approved by the Guidelines Review Committee, 2018).^[11] Besides that, the 2017 U.S. Centers for Disease Control and Prevention (CDC) guideline even recommend against administration of SAP after closure of the operation site in all clean or clean-contaminated procedures (Berrios-Torres et al, 2017).^[12]

Never the less, recommendations on shortened SAP remain a matter of controversy, especially in

conditions with potentially higher risk for SSI - including presence of a wound drain - or prosthetic procedures with high risk for devastating outcomes if SSI occurs (Tan et al, 2019).^[13] A retrospective cohort study found patients with total hip or knee arthroplasties (THA/TKA) to be 4–5 times more likely to develop a periprosthetic joint infection (PJI) if they were not administered extended oral SAP (Inabathula et al, 2018).^[8]

On the other hand, a published meta-analysis of 51,627 total joint arthroplasties (TJA) found no added benefit of prolonged antibiotic prophylaxis (PSAP, defined as administration ≥ 24 h postoperative) (Siddiqi et al, 2019).^[14] Therefore, the shortest effective and safe duration of SAP in SSI prevention in orthopaedic surgery remains a topic of debate.

Implementation and adherence to guidelines is reportedly insufficient and non-adherence may even lead to higher SSI proportions (Metsini et al, 2018).^[15]

Furthermore, most studies in the literature evaluate SSI and SAP in patients undergoing either prosthetic surgery of the hip or knee, knee arthroscopy or spinal surgery (Urquhart et al, 2019).^[16]

The present study was conducted in the Department of Orthopaedics, NDMC Medical College and Hindu Rao Hospital New, Delhi with the objective to study the efficacy of short term versus long-term antibiotic prophylaxis in preventing surgical site

infection after an orthopaedic surgery. A total of 113 patients were included in the study.

Misganaw et al,^[17] (2020) assessed 68 patients who underwent major surgery revealed an overall surgical site infection rate of 23.4%. Prophylactic antibiotics were administered for 59 operations; of these, 33 (48.6%) had inappropriate timing of administration. A combination of ceftriaxone and metronidazole 28 (47.46%) was frequently used. Factors associated with surgical site infection were wound type, patient's co-morbid condition, duration of the procedure, the timing of administration, and omitting prophylaxis use. The study indicated a higher rate of surgical site infection and also revealed that wound class, preexisting medical condition, prolonged duration of surgery, omitting of prophylaxis use, and inappropriate timing of administration were highly associated with surgical site infection.

In the present study, short term prophylaxis of 24 hours administered by IV route was given in 59 (52.2%) patients, while long-term prophylaxis of 5 days (IV for 1 day with 4 days oral antibiotics given in 54(47.8%) patients. Albaker (2021),^[18] compared the effectiveness perioperative antibiotic prophylaxis of short course against long-term administration of surgical site infection preventive antibiotics. Total 200 patients were included in the study among them 100 was in Group I from 10-70 years age and 100 were in Group II from 7-70 years age. Only 8 (4%) patients developed surgical site infection and culture showed growth of *Staphylococcus aureus* and *Escherichia coli* spp. The study concluded that short course of perioperative antimicrobial prophylaxis for prevention of infections in elective orthopaedic surgeries could shorten hospitalization, post-operative morbidity and unnecessary usage of long-term antibiotics which also decreased the chance of antibiotic resistance in elective orthopaedic surgery. In present study, infected and uneventful finding were in 3.5% and 96.5% patients respectively. SH score 1 was among majority of patients (96.5%) in the present study. Infected findings were slightly higher in long-term prophylaxis (3.7%) than short term (3.4%). There was no significant ($p>0.05$) difference in finding with time of prophylaxis.

In this study, SH score was higher in short term prophylaxis (98.3%) than long-term (94.4%). There was no significant ($p>0.05$) difference in SH score with time of prophylaxis.

In Alsaeed et al.'s study (2022),^[19] prophylactic antibiotics were administered to 157 patients undergoing surgery (Group 1), while 52 patients did not receive preoperative antibiotics (Group 2). The most frequently prescribed prophylactic antibiotics included metronidazole, cefuroxime, cefazolin, and ceftriaxone. Additionally, other antimicrobials such as cefotaxime, amoxicillin/clavulanic acid, cephalexin, and amoxicillin were used. Surgical site infections occurred in one patient who received preoperative antibiotics and in three patients from

Group 2. The average hospital length of stay was 38.5 ± 9.2 hours for Group 1 and 57.3 ± 12.1 hours for Group 2. Rohrer et al. (2021) conducted a study on the prolonged use of antibiotic prophylaxis in elective orthopaedic surgery, as outlined in their research.^[20] The cross-sectional analysis focused on 1292 patients who underwent elective orthopaedic procedures, including total joint arthroplasties, at a Swiss center between 2015 and 2017. The study compared patient co-morbidities, surgical characteristics, and the occurrence of surgical site infections (SSIs) at 90 days between the prolonged surgical antibiotic prophylaxis (PSAP) group and the surgical antibiotic prophylaxis (SAP) group (administered < 24 hours post-operatively). PSAP utilization was observed in 12% of cases (155 out of 1292). Factors associated with PSAP in comparison to the SAP group included older age (63 vs. 58 years; $p < 0.001$), higher BMI (29 vs. 27 kg/m²; $p < 0.001$), ASA classification ≥ 3 (31% vs. 17%; $p < 0.001$), and the presence of lung disease (17% vs. 9%; $p = 0.002$). Surgery-related factors linked to PSAP included the use of prosthetics (62% vs. 45%; $p < 0.001$), knee surgery (65% vs. 25%; $p < 0.001$), longer surgery duration (87 vs. 68 minutes; $p < 0.001$), and the use of drains (90% vs. 65%; $p < 0.001$). Notably, all four SSIs occurred in the SAP group (0 vs. 4; $p = 1.0$). The administration frequency of PSAP varied among surgeons, with proportions ranging from 0 to 33%. However, it is the limitation of our study that we have observed the patients for SSI only for 30 days and not up to 1 year. This will be the future prospect of our study.

CONCLUSION

The study shows that there is no significant difference in rate of infection at the post-operative surgical site with short term antibiotic prophylaxis as compared to long-term prophylaxis. Hence, short term prophylaxis can be preferred over long-term prophylaxis as it results in reduced risk of antibiotic resistance, better patient compliance and increased cost effectiveness.

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