Section: Orthopedics

Original Research Article

COMPARATIVE STUDY BETWEEN SHORT TERM AND LONG TERM ANTIBIOTIC PROPHYLAXIS IN PREVENTION OF SURGICAL SITE INFECTION AFTER ORTHOPEDIC SURGERY

Received : 18/10/2023
Received in revised form : 20/11/2023
Accepted : 04/12/2023

Keywords:
Antibiotic, SSI, CDC, Organism.

Corresponding Author:
Dr. Rohan Yadav,
Email: rohanyadavr1@gmail.com

DOI: 10.47009/jamp.2023.5.6.141

Source of Support: Nil,
Conflict of Interest: None declared

Int J Acad Med Pharm
2023; 5 (6); 683-687

Niket Raj Garg[1], Pankaj Kumar Singh[2], Avinash Kumar Singh[1], Rohan Yadav[1]

[1]Assistant Professor, Department of Orthopedics, Heritage Institute of Medical Scienceеs, Varanasi, Uttar Pradesh, India
[2]Associate Professor, Department of Orthopedics, Heritage Institute of Medical Scienceеs, Varanasi, Uttar Pradesh, India

Abstract

Background: Surgical site infection(SSI) after an orthopaedics surgery is a nightmare for any orthopaedic surgeon. To prevent that beside using strict aseptic measures almost all of us give prophylactic intravenous antibiotics to the patient just before the surgery and also few hours to few days after surgery. However, it is not well established that the number of doses of prophylactic IV antibiotics needed are well enough for prevention of SSI. Most of the time an orthopaedics surgeon give unnecessary doses of IV antibiotics to patient for prevention of SSI. Hence we compared the short term vs long term antibiotic prophylaxis for prevention of SSI. **Materials and Methods:** Patients with age > 13 years undergoing orthopaedics surgery were randomly divided in to 2 groups. Both the group received IV antibiotic 30 minutes before the time of incision followed by two further prophylactic IV antibiotic dose. The 2ndgroup received additional oral antibiotics 12 hourly in next 4 days. **Result:** Among the 113 patients enrolled, 59 patients got the short term antibiotic prophylaxis while 54 patients got long term prophylaxis. Comparison between the two group done after calculating SH score. Among 59 patients who receive 3 prophylactic IV antibiotics only 2 patients with rate of 3.4 % got infected while 54 patients who receive additional oral antibiotics got infected with rate of 3.7 %. The rate of infection was same 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 increased cost effectiveness.

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 Centers 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, Escherhia coli, klebsiella, 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 (Bratzleret 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 defenses.

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 sequel).[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 orthopedic surgery.

MATERIALS AND METHODS

A prospective observational study was conducted in tertiary care hospital in Varanasi, India from September 2020 to august 2022 comparing short term and long term antibiotic prophylaxis in prevention of surgical site infection after orthopedic 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 orthopedic 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 repeat of dose if surgery prolongs for more than four hours. Both groups received post operative antibiotics 6 hours after surgery & repeat of dose after 12 hours of 2nd dose. We used a broad spectrum antibiotic viz. Cefuroxime axetil 50-100mg/kg IVand 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 3rdIV antibiotic dose.

Post operative examination of surgical site was done while dressing the wound on regular basis thereafter on the day of stitch removal and after 30days of surgery.

Comparison of incidence of surgical site infection between two groups was done.

Patients were followed up for 30 days post operatively. 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 infectioni. eCRP, CBC, ESR, and pus culture sensitivity.

We have included South Hampton Score for assessment of wound post surgery:

Grade 0Normal healing
Grade 1Normal healingwith mild bruising and haematoma
Grade 2Erythema plus other sign of inflammation
Grade 3Clear or haemoserous discharge
Grade 4Pus discharge
Grade 5Deep 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 athreshold 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

ISSN (O): 2687-5365; ISSN (P): 2753-6556

and long term antibiotic prophylactic patients 2 from each group got infected post-surgery. SH score of each patients came >2.Infected finding was 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: Comparison of SH score between short term and long termprophylaxis

SH score	Short term(n=59)		Long term(n=54)		p-value1
	No.	**%**	**No.**	**%**	
1	58	98.3	51	94.4	0.26
≥2	1	1.7	3	5.6	

[1]Chi-square test

[Table 1& Figure 7] shows the comparison of SH score between short term and long term Prophylaxis.

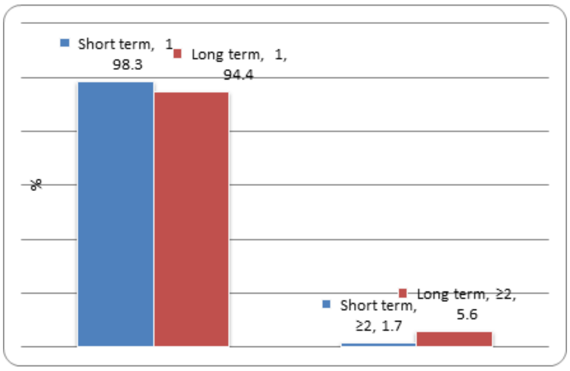

Figure 1: Comparison of SH score between short term and long termprophylaxis

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 24hours 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, HIMS with the objective to study the efficacy of short term versus long term antibiotic prophylaxis in preventing surgical site infection after an orthopedic 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

ISSN (O): 2687-5365; ISSN (P): 2753-6556

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 orthopedic surgeries cold shorten hospitalization, post-operative morbidity and unnecessary usage of long term antibiotics which also decreased the chance of antibiotic resistance in elective orthopedic 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 1 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 increased cost effectiveness.

REFERENCES

1. Horan TC, Andrus M, Dudeck MA. CDC/NHSN Surveillance definition of health care associated infection and criteria for specific types of infections in acute setting. Am J Infect Control 2008;36:309-32.
2. Zimlichman E, Henderson D, Tamir O, Franz C, Song P, Yamin CK, et al. Health care-associated infections: a meta-analysis of costs and financial impact on the US health care system. JAMA Intern Med 2013;173(22):2039– 46
3. Badia JM, Casey AL, Petrosillo N, Hudson PM, Mitchell SA, Crosby C. Impactof surgical site infection on healthcare costs and patient outcomes: asystematic review in six European countries. J Hosp Infect. 2017;96(1):1–15.
4. Umscheid CA, Mitchell MD, Doshi JA, Agarwal R, Williams K, Brennan PJ.Estimating the proportion of healthcare-associated infections that arereasonably preventable and the related mortality and costs. Infect Control Hosp Epidemiol. 2011;32(2):101–14.
5. Cohen ME, Salmasian H, Li J, Liu J, Zachariah P, Wright JD, et al. Surgical antibiotic prophylaxis and risk for postoperative antibiotic-resistant infections. J Am CollSurg 2017;225(5):631–638.
6. Branch-Elliman W, O'Brien W, Strymish J, Itani K, Wyatt C, Gupta K. Association of duration and type of surgical prophylaxis with antimicrobialassociated adverse events. JAMA Surg 2019;154(7):590–8.
7. Berrios-Torres SI, Umscheid CA, Bratzler DW, Leas B, Stone EC, Kelz RR, et al.Centers for disease control and prevention guideline for the prevention ofsurgical site infection, 2017. JAMA Surg. 2017;152(8):784–91.
8. Inabathula A, Dilley JE, Ziemba-Davis M, Warth LC, Azzam KA, Ireland PH, et al.Extended Oral antibiotic prophylaxis in high-risk patients substantially reducesprimary Total hip and knee Arthroplasty 90-day infection rate. J Bone JointSurg Am. 2018;100(24):2103–9.
9. Bedouch P, Labar`ere J, Chirpaz E. Compliance with guidelines on antibiotic prophylaxis in total hip replacement surgery: results of a retrospective study of 416 patients in a teaching hospital. Infect Control HospEpidemiol2004;25:302-7.
10. Namias N, Harvill S, Ball S. Cost and morbidity associated with antibiotic prophylaxis in the ICU. J Am CollSurg1999;188:225-8.
11. WHO Guidelines Approved by the Guidelines Review Committee. GlobalGuidelines for the Prevention of Surgical Site Infection. Geneva: WorldHealth Organization 2018.
12. Berrios-Torres SI, Umscheid CA, Bratzler DW, Leas B, Stone EC, Kelz RR, et al. Centers for disease control and

ISSN (O): 2687-5365; ISSN (P): 2753-6556

prevention guideline for the prevention of surgical site infection, 2017. JAMA Surg 2017;152(8):784–91.
13. Tan TL, Shohat N, Rondon AJ, Foltz C, Goswami K, Ryan SP, et al.Perioperative antibiotic prophylaxis in total joint Arthroplasty: a single doseis as effective as multiple doses. J Bone Joint Surg Am. 2019;101(5):429–37.
14. Siddiqi A, Forte SA, Docter S, Bryant D, Sheth NP, Chen AF. Perioperativeantibiotic prophylaxis in Total joint Arthroplasty: a systematic review andMeta-analysis. J Bone Joint Surg Am. 2019;101(9):828–42.
15. Metsini A, Vazquez M, Sommerstein R, Marschall J, Voide C, Troillet N, et al. Point prevalence of healthcare-associated infections and antibiotic use in three large Swiss acute-care hospitals. Swiss Med Wkly 2018;148(1718).
16. Urquhart JC, Collings D, Nutt L, Kuska L, Gurr KR, Siddiqi F, et al. The effectof prolonged postoperative antibiotic administration on the rate ofinfection in patients undergoing posterior spinal surgery requiring a closedsuctiondrain: a randomized controlled trial. J Bone Joint Surg Am. 2019;101(19):1732–40.
17. Misganaw D, Linger B and Abesha A. Surgical Antibiotic Prophylaxis Use and Surgical Site Infection Pattern in Dessie Referral Hospital, Dessie, Northeast of Ethiopia. BioMed Research International 2020.
18. Albaker AMB. Efficacy of Short course perioperative antibiotic prophylaxis: surgical site infection in elective orthopedic surgery. PJMHS 2021; 15 (1).
19. Alsaeed O M, Bukhari A A, Alshehri A A, et al. The Use of Antibiotics for the Prevention of Surgical Site Infections in Two Government Hospitals in Taif, Saudi Arabia: A Retrospective Study. Cureus 2022; 14(7).
20. Rohrer F, Maurer A, Noetzli H, Gahl B, Limacher A, Hermann T and Bruegger J. Prolonged antibiotic prophylaxis use in elective orthopaedic surgery – a crosssectional analysis. BMC Musculoskeletal Disorders 2021; 22 (420).