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Original Research Article

Optimizing Preoperative Antibiotic Prophylaxis Timing to Reduce Surgical Site Infection

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Abstract

Background: Whether the risk of surgical site infections (SSIs) changes with the application of surgical antibiotic prophylaxis (SAP) during 60–30 or 30–0 minutes before to incision is the hypothesis to be tested. The significance of properly scheduling SAP prior to surgery has long been understood. The best timing for an incision should ideally occur 60–0 minutes beforehand, although the evidence that is now available is inconsistent. Here, we use a carefully crafted observational cohort to assess prior discrepancies.

Methods: A tertiary referral facility located in Odisha underwent an observational cohort study. Patients with SAP indications undergoing orthopedic, gynaecologic, or general surgery were tracked after two years to check for the occurrence of superficial and deep surgical site infections (SSI), as defined by the Centers for Disease Control and Prevention. Multivariable logistic regression was used to evaluate the relationship between the time of SAP and SSI.

Results: Following 300 surgical operations, 150 SSIs were found. Within 60 minutes following the incision, SAP was delivered in 86% of the surgeries. The only antibiotics utilized were those with short infusion times. SSI risk was not shown to change significantly after SAP was administered 60–30 minutes or 30–0 minutes before to incision, according to multivariable logistic regression.

Conclusions: In this cohort, there was no discernible improved timing interval for SAP with short infusion times within the 60-minute window before to incision. The variations in SSI risk shown in previous research could not be replicated by us.

Keywords: perioperative care, antibiotic stewardship, antibiotic prophylaxis, surgical site infection, infection prevention, wound infection.

Introduction

A substantial fraction of hospital-acquired infections in the US are caused by surgical site infections (SSI), which are a major issue in surgery [1]. These infections cause higher mortality rates, greater post-operative problems, and yearly healthcare expenses in the billions of dollars. Surgeons employ surgical antibiotic prophylaxis (SAP) to lower the risk of SSI. It is important to deliver SAP at the right time; recommendations suggest doing so just before making an incision. The precise period within the 120 minutes prior to incision, however, is still up for discussion and needs more investigation [2].

Conflicting information is now available regarding the best time to perform SAP within the 60 minutes prior to incision [3]. While some studies recommend SAP be administered no more than 30 minutes prior to incision to lower the risk of SSI, others claim benefits should be realized if SAP is administered later or not at all [4]. Sadly, it is difficult to make firm conclusions from these trials due to differences in the SAP regimen, including the kind of antibiotics utilized, intraoperative redosing, preoperative antibiotic usage, and postoperative antibiotic usage.

There was no difference in the risk of surgical site infections (SSIs) between early SAP administration in the anesthetic room versus later administration in the operating room, according to a recent large multicenter randomized controlled experiment [5]. The actual SAP timings of the two groups did, however, overlap, which might have skewed the results. Consequently, there is still doubt.

The goal in doing this study is to determine whether there are any differences in SSI risk between SAP administration done 60–30 minutes prior to incision and SAP administration done 30–0 minutes prior to incision. Crucially, the study will take into account elements including infusion time, antibiotic half-life, preoperative and postoperative antibiotic use, and intraoperative redosing. In order to reduce surgical site infections, this research will help to clarify recommendations for the best time to administer surgical antibiotic prophylaxis.

Methodology

Study design: This study complies with epidemiology reporting criteria for observational studies. Surgical Antibiotic Prophylaxis (SAP) timing and the risk of Surgical Site Infections (SSI) are the subjects of this observational cohort study. Through the use of multivariable logistic regression, the study uses the time interval between SAP delivery and incision to categorize patients and accounts for any confounding variables.

Study setting: Between 'February 2017 to February 2019', the 'Hi-Tech medical college and hospital, Bhubaneswar', hosted the study. It includes patients receiving procedures in dedicated operating rooms for gynaecologic, orthopedic, or general conditions. As part of their routine clinical treatment, patients were observed for SSI for 30 days (or 1 year in the case of surgeries involving implanted foreign substances).

Participants and Procedure: Adult patients without pre- or postoperative antibiotic use who were undergoing major surgical operations necessitating SAP were eligible to participate. Individuals having preoperative infections or undergoing day surgery were not included. Patients with implanted foreign bodies and CDC wound classes II, III, or I.5 were recommended to use SAP. Cephalosporin administration was advised by local recommendations, usually beginning 60–30 minutes prior to incision, though the precise start time may vary. There was no use of agents that needed longer infusion times. In other cases, intraoperative redosing was recommended.

Patients were observed while receiving standard clinical care, and SSI surveillance adhered to CDC regulations. Data were gathered and examined from electronic health records.

Variables: In order to mitigate bias, outcome assessors were blinded to the SAP's timing, and medical staff was not informed of data collecting. To avoid bias, patients with pre-existing infections, day care surgery, and direct pre- or postoperative antibiotic use were excluded. Multiple imputation was used to handle missing data.

Statistical Analysis: In order to identify a 40% difference in SSI rates, the trial planned to enroll 1500 patients in each arm. In order to avoid making assumptions about linearity, data were analyzed using logistic regression with variables classified. For the statistical analysis, group Lasso with cross-validation, multiple imputation, and Rubin rules were applied. Additionally, exploratory and sensitivity studies were carried out.

In a nutshell this study examines how SAP timing affects the incidence of surgical site infections (SSIs) in a range of surgical procedures, taking into account a number of variables and utilizing rigorous statistical techniques to address potential biases.

Results

In particular operating rooms, 368 patients had surgery between 'February 2017 to February 2019'. 300 of the eligible patients were examined out of them. Within 60 minutes of their surgery, the majority of these patients (86%) got Surgical Antibiotic Prophylaxis (SAP). In particular, 105 patients (34%) took SAP between 60 and 30 minutes prior to surgery, whereas 150 patients (51%) had it between 30 and 0 minutes prior. A subset of patients (8%) had SAP after the 60-minute window, 0.1% received it more than 120 minutes beforehand, and 3% received it after the incision.

Table 1: Features of the Procedure and the Patient

Variable	Total
Age in years (%)	20.9
Male (%)	41.2
Smoking (%)	44.1
Diabetes (%)	10.0
Cardiovascular disease (%)	40.2
Pulmonary disease (%)	8.3
Immunosuppressant use (%)	7.6
Non-clean procedures (%)	54.2

Laparoscopic surgery (%)	10.2
Implantation of a foreign body (%)	54.4
Length of stay	12.5

A wide range of individuals, including different ages and surgical procedures, were included in the study. Cefuroxime plus clindamycin (40%) or cefuroxime alone (20%) or cefamandole (14%) were the most often utilized SAP medications. Approximately 26% of patients were eligible for intraoperative redosing but were not given it.

A total of 16 (5.3%) Surgical Site Infections (SSI) were identified during the 30-day follow-up (or 1-year follow-up for surgeries involving implanted foreign substances). Of these, 45 (58%) were superficial and 35 (40%) were deep. There was no discernible difference in the SSI risk between SAP administration 60–30 minutes before incision and 30–0 minutes before incision, even after correcting for a number of variables.

Sensitivity studies that took into account patients who were given intraoperative redosing when necessary, extended the infusion period by ten minutes, and took into account "organ/anatomic space SSI" in the result did not substantially alter the findings. An exploratory research revealed that the probability of SSI, particularly organ/anatomical space infections, was reduced when SAP was administered 120 to 60 minutes prior to incision as opposed to 30 to 0 minutes. However, when specific requirements were satisfied, such having intraoperative redosing, this difference was less noticeable.

This study examined the relationship between the timing of SAP and the risk of SSI, taking into account a number of variables and doing sensitivity and exploratory analyses. The findings indicated that there was no discernible variation in SSI risk amongst the various SAP administration time intervals.

Discussion

There was no obvious optimal timing found in this trial for Surgical Antibiotic Prophylaxis (SAP) with a brief infusion period within the 60 minutes prior to surgery. The study was unable to validate variations in the risk of surgical site infections (SSIs) seen in previous investigations. Upon closer examination, it appeared that if SAP was administered between 120 and 60 minutes before to surgery, as opposed to 30 or 15 minutes beforehand, there would be a decreased chance of SSI. When compared to 60–0 minutes prior to surgery or when patients who were supposed to receive additional SAP were not given it, this wasn't as evident, though.

According to available data, SAP must be present in the body's tissues both before and during the surgery in order for it to be effective [6, 7, 8]. SAP should be administered no later than 120 minutes prior to surgery, although the optimal time to administer it is in the final 60 minutes is debatable [6]. While some studies support SAP if administered no later than 30 minutes before surgery [4, 9], others point to advantages if SAP is administered later or not at all [10, 11]. The antibiotics used, preoperative antibiotic use, intraoperative redosing, and postoperative antibiotic use are different among these trials. These differences could skew the data and obscure any impact of SAP time on SSI [4, 11].

Because of the shortcomings of earlier research, medical practitioners were uncertain about the most effective strategy [5]. This uncertainty was not resolved either by a recent trial. Therefore, taking into account earlier shortcomings, this study sought to shed light on this matter.

This study has several drawbacks, such as a limited sample size, accounting only for known variables, variations in the local redoing technique, and lack of control for patient distribution over temporal intervals. However, it was conducted in an area with solid antibiotic stewardship procedures, focused on pertinent SSIs, and had several strengths, including a thorough documentation of SAP timing and other parameters.

Conclusion

This study concluded that there was insufficient data to recommend a precise timing window for SAP with a brief infusion period within the 60 minutes before to surgery. These results are consistent with recent guidelines from healthcare organizations to give antibiotic prophylaxis before to incision while taking half-life of the antibiotic into account.

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