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Original Research Article

A comparative study of surgical site infections in clean elective surgical procedures with and without antibiotic prophylaxis

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ABSTRACT

Background: Surgical site infections (SSI) are the primary (40%) cause of nosocomial infection in surgical patients. Surgical antibiotic prophylaxis (SAP) is the use of antibiotics to prevent infections at the surgical site. However, in clean surgical wound inappropriate antibiotic prophylaxis such as inappropriate selection, timing and duration are associated with an increase in the prevalence of antibiotic resistance, cause adverse drug reaction, cost burden for treatment and increased risk of surgical site infections. Objective of this study is to evaluate the judicious omission of antibiotic in clean elective cases.
Methods: This observational case-control study carried out at Command Hospital, Western Command Chandimandir Haryana India, compared surgical site infection (SSI) rates in 224 patients undergoing elective clean surgical procedures, with 112 receiving antibiotic prophylaxis (control group) and 112 not receiving antibiotics (case group).
Results: The study found increased induration on postoperative day 3 in patients not receiving antibiotics had a higher incidence of induration (29.5% vs 12.5%) however no significant difference in major grade SSI (as per Southampton Wound Grading System) rates and SSI rates were comparable between groups on postoperative days 7, 14 and 30.
Conclusions: The study suggests that antibiotic prophylaxis may reduce early postoperative induration, but its effectiveness in preventing long-term SSIs is uncertain. Further research is needed to confirm the results and establish clear guidelines for antibiotic prophylaxis in elective clean surgical procedures. The study highlights the importance of judicious antibiotic use.

Keywords: Antibiotics, Prophylaxis, SSI

INTRODUCTION

Surgical site infections (SSIs) account for the major portion (40%) of nosocomial infections among surgical patients.[1] SSIs are divided into two groups by the Centre for Disease Control and Prevention (CDC): incisional and those involving an organ or space, such as meningitis.[2] Wounds are classified into 4 groups: clean, cleancontaminated, contaminated and dirty-infected wounds, with progressively increasing risk of SSI.[3]

Three fundamental elements contribute either individually or collectively to the occurrence of postoperative wound infections the introduction of bacteria in sufficient quantities and with the required level of virulence. A local environment where contaminating microbes can thrive. A reduction in the host's ability to resist infection, whether locally or systemically. Strategies aimed at preventing postoperative infections target these three elements.[4,5]

Surgical antibiotic prophylaxis (SAP) involves the use of antibiotics to prevent infections at the surgical site. When appropriately administered at the correct time, for the right duration and for the suitable surgical procedure, surgical antibiotic prophylaxis proves to be an effective strategy in managing postoperative infections.[6] In practice, antibiotics are frequently and inappropriately used for preventing surgical site infections. These improper practices, such as incorrect antibiotic selection, timing and duration, are linked to a rise in antibiotic resistance, adverse drug reactions, higher chances of SSIs, a growing demand for novel medications and escalating medical costs.[7-10] Centre for Disease Control and Prevention has recommended that clean procedures should not involve the administration of prophylactic antibiotics or the application of topical antimicrobials to surgical incisions.[11]

The inappropriate and unnecessary use of antimicrobials is associated with significant risks for patients.[12] If antibiotics are administered to prevent infections following surgery or medical procedures, they should be used prior to the onset of bacterial growth, within the critical timeframe.[13,14]

Hence, intravenous infusion during the induction of anaesthesia is considered the most effective approach. There is no indication that additional doses of antibiotics post-surgery contribute to the prophylaxis for infections and this practice may only promote the development of antibiotic resistance.[15]

The most common types of bacteria that lead to infections in surgical procedures include Streptococci, *Staphylococci, Clostridia*, *E coli*, Klebsiella, Pseudomonas and others.[16,17] Sources of infection can be exogenous i.e., through poor hand hygiene, as well as endogenous like contamination of wound from bowel content. Objective of this study is to evaluate the judicious omission of antibiotic in clean elective cases.

METHODS

The observational case control study was conducted at the Dept of Surgery, Command Hospital, Western Command Chandimandir Haryana India, for 12 months from 29 June 2022 to 29 June 2023. Consecutive patients reporting for surgery to the department were recruited by screening patient cards meeting the inclusion criteria.

The sample size was calculated based on a previous study by Walia et al and the formula given by Sahai et al Khurshid et al. The calculated sample size for each arm was 112 (total 224) with 80% power and 95% confidence interval. All patients fitting the inclusion criteria were included in either arm by using simple random number sampling: https://randomnumbergenerator.org/1-100.

Data was collected in a predesigned format, group A (Control group), Prophylactic antibiotic Injection Amoxicillin+Clavulanate 1.2 gm intravenous was given at the time of induction and group B (case group) were not given any antibiotics. Patients were followed up at post operative day 3, 7, 14 and 30 for development of SSI. Data were entered in into Microsoft Excel and analysed using SPSS version 21.0 (IBM Corps, Armonk, NY). Descriptive statistics, including tables and graphs and findings were summarized. The Chi- Square test was employed for categorical variables, with a p- value of less than 0.05 considered statistically significant.

Inclusion criteria

Patients with more than 18 years age who give consent for study, admitted for elective surgical procedures like varicocelectomy, surgeries for hydrocele, thyroidectomy, surgeries for varicose veins, congenital inguinal hernia repair, circumcision, split skin grafting, lipoma excision.

Exclusion criteria

Antibiotic therapy within 48 hours to 7 days prior to surgery due to any reason. surgery which includes implantation, patient with malignant disease, patient with immunosuppressive state (diabetes, steroid therapy, HIV infection, immunosuppressive therapy).

RESULTS

In the study, the overall incidence of SSI was 12.5% in controls, which was significantly lower than that of cases, which was 29.4%. On day 3, 87.5% had a Grade of 0, 8.9% had a Grade of 2 and 3.6% had a grade of 3 among control. Among the cases, 70.5% had Grade 0, 26.8% had Grade 2 and 2.7% had Grade 3.

The distribution of the SSI was found to be significantly higher among cases. However, these were minor grade SSI which required no intervention or specific management. The distribution was comparable on the 7th, 14th and 30th day after surgery for both cases and control group.

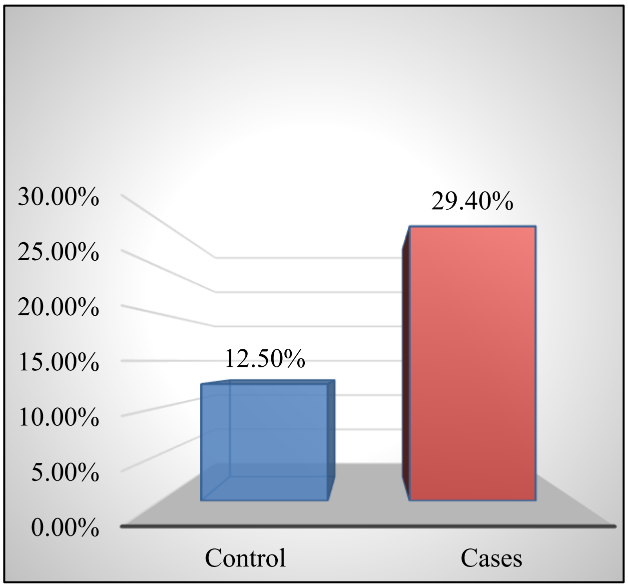

Figure 1: Distribution of patients according to incidence of surgical site infection.

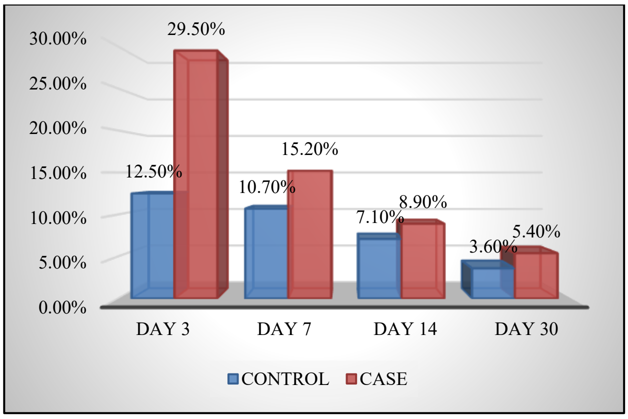

Figure 2: Induration and erythema on post op days: Maximum at post op day 3 with significantly high incidence in control group.

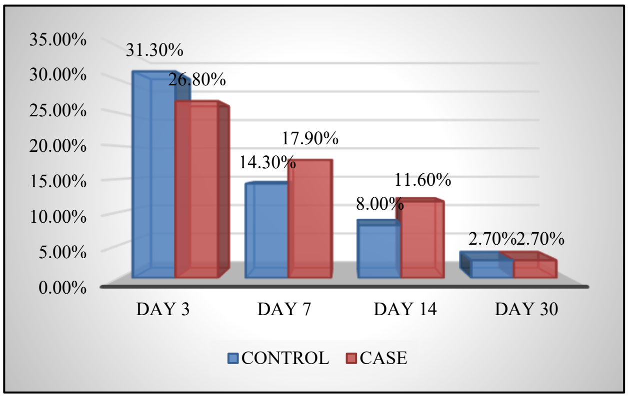

Figure 3: Distribution of patients according to discharge from wound at follow-up: Maximum incidence at post op day 3, however only serous discharge required not additional management.

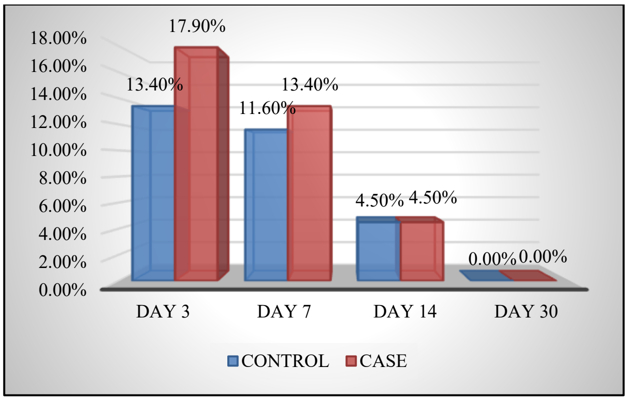

Figure 4: Distribution of patients according to leucocytosis at follow-up: higher incidence of leucocytosis in cases, however resolved in further post op days without change in management plan.

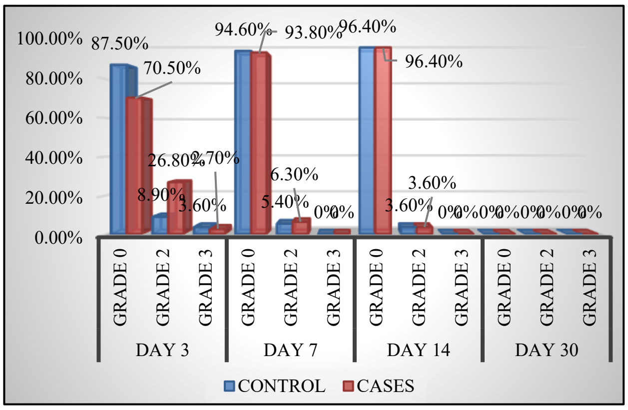

Figure 5: Distribution of patients according to surgical site infection grading: lower grades of SSI in early postoperative days, however resolved without changing management plan.

Table 1: Demographic distribution of patients.

Total number of patient enrolled=224	
Male	130
Female	94

Table 2: Distribution of patients according to surgical site infection grading.

Present		Control (n=112)		Cases (n=112)		P value
		n	%	N	%	
Day 3	Grade 0	98	87.5	79	70.5	0.002*, sig
	Grade 2	10	8.9	30	26.8	
	Grade 3	4	3.6	3	2.7	
Day 7	Grade 0	106	94.6	105	93.8	0.500, NS
	Grade 2	6	5.4	7	6.3	
	Grade 3	0	0	0	0	
Day14	Grade 0	108	96.4	108	96.4	0.639, NS
	Grade 2	4	3.6	4	3.6	
	Grade 3	0	0	0	0	
Day 30	Grade 0	0	0	0	0	NA
	Grade 2	0	0	0	0	
	Grade 3	0	0	0	0	

Chi-square test, level of significance set<0.05, Ns: non-significant, *sig: significant.

DISCUSSION

Despite advances in surgical techniques, sterile protocols and perioperative antibiotic regimens, SSI remains a significant problem. Post-operative SSIs continue to pose a significant challenge among patients undergoing surgery, leading to prolonged hospital stays, heightened demand for nursing and wound care, increased financial burdens, repeat hospital visits and the necessity for additional surgical interventions.[18] Surgeons in developing nations continue to use antibiotics out of unfounded concern for infections and post-surgery complications.

Some research hints at the redundancy of antibiotics in clean surgical procedures. However, these findings are predominantly from developed countries, where circumstances vary. Other studies advise antibiotic prophylaxis for surgeries with a heightened risk of post-surgical wound infections.[19,20] The efficacy of antibiotic use for infection prevention in clean surgeries hinges on their ability to reach the vulnerable tissue. Administering antibiotics post -surgery is unnecessary when there are no signs of wound infection. This study's primary aim was to assess the infection risk in elective clean surgeries by foregoing antibiotic treatment. Our analysis involved 224 patients scheduled for such procedures using a case-control approach. While the control group received prophylactic antibiotics during induction, the case group did not receive any.

In the study, there was no significant difference between case and control in respect to demographic parameters like age, sex etc. There was no significant difference in terms of surgical procedures, duration of surgeries, pre and post operative hospital stay. These figures contrast with a study by Bendre et al, involving 100 cases who were divided into two groups. One group received a single dose of ceftriaxone within 2 hours of surgery without postoperative antibiotics, while the other group was administered multiple doses of postoperative antibiotics.[21] Habash et al, omitted use of prophylactic antibiotics in laparoscopic cholecystectomy and found no significant difference in outcome.[22]

Shetye et al emphasized that the unwarranted use of prophylactic antibiotics in cases categorized as clean or clean-contaminated does not offer any advantage and on the contrary increases costs and raises the risk of developing antibiotic resistance strains.[23] Risk of SSIs were 2.5 times more likely in patients not given antibiotic prophylaxis in one of the similar study.[24] Prasanna et al, in their study compared the frequencies of wound site infections in patients undergoing clean elective general surgery operations with no antibiotics and single-dose prophylactic antibiotics and concluded that a single dose of prophylactic antibiotics is not required in all clean surgical cases.[25] Jordaan et al conducted a cross-sectional study in orthopaedic patients to study adherence to laid down guidelines in a hospital regarding use of prophylactic antibiotics.[26]

Our study has several limitations. Firstly, the sample size was relatively small, which may limit the generalizability of our findings. Secondly, it is a single centre study. Future studies with larger sample sizes and more robust designs are needed to confirm our findings.

CONCLUSION

The study investigated development of surgical site infection in elective clean surgical procedures without antibiotic prophylaxis in comparison to patients who received antibiotic prophylaxis for the same surgery. Only minor grade SSI showed higher incidence during initial 3 days in the case group and there was no difference in major grade SSI in both groups. Hence, the use of prophylactic antibiotics in clean elective cases is not beneficial; it just adds to the cost and increases the chances of developing antibiotic-resistant strains.

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Ethical approval: The study was approved by the Institutional Ethics Committee

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