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ORIGINAL ARTICLE

Efficacy of Antibiotic Prophlaxis in Preventing Surgical Site Infections: A Review of Current Practices and Emerging Alternatives in General and Plastic Surgery

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ABSTRACT

Background: Effective preventive measures are necessary to reduce the incidence of surgical site infections (SSIs), which continue to be a leading cause of postoperative morbidity.

Objective: This study aimed to evaluate the efficacy of antibiotic prophylaxis in preventing SSIs in general and plastic surgery, compare different antibiotic regimens, and analyze factors influencing infection rates.

Methodology: A prospective observational study was conducted from at the department of Surgery, Mardan Medical Complex, Mardan from January 2022 to December 2022. There were 116 patients in all having either general or plastic surgery. Based on surgical indications, cefazolin, cefuroxime, or clindamycin-gentamicin were used in antibiotic prophylaxis in accordance with FDA recommendations. To evaluate the incidence of SSI, patients were monitored for 30 days after surgery. SPSS version 25 was used to gather and analyze data on patient demographics, comorbidities, wound categorization, surgery specifics, and preventative measures. Chi-square tests were used for categorical variables.

Results: General surgery had a greater infection rate than plastic surgery, with an overall SSI incidence of 14.66%. With the lowest infection incidence, cefazolin was the most effective antibiotic; SSI rates were greater for cefuroxime and clindamycin-gentamicin. While the difference in SSI rates between general and plastic surgery was not statistically significant, wound classification and the presence of drains were strongly linked with infection risk ($p < 0.05$).

Conclusion: The most effective drug cefazolin proves to significantly reduce the possibility of surgical site infection according to research. Perioperative infection control methods must be optimized because of this requirement.

Keywords: Surgical site infection, antibiotic prophylaxis, general surgery, plastic surgery, cefazolin, infection control

INTRODUCTION

Healthcare systems throughout the world encounter serious challenges due to surgical site infections (SSIs) since they are major factors leading to postoperative complications and mortality[1]. Surgical site infections remain a major hospitalization driver that increases medical costs and harms patients badly despite recent advances in surgical techniques and infection control practices[2]. Wound contamination risks together with surgical duration and tissue manipulation practices cause different specialties to experience different rates of surgical site infections. Two different problems affect surgical patients in general and plastic procedures[3].

The primary method of minimizing SSIs involves antibiotic prophylaxis and surgeons agree on this approach. Antimicrobial medications help cut down surgical infections fast in operations classified as clean-contaminated and contaminated[4]. Prolonged discussions exist about antibiotic resistance together with antibiotic dose selection and adverse drug effects that affect the proper use of preventive antibiotics[5]. The medical community needs to find proper ratios between effective infection prevention and avoidable drug exposure considering the escalating antimicrobial resistance threat[6].

The selection process for prophylactic antibiotics in plastic surgery and other medical fields gets determined by variables including patient health risks and surgical duration and implanted materials[7,8]. Although most patients should only need a single dose of antibiotics before surgery, there is ongoing debate on whether or not extended prophylaxis is necessary, especially for procedures with a high risk of infection[9]. Furthermore, new pharmacological agents, antimicrobial-coated sutures, antiseptic wound irrigation, and other non-traditional methods of infection prevention are being investigated as possible alternatives to or supplements to conventional antibiotic prophylaxis[10,11].

The analysis of novel prophylactic antibiotic strategies together with the improvement of existing procedures marks the primary area of recent research focus. Comparative research on new antimicrobial medications and combination preventive medicine and individual treatments targeting high-risk patients will shape future surgical infection control methods. Patient success and antibiotic risk reduction demand integrated evidence-based advice and usable clinical approaches.

Research Objective: The main goal of this research targeted the evaluation of antibiotic preventive measures against SSIs and the analysis of present practices while investigating potential new infection control strategies.

METHODOLOGY

Study Design and Setting: This prospective observational research was conducted at the department of Surgery, Mardan Medical Complex, Mardan from January 2022 to December 2022

Inclusion and Exclusion Criteria: Participants in the research underwent either general or plastic surgical procedures and received pre-operative antibiotics. Additionally, scheduled surgeries had patients who were willing to join the study and supply consent. The patients excluded from the study had prior sepsis or infection, antibiotic sensitivity problems or required emergency non-antibiotic surgical procedures.

Sample Size: A total of 116 patients were included in the study, selected through convenient sampling.

Dosage According to FDA: Following the standards set out by the FDA, antibiotic prophylaxis was given. Cefazolin or another first-line antibiotic (1-2g IV) was given one time, within the hour before to incision, as a preoperative dosage. When longer prophylaxis was required, extra intraoperative dosages were given according to the length of the surgery and the amount of blood loss.

Data Collection: Details on the patients, their surgeries, their antibiotic treatments, and the results of any infections that occurred after surgery were culled from their organized clinical records. For

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30 days after surgery, patients were monitored to determine the occurrence of surgical site infections (SSIs). Information on the kind of wound, the length of surgery, the presence or absence of drains, and any extra precautions that were taken were documented.

Statistical Analysis: The SPSS version 25 was used for the analysis of the collected data. While chi-square tests were used for categorical data, descriptive statistics such as standard deviation and mean were employed for continuous variables. Infection rates after various surgical procedures and antibiotic prophylaxis regimens were compared to ascertain the efficiency of the former.

Ethical Approval: The Institutional Review Board gave its stamp of approval to the research. Prior to their involvement, all patients were asked to provide their informed permission.

RESULTS

The 116 patients' demographic information and surgical features are listed in Table 1. For general surgery, the average age was 45.60 ± 12.30 years, whereas for plastic surgery, it was 42.80 ± 11.70 years. 51.72% of patients undergoing cosmetic surgery and 60.34% of patients undergoing general surgery were male. Comorbidities included hypertension (13.79% vs. 10.34%) and diabetes (17.24% in general surgery vs. 12.07% in plastic surgery). Compared to cosmetic surgery (31.03%), the prevalence of drains was somewhat greater in general surgery (34.48%).

Table 1: Patient Demographics and Surgical Characteristics

Variable		General Surgery (n=58)	Plastic Surgery (n=58)
Mean Age (years)	Mean ± SD	45.60 ± 12.30	42.80 ± 11.70
Gender (n;%)	Male	35 (60.34%)	30 (51.72%)
	Female	23 (39.66%)	28 (48.28%)
Comorbidities (n;%)	Diabetes	10 (17.24%)	7 (12.07%)
	Hypertension	8 (13.79%)	6 (10.34%)
	Obesity	4 (6.90%)	5 (8.62%)
Wound Classification	(n;%)	35 (60.34%)	38 (65.52%)
Presence of Drains	(n;%)	20 (34.48%)	18 (31.03%)

Table 2 shows that the average length of operation for cosmetic surgery was 85.70 ± 18.90 minutes, whereas the mean for general surgery was 95.50 ± 20.30 minutes. In 27.59% of instances involving cosmetic surgery and 31.03% of cases involving general surgery, additional preventive measures such antiseptic irrigation and antimicrobial sutures were used.

Table 2: Surgical Details and Prophylactic Measures

Variable	General Surgery (n=58)	Plastic Surgery (n=58)
Mean Duration of Surgery (minutes)	95.50 ± 20.30	85.70 ± 18.90
Additional Prophylactic Measures (%)	18 (31.03%)	16 (27.59%)

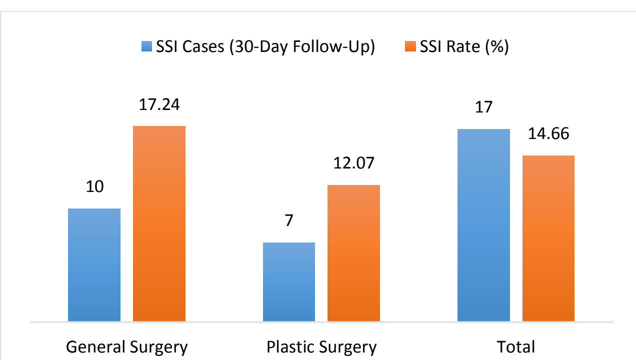

Figure 1: Surgical Site Infection Rates by Procedure Type (30-Day Follow-Up)

The 30-day postoperative SSI rates are shown in Figure 1. With an overall SSI incidence of 14.66%, general surgery had a higher infection rate (17.24%) than plastic surgery (12.07%).

Differences in SSI rates according to the antibiotic used are seen in Figure 2. While cefuroxime had a higher infection rate (20.00%) and the combination of clindamycin and gentamicin had the greatest SSI rate (23.08%), cefazolin was the most effective, with an 8.33% SSI rate.

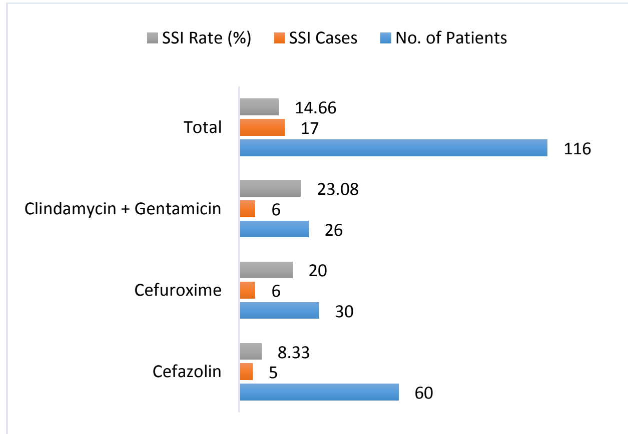

Figure 2: Comparison of Infection Rates by Antibiotic Type

The findings of the chi-square analysis are shown in Table 3. Certain antibiotics were more successful than others, as shown by the statistically significant relationship between antibiotic type and SSI ($p = 0.033$). Significant associations with SSI risk were also seen for wound classification ($p = 0.012$) and drain presence ($p = 0.019$); however, there was no statistically significant difference between surgical specializations and SSIs ($p = 0.072$).

Table 3: Chi-Square Analysis of Categorical Variables

Variable	Chi-Square Value	p-Value
Surgical Specialty vs SSI	3.24	0.072
Antibiotic Type vs SSI	6.83	0.033
Wound Classification vs SSI	8.95	0.012
Presence of Drains vs SSI	5.47	0.019

DISCUSSION

SSI remains an important problem in surgical recovery that impacts both patients' recovery process and healthcare costs as well as surgical outcome completeness. A variety of conditions including antibiotic choice and patient traits alongside surgical procedures determine how well antibiotics prevent surgical site infections (SSIs). Research examined SSI response factors in addition to evaluating different antibiotic prevention methods within the domains of plastic and general surgery domains.

The studied population from both general surgery and plastic surgery showed that antibiotic prophylaxis prevents surgical site infections effectively. The total surgical site infection rate amounted to 14.66% in our study but general surgery procedures yielded a 17.24% higher risk than plastic (cosmetic) surgery procedures (12.07%). Research findings match other studies showing that general surgical operations produce higher SSI rates because they introduce greater risks of wound contamination and require longer durations of operations[12].

According to our data the prophylactic antibiotic SSI rates came out to 8.33% for cefazolin and 20.01% for cefuroxime and 23.18% for clindamycin/gentamicin. Cefazolin serves as the preferred antibiotic prophylaxis for clean-contaminated and contaminated procedures due to its broad antibacterial spectrum and low drug resistance pattern per current clinical guidelines. Experimental results indicates that SSI rates recorded lower frequencies when cefazolin was used as a prophylaxis in general surgery based on a study by Allen et al.[14]. On the other hand, studies have highlighted the increasing resistance to second-generation cephalosporins and aminoglycosides, and the increased SSI rates seen with cefuroxime and clindamycin-gentamicin raise concerns about possible resistance[15].

We found a statistically significant association between wound classification and SSI risk ($p = 0.012$ for wound classification and $p = 0.019$ for drain presence). The increased infection rates seen in patients with filthy or contaminated wounds are in line with earlier studies that highlighted the significance of wound state in predicting infection risk[16]. In a similar vein, Reiffel et al.[17] found that surgical drains, because of their ability to harbor germs, increase the incidence of surgical site infections (SSIs). The need of using drains carefully and exploring other methods of wound treatment to reduce the risk of infection is highlighted by our results.

The efficacy of other preventative treatments, such as antimicrobial sutures and antiseptic wound irrigation, on lowering SSIs was not independently evaluated, despite their use in 31.03% of general surgery and 27.59% of cosmetic surgery cases, respectively. Research that analyzes the prevention capabilities of triclosan-coated sutures and chlorhexidine irrigation adjuncts requires further development since their infection reduction potential has been demonstrated in existing studies[18]. More detailed research of these preventive strategies under antibiotic-free conditions should be conducted to maximize their effectiveness.

Study Strength and Limitations: A prospective observational study design with clearly defined follow-up period of 30 days enables researchers to obtain vital knowledge about antibiotic prophylaxis avoidance of SSIs in cosmetic surgery fields. A healthcare professional can produce better results through standardized antibiotic medication protocols approved by the FDA. Examining different antibiotic treatments demonstrates the need for picking optimal preventive medications because they minimize infection risks. The research has limited general applicability because it utilized easy sampling with a small participant group (n = 116). Confounding variables that could have altered SSI results were insufficiently addressed despite the lack of consideration given to surgical techniques and hospital environment and surgeon qualifications. The research lacks microbiological testing which verifies microorganism resistance patterns because applying this approach would deliver a deeper understanding of antibiotic effectiveness.

CONCLUSION

The study demonstrates cefazolin produces the greatest antibiotic results while proper antibiotic prevention reduces SSIs sufficiently in general surgery procedures and cosmetic surgeries. Preventative measures need customization because general surgery poses a higher infection risk than cosmetic surgery according to research findings. The need of thorough perioperative infection control methods was emphasized by the significant correlations found between infection rates and variables including wound categorization and drain presence. Even if other preventative measures were used, further research is necessary to fully understand their effects. Future studies should concentrate on improving antibiotic selection, investigating other preventative strategies, and honing infection control procedures in order to enhance surgical outcomes, given the rising worry about antimicrobial resistance.

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