Pattern of Surgical Antibiotic Prophylaxis in a Corporate Hospital of Chattogram

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Abstract

Background: Surgical Site Infections (SSIs) are among the most common postoperative complications, significantly contributing to patient morbidity, prolonged hospital stays and increased healthcare costs. SSIs occur at or near the surgical incision within 30 days of the procedure or one year if an implant is placed. Risk factors include patient-related elements (e.g. Diabetes, obesity), procedural factors (e.g. Duration of surgery, sterilization practices) and perioperative care.Surgical antibiotic prophylaxis, a fundamental part of standard operative procedures to avert infections at the site of surgery, has improved postoperative recovery. Irrational and excessive use of antibiotics is common in surgical prophylaxis, resulting in increased treatment expenditures and antimicrobial resistance. This study aimed to determine the prescription pattern of prophylactic antibiotics in surgeries by different departments of a Corporate Hospital in Chattogram.

Materials and methods: A retrospective analytical study included the data of 997 patients, underwent different surgeries at a corporate hospital in Chattogram, Bangladesh, from May 2023 to June 2024. Demographic data, types of surgery, and types of antibiotics used were collected from the hospital's electronic health records and analyzed by using Microsoft Excel 2016.

Results: In this study, females were predominant (74.22%) overmales.The mean age was32.37±14.78 years. One-third of our patients belonged to the age group of 21-30 years. The highest bulk of patients (40.56%) were from obstetrics surgery. Ceftriaxone was the most commonly used antibiotic during the 30-60 minutes before incision. The orthopaedic surgery department used Cefazolin in both pre- and post-operative cases.

Conclusion: The most used antibiotic for surgical case prophylaxis was Ceftriaxone. To control antimicrobial resistance, it is necessary for every hospital to follow antimicrobial guidelines and antibiotic stewardship program.

Key words: Antibiotic prophylaxis; Antimicrobials; Surgical operations; Surgical Site Infection (SSI).

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Introduction

Surgical Site Infections (SSIs) are among the top causes of nosocomial infections in surgical patients (40%) and the third most common form of such infections among indoor patients (14%–16%).[1] The Centers for Disease Control and Prevention (CDC) have classified SSIs as superficial incisional (Skin or subcutaneous tissue), deep incisional (Muscle and fascia) or organ or space SSIs (Cellulitis at the incision site or meningitis). By definition, both kinds appear by day 30 after surgery. This time frame is extended to one year if a deep infection is linked to prosthesis installation.[2] In addition, the United States National Research Council created a model to classify incisions as clean to clean-contaminated, then contaminated, and finally unclean wounds according to the level of contamination.[3]

Development of postoperative infection at surgical site depends upon several factors like magnitude of per-operative microbial contamination, the aggressiveness of the contaminating organism, and defense by host. Furthermore, patient characteristics, surgical and environmental factors can be used to categorize risk factors for postoperative site infection.[4,5] The short course of antibiotics, started only before operative processes, to prevent postoperative Surgical Site Infections (SSIs) is called Surgical Antibiotic Prophylaxis (SAP).[6] Nowadays, it is thought that surgical antibiotic prophylaxis is necessary for standard surgical operations to lower surgical site infections and enhance postoperative recovery. The rise in therapeutic expenses and the development of antimicrobial resistance were due to abuse and overuse of antibiotics.[7]

The CDC estimates that infections linked to hospitals cause 99,000 fatalities annually. Among the top three common forms of nosocomial infection is Surgical-Site Infection (SSI).[8,9] The rates of SSI range from 2.5% to 41.9% worldwide, with greater rates in underdeveloped nations.[10]

Studies as early as 1961 demonstrated that, following antibiotic therapy before surgical incision, wounds contaminated with and without Staphylococcus aureus were identical.[11] The U.S. Surgical Infection Prevention (SIP) Project was started in 2002 to reduce postoperative Surgical Site Infections (SSI)-related morbidity and mortality. One of the project's efforts was to choose prophylactic antibiotics carefully, provide them within an hour of the incision, and stop using them within 24 hours after surgery.[12]

Over time, surgical prophylactic principles have been established in several nations. To give practitioners a standardized method for the prudent, secure and efficient use of antimicrobial drugs to prevent Surgical-Site Infections (SSIs) the recommendations were created.[13] Numerous epidemiological studies have been carried out in various nations that describe the scenarios of prophylactic antibiotics in clinical settings for various surgical procedures.[14] However, few research papers have been published on this topic and no established guidelines regarding surgical antibiotic prophylaxis in Bangladesh. Therefore, the current retrospective investigation aimed to assess the choice and timing of prophylactic antibiotic prescribed among surgical patients for different surgical operations among hospitalized patients in a corporate hospital of Chattogram, Bangladesh.

Materials and methods

A retrospective analysis was done in Apollo Imperial Hospitals Ltd, Chattogram, between May 2023 to June 2024, where the data of 997 patients, who underwent various types of surgeries were included. Demographic data (Age, gender) and department of admission were recorded from the treatment record—data regarding antibiotics used as prophylaxis was obtained using a structured data collection form. The Institutional Review Board (AIHL/IRB/2025-01) of the Apollo Imperial Hospitals Ltd approved toconduct the study and permission was granted for taking data from the electronic database records. The data was from the above-mentioned period, but was taken later after this ethical approval. Data was assembled and analyzed using Microsoft Excel 2016 and presented as mean, frequency and percentage in tables and charts.

Results

Out of 997 patients, 257 (25.78%) were male and 740 (74.22%) were female. Figure 1.

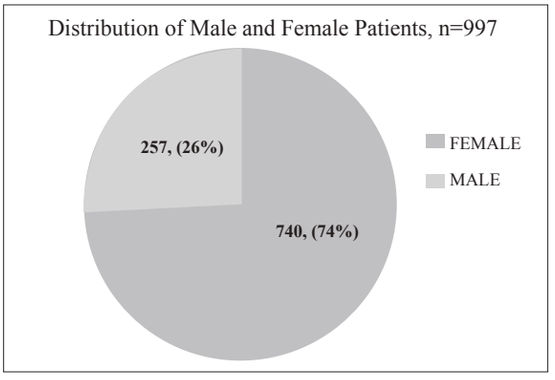

Figure 1 Distribution of male and female patients (n=997)

Patients' age ranged from three months to 93 years. Modal age group was 21-30 years (34.1%), followed by 31-40 years (30.6%) and 41-50 years (10.6%), 1-10 years (7.7%), 11-20 years (6.8%), 51-60 years (4.4%), 61-70 years (3.5%), 71-80 years (1.8%) and lowest was 81 years and above was 0.4%. (Figure 2). The Mean+SD:was 32.37±14.78 years.

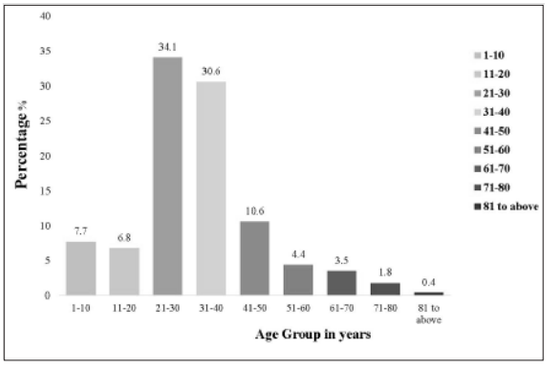

Figure 2 Age distribution of patients (n=997)

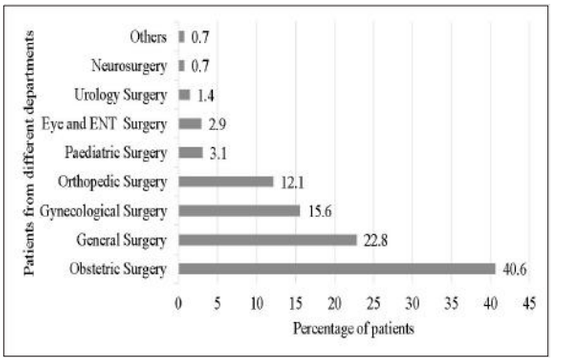

Figure 3 Distribution of patients by Departments (n=997)

The highest bulk of patients were from Obstetrics surgery [n=405, 40.56%] followed by the Department of General Surgery [n=227, 22.8%] Gynecologic surgery [n=156, 15.6%] and Department of Orthopedic Surgery [n=121, 12.1%] Department of Paediatric surgery [n=31, 3.1%] Department of Eye and ENT [n=29, 2.9%] Department of Urology [n=14, 1.4%] Department of Neurosurgery [n=7, 0.7%] Others [n=7, 0.7%] (Figure 3).

The current study showed that Ceftriaxone was mostly used as an antibiotic and was used 30-60 min before incision at different departments. Regarding post-operative antibiotics usage, Ceftriaxone was the drug of choice by obstetrics, general surgery, and gynaecology departments. The orthopaedic surgery department used Cefazolin in both pre- and post-operative cases (Table I).

Table I Timing and types of common antibiotics used in different departments

Department	Total Patient	30-60 min before Incision Pre-Operative Antibiotics			Post-Operative Antibiotics			Antibiotics on Discharge for 5-7 days				
		CTX*	CFZ*	CXM*	CTX*	CFZ*	CXM*	FEP*	CEF*	CXM*	AMC*	Lzd*
Obstetric Surgery	405	315 (77.8%)	-	90 (22%)	313 (77%)	-	92 (23%)	252 (62%)	-	-	102 (26%)	-
General Surgery	227	159 (71.6%)	-	40 (18%)	63 (28.4%)	-	63 (28.4%)	-	-	42 (18.9%)	-	-
Gynecology	156	90 (60.3%)	-	50 (32.1%)	47 (30.1%)	-	33 (21.2%)	-	-	-	38 (24.4%)	-
Orthopedics	121	23 (19.8%)	74 (62.2%)	-	17 (14.3%)	53 (44.5%)	-	-	-	-	-	80 (67.2%)
Pediatric Surgery	31	19 (61.3%	-	-	-	-	20 (64.5%)	-	2 (6.5%)	2 (6.5%)	-	-
ENT	29	19 (65.5%)	-	-	-	-	6 (20.7%)	-	-	-	5 (17.2%)	-
Urology	14	8 (57.1%)	-	-	-	-	3 (21.4%)	-	-	5 (35.7%)	-	-
Neurosurgery and others		14	9 (64.28%)	-	-	-	-	5 (35.7%)	-	-	4 (28.6%)	- -

*CTX- Ceftriaxone, CFZ- Cefazolin, CXM- Cefuroxime, FEP- Cefepime, CEF- Cefixime, AMC- Amoxicillin Clavulanic Acid, Lzd- Linezolid.

Discussion

Postoperative SSI is decreased by antibiotic prophylaxis, along with the patient's age, general health, asepsis, antisepsis, proper sterilization and disinfection in operating rooms and wards.[15] Even in hospitals with the most advanced equipment, the prevalence of SSI is rising worldwide.[16] Of the 997 patients in this study, male: female was 1:2.87. patients from Obstetric surgery were highest (40.56%) in this study followed by General surgery (22.8%). Gynecologic surgery accounted for (15.6%) of the total number of patients, followed by orthopedic surgery (12.1%).

The high number of surgeries in the current study performed in the Obstetrics and Gynecology departments contributed to the higher proportion of female patients receiving surgery. This went counter to certain studies conducted in Bangladesh, India, and Ethiopia that indicated general surgery ranked highest in terms of numbers.[17,18] The highest number of patients were from age group of 21-30 years (34.1%) followed by 31-40 years (30.6%) and 41-50 years (10.6%). The age span for surgery patients matches up with some research done in India and Bangladesh.[19,20]

A multidisciplinary team comprising everyone with expertise (Such as surgeons, anesthetists, microbiologists and infection control specialists) should create local guidelines or protocols that offer evidence-based suggestions to decrease the improper prescription of prophylactic antibiotics. While many different organisms can infect surgical patients, SSI is mostly caused by a few common diseases. The antibiotics that are administered only must cover them. Patterns of local resistance should be considered when selecting an antibiotic. Antibiotics with a narrow spectrum and lower cost should be the first choice for prophylactic use during surgery.[21,22] Ceftriaxone (65.1%) was the most often prescribed antibiotic, according to the current study's antibiotic usage pattern, which is consistent with findings from earlier research conducted in Bangladesh, India, and Nepal[23]. Cefuroxime use was adjacent to ceftriaxone use. However, another study carried out in Bangladesh revealed that among surgical patients, cefotaxime was the most often used antibiotic, followed by cefoperazone, then ceftriaxone, and lastly amoxicillin with clavulanate (20%).[24] The varying sensitivity patterns of the targeted microorganisms, which are frequently the cause of surgical site infections, could be the reason for the variations in the antibiotics chosen for prophylaxis.[25]

Staphylococcus aureus is the most dominant organism responsible for surgical site infections and Cefazolin is more active against these bacteria and is rarely encountered in elective surgery.According to the ASHP, cefazolin is the first antimicrobial drug recommended for postoperative prophylaxis.[26] The current study showed Orthopaedic surgery department used Cefazolin in both pre- and post-operative cases, which was the ideal guideline and they followed it very well.

On the other hand, only patients undergoing orthopaedic surgery were given this medication both before and after surgery, 62.2% and 44.5%, respectively in the current study. As we theorized, several factors might interact to challenge suitable antibiotic administration, including individual knowledge, beliefs, attitudes and practice; provision of duties for antibiotic prophylaxis; team communication and institutional support for endorsing and monitoring antibiotic prophylaxis.[27] Third-generation cephalosporins are not advised for surgical prophylaxis for several reasons, including the fact that they are generally costly, their widespread use is linked to the development of bacterial resistance and they are less effective against staphylococci.[28] Consequently, postoperative infections should be treated with broad-spectrum antibiotics, but not for antimicrobial prophylaxis.[29] Additionally, third-generation broad-spectrum antibiotics decrease patients' normal flora and facilitate the infection of vulnerable patients by drug-resistant organisms in hospital, which may raise the prevalence of SSI in hospitals.[30] The current study's high third-generation broad-spectrum cephalosporin utilization rate may be caused by the absence of 1st and 2nd generation cephalosporins, the accessibility and affordability of ceftriaxone, healthcare professionals' poor adherence to hospital protocols and the perception that broad or multiple antibiotics are more useful to prevent SSIs.[31]

To ensure that the surgical site has sufficient intra-tissue concentration of the antibiotic, preoperative antimicrobial prophylaxis should begin 30 to 60 minutes before the procedure begins.[32] Although ceftriaxone was the most used medication with a lengthy half-life in this study, redosing might not be necessary. In the combination therapy of two-drugs, ceftriaxone and cefuroxime, were mostly used in this current study. The variation in prophylactic antibiotic selection may be because of the difference in the sensitivity pattern of common causative agents for surgical site infection.[33]

Limitations

Data relating to basic characteristics, such as comorbidities, obesity, Body Mass Index (BMI) medications (i.e Immunosuppressants, steroids), nutritional status etc. were not recorded in this study, which are recognized variables for risk of infection that may have an impact on the antibiotic prophylactic regimen chosen by the clinician. All these factors may have influenced the results, therefore future research should take them into account.

Conclusions

Higher number of surgeries performed in the Obstetrics and Gynecology Departments resulted in females' predominance among the respondents. About two-thirds of our patients belonged to the 21-40 years age group. As pre- and per-operative antibiotic Ceftriaxone was mostly used one among most of the departments. Cefazolin was the drug of choice by Orthopedic surgery Department in both pre- and post-operative cases.Antimicrobials are crucial components of prevention and management of infection. Rational use of antibiotics can prevent resistance and maintain sensitivity.

Recommendations

Implementation of an antibiogram in each hospital could be vital for doctors to play a role in the suppression of antimicrobial resistance. Surveillance program should be established so that the surgeons can prescribe antibiotics according to protocol.

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Contribution of author

MAH- Conception, design, acquisition of data, drafting and final approval.
AAK- Acquisition of data, interpretation of data, manuscript writing, critical revision and final approval.
NC-Conception, drafting and final approval.
PD-Data analysis, drafting and final approval.
TZ-Data analysis, critical revision and final approval.
SI-Acquisition of data, drafting and final approval.
RD-Acquisition of data, interpretation of data, drafting and final approval.
AW-Acquisition of data, drafting and final approval.
SNM-Acquisition of data, drafting and final approval.
SSE-Acquisition of data, drafting and final approval.
FC-Acquisition of data, drafting and final approval.
MSIR-Acquisition of data, drafting and final approval.

Disclosure

The authors declared no conflict of interests.

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