



# Adherence to Surgical Antibiotic Prophylaxis in Surgery: A Prospective Study

Ann Nema Thomas <sup>1\*</sup> and Sandra Magdalene <sup>2</sup>

## Abstract

**Background:** Pre-operative antibiotic prophylaxis is crucial to reduce the risk of post-operative infections at surgical sites, thereby minimizing patient burden, prolonged hospital stays, and additional medication needs. Guidelines recommend administering prophylactic antibiotics 30-60 minutes before incision to achieve optimal outcomes. This study aimed to evaluate adherence to these guidelines in a hospital setting. **Methods:** A prospective observational study was conducted over two months, including 685 surgical cases from various departments such as gynecology, orthopedics, urology, and pediatrics. Cardiac cases were excluded. A clinical pharmacist monitored the administration of antibiotics from the receiving room to the recovery room. If surgery exceeded four hours, a second antibiotic dose was administered. Post-surgery, cases were monitored for surgical site infections (SSIs). Compliance with hospital guidelines on prophylactic antibiotic administration was evaluated. Data were analyzed using Microsoft Excel. **Results:** Of the 685 cases, 629 (91.82%) received appropriate antibiotics per hospital guidelines, while 8.18% deviated from the protocol. The most commonly used antibiotics were Cefuroxime axetil (30%), followed by Ceftazidime (15%) and Cefoperazone (15%). Ciprofloxacin was the least used (1%). Antibiotics

were administered within the specified time frame in 86% of cases. Compliance rates varied by department and type of surgery, with elective surgeries showing higher adherence than emergency surgeries. **Conclusion:** The study highlights the need for improved compliance with antibiotic prophylaxis guidelines, specifically ensuring administration within 60 minutes of incision to prevent SSIs and hospital-acquired infections. Adherence to hospital antibiotic policies is essential for optimal surgical outcomes and best practices in the operating theatre.

**Keywords:** Surgical site infection, pre-operative prophylaxis, antibiotic adherence, surgical guidelines, infection control

## Introduction

Pre-operative antibiotic prophylaxis is a critical component of infection control strategies aimed at reducing the incidence of post-operative infections at the surgical site (Bratzler et al., 2013). Defined as the administration of antibiotics prior to surgery, this practice is designed to decrease the risk of surgical site infections (SSIs), which can significantly impact patient outcomes and healthcare costs (Mangram et al., 1999). SSIs are associated with prolonged hospital stays, increased use of medications, additional surgical interventions, and, in some cases, higher rates of morbidity and mortality (Allegranzi et al., 2016).

The timing of prophylactic antibiotic administration is pivotal to its effectiveness. Literature and clinical guidelines, such as those from the Scottish Intercollegiate Guidelines Network (SIGN 104), emphasize that antibiotics should be administered within a specific time frame ideally 30 to 60 minutes before the surgical incision (Edmiston et al., 2011). This timing ensures that adequate tissue concentrations of the antibiotic are achieved, which is crucial for

**Significance** | Ensuring timely and guideline-adherent antibiotic prophylaxis minimizes surgical site infections and enhances patient outcomes.

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preventing infections by common pathogens encountered during surgery (Gagliardi et al., 2012). Delays in administration or excessive timing beyond this window can lead to suboptimal drug levels at the infection site, potentially compromising the prophylactic efficacy (Berríos-Torres et al., 2017). The primary aim of administering prophylactic antibiotics is to mitigate the risk of SSIs, thereby enhancing patient recovery and reducing overall healthcare costs (Muñoz & Ortega, 2015). Effective prophylaxis not only aims to prevent infections but also supports the patient's swift return to normal functioning by avoiding complications that can arise from SSIs (Friedman et al., 2017). Adherence to established guidelines is, therefore, essential in achieving these objectives. The guidelines for surgical antibiotic prophylaxis are well-documented and include not only timing but also the choice of antibiotic, dosage, and duration of prophylaxis (Moucha et al., 2011).

The impact of adherence to these guidelines is significant. Studies have shown that proper adherence to antibiotic prophylaxis protocols is associated with a lower incidence of SSIs and better patient outcomes (Webb et al., 2014). Conversely, non-compliance can lead to increased infection rates and associated costs (Rybak et al., 2013). Thus, continuous monitoring and evaluation of adherence to prophylaxis guidelines are crucial in maintaining high standards of surgical care (Silver et al., 2010).

Given the importance of adherence to prophylactic antibiotic guidelines, this study aims to evaluate the level of compliance with these guidelines in a clinical setting. By assessing adherence to timing and choice of antibiotics as per hospital protocols, this study seeks to identify gaps in practice and provide insights into improving prophylactic strategies (Steinberg et al., 2009). The findings will contribute to enhancing the quality of surgical care and patient safety by ensuring that prophylactic measures are optimally implemented (Nakamura et al., 2016).

Overall, this research is essential for understanding the current state of prophylactic antibiotic use and its impact on infection rates and patient outcomes. By focusing on adherence to guidelines, the study hopes to foster improvements in surgical practices and support better patient care through evidence-based recommendations (Koh et al., 2020; Roberts et al., 2014).

## Materials and Methods

### *Study Design and Duration*

This prospective observational study was conducted over a period of two months to evaluate adherence to pre-operative antibiotic prophylaxis guidelines. The study aimed to monitor and assess the implementation of antibiotic prophylaxis protocols in a surgical setting.

### *Study Population*

The study encompassed a total of 721 surgical cases from various departments, including gynecology, orthopedics, urology, and pediatrics. Cardiac surgical cases were excluded due to their specific protocols and complexities, resulting in a final sample size of 685 cases. The selection criteria ensured a diverse representation of surgical disciplines while focusing on generalizable practices of prophylaxis across different types of surgery.

### *Data Collection and Monitoring*

A trained clinical pharmacist was stationed in the operating theatres to oversee the entire perioperative process. The pharmacist was responsible for:

**Pre-Operative Phase:** Monitoring the administration of prophylactic antibiotics, ensuring that they were given within the recommended 30 to 60 minutes before the surgical incision as per the hospital guidelines (Bratzler et al., 2013).

**Intraoperative Phase:** Observing and documenting key events including sign-in, time-out, and sign-out procedures, which are critical for ensuring compliance with safety and prophylaxis protocols (Moucha et al., 2011).

**Post-Operative Phase:** Following up with patients in the recovery room to monitor for any immediate post-operative issues and ensuring that additional doses of antibiotics were administered if the surgical duration exceeded four hours (Edmiston et al., 2011).

### *Antibiotic Administration and Monitoring*

Prophylactic antibiotics were administered as per the hospital's standard guidelines. In cases where surgery extended beyond four hours, a second dose of the antibiotic was administered. The clinical pharmacist documented these events, including the timing and type of antibiotics given, to ensure adherence to the guidelines and to address any deviations from the prescribed protocol (Friedman et al., 2017).

### *Follow-Up and Surveillance*

Post-surgery, patients were monitored for any signs of surgical site infections (SSIs) during their hospital stay. The clinical pharmacist and surgical team collected data on infection rates, type of infections, and any additional treatments required. This follow-up period was crucial for assessing the effectiveness of prophylaxis and the overall compliance with the guidelines (Allegranzi et al., 2016).

### *Compliance Evaluation*

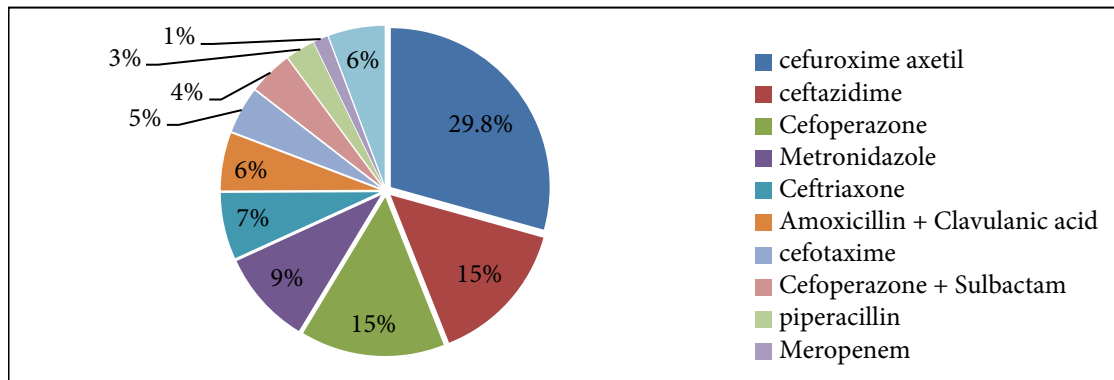
Compliance with prophylactic antibiotic administration was evaluated based on adherence to timing, dosage, and choice of antibiotics as outlined in the hospital guidelines (Berríos-Torres et al., 2017). The clinical pharmacist's observations and documented data were used to assess whether prophylactic measures were implemented correctly and to identify any areas for improvement (Silver et al., 2010).

### *Data Analysis*

Data collected from the study were entered into Microsoft Excel for analysis. The analysis involved calculating the rates of compliance

**Table 1.** Time of administration

Compliance with Antibiotic Prophylaxis			
Variable	Total number of surgeries	Adherence in dosing time	Adherence in antibiotic selection
Patient care department			
General Surgery	180	142	152
Orthopedics	136	101	124
Urology	107	98	101
Obstetrics and Gynecology	84	80	84
Neurology	72	67	70
Vascular Surgery	44	42	41
Oncology	26	25	22
Plastic Surgery	12	10	11
Ophthalmology	10	10	10
ENT	9	9	9
Pediatric Surgery	5	5	5
Type of surgery			
Emergency	51	13	44
Elective	634	576	585



**Figure 1.** Most commonly used Antibiotics Administration of antibiotic within the specified time frame was seen in 86% of the cases.

with the prophylaxis guidelines, incidence of SSIs, and the effectiveness of the prophylactic measures. Descriptive statistics were used to summarize the data, and any deviations from the guidelines were examined to determine their impact on infection rates and patient outcomes (Webb et al., 2014).

#### **Ethical Considerations**

The study was conducted in accordance with ethical standards, ensuring that patient consent was obtained where necessary and that patient confidentiality was maintained throughout the study period.

This detailed approach provided a comprehensive evaluation of pre-operative antibiotic prophylaxis adherence, offering insights into potential improvements in surgical infection prevention practices.

#### **Results**

This study included a total of 685 surgical cases, with 629 (91.82%) adhering to the hospital's antibiotic prophylaxis guidelines. The remaining 56 cases (8.18%) did not fully comply with the protocol. The high adherence rate demonstrates the effectiveness of the implemented guidelines and the vigilance of the monitoring processes in place. However, the 8.18% deviation rate indicates areas for potential improvement in adherence as shown in figure 1.

#### **Antibiotic Utilization**

Among the antibiotics administered, Cefuroxime axetil was the most frequently used, prescribed in 200 cases (30%). This preference aligns with its broad-spectrum activity, which is suitable for a variety of surgical procedures (Gagliardi et al., 2012). Cefazidime and Cefoperazone were each used in 100 cases (15%), reflecting their roles in covering a broad spectrum of pathogens, particularly Gram-negative bacteria. Ciprofloxacin, the least commonly used antibiotic, was prescribed in only 7 cases (1%). This limited use may be due to its narrower spectrum of activity compared to the other antibiotics (Silver & Gallegos, 2010).

#### **Timing of Administration**

The timing of antibiotic administration was evaluated, with 86% of the antibiotics administered within the recommended 30 to 60 minutes before the surgical incision. This timing is critical for ensuring effective prophylaxis, as it allows for adequate tissue concentrations of the antibiotic at the time of the incision, thereby maximizing the potential to prevent surgical site infections (Bratzler et al., 2013). The remaining 14% of cases where antibiotics were administered outside this window suggest opportunities for further optimization. Deviations in timing could be attributed to operational challenges or delays in the surgical process.

#### **Departmental and Surgical Type Variations**

Compliance with antibiotic prophylaxis guidelines varied by department and type of surgery. Table 1 provides a detailed breakdown of adherence by department and type of surgery.

Elective surgeries exhibited significantly higher adherence rates compared to emergency procedures. This variation is likely due to the more controlled environment and advanced planning available for elective surgeries, as opposed to the urgent and unpredictable nature of emergency cases (Webb et al., 2014).

While the overall compliance with prophylactic antibiotic guidelines is high, particularly with adherence to the timing of administration, there are notable areas for improvement. Addressing the observed deviations and optimizing adherence in emergency settings could further enhance the effectiveness of antibiotic prophylaxis and reduce the risk of surgical site infections.

#### **Discussion**

The findings from this study reveal a commendable adherence rate of 91.82% to prophylactic antibiotic guidelines, demonstrating overall effective compliance with established protocols. This high rate of adherence underscores the effectiveness of the implemented guidelines and the commitment of the surgical teams to adhere to best practices. However, the 8.18% of cases that deviated from the protocol highlight areas where improvements can be made. These deviations could be attributed to several factors, including logistical challenges, miscommunications among the surgical team, or unanticipated procedural complexities.

#### **Antibiotic Selection**

The predominant use of Cefuroxime axetil aligns with contemporary recommendations for broad-spectrum prophylaxis. Cefuroxime is favored in many guidelines due to its broad activity against both Gram-positive and Gram-negative bacteria, which is crucial in preventing surgical site infections (Gagliardi et al., 2012). The lower usage rate of Ciprofloxacin, which is more effective against Gram-negative bacteria but less so against Gram-positive pathogens, reflects its narrower spectrum and lesser suitability for general prophylaxis (Silver & Gallegos, 2010). The choice of antibiotics should be tailored to the specific surgical procedure and the local microbial flora to optimize prophylaxis (Gagliardi et al., 2012).

#### **Timing of Administration**

The adherence rate of 86% for administering antibiotics within the recommended 30 to 60 minutes before incision reflects a well-managed process. Timely administration of prophylactic antibiotics is crucial for achieving optimal tissue concentrations at the time of incision, which is essential for preventing surgical site infections (Edmiston et al., 2011). The 14% of cases that did not meet this timing requirement indicate that there is still room for improvement. Deviations from the recommended timing could result from various factors, including delays in surgical preparation or challenges in coordinating antibiotic administration (Moucha et al., 2011). Addressing these issues through better coordination and

more stringent adherence to protocols can help enhance timing compliance.

### **Variation by Department and Type of Surgery**

The study found that compliance varied significantly by department and type of surgery. Elective surgeries exhibited higher adherence rates compared to emergency procedures. This discrepancy is likely due to the different pressures and complexities associated with emergency surgeries, which often require rapid decision-making and execution (Webb et al., 2014). In contrast, elective procedures usually allow for more thorough preoperative preparation and adherence to protocols. To address this disparity, targeted training and reinforcement of antibiotic prophylaxis protocols in high-pressure situations, such as emergencies, could help improve overall compliance.

### **Conclusion**

This study demonstrates a high level of adherence to surgical antibiotic prophylaxis guidelines, with 91.82% of cases following the protocol. The majority of antibiotics administered were consistent with recommendations, with Cefuroxime axetil being the most frequently used. Timely administration, within the critical 30 to 60 minutes before incision, was achieved in 86% of cases. However, deviations in both adherence and timing highlight areas for improvement. Enhanced training for surgical teams and better logistical coordination, especially in emergency settings, are necessary to address these gaps. Ensuring strict compliance with prophylaxis guidelines is crucial for reducing surgical site infections and improving patient outcomes. Continued efforts in monitoring and protocol reinforcement will be vital in optimizing prophylactic practices and minimizing infection risks in surgical procedures.

### **Author contributions**

A.N.T., conceptualized and developed the methodology, and prepared the original draft and collected, S.D., reviewed and edited the writing.

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### **Competing financial interests**

The authors have no conflict of interest.

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