

## PROSPECTIVE OBSERVATIONAL STUDY ON ANTIBIOTIC-PRESCRIBING PATTERN AND MEDICATION ERRORS IN SURGICAL PROPHYLAXIS IN A SPECIALTY HOSPITAL

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### ABSTRACT

**Objective:** The objective was to study the antibiotic-prescribing patterns, identify the medication errors and impact of surgical antimicrobial prophylaxis (SAP) in preventing surgical site infection (SSI), and to understand the prescribers' adherence to surgical prophylaxis guidelines.

**Methods:** The study was conducted for a period of 6 months in all surgical departments of a specialty hospital. Data were collected from inpatients records. Australian guideline for SAP was used to assess the appropriateness in prescribing pattern. The sample size was calculated using Raosoft sample size calculator.

**Results:** A prospective observational study was carried out among 178 patients. Of which, 100 were male and 78 were female. Four hundred and thirty-three antimicrobials were prescribed as pre- and post-operative surgical prophylaxis, among that 87% prescribed by brand name and 13% by generic. Seventy-one percent received single antimicrobial agent preoperatively, of which 99.5% prescribed as parenteral and 0.5% as oral formulation. Most often prescribed antibiotic was cefoperazone (28%) of cephalosporin group. Only 5.6% of cases had compliance with SAP guidelines. In this study, 11 patients affected with SSI due to inappropriate antibiotic selection and non-adherence to prophylactic antibiotic guidelines.

**Conclusion:** The present study revealed that there is a poor compliance to SAP guidelines in terms of inappropriateness in antibiotic drug selection, dose, duration, and omission of drugs. Inappropriateness and non-compliance are mainly due to unavailability of clinical pharmacist to assist the physicians in the selection and administration of correct choice of prophylactic drug and unavailability of proper national or local guidelines. Hence, there is dire need to make local SAP guidelines to improve SAP-prescribing pattern.

**Keywords:** Surgical antibiotic prophylaxis, Surgical site infection, Surgical antimicrobial prophylaxis guidelines surgical wounds.

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### INTRODUCTION

Surgical site infection (SSI) is one of the most often post-operative complications and represents a notable burden in terms of patient morbidity and mortality [1]. SSIs usually occur at or near the incision area within 30 or 90 days, depending upon the procedure performed. SSIs are often localized to the incision site but can also extend into deeper adjacent structures [2].

Surgical antibiotic prophylaxis plays a major role in preventing occurrence of SSI after procedure. Appropriate antimicrobial agent (AMA) selection mainly depends on the pathogens most likely to cause an infection. Narrow-spectrum antibiotics are often used as pre-operative prophylactic agent because in which most organisms responsible for hospital-acquired infections are covered. The selection of antibiotic with the narrowest antibacterial spectrum is required to reduce the occurrence of multiresistant pathogens and also because broad-spectrum antibiotics may be required later if the patients develop series sepsis. Therefore the use of 'third generation' cephalosporins such as ceftriaxone and cefotaxime should be avoided as surgical prophylaxis due to its lower efficacy in preventing SSI [3]. Cefazolin is considered as a primary choice of antibiotic for surgical prophylaxis due to its greater effectiveness toward methicillin-resistant *Staphylococcus aureus* and methicillin-susceptible *S. aureus* infection. In some cases, especially for surgery >4 h, redosing after 4 h is necessary to maintain the plasma drug concentration. In appendectomy/colorectal surgery, cefazolin+metronidazole-like drugs are needed for its better effectiveness because they are more prone to anaerobic infection at surgical site. Parenteral second-generation cephalosporins such as cefotetan are sometimes used as a more convenient antibiotic compared to first-generation cephalosporins because of its improved anaerobic and aerobic Gram-negative coverage.

These are also used as an alternative to the combination of metronidazole plus either first-generation cephalosporins or gentamicin for abdominal surgical prophylaxis, but they are more expensive. The bacterial flora in some hospitalized patients may include multiresistant bacteria such as methicillin-resistant staphylococci. In such cases, vancomycin is added with cephalosporins to prevent the post-operative SSI. Apart from drug selection, timing also has importance. Surgical antimicrobial prophylaxis (SAP) must be started within 1 h before incision. In case of patients receiving vancomycin, it must be administered within 2 h before surgery. Prophylactic antibiotic should be discontinued within 24 h of surgery completion. However, in case of cardiothoracic surgery, it must be continued for 48 h [4].

### METHODS

A prospective observational study was conducted in a surgical ward in all departments of a specialty hospital in Salem, Tamil Nadu, for a period of 6 months from February 2019 to July 2019. During the study period, patients who underwent surgery and met our inclusion criteria were conveniently selected, and the study population (178 patients) was calculated using Raosoft sample size calculator.

The baseline data collection was done by case sheet analysis, and further information was collected from either patient or their caretakers and recorded on data collection form which was previously prepared. The patient admitted for <3 days and those not willing to provide signed consent and patients who died or referred to higher centers were excluded from our study.

The data were collected in three parts. The first part includes patient demographic data (age, gender, and date of admission and discharge),



Vessal *et al.* [7], 2019, reported that prophylactic antibiotics were administered in 98% of the procedures, whereas only 68% of the surgeries required them according to guidelines. Vessel suggests that the surgeons in Iran are aware of the value of antibiotics in preventing SSI.

Another error noted was the omission of drugs in both pre- and postoperatively. About 30.3% of prescriptions omit both pre- and post-operative drug. Antibiotic administration pattern in surgeries required prophylaxis which demonstrates the prescribing pattern and prescribers' knowledge about SAP prophylaxis.

Apart from 433 antibiotics, two more antibiotics administered to patients as intraoperative dose in a prolonged surgery of around 9 h. Only 2.3% of cases satisfy all the recommendations noted in guidelines, and rest shows abnormalities in either antibiotic selection, timing or dose of administration.

Vessal *et al.* [7] reported that only 7.5% were received correct drug with correct dose. Only 0.9% was prescribed according to guideline.

**Table 4: Surgical prophylaxis compliance**

S. No.	SAP compliance	Frequency (n=178)	Percentage
1.	According to guideline	10	5.6
2.	Not according to guideline	168	94.3
Total		178	100

SAP: Surgical antimicrobial prophylaxis

The intervention of this study is that majority of cases were non-compliance with guidelines in terms of drug selection, dose, and timing. The details regarding prescriber compliance to SAP guideline are shown in Table 4.

In this study, 94.3% were non-compliance with guideline due to lack of knowledge about prophylactic guidelines. Only 5.6% were prescribed according to guideline and satisfy all criteria mentioned in guidelines. In the Australian guideline, cefazolin is considered as the primary choice of cephalosporins for SAP. However, in our study, none of the patients were treated with respective drug. ceftriaxone and cefoperazone were the most often drugs prescribed. About 55.1% of cefoperazone and 28% of ceftriaxone included in both pre- and post-operative prescription. Sixty participants were given ceftriaxone only as surgical prophylaxis, despite the fact that Australian guideline does not recommend it for any procedures. Ceftriaxone is a broad-spectrum antibiotic; therefore, its use as SAP would rise to the emergence of resistance and would either lead to a lack of response for any infections.

A study conducted in Ayder Referral hospital reported that the total compliance to SAP guidelines was 25%. Majority of the non-compliance was inappropriate SAP selection and extending the duration of antibiotic prophylaxis to more than 24 h. About 19.4% of procedures were non-compliant to SAP guideline in terms of indications.

Mousavi *et al.* [8] conducted an "audit of perioperative antimicrobial prophylaxis: compliance with international guideline" reported that in her study, only 22% of cases are under compliance with all recommendations.

**Table 5: Risk factor associated with SSI**

S. No.	Risk factors	Category	Number of patients (178)	Frequency of SSI (11)	Percentage
1.	Age	0-12	7	0	0
		13-18	12	1	8.33
		19-35	47	2	4.2
		36-50	40	2	5
		51-65	49	4	8.1
		66-84	21	2	9.52
		≥85	2	0	0
2.	Gender	Male	100	7	7
		Female	78	4	5.12
3.	Comorbidity	DM only	19	4	21.05
		HTN only	8	2	25
		DM+HTN	24	0	0
		DM+HTN+Necrotising fasciulitis, anemia	3	0	0
		Miscellaneous	11	0	0
		No-comorbidity	113	5	4.42
4.	Procedure	Wound debridement and secondary suturing	10	4	40
		CABG and post-CABG infection	5	2	40
		TKR	3	2	66.66
		Emergency LSCS	18	1	5.55
		TAH	15	1	6.66
		I and D	4	1	25
		Antibiotics received	162	9	5.55
5.	Pre-operative	Not received	16	2	12.5
		Antibiotics received	168	11	6.54
6.	Antiseptic wash	Not received	10	0	0
		Povidone-iodine only	154	9	5.84
7.	Antibiotic administration	Povidone-iodine+NS	13	1	7.69
		NS only	7	1	14.28
		Inappropriate drug	151	11	7.28
		Appropriate drug	21	0	0
		Inappropriate dose	57	6	10.52
7.	Antibiotic administration	Appropriate dose	115	5	4.34
		Inappropriate duration	126	8	6.34
		Appropriate duration	46	3	6.52

SSI: Surgical site infection, DM: Diabetes mellitus, HTN: Hypertension, CABG: Coronary artery bypass graft, TKR: Total knee replacement, LSCS: Lower segment cesarean section, NS: Normal saline, TAH: Total abdominal hysterectomy

