

## Pattern of antimicrobial usage for prophylaxis of surgical site infection in a tertiary care hospital of Western Uttar Pradesh

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### ABSTRACT

**Background:** The practice of giving antibiotic prophylaxis has resulted in the reduction of surgical site infections (SSI), thus reducing cost, morbidity, and mortality. Common nosocomial infections in surgical patients include SSIs, urinary tract infections (UTIs), pneumonias and blood stream infections (BSIs). The present study was, therefore, designed to analyze the efficacy of antimicrobials used for prophylaxis during surgery in a tertiary care hospital in India.

**Methods:** Total 100 patients were enrolled. Name, timing, route, dose of antimicrobials given were recorded. All the relevant data was taken from the patient's medication charts and medical records. Chi-square test and t-test were applied.

**Results:** The optimal time of giving antimicrobial prophylaxis in present study was 1 hour before the surgery. A total of 8 different antimicrobials were prescribed to 100 patients, out of which most commonly prescribed were cephalosporin i.e. 82%. Majority of SSI (57.12%) occurred when the duration of surgical antimicrobial prophylaxis (SAP) was for  $\geq 2$  hours (p value  $< 0.05$ ). Common organisms seen in SSI were *E. coli*, *S. aureus*, *Pseudomonas* and *KleibSELLA* species. The hospital stay of patients with SSI was more as compared to patients without SSI in present study (p value  $< 0.05$ ).

**Conclusions:** It has been observed that inappropriate selection and timing of giving SAP play an important role in developing SSI, which can be adequately controlled by adopting SAP guidelines, good infection control practices and risk factor analysis.

**Keywords:** Antimicrobials, Surgical antimicrobial prophylaxis, Surgical site infection

### INTRODUCTION

The burden of infectious diseases in India is one of the highest in the world.<sup>1</sup> Antibiotics are among the most frequently prescribed drugs worldwide.<sup>2,3</sup> The concern of clinicians regarding inappropriate antibiotic use is a serious matter because it not only enhances the risk of emergence of multidrug-resistant bacteria but also imposes a financial burden on patients from lower socioeconomic status.

Antimicrobial prophylaxis, a very brief course of antibiotics initiated just before the start of surgical

procedures, recommended to reduce postoperative infection.<sup>4</sup> The practice of giving antibiotic prophylaxis has resulted in the reduction of surgical site infections, thus reducing cost, morbidity, and mortality.<sup>5,6</sup> But inappropriate prophylaxis by unnecessary use of broad-spectrum agents and continuation of therapy beyond the recommended time period increases the risk of adverse effects and promote the emergence of resistant organisms.

Common nosocomial infections in surgical patients include surgical site infections (SSIs), urinary tract infections (UTIs), pneumonias and blood stream infections (BSIs).

The present study was, therefore, designed to analyze the efficacy of antimicrobials used for prophylaxis during surgery in a tertiary care hospital in India.

## METHODS

This prospective, observational study was carried out in a tertiary care hospital - Chhatrapati Shivaji Subharti Hospital, Subharti Medical College, Meerut, India after receiving approval from the Institutional Ethics Committee (IEC). The study was carried out in male and female surgical, orthopedics, obstetrics and gynecology wards of CSSH, Meerut. Adult patients who underwent surgery were included in the study. Total 100 patients were enrolled. Name and timing of antimicrobials given were recorded. Surgical site assessment was done by clinical symptoms, examination and microbiological evaluation if needed. Compliance with antimicrobial guidelines was assessed and deviation if any with reasons was recorded. Duration of stay and time of discharge after surgery or any other intervention was recorded. Any secondary / nosocomial infection (mouth, respiratory, urinary, GIT, skin or others) was recorded. All the relevant data was taken from the patient's medication charts and medical records. Details recorded included patient's demographic data, antibiotic allergy, type of surgery, wound class (clean, clean-contaminated or contaminated), duration of operation, and parameter of antibiotic prophylaxis (antibiotic choice, route, dose, timing and duration of prophylaxis).

### Inclusion criteria

Adult patients who underwent surgical procedures in Department of Surgery, Orthopedics and Obstetrics and Gynaecology were included.

### Exclusion criteria

- Patients aged less than 14yrs
- Patients who were not willing to give consent.

### Statistical analysis

Data entry was made from the case record form into the Microsoft Excel program. Chi-square test and T-test are applied. SPSS was used for statistical analysis.

## RESULTS

Of all the 100 patients enrolled, 47% were males and 53% were females (Table 1), 35 patients were enrolled from department of surgery, 29 from orthopaedics and 36 from obstetrics and gynaecology (Table 2). Out of total 100 patients, 87% patients showed favourable results while 13% patients showed unfavourable results i.e. presence of post-surgery infection (Table 3). A total of 13 different antimicrobial combinations were prescribed to 100 patients. Highly prescribed antimicrobial was Ceftriaxone i.e. prescribed to 62% patients while, amikacin (10%),

cefuroxime (8%), cefuroxime-amikacin 1%, cefotaxime-sulbactam (1%), cefoperazone-sulbactam + gentamicin (1%), ceftriaxone-sulbactam (3%), cefoperazone-sulbactam + amikacin (1%), cefotaxime-sulbactam+ amikacin (1%), amoxicillin-clavulanic acid (4%), ampicillin (3%) and cefoperazone (3%), ampicillin-clavulanic acid (4%) (Table 4).

**Table 1: Gender distribution.**

Gender	No. of patients	Percentage (%)
Male	47	47.0
Female	53	53.0
Others	Nil	Nil
Total	100	100.0

**Table 2: Distribution of patients based on surgical department.**

Department	No. of patients	Percentage %
Surgery ward	35	35
Orthopaedic ward	29	29
Gynaecology and Obstetric ward	36	36
Total	100	100

**Table 3: Outcome of surgical antimicrobial prophylaxis.**

Outcome	No. of patients
Favourable	87
Not favourable	13

**Table 4 Details of antimicrobials prescribed for surgical prophylaxis with ATC classification.**

Antimicrobial agent	No. of patients prescribed (%)	ATC classification
Ceftriaxone only	62	J01DD
Ceftriaxone-sulbactam	3	J01DD
Ceftriaxone+ Amikacin	5	J01DD
Cefuroxime	8	J01DC
Cefuroxime+Amikacin	1	J01DC
Cefotaxime-sulbactam	1	J01DD
Cefoperazone-sulbactam+ gentamicin	1	J01DD
Cefoperazone-sulbactam + amikacin	1	J01DD
Cefotaxime-sulbactam+ amikacin	1	J01DD
Amikacin	10	J01G
Ampicillin-clavulanic acid	4	J01FA
Ampicillin	3	J01FA
Total	100	J01

**Table 5: Incidence of SSI according to timing of antimicrobial prophylaxis.**

Timing	Total patients	SSI not present	SSI present (percentage)
<2 hours	93	85 (91%)	08 (8.6%)
>2 hours	07	03 (42.8%)	04 (57.12%)*

\*P value&lt;0.05

**Table 6: Organisms seen after culture sensitivity.**

Organisms seen after culture sensitivity	Number of patients	Percentage (%)
<i>E.coli</i>	6	46.15
<i>Pseudomonas</i> species	4	30.8
<i>Staphylococcus aureus</i>	2	15.4
<i>Kleibsell</i> a species	1	7.8

Total of 93 patients received Surgical Antimicrobial Prophylaxis (SAP) <2hours before surgery and out of 93, 8 patients suffered from Surgical Site Infection (SSI) i.e.8.6%. 07 patients received SAP >2hours before surgery and out of 07, 04 patients suffered from SSI i.e.57.14% (p value <0.05) (Table 5).

Most common organism encountered at surgical site were *E. coli* (46.15%), followed by *Pseudomonas* species (30.8%) *S. aureus* (15.4%) and *Kleibsell*a species (7.8%) (Table 6). The hospital stay of patients with SSI was 4.5±2.12 days and patients without SSI was 2.5±2.23 days with a p value of 0.00017 which is highly significant (Table 7).

**Table 7: Hospital stay (days) of patients with/without SSI.**

Group	Hospital stays (days)	P value	Significance
With SSI	4.5±2.12	0.00017*	Highly significant
Without SSI	2.5±2.23		

## DISCUSSION

With the advent of newer costly antibiotics, cost of treatment has increased many folds. In additions, resistant pathogens, nosocomial infections and cross infections further increase the financial burden on patient.

In our study, out of 100 patients, 35 patients were enrolled from department of surgery, 29 from orthopaedics and 36 from obstetrics and gynaecology. 47% were males and 53% were females with mean age of (43.06±17.40) and (39.85±15.66) years respectively .The reason for 53% females could be due to inclusion of female department exclusively i.e. department of gynaecology and obstetrics.

The optimal time of giving antimicrobial prophylaxis in our study was 1 hour before the surgery i.e. in 93%

patients; antimicrobials were given with in 1 hour before surgery, which is in accordance to the ICMR treatment guidelines which recommends that antibiotics should be administered before an incision is made to ensure that antimicrobial levels in the tissue are adequate and maintained for the duration of the procedure and prophylaxis should be started preoperatively in most circumstances, ideally within 30-60 minutes before incision.<sup>7</sup>

A previous study also recommended administration of the first dose of the antimicrobial beginning within 60 minutes before surgical incision.<sup>8</sup>

Our data suggests that majority of SSI (57. 12%) occurred when the duration of SAP was for ≥2 hours (p value <0.05). These findings are similar to findings of previous study which reported that compared with antibiotic administration within 60 minutes prior to incision, higher SSI rates were observed for timing more than 60 minutes prior to incision.<sup>9</sup>

It has been observed that duration of surgery also influences wound infection and procedures that take more than two hours are associated with higher infection rates. Longer exposure of tissues to theatre environment, hypothermia and requirement of blood transfusion, all of them are potential risk factors for SSI. Present study reveals a clear-cut increased number of SSI cases i.e. 26% cases, where surgery has been prolonged ≥2 hours. Studies conducted on SSI in Aurangabad, Mumbai, Hyderabad, have reported a similar observation. In fact, this correlation has been established since 1964 by the Public health laboratory services (PHLS) in England and Wales.<sup>10-13</sup>

In present study authors found that total of 8 different antimicrobials were prescribed to 100 patients. Out of which most commonly prescribed antimicrobial were cephalosporins i.e. 82% and among them, third generation cephalosporins were most commonly used. According to SIGN and ASHP guidelines, cefazolin (first generation cephalosporin) should be the drug of choice for prophylaxis of surgical site infection but resistance to 1<sup>st</sup> and 2<sup>nd</sup> generation cephalosporin is very common in our setting because these antibiotics are used for common infections.<sup>14</sup> Hence, for this reason third generation cephalosporins were preferred in our study. Present study findings are similar to findings of a previous study where they reported that the most frequently prescribed classes of antibiotics were cephalosporins (42%) followed by penicillins (34%) and out of cephalosporin group, 10% received ceftriaxone prior to their surgery.<sup>15</sup>

For surgical prophylaxis it is important to select an antibiotic with narrowest antibacterial spectrum to reduce the emergence of resistance and also because broad spectrum antibiotics may be required later if patient develops serious sepsis. Therefore, it is recommended that the use of third generation cephalosporins such as

ceftriaxone and cefotaxime be avoided in surgical prophylaxis.<sup>16</sup>

Most common organism seen in surgical site infection was *E. coli*, *Staphylococcus aureus*, *Pseudomonas* and *Kleibsellia* species. These findings are similar to the findings of a study which reported that *E. coli* was the commonest pathogen, followed by *Pseudomonas aeruginosa* and *Staphylococcus aureus* while some studies reported that *S. aureus* is the most common organism predominantly isolated from SSI.<sup>17-19</sup> The possible reason for this difference is that there is different pattern of organisms in different hospital setups and lesser number of abdominal and perineal operations in these studies were included, compared to present study.

The hospital stay of patients with SSI was more as compared to patients without SSI in our study (p value of 0.00017). A previous study reported a mean duration of 6.4 days of antibiotic use in a study of Taiwanese patients.<sup>20</sup> Even though evidence from literature fails to support prolonged administration of antimicrobial agents in the hospitals, usage beyond 24 hours is common.<sup>21</sup> Longer courses of antibiotics are falsely believed to be a good preventive measure against SSI.

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