

# A Retrospective Study on Usage of Surgical Antimicrobial Prophylaxis in a Tertiary Care Hospital

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## ABSTRACT

**Background:** Randomized controlled trials have shown that prophylactic antibiotics are effective in preventing surgical site infections; however, it is precarious how the timing of prophylactic antibiotic administration and intra-operative re-dosing affects the risk of surgical site infection.

**Objectives:** To assess the selection of antibiotics for surgical prophylaxis, To evaluate the timing of administration of prophylactic antibiotics, To analyze the duration of prophylactic antibiotics, To assess the re-dosing of antibiotics.

**Materials and Methods:** A retrospective study was carried out by collecting data of 156 patients who undergo surgery in Basaveshwara medical college hospital and research Centre, Chitradurga. P-value less than 0.05 was taken to indicate significant difference.

**Results:** Of the 156 patients who underwent surgery, the absolute risk of getting surgical site infections 0.07 i.e. 12 (7.7%) subsequently had surgical site infections. The Relative Risk compared with SSI and Compliance, 0.48; 95 percent Confidence interval, 0.11 to 2.10. The Statistical significance status is Non-significant as P-value is 0.310.

**Conclusion:** In surgical practice there is considerable variation in the timing of the prophylactic administration of antibiotic and prolonged use of prophylactic antibiotic more than 24 hours is noted. The timing of antibiotic and intra-operative re-dosing is not significantly associated with SSI occurrence. While adherence to the timely prophylactic antibiotic

measure is not bad care, there is little evidence to suggest that it is better care. Future effort for reducing SSI should strongly co-relate with improved outcomes and include studies to refine recommended antibiotic choice and re-dosing.

**Keywords:** SAP, SSI, Antimicrobials, Antibiotics, Re-dosing, Timing, Duration.

## INTRODUCTION

The Surgical site infections is the most common infections that accounting for approximately around 500,000 nosocomial infections and also increased health care costs around \$2 billion. Usage of prophylactic antibiotics plays an important role in avoidance of surgical site infections which occur within 30 days of surgery that result in the increased usage of antibiotic, increased costs and prolonged hospitalisation. Antibiotic prophylaxis can decrease the threat of infections in postoperative wound infections, but additional antibiotic use increases the selective pressure favouring the appearance of antimicrobial resistance. Therefore careful antibiotic use is essential in the hospital.<sup>7</sup>

Surgical antibiotic prophylaxis is mainly carried out in case of surgical wounds like clean and clean contaminated. There are some proper guidelines for the usage of prophylactic antimicrobials which contain the selection of appropriate antibiotics, timing of administration,

duration of prophylactic antibiotic and the re dosing. Cephalosporin is recommended as a prophylactic antibiotic for most of the patients who are undergoing clean-contaminated surgeries (e.g., cardiothoracic, gastrointestinal, orthopedic, vascular, gynecologic). A single administration is the rule for the majority of procedures. The treatment should never exceed more than 48 hours except in specific surgeries like prostate surgery, the best route of administration is intravenous.<sup>7</sup>

The appropriate timing for the administration of surgical antimicrobial is based on a theoretical principle: at the time of incision the antibiotic concentration at surgical site must reach its peak. Thus, the timing depends on the pharmacokinetics of each antibiotic. Studies shows that surgical antimicrobial prophylaxis can decrease the risk of SSI by around 50%.

According to the recent survey of world health organization demonstrates a prevalence of nosocomial infection in range of 3-21%. Global estimates of SSI have varied from 0.5%-15% studies shows that in India it ranges from 25%-38%. SSI is mainly occurred because of lack of proper hygiene in theatre, pre and post-operative care and type of surgery.<sup>7</sup>

In developed countries the SSIs contribute to 14%-16% of the expected 2-million HAIs reporting 1.9% SSI rate and they occur in 2%-5% of patients after clean extra abdominal operations and in up to 20% of patients undergoing intra - abdominal procedures. SSIs are related with the substantial economic costs. In India an estimated 72% of healthcare expenditure is out-of-pocket, the additional cost associated with SSI (e.g. additional treatment and loss of ability to work) represent potentially significant load to patients and their families.<sup>6</sup>

In pre-, intra- and post-operative period one-third of the Surgical Site Infection can be prevented by taking appropriate infection control measures. The primary administration of short course of an antimicrobial agent is the Surgical

antimicrobial prophylaxis that is given before the surgery. It is proven as a useful measure in the pre-operative period. The infections that may lead to sepsis, organ failure and death during hospital stay can be prevented using Surgical Antimicrobial prophylaxis (SAP).<sup>6</sup>

The impact of SSIs, describes their measurement and reporting, and most importantly provides preoperative strategies for their prevention with a focus on the appropriate use of prophylactic antibiotics. Considering the above facts there is a tare need to study about the surgical antimicrobial usage to prevent surgical site infections, to prevent antibiotic resistance and to contribute to the betterment of patient care.

## **MATERIALS AND METHODS**

**Study design:** It was a Retrospective Observational Study

**Study site:** The study was conducted at Basaveshwara Medical College and Research Centre Chitradurga

**Study period:** The study was conducted over a period of six months from 2018 to 2019.

**Study subjects:** This study will include patients attending surgical procedures from operation theatre of Basaveshwara Medical college hospital and Research centre, Chitradurga. Patients who meet the following criteria will be enrolled

### **Inclusion criteria:**

- Clean & Clean contaminated wound type of surgery
- Both gender of all age groups
- Patients who undergoing surgery

### **Exclusion criteria:**

- Contaminated & Dirty-Infected wound type of surgery

### **Ethical approval:**

The study was approved by the "Institutional Ethical Committee" of the SJM College of Pharmacy, Chitradurga. SJMCP/IEC/2018-2019/04

**Sources of data:**

- Medical records of the patients from operation theatre
- Evaluation of data collection form

**Study procedure:**

- A six month hospital based Retrospective study undertaken in Basaveshwara Medical College Hospital and Research Centre, Chitradurga.
- The study was initiated after receiving approval from the Institutional Ethics Committee.
- A total of 156 surgical cases were randomly considered for the study.
- Data will be entered in Microsoft excel sheets.

**Statistical analysis:**

Parametric data were analyzed with student’s T-test/Z-test. Nominal categorical data between the groups was compared using chi-square test or Fisher’s exact test.

**RESULTS**

1. A total of 156 patient’s data was collected from MRD department. Among the whole 156, 67% were males and 33% were females.

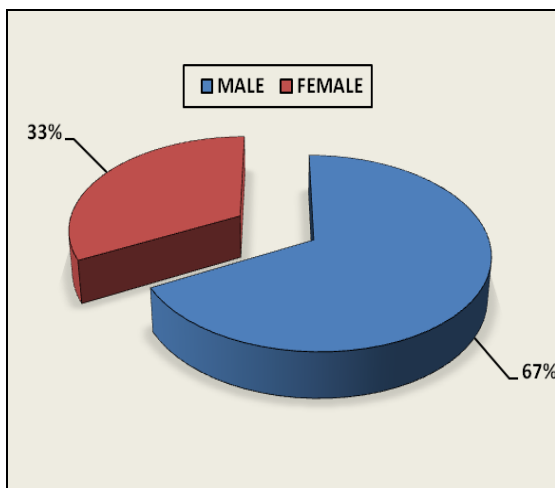


Fig 1: Distribution of patients according to gender

2. In the study population 69.8% were from general surgery department and 14.1 % in orthopedic department, in ENT 10.8% and 5.1% in OBG

department. SSI is mostly seen in General department is 8, 3 in ortho and 1 in ENT. The results are given in figure 2

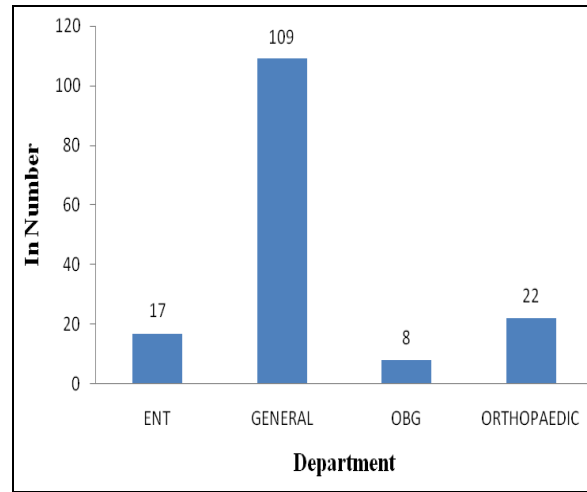


Fig 2: Distribution of patients according to department

3. In the study population, about 67% were clean type of surgery and 30 % were clean contaminated surgery. The results are given below figure 3

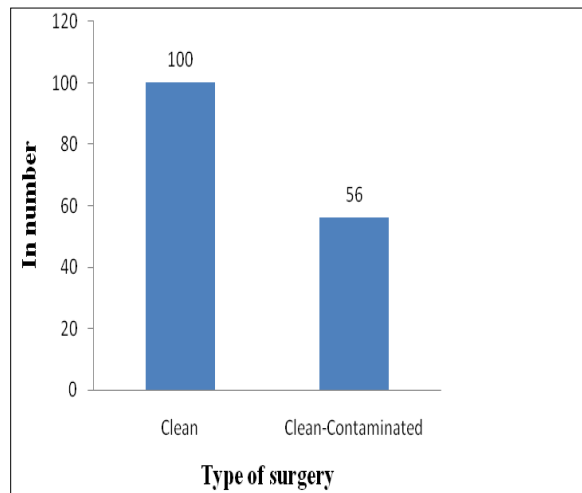


Fig 3: Distribution of patients according to type of surgery

4. For the preoperative data, mostly prescribed classes of antibiotics were Cephalosporin’s that is ceftriaxone and ceftazidime followed by, penicillins and other antibiotics. The risks are given in figure 4

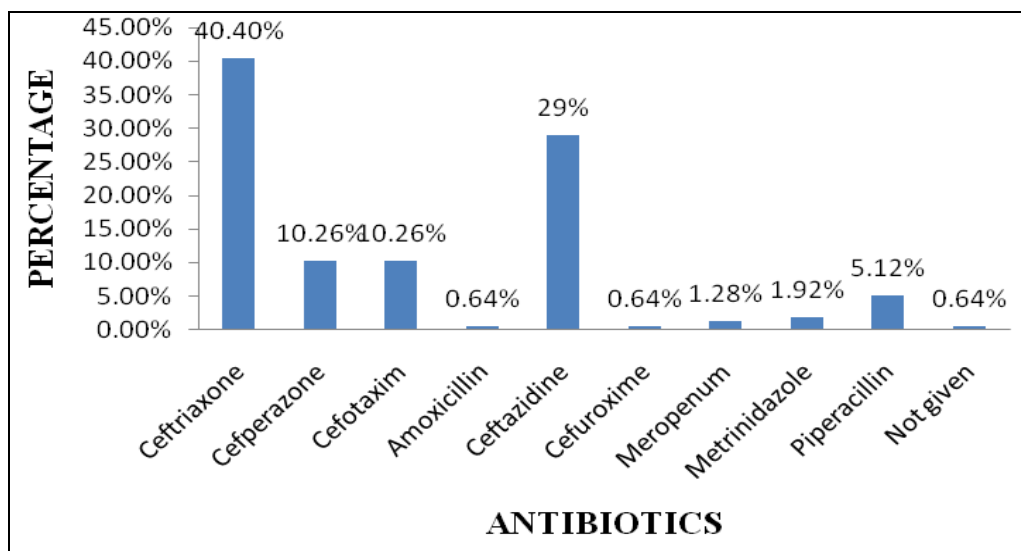


Fig 4: Distribution of patients based on usage of prophylactic antibiotic

5. Patients who received additional doses of intra operative antibiotic dose if surgery lasts more than the required timing is 0 patients received. Patients who did not received an additional dose(s) of intra operative antibiotic dose if surgery lasts more than the required timing (double the half-life of an

antibiotic is about 100% that is all these 10 patients didn't received the antibiotics. Patients who did not received antibiotic in 60 minutes of pre incision are of 34.6% and patients stopped receiving antibiotic within 24 hours of surgery are of 49.3% and in this study the overall compliance is 29.4 %

Table 1: Adherence to the surgical antibiotic prophylaxis parameters

<i>Surgical prophylaxis</i>	<i>No.</i>	<i>Percentage</i>
Patients who were eligible for Re-dosing	10	6.4% (out of whole surgeries)
Patients who received an additional dose(s) of intra operative antibiotic dose if surgery lasts more than the required timing ( double the half-life of an antibiotic ) n = 10	0	0%(out of surgeries required Redosing )
Patients who did not received an additional dose(s) of intra operative antibiotic dose if surgery lasts more than the required timing ( double the half-life of an antibiotic ) n = 10	10	100%(out of surgeries required Redosing )
Patients who received an additional dose(s) if intra operative blood loss exceeds >1500ml	0	0%
Patients who did not received antibiotics in 60 min window pre incision	54	34.60%
Patients stopped receiving antibiotics within 24hrs of surgery	77	49.30%
Overall Compliance	46	29.40%

6. In the present study 34.6% of patients did not receive antibiotics before 60 minutes, 0% of patients didn't receive re-dosing and 50.64% of patient's duration of antibiotics exceeds more than 24 hours.

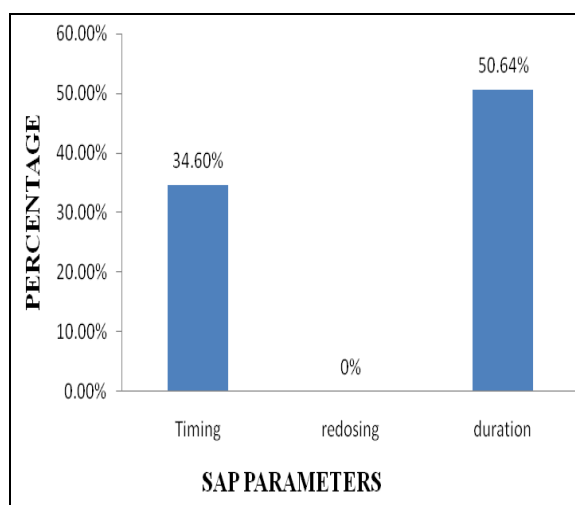


Fig 5: Distribution of patients according to Non compliance of SAP parameters.

7. The study shows that there are 5 staphylococcus aureus and 3 E. coli which are more in number compared to klebsiella, MRSA and CONS.

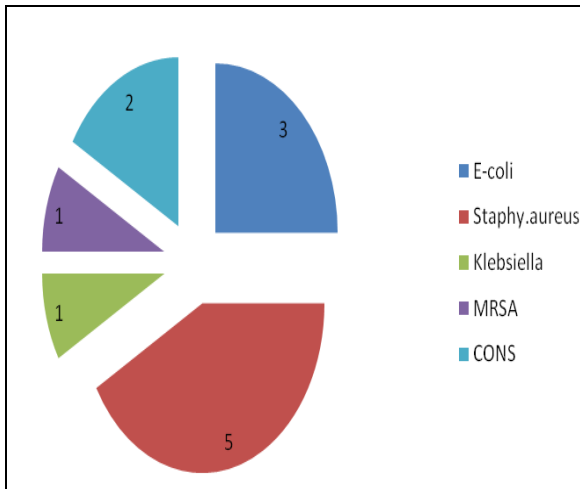


Fig 6: Pie chart of organisms isolated from the wound

8. In this study the patients who are affected with SSI are of 12 ( 7.7%) and out of overall compliance 2 patients are at risk of SSI ,out of 110 patients who show noncompliance 10 patients are reported with SSI. The results are shown in figure 7.

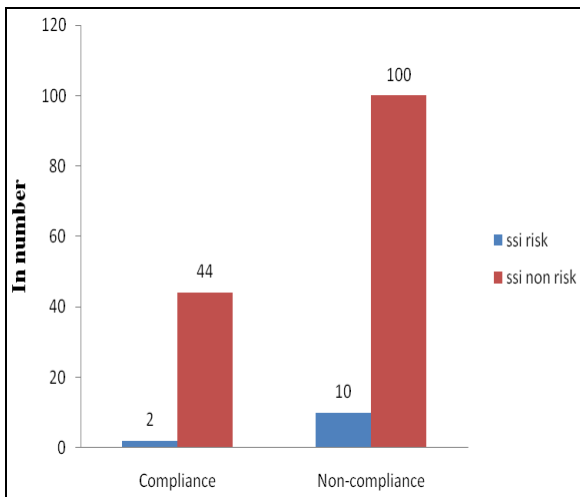


Fig 7: Distribution of patients at risk of SSI based on compliance and non compliance

### RR (compliance and risk of SSI)

Relative risk (0.48, CI (0.11 – 2.10)

P Value = 0.310

In the present study the Relative Risk between SSI and Compliance RR (0.48, CI (0.11-2.10), the statistical

significance status is Non-Significant as P value is 0.310 and Absolute risk = 0.07

### DISCUSSION

In our study the overall compliance is of 29.4% while non-compliance is more due to the factors like re-dosing, timing of administration and duration of prophylactic antibiotics.

In the present study about 6.4% of the patients were eligible for re-dosing but none of them received the proper antibiotic in people who need additional dose for surgery that lasts more than required timing is 0% and those who did not receive an additional dose is 100%. This study reveals that 49.3% of patients stop receiving antibiotic within 24 hours of surgery, that is in 79 patients the antibiotic therapy exceeds 24 hours that can cause antibiotic resistance, ineffective in reducing infections and risk of colitis.

The study reveals that the most commonly used prophylactic antibiotics are mainly Ceftriaxone, Cefazidime and Cefotaxime. They are 3<sup>rd</sup> generation Cephalosporin's, broad spectrum antibiotic and bactericidal in nature which is having activity against the bacteria's like Staphylococcus aureus and E-Coli, mostly seen organism in case of SSI. clean type of surgeries are more compared to clean contaminated which is found to be obverse with study conducted by Sharma P *et al.*, Out of 200 patients, 193 received intravenous preoperative antimicrobial dose on the day of surgery. The third-generation cephalosporin (61%) is the most usually prescribed group. Fixed-dose combinations was also used frequently, among them Piperacillin + tazobactam (20.5%) was the common combination used. 8.23 days was the average duration of administration of postoperative prophylactic antimicrobial.

When come to the timing of prophylactic antibiotic about 34.60% of patients do not receive antibiotic in 60 minutes of pre-incision that is according to the surgical antimicrobial prophylaxis the timing of incision of prophylactic antibiotic

is about half an hour or one hour before incision. The timing of prophylactic antibiotic may cause SSI because in our study out of 12 SSI, 6 are of improper timing of administration. Respectively which was found to be in line with the study conducted by Richman JS *et al.*, Of the 32 459 operations, prophylactic antibiotics were administered at a median of 28 minutes (inter quartile range, 17-39 minutes) prior to surgical incision, and 1497 cases (4.6%) developed an SSI. Compared with procedures with antibiotic administration within 60 minutes prior to incision, higher SSI rates were observed for timing more than 60 minutes prior to incision. This study reveals that 49.3% of patients stop receiving antibiotic within 24 hours of surgery.

The main part of findings in our study is the reported rate of SSI out of 156 cases 12 cases have been reported as SSI and major found organism isolated from the wound is gram positive organism staphylococcus aureus. SSI is mostly seen in clean contaminated type of surgery and commonly seen if the duration of surgery exceeds more than 30 minutes.

The IV route of administration is highly recommended, as it produces reliable and predictable serum and tissues concentration; it is widely used type of formulation in our study for surgical antibiotic prophylaxis, which shows similarity with studies lead by Lilani SP *et al.*, SSI was 3.03% in clean surgeries and 22.4% in clean contaminated surgeries. There was no infection in surgeries lasting for less than 30 minutes, while surgical site infection rate was high (38.46%) for operation that lasted for 120 minutes. Staphylococcus aureus was the commonest isolated.

In the present study relative risk between SSI and compliance is 0.48% <1 and our p value is 0.310 between the CI (0.11-2.10) which signifies that risk of SSI is less, and from our result we concluded that SSI is not occurred due to the inappropriateness of timing of

administration, re-dosing and duration of prophylactic antibiotic.

The data on post-operative infection was limited and most of the infections were un-noticed. Our findings have several limitations which were restricted to the information which was available in Medical Records.

## CONCLUSION

According to the analyzed results and from view of literature, the conclusions made are;

- Surgical antimicrobial prophylaxis is an important factor which is essential to prevent surgical site infections.
- In the Retrospective study shows that the most commonly used prophylactic antimicrobials are 3rd generation cephalosporin's in which they are broad spectrum and bactericidal in nature.
- In surgical practice there is considerable variation in the timing of the prophylactic administration of antibiotic and prolonged use of prophylactic antibiotic more than 24 hours is noted.
- The timing of antibiotic and intra-operative re-dosing is not significantly associated with SSI occurrence. While adherence to the timely prophylactic antibiotic measure is not bad care, there is little evidence to suggest that it is better care.
- Future effort for reducing SSI should strongly co-relate with improved outcomes and include studies to refine recommended antibiotic choice and re-dosing.
- The study also concludes the necessity of up gradation of knowledge and guidelines about surgical antimicrobial prophylaxis which will contribute to the better patient care.

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