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### Evaluation of Antibiotic Usage as Surgical Prophylaxis in Post-Operative Wards

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#### ABSTRACT

Antibiotic Prophylaxis should be appropriate to reduce the risk of postoperative surgical infections. Surgical Site Infections (SSIs) are responsible for Increased Mortality and Morbidity rate during surgical operations which lead to major complications. The inappropriate and overuse of antibiotics effects the cost and efficacy of drugs which leads to the resistant bacteria. To assess the pattern of antibiotic usage in surgical in-patients and for Postoperative wound infections. The present study is a prospective observational study done for a period of six months in Basaweshwara Medical College and Research Centre, Chitradurga in surgical ward. A Total of 162 patients were enrolled into the study. Among them, Surgical Site Infection (SSIs) was found in 37 (22.8%) patients and patients without SSIs are 125 (77.2%). The patients with age group 25-60 years were 104 (64.2%) in which SSIs are more (23). According to the study male patients underwent more surgeries (107 (66%)) in which 21 (56.8%) are with SSIs. Infection rate were more in males when compare to females in the study. A total of 265 antibiotics were used among 162 patients in which third generation cephalosporins are more preferred. The study concludes that there is a proper need to control the use of antibiotics appropriately. The inappropriate use leads to economic burden and resistance. SSIs may decrease the quality of life of the patients. Hence minimization of SSI is also very important in the developing countries by maintaining infection control plans by suitable organizations which makes an impact on the infections

**Keywords:** Antibiotics, Surgical Site Infections (SSIs), Prophylaxis.

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## INTRODUCTION

The Modern therapeutic agent's uses and its contribution for diagnosis, prevention of infectious diseases are of no need to be proven. The usage of antibiotics as surgical prophylaxis in medical surgery postoperative wards is a standard requisite care. But it is a rememberable thing that every drug has its hazard character which is known and unknown. The antibiotic inappropriate usage leads to the resistance and increased hospital expenses.<sup>1</sup>

### Definition

Antibiotics are defined as the variety of substances that are produced by or derived from certain fungi, bacteria and other organisms which can destroy or inhibit the growth of other microorganisms. Antibiotics are widely used in the treatment and prevention of infectious diseases. WHO strongly recommends that governments focus control and prevention efforts in four main areas:

- Surveillance for antimicrobial resistance
- Rational antibiotic use, including education of healthcare workers and the public in the appropriate use of antibiotics
- Introducing or enforcing legislation related to stopping the selling of antibiotics without prescription and
- Strict adherence to infection prevention and control measures, including the use of hand-washing measures, particularly in healthcare facilities.<sup>2</sup>

It is a fascinating need to develop a method to evaluate the usage of antibiotics in surgery wards as prophylactic treatment. The intention is to save the valuable treasure of antibiotics not to be unuseful<sup>3</sup>. The post-operative prophylactic treatment of antibiotic has shown a bad impact of causing the Surgical Site Infection (SSIs). SSIs are responsible for increased expenses, Mortality and Morbidity during surgical operations which lead to major complications<sup>4</sup>. Surgical antibiotic prophylaxis (SAP) is defined as the use of antibiotics to prevent infections at the surgical site. SSIs are the second commonest nosocomial infection approximately accounting for one quarter of 2 million hospital acquired infections in USA annually. SSI is also a health care associated infection which affects the hospital stay and its cost. On an estimated 27 million surgical procedures, surgical site infections are reported in up to 500,000 cases each year<sup>5,6</sup>. There are 3 different types of surgical site infection according to the Centre for Disease Control and Prevention (CDC). The criteria put forth by the CDC, SSIs are classified as either.

1. Superficial Incisional SSIs (involving only skin and subcutaneous tissue)

2. Deep Incisional SSIs (involving underlying soft tissue) and

3. Organ/Space SSIs<sup>7</sup>

The usage of antibiotics in single or combinations are preferred now a days in deeply infected cases. The guidelines are also violated by using the antibiotics for long duration than mentioned. In India due to lack of adequate educating methods and guidelines it became a need to evaluate the prescribing patterns and usage of antibiotics in surgical post-operative wards. By seeing all the above facts the present study is carried out at Basaweswara medical college and Research Centre, a Tertiary care teaching hospital for evaluating the usage of surgical antibiotics as prophylaxis in post-operative wards.

## MATERIALS AND METHODS

**Study site:** The study will be conducted at Medicine surgical inpatient wards of Basaweswara Medical College Hospital (BMCH) & Research Centre, Chitradurga.

**Study design:** This is a prospective observational study.

**Study period:** The study will be conducted over period of three months.

**Study subjects:** All patients who presented to the Medicine surgical inpatient ward of the hospital during the period from February 2014 to April 2014 will be eligible for enrolment. Patient who meets the following criteria will be enrolled.

### Inclusion criteria

- Patient's undergone surgery.
- Patients of age above 18 years of either gender.
- Patients who were willing to participate in the study.

### Exclusion criteria

- Patient of age below 18 years.
- Minor surgeries (where no usage of prophylactic antibiotics found )

### Source of data

The data for the study was collected by using the following:

- Case sheets of the In-patients.
- Laboratory investigational data reports.

### Study procedure

The patient who had undergone surgery and is being treated with the antibiotics in the medicine surgical wards history will be recorded from the case sheets. The patient demographic details is also be collected. The details of the antibiotics and the other therapy given to the patients will be

collected in terms of dose, duration and route of administration. Patients are followed upto the time of discharge. The surgery status is assessed for any infection. In case of any surgical site infection, the treatment given for that is also collected. The cost of the antibiotics prescribed, Rationality of the prescription, Quality of life will also be analyzed.

## RESULTS AND DISCUSSION

### **Patient Characteristics associated with Surgical Site Infection (SSI):**

A Total of 162 patients who were admitted in surgical ward and who fulfill the inclusive criteria were included in the study. Surgical Site Infection (SSI) was found in 37 (22.8%) patients and patients without SSI were 125 (77.2%). The patients with age group 25-60 years were 104 (64.2%) in which SSI were found in 23 (62.2%), patients without SSI were 81 (64.8%). Age Group >60 years were 36 (22.2%) patients in which 8 (21.6%) were with SSI and 28 (22.4%) without SSI, followed by age group < 25 years were 22 (13.6%) in which 6 (16.2%) patients with SSI and 16 (12.8%) without SSI. Male patients underwent more surgeries in the study of count 107 (66%), in which 21 (56.8%) are with SSI and 86 (68.8%) without SSI. 55 (34%) were Females in which 16 (43.2%) patients are with SSI and 39 (31.2%) patients without SSI. Infection rate were more in males when compare to females in the study. BMI (Body Mass Index) greater than 30 were found in 41 (25.3%) patients in which SSI were found in 10 (27%) patients, patients without SSI were found in 31 (24.8%) patients. BMI less than 30 were found in 121 (74.7%) patients in which patients with SSI were 27 (73%) and without SSI were 94 (75.2%). Patients with smoker were 63(38.9%) in which SSI were found in 16 (43.2%) and without SSI were found in 47 (37.6%) patients. Patients without smoker were 99 (61.1%), patients with SSI were 21(56.8%) and without SSI were 78 (62.4%) patients. Patients with Diabetes underwent surgery were 42 (25.9%) in which SSI were found in 12 (32.4%) patients and patients without SSI were found in 30 (24%). Patients without Diabetes were 120 (74.1%) in which SSI were found in 25 (67.6%) patients and patients without SSI were found in 95 (76%).

### **Operation Characteristics with SSI**

Operation Characteristics found in this study was wound class, preoperative stay, post operative stay, Prophylactic antibiotics and duration of operation (hrs).

### **Surgical wound classification**

Among the 162 patients, 120 (70.1%) had clean wound, 25 (15.4%) had clean-contaminated wound, 9 (5.6%) had contaminated wound and 8 (4.9%) had dirty wound. The rate of SSI was (20)

54.1%, (11)29.7%, (4) 10.8% and (2) 5.4% in clean, clean- contaminated, contaminated and dirty wound respective.

### **Preoperative stay**

A total of 162 patients, 102 (63%) patients stayed less than five days before surgery in hospital in which SSI were found in 20 (54.1%) patients and patients without SSI were 82 (65.6%). 60 patients stayed more than five days in which 17 (45.9%) patients were with SSI and 43 (34.4%) patients were without SSI.

### **Postoperative Stay**

123 (75.9%) patients were stayed less than 8 days after surgery in which 97 (77.6%) patients without SSI and patients with SSI was 26 (70.2%). Patients stayed more than 8 days after surgery was 39 (24.1%) among which patients with SSI were 11 (29.7%) and without SSI were 28 (22.4%).

### **Prophylactic Antibiotics**

A total 162 patients, 79 (48.8%) patients received prophylactic antibiotics and 83 (51.2%) patients have not received any prophylactic antibiotics. The rate of SSI is high with the patients who have not received any prophylactic antibiotics 22 (59.5%).

### **Duration of operation**

The duration of operation range from less than one hour to greater than two hours. The SSI rate in patients with duration of operation <1 hr was 10 (27.0%), 1-2 hrs was 13 (35.1%) and >2 hrs was 14 (37.9%).

### **Surgical Procedures and SSI**

The surgical procedures in the study were Herniorrhaphy 29 (17.9%), Appendectomy 27 (16.7%), Fasciotomy 16 (9.8%), Hemorrhoidectomy 16 (9.8%), Prostatectomy 13 (8%), Amputation 12 (7.4%), Parotidectomy 8 (4.9%), Colectomy Surgery 7 (4.3%), Skin Grafting 5 (3.15), Laparotomy 4 (2.5%), Mastoidectomy 4 (2.5%), Lumpectomy 4 (2.5%), Urethrotomy 3 (1.9%), Vagotomy 3 (1.9%), Pyeloplasty 3 (1.9%) and others 8 (4.9%) includes drainage of abscess, testicular abscess, liver abscess. The SSI rate were 16.2% in Appendectomy, 13.5% Fasciotomy, 10.8% Prostatectomy, 10.8% Amputation, 8.1% Herniorrhaphy, 8.1% Hemorrhoidectomy, 5.4% Parotidectomy, 5.4% Colectomy Surgery, 5.4% Laparotomy, 5.4% Lumpectomy, 2.7% Mastoidectomy and followed by 8.1% others.

### **Number of Antibiotics prescribed**

A total of 265 antibiotics were prescribed for 162 patients in which majority of them are on single antibiotics 73 (45.1%), followed by two antibiotics 75 (46.3%) and three antibiotics 14 (8.6%)

### Antibiotic classes

A total of 265 antibiotics were prescribed in which the majority of the antibiotic class were 3<sup>rd</sup> Generation Cephalosporins 108 (40.7%), followed by Beta-lactamase inhibitors 80 (30.2%), 4<sup>th</sup> Generation Cephalosporins 39 (14.8%), Aminoglycoside 11 (4.2%), Fluoroquinolones 11 (4.2%), Penicillin 9 (3.4%), Oxazolidinone 3 (1.1%) and 1<sup>st</sup> Generation Cephalosporins, Sulphonamide 2 (0.7%).

### Adverse Drug Reactions associated with Antibiotics

The common Adverse Drug Reactions (ADR) associated with the antibiotics was vomiting, nausea, diarrhea, hypersensitivity reaction and gastric irritation. A total of 15 ADRs were found in which Cefotaxime induced vomiting 1 (6.7%), nausea 1 (6.7%), diarrhea 1 (6.7%), and gastric irritation 1 (6.7%), Ceftriaxone induced vomiting 1 (6.7%), hypersensitivity reaction 2 (13.3%), Penicillin induced vomiting 1(6.7%) and hypersensitivity reaction 1 (6.7%), Amikacin induced nausea 2 (13.3%) and hypersensitivity reaction 1 (6.7%) and followed by Cefexime induced diarrheas 1 (6.7%) and gastric irritation 1 (6.7%). A total of 162 patients undergone surgery in which the SSI were found with 37 (22.8%) patients and patients without SSI were 125 (77.2%). Study conducted by *Ibtesam K et al.*, is much similar to present study in which the SSI were found in 22.6% and without SSI were 77.6%<sup>8</sup>. In the study most of the patients were under the age group of 25-60 years and showed males dominancy. The study conducted by *Patel Disha et al.*, comprises the similarity where majority of the patients were under the age group of 25-60 years and even male were high<sup>9</sup>. The operation Characteristics like surgical wound classification in which the SSI rate were more in clean and followed by clean contamination wound. SSIs were more found in patients who stay less than five days in the hospital at preoperative stage and patients who have not received prophylaxis were more prone to get SSI. SSIs rate were more in patients who underwent surgery more than 2 hrs. Similar operation characteristics were found in *Ibtesam K et al.*, study<sup>8</sup>. *M.G. Gandage, et al.*,<sup>6</sup> Study on 104 patients shows SSIs in 14 male and 4 Female patients. Most of the studies shows that the SSIs are most dominant in male population. The surgical procedure which is used more in the study was herniorrhaphy followed by appendectomy. *Mawalla et al.*, conducted a study in which Laparotomy and Open prostatectomy were most commonly used surgical procedures<sup>4</sup>. Two drug therapies were prescribed more followed by single drug therapy and tripe drug therapy. In *Sahar et al.*, study monotherapy were more prescribed followed by multiple therapies<sup>10</sup>. The class of antibiotics most commonly used in the study was 3<sup>rd</sup> Generation Cephalosporins and followed by Beta-lactamase inhibitors. The study which is similar to present study conducted by M.G. Gandage *et al.*, in which

Cephalosporins were most commonly prescribed followed by Beta-lactamase inhibitors<sup>6</sup>. A total of 15 ADRs were seen in the present study. The ADRs associated with antibiotics were vomiting, nausea, diarrhea, hypersensitivity reaction and gastric irritation.

**Table 1: Distribution of Patient Characteristics associated with Surgical Site Infection (SSI).**

SL No	Patients Characteristics	SSI (n=37)	No SSI (n=125)	Total (n=162)	Comparisons
1	<b>Age</b>				X <sup>2</sup> (2,n=162)=0.284, p=0.8676
	<25	6 (16.2%)	16 (12.8%)	22 (13.6%)	
	25-60	23 (62.2%)	81 (64.8%)	104 (64.2%)	
	>60	8 (21.6%)	28 (22.4%)	36 (22.2%)	
2	<b>Gender</b>				X <sup>2</sup> (1,n=162)=1.847, p=0.1742
	Male	21(56.8%)	86 (68.8%)	107 (66.0%)	
	Female	16 (43.2%)	39 (31.2%)	55 (34%)	
3	<b>BMI</b>				X <sup>2</sup> (1,n=162)=0.075, p=0.7843
	>30	10 (27%)	31 (24.8%)	41 (25.3%)	
	<30	27 (73%)	94 (75.2%)	121 (74.7%)	
4	<b>Smoking</b>				X <sup>2</sup> (1,n=162)=0.383, p=0.5362
	No	21 (56.8%)	78 (62.4%)	99 (61.1%)	
	Yes	16 (43.2%)	47 (37.6%)	63 (38.9%)	
5	<b>Diabetic</b>				X <sup>2</sup> (1,n=162)=1.057, p=0.3039
	No	25 (67.6%)	95 (76%)	120 (74.1%)	
	Yes	12 (32.4%)	30 (24%)	42 (25.9%)	

**Table 2: Distribution of SSI according to operation characteristics**

SL No	Operation Characteristics	SSI (n=37)	No SSI (n=125)	Total ( N=162)	Comparisons
1	<b>Wound Class</b>				X <sup>2</sup> (3,n=162)=11.352, p=0.0100
	Clean	20 (54.1%)	100 (80%)	120 (70.1%)	
	Clean contamination	11 (29.7%)	14 (11.2%)	25 (15.4%)	
	Contamination	4 (10.8%)	5 (4.0%)	9 (5.6%)	
	Dirty wound	2 (5.4%)	6 (4.8%)	8 (4.9%)	
2	<b>Preoperative stay</b>				X <sup>2</sup> (1,n=162)=1.632, p=0.2014
	<5	20 (54.1%)	82 (65.6%)	102 (63.0%)	
	>5	17 (45.9%)	43 (34.4%)	60 (37.0%)	
3	<b>Post operative stay</b>				X <sup>2</sup> (1,n=162)=0.839, p=0.3596
	<8	26 (70.2%)	97 (77.6%)	123 (75.9%)	
	>8	11 (29.7%)	28 (22.4%)	39 (24.1%)	
4	<b>Prophylactic antibiotics</b>				X <sup>2</sup> (1,n=162)=1.298, p=0.2545
	Received	15 (40.5%)	64 (51.2%)	79 (48.8%)	
	Not received	22 (59.5%)	61 (48.8%)	83 (51.2%)	
5	<b>Duration of Operation (hrs)</b>				X <sup>2</sup> (2,n=162)=0.596, p=0.7424
	<1	10 (27.0%)	50 (40.0%)	60 (37.1%)	
	1-2	13 (35.1%)	36 (28.8%)	49 (30.2%)	
	>2	14 (37.9%)	39 (31.2%)	53 (32.7%)	

**Table 3: Distribution of Surgical procedures and SSI.**

SL No	Surgical Procedures	SSI (n=37)	No SSI (n=125)	Total (N=162)	Comparisons
1	Herniorrhaphy	3 (8.1%)	26 (20.8%)	29 (17.9%)	X <sup>2</sup> (15,n=162)=13.213, p=0.5858
2	Appendectomy	6 (16.2%)	21 (16.8%)	27 (16.7%)	
3	Fasciotomy	5 (13.5%)	11 (8.8%)	16 (9.8%)	
4	Hemorrhoidectomy	3 (8.1%)	13 (10.4%)	16 (9.8%)	
5	Prostatectomy	4 (10.8%)	9 (7.2%)	13 (8.0%)	
6	Amputation	4 (10.8%)	8 (6.4%)	12 (7.4%)	
7	Parotidectomy	2 (5.4%)	6 (4.8%)	8 (4.9%)	
8	Colectomy Surgery	2 (5.4%)	5 (4.0%)	7 (4.3%)	
9	Skin Grafting	0 (0%)	5 (4.0%)	5 (3.1%)	
10	Laparotomy	2 (5.4%)	2 (1.6%)	4 (2.5%)	
11	Mastoidectomy	1 (2.7%)	3 (2.4%)	4 (2.5%)	
12	Lumpectomy	2 (5.4%)	2 (1.6%)	4 (2.5%)	
13	Urethrotomy	0 (0%)	3 (2.4%)	3 (1.9%)	
14	Vagotomy	0 (0%)	3 (2.4%)	3 (1.9%)	
15	Pyeloplasty	0 (0%)	3 (2.4%)	3 (1.9%)	
16	Others	3 (8.1%)	5 (4.0%)	8 (4.9%)	
	Total	37 (100%)	125 (100%)	162 (100%)	

**Table 4: Distribution of Number of Antibiotics Prescribed**

No. of Antibiotics	No. Of Patients	Total (n=265)
1	73 (45.1%)	73 (27.5%)
2	75 (46.3%)	150 (56.7%)
3	14 (8.6%)	42 (15.8%)
Total	162 (100%)	265(100%)

**Table 5: Distribution of different antibiotic classes**

Antibiotic Classes	Total (n=265)
3 <sup>rd</sup> generation Cephalosporins	108 (40.7%)
Beta-lactamase inhibitors	80 (30.2%)
4 <sup>th</sup> generation Cephalosporins	39 (14.8%)
Aminoglycoside	11 (4.2%)
Fluoroquinolone	11 (4.2%)
Penicillin	09 (3.4%)
Oxazolidinone	03 (1.1%)
1 <sup>st</sup> generation Cephalosporins	02 (0.7%)
Sulphonamide	02 (0.7%)
Total	265 (100%)

**Table 6: Distribution of Adverse Drug Reactions associated with Antibiotics**

Antibiotics	ADRs	Number (n=15)
Cefotaxime	Vomiting	1 (6.7%)
Ceftriaxone	Vomiting	1 (6.7%)
Penicillin	Vomiting	1 (6.7%)
Amikacin	Nausea	2 (13.3%)

Cefotaxime	Nausea	2 (13.3%)
Cefexime	Diarrhoea	1 (6.7%)
Cefotaxime	Diarrhoea	1 (6.7%)
Ceftriaxone	Hypersensitivity Reaction	2 (13.3%)
Penicillin	Hypersensitivity Reaction	1 (6.7%)
Amikacin	Hypersensitivity Reaction	1 (6.7%)
Cefotaxime	Gastric Irritation	1 (6.7%)
Cefexime	Gastric Irritation	1 (6.7%)
Total	5 ADRs	15 (100%)

## CONCLUSION

The antibiotic usage as surgical prophylaxis is a standard care but the inappropriate use causes increased cost, stay prolongation and even infections due to resistance. In the study SSIs found is one of the major problem after surgery and which prolongs the patient's hospital stay. SSI rate were more associated with age group 25-60 years, male gender, BMI less than 30, clean and clean-contamination wound, patients who have not received any prophylaxis antibiotics, operation duration more than 2 hours, appendectomy surgical procedure in the study. This SSI may decrease the quality of life of the patients and also increases the economic burden. Hence minimization of SSI is very important in the developing countries by maintaining infection control plans by suitable organizations which makes an impact on the infections. The study also suggests to have a standard guidelines for the use of antibiotics as surgical prophylaxis which promote the rational use of antibiotics.

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