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Usage of Surgical Antibiotic Prophylaxis in Tertiary Care Hospital; A Prospective Observational Study

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ABSTRACT

The number of surgical procedures performed continues to rise, and surgical patients are initially seen with increasingly complex co-morbidities. The financial costs of treating surgical site infections (SSIs) are increasing. It is estimated that almost half of SSIs are deemed preventable using evidence-based strategies. The principle objective of the study was to assess the use of antibiotic as surgical prophylaxis at tertiary care teaching hospital.

A prospective observational study carried out in 105 patients whose data were collected using prepared forms and was examined to explore the medical condition, hospital stay, co morbidities, addictions, surgical procedure performed, prophylactic antibiotic given its dose, time and duration and was observed for 30 days post-surgery for incidence of Surgical Site Infection (SSI) and compared with ASHP, ICMR guidelines. Most common prophylactic antibiotic used was Ceftriaxone as Single agent and Ceftriaxone and Metronidazole in Combination. SSI was found in 45 patients. A total of 12 prescriptions were found to in compliance with the ASHP and ICMR guidelines.

Most of the prophylactic antibiotics prescribed by Osmania general hospital are not in accordance with ASHP and ICMR guidelines. Use of Broad spectrum antibiotic for extended period was common both pre-operatively and post-operatively.

KEY WORDS: Antimicrobial agent, Guideline adherence, Surgical procedure, Surgical prophylaxis, Surgical site infection.

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INTRODUCTION

Prophylactic Antibiotics: Antibiotics administered prior to the contamination of previously sterile tissues or fluids are called prophylactic antibiotics.[1]

Antibiotic Prophylaxis is the administration of antibiotics before or at the time of a surgical intervention, with the aim of avoiding the development of infection.

Antibiotic prophylaxis is used for surgical procedures that can give rise to spread of bacteria, which can cause infection after the surgery[2]

Surgical Site Infection (SSI) *Defined* by the Centers for Disease Control and Prevention (CDC)] as infections of the incision or organ or space that occur after surgery.

- Infection occurs when a pathogenic organism proliferates in a surgical wound leading to local and sometimes systemic signs and symptoms. Surgical site infections increase morbidity, extend the hospital stay.[3]

Surgical site infections (SSIs) are one of the most common Health Care Associated Infections (HCAIs) and represent a considerable cause of morbidity with 2-11-fold higher mortality. Patients developing SSIs are 60% more likely to be admitted to an ICU, are more than five times more likely to be re-hospital, and are twice as likely to die as similar patients without SSIs.[2] Surgical site infections (SSI) are grave postoperative complications with significant impact on morbidity and mortality. According to the National Nosocomial Infections Surveillance (NNIS) system, SSI are the third most frequently reported nosocomial infections, accounting for 12%-16% of all nosocomial infections among hospitalized patients.[4]

Peri-operative antimicrobials administered as prophylaxis for SSIs account for the majority of in-hospital antimicrobial prescriptions. Usually, long courses of antibiotic prophylaxis are administered, which are often associated with increasing antimicrobial resistance, super-infection with resistant pathogens, toxicity and excessive cost. Widespread and superfluous administration of antibiotics is one of the major contributors for development of drug resistance.[2]

It has been assessed that around half of SSIs are preventable by use of evidence-based strategies. [5]

The use of antibiotic prophylaxis is just one of many steps taken to help decrease the rate of surgical site infections.[6]

Table 1: Recommended antibiotics for type of surgical procedure as per ASHP Guidelines

TYPE OF PROCEDURE	RECOMMENDED AGENT	ALTERNATIVE AGENT
Gastroduodenale Procedures involving entry into lumen of gastrointestinal tract	Cefazolin	Vancomycin or Clindamycin+Aminoglycoside or Aztreonam or Fluroquinolone
Procedures without entry into gastrointestinal tract	Cefazolin	Vancomycin or Clindamycin+Aminoglycoside or Aztreonam or Fluroquinolone
Biliary tract Open procedure	Cefazolin, Cefoxitin, Cefotetan, Ceftriaxone, Ampicillin-Sulbactum	Vancomycin or Clindamycin+Aminoglycoside or Aztreonam or Fluroquinolone
Colorectal	Cefazolin, Cefuroxime	Vancomycin,Clindamycin
Thoracic Clean	Cefazolin, Ampicillin-Sulbactum	Vancomycin,Clindamycin

Table 2: Recommended antimicrobial agent,Doses and Redosing Interval as per ASHP Guidelines

ANTIMICROBIAL AGENT	DOSE	REDOSING INTERVAL
Ampicillin	2 g	2
Ampicillin-Sulbactum	3 g	2
Aztreonam	2 g	4
Cefazolin	2 g	4
Cefuroxime	1 g	4
Cefotaxime	1.5 g	3
Cefoxitin	2 g	2
Cefotetan	2 g	6
Ceftriaxone	2 g	N/A
Ciprofloxacin	400 mg	N/A
Clindamycin	900 mg	6
Ertapenem	1 g	N/A
Fluconazole	400 mg	N/A
Gentamycin	5 mg/kg	N/A
Levofloxacin	500 mg	N/A
Metronidazole	500 mg	N/A
Moxifloxacin	400 mg	N/A
Piperacillin-Tazobactum	3.75 g	2
Vancomycin	15 mg/kg	N/A

MATERIALS & METHODS

The study was conducted in the Department of surgery, Osmania General Hospital, Hyderabad, India for a period of six months. It was a prospective observation study conducted in a total of 105 patients fulfilling the selection criteria.

Inclusion criteria:

- Patients of either sex.
- Patients of more than 12 years of age.
- All patients undergoing Clean, Clean-Contaminated and Contaminated types of surgical procedures.

Exclusion criteria:

- Refusal to be a part of the study.
- Emergency procedure and Trauma.
- Pregnant and Lactating women
- Patient with HIV and TB
- Deontology and plastic surgery.

Relevant data was collected after obtaining patients consent on the approved Informed consent form from the patients.

The following data was collected on designed data collection form for the study by observing patients case sheet and interviewing patient or patient representatives. Patient's demographic data, Prescription prescribed by the physician, Patients medications, medical and social history to analyse co morbidity and risk factors for the infections.

The data was analysed by grouping surgical procedures into Clean, Clean-Contaminated and Contaminated based on NRC wound classification.

The collected data of antibiotic parameters were assessed against guidelines published by American Society of Health-System Pharmacists (ASHP) and Indian Council of Medical Research (ICMR).

Selection of antibiotic, Dose of antibiotic, Duration of antibiotic prophylaxis was deemed "CORRECT" if they were in compliance with the guideline. In case of the Timing of antibiotic administration "CORRECT" value was plotted if the antibiotic prophylaxis was given within 60 minutes before incision and plotted as "NOT-MENTIONED" if the time was not mentioned in the case sheet.

Data analysis: The data was recorded, tabulated and the results were made by Graphical data representation.

RESULTS:

The study involved a sample of 105 who underwent surgery. Patients age range from 12-80 years.

Table 3: sample characteristics

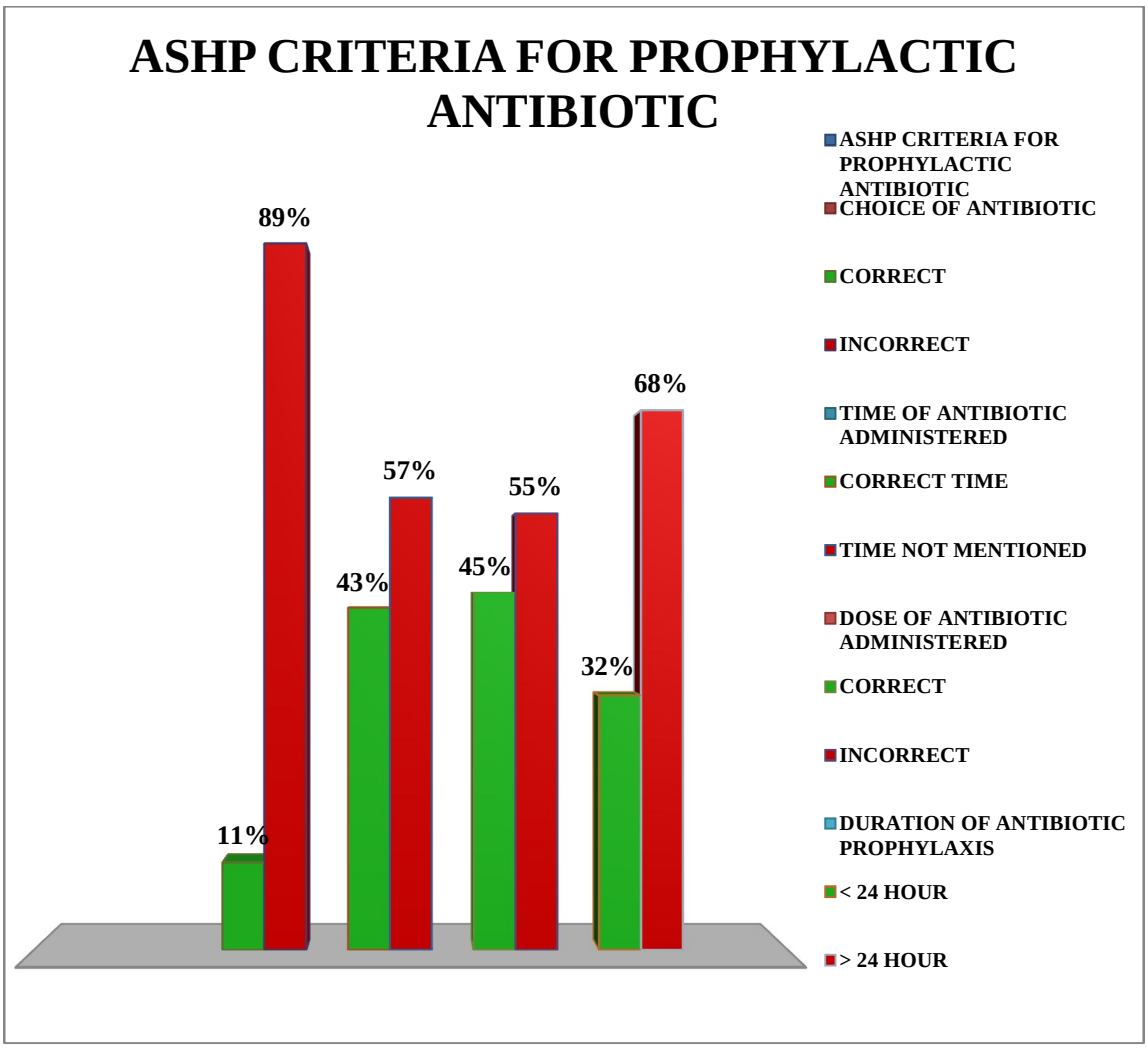
VARIABLE	NUMBER	PERCENTAGE
GENDER		
FEMALE	52	49%
MALE	53	51%
AGE		
10-49	70	66%
> 50	35	34%
COMORBIDITIES		
PATIENTS WITH CO-MORBIDITY	7	7%
PATIENTS WITHOUT CO-MORBIDITY	98	93%
NRC WOUND CLASSIFICATION		
CLEAN	37	35%
CLEAN-CONTAMINATED	67	64%
CONTAMINATED	1	1%
PRE-OPERATIVE HOSPITAL STAY		
=/< 7 DAYS	81	77%
>7 DAYS	24	23%

Table 4: type of surgical procedure

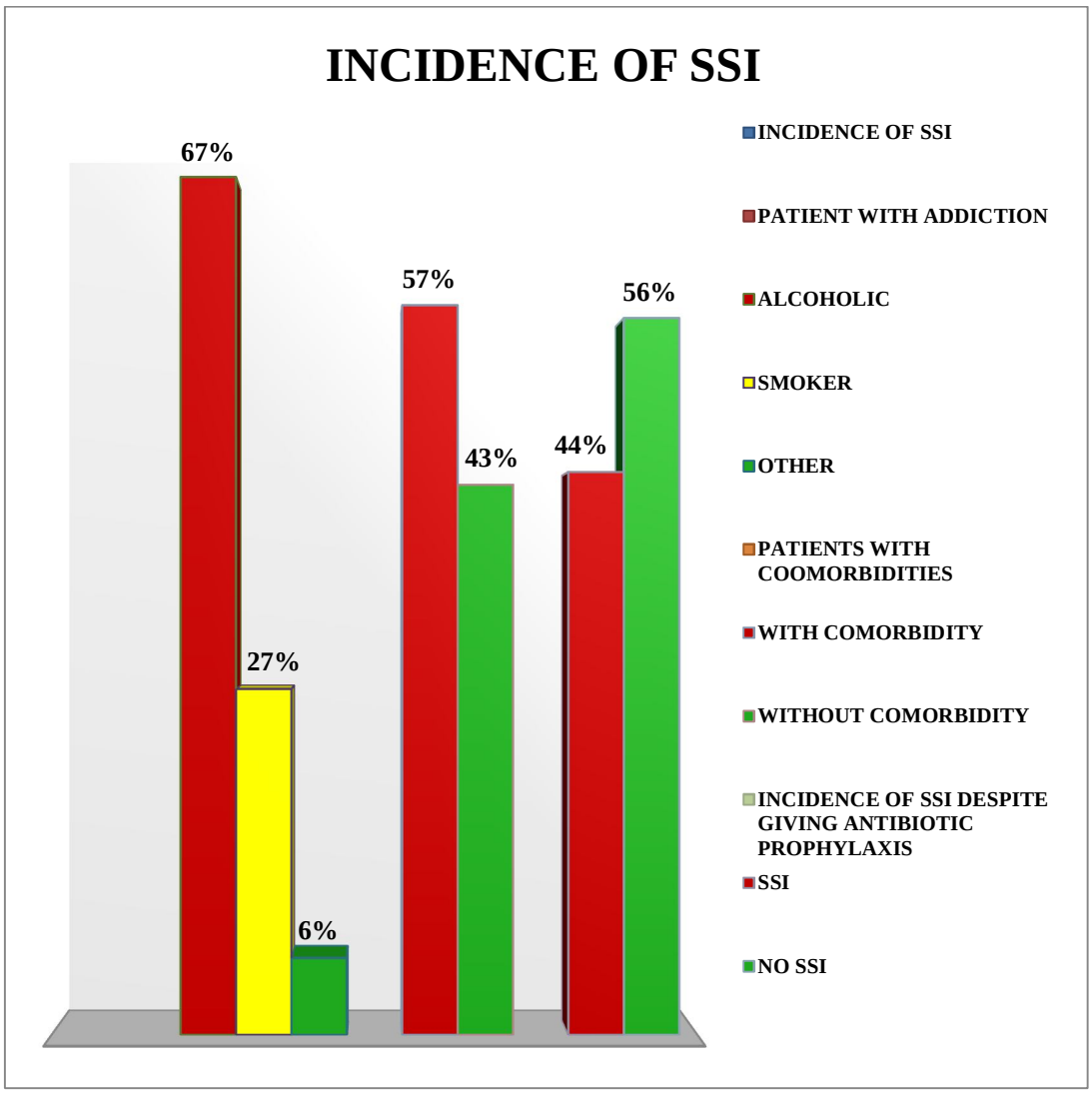
TYPE	NUMBER	PERCENTAGE
APPENDECTOMY	9	9%
BILIARY TRACT SURGERY	14	13%
CANCER SURGER	5	5%
COLO-RECTAL SURGERY	12	11%
GASTRO-DUODENAL SURGERY	14	13%
HEAD AND NECK SURGERY	7	7%
HERNIA REPAIR	16	15%
REPRODUCTIVE ORGAN SURGERY	2	2%
SMALL INTESTINE SURGERY	22	21%
OTHER	4	4%

Table 5: prophylactic antibiotic

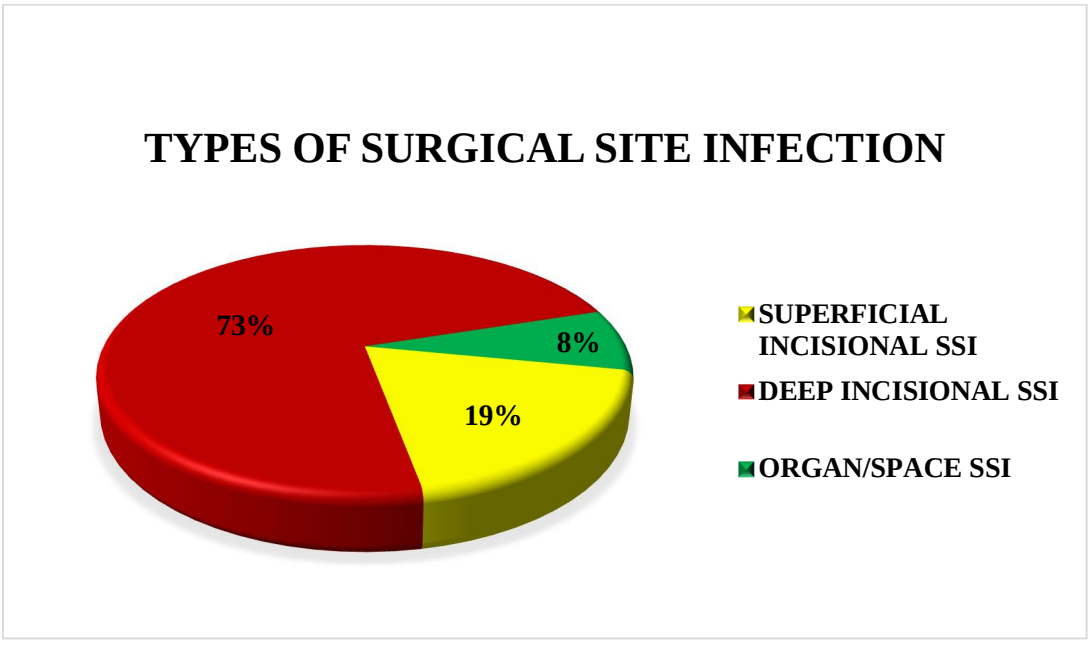
NAME OF ANTIBIOTIC	NUMBER	PERCENTAGE
AMIKACIN+CEFTRIAZONE+METRONIDAZOLE	14	13%
CEFOPERAZONE+ CLAVULANATE +METRONIDAZOLE+CLINDAMYCIN	1	1%
CEFTRIAXONE	56	53%
CEFTRIAXONE+ METRONIDAZOLE	29	28%
MEROPENEM+ METRONIDAZOLE	1	1%
PIPERACILLIN + TAZOBACTUM+ METRONIDAZOLE	2	2%
NO ANTIBIOTIC	2	2%



Graph 1: ASHP Criteria for Prophylactic Antibiotic in Study Population



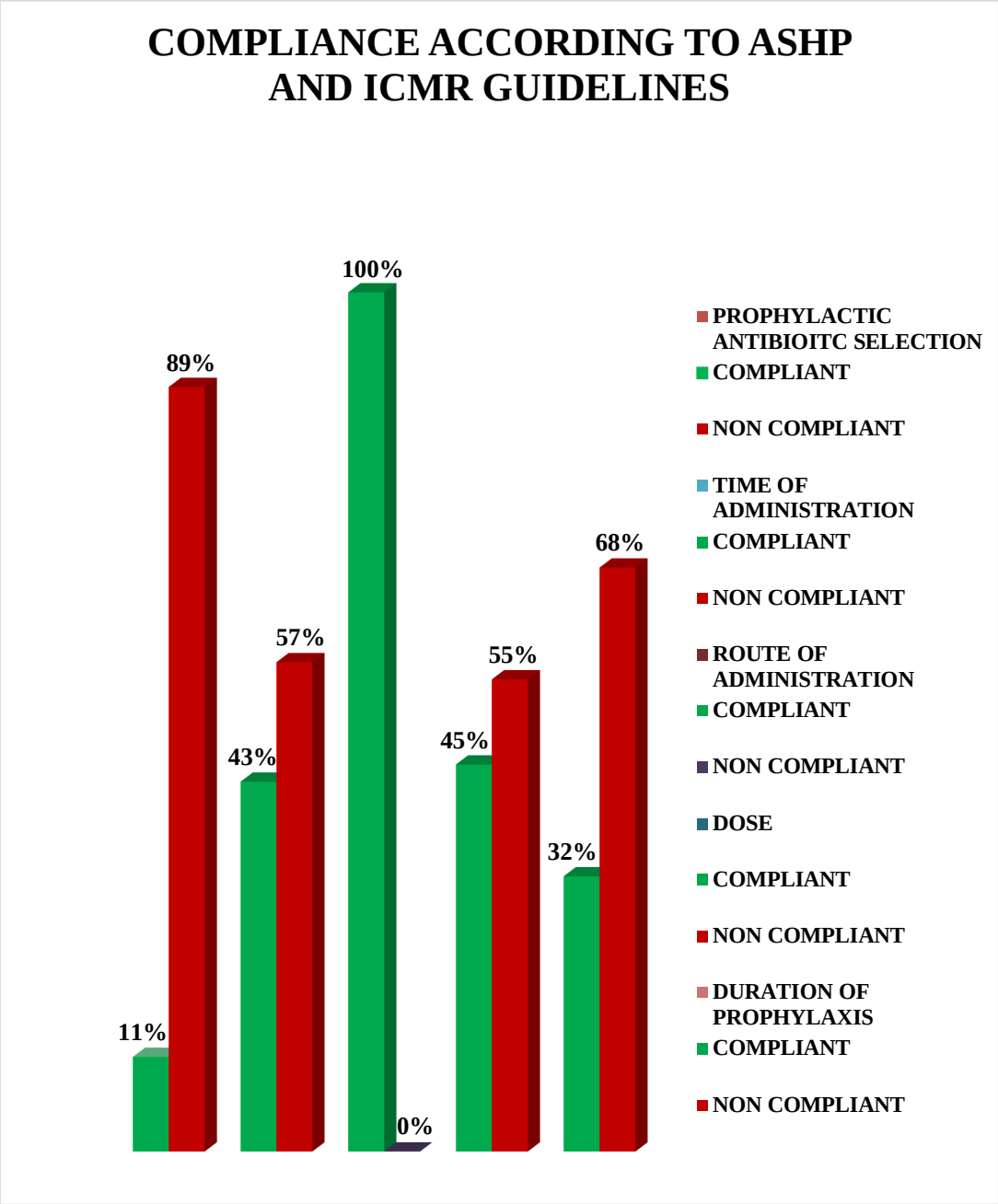
Graph 2: Incidence of SSI in Study Population



Graph 3: Types of Surgical Site Infection (SSI)

Table: 6 need of prophylactic antibiotic

TOTAL	NUMBER	PERCENTAGE
ANTIBIOTIC GIVEN	103	98%
ANTIBIOTIC NEEDED	77	73%
ANTIBIOTIC GIVEN BUT NOT NEEDED	26	25%
ANTIBIOTIC NOT GIVEN	2	2%



Graph 4: Compliance According to ASHP and ICMR Guidelines in Study Population

DISCUSSION:

The work was done in a total of 105 surgical procedures performed in Osmania general hospital in Department of General Surgery for duration of 6 month in view of existing controversies

and lack of consensus on published literature on Surgical Antibiotic Prophylaxis. The principal aim of our study was to assess the use of antibiotics as surgical prophylaxis

Antibiotic prophylaxis is expected to decrease the incidence of SSI. It ensures that an adequate concentration of an appropriate antimicrobial agent is present in the blood, tissues, and surgical wound during the entire time the incision is open and at risk of bacterial contamination. The choice and duration of antibiotic prophylaxis should cause minimum conceivable effect on the patient microbiota. In this way, it is critical to watch the guidelines for administration of right prophylactic antibiotic.

This study observed that prophylactic antibiotics usage in the surgical department is mostly empirical and not based on any national or international guidelines. The most important finding of this study is that in greater part of patients, the duration of prophylaxis was extended beyond 24 hours. And use of more than single doses extended use of prophylactic antimicrobials has been linked with the appearance of bacterial resistance, the risk of super-infection.

In our study, the compliance to ASHP guidelines was 11% for prophylactic antibiotic selection, 43% for time of administration, 100% for route of administration, 45 % for dose of the prophylactic antibiotic and 32% for duration of surgical antibiotic prophylaxis.

Majority noncompliance in this study was inappropriate antibiotic selection and extending of duration of antibiotic prophylaxis beyond 24 hours which was found in 68 % cases. The most commonly prescribed antibiotic was ceftriaxone in 53% cases followed by the combination of Ceftriaxone and Metronidazole in 28% cases.

As per principles of surgical antibiotic prophylaxis it is recommended to select an antibiotic with narrowest spectrum that is effective against the likely pathogens that can contaminate the wound, ceftriaxone is a broad spectrum antibiotic, its use would lead to emergence of resistance. The ASHP recommends prophylaxis with Cefazolin as first choice and single agent for most procedures (clean and clean-contaminated). Only 11% of our patients received the appropriate agent; use of >1 drug without any indication for multidrug prophylaxis, and use of antibiotics not recommended for prophylaxis, such as third-generation Cephalosporin, are the most common errors in antibiotic selection. Ceftriaxone was found to be administered in low a dose that is 1 gram, whereas the recommended dose of Ceftriaxone according to ASHP guidelines is 2grams. The misuse and overuse of antibiotics are associated with the emergence of bacterial resistance and increase in health-associated costs.

In this study, about 26 patients were given surgical antibiotic prophylaxis despite not being indicated whereas 2 patients who had an indication were not given it.

Although antimicrobial prophylaxis can decrease the incidence of SSI, this benefit must weigh against the risks of adverse drug reactions, the emergence of resistant bacteria and the direct

monetary cost. One potential strategy to enhance antimicrobial practice in hospitals is institutionalization, either by receiving an international guideline or by developing a local hospital guideline.

Pre-operative hospital stay was found to be more than 7 days in 23 % of patients.

The incidence of SSI was found in 45 cases out of 105 cases accounting for 44 % of total cases. Most common SSI sign was found to be Abscess/Purulent discharge and Tenderness.

On evaluation of our study sample, it was found that:

- The total compliance in our study was 11% , this is lower than from results in the study by ***Mousavi et al(2017)*** which is 22 % and by ***Madhusudhan et al.(2016)*** in which compliance was found to be high.
- Most commonly used agent was ceftriaxone which is consistent with the findings of ***Mohamoud et al. (2016), Madhusudhan et al. (2016) and Kaur et al. (2015).***
- In about 43% cases prophylactic antibiotic was administered at correct time, this is higher than results from ***Gouvêa et al. (2016)*** who found that antibiotic was prescribed at correct time in 27% Cases.
- The incidence of SSI was higher in our study (45 cases of SSI out of 105patients) compared to ***Laloto et al.(2017)*** in which 20 cases developed SSI out of 105patients and ***Madhusudhan et al.(2016)*** in which 17 patients developed SSI out of 539patients.
- It was found that 2 out of 105 cases didn't receive prophylactic antibiotic. This is lower than the results of study conducted by ***Mallapur et al. (2014)*** in which it was found that 80 out of 106 cases didn't receive prophylactic antibiotic.
- In our study area 27 % of patients received antibiotics were not indicated. This is lower than results of study by ***Alavi et al. (2014)*** who concluded that 44% patients received surgical prophylactic antibiotic who were not indicated for it.

CONCLUSION:

The study concluded that most of the prescribed antibiotics for surgical prophylaxis in Osmania General Hospital are not in accordance with ASHP and ICMR guidelines. This explains the low adherence to appropriate surgical antibiotic prophylaxis with high rate of broad spectrum antibiotic use and extended duration of prophylaxis.

Major reason for non-compliance is the untruthful belief that Broad-Spectrum antibiotics and elongated therapy will be more effective in preventing SSI than short duration of narrow spectrum antibiotics. Undiscriminating use of these broad-spectrum antimicrobial agents as prophylaxis favours the incidence of multi-drug resistant strains.

There is a need to consider most of the recommended SAP antibiotics, specifically Cefazolin. Compliance with the principles of appropriate antibiotic prophylaxis for surgery should

be firmly reviewed. Necessity to promote the rational use of antibiotics in surgical prophylaxis, implementation of the Evidence Based Guidelines and recommendations for antimicrobial surgical prophylaxis are firmly required. Identifying and examining high risk patients and consequently taking all appropriate care should be done to decrease the risk of SSIs.

Administration of the first dose of antibiotics in surgical prophylaxis within 1 hour skin incision and reducing the preoperative hospital stay and duration of operation further decrease the incidence rate of SSIs.

Avoidance of extended administration of surgical antimicrobial prophylaxis as antimicrobial resistance is one of global threat, which results partly due to unnecessary extended administration.

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