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Surgical Antibiotic Prophylaxis: A Gap Betweenguidleines and Practices

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ABSTRACT

Surgical Antibiotic Prophylaxis (SAP) plays a critical role in preventing postoperative infections, reducing hospital stays, and improving patient outcomes. This study, conducted at Krishna Institute of Medical Sciences (KIMS), Kondapur, evaluates the adherence to SAP guidelines and the impact of prophylactic antibiotic administration on patients undergoing surgery. A prospective observational study was performed on 330 patients undergoing various surgical procedures. Data collection focused on patient demographics, surgery type, antibiotic administration timing, selection, and duration. The study found that the majority of surgeries were clean (65.75%) and clean-contaminated (29.4%), requiring appropriate antibiotic prophylaxis. The most commonly used preoperative antibiotic was Cefuroxime (31.2%), while Cefuroxime (43.6%) and Cefditoren (13%) were the predominant postoperative antibiotics. Third-generation cephalosporins were the most frequently used antibiotic class (40%), followed by second-generation cephalosporins (31.2%). Adherence to WHO guidelines was high, with 98.8% of patients receiving preoperative antibiotics within the recommended timeframe. However, minor deviations in redosing and antibiotic selection were observed.A significant correlation was found between antibiotic administration timing and infection prevention. The study highlights the need for continued adherence to global guidelines and antimicrobial stewardship to minimize resistance and improve patient safety. Future recommendations include enhanced monitoring, periodic training for healthcare providers, and optimized antibiotic selection based on hospital-specific resistance patterns. These findings emphasize the importance of evidence-based SAP protocols in reducing surgical site infections and ensuring better healthcare outcomes..

Keywords: *Surgical Antibiotic Prophylaxis, Antibiotic Resistance, Preoperative Antibiotics, Post-operative Infection Prevention*

1. INTRODUCTION

Surgical antibiotic prophylaxis [SAP] refers to the use of antibiotics to reduce the risk of infection in patients undergoing surgical procedures following the standard guidelines of prevention of surgical site infections. It plays a modern role in crucial surgical care by minimizing the incidence of postoperative infections, which can lead to prolonged hospital stays, increased health care costs, and patient morbidity. The development of anti-microbial is one of the significant achievements, prior to antimicrobial era infections would also lead to morbidity. The decision to administer antibiotics before surgery depends on multiple factors, including type of surgery, the patients risk profile, and the potential for bacterial contamination during the procedure. Proper implementation of SAP including selection the right antibiotic, time of administration, and duration of use is essential to ensure its effectiveness while minimising the risk of antibiotic resistance which is a great concern in present world. The indigenous bacteria of the microbiome play a crucial role in defending the host by preventing the colonization of potentially harmful pathogens. However, in certain situations, opportunistic pathogens can disrupt the microbiota, diminishing its protective effect. Antibiotics exert significant selection pressure on the human microbiome, which can increase the risk of antimicrobial resistance (AMR) and have a substantial impact on the gut microbiota. While antibiotics can eliminate susceptible bacteria, their use can also promote the overgrowth of pathogenic bacteria, some of which may be multidrug-resistant. Additionally, antibiotics can facilitate the transfer of resistance genes, spreading resistance to other bacterial strains.

Prophylaxis means prevention and there are three types primary, secondary, eradication. Primary prophylaxis means prevention of an early infection, secondary prophylaxis means prevention of reactivation or reappearance of a pre-existing infection, eradication refers to elimination of microorganisms. The goal of antibiotic surgical prophylaxis is to ensure adequate serum and tissue levels of the drug at the time of incision, and for the duration of surgery. Antimicrobial prophylaxis begins with the idea that no infection exists but that during the operation there can be a low-level inoculum of bacteria introduced into the body. However, if sufficient antimicrobial concentrations are present, bacteria can be controlled without infection developing. If an infection is already present, or presumed to be present, then antimicrobial use is for treatment, not prophylaxis, and the goal is to resolve the infection.

Most of the prophylactic antibiotics are given within 120 mins before the incision and few surgeries may also require redosing at one or two half-lives of the antibiotic is recommended for the longer duration of procedure. Various guidelines exist for Surgical Antimicrobial Prophylaxis (SAP), including those from the Centres for Disease Control and Prevention (CDC), the American Society of Health-System Pharmacists (ASHP) on antimicrobial prophylaxis in surgery, the Scottish Intercollegiate Guidelines Network (SIGN), and the National Institute for Health and Care Excellence (NICE). In India, the National Centre for Disease Control (NCDC) issued SAP guidelines in 2016. Additionally, the World Health Organization (WHO) identified discrepancies in national guidelines and published its own recommendations in 2016. A comparison of these guidelines revealed that antimicrobial prophylaxis is the only consistent element across all, with notable variations in the timing of drug administration. The guidelines are intended to provide the practitioners with a standardized approach to the rational use of antimicrobial agents for the prevention of Surgical Site Infections (SSI). The routine use of prophylactic antibiotics is standard practice for patients undergoing procedures involving the implantation of artificial devices or foreign bodies, bone grafting, and surgeries that involve extensive dissections or are expected to result in significant blood loss. This activity will focus on the rationale, timing, selection of appropriate agents, coverage, and monitoring guidelines that are important for inter professional team members involved in administering preoperative antibiotics.

SAP is a critical aspect of per-operative care aiming to reduce these risks and improve patient outcome. Some of the errors that may occur in the SAP are no redosing of antibiotics even if the duration of surgery is more than four hours, administering the first dose too early, and inappropriate use of broad-spectrum antibiotics which may lead to resistance.

Our hospital KIMS is a tertiary care hospital, Patients undergo operative procedures, and this study was designed with following main objective to collect baseline data. To assess the procedure of surgical antibiotic prophylaxis [SAP] in patients who underwent surgery belonging to different surgical departments..

2. MATERIALS AND METHOD

A prospective observational study was undertaken in KIMS Hospital Kondapur , a 200 operational bedded tertiary care hospital with various departments.

SITE: KIMS Hospital (Kondapur, Telangana)

STUDY DESIGN: It's a hospital based prospective study on surgical antibiotic prophylaxis in patients who underwent surgeries in the hospital and are given prophylactic antibiotics based on WHO guidelines.

STUDY PERIOD: The study is conducted for 6months

SAMPLE SIZE: Total 330 patients that are undergoing a planned or emergency surgery were included in this study.

INCLUSION CRITERIA AND EXCLUSION CRITERIA:

The following inclusion and exclusion criteria were taken in account for selecting the suitable participants for the study and to avoid bias.

Inclusion criteria:

- Adults (>18 years) patients.
- Patients who are undergoing planned or emergency surgery.
- Patients who are receiving antibiotic prophylaxis according to standard hospital protocols

Exclusion Criteria:

- Children (<18years)
- Pregnant women

SOURCE OF DATA COLLECTION: The study was conducted for patients meeting inclusion criteria. Relevant data of all 330 patients were collected from patient medical records and through patient interviews. All patients were visited daily during their hospital stay and interviewed. Every patient was then followed up till they were discharged and their case record

sheets were reviewed for gathering necessary information as per case record form.

DESIGNING DATA COLLECTION FORMS: The form includes

- Demographics of patient (Age, Gender, allergies to antibiotics)
- Type of surgery
- Surgery details (Time of incision, closure)
- Antibiotic regimen details (class, Dose, Dosage form, frequency)
- Antibiotic administration time.

3. RESULTS

In the study conducted 330 patients were admitted in the hospital and had undergone surgical procedure in various departments of Krishna Institute of Medical Sciences, Kondapur. The data of all these surgeries is collected and analysed based on patient demographics, pre-operative antibiotic usage and post-operative antibiotic usage.

Distribution based on gender: Among the patients who have undergone surgery based on WHO guidelines of Surgical Antibiotic Prophylaxis the frequency of male patients is more than frequency of female patients in which male frequency is 182 i.e.55.2% and female frequency is 148 i.e.44.8% of total.

Sex	Frequency	Percentage
Male	182	55.2%
Female	148	44.8%

Distribution based on age:

In 330 patients who had undergone surgery based on WHO guidelines of Surgical Antibiotic Prophylaxis majority of the patients are in the age group middle adults(40-59years) (115, 34.84%)followedbyolderpatients(60-74years)(103,31.21%)andyoungadults(19-39years) (82, 24.84%), The least frequency was in age group old-old (≥75 years) (30, 9.90%).

Age in years	Frequency	Percentage
19-39years	82	24.84%
40-59years	115	34.84%
60-74years	103	31.21%
≥75 years	30	9.09%

Distribution based on Department of the surgery:

Significant number of surgeries were seen in Orthopedics (98,29.69%) followed by Spine surgery (57,17.27), Urology (55, 16.7%), General Surgery (41,12.42%), Neurology (20,6.06%),Breast Oncology(13,3.93%),Cardiology and ENT each (9,2.72%), Vascular surgery (6,1.81%),Pulmonology,PlasticsurgeryandEndocrinesurgeryeach(3,0.9%)and Nephrology with least surgeries (2,0.6%).

Department	Frequency	Percentage
Orthopaedics	98	29.69%
Spine Surgery	57	17.27%
Urology	55	16.7%
General Surgery	41	12.42%
Neurology	20	6.06%

Breast Oncology	13	3.93%
Cardiology	9	2.72%
ENT	9	2.72%
Gastroenterology	7	2.12%
Vascular Surgery	6	1.81%
Surgical Oncology	4	1.21%
Plastic Surgery	3	0.9%
Pulmonology	3	0.9%
Endocrine Surgery	3	0.9%
Nephrology	2	0.6%

Distribution based on Surgical Wound Class:

Majority of the surgeries were Type I (Clean) (217,65.75%) followed by Type II (Clean- Contaminated)(97,29.4%),Type III (Contaminated) (12,3.63%) and the least surgeries were Type IV (Dirty-Infected) (4,1.21%).

Type of surgery	**Frequency**	**Percentage**
Type I (Clean)	217	65.75%
Type II(Clean-Contaminated)	97	29.4%
Type III(Contaminated)	12	3.63%
Type IV(Dirty-Infected)	4	1.21%

Distribution based on Duration of Surgery:

Majority of the surgeries were done in between 2-3 hours (187,56.7%) followed by 1Hour surgeries(83,25.15%),30minutessurgeries(37,11.21%),4hourssurgeries(17,5.15%)and the least number of surgeries were done beyond 4hours (6,1.81%).

Duration Of Surgery	**Frequency**	**Percentage**
30minutes	37	11.21%
1 hour	83	25.15%
2-3Hours	187	56.7%
4 Hours	17	5.15%
Beyond4Hours	6	1.81%

Analysis of Pre-Operative Antibiotic usage:

The most used antibiotic in pre-operative prophylaxis is Cefuroxime(103,31.20%) followed by Cefoperazone (63,19.10%), Cefoperazone with Sulbactam (47,14.20%), Ceftriaxone (39,11.60%), Amoxicillin with Clavulanate potassium (36,10.90%), Cefoperazone sodium (30,9.10%),Meropenem(6,1.80%),PiperacillinwithTazobactam(3,0.90%),Metronidazole (2,0.60%) and the least used is Amikacin (1,0.30%).

Antibiotic	Frequency	Percentage
Cefuroxime	103	31.20%
Cefoperazone	63	19.10%
Cefoperazone/sulbactam	47	14.20%
Ceftriaxone	39	11.60%
Amoxicillin/clavulanate potassium	36	10.90%
Cefoperazonesodium	30	9.10%
Meropenem	6	1.80%
Piperacillin/Tazobactam	3	0.90%
Metronidazole	2	0.60%
Amikacin	1	0.30%

WhenthesePreoperativeAntibioticsarecategorizedaccordingtotheirclassesitisobserved that the highest used class is Cephalosporin's Generation III (132,40%) followed by Cephalosporin's Generation II (103,31.21%), Cephalosporin's Generation II in combination with Beta Lactams (47,14.24%), Beta Lactams (39,11.81%) and the negligible count can be seen in classes of Carbapenems (6,1.81%),Nitroimidazoles (2,0.6%)and lowest in Aminoglycosides (1,0.3%).

Antibiotic Class	Frequency	Percentage
Cephalosporins-Generation III	132	40%
Cephalosporins-Generation II	103	31.21%
Cephalosporins-GenerationIII+Beta Lactams	47	14.24%
Beta Lactams	39	11.81%
Carbapenems	6	1.81%
Nitroimidazoles	2	0.6%
Aminoglycosides	1	0.3%

Analysing based On Pre-Operative Antibiotic Administration Time:

Majority of patients were given Pre-Operative Antibiotic 30minutes prior the surgery (202,61.21%)and few patients were given1Hour priorsurgery (99,30%),In some cases Antibiotics were given beyond 1hour like 3Hours prior surgery (27,8.18%) and Beyond 3hours (2,0.60%).

Time of antibiotic Administration	Frequency	Percentage
Before 30Minutes	202	61.21%
Before 1Hour	99	30%
Before 3Hours	27	8.18%

Beyond 3Hours	2	0.60%

Analysis of Post-Operative Antibiotic usage:

Majorly used post-operative Antibiotic is Cefuroxime (144,43.6%) followed by Cefditoren (43,13%) and Cefixime (43,13%) which are in about same frequency and then Amoxicillin with clavulanate potassium (39,11.8%), Levofloxacin with Cefuroxime (21,6.4%), Cefpodoxime (12,3.6%),Levofloxacin(6,1.8%),Faropenem(5,1.5%),Cefoperazone(4,1.2%),Ceftriaxone(3,0.9%),Cefaxone(3,0.9%),Ofloxacin(2,0.6%),Meropenem(2,0.6%),Neomycin(1,0.3%),Nitrofurantoin(1,0.3%)andLinezolid(1,0.3%).

Antibiotic	**Frequency**	**Percentage**
Cefuroxime	144	43.60%
Cefditoren	43	13.00%
Cefixime	43	13.00%
Amoxicillin/clavulanate potassium	39	11.80%
Levofloxacin/cefuroxime	21	6.40%
Cefpodoxime	12	3.60%
Levofloxacin	6	1.80%
Ceftriaxone	6	1.80%
Faropenem	5	1.50%
Cefoperazone	4	1.20%
Ofloxacin	2	0.60%
Meropenem	2	0.60%
Neomycin	1	0.30%
Nitrofurantoin	1	0.30%
Linezolid	1	0.30%

WhenthesePostoperativeAntibioticsarecategorizedaccordingtotheirclassesitisobserved thatthe highest used class is Cephalosporins-Generation II (144,43.63%) followed by Cephalosporins-Generation III (108,32.72%), Beta Lactams (39,11.81%), Fluroquinolones in combination with Cephalosporins-Generation III (21,6.36%), Fluroquinolones (8,2.42%), Carbapenems.

(7, 2.12%) then the least used post-operative antibiotic classes are Aminoglycoside (1,0.3%), Nitrofurans (1,0.3%), Oxazolidinones (1,0.3%) each with same frequency.

Antibiotic	**Frequency**	**Percentage**
Cephalosporins-Generation II	144	43.63%
Cephalosporins-Generation III	108	32.72%
Beta Lactams	39	11.81%

Fluroquinolones + Cephalosporins-GenerationIII	21	6.36%
Fluroquinolones	8	2.42%
Carbapenems	7	2.12%
Aminoglycosides	1	0.30%
Nitrofurans	1	0.30%
Oxazolidinones	1	0.30%

Distribution based on Duration of Post-Operative Antibiotic in Intravenous dosage form:

In majority of the cases the post-operative antibiotic was prescribed in form of intravenous dosage for 2days (142,43%), followed by days (97,29.4%), 4days (34,10.3%), 5days (24,7.27%),1day(9,2.72%),6days(9,2.72%),8days(7,2.12%),7days(5,1.51%)and10days(3,0.9%)invery few cases. After the usage of Intravenous Dosage form the drugs are changed into Oral Dosage form for the convenience of the patient during discharge.

Duration In days	Frequency	Percentage
1	9	2.72%
2	142	43%
3	97	29.40%
4	34	10.30%
5	24	7.27%
6	9	2.72%
7	5	1.51%
8	7	2.12%
10	3	0.90%

Distribution based on Duration of Post-Operative Antibiotic in Oral dosage form:

Following the Intravenous Dosage form Oral Dosage Form is given for the patient during discharge. In majority of the cases the post-operative antibiotic was prescribed inform of oral dosage for 5days (184, 55.75%) followed by 3days (52, 15.75%), 10days (50, 15.15%), 7days (36, 10.9%) and was prescribed 2days (4, 1.21%) and 6days (4, 1.21%) in least number of cases.

Duration In days	Frequency	Percentage
2	4	1.21%
3	52	15.75%
5	184	55.75%
6	4	1.21%
7	36	10.90%

10	50	15.15%

Adherence to WHO guidelines on administration timing of Preoperative antibiotics:

Based on all the cases observed, 98.8%casesareseencomplyingtheWHOguidelines whereas in 1.2% cases the antibiotic wasn't given 1hour prior to the surgery.

Was the antibiotic given 1hour prior to surgery	Frequency	Percentage
Yes	310	98.8%
No	20	1.2%

Duration of Total antibiotic prophylaxis:

The total antibiotic duration was given mostly for 7days (89, 27%), followed by 8days (56,17%), 9days (37,11.21%), 5days(26,7.87%), 13days (25,7.5%),10days (23,7%),6days (22,6.7%) 12days (21,6.36%),11days(12,3.6%),14days(9,2.7%),15days(5,1.5%),

16 days (2, 0.6%) and in least number of cases the antibiotic duration was for 18days (1, 0.3%) and 20 days (1, 0.3%)

Duration(Days)	Frequency	Percentage
4	1	0.30%
5	26	7.87%
6	22	6.70%
7	89	27%
8	56	17%
9	37	11.21%
10	23	7%
11	12	3.60%
12	21	6.36%
13	25	7.50%
14	9	2.70%
15	5	1.50%
16	2	0.60%
18	1	0.30%
20	1	0.30%

4. CONCLUSION

This study concludes critical patterns in surgical antibiotic usage, highlighting both effective practices and areas for refinement. The high compliance with WHO guidelines, particularly in the timely administration of preoperative antibiotics, has significantly contributed to reducing surgical site infections and enhancing patient outcomes. The predominant use of cephalosporin-based antibiotics reflects their broad-spectrum efficacy and role in promoting antimicrobial stewardship. Gender and age-based trends reveal a higher prevalence of surgical interventions among males and middle-aged adults, likely

attributed to occupational exposures, lifestyle factors, and delayed healthcare-seeking behavior. The substantial proportion of orthopedic and spine surgeries points to an increasing burden of musculoskeletal disorders requiring specialized care. Efficient surgical durations and well- structured postoperative antibiotic protocols reflect optimized workflows aimed at minimizing complications and hospital resource utilization. However, occasional deviations from established protocols emphasize the need for continuous surveillance, staff training, and quality improvement initiatives. Overall, these findings highlight the importance of judicious antibiotic use, adherence to evidence-based guidelines, and targeted interventions to curb antimicrobial resistance while improving surgical care outcomes.

Antimicrobial prophylaxes guidelines help prevent infections andreduceantibioticresistance. Their development, dissemination, and adoption ensure consistent, evidence-based care, improving patient safety and outcomes

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