Importance of surgical antibiotic prophylaxis to eliminate the risk of surgical site infections

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Abstract

Antibiotic prophylaxis can lower the incidence of surgical wound infections, however antimicrobial abuse and overuse raises both the cost and the selection pressure that favours the growth of resistant bacteria. Our major goal was to investigate the use of prophylactic antibiotics in various procedures across a large number of patients. [1]

A pre-tested proforma was completed, which contained information on patient characteristics, antimicrobial drug choice, route, timing, and total length of prophylaxis. Antibiotic prophylaxis was also evaluated in accordance with normal guidelines. Interventions are needed to encourage the creation, distribution, and implementation of evidence-based antimicrobial prophylactic guidelines. Findings support the use of antibiotics after surgery to prevent infections and corroborate the significance of SAP in lowering postoperative SSI across a variety of operations.

The findings of this scoping review have added to the evidence base that can be used to help build global guidelines to prevent SSI. However, high-quality systematic reviews and research that encompasses a wide range of demographics and contexts are required. Surgical site infections (SSIs) are infections that appear within 30 days of an operation or surgical wound infection surveillance. The objective of this study was to assess preoperative and postoperative antimicrobial uses. [2]

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1. INTRODUCTION

Antibiotics are described as "a chemical substance produced by micro-organisms with the property of suppressing the growth of bacteria or eliminating other micro-organisms," according to waksman.in a high-dilution situation. [3] Antibiotics are made through a fermentation process in which a large number of microorganisms and humans are allowed to develop in optimal conditions in the presence of growth media before being destroyed to produce antibiotics that can kill microorganisms when given at low concentrations. Apart from the above-mentioned industry procedure, they are natural compounds that can prevent microbial development in both animals and humans.[4]

Example-antibodies.

Antibiotics classification [5]

Penicillins - natural - penicillin G, penicillin VK

Penicillin resistant - methicillin, oxacillin, nafcillin.

Cephalosporins –

First generation -, Cephalothin Cefazolin (Ancef, Kefzol) Cephapririn Cephalexin (Keflex)

Second generation - Cefacor, Cefotetan (Cefotan) other

Third generation - Ceftriaxone (Rocephin) other

Fourth generation - cefpirome, cefipime

Fifth generation - Ceftarloine.

Floroquinolones- Ciprofloxacin (Cipro), Levofloxacin (Levaguin), Moxifloxacin, (Avelox)Norfloxacin

Aminoglycosides - amikacin, gentamycin, neomycin, tobramycin.

Monobactums - azetreonam

Carbapenams - meropenam, ertapenam, imienem.

Macrolides - azithromycin, clarithromycin, clindamycin, erythromycin.

Others - vancomycin, doxycycline, linezolid, tetracycline, rifampin, trimethoprim/sulfamethoxazole

Prophylactic use of antibiotics –

Pre-clinical manifestation antibiotics are used as prophylactics to prevent and suppress the formation of infection at the surgical site, which is known as prophylactic therapy. This treatment is used to fight against any infection-causing microbes. After surgery, targeted therapy is used to inhibit the recurrence of infection, and the entire course should be completed to avoid resistance. [6-7]

Prophylactic treatment of infection at surgical site –

Surgical site infection is an infection that develops in the area of the body where the incision was made following surgery. Sugical site infection can sometimes be a superficial infection that mostly affects the skin.[8] . Other ssis are more serious and can affect tissues beneath the skin, organs, or implants. Ssi varies based on the type of operation and the pathogen infecting the patient.[9]

Ssi is the most frequent type of hospital-acquired illness, and it is also the most preventable. It is the most significant unfavourable surgical outcome, and it is most commonly documented in low- and middle-income nations. [10]

Epidemiology Ssi is the third most frequent nosocomial infection, accounting for 14 to 16 percent of all infections. Nosocomial infections are the most prevalent among surgical patients. It is responsible for 20% of all HAIs in hospitalised patients. Up to 60% of ssis is thought to be avoidable if evidence-based guidelines are followed.

Each ssi is linked to an additional 7 to 11 days in the hospital after surgery. When compared to operational patients without a ssi, patients with a ssi had a 2 to 11 times IR risk. Ssi is directly responsible for 77 percent of mortality in patients with ssi.

The postoperative complication is usually seen between 7 to 10 days of the operation and is a life-threatening complication that affects the patient's quality of life and is related with higher morbidity and lengthening the hospital stay, which can result in financial hardship for the patient. The majority of ssi can be avoided. [11]

Causes

The causative organism is mostly depending on the type of surgery and the most commonly isolated organisms are

- ✓ Staphylococcus aureus
- ✓ Coagulase negative
- ✓ Staphylococci
- ✓ Entercoccus spp.
- ✓ E.coli

The majority of ssis are caused by microbial contamination at the incision site from the patient's own body after surgery. During surgery, infections produced by microorganisms from outside sources are less common than infections caused by the patient's own body flora.

Gram-positive cocci are the most common pathogens found on skin and mucosal surfaces. In the groyne and perineal areas, however, gramme negative areobes and anaerobic bacteria contaminate the skin. TABLE 1 [12]

Pathogen	Frequency (%)
Staphylococcus aureus	20
Coagulase negative staphylococci	14
Enterococci	12
e.coli	8
Pseudomonas auregnosa	8
Enterobacter species	7
Protease mirabilis	3

Klebsiella pneumonia	3
Other streptococci	3
Candida albicans	3
Group d streptococci	2
Other gram positive aerobes	2
Bacteroids fragilis	2

Risk factors

- ✓ Surgery that lasts more than 2 hrs
- ✓ Having other comrobid conditions.
- ✓ Being an elderly adult
- ✓ Obesity
- ✓ Smoking
- ✓ Cancerous patient
- ✓ Weak immue system.
- ✓ Undergone any emergency surgery

TYPES

Surgical wounds are divided into four kinds by the American College of Surgeons–National Surgical Quality Improvement Program (ACS-NSQIP): clean, clean/contaminated, contaminated, and dirty wounds. [4 Surgical wounds are divided into four kinds by the American College of Surgeons–National Surgical Quality Improvement Program (ACS-NSQIP): clean, clean/contaminated, contaminated, and dirty wounds.

CLASS I – CLEAN

In which surgical procedures are clean and in which disinfection of operative field is controlled .This class of lowest rate of wound infection .antibioticsare not used as prophylactiically but in case of operation time greater than 4hrs or breaks in sterile techqnique , the infection rate may rise considerably . example in case of class1 complicated procedure such as CABG which may have infection rate of 5% or even higher even though antibiotics is given .

CLEAN- Elective , non traumatic surgery **,** no viscera or tract entered , no infection at the site ,no break -in techqnique i.e,these arenot inflamed or contaminated wound so that there is no involvement of surgeries on an internal organs.

EXAMPLES- herniorrhaohy, mastectomy, cosmetic surgery . [13]

CLASS II- CLEAN- CONTAMINATED- in which surgical procedures are clean contaminated which involve cutting across mucous membrane electively where the minimal spillage of contents takes place . antibiotics is considered higher than the class I surgery because the rate of wound infection is higher than that the class I surgery and ranges from 8% to 29% depending on the type of procedure.

EXAMPLES – Hysterectomy and elective intestinal surgery. [14]

CLEAN -CONTAMINATED - Elective surgery with opening of any viscera/ tract but minimal spillage, no contact with infected material, minor break-in technique ,these have no evidence of infection at the timeof surgery but do involve surgeries on internal organ.

EXAMPLES – Laryngectomy, uncomplicated appendectomy, cholecystectomy, transurethral resection of prostate gland.

CLASS III – CONTAMINATED - in which surgical procedures are contaminated which involve perforation of inflamed tissue where infection is already present or where excessive spillage from a viscous occurs .

CONTAMINATED – Gross spillage from GI-tract .the opening of the infected biliary or genitourinary tract , penetrating injury <4 hr old , grafting on the chronic open wound , a major break-in technique , these involve the opearting on an internal organs where the spilling of contents from the organ into the wound take place.

EXAMPLES – Large bowel resection , biliary or genitourinary tract surgery with infected bile or urine.

CLASS IV – DIRTY in which surgical procedures are dirty which involve gross purulence is encountered .

DIRTY – opening of abscess or purulent site , preoperative penetrating injury >4hrs, these are wounds in which a known infection is already present at the time of surgery .

GUIDELINES

antimicrobial Prophylaxis for Surgery: An Advisory Statement from the National Surgical Infection PreventionProject (NSIPP), 200.

Antibiotic choice - Cefazolin, cefuroxime, or cefamandole If the patient has a beta-lactam allergy, vancomycin or clindamycin.

Dose - Cefazolin IV: 1-2 gm (20-30) mg per kg standard dose. If < 80 kg, use 1 gm; if > 80 kg, use 2 gm. End stage renal disease t½ = 40-70 hours.

Cefuroxime IV: 1.5 gm standard dose, 50 mg/kg adjusted dose. End stage renal dis-ease t½ = 15-22 hours. Cefamandole IV: 1 gm standard dose. End stage renal disease t½ = 12.3-18 hours.

Vancomycin IV infusion: 1 gm over 60 minute standard dose, 10-15 mg per kg (adult) adjusted. End stage renal disease t½ = 44.1-406.4 hours.

Clindamycin IV: 600-900 mg standard dose. If < 10 kg, use at least 37.5 mg; if > 10 kg, use 3-6 mg/kg. End stage renal disease t½ = 3.5-5.0 hours

Duration of antibiotic use - 24 hours or less. [30]

The Society of Thoracic Surgeons (STS) Practice Guideline Series: Antibiotic Prophylaxis In Cardiac Surgery, 2006-2007b

Antibiotic choice - Cefazolin

If presumed or known MRSA colonization, vancomycin (1-2 doses) + cefazolinIn

if patients with beta-lactam allergy, vancomycin (up to 48 hours) + aminoglycoside (1 pre-operative and 1 post-operative dose)

Dose - Cefazolin IV: 1 gm pre-operative prophylactic dose; for a patient > 60 kg, 2 gm is recommended.

Vancomycin IV infusion over 1 hour: dose of 1-1.5 gm or a weight-adjusted dose of 15 mg per kg

Aminoglycoside IV; (usually gentamicin, 4 mg per kg) in addition to vancomycin prior to cardiac surgery.

Duration antibiotic use - 48 hours or less. [31]

2. METHODOLOGY

Study site -

The proposed study was conducted at inpatient wards of general medicine and surgery department of KIMS hospitals hyderabad.KIMS hospital is a 300 bed multi speciality tertiary care hospital having various department like general medicine, surgery, pediatrics,

Psychiatry, pulmonology, Neurology, Nephrology, Ophthalmology, Gastroenterology, Skin, Orthopedics, Urology, Obstetrics and Gynecology, Ear, Nose, and Throat[ENT] and Sexually Transmitted Diseases[STD] and Radiology. Medicine and surgery departments accommodate about 200 patients in each department. Patients are admitted either from the outpatient, emergency and casualty departments or transferred from the wards of other clinical specialties to above departments.

STUDY DESIGN-

The present study was Retrospective Observational Study.

STUDY DURATION-

The was conducted over a period of six months from December 2021 to May 2022.

STUDY CRITERIA-

INCLUSION CRITERIA

Age – of all groups

Gender – including both genders
Case specificity – patients with planned surgeries .

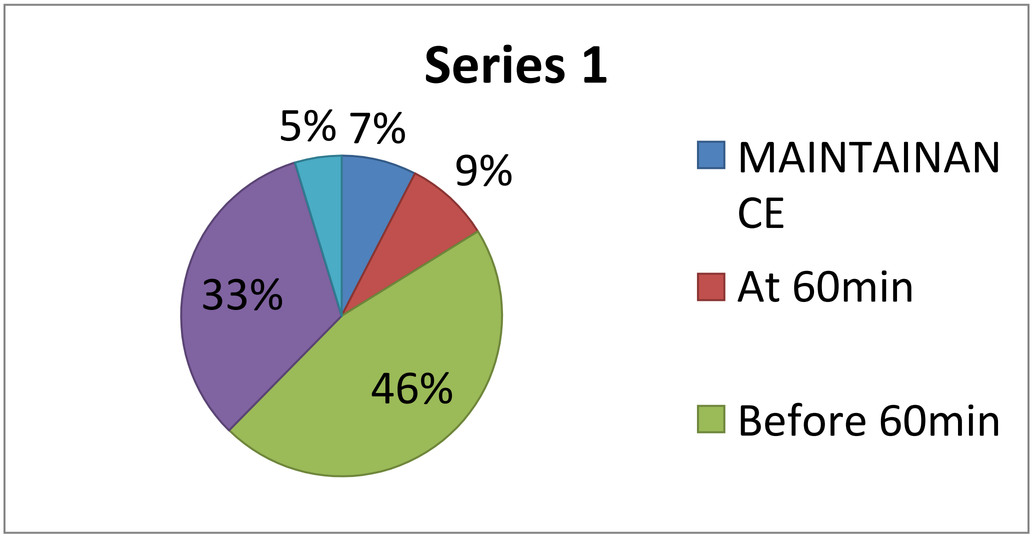
EXCLUSION CRITERIA

Immunocompromised patients
Sepsis
Patients on immunosupressants
Congenital or acquired immunogenicity.

RESULTS

TIME	**NO.OF PATIENTS**
MAINTENECE	37
AT 60MIN	42
BEFORE 60MIN	226
AFTER 60 MIN	167
AT INSCION	23

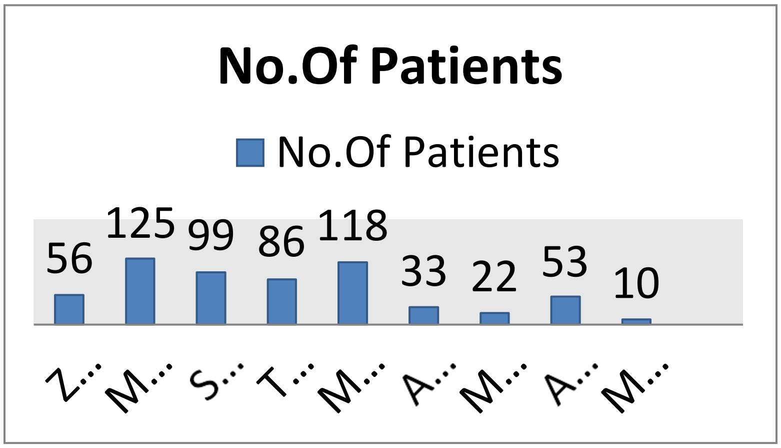
ANTIBIOTICS GIVEN TIME



ANTIBIOTICS USED

ANTIBIOTC	NO. OF PATIENTS
ZOSTUM	56
MONOCEF	125
SUPACEF	99
TAXIM	86
MAGNEXFORTE	118

AUGMENTIN	33
MEROPENAM	22
AMIKACIN	53
METROGYL	10



3. DISCUSSION :

In the present study conducted on 720 patients it was found that the most of the patients treated with antibiotics were of age-group 30 – 40(26%) age group, followed by age group.60-70 (17%) Young adults were prescribed less when compared to geriatric patients. It was also founded that male were given with more antibiotics when compared to females. Patients with age group 30-60 were prescribed more antibiotics (48.5%) and patients below age 12 were given least antibiotics (8.5%).

In the study conducted, it was found that the most commonly prescribed antimicrobial class was Cephalosporins (52.1%), fluoroquinolones (18.62%), macrolides (8.27%). According to Siavash Shahbazi Nia et.al at 2018, the most commonly prescribed class of antimicrobials were cephalosporins (91.4%), followed by fluoroquinolones (28.7%), then anti-fungals (26%).

From the present study it was also founded that the most prescribed drugs class at the time of discharge was cephalosporins (34.17%), followed by fluoroquinolones (17.72%) The most prescribed anti-microbial was found to be monocef (17.8%), then magnex forte(16.8%) supacef (14.1%), taxim (12.2%), zostum (8%), amikacin (7.57%) , augmentin (4.71%), meropenem (3.14%) .metrogyl (1,42%).

In the study conducted, it was found that antibiotics were mostly given in iv route when comoared to other routes of administration . the percentage was found to be IV (92%) ORAL (5%) MAINTAINENCE DOSE (3%).

In the present study , the antibiotic given time was found to be

At 60min – 15%

Before 60 min – 32%

After 60min – 23%

At inscion – 6%

According to the standard American guidelines of surgery , antibiotic has to be administered 30min to 60 min prior to the inscion to prevent surgical site infections. In this study , out of 700 patients 70% of them were administerd antibiotics at coreect time according to the guidelines provided.

4. CONCLUSION

An efficient management technique for lowering postoperative infections is surgical antibiotic prophylaxis, offered that the right antibiotics are administered at the proper time for both for the right surgical procedures and the right lengths of time.Surgery antibiotic prophylaxis is typically administered as a once the patient has stabilised, administer a single intravenous dosage prior to a skin incision while under anaesthesia. It is crucial to usea focused antibiotic that is suitable for the surgical location.Guidelines for hospital surgical antibiotic prophylaxis should periodic evaluations, as both the price of individual medicinesConsidering the prevalence of microorganisms with multiple resistance in specific units or Hospitals are frequently changing.

An evidence-based prophylactic antibiotic regimen would probably result in significant savings on antibiotic costs without raising patient risk . A technique like this one might help lower the cost of treating SSI brought on by resistant pathogens. It should be highlighted that such a methodology couldn't be created without sensitivity test programme. But there should be substantial thought put into moving to a single prophylactic pre-operative dose plan. This simple adjustment in procedure might result in a large cost decrease and possibly slow the emergence of infections with heightened resistance.

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