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A PROSPECTIVE STUDY ON ANTIMICROBIAL PROPHYLAXIS USE IN ORTHOPEDIC SURGICAL INPATIENTS AT A TERTIARY CARE HOSPITAL

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ABSTRACT

Introduction: Surgical Antimicrobial Prophylaxis plays a crucial role in prevention of Surgical Site Infections which are potentially preventable and are multifactorial in nature. **Materials and Methods:** A prospective, observational, single centre study was conducted on 165 patients to study the administration of surgical antimicrobial prophylaxis and incidence of surgical site infections. **Results:** Most common surgeries were Knee Replacement, Hip replacement, Open Reduction Internal Fixations, and Closed Reduction and Manipulations. The most utilized drug irrespective of surgical procedure was found to be cefuroxime at 1.5 grams, both preoperatively and post operatively. Out of 165 patients, 9 patients showed signs of SSI (incidence rate:5.45%), while others had healthy wound recovery. **Conclusion:** The prevention of SSIs, while accounting for significant risk factors, avoiding increased postoperative hospital stay and escalated expenses justifies the adoption of the practice of antimicrobial prophylaxis and employment of a parameter-based detection and treatment.

KEYWORDS

surgical site infection, surgical antimicrobial prophylaxis, orthopedic surgery, incidence.

INTRODUCTION

SSIs are the most common cause of nosocomial infections and the most common cause of mortality after surgery. SSIs have always proven to be detrimental and can occur as problematic infections in 3% to 10% of cases. Their occurrence inevidently lead to side effects and increases healthcare costs. [1]

Surgical site infection is defined as an infection that occurs within 30 days after the operation and involves the skin and subcutaneous tissue of the incision (superficial incisional) and/or the deep soft tissue (for example, fascia, muscle) of the incision (deep incisional) and/or any part of the anatomy (for example, organs and spaces) other than the incision that was opened or manipulated during an operation (organ/space). [14]

They are potentially preventable major sources of post-operative morbidity and remain the most common surgical complication. WHO Statistics suggest that 10 in every 100 surgical inpatients are prone to developing health care associated infections. [2]

As per the Centre for Disease Control and Prevention's (CDC) National Nosocomial Infections Surveillance System (NNIS), SSIs can be classified as: **Incisional** (Superficial, involving only skin or subcutaneous tissue or Deep, involving fascial and muscle layers), and **Organ/space** (involving any anatomical site other than incision site) [3]

The SSIs can be mainly caused by a lot of factors, such as through hospital staff, other patients, IV drugs, blood products, air, apparatus, and fomites. The major inflicting pathogen in orthopedic surgeries was found to be *Staphylococcus aureus,* and the prevalence of MRSA continues to be on the rise.

The fungal infections are caused in immunocompromised individuals due to *Aspergillus spp* and *Candida albicans.* Such infections lead to increased length of postoperative hospital stay, drastically escalated expenses, higher rates of hospital readmissions, and jeopardized health outcomes. Hence, to prevent any potential infections, we must adopt the practice of antimicrobial prophylaxis. [2]

The aim Surgical Antimicrobial Prophylaxis (SAP) is to prevent the occurrence of infection. Therefore, the goals of prophylactic or therapeutic administration of antibiotics in surgical patients should include:

- Their use in a manner that is supported by evidence of effectiveness,
- Minimization of the effect of antibiotics on the patient's normal bacterial flora
- Minimization of adverse effects,
- Ensuring minimal change to the patients host defenses. [4]

The choice of antibiotic depends on the most encountered pathogen, the type of operation, the likelihood of development of resistance, and financial costs involved. Ensuring the right indication, the right antibiotic at the right dose, proper administration route with the right timing and duration. [5][6]

SSI Risk Factors:

The incidence of Surgical site infection depends inherently upon both patient and procedure related factors.

- Patient related: age, nutritional status, diabetes, smoking, obesity, co-existing infections at distal body sites, colonization by resistant species of microorganisms, altered immune responses, and length of perioperative stay. [3]
- Operation/procedure related: Duration of surgical scrub, perioperative skin preparation, shaving, duration of operation, antimicrobial prophylaxis used, operating room ventilation, instrument sterilization, prosthetic implantations, surgical techniques and drains. [3]

Surgical Antimicrobial Prophylaxis (sap):

Surgical antibiotic prophylaxis (SAP) is among the most important of pillars of SSI prevention and is, to put simply, the prevention of infectious complications by administering an effective antimicrobial agent prior to patient's exposure to contamination during surgery. [10] The practice is also defined as “the rational, safe and effective use of antimicrobial agents for the prevention of (initial) SSIs” [11] or as “the use of antibiotics to prevent postoperative infection”. [12] It doesn't

include pre-operative decolonization or treatment of pre-existing infections.

However, SAP is often used inappropriately in many settings around the world and this misuse diminishes patient safety and increases acquisition and transmission of antimicrobial resistance (AMR) in the case of surgical procedures. Inappropriate SAP mainly consists of incorrect antibiotic choice, dose, timing or route of administration or duration. The results of a WHO global survey conducted in 2014 showed that the practice of inappropriate SAP duration is indeed a major problem worldwide, wherein the prolongation of prophylactic antibiotic therapy beyond international standards (that is, one pre-operative dose and repetition during the intervention if necessary, according to specific criteria) in 43.5% of procedures on average was observed. [13]

The classification system by the National Research Council (NRC) is usually the primary determinant which warrants whether antimicrobial prophylaxis is to be initiated or not.

Scheduling Antibiotic Administration:
Two principles must be considered:
(a) the agents should be administered to the patient prior to the initial surgical incision,
(b) bactericidal antibiotic concentrations should be maintained at the surgical site throughout the operation/procedure.

Although a lot of scientific models have demonstrated that a single dose of antimicrobial maybe efficient and cost effective, longer lasting operations often require intra-operative doses of antibiotics to maintain adequate drug levels to last throughout surgery. [7][8]

The antibiotic agent must be selected based on the drugs pharmacology, microbiology, clinical experience and economic burden on patient. As seen in surgical practice, most of the orthopaedic surgeries are clean by definition and therefore, prophylactic antibiotics generally are indicated only when prosthetic materials are to be implanted (such as pins, plates, and artificial joints). A surgical infection complication in these cases may lead to significant morbidity or failure of the implant. [9]

MATERIALS AND METHODS:

Aims:
1. To study the dosage, timing and duration of administration of antimicrobials used for prevention of infections in pre- and post-operative orthopedic surgical patients.
2. To study the incidence of surgical site infections (SSIs) in the orthopedic surgical patients.

Inclusion criteria:
1. All patients who underwent orthopedic surgeries requiring antimicrobial prophylaxis during the study period.
2. Patients older than 18 years and younger than 80 years of age.
3. Patients undergoing both elective and non-elective surgeries.

Exclusion criteria:
1. Post-operative follow-up procedures. (Suture/implant removal, irrigations, debridement surgery).
2. Patients below 18 years and above 80 years of age.
3. Patients undergoing surgery with pre-existing infection.
4. Pregnant women.
5. Patients allergic to specific antibiotics.

A prospective, observational study was conducted on antimicrobial prophylaxis of orthopedic surgical inpatients in a tertiary care hospital from June 2021 to March 2022, on 165 orthopedic surgical patients, after obtaining the approval of the Research and Ethics Committee.

Medical records, along with physician notes of all patients undergoing orthopedic surgery was collected in a data collection form and patient's follow-up was done post-surgery to evaluate post- operative usage of antibiotics. All the surgical patients during the study period were regularly observed during their hospitalization by their respective physician/surgeon and his team. The patient's in-ward progress charts were monitored closely by the investigators, from the time of admission till the date of discharge.

The administration of surgical antimicrobial prophylaxis aims to eradicate the presence of any post-operative SSIs. In case, as this development is pretty multi-factorial in nature, there might be an occurrence of an infection. Therefore, the incidence of SSIs, if any, were studied for 72 hours or until discharge. The components used to track presence of surgical site infections in the hospital are as follows: Presence of fever (>100.4-degree Fahrenheit- for 3 readings within 24 hours), Purulent discharge from the surgical site, pain at the surgical site >=3, tenderness/localized swelling, if culture is sent from the surgical site, and the changes observed in the TLC from the baseline (10% change). In case of a suspected wound infection, sample was taken from the surgical site and transported to the microbiology laboratory for culture and sensitivity testing.

The collected data was assessed and patients were categorized based on various risk factors that were pre-disposing in orthopaedic surgeries. Statistical analysis tools like Microsoft Excel were used to consolidate the information and generate the results.

Data Confidentiality: The Identity of Patient, Physician/consultant and Organization/Institution to be strictly kept confidential when the results are published, as mentioned in the approval letter by Apollo Research and Innovations – Ethics Committee.

RESULTS

Out of 165 patients, 81 (49.1%) were Male and 84 (50.9%) were Female. The patients aged between 56-65 years old are identified as the riskier age group undergoing orthopaedic surgeries being at a frequency of 57 patients.

While this study had 3% patients in the underweight population, and 29.6% falling into the normal BMI category; we observed that a significant number of patients have abnormal BMI out of which 34% of patients are categorized as overweight and 25.4% of them as Obese.

Hypertension, as a comorbidity was found in a total of 67 cases throughout the study whereas DM was seen in 31. Hypothyroidism, Rheumatoid arthritis (RA) and coronary artery disease (CAD) is seen in 24, 12 and 11 cases, respectively.

The major orthopedic surgeries that were performed during the period were Knee Replacement (77 patients), Open Reduction Internal Fixations (ORIF) (25 patients), Closed Reduction and Manipulations (15 patients), K-Wire fixation (14 patients) and Hip replacement (9 patients). Most of the operations among these were Elective (57.3%), and the rest were Semi-Elective (42.7%).

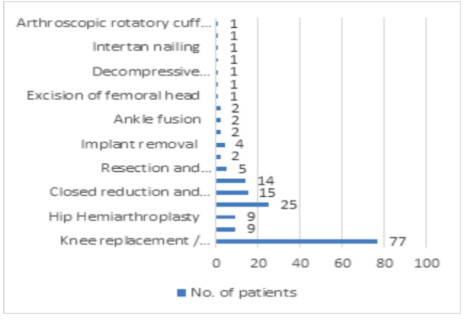

Figure 1 - Distribution of patients based on surgical procedure

The most utilized drug irrespective of surgical procedure for Pre-op SAP was found to be cefuroxime at a dose of 1.5 grams. The second mostly used drug is Cefoperazone + Sulbactam at a dose of 3 grams followed by Teicoplanin at a dose of 400 mg. We see that Cefuroxime at a dose of 1.5gram has been utilized in majority of the TKRs, closely followed by Teicoplanin at 400mg and Cefoperazone + Sulbactam at a dose of 3grams. In THRs, the most commonly used drug was seen to be Teicoplanin 400mg along with Amoxicillin + Clavulanate Potassium at a dose of 1.2grams. In ORIF surgeries, Cefuroxime at a dose of 1.5 grams was mostly used followed by Cefoperazone + Sulbactam at a dose of 3grams. In CRIF surgeries Cefuroxime 1.5 grams and Ceftriaxone at a dose 2 grams have been utilized at the same frequency. In K-Wire fixation, Ceftriaxone 2grams was mostly used.

The Antibiotic Prophylaxis was administered 15 minutes before the surgical procedure in 21.2% of the surgeries. The antibiotic prophylaxis was given 20 minutes before surgery in 17.5% of orthopedic cases, and was administered 30-55 minutes before surgery

in 19.3% of all orthopedic surgical procedures. The SAP was administered 60 minutes or more prior to the induction of surgery in 4.2% of the patients.

It is conclusive that the majority of patients were administered antimicrobials for 2-4 days (in 69% patients). Rarely, they exceeded their hospitalization stay for more than 7 days.

The most utilized drug irrespective of surgical procedure for post-operative SAP was found to be cefuroxime at a dose of 1.5 grams IV. The next most utilized drugs were Cefoperazone + Sulbactam at a dose of 1.5 grams IV, and Tab Cefuroxime at 500 mg.

In the study, 94.4% of patients had a healthy wound recovery with no signs of any infection while hospitalized. On the other hand, a comparatively small percentage of 5.6% patients showed signs of SSIs. The occurrence of SSIs was tracked based upon presence of fever, purulent discharge from the surgical site, pain at surgical site, tenderness or localized swelling, change in TLC from baseline, and any culture tests that were done for the suspected infection at the surgical site.

Table 1 – Distribution based on Pre-op SAP used

PRE-OPERATIVE SAP	NO. OF PATIENTS
Cefoperazone + Sulbactam 1g	1
Cefoperazone + Sulbactam 1.5g	9
Cefoperazone + Sulbactam 2g	5
Cefoperazone + Sulbactam 2.5g	2
Cefoperazone + Sulbactam 3g	42
Cefuroxime 750mg	1
Cefuroxime 1g	2
Cefuroxime 1.5g	66
Cefuroxime 2g	2
Cefuroxime 3g	1
Amikacin 500mg	12
Teicoplanin 400mg	38
Amoxicillin/clavulanate potassium 1.2g	13
Ceftriaxone 1g	5
Ceftriaxone 2g	21
Ceftriaxone 3 g	1

The drug most prescribed upon discharge was Cefuroxime at a dose of 500mg PO BD given in 89.6% of the discharged patients. The next most prescribed drug given in 9.69% of study population is Tab. Amoxicillin + Clavulanate Potassium 625mg PO BD. The other drugs were sparingly used. The no. of days that were mostly recommended for discharge antibiotic therapy was 5 days (108 patients); followed by the duration of 7 days (49 patients).

Incidence rate of SSIs:

The SSI rates per 100 operative procedures are calculated by dividing the number of SSIs by the number of specific operative procedures and multiplying the results by 100.

Incidence rate

= (New Cases / Population under study) x 100
= (9 / 165) x 100)
= 5.45%

The incidence rate of SSIs in our study was found to be 5.45%.

DISCUSSION

Surgical Antimicrobial Prophylaxis is common in orthopaedic surgeries such as Hip and Knee Arthroplasty, Spine surgery, and Open reduction and Internal fixation of fractures; as it is a very effective therapy in decreasing SSIs. To ensure that we reap the maximum benefits of SAP while minimizing adverse effects, the best antimicrobial agent available must be selected at an appropriate dose, and must be administered before incision, keeping in mind that the recommended duration of administration of SAP is 24 hours. SAP is administered as an adjunct to modulate intra operative contamination of the surgical wound. This Antibiotic should be safe and have the smallest impact possible on the normal bacterial flora of the patient. [15]

Our study revealed 67.2% of the patients that have undergone orthopaedic surgeries had an abnormal BMI consisting of 34% of overweight patients and 25.4% of obese patients. There were no patients in morbidly obese category.

In a similar study conducted by Anouk et al 2019, found that 40% of patients undergoing surgery were overweight, 27% had obesity and 2% were morbidly obese. A defined trend of increasing SSI risk proportionate to increasing BMI was observed for almost all surgery types. [16] It was also concluded that overweight people seem to be

Table 2 - Classification of SSI developed patients based on risk factors

	Patients developed surgical site infection (n=9)								
SSI developed patients	1	2	3	4	5	6	7	8	9
Age	52	45	57	50	70	59	50	50	65
Gender	Female	Male	Female	Male	Female	Male	Male	Female	Female
BMI	30 (obese)	28 (overweight)	34 (obese)	34 (obese)	30.3 (obese)	30 (obese)	22.2 (normal)	22.6 (normal)	28.8 (overweight)
Surgical Procedure	Bilateral Total Knee Replacement	Right Intertan Nailing Femur	Bilateral Total Knee Replacement	Open Reduction and Internal Fixation Right Distal Femur and Left Distal Radius	Bipolar Hemiarthroplasty of Right Hip	Left Total Hip Replacement	Right ankle Implant, Open Reduction Internal Fixation	Bilateral Total Knee Replacement	Right total Hip Replacement
Urgency of Operation	Elective	Semi Elective	Elective	Semi Elective	Semi Elective	Elective	Semi Elective	Elective	Elective
Infection at remote site	-	-	-	-	UTI	-	-	-	-
Diabetes	No	Yes	No	Yes	Yes	Yes	No	No	No
Hypertension	No	No	No	Yes	Yes	Yes	No	No	No
Malignancy	No	No	No	No	No	No	No	No	No
Foley's Catheterization	Yes	Yes	Yes	Yes	Yes	Yes	No	No	Yes
Drain inserted	No	No	No	Yes	No	No	No	Yes	Yes
Implants	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes
Duration of surgery	1 hr 40 min	1 hr 10 min	2 hrs 45min	2 hrs 10 min	1 hr 5 min	3 hrs	1 hr 10 min	1 hr 30 mins	1 hr
No. of antimicrobial prophylactic drugs	1	1	2	1	1	2	1	1	1

Name, dose, route of antimicrobial prophylaxis	Inj.Cefoperazone +Sulbactam 2g IV	Inj.Cefuroxime 1.5g IV	Inj.Cefoperazone + Sulbactam 3g IV Inj Amikacin 500mg IV	Inj.Cefoperazone +Sulbactam 3g IV	Inj.Cefuroxime 3g IV	Inj. Cefuroxime 2g IV Inj Amikacin 500mg IV	Inj.Cefoperazone + Sulbactam 2.5g IV	Inj.Cefuroxime 1.5g IV	Inj.Cefoperazone + Sulbactam 1.5g IV
Duration of hospital stay	4 days	4 days	4 days	4 days	4 days	3 days	3 days	23 days	3 days
No. of days after surgery showed SSI	1 day	2 days	2 days	2 days	2 days	1 day	1 day	3 days	2 days
Class of surgical site infection	Superficial and incisional	Superficial and incisional	Superficial and incisional	Superficial and incisional	Superficial and incisional	Superficial and incisional	Superficial and incisional	Superficial and incisional	Superficial and incisional
Culture & sensitivity	-	-	-	-	E.Coli	-	-	Streptococcus beta hemolyticus	-
Organism sensitive to drugs	-	-	-	-	Amikacin, Gentamyci, Colistin, Tigacyclin	-	-	Ceftriaxone, cotrimoxazole,amoxicillin, linezolid and vancomycin	-
Organism resistant to drugs	-	-	-	-	Ceftriaxone, Cotrimoxazole, Ampicillin	-	-	Erythromyci, tetracyclin, clindamycin, levofloxacin	-
Antibiotics prescribed to treat SSI	T.Cefuroxime 500mg PO BD 2 days, then resolved SSI	Inj.Cefoperazone + Sulbactam 1.5g IV BD fever reduced in 2 days	Inj.Cefoperazone + Sulbactam 1.5g IV BD fever reduced in 2 days	Inj.Cefoperazone + Sulbactam 1.5g IV BD	Inj.Ciprofloxacin 200 mg/ 100ml IV BD Cefoperazone + Sulbactam 3g IV BD InjAmikacin 1g IV OD	T. Cefuroxime 50mg PO BD	Inj.Cefoperazone + Sulbactam 1.2g IV BD	Inj.Cefoperazone + Sulbactam 3g IV BD, then Inj cefazolin 2 g IV TID for 3 weeks	Inj.Cefuroxime 1.5g IV BD
Was the patient on post-up antibiotic prophylaxis when SSI detected	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

strongly over represented among the patients requiring orthopedic surgeries as per another study by OM Bostman et al 1994. [17]

Comorbidities, which represents a concomitant disease that a patient may have along with the one that warrants orthopedic surgery. Among the patients in our study the most common ones were HTN and DM.

In a study that was done by Belene *et al* 2018 states that presence of comorbidities increases the short-term risk of hospital re admissions and mortality. The long-term impact on post-surgery body function, quality of life and the pain experienced by the patients was found to vary across different comorbid conditions. For example, of all the patients that had undergone Hip or Knee replacement surgeries in this study, 83.7% of patients had at least one comorbid condition. [18]

The Malaysian National Clinical Practice guidelines on rational use of antibiotics in orthopedic surgery recommends the combination of cloxacillin and gentamycin as first choice, 2nd generation cephalosporins as second choice of antibiotics in arthroplasty and ORIF of fractures. Yeap *et al* compared 2nd and 3rd generation Cephalosporins of SAPs, and found that Cefuroxime (2nd generation cephalosporin) was used in 52.7% cases and cefoperazone or ceftriaxone (3rd generation cephalosporin) was used in 47.3% of ORIF surgeries. When it came to patients undergoing arthroplasty, Cefuroxime (2nd generation cephalosporin) was used in 11.8% cases, while the rest of the arthroplasties used Ceftriaxone and cefoperazone (3rd generation cephalosporins). This study concluded that the most popular SAP is comprised mainly of Cephalosporins; 3rd generation cephalosporins being used for arthroplasty, and 2nd generation cephalosporins being used for fracture fixation. [20]

When we studied the distribution based on pre-operative SAP used for all orthopedic surgeries during our study period, the most utilized drug irrespective of surgical procedure was found to be cefuroxime at a dose of 1.5 grams. The second most commonly used drug was Teicoplanin at a dose of 400 mg, followed by Cefoperazone + Sulbactam at a dose of 3 grams. The use of Ceftriaxone 2grams was also widely seen. All of these drugs were given via IV route. The study conducted by Ish Kumar *et al* 2015 stated that Pre-operative SAP is very important to ensure adequate Antimicrobial drug concentration. It must also be noted that experts report initiation of SAP after the skin is incised to be an ineffective practice. [19] Stefansdottir A *et al* 2009 puts forth the consideration that SAP must be administered 30 minutes before skin incision and administration practices that use SAP greater than 60 minutes before surgery or incision are usually associated with higher risk of SSI. [21] Therefore, as said by Thonse R *et al* 2004, most of the studies agree that SAP should ideally be initiated 30-60 minutes before surgery as antibiotic concentration typically appears in the blood and bone within 20 and 60 minutes respectively, and it is needed that they be maintained above the MIC of the pathogens until the cessation of the surgery. SAP has the least effects when given after the application of the tourniquet post-surgery. [22] Our study was consistent with global trends.

Our patients were also initiated on post-operative prophylaxis which can be compared with the concept of prolonged surgical antibiotic prophylaxis, PSAP use (defined as administration of SAP greater than 24 hours after elective orthopedic surgery), which was found to be 12% in a study conducted by Felix R et al 2021. The patient related factors that influenced PSAP were older age (greater than 58 years), higher BMI, presence of comorbidities, longer duration of surgery (greater than 60 minutes), nature of surgery (prosthetic surgery) and presence of drains. The frequency of PSAP administration ranged between 0-33% in this study. [23]

Once the post-operative SAP was discontinued in the hospital, all the patients in our study were prescribed oral anti-microbial prophylactic drugs. In a study done on patients undergoing THA and TKA, there was no difference found in the rate of infection between prophylaxis given for 24 hours and 7 days post-surgery. There is also reasonable evidence available stating that a properly single dose antibiotic prophylaxis might be sufficient to prevent SSIs. [24]

When the practice of using extended oral antibiotic prophylaxis in

orthopedic patients is observed, it substantially reduces the SSI rates in THA and TKA. This is backed by the evidence of a retrospective cohort study performed on 2,181 TKA and THA surgeries wherein extended oral antibiotic prophylaxis for 7 days after discharge was prescribed for patients undergoing the mentioned prosthetic surgeries, as they are at a higher risk of developing PJI (prosthetic joint infections). The benefits of implementing this therapy of extended oral SAP weighed adequately against potential consequences such as development of AMR (antimicrobial resistance). [25]

Following all the parameters of our study that were discussed above, the SAP was initiated in surgical in patients of our tertiary care hospital and the occurrence of SSIs in these patients was tracked. Out of 165 patients, 151 (94.2%) of patients had a healthy wound recovery with no signs of any infection. On the other hand, a comparatively small fraction of 9 (5.8%) of patients showed signs of SSIs.

In the study conducted by Charles E *et al* 2019 which considered impact of patient comorbidities on SSIs, within 90 days of THA, TKA and revision TJR; the comorbidities that were found to be correlated with SSI occurrence were diabetes, congestive heart failure, coagulopathy, metastatic cancer, immunodeficiency syndrome and paralysis. [26] In another study conducted by AP Meijs *et al* 2015, BMI was considered a potential risk factor for the development of SSIs. Their study concluded that for most surgical procedures, obese and morbidly obese patients had at least 1.3 times more risk of SSIs when compared to normal weight patients. A pattern of increased risk of SSI along with increasing BMI from normal to morbidly obese was observed. This was more significant in surgeries with clean wounds with relative risk for morbidly obese patients to develop an SSI, and was found to range up to 7.8 times for deep incisional SSIs in THAs [27]

Although we cannot reveal a clear pattern that can differentiate males and females in relation to SSIs, emphasis should be placed on differences in male and female micro biome composition, as well as considering individual underlying comorbidities.[28] SSI commonly complicates surgical procedures in older people and is associated with substantial attributable mortality and costs. Old age (greater than 60 years), hypertension, diabetes mellitus and type III incisions (when compared to type I and type II incisions) were independently identified as risk factors for SSI after orthopedic surgery. The same study hypothesized that when compared with upper limbs and hands, surgery done on lower extremities had a comparatively lower risk of infection, while spine and joint surgeries did not have increased risk when compared to foot surgery. [29]

Asymptomatic Bacteriuria (ASB), has been associated with superficial and deep joint infection and is therefore considered as an independent risk factor for PJI. This might be the reason why urinary catheterization is linked to SSIs in THAs, with higher risk of sepsis within 5 days of surgery. While ASB did not result in direct seeding of microorganisms to the surgical site, it is a risk factor for infection by gram negative organisms. As a result of these conclusions, an antibiotic cover is given for urinary catheterization. [24] When the above study is correlated with our study practices, we observed that Inj. Gentamycin 60mg IV STAT was always administered to patients prior to Foley's removal.

These risk factors are elucidated in detail in table 2, wherein the 9 patients who developed SSIs were studied, they were monitored for the presence of any risk factors that predisposed them to an infection. The risk factors were identified as age, BMI, presence of infection at remote area, diabetes, malignancy, Foley's catheterization, insertion of drains, implants/prosthetics, duration of surgery, no. of SAP drugs and the mode of administration, timing prior to surgery at which SAP was given and duration of hospital stay.

CONCLUSION

We understand that the development of SSI is a multi-factorial dependent process, which can again be influenced by factors not related to the patient as well. Such as, staff involvement, surgical technique used, and the surgical environment. In this study, we were able to examine mostly patient related factors that may lead to SSI occurrences i.e., BMI, DM, HTN, Malignancy and infection at remote site. Careful monitoring of these influencing factors by the Clinical Pharmacist can be beneficial in prevention and/or treatment of SSIs post-surgery.

The percentage utilization of SAP according to the most common orthopedic surgeries was calculated in terms of drug choice, dose, time of administration and duration of treatment. Doses of antibiotics are rightfully prescribed, as they were congruous with other tertiary care hospitals. Therefore, dose compliance rate is hypothesized to be 100%. Time of administration is important for drugs that are administered through IV, since their onset of action is rapid and attains peak plasma concentrations faster than oral drugs.

Our study emphasizes the importance of the practice of implementing SAP in order to avoid SSIs and other serious issues like antibiotic resistance. Although this study majorly compares the percentage utilization of antibiotics to the recommendations followed by hospitals majorly in developed countries, this study may serve an important role to define trends in other hospitals in our developing country which are not established on a large scale. This study may serve as a reference to analyze the recent practices that are being adopted by experienced orthopedic surgeons. Correlation of the same with the number and degree of SSI incidence is helpful as well. By continuous efforts, educating and conducting workshops in different settings, we assume that the overall percentage utilization of SAP will increase in the coming years. This can hope to decrease the length of hospital stay, socio-economic burdens, post-surgical morbidity and mortality.

Based on Publication Policy:

The data collected is analysed after obtaining Approval from the Head of the Institution and Research and Ethics Committee.

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Academic project – no funding has been received.

Abbreviations used:

1. ABX-Antibiotics
2. AKI-Acute Kidney Injury
3. AMR-Antimicrobial Resistance
4. AOR-Adjusted Odds Ratio
5. ASA-American Society of Anesthesiology
6. ASB-Asymptomatic Bacteriuria
7. ASC/AST-Active Surveillance Culture/Testing
8. ASHP-American Society of Health-System Pharmacists
9. BD-Twice a day
10. BMI-Body Mass Index
11. CABG-Coronary Artery Bypass Grafting
12. CAD-Coronary Artery Disease
13. CAUTI-Catheter Associated Urinary Tract Infections
14. CDC-Centre for Disease Control & Prevention
15. CI-Confidence intervals
16. CKD-Chronic Kidney Disease
17. CLABSI-Central Line Associated Bloodstream Infections
18. CRIF-Closed Reduction & Internal Fixation
19. CT-Computerized Tomography
20. CVA-Cerebrovascular Accident
21. DIP-Deep Incisional Primary
22. DIS-Deep Incisional Secondary
23. DM-Diabetes Mellitus
24. DUE-Drug Utilization Evaluation
25. HAI-Healthcare Associated Infections
26. HTN-Hypertension
27. INJ-Injection
28. IV-Intravenous
29. LSCS-Lower Segment Cesarian Section
30. MIC-Minimum Inhibitory Concentration
31. MRSA-Methicillin Resistant Staphylococcus aureus
32. NCD-Non Communicable Diseases
33. NHSN-National Healthcare Safety Network
34. NI-Nosocomial Infection
35. NNIS-National Nosocomial Infections Surveillance System
36. NRC-National Research Council
37. OR-Odds Ratio
38. ORIF-Open Reduction & Internal Fixation
39. PFS-Pelvic Fracture Surgery
40. PJI-Prosthetic Joint Infections
41. PO-Per Oral
42. PSAP-Prolonged Surgical Antibiotic Prophylaxis
43. PTCA-Percutaneous Transluminal Coronary Angioplasty
44. RA-Rheumatoid Arthritis
45. SAP-Surgical Antimicrobial Prophylaxis
46. SIP-Superficial Incisional Primary
47. SIR-Standardized Infection Ratio

48. SIS-Superficial Incisional Secondary
49. SPSS-Statistical Package for Social Sciences
50. SSI-Surgical Site Infection
51. STAT-Immediately
52. TAB-Tablet
53. THA-Total Hip Arthroplasty
54. THR-Total Hip Replacement
55. TKA-Total Knee Arthroplasty
56. TKR-Total Knee Replacement
57. TLC-Total Leucocyte Count
58. UTI-Urinary Tract Infection
59. VAP-Ventilator Associated Pneumonia
60. VRE-Vancomycin Resistant Enterococcus
61. WHO -World Health Organization

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