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A STUDY OF ADHERENCE OF SURGEONS TO ANTI-MICROBIAL PROPHYLAXIS GUIDELINES IN A MULTI SPECIALITY HOSPITAL

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ABSTRACT: Background: The use of antimicrobial prophylaxis for surgical procedures is one of the measures employed to prevent the development of (SSI). The appropriate choice of antimicrobial agents, dosage regimen, timing, duration must be properly done. Proper adherence to the surgical guidelines by the physician is needed to improve overall patient care and prevention of surgical site infections that is likely to emerge after few months or days of surgical procedures. **Objective:** To access and analyze antimicrobial SSI prophylaxis compliance in accordance with institutional standards by physicians and to identify potential opportunities for improvement to its adherence. **Methods:** A retrospective observational study was done in patients who underwent surgeries such as CABG, LSCS, Lapchole and TKR in a multi-specialty hospital using a data collection form from the operation theatre surgical checklist records. **Results:** A total of 559 patients were collected; 201 (35.95%) were male and 358 (64.04%) were female. The most common age group was between 41-60 (54.00%) years of age. The widely used antibiotic is Cefazolin followed by cefuroxime in 90% of the cases. **Conclusion**: Adherence to separate aspects of hospital guidelines for surgical prophylaxis is favorable, overall adherence to all parameters is hard to achieve. Adherence to guidelines on selection of antibiotic and timing needs improvement, in particular. To increase the quality of antimicrobial prophylaxis in surgery, effort should be put into developing guidelines acceptable to surgeons, in adequately distributing the guidelines and to facilitating logistics. Audits of surgical prophylaxis may help hospitals to identify barriers in surgical adherence.

KEYWORDS: SSI, Prophylaxis, Antibiotic, Compliance.

1. INTRODUCTION

Surgical antimicrobial prophylaxis (SAP) is an initial administration of short course of an antimicrobial agent prior to surgery in order to prevent surgical site infections (SSI's). SAP is critical in preventing infections that may lead to sepsis, organ failure, and death during hospital stay.[1] SSIs of the sternal wound and underlying mediastinum occur in 0.4%-4% of cardiac surgical procedures, with over 50% due to the coagulase-positive Staphylococcus aureus or the coagulase- negative Staphylococcus epidermis.[2] A 1999 analysis estimated that SSIs are linked to approximately 20,000 in-hospital deaths each year and may account for $1 billion to $10 billion in US health care costs.[3] Although the principles of antimicrobial prophylaxis in surgery are clearly established and several guidelines have been published, the implementation of these guidelines is problematic among surgeons.[4]

Prophylaxis refers to the prevention of an infection and can be characterized as primary prophylaxis, secondary prophylaxis, or eradication.[5] The basic principle of antibiotic prophylaxis in surgery is to reach adequate drug levels both in the serum as well as the wound tissue during the entire time the skin incision is open in the operating room.[6] Recent studies assessing the current practice of prophylaxis throughout the world have shown that over-consumption of antimicrobial drugs and inappropriate timing remains a problem in surgical prophylaxis.[7] The over-use of antibiotics can result in a rising frequency of adverse effects, emergence of drug resistant organisms, as well as increased cost.[8]

Most studies demonstrated that non- compliance is mainly caused by inappropriate antibiotic selection, timing of administration, and prolonged duration of prophylaxis.[9] The guidelines are intended to provide practitioners with a standardized approach to the rational, safe, and effective use of antimicrobial agents for the prevention of surgical-site infections (SSIs) based on currently available clinical evidence and emerging issues.[10]

2. METHODS

2.1. Research methodology

A Retrospective Observational Study of six months was conducted in a multi-specialty hospital during the period of September 2014 to February 2015.

2.2. Sample size and study population

The study sample was chosen from patients who underwent surgeries such as CABG (Coronary Artery Bypass Grafting), LSCS (Lower Cesarean Section Surgery), Laparoscopic

cholecystectomy (Lapchole) and Total Knee Replacement (TKR) surgeries from September 2014 to February 2015. The data collection was done by using a form from operation theatre surgical checklist and 559 sample size were collected.

2.3. Sampling Frame

The sampling frame comprised of all the patients of age group from 20 to 80 years who underwent sugeries such as CABG, LSCS, Laparoscopic cholecystectomy and Total Knee Replacement surgeries from the month of September 2014 to February 2015 taken from the surgical safety checklist which contains the patient's demographic data, registration number, date of admission, date of surgery.

2.4. Assessment

Compliance with institutional practice standards included meeting the 3 criteria. Antibiotic selection and dosing was considered appropriate if the antibiotic combination and dosing corresponded with Table 1 or a suitable alternative that had comparable microbial coverage. Antibiotic timing compliance was met when the medication infusion was started within 1 hour of the incision time and completed before the incision. Exceptions included vancomycin and fluoroquinolones, which should be started between 60 and 120 minutes before the incision.

2.5. Inclusion criteria

- The study population included all patients from September 2014 to February 2015 who were scheduled for major surgery (CABG, LSCS, Lapchole and TKR) that required SAP for the clean as per the current hospital guidelines.

2.6. Exclusion criteria

- Patients aged below 20 years and above 80 years of age.
- Contaminated surgeries were excluded because antibiotics would be routinely administered as a therapeutic intervention. Also, we excluded surgery for infants and cancer,as well as surgery that did not imply clear regimen for prophylaxis or hospital guidelines.

2.7. Data collection and management

A Standard Data collection form for the assessment of surgical prophylaxis adherence by the physicians was developed and is used for this study. A data collection form was designed

which has to be completed by reviewing patient case files from the surgical safety checklist from the operation theatres. Operation theatre log books were reviewed for patients who underwent surgery and were administered with SAP regimen according to the hospital guidelines. Data included patient's gender, age, type of surgery, antibiotic allergy, history of chronic illness, antibiotic type, antibiotic dose, antibiotic route of administration, and duration of antibiotic use. The patient's microbiological data were confirmed for no current infection, and the antibiotics prescribed were only used for surgical prophylaxis.

2.8. Data analysis

Descriptive analyses of data were performed by using Two Way ANOVAs test in SPSS software (version, 16).

Table 1: Institutional criteria for antibiotic prophylaxis for surgical site infections[10, 11, 15, and 22]

TYPE OF SURGERY	DRUGS TO BE USED	DOSE TO BE USED	TIME (Prior to Insition)
Cardiac	Cefazolin/Cefuroxime vancomycin	➢ 80 kg: 1 g; 80-120 kg: 2 g; 120 kg: 3 g ➢ 15 mg/kg	15-30 Min 60-120 Min
Gynaecologic: caesarean	cefazolin	➢ 80 kg: 1 g; 80-120 kg: 2 g;120 kg: 3 g	15-30 Min
Orthopaedic	Cefazolin or cefuroxime	➢ 80 kg: 1 g; 80-120 kg: ➢ 2 g; 120 kg: 3 g ➢ 1.5 g	15-30 Min
Laparoscopic procedure	Cefazolin/ Cefuroxime	➢ 80 kg: 1 g; 80-120 kg: ➢ 2 g; 120 kg: 3 g	15-30 Min

3. RESULTS

3.1. Gender distribution of patients

Out of 559 patients, 204 (36.49%) were male patients and 355 (63.50%) were female patients.

3.2. Age distribution of patients

Among 559 patients, 220 (39.35%) patients were aged between 20-35 years, 85 (15.20%) were aged between 36-50 years, 148 (26.47%) were aged between 51-65 years and 106 (18.96%) were aged between 66-80 years of age.

3.3. Patients admitted in Departments

The number of patients underwent LSCS surgery was 218 (38.98%), Lapchole surgery was 146 (26.11%), CABG surgery was 95 (16.99%) and TKR surgery was 100 (17.88%).

3.4. Antibiotic Selection

Proper selection of antibiotic is a major factor in making good surgical prophylaxis in order to avoid post-surgical complications. Out of 218 patients in LSCS surgery, 211 (96.78%) were compliance and 7 (3.21%) were non-compliance, 146 patients in Lapchole surgery 129 (88.35%) were compliance and 17 (11.65%) were non-compliance, 95 patients in CABG surgery 2 (2.10%) were compliance and 93 (97.89%) were non- compliance and 100 patients in TKR, 90 (90%) were compliance and 10 (10%) were in non-compliance.

Out of 559 patients, combining all four surgical procedures the overall compliance to selection of proper antibiotic according to the hospital guidelines was found to be 77.28%

Among four surgeries least compliance to guidelines in antibiotic selection was found in CABG surgery (2%) and more was found in LSCS (96.78%)

3.5. Antibiotic Timing

Many antibiotic doses failed both to start within 1 hour before incision and to complete infusing before incision time .Out of 218 patients in LSCS surgery, 113 (51.83%) were compliance and 105 (48.16%) were non-compliance, 146 patients in Lapchole surgery, 92 (63.01%) were compliance and 54 (36.38%) were non-compliance, 95 patients in CABG surgery, 88 (92.63%) were compliance and 7 (7.60%) and 100 patients in TKR , 64 (64%) were compliance and 36 (36%) were in non-compliance.

Out of 559 patients combining all four surgical procedures the overall compliance to proper timing of antibiotic according to the hospital guidelines was found to be 63.8%

Among four surgeries least compliance to guidelines in antibiotic timing was found in LSCS surgery (51.83%) and more was found in CABG (92.63%)

3.6. Antibiotic Dosing

Out of 218 patients in LSCS surgery, 211 (96.78%) were compliance and 7 (3.21%) were non-compliance, 146 patients in Lapchole surgery, 126 (86.3%) were compliance and 20 (13.69%) were non-compliance, 95 patients in CABG surgery, 2 (2.10%) were compliance

and 93 (97.89%) and 100 patients in TKR, 88 (88%) were compliance and 12 (12%) were in non-compliance.

Out of 559 patients combining all four surgical procedures the overall compliance to proper dosing of antibiotic according to the hospital guidelines was found to be 76.38%

3.7. Overall compliance

By checking whether all three criteria's needed to satisfy adherence of surgical guidelines by physician, from among 559 surgeries taken ,54 % adherence was found in lap chole, 53 % was found in TKR, 50% was found in LSCS and only 2 % adherence was found in CABG case which needs the most important care and review . Thus total overall adherence to surgical guidelines of hospital by physician the adherence percentage was found to be only 39.75%

Table: 2 Comparison of Selection, Timing and Dosing of Antibiotics in Various Surgeries

	LSCS			LAPCHOLE			CABG			TKR		
	ANTIBIOTIC			ANTIBIOTIC			ANTIBIOTIC			ANTIBIOTIC		
	SELCTION	TIMIG	DOSING	SELCTION	TIMIG	DOSING	SELCTION	TIMIG	DOSING	SELCTION	TIMING	DOSING
COMPLIANCE	211	113	211	129	92	126	2	88	2	90	64	88
NON COMPLIANCE	7	105	7	17	54	20	93	7	93	10	36	12

TWO-WAY ANOVA		
Interaction	P VALUE	0.0129
Row Factor		0.0013
Column Factor		0.0567

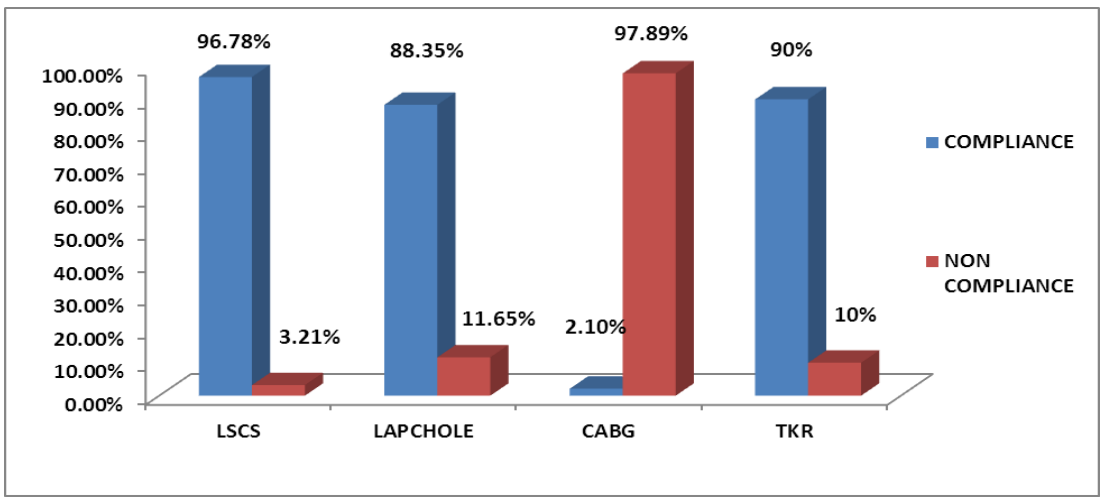

Fig I: Compliance and Non Compliance in Selection of Antibiotics

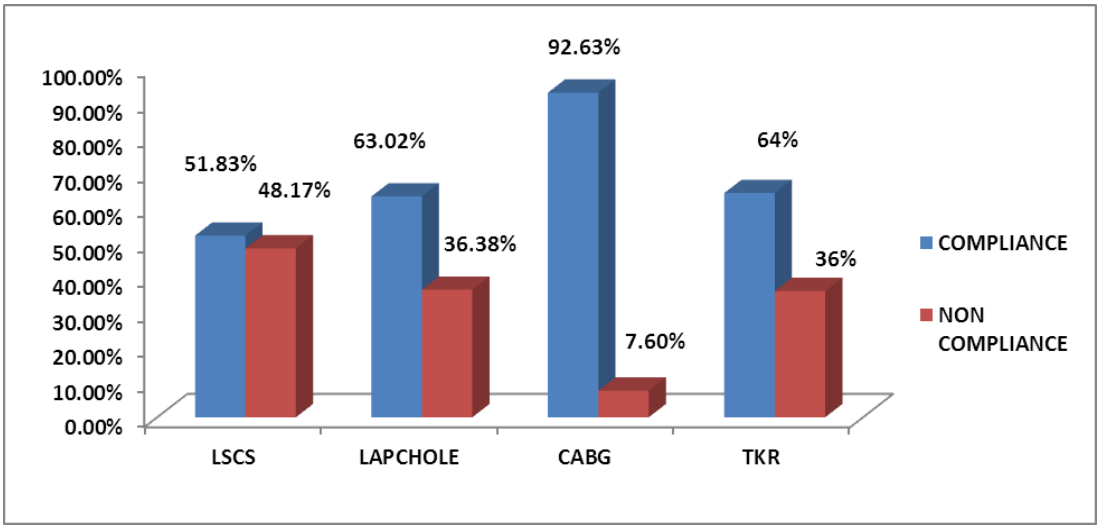

Fig II: Compliance and Non Compliance in Timing of Antibiotics

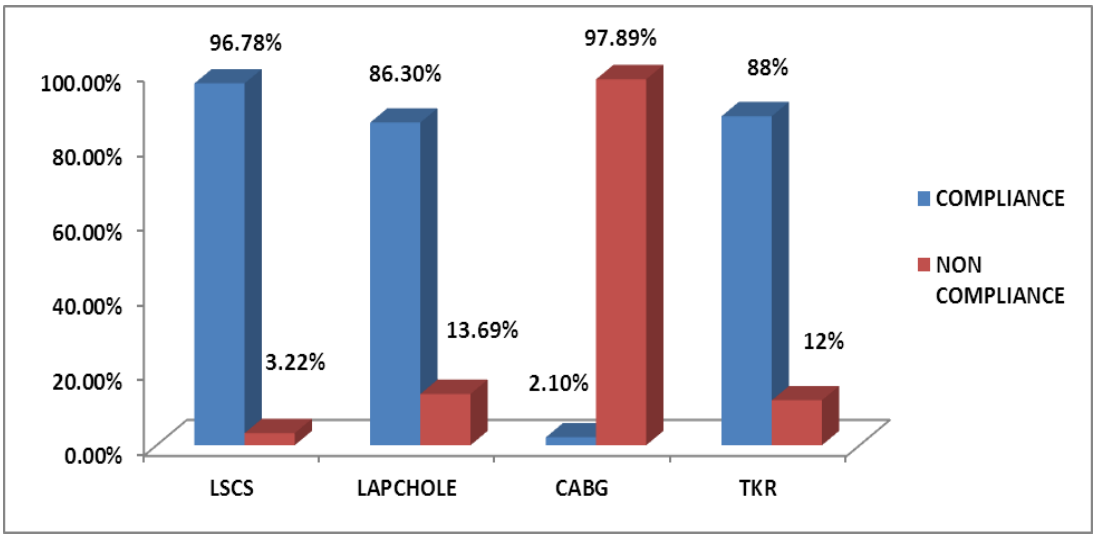

Fig III: Compliance and Non Compliance in Dosing of Antibiotics

4. DISCUSSION

Surgical antibiotic prophylaxis is an effective management strategy for reducing post-operative infections, provided that appropriate antibiotics are given at the correct time for appropriate durations and for appropriate surgical procedures.[22]

4.1 Timing of antibiotics

The administration of prophylactic antibiotics within the 60 minutes before incision was established in 1989. This practice was further supported in 1992 when a reduced risk of wound infection was found with preoperative antibiotics given within 2 hours of incision. Currently, no consensus exists on completing prophylactic antibiotic infusions before incision.[3] To encourage appropriate antimicrobial prophylaxis, the Centers for Medicare and Medicaid Services and the Joint Commission have recently adopted performance measures

specifying the timing and duration of surgical prophylaxis and say that proper antibiotic timing before incision increase quality of life of patient [14]. In this study of adherence to surgical prophylaxis by physicians, we came to the fact that most of the physicians are not following proper timing of antibiotic administration before commencing of surgery especially in caesarean sections followed by improper selection of antibiotics that is recommended in the prophylaxis guidelines. Because of lack in adherence of proper timing of antibiotic administration, the chances of acquiring post microbial infections will get increased and will cause patients to face the problems of further infections and health risks .Even though each hospitals are having their own surgical guidelines and protocols, adherence to these guidelines are not properly endeavoring by the physicians in practice which can lead to many consequences of post microbial infections.

Lack of proper adherence in antibiotic timing can be seen in caesarean section which is in very shorter duration prior to the commencing of surgical incision. Antibiotic administration in caesarean surgeries done in this hospital is majorly 2 or 3 minutes before the surgery which is considered to be too less to get activated the drug in the human body. As considering the pharmacological aspects and studying the proper kinetics of these drugs, commonly recommended for use in surgical prophylaxis, it requires minimum 10 to 15 minutes to get activated in the human body which is determined at the time of clinical studies of drugs to produce effects and activity against microorganisms commonly causing infections. Performing these types of bad and unhealthy practices can cause health risk to mothers after surgical procedure which in future can cause loss of wealth as well as proper mental relaxation

4.2 Proper antibiotic selection

Stone et al published a study in 1976 that showed a significant reduction in wound infection rates when antibiotics were given preoperatively instead of postoperatively or not at all [3]. To encourage appropriate antimicrobial prophylaxis, the Centers for Medicare and Medicaid Services and the Joint Commission have recently adopted performance measures specifying the choice of antimicrobial agent[14] Antibiotic selection is seen the most compliance in our study. Comparing to other factors used to access the compliance of antibiotic prophylaxis adherence, antibiotic selection as one of the factors in this study had more compliance and proper adherence. In our study we came to the knowledge that the antibiotic Cefazolin and cefuroxime is the most widely used antibiotic [78.9%]. Proper selection of anti-biotic can

have good positive effects in patients and those recommended antibiotic have activity against particular microbes which is considered to be become affected after performing surgery. But in this current study fact is that the only overall compliance of anti-biotic selection is in high percentage, comparing individual surgeries selection of proper anti-biotic in coronary artery bypass grafting is only 2% which is too low. A heart surgery requires special care and monitoring and by considering this fact it should be well practiced and followed by the physician to administer the proper anti-biotic in heart surgeries. In our study antibiotic proper selection is done in LSCS procedure and compliance can be seen as 96.78 %.

4.3 Antibiotic dosing

Ideally, a single dose of a single antibiotic with a spectrum appropriate to cover the most common infecting organisms is considered the most judicious practice. There have been many reviews and published guidelines to cover most instances where prophylaxis is recommended and where it is not considered appropriate. However, there remains the complex problem of appropriate antibacterial selection, and then frequency, duration and timing of each dose. The most common infecting organisms are Staphylococcus aureus, E. coli and beta hemolytic Streptococci. Much research has been conducted on the use of antibiotics during LSCS in countries throughout the world, ranging from developed to developing. Many regimens have been tried and tested and there seems to be very little significant benefit of one over another. It is now well established that antibiotic prophylaxis in LSCS surgery reduces the risk of infection and endometritis in all types of patients and has proven to be of benefit even to those at the lowest risk. [23]. Along with selection of proper antibiotic, selecting proper dose is also a major factor in proper surgical prophylaxis. Pharmacokinetic properties of a drug are will checked and thus dosing is fixed for antibiotic for their action and is recommended in the guidelines. Selection and fixing of doses below the recommended guidelines will not provide any microbial action and thus action of microbes will not get subsided in the required site. Dose selection below the therapeutic level will produce sub therapeutic effect. Appropriate antibiotic dose should be done in order to get the therapeutic concentration of the drug at the particular site as well as to achieve therapeutic target to produce appropriate action of anti-biotic. In this study antibiotic dosing is properly done with respective antibiotics that are used in the surgical procedures. An overall compliance of 76.38% is seen with appropriate anti-biotic dosing.

The limitations of the current study include the involvement of small number of patients which did not give complete overview of the compliance rate among the different departments. The retrospective nature of the study is another limitation. Moreover, the current study did not analyze one important element of surgical antibiotic prophylaxis—the redosing nature of antibiotics. However, this is perhaps not crucial in the results as being noncompliant with one element of the prophylaxis is already considered as a guidelines deviation.

5. CONCLUSION

Antibiotic prophylaxis is one of the efforts necessary to minimize SSI. This assessment quantified the institution's noncompliance majorly in lack of adherence to proper timing compliance which is done too short for caesarean section and not following any adherence to selection of antibiotic recommended to be used in coronary artery bypass grafting procedures for SSI prophylaxis based on institutional standards. Several opportunities for improved compliance were identified and addressed within the institution. Further research will determine whether these changes will improve noncompliance. However, compliance with evidence based guidelines remains consistently poor. In our study, non-adherence was most commonly due to inappropriate choice of drug in CABG and use of antimicrobial prophylaxis for longer duration than recommended in LSCS. This has the potential of ineffective prevention of SSI and emergence of resistant strains of bacteria within the institution. Deep evaluation of barriers that may hinder universal implementation of guidelines is warranted and solutions to increase adherence should be encouraged. It is evident from the literature that effective strategies which include addressing the knowledge and attitudes of staff together with quantitative and qualitative approaches help to improve the compliance rate with the SAP guidelines. Moreover, interactive workshops to address current controversies and solutions to overcome the compliance barrier are useful for enhancing surgical staff commitment towards hospital guidelines. Also auditing antibiotic use against agreed standards should be seen as a quality indicator to decrease the rate of SSI. The study highlights that there is a potential opportunity for a clinical pharmacist to facilitate evaluation of quality assured SAP management process across all surgical disciplines. Further, prospective studies are recommended to address these critical issues in more detail.

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