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A CRITICAL APPRAISAL: A COMPARISON STUDY OF ANTIMICROBIAL PROPHYLAXIS IN SURGERY

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Abstract

Back ground: Antimicrobial prophylaxes for the surgical patients remain one of the major types of medication errors in the hospitals. So, any error in the administration of dose of antimicrobial prophylaxis increases the rates of surgical site infections. The Aim of the study was not only to evaluate the risk of surgical wound infection and hospital acquired infections among patients with and without tolerable antibiotic prophylaxis but also, to offer simulations to forecast the numerous internal factors of hospital infection and surgical wound infection. Optimal and ideal usage of antimicrobial prophylaxis involve proper case selection; use of suitable agents; route of administration, appropriate dosing, , timing, and duration; and intraoperative dosing. The use of different antibiotics before, during, or after a diagnostic, therapeutic, or surgical procedure, was compared and evaluated in different patients with standard guidelines.

Method/Design of study: A prospective cohort study was performed over 12 months, with data collected by pharmacists through visits to different Surgical (II & III), Medical (I, II & III) and ENT ward of BVH (Bahawal Victoria Hospital) with the principle conditions requiring surgery. The population includes 875 patients (12-75year) admitted in the different surgical wards. All the aspects of prescription were considered including the comparison with standard treatment, parts of prescription, drug interactions, adverse drug reactions & number of drugs prescribed per prescription. Different parameters were used for the analysis of data.

Results: Of the 875 patients underwent surgery, 184 (21.18%) received appropriate peri-operative prophylaxis and were completely following the guidelines, 93 (10.58%) received appropriate peri-operative prophylaxis but slightly deviating from guidelines, 277 (31.76%) received inadequate prophylaxis with moderately deviating the guidelines,

while 321 (36.74%) received inadequate prophylaxis and were not following the guidelines. For those who received adequate antibiotic prophylaxis, the percentage of surgical wound infection was 10.65% compared with the group who received inadequate prophylaxis in which the percentage of surgical wound infection was 33.40%. Other findings indicate that most of the prescriptions had incomplete structure; Subscription & Signatura were not present. Most frequently encountered drug interactions were Ceftriaxone + Diclofenac Na^+ and Gentamicin + Diclofenac Na^+. It was found that some of the prescriptions were irrational and deviated from the guidelines.

Therefore, the choice of antimicrobial agent should be made on the basis of the criteria of hospital committee.

Conclusion:

The results indicated that the prophylactic treatment of major surgery after evaluating the prescriptions is not completely following the recommendations for antimicrobial prophylaxis in surgery. So, we conclude that the effective use of antimicrobial prophylaxis requires monitoring of, and will subsequently reduce postoperative infection rates, especially in high-risk patients. This study indicates the progress toward better prophylactic treatment of patients requiring surgery and the challenges for the future.

Key words:

Antimicrobial prophylaxis, drug interactions, adverse drug reactions & Subscription.

1. Introduction

As a general rule, a procedure is considered to be a surgical when it involves cutting of a patient's tissues or closure of a previously sustained wound. Other procedures that do not necessarily fall under this rubric, such as angioplasty or endoscopy, may be considered surgery if they involve "common" surgical procedure or settings, such as use of a sterile environment, anesthesia, antiseptic conditions, typical surgical instruments, and suturing or stapling. Major surgery often involves opening one of the major body cavities the abdomen (laparotomy), the chest (thoracotomy), or the skull (craniotomy)-and can stress vital organs [1]. This surgery is usually performed by using general anesthesia in a hospital operating room. A stay of at least one night in the hospital usually is needed after major surgery. But in minor surgery, major body cavities are not opened [2]. Minor surgery can involve the use of local, regional, or general anesthesia and may be performed in an emergency department, an ambulatory surgical center, or a doctor's office. Usually, the person can return home on the same day that minor surgery is performed[3].

Microbial contamination during a surgical procedure is a precursor of surgical site infection. Most surgical wounds are contaminated by bacteria, but only a minority progress to clinical infection [4]. Infection does not occur in most patients because their innate host defenses eliminate contaminants at the surgical site efficiently. [5] There are at least three important determinants of whether contamination will lead to surgical site infection: the dose of bacterial contamination, the virulence of the bacteria and the resistance of the patient. [6] This is demonstrated in the following formula: [7]

$$\frac{\textit{Dose of bacterial contamination} \times \textit{virulence of bacteria}}{\textit{Resistance of host}} = \textit{Risk of SSI}$$

The probability of infection increases proportionally as the number and virulence of the bacteria increase [8]. Local characteristics of the wound, such as residual dead tissue, sutures or other foreign material or the presence of drains, will amplify the consequence of the bacterial inoculum[9]. The methods used for surveillance of surgical site infections were originally designed for monitoring inpatients only [10]. Over the past decade, the shift from inpatient to outpatient surgical care has been dramatic, making traditional surveillance methods considerably more difficult to employ [11]. Most hospitals do not have the resources to monitor all surgical patients all the time; therefore [12], they should target their efforts to high-risk procedures and combine computer-assisted, laboratory-based screening with case confirmation by surgeons. [13]

The basic principle of antimicrobial prophylaxis in surgery is to achieve adequate serum and tissue drug levels that exceed, for the duration of the operation, the MICs for the organisms that are likely to be encountered during the operation [14]. The choice of antimicrobial prophylaxis is always best evaluated using the results of properly conducted clinical trials [15]. Antibiotic prophylaxis in elective surgeries is essential to prevent Surgical Site Infection (SSI), chest infection and urinary tract infections. SSI is second only to urinary tract infection as the most common nosocomial infection in hospitalized patients. It has been estimated that SSI develops in at least 2% of hospitalized patients undergoing operative procedures. The mortality rate was 3% among patients who developed SSI [16].

In the absence of studies specific to the procedure in question, extrapolation from data on regimens for different procedures in the same anatomic site in question usually can be made. Subsequent modifications to each prophylactic regimen should be based on Intraoperative findings or events [17]. The antimicrobial selection is based on cost, antibacterial activity, adverse-effect profile, ease of administration and pharmacokinetic profile. In the present study we made an effort to evaluate and compare the extent of rationality in administering antimicrobial prophylaxis on elective surgeries across different wards within the same hospital.

Methodology

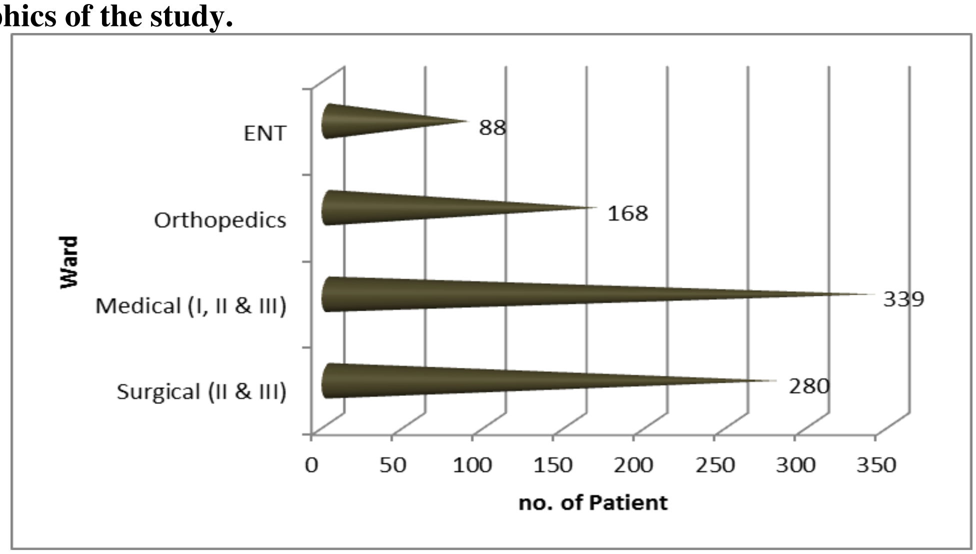
Methods of the baseline surveys were consistent with the recommendations for antimicrobial prophylaxis in surgery written by Salman Kanji and John W. Devlin. A prospective cohort study was performed in Bahawal Victoria Hospital, over 12 months from September 2010 to August 2011. The approval of this study was taken from the Institutional Ethical Committee of Faculty of Pharmacy and Alternative Medicine, the Islamia University, Bahawalpur, as well as from the Principle and M.S. of Bahawal Victoria Hospital, Bahawalpur.

The data was collected by pharmacists and the population includes 875 patients (12-75year) admitted in the different surgical wards i.e. II & III (n=280), Medical i.e. I, II & III (n= 339), Orthopedics (n=168) and ENT (n= 88) ward of BVH (Bahawal Victoria Hospital) with the principle conditions requiring surgery (Table 1).

Table-1: Demographics of the study.

Different wards	No. of patients
Surgical (II & III)	280
Medical (I, II & III)	339
Orthopedics	168
ENT	88

Figure-1: Demographics of the study.



This data was collected by reviewing of the medical record and consultation with the medical doctor and nurses attending the patients. All the aspects of prescription were considered including the comparison with standard treatment, parts of prescription, drug interactions, adverse drug reactions & number of drugs prescribed per prescription. Different statistical tools were used for the analysis of data.

Results and Discussion

875 prescriptions were collected from different wards of surgery. These prescriptions were evaluated accordingly. Following parameters were considered:

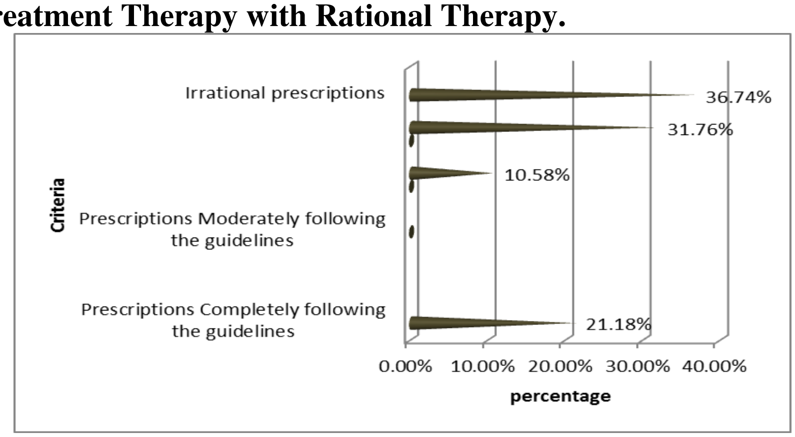
- Comparison of treatment therapy with rational therapy *(the recommendations for antimicrobial prophylaxis in surgery)* written by Salmann Kanji And John W. Devlin

Out of these, the prescriptions, 184 (21.18%) prescriptions were completely according to recommended in the rational therapy, 93 (10.58%) prescriptions were slightly deviated from that is recommended in the rational therapy (same generation), 277 (31.76%) prescriptions were moderately deviated from that is recommended in the rational prescription (same class but different generation) and 321 (36.74%) prescriptions were irrational and are total different from that is recommended in the rational prescription (Table.2, Figure: 2).

Table-2: Comparison of Treatment Therapy with Rational Therapy.

CRITERIA	**PERCENTAGE**	
Prescriptions Completely following the guidelines	**21.18%**	
Prescriptions Moderately following the guidelines	**Number of prescriptions not containing the drugs in accordance with the Guidelines**	
	Slightly deviated	**10.58%**
	Moderately deviated	**31.76%**
Irrational prescriptions	**36.74%**	

Figure: 2 Comparison of Treatment Therapy with Rational Therapy.



According to the recommendations for antimicrobial prophylaxis in surgery written by Salmann Kanji And John W. Devlin, following antibiotics are included in the prophylactic therapy containing:

1. Cefazolin.
2. Cefoxitin and Cefotetan.
3. Clindamycin, Neomycin, Erythromycin, Cefuroxime, Amoxicillin and Ampicillin.

While evaluating the prescriptions it was observed that some prescriptions were in accordance with the recommendations in the guidelines. Mostly drugs of the prescriptions were not following the recommendations (Table 3).

Table-3: General prescription evaluation in different wards.

Crieteria	Surgical (II & III)	Medical (I, II & III)	Orthopedics	ENT
Prescriptions Completely following the guidelines	104 (56.65%)	25 (13.59%)	34 (18.47%)	21 (11.41%)
Prescriptions slightly deviating from the guidelines	25 (26.88%)	31 (33.33%)	21 (22.58%)	16 (17.21%)
Prescriptions moderately deviating from the guidelines	54 (19.49%)	128 (46.21%)	65 (23.46%)	30 (10.83%)
Irrational prescriptions	97 (30.22%)	155 (48.29%)	48 (14.95%)	21 (6.54%)

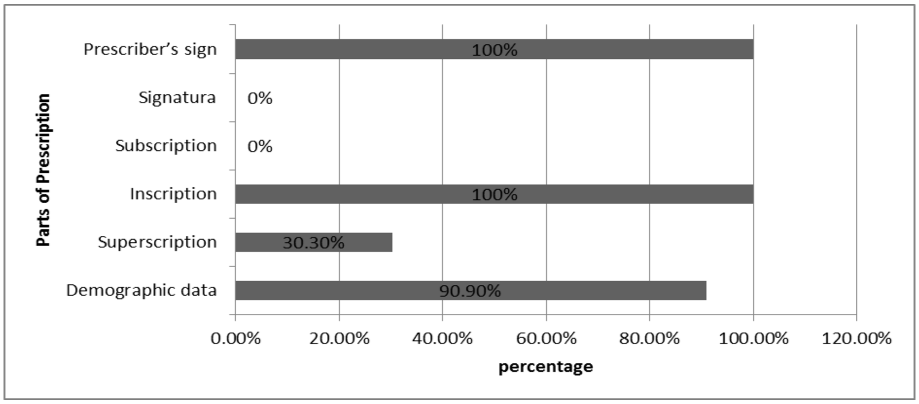
ii. Evaluation of Structure of prescription:

Most of the prescriptions were incomplete. Table 4 and figure 3 shows parts of prescription and percentage of prescriptions containing the relative parts. Different parts of prescription were considered separately while evaluation.

Table-4: Evaluation of structure of prescription.

PARTS OF PRESCRIPTION	PERCENTAGE
Demographic data	90.90%
Superscription	30.30%
Inscription	100%
Subscription	0%
Signatura	0%
Prescriber’s sign	100%

Figure-3: Evaluation of structure of prescription.



iii. Drug Interactions Encountered:

Some drug interactions were suspected in the prescriptions which are listed in table-5.

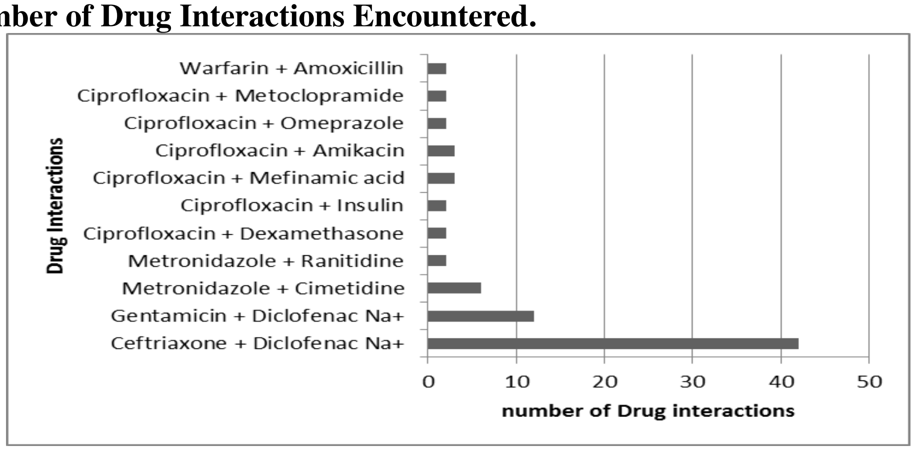
Total number of Drug interactions = 78 prescriptions.

In table and figure no. 4 different drug interactions are shown.

Table-5: Types and Number of Drug Interactions Encountered.

DRUG INTERACTIONS	NUMBER OF D/I
Ceftriaxone + Diclofenac Na^+	42
Gentamicin + Diclofenac Na^+	12
Metronidazole + Cimetidine	6
Metronidazole + Ranitidine	2
Ciprofloxacin + Dexamethasone	2
Ciprofloxacin + Insulin	2
Ciprofloxacin + Mefinamic acid	3
Ciprofloxacin + Amikacin	3
Ciprofloxacin + Omeprazole	2
Ciprofloxacin + Metoclopramide	2
Warfarin + Amoxicillin	2

Figure-4: Type and Number of Drug Interactions Encountered.



The outcomes of the important one's of these interactions are discussed as follows:

Diclofenac increases biliary excretion and decreases renal elimination of ceftriaxone in patients with bile duct drains. The nephrotoxic effect of getamicin may be potentiated by nonsteroidal anti-inflammatory drugs (NSAIDs) like diclofenac.

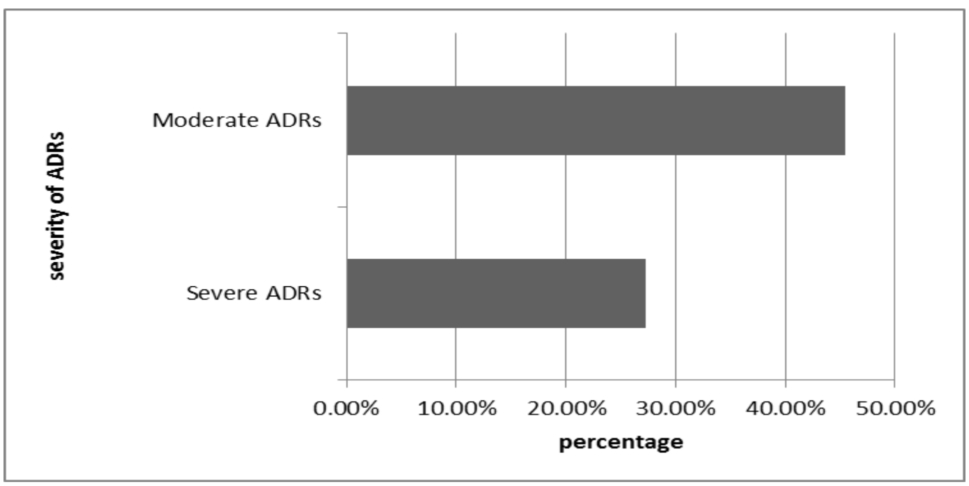
iv. ADRs Observed:

ADRs were classified on the basis of Severity. There were 42 types ADR were observed including: Severe ADRs and Moderate ADRs (Table 6 & figure 5). Among the observed ADRs the percent severity of Severe ADRs was 11 (27.27%) and of moderate ADRs was 19 (45.45%) and the remaining were side effects of the medication.

Table-6: Severity of ADRs.

SEVERITY OF ADRs	PERCENTAGE
Severe ADRs	27.27%
Moderate ADRs	45.45%

Figure-5: Severity of ADRs.



Conclusion

Our results indicate that the prophylaxis treatment of major surgery after evaluating the prescriptions in the different surgical wards of BVH is not completely following the recommendations for antimicrobial prophylaxis in surgery written by Salmann Kanji And John W. Devlin [18] .By the evaluation of structure of prescription, it is concluded that most of the parts of prescription are missing. There is various numbers of ADRs and drug interactions are observed.

As costly medications have prescribed for prophylaxis that is a major problem for patients. So, the addition of clinical pharmacist services in the care of patients generally resulted in improved care, with no evidence of harm because of cost-effective medication. Interacting with the health care team on patient rounds, interviewing patients, prescription evaluation, monitoring ADRs and drug interactions all resulted in improved outcomes.

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