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## Prophylactic antibiotic in general surgery

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### Abstract

**Objectives:** To evaluate the role of antibiotic prophylaxis in general surgery with the incidence of wound infection and in comparison with extended regimen antibiotics.

**Methods:** A prospective study of 150 patients were enrolled and operated upon electively which are divided into 2 groups. 100 patients were taking prophylactic antibiotics and 50 patients were on extended antibiotic regimen. Questionnaires concerning age, sex, type of surgery, complications and parameters of antibiotic prophylaxis (antibiotic choice, route, dose, timing of first dose and duration of prophylaxis) were completed.

**Results:** Patients with prophylactic antibiotic, 79% of patients underwent a clean surgical operation and 21% underwent a clean contaminated operation. Inguinal hernia and open cholecystectomy were the commonest operation in each category, 4% of this group developing wound infection, also we take comparison with 50 cases in which we use extended antibiotic regimen Laparoscopic cholecystectomy and Para umbilical hernia were the commonest operations in this category, 6% of this group developing wound infection Ampicillin and cefotaxime were the most frequently prescribed antibiotics (50%, 50% respectively). All the 100 patients were received the antibiotic on time.

**Conclusions:** This study found that the use of pre-operative prophylactic antibiotics does have a statistically significant effect on postoperative infection rates in surgical management.

**Keywords:** Antibiotic, infection, treatment

### Introduction

Antibiotic prophylaxis defined as the Use of antibiotics before, during or after a diagnostic or infectious complications therapeutic surgical procedure to prevent Surgical site infections are the second commonest nosocomial infection "T" up to 2% to 5% of patients undergoing clean extra abdominal operations and up to 20% of patients undergoing intra-abdominal operations will develop surgical site infections "I" Surgical site infections result in a number of costs to the patient, to the healthcare system and to the community. In a study by Leaper *et al.* it was estimated that 30 million surgical procedures were conducted in Europe each year and the possible range for the number of cases of surgical-site infections per year fell between 450 000 and 6 000 000 These surgical-site infections could be costing European healthcare systems between 1.47 and 19.1 billion Euros. Optimal prophylaxis ensures that adequate concentrations of an appropriate antimicrobial are present in the serum, tissue, and wound during the entire time that the incision is open and at risk for bacterial contamination. The antimicrobial should be active against bacteria that are likely to be encountered during the particular type of operation being performed and should be safe for the patient and economical for the hospital. The selection and duration of antimicrobial prophylaxis should have the smallest impact possible on the normal bacterial flora of the patient and the microbiologic ecology of the hospital [14]. Establishing a "prophylaxis indicated" status for a given procedure requires consideration of the likelihood of infection without antibiotics and the morbidity and cost of an infectious complication. The discussion of these issues is facilitated by a taxonomy that classifies a procedure according to the level of microbial contamination routinely associated with that procedure and the likelihood of infection The incidence of infection ranges widely across classes--less than 2 percent for clean procedures (e.g., breast biopsy) to over 40 percent for dirty procedures (colon perforation with diffuse fecal contamination). It is generally agreed that antibiotic prophylaxis is warranted in all procedures in the categories of clean-contaminated, contaminated or dirty [3]. Appropriately administered antibiotic prophylaxis reduces the

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incidence of surgical wound infection. Prophylaxis is uniformly recommended for all clean-contaminated, contaminated and dirty procedures. It is considered optional for most clean procedures, although it may be indicated for certain patients and clean procedures that fulfill specific risk criteria. Antibiotic selection is influenced by the organism most commonly causing wound infection in the specific procedure and by the relative costs of available agents. In certain gastrointestinal procedures, oral and intravenous administration of agents with activity against gram-negative and anaerobic bacteria is warranted, as well as mechanical preparation of the bowel [12]. Postoperative wound infections have an enormous impact on patients quality of life and contribute substantially to the financial cost of patient care. The potential consequences for patients range from increased pain and care of an open wound to sepsis and even death. Approximately! Million patients have such wound infections each year in the United States, extending the average hospital stay by one week and increasing the cost of hospitalization by 20 percent [4]. This translates to an additional \$1.5 billion in health care costs annually [5]. The basic principle of antimicrobial prophylaxis in surgery is that there is a delay before host defenses can become mobilized after a breach in an epithelial surface, whether by trauma or surgery. The acute inflammatory, humoral and cellular defenses take up to 4 hours to be mobilized. This is called the decisive period, and it is the time when the invading bacteria may become established in the tissues. It is therefore logical that prophylactic antibiotic should be given to cover this period and that they could be decisive in preventing an infection from developing. The tissues levels of antibiotics should be above the minimum inhibitory concentration for the pathogens likely to be encountered [6]. The timing of antimicrobial prophylaxis is considered to be optimal if it is administered between 30-60 minute before incision "7". Three doses of an antimicrobial agent is sufficient for most surgical operations "5" the prolonged use of prophylactic antimicrobials is associated with the emergence of resistant bacterial strains. "" 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. The choice of antibiotics used will fulfill the following criteria:

1. Available
2. Not expensive- wide antimicrobial effect The goals of antibiotics prophylaxis are (1): 1-reduce surgical site infection- 2-minimise the effect of antibiotics on bacterial flora
3. Minimise the adverse effects4-cause minimal change to patient immune competence. There is published evidence to support the use of many prophylactic antimicrobial regimens besides those included in this advisory statement or in existing guidelines. However, factors such as cost half-life, safety, and antimicrobial resistance favor the use of older agents with a relatively narrow spectrum the use of newer, broad-spectrum drugs that are front-line therapeutic agents should be avoided in surgical prophylaxis to reduce emergence of bacterial strains that are resistant to these antimicrobials [20].

#### Patients and Methods: Study population

The purpose of this study was to assess the adherence of general surgeons to major aspects of surgical prophylaxis in our hospital and incidence of wound infection. This prospective study was performed in department of general surgery in Al-Yarmouk Teaching Hospital from April 2008 to April 2009. 150 patients

were included in the study. The criteria for inclusion in the study were the following:

- A. All surgical operations were elective
- B. Surgical operations were clean or clean contaminated

Patients with acute appendicitis were included in the study. Patients were excluded from the study if they were operated on urgently or contaminated or dirty. The operations were performed by different surgeons during the period of one year. All contaminated and dirty operations were excluded from the study.

#### Data collection

The study was conducted on a real time basis. Files were reviewed preoperatively and post-operative period for one month The collection of data for every patient was obtained from the first day of admission, preoperatively and postoperatively. The questionnaire included personal data medical history, the type of operation and details about antimicrobial surgical prophylaxis. The following aspects of surgical prophylaxis were examined: the antibiotic agent, the route of administration, the dosage, the timing of administration, the timing of operative redosing and the duration of prophylaxis 150 patients were taken for the study. First group 100 patients were received prophylaxis antibiotics and the second group received extended regimen antibiotics, which consisted of anywhere from 24 hours to 10 days of antibiotics in the postoperative period. The above patients were divided into 2 groups: First-100 patients taking prophylactic antibiotics were divided as the Following. 79 patients take ampicillin vial Igm intravenously, undergone clean operation, 60 minutes before incision and then every 6 hours for other 2 doses 21 patients take cefotaxime 1 gm intravenously, undergone clean contaminated operation, 60 minutes before incision and then every 8 hours for other 2 doses. Second-50 patients who were received antibiotics cefotaxime), IV every 8 hours from time of surgery till 5-7 days postoperative. All the patients were examined before discharge in the second post-operative day, as an outpatient at the seventh post-operative day. At the time of removing the stitches and after one month of surgery with the instructions were given to them to be seen in between the two examinations in case of any sign of infection appeared in the wound like redness in the wound edges, swellings, pain and discharge

#### Results

In the first group the most frequent operations are inguinal hernia 20 (20%) and hemorrhoids 10 (10%), anal fissure 10 (10%), Para umbilical herma 10 (10%), open cholecystectomy 8 (8%) and appendectomy (8%) were the most frequent one. Table (1) In the second group (extended regimen antibiotics) the laparoscopic cholecystectomy 20(40%) was the most frequent operation with Para umbilical hernia 12(24%) table (3). The majority of operations did not exceed 3 hours. Clean and clean contaminated operations are summarized in Table (1) First group 100 patients were taking prophylactic antibiotic, 19 patients with clean operation taking ampicillin 1 gm LV and 21 patients with clean contaminated operation taking cefotaxime 1 gm LV Table (2) The results were as the following 79 patients with clean operation 2(2%) patients develop wound infection and 21 patients with clean contaminated operation, 2(2%) patients develop wound infection. The second group 50 patients received extended regimen antibiotics table (3), which consisted of anywhere from 24 hours to 10 days of antibiotics in the postoperative period. 3 patients develop wound infection (6%)

table (4) The type of wound infection in the first group ranges from stitch abscess in 2 infected haematoma I patient and pus collection in 1 patient. While in second group were either stitch abscesses in 1 or 2 patients with abscess formation. No organ space infection was recorded. Table (5). There were no intra-abdominal infections recorded. There is also a respiratory tract infection in 2 patients in prophylactic regimens and only one patient in non-prophylactic one. Table (4) there are no recorded cases of urinary tract infection in our study. Table (4). The hospital stay for the first group was 1-4 (mean 1.8) day while in the Second group was 1-4 day (mean 2) according to the type of surgery.

**Discussion**

Several studies have been performed investigating the utility of prophylactic antibiotics in surgery. A wide variety of antibiotics, either line or in combination, have been evaluated. With regards to surgical prophylaxis, the data from these studies support several recurring themes: A single preoperative dose of antibiotic is as effective as a 5-day course of postoperative therapy assuming an uncomplicated procedure (13, 15, 22) Prophylactic antibiotics should target the anticipated organisms [13, 15].

- Complicated, contaminated, or dirty procedures should receive additional postoperative coverage (14, 15, 18, 20). During prolonged procedures, antibiotic prophylaxis should be readministered every 3 hours [14-18].
- Prophylactic antibiotics should be administered within 1 hour prior to in our study the incidence of wound infection in patient with antibiotic prophylaxis was 4%, while in patients with extended regimen antibiotic incision [14-20]. Was 6% Overall, 100% of patients received antimicrobial prophylaxis on time in our study. The most frustrating event in surgical practice is the breakdown of wound by infection since it prolongs hospitalization there are many studies about the incidence of wound infection. Maingot shows that wound infection occurs in about 5% of elective operations and the percentage is much less if one disregards minor redness of skin edges, discharge of some clear serous fluid or a small stitch abscess, Cellulites in and around the wound and abscess formation with purulent discharge occur in approximately 1% of cases [9]. The type of wound infection in the first group ranges from stitch abscess in 2, infected haematoma I patient and pus collection in I patient. While in second group were either stitch abscesses in 1 or 2 patients with abscess formation. No organ space infection was recorded Table (5). There were no intra-abdominal infections were recorded. There is also a respiratory tract

infection in 2 patients in prophylactic regimens and only one patient in non-prophylactic one Table (4). There are no recorded cases of urinary tract infection in our study. Table (4). This gives us a clue that there is no difference whether we cover the patient with antibiotic or not for prevention of wound like immune compromised patients or in the area of overcrowded hospital There are many studies shows that the hernia repair is a clean surgery even with the presence of risk factors and no antibiotic prophylaxis was needed (9) This gives us an advantage of stopping abuse of the antibiotic and save it to other patients who may in need for it The most used antibiotic was ampicillin and cefotaxime because they are available and not costly. There is no significant difference in hospital stay except for some cases that require prolonged hospitalization because of antibiotics given to the patient and mostly in the second group and those developing complications All patients with respiratory tract infection had previous history of smoking and chronic airway obstruction There are limitations in the study The first limitation concerns the inclusion of appendicectomies in the study population: The characterization of non-perforated and non-gangrenous appendicectomies was based on surgeon judgment, as it was not possible to find the whole number of histological reports of the specimens of appendices Another limitation is that only patients from one surgical unit participated in the study so the results are representative only for on clinic. The argument against prophylaxis for clean procedures, based on the intrinsically low rate of infection without antibiotic treatment, is overly simplistic for several reasons. For specific clean procedures, infection may be unlikely, but the morbidity and cost of even infrequent infection can justify the use of prophylaxis: Besides in colorectal surgery, antibiotic prophylaxis should consist of mechanical bowel preparation and administration of parenteral antibiotics at induction of anesthesia (10, 11, 12) Especially for colorectal surgery in our study, the most frequently prescribed antibiotic regimens were cefotaxime 21 % and ampicillin 79%.

**Conclusion**

1. There is no difference in incidence of wound infection between prophylactic and extended regimen antibiotics.
2. The cost of using prophylactic antibiotic is lower than in extended regimen antibiotics one.
3. Adherence of most surgeons to the use of prophylactic antibiotics is not recommended.
4. Stopping abuse of the antibiotic and save it to other patients who may in need for it.

**Table 1:** Surgical operations (First group)

Clean operation	Number	%	Clean contaminated operation	Number	%
Inguinal hernia	20	20	Open cholecystectomy	8	8
Incisional hernia	4	4	Closure colostomy	2	2
Paraumbilical hernia	10	10	Hydatid cyst	3	3
hemorrhoids	10	10	appendectomy	8	8
varicocele	4	4			
hydrocele	4	4			
Anal fissure	10	10			
Breast mass	5	5			
lipoma	6	6			
goiter	6	6			
total	79				

**Table 2:** Antibiotics used in first group

Antibiotics	Number of patients	%
Ampicillin	79	79
Cefotaxime	21	21
Total	100	100

**Table 3:** Antibiotics used in extended regimen antibiotics

Antibiotics	Number of patients	%
Ampicillin	50	50
Cefotaxime	50	50
Total	100	100

**Table 4:** Extended regimen antibiotic operations

Operation	Number	%
Laparoscopic cholecystectomy	20	40
Hydatid cyst	2	4
Varicose vein	4	8
Inguinal hernia	6	12
Paraumbilical hernia	12	24
Breast mass	6	12
Total	50	100

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