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Prescription of Antibiotics in Prevention of Surgical Infections in Kabul health Centers, A Cross-sectional Study in 2021 – 2022

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Abstract: **Introduction:** Surgery is one of the major and complex medical procedures which can save the patient's life if performed properly. However, negligence and carelessness during surgical procedures will lead to deterioration of the patient's health. One of the major challenges that patients often face after surgery is surgery-related infections that can even lead to the death of the patient, but these infections can be prevented and/or treated with appropriate antibiotics.

Aims of the Study: The main purpose of this study is to evaluate the rate of prescribing antibiotics in the prevention of infections caused by surgery in some health centers in Kabul.

Research Method: This research is a cross-sectional descriptive, prospective study. The questionnaires were prepared and distributed in 3 health centers in Kabul that had surgery departments, in the second 6 months of 1400 A. H. (equivalent to 2021 to 2022) and after collecting data, the results have been analyzed.

Results: In this study, the rate of antibiotics was administered to 64 patients, who have undergone surgery, in Kabul health centers; the highest age group of patients in the range of 20 to 30 years with a frequency of 18 patients (28.13%), the majority of male patients with a frequency of 34 patients (53.12%), the most surgical procedures were related to digestion and general with a frequency of 29 patients (45.31%) and the most prescribed antibiotics were gentamicin (29.69%) and ceftriaxone (28.13%) with frequencies of 19 and 18 patients, respectively, are among the major data received in this study.

Conclusion: Surgery is one of the major medical procedures that requires high precision and caution that is always associated with infections caused by surgery and can be prevented by surgery with appropriate antibiotics to prevent infections caused by surgery in patients.

Keywords: Antibiotics, surgery and prevention of infections

1. Introduction

There is no doubt that one of the great events in modern surgery is the discovery of antibiotics and their use in surgery. Also, the use of antibiotics to prevent surgical infections, whether superficial infections at the incision site or deep infections, the use of antibiotics in surgery has increased[4]. Accordingly, the microbial resistance strain has also increased. Fortunately, scientists have discovered newer antibiotics every year and marketed them to consumers. However, the speed of microbial resistance is faster than the emergence of new antibiotics. Therefore, the danger that threatens the surgical profession and science is that in the coming years we will not have any effective antibiotics to fight resistant bacteria[21]. In 1992, a research committee was established on wound infection. The new definitions of wound infection required that the name of the infection be changed to Surgical Site Infection (SSI). In the new definition, operative site infection includes infection at all levels of surgery, including superficial infections at the incision site that are limited to the skin and subcutaneous tissue to deep infections that involve the muscles. It also includes the spaces around

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the organs and viscera such as intraventricular abscesses, empyema, and mediastinum[5,11]. SSI is the most common nosocomial infection, with a prevalence of up to 38%, which, according to the definition, in both types of normal surgery, occurs up to one month after surgery. However, if any foreign body, such as a vascular graft or joint prosthesis, is used in the surgery, the infection may be seen for up to a year after surgery. 60% to 80% of SSIs are limited to incision and are superficial[5,6,18]. The bacteria that causes SSI depend on the microbial flora of the organ where the surgery was performed. In clean surgeries, Staphylococcus aureus is the most common pathogen (52%) followed by staphylococcus coagulase-negative (8.5%), enterococci (6.5%), coli bacillus (6.0%), followed by Pseudomonas, Streptococcus and Proteus, each 2% to 3% and finally fungi and the number of negative or unreliable cultures are present, but in clean-contaminated and contaminated infected wounds, E. coli and other enterobacteria are often more common. Candidate infections have also been seen in SSI[5,6,16]. The use of antibiotics has played a major role in the prevention of surgical infections, as well as the use of laxatives to reduce the number of intestinal microbes and the use of oral antibiotics from 18 to 24 hours before surgery and appropriate intravenous antibiotics before initiation of surgery helps reduce SSI[5,16].

1.1 Method of Selecting Antibiotics for Prevention

To do this, one needs to know the pathogens at the surgical site and how sensitive they are to antibiotics. For example, vancomycin should be used when a foreign body is to be implanted in the body, or if the prevalence of methicillin-resistant Staphylococcus aurous is more than 15%. The main antibiotics used in surgery are as follows: For many clean surgeries, the first generation of cephalosporin such as cefazolin, cephalexin or the second generation such as cefuroxime and cefoxitin are suitable. Considering the history of allergy to penicillin, the probability of allergy to cephalosporin is 5%, therefore the allergy test should be taken from the patient in the beginning. For Clean-Contaminated surgeries and the digestive system from the distal ilium to the bile ducts, ear, throat and gynecology; amoxicillin with clavulanic acid, ampicillin with sulbactam or the first or second generation of cephalosporin with metronidazole were used. Cephalosporins of the third and fourth generations, Carbapenems, Aztreonam and Quinolone should not be used because of their resistance[5,6,16].

1.2 Dosage, Methods and Timing of Antibiotic Administration

In many cases, the therapeutic dose and standard should be used for prevention. These drugs should normally be given intravenously (bolus) and should never be poured into injectable serums, as there is a risk of both contamination and dosage miscalculation. Precautionary antibiotics should have been used less than an hour before the surgical incision is made, as the bactericidal concentration of the medicine must be present in blood serum and the tissues of the patient at the start of the surgery. The best time to inject the drug is before initiating anesthesia[4,5,6,12,13]. Because, in this case, the injection is simultaneously before the tissue infection and the required concentration will remain during the operation and a few hours after it's over.

If surgery lasts more than three hours or bleeding occurs at the same time (massive = 1500cc), preventive antibiotics should be repeated and the time of recurrence depends on the half-life of the antibiotic used[6,15,20]. Prescribing antibiotics to prevent infection in surgery is an effective strategy to reduce post-operative infections, provided that appropriate antibiotics are prescribed at the right time and for a minimum sufficient time and with appropriate surgical procedures[2]. It is estimated that 30-50% of antibiotic use in health centers is for the prevention of infections during surgery, but 30-90% of prescribed prophylaxis is inappropriate and, in most cases, antibiotics are given at the wrong time, or their usage continues for a very long time[17]. The use of antibiotics to prevent infection at the surgical site is quite effective as long as its principles and rules are followed, and this has been proven by many experts and researchers during ballad studies. The following points should be considered for proper treatment with antibiotics:

- Precautionary necessity
- Antibiotic type
- Right dose
- Rate (start time of prescription)
- Duration of antibiotic use
- Consider time intervals in the administration

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If the preventive prescription of antibiotics is not done according to the principles, many complications such as disruption of the body's natural microbial flora, the addition of a new infection, Super Infection, the growth of antibiotic-resistant bacteria, bacterial infection, increased risk of drug poisoning and unnecessary costs will occur[25]. The effects of prescribing preventive antibiotics in preventing surgical site infections have been proven over 20 years ago. The guiding principles of systematic prescription of prophylaxis antibiotics are based on the belief that the accumulation of antibiotics in the host's tissue can strengthen the body's defense mechanisms and help eliminate the bacterial agents that have accumulated at the site[14].

2. Research objectives

The aim of this study was to evaluate the rate of antibiotics' prescription in the prevention of surgical infections in patients undergoing surgery.

3. Method of research

This research is a prospective cross-sectional descriptive study that was performed on patients who underwent surgery in the six months of 2021 to 2022 in health centers. In this study, the required information was collected from the patients by means of questionnaires containing questions related to the patient's demographic information, the type of antibiotic prescribed, the form of the antibiotic and the duration of its administration.

4. Ethical considerations

In this study, no compulsion or force to collect and participate in the study was done and all data related to patients are protected. Data collection and filling out research questionnaires were done after obtaining the patient's consent and with the cooperation of the relevant surgeon.

5. Data analysis

After collecting data from the patient, first the collected data was evaluated, incomplete information was removed from the research and other required and completed data were analyzed by programs such as: Microsoft Excel and SPSS version 27.0.0. Various tables and charts were used to better present the data obtained in this study.

6. Results

Considering the variables listed in the research questionnaire, the results obtained from the data of 64 operated patients, including demographic information of the patient, number of days hospitalized, type of surgery, dosage forms and type of antibiotic prescribed, are presented below.

- Patient age: All patients included in this study (64) are divided into 5 categories regarding their age (less than 20 years, 20 to 30 years, 31 to 40 years, 41 to 50 years and more than 50 years). The highest age group is related to the category of 20 to 30 years and the lowest is in the age category above 50 years. Frequency and percentage of age categories of participants in this study are listed in the table (1) below:

Table (1): *Age categories of patients*

NO	Age	Frequency (n)	Percentage (%)
1	less than 20 years	11	17.19%
2	20-30 years	18	28.13%
3	31-40 years	16	25.00%
4	41-50 years	10	15.62%
5	over 50 years	9	14.06%
	Total	64	100.00%

- Patient Gender: Of the 64 participants in the study, 34 were male and 30 were female.

- Patient education level: Considering the patient education level, all participants in this study are divided into illiterate, primary, secondary and high categories. Most patients in this study had a primary and secondary education level. The following table (2) shows the frequency and percentage of the educational level categories of the participants:

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Table (2): *Level of education of patients*

NO	Education level	Frequency (n)	Percentage (%)
1	Illiterate	11	17.19%
2	Primary	20	31.25%
3	Secondary	24	37.5%
4	High	9	14.06%
	Total	64	100.00%

- Duty of the patient: Out of 64 patients who underwent surgery, 7 patients are health workers and 32 patients are engaged in other duties. Twenty-five patients are still unemployed.
- Patient's residence: Out of 64 patients who underwent surgery, 40 patients are from Kabul province and 24 patients are from other provinces of the country.
- Number of hospitalized days: Considering the hospitalized days of operated patients, categories (less than one day, one to five days, 6 to 15 days and more than 15 days) were divided. Most of the patients were of the category hospitalized one to five days (42.19%).
- Type of surgery: In this study, patients underwent surgical procedures in the digestive or general departments, urology, orthopedics, ear, throat and nose, heart, gynecology, dentistry and other rare surgeries. Most of the surgery statistics are related to digestive and general surgery (45.31%). Frequency and percentage statistics of the type of surgical procedures performed are presented in the following chart (1):

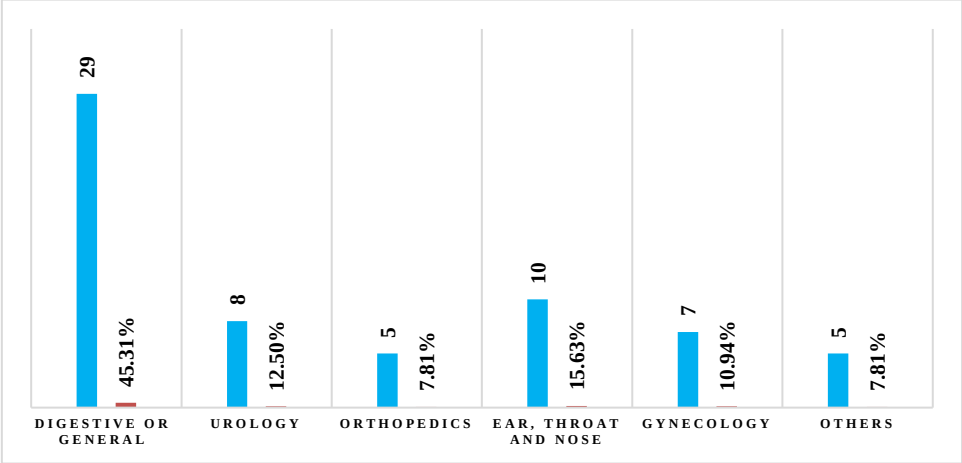

Chart (1): *Frequency and percentage of the type of surgical procedures performed*

- Prescribed dosage form of antibiotics: Although most antibiotics are used in various dosage forms of medicine to prevent infections in surgery, but in this study, most antibiotics prescribed are injectable (42.19%). In the following chart (2), the frequency and percentage of drug dosage forms of antibiotics prescribed to patients are presented:

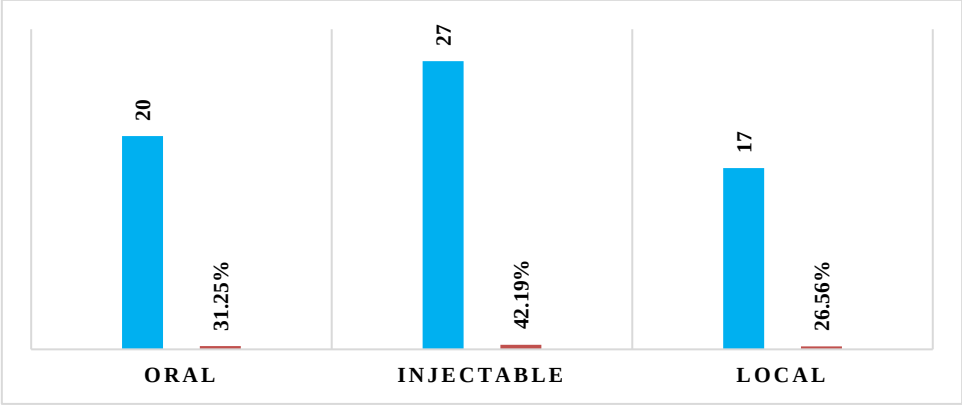

Chart (2): *Dosage forms of prescribed antibiotics*

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- Types of antibiotics prescribed: Most antibiotics prescribed in this study are antibiotics such as: gentamicin-vancomycin, penicillin, amikacin, clindamycin, cefazolin, ciprofloxacin, cephalexin, ceftriaxone and metronidazole. In the following chart (3), the frequency and percentage of the main antibiotics prescribed to prevent surgical infections in patients in this study are presented:

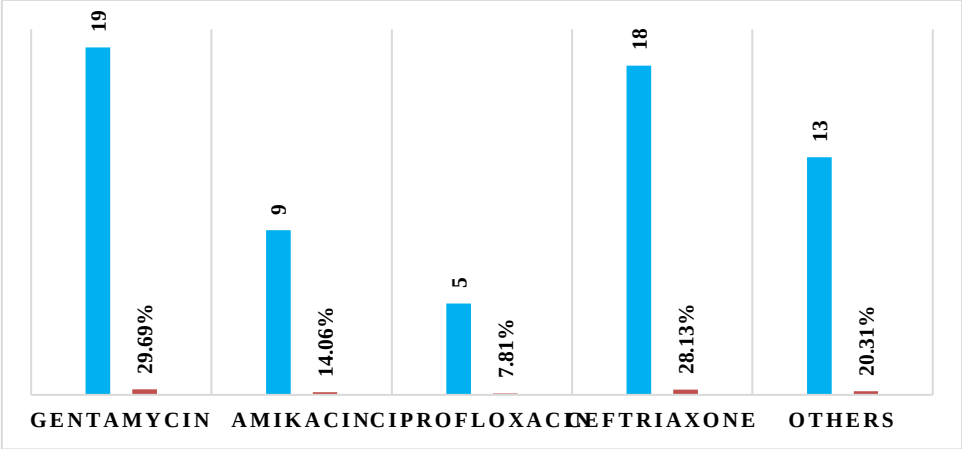

Chart (3): *Type of antibiotics prescribed*

7. Discussion

In a study conducted by Ahmad Shabanian et al. in 2015, over 450 patients with elective orthopedic surgery (300 men and 150 women), the most common antibiotic used was cefazolin in 438 patients (97.3%), gentamicin in 276 patients (62%) and Amikacin, the lowest, was used in 8 patients (1.8%). In a study conducted by Saeed and Mahdieh Reiszadeh on the administration of antibiotics before and after surgery in 279 patients undergoing surgery, the maximum age of prescribed antibiotics (above 50 years old); the most days of hospitalization, one day (77.1%); the most common type of surgery was general surgery (32.3%); and the most commonly prescribed antibiotic was cefazolin (30.5%). In a study conducted by Leila Eliassy et al., pertaining the prescription of antibiotics before surgery, over 2282 patients during surgery in 2015, reported that the highest number of antibiotics prescribed is cefazolin[3]. In a study conducted by Chow et al. between 1990 and 2004 pertaining orthognathic patients, it was found that taking antibiotics in a preventive manner could play an active role in preventing chronic and acute infections[10]. A 2008 study by Truong et al. on the use of antibiotics in Vietnamese hospitals reported that antibiotics were prescribed (93.2%) in the surgical ward [24]. In a 2018 study by Saleem et al., on more than 1954 patients in 13 hospitals in 7 different cities in Pakistan, 1516 (77.6%) of surgical patients used antibiotics. The most commonly used antibiotics were ceftriaxone (35%), metronidazole (16%) and ciprofloxacin (6%)[22]. In a study conducted by Ceyhan et al. in Turkey in more than 12 different hospitals, the rate of antibiotics prescribed to 1302 surgical (children) patients was 54.6%[9]. In another study conducted by Talaat et al. in 2011 in Egypt on more than 18 hospitals reported that the most prescribed antibiotics were the third generation of cephalosporins (28.7%) and the most common reason for prescribing antibiotics in this study was prevention of surgical infections (39%)[23]. In a study conducted by Abubakar et al. in 2019, about (22.5%) reason for taking antibiotics can be considered as a prevention of infections caused by surgery. According to the statistics obtained from this study, the most prescribed antibiotics were metronidazole (30.5%), ciprofloxacin (17.1%), ceftriaxone (16.8%), amoxicillin-clavulanic acid (12.5%) and gentamicin (11.8%)[1]. In a 2016 study by Bediako-Bowan et al. among 2107 patients, of whom 540 were in the surgical ward, about 70.7% of surgical patients used antibiotics[7]. In a 2016 study by Labi et al., over 677 patients, 348 patients (51.4%) were prescribed antibiotics, with most antibiotics being administered in pediatric surgery. According to the findings of this study, the most prescribed antibiotics are reported as metronidazole (17.5%), amoxicillin-clavulanic acid (13.4%), ceftriaxone (12%), cefuroxime (10%), cloxacillin (8.5%), meropenem (2%) and vancomycin (2%)[19].

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8. Conclusion

Surgery is one of the fundamental medical procedures. Since surgical operations involve incision and cutting, there is a possibility of surgical infections in patients, which can be eliminated by prescribing broad-spectrum antibiotics. According to the findings of this study, the most commonly prescribed antibiotics to prevent surgical infections are gentamicin and ceftriaxone.

9. Conflict of interest

Not available

10. Thanks and appreciation

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