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The assessment effect of antibiotic as prophylaxis against post-operative complications in elective surgery

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Abstract

***Background & Aims*:** Nowadays, complications of post-operative surgery are major problems for hospitals and occupying hospital beds that lead to the human and financial costs to society and the individual. The aim of this study is to use of appropriate antibiotic as prophylaxis to reduce infection and length of stay in hospital, prevention of drug resistance and postoperative complications.

***Materials & Methods*:** The present study was carried out on elective surgical patients, including: cholecystitis, inguinal hernia, thyroidectomy and contracture of burn. In this study, the patients were divided into two groups; receiving Cefazolin as prophylactic antibiotic and not receiving Cefazolin.

***Results*:** The results of this study showed that of 618 patients receiving Cefazolin as prophylaxis only 6 patients had postoperative complications and the average length of stay in hospital was 2 days, while in the not receiving Cefazolin group, there were 23 patients of post-operative complications and the average length of stay in hospital was 3.5 days.

***Conclusion*:** According to the findings, antibiotic Cefazolin as prophylaxis reduced post-operative complications and duration of hospitalization.

***Keywords*:** postoperative complications, Cefazolin, prophylaxis, elective surgery

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Introduction

Postoperative complications are one of the major problems in hospitals, which leads to financial costs to communities and the patient (1). Postoperative complications refer to any deviation from the health during the 30 days after surgery (2). These complications include: site infections, bronchial pneumonia, urinary tract infections and kidney failure, stroke, pulmonary embolism, myocardial infections and cellulitis (2). The most common postoperative complication is surgical site infection (SSI) (3). SSIs are fairly common, occurring in 2 to 5 percent of surgeries involving incisions. Rates of infection differ according to the type of surgery (4). As many as 500,000 SSIs happen in the United States annually (5). Most SSIs are staph infections. SSI is classified as an infection that

begins at the site of a surgical wound fewer than 30 days after the incision is made (6). SSI Leading to increased disease, increased antibiotic use, re-surgery, prolonged admission and care in special sectors, It also increases mortality in patients (7). Causes and risk factors of surgical site infections include surgery that lasts more than 2 hours, elderly, pollution of the operating environment, weak Surgical Techniques, Smoking, weak immune system, diabetes, inappropriate nutritional status of the patient, etc (8, 9).

Antibiotic is type of antimicrobial substance active against bacteria and is the most important type of antibacterial agent for fighting bacterial infections(10). Antibiotic medications are widely used in the treatment and prevention of such infections. They may either kill or inhibit the growth of bacteria(10). Antibiotic therapy as prophylaxis is one of the important factors in surgical procedures (11). Using correctly antibiotics and completing the prescribed dose are very important, as misuse can cause drug resistance.(12) The use of prophylactic antibiotics in the right time is very important as best time to inject prophylactic antibiotic is 30 minutes before the surgery (2). Some studies reported that usage of prophylactic antibiotic have not any positive effects on SSI (13). In other hand, it is reported that prophylactic antibiotic reduced postoperative complications(14, 15) .

Cephalosporins are one of the most important prophylactic antibiotics and have the same mode of action as penicillins, they are classified into four groups or generations based on the antimicrobial activity spectrum (16). First-generation cephalosporins are active predominantly against Gram-positive bacteria, and successive generations have increased activity against Gram-negative bacteria (17). Cefazolin is the first generation of cephalosporins that used to treat cellulitis, urinary tract infections, pneumonia, endocarditis, joint infection, and biliary tract infections (18). It is also used to prevent group B streptococcal disease around the time of delivery and before surgery and is typically given by injection into a muscle or vein (19).

Given that contradictory effect of antibiotics as prophylaxis and the use of appropriate antibiotics and reduction of postoperative complications are very vital, so the aim of this study was to investigate the effect of Cefazolin as prophylactic antibiotic on postoperative complications.

Materials & Methods

This study is an experimental and prospective clinical trial assessment that was conducted in a 6-month period in the surgical wards of Imam Khomeini Hospital in Urmia. Admitted patients for elective surgery including inguinal hernia, cholecystitis, contrast and chest tibial occlusion were selected. This research was carried out in accordance with the Helsinki Protocol for the care and use of patients. 1236 patients (18 to 60 years old) of any type of surgery were randomly divided into two groups:

1- **Receiving Cefaz**olin (as prophylactic antibiotic) (group 1): (618 patients include: 222 patients with cholecystitis, 280 patients with inguinal hernia, 68 patients with thyroidectomy and 48 patients with contracture of burn)

2- **Not receiving Cefazolin** (group 2): (618 patients include: 222 patients with cholecystitis, 280 patients with inguinal hernia, 68 patients with thyroidectomy and 48 patients with contracture of burn)

All patients had same admission conditions and therapeutic trials and they were hospitalized one day before surgery and CBC and U / A tests were performed for them. After serum therapy, patients in the receiving Cefazolin group received 1 gr of Cefazolin ampoules, half an hour before surgery, while patients in the not receiving Cefazolin, only had serum therapy without

any Cefazolin. During the hospitalization, the vital signs and the location of the ulcer were regularly monitored and at the time of discharge, CBC and U / A tests were performed for patients.

All values were analyzed by 1-way analysis of variance (ANOVA), and the Tukey test was used to compare quantitative data. Values less than 0.05 were considered statistically significant in all cases. Results are expressed as means ± SEM.

Results

Effects of Cefazolin as prophylactic antibiotic on post-operative complications

Figure 1 shows that the use of Cefazolin in the receiving antibiotic group decreased post-operative complications compared to the not receiving antibiotic group, but this but this increase was not significant. (P= 0.33)

The number of total patients in the each receiving Cefazolin and not receiving antibiotic groups was 618 that 6 patients from first group (3 cases of cholecystectomy, 2 cases of horny inguinal and 1 case of contrast-sensitive diagnosis) referred to hospital with post-operative infection, that

, while 23 patients from the second group (12 cases of cholecystectomy, 7 cases of horny inguinal, 3 case of contrast-sensitive and 1 case of thyroidectomy diagnosis) referred to hospital with post-operative infection. (Fig 2).

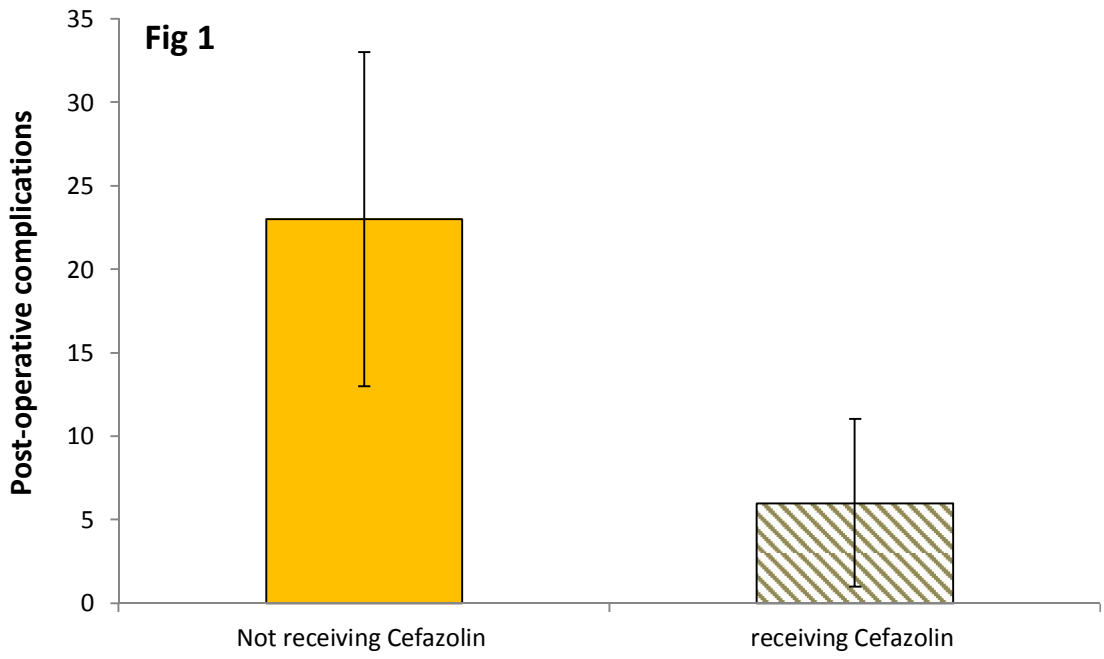

Fig 1. Indicates the number of patients with post-operative complications in Not receiving Cefazolin and receiving Cefazolin groups.

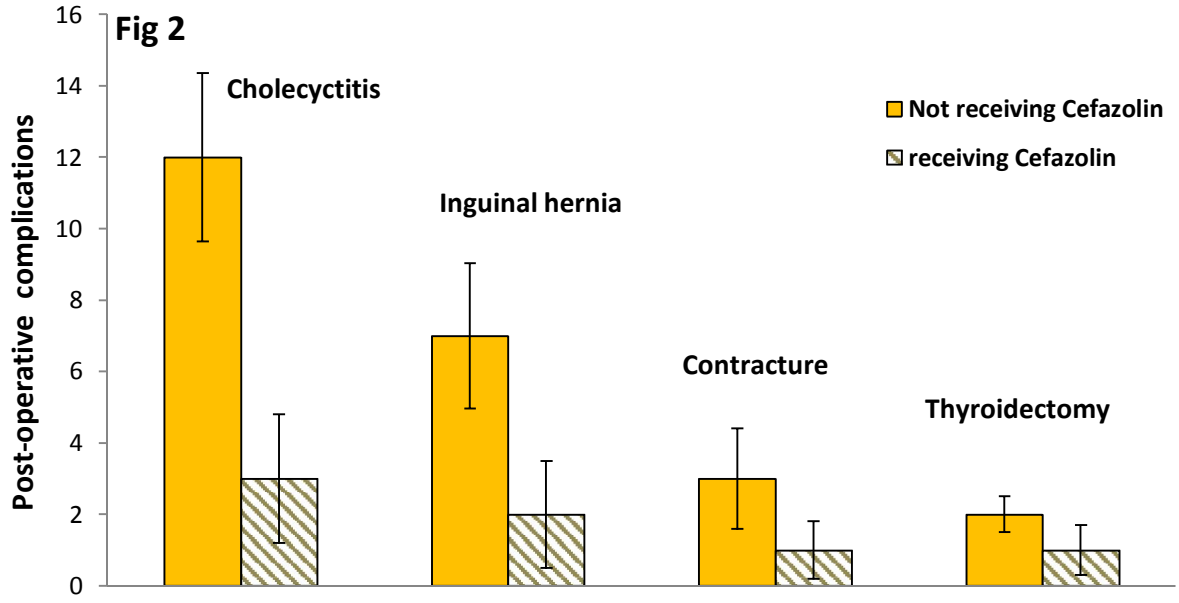

Fig 2. Indicates the number of patients with post-operative complications by separating the type of surgery in Not receiving Cefazolin and receiving Cefazolin groups.

Effects of Cefazolin as prophylactic antibiotic on White Blood Cells (WBC) Count in blood:

Results obtained from blood tests depicted in figure 3. According this Fig, WBC significantly (P=0.007) increased in not receiving Cefazolin group compared to admission time. Also, WBC significantly (P= 0.047) was more in the not receiving Cefazolin group when compared with receiving Cefazolin group.

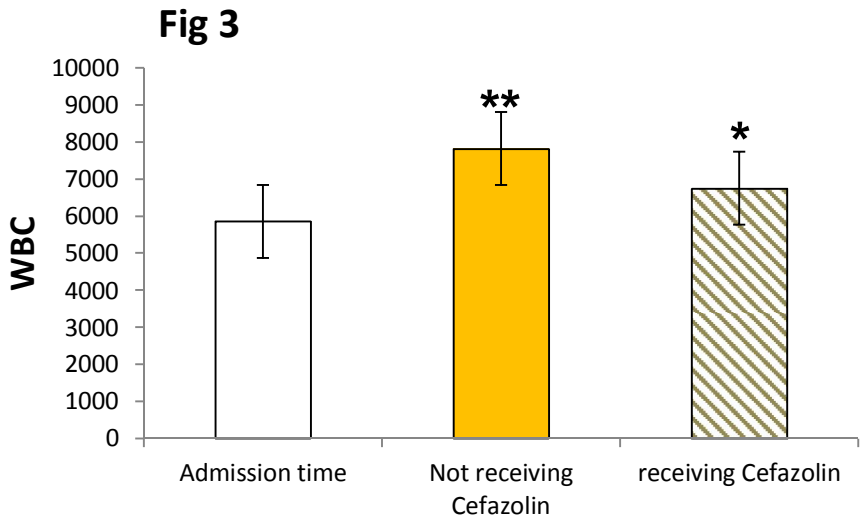

Fig 3. Indicates the Count WBC at the time of admission and in Not receiving Cefazolin and receiving Cefazolin groups. Data are shown as mean ± SEM. * indicated significant change compared with Not receiving Cefazolin group. ** indicated significant change compared with Admission time.

Effects of Cefazolin as prophylactic antibiotic on White Blood Cells (WBC) Count in urine:

Figure 4 illustrates that White Blood Cells (WBC) count in urine significantly (P= 0.012) increased in not receiving Cefazolin group compared to admission time. Also, according to Fig 4, White Blood Cells (WBC) count in urine increased in receiving Cefazolin group compared to admission time but not significantly and decreased (not significantly) in receiving Cefazolin group compared to not receiving Cefazolin group.

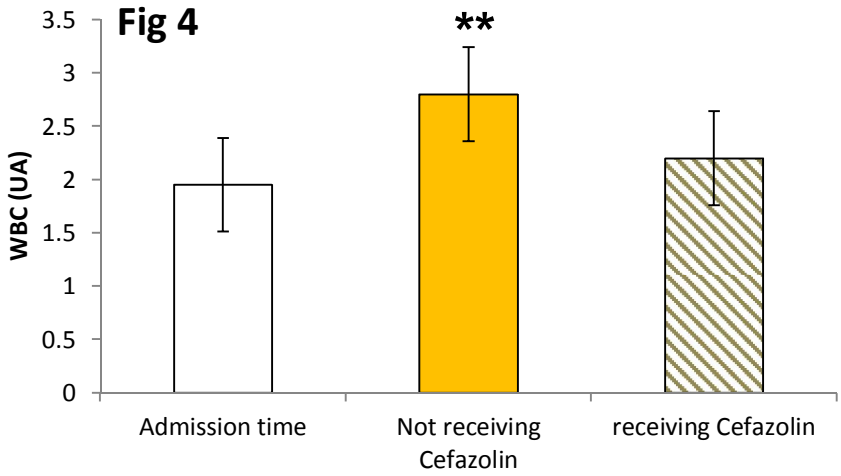

Fig 4. Indicates the Count WBC in urine at the time of admission and in Not receiving Cefazolin and receiving Cefazolin groups. Data are shown as mean ± SEM. ** indicated significant change compared with Admission time.

Effect of Cefazolin as prophylactic antibiotic on degree of fever:

One-way ANOVA showed that degree of fever in receiving Cefazolin and not receiving Cefazolin groups significantly (P< 0.0001) increased compared to admission time (Fig 5). Moreover, Cefazolin prescription in receiving Cefazolin group decreased significantly (P= 0.002) degree of fever compared to not receiving Cefazolin group.

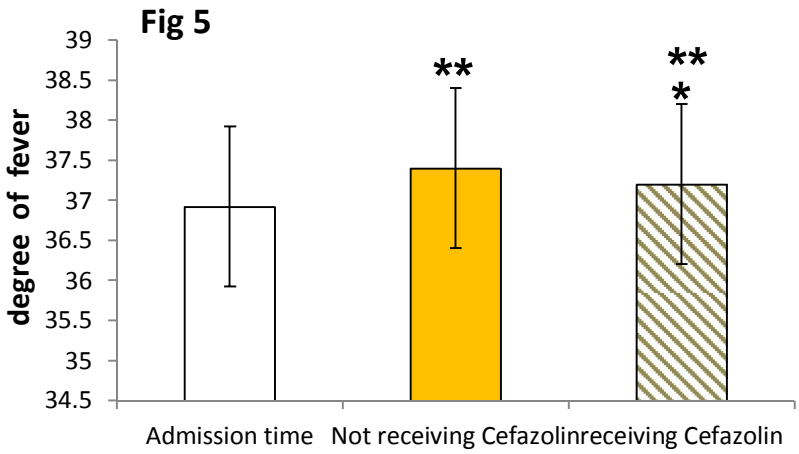

Fig 5. Indicates the degree of fever at the time of admission and in Not receiving Cefazolin and receiving Cefazolin groups. Data are shown as mean ± SEM. * indicated significant change compared with Not receiving Cefazolin group. ** indicated significant change compared with Admission time.

Effect of Cefazolin as prophylactic antibiotic on duration of hospitalization:

Figure 6 illustrates the effect of Cefazolin on duration of hospitalization in the study groups. According to this figure, average length of stay in hospital significantly decreased in receiving Cefazolin group. As, the average length of stay in hospital was 2 days, while in the Not receiving Cefazolin group, the average length of stay in hospital was 3.5 days.

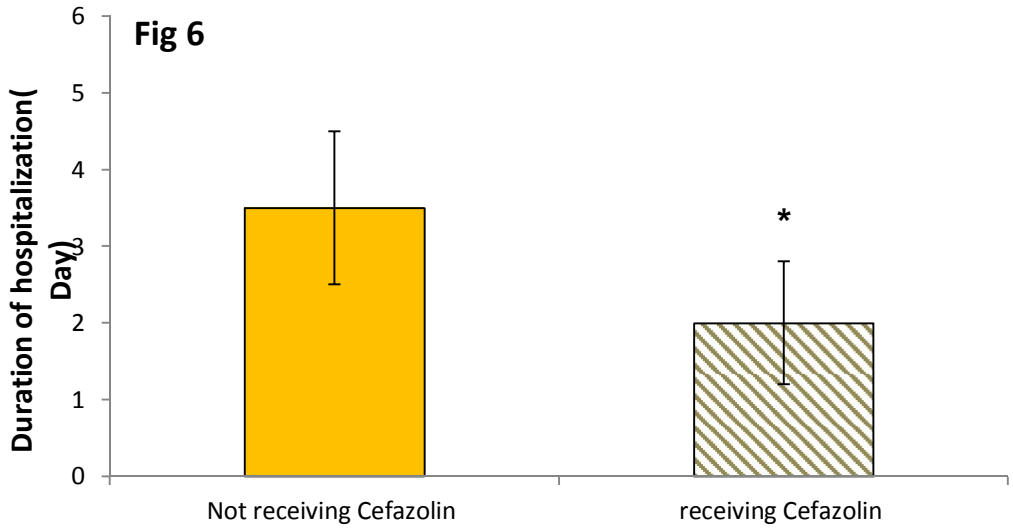

Fig 6. Indicates the duration of hospitazilation in Not receiving Cefazolin and receiving Cefazolin groups. Data are shown as mean ± SEM. * indicated significant change compared with Not receiving Cefazolin group.

Discussion

This study was conducted in Imam Khomeini Hospital in 1397, results of this study showed that Cefazolin treatment as prophylaxis antibiotic before surgery significantly reduces postoperative infection. Increasing white blood cell count is one of the indicators of post-operative infection (20). Our study showed that the mean of WBC in not receiving Cefazolin significantly increased compared to receiving group that this finding confirms the presence of post-operative infection in this group of patients. In this study post-operative infection in patients who did not receive antibiotics were approximately equal in all types of surgeries, so this finding suggests that site infections can occur in any type of surgery. The presence of more white blood cells in the urine of untreated patients with antibiotics also confirms the infection in these patients. According to findings of this study, the average body temperature was higher in patients without antibiotic pre-treatment, but body temperature changes were not significant, which could indicate that the infection was not severe. Today, there are still contradictions regarding the timing, duration of antibiotic treatment and the choice the type of antibiotic used in surgery (21). In our study, Cefazolin were used half an hour before surgery, which was satisfactorily similar to previous studies. In the last two decades, we have witnessed a considerable increase in both the number and the severity of infections caused by Gram-positive bacteria such *Staphylococcus aureus* (22). In many institutions, Gram-positive bacteria are the cause of more than 50% of all bloodstream infections (23). Today, first-generation cephalosporins are used as a proper choice for preventing post-operative infections which are relatively non-toxic, inexpensive and easily penetrate into soft tissue and bone (16). A clinical human study

has shown that the use of antibiotics 2 hours before skin cutting has the greatest effect on reducing wound infections (22). Over the past decades, more studies have suggested that antibiotic prescribing should continue after surgery (24). However, therapeutic protocols are different and are used in single dose or multiple dosages after surgery (24). Finally, the results of this study showed that the use of Cefazolin half an hour before surgery significantly reduced postoperative infection.

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