

# Comparison of Single Dose with Multiple Dose Antibiotic Prophylaxis with Cefuroxime in Open Cholecystectomy

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## Abstract

**Objectives:** To compare single dose with multiple dose antibiotic prophylaxis with Cefuroxime in open cholecystectomy in terms of post operative surgical site infection, hospital stay and cost effectiveness.

**Study Design:** Quasi experimental study.

**Place and Duration of study:** The study was conducted in the Surgical Unit of Punjab Employees Social Security Institution Islamabad and Ahmed Hospital Rawalpindi Teaching Hospitals of IMDC Islamabad, from 1st August 2010 to 30th September 2011.

**Methodology:** A total of one hundred and ten patients requiring elective open cholecystectomy were included. Patients with acute cholecystitis, jaundice, diabetes, malignancy, choledocholithiasis and co morbidity were excluded. Patients were divided in to two groups, 55 patients in each group, Group A received only single dose of Cefuroxime and Group B received multiple doses (six).

**Results:** In this study, 97 (88%) patients were females and 13 (12%) were males. The mean age was 40.69 years. In Group A, 4 (5.5%) patients, and in Group B, 7 (12.7%) patients developed surgical site infection. Mean hospital stay in Group A was 2.18 days and in Group B 2.43 days. Cost of antibiotics in Group A was six times less than Group B.

**Conclusion:** There is no difference in single dose and multiple doses prophylaxis with Cefuroxime in low risk patients for elective open cholecystectomy in terms of post operative surgical site infection and hospital stay however single dose is more cost effective.

**Key words:** Open Cholecystectomy, Single dose, Prophylaxis, Cefuroxime

## Introduction

Cholelithiasis is very common problem in general surgery practice all over the world. In Pakistan the overall incidence of Cholelithiasis is 9.03%.<sup>1</sup> Cholelithiasis affects approximately 10% of the adult population in the United States.<sup>2</sup>

Currently, the most frequently performed operation for symptomatic gall stones and cholecystitis is laparoscopic cholecystectomy in developed countries. Open cholecystectomy involves major abdominal surgery and is used as the first line treatment where laparoscopic facilities are not available.<sup>3-4</sup>

Wound infection is not a new problem; it has been documented for at least 4000-5000 years. Egyptians had some concept of infection. The concept of prophylaxis had also been known earlier by Assyrians. Greeks independently explained it and later on Hippocratic teaching described the use of antimicrobials.<sup>5</sup>

In abdominal surgery, infectious complications are the main causes of postoperative morbidity and financial cost.<sup>6</sup>

Although surgical infection rate has decreased dramatically during the last 25 years, morbidity and mortality of these infections in surgical treatment remains substantial.<sup>7</sup> The incidence of surgical site infections in general surgery is related to many factors, and the main risk factors for developing infections are: endogenous, host-related, exogenous, procedure and environment related.<sup>8</sup> Therefore, antibiotics have long been used in surgery, for prevention and treatment of infections. The World Health Organization has established the rationale of use of antibiotics as a priority in its campaign.<sup>9</sup> Peri-operative antibiotic prophylaxis is safe and its effectiveness is proven.<sup>10,11</sup> Inappropriate use of surgical antibiotic prophylaxis is common, e.g., incorrect timing, improper duration, and oral route of administration of antibiotics.<sup>12</sup> The timing of first dose is very important<sup>7</sup>, and improper timing is one of the most common faults regarding surgical prophylaxis.<sup>13</sup> The agent selected should be the one to which the expected organisms are highly sensitive<sup>14</sup>, and the dose should have large volume of distribution, lower toxicity, and longer half-life, allowing single dose administration.

The effectiveness of prophylactic antibiotics in elective cholecystectomy is well-established and the choice of antibiotic remains a concern. Cholecystectomy is a clean contaminated type of surgery and with prophylaxis surgical site infection is less than 10% and without prophylaxis

surgical site infection can be up to 20%.<sup>5</sup> The source of infection can be endogenous (infected bile/gallbladder wall) or exogenous. In certain trials, the frequency and type of bacteria in bile, the factors predicting the presence of bacteria in bile, and the relationship between bacteria in bile and subsequent wound sepsis have been evaluated.<sup>15-16</sup>

In this article we report the use of second generation cephalosporin (Cefuroxime), as mentioned in the text<sup>17</sup>, for prophylaxis and comparison of single dose with multiple doses of intravenous Cefuroxime in terms of wound infection, hospital stay and cost effectiveness.

### Material and Methods

It was a Quasi Experimental study. The study was conducted in the Surgical Unit of Punjab Employees Social Security Institution Islamabad and Ahmed Teaching Hospital of Islamabad Medical & Dental College, from 1<sup>st</sup> August 2010 to 30<sup>th</sup> September 2011. Total 110 patients without any gender discrimination were included in the study with chronic cholecystitis due to gall stones or acalculous choric cholecystitis or symptomatic gall stones. Age of the patients ranged from 20 to 65 years. Patients with acute cholecystitis, choledocholithiasis, malignancy, co morbid like diabetes, hypertension, hepatitis, jaundice, chronic renal failure and history of pancreatitis were excluded from the study. All the patients were admitted through the OPD in the surgical ward for open cholecystectomy. Permission was taken from the Hospital ethical committee for the study. The patients were thoroughly examined in the wards and all the routine and specific investigations done to confirm the diagnosis. Detailed informed consent was taken. The patients were divided into two groups Group A and B by randomization selection. In group A patients were given 750 mg of Cefuroxime intravenously, one hour before induction of anesthesia. In group B, multiple doses of 750 mg of Cefuroxime were given intravenously; first dose at 1 hour before induction of anesthesia, and subsequent doses were given at an interval of 8 hours after surgery for 2 days (six doses). After operation, the patients were observed for postoperative sepsis in the ward for two days

Grade-I infection	Slight reddening and induration of wound edges requiring no intervention.
Grade-II infection	Slight serous discharge from wound, requiring no intervention
Grade-III infection	Obvious infection or purulent discharge from wound, requiring repeated change of dressings and institution of antibiotics

. Daily record of pulse, temperature, respiratory rate, abdominal tenderness, and bowel sounds was maintained. Blood complete picture was done on 2nd post op day and wound was examined before discharging the patient. Subsequently, the patients were observed on the 5<sup>th</sup>, 7<sup>th</sup>, 15<sup>th</sup>,

21<sup>st</sup> and 30<sup>th</sup> day, in surgical outpatient department, for wound infection and fever. Wound infection was categorized into three grades depending on severity (Table I):

The data was collected on a preformed proforma and entered into SPSS software version 16 and analyzed. Mean  $\pm$  standard deviation will be calculated for age and hospital stay. Frequencies and percentages were calculated for gender and wound infections in both groups. Chi square test was used to compare the frequency of wound infection in group A and Group B patients. P-value <0.05 was considered significant.

### Results

In a total number of 110 patients included in the study, the age ranged from 20 years to 65 years with a mean  $\pm$  SD of 40.69  $\pm$  7.76 years. Maximum number of patients was in the age group of 36 to 45 years (Figure I). There were 97 (88%) females and 13 (12%) male patients.

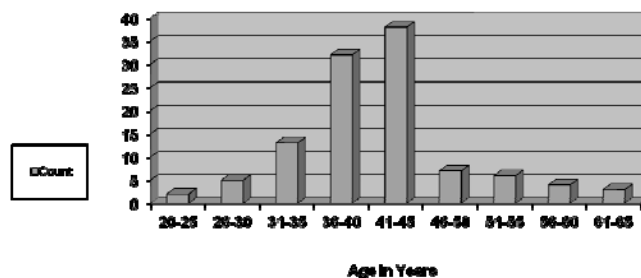


Figure 1: Distribution of Patients by Age Groups

In Group A, 3 patients (5.5%) developed Surgical Site Infection, while 52 patients had normal wound healing; 2 patients developed Grade II infection, while one patient developed Grade III infection. In Group B, 7 patients (12.7%) developed surgical site infection; of them, 1 patient developed Grade I, 4 patients developed Grade II and 2 patients developed Grade III infection. (Figure 2) On comparing the results of both Groups by applying Chi Square test a value 0.990 was obtained which was insignificant.

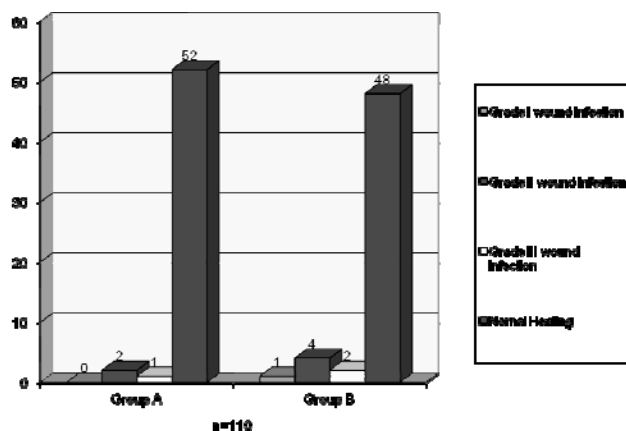
Mean hospital stay in the Group A patients was 2.18 days with Standard Deviation (SD) of  $\pm$  0.181, while Mean hospital stay in the Group B patients was 2.43 days with Standard Deviation (SD) of  $\pm$  1.21

In terms of cost effectiveness the cost of antibiotics in Group B were 6 times more as compare to Group A.

### Discussion

Gall stones are a very common problem in every part of the world and cholecystectomy is most common procedure in surgical settings.<sup>2</sup> In developed countries and institution where facilities of laparoscope are available, laparoscopic cholecystectomy is the procedure of choice. Open cholecystectomy is still first line of treatment where

facilities, cost effectiveness and expertise matter.<sup>3</sup> Leo and colleagues published a study in 2006 and discussed the open cholecystectomy for gall bladder disease and concluded this procedure as effective, compatible with short hospital stay, evidence-based gall-bladder surgery, and training of surgical residents.<sup>18</sup> Cholecystectomy is clean contaminated type of procedure, and wound infection without prophylaxis can affect 20% of individuals.<sup>5</sup> Prophylaxis is still a debatable issue and different studies are conducted on the issue.<sup>19</sup> Pea and colleagues published a study in 2003 and advised second generation cephalosporin prophylaxis for clean contaminated cases for ultra short period and also recommended that post surgical prophylaxis is not advisable.<sup>20</sup> Similarly the concept of chemoprophylaxis which is the base of our study is also recommended by the Bowater and his colleagues in the study published in 2009. They concluded that the prophylaxis is effective in post operative wound infections.<sup>21</sup>



**Figure 2: Frequency and Grades of Wound Infections in Both Groups**

The results of our study showed that females were mostly affected by the gall bladder disease (88%) as compared to males (12%). The results of gender frequency of our study are similar to a previous study published in 2008 , showing that incidence of gallbladder disease among females in Pakistan is 3.3 time more as compared to males.<sup>1</sup>

The results of our study showed that the 3 patients (5.5%) developed wound infection in Group A amongst these patients, 2 patients developed Grade II, and one patient developed Grade III wound infection; all the patients in this group were receiving single dose of Cefuroxime for prophylaxis. In Group B which was receiving multiple doses for prophylaxis, 7 patients (12.7%) developed wound infection. In this group one patient had Grade I, 4 patients had Grade II and 2 patients had Grade III wound infections. On comparing the results of both groups the p value had showed statistically insignificant result, but clinically the Group A had better results as compared to the Group B. Compliance of the patients were also better in Group A as

compared to Group B. In a previous study, Zahid et al compared the results of single dose versus three-dose prophylaxis by cefotaxime sodium in patients undergoing elective cholecystectomy. The results were like our study; single dose group had 4% wound infection, while three doses group had 5.3% wound infection. The authors recommended single dose antibiotic prophylaxis with cefotaxime.<sup>22</sup>

Another study showed 4.3% wound infection with single antibiotic in two doses, and recommended single antibiotic prophylaxis for elective cholecystectomy.<sup>23</sup>

Kufman conducted a double blind, controlled randomized trial to evaluate the effectiveness of a single dose of prophylactic antibiotic (gentamycin) for elective cholecystectomy. All patients recognized pre-operatively as being at risk were excluded. The treatment group comprised of 102 patients received a single dose of antibiotic and the 74 patients in the control group received a placebo. Of the patients who received antibiotic, wound infection developed in 4.9% as compared to 13.5% in the control group.<sup>24</sup>

Mean hospital stay in our study was 2.18 days for Group A patients and 2.43 days for Group B patients which were slightly high as compared to the study conducted by Leo and colleagues<sup>18</sup>, but our results are better as compare to study conducted by Zahid.<sup>22</sup>

In our study cost of antibiotics of Group A is simply six times less with Group B that is also major concern for the underdeveloped countries and for patients also.

## Conclusion

There is no difference in single dose and multiple doses prophylaxis with Cefuroxime in low risk patients for elective open cholecystectomy in terms of post operative surgical site infection and hospital stay. The risk of postoperative wound infection can be effectively managed by single dose prophylactic antibiotic (Cefuroxime). The single dose prophylaxis also has the benefit of cost effectiveness. We recommend large scale multi centre studies in Pakistan to augment our conclusion.

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