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Effectiveness of Single Dose versus Multiple Dose of Pre-Operative Antibiotic: A Prospective Observational Study

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ABSTRACT
Research has indicated that when preventive antibiotics are given during a caesarean section, they dramatically decrease the occurrence of maternal postpartum fever, wound infection, endometritis, urinary tract infections, major infectious morbidity, death and length of hospital stay, when compared to a placebo. Patients who had acute cholecystitis, choledocholithiasis, and other medical conditions such as diabetes mellitus, hypertension, cardiac or renal failure, ischemic heart disease, immunosuppression and those who underwent open surgery were not included in this study. Following admission, a comprehensive medical history, physical examination findings, routine blood test results, and ultrasound report were recorded in the proforma sheet. The patients were randomly divided into two equal groups one group was assigned as the single dose group (SD), while the other group was assigned as the multiple dose group (MD). single dose (SD) group, consisting of 45 patients and multiple doses (MD) group, also consisting of 45 patients. Both groups got the intended treatment and were evaluated. Among the 90 patients, 68 (75.5%) were girls and 22 (24.4%) were males. The average age of individuals with symptomatic cholelithiasis was 44.621±13.15 years, with a minimum age of 18 years and a maximum age of 77 years. Our research suggests that using a single dosage of antibiotics before anaesthesia induction for laparoscopic cholecystectomy is equally effective as using numerous doses of antibiotics in preventing surgical site infections during the post-operative period.

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Key Words
Antibiotics, surgical site infections, adverse drug reactions

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INTRODUCTION

In nations such as India, symptomatic cholelithiasis is a common health issue. The initial open chole cystectomy was pioneered and carried out by Langenbach in 1892, while the laparoscopic cholecystectomy was established by Philip Mouret. This technique is now considered the standard method for treating symptomatic cholelithiasis.[1] Surgical Site Infection (SSI) is widely recognised as the primary issue in any surgical procedure. While laparoscopic cholecystectomy is a less intrusive surgery, there is a high occurrence of surgical site infections in patients. It is also thought that preventive antibiotics have a significant effect in preventing surgical site infections (SSI)[2,3]. Nevertheless, excessive use of antibiotics can lead to unnecessary expenses, adverse drug reactions, or the emergence of various drug-resistant microbes. Various research indicate that different antibiotic regimens should be used during laparoscopic cholecystectomy[4,5]. However, most of the studies were conducted in wealthier countries where there is a strong emphasis on maintaining hygiene in operating rooms. These countries also have features such as automatic doors and laminar air flow systems, which may have resulted in fewer cases of surgical site infections (SSI) after surgery. It is important to note that these settings are significantly different from those found in developing countries. The purpose of our study was to compare the effectiveness of a single dose of antibiotics with many doses in preventing surgical site infections in patients undergoing laparoscopic cholecystectomy.

It has become the most frequently done surgical surgery during childbirth worldwide, making up approximately 25% of all deliveries in certain countries[6,7]. Delivery via C-section is linked to a significantly higher risk of postpartum infections, such as endometritis, urinary tract infection, and wound infection, compared to vaginal delivery. The risk might be 5-20 times larger[8]. in Preoperative preventive antibiotics are meant to decrease the amount of bacteria present and alter the conditions at the surgical site when the body's defences are temporarily weakened due to the surgery[9]. Research has indicated that when preventive antibiotics are given during a caesarean section, they dramatically decrease the occurrence of maternal postpartum fever, wound infection, endometritis, urinary tract infections, major infectious morbidity, death and length of hospital stay, when compared to a placebo[10]. Evidence from randomised controlled trials indicates that for caesarean delivery, short-term antibiotic prophylaxis is as effective as long-term antibiotic prophylaxis[11,12]. The majority of these research were conducted in countries with high economic levels. Research has indicated that long-term antibiotic prophylaxis does not provide any additional benefits in reducing postpartum infections compared to short-term antibiotic prophylaxis. However, it does come with increased costs, a larger workload for medical staff, and a potential danger of antibiotic resistance[13,14]. Environmental considerations, such as the origin, storage and quality of the antibiotics; drug misuse and the emergence of antibiotic resistance have rendered a shorter antibiotic treatment less preferable in tropical regions. Many obstetricians in India appear hesitant to adopt the evidence-based recommended single-dose regimen for surgical prophylaxis, despite being well-informed. This may be due to concerns about an elevated risk of postoperative infection in our setting, even though there is no evidence to support this longstanding belief[15]. This procedure goes against the notion of surgical prophylaxis as a method to prevent infections, since a therapeutic treatment is given.

MATERIALS AND METHODS

The study received prior approval from the institutional research committee. A total of 90 cases were enrolled in this investigation with previous agreement. The research was conducted for a duration of ten months, and the participants who had chosen to have elective laparoscopic cholecystectomy were included in our study. Patients who had acute cholecystitis, choledocholithiasis, and other medical conditions such as diabetes mellitus, hypertension, cardiac or renal failure, ischemic heart disease, immunosuppression and those who underwent open surgery were not included in this study. Following admission, a comprehensive medical history, physical examination findings, routine blood test results and ultrasound report were recorded in the proforma sheet. The patients were randomly divided into two equal groups one group was assigned as the single dose group (SD), while the other group was assigned as the multiple dose group (MD). The SD group received intravenous ceftriaxone (2 gm) during anaesthesia induction, while the MD group received intravenous ceftriaxone (2 gm) during anaesthesia induction followed by intravenous ceftriaxone (1 gm) twice a day for two days after the operation. A standard gallbladder removal surgery was performed with appropriate measures to prevent infection. All patients were monitored daily for two days after the surgery, and then a follow-up was conducted at 1 week and 3 weeks to check for any surgical site infections (SSI). Fever, redness and pain at the location of the port, drainage from the wound, separation of the wound edges, and the formation of an abscess in the wound were all classified as surgical site infections (SSI).

Statistical analysis: The observations were statistically analysed using SPSS-20, employing the chi-square test and independent sample t-test. Mean standard

deviation (min-max) was used for continuous measurements, whereas numbers (%) were used for categorical measurements. The p>0.05 was considered statistically significant.

RESULTS

A total of 90 randomly selected patients were divided into two groups single dose (SD) group, consisting of 45 patients and multiple doses (MD) group, also consisting of 45 patients. Both groups got the intended treatment and were evaluated. Among the 90 patients, 68 (75.5%) were girls and 22 (24.4%) were males. The average age of individuals with symptomatic cholelithiasis was 44.621±13.15 years, with a minimum age of 18 years and a maximum age of 77 years. The highest number of cases occurred in the age range of 30-39 years (29.2%), as seen in [Table 1].

Out of the 90 patients who were part of the study, 55 patients received a single dose of ceftriaxone (1gm) during anaesthesia induction (referred to as the SD group), while the remaining 45 patients (referred to as the MD group) received multiple doses of ceftriaxone (1 gm) during anaesthesia induction. The MD group continued to receive these multiple doses twice a day for 24 hrs after the surgery. There was no statistically significant difference seen in the demographic characteristics of the two groups, as shown in (Table 2).

Only three (3.1%), out of 45 patients in the SD group, experienced a rise in body temperature on the first day after surgery, which was alleviated with medication to reduce fever. Two additional patients (6.3%) experienced soreness, redness and inflammation around the umbilical cord during the second week of follow-up. These symptoms alleviated with the use of anti-inflammatory medication and removal of the sutures. Another patient (3.4%) also experienced discharge from the wound, which improved after draining the wound, removing the stitches and administering a course of antibiotics. Nevertheless, a culture and sensitivity test was conducted on the wound swab, yielding sterile results. All these individuals were monitored until the fourth week and they no longer showed symptoms (Table 3). Likewise, in the MD group, out of 45 patients, 4 patients (6.2%) experienced redness and little pain at the umbilical port site. This condition improved after 2 weeks after follow-up with the use of anti-inflammatory medication. Another patient had an open wound, which gradually healed with constant bandages and a course of antibiotics. Secondary intention wounds healed without suturing by the third week (Table 4).

DISCUSSIONS

Therefore, in order to reduce the risk of surgical site infection the use of antibiotics for prophylaxis plays a crucial role in ensuring a surgery free from contamination. Between the ages of,[16-18] While the exact significance of antibiotic prophylaxis in laparoscopic cholecystectomy remains unclear. The likelihood of surgical site infection (SSI) in laparoscopic cholecystectomy is significantly lower for several reasons, including minimal tissue manipulation, reduced risk of contamination and smaller incisions[19-20]. However, Chang *et al*.[21] colleagues do not support the use of preventive antibiotics in laparoscopic cholecystectomy.Furthermore, a single dose of antibiotics was found to be effective before surgery, as demonstrated by Sutariya *et al*.[17] While Abro *et al*.[22] suggested using repeated doses of antibiotics instead of a single dose. It should be noted that most of the investigations were conducted in wealthier countries, where hygiene and surgical facilities were significantly better compared to developing ones. Our latest study aimed to compare the effectiveness of a single dose of antibiotics against numerous doses in preventing surgical site infections (SSI) in laparoscopic cholecystectomy. It has been noticed that women are more frequently impacted by gallstone disease than men. In our research, 58 (82.9%) of the participants were female patients, while 12 (17.1%) were male patients. In general, gallstone disease is commonly observed throughout the fourth decade of life. The age range in our current study varied from 18-79 years, with the highest percentage (28.6%) observed in the 30-39 age group, followed by the 40-49 age group (25.7%). The average age was (43.62 12.18) years, which was consistent with the study conducted in Saudi Arabia[23,24]. It is widely known that age is a significant risk factor in open cholecystectomy, however it does not have any connection with surgical site infections in laparoscopic cholecystectomy. The rate of wound infection was 4% among all 35 patients in the SD group. Only one patient (2.9%) experienced fever on the day after the surgery, and an additional two patients (5.7%) reported redness and soreness at the location where the surgical ports were placed. One more patient (2.9%) had experienced wound drainage. The management of these complaints was handled cautiously utilising wound bandages, pain relievers and fever reducers, resulting in total recovery of all patients by the fourth week of follow-up. However, the wound illness rate for MD groups was just 3%. Only two patients (5.7%) experienced redness

Table 1: Distribution of patients in different age groups

Age group (years)	No. of patients (%)
10-19	05 (5.5)
20-29	18 (20.0)
30-39	23 (25.5)
40-49	22 (24.4)
50-59	12 (13.3)
60-69	10 (11.1)
70-79	00 (00.0)
Total	90 (100)

Table 2: Wound complications in SD group

Type of surgical site infection	First day post-operative	Second operative day	Post-after 2nd week	After 4th weeks
Fever	1	Nil	Nil	Nil
Port site redness, ten-dearness	Nil	Nil	2	Nil
Discharge from wound	Nil	Nil	1	Nil
Wound gape	Nil	Nil	Nil	Nil
Wound abscess	Nil	Nil	Nil	Nil

Table 3: Wound complications in MD group

Type of surgical site infection	First post-operative day	Second post-operative day	After2nd week	After 4th weeks
Fever	Nil	Nil	Nil	Nil
Port site redness, tenderness	Nil	2	Nil	Nil
Discharge from wound	Nil	Nil	Nil	Nil
Wound gape	Nil	1	Nil	Nil
Wound abscess	Nil	Nil	Nil	Nil

Table 4: Comparison of wound infection between two groups using chi-square test

Groups	Wound infection, n (%)	No wound infection, n (%)
Single dose	6 (13.3)	39 (86.6)
Multiple dose	5 (11.1)	40 (88.8)

and pain at the site where the port was inserted, while another patient made a complaint about a wound that had separated somewhat. This complaint was treated conservatively and the patient recovered by the fourth week of follow-up. We determined that the total rate of surgical site infections (SSI) in our study was 3.5%, which was similar to the rates reported by Gaur *et al*.[25] and Koc *et al*.[26] who found a 2-3% incidence of wound infection in laparoscopic cholecystectomy. During the study, it was found that the rate of wound infection was 4% in the SD group and 3% in the MD group. However, these differences were not statistically significant. Therefore, it can be plainly stated that a single dose of antibiotics may be just as effective as numerous doses in treating SSI, while some studies were strict in advocating for the use of multiple doses. However, Meijer *et al*.[27] in a comparable study to ours, did not show significant variation in SSI between single and repeated doses of antibiotics. Similarly, Waldvogel and colleagues proposed using antibiotics for prevention, with a maximum duration of 24 hrs[28]. The strength of our study has been its sample size, which effectively facilitated the detection of surgical site infections. While the findings of our study may be relevant to different hospitals in India and other developing nations, as the intervention settings and operating room environments are rather similar.

CONCLUSION

We have demonstrated that administering a single dose of ceftriaxone and metronidazole before making the incision is as effective in preventing post-caesarean section infection complications compared to using numerous doses of antibiotic prophylaxis. The one-time method is a cost-effective choice, decreases the amount of labour for hospital employees, and could potentially lower the chance of antibiotic resistance. Our research suggests that using a single dosage of antibiotics before anaesthesia induction for laparoscopic cholecystectomy is equally effective as using numerous doses of antibiotics in preventing surgical site infections during the post-operative period. In addition, the expense of hospitalisation could be reduced by implementing a single antibiotic dosage plan. However, if the study had been larger and had included patients from multiple centres, it would have been more informative.

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