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Antibiotics in Laparoscopic Cholecystectomy: Outcomes in Single versus Multiple Dose Phylaxis in Terms of Surgical Site Infections

Muhammad Arslan Zafar, Muhammad Qasim Butt, Usman Ghani, Mansoor Tariq Azeem , Muhammad Zain Farooq, *Ishel Farid Malik

Department of General Surgery, Pak Emirates Military Hospital Rawalpindi/National University of Medical Sciences (NUMS) Pakistan, *Department of Medicine, Armed Forces Institute of Rehabilitation Medicine/National University of Medical Sciences (NUMS) Rawalpindi Pakistan

ABSTRACT

Objectives: To study the frequency of surgical site infections post-laparoscopic cholecystectomy in patients receiving a full course of post-operative antibiotics versus a single stat per-operative dose.

Study Design: Quasi experimental study.

Place and Duration of Study: Department of General Surgery, Pak-Emirates Military Hospital Rawalpindi, Pakistan from Jan to Dec 2020.

Methodology: The quasi experimental study involved a total of 798 patients who were planned to undergo Laparoscopic Cholecystectomy. The recruited participants were put into two groups with 399 patients in group-A and 399 patients in group-B. Group-A received a single dose of Ceftriaxone 1g at the time of surgery while group-B received the same drug twice daily for three days. All patients were followed up for two weeks. Data was analyzed using Statistical Package of Social Sciences (SPSS) 26.0.

Results: A total of 13(1.6%) patients developed surgical site infections in group-A, while 14(1.7%) occurred in group-B. Of these 5(0.6%) and 8(1.0%) were port site infections, 4(0.5%) and 3(0.3%) patients had fever with no localizing sign, 4(0.5%) and 3(0.3%) developed sub-diaphragmatic abscesses, in group-A and B, respectively. Only one case of peritonitis was seen in group-B, in the whole study. No statistical difference was seen between either group at any point.

Conclusion: Administration of a single dose peri-operative antibiotic prophylaxis was not associated with an increase in surgical site infection when compared to multiple dose prophylaxis in patients undergoing laparoscopic cholecystectomy.

Keywords: Laparoscopic Cholecystectomy, Multiple Dose Antibiotic, Single Dose Antibiotic, Surgical Site Infection (SSI).

How to Cite This Article: *MA, Butt MQ, Ghani U, Azeem MT, Farooq MZ, Malik IF. Antibiotics in Laparoscopic Cholecystectomy: Outcomes in Single Versus Multiple Dose Phylaxis In Terms of Surgical Site Infections. Pak Armed Forces Med J 2024; 74(6): 1481-1484. DOI: https://doi.org/10.51253/pafmj.v74i6.6455*

INTRODUCTION

The gall bladder lies on the visceral surface of liver and functions as a reservoir for bile; concentrating it to play its role in food digestion. Approximately 6 % males and 9 % females suffer from gallstones in the United States, most of whom are asymptomatic, with a 1 – 2 % chanced of developing symptoms or complications per annum.[1] Symptoms include right upper quadrant or epigastric pain (which may radiate to the back), nausea, bloating, dyspepsia, and intolerance to fatty food, and most of these symptoms can be managed conservatively.[2] However, these patients are more prone to develop complications like biliary colic, cholecystitis, empyema, biliary obstruction and acute biliary pancreatitis,[3] the criterion standard for treatment in such cases is laparoscopic cholecystectomy.[4]

Laparoscopic cholecystectomy, like all surgical procedures, is not without complications; the procedure is associated with bile leakage, bile duct injury, haemorrhage, surgical site infection, abdominal wall/omental/sub-capsular liver haematomas, port site hernias, bowel injury and postoperative acute pancreatitis to name a few.[5] Varying rates of surgical site infections (SSIs) have been reported ranging from 0.94 % to 2.75 % of cases.[6,7] This complication may occur despite the best aseptic measures.

Various modalities for control of this complication have been advocated including the use of disposable instruments, properly sterilisation, autoclavable laparoscopic hand instruments, instruments with good ergonomics, limited joints, and method for cleaning debris in these joints, appropriate guidelines for concentration, contact time and cycles for instrument sterilization with liquid sterilizers, prevention of spillage of bile during surgery, use of non-porous specimen retrieval bags and irrigation/cleaning of the port site before suturing.[8] Pre and post-surgery antibiotic prophylaxis has also been recommended with varying success.[9,10]

Correspondence: Dr Muhammad Arslan Zafar, Department of General Surgery, Pak Emirates Military Hospital Rawalpindi Pakistan

Received: 23 Mar 2021; revision received: 07 July 2021; accepted: 17 Feb 2022

The general patient perception for laparoscopic procedures is that it is a clean surgery which should not be associated with infections, which reflects poorly on the surgeon and the institution when it does occur, tarnishing reputations undeservedly. To avoid this, surgeons routinely prescribe antibiotics to prevent surgical site infections which may not be established best practice. In addition, it puts an avoidable strain on finances and increases the chance of developing increased microbial resistance to antibiotics. This study aimed to establish whether there was any advantage of administering a full course of antibiotic prophylaxis versus administration of a single dose to prevent surgical site infections in the hope that an established guideline for best practice may be established for this commonly performed surgical procedure.

METHODOLOGY

This was a quasi experimental study conducted from January 2020 to December 2020 in the Department of General Surgery, Pak-Emirates Military Hospital, Rawalpindi. The sample consisted of 798 consenting patients who were to undergo laparoscopic cholecystectomy, chosen via non-probability consecutive sampling, after approval by hospital ethical committee (write ERC number-RTMC#SGR-2019-124-10965). The sample size was calculated using the WHO sample size calculator an anticipated population proportion 1 of 0.085, and an anticipated population proportion 2 of 0.041.[11]

Inclusion Criteria: Patients of both genders, between 18 to 75 years of age with cholelithiasis, patients who were non-diabetic or were diabetic with good control (HbA1c <7.5%), and with ASA class I to III were included in the study.

Exclusion criteria: Patients with previous abdominal surgery, current biliary pancreatitis, biliary leakage during surgery, evidence of concurrent infection, any antibiotic therapy within 1 week, on steroid therapy, chemotherapy, or radiotherapy were excluded.

A questionnaire was filled out by each patient on admission to collect demographic data, and medical history, and all patients underwent relevant pre-anaesthesia work-up. All patients received Ceftriaxone 1g intravenously after anaesthesia induction but prior to skin incision, which was followed by standard 4-port laparoscopic cholecystectomy. Post-operatively, patients were divided into two groups as shown in figure. Group-A (n=399) received a single dose of Ceftriaxone 1g in the recovery room while group-B (n=399) received Ceftriaxone 1g intravenously twice daily for 3 days post-surgery, first dose was given in the recovery room while the rest were given on the ward floor as per schedule, unless patient was fit for discharge before that time in which case patient was switched to oral Cefuroxime 400mg twice daily to complete the 3-day course of antibiotics. All patients were advised follow at Day 7, 14 and 28 days post-surgery, at each point they underwent evaluation for surgical site infections. Stitches were removed on Day 14.

Data was analyzed using Statistical Package of Social Sciences (SPSS) version 26.0. Mean and SD was calculated for quantitative variables like age, body mass index, total operation time and duration of hospital stay. Qualitative variables like gender, ASA class, presence of diabetes, total incidence of SSIs, incidence of port-site infection, fever, sub-diaphragmatic abscess and peritonitis were recorded in terms of frequency and percentage. Chi square test was applied for qualitative variables. Independent sample t-test was applied for quantitative variables. The *p*-value of ≤0.05 was considered significant.

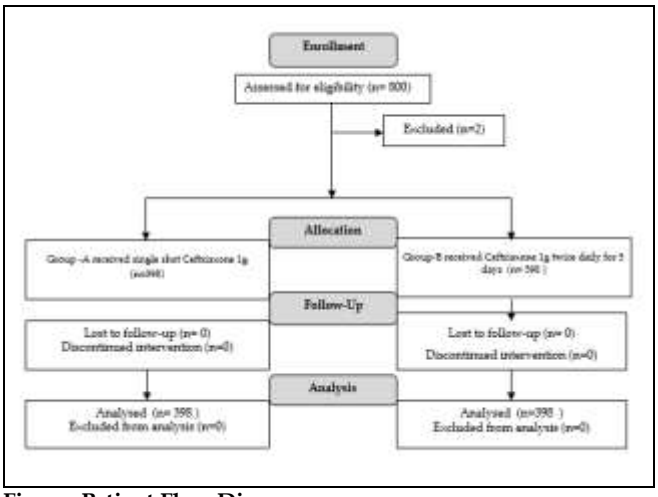

Figure: Patient Flow Diagram

RESULTS

A total of 798 patients were studied, and the female 513(64.3%) to male 285(35.7%) ratio was 1.8:1. The mean age of the sample was 48.78±10.71 years. The pre-laparoscopic cholecystectomy patients characteristics are shown in Table-I, all variables were compared to the development of surgical site infections for significance. Gender (*p*=0.08), age (*p*=0.19), body mass index (*p*=0.38), the presence of absence of diabetes mellitus (*p*=0.69), ASA scale

(p=0.323), and total operation time (p=0.97) had no effect on the development of surgical site infections, and there was no statistical difference between each of the aforementioned variables across both groups.

Table-I Demographic Characteristics of Patients

Variables	Group-A	Group-B	*p* -value
Gender			
Male	147(18.4%)	138 (17.3%)	0.08
Female	252(31.6%)	261 (32.7%)	
Age (years)	49.27±10.57	48.28 ±10.84	0.19
Body Mass Index	26.45±4.96	26.15±4.82	0.38
Diabetes Mellitus			
Present	85(10.7%)	97(12.2%)	0.69
Absent	314(39.3%)	302(37.8%)	
American Society of Anesthesiologists Physical Status(ASA)			
ASA I	192(24.1%)	203(25.4%)	0.323
ASA II	178(22.3%)	169(21.2%)	
ASA III	29(3.6%)	27(3.4%)	
Total OperationTime	56.67±13.25	56.64 ±12.49	0.97

Characteristics for the development of surgical site infections are shown for both groups in Table-II. The incidence of port site infections, fever, formation of sub-diaphragmatic abscesses, fever, peritonitis and overall surgical site infections were compared across both groups. The comparison showed that there was no statistical difference between any of the aforementioned variables across both groups.

Table-II Distribution of Surgical Site Infections Among The Two Groups

Variables	Group-A	Group-B	*p*-value
Surgical Site Infection			
Present	13(1.6%)	14(1.7%)	0.84
Absent	386(48.4%)	385(48.3%)	
Port Site Infection			
Present	5(0.6%)	8(1.0%)	0.4
Absent	394(49.4%)	391(49.0%)	
Fever			
Present	4(0.5%)	3(0.3%)	0.7
Absent	395(49.5%)	396(49.7%)	
Sub-Diaphragmatic Abscess			
Present	4(0.5%)	3(0.3%)	0.70
Absent	395(49.5%)	396(49.7%)	
Peritonitis			
Present	0(0%)	1(0.12%)	0.32
Absent	399(50%)	398(49.8%)	

DISCUSSION

Females formed the majority of our sample as 513(64.3%) were women. In this study, a total of 27(3.3%) patients suffered from surgical site infections and there was no statistical difference between the groups in terms of incidence of infections. Thirteen (1.6%) suffered from port site infections, 7(0.8%) had fever, 7(0.8%) developed sub-diaphragmatic abscess and 1(0.12%) patient developed peritonitis. Comparing the female predominance in our study Sutariya *et al*., reported on a population that was 116(64.4%) female patients.[12] The population in Naser *et al*., had an even higher female majority: 25(83.3%) of the patients were female,[13] while Zahid *et al*., reported on a population that was almost exclusively female: 114(86%).[14] These figures are consistent with a female preponderance for the development of gallstones. The mean age of the sample was 48.78±10.71 in our study. Sheikh *et al*., describe a slightly younger population of 40.69+7.76 years.[15] Shah *et al* reported on similar age of 38.88±14.19 years,[16] while Koirala *et al*., also reported a similar age.[17] All the studies reported a slightly younger age than our study. We attribute this difference to different patient selection protocols for elective surgery.

There was no difference between single dose and multi-dose antibiotics in terms of the development of any specific sub-type of surgical site infections. Sutariya *et al*., reported 3.9% total SSI rate in their study, with 4% occurring in the single dose group, while 3.8 % occurred in the multiple dose group. Two point two percent of patients in both groups suffered from port site infections.[12] Shah *et al*., reported a much higher SSI rate of 18.3% (n=22) with 15.3% (n=11) cases occurring in the single dose group, while 22.9% (n=11) occurred in the multiple dose group, the difference between the groups was not significant.[16] Of these patients, 9.7% (n=7) and 6.2% (n=3) developed port site infections, in single and multiple dose groups, respectively, findings that were similar to Choudhary *et al*.[16,18] Lastly, port site infection was seen in 8.5% of patients of single dose group while in the multiple dose group 4.1% of patients had infections, however the difference was not statistically significant.[11] None of the studies quoted above found any difference in the incidence of SSIs between patients on single dose of antibiotic versus multiple dose administration.

The primary aim of antibiotic prophylaxis post-surgery is to reduce the incidence of surgical site infections post-surgery. In the era of emerging antibiotic resistance, judicious use is indicated: the use of antibiotics needs to be governed by evidence. There is growing proof that administration of a single dose of antibiotics is as good as administering multiple antibiotics not just in terms of prevention of surgical site infections, but also in terms of costs and shortened

hospital stay[19]. Moreover, unnecessary drug administration reduces the possibility of eliciting unwarranted side effects. It should be noted that the reason for low incidence of infections during laparoscopy might also be attributed to minor surgical trauma, early patient mobilization, faster resumption of permitted nutrition. In addition, we excluded patients with acute cholecystitis or who had gall bladder perforation or bile leakage, whether full dose antibiotics should be given in these cases to prevent SSIs needs further study. Other substantial factors for the development SSIs include mechanical damage to tissues and contamination with the microflora from the skin, inappropriate dressing or poor wound care post-operatively. This diverse etiology needs to be assessed further in order to ascertain and prevent the qualitative and methodological errors in laparoscopic cholecystectomy that lead to development of SSIs.

CONCLUSION

The administration of full courses of prophylactic antibiotics in the post-operative phase for an uneventful laparoscopic cholecystectomy in patients has no advantage over administration of a single dose in terms of prevention of surgical site infections. Therefore, it appears to be more practical for patients undergoing elective laparoscopic cholecystectomy to have a single dose of antibiotic administered in the peri-operative phase as prophylaxis, and the same should be adopted as a standard protocol.

Conflict of Interest: None.

Funding Source: None.

Authors' Contributions:

The Following authors have made substantial contributions to the manuscript as under:

MAZ & MQB: Conception, study design, drafting the manuscript, approval of the final version to be published.

UG & MTA: Data acquisition, data analysis, data interpretation, critical review, approval of the final version to be published.

MZF & IFM: Conception, data acquisition, drafting the manuscript, approval of the final version to be published.

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved

REFERENCES

1. Tanaja J, Lopez RA, Meer JM. Cholelithiasis. Treasure Island (FL): StatPearls Publishing; 2021.
2. Jones MW, Weir CB, Ghassemzadeh S. Gallstones (Cholelithiasis); Treasure Island (FL): StatPearls Publishing; 2021.
3. Gutt C, Schläfer S, Lammert F. The treatment of gallstone disease. Dtsch Arztebl Int 2020 28; 117(9): 148-158. https://doi.org/10.3238/arztebl.2020.0148
4. Hassler KR, Collins JT, Philip K, Jones MW. Laparoscopic cholecystectomy. Treasure Island (FL): StatPearls Publishing; 2021.
5. Triantafyllidis I, Nikoloudis N, Sapidis N, Chrissidou M, Kalaitsidou I, Chrissidis T. Complications of laparoscopic cholecystectomy: our experience in a district general hospital. Surg Laparosc Endosc Percutan Tech 2009; 19(6): 449-458. https://doi.org/10.1097/sle.0b013e3181bd8f6d
6. Radunovic M, Lazovic R, Popovic N, Magdelinic M, Bulajic M, Radunovic L, et al. Complications of laparoscopic cholecystectomy: Our experience from a retrospective analysis. J Med Sci 2016 15; 4(4): 641-646. https://doi.org/10.3889/oamjms.2016.128
7. Yi F, Jin WS, Xiang DB, Sun GY, Huaguo D. Complications of laparoscopic cholecystectomy and its prevention: a review and experience of 400 cases. Hepatogastroenterology 2012; 59(113): 47-50. https://doi.org/10.5754/hge11232
8. Sasmal PK, Mishra TS, Rath S, Meher S, Mohapatra D. Port site infection in laparoscopic surgery: A review of its management. World J Clin Cases 2015 16; 3(10): 864-871. https://doi.org/10.12998/wjcc.v3.i10.864
9. Guler Y, Karabulut Z, Sengul S, Calis H. The effect of antibiotic prophylaxis on wound infections after laparoscopic cholecystectomy: A randomised clinical trial. Int Wound J 2019; 16(5): 1164-1170.https://doi.org/10.1111/iwj.13175
10. Matsui Y, Satoi S, Kaibori M, Toyokawa H, Yanagimoto H, Matsui K, et al. Antibiotic prophylaxis in laparoscopic cholecystectomy: a randomized controlled trial. PLoS One 2014 5; 9(9): e106702.https://doi.org/10.1371/journal.pone.0106702
11. Thapa SB, Kher YR, Tambay YG. Single dose Intraoperative Antibiotics versus Postoperative Antibiotics for Patient Undergoing Laparoscopic Cholecystectomy for Symptomatic Cholelithiasis: A Randomized Clinical Trial. J Lumbini Med Coll 2017; 5(1): 13-17.https://doi.org/10.22502/jlmc.v5i1.112
12. Sutariya PK, Thekdi PI. Single dose versus multiple dose prophylactic antibiotic in laparoscopic cholecystectomy: a comparative study. Int Surg J 2016; 3(2): 633-636. https://doi.org/10.18203/2349-2902.isj20161135
13. Naser S, Banerjee A, De U, Mandal S, Mandal A. Single Dose vs Multiple Dose Prophylactic Antibiotic to Prevent Early Port-Site Infection in Elective Laparoscopic Cholecystectomy. Int J Contemp Med Res 2019; 6(6): F28-F34. http://doi.org/10.21276/ijcmr.2019.6.6.32
14. Zahid MA, Bakhsh R, Dar FS, Akhter N, Malik ZI. Comparison of single dose and three dose antibiotic prophylaxis with cefotaxime sodium in cholecystectomy. J Ayub Med Coll Abbottabad 2003; 15(1): 38-40.
15. Shaikh SA, Iqbal M, Chaudhary IM. Comparison of Single Dose with Multiple Dose Antibiotic Prophylaxis with Cefuroxime in Open Cholecystectomy. J Islamabad Med Dent Coll 2012; 1211(1): 2-5.
16. Shah YD, Thekdi PI, Raut S, Patel KG. Single shot versus multiple shot antibiotic therapy in patients undergoing laparoscopic surgery: our experience. Int J Res Med Sci 2013; 1(3): 252-256.http://doi.org/10.5455/2320-6012.ijrms20130818
17. Koirala A, Thakur D, Agrawal S, Chaudhary BL. Single dose versus multiple dose antibiotics in laparoscopic cholecystectomy: A prospective comparative single blind study. J Am Soc Nephrol 2018; 5(1): 11-15. https://doi.org/10.3126/jsan.v5i1.23212
18. Choudhary RK. A Prospective Randomized Trial for Role of Antibiotic Prophylaxis in Laparoscopic Surgery. Int J Med Res Prof 2015; 1(2); 83-86.