Open Access

Original Article

Comparison of Post-Operative Surgical Site Infection in Uncomplicated Laparoscopic Cholecystectomies in Patients Who Received Post-Operative Antibiotics versus Patients who did not Receive Post-Operative Antibiotics; A Comparative Study

Umer Naeem, Syed Mukarram Hussain, Muhammad Danial Yousaf, Muhammad Saqlain, Muhammad Imran, Najm Ul Hassan

Department of General Surgery, Combined Military Hospital/National University of Medical Sciences (NUMS) Rawalpindi Pakistan

ABSTRACT

Objective: To compare the frequency of post-op "surgical site infection" in uncomplicated laparoscopic cholecystectomies in patients who received post-op antibiotics versus those who did not.

Study Design: Quasi-experimental study

Place and Duration of Study: Department of General Surgery, Combined Military Hospital, Rawalpindi, Pakistan from Jun 2022 to May 2023.

Methodology: A total of 342 patients [171 in the Antibiotics-Group and 171 in the No-Antibiotics-Group] fulfilling the inclusion criteria who underwent uneventful laparoscopic cholecystectomy were included in the study. In all these patients, baseline characteristics were documented. Patients in Group-A were given antibiotic therapy post-operatively, while patients in Group-B were not given antibiotics after the operation. Patients in both groups were followed up on day 10 after the surgery to assess for "surgical site infection.

Results: In our study, the mean age of the study population was 38.41±10.12 years. There were 127(37.13%) male participants, while 215(62.87%) participants were female. The mean body mass index (BMI) was 31.14±4.49 kg/m^2. Composite frequency of "surgical site infection" was 38(11.10%). In patients who were given post-op antibiotics, the frequency of "surgical site infection" was 16(9.35%), while in patients who did not receive any antibiotics after the surgery, the frequency of "surgical site infection" was 22(12.86%), (p=0.302).

Conclusion: Antibiotic therapy should be reserved for patients who develop "surgical site infection" instead of being used in all patients.

Keywords: Laparoscopic Cholecystectomy, Post-operative Antibiotics, Surgical Site Infection.

How to Cite This Article: *Naeem U, Hussain SM, Yousaf MD, Saqlain M, Imran M, Hassan NU. Comparison of Post-Operative Surgical Site Infection in Uncomplicated Laparoscopic Cholecystectomies in Patients Who Received Post-Operative Antibiotics versus Patients who did not Receive Post-Operative Antibiotics; A Comparative Study. Pak Armed Forces Med J 2025; 75(1): 68-72. DOI:* https://doi.org/10.51253/pafmj.v75i1.10358

INTRODUCTION

The field of surgery is one of the oldest in the medical profession. However, it has undergone a continual process of innovation throughout the centuries, and its continuation is seen as essential.[1] Traditionally, whenever a patient presented to the emergency room with symptomatic gallstones or had the diagnosis of "acute cholecystitis", surgeons tend to remove the gallbladder surgically through open technique. However, with the advances in the field of surgery, this practice has undergone a complete transition and is now performed laparoscopically, which has been considered the gold standard now.[2] Despite this, in developing nations, a large number of healthcare facilities lack the facilities for laparoscopic surgeries due to a lack of equipment availability or experienced personnel and still practice the open technique of cholecystectomy.[3] Although the risk of infection at the surgical site is far lower in laparoscopic surgeries than in exploratory open procedures, it is still possible.[4]

Both gram-positive (such as *Staphylococcus aureus* and *Enterococcus spp*.) and gram-negative (such as *Klebsiella pneumoniae, Enterobacter spp*. and *Escherichia coli*) bacteria can cause surgical wound infections.[5] Surgical site infections are a leading cause of death and disability, and they are the consequence of a complicated process involving interactions between many biochemical processes on the molecular level. Most surgical site infections are brought on by intrinsic microbiota, typically found on the skin, mucous membranes, and hollow internal organs. The likelihood of surgical site infections is significantly enhanced when such overabundance of microbiological contamination surpasses a certain level.[6] Several factors have been reported in the literature that are associated with a higher risk of developing infection at the surgical site. These factors include the age of the operated patient, their status of

Correspondence: Dr Umer Naeem, Department of General Surgery, Combined Military Hospital, Rawalpindi Pakistan

Received: 16 May 2023; revision received: 01 Jul 2023; accepted: 03 Jul 2023

nutrition, the presence of any co-existing disease affecting their immune responses, the use of any agent that can attenuate their immune system, the habit of cigarette smoking and higher body weight.[7]

Contrary to these, an important method that is one of the most commonly practised globally, especially in our local healthcare facilities, is the use of antibiotics, which are mostly started before the operation and continued for a few days after the surgery. However, when we review the literature regarding the role of such frequent use of antibiotics for preventing the occurrence of "surgical site infections", we found that there is a lack of consensus, with some studies favouring the use of antibiotics for reducing the frequency of "surgical site infections" while most studies advocating that this practice may be unnecessary.[8,9]

Based on this inconclusiveness regarding the role of antibiotics in preventing post-operative "surgical site infection," we conducted this study so that an evidence-based plan could be formulated regarding the decision to use antibiotics regularly. This may not only help reduce the prevailing resistance to antibiotics in the future but also reduce the financial burden of the patients.

METHODOLOGY

The quasi-experimental study was conducted at the Department of General Surgery of Combined Military Hospital, Rawalpindi Pakistan from Jun 2022 to May 2023 after obtaining approval from the Ethical Committee (certificate number: 379). For sample size calculation, we used WHO sample size calculator software in which we used a "calculator for two proportions" taking, anticipated frequency of "surgical site infection" with antibiotics of 1%, and anticipated frequency of "surgical site infection" without antibiotics of 5.9%.[10]

Inclusion Criteria: We included all the patients who were aged 18 years or above, of either male or female gender, who were scheduled to have elective uncomplicated laparoscopic cholecystectomy and had "American Society of Anesthesiology" ASA status I and II.

Exclusion Criteria: We excluded all the patients who were unfit for surgery, ASA III/IV/V/VI, were asthmatic, had any immune system suppressing condition (like diabetes or malignancy), cholangitis, choledocholithiasis, empyema gallbladder, gangrenous gallbladder, gallbladder malignancy, intraoperative gallbladder rupture or bile leakage, had coagulation disorder or had used antibiotics within seven days of current hospital admission.

All the patients were selected from the indoor facility of the general surgery department of our institution. After selecting the study pool, baseline characteristics, including age, body mass index (BMI) and gender of the patients, were documented. All patients were then divided randomly into two equal groups. In Group-A we added 171 patients who were started on antibiotics (injection of ceftriaxone 1g twice daily + injection of metronidazole 500mg IV x thrice daily) on the day of surgery and was continued for three days after surgery. In Group-B, we added 171 patients who were only given wound care without antibiotics (Figure).

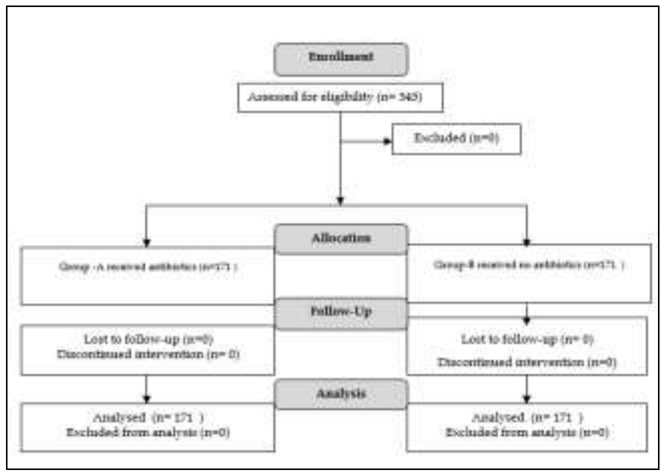

Figure: Patient Flow Diagram (n=342)

The operative technique and protocol used were similar in both groups. First, a pre-operative antibiotic (injection ceftriaxone 1g IV) stat dose was given within one hour of the commencement of surgery. The skin was prepared by using "povidone solution". The standard 4-port technique was used in all patients of the study. The gallbladder was retrieved through the "epigastric port" using Endobag. The single drain was placed in the "sub-hepatic" area. After drain removal, patients were discharged from the hospital. Patients in both groups were directed to re-visit us for a follow-up on day 10 to assess for the presence of "surgical site infection". Surgical site infection was defined as "presence of pus or any discharge at the surgical wound site which is accompanied by pain, fever and raised white blood cell count (> 11 x 103/mm3).[11] In case a patient does develop an infection at the surgical site, it was made sure that the consultant surgeon who performed the operation examined the patient and provided an appropriate plan of treatment for these patients, either through surgical intervention of the infected wound site or through modification of the antibiotic regimen.

"Data was analyzed using Statistical Package for Social Sciences (SPSS) 22.00. Quantitative data (age, BMI, duration of hospital stay, operative time, duration of drain, TLC) was represented using mean with standard deviation. Qualitative data (gender, ASA status, fever, pain and surgical site infection presence) was represented using percentage and frequency. Chi-square test (for comparison of qualitative variables) and independent t-test (for comparison of quantitative variables) were applied, and *p*-value of ≤0.05 was taken as statistically significant.

RESULTS

Our study sample was 342 patients [171 in the Antibiotics-Group and 171 in the No-Antibiotics-Group]. In our study, we found out that the value of the mean age of our study pool was 38.41±10.12 years. In our study, there were 127(37.13%) male participants, while the 215(62.87%) participants were female. In our study, the mean body mass index (BMI) was 31.14±4.49 kg/m². The frequency of ASA status I was 183(53.51%), and of ASA status II was 159(46.49%).

After assessing this, we compared the baseline characteristics between our study groups and found that the mean age of the study participants who were in the "Post-Op Antibiotics" Group was 35.43±10.03 years, while in the "No Post-Op Antibiotics" Group mean age was 41.40±9.09 years, (*p*<0.001). Similarly, we found that the mean BMI of the study participants who were in the "Post-Op Antibiotics" Group was 31.27±4.42 kg/m², while in the "No Post-Op Antibiotics" Group, the mean BMI was 31.01±4.56 kg/m² (*p*=0.597). On comparison of gender distribution, we found that no statistical difference was observed between our study groups in terms of gender distribution (*p*=0.576) and ASA status (*p*=0.329) (Table-I).

Our study found that the composite frequency of "surgical site infection" was 38(11.10%). Corresponding to this, fever and pain were present in all patients with SSI, and the mean TLC was 14.05±1.29 per mm3. In our study, the mean operative time in " Antibiotics Group" was 57.09±5.64 minutes. In contrast, in " No Antibiotics Group, it was 57.73±5.98 minutes (*p*=0.303). In our study, the mean duration of the drain in "Antibiotics Group" was 3.57±0.49 days while in "No Antibiotics Group, it was 3.57 0.50 days (*p*=1.000). In our study, mean duration of hospital stay in "antibiotics group" was 3.57±0.50 days and in "no antibiotics group it was 3.57±0.50 days (*p*=1.000). In our study, we found that in patients who were given antibiotics after surgery, frequency of "surgical site infection" was 16(9.35%) while in patients who did not receive any antibiotics after the procedure, frequency of "Surgical Site Infection (SSI)" was 22(12.86%), (*p*=0.302) (Table-II).

Table-I: Comparison of Baseline Characteristics Among Study Groups (n = 342)

Characteristic	Antibiotics-Group(n = 171)		No Antibiotics-Group (n=171)		*p*-value
Age (Mean±SD)	35.43±10.03 years		41.40±9.09 years		<0.001
Body Mass Index (Mean±SD)	31.27±4.42 kg/m²		31.01±4.56 kg/m²		0.597
Gender	Male	Female	Male	Female	
	61 (35.67%)	110 (64.33%)	66(38.59%)	105(61.41%)	0.576
American Society of Anesthesiology Status	I	II	I	II	
	87(50.88%)	84(49.12%)	96(56.14%)	75(43.86%)	0.329

Table-II: Comparison of Operative and Post-Operative Parameters between Study Groups (n = 342)

Parameters	Antibiotics-Group (n=171)	No Antibiotics-Group (n=171)	*p*-value
Operative time	57.09±5.64 minutes	57.73±5.98 minutes	0.303
Duration of drain	3.57±0.49 days	3.57±0.50 days	1.000
Duration of hospital stay	3.57±0.49 days	3.57±0.50 days	1.000

Additionally, the mean TLC count in patients who had SSI was 14.05±1.29 x 103 /mm3, while in those without SSI, it was 7.57±1.18 x 103 /mm3 (*p*<0.001).

DISCUSSION

Several protective measures can help reduce the probability of contracting infection at the operation site. These factors include establishing a favourable and improved environment of the operation theatres by ensuring that it is appropriately sterilized and properly ventilated, improving the technique of the operative procedure to be performed and making maximum effort to reduce the time required to complete the operation.[12,13] One complication of surgery is the infection of the operation site, in which various microorganisms can be mainly found on the operated person's body, such as normal flora.[14] Antibiotics are the mainstay of treatment for "surgical site infection" once it is developed. However, when it comes to the prophylactic role of antibiotics to prevent the development of infection at the surgical site, it is still unclear since results from previous studies are highly variable.[15] In this comparative study, we focused on this important aspect of antibiotic use in post-surgery patients who underwent uneventful laparoscopic cholecystectomy.

In our study, based on mean age, we found that most patients belonged to the middle age group. We also observed that the majority of the patients who underwent laparoscopic cholecystectomy and were part of our study were females. This may be because having female gender, especially those who are of middle age, increases the risk of developing gallstones and subsequently the need to have cholecystectomy.[16] We also found, based on the value of mean BMI, that the majority of our patients were overweight. This may be due to the strong association of having a higher body mass index (BMI) with the risk of developing gallstones.[17] In terms of frequency of "surgical site infection", we found that based on percentage, it was low in patients who were given antibiotics, showing that antibiotic use has a potential protective role to avoid developing "surgical site infection". This was congruent with what was reported by a study conducted by Shrestha *et al.*[18]

However, we found no statistically significant difference between our study groups when we compared the "surgical site infection" frequency in antibiotics versus no post-operative antibiotic use groups. This finding was congruent with multiple studies conducted in the past.[19,20] However, contrary to what we found in our study, Matsui *et al.*,[10] and Alsaeed *et al.*,[21] reported that the difference in the frequency of "surgical site infection" among patients who receive antibiotics post-operatively as compared to those in which antibiotics are not administered post-operatively, was statistically significant. Based on the findings of our study, we do not recommend injudicious use of antibiotics in all the patients who undergo uncomplicated laparoscopic cholecystectomy. Instead, we recommend reserving this practice for those who develop "surgical site infection".

ACKNOWLEDGEMENTS

We are thankful to Dr. Fatima Farooq for her support and guidance throughout our research, which was very helpful in compiling our research project. We are also thankful to the whole surgical team and the study participants, who have helped us thoroughly address this public health problem and conduct this research.

CONCLUSION

In conclusion, antibiotic therapy should be reserved for patients who develop "surgical site infection" instead of being used in all surgical patients.

Conflict of Interest: None.

Funding Source: None.

Authors' Contribution

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

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

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

MI & NUH: 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. Riskin DJ, Longaker MT, Gertner M, Krummel TM. Innovation in surgery: a historical perspective. Ann Surg 2006; 244(5): 686-693. https://doi.org/10.1097/01.sla.0000242706.91771.ce
2. Soper NJ, Stockmann PT, Dunnegan DL, Ashley SW. Laparoscopic cholecystectomy. The new 'gold standard'? Arch Surg 1992; 127(8): 917-921. https://doi.org/10.1001/archsurg.1992.01420080051008
3. Arif M, Alam A. Open Cholecystectomy still an essential procedure in the era of minimally invasive surgery? A prospective analysis of patients presenting with gallstone disease at a community hospital. Pak J Med Health Sci 2019; 13(1): 134-137.
4. 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; 3(10): 864-871. https://doi.org/10.12998/wjcc.v3.i10.864
5. Seidelman JL, Mantyh CR, Anderson DJ. Surgical site infection prevention: A review. JAMA 2023; 329(3): 244-252. https://doi.org/10.1001/jama.2022.24075
6. Young PY, Khadaroo RG. Surgical site infections. Surg Clin North Am 2014; 94(6): 1245-1264. https://doi.org/10.1016/j.suc.2014.08.008
7. Imamura K, Adachi K, Sasaki R, Monma S, Shioiri S, Seyama Y, et al. Randomized comparison of subcuticular sutures versus staples for skin closure after open abdominal surgery: a multicenter open-label randomized controlled trial. J Gastrointest Surg 2016; 20(12): 2083-2092. https://doi.org/10.1007/s11605-016-3283-z

8. de Jonge SW, Boldingh QJJ, Solomkin JS, Dellonger EP, Egger M, Salanti G, et al. Effect of postoperative continuation of antibiotic prophylaxis on the incidence of surgical site infection: a systematic review and meta-analysis. Lancet Infect Dis 2020; 20(10): 1182-1192. https://doi.org/10.1016/S1473-3099(20)30084-0
9. Suresh K, Chandrashekara S. Sample size estimation and power analysis for clinical research studies. J Hum Reprod Sci 2012; 5(1): 7-13. https://doi.org/10.4103/0974-1208.97779
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; 9(9): e106702. https://doi.org/10.1371/journal.pone.0106702
11. Zabaglo M, Sharman T. Postoperative wound infection. In: StatPearls. Treasure Island (FL): StatPearls Publishing; 2022.
12. Spagnolo AM, Ottria G, Amicizia D, Perdelli F, Cristina ML. Operating theatre quality and prevention of surgical site infections. J Prev Med Hyg 2013; 54(3): 131-137.
13. Mekhla, Borle FR. Determinants of superficial surgical site infections in abdominal surgeries at a Rural Teaching Hospital in Central India: A prospective study. J Family Med Prim Care 2019; 8(7): 2258-2263. https://doi.org/10.4103/jfmpc.jfmpc_419_19
14. Zabaglo M, Leslie SW, Sharman T. Postoperative Wound Infections. In: StatPearls. Treasure Island (FL): StatPearls Publishing; 2025.
15. Purba AKR, Setiawan D, Bathoorn E, Postma MJ, Dik JH, Friedrich AW, et al. Prevention of surgical site infections: A systematic review of cost analyses in the use of prophylactic antibiotics. Front Pharmacol 2018; 9: 776. https://doi.org/10.3389/fphar.2018.00776
16. Patel AM, Yeola M, Mahakalkar C. Demographic and risk factor profile in patients of gallstone disease in central India. Cureus 2022; 14(5): e24993. https://doi.org/10.7759/cureus.24993
17. Song ST, Shi J, Wang XH, Guo YB, Hu PF, Zhu F, et al. Prevalence and risk factors for gallstone disease: A population-based cross-sectional study. J Dig Dis 2020; 21(4): 237-245. https://doi.org/10.1111/1751-2980.12857
18. Shrestha S, Shrestha BB, Ghimire P. Antibiotic prophylaxis in laparoscopic cholecystectomy: A retrospective study. Med J Pokhara Academy Health Sci 2020; 3(2): 268-271. https://doi.org/10.3126/mjpahs.v3i2.35598
19. Chauhan VS, Kariholu PL, Saha S, Singh H, Ray J. Can post-operative antibiotic prophylaxis following elective laparoscopic cholecystectomy be completely done away with in the Indian setting? A prospective randomised study. J Minim Access Surg 2018; 14(3): 192-196. https://doi.org/10.4103/jmas.JMAS_95_17
20. Yan RC, Shen SQ, Chen ZB, Lin FS, Riley J. The role of prophylactic antibiotics in laparoscopic cholecystectomy in preventing postoperative infection: a meta-analysis. J Laparoendosc Adv Surg Tech 2011; 21(4): 301-306. https://doi.org/10.1089/lap.2010.0436
21. Alsaeed OM, Bukhari AA, Alshehri AA, Alsumairi FA, Alnami AM, Elsheikh HA, et al. The use of antibiotics for the prevention of surgical site infections in two government hospitals in Taif, Saudi Arabia: A retrospective study. Cureus 2022; 14(7): e26731. https://doi.org/10.7759/cureus.26731

....