

Review Article

Role of Antibiotic Prophylaxis in Laparoscopic Cholecystectomy

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***Corresponding author:** Ahmed Elsaady, Department of General Surgery, Kafr Elshikh General Hospital, Egypt**Received:** January 30, 2019; **Accepted:** March 06, 2019; **Published:** March 13, 2019**Abstract**

Laparoscopic cholecystectomy is one of the most common abdominal surgical procedures all over the world. It carries a lot of advantages over the open procedure. One of these advantages is the marked decrease in the incidence of surgical site infection. However, no wound is immune and SSI is still present and may be troublesome. The role of antibiotic prophylaxis in preventing or reducing SSI is still a matter of controversy in laparoscopic cholecystectomy. This study is a prospective one that conducted over two years to assess the role of antibiotic prophylaxis and best regimen. Four hundreds and fifty six patients were included which were divided into two large groups; group of simple cholecystectomy and group of risky cholecystectomy. Each group were further subdivided into three groups; one received no antibiotic at all, the second received single dose of antibiotic, and a third one received antibiotic for at least five days. Sixteen cases developed SSI in the whole study (approximately 3.5%). Group of simple cholecystectomy reported three cases (~1%) suffered from SSI with insignificant value between the three groups. On the other hand in group B (risky group), thirteen patients developed surgical site infections (~7%) with high statistical significance between the group where patient did not received antibiotics at all and other two groups received antibiotics. Also significant value was found between the group used single dose antibiotic (group 5) and those with at least five days administration of antibiotics, the latter reported less incidence of SSI.

The study concluded that; no role of antibiotic prophylaxis in simple cholecystectomy. On the other hand prophylactic antibiotic is strongly recommended in risky cholecystectomy. It is better to give the antibiotic for at least five days in such risky groups. The presence of immune-compromised state, long operation, intraoperative complications, gall bladder injury or spillage of stones make the operation is risky and prone to develop SSI.

Keywords: Antibiotic prophylaxis; Port site infection; Surgical site infection; Laparoscopic cholecystectomy

Introduction

Laparoscopic cholecystectomy is one of the most commonly performed abdominal surgeries [1]. Although, the risk of Surgical Site Infection (SSI) in laparoscopic cholecystectomy is low compared to the open era, but still troublesome. An important issue in preventing such infection in open cholecystectomy is the use of antibiotic prophylaxis. However a lot of controversies are found in the use of antibiotic prophylaxis in laparoscopic cholecystectomy. This study is a prospective one aims at demonstrating the efficacy of antibiotic use in preventing SSI.

Materials & Methods

All cases of laparoscopic cholecystectomy done from (August 2016 to November 2018) were involved in the study. The patients were divided into main two large group; group A referred as simple cholecystectomy and group B which referred as risky cholecystectomy. Risky cholecystectomy included any patient with one or more of the following risk factors mentioned in Table 1. These include prolonged duration, opening of the Gall Bladder (GB), spillage of stone, intraoperative complications (include bleeding more than 100cc, leak,

emphysema, etc.), suspicions of malignancies as well as immune-compromised state such as diabetes, steroid intake.. etc. Group A (simple cholecystectomy) were further subdivided into three groups. Group 1 where no antibiotic were given at all. Group 2 received one perioperative dose of antibiotic. Group 3 received antibiotic for at least five days. Also, group B (risky cholecystectomy) were subdivided into three groups. Group 4 that included patients who did not received antibiotics, group 5 included patients who received one perioperative dose of antibiotic, & group 6 received antibiotic for at least five days. The antibiotic received was ceftriaxone. The study documented the occurrence of Surgical Site Infection (SSI) in all patients as well as the occurrence of any remote infection anywhere (e.g. chest infection, site of IV line...) and compared the different groups. The aim of the study is to assess the value of giving antibiotic prophylaxis or not and to compare the best effective approach in antibiotic prophylaxis in laparoscopic cholecystectomy to prevent or reducing surgical site infections.

Results

Four hundreds & fifty six (456) patients were involved in the study. Group A (simple cholecystectomy) included two hundreds &

seventy four (274 ~60%). Ninety patients 90 (~32%) patients received no antibiotic prophylaxis at all (group 1). While, one hundred and one 101 (37%) patients received single perioperative dose, and eighty-eight patients (88 ~31%) received antibiotic for one week. Group B (risky cholecystectomy included one hundred and eighty two patients (182 ~40%). Forty-five (~25%) patients received no antibiotic (group 4). Seventy patients (~39%) of group B received single perioperative dose (group 5). Sixty seven patients (~ 37%) received antibiotic for seven days (group 6).

Sixteen cases developed SSI in the whole study (approximately 3.5%).

Group A reported three cases (~1%) suffered from surgical site infections. All were minor at the trocar sites and relieved medically. Group I had one patient about 1.1% suffering, while group 2 had only one patient suffered from SSI (0.9%) and one patient belonged to group 3 approximately 1.2% with p value was insignificant between the three groups.

On group B, thirteen patients developed surgical site infections (~7%). Four patients in group 4 (nearly 9%), two of them had sub-hepatic collection while the remaining part localized at the trocar sites and were minor. One case of the sub-hepatic collection improved medically while the other by ultrasound guided drainage. Five patients of group 5 developed SSI (about 7%), all cases were localized at the trocar site, and all improved medically except one, which discharged stone from the epigastric port (site of GB removal). Four patients developed SSI (~6%) in-group 6, five of them localized to trocar site, while one developed sub phrenic collection that drained by ultrasound. On comparison there was a high statistical significance between group 4 (patient not received antibiotics) and groups received antibiotics (5&6) with P value 0.001. Also a significance was found between group used single dose antibiotic (group 5) and those with one week administration of antibiotics group (6) with P value .01.

Discussion

Laparoscopic cholecystectomy is one of the most commonly performed abdominal surgeries [1]. It is the gold standard treatment for symptomatic gallstones [2]. Laparoscopic cholecystectomy carries a lot of advantages including decreased intra-abdominal adhesions, post-operative pain, and hospital stay with earlier return to work [3]. It also has minimum surgical incisions with better cosmetic results as well as less postoperative Surgical Site Infections (SSI) [4]. However, no surgical wound is completely immune to infections [5]. Despite the advances in the fields of antimicrobial agents, sterilization & surgical techniques, and operating room ventilation, port site infection still prevail [6]. The incidence of Port Site Infection (PSI) is variable, ranging mostly from .1 to 10% [7]. Table 1 demonstrated the frequencies of PSI in different studies [8].

Some risk factors were reported in literature to be significant in increasing the incidence of port site infections. These include; long operation, diabetes, steroid intake and immune compromised state, opening of gall bladder, and spillage of gall bladder stones [8]. Surgical Site Infection (SSI) was defined as infection, which occurs within 30 days of the surgical procedure. It was categorized into three types; (1) Superficial incisional SSI which involve skin and subcutaneous tissue

Table 1: Risk factors in laparoscopic Cholecystectomy for development of surgical site infection.

1	More than forty minute operative time
2	Intraoperative complication (bleeding >100cc, leak, visceral injury, emphysema)
3	Opening of the gall bladder
4	Spillage of stones
5	Acute cholecystitis grade III (Tokyo classification)
6	Suspicious of malignancy
7	Diabetic
8	Immune compromised or chronic disease such as rheumatoid arthritis, steroid intake.

Table 2: The frequency of port site infection after laparoscopic cholecystectomy in some studies [8].

No	Study	No of patients	Frequency of infection
1	Den Hoed et al 1998 [9]	189	10 (5.3%)
2	Shindholimath et al 2003 [10]	113	7 (6.3%)
3	Chuang et al 2004 [11]	420	6 (1.4%)
4	Triantafyllidis et al 2009 [12]	1009	14 (1.39%)
5	Yi et al 2012 [13]	400	11 (2.75%)
6	Taj et al 2012 [14]	492	27 (5.48%)
7	Yanni et al 2013 [15]	100	4 (4%)
8	Mir et al 2013 [16]	675	45 (6.7%)
9	Karthik et al 2013 [17]	570	10 (1.8%)

but the infection still above the fascia. (2) Deep incisional SSI which involve fascia and muscle layers; and (3) Organ/Space SSIs [19].

In addition to the previous classification of surgical site infection, it is also classified according to the time of presentation into; early cases that develops PSI within a week of the surgical procedure and late cases that developed after three to four weeks [6]. Early group constitutes the most common type & usually responds well to the commonly used antimicrobial agents. While, those presented late are rare & frequently don't response to the usual antimicrobial agents. They are usually caused by atypical mycobacterium species [6]. They may respond to macrolides, quinolones, tetracyclines and or aminoglycosides alone or in combinations [6].

A lot of controversies were found in the role of antibiotic prophylaxis in laparoscopic cholecystectomy in term of to use or not & the best regimen (Table 2).

Many studies reported the effective role of antibiotic prophylaxis in preventing SSI [18-20]. More recently Matsui Y et al reviewed seven meta-analyses regarding prophylactic antibiotics for low-risk laparoscopic cholecystectomy. They examined a total of 28 RCTs and concluded that; prophylactic antibiotics reduce the incidence of postoperative infections after elective laparoscopic cholecystectomy [21]. Also Liang B et al conducted a comprehensive literature review of the PubMed, Embase, and Cochrane Library databases for RCTs that compared antibiotic prophylaxis *versus* placebo or no antibiotics and concluded that two doses of antibiotic and 3-10 doses of antibiotic significantly reduced the incidence of surgical site infections compared with placebo or no antibiotics, while a single dose of antibiotic administration did not [22].

On the other hand many studies denied the role of antibiotic prophylaxis in laparoscopic cholecystectomy [23]. Since 1995, Watkin DS et al studies concluded that routine antibiotic prophylaxis may be unnecessary during elective laparoscopic cholecystectomy [24]. Other authors reported that antibiotic prophylaxis has no role in SSI, even if you provide antibiotics for longer duration they do not assist in the prevention of infection [25]. One of the studies says that whether it is high risk or low risk procedures, antibiotic prophylaxis may not affect or control the surgical site infection [26]. A study by Yan C suggested that there is no significant risk reduction with prophylactic antibiotics [29]. By statistical data there is no difference in SSI rate in the cases with or without antibiotic prophylaxis [28].

Similarly, some authors said that there is no significant benefit of extended antibiotic therapy in reducing SSI after cholecystectomy for mild and moderate acute cholecystitis (Tokio I and II) [29,30].

Zhou H et al 2009 reported that Studies have shown beneficial effects of prophylaxis in cases of open cholecystectomy but their effects in laparoscopic surgery is not well established. So, outcomes of antibiotic prophylaxis; useful or not in cases of laparoscopic surgery is yet to be established [31].

So, again a lot of controversies are present in actual significance of routine antibiotic prophylaxis, with many studies supporting the beneficial value while other denied such value.

Sanabria A et al did a systematic review and concluded that there is not sufficient evidence to support or refute the use of antibiotic prophylaxis to reduce surgical site infection and global infections in patients undergoing elective laparoscopic cholecystectomy [19].

Accordingly, this study was set up to assess the role of antibiotic prophylaxis. The rationale in the study is to differentiate between patient with and without risk factors similar to the classification of surgical wound into clean, clean contaminated and contaminated wound. The study considered the presence of one or more of the risk factors (mentioned in Table 1) are sufficient to deal with the case as risky one with especial perioperative consideration than simple laparoscopic cholecystectomy. There is a long list for risk factors of difficult cholecystectomy, but the study considered the intraoperative findings as a net result for true difficulties rather than just risk factors. So, the study considered prolonged duration (more than forty minutes), intraoperative complications and mishaps (e.g. bleeding >100cc, visceral injuries, leak, etc.) as well as GB injury, stone spillage & suspicions of malignancies in addition to the immune-compromised state (such as diabetes, steroid, rheumatoid) are risk factors.

This study reported an incidence of approximately 3.5% of surgical site infection with 1% in simple cholecystectomy group and about 7% in risky group. The study demonstrated no significances at all in the three group of simple cholecystectomy. No difference in the incidence rate of SSI in patients that did not received antibiotic at all, or patients received single or more doses of antibiotics. On the other hand marked significance were found between the group that didn't received antibiotic (group 4) and those received antibiotic (group 5&6) in-group B risky cholecystectomy.

So, no role of antibiotic prophylaxis in simple cholecystectomy has been founded. While prophylactic antibiotic is recommended in

risky cholecystectomy for at least five days.

Conclusion

Although the risk of surgical site infection post laparoscopic cholecystectomy is low, but it is one of the troublesome complication. The presence of immune-compromised state, long operation, intraoperative complications, gall bladder injury or spillage of stones make the operation very risky to develop SSI. No role of antibiotic prophylaxis in simple cholecystectomy. On the other hand, prophylactic antibiotic is strongly recommended in risky cholecystectomy. It is better to give the antibiotic for at least five days in such risky groups.

References

- Perez A, Theodore N, Pappas. Operative management of cholecystitis and cholelithiasis shackelford's surgery of the alimentary tract charles j. yeo, steven r. demeester, david w. mcFadden, jeffrey b. matthews, james w. fleshman Elsevier. Eighth edition. 2019; 108-109.
- Adnan M, Naqvi AM, Rasheed H. Laparoscopic cholecystectomy: An audit of 500 patients. *Journal of Ayub Medical College Abbottabad*. 2011; 23.4: 88-90.
- Karthik S, Augustine AJ, Shibumon MM, Pai MV. Analysis of laparoscopic port site complications: A descriptive study. *J Minim Access Surg*. 2013; 9: 59-64.
- Zacks SL, Sandler RS, Rutledge R, Brown RS. A population-based cohort study comparing laparoscopic cholecystectomy and open cholecystectomy. *Am J Gastroenterol*. 2002; 97: 334-340.
- Saud DJ, Al-Hail ACM. Surgical site infection after laparoscopic cholecystectomy. *Basrah Journal of Surgery*. 2010; 16: 119-121.
- Prakash KS, 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: 864-871.
- Hamzaoglu I, Baca B, Böler DE, Polat E, Ozer Y. Is umbilical flora responsible for wound infection after laparoscopic surgery? *Surg Laparosc Endosc Percutan Tech*. 2004; 14: 263-267.
- Gharde P, Swarnkar M, Waghmare LS, et al. Journal of surgical technique and case reports Role of antibiotics on surgical site infection in cases of open and laparoscopic cholecystectomy: A comparative observational study. *Journal of surgical technique and case reports*. 2014; 6: 1-4.
- Den Hoed PT, Boelhouwer RU, Veen HF, Hop WC, Bruining HA. Infections and bacteriological data after laparoscopic and open gallbladder surgery. *J Hosp Infect*. 1998; 39: 27-37.
- Shindholimath VV, Seenu V, Parshad R, Chaudhry R, Kumar A. Factors influencing wound infection following laparoscopic cholecystectomy. *Trop Gastroenterol*. 2003; 24: 90-92.
- Chuang SC, Lee KT, Chang WT, Wang SN, Kuo KK, Chen JS, et al. Risk factors for wound infection after cholecystectomy. *J Formos Med Assoc*. 2004; 103: 607-612.
- Triantafyllidis I, Nikoloudis N, Sapidis N, Chrissidou M, Kalaitidou I, Chrissidis T. Complications of laparoscopic cholecystectomy: our experience in a district general hospital. *Surg Laparosc Endosc Percutan Tech*. 2009; 19: 449-458.
- 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: 47-50.
- Taj MN, Iqbal Y, Akbar Z. Frequency and prevention of laparoscopic port site infection. *J Ayub Med Coll Abbottabad*. 2012; 24: 197-199.
- Yanni F, Mekhail P, Morris-Stiff G. A selective antibiotic prophylaxis policy for laparoscopic cholecystectomy is effective in minimising infective complications. *Ann R Coll Surg Engl*. 2013; 95: 345-348.

16. Mir MA, Malik UY, Wani H, Bali BS. Prevalence, pattern, sensitivity and resistance to antibiotics of different bacteria isolated from port site infection in low risk patients after elective laparoscopic cholecystectomy for symptomatic cholelithiasis at tertiary care hospital of Kashmir. *Int Wound J*. 2013; 10: 110-113.
17. Karthik S, Augustine AJ, Shibumon MM, Pai MV. Analysis of laparoscopic port site complications: A descriptive study. *J Minim Access Surg*. 2013; 9: 59-64.
18. Warren DA, Nickel KB, Wallace EA, Mines D, Tian F, Symons WJ, et al. Risk Factors for Surgical Site Infection after Cholecystectomy. *Infect Dis*. 2017; 4: ofx036.
19. Sanabria A, Dominguez LC, Valdivieso E, Gomez G. Antibiotic prophylaxis for patients undergoing elective laparoscopic cholecystectomy. *Cochrane Database Syst Rev*. 2010.
20. Scott JD, Forrest A, Feuerstein S, Fitzpatrick P, Schentag JJ. Factors associated with postoperative infection. *Infect Control Hosp Epidemiol*. 2001; 22: 347-351.
21. Matsui Y, Satoi S, Hirooka S, Kosaka H, Kawaura T, Kitawaki T, et al. Reappraisal of previously reported meta-analyses on antibiotic prophylaxis for low-risk laparoscopic cholecystectomy: an overview of systematic reviews. *BMJ Open*. 2018; 8: e016666.
22. Liang B, Dai M, Zou Z. Safety and efficacy of antibiotic prophylaxis in patients undergoing elective laparoscopic cholecystectomy: A systematic review and meta-analysis. *J Gastroenterol Hepatol*. 2016; 31: 921-928.
23. Chang WT, Lee KT, Chuang SC, Wang SN, Kuo KK, Chen JS, et al. The impact of prophylactic antibiotics on postoperative infection complication in elective laparoscopic cholecystectomy: A prospective randomized study. *Am J Surg*. 2006; 191: 721-725.
24. Watkin DS, Wainwright AM, Thompson MH, Leaper DJ. Infection after laparoscopic cholecystectomy: are antibiotics really necessary? *Eur J Surg*. 1995; 161: 509-511.
25. Rodríguez-Sanjuán JC, Casella G, Antolín F, Castillo F, Fernández-Santiago R, Riaño M, et al. How long is antibiotic therapy necessary after urgent cholecystectomy for acute cholecystitis? *J Gastrointest Surg*. 2013; 17: 1947-1952.
26. Gurusamy KS, Koti R, Wilson P, Davidson BR. Antibiotic prophylaxis for the prevention of Methicillin-Resistant Staphylococcus Aureus (MRSA) related complications in surgical patients. *Cochrane Database Syst Rev*. 2013; 8: CD010268.
27. Darkahi B, Videhult P, Sandblom G, Liljeholm H, Ljungdahl M, Rasmussen IC. Effectiveness of antibiotic prophylaxis in cholecystectomy: A prospective population-based study of 1171 cholecystectomies. *Scand J Gastroenterol*. 2012; 47: 1242-1246.
28. Sharma N, Garg PK, Hadke NS, Choudhary D. Role of prophylactic antibiotics in laparoscopic cholecystectomy and risk factors for surgical site infection: A randomized controlled trial. *Surg Infect (Larchmt)*. 2010; 11: 367-370.
29. 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 A*. 2011; 21: 301-306.
30. La Regina D, Di Giuseppe M, Cafarotti S, Saporito A, Ceppi M, Mongelli F, et al. Antibiotic administration after cholecystectomy for acute mild-moderate cholecystitis: a PRISMA-compliant meta-analysis. *Surg Endosc*. 2018.
31. Zhou H, Zhang J, Wang Q, Hu Z. Meta-analysis: Antibiotic prophylaxis in elective laparoscopic cholecystectomy. *Aliment Pharmacol Ther*. 2009; 29: 1086-1095.