International Surgery Journal
Saadhi IR et al. Int Surg J. 2023 Oct;10(10):1568-1571
http://www.ijsurgery.com
pISSN 2349-3305 | eISSN 2349-2902

DOI: https://dx.doi.org/10.18203/2349-2902.isj20232862

Original Research Article

Surgical site infections: a cross-sectional study of bile culture

Ikhdin Radiamin Saadhi[1]*, Ida Bagus Budhi[2], Widyanti Soewoto[3], Agus Rahardjo[2], Hengky Agung[3]

[1]Department of Surgery, Faculty of Medicine, Sebelas Maret University, Surakarta, Indonesia
[2]Department of Surgery, Digestive Division, Faculty of Medicine, Sebelas Maret University, Surakarta, Indonesia
[3]Department of Surgery, Oncology Division, Faculty of Medicine, Sebelas Maret University, Surakarta, Indonesia

Received: 01 September 2023
Accepted: 15 September 2023

***Correspondence:**
Dr. Ikhdin Radiamin Saadhi,
E-mail: misterikhdin@gmail.com

ABSTRACT

Background: Surgical site infections (SSIs) are one of the most common reported healthcare-associated infections worldwide. SSIs are also the most common complication of various surgical procedures, including cholecystectomy which is the standard surgical procedure for calculus cholecystitis. The association between SSIs and cholecystectomy is suspected due to infection from pathogens in the bile. This study aims to determine the relationship between bile culture results and the incidence of SSIs in patients with calculus cholecystitis undergoing cholecystectomy procedures.
Methods: This study was an analytic observational study with a cross-sectional design which involved 44 subjects. The data obtained were then analyzed using the Chi square method with the IBM statistical package for the social sciences (SPSS) version 26.
Results: There were 44 subjects with calculus cholecystitis included in this study. None of the subjects in this study had SSIs, and also 54.5% of the subjects were given postoperative antibiotics. The results of data analysis showed no significant association between bile culture and SSIs ($p>0.05$). Additional analysis in this study also revealed no association between type of surgery and bile culture ($p>0.05$) and between postoperative antibiotic administration and SSIs ($p>0.05$).
Conclusions: Positive bile culture was not associated with the incidence of SSIs in calculus cholecystitis patients undergoing cholecystectomy procedures. The findings of this study also revealed no association between type of surgery and SSIs and postoperative antibiotic administration is not a mandatory for every cholecystectomy procedure.

Keywords: Bile culture, Calculus cholecystitis, Cholecystectomy, SSIs

INTRODUCTION

Surgical site infections (SSIs) are infections of surgical incisions or organ spaces that occur within thirty days postoperatively.[1,2] SSIs are one of the most common reported healthcare-associated infections worldwide.[3] The incidence of SSIs is more prevalent in developing countries such as Indonesia.[4] It is estimated that 1-3% of all surgical procedures develop SSIs.[5] The World Health Organization (WHO) reported an incidence of SSIs of 7.8% in neurosurgical, orthopedic, and general surgical procedures in Southeast Asian countries.[6]

SSIs are the most common complication of various surgical procedures, including cholecystectomy which is the standard surgical procedure for calculus cholecystitis. Recent studies have reported a high morbidity rate of 7.6% for cholecystectomy. This high morbidity rate is partly due to SSIs, which are reported to occur in 10% of cholecystectomies.[7-9] The high incidence of SSIs is suspected due to pathogen contamination of the bile fluid in the surgical incision and organ space. Positive culture bile culture correlate with an increased risk of postoperative infection.[10] The rate of positive bile culture ranges from 29-54% in cases of calculus cholecystitis.[11]

Therefore, this study aims to explore the association between bile culture and the incidence of SSIs in patients with calculus cholecystitis who undergo cholecystectomy.

METHODS

This study was an analytic observational study with a cross-sectional design conducted on calculus cholecystitis subjects who underwent cholecystectomy surgical procedures. The study was conducted at Dr. Moewardi Hospital, Surakarta, Indonesia in August-December 2022. The inclusion criteria in this study were subjects diagnosed with calculus cholecystitis based on radiologic findings, body mass index (BMI) <25 kg/m^2, and subjects who were indicated to undergo cholecystectomy. Meanwhile, the exclusion criteria were subjects with a history of type 2 diabetes mellitus, BMI categorized as overweight or obese, and subjects who underwent cholecystectomy other than laparoscopic and laparotomy procedures.

The bile fluid sampling process is performed in conjunction with the cholecystectomy procedure. The bile fluid then sent to the microbiology laboratory for culture using a standardized procedure. SSIs in this study were assessed using the National Healthcare Safety Network surgical site infection (NHSN-SSIs) checklist. The data obtained were then analyzed using IBM SPSS version 26 (Chicago, USA). The data analysis technique used was chi square. A p value of <0.05 was considered statistically significant. This study was approved by the ethics committee of Dr. Moewardi Hospital, Surakarta, Indonesia with number 1.491/XII/HREC/2022.

RESULTS

Subject characteristics

In the study there were 44 subjects. Most of the subjects were female (65.9%) with an average age of 45.3 years. The most common type of surgery performed was laparoscopy which accounted for 70.5% of the subjects. There were various types of organisms identified in the bile culture, but most of the bile culture showed no growth. The most common organism identified was *E. coli* which was found in 9% of cases followed by *E. aerogenes* and *K. pneumoniae* with equal percentages of 4.5%. Other organisms identified were *Bacillus sp., C. iwoffii, E. cloacae, S. arlette, S. cohnii*, and yeast. The only organism belonging to the fungal group, yeast, was found in 1 case. Subjects in this study also received systemic antibiotics after surgery which were given to 54.5% of subjects (Table 1).

Bile culture and SSIs

Positive bile culture were found in 13 subjects with various organisms from bacteria and fungi. There were 8 different bacterial and 1 fungal species identified in the bile cultures of subjects with calculous cholecystitis in this study. SSIs were not found in all 44 subjects in this study. Therefore, there was no association between the bile culture and SSIs in subjects with calculous cholecystitis due to the absence of SSIs in all subjects (Table 2).

Table 1: Subject's characteristics.

Characteristics	N (%)/mean±standard deviation
Sex	
Male	15 (34.1)
Female	29 (65.9)
Age (years)	45.3±10.2
Surgery type	
Laparoscopy	31 (70.5)
Laparatotomy	13 (29.5)
Bile cultures	
No growth	30 (68.2)
Bacillus sp.	1 (2.3)
Cinerobacter iwoffii	1 (2.3)
Enterobacter aerogenes	2 (4.5)
Enterobacter cloacae	1 (2.3)
Escherechia coli	4 (9)
Klebsiella pneumonia	2 (4.5)
Staphylococcus arlettae	1 (2.3)
Staphylococcus cohnii	1 (2.3)
Yeast	1 (2.3)
SSIs	
Present	0 (0)
Absent	44 (100)
Postoperative antibiotics	
Yes	24 (54.5)
No	20 (45.5)

Table 2: Association between bile culture and SSIs.

Bile culture	SSIs		Total	P
	Absent	Present		
Negative	31	0	31	>0.05
Positive	13	0	13	
Total	44	0	44	

Surgery type and bile culture

In subjects who underwent laparoscopic surgery, there were more subjects with positive culture (10 subjects) compared to the laparotomy surgery (4 subjects). The association between the type of surgery and the bile culture obtained p>0.05 which means there is no significant association between the surgery type and the bile culture (Table 3).

Postoperative antibiotics and SSIs

Subjects who were given postoperative systemic antibiotics and those who were not had almost the same number in this study, 54.5% and 45.5% respectively, but none of the subjects experienced SSIs either received or

did not receive postoperative systemic antibiotics. The association between postoperative antibiotic administration and SSIs was found to be insignificant with a p>0.05 value (Table 4).

Table 3: Association between surgery type and bile culture.

Surgery type	Bile culture		Total	P
	Absent	Present		
Laparoscopy	21	10	31	>0.05
Laparotomy	9	4	13	
Total	30	14	44	

Table 4: Association between postoperative antibiotic administration and ILO.

Postoperative antibiotics	SSIs		Total	P
	Absent	Present		
Yes	20	0	20	>0.05
No	24	0	24	
Total	44	0	44	

DISCUSSION

The results of this study showed that there was no association between bile culture and SSIs in patients with calculus cholecystitis who underwent cholecystectomy. In this study, there were no patients with SSIs, although the results of bile culture showed positive results in 14 patients (31.8%). This result is in line with the research of Lee et al who also found no relationship between positive culture results and SSIs in patients undergoing spinal surgery.[12] The absence of an association between bile culture and SSIs in this study may be due to several factors such as hygiene, wound care compliance, and age.

Hygiene, especially hand hygiene is the factor that can affect the presence or absence of SSIs, because with good hygiene the cleanliness of the surgical wound will be well maintained so that microbes will find it difficult to live and cause infection. Hand hygiene is the most effective strategy to protect patients from healthcare-associated infections and limit the spread of bacteria.[13] Patient compliance in caring for surgical wounds is also influential in preventing SSIs. Dressing the surgical wound will provide a barrier from environmental contamination so that the risk of SSIs will be reduced.[14] Patients in this study had an average age of 45 years which is classified as late adulthood. Elderly have a 4x higher risk of suffering from SSIs. This is influenced by factors such as comorbid diseases and decreased wound healing ability.[15]

This study also found that there was no association between the type of surgery and SSIs. In general, patients with calculus cholecystitis in this study underwent two types of surgery, laparoscopy and laparotomy. This result is different from Wang et al who found a difference in the incidence of SSIs between patients undergoing laparoscopy and laparotomy, although other risks such as intra-abdominal abscess, thromboembolism, and ileus were similar between the two types of surgery.[16] Another finding in this study was the diverse bile fluid culture results. There were 9 types of microorganisms consisting of 8 bacteria and 1 fungus. The finding of fungi in the culture results in this study is odd because fungi, especially yeast, are not organisms that can grow in the gallbladder. This may be due to contamination with other organs so that the bile culture results show the presence of fungi. As research by Nam et al reported that fungal contamination in culture results can manifest in various morphological patterns, such as yeast, pseudohyphae, and hyphae.[17]

The last finding in this study was, there was no association between postoperative antibiotic administration and SSIs. Although almost half of the subjects in this study did not receive postoperative antibiotics, none of them experienced SSIs. This result is in line with the systematic review by de Jonge et al who found that there was no significant benefit of postoperative antibiotic administration compared to patients who were not given antibiotics. Surgical procedures that have followed good practice standards will be able to avoid the occurrence of SSIs. Postoperative antibiotic administration is necessary when the surgical procedure performed is not in accordance with the implementation standards, especially in aseptic aspects.[18] A randomized-controlled trial study conducted in patients with calculus cholecystitis showed that among patients with mild or moderate calculus cholecystitis who received preoperative and intraoperative antibiotics, lack of postoperative treatment with antibiotics did not result in a greater incidence of postoperative infection.[19] A study by Budhi et al in 158 patients with calculus cholecystitis also found that not giving oral antibiotics after cholecystectomy with laparotomy was not associated with the onset of SSIs and was safe and appropriate to do.[20]

The findings in this study indicate that the administration of postoperative antibiotics is not an absolute requirement and is only needed in certain conditions where the surgery performed, especially cholecystectomy, has steps that are not in accordance with the procedure, increasing the risk of SSIs. Especially in laparoscopic surgery which is less invasive than laparotomy, postoperative antibiotics are not necessary. However, if there is any doubt especially in cholecystectomy with laparotomy which requires a larger surgical incision then postoperative antibiotics may be considered. This is the first study to investigate the relationship between bile culture and SSIs, but further research is needed.

CONCLUSION

Positive bile culture are not associated with the incidence of SSIs in patients with calculus cholecystitis undergoing cholecystectomy. The type of surgery (laparoscopic and laparotomy) performed for cholecystectomy is not related to the bile fluid culture. Postoperative antibiotic

administration was not associated with the onset of SSIs, so postoperative antibiotic administration is not an absolute thing to be given. Future studies are expected to not only assess SSIs based on certain criteria but also perform culture on surgical wounds. The results of this study also indicate that antibiotics should only be given as prophylaxis, while postoperative antibiotics do not need to be given.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: The study was approved by the Institutional Ethics Committee

REFERENCES

1. Horan TC, Andrus M, Dudeck MA. CDC/NHSN surveillance definition of health care-associated infection and criteria for specific types of infections in the acute care setting. Am J Infect Control. 2008;36(5):309-32.
2. Berríos-Torres SI, Umscheid CA, Bratzler DW. Centers for Disease Control and Prevention Guideline for the Prevention of Surgical Site Infection, 2017. JAMA Surg. 2017;152(8):784-91.
3. Carvalho RLR, Campos CC, Franco LMC, Rocha AM, Ercole FF. Incidence and risk factors for surgical site infection in general surgeries. Rev Lat Am Enfermagem. 2017;25:e2848.
4. Curcio D, Cane A, Fernández F, Correa J. Surgical site infection in elective clean and clean-contaminated surgeries in developing countries. Int J Infect Dis. 2019;80:34-45.
5. Alkaaki A, Al-Radi OO, Khoja A, Alnawawi A, Alnawawi A, Maghrabi A, et al. Surgical site infection following abdominal surgery: a prospective cohort study. Can J Surg. 2019;62(2):111-7.
6. Leaper DJ, Edmiston CE. World Health Organization: global guidelines for the prevention of surgical site infection. J Hosp Infect. 2017;95(2):135-6.
7. Chaochankit W, Samphao S, Mahattanobon S, Sungworawongpana C. Clinical Predictive Score for Cholecystectomy Wound Infection: WEBAC Score. J Gastrointest Surg. 2023;5.
8. Nishida Y, Otagiri N, Yoshifuku S, Misawa K, Ko K, Sasahara K, et al. Gram staining of gallbladder bile samples is useful for predicting surgical site infection in acute cholecystitis patients undergoing an early cholecystectomy. J Hepatobiliary Pancreat Sci. 2020;27(12):962-7.
9. Bogdanic B, Bosnjak Z, Budimir A, Augustin G, Milosevic M, Plecko V, et al. Surveillance of surgical site infection after cholecystectomy using the hospital in Europe link for infection control through surveillance protocol. Surg Infect (Larchmt). 2013;14(3):283-7.
10. Darkahi B, Sandblom G, Liljeholm H, Videhult P, Melhus Å, Rasmussen IC. Biliary microflora in patients undergoing cholecystectomy. Surg Infect (Larchmt). 2014;15(3):262-5.
11. Pisano M, Allievi N, Gurusamy K, Borzellino G, Cimbanassi S, Boerna D, et al. 2020 World Society of Emergency Surgery updated guidelines for the diagnosis and treatment of acute calculus cholecystitis. World J Emerg Surg. 2020;15(1):61.
12. Lee JC, Baek MJ, Choi SW, Kwon SH, Kim KH, Park SY, et al. Retrospective analysis of culture-negative versus culture-positive postoperative spinal infections. Medicine (Baltimore). 2018;97(20):e10643.
13. Tartari E, Weterings V, Gastmeier P, Bano JR, Widmer A, Kluytmans J, et al. Patient engagement with surgical site infection prevention: an expert panel perspective. Antimicrob Resist Infect Control. 2017;6:45.
14. Walter CJ, Dumville JC, Sharp CA, Page T. Systematic review and meta-analysis of wound dressings in the prevention of surgical-site infections in surgical wounds healing by primary intention. Br J Surg. 2012;99(9):1185-94.
15. Kaye KS, Anderson DJ, Sloane R, Chen LF, Choi Y, Link K, et al. The effect of surgical site infection on older operative patients. J Am Geriatr Soc. 2009;57(1):46-54.
16. Wang J, Cheng L, Liu J, Zhang B, Wang W, Zhu W, et al. Laparoscopy vs. Laparotomy for the Management of Abdominal Trauma: A Systematic Review and Meta-Analysis. Front Surg. 2022;9:817134.
17. Nam SY, Lee SJ, Lim HJ, Park JY, Jeon SW. Clinical risk factors and pattern of initial fungal contamination in endoscopic biopsy-derived gastrointestinal cancer organoid culture. Korean J Intern Med. 2021;36(4):878-87.
18. de Jonge SW, Boldingh QJJ, Solomkin JS, Dellinger 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):1182-92.
19. Regimbeau JM, Fuks D, Pautrat K, Mauvais F, Haccart V, Msika S, et al. Effect of postoperative antibiotic administration on postoperative infection following cholecystectomy for acute calculous cholecystitis: a randomized clinical trial. JAMA. 2014;312(2):145-54.
20. Budhi IB, Kade MIA, Laely S, Bagus MI, Ayu SI. No need for the continuation of oral antibiotic on mild and moderate calculous cholecystitis undergoing elective cholecystectomy. BJS. 2020;107(S3):90.

Cite this article as: Saadhi IR, Budhi IB, Soewoto W, Rahardjo A, Agung H. Surgical site infections: a cross-sectional study of bile culture. Int Surg J 2023;10:1568-71.