12-18-2020

Analysis of Preoperative and Intraoperative Risk Factors Of Surgical Site Infection In Gastrointestinal Surgeries

Annisa Syafitri

Training Program in Surgery, Department of Surgery, Faculty of Medicine Universitas Indonesia, dr. Cipto Mangunkusumo General Hospital, Jakarta, syafitriannisa@gmail.com

Yarman Mazni

Division of Digestive Surgery, Department of Surgery, Faculty of Medicine Universitas Indonesia, dr. Cipto Mangunkusumo General Hospital, Jakarta, yarmanmazni@gmail.com

Setyawati Budiningsih

Department of Community Medicine, Faculty of Medicine University of Indonesia, dr. Cipto Mangunkusumo General Hospital, Jakarta, setyawatib@yahoo.com

Follow this and additional works at: <https://scholarhub.ui.ac.id/nrjs>

Part of the [Surgery Commons](#)

Recommended Citation

Syafitri, Annisa; Mazni, Yarman; and Budiningsih, Setyawati (2020) "Analysis of Preoperative and Intraoperative Risk Factors Of Surgical Site Infection In Gastrointestinal Surgeries," *The New Ropanasuri Journal of Surgery*: Vol. 5 : No. 2 , Article 5.

DOI: 10.7454/nrjs.v5i2.1085

Available at: <https://scholarhub.ui.ac.id/nrjs/vol5/iss2/5>

This Article is brought to you for free and open access by the Faculty of Medicine at UI Scholars Hub. It has been accepted for inclusion in The New Ropanasuri Journal of Surgery by an authorized editor of UI Scholars Hub.

Analysis of Preoperative and Intraoperative Risk Factors Of Surgical Site Infection In Gastrointestinal Surgeries

Annisa Syafitri,¹ Yarman Mazni,² Setyawati Budiningsih.³

1. Training Program in Surgery, 2. Division of Digestive Surgery, Department of Surgery, 3. Department of Community Medicine, Faculty of Medicine Universitas Indonesia, dr. Cipto Mangunkusumo General Hospital, Jakarta.

Corresponding author: syafitriannisa@gmail.com Received: 18/Jul/2020 Accepted: 13/Dec/2020 Published: 18/Dec/2020

Website: <https://scholarhub.ui.ac.id/nrjs/> DOI:10.7454/nrjs.v5i2.1085

Abstract

Introduction. Surgical site infection (SSI) after gastrointestinal surgery can affect the mortality and morbidity of the patients. Risk factors are needed to prevent and decrease the number of SSI. This study investigated the incidence of SSI, the preoperative and intraoperative risk factors of gastrointestinal surgeries.

Method. A retrospective audit analysis of age, nutritional status, preoperative length of stay, length of surgery, type of surgery, degree of contamination in adult gastrointestinal surgery patients at dr. Cipto Mangunkusumo General Hospital from 2012 to 2016. Outcomes consisted of incidence, and potential univariate risk factors were determined to investigate the independently associated factors using multivariate logistic regression.

Results. In four years, the incidence of SSI is 3.4% among 4,357 gastrointestinal surgeries, with 86.4% of surgical site infections appears in contaminated wound operations. Our study included 116 subjects. From univariate analysis between SSI as dependent factors and the risk factors, age ($p = 0.2$), preoperative length of stay ($p = 0.06$), length of surgery ($p = 0.1$), and degree of contamination ($p = 0.003$) have correlative association with SSI. The risk factor with surgical site infection is surgical wound contamination (OR = 1.233, $p = 0.011$) and independent from other risk factors.

Conclusion: Four factors correlate with SSI; there are age, preoperative length of stay, length of surgery, and degree of contamination. The degree of contamination is a significant risk factor for SSI.

Keywords: gastrointestinal surgeries, intraoperative risk factors, preoperative risk factors, surgical site infection

Introduction

Hospital-acquired infections (HAI), which were nosocomial infections at an early date, remain a significant cause of morbidity and mortality. About 1 in 20 patients experience an infection related to hospital care.¹ The most common HAI is urinary tract infection (UTI), accounting for 35%, surgical site infection (SSI) of 20%, nosocomial pneumonia of 15%, and others. Based on a survey, nosocomial infections remain high, one of which is surgical site infection (SSI), with 90% of the cause being bacterial.¹

In Indonesia, the incidence of SSI from several studies in several teaching hospitals ranged from 5.32 to 13.9% in cases of clean and clean-contaminated surgeries. In dr. Cipto Mangunkusumo Hospital (RSCM), the prevalence of post-abdominal SSI surgery in children reached 7.2% in 2009-2011. In January 2007, the RSCM surgical department reported SSI incidence in adults reaching 10%.

SSI is an infection that occurs in patients after surgery up to 30 days postoperatively or up to 90 days if implants are placed.³

Some risk factors influence SSI. These factors can be divided into preoperative risk factors, which can be further classified into internal and external factors. Internal factors include age, comorbid, nutritional status, smoking, external factors (preoperative length of stay, physiologic status of ASA, antibiotic prophylaxis). Intraoperative risk factors consist

of cases, type of surgery, classification of the surgical wound, surgery duration, and operating theater environment. Finally, postoperative risk factors can be seen in wound care.

Despite mortality and morbidity, SSI may also cause the prolonged hospital length of stay, increasing the need for antibiotics and total costs. We need to reduce the incidence of SSI; one attempt would be by conducting a systematic approach to the risk factors that may be responsible for SSI. Thus, the study aimed to evaluate gastrointestinal surgery at RSCM 2012-2016 and the influencing factors.

Method

A retrospective cohort was carried out, taking data from the registry of the Digestive Surgery Division, Department of Surgery RSCM, and medical records from 2012 to 2016. Subjects were those who underwent digestive surgery during 2012-2016, divided into two groups. The first group was those with SSI, and the second one was the control group. Minimum calculated samples were 58 subjects for each group, with a total of 116.

Samples were taken by random sampling method: the preoperative risks (age, body mass index, albumin serum, subjective global assessment, preoperative length of stays), intraoperative factor (duration of surgery, the timing of surgery, classification of surgery, and operating theater) are variable of interests subjected to analysis. Statistical analysis carried out

using univariate, bivariate, and multivariate methods. The committee of ethics Faculty of Medicine, Universitas Indonesia approved the study.

Results

There were 4357 operations performed. The surgical site infection was found in 148 operations for four years (3.4%). Most subjects were aged 31 to 50 years. SSI was found in 40.7% of subjects and 55.9% of non-SSI. Of the body mass index, subjects with normal BMI were the most common.

In those with SSI, 47.5% had normal BMI, and 42.4% of non-SSI subjects had normal BMI. The majority of subjects who proceeded with surgery showed hypoalbuminemia: 64.4% in the SSI group and 67.8% in the non-SSI group.

Subjective Global Assessment showed that the group with category A is mostly found (47.5% and 57.6%). For subjects with SSI, the length of stay was more than seven days (66.1%), while for the non-SSI, the length of stay was less than or equal to 7 days (50.8%).

Table 1. Preoperative risk factors^{4,6} in gastro-intestinal surgeries in RSCM 2012-2016

Preoperative risk factors	SSI		Non-SSI	
	n	%	n	%
Age				
– 18–30 years	12	20.3	9	15.3
– 31–50 years	24	40.7	33	55.9
– 51–75 years	23	39.0	16	27.1
– >75 years	0	0.0	1	1.7
Body mass index				
– Underweight	15	25.4	13	22.0
– Normal	28	47.5	25	42.4
– Overweight	8	13.6	9	15.3
– Pre-obese	8	13.6	11	18.6
– Obese	0	0.0	1	1.7
Albumin serum				
– Hypoalbuminemia	38	64.4	40	67.8
– Normal	20	33.9	19	32.2
– Hyperalbuminemia	1	1.7	0	0
Subjective Global Assessment				
– A	28	47.5	34	57.6
– B	25	42.4	20	33.9
– C	6	10.2	5	8.5
Preoperative length of stay				
– ≤ 7 days	20	33.9	30	50.8
– > 7 days	39	66.1	29	49.2

Table 2. Intraoperative risk factors^{1,7} in gastro-intestinal surgeries in RSCM 2012-2016

Intraoperative risk factors	SSI		Non-SSI	
	n	%	n	%
Duration of surgery				
– ≤180 min	32	54.2	40	67.8
– >180 min	27	45.8	19	32.2
Type of surgery				
– Elective	42	71.2	43	72.9
– Emergency	17	28.8	16	27.1
GI series				
– Upper Gastrointestinal	13	22.0	8	13.6
– Lower Gastrointestinal	29	49.2	36	61.0
– Hepatopancreatobiliary	17	28.8	15	25.4
Classification of surgery				
– Clean-contaminated	8	13.6	22	37.3
– Contaminated	51	86.4	37	62.7
– Dirty	0	0.0	0	0.0
Operating theater				
– Central OT	40	67.8	43	72.9
– Emergency OT	19	32.2	16	27.1

Table 3. Bivariate analysis of risk factors and surgical site infection in digestive surgeries

Risk factors	p value
Age	0.243
Body mass index	0.665
Albumin level	0.697
Subjective Global Assessment	0.541
Preoperative length of stay	0.062
Duration of surgery	0.131
Type of surgery	0.837
GI Series	0.430
Classification of surgery	0.003
Operating room	0.545

The duration of surgeries less than or equal to 180 minutes was the most common in both groups, namely 54.2% in the SSI group and 67.8% in the non-SSI group. Elective surgery was performed in 71.2% of SSI subjects and 72.9% in non-SSI subjects, with the most types of cases were lower gastro-intestinal (49.2% and 61%). Most of the surgery

classified as contaminated surgery, 86.4% in the SSI group, and 62.7% in the non-SSI group.

Four risk factors, namely, age, preoperative length of stay, surgery duration, and classification of surgery, proceeded to multivariate analysis.

Table 4. Multivariate logistic regression analysis in digestive surgeries in RSCM 2012- 2016

Variables	B	SE	Wald	df	Sig.	Exp(B)	95% CI for EXP(B)	
							Lower	Upper
Age	-0.016	0.276	0.003	1	0.953	0.984	0.573	1.689
Preoperative length of stay	0.548	0.428	1.640	1	0.200	1.730	0.748	4.001
Length of surgery	0.054	0.440	0.015	1	0.902	1.056	0.445	2.502
Classification of surgery	1.233	0.487	6.411	1	0.011	3.432	1.321	8.913
Constant	-4.308	1.493	8.324	1	0.004	0.13		

Multivariate logistic regression analyzes the four risk factors and found that the degree of contamination is an independent factor to $p = 0.011$. The degree of contamination can also be referred to as a predictive factor for SSI.

Discussion

SSI is the most common postoperative complication and occurs in about 5% of all patients undergoing surgery. In Southeast Asia, from 2000 to 2012, the incidence of SSI was 7.8%.⁸ Department of Surgery in RSCM had reported the incidence of SSI in post-abdominal surgery in adults reached up to 10% in 2007. This study found the incidence of SSI was 3.4%, showing a significant reduction in SSI incidence for digestive surgery in RSCM.

According to the CDC criteria that define SSI as an infection in operations that occur within 30 days after surgery or 90 days when using implants, the research data obtained from hospitalized patients. The average hospital stay after surgery is 7 to 14 days. To monitor the presence or absence of SSI according to the CDC criteria, it must observe up to 30 days, not only in hospitals.

There are several reasons why SSI in developing countries are numerous. Due to the lack of human resources and research or surveys on SSI, lack of application in implementing SSI standard definitions, lack of existing microbiology or diagnostic tools, and not acceptable medical records should be identified.⁸

This study classifies these risk factors into two groups: preoperative risk factors and intraoperative. Some may be subjected to modified in preoperative risk factors, and others may not, namely age. Increased age of up to 50 years is a risk factor for SSI, but after 50, SSI's risk decreases.⁸ This is consistent with the previous research. In this study, the age group of 31-50 years and 51-75 years has 40.7% and 39%. This age group is divided into two groups based on previous studies showing an increased risk of SSI in the age group above 50.⁵ However, this study found the age group of 31-50 years and 51-75 years, followed by an increase in SSI prevalence by nearly the same amount.

Albumin is one of the preoperative risk factors often associated with SSI. Patients with hypoalbuminemia at risk of 36% to SSI. But this was not seen in this study. A total of 64.4% of the subjects with hypoalbuminemia in this study found no correlation with an increased prevalence of SSI in RSCM.

In this study, 66% of subjects with SSI get a length of more than seven days before surgery. Everyone week increase in the preoperative length of stay is followed by an increase in infection risk by 15%. The length of stay before surgery for more than seven days is at risk of 4.4%.

Extension of the preoperative length of stay improves colonization of antibiotic-resistant nosocomial pathogens. Therefore, it is recommended to reduce the preoperative length of stay. Before admission to the unit for surgery, ensure complete preparation for surgery to be scheduled soon. The recommended preoperative length of stay is two days.⁸

In addition to the preoperative length of stay, the length of surgery is also a risk factor associated with SSI. The duration of surgery with more than 180 minutes is a risk factor for SSI. Many factors are expected to increase surgery length, including the types of cases, surgery techniques, operators who perform surgery, complications during surgery such as hypotension or bleeding. RSCM a teaching hospital where a medical specialist and sub-specialist student do most surgery. Consequently, the surgery takes longer and increase the risk of SSI.

The classification of surgery, which represent degree of contamination is a predictor and a significant factor in the onset of SSI. The majority of existing operations were contaminated (86.4%) in the SSI group, taken from elective and emergency surgery. Surgery in the emergency operating room is not performed in optimal preoperative preparation, such as elective surgery types, because the surgery aims to tackle emergencies in advance. Therefore, most of the surgery is contaminated. In the analysis, patients with a degree of contamination of contaminated or dirty are significant to SSI onset. Patients with contaminated surgery have a likelihood of 3.4 times to have SSI compared to others. Adequate post-surgical treatment and appropriate antibiotics may prevent the SSI in these patients.¹⁰

This study showed some risk factors and showed a correlation to SSI.

With sufficient samples, there are four factors associated with SSI, which the classification of surgery denoting the degree of contamination that is a predictive factor of SSI. However, this study has some limitations, such as incomplete data because this study used medical records designed for services, not particular for research purposes. In addition, data is taken merely from inpatients, excluding those outpatients. Thus, the incidence may differ should the outpatients included.

The study was designed to focus on postoperative risk factors. Since there was no data on wound care available, these factors were unable to be analyzed in the study.

Conclusion

There is a significant association between intraoperative risk factors and SSI in RSCM. The classification of surgery denoting the degree of contamination is a significant risk factor for SSI. Based on these findings, there were recommendations. Subjects above 50 years should be ensured that there are no nutritional issues since the group is at risk

for SSI. The length of preoperative days should be less than seven days. Subjects with multiple risk factors or a degree of contamination must be aggressively treated with antibiotics, nutrition, and post-operative wound care. The scope of research needs to be widening, including post-operative risk factors.

Disclosure

Authors disclosed no conflict of interest

Acknowledgment

References

1. Haryanti L, Pudjiadi AH, Ifran EKB, Thayeb A, Amir I, Hegar B. Prevalens dan Faktor Risiko Infeksi Daerah Operasi Pasca-bedah. *Sari Pediatri*. 2013;15(4):207-12.
2. Mangram AJ, Horan TC, Pearson ML, Silver LC, Jarvis WR. Guideline for Prevention of Surgical Site Infection, 2016. Centers for Disease Control and Prevention (CDC) Hospital Infection Control Practices Advisory Committee. *Am J Infect Control*. 2016;27(2):97-132; quiz 3-4; discussion 96.
3. Owens CD, Stoessel K. Surgical site infections: epidemiology, microbiology and prevention. *J Hosp Infect*. 2008;70 Suppl 2:3-10.
4. Jeyamohan D. Angka Prevalensi Infeksi Nosokomial pada Pasien Luka Operasi Pasca Bedah di Bagian Bedah di Rumah Sakit Umum Pusat Haji Adam Malik, Medan dari Bulan April sampai September 2010 [cited 2014 16 October]. Available from: <http://repository.usu.ac.id/handle/123456789/21521>
5. Raka L, Krasniqi A, Hoxha F, Musa R, Mulliqi G, Krasniqi S, et al. Surgical site infections in an abdominal surgical ward at Kosovo Teaching Hospital. *J Infect Dis*. 2007;1(3):337-41.
6. Richards C, Edwards o, Culver D, Emori TG, Tolson J, Gaynes R. Does Using a Laparoscopic Approach to Cholecystectomy Decrease the Risk of Surgical Site Infection? *Ann Surg*. 2003;237(3):358-62.
7. Abraham NS, Young JM, Solomon MJ. Meta-analysis of short-term outcomes after laparoscopic resection for colorectal cancer. *Br J Surg*. 2004;91(9):1111-24.
8. Ling ML, Abbas A, Morikane K, Apisamthanarak A, Lee KY, Warrier A et al. The Apsic Guidelines for The Prevention of Surgical Site Infection. March 2018
9. Lars UH, Kallehave P, Peer JK, Lisbeth NM, Torben J. Risk Factors for Tissue and Wound Complications in Gastrointestinal Surgery. *Ann Surg*. 2005;241:654-8.
10. Razavi SM, Ibrahimpoor M, Sabouri Kashani A, Jafarian A. Abdominal surgical site infections: incidence and risk factors at an Iranian teaching hospital. *BMC Surg*. 2005;5:2.
11. Cho M, Kang J, Kim I, Lee KY, Sohn SK. Underweight Body Mass Index as a Predictive Factor for Surgical Site Infections after Laparoscopic Appendectomy. *Yonsei Med J*. 2014; 55(6): 1611-16
12. Pereira HO, Rezende EM, Coultro BRG. Length of Preoperative Hospital Stay: A Risk Factor for Reducing Surgical Infection in Femoral Fracture Cases. <http://dx.doi.org/10.1016/j.rboe.2015.09.006>