ORIGINAL ARTICLE:

Pattern of disease and type of operation of Surgical Site Infection in obstetrics and gynecology at Dr Soetomo Hospital, Surabaya, Indonesia

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ABSTRACT

Objectives: to find correlation between risk factors and classification of SSI, the distribution of SSI, and cost in Soetomo Hospital.
Materials and Methods: descriptive retrospective observational with correlation analysis between risk factors and SSI classification according to Centers for Disease Control (CDC) definition with univariate analysis. Sub-group descriptive analysis on microbiology result, length of stay (LOS) and cost was also performed. All patients was diagnosed SSI between January 2015 until June 2017.
Results: age, referral cases, Body Mass Index, Hemoglobin and Albumin results, types of surgery, types of case are the risk factors we included. Analysis result shows no strong and significance correlation in all risk factors (r 0.053 – 0.447; p 0.072 – 0.971). According to SSI types, the distribution are: superficial (7; 13.2%), deep (26; 49.1%), organ/space (20; 37.7%). Extended-Spectrum Beta-Lactamase (ESBL) was obtained in 19 (14 Obstetrics; 5 Gynecology) from 28 patients with microbiology results. Five deaths occured in ESBL patients (1 Obstetrics; 4 Gynecology; ratio 1 : 11.2). Mean length of stay in Obstetrics and Gynecology was 41.7 and 19.2 days, respectively. Mean cost per day in Obstetrics and Gynecology was 1.2 amd 2.6 million rupiah, respectively.
Conclusions: no strong and significant results in all risk factors. Death rate in SSI and malignancy with positive ESBL result are high. Less cost needed for SSI patients, but with longer LOS. Comprehensive approaches are needed to patients at risk of SSI, further study with larger sample are needed.

Keywords: surgical site infection, ESBL, cost, length of stay

ABSTRAK

Tujuan: mengetahui hubungan antara faktor resiko dengan derajat keparahan SSI, distribusi SSI, dan biaya yang diperlukan.
Bahan dan Metode: deskriptif retrospektif observasional dengan analisis faktor resiko dan hubungan dengan jenis SSI. Dilakukan analisis sub grup terhadap hasil biakan kuman, lama masa inap dan biaya yang diperlukan.
Hasil: usia, rujukan, indeks massa tubuh, kadar Hb, Albumin, setting operasi, dan jenis kasus merupakan faktor resiko yang kami pilih. Hasil analisis menunjukkan tidak ada korelasi yang kuat dan kemaknaan pada semua faktor resiko (r 0,053 – 0,447; p 0,072 – 0,971). Distribusi SSI menurut jenisnya: superficial (7; 13,2%), deep (26; 49,1%), organ/space (20; 37,7%). Kuman dengan Extended-Spectrum Beta-Lactamase (ESBL) didapatkan pada 19 (14 Obstetri; 5 Ginekologi) dari 28 pasien dengan biakan kuman. Lima kematian pada SSI dengan ESBL (1 Obstetri; 4 Ginekologi). Rerata masa inap pada Obstetri dan Ginekologi 41,7 dan 19,2 hari. Rerata biaya per hari untuk Obstetri dan Ginekologi berurutan 1,2 dan 2,6 juta rupiah.
Kesimpulan: tidak ada faktor resiko yang bermakna dengan korelasi yang kuat. Kematian pada pasien SSI dan keganasan dengan hasil biakan kuman ESBL (+) sangat tinggi. Biaya yang diperlukan untuk merawat pasien dengan SSI lebih sedikit namun dengan masa rawat inap yang jauh lebih lama. Diperlukan penanganan yang lebih komprehensif terhadap pasien dengan resiko SSI dan studi lebih lanjut dengan sampel yang lebih banyak untuk mempertajam hasil dari studi ini.

Kata kunci: Infeksi Daerah Operasi, ESBL, biaya, lama masa inap

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INTRODUCTION

Regional Infection Operations (SSI) are still a big problem in the world. The World Health Organization (WHO) in 2016 stated SSI incidence rates were on average 11.8% (1.2 - 23.6%) worldwide and 2.5 - 41.9% in developing countries.[1] Operations in the field of Obstetrics and Gynecology, the majority are laparotomies who have a high enough risk of SSI.[2] Various factors include: age, referral cases, Body Mass Index (BMI), hemoglobin (Hb) and albumin levels, types of cases and operating settings, closely related to SSI events.[3-8]

Regional Infection Operations are divided into superficial, deep, and organ/space Surgical Site Infection (SSI) according to the criteria of the Centers for Disease Control and Prevention (CDC). Superficial incisional SSI means that the infection only involves the skin and subcutaneous tissue. Deep incisional SSI involves fascia and muscle, also including superficial and deep SSI. SSI organ/space is an infection involving all organs and cavities apart from the part of the surgical incision, which is opened or manipulated during surgery.[9]

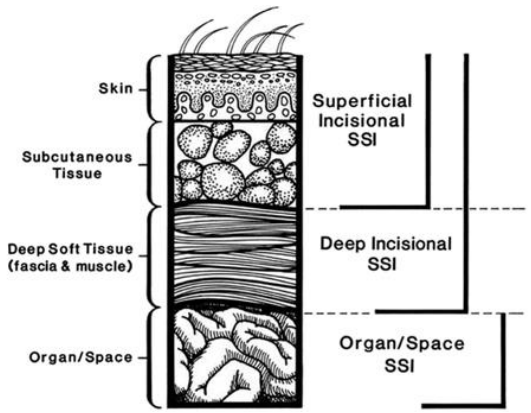

Figure 1. Type of operating area infection (9)

Knowing the incidence of SSI and how the relationship between risk factors with the type of SSI can help identify the potential of SSI in subsequent cases in Dr. Soetomo. Germ culture results, mortality, length of stay and how much it costs to treat patients with SSI will show the importance of this to be overcome.

MATERIALS AND METHODS

This research is an observational descriptive study with an analysis of SSI risk factors and their relationship to the severity of SSI. We also carried out subgroup analyzes of patients with ESBL (+), length of treatment and costs needed to treat patients with SSI. Our study was conducted from February to April 2018 at Dr. Soetomo Hospital, Surabaya, Indonesia. The population of this study were all postoperative patients in the period January 2015 to June 2017. All SSI patients according to the CDC criteria, both referral and non-referral, were included in our study sample (total sampling). We obtain patient data through medical records that are confirmed by Resident scientific activity reports, inpatient registration books and operating room registration books.

Inclusion criteria were all postoperative patients with SSI, indications of surgery in the field of obstetrics and gynecology, and were treated at Dr. Soetomo Hospital. We included in the medical records that were illegible, incomplete or missing, were included in the exclusion criteria. SSI risk factors such as age, origin of referral, BMI, hemoglobin and albumin levels, type of case and operating settings were included as independent variables. SSI type, cost and maintenance period as dependent variables. Surgery complication, patient comorbid, operating room location and operating room germ map as confounding variables.

We use univariate analysis in the form of a contingency correlation coefficient to see the relationship between two polycotomic categorical variables with a strong significance on the correlation coefficient r close to 1 and $p < 0.05$. If there is more than one significant variable, we do a multivariate analysis. All statistical calculations use Statistical Package for Social Science (SPSS) software.

The research budget is sourced from personal funds and our ethical eligibility is obtained from the Ethics Commission for Basic Science/Clinical Research at Dr. Soetomo Hospital/Faculty of Medicine, Unievrsitas Airlangga, Surabaya, Indonesia.

RESULTS AND DISCUSSION

During January 2015 to June 2017 (30 months) a total of 2106 operations were obtained with 1087 operations in the field of Obstetrics and 1019 Gynecological operations. Regional Operating Infection occurred in 53 cases (2.52%), with 32 (2.94%) cases of Obstetrics and 21 (2.06%) Gynecological cases. All cases of SSI were laparotomy (table 1).

The characteristics of all our samples are shown in Table 2. The majority of SSI types are deep (26; 49.1%) and organ/space (20; 37.7%); the most age over 35

years (32; 60.4%), with the youngest age 17 years in the case of Obstetrics and the oldest 73 years in the case of gynecology (malignancy); according to the most references are referral cases from other hospitals (37; 69.8%); according to the highest BMI in patients with a BMI above 30 kg/m2 (34; 64.2%) with the lowest BMI 22 kg/m2 and the highest 57 kg/m2; according to the most Hb levels in Hb less than 10 g/dL (34; 64.2%) with the lowest Hb levels 5 g/dL; according to albumin levels, the highest albumin levels were less than 3 g/dL (40; 75.5%) with the lowest albumin levels 1.5 g/dL in the case of Obstetrics; the most types of operations are in cito/urgent conditions (37; 69.8%); and consisted of 32 cases of Obstetrics (60.4%) and 21 cases of Gynecology (39.6%). Of the wound types in sequence, 12 (22.6%), 30 (56.6%), 6 (11.3%), 5 (9.4%) patients were clean, contaminated, contaminated and dirty/ infected wounds clean/infected.

We further divided the sample into two large groups namely the Obstetrics and Gynecology cases group. We then performed a univariate analysis to see the relationship of each risk factor with the type of SSI using contingency correlation (tables 3 and 4). From the results of data analysis we did not get a significant correlation for all risk factors in the case of Obstetrics and Gynecology with regard to the type of SSI.

From the data on germ culture, we got 28 patients with germ culture results, 19 of them with ESBL-producing germs (67.9%; 14 cases of obstetrics and 5 cases of gynecology). Five patients with ESBL (+) died, one case of Obstetrics and four cases of gynecology with malignancy (table 5). The length of stay of patients with SSI in the case of Obstetrics and Gynecology is sequential seven to 133 days (mean 41.7 days) and four to 40 days (mean 19.2 days).

The total costs required in the case of Obstetrics and Gynecology are 3.7 - 166 million rupiah (mean 51.4 million rupiah) and 5 - 150 million rupiah (mean 49.4 million rupiah) with an average cost per day 1, 2 million rupiah (0.7 - 2 million rupiah) for the Obstetrics case and 2.6 million rupiah (0.9 - 8.3 million rupiah) for the Gynecology case. Because there were no significant variables for all risk factors, we did not proceed with multivariate analysis.

Table 1. Number of SSIs based on Obstetrics and Gynecology cases from January 2015 to June 2017

Year	Obstetrics/SSI	Gynecology/SSI	Total/SSI (%)
2015	429/11	405/8	834/19 (2.28%)
2016	440/15	412/8	852/23 (2.69%)
2017	218/6	202/5	420/11 (2.62%)
Total	1087/32 (2.94%)	1019/21 (2.06%)	2106/53 (2.52%)

Table 2. Characteristics of the sample

Characteristics		n (%)
SSI	Superficial SSI	7 (13.2)
(n = 53)	Deep SSI	26 (49.1)
	Organ/space SSI	20 (37.7)
Age	<35 years	21 (39.6)
(n = 53)	>35 years	32 (60.4)
Referral	Referred	37 (69.8)
(n = 53)	Non-Referred	16 (30.2)
BMI	<30 kg/m^2	19 (35.8)
(n = 53)	>30 kg/m^2	34 (64.2)
Hb	<10 g/dL	34 (64.2)
(n = 53)	>10 g/dL	19 (35.8)
Albumin	<3 g/dL	40 (75.5)
(n = 53)	>3 g/dL	13 (24.5)
Type of operation	Cito/Urgent	37 (69.8)
(n = 53)	Elective	16 (30.2)
Type of case	Obstetrics	32 (60.4)
(n = 53)	Gynecology	21 (39.6)
Type of wound	Clean	12 (22.6)
(n = 53)	Clean contaminated	30 (56.6)
	Contaminated	6 (11.3)
	Dirty/infection	5 (9.4)

Table 3. Univariate analysis in the case of Obstetrics

Characteristics (n = 32)	Total (%)	Superficial SSI (%)	Deep SSI (%)	Organ/Space SSI (%)	r	*P* value
Age (years)						
<35	22 (68.7)	3 (13.6)	9 (40.9)	10 (45.5)	0.262	0.357
>35	10 (31.3)	0 (0)	3 (30)	7 (70)		
Referral						
Referred	29 (90.6)	0 (0)	1 (33.3)	2 (66.7)	0.116	0.803
Non-Referred	3 (9.4)	3 (10.3)	11 (37.9)	15 (51.7)		
BMI (kg/m^2)						
<30	12 (37.5)	2 (16.7)	3 (25)	7 (58.3)	0.242	0.370
>30	20 (62.5)	1 (5)	9 (45)	10 (50)		
Hb (g/dL)						
<10	22 (68.8)	1 (4.5)	9 (40.9)	12 (54.5)	0.242	0.369
>10	10 (31.2)	2 (20)	3 (30)	5 (50)		
Albumin (g/dL)						
<3	27 (84.4)	3 (11.1)	10 (37)	14 (51.9)	0.138	0.734
>3	5 (15.6)	0 (0)	2 (40)	3 (60)		
Type of operation						
Cito/urgent	31 (96.9)	3 (9.7)	11 (35.5)	17 (54.8)	0.226	0.423
Elective	1 (3.1)	0 (0)	1 (100)	0 (0)		

r: contingency correlation coefficient

Table 4. Univariate analysis in gynecological cases

Characteristics (n = 21)	Total (%)	Superficial SSI (%)	Deep SSI (%)	Organ/Space SSI (%)	r	*p* value
Age (years)						
<35	1 (4.8)	0 (0)	1 (100)	0 (0)	0.156	0.769
>35	20 (95.2)	4 (20)	9 (65)	3 (15)		
Referral						
Referred	8 (38.1)	1 (12.5)	6 (75)	1 (12.5)	0.146	0.797
Non-Referred	13 (61.9)	3 (23.1)	8 (61.5)	2 (15.4)		
BMI (kg/m^2)						
<30	7 (33.3)	0 (0)	7 (100)	0 (0)	0.447	0.072
>30	14 (66.7)	4 (28.6)	7 (50)	3 (21.4)		
Hb (g/dL)						
<10	12 (57.1)	1 (11.1)	6 (66.7)	2 (22.2)	0.234	0.545
>10	9 (42.9)	3 (25)	8 (66.7)	1 (8.3)		
Albumin (g/dL)						
<3	13 (61.9)	3 (23.1)	9 (69.2)	2 (25)	0.247	0.506
>3	8 (38.1)	1 (12.5)	5 (62.5)	1 (7.7)		
Type of operation						
Cito/urgent	6 (28.6)	1 (16.7)	4 (66.7)	1 (16.7)	0.053	0.971
Elective	15 (71.4)	3 (20)	10 (66.7)	2 (13.3)		
Type of case						
General gin.	5 (23.8)	2 (40)	3 (60)	0 (0)	0.326	0.287
Oncology	16 (76.2)	2 (12.5)	11 (68.8)	3 (18.8)		

r: contingency correlation coefficient

Table 5. Description of cases with ESBL (+)

	Culture results (+)	ESBL (+)	Died	Ratio (O : G)
Obstetrics (n = 32)	23	14	1	1 : 11.2
Gynecology (n = 21)	5	5	4	

Table 6. Description of costs in patients with SSI

	Length of treatment (day)	Cost per day (million rupiah)	Total Cost (million rupiah)
	mean (min – max)	mean (min - max)	mean (min - max)
Obstetrics	41.7 (7 – 133)	1.2 (0.7 – 2.0)	51.4 (3.76 – 166.1)
Gynecology	19.2 (4 – 40)	2.6 (0.9 – 8.3)	49.4 (5.01 – 150.3)

SSI incidence of 2.94% in Obstetrics cases and 2.06% in Gynecological cases, or a total of 2.52% in all cases is still in accordance with WHO data where SSI incidence rates 1.6 - 2.6% in developed countries and an average of 11.8% (1.2 - 23.6%) in developing countries (1, 10) This may occur because not all postoperative patients in Dr. Soetomo who has a superficial SSI type received treatment at the hospital where we conducted the study, or it could be because the patient was treated polyclinically. Another thing might be because the diagnosis of SSI was not made even though clinically the patient had met the SSI criteria.[4]

Most types of injuries are contaminated clean wounds. This is probably due to the case of Obstetrics found in surgery with indications of premature rupture of membranes, labor congestion or hysterectomy in cases of bleeding. In the case of gynecology, the majority of surgical procedures are total hysterectomy for malignancy.

Wound healing will take longer in old age. The ability to heal wounds, collagen density, melanocyte levels and many other factors will decrease in number and function over the age of 30 years.[11] In the results of this study there was no significance in the relationship between age and type of SSI. many other factors certainly play a role in the pathophysiology of SSI.

In a study in Ethiopia, it was found that 72.7% of SSIs were referral cases.[4] This data does not differ greatly from our observations that 69.8% of SSI incidents were referral cases from nearby hospitals even though they did not have a significant correlation with SSI type.

Obesity is an important risk factor in the occurrence of SSI and is related to the degree of severity, especially in the act of pregnancy. Patients with obesity have a higher incidence of SSI when compared with patients with normal or overweight BMI.[7] These data are in accordance with our results in which 34 (64.2%) patients were obese (BMI more than 30 kg/m2) who experienced SSI. Although no significant relationship was found with the type of SSI, the correlation coefficient value on this risk factor was higher than the other risk factors in the case of gynecology (r = 0.447).

Low Hb levels can be associated with chronic illness and malignancy, related to the amount of bleeding that has occurred and the possibility of transfusion before surgery. Transfusion apparently increases the risk of severe infections in patients by 10 - 12%.[12] Anemic conditions and bleeding can indirectly be interpreted as the presence of tissue hypoxia, especially the skin, which is often 'sacrificed' and will inhibit wound healing in surgical incisions and allow bacteria to inoculate the surgical wound.[5] In this study we did not get a significant correlation on Hb levels related to the type of SSI.

Serum albumin is an important predictor of infection. Bhuyan and Das in 2016 stated that preoperative serum albumin levels were a good predictor for postoperative outcomes related to SSI. Patients with serum albumin levels less than 3.0 g/dL, 45.5% will experience SSI complications, with a mortality rate of 18%.[6] The incidence of superficial and deep SSI alone will increase in patients with albumin levels below 3, 0 g/dL.[13] In this study we got a higher rate related to the incidence of SSI in hypoalbumin conditions (75.5%).

From 53 SSI cases, we found 37 (69.8%) operations were performed in an emergency (cito or urgent), and 16 (30.2%) operations were carried out electively. Of the 16 elective surgeries that underwent SSI, 15 cases were gynecological cases dominated by malignancy, and one case of Obstetrics with placenta accreta was left (in situ) and had an infection. This condition is in accordance with a meta-analysis study in China of about 490,000 patients where the incidence of SSI is higher in emergency surgery than elective.[8]

Of the 32 cases of Obstetrics that experienced SSI, 31 were emergency surgeries both cito and urgent and one elective operation with placenta accreta with placenta in situ. While from 21 cases of gynecology who experienced SSI, 6 (28.6%) cases were carried out in a cito or urgent condition, and the remaining 15 (71.4%) cases were in elective settings. The incidence of SSI in elective cases is likely in this study possibly related to obesity and malignancy according to a study from Wall et al., in 2003.[14] In emergency cases surgery is usually done in conditions of patients who have not been optimal for surgery, such as anemia and hypoalbumin.[8]

Mortality in this study was eight out of 53 cases (15.1%). Two patients died in the case of Obstetrics with suspected causes of death of Fasciitis necroticans and severe sepsis in the first case, as well as Idiopathic Trombocytopenia Puerpuera and severe sepsis in the second case. From the gynecology field, there were six deaths, all of which were cases of advanced-stage malignancy with severe comorbid sepsis in four cases. Mortality in SSI ranged from 8.3 to 17.6% of all SSI cases.[15]

From our observations, the mortality ratio in Obstetrics versus Gynecology cases is 1: 11.2 or in other words, Gynecological patients with SSI and ESBL (+) have a 11.2x chance of dying than in Obstetrics. This is in accordance with the results of a study from Senegal which states that SSI cases with ESBL (+) and comorbid malignancies have a higher Case Fatality Rate (16).

Average stay in Obstetrics and Gynecology 41.7 and 19.2 days. The average cost per day for Obstetrics and Gynecology is 1.2 and 2.6 million rupiah, respectively. Even though SSI patients have long hospitalizations, it turns out that the costs required are on average less per day. The universal insurance system that sets a maximum cost limit for each diagnosis certainly has an impact on the costs that must be borne by the Hospital to cover its shortcomings. This potential problem must be identified to reduce losses by the Hospital.[17]

CONCLUSION

There were no significant risk factors with a strong correlation with the type of SSI. Deaths in SSI patients and malignancies with ESBL (+) germ culture results are very high. The cost per day for SSI patients is less but with a much longer stay. More comprehensive treatment is needed for patients at risk of SSI and further studies with more samples to sharpen the results of this study.

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