

## Factors Associated with Occurrence of Postoperative Surgical-Site Infection and Length of Hospitalization in Children with Intussusception

Leecarlo M. Lumbangaol

Surgery Department, Division of Pediatric Surgery, Tarakan District Hospital, Jakarta, Indonesia

### Abstract

Surgical-site infection (SSI) is one of the most common surgical post-laparotomy complications, either manual reduction or resection anastomotic, such as intussusception case. This retrospective cohort study aimed to identify factors associated with occurrence of postoperative surgical-site infection and length of hospitalization using medical records in Tarakan District Hospital from January 2014 to December 2015. Odds ratios and 95% confidence intervals were calculated to evaluate the association between potential clinical factors and the occurrence of surgical-site infection as well as length of hospitalization. Sepsis, perioperative level of hemoglobin, and the type of postoperative ward were found potentially increase the risk of the occurrence of surgical-site infection. Low preoperative level of albumin and Hemoglobin, prolonged surgery, postoperative sepsis, hospitalized in the pediatric intensive care unit (PICU) ward and resection were also increased the risk of longer hospitalization in patients with intussusceptions. It is hoped that interventions to prevent the occurrence of SSI and to shorten the length of hospitalization among children with intussusceptions in Tarakan District Hospital can take place in the future.

**Key Words:** risk factors, intussusception, surgical-site infection, length of hospitalization

## Faktor yang Berhubungan dengan Kejadian Infeksi Luka Operasi dan Lama Rawat di Rumah Sakit Pasca Tindakan Intususepsi pada Anak

### Abstrak

Infeksi pada luka operasi (*surgical-site infection*, SSI) adalah salah satu komplikasi bedah yang paling umum pasca laparotomi, termasuk kasus intususepsi. Studi kohort retrospektif ini bertujuan untuk mengidentifikasi faktor yang berhubungan dengan terjadinya infeksi luka pasca operasi dan lama rawat inap dengan menggunakan catatan medis di RSUD Tarakan dari Januari 2014 sampai Desember 2015. Odds ratio dan interval kepercayaan 95% dihitung untuk mengevaluasi hubungan antara faktor klinis dan terjadinya infeksi luka operasi serta lama rawat inap. Sepsis, kadar hemoglobin perioperatif, dan lokasi rawat PICU ditemukan berpotensi meningkatkan risiko terjadinya SSI. Rendahnya kadar albumin dan Hb praoperasi, durasi operasi yang lama, sepsis pasca operasi, dirawat di *pediatric intensive care unit* (PICU) dan reseksi juga meningkatkan risiko rawat inap yang lebih lama pada pasien dengan intususepsi di RSUD Tarakan. Dengan pengetahuan ini, diharapkan bahwa intervensi untuk mencegah terjadinya SSI dan untuk mempendek lama rawat inap pada anak-anak dengan intususepsi di RSUD Tarakan dapat dilakukan di masa depan.

**Kata kunci:** faktor risiko, intususepsi, infeksi luka operasi, lama rawat

LML: Penulis Koresponden; E-mail: leecarlo\_millano@yahoo.com.

## Introduction

Intussusception is an invagination of the intestine into the intestine itself and usually involves the colon and small bowels. It is an emergency situation where a late diagnosis often occurs and causes bowel perforation, obstruction, and necrosis.<sup>1</sup>

The management of intussusceptions is generally divided into (1) non-operative management (i.e. a reduction using hydrostatic or pneumatic pressure) and (2) operative management (i.e. a manual reduction (milking procedure) or an anastomosis resection). The operative management is done when non-operative management fails, which occurs in 10% of cases.<sup>2,3</sup>

Unfortunately intussusceptions cases that are managed surgically leave complications such as surgical wound infection that would increase the postoperative length of stay in the hospital. Some studies conclude that the rate of surgical wound infections in patients with intussusceptions is around 26% and the dehiscid wound is up to 8%.<sup>3</sup>

This study attempts to explain the factors that play a role in the occurrence of surgical wound infections in patients that undergone surgical laparotomy in Tarakan District Hospital, Jakarta.

## Materials and Method

This study was done in the Pediatric Surgery Division of Tarakan District Hospital, Jakarta from January 2014 to December 2015. This retrospective cohort

study evaluated factors associated with the occurrence surgical wound infections and the length of hospitalization of patients with intussusceptions. These factors included pre and post-operative hemoglobin (Hb) level ( $\leq 12$  g/dl vs.  $>12$  g/dl), pre and post-operative albumin level (g/dl), duration of operation, postoperative sepsis (present vs. absent), type of ward for postoperative care (pediatric intensive care unit (PICU) vs. non-PICU), resection, and patient's nutritional status. Subjects for this study were included through consecutive non probability sampling by entering the ICD X code for intussusceptions (K.56.1).

Odds ratios and 95% confidence intervals were calculated to evaluate the association between potential clinical factors and the occurrence of surgical-site infection as well as length of hospitalization. Statistical significance was tested with Chi-square test. All analysis were done using the SPSS 17<sup>th</sup> Edition.

## Results

There were 34 patients with 21 male (61.8%) and 13 females (38.2%). There were 18 patients aged 3-9 months (52.9%), 4 patients aged 9-12 months (11.8%), and 12 patients aged  $>12$  months (35.3%) (Table 1).

### Surgical wound infection

Table 2 shows that the risk of surgical wound infection were higher in patients with preoperative Hb level  $\leq 12$  g/dl than

**Table 1.** Demographic Characteristic of subjects

Characteristic		n	%
Sex	Male	21	61.8
	Female	13	38.2
Age	3 – 9	18	52.9
	9 – 12	4	11.8
	> 12	12	35.3

>12 g/dl (Odds Ratio (OR) 19.3 (95% confidence interval (CI) 2.1-177.9). The risk was also higher in patients with than without post-operative sepsis (OR 21.3 95% CI 3.6-124.8), and in PICU than non-PICU patients (OR 11.2, 95% CI 2.2-56.9).

### Length of hospitalization

Factors associated with the length of hospitalization were pre-operative albumin

concentration, pre and post-operative hemoglobin level, sepsis, type of ward for post-operative care, and anastomosis resection (Table 3). Patients with albumin level <2.56 g/dl had longer hospitalization compared to patients with albumin level > 3.52 g/dl ( $p=0.027$ , OR 30.0, 95% CI 1.5-611.8). Patients with surgery longer than 120 minutes; had pre- and post-operative Hb  $\leq$  12 g/dl; had postoperative sepsis; stayed in PICU ward; and had resection also had

**Table 2.** Factors associated with surgical wound infection

		n (%)	Surgical wound infection		P	OR	95% CI	
			Yes	No			Lower	Upper
Preoperative Hb	$\leq$ 12 g/dl	22 (64.7%)	14 (9.7%)	8 (23.5%)	0.009	19.3	2.1	177.9
	> 12 g/dl	12 (35.3%)	1 (5.3%)	11 (32.4%)				
Postoperative Sepsis	Present	15 (44.1%)	12 (35.3%)	3 (8.8%)	<0.001	21.3	3.6	124.8
	Absent	19 (55.9%)	3 (8.8%)	16 (47.1%)				
Ward	PICU	17 (50.0%)	12 (35.3%)	5 (14.7%)	0.004	11.2	2.2	56.9
	Non-PICU	17 (50%)	3 (8.8%)	14 (41.2%)				

**Table 3.** Factors associated with length of hospitalization

Variables	Value	N (%)	Length of stay		P-value	OR	95% CI	
			> 10 days (%)	$\leq$ 10 days (%)			Lower	Upper
Preoperative Albumin level	< 2.56	6 (17.6)	5 (14.7)	1 (2.9)	0.027	30.0	1.5	611.8
	2.56-3.52	21 (61.8)	10 (19.4)	11 (32.4)	0.145	5.5	0.6	53.5
	> 3.52	7 (20.6)	1 (2.9)	6 (17.6)	Reference			
Duration of surgery	> 120 minutes	16 (17.1)	12 (35.3)	4 (11.8)	0.004	10.5	2.2	51.3
	$\leq$ 120 minutes	18 (52.9)	4 (11.8)	14 (41.2)				
Preoperative Hb	$\leq$ 12 g/dl	22 (64.7)	14 (41.2)	8 (23.5)	0.015	8.8	1.5	50.3
	> 12 g/dl	12 (35.3)	2 (5.9)	10 (29.4)				
Postoperative Hb	$\leq$ 12 g/dl	28 (82.4)	16 (47.1)	12 (35.3)	0.120	6.7*	0.69	64.8
	> 12 g/dl	6 (17.6)	0 (0.0)	6 (17.6)				
Postoperative Sepsis	Present	15 (44.1)	13 (38.2)	2 (5.9)	0.003	34.7	5.0	239.6
	Absent	19 (55.9)	3 (8.8)	16 (47.1)				
Ward	PICU	17 (50.0)	13 (38.2)	4 (11.8)	0.002	15.2	2.8	81.1
	Non-PICU	17 (10.0)	3 (8.8)	14 (41.2)				
Resection	Resection	21 (61.8)	13 (38.2)	8 (23.5)	0.034	5.4	1.1	25.8
	No resection	13 (38.2)	3 (8.8)	10 (29.4)				

\*Because there was none of the patients with Hb >12/dl had hospitalization >10 days, OR was calculated as if there was one patient with Hb >12/dl had hospitalization >10 days .

a higher risk of having hospitalization >10 days. Nevertheless, the confidence intervals were very wide due to small number of cases.

## Discussion

Surgical wound infections account for a large portion of morbidity with a rate of 500,000 cases per year from 27 million surgeries, including for intussusceptions.<sup>4</sup> Even though the bacteria causing surgical wound infections are considered contaminants, the infection does not occur in some surgical wounds. Some case reports mentioned that the patient's condition and environment were contributors for the occurrence of surgical wound infection (Figure 1).<sup>5,6</sup> Odom-Forren<sup>7</sup> found that factors contributing to surgical wound infections are the number of bacteria contaminants, the bacteria's virulence, the micro-environment around the surgical wound, and the immune system of the host.

The host innate immunity is a large contributing factor for surgical wound infection. When the defense mechanism of the host is low, the occurrence of surgical wound infection is high. The immune system of the host is affected by the two factors, i.e. genetic and acquired factor. The genetic factor is varied among individuals, in definition that some patients are genetically more susceptible to infections than others. The acquired factors, that are more general and familiar, include physiological conditions such as hypoglycemia, hypothermia, sepsis and others (Figure 2)<sup>5</sup>

Fry and Fry<sup>5</sup> and Gould<sup>6</sup> studied risk factors of surgical wound infection, which were surgeries that involved the abdomen, the duration of surgery that was longer than two hours, chronic pulmonary disease, and low level of pre-operative albumin concentration. The management to prevent surgical wound infection involves a complex system including pre-operative prophylactic

antibiotics that was according to the wound culture or empirical culture in the hospital. Prophylactic antibiotics, when needed, can be given minimally 30 minutes before the surgery is conducted.<sup>5-8</sup>

## Conclusion

In this study we found that sepsis, perioperative level of hemoglobin, and the type of postoperative ward potentially increased the risk of the occurrence of surgical wound infection. Low preoperative level of albumin and hemoglobin, long operation duration, postoperative sepsis, hospitalized in the PICU ward, and resection were also increased the risk of longer hospitalization in patients with intussusceptions at Tarakan District Hospital. With this knowledge we hope that in the future interventions can be taken to prevent the occurrence of surgical wound infections and to shorten the length of hospitalization.

## References

1. Applegate KE. Intussusception in children: evidence-based diagnosis and treatment. *Pediatr Radiol* 2009; 39 (suppl 2): S140-3
2. Ignacio RC, Fallat ME. Intussusception. In: Holcomb III GW, Murphy JP, Ostlie DJ, editors. *Aschraft's Pediatric Surgery* 5<sup>th</sup> ed. New York, Saunders Elsevier.; 2010. p. 508-16
3. Ein SH, Daneman A. Intussusception. In: Grossfeld JL, O'Neill Jr JA, Fonkalsrud EW, Coran AG, editors. *Pediatric Surgery* 6<sup>th</sup> ed. Philadelphia, PA, Mosby Inc.; 2006. p. 1313-41
4. Nichols RL. Preventing surgical site infections: a surgeon's perspective. *Emerging Infect Dis* 2001; 7: 220-4
5. Fry DE, Fry RV. Surgical site infection: the host. *AORN J*. 2007; 86(5): 801-10
6. Gould D. Causes, prevention, and management of surgical site infection. *Nurse Standard*. 2012; 26: 47-56
7. Odom-Forren J. Surgical-site infection: still a reality. *Nurs Management*. 2005; 11:16-20
8. Brook I. Microbiology and management of post-surgical wounds infection in children. *Pediatr Rehab* 2002; 5: 171-6