RESEARCH ARTICLE

pISSN: 0126-074X | eISSN: 2338-6223
https://doi.org/10.15395/mkb.v56.3204
Majalah Kedokteran Bandung. 2024;56(2):141–152

Majalah Kedokteran Bandung (MKB)

Received: January 27, 2023
Accepted: April 11, 2023
Available online: June 30, 2024

Correlation of Nutritional Status and Early Feeding with Post-Laparotomy Surgical Site Infection in Perforated Peptic Ulcer Patients

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Abstract

A perforated peptic ulcer is an emergency requiring immediate treatment by laparotomy. Special attention needs to be established on systemic nutritional status. The postoperative early feeding is important to patients with preoperative non optimum nutritional status. This study aimed to examine the correlation between nutritional status, early feeding, and post-laparotomy surgical site infection in perforated peptic ulcer patients. This was a prospective observational study on 32 patients with perforated peptic ulcers underwent emergency laparotomy at Dr. Hasan Sadikin General Hospital Bandung, Indonesia, from October 2021–2022. The nutritional status was assessed using Albumin, SGA. Eleven subjects had severe hypoalbuminemia and six subjects had severe malnutrition (SGA C). Early feeding was not performed on 7 subjects. The highest surgical wound infection rate was found on the 7th day with an incidence rate of 18.8%. Among patients experiencing infection, six (6) had SGA C ($p<0.001$) and severe hypoalbuminemia ($p=0.001$) and 4 subjects were given early feeding ($p=0.451$). On the 14th day, Three SGA C and one SGA B experienced infection ($p=0.01$), while 3 subjects and 1 subjects who experienced infection had moderate hypoalbuminemia and severe hypoalbuminemia, respectively ($p=0.16$), Three subjects were not given early feeding $p=0.01$. On the 21st day to the 30th day, 1 subject with SGA C ($p=0.10$) and severe hypoalbuminemia ($p=0.37$), and early feeding was not performed ($p>0.05$). There is no association among albumin level, SGA, and early feeding in post-laparotomy wound infection in perforated peptic ulcer patients.

Keywords: Breast cancer, histopathology, recurrency

Introduction

Peptic ulcer perforation is a focal defect caused by acidity or gastric acid activity on the epithelium of the digestive tract wall that occurs in the mucosa, submucosa, to the muscularis layer, at the bottom of the oesophagus, stomach, and duodenum. Perforated peptic ulcer is an emergency that requires immediate treatment (source control) by laparotomy in the form of debridement of necrotic or infected tissue, and primary suturing of defects due to ulcers accompanied by aerobic and anaerobic antibiotics. Delays in treatment will further increase the risk of complications, morbidity, and mortality.[1]

Approximately 2–14% of the 4 million people per year in the world who suffer from peptic ulcers experience perforated peptic ulcers. Although the number is relatively small, peptic ulcer perforation is a life-threatening condition with mortality rates varying from 10-40%.[2] The prevalence of peptic ulcer perforation patients who experience more serious complications is as much as 35%.[3] According to data from the World Health Organization (WHO) in 2014, deaths from peptic ulcer disease in Indonesia reached 1,081 or 0.08% of total deaths.[4] In 2018, deaths from peptic ulcer disease in Indonesia increased to 25,559 or 1.50% of total deaths. Assessment of Peptic Ulcer Characteristics at Dr. Hasan Sadikin

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General Hospital (RSHS) in 2012 found that the frequency of peptic ulcer was 38 patients and more common in men.[5]

Perforated peptic ulcer is one of the indications for performing emergency laparotomy in patients with several preoperative systemic conditions which may not be optimal, thereby increasing morbidity and mortality. One condition that needs attention is preoperative nutritional status. A non-optimal condition during the preoperative period must be corrected postoperatively in various measures, one of which is by providing postoperative supportive therapy, such as early feeding. The main goal of early feeding is to support the patient's nutrition to meet postoperative nutritional needs and prevent surgical wound infection.

Patients who have undergone laparotomy are advised to perform early feeding immediately. An early feeding protocol after surgery has been developed as an effort to minimize fasting time, improve the healing process, restore bowel function, and reduce postoperative hospital stay. Early feeding nutrition was started immediately one day after surgery.[6] In a study conducted by Kishore et al showed that patients who were given early feeding nutrition had a lower prevalence of surgical site infection when compared to fasting patients. It was found that 10 out of 37 patients experienced surgical site infection in the early feeding group 22 out of 37 patients experienced surgical site infection in the fasted group, and 5 out of 37 patients were not described clearly in this study.[7]

Patients whose nutritional status is not optimal and early feeding is not carried out can cause postoperative morbidity, which includes bleeding (5.3%), fascia dehiscence (5%), ileus (3.3%), intra-abdominal abscess (3.7%), anastomotic leakage (3.5%), or surgical site infection (10%).[8] In a study conducted by Britt in 2016 in Germany, post-laparotomy morbidity was found to be 14% with a 30-day postoperative mortality rate in laparotomy patients of around 8% without treatment of early feeding.[9] In a study conducted by Ze Li in 2019 in China, it was shown that the incidence of morbidity for emergency laparotomy procedures was higher than elective laparotomy with a percentage ratio of 6.7% to 3.2%, also without early feeding treatment.[10] Appearing will cause prolonged hospital stay, increase the economic burden on the patient or the hospital, permanent disability to death.[11]

This could happen if there is interference with tissue perfusion, infection, and malnutrition which will disrupt the wound healing process.[6] In a study conducted by Gundel et al.,[3] of 1386 patients who had undergone laparotomy and were included in the PROXI trial which was followed up, 272 patients (19.6%) experienced surgical site infection.12 Meanwhile, based on data collection conducted at the Dr. Hasan Sadikin General Hospital Medical Record Installation in 2016, there were 25.1% cases of abdominal surgical site infection in adult patients who underwent laparotomy.

The nutritional condition of preoperative patients, especially surgical patients with critical conditions who are in the emergency room, needs to be assessed adequately.[14] Assessment of nutritional status can use Subjective Global Assessment (SGA), Bioelectrical Impedance Analysis (BIA) and albumin is a method for determining the nutritional status of incoming patients. to the hospital by assessing the medical history and physical examination, it is known to be functional at detecting malnutrition-related complications and only takes approximately 10 minutes.[15]

Anthropometric measurements using BIA measure the resistance of a weak electric current ($800\mu A$; 50KHz) that is distributed between a person's right ankle and right wrist.[16] In this study, the inspection method was carried out using a Samsung Watch 4. After systematic correction, smart-watch BIA devices are capable of stable, reliable, and accurate body composition measurements, with precision comparable to but lower than that of laboratory measures ($p<0.05$; correlation coefficient=0.97). These devices allow for measurement in environments not accessible to laboratory systems, such as homes, training centers, and geographically remote locations. There is a study that states that 36.7% of patients have abnormal albumin levels before surgery and are at risk for non-healing wounds.[17]

Nutritional status is important to prevent the occurrence of surgical site infection.[7] However, there has been limited research on the correlation between nutritional status and early feeding with the incidence of post-laparotomy surgical site infection in patients with perforated peptic ulcers in West Java. Central General Hospital Dr. Hasan Sadikin is a central referral hospital in West Java with many cases of peptic ulcer perforation. The results of this study can be used as a reference for Dr. Hasan Sadikin General Hospital in treating patients with perforated peptic ulcers. Therefore, the authors are interested in researching the correlation between preoperative nutritional status and early feeding

with the incidence of post-laparotomy surgical site infection in perforated peptic ulcer patients at Dr. Hasan Sadikin General Hospital.

Methods

This study is a prospective observational study with research subjects who were patients with perforated peptic ulcers who underwent emergency laparotomy at Dr. Hasan Sadikin General Hospital from October 2021 to October 2022. The inclusion criteria were patients with perforated peptic ulcer, patients who underwent emergency laparotomy, and age above 18 years old. The exclusion criteria in this study were patients with a history of previous laparotomy, history of laparotomy along any surgery on other parts of the body, history of cancer, patients with comorbid conditions: uncontrolled diabetes mellitus, congestive heart disease, end-stage renal disease, human immunodeficiency virus, and systemic lupus erythematosus, patients with MODS based on APACHE II Score, and history of uncontrolled use of NSAID. Drop out criteria in this study were uncalculated nutritional status assessment using SGA, BIA and albumin level, patients who died before 30th day post laparotomy, patients who underwent morbidity during care and prevent wound healing such as uncontrolled diabetes mellitus (based on anamnesis and random blood glucose above 200mg/dl), end stage renal disease (based on serum urea and creatinine), acute exacerbation on chronic obstructive pulmonary disease, congestive heart failure, and hospital acquired pneumonia (based on anamnesis, physical assessment and thorax x-ray), patients who surgical site assessment could not be assessed on the 7th, 14th, 21st, and 30th day (for example, patients did not come for follow up), patients with disease that interfere with nutritional status assessment or with nutritional therapy given (for example, post-laparotomy patients who underwent lower gastrointestinal bleeding based on anamnesis and physical assessment, end stage renal disease based on serum urea and creatinine, and hospital acquired pneumonia based on anamnesis, physical assessment and thorax x-ray.

The sample size is calculated by consecutive sampling, this study requires a minimum sample of 31 research subjects. Primary data was obtained by direct observation of research subjects. Nutritional status was assessed right before emergency laparotomy, on the 7th, 14th, 21st, and 30th day. Each patient surgery undergoes a preoperative albumin level test, SGA screening, and BIA measurement using a smartwatch. BIA was determined by 4 variables: body fat, total body water, skeletal bone mass, and muscle mass. SGA is divided into well nutrition (SGA A), moderate malnutrition (SGA B), and severe malnutrition (SGA C). Early feeding was performed to assess its correlation with surgical site infection. Essential factors during follow-up were put on the surgical site, loose stitches, and symptoms of infection (fever, pain on surgical site, local swelling on surgical site).

This research has received ethical clearance from the Research Ethics Committee of Dr. Hasan Sadikin General Hospital Bandung (RSHS) with a number of ethical approvals LB.02.01/X.6.5/353/2021.

Results

The number of samples in this study was 40 subjects. Among those, 5 subjects had exclusion criteria (1 subject with a history of laparotomy, 3 subjects with comorbid disease, and 1 subject with MODS), 3 subjects dropped out from the research due to death before day 30th after laparotomy (1 subject underwent post-laparotomy morbidity, 1 study subject had postoperative comorbid disease and 1 subject did not come to the digestive surgery department during follow up on day 21st and 30th). 32 subjects met the inclusion criteria. Research data obtained includes age, sex, height, body mass index, nutritional status based on subjective global assessment, total body water, body fat, muscle mass, bone mass, albumin level, and surgical site infection incidence on the 7^{th}, 14^{th}, 21^{st}, and 30^{th} day (Table 1).

Analysis result of the correlation between SGA and albumin with the incidence of post-laparotomy surgical site infection on day 7th shows $p<0.001$ and $p=0.001$ with correlation values of 0.707 and 0.553, respectively. In this study, there is no correlation between early feeding and incidence of post-laparotomy surgical site infection on day 7^{th} $p=0.451$ (Table 2).

A difference was shown compared with the SGA result on day 7th which showed a strong positive correlation with the incidence of surgical site infection. Analysis result of the correlation between SGA and incidence of post-laparotomy surgical site infection on day 14th shows $p=0.008$ with a correlation value of 0.408.

Table 1 Distribution Criteria of Research Subjects

Characteristics	Total (n=32)	Surgical Site Infection on Day 7th		Surgical Site Infection on Day 14th		Surgical Site Infection on Day 21st		Surgical Site Infection on Day 30th	
		No	Yes	No	Yes	No	Yes	No	Yes
Age (years old)									
Mean	55.9	57.0	50.8	56.2	53.7	56.3	41	56.3	41
Median	58.5	58.5	54.5	59.5	53.5	59	41	59	41
Range	62 (23–85)	58 (27–85)	44 (23–67)	62 (23–85)	26 (41–67)	62 (23–85)	–	62 (23–85)	-
Sex									
Men	20	16	4	18	2	19	1	19	1
Women	12	10	2	10	2	12	–	12	-
Weight (kg)									
Mean	62.4	62.9	60.5	62.7	60.5	62.4	64	62.4	64
Median	61.1	61.1	61.6	61.1	61.6	59.2	64	59.2	64
Range	61 (35–96)	61 (35–96)	16.4 (50.1–66.5)	61 (35–96)	13.9 (52.6–66.5)	62 (23–85)	–	62 (23–85)	-
Height (cm)									
Mean	154	154.3	152.8	154	154	154.1	151	154.1	151
Median	154.5	154.5	154.5	154.5	154	155	151	155	151
Range	29 (136–165)	29 (136–165)	12 (145–157)	29 (136–165)	6 (151–157)	29 (136–165)	–	29 (136–165)	-
BMI (kg/m^2)									
Mean	26.3	26.4	25.8	26.4	25.5	26.3	28	26.3	28
Median	25.5	25.5	25.7	25.5	25.8	25.2	28	25.2	28
Range	21.5 (17.9–39.4)	21.5 (17.9–39.4)	4.2 (23.8–28)	21.5 (17.9–39.4)	5.6 (22.4–28)	21.5 (17.9–39.4)	–	21.5 (17.9–39.4)	-
TBW (%)									
Normal	7 (21.9%)	7 (100%)	- (0%)	6 (85.7%)	1 (14.3%)	7 (100%)	- (0%)	7 (100%)	- (0%)
Abnormal	25 (78,1%)	19 (76,0%)	6 (24,0%)	22 (88,0%)	3 (22,0%)	24 (96,0%)	1 (4,0%)	24 (96,0%)	1 (4,0%)
Body fat (%)									
Normal	13 (40,6%)	12 (92,3%)	1 (7,7%)	12 (92,3%)	1 (7,7%)	13 (100%)	- (0%)	13 (100%)	- (0%)
Moderate	13 (40,6%)	8 (61,5%)	5 (38,5%)	10 (76,9%)	3 (13,1%)	12 (92,3%)	1 (7,7%)	12 (92,3%)	1 (7,7%)
High	6 (18,8%)	6 (100%)	- (0%)	6 (100%)	- (0%)	6 (100%)	- (0%)	6 (100%)	- (0%)
Skeletal *Bone mass* (%)									
Normal	9 (28,1%)	7 (77,7%)	2 (22.3%)	8 (88.8%)	1 (11.2%)	9 (100%)	- (0%)	9 (100%)	- (0%)
Abnormal	23 (71.9%)	19 (82.6%)	4 (17.4%)	20 (86.9%)	3 (13.1%)	22 (95.6%)	1 (4.4%)	22 (95.6%)	1 (4.4%)

Table 1 (Continued)

Characteristics	Total (n=32)	Surgical Site Infection on Day 7th		Surgical Site Infection on Day 14th		Surgical Site Infection on Day 21st		Surgical Site Infection on Day 30th	
		No	Yes	No	Yes	No	Yes	No	Yes
Muscle mass (%)									
Normal	21 (65.6%)	17 (80.9%)	4 (19.1%)	19 (90.4%)	2 (9.6%)	21 (100%)	-(0%)	21 (100%)	-(0%)
Abnormal	11 (34.4%)	9 (81.8%)	2 (18.2%)	9 (81.8%)	2 (18.2%)	10 (90.9%)	1 (9.1%)	10 (90.9%)	1 (9.1%)
SGA									
A	9 (28.1%)	9 (100%)	- (0%)	9 (100%)	- (0%)	9 (100%)	-(0%)	9 (100%)	- (0%)
B	17 (53.1%)	17 (100%)	- (0%)	16 (94.1%)	1 (5.9%)	17 (100%)	-(0%)	17 (100%)	- (0%)
C	6 (18.8%)	- (0%)	6 (100%)	3 (50.0%)	3 (50.0%)	5 (83.3%)	1 (14.7%)	5 (83.3%)	1 (14.7%)
Albumin									
Normal	7 (21.9%)	7 (100%)	- (0%)	7 (100%)	- (0%)	7 (100%)	- (0%)	7 (100%)	- (0%)
Moderate	14 (43.8%)	14 (100%)	- (0%)	13 (92.8%)	1 (7.2%)	14 (100%)	- (0%)	14 (100%)	- (0%)
Severe	11 (34.4%)	5 (45.5%)	6 (54.5%)	8 (72.7%)	3 (27.3%)	10 (90.9%)	1 (9.1%)	10 (90.9%)	1 (9.1%)
Early feeding									
Yes	25 (78.1%)	21 (84.0%)	4 (16.0%)	24 (96.0%)	1 (4.0%)	25 (100%)	-(0%)	25 (100%)	- (0%)
No	7 (21.9%)	5 (71.4%)	2 (28.6%)	4 (57.2%)	3 (42.8%)	6 (85.7%)	1 (14.3%)	6 (85.7%)	1 (14.3%)

Note: Body mass index (BMI), total body water (TBW), subjective global assessment (SGA)

An interesting result because on day 7th, albumin level is moderately correlated with the incidence of surgical site infection. Table 3 shows from 11 subjects with severe hypoalbuminemia, only 3 subjects suffered from surgical site infection on day 14th (p=0.168) (Table 3).

Another assessment was made on the correlation between early feeding and incidence of post-laparotomy surgical site infection on day 14th with the result p=0.006 and correlation value of 0.437 (Table 3), where the result on day 7th shows no correlation.

In this study, there is no correlation between SGA and albumin with the incidence of post-laparotomy surgical site infection on day 21st shows p=0.107 and p=0.373 with correlation values of 0.350 and 0.241, respectively (Table 4). There is no correlation between early feeding and incidence of post-laparotomy surgical site infection on day 21th p>0.05 (Table 4). A difference was shown compared with SGA results on days 7th and 14th which showed a positive correlation with the incidence of surgical site infection. This is an interesting topic to be discussed later.

From the analysis result of 7 variables, no variable is statistically correlated with the incidence of surgical site infection. P value and correlation value shown on day 21st and day 30th were equal due to no change in condition between those days (Table 5).

Discussion

This study assessed the correlation between nutritional status assessed by various variables and early feeding treatment, which was then

Table 2 Correlation Between Nutritional Status and Early Feeding with Incidence of Post-Laparotomy Surgical Site Infection Day 7th

Characteristics	Surgical Site Infection Day 7th (n=32)		C	p-value*
	No	Yes		
TBW				
Normal	7 (100%)	- (0%)	0.246	0.150
Abnormal	19 (76.0%)	6 (24.0%)		
Body fat				
Normal	12 (92.3%)	1 (7.7%)		
Moderate	8 (61.5%)	5 (38.5%)	0.390	0.057
High	6 (100%)	- (0%)		
Skeletal Bone mass				
Normal	7 (77.7%)	2 (22.3%)	0.056	0.753
Abnormal	19 (82.6%)	4 (17.4%)		
Muscle mass				
Normal	17 (80.9%)	4 (19.1%)	0.011	0.952
Abnormal	9 (81.8%)	2 (18.2%)		
SGA				
A	9 (100%)	- (0%)		
B	17 (100%)	- (0%)	0.707	0.000
C	- (0%)	6 (100%)		
Albumin				
Normal	7 (100%)	- (0%)		
Moderate	14 (100%)	- (0%)	0.553	0.001
Severe	5 (45.5%)	6 (54.5%)		
Early feeding				
Yes	21 (84.0%)	4 (16.0%)	0.132	0.451
No	5 (71.4%)	2 (28.6%)		

*p value was analyzed by contingency coefficient test

associated with surgical site infection events, where various results were obtained. One of the nutritional status assessments used is bioelectrical impedance analysis (BIA). After systematic correction, smart-watch BIA devices are capable of stable, reliable, and accurate body composition measurements, with precision comparable to but lower than that of laboratory measures $p<0.05$. Smartwatch allows for measurement in environments not accessible to laboratory systems, such as homes, training centers, and geographically remote locations. The subjects of this study obtained quite diverse body composition in patients with peptic ulcer perforations that occurred, with most of them obtaining abnormal values. In this study, the four parameters of BIA variables (body fat, total body water, skeletal bone mass, and muscle mass) that were assessed were statistically proven not to had a correlation with the incidence of surgical site infection at all assessment time points. The result is different from the previous study where %BF is associated with a 5-fold increased SSI risk. The Justine et al study showed that Smart scales are not accurate for body composition and should not replace dual X-ray absorptiometry (DEXA) in patient care, with some error factors will be detected.[12]

Body composition measurements are important to assess nutritional depletion and lean muscle mass wasting in elderly individuals and acutely ill patients. Information on the total

Table 3 Correlation Between Nutritional Status and Early Feeding with Incidence of Post-Laparotomy Surgical Site Infection Day 14th

Characteristics	Surgical Site Infection on Day 14th (n=32)		C	p-value*
	No	Yes		
Total body water (TBW)				
Normal	6 (85.7%)	1 (14.3%)	0.290	0.872
Abormal	22 (88.0%)	3 (22.0%)		
Body fat				
Normal	12 (92.3%)	1 (7.7%)		
Moderate	10 (76.9%)	3 (13.1%)	0.267	0.292
High	6 (100%)	- (0%)		
Skeletal Bone mass				
Normal	8 (88.8%)	1 (11.2%)	0.026	0.882
Abnormal	20 (86.9%)	3 (13.1%)		
Muscle mass				
Normal	19(90.4%)	2 (9.6%)	0.123	0.482
Abnormal	9(81.8%)	2 (18.2%)		
Subjective global assessment (SGA)				
A	9 (100%)	- (0%)		
B	16 (94.1%)	1 (5.9%)	0.482	0.008
C	3 (50.0%)	3 (50.0%)		
Albumin				
Normal	7 (100%)	- (0%)		
Moderate	13 (92.8%)	1 (7.2%)	0.316	0.168
Severe	8 (72.7%)	3 (27.3%)		
Early feeding				
Yes	24 (96.0%)	1 (4.0%)	0.437	0.006
No	4 (57.2%)	3 (42.8%)		

*p value was analyzed by contingency coefficient test

body water (TBW) can be used to estimate body composition and its compartments such as fat-free mass, fat mass, and body solids. TBW is composed of two compartments: intracellular water (ICW) and extracellular water (ECW). ICW consists of the fluid in the muscle and organ cells and ECW includes plasma, interstitial fluid, and connective tissue fluids. In acutely ill patients, estimated TBW does not reliably reflect fat-free mass due to disturbances of ICW caused by protein malnutrition, changes in TBW, and changes in the ratio of ICW and ECW due to injury and inflammation.[18]

In general, total body water provides an overview of the patient's dehydrated condition. Although 25 study subjects gave an abnormal total body water description, it did not affect the incidence of surgical site infection. In a study conducted by Oya et al which examined perioperative body fluid levels on complication rates, it was found the incidence of postoperative complications was correlated with the amount of extracellular water (ECW) and ECW/TBW, which indicated that there was a large amount of fluid out of the intracellular which makes a factor in the occurrence of postoperative complications. TBW does not describe the conditions of specific physiological changes that occur in patients with physiological abnormalities, because the amount of transitions changes from

Table 4 Correlation between Nutritional Status and Early Feeding with the Incidence of Post-Laparotomy Surgical Site Infection On Day 21st

Characteristics	Surgical Site Infection on Day 21st (n=32)		C	p-value*
	No	Yes		
Total body water				
Normal	7 (100%)	- (0%)	0.095	0.591
Abnormal	24 (96.0%)	1(4.0%)		
Body fat				
Normal	13 (100%)	- (0%)		
Moderate	12 (92,3%)	1 (7,7%)	0.212	0.470
High	6 (100%)	- (0%)		
Skeletal Bone mass				
Normal	9 (100%)	- (0%)	0.112	0.525
Abnormal	22 (95.6%)	1 (4.4%)		
Muscle mass				
Normal	21 (100%)	- (0%)	0.241	0.160
Abnormal	10 (90.9%)	1 (9.1%)		
Subjective global assessment				
A	9 (100%)	- (0%)		
B	17(100%)	- (0%)	0.350	0.107
C	5(83.3%)	1(14.7%)		
Albumin				
Normal	7(100%)	- (0%)		
Moderate	14(100%)	- (0%)	0.241	0.373
Severe	10(90.9%)	1(9.1%)		
Early feeding				
Yes	25(100%)	- (0%)	0.321	0.055
No	6(85,7%)	1(14,3%)		

*p value was analyzed by contingency coefficient test

intracellular to extracellular, from intravascular to extracellular.[18]

This study assessed the body fat of the subjects as part of the BIA. Most of the body fat in the subjects of this study was in normal to high conditions, there were no research subjects with low body fat values. An analytical test was carried out on the incidence of surgical site infection, but no statistically significant correlation was obtained, this was indicated by the absence of research subjects with high levels of body fat who experienced surgical site infection events. The study conducted by Weisberg et al assessed the relationship between the percentage of body fat and the incidence of surgical site infection and concluded that there was a five times greater risk of surgical site infection in patients with high body fat.[19]

This is not following this study where research subjects with high levels of body fat did not experience surgical site infection. Body fat is related to comorbid factors that indirectly affect the occurrence of surgical site infection, patients with high levels of body fat are more at risk of developing chronic diseases, and fat directly triggers inflammation in the body. Further research is needed on the correlation between body fat and the incidence of surgical site infection. There are several possibilities that might contribute to insignificant results in this

Table 5 Correlation Between Nutritional Status and Early Feeding with Incidence of Post-Laparotomy Surgical Site Infection Day 30th

Characteristics	Surgical site infection on Day 30th (n=32)		C	p-value*
	No	Yes		
Total body water				
Normal	7(100%)	- (0%)	0.095	0.591
Abnormal	24(96.0%)	1(4.0%)		
Body fat				
Normal	13(100%)	- (0%)		
Moderate	12(92.3%)	1(7.7%)	0.212	0.470
High	6(100%)	- (0%)		
Skeletal Bone mass				
Normal	9(100%)	- (0%)	0.112	0.525
Abnormal	22(95.6%)	1(4.4%)		
Muscle mass				
Normal	21(100%)	- (0%)	0.241	0.160
Abnormal	10(90,9%)	1(9,1%)		
Subjective global assessment				
A	9(100%)	- (0%)		
B	17(100%)	- (0%)	0,350	0,107
C	5(83.3%)	1(14.7%)		
Albumin				
Normal	7(100%)	- (0%)		
Moderate	14(100%)	- (0%)	0.241	0.373
Severe	10(90.9%)	1(9.1%)		
Early feeding				
Yes	25(100%)	- (0%)	0.321	0.055
No	6(85.7%)	1(14.3%)		

*p value was analyzed by contingency coefficient test

study; even though there are several subjects with high body fat numbers, the percentage is not large, besides that, it might be due to the body fat grouping being quite broad in this study. For better results in future studies, we recommend assessing body fat in numerical form.

Skeletal bone mass and muscle mass in BIA were assessed as a sign of chronic malnutrition. Most of the subjects had normal conditions and the result showed no statistical correlation with the incidence of surgical site infection. The condition of decreased bone and muscle composition in theory indicates a chronic disease process, not only related to malnutrition. In a study conducted by Fujikawa et al which assessed the condition of decreased skeletal muscle mass in colitis patients who underwent surgery, it was found that the results of this decrease provided a positive correlation with the incidence of surgical site infection. This is in line with our study where most subjects were in normal muscle mass condition so that it did not affect the incidence of surgical site infection. The higher the muscle mass means the higher the level of free fat mass, which can help minimize inflammation, and postoperative stress and have the effect of reducing complications.[20]

Subjective global assessment is a measuring tool to screen the condition of nutritional status of patients, especially in acute conditions. In

this study assessed the condition of SGA in preoperative conditions to be able to provide information and predictions about the incidence of surgical site infection. In our study, a statistically significant correlation was found in the surgical site infection that occurred on post-laparotomy days 7th and 14th, while on days 21st and 30th, SGA was not statistically significant. This is by various previous studies where in the study of Fukuda et al, patients with SGA C experienced a high incidence of surgical site infection, even though they were given adequate nutrition during the postoperative process.[21] A study by Eu et al.,[22] assessed nutritional status for events of surgical site infection in orthopedic patients, the results showed that SGA B and C conditions had a statistical effect on the incidence of surgical site infection. This shows that SGA is quite good at representing malnutrition in patients, and malnutrition directly causes surgical site infection.Malnutrition will disrupt wound healing, especially during the inflammatory and proliferative phases where infection prevention occurs as well as new tissue formation and sufficient protein levels are needed in that phase. Malnutrition indicates the body lacks protein in the body which causes the wound healing process to be hampered and conditions of infection easily occur.

In post-laparotomy days 21st and 30th, it was found that SGA no longer influenced the incidence of surgical site infection may be too distant, so the initial SGA data becomes irrelevant for the assessment. Assessment of the nutrition status of newly hospitalized patients is an initial stage of nutrition intervention which will affect the duration of stay and the history of patients' diseases during hospitalization. Harimawan[23] study showed that the majority of newly hospitalized patients were undernourished (50.6%); the preliminary status of patients assessed using the SGA method could affect the length of stay, relative risk (RR)=3.67 but not the status of discharge (RR=0.97).

Albumin is a sensitive screening tool in determining the occurrence of malnutrition conditions, various studies state that albumin is an independent preoperative risk causing surgical site infection. In this study, the results showed that albumin had an effect and had a strong correlation with the incidence of surgical site infection in post-laparotomy day 7th. This is by the meta-analysis study conducted by Yuwen et al.[24] who conducted a meta-analysis of albumin as a risk factor for surgical site infection. Hypo albumin conditions <3.5 mg/dL are known to provide a 2.5-fold risk of developing a surgical site infection event.

On post-laparotomy days 14th, 21st, and 30th, albumin level was not a statistically significant variable. This is shown in Tables 2, 3, and 4 that the condition of the patient with hypoalbumin has improved, and is no longer experienced surgical site infection. The calculation of albumin levels which is only done before surgery also gives a picture of data that may be biased on post-laparotomy days 14th, 21st, and 30th because the albumin levels may be no longer the same considering that most of the patients were carried out early feeding. Albumin which also functions as a marker of protein levels in the body has a very important role in wound healing and prevention of infection, the majority of which work early in the wound healing process, namely in the first 7 days, so that patients with hypoalbuminemia will give symptoms of infection and a high risk of surgical site infection during the first week.

Enteral nutrition within 24 hours postoperatively is considered as early enteral feeding. In this study we provided treatment in the form of early feeding for all research subjects, but there were 7 subjects who could not be carried out early feeding due to unstable hemodynamics, clear signs of gastroparesis, vomiting symptoms and increased risk of aspiration.

Statistical analysis showed that early feeding had a statistically significant correlation with the incidence of surgical site infection on post-laparotomy day 14th. This is by the meta-analysis conducted by Lewis et al which assessed the effect of early feeding on patient outcomes after gastrointestinal surgery which proved to significantly reduce the risk of infection.[25] The same result was conveyed. by Luis et al who said that giving early feeding would reduce the risk of surgical site infection, especially after day 4th, and reduce the length of stay.[25] This study where the incidence of surgical site infection in research subjects who were not given early feeding treatment on post-laparotomy day 7th did not change on post-laparotomy day 14th. Theoretically, this happens due to changes in nutritional status cannot happen immediately and nutritional improvements should be done gradually following the conditions of the patients, this is what causes research subjects who experience surgical site infection on post-laparotomy day 7th to improve days later.

Surgical site infection events in post-laparotomy days 21st and 30th occurred in 1 study subject who was known to be malnourished and

unable to do early feeding but was not statistically significant. This study still cannot ignore this because it shows that surgical site infection can happen from this condition in the long term, even though the percentage is small and not statistically significant. The subjects of this study also did not perform proper wound cultures because sometimes during control the patients were not in contact with researchers but with the nurses so negligence could occur in wound care procedures. In addition, patients who came to the digestive surgery department for follow-up on post-laparotomy day 30th generally appeared to have good nutritional status, and patients who initially had poor nutritional status generally experienced improvement in nutritional status.

This research is interesting for further development, considering there are some limitations in this research. This study uses nominal and ordinal categorical groupings to determine the nutritional status of patients. This study also did not measure the phase angle which is a better part of BIA in determining nutritional status, but this cannot be calculated due to the lack of availability of tools. The early feeding treatment in this study was also unbalanced, which impacts inadequate results.

There was no association between albumin, nutritional status i.e. SGA, and early feeding on the incidence of post-laparotomy ILO in patients with perforated peptic ulcer at RSHS. This is likely due to the course of improvement of nutritional status and albumin after treatment. Also changes in nutritional status cannot occur quickly so early feeding is not statistically significant.

In this study offer some suggestions for future studies on similar topics namely; early feeding treatment can be grouped into case and control groups so that the results will be better, variable grouping with a numerical scale, conducting multivariate assessments to be able to assess possibilities occurs and how much risk each independent variable carries, nutritional assessments were carried out again at the ILO assessment on POD days 7, 14, 21 and 30 with the expectation that nutritional status data would be relevant, and last wider sampling was carried out again.

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