A Comparison of Early and Late Feeding After Emergency Gastrointestinal Surgery

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A Comparison of Early and Late Feeding After Emergency Gastrointestinal Surgery

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<TABLE OF CONTENTS>

LIST OF FIGURES

LIST OF TABLES

ABSTRACT

A Comparison of Early and Late Feeding After Emergency Gastrointestinal Surgery

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The adopt of early feeding after emergency gastrointestinal (GI) surgery is still debate despite a recommendation of early feeding by the guidelines of the Society of Parenteral and Enteral Nutrition. The aim of this study was to compare and assess the feasibility of early feeding in patients that have undergone emergency GI surgery. This study was retrospective review of 112 patients that underwent emergency GI surgery from March 2008 to December 2011. Inclusion criteria were followings; stayed in the ICU less than 3 days and undergone bowel resection and/or anastomosis. Exclusion criteria were followings; stayed in the ICU more than 3 days (n=19), severe shock requiring massive resuscitation (n=4), short bowel syndrome (n=3), sustained intestinal ischemia (n=1) and perforation (n=1). So, total 84 patients were analyzed. They were divided into an early (E; n=44) or a late (L; n=40) group according to time of the commencement of feeding. Early feeding was defined when oral or enteral feeding was started within 48 hours after surgery with liquid or soft diet or enteral formula. The most common cause of operation was bowel perforation, and the small bowel was the

most common involved site. There were no significant intergroup differences between causes, sites, methods of operation, overall complications and other outcomes. However, the length of intensive care unit stay (1 vs 2 days, p=0.038) and the length of hospital stay after operation was significantly longer (9 vs 12 days, p=0.012), and pulmonary complications were also significantly more common in group L (13.6 vs. 47.5%, p=0.001). In E group, one patient underwent re-operation to treat an anastomotic disruption. There was no post-operative mortality in this study. After emergency GI surgery, early feeding may be possible in selected patients without severe inducing complications.

Key words : Emergency Treatment; Gastrointestinal Tract; Surgical procedures, Operative; Enteral nutrition

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I. INTRODUCTION

Nutritional support plays important roles in wound healing and postoperative recovery.[1,2] Poor nutritional status is strongly associated with delayed wound healing and longer hospital stays in postoperative patients.[3,4] In particular, patients that undergo emergency gastrointestinal (GI) surgery have the impared nutritional status and elevated basal energy expenditure,[5,6] thus, nutritional support is more important for them. Several reports have emphasized that early enteral feeding could be started as soon as possible after resuscitation because the immunomodulatory effect of enteral feeding could assist recovery.[7-10] However, patients with emergent gastrointestinal condition have an edematous or ischemic bowel, and then they are high risk group of the postoperative complications such as ileus, obstruction, or anastomotic failure. For these reasons, the majority of surgeons hesitate to commence early feeding after emergency GI surgery. Furthermore, only few reports have been issued on the

safety of early feeding.[6,11,12] The aim of this study was to assess the safety and feasibility of early feeding in patients that have undergone emergency GI surgery.

II. MATERIALS AND METHODS

1. Patients

Current study reviewed the archived records of patients that underwent emergency GI surgery from March 2008 to December 2011. Enrolled patients had undergone bowel resection and/or anastomosis. Patients that underwent simple appendectomy, cholecystectomy, primary repair of perforated viscera, and adhesiolysis without bowel anastomosis were excluded, and patients with severe shock, intestinal ischemia, sustained bowel perforation, short bowel syndrome, or treated in the intensive care unit more than 3 days were also excluded. Severe shock was defined the mean arterial pressure was maintaining more than 60mmHg (or >80 mmHg if patient has baseline hypertension) with the support of vasopressor such as high doses dopamine (>15mcg/kg/min) or norepinephrine (>0.25mcg/kg/min) after adequate fluid resuscitation.[13] Short bowel syndrome was defined as less than 1.5 meters of the small intestine after surgery left to absorb sufficient nutrients.[14]

Clinical and surgical data and details of surgical outcomes were collected. The clinical data consisted of gender and age, the Acute Physiology And Chronic Health Evaluation (APACHE) II score[15] on admission, operative data of causes, methods, sites, the ratio of intensive care unit (ICU) care, the ratio of vasopressor use, the ratio of mechanical ventilation (MV) and the duration of MV. Outcomes were complication rates, types of complications, postoperative lengths of stay (LOS) in hospital and ICU. Type of complications were wound problem, postoperative ileus, abdominal pain, diarrhea, pulmonary complication, newly developed sepsis, inta-abdominal abscess, anastomosis leakage. Ileus was defined as partial or complete non-mechanical blockage of intestine confirmed by x-rays of abdomen. Diarrhea was defined as more than 3 times per day and/or stool volume in excess of 500 ml/day. Pulmonary complication that comfirmed by chest x-ray included atelectasis, pleural effusion and pneumonia. Sepsis was defined as systemic inflammatory response syndrome (SIRS) with documented infection. In addition, standard values were used for its diagnosis, axillary temperature > 38^0C/ < 36^0C; Heart Rate >90/min; Respiratory Rate > 20/min; white blood cell count in excess of 12000 cells/mm^3 or <4000 cells/mm^3 or with over 10% immature cells.

Patients were allocated to two groups according to times of feeding commencement, that is, into an early group (E) or a late group (L). Early feeding was defined when a liquid or soft diet enterally or by mouth was started

within 48 hours of surgery. Late feeding was defined when a liquid or soft diet enterally or by mouth was started beyond 48 hours of surgery.

2. Statistical analysis

All values are presented as percentages or medians and ranges. Categorical variables were analyzed by using the Chi-square test, and continuous variables using the Student's t-test. Statistical analysis was performed using SPSS 18.0 (SPSS Inc, Chicago, Ill, USA). Statistical significance was accepted for *p* values of < 0.05.

III. RESULTS

1. Demographics

Total 112 patients were enrolled in this study. However, 9 patients were excluded because these patients were not feasible enteral feeding after GI surgery; 4 severe shock, 3 short bowel syndrome, 1 intestinal ischemia, and 1 sustained bowel perforation. And we excluded 19 patients who stayed in the ICU more than 3 days after operation (Figure 1). So, total 84 patients were analyzed. There were 47 men and the median age was 64 years (16-102). The median APACHE II score on admission was 16 (range, 10-34). Fifty-three patients (63.1%) were managed in the ICU, and 7 (8.3%) were required the

vasopressor due to immediate postoperative hypotension. Accompanying mechanical ventilation (MV) was performed in 22 patients (26.2%), and its median duration was 1 day (range, 1-3). Median postoperative LOS in hospital and in ICU were 11 days (range, 4-72) and 2 days (range, 1-3), respectively. The most common cause of operation was the bowel perforation (n=37, 44.0%), followed by intestinal obstruction (n=22, 26.2%) (Figure 2). The small bowel (n=43, 51.2%) was the most common site of operation, followed by the colon (n=32, 38.1%) (Figure 3). The most common type of surgery was the segmental resection with primary anastomosis of the small bowel (n=33, 39.3%). Oral feeding was performed in 65 patients (77.4%) and enteral feeding in 19 patients (22.6%). Fifty-two patients (61.9%) experienced postoperative complications, and wound problems, such as infection and seroma, were the most common. Twenty-five patients (29.8%) experienced a pulmonary complications, that is, atelectasis in 8, pneumonia in 2, and pleural effusion in 15. Five patients with pleural effusion were managed by percutaneous catheter drainage.

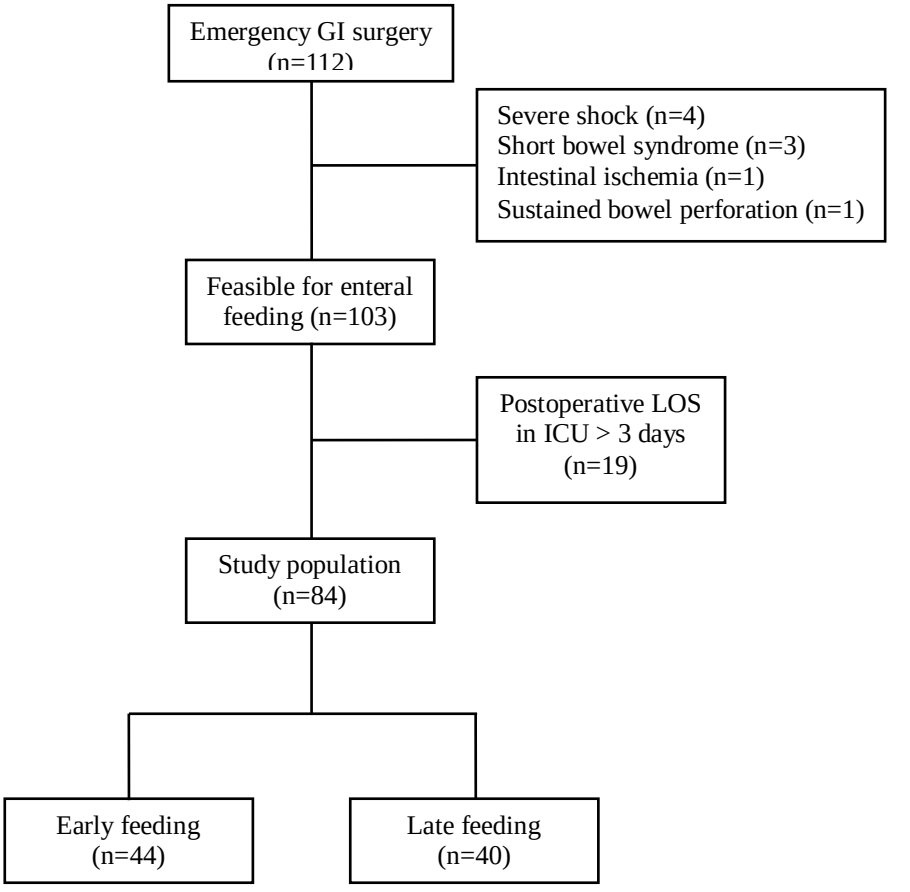

Figure 1. Patients selection. Total 112 patients were enrolled in this study. However, 28 patients were excluded according to the exclusion criteria.

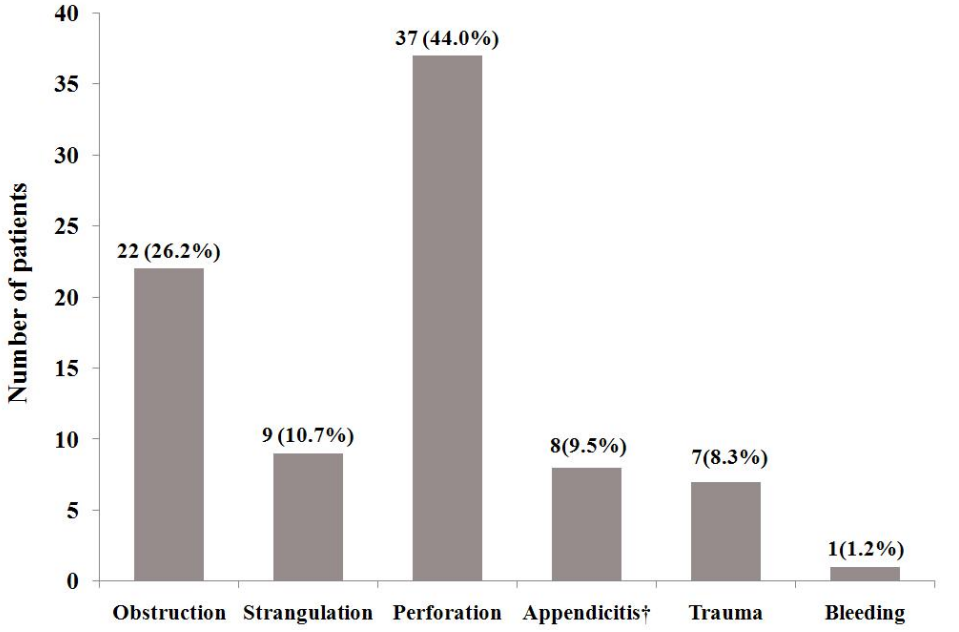

Figure 2. Causes of surgery. † All patients with appendicitis was received ileocecectomy due to severe inflammation.

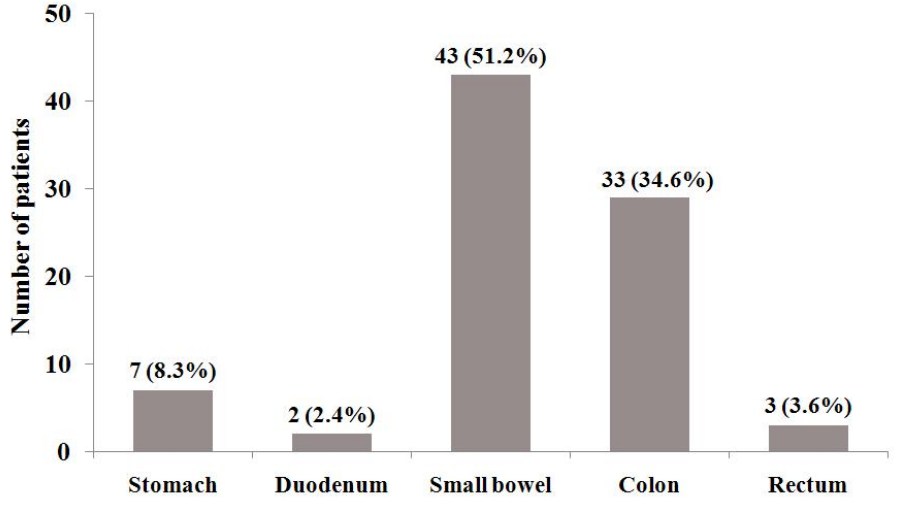

Figure 3. Sites of operation. The small bowel was the most common site of operation.

2. Comparison of the early and late feeding groups.

Early feeding group (E) contained 44 patients (52.4%) and late group (L) contained 40 patients (47.6 %). No significant intergroup differences were for causes, sites, methods of operation (Tables 1 and 2), genders, ages, APACHE II score on admission, the ratio of vasopressor use, the ratio of ICU care, the ratio of MV and the duration of MV (Table 3). However, postoperative LOS in ICU and postoperative LOS in hospital were significantly longer in the L group. The incidences of postoperative complications were not significantly different in the two groups (Table 4). However, pulmonary complications were significantly more common in the L group. Five patients who underwent percutaneous catheter drainage of pleural effusion were L group. In E group, there were no patients who underwent percutaneous catheter drainage of pleural effusion. An intra-abdominal abscess developed in 2 patients (1 in each group), but in both cases was well controlled by percutaneous catheter drainage. One patient in group E, who received pyloric exclusion and gastrojejunostomy due to duodenal perforation, required re-operation to treat anastomotic disruption. However, the patient was well recovered after re-operation. There was no postoperative mortality in this study.

Table 1. Causes of surgery in the two groups

Cause	Group E (n=44)	Group L (n=40)	*p*-value
Obstruction	10 (22.7)	12 (30.0)	0.212
Strangulation	8 (18.2)	1 (2.5)	
Perforation	19 (43.2)	18 (45.0)	
Appendicitis†	3 (6.8)	5 (12.5)	
Trauma	3 (6.8)	4 (10.0)	
Bleeding	1 (2.3)	0 (0.0)	

Values were represented as *n* (%), † All patients with appendicitis was received ileocecectomy due to severe inflammation.

Table 2. Operation types in the two groups

Method	Group E (n=44)	Group L (n=40)	*p*-value
Small bowel resection + anastomosis	19 (43.2)	14 (35.0)	0.103
Colon resection + anastomosis	9 (20.5)	10 (25.0)	
Bypass surgery	5 (11.4)	6 (15.0)	
Colon resection + colostomy	10 (22.7)	3 (7.5)	
Small bowel resection + ileostomy	0 (0.0)	2 (5.0)	
Gastrectomy	1 (2.3)	5 (12.5)	

Values were represented as *n* (%), The most common operation type was the segmental resection with primary anastomosis of the small bowel.

Table 3. Clinical data and surgical outcomes in the two groups

Variable	Group E (n=44)	Group L (n=40)	*p*-value
Gender (M:F)	15 : 29	18 : 22	0.054
Age (Years)	65.5 (16-92)	62.5 (32-102)	0.562
APACH II score	15.0 (10-34)	17.5 (10-34)	0.333
Vasopressor use	3 (10.0)	4 (17.4)	0.431
ICU care	30 (68.2)	23 (57.5)	0.311
MV	10 (22.7)	12 (30.0)	0.449
Duration of MV (days)	1 (1-4)	1 (1-2)	0.451
Postoperative LOS in ICU (days)	1 (1-3)	2 (1-3)	0.038
Postoperative LOS in hospital (days)	9 (4-38)	12 (6-72)	0.041
Overall complication	23 (52.3)	29 (72.5)	0.057
Mortality	0 (0.0)	0 (0.0)	

Categorical variables were represented as *n* (%) and continous variables were represented medians and ranges, Postoperative LOS in ICU and postoperative LOS in hospital were significantly longer in the L group. ICU, intensive care unit; MV, mechanical ventilation; LOS, length of stay.

Table 4. Complications after emergency gastrointestinal surgery in the two groups

Complication	Group E (n=44)	Group L (n=40)	*p*-value
Wound problems	11 (25.0)	9 (22.5)	0.788
Postoperative ileus	4 (9.1)	5 (12.5)	0.614
Abdominal pain	7 (15.9)	6 (15.0)	0.908
Diarrhea	3 (6.8)	0 (0.0)	0.093
Pulmonary complications	6 (13.6)	19 (47.5)	0.001
Sepsis (newly develop)	0 (0)	1 (2.5)	0.291
Intra-abdominal abscess	1 (2.3)	1 (2.5)	0.946
Anastomosis leakage	1 (2.3)	0 (0)	0.337

Values were represented as *n* (%). Wound problem was the most common complication and there were no differences in complications between two groups except pulmonary complications.

IV. DISCUSSION

The findings of this study suggest that early feeding may be safe after emergency GI surgery. In particular, the early feeding group showed no significant increase in complication rates, but significantly lower pulmonary complication rates and shorter hospital stay than the late group.

Traditionally, enteral feeding is not started until bowel motility has been recovered after elective surgery on the GI tract,[16] which means that the starting time of enteral feeding after emergency operation is delayed far more than after elective surgery. Because patients that undergo emergency GI surgery have an edematous or ischemic bowel, healing process of an anastomosis is usually delayed, which can result in anastomotic failures, such as disruption or leakage. On the other hand, poor enteral intake can lead to malnutrition or delayed growth of bowel mucosa, which increases postoperative morbidity and mortality.

Several studies have demonstrated the beneficial effects of early enteral feeding in patients that have undergone GI surgery, and they showed the good tolerance to enteral feeding and reductions in septic morbidity.[17,18] Whenever bowel continuity is maintained after surgery, enteral feeding is preferred nutritional supportive option over parenteral nutrition by the several

guidelines.[19] However, despite the beneficial effect of early enteral feeding, the time of feeding commencement after emergency GI surgery remains controversial in surgeons. Furthermore, few studies have addressed the beneficial effects of early enteral feeding after emergency surgery.[6,11,12,20] One previous report on early enteral feeding after emergency GI surgery focused on patients with peritonitis. However, enrolled patients mostly had perforated gastric and duodenal ulcers thus, feeding materials were not passed through anastomosis sites because a naso-gastric or percutaneous jejunal tube was used for the route of feeding. In current study, a large proportion of patients had undergone bowel resection with anastomosis, and most patients (67%) were fed per os.

Complications associated with early feeding, such as, abdominal pain, diarrhea, and postoperative ileus were investigated. Even though complications developed in 23 patients, all had recovered without any problem by conservative management. The majority of complications were wound problems, such as infection or seroma, and no differencies was found in two groups. Anastomotic leakage developed in only one patient in early feeding group, and he recovered after re-operation. Furthermore, there was no post-operative mortality.

Barlow et al.[9] demonstrated that operative morbidity was less common in patients who underwent major upper GI surgery with early enteral nutrition than

the patients with conventional nutrition. And chest infection was significant lower in the patients with early enteral nutrition. Moore et al.[17] also reported that the patients with early enteral feeding showed lower incidence of pneumonia and other septic complications than the patients with conventional treatment in meta-analysis of high-risk surgical patients. In accordance with previous studies, present study shows that pulmonary complications were significantly lower in the early feeding group. However, the majority of pulmonary complications was pleural effusion in this study and was treated by percutaneous catheter drainage. Furthermore, it would appear that percutaneous catheter drainage for pleural effusion prolonged hospital stay in late group, which also suggests that early feeding resulted in better fluid balance; however, this was not evaluated. It was also noted that after feeding had started, intravenous fluid intake is reduced, indicating that early enteral feeding could reduce the incidence of pleural effusion.

The present study has several limitations. First, this retrospective study was performed on data collected from medical records, which did not contain fluid balance or nutritional data, and thus, the beneficial effects of early feeding on nutrition was not demonstrated in this study. Second, the study is prone to selection bias, because patients requiring high-dose vasopressor treatment and hemodynamically unstable patients were excluded.

V. CONCLUSION

Current study demonstrated that the early enteral feeding after emergency GI surgery did not increased complication rates. Moreover, early enteral feeding group has shorter post-operative hospital stay than late feeding group. Thus, early enteral feeding may be possible in selected patients that undergo emergency GI surgery for an acute abdomen. And the prospective study is needed to confirm the safety and feasibility of early enteral feeding after emergency GI surgery.

REFERENCES

1. Bisgaard T, Kehlet H. Early oral feeding after elective abdominal surgery - What are the issues? Nutrition 2002;18:944-8.
2. Fearon KC, Luff R. The nutritional management of surgical patients: enhanced recovery after surgery. Proc Nutr Soc 2003;62:807-11.
3. Giner M, Laviano A, Meguid MM, Gleason JR. In 1995 a correlation between malnutrition and poor outcome in critically ill patients still exists. Nutrition 1996;12:23-9.
4. Pennington CR, Powell-Tuck J, Shaffer J. Review article: artificial nutritional support for improved patient care. Aliment Pharmacol Ther 1995;9:471-81.
5. Hill GL, Blackett RL, Pickford I, Burkinshaw L, Young GA, Warren JV, et al. Malnutrition in surgical patients. An unrecognised problem. Lancet 1977;1:689-92.
6. Kaur N, Gupta MK, Minocha VR. Early enteral feeding by nasoenteric tubes in patients with perforation peritonitis. World J Surg 2005;29:1023-7.
7. Pupelis G, Selga G, Austrums E, Kaminski A. Jejunal feeding, even when instituted late, improves outcomes in patients with severe pancreatitis and peritonitis. Nutrition 2001;17:91-4.
8. Lassen K, Soop M, Nygren J, Cox PB, Hendry PO, Spies C, et al. Consensus review of optimal perioperative care in colorectal surgery: Enhanced Recovery After Surgery (ERAS) Group recommendations. Arch Surg 2009;144:961-9.
9. Barlow R, Price P, Reid TD, Hunt S, Clark GW, Havard TJ, et al. Prospective multicentre randomised controlled trial of early enteral nutrition for patients undergoing major upper gastrointestinal surgical resection. Clin Nutr 2011;30:560-6.
10. Daly JM, Lieberman MD, Goldfine J, Shou J, Weintraub F, Rosato EF, et al. Enteral nutrition with supplemental arginine, RNA, and omega-3 fatty acids in patients after operation: immunologic, metabolic, and clinical outcome. Surgery 1992;112:56-67.
11. Singh G, Ram RP, Khanna SK. Early postoperative enteral feeding in patients with nontraumatic intestinal perforation and peritonitis. J Am Coll Surg 1998;187:142-6.
12. Malhotra A, Mathur AK, Gupta S. Early enteral nutrition after surgical treatment of gut perforations: a prospective randomised study. J Postgrad Med 2004;50:102-6.
13. Bone RC, Balk RA, Cerra FB, Dellinger RP, Fein AM, Knaus WA, et al. Definitions for sepsis and organ failure and guidelines for the use of innovative therapies in sepsis. The ACCP/SCCM Consensus Conference Committee. American College of Chest Physicians/Society of Critical Care Medicine. Chest 1992;101:1644-55.

14. O'Keefe SJ, Buchman AL, Fishbein TM, Jeejeebhoy KN, Jeppesen PB, Shaffer J. Short bowel syndrome and intestinal failure: consensus definitions and overview. Clin Gastroenterol Hepatol 2006;4:6-10.
15. Knaus WA, Draper EA, Wagner DP, Zimmerman JE. APACHE II: a severity of disease classification system. Crit Care Med 1985;13:818-29.
16. Wilmore DW, Long JM, Mason AD, Jr., Skreen RW, Pruitt BA, Jr. Catecholamines: mediator of the hypermetabolic response to thermal injury. Ann Surg 1974;180:653-69.
17. Moore FA, Feliciano DV, Andrassy RJ, McArdle AH, Booth FV, Morgenstein-Wagner TB, et al. Early enteral feeding, compared with parenteral, reduces postoperative septic complications. The results of a meta-analysis. Ann Surg 1992;216:172-83.
18. Lewis SJ, Egger M, Sylvester PA, Thomas S. Early enteral feeding versus "nil by mouth" after gastrointestinal surgery: systematic review and meta-analysis of controlled trials. BMJ 2001;323:773-6.
19. Braga M, Ljungqvist O, Soeters P, Fearon K, Weimann A, Bozzetti F. ESPEN Guidelines on Parenteral Nutrition: surgery. Clin Nutr 2009;28:378-86.
20. Lee HS, Shim HJ, Lee JG, Kim KS. [The safety of early enteral feeding after emergency gastrointestinal surgery]. Korean J Gastroenterol 2011;58:318-22.

ABSTRACT

응급 위장관 수술 후
조기 경장 영양군과 후기 경장 영양군의 비교 연구

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이 형 순

본 연구의 목적은 응급 위장관 수술을 받은 환자에서 조기 경장영양의 안전성 및 효용성을 평가하기 위함이다. 2008년 3월부터 2011년 12월까지 연세대학교 세브란스 병원에서 응급 위장관 수술을 시행 받은 112명의 환자를 대상으로 하였다. 환자의 중증도를 보정하기 위하여, 중환자실에서 4일 이상 치료받았던 환자는 제외하였다 (n=19). 48시간 이내에 경장 영양을 시작한 환자들을 조기 경장 영양군, 48시간 이후에 경장 영양을 시작한 환자들을 후기 경장 영양군으로 나누어 임상 자료와 수술적 결과를 비교하였다. 장 천공으로 인한 응급수술이 가장 많았으며, 소장 천공이 가장 많았다. 수술의 부위, 방법, 원인은 두 군간의 차이가 없었으나, 수술 후 중환자실 재원기간과(1 vs 2 일, p=0.038) 수술 후 총 재원기간이 후기 경장 영양군에서 유의하게 길었다 (9 vs 12 일, p=0.012). 또한, 폐 합병증이 후기 경장 영양군에서 통계적으로 유의하게 많았다 (13.6 vs. 47.5 %, p=0.001). 조기 경장 영양군에서 문합부 누출이 한 명에서 발생하였으나, 재수술 후 회복하였으며, 본 연구에서 수술 후 경장영양을 시작하고 사망한 환자는 없었다. 조기 경장 영양은 급성 복증으로 응급 위장관 수술을 받은 환자에서 비교적 안전하게 시행될 수 있을 것으로 생각된다. 그러나 조기 경장 영양의 시작 전에 환자 상태에 대한 정확한 평가가 선행되어야 할 것으로 생각된다.

핵심되는 말 : 응급 수술, 위장관, 수술적 치료, 경장 영양