

Original Article

Post-operative nutritional practice in emergency laparotomy

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ABSTRACT

INTRODUCTION. Post-operative nutrition in emergency abdominal surgery can be challenging, and evidence on nutritional management in this population needs to be included in guidelines. This study aimed to describe the nutritional practice after emergency laparotomy at a university hospital and compare the routine practice to current guidelines.

METHODS. This was a single-centre retrospective cohort study of consecutive patients undergoing emergency laparotomy from August 2021 to August 2022. Patients transferred to other hospitals or non-surgical wards were excluded. Nutritional data during admission were assessed daily from post-operative day (POD) 1 up to POD 30.

RESULTS. A total of 231 patients were included; 118 (51.1%) were male, and the median age was 71 years (IQR: 58-79 years). Bowel obstruction was found in 144 (62.3%) of patients. The median length of stay was eight days (IQR: 5-14 days). Any oral intake on POD 1 was achieved by 113 (48.9%), increasing to 203 (87.9%) on POD 5. Nasogastric tubes and dietary restrictions were standard in patients not achieving oral intake on POD 1. Parenteral nutrition was used in 66 (28.6%) patients; the median time from surgery to initiation of parenteral nutrition was four days (IQR: 3-6.75 days), and the median duration of parenteral nutrition was seven days (IQR: 5-15 days).

CONCLUSIONS. Early oral intake after major emergency abdominal surgery was only achieved in half of the patients, and current practice deviates from current guidelines. Special considerations should be made in patients undergoing emergency laparotomy as their post-operative condition differs from that of elective cases.

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TRIAL REGISTRATION. Not relevant.

Post-operative nutrition is an essential part of care in abdominal surgery [1]. Although malnutrition is generally not a problem in emergency surgery patients, proper risk identification is important as nutritional prehabilitation is often impossible due to the urgency of emergency surgical conditions [2, 3].

The current guideline on nutrition in surgery by the European Society for Clinical Nutrition and Metabolism (ESPEN) emphasises early oral nutrition [1], and increased calorie intake has been shown to reduce the risk of adverse events in surgical and medical patients [4]. Tube feeding should be initiated in cases with expected inadequate oral intake, preferably within the first 24 hours after surgery, and has been shown to be safe [5]. Parenteral nutrition (PN) should be started after seven days of inadequate combined oral and enteral intake.

However, PN may be used in the early post-operative phase in patients with contraindications for enteral feeding [6]. Currently, the ESPEN guideline focuses primarily on elective surgery, making it difficult to apply in emergency surgical settings [1].

Early oral intake after abdominal surgery can be challenging. Only 10-50% of patients achieve adequate nutrition in the early post-operative phase after emergency surgery [5, 7]. Several causes of reduced oral intake in abdominal surgery have been identified, including loss of appetite, post-operative ileus and nausea [7, 8]. These factors may also affect tolerance of tube feeding, leaving PN as the only viable early feeding route in some patients.

Few studies have investigated the management of post-operative nutrition in emergency laparotomy patients within an established Enhanced Recovery After Surgery (ERAS) programme [9]. This study aimed to describe the current nutritional practices and feeding techniques in patients who underwent emergency laparotomy at a Danish University Hospital and to assess adherence to current ESPEN guidelines.

Methods

A single-centre retrospective cohort study at Copenhagen University Hospital, Herlev, was conducted after approval from the regional data protection agency (p-2020-1166) and the local ethics committee of the Capital Region of Denmark (R-21038079). The manuscript was prepared according to the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) guidelines for reporting cohort studies [10].

Setting

At Copenhagen University Hospital, Herlev, all patients undergoing emergency laparoscopy or laparotomy for bowel obstruction, mesenteric ischemia, perforated hollow viscus or intraabdominal bleeding were prospectively registered as from 1 August 2021. The population is referred to as *AHA* (Acute High-risk Abdominal).

The hospital serves a population of approximately 465,000 people, performs around 350 emergency surgeries annually and has a well-implemented ERAS fast-track care bundle for emergency surgery. The bundle includes rapid abdominal computed tomography (CT), surgery within six hours of arrival at the hospital and a standardised perioperative anaesthesia protocol [6]. Ward rounds are performed by dedicated emergency surgeons. Patients are assessed regularly by physiotherapists to ensure early mobilisation. Counselling with a dietician is available daily, and efforts are made to avoid undernutrition (< 75% of requirement) and increase food quality [11, 12].

Population

This study included adult (≥ 18 years) patients who underwent *AHA* emergency laparotomy from 1 August 2021 to 31 July 2022. We included patients undergoing primary laparotomy or re-laparotomy. Patients were identified using the surgical log of the hospital (Sundhedsplatformen, Epic Systems Corp, Verona, USA). Trauma patients and patients transferred to a non-surgical ward or another hospital within the first 48 hours of surgery were excluded. Furthermore, patients only admitted to the intensive care unit (ICU) were excluded from the study, as its aim was to describe the nutritional practice at the surgical ward.

Data collection

All variables were retrieved from the electronic patient chart and registered in a Research Electronic Data Capture (REDCap) database.

Baseline demographics included age, sex, height, weight, BMI, American Society of Anesthesiologists

classification (ASA), World Health Organization (WHO) Performance Status, pre-existing cardiovascular, pulmonary or renal disease, diabetes, history of malignancy, smoking history and weekly alcohol intake. Mortality was assessed at 30 days after surgery.

Nutritional variables were assessed daily from post-operative day (POD) one until discharge or POD 30, whichever came first. They included episodes of vomiting or aspirates, the presence of a nasogastric tube, dietary restriction, administration of PN and type of PN. Food intake was registered in the patient chart as a percentage of the meal eaten, without the possibility of determining the amount of calories or protein consumed, as meals were not standardised. Nutritional Risk Screening 2002 (NRS-2002) was used for nutrition screening.

Individual calorie requirements were calculated by dieticians using the Harris-Benedict equation, and protein requirement was set at 1.3-1.5 g/day as recommended by the Danish Health Authority [13]. Dietary restrictions were grouped as *fluids only* or *nil per mouth* as determined by the surgeon in charge.

Early oral intake was defined as any intake of solids or non-clear liquids on POD 1. Tube feeding was defined as any flow rate during the first 30 post-operative days. Parenteral nutrition was categorised as supplementary parenteral nutrition (SPN) or total parenteral nutrition (TPN), with TPN being defined as > 75% of energy requirement achieved through PN.

Statistics

Baseline data are presented as numbers and percentages for categorical variables and means with standard deviation or medians with interquartile range (IQR) for continuous variables. The distribution of continuous data was assessed by visual inspection of histograms. Groups were compared using Fisher's exact test for categorical data or the Mann-Whitney U-test for continuous data. Thirty-day mortality was evaluated using a binary logistic regression model with sex, age (above or below 70 years), and feeding technique (oral, enteral, or parenteral) as independent variables.

Due to the descriptive nature of this study, variables with multiplicity were not tested.

All tests were two-sided, and a $p < 0.05$ was considered statistically significant. Analyses were performed using R version 4.3.0 (R Foundation for Statistical Computing, Vienna, Austria).

Trial registration: not relevant.

Results

A total of 320 patients underwent emergency surgery in the study period, of whom 81 underwent laparoscopy. Two trauma patients and six patients transferred to other departments were excluded, leaving 231 patients eligible for analysis. The median age was 71.0 years (IQR: 58-79 years), and 118 (51.1%) were male. Baseline demographics are presented in **Table 1**.

TABLE 1 Baseline demographics.

	No parenteral nutrition ^a	Parenteral nutrition ^b	All patients	p value ^c
Patients, n	165	66	231	
Sex, male, n (%)	75 (45.5)	43 (65.2)	118 (51.1)	0.008
Age, median (IQR), yrs	71.0 (58-79)	71.5 (58.25-76.75)	71 (58.0-79.0)	0.61 ^d
BMI, median (IQR), kg/m ²	23.74 (21.26- 27.39)	24.77 (20.69-29.74)	24.03 (20.98-27.89)	0.14 ^d
Comorbidities, n (%)				
Cardiovascular:				0.01
Arrhythmia	25 (15.2)	6 (9.1)	31 (13.4)	
Ischaemic heart disease	13 (7.9)	5 (7.6)	18 (7.4)	
Hypertension	55 (33.3)	30 (45.4)	85 (36.8)	
Pulmonary ^f	25 (15.2)	13 (19.7)	38 (16.5)	0.43
Diabetes	25 (15.2)	8 (12.1)	33 (14.3)	0.68
Renal ^g	7 (4.2)	3 (4.5)	10 (4.3)	1.0
History of malignancy, n (%)				
Previous	25 (15.2)	13 (19.7)	38 (17.3)	
Current, localised	12 (7.3)	6 (9.1)	18 (7.8)	
Current, disseminated	20 (12.1)	5 (7.6)	25 (11.2)	
Active smoker, n (%)	28 (17.0)	22 (33.3)	50 (22.1)	0.01
Alcohol intake > 7 U weekly ^h	48 (29.1)	20 (30.3)	68 (31.2)	0.81
ASA classification, n (%)				
1-2				0.002 ^e
1-2	103 (62.4)	28 (42.4)	131 (56.7)	
3	52 (31.5)	31 (47.0)	83 (35.9)	
4	10 (6.1)	7 (10.6)	17 (7.4)	
WHO performance status, n (%)				
0-1				0.003 ^e
0-1	131 (79.4)	46 (69.7)	177 (77.0)	
2	19 (11.5)	17 (25.7)	36 (15.6)	
3	11 (6.7)	2 (3.0)	13 (5.7)	
4	3 (1.8)	1 (1.5)	4 (1.7)	
GLIM-criteria stage, n (%)				
0: none to mild				0.72 ^e
0: none to mild	118 (71.5)	46 (69.7)	164 (74.2)	
1: moderate	25 (15.2)	10 (15.2)	35 (15.6)	
2: severe	14 (8.5)	8 (12.1)	22 (10.2)	
Clinical Frailty Scale, n (%)				
1-3				0.003 ^e
1-3	94 (57.0)	24 (36.4)	118 (53.2)	
4-6	50 (30.3)	36 (54.5)	86 (38.7)	
7-9	13 (7.9)	5 (7.6)	18 (8.1)	

ASA = American Society of Anesthesiologists; GLIM = Global Leadership Initiative in Malnutrition; WHO = World Health Organization

a) Patients not receiving parenteral nutrition at any point during admission.

b) Patients who received any dose of parenteral nutrition at any point after surgery.

c) Tests are Fisher's exact t-test unless indicated by d or e.

d) Mann-Whitney U-test.

e) χ^2 test.

f) Asthma, COPD or pulmonary fibrosis.

g) Chronic kidney disease, dialysis or hydronephrosis.

h) 1 U \approx 12 g of ethanol.

A primary laparotomy was performed in 205 patients (88.7%). The most common intraoperative finding was bowel obstruction, recorded for 144 (62.3%) patients. The median post-operative length of stay was 7.3 days (4.5-13.8). Operative details are provided in [Supplementary file 1](#).

Oral nutrition

Post-operative nutritional details are presented in [Table 2](#). Nutritional Risk Screening (NRS-2002) was performed in fewer than 5% of patients. Any oral intake was achieved by 119 patients on POD 1 (51.5%), which increased to 210 (90.9%) by POD 5. A nasogastric tube was present on POD 1 in 136 (58.9%) patients.

TABLE 2 Nutritional details during admission.

	No parenteral nutrition	Parenteral nutrition	All patients	p value ^a
Patients, n	165	66	231	
Time to oral nutrition, median (IQR), days	1 (1-2)	2 (1-4.25)	1 (1-2)	< 0.001 ^b
Enteral feeding, n (%)	9 (5.5)	9 (13.6)	18 (7.8)	0.05
Time from surgery to first bowel movement, mean (\pm SD), days	2.86 (\pm 1.39)	4.1 (\pm 2.6)	3.2 (\pm 1.93)	0.002 ^b
<i>Nasogastric tube</i>				
Tube at any time point after surgery, n (%)	94 (57.0)	62 (93.4)	156 (67.5)	< 0.0001
Time with tube, median (IQR), days	2 (1-3)	7 (5-11.75)	3 (1.0-6.25)	< 0.0001 ^b
Instances of vomiting or aspirates, n (%)	82 (49.7)	61 (92.4)	143 (61.9)	< 0.0001
Any dietary restriction, n (%)	79 (47.9)	56 (84.8)	135 (58.4)	< 0.0001
Time of dietary restriction, median (IQR), days	2 (1-4)	5 (2-7)	2 (1-4)	< 0.0001 ^b
Seen by a dietician, n (%)	30 (18.2)	60 (90.9)	90 (39.0)	< 0.0001
Individual dietary counselling at discharge, n (%) ^c	4 (2.4)	24 (36.3)	28 (12.1)	< 0.0001
30-day mortality, n (%)	19 (11.5)	6 (9.1)	25 (10.8)	0.81

IQR = interquartile range; SD = standard deviation

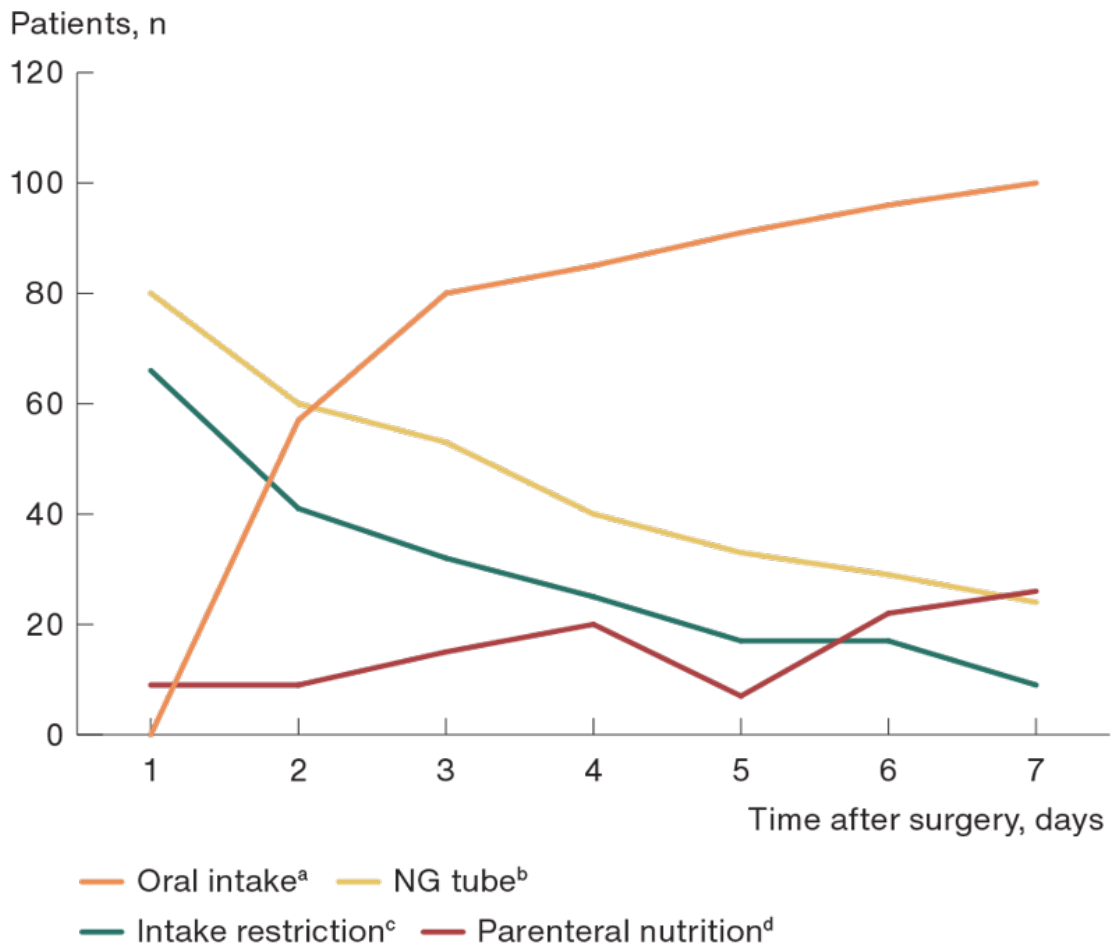
a) Tests are Fisher's exact t-test unless indicated by b.

b) Mann-Whitney U-test.

c) Includes home parenteral nutrition, home tube feeding, and prescription for nutritional supplements.

Among the 112 patients not achieving oral intake on POD 1, intake restrictions were present in 68 (60.7%). Bowel discontinuity following damage control surgery was the cause of nil per mouth in ten (8.9%) patients. **Figure 1** details the first post-operative week for these 112 patients.

FIGURE 1 Development in restrictions, intake and parenteral nutrition during the first post-operative week in patients unable to achieve oral intake on post-operative day 1.



- a) Any oral intake achieved.
- b) Presence of a nasogastric tube.
- c) Intake restrictions in place on that day.
- d) Parenteral nutrition administered.

Parenteral nutrition

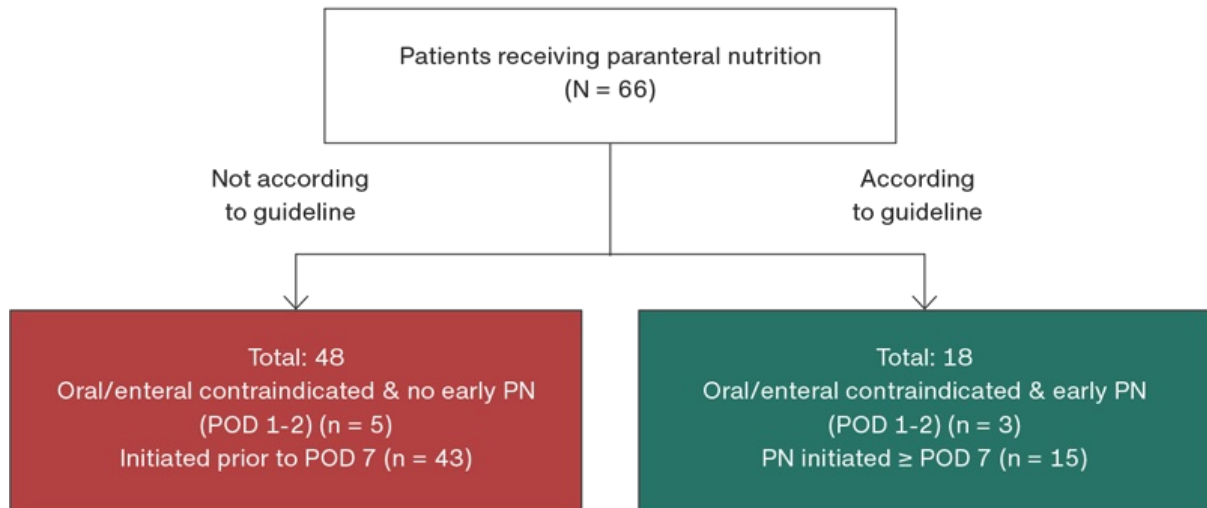
Parenteral nutrition was used in 66 patients (28.6%). The median start day of PN was POD 4 (IQR: 3-6.75), and the median duration of PN was seven days (IQR: 5-15 days). See [Supplementary file 2](#) for details on PN. Patients who received PN had significantly longer post-operative LOS at 17 days (IQR: 13-30 days) than patients not receiving PN: seven days (IQR: 4-9 days), $p < 0.0001$.

Adherence to guidelines

Among the 66 patients receiving PN, 18 (27.3%) were treated according to the ESPEN guideline. See [Figure 2](#).

Tube feeding was used in 18 patients (7.8%), predominantly during stays in the ICU (13 of 18, 72.2%).

FIGURE 2 Treatment according to the ESPEN guideline in patients receiving parenteral nutrition.



ESPEN = European Society for Clinical Nutrition and Metabolism; PN = parenteral nutrition; POD = post-operative day.

Using logistic regression, 30-day mortality was significantly associated with age > 70 years (OR = 2.69, 95% CI: 1.16; 6.72, $p = 0.02$) and use of tube feeding (OR = 8.78, 95% CI: 1.84; 42.46, $p = 0.005$).

Discussion

In this study, which compares our nutritional practice in emergency laparotomy patients to the ESPEN guidelines, we found that only 27.3% of patients receiving PN were treated according to the ESPEN guidelines. Early oral intake was achieved in only half of the patients. Parenteral nutrition was used in 66 (28.6%) patients, and the median start day of PN was POD 4. Patients receiving PN had a significantly longer lengths of stay, underwent more reoperations and had more days with intake restrictions or nasogastric tubes than patients not receiving PN.

We found that adherence to the ESPEN guideline regarding PN was low at only 27.3%. In most cases (43 of 48), lack of adherence was due to PN starting before POD 7. The early approach to PN aligns with UK studies reporting a median start of PN between days four and six in emergency surgery [2, 14, 15]. In our study, patients who received PN had significantly more days with vomiting or aspirates and more days with a nasogastric tube and dietary restrictions, $p < 0.0001$, < 0.0001 and < 0.0001 , respectively. This could indicate a risk of post-operative ileus, which has an incidence of 10-30% after abdominal surgery and may reduce the feasibility or adequacy of oral and tube feeding [7, 16, 17]. In these patients, early PN could be justified [1, 6] and might also explain why only 7.8% of the patients received enteral nutrition. The lack of nutritional prehabilitation in emergency surgery may also contribute to higher usage and earlier initiation of PN than for elective surgery.

Routine or prophylactic nasogastric intubation is not recommended, yet 58.9% had a nasogastric tube in place in the early post-operative phase [6]. The high incidence may be due to bowel dilatation and the risk of aspiration, as most patients underwent surgery for bowel obstruction (62.3%).

Previous studies have reported the use of PN in emergency surgery ranging from 14.6% to 89% [2, 5, 14]. In this study, PN was administered to 28.6% of the patients. Significantly more patients undergoing a reoperation received PN. Reoperations would increase the surgical stress inflicted on the patient and, combined with reduced food intake between primary surgery and the reoperation, extend their time in a catabolic state [18]. Patients receiving PN also had significantly longer post-operative lengths of stay, indicating that PN was primarily used in complicated cases. Despite this, the use of PN was not associated with 30-day mortality, as measured by logistic regression. The association between 30-day mortality and enteral nutrition could be explained by a low number of events and differences in disease severity, as 72.2% of the patients receiving enteral nutrition had an ICU admission.

This study identified some of the challenges faced in emergency surgery post-operative care. Despite the ERAS setup at our department, focus on post-operative nutrition is needed. According to the National Health Authority, nutritional screening should be performed on all admitted patients, but it was performed in less than five per cent of our patients [13]. The recommendation was published halfway through the study period, which may explain the poor adherence. Even so, lack of screening remains a problem on wards, and a lack of awareness seems to be a factor [19, 20].

The inability to accurately determine intake may explain why the guidelines were not followed in most cases. Determining if requirements are met is key when deciding when to switch from one feeding technique to another. Without this information, determining when PN is necessary and when it should be terminated is left largely to the clinician's discretion, likely resulting in considerable individual variation. The high incidence of nasogastric tubes, vomiting and dietary restrictions helps explain why early enteral feeding was not seen as feasible and PN was chosen instead.

This study has limitations. It was a single-centre study, and even though its challenges are well-described, our findings result from local guidelines and clinical practice. They may not be generalisable or representative of nutritional practices elsewhere. The cost and availability of PN may also influence its use, especially in places with limited resources. The consecutive design strengthens the study, with little missing data overall and a high data granularity. We provided detailed, daily information on factors likely to influence the feasibility of enteral nutrition.

Future guidelines should differentiate elective and emergency abdominal surgery, as the populations differ. The lack of prehabilitation and the post-operative challenges may warrant a different nutritional approach to emergency surgery patients. Although controversial, earlier PN may be considered and better identification of patients needing nutritional support to eliminate the delay from decision-making to initiation [15].

Conclusions

Nutritional practice differed substantially from the guidelines, with earlier PN onset than recommended. However, the duration of PN indicated that selecting patients based on clinical appearance was feasible. Future guidelines must adequately account for the challenges of post-operative nutrition in emergency laparotomy patients.

Data availability statement

The datasets generated and/or analysed during the present study are not publicly available due to privacy concerns, but are available from the corresponding author on reasonable request.

Previous presentation

A modified version of the abstract was presented as a poster at the 46th ESPEN Congress on 8 September 2024.

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Supplementary material: <https://content.ugeskriftet.dk/sites/default/files/2025-04/a11240841-supplementary.pdf>

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