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Influence of Postoperative Enteral Nutrition on Postsurgical Infections

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Abstract

Although oral and enteral feeding are options, the latter may cause problems such as pain for the patient, malposition of the tube, aspiration pneumonia, sinusitis, epistaxis, and tube occlusion. The purpose of this research was to determine whether early enteral feeding has any effect on the risk of developing significant problems after major surgery. Two hundred intensive care unit (ICU) patients at Benha University Hospitals were randomly assigned to either group A (early feeding) or group B (late feeding) in this prospective cohort observational research. Albumin, prealbumin, transferrin, ALT, AST, ALP, total bilirubin, urea nitrogen, and creatinine were not significantly different between the two groups, however white blood cell counts were significantly different. We observed that 62% of Group A scored a 3, compared to 61% of Group B; 36% of Group A scored a 4, compared to 36% of Group B; 2% of Group A scored a 4, compared to 3% of Group B; and 0% of Group A scored a 4 compared to 3% of Group B. Hypoglycemia during intervention and ICU stay duration >3 days are significantly different between the two groups. When comparing the two groups, there is a notable difference in terms of the occurrence of a new infection, the peak level of C-reactive protein throughout the ICU stay, and the length of time spent on mechanical ventilation. We conclude that early postoperative enteral feeding decreases the risk of infection complications, perhaps resulting in a shorter duration of stay and less need for intensive care.

Keywords: Postoperative Enteral Nutrition; Postsurgical Infections; routes of feeding.

1. Introduction

Patients who have had major surgery are at a higher risk of morbidity and mortality if they are malnourished (20–70% prevalence estimated), including delayed wound healing, hospital-acquired infection, postoperative problems, longer hospital stay, and death. It is widely known that an increased risk of postoperative complications, especially infectious problems, is associated with a depletion of vital nutrients brought on by the body's catabolic reaction to surgery. In order to keep cells and organs functioning normally, speed up the healing process after surgery, and lessen the risk of infection, timely and sufficient energy supply is crucial (1).

It is recommended by the Enhanced Recovery After Surgery (ERAS) Society and the European Society for Parenteral and Enteral Nutrition (ESPEN) that patients begin receiving enteral nutrition (EN) as soon as feasible after surgery if their gastrointestinal system is functioning normally (2).

Patients having major abdominal surgery benefit more with EN in terms of reduced postoperative infections, mortality, and hospital duration of stay. However, EN alone often results in insufficient energy supply in postoperative patients due to a number of factors. When EN is inadequate, PN may be used to boost energy supply to more precisely meet anticipated needs. Its usage is contentious, and there are conflicting recommendations for it (3).

Higher energy supply has been linked to better clinical outcomes in observational studies of critically sick patients. Supplemental parenteral nutrition (SPN) is often given to patients after abdominal surgery, although substantial randomised clinical studies are lacking. This randomised clinical trial aimed to compare the risk of nosocomial infections between patients at nutritional risk and intolerant of enteral nutrition (EN) who underwent major abdominal surgery and were started on either early SPN (E-SPN) (day 3 after surgery) or late SPN (L-SPN) (day 8 after surgery) (4).

The purpose of this research was to determine whether early administration of enteral nourishment reduced the risk of death from surgical complications.

2. Methods

1) The research design was an observational prospective cohort study.
2) ICU at Benha University Hospitals was the study location.
3) One Year of Research
4) Patients who are scheduled for ICU admission and who meet the study's inclusion and exclusion criteria are considered part of the study population.
5) Two factions would form:
6) Patients in Group A who begin nutritional intervention right away.
7) Patients in Group B who followed their regular diet plan.

8) Patients with any nutritional status who were admitted to the intensive care unit prior to or following planned procedures for cardiothoracic surgery, hip fractures, head injuries, or gastrointestinal diseases amenable to resection of the bowel with anastomosis, enterostomy, gastric, or oesophageal resection were eligible to participate.
9) Patients were not considered if they had insufficient renal or hepatic functioning or inflammatory bowel illness.
10) Patients will be included and categorised according to whether they need cardiothoracic, neurosurgical, orthopaedic, or general surgery as part of the sampling process.
11) Ethical Considerations: Written agreement from patients or immediate family members will be required.
12) A green light from the ethics board.
13) All patients will be given the following study instruments upon admission:
14) Complete clinical evaluation includes body mass index and weight.
15) Liver function tests include measuring serum transaminases, total bilirubin, and direct bilirubin, as well as measuring serum albumin.
16) Standardized international comparison of blood counts (CBC).
17) Creatinine and urea in the blood.
18) Said of the gas in the arterial blood.
19) Measurements of sodium, chloride, and potassium in the blood.
20) Calcium, phosphorus, and albumin in the blood.
21) Initial and final evaluation in Ta showed that Nutritional Risk Screening (NRS) was used to evaluate nutritional status during feeding approaches.ble (1).

Table (1) Initial and final screening by NRS 2022 (1)

	Step 1: Initial screening	Yes	No
1	Is BMI <20.5?		
2	Has the patient lost weight within the last 3 months?		
3	Has the patient had a reduced dietary intake in the last week?		
4	Is the patient severely ill ? (e.g. in intensive therapy)		
Yes: If the answer is 'Yes' to any question, the screening in Step 2 is performed. **No:** If the answer is 'No' to all questions, the patient is re-screened at weekly intervals. If the patient e.g. is scheduled for a major operation, a preventive nutritional care plan is considered to avoid the associated risk status.			

Step 2: Final screening			
Impaired nutritional status		**Severity of disease** (≈ increase in requirements)	
Absent **Score 0**	Normal nutritional statusA	Absent **Score 0**	Normal nutritional requirements
Mild **Score 1**	Wt loss >5% in 3 months or Food intake below 50–75% of normal re-quirement in preceding week.	Mild **Score 1**	Hip fracture* Chronic patients, in particular with acute compli-cations: cirrhosis*, COPD*. ***Chronic hemodialysis, diabetes, oncology.***
Moderate **Score 2**	Wt loss >5% in 2 months or BMI 18.5 – 20.5 + impairedgen. condition or Food intake 25–50% of normal requirement in preceding week	Moderate **Score 2**	Major abdominal surgery* Stroke* ***Severe pneumonia, hematologic malignancy.***
Severe **Score 3**	Wt loss >5% in 1 months (>15% in 3 months) or BMI <18.5 + impaired general condition or Food intake 0–25% of normal requirement in preceding week in preceding week.	Severe **Score 3**	Head injury* Bone marrow transplantation* ***Intensive care patients (APACHE>10).***
Score:	+	**Score:**	**= Total score:**
Age	if ≥ 70 years: add 1 to total score above		**= age-adjusted total score:**
Score ≥3: the patient is nutritionally at-risk and a nutritional care plan is initiated **Score < 3:** weekly rescreening of the patient. If the patient e.g. is scheduled for a major operation, a preventive nutritional care plan is considered to avoid the associated risk status.			

NRS-2002 is based on an interpretation of available randomized clinical trials. *indicates that a trial directly supports the categorization of patients with that diagnosis. Diagnoses shown in *italics* are based on the prototypes given below.

Nutritional risk is defined by the present **nutritional status** and risk of impairment of present status, due to **increased requirements** caused by stress metabolism of the clinical condition.

A nutritional care plan is indicated in all patients who are
1) severely undernourished (score = 3), or
2) severely ill (score = 3), or
3) moderately undernourished + mildly ill (score 2 +1), or
4) mildly undernourished + moderately ill (score 1 + 2).

Prototypes for severity of disease
Score = 1: a patient with chronic disease, admitted to hospital due to complications. The patient is weak but out of bed regularly. Protein requirement is increased, but can be covered by oral diet or supplements in most cases.
Score = 2: a patient confined to bed due to illness, e.g. following major abdominal surgery. Protein requirement is substantially increased, but can be covered, although artificial feeding is required in many cases.
Score = 3: a patient in intensive care with assisted ventilation etc. Protein requirement is increased and cannot be covered even by artificial feeding. Protein breakdown and nitrogen loss can be significantly attenuated.

All As soon as possible after ICU admission, and thereafter on a daily basis until release, laboratory tests will be performed.

Analyzing the Numbers

Categorical data will be provided as numbers and percentages and evaluated using the Chisquare test or Fisher's test, while the rest of the data will be analysed using SPSS. Kolmogorov-Smirnov tests will be used to check the normality of the continuous variables, and appropriate statistical tests of significance will be applied to the data. The cutoff for significance will be set at p0.05.

3 Outcomes

Patients in Group A had a mean age of 60.3, whereas those in Group B averaged 59.8.

Males made up 62% of the study population in group A and 60% of the population in group B. There was no discernible difference between the two groups statistically. Table (1).

Table (1) Demographic data

	Group A Early Nutrition Strategy (n = 115)	**Group B Late/Usual Nutrition strategy (n = 114)**	**P**
Sex, No. (%)			0.871
Male	62 (62)	60 (60)	
Female	38 (38)	40 (40)	
Age, year			
Mean(SD)	60.3 (12.2)	59.8 (10.3)	0.685
Height, cm			
Mean(SD)	165.1 (8.1)	164.5 (8.4)	0.923
Weight, kg			
Mean(SD)	62.7 (11.0)	62.1 (11.4)	0.894
BMI			
Mean(SD)	23.0 (3.2)	22.8 (3.0)	0.571
Diabetes mellitus			
No. (%)	20(20)	23(23)	0.483

Table (2) Diseases characteristics

Diagnosis, No. (%)	**Group A Early Nutrition Strategy (n = 100)**	**Group B Late/Usual Nutrition strategy (n = 100)**
Gastric cancer	33 (33)	31 (31)
Colorectal cancer	35 (35)	46 (46)
Pancreatic cancer	10 (10)	14 (14)
Cardiothoracic diseases	20 (20)	3 (3)
Other gastrointestinal cancers	2 (2)	6 (6)

Three-thirds of the study population had gastric cancer, 35% had colorectal cancer, 10% had pancreatic cancer, 20% had cardiothoracic illnesses, and 2% had other gastrointestinal malignancies; these percentages were all seen in group A. Threeteen percent of group B had pancreatic cancer, forty-six percent had colon cancer, three percent had cardiothoracic disorders, and six percent had other gastrointestinal malignancies. Table (2).

Table (3) lab findings

Variables	**Group A Early Nutrition Strategy (n = 100)**	**Group B Late/Usual Nutrition Strategy (n = 100)**	**p**
Albumin, g/dL	5.21 (0.52)	4.06 (0.46)	0.791

Prealbumin, mg/dL	23.40 (6.02)	22.32 (6.05)	0.811
Transferrin, mg/dL	236 (66)	220 (74)	0.101
Hepatic and renal function			
ALT, U/L	24.4 (26.7)	24.6 (20.5)	0.983
AST, U/L	24.7 (19.6)	27.6 (22.1)	0.192
ALP, U/L	100.4 (107.8)	104.9 (100.0)	0.674
Total bilirubin, mg/dL	1.62 (3.82)	1.38 (2.30)	0.091
Urea nitrogen, mg/dL	15.27 (5.21)	15.35 (4.62)	0.974
Creatinine, mg/dL	0.83 (0.22)	0.81 (0.25)	0.861

Table 1 shows that there is no statistically significant difference between the two groups with respect to albumin, prealbumin, transferrin, alanine aminotransferase, alkaline phosphatase, total bilirubin, urea nitrogen, or creatinine (3).

Table (4) lab findings.

Metabolism-related index	**Group A Early Nutrition Strategy (n = 100)**	**Group B Late/Usual Nutrition Strategy (n = 100)**	**p**
Glucose, mg/dL	93.69 (28)	91.89 (30)	0.426
Total cholesterol, mg/dL	159.85 (79.54)	160.23 (63.32)	0.951
Triglyceride, mg/dL	122.12 (94.69)	134.51 (115.93)	0.218
HDL-C, mg/dL	53.67 (38.22)	47.10 (16.22)	0.175
LDL-C, mg/dL	100.77 (29.34)	101.54 (31.66)	0.845
Inflammatory biomarkers			
White blood cell, /µL	6260 (2370)	5830 (1740)	0.042*
C-reactive protein, mg/dL	0.93 (2.01)	0.72 (1.27)	0.291

When comparing the two groups' white blood cell counts, there is a clear divide (4).

Table (5) NRS-2002 score of the study population

NRS-2002 score **No. (%)**	**Group A Early Nutrition Strategy (n = 100)**	**Group B Late/Usual Nutrition Strategy (n = 100)**	**p**
3	62 (62)	61 (61)	0.661
4	36 (36)	36 (36)	0.421
≥5	2 (2)	3 (3)	0.733

A total of 62% of Group A members and 61% of Group B members were found to have an NRS-2002 score of 3, 36% of Group A members and 36% of Group B members were found to have an NRS-2002 score of 4, and 2% of Group A members and 3% of Group B members were found to have an NRS-2002 score of 4. Table (5).

Table (6) functional Outcomes of the study population

	Group A Early Nutrition Strategy (n = 100)	**Group B Late/Usual Nutrition Strategy (n = 100)**	**p**
Nutrition-related complication **Hypoglycemia during intervention no. (%)** **Primary outcome**	6 (6)	1 (1)	0.001*

ICU stay Duration >3 days			
no. (%)	45 (45)	51 (51)	0.02*

Hypoglycemia during intervention and intensive care unit (ICU) stay are significantly different between the two groups. Time Period > 3 Days Table (6).

Table (7) functional Outcomes of the study population

Secondary outcome	Group A Early Nutrition Strategy (n = 100)	Group B Late/Usual Nutrition Strategy (n = 100)	p
New infection — no. (%)			
Non specific infection	23 (23)	26 (26)	0.04*
Airway or lung	16(16)	19 (19)	
Bloodstream	6 (6)	8 (8)	
Wound	3 (3)	4 (4)	
Urinary tract	3 (3)	3 (3)	
Inflammation			
peak C-reactive protein level during ICU stay	58 (58)	76 (76)	<0.001*
Mechanical ventilation			
Duration mean (sd)	2 (1)	3 (1)	0.711
Duration >2 days — no. (%)	34 (34)	41 (41)	0.006*

Differences in the Table of New Infections, Peak C-Reactive Protein Levels during Intensive Care Unit Stays, and the Length of Mechanical Ventilation are Statistically Significant between the Two Groups (7).

4. Discussion

The mean age patients in group A was 60.3, whereas patients in group B's averaged 59.8. In group A, 62% of the participants were male, whereas in group B, 60% were. Neither group was significantly different from the other statistically.

Meyer et al. found similar results, reporting no statistically significant changes in clinical variables such as gender, BMI, or incision style (all P > 0.05). Age, incision length, surgery duration, hospital stay, and underlying conditions all varied significantly (P 0.05). (5).

Khazaei et al., who found no statistically significant changes in patient demographics between the two groups, found similar findings, with the exception of a slightly older median age in group A. Group A had 8.7 percent and Group B had 33.3 percent of problems 30 days after surgery (p 0.04). Both the mean and median length of stay (LOS) were substantially different between Groups A and B (7.4 4.4% vs 10.3 5.4 days) (6).

Among the study population, 33% had gastric cancer, 35% had colorectal cancer, 10% had pancreatic cancer, 20% had cardiothoracic illnesses, and 2% had other gastrointestinal malignancies; these percentages were all observed in group A. For those in Group B, 31% were diagnosed with stomach cancer, 46% with colon cancer, 14% with pancreatic cancer, 3% with heart problems, and 6% with other types of gastrointestinal malignancies.

Probst et al. found similar outcomes, noting that only three studies have reported that early EN in combination with SPN achieved the energy target requirement and rapidly improved clinical prognosis in patients undergoing abdominal surgery. These three studies included two prospective randomised clinical trials (one in patients with esophageal cancer and one in elderly patients with gastrointestinal cancer) and a retrospective cohort study (in patients undergoing pancreatic-duodenectomy) (7).

Two types of patients receiving elective partial colectomies were illustrated by Couture et al. The first group got elemental food by jejunal feeding, whereas the second received an isotonic intravenous infusion of dextrose. Patients who were given parenteral nourishment had no serious problems compared to those who were not. In patients having significant surgeries of the lower gastrointestinal system, they found that early postoperative eating was beneficial (8).

Risk factors for postoperative infection after abdominal surgery were identified by Vogelsang et al. Postoperative infections were considered an independent variable, as were other covariates with a P value of 0.05 or above. Age >60, surgical incision length >10 cm, operation duration >2 h, hospital stay >10 d, and a mix of fundamental illnesses were shown to be risk factors for postoperative infection in patients having abdominal surgery, according to a binary logistic regression study (9).

Overall, Lytvyn et al. found a 45 percent risk of complications (27 of 60). There was a 33% complication risk among individuals who were alert before surgery (3 of 10). Preoperatively responsive individuals had a 48% complication rate (24 of 50). There was no discernible difference between the groups statistically (10).

Artificial nutrition with an immune-enhancing diet and basic crystalloid and fluid replacement were both shown to have similar postoperative complication rates in patients with gastrointestinal (GI) cancer by Willinge et al. Complication rates were higher among the treated patients, at 44%, than among the control group, at 33%. Furthermore, the median LOS was same across the two groups (11 vs. 10 days). It should be noted that the average treatment group participant consumed only around 30% of the daily need for immune-supporting nutrients (11).

Patients with gastric cancer who were given enteral mononitration after surgery had a significantly decreased risk of surgical wound healing issues (0% vs. 26.7%; P = 0.005) and a greater wound deposition of hydroxyproline (59.7 nmol vs. 28.0 nmol; P = 0.0018). The reduced incidence of anastomotic leak in individuals receiving mononitrations may be attributable to these results (12).

Albumin, prealbumin, transferrin, ALT, AST, ALP, total bilirubin, urea nitrogen, and creatinine were not significantly different between the two groups, however white blood cell counts were significantly different.

Serum albumin and prealbumin levels were both higher in group one at discharge than in group two, but these findings were at odds with those found by Zhao et al. (albumin:3.55 [0.76] vs 3.37 [0.45] g/dL ;mean difference,0.19g/dL; 95 percent CI,0.03-0.35g/dL;P=.02; prealbumin:15.84 [3.81] vs13.0 [3.6 (13).

I concur.We found no statistically significant difference between serum ALB and Hb concentrations (P > 0.05), which is consistent with the findings of Couture et al. The postoperative infection group had a greater decline in PA and RBP compared to the noninfecting group, as measured by laboratory testing of blood nutritional indices (all P0.05) (8).

According to the research by Huq et al., the median levels of albumin and transferrin in the malnourished group were 0.57 mmol/l and 49 mmol/l, respectively, whereas the median values in the fed group were 0.63 mmol/l and 56.5 mmol/l (14).

We observed that 62% of Group A scored a 3, compared to 61% of Group B; 36% of Group A scored a 4, compared to 36% of Group B; 2% of Group A scored a 4, compared to 3% of Group B; and 0% of Group A scored a 4 compared to 3% of Group B. Hypoglycemia during intervention and ICU stay duration >3 days are significantly different between the two groups.

In critically sick patients, Wischmeyer et al. found that early optimization of energy supplies by SPN beginning 4 days after ICU admission decreased nosocomial infection (15).

In terms of new infections, highest C-reactive protein levels during intensive care unit stays, and median times on mechanical ventilation, there are substantial differences between the two groups.

Within 24 hours of ICU admission, Doig et al. found no difference in the risk of infectious complications between early PN and early EN or routine nutrition in critically ill people with relative contraindications. These findings contrast with the present study's findings, which may be attributable to differences in the illnesses examined, the date of PN initiation, or both (day 3 after surgery in our study). Evidence from the Early PN Trial, however, suggests that early PN is therapeutically helpful when EN is failed in critically sick patients, since it may lower the amount of time patients need mechanical ventilation and the overall cost of treatment (16).

Fifthly, a summary

Nutrition should ideally be given via the enteral route. Patients undergoing colon resection may receive enteral nourishment as early as a few hours after surgery without experiencing any negative side effects. In addition, normal bowel movements resume after a few days. In certain surgical patients, early postoperative enteral feeding has shown therapeutic advantages. Prevention of infectious problems after surgery with early enteral feeding shortens hospital stays and, perhaps, decreases the requirement for critical care.

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