DOI: https://doi.org/10.3329/medtoday.v37i1.79248

Original Article

OPEN ACCESS

Influence of Nutritional Support Methods on Postoperative Well-being in Pancreaticoduodenectomy Patients

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Abstract

Introduction: *Early enteral feeding has gained attention as a potential method to enhance postoperative recovery in patients undergoing pancreaticoduodenectomy. Traditionally, postoperative feeding was delayed to stabilize intestinal anastomoses, but recent evidence suggests that early enteral feeding may offer significant advantages. By examining the effects of early versus delayed enteral feeding, we aim to understand its impact on postoperative outcomes and guide best practices in perioperative care.* ***Materials and Methods:*** *This prospective case-control study took place in the Department of Surgery of Bangabandhu Sheikh Mujib Medical University (BSMMU), Dhaka. This study was conducted from 1st January to 31st December 2016. A total of 30 patients were selected as study subjects by purposive sampling technique. Patients were divided into two groups; case (Group I, n=15) and control (Group II, n=15). Statistical analysis of the results was obtained by using Statistical Packages for Social Sciences (SPSS-21.0). Statistical significance was set at p<0.05 and the confidence interval was set at 95% level.* ***Result:*** *The study compared early and delayed enteral feeding in pancreaticoduodenectomy patients. Demographic and preoperative nutritional statuses were similar between groups. Significant differences were observed in intraoperative metrics, with the case group showing less blood loss (540.00 ± 91.03 ml vs. 613.33 ± 83.38 ml, p=0.029) and shorter operation times (4.40 ± 1.12 hrs vs. 5.30 ± 0.65 hrs, p=0.012). Postoperatively, hemoglobin levels and lymphocyte counts increased more in the case group, indicating better recovery. Differences in surgical techniques also varied significantly between groups.* ***Conclusion:*** *This study evaluated the effects of early versus delayed enteral feeding on postoperative outcomes in pancreaticoduodenectomy patients. The results show that early enteral feeding enhanced lymphocyte counts, indicating better immune function.*

Keywords: *Nutritional Support, Pancreaticoduodenectomy, Hemoglobin, Lymphocyte.*

Number of Tables: 04;Number of Figures: 04; Number of References: 12; Number of Correspondences: 03.

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Introduction:

Pre-existing malnutrition is a significant challenge in patients requiring a pancreaticoduodenectomy[1]. Complete nutritional correction is often unattainable before surgery due to disease progression and its effects. These patients face increased operative stress, as the procedure involves extensive dissection, surgical resections that affect digestion, multiple anastomoses, and prolonged operation times, all of which exacerbate nutritional deficiencies and contribute to high postoperative morbidity[2]. Malnutrition compromises immune function, increases infection rates, impairs cardiovascular reflexes, and delays wound healing and recovery[3]. This can further deteriorate during the postoperative phase due to fasting and subsequent treatments, making nutritional support critical for reducing complications. Clinical practice in postoperative feeding after pancreaticoduodenectomy is inconsistent, with various approaches including intravenous fluids, parenteral nutrition, and enteral feeding through different routes. Perioperative nutritional supplements, including early enteral feeding

Received: 03 October 2024 *Accepted revised version:* 20 December 2024

(EOF), have been shown to improve outcomes, reduce postoperative complications, and enhance immune function, lowering sepsis risk and hospital stays[4]. Compared to total parenteral nutrition (TPN), EOF has been associated with fewer incidences of pancreatic fistulas, hemorrhages, and infectious complications[5]. Enteral feeding is more physiological, cost-effective, and beneficial as it stimulates enterocyte growth, improves mucosal barriers, and reduces bacterial translocation, promoting natural nutrition without the drawbacks of prolonged TPN[6]. The European Society for Parenteral and Enteral Nutrition advocates for early enteral feeding in patients undergoing major gastrointestinal surgeries like pancreaticoduodenectomy, though complications such as diarrhea and feeding intolerance are possible[7]. Nutritional support is a cornerstone of postoperative care, particularly in the context of pancreaticoduodenectomy. Adequate nutrition is crucial for promoting wound healing, reducing the risk of infections, and supporting overall recovery. Traditional methods of nutritional support have included enteral feeding, but recent advancements have introduced more sophisticated approaches, such as individualized enteral nutrition and tailored parenteral nutrition[8]. Pancreaticoduodenectomy is a common procedure at Bangabandhu Sheikh Mujib Medical University (BSMMU), where early postoperative parenteral nutrition is standard, with enteral feeding typically initiated on the 6th or 7th postoperative day. This study aims to evaluate the influence of nutritional support methods on postoperative well-being in pancreaticoduodenectomy patients.

Materials and Methods:

This prospective case-control study took place in the Department of Surgery of Bangabandhu Sheikh Mujib Medical University (BSMMU), Dhaka, from 1st January to 31st December 2016. Patients operated by pancreaticoduodenectomy at Bangabandhu Sheikh Mujib Medical University (BSMMU), were considered as the study population. A total of 30 patients were selected as study subjects by purposive sampling technique. Patients were divided into two groups; case (Group I, n=15) and control (Group II, n=15). In case groups, enteral feeding was started 48 48hrs after operation, in the first 24 hrs. drinking water, ORS, green coconut water, 20-30 ml per hrs. trough NJ (naso-jejunal) tube, then gradually increased up to 5th POD, and include clear soaps, formulated balanced diet assure powder, dal water, with parenteral 25% glucose saline 500ml daily amino acids and fatty solution 500ml every alternate day, vit B complex, vit C daily .9% N/S 1000 ml, potassium 40 mg daily. After calculation of daily calorie and fluid requirements. Fluid was given 30-40ml/kg/day and calorie also 30-40kca/kg/day. This schedule continued up to the 5th POD then the n-j tube and allowed oral feeding by soft rice with fish vegetables and fruits. Also, continue parenteral amino acid and fatty sol. In the control group, TPN was continued up to the 6th or 7th POD. All necessary data were collected in a predesigned data collection sheet. Then the data was entered into the computer and statistical analysis of the results was obtained by using Statistical Packages for Social Sciences (SPSS-21.0) (SPSS Inc, Chicago, IL, USA). Different statistical methods were adopted for data analysis. The results were presented in tables and figures as necessary and compared by t-test, chi-square test, and Fisher's Exact test. The statistical terms included in this study are mean, standard deviation, and percentage. Statistical significance was set at $p<0.05$ and the confidence interval was set at 95% level. Informed written consent was taken from the participants. Ethical clearance was taken from the ethics committee of BSMMU. Inclusion Criteria were Patients having Pancreaticoduodenectomy operation, Patients willing to enroll in the study and Patients aged 18 or more than 18 years. Exclusion criteria were Patients having severe co-morbidities, Patients aged less than 18 years and The patient not willing to enroll in the study.

Results:

Table I: Demographic difference between two groups (N=30):

Parameter	Group		p-value
	Case (n=15)	Control (=15)	
Age (years)			
<35	2 (13.3) #	3 (20.0)	0.581[a]
35-45	3 (20.0)	4 (26.7)	
45-55	7 (46.7)	6 (40.0)	
>55	3 (20.0)	2 (13.3)	
Mean ± SD	49.13± 11.65	46.87 ± 10.56	
Sex			
Male	6 (40.0)	9 (60.0)	0.273[b]
Female	9 (60.0)	6 (40.0)	
Diagnosis			
Pancreatic head malignancy	1 (6.7)	2 (13.3)	0.824[b]
Ampullary carcinoma	10 (66.7)	9 (60.0)	
Lower bile duct carcinoma	4 (26.7)	4 (26.7)	
Co-morbidities			
DM	5 (33.3)	4 (26.7)	0.999[c]
HTN	6 (40.0)	5 (33.3)	0.705[b]
Bronchial asthma	2 (13.3)	2 (13.3)	0.999[c]

[a]t test was done to measure the level of significance.

[b]Chi square test was done to measure the level of significance.

cFisher's Exact test was done to measure the level of significance.

#Figure within parentheses indicates in percentage.

Table I shows the Demographic difference between the two groups. The maximum patient age in both groups is between 35—and 55 years. (66.7%). The mean age of patients in case groups was 49.13 ± 11.65 and control groups were 46.87 ± 10.56. Maximum patients in both groups diagnosis were ampullary carcinoma. Common Comorbidities DM and HTN in both groups. There were no statistically significant differences in both groups according to the distribution of age, sex, diagnosis, and comorbidities.

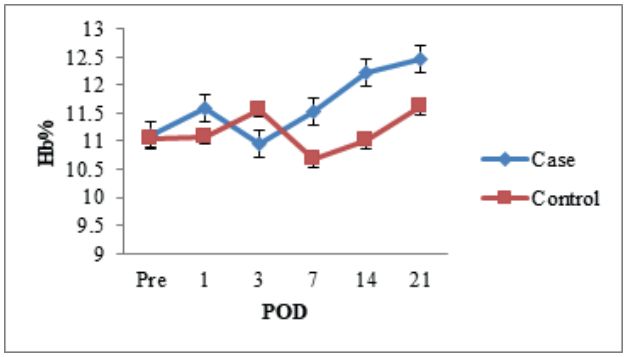

Figure 1: Postoperative Hb level between two groups

Figure 1 shows the comparison of postoperative Hb levels between the two groups. Serum Hb levels were almost similar in both groups in the first 3 PODs but the Hb level increased significantly in the case group than the control group from 7 POD onward of the follow-up period.

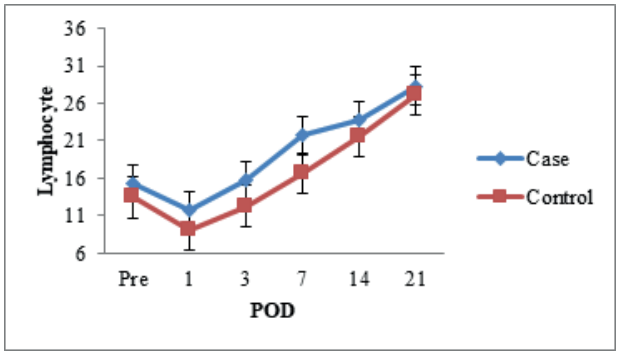

Figure 4: Postoperative lymphocyte level between two groups

Figure 4 shows the postoperative lymphocyte count of the two groups.

Lymphocyte count decreased in the initial post-operative period up to the 3rd pod in both groups, but the lymphocyte count increased in the case group significantly more than the control group from the 3rd POD onward.

Table II: Differences in nutritional status of patients before surgery between two groups (N=30)

Parameter	Group		p-value*
	Case (n=15)	Control (n=15)	
BMI (kg/m^2)			
Underweight	1 (6.7)	0 (.0)	-
Normal	12 (80.0)	14 (93.3)	
Overweight	2 (13.3)	1 (6.7)	
Mean ± SD	22.44 ± 2.66	22.15 ± 2.00	0.736
Serum Albumin	31.47 ± 4.34	32.13 ± 4.87	0.695
Total protein	66.00 ± `.69	65.7 ± 1.18	0.804

*A t-test was done to measure the level of significance.

#Figure within parentheses indicates in percentage.

Table II shows Differences in the nutritional status of the patient before surgery between the two groups. The mean BMI in the case group was 22.44 ± 2.66(kg/m^2) and control group 22.15 ± 2.00(kg/m^2) Most of the patients in the case group(80%), and control group (93.3%) were in normal BMI (18---25) kg/m^2. The mean serum albumin level was 31.47 ± 4.34(mg/l) in the case group and 32.13 ± 4.87(mg/l) in control group. The Differences in the nutritional status of patients before surgery between the two groups were not statistically significant.

Table III: Differences in intraoperative findings & measures taken between two groups (N=30)

Parameter	Group		p-value
	Case (n=15)	Control (n=15)	
CV line placement	15 (100.0)	15 (100.0)	-
Epidural analgesia	10 (66.7)	8 (53.3)	0.456**
Blood loss	540.00 ± 91.03	613.33 ± 83.38	0.029*
Operation time (hours)	4.40 ± 1.12	5.30 ± 0.65	0.012*
Blood transfusion (units)	2.60 ± 0.63	2.73 ± 0.70	0.590*

*A t-test was done to measure the level of significance.

**A Chi-square test was done to measure the level of significance.

Data was expressed as Mean ± SD.

Table III shows Differences in intra-operative findings & measures taken between the two groups. In all patients in both groups, CV lines were placed, and epidural analgesia was given (66.7%) patients in the case group, and (53.3%) patients in the control group. Differences in CV line placement, Epidural analgesia, and per-operative blood transfusion between the two groups were not statistically significant. But mean blood loss (ml) in case group 540.00 ± 91.03, wherein control group 613.33 ± 83.38, (p-value .029), and operation time(hrs.) in case group 4.40 ± 1.12 wherein control group 5.30 ± 0.65, (p-value .012), the difference between two groups were statistically significant.

Table IV: Differences in operational technique between two groups (N=30)

Parameter	Group		p-value
	Case (n=15)	Control (n=15)	
Pancreatico jejunal anastomosis			
Duct to mucosal	13 (86.7) #	3 (20.0)	0.001*
End to end	2 (13.3)	12 (80.0)	
Stent placement			
Yes	15 (100.0)	15 (100.0)	-
No	0 (.0)	0 (.0)	
Biliary-enteric anastomosis stent placement			
Yes	10 (66.7)	15 (100.0)	0.042**
No	5 (33.3)	0 (.0)	
Gestrojejunostomy			
Stapler	5 (33.3)	4 (26.7)	0.999**
Hand sewing	10 (66.7)	11 (73.3)	

*A Chi-square test was done to measure the level of significance.

**Fisher's exact test was done to measure the level of significance.

#Figure within parentheses indicates in percentage.

Table IV shows the Differences in operational technique between the two groups. The difference between the Pancreatico-jejunal anastomotic technique (p-value .001) and the number of biliary-enteric stent placements (p-value .042)

was statistically significant. Several Pancreatico jejunal stent placement and gastro-jejunostomy techniques found no statistical difference between the two groups.

Discussion:

The single-centered case-control study has been taken to evaluate the effect of early and delayed starting of enteral feeding after pancreaticoduodenectomy. Patients of early enteral feeding are included in the case group and patients of delayed enteral feeding are in the control group. In the past patients who underwent major gastro-intestinal surgeries having an intestinal anastomosis were not fed orally early, primarily to stabilize the intestinal anastomosis to avoid possible mechanical pressure induced by food passage. However, it remains unclear whether delayed postoperative oral feeding would enhance recovery after surgery, especially since a period of starvation following GIT surgery showed no benefit to patients[9]. This study evaluated the differences in nutritional status, postoperative hemoglobin, and lymphocyte count intraoperative findings, and operational techniques between two groups of patients undergoing pancreaticoduodenectomy. Our analysis revealed several key insights into how these factors may influence surgical outcomes and recovery. This study indicates that there were no statistically significant differences in the nutritional status of patients before surgery between the two groups. Both groups had similar mean BMI, serum albumin, and total protein levels, suggesting that baseline nutritional status did not differ markedly between them. The mean BMI was within the normal range for most patients, and serum albumin and total protein levels were consistent with typical preoperative values observed in surgical patients[10]. This study highlights significant differences in intraoperative metrics between the two groups. Notably, the case group experienced less blood loss (540.00 ± 91.03 ml) compared to the control group (613.33 ± 83.38 ml), with a p-value of 0.029, indicating statistical significance. This reduced blood loss may reflect differences in surgical technique or patient management strategies. Similarly, the operation time was significantly shorter in the case group (4.40 ± 1.12 hours) compared to the control group (5.30 ± 0.65 hours) with a p-value of 0.012. Shorter operation times have been associated with reduced perioperative complications and improved recovery[11]. Post-operative HB levels increase much more in the case group than in the control group. Serum albumin levels also increase more in the case group than control group. Lymphocyte counts initially pod similar in both groups but significantly increased in the case group than the control group later after starting early enteral feeding. That means early enteral feeding improves immunological function than delayed feeding. Recent research has shown that EOF enhances immunocompetence, decreases clinical infection rates, maintains gut structure and function, and can potentially attenuate, catabolic stress responses in patients after surgery[8,12].

Conclusion:

This study evaluated the effects of early versus delayed enteral feeding on postoperative outcomes in pancreaticoduodenectomy patients. The results show that early enteral feeding enhanced lymphocyte counts, indicating better immune function. These findings suggest that early enteral feeding supports better nutritional recovery, reduces surgical complications, and improves overall postoperative well-being. Future research could further validate these benefits in larger studies.

Conflict of Interest: None.

Acknowledgement:

We would like to express our sincere gratitude to the Department of Surgery at Bangabandhu Sheikh Mujib Medical University (BSMMU), Dhaka, for their support and collaboration in conducting this study. Special thanks to all the patients who participated in this research. We also extend our appreciation to the nursing staff and surgical team for their invaluable assistance during the postoperative care of the patients. Lastly, we acknowledge the ethical review board of BSMMU for their guidance and approval of this study.

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