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Comparative Analysis of Enteral Feeding vs. Total Parenteral Nutrition in Post-Pancreaticoduodenectomy Recovery: Complications, and Length of Hospital Stay

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Abstract
Introduction: *Pancreaticoduodenectomy, a major surgical procedure commonly performed for pancreatic or periampullary cancers, is associated with significant postoperative complications and prolonged recovery times. This study is undertaken to compare enteral feeding vs. total parenteral nutrition in post-pancreaticoduodenectomy recovery in terms of complications, and length of hospital stay.*
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.*
Results: *In this study, the majority of patients in both groups were aged 55 years and above. The postoperative hemoglobin level increased significantly in the case group (12.22 mg/dL) compared to the control group (11.01 mg/dL). There were two mortalities (13.3%) in the control group, with none in the case group. Wound infections were significantly higher in the control group (66.7%) compared to the case group (13.3%) ($p=0.003$). The case group had shorter hospital stays ($p=0.011$) and higher postoperative weight gain ($p=0.028$). Other complications showed no statistically significant differences.*
Conclusion: *This study demonstrates that early enteral feeding (EOF) after pancreaticoduodenectomy is a safe, feasible, and effective nutritional support strategy. It significantly reduces postoperative complications, particularly wound infections, shortens the length of hospital stay, and promotes weight gain compared to delayed feeding. EOF patients showed improved postoperative outcomes, without an increase in complication rates, supporting its role as a beneficial intervention in post-pancreaticoduodenectomy care.*
Keywords: *Early enteral feeding, Pancreaticoduodenectomy, Total Parenteral Nutrition*

I. INTRODUCTION

Pre-existing malnutrition is a major problem that requires a Pancreaticoduodenectomy operation [1]. Full correction of nutritional deficiency is not always possible preoperatively due to the nature and secondary effect of the disease. Operative stress is also higher in these patients as the procedure needs wide dissection, surgical resections that affect the digestive process, also need multiple anastomoses, and long operation time. All these factors produce severe nutritional deficiency in such patients which is the cause of high postoperative morbidity [2]. Malnutrition impairs immune function and increases the rate of infection. Cardiovascular reflexes, vasoconstrictor response to cold, and heat conservation are also affected by malnutrition [3]. Malnutrition also contributes to increased surgical risk, poor wound healing, anastomotic failure, and slow recovery from surgery. This malnutrition can get even worse during the postoperative period due to fasting and subsequent treatments. So operative feeding is very important for them to reduce complications. Clinical experience focusing on post-operative feeding after pancreaticoduodenectomy is very limited. There is significant clinical practice variation

including intravenous fluid therapy, peripheral and central line nutrition, feeding jejunostomy, nasojejunal, and nasoduodenal tube feeding. Perioperative nutrition supplements including early enteral feeding have been demonstrated to be effective in improving clinical outcomes and decreasing postoperative complications by repairing immune functions, reducing risk of sepsis, and length of hospital stay.[4]).incidence of pancreatic fistulas, hemorrhages, and infectious complications are more common in the case of TPN [5]. Enteral feeding is more physiological, beneficial, practicable, and cost-effective.EOF has been found to stimulate enterocyte growth, improve mucosal barrier functions, decrease bacterial translocation, and stimulate small bowel peristalsis. EOF can provide natural and adequate nutrition. Therefore, avoiding the need for prolonged parenteral nutrition which can lead to intestinal membrane atrophy and higher hospital expenses.[6] The European Society for Parenteral and Enteral Nutrition recommends routine use of early enteral nutrition in case of patients undergoing major gastrointestinal surgery for cancer including pancreaticoduodenectomy. However, enteral feeding is associated with complications such as diarrhea, abdominal distention, abdominal cramps feeding intolerance [7]. Therefore, this can be said that the optimal nutritional method after pancreatic surgery has still not been identified. Pancreaticoduodenectomy operation is frequently performed in different units of the Department of Surgery of Bangabandhu Sheikh Mujib Medical University (BSMMU). The current practice is parenteral nutrition in the early postoperative period for maintenance of nutritional status and enteral feeding is usually started at $6^{th}/7^{th}$ POD. This study is undertaken to compare enteral feeding vs. total parenteral nutrition in post-pancreaticoduodenectomy recovery in terms of complications, and length of hospital stay.

II. 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:

- Patients having Pancreaticoduodenectomy operation.
- Patients willing to enroll in the study.
- Patients aged 18 or more than 18 years.

Exclusion criteria:

- Patients having severe co-morbidities
- Patients aged less than 18 years.
- The patient not willing to enroll in the study.

III. Results

Table 1: 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] test was done to measure the level of significance.
[b]Chi square test was done to measure the level of significance.
[c]Fisher's Exact test was done to measure the level of significance.
[#]Figure within parentheses indicates in percentage.

Table 1 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.

Table 2: Differences in clinical presentation between two groups (N=30)

Parameter	Group		p-value
	Case (n=15)	Control (n=15)	
Abdominal pain	9 (60.0)	7 (46.7)	0.464*
Jaundice	11 (73.3)	13 (86.7)	0.651**
Fever	3 (20.0)	4 (26.7)	0.999**
Weight loss	11 (73.3)	4 (26.7)	0.011*
Pruritus	9 (60.0)	8 (53.3)	0.713*

*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 2 shows Differences in clinical presentation between the two groups. Regarding clinical presentation, the maximum number of patients present with jaundice (73.3%) in case groups and (86.7%) in control groups. Abdominal pain (60%) in case groups and (46.7%) in control groups. Weight loss (60%) in case groups and (53.3%) in control groups.pruritis (60%) and (53.3%) respectively. There were few patients with fever. No statistically significant difference in clinical presentation between the two groups.

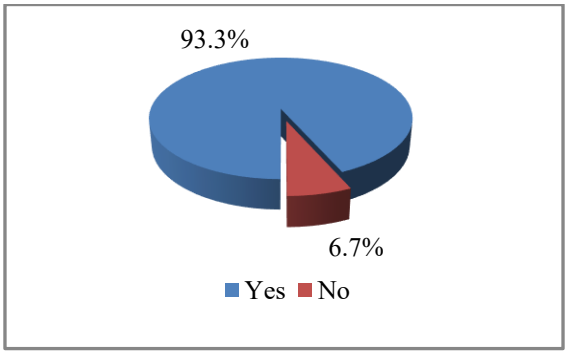

Figure 1: Distribution of post-operative early enteral feeding tolerance in the case group

Figure 1 shows the post-operative early enteral feeding tolerance of the case group. Maximum patients in case group more than 90% well tolerated early enteral feeding. Only one patient developed abdominal cramps, and vomiting.

Table 3: Differences in complications between two groups (N=30)

Parameter	Group		p-value
	Case (n=15)	Control (n=15)	
Mortality	0 (.0) [#]	2 (13.3)	0.483**
Morbidity			
Wound infection	2 (13.3)	10 (66.7)	0.003*
Wound dehiscence	0 (.0)	3 (20.0)	0.224**
Pancreatic leak	1 (6.7)	3 (20.0)	0.598**
Biliary leak	0 (.0)	4 (26.7)	0.100**
Renal dysfunction	3 (20.0)	3 (20.0)	0.999**
Respiratory infection	2 (13.3)	3 (20.0)	0.999**

*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 3 shows the postoperative difference in mortality and morbidity between the two groups.

There are two postoperative mortality (13.3%), all are in the control group, and no mortality in the case group. Wound infection occurs much more in the control group (66.7%) than case group (13.3%), which is statistically significant, p-value (.003). Wound dehiscence is also more common in the control group (20%) than case group (0%). Pancreatic leaks were more in the control group (20%) than case group (6,7%), and Biliary leaks in the control group (26.7%) but not in the case group, though statistically not significant (p-value,.1). Renal dysfunction and Respiratory infection rate almost similar in both groups.

Table 4: Differences in length of hospital stay and post-operative weight gain between two groups (N=30)

Length of hospital stay	Group		p-value
	Case (n=15)	Control (n=15)	
Length of hospital stay after operation (days)	13.20 ± 4.48	17.80 ± 4.80	0.011*
Weight gain	11 (73.3)	5 (33.3)	0.028**

*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 4 shows Differences in length of hospital stay and post-operative weight gain between the two groups.

The mean length of postoperative hospital stay (days) in the control group is (17.80 ± 4.80) and in the case group is (13.20 ± 4.48), p-value is .011, difference is statistically significant. This table also shows the post-operative weight gain of the patient in the case group (73.3%) whereas in the control group (33.3%), the p-value is .028 difference of which is statistically significant.

IV. 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 our study, postoperative early enteral feeding was well tolerated in the case group (93.3%) which is more than a previous study by Baradi et al [8]. The mortality rate shows a discrepancy, with two cases (13.3%) occurring in the control group, while no mortality was recorded in the case group. Although this is clinically relevant, the difference was not statistically significant (p=0.483). Previous studies have emphasized that enteral feeding may reduce mortality in surgical patients through better postoperative outcomes [8]. One of the most striking findings is the difference in wound infection rates between the groups. The control group had a significantly higher incidence of wound infections (66.7%) compared to the case group (13.3%), with a p-value of 0.003, making this finding statistically significant. This aligns with existing literature showing that early enteral feeding can enhance immune function and reduce the risk of infection [9]. Reduced wound infection rates in the case group likely reflect the protective effect of nutritional support on wound healing and immune competence. Wound dehiscence occurred in 20% of the control group but was absent in the case group, though this difference was not statistically significant (p=0.224). Similar trends were noted for pancreatic leaks and biliary leaks, where higher occurrences were seen in the control group (20% and 26.7%, respectively) compared to the case group (6.7% and 0%, respectively). Despite the lack of statistical significance, the higher incidence in the control group indicates the potential benefit of early postoperative nutritional intervention in mitigating these complications [10,11]. Renal dysfunction and respiratory infections had similar rates between both groups (20% and 13.3%, respectively). The lack of significant differences suggests that factors other than nutritional intervention may predominantly influence these complications, and they may require broader management strategies to address in postoperative care [12,13]. In our study regarding the length of hospital stay after the operation (days) in the case (EOF) group five days less than the control group p-value<.05, which is statistically significant. This may be explained by a more rapid return of GIT function and a lower number of complications in the EOF group. The findings were comparable with a study done by Yermilov et al. [14]. Post-operative weight gain in the case group 73.3% patients weight gain in other hand 33.3% in control group. P-value .028 difference which is significant statistically. The findings were comparable with a study done by Liao et al. [5] but Nagata et al. [7] found no difference between the two groups in their study. So, in this study, we observed EOF is a clinically safe, feasible, and effective method of nutritional support in patients who have undergone PD, Moreover, compared to the traditional delayed enteral feeding, EOF after PD significantly decreased LOS without increasing complications rate.

Limitations of The Study

The study was conducted in a single hospital with a small sample size. So, the results may not represent the whole community.

V. CONCLUSION

This study demonstrates that early enteral feeding (EOF) after pancreaticoduodenectomy is a safe, feasible, and effective nutritional support strategy. It significantly reduces postoperative complications, particularly wound infections, shortens the length of hospital stay, and promotes weight gain compared to delayed feeding. EOF patients showed improved postoperative outcomes, without an increase in complication rates, supporting its role as a beneficial intervention in post-pancreaticoduodenectomy care.

VI. RECOMMENDATION

Based on the findings, it is recommended that early enteral feeding (EOF) should be implemented as a standard postoperative nutritional strategy for patients undergoing pancreaticoduodenectomy. EOF improves recovery by reducing postoperative complications, shortening hospital stays, and promoting weight gain. It should be initiated in clinically stable patients to optimize outcomes. Further research is encouraged to explore the long-term benefits and refine guidelines for specific patient populations.

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