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EFFECT OF EARLY STARTING LOW-COST INDIGENOUS ENTERAL FEEDING FOR PANCREATODUODENECTOMY PATIENTS IN EARLY POST-OPERATIVE PERIOD

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ABSTRACT

Background: Till date most of the time, nutrition after pancreatoduodenectomy (PD) is maintained by parenteral nutrition in the early postoperative period in our setting leading to higher mortality and morbidity. On the other hand, enteral feeding is practiced with commercially formulated costly preparation in rich countries which may not be affordable always in our situation. This study was conducted to see the effect of early enteral formulated feeding from locally available resources. **Objective**: To established a cost-effective enteral feeding protocol using indigenous food for treating PD patients in our setting. **Methodology:** Thirty patients who underwent PD in the Department of Hepatobiliary, Pancreatic & Liver Transplant Surgery, BSMMU, Dhaka from January 2020 to December 2020 were included in the study. They were categorized into two groups; Group A(n=15): enteral feeding made with indigenous food and started from POD 2 through nasojejunal tube with additional parenteral support and Group B(n=15): only parenteral nutrition without any enteral feeding continued up to six / seven POD. In all patients, serum albumin, total bilirubin, serum alkaline phosphatase, total count and CRP were measured on POD 1, 3, 7 & 14 for assessing nutritional, cholestatic, immunological and inflammatory status. **Result:** Serum albumin and lymphocyte count were significantly improved following 3rd POD onwards in Group A. The total bilirubin, alkaline phosphatase, total count and CRP were reduced faster in group A, but remained persistently elevated in Group B. In Group A, the morbidity and postoperative hospital stay were found significantly lesser than Group B. Group B had more nutrition related cost than group A. **Conclusion:** Early starting of enteral feeding prepared from indigenous food is an effective method of maintaining nutrition after PD. It improves the nutrition, immune condition, markedly reduces inflammation and cholestasis after PD and thus it reduces morbidity, post-operative hospital stays and nutrition related cost.

KEYWORDS: Early and delayed Enteral feeding; indigenous food, early enteral nutrition, Pancreatoduodenectomy.

INTRODUCTION

Pancreaticoduodenectomy (PD) has been considered standard treatment of choice for malignant neoplasm and some benign lesion of Pancreatic head, ampulla, distal bile duct, duodenum.[1] Many patients already have pre-existing malnutrition due to jaundice & tumor effects which aggravate further on postoperative period[2] due to extensive resection and prolong fasting. As Malnutrition result in high post-operative morbidity, mortality and hospital cost[3], appropriate nutritional therapy is of great significance for post-operative rehabilitation following PD.

Current clinical variation of nutrition provision following PD includes early enteral feeding through nasojejunal tube or jejunostomy tube or total parenteral nutrition with delayed enteral feeding.[4] But optimum route of nutritional provision continues to be debated.[5] The European Society for Parenteral and Enteral Nutrition (ESPEN) recommended early enteral nutrition (EEN)

should be routinely used in patients having gastrointestinal surgery for cancer including PD.[6] Early enteral nutrition (EEN) found to stimulate enterocyte growth, prevent mucosal atrophy, improve barrier function, reduce bacterial translocation and improve clinical outcome.[7] EEN also stimulate appetite, faster normalization of dietary intake[3] and stimulate innate immunity.[8]

Current investigation in enteral nutrition focused on the ability to modulate metabolic response to injury via formulated enteral diet.[9] Thus, EEN is more physiological, beneficial, practicable and cost-effective.[10] But commercially available enteral nutritional formula diet in international market like Osmolite, Stresson[11], Jevity[3], and Nutrison protein plus[4] are too costly, less affordable and not always locally available. Currently, data regarding formulation of enteral feed using local cheap available food are scarce. So, this study was conducted to see the effectiveness of formulated early enteral feeding from locally available food and compare with traditional nutritional care (TPN) to develop a low cost-effective nutritional protocol after PD in BSMMU.

MATERIALS AND METHODS

This is a case-controlled prospective study. The study includes patients (n=30) that underwent pancreatoduodenectomy surgery in different units of the Department of Surgery of Bangabandhu Sheikh Mujib Medical University, Dhaka from January 2020 to December 2020. All patients were evaluated thoroughly before surgery. Associated deficiency were corrected and co morbidity were optimized. Some needed preoperative biliary decompression. Appropriate antibiotics were applied before the surgery when required. Informed consent was taken for operation after proper counseling.

Patients were categorized into two group, A and B. In group A (n=15), a nasojejunal (NJ) feeding tube was inserted per operatively to initiate post-operative early enteral feeding (Fiqure 1). Enteral feeding was initiated on POD 2. Blended formulated diet was prepared from indigenous food (rice gruel, dal, egg white, soybean oil, table salt and coconut water) (attachment 1). This regimen contains 1kcal/ml of food. Calorie values were obtained from authentic online sources (www.nutritionix.com). Feeding was started with 25 ml/ 2hourly from 2nd POD and a total10 feeds were given through a NJ tube. The tube was flushed with 25 ml coconut water after each feed. Feeding was increased daily 25ml/2 hourly in the subsequent PODs until reached 150 ml/2 hourly (>1500kcal through enteral route). Daily additional fluid and calorie requirement were calculated and provided with intravenous fluid with daily adjustment to maintain standard fluid (25-40 ml/ kg/day), electrolytes and energy requirement (25-40 kcal/kg/day). The NJ tube was removed on 7th PODs and normal soft diet was resumed orally. The patient who experienced abdominal cramps and diarrhea after initiating the formula food using indigenous materials through NJ tube were excluded from the study. In group II (n=15), nutritional support provided only with Kaviben as TPN. Then compared the outcome postoperatively up to hospital stay and recorded. Patient's data were recorded on a preformed data collection sheet. Post-operatively, the serum albumin levels, total lymphocyte count, total bilirubin levels, serum alkaline phosphatase, CRP and total count levels were measured on PODs 1, 3, 7 and 14 in all the patients to evaluate impact of different routes of nutrition provision on the post-operative nutritional, immunological, cholestatic and inflammatory status. The mortality, surgical, tube and feeding related morbidity, duration of post-operative hospital stays and nutrition related cost (both enteral and intravenous nutrition except albumin) were also documented.

Data was documented in a data collection sheet and then compiled systematically, computed, analyzed with software (SPSS 26) and compared between the two groups.(attachment 2) Data are stated as mean ±SD and percentage. Statistical analysis was done using the unpaired t test and Chi square ($\chi 2$) test. P value 0.05 or less were leveled as significant.

RESULTS

Participant Selection

Patient were allocated nonrandom purposively. Total 30 patients included. All patients in the EEN group underwent treatment per protocol (Figure 1). No patients were lost to follow-up.

Patient Baseline Data

Patient baseline characteristics are shown in Table 1. There were no significant differences among the treatment groups in terms of age, sex, BMI, indications, symptoms, preoperative biliary drainage, comorbidity, diagnosis, preoperative liver function test including albumin level (Table 2).

Primary Endpoint Analysis

Marked improvement of nutritional, cholestatic, immunological and inflammatory parameter (Figure 2-5) in Group A taking indigenous feeding compared to TPN in group B. Table 3 shows 80% (12/15) patient tolerated nasojejunal feeding as feeding were made from indigenous food with whom they were already accustomed. Three patients developed feeding related complications; nausea 1, diarrhea 1 and the other bloating 1. Enteral feeding was stopped in first two patients for 24 hours and then restarted which was tolerated then. The third patient who developed bloating, managed by adding more pancreatic enzyme supplement. Three patients had nasojejunal tube related morbidity; self-withdrawal of NJ tube at 6th POD and the other 2 patients had nasal ischemia which were managed by topical steroid antibiotic preparation.

Secondary Endpoint Analysis

Table 4 shows albumin transfusion rate is significantly low in Group A than Group B (1.47±0.99 vs 3.40±1.68). Surgical morbidity also significantly lower in Group A than Group B (3/15 vs 10/15, p=0.01). Among them wound infection rate is less in Group A (2/15 vs 7/15, p=0.04) But biliary leakage and pancreatic fistula are almost similar in both groups as it is more technical than nutritional. 2 patients need relaparotomy and 2 mortalities in Group B (statistically not significant). As more complication in Group B, length of hospital stay is significantly longer in Group B in contrast to Group A (15.27±6.41 vs 10.47±2.10, p=0.001). But nutrition related cost (preparation of formula feed from indigenous food plus intravenous fluid and kaviben) is significantly less in amount in contrast to group B. (5982.67±684.49 vs 29055.67±13035.95 BDT, p=<0.001[s]).

Table I: Comparison of patient's demography between two groups.

Variables	Group A (n=15)	Group B (n=15)	P value
Age (Years)			
Mean ± SD	52.80±11.25	54.20±11.16	NS
Sex			
Male No. (%)	9 (60.0)	10 (66.7)	NS
Female No. (%)	6 (40.0)	5 (33.3)	
BMI (kg/m^2)			
Mean ± SD	21.71±2.08	21.47±1.96	NS
Biliary stenting			
No. (%)	7(46.7)	6(40.0)	NS

Table II: Difference in preoperative biochemical parameter between two groups.

Parameter	Group A (n=15)	Group B (n=15)	P value
Nutritional	**mean ± SD**	**mean ± SD**	
Serum Albumin (gm/l)	34.83±0.46	33.46±0.37	0.376^{ns}
Cholestatic			
Serum bilirubin (mg/dl)	5.29±3.22	6.36±3.45	0.387^{ns}
ALP(IU/L)	308.27±247.30	327.47±219.09	0.384^{ns}
Inflammatory			
Total count (cell/mm^3)	9206.67±1728.11	9506.67±1673.95	0.362^{ns}
CRP (mg/dl)	12.60±5.65	10.47±4.39	0.258^{ns}
Immunological			
Lymphocyte count(cell/mm^3)	2261.93±1326.12	2236.60±1037.75	0.154^{ns}

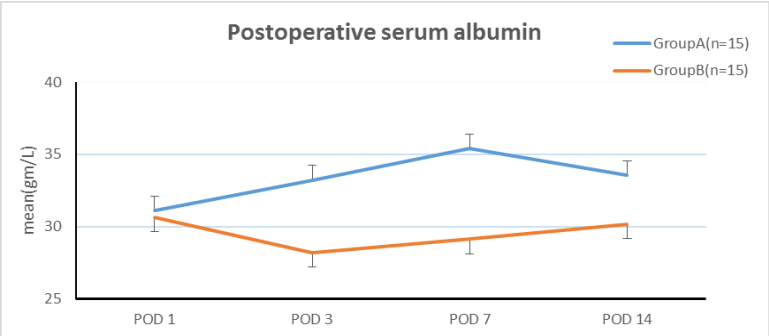


Figure 2: Changes in serum in albumin between two groups

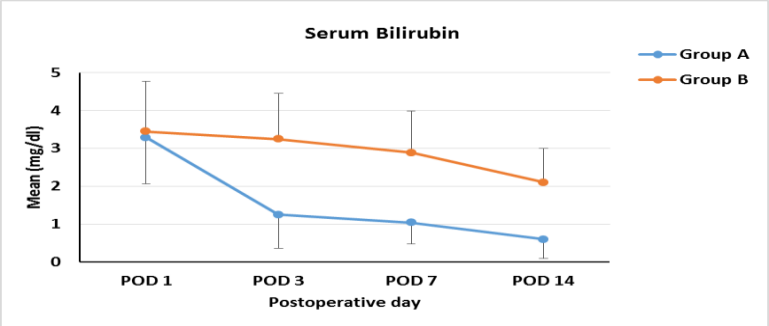


Figure 3: Changes in serum in bilirubin between two groups.

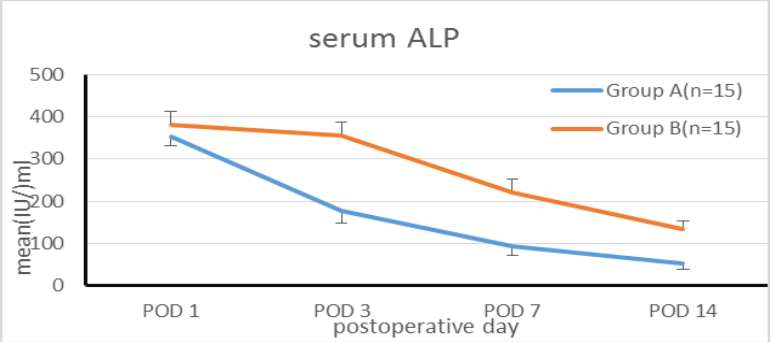


Figure 4: Changes in serum in ALP between two groups.

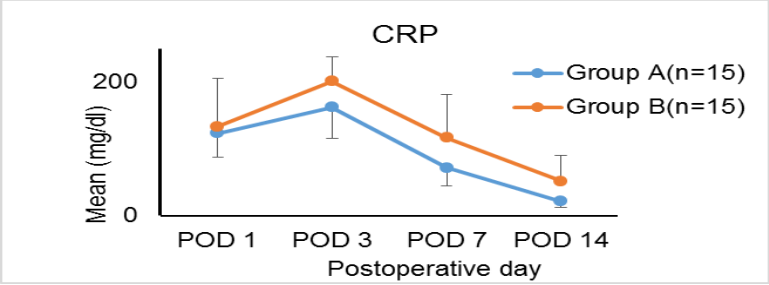


Figure 5: changes in CRP level between two groups.

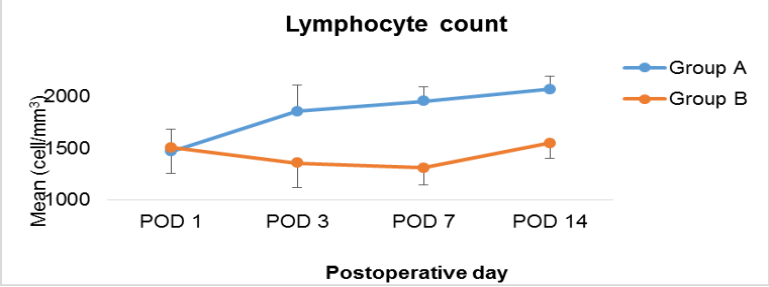


Figure 6: changes in lymphocyte count between two groups.

Table III: Tube and feeding related morbidity in Group A.

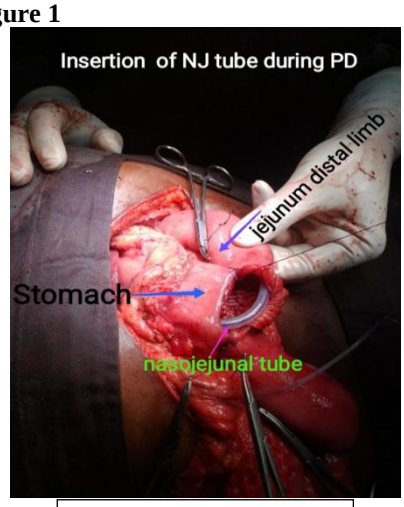
Parameter	Group A (n=15)	
	Frequency (n)	Percentage (%)
Tube related morbidity	3	20.0
Dislodgement	1	6.7
Nasal injury	2	13.3
Feeding related morbidity	3	20.0
Nausea	1	6.7
Bloating	1	6.7
Diarrhoea	1	6.7

Table IV: Post operative outcome comparison between two groups.

Variables	Group A (n=15)	Group B (n=15)	P value
Albumin requirement*(unit)	1.47±0.99	3.40±1.68	0.001^{s}
morbidity * No. (%)	3(20.0)	10(66.7)	0.010^{s}
Wound infection	2 (13.3)	7(46.67)	0.041^{s}
Bile leakage	0 (0.00)	2 (13.3)	0.143^{ns}
Pancreatic fistula	2(13.3)	4(26.7)	0.174^{ns}
Relaparotomy	0 (0.00)	2 (13.3)	0.143^{ns}
Readmission	0 (0.00)	1 (6.7)	0.309^{ns}
Mortality, No (%)	0 (0.00)	2 (13.3)	0.143^{ns}
Length of hospital stay mean±SD	10.47±2.10	15.27±6.41	0.010^{s}

Nutrition related cost mean±SD	5982.67±684.49 (BDT)	29055.67±13035.95 (BDT)	<0.001[s]

Figure 1



Intraoperative placement of NJ tube

Indigenous food material

Blended food

DISCUSSION

Accurate calorie weighted nutrition and proper route of administration is very important for safe postoperative outcome after PD.[12] TPN were used for years for maintaining nutrition but many authors described a number of routes for enteral nutrition after PD with good outcome.[13]

In this study, we evaluated the outcome of early enteral feeding using indigenous food materials through nasojejunal tube in one group (Group A) and Total parenteral nutrition in another group (Group B) after PD. Total 30 patients we studied. We have seen, significant improvement in postoperative nutritional, cholestatic, immunological and inflammatory parameter in Group A in comparison to Group B.

Guilibad[14] described use of TPN (kabiven, Fresenius kabi, Olimel, Baxter) in one group and EN (Peptamen HN, Nestle) started after 24 h of feeding tube insertion in another group. These regimens are too costly and not always available in local market. Some regimen is not properly calorie weighted. In our study, we used Kaviben as TPN in Group B and formulated feeding regimen from indigenous food (rice gruel, boiled red lentil (dal), boiled egg white, soyabin oil, table salt and coconut water) in Group A. This EN regimen contained 100kcal /100 ml of blended food with added pancreatic enzyme while serving. This is why more than 80% patient tolerate feeding as they are already accustomed with locally available food in their daily life. One case of diarrhea and one case of nausea managed with temporary stoppage, proper preparation of feeding regimen, preservation and restart within 24 hours. Bloating in one patient (6.7%), need increase in amount of pancreatic enzyme supplement and prokinetic addition. None of the patient requiring restart of TPN. Tube related complication occurred only in 3 (20%) patients in the form of self-withdrawal due to discomfort (6.7 %) at 6th POD, nasal ischemia in 2 patients (13.3 %) due to tight fixation, managed with topical steroid antibiotic preparation. Hwang et al.,[15] also support out data where tube related complication was 41%.

Our observation was that nutritional, immunological parameter and inflammatory marker remain almost similar in 1st POD. Thereafter significantly improved on POD3 onwards until discharge of the patients who had initiated early enteral feeding (Group A) than who had delayed feeding (Group B). Albumin transfusion requirement was significantly less in Group A than Group B to maintain optimum serum albumin level at postoperative period (1.47 vs 3.40, p=0.001). Post-operative intrahepatic cholestasis (bilirubin and ALP) was reduced faster in the early enteral nutrition group than delayed starting oral feeding group after 1st POD until discharge. All these findings can be explained by many authors.[14-16] Zhu et al.,[17] reported in absence of food in the gut has negative consequences on metabolic, endocrine, intestinal and liver function. Whereas, early enteral feeding enhances hepatic circulation, improve liver function and bile flow by several enteric hormones such as cholecystokinin, peptide and gastrin which are stimulatory to gut functions.[18]

Gerritsen[4] reported that early enteral feeding has less incidence of bacterial translocation and wound infections rate were higher in the TPN group (NJT/TPN: 16%and 30%, P00.02). Our study also supports that data (13.3% vs 46.67%, p=0.04). Hwang[15] demonstrated rate of mortality, morbidity and LOS (25.9±8.5 days vs. 32.3±16.3 days; p=0.01), the rates of anastomotic leak

(1.2% vs. 16%, p=0.00) and reoperation (3.7% vs. 20%, p=0.01) were significantly lower in the early enteral group in comparison to TPN group. In our study, morbidity is less (20% Vs 66.7%), no mortality (0 Vs 2) and average 5 days less hospital stay in Group A in compare to group B (10.47 Vs 15.27, p=0.01). Bile leakage and pancreatic fistula incidence are similar in both group as it depends more on technical factor than nutritional. One case of readmission and 2 cases of relaparotomy needed in Group B in compare to none in group A. Though these are not statistically significant. Bidhan et al.,[19] found similar data that also support our data.

Theophile et al.,[14] reported mean nutritional cost in nasogastric feeding group using commercially available enteral feeding formula was 773 euros +/− 177. In our study, we found cost is significantly less in Group A in comparison to Group B (5982.67 BDT vs 29055.67 BDT, p=0.001). Nutritional cost included both oral and intravenous nutrition related cost except albumin.

This study had some limitation as short study period and small sample size. Outcome observed up to hospital discharge only. CD4:CD8 could not be measure to see more accurate immunological effect. Randomization of sampling were not done.

CONCLUSION

Enteral feeding preparation from indigenous food is calorie weighted, easily prepared, very cheap and well tolerated by native peoples. It improves nutritional, immunological, inflammation and cholestasis. Thus, it reduces morbidity, the hospital stays and nutrition related cost. So, it may be considered as an alternate to commercially available enteral feeding after PD.

Data Availability Statement

The raw data supporting the conclusions of this article will be made available by the corresponding authors on reasonable request (drquiyum2051@gmail.com).

Ethics Statement

The studies involving human participants were reviewed and approved by IRB board, BSMMU, Dhaka, Bangladesh. The patients/participants provided their written informed consent to participate in this study.

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Conflict of Interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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