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Role of Early Enteral Nutrition in the Management of Postoperative Enterocutaneous Fistula

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Abstract **Original Research Article**

Background: Postoperative enterocutaneous fistula (ECF) is a challenging complication that significantly impacts morbidity and mortality. Nutritional management plays a crucial role in optimizing outcomes, with early enteral nutrition (EEN) emerging as a preferred strategy over total parenteral nutrition (TPN). This study aimed to compare the effectiveness of EEN versus TPN in postoperative ECF patients. ***Methods:*** A prospective observational study was conducted at the Department of Surgery, Bangabandhu Sheikh Mujib Medical University (BSMMU), Dhaka, Bangladesh, from July 2024 to January 2025 on 30 postoperative ECF patients. Participants were divided into two groups: early enteral nutrition (EEN) group (n=15) and total parenteral nutrition (TPN) group (n=15). Key outcome measures included fistula closure rate, time to closure, nutritional parameters (serum albumin, total protein), length of hospital stay, and incidence of complications. ***Results:*** EEN was associated with higher spontaneous fistula closure rates (66.7% vs. 40%, p=0.048), shorter closure time (22.8 ± 4.9 vs. 31.2 ± 6.3 days, p=0.002), and improved serum albumin (p=0.003). The hospital stay was significantly shorter in the EEN group (25.6 ± 5.3 vs. 36.4 ± 7.1 days, p<0.001). The incidence of infectious complications was lower in EEN (20% vs. 46.7%, p=0.037). ***Conclusion:*** EEN demonstrated superior outcomes over TPN in postoperative ECF patients, promoting faster fistula closure, better nutritional recovery, and reduced complications. These findings support the routine use of early enteral nutrition in ECF management.

Keywords: Enterocutaneous fistula, early enteral nutrition, total parenteral nutrition, postoperative complications, fistula closure, nutritional support.

INTRODUCTION

Enterocutaneous fistula (ECF) is a challenging surgical complication characterized by an abnormal communication between the gastrointestinal tract and the skin, leading to significant morbidity and mortality [1]. It commonly arises after abdominal surgery, trauma, inflammatory bowel disease, or malignancy, with postoperative ECF accounting for a substantial proportion of cases [2]. Management of ECF is complex and multifaceted, and various modalities encompass a team approach for infection control, fluid and electrolyte balance, nutritional support, and surgery if indicated [3]. Among these, nutritional management has become important in the optimization of patient recovery and fistula healing [4].

Conventionally, total parenteral nutrition has been the cornerstone of nutritional support for patients with ECF, especially in those with high-output fistulas [5]. TPN bypasses the gastrointestinal tract and thus, via intravenous administration, provides the needed nutritional requirements and minimizes luminal flow to presumably enhance spontaneous closure of fistulas [6]. However, long-term use of TPN has been found to be associated with complications related to catheter infections, metabolic disturbances, liver dysfunction,

and increased health care costs [7]. It also does not maintain gut integrity, leading to mucosal atrophy with resultant bacterial translocation that may adversely affect septic complications in the critically ill patient [3].

In return, EEN became popularized to become a reasonable altemative; it is promoting gut stimulation even in patients with ECF [8]. EEN incorporates nutrition delivery via the gut either orally or via feeding tubes placed distally to the fistula when possible [9]. There is emerging evidence that, compared with TPN, EEN can maintain gut mucosal integrity, improve immune function, and reduce infectious complications [6]. Enteral feeding stimulates gut-derived hormones that promote motility and absorptive activity and may support the process of spontaneous fistula closure [10]. However, despite these potential advantages, there is still caution about the practicality of EEN for patients with high-output fistulas in whom large quantities of luminal secretion may lead to fluid and electrolyte imbalance [11].

Various studies have evaluated different nutritional strategies in the clinical outcomes of ECF patients; however, very few data are available regarding the Bangladeshi population [12]. Nutritional strategies and outcomes might be different due to socioeconomic constraints, limitations in resources, and inequity in health infrastructures [13]. Malnutrition is also one of the major issues among surgical patients in Bangladesh. Nutritional intervention with efficacy is highly crucial for postoperative recovery among surgical patients [4]. This means that regional data are still required to determine whether EEN offers superior benefits compared to TPN in this patient group.

The aim of the study was to evaluate the role of early enteral nutrition in the management of postoperative enterocutaneous fistula at Bangabandhu Sheikh Mujib Medical University, Dhaka. This study will compare the clinical outcomes in terms of time to fistula closure, spontaneous closure rates, length of hospital stay, and complications associated with EEN and TPN in order to provide useful insights into the optimal nutritional strategies for ECF management in a Bangladeshi setting. The findings from this study may contribute to evidence-based guidelines and help refine the nutritional protocols in an effort to improve patient outcomes.

METHODOLOGY & MATERIALS

This prospective observational study was conducted at the Department of Surgery, Bangabandhu Sheikh Mujib Medical University (BSMMU), Dhaka, Bangladesh, from July 2024 to January 2025. A total of 30 patients diagnosed with postoperative enterocutaneous fistula (ECF) were included based on predefined inclusion and exclusion criteria. Patients with malignant fistulas, underlying bowel ischemia, or hemodynamic instability were excluded. The selected patients were prospectively divided into two groups: one group of patients in whom early enteral nutrition was provided and the other managed with total parenteral nutrition. EEN was started in the presence of a functional distal gut with no evidence of bowel obstruction or high-output fistula-related contraindications.

Nutritional support was provided according to institutional policy. Early enteral nutrition (EEN) was administered via either a nasojejunal or feeding jejunostomy tube, using a peptide-based or elemental diet that was high in protein and low in fat. Total parenteral nutrition (TPN) was initiated through a central venous catheter and was individually prepared based on the calorie and protein requirements of each patient. The nutritional status, serum albumin, total protein levels, and inflammatory markers of the patients were closely monitored. The clinical outcomes included time to fistula closure, length of stay in the hospital, spontaneous closure rates, and complications like infections and electrolyte imbalances. For data analysis, SPSS version 26 was used. Data are presented as mean ± SD for continuous variables and as percentages for categorical data. Independent t-tests and chi-square tests were conducted for intergroup comparisons, and the p-value was considered significant if less than 0.05.

RESULTS

Table I: Baseline Characteristics of Patients (n=30)

Characteristic	EEN Group (n=15)	TPN Group (n=15)	p-value
Age (years, Mean ± SD)	48.6 ± 10.2	50.1 ± 9.7	0.61
Male/Female (n)	11/4	10/5	0.72
BMI (kg/m², Mean ± SD)	23.4 ± 2.5	23.2 ± 2.8	0.83
Comorbidities (n, %)	8 (53.3%)	7 (46.7%)	0.79
Fistula Type (Low/High Output)	9/6	8/7	0.82

Table I presents the baseline characteristics of the study population, comparing the EEN and TPN groups. The mean age was 48.6 ± 10.2 years in the EEN group and 50.1 ± 9.7 years in the TPN group (p = 0.61). The male-to-female ratio was 11:4 in the EEN group and 10:5 in the TPN group (p = 0.72). The mean BMI was 23.4 ± 2.5 kg/m² in the EEN group and 23.2 ± 2.8 kg/m² in the TPN group (p = 0.83). Comorbidities were present

in 53.3% of EEN patients and 46.7% of TPN patients (p = 0.79). Fistula types were comparable, with 9 low-output and 6 high-output fistulas in the EEN group, compared to 8 low-output and 7 high-output fistulas in the TPN group (p = 0.82).

Table II: Nutritional and Metabolic Parameters at Baseline and Follow-up

Parameter	Baseline (EEN)	Baseline (TPN)	Follow-up (EEN)	Follow-up (TPN)	p-value
Serum Albumin (g/dL)	2.8 ± 0.6	2.7 ± 0.5	3.9 ± 0.4	3.2 ± 0.5	0.003
Total Protein (g/dL)	5.3 ± 0.7	5.2 ± 0.8	6.4 ± 0.5	5.7 ± 0.6	0.005
CRP (mg/L)	48.7 ± 12.5	50.2 ± 13.1	22.3 ± 9.7	30.8 ± 10.2	0.001
Weight Change (kg)	-3.1 ± 1.2	-3.4 ± 1.5	+2.8 ± 1.3	+1.1 ± 1.4	0.002

Table II shows the nutritional and metabolic changes in both groups. Serum albumin improved significantly in the EEN group (2.8 ± 0.6 to 3.9 ± 0.4 g/dL) compared to TPN (2.7 ± 0.5 to 3.2 ± 0.5 g/dL, p = 0.003). Total protein also increased more in EEN (5.3 ± 0.7 to 6.4 ± 0.5 g/dL) than in TPN (5.2 ± 0.8 to 5.7 ± 0.6 g/dL, p = 0.005). CRP levels dropped significantly in both groups but more so in EEN (p = 0.001). Weight gain was higher in EEN (+2.8 ± 1.3 kg) versus TPN (+1.1 ± 1.4 kg, p = 0.002).

Table III: Clinical Outcomes between EEN and TPN Groups

Outcome	EEN Group (n=15)	TPN Group (n=15)	p-value
Spontaneous Closure (n, %)	10 (66.7%)	6 (40%)	0.048
Time to Fistula Closure (days, Mean ± SD)	22.8 ± 4.9	31.2 ± 6.3	0.002
Length of Hospital Stay (days, Mean ± SD)	25.6 ± 5.3	36.4 ± 7.1	<0.001
Infectious Complications (n, %)	3 (20%)	7 (46.7%)	0.037
30-day Mortality (n, %)	1 (6.7%)	2 (13.3%)	0.56

Table III compares clinical outcomes between the EEN and TPN groups. Spontaneous fistula closure was higher in the EEN group (66.7% vs. 40%, p = 0.048), with a significantly shorter closure time (22.8 ± 4.9 vs. 31.2 ± 6.3 days, p = 0.002). Hospital stay was also reduced in the EEN group (25.6 ± 5.3 vs. 36.4 ± 7.1 days, p < 0.001). Infectious complications were lower with EEN (20% vs. 46.7%, p = 0.037). Mortality rates showed no significant difference (6.7% vs. 13.3%, p = 0.56).

Table IV: Complications Associated with EEN vs. TPN

Complication	EEN Group (n=15)	TPN Group (n=15)	p-value
Catheter-related Sepsis (n, %)	2 (13.3%)	6 (40.0%)	0.05
Electrolyte Imbalance (n, %)	3 (20.0%)	6 (40.0%)	0.16
Refeeding Syndrome (n, %)	1 (6.7%)	2 (13.3%)	0.56
Diarrhea (n, %)	4 (26.7%)	5 (33.3%)	0.69

Table IV summarizes the complications observed in both groups. Catheter-related sepsis was significantly lower in the EEN group (13.3% vs. 40.0%, p = 0.05). Electrolyte imbalance was more frequent in the TPN group (40.0% vs. 20.0%), though not statistically significant (p = 0.16). Refeeding syndrome occurred in 6.7% of EEN patients and 13.3% of TPN patients (p = 0.56). Diarrhea rates were comparable between groups (26.7% vs. 33.3%, p = 0.69).

DISCUSSION

Postoperative enterocutaneous fistula (ECF) is a challenging clinical condition, for which optimal nutritional care is required to enhance patient recovery. Our research compared early enteral nutrition (EEN) with total parenteral nutrition (TPN) and illustrated how EEN was associated with earlier fistula closure, reduced duration of hospital stay, enhanced nutritional indices, and less complication.

Nutritional support is critical in the management of ECF, as patients tend to experience malnutrition, fluid loss, and metabolic disturbances [14]. In our study, spontaneous closure rates were significantly greater in the EEN group (66.7%) than in the TPN group (40%) (p = 0.048). Additionally, closure time of the fistula was faster among the EEN group (22.8 ± 4.9 days vs. 31.2 ± 6.3 days, p = 0.002), demonstrating a linear benefit of enteral nutrition. These findings are consistent with Sun *et al.*, who reported fewer postoperative complications and faster recovery in Crohn's disease patients who received enteral nutrition compared to TPN [15]. Gordon-Dixon *et al.*, also highlighted the importance of sole enteral nutrition in preoperative

optimization, particularly for inflammatory bowel disease, which is akin to the pathophysiology of ECF [16].

EEN was linked to notable improvements in serum albumin ($p = 0.003$), total protein ($p = 0.005$), and weight gain ($p = 0.002$) in comparison to TPN. This indicates improved nutrition absorption and catabolism reduction, aligning with evidence from Xu *et al.*, who indicated increased postoperative recovery in patients with preoperative enteral nutrition [17]. Furthermore, our study showed a greater reduction in C-reactive protein (CRP) levels ($p = 0.001$) in the EEN group, indicating better systemic inflammation control. Kamada *et al.*, confirmed that chronic inflammation is a major risk factor for refractory ECF, and adequate enteral nutrition is able to modulate immune functions and facilitate healing [18].

Our results demonstrated a significantly shorter hospital stay in the EEN group (25.6 ± 5.3 days) versus the TPN group (36.4 ± 7.1 days, $p < 0.001$). This is clinically relevant because longer hospital stay is correlated with higher risks of nosocomial infections, resource utilization, and healthcare cost [9]. Hogan *et al.*, also reported enhanced earlier recovery and lower hospitalization in patients who underwent early enteral nutrition after significant abdominal surgery, which is in agreement with our findings [19]. Similarly, Mišánik *et al.*, emphasized the importance of early oral hydration in managing patients with high-output ECF for reducing intestinal failure-associated complications [20].

One of the key benefits of EEN was the lower rate of infectious complications (20% vs. 46.7%, $p = 0.037$). TPN has been shown to increase the risk of catheter-related bloodstream infections (CRBSI) and sepsis, resulting in prolonged morbidity [21]. This was also confirmed in our study, as catheter-related sepsis was notably lower in the EEN group (13.3%) than in the TPN group (40%, $p = 0.05$). This is in accordance with Rebollar *et al.*, who indicated that reducing parenteral nutrition lowers sepsis-related complications in ECF patients [22]. Likewise, Selvaraj *et al.*, and Fansiwala *et al.*, emphasized that sustaining enteral feeding can maintain gut integrity, minimize bacterial translocation, and maximize immune function [23, 24].

Although EEN demonstrated better results, tolerability concerns still exist. Our research did not reveal any significant differences in electrolyte disturbances ($p = 0.16$), refeeding syndrome ($p = 0.56$), or diarrhea ($p = 0.69$) between the groups, suggesting that EEN was tolerated well. According to Limb & Read, intestinal failure has a high level of concern in the management of ECF, and proper monitoring of an enteral nutrition regimen can prevent associated complications [25]. Liao *et al.*, also emphasized that chyme reinfusion and fistuloclysis techniques can optimize the enteral nutrition delivery with minimal adverse effects [26].

Our findings are also consistent with multiple recent publications favoring early enteral nutrition. Alves *et al.*, and Nukala *et al.*, reaffirmed that early feeding has a salient effect on fistula closure by spontaneous occlusion [27, 28]. Additionally, Boukar *et al.*, concluded, in a five-year retrospective assessment of ECF patients, that enteral nutrition was associated with improved long-term results [29]. Wainstein *et al.*, and Christensen *et al.*, highlighted that enteral nutrition should be given priority in ECF management plans as, apart from improving survival rates, it reduces the need for extended TPN, which has higher risks of metabolic and infectious complications [30, 31].

Limitations of the study

The primary limitation of our study is the small sample size (n=30), which may affect the generalizability of our findings; a larger, multicenter study would provide more robust and widely applicable results. Additionally, our follow-up period was relatively short, preventing the assessment of long-term nutritional and functional outcomes. Furthermore, as a single-center study, our findings may not be universally applicable across different healthcare settings, highlighting the need for future research in diverse clinical environments.

CONCLUSION

Our study supports early enteral nutrition as a superior strategy over total parenteral nutrition for the management of postoperative enterocutaneous fistula. EEN was associated with higher spontaneous closure rates, faster recovery, improved nutritional status, shorter hospital stay, and fewer complications. These findings reinforce current clinical guidelines advocating early enteral feeding as the preferred approach in ECF patients. By integrating these results into clinical practice, healthcare providers can optimize patient outcomes, reduce hospital burden, and improve overall quality of care.

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