International Journal of Life Sciences, Biotechnology and Pharma Research Vol. 14, No. 2, February 2025 Online ISSN: 2250-3137
Print ISSN: 2977-0122

DOI: 10.69605/ijlbpr_14.2.2025.35

ORIGINAL RESEARCH

Efficacy of early enteral feeding by naso-jejunal tube in patients with upper gastrointestinal perforation in the prevention of septic complications: a prospective randomized controlled study

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Received: 23 December, 2024 Accepted: 17 January, 2025 Published: 07 February, 2025

ABSTRACT

Background: Early enteral nutrition has been increasingly recognized as a crucial aspect of postoperative care, particularly in patients with acute gastrointestinal perforations. Nasal feeding via a nasojejunal (NJ) tube may confer benefits such as faster return of bowel function, reduced infectious complications, and improved nutritional status. However, limited data exist on its efficacy in preventing septic complications in patients with upper gastrointestinal (GI) perforations. **Methods:** A prospective, randomized controlled study was conducted at the Department of General Surgery, Medical College Baroda and Sir Sayajirao General Hospital Vadodara, between September 2021 and November 2022. Sixty patients (age 18–70 years) with traumatic or non-traumatic perforations proximal to the ligament of Treitz were equally randomized into two groups: the Test Group (TG), receiving early enteral feeding via an intraoperatively placed nasojejunal tube starting 24 hours post-surgery, and the Control Group (CG), managed with conventional nil-per-os (NPO) until bowel function returned. Primary outcome was the incidence of septic complications. Secondary outcomes included change in nutritional status, length of hospital stay, compliance with NJ tube feeding, and mortality. **Results:** Early enteral feeding significantly improved postoperative nutritional parameters. Patients in TG demonstrated higher daily energy ($p<0.05$ from postoperative day 2 onward) and protein intake ($p<0.05$ from day 4 onward) compared with CG. Postoperative serum albumin on day 7 was significantly higher in TG (3.20±0.36 g/dL) versus CG (2.71±0.36 g/dL; $p<0.05$). Surgical site infection was significantly lower in TG (23.3%) compared to CG (50%; $p=0.03$). Overall length of hospital stay was reduced (13.82±3.5 days vs. 17.03±6.8 days; $p=0.03$). Mortality did not differ significantly between groups. **Conclusion:** Early enteral feeding through a nasojejunal tube in upper GI perforation patients is a safe, feasible strategy that significantly reduces septic complications (especially surgical site infections) and improves nutritional recovery. Early enteral nutrition should be considered a vital component of postoperative management in these patients.

Keywords: early enteral nutrition, nasojejunal tube, upper GI perforation, septic complications, surgical site infection

INTRODUCTION

Perforation of the upper gastrointestinal (GI) tract remains a significant surgical emergency associated with high morbidity and mortality [1]. Common causes include peptic ulcer disease, traumatic injuries, and less frequently, iatrogenic perforations [2]. Such patients often present in an acute condition with peritonitis, sepsis, and fluid-electrolyte imbalances. The traditional management involves fluid resuscitation, controlling the source of sepsis (via surgery), and postoperative nil-per-os (NPO) until the return of bowel function [3]. However, the postoperative phase can be prolonged in critically ill patients, leaving them at risk for malnutrition, poor wound healing, and septic complications.

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In recent years, early enteral feeding has emerged as a standard of care in many critically ill populations, including those with trauma, burns, and postoperative states [4]. It is hypothesized that early enteral nutrition helps maintain gut integrity, reduce bacterial translocation, and modulate the systemic inflammatory response [5]. Specifically, in case of an upper GI perforation, the intraperative placement of a nasojejunal (NJ) tube makes it feasible to start feeding beyond the level of injury, thus preventing anastomotic breakdown in primary repairs while simultaneously optimizing nutritional support [6].

Though the practices have witnessed growing evidence favoring early enteral feeding, they are still underutilized in practice, mainly because of concerns associated with feeding intolerance, risk of aspiration, and lack of standard protocols for standardized use [7]. Yet, multiple studies have demonstrated that the benefits of early feeding (e.g., reduced infectious complications, shorter hospital stays) often outweigh the risks in carefully selected patients [5,8]. The nasojejunal route is particularly advantageous because it bypasses the stomach, potentially minimizing the risk of gastric stasis and aspiration, especially if the perforation involved the duodenum or lower esophagus.

In this setting, the objectives of this research were to establish whether early enteral feeding using an intraoperatively placed nasojejunal tube could help prevent septic complications in patients who underwent emergency laparotomy for upper GI perforation. Secondary objectives consisted of assessing other postoperative complications like intra-abdominal abscess and anastomotic leak, alterations in nutritional status, length of hospital stay, mortality, and overall compliance with the nasojejunal feeding regimen.

It is anticipated that the study findings will contribute to a standardized approach in the postoperative management of upper GI perforation, providing evidence to support an early, protocol-driven feeding strategy. By demonstrating improvements in clinical and nutritional outcomes, this research could influence future guidelines and encourage surgeons worldwide to adopt early enteral feeding practices. Ultimately, improved nutritional management may result in better recovery, reduced infectious complications, and lower healthcare costs for this vulnerable patient population [6].

MATERIALS AND METHODS

Study Design and Setting

A prospective, randomized controlled study was conducted in the Department of General Surgery, Medical College Baroda and Sir Sayajirao General Hospital, Vadodara. The study period spanned from September 2021 to November 2022, after obtaining approval from the Institutional Ethics Committee (IEC number: IECHR-PGR/116-2021).

Study Population

All adult patients (18–70 years) undergoing emergency exploratory laparotomy for either traumatic or non-traumatic perforations of the upper gastrointestinal tract (proximal to the ligament of Treitz) were screened for eligibility. Patients were excluded if they:

- Had diabetes mellitus.
- Were known cases of chronic renal disease or chronic liver disease.
- Had GI perforation associated with malignancy.
- Had head injury.
- Refused consent.

Randomization

After obtaining informed written consent, eligible patients were randomized into two groups using the closed-envelope technique:

1. **Test Group (TG)**: Nasojejunal tube placed intraoperatively, with early enteral feeding initiated 24 hours postoperatively.
2. **Control Group (CG)**: Conventional postoperative management (NPO until return of bowel function).

A total of 63 patients met the inclusion criteria, with three patients excluded due to accidental removal of the nasojejunal tube within the first 48 hours. Ultimately, 60 patients completed the study (30 in each group).

Surgical Management and Feeding Protocol

Surgery consisted of laparotomy with primary perforation repair or a damage-control procedure at the discretion of the consultant surgeon.

- **Nasojejunal Tube Placement (Test Group)**: After identifying the perforation, a single-lumen 14-Fr polyurethane nasojejunal feeding tube (Romsons®) was inserted through the nostril and advanced beyond the pylorus into the jejunum. Correct position was verified intraoperatively and postoperatively (via C-arm on post-op days 3 and 7, or if feed was found in the gastric aspirate).
- **Feeding Regimen**: Enteral feeds commenced 24 hours post-surgery at 50 mL/h and gradually increased to 100 mL/h. Nutritional goals were 35–45 kcal/kg/day and 1.5–2 g protein/kg/day. A standardized “NJ Diet” prepared in the hospital kitchen provided 600 kcal and 16.6 g protein per 500 mL. Adjustments were made for feed intolerance (abdominal distension, diarrhea, etc.) by slowing or temporarily discontinuing the infusion.

The nasogastric (NG) tube was removed under C-arm guidance once the gastric aspirate was minimal (<50 mL) and the patient’s oral intake was being established. The nasojejunal tube was removed when the patient could tolerate approximately 2 L of oral feeding per day.

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Measured Outcomes

- **Primary Outcome**: Incidence of septic complications (assessed by surgical site infection, pneumonia, intra-abdominal abscess, and postoperative leak).
- **Secondary Outcomes**:
  - Incidence of complications related to feeding tube (accidental removal, nasal irritation, clogging).
  - Changes in nutritional status (body weight and serum albumin on admission, day 3, and day 7 postoperatively).
  - Length of hospital stay.
  - Mortality.
  - qSOFA score for sepsis monitoring.

Statistical Analysis

Data were compiled in Microsoft Excel and analyzed using appropriate statistical tests:

- Continuous variables (e.g., weight, albumin levels, energy/protein intake) were compared using the Student's *t*-test or Mann–Whitney *U* test as appropriate.
- Categorical variables (e.g., incidence of complications) were compared using the chi-square test.
- Significance was set at $p<0.05$ (95% confidence interval).

RESULTS

Overview of Findings

A total of 60 patients (30 in each group) were analyzed, with mean ages of 43.9±14.52 (TG) and 46.87±12.36 years (CG). The majority of patients were male in both groups (83% vs. 80%). At admission, the mean weight, height, and prevalence of malnutrition did not differ significantly between the two groups. Baseline serum albumin was also comparable.

From the second postoperative day onwards, the Test Group showed a significantly higher caloric and protein intake compared to the Control Group ($p<0.05$). By postoperative day 7, the mean serum albumin was significantly higher in TG (3.20±0.36 g/dL) than in CG (2.71±0.36 g/dL; $p<0.05$). Similarly, day 7 body weight also declined less in TG compared to CG, suggesting better preservation of nutritional status in the early enteral feeding group.

Regarding septic complications, surgical site infection (SSI) was significantly lower in TG (23.3%) versus CG (50%; $p=0.03$). The incidence of pneumonia, intra-abdominal abscess, and postoperative leaks did not differ significantly between the groups, although the overall number of complications (15 in TG vs. 27 in CG) favored the early enteral feeding approach. The length of hospital stay was significantly shorter for the Test Group (13.82±3.5 days vs. 17.03±6.8 days, $p=0.03$). There was no statistically significant difference in mortality (3.33% in TG vs. 6.66% in CG; $p=0.55$).

Patients in the Test Group reported minimal feeding intolerance, with a 10% incidence of mild complications like transient abdominal distension or diarrhea. Minor NJ tube-related issues included irritation at the nasal insertion site (9%) and clogging (3%), but none required early NJ tube removal unless accidentally dislodged.

Overall, early nasojejunal feeding was well-tolerated, led to improved nutritional and clinical outcomes, and showed potential in reducing postoperative septic events in upper GI perforation cases.

KEY RESULTS TABLES AND FIGURES

TABLE 1. POSTOPERATIVE DAILY ENERGY INTAKE

Postoperative Day	Test Group (kcal/day)	Control Group (kcal/day)	*p*-value
Day 1	657.3 ± 48.09	648 ± 62.9	0.26 (NS)
Day 2	1109 ± 276.9	652 ± 59	<0.05 (S)
Day 3	1527 ± 621	674.67 ± 43.4	<0.05 (S)
Day 5	2298 ± 329.4	884.67 ± 316.9	<0.05 (S)
Day 7	2459 ± 142.5	1715 ± 733.1	<0.05 (S)

TABLE 2. COMPARISON OF SURGICAL SITE INFECTION AND TOTAL COMPLICATIONS

Variable	Test Group (n=30)	Control Group (n=30)	*p*-value
Surgical Site Infection	7 (23.3%)	15 (50%)	0.03 (S)
Pneumonia	5 (16.7%)	6 (20%)	0.64 (NS)
Intra-abdominal Abscess	2 (6.7%)	3 (10%)	0.30 (NS)
Postoperative Leak	1 (3.3%)	3 (10%)	0.30 (NS)
Total Complications	15	27	0.04 (S)

TABLE 3. CHANGES IN NUTRITIONAL PARAMETERS

Parameter	Test Group (n=30)	Control Group (n=30)	*p*-value
Serum Albumin (g/dL)			
On Admission	3.14 ± 0.38	3.07 ± 0.39	0.27 (NS)
Postoperative Day 7	3.20 ± 0.36	2.71 ± 0.36	<0.05 (S)
Weight (kg)			

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On Admission	46.7 ± 8.22	44.6 ± 6.94	0.15 (NS)
Postoperative Day 7	45.7 ± 8.34	42.13 ± 7.37	0.04 (S)

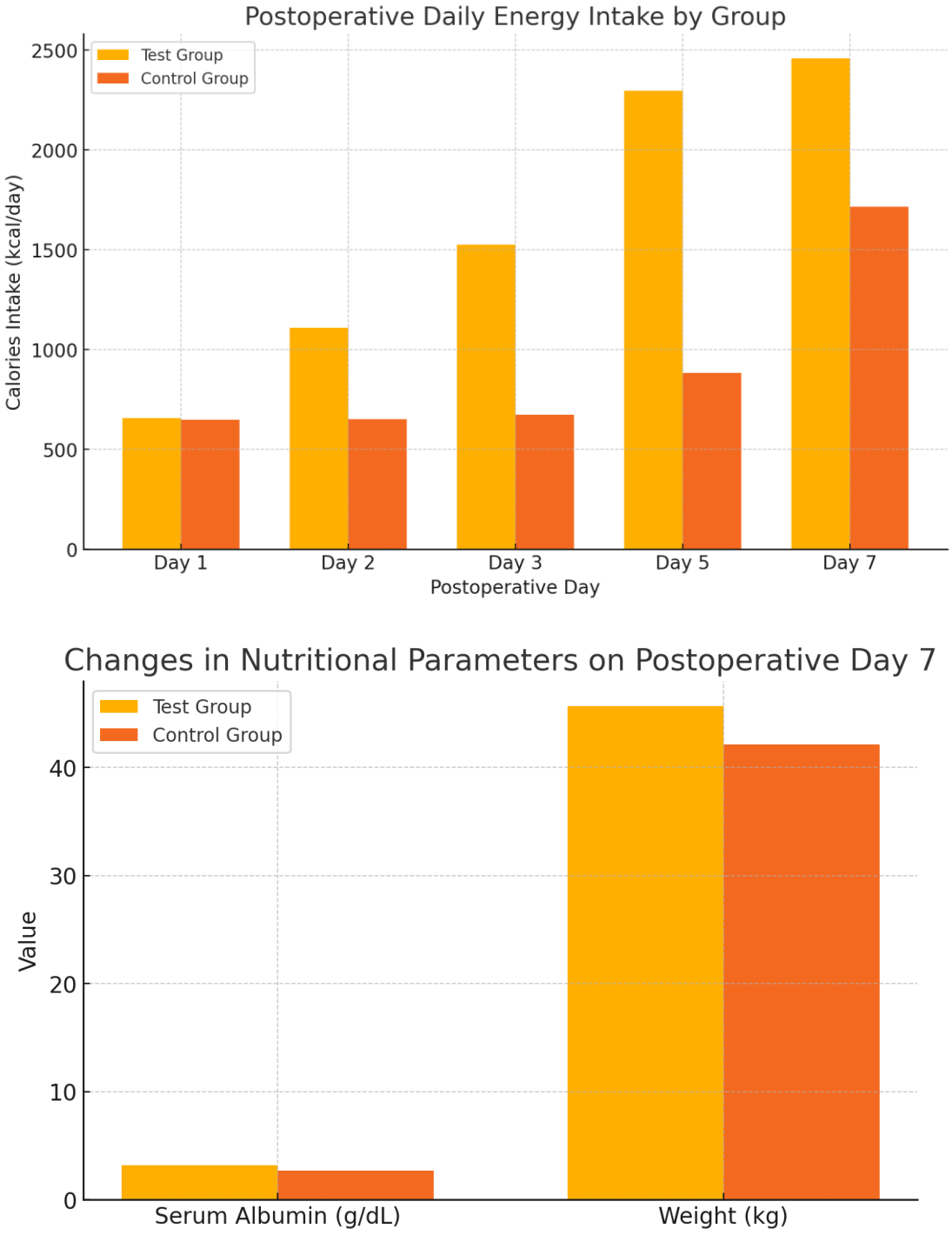

Figure 1. Comparison of Postoperative Length of Stay

DOI: 10.69605/ijlbpr_14.2.2025.35

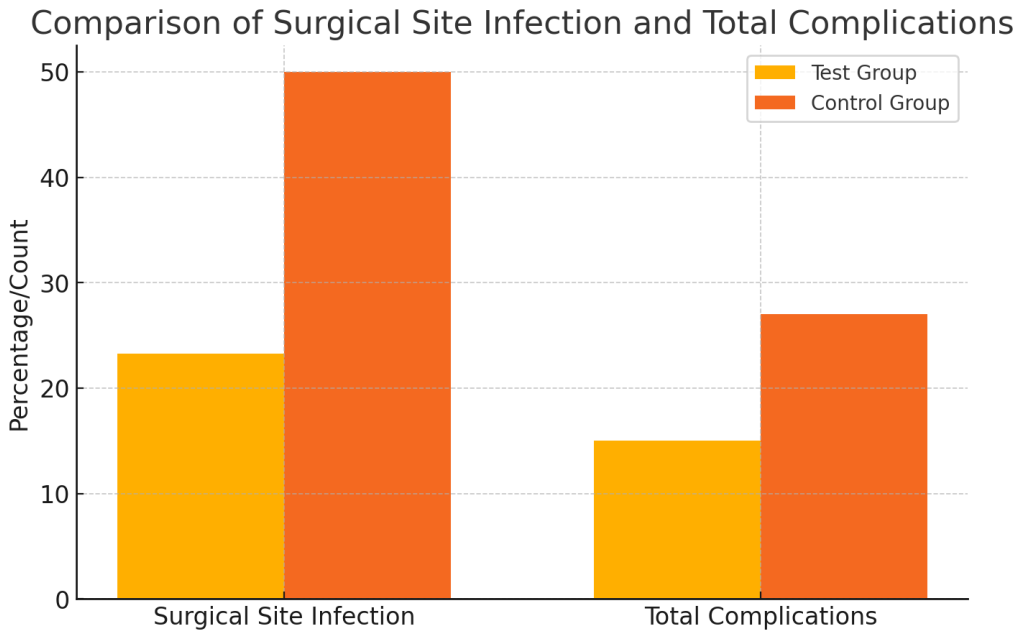

Figure 2. Incidence of Surgical Site Infection

DISCUSSION

The present prospective randomized trial demonstrates that early nasojejunal (NJ) feeding in patients with upper GI perforations significantly reduces postoperative complications, particularly surgical site infections, while supporting better nutritional recovery. Our findings align with previous research indicating the benefits of early enteral nutrition in surgical patients [9,10]. By bypassing the stomach and introducing feeds into the jejunum, we potentially mitigated the risk of aspiration and feed intolerance, commonly cited concerns in the postoperative setting [11].

In this study, serum albumin levels on postoperative day 7 were notably higher in the Test Group compared to the Control Group, suggesting that early enteral feeding preserved lean body mass and improved protein metabolism. Although serum albumin can be influenced by acute-phase reactants and fluid shifts, several studies also point to its utility as a surrogate marker of nutritional status, particularly in stable postoperative patients [12]. Moreover, patients in the Test Group experienced less weight loss by day 7, reinforcing the protective role of early enteral feeding against the catabolic insult characteristic of the postoperative period [13].

Surgical site infections were significantly lower in the early enteral feeding group, which can be attributed to improved immune function, gut mucosal integrity, and reduced bacterial translocation [14,15]. The minimal difference in pneumonia and intra-abdominal abscess rates between the two groups suggests that other factors, such as operative time and perioperative antibiotic use, may play a role. However, the consistently lower total number of septic events in the Test Group highlights the cumulative advantage of early enteral feeding [16].

The shorter length of hospital stay observed in the Test Group (13.82 vs. 17.03 days) has important clinical and economic implications, particularly in resource-limited settings. Early restoration of gut function may help expedite postoperative recovery, facilitate earlier mobilization, and reduce overall healthcare costs [10]. While mortality was not significantly different, likely due to the relatively small sample size, the trend favored early enteral feeding.

Feeding and tube-related complications were acceptably low, with minor symptoms such as irritation at the nasal insertion site and intermittent clogging. These issues can be mitigated with refined insertion techniques, careful nursing, and prophylactic measures (e.g., flushing the tube regularly).

Overall, the present study strengthens the argument for adopting an early enteral feeding strategy in patients undergoing surgical repair of upper GI perforations. Future research with a larger sample size and multi-institutional collaboration would help validate these findings and refine protocols regarding feed composition, rate of advancement, and the role of immunonutrition.

CONCLUSION

Early enteral feeding via a nasojejunal tube in patients with upper gastrointestinal perforations is both feasible and beneficial. This approach significantly reduces surgical site infections, shortens the length of hospital stay, and helps maintain better nutritional indices compared to conventional nil-per-os management. Minor complications related to the feeding tube or feeding intolerance were manageable and did not compromise patient outcomes. These findings support the routine use of early enteral feeding in the postoperative management of upper GI

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perforations and highlight the need for standardized protocols to maximize patient recovery and reduce the burden of septic complications.

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