Original Article

Comparison of the outcome of early versus delayed oral feeding after gastrointestinal anastomosis in adults

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Abstract

Background: Patients are routinely placed on nil per oral after gastrointestinal anastomosis and only allowed oral intake after the onset of bowel sounds or the passage of flatus. Studies suggest that oral feeding within 24hours of anastomosis is safe.
Aims: To compare the time for return of bowel motility, complication rates and length of postoperative hospital stay between early and delayed oral feeding group.
Methods: This study was a prospective randomized control study. Sixty patients were randomized equally into early (study) and delayed (control) oral feeding groups. The study group was commenced on oral feeding 24hours postoperatively and the control group after passing flatus. Outcome measures were evaluated and compared using chi-square test and t-test with SPSS version 20 software.
Results: The study and control groups passed flatus 42.6±22.0hrs and 70.3±23.3hrs postoperatively (*p=0.000*), passed stool at 69.8±37.0hrs and 89.5±29.2hrs postoperatively (*p=0.026*) and bowel sounds returned 31.4±13.3hrs and 53.8±21.7hrs postoperatively (*p=0.000*) respectively. Eight (27.6%) and 17(56.7%) patients had surgical site infection in the study and control group respectively (*p=0.024*). No patient in the study group had anastomotic leak while one (3.3%) leaked in the control group (*p=1.000*). The length of postoperative hospital stay was 9.6±4.8 and 13.9±7.9 days in the study and control group respectively (*p= 0.021*).
Conclusions: Early oral feeding after anastomosis led to an earlier return of bowel sound, passage of flatus and stool. There was also an observed reduction in the rate of surgical site infection and a reduction in the length of postoperative hospital stay among the early feeding group but no effect on anastomotic leak or chest infection.

Keywords: Early oral feeding, delayed oral feeding, gastrointestinal anastomosis, anastomotic leak, chest infection.

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INTRODUCTION

In our environment, patients are routinely placed on nil per oral and nasogastric tube drainage after gastrointestinal anastomosis and only allowed oral intake after return of normal bowel sounds and passage of flatus, which usually takes about three to five days.[1] This delayed oral feeding (DOF) regime is based on the premise that early oral feeding (EOF) could lead to anastomotic leak and also predispose to postoperative vomiting, hence the need to allow some time for the anastomosis to heal and for bowel motility to return.[2] Recently, a lot of emphasis has been placed on EOF especially as a component of enhanced recovery after surgery (ERAS) protocol.[3]

EOF is the commencement of calorie containing diet within 24hours of surgery regardless of the return of normal bowel sound or passage of flatus.[4] Studies have shown that EOF is safe and may be associated with better outcomes.[5] EOF reduces the stress response and catabolism that accompanies surgery and helps return the body faster to its baseline physiologic state.[6] It is believed that the presence of luminal nutrients stimulates intestinal peristalsis and reduces the time taken for the return of normal bowel sound and passage of flatus.[7] Luminal nutrient also helps maintain mucosa barrier function and prevents translocation of luminal bacteria into the circulation thereby reducing postoperative septic complications .[8] EOF have also been reported to enhance wound healing and increase anastomotic strength especially in malnourished patients.[5,9]

In a systematic review of 14 randomized control trials, Andersen *et al*.,[10] concluded that DOF had no advantage and that while EOF may be associated with a slight increase in vomiting, it did not increase anastomotic leakage. Kumar *et al.,*[11] reported a significant reduction in the time taken to pass flatus and stool among patients commenced on EOF and El Nakeeb *et al*.,[12] reported a reduction in postoperative pneumonia among EOF group when compared to DOF group.

The aim of this study was to compare the outcome of patients commenced on EOF with those on DOF and to determine if EOF led to a faster return of bowel motility. This study also compared the complication rate and length of postoperative hospital stay (LOPHS) between both groups.

SUBJECTS AND METHODS

Study setting and design

This study is a prospective randomized control study carried out in the General Surgery Division of a tertiary hospital between February 2016 and February 2017.

Study population

Consenting adults 18years and above who had elective or emergency gastrointestinal anastomosis were recruited into the study. Patients less than 18years, those requiring a protective stoma after an anastomosis, patients who had simple closure of an intestinal perforation and those who required mechanical ventilation in the postoperative period were excluded from the study.

Sample size and sampling technique

The minimum sample size was calculated using the formula for Superiority study for randomized control study by Zhong.[13]

$$N = \frac{2\,(Z_{\alpha} + Z_{1-\beta})^2 \times \sigma^2}{(\delta - \delta_0)^2}$$

Where,

N= Minimum sample size, α= Confidence level (95%), 1-β=Power of the study(80%) σ= pooled standard deviation

δ= Mean outcome in standard treatment group (DOF)

δ_0= Mean outcome in the new treatment group (EOF)

Imputing values from a previous study by Hosseini *et al.,*[14]

$$N = \frac{2\,(Z_{0.05} + Z_{0.8})^2 \times 2.8^2}{1.62^2}$$

$$N = \frac{2\,(1.96 + 0.84)^2 \times 7.84}{2.56}$$

$$N = \frac{2 \times 7.84 \times 7.84}{2.56}$$

N = 48 Patients per group

Sample size correction for a finite population of less than 10,000 was done using the formula by Araoye.[15]

$$N^* = \frac{N}{1 + N/N_0}$$

Where,

N* = Corrected sample size

N = Estimated sample size

N_0= Population size (Number of anastomoses in the Institution per year)

$$N^* = \frac{48}{1 + 48/40}$$

N* = 22 Patients per group.

Allowing for an attrition rate of 10%, minimum sample size will be 25 patients per group.

Minimum number of patients for the study will be

2 x 25 = 50.

Postoperatively, a research assistant randomly picked from a pool of sealed envelopes containing numbers 1-60 and the patients were allocated to the group (EOF or DOF) assigned to that particular number by the randomizer software. The allocation ratio was 1:1.

Preoperative management

All patients had detailed history and clinical examination followed by routine preoperative investigations such as full blood count, electrolyte and urea, serum protein, blood grouping and cross matching. Where indicated, patients for elective surgery had upper and lower gastrointestinal endoscopy. Patients for elective left colonic resection had a 3-day mechanical bowel preparation. Patients who had emergency surgeries were resuscitated with intravenous fluids, electrolyte imbalance and anaemia were corrected and they were optimized for surgery. Nasogastric tube was passed on admission for patients who had emergency surgery and on the morning of the surgery for elective cases.

Patients were given ceftriaxone (1 gram) and metronidazole (500mg) to cover for Gram negative micro-organisms and anaerobes at induction of anaesthesia. Anaesthesia was by general anaesthesia and endotracheal tube intubation using standard technique. The peritoneal cavity was explored through an adequate access and appropriate surgery carried out depending on the pathology. Anastomosis was done in two layers with vicryl 2/0 in all cases. The incision was closed using the mass closure technique with non-absorbable nylon 1 suture to the fascia and nylon 2/0 to the skin.

Postoperative management

Patients that had elective surgeries had antibiotics continued over the next 24hours while those with peritoneal contamination had therapeutic antibiotics until there was no clinical evidence of infection. They also received adequate analgesia and were on intravenous fluid until oral intake was established. Auscultation for bowel sound was done 6hrly postoperatively for all patients and abdominal girth measured 12hourly after an initial baseline measurement in the immediate postoperative period.

EOF group

Patients in the EOF group had their nasogastric tube removed and were commenced on 30ml/hr of water 18 hours postoperatively. Calorie containing liquid was commenced 24 hours postoperatively with Lucozade boost (Glaxosmithkline, Batch number: EP37IW) which contains 74kcal/100mls at 50ml/hr to provide at least 50% of patients daily caloric requirement which was estimated using the formula 25kcal/kg/day for average adult caloric requirement.[16] Fortified pap; a locally prepared equivalent of WHO F-100 formula which provided 116kcal per 100mls was commenced at 48hrs postoperatively.[17] Patients were allowed normal diet 72hours postoperatively.

DOF group

Patients in the DOF group had their nasogastric tube removed when there were normal bowel sounds and passage of flatus following which they were commenced on oral intake as per protocol for the EOF group.

Both groups were monitored by trained research assistants who were blinded to the group the patients belonged to for the following outcome measures:

i) Time taken to pass flatus: Time from end of surgery to first passage of flatus as reported by the patient.
ii) Time for return of bowel sounds: Time from end of surgery to return of normal bowel sounds.
iii) Time to pass stool: Time from end of surgery to passage of first stool by the patient.
iv) Anastomotic leak: Presence of fever (>38^{0}C), tachycardia (>90bpm), localized or generalized abdominal tenderness and/or leakage of luminal content from the surgical wound or from a drain placed intraoperatively.
v) Surgical site infection (SSI): Presence of erythema, purulent discharge from wound and/or positive wound swab culture within 30 days of surgery.
vi) Postoperative chest infection: Presence of any three of fever (>38^{0}C), leucocytosis (>12,000 cells/mm^3), infiltrates on chest x-ray and positive sputum culture within 30 days of surgery.
vii) Vomiting: 2 or more episodes ≥ 100mls.
viii) Abdominal distension: Two centimeters increase in abdominal girth above initial baseline measurement at 15cm from the pubic symphysis.
ix) LOPHS: Time from end of surgery to when patient was discharged.

Patients with anastomotic leak had a reoperation, peritoneal irrigation, a diverting stoma and peritoneal drainage. Those with SSI received local wound care and those with chest infection received appropriate antibiotics and chest physiotherapy. Oral intake was discontinued in those with progressive abdominal distension or two or more episodes of vomiting in 24hours and nasogastric tube re-inserted. The nasogastric tube was removed after the abdominal distension and vomiting subsided and the patients were commenced on graded oral intake. Patients were discharged after meeting the following criteria: ability to tolerate full oral intake in the absence of vomiting or progressive abdominal distension, passage of stool, ability to ambulate and absence of any other serious complication. They were followed up on out-patient basis two weekly for a total of 6 weeks following which they exited the study.

Ethics

The study was conducted in accordance with the principles of the revised edition (2010) of the Helsinki declaration (1945) on human subject research. Ethical approval was obtained from the Health Research Ethics Committee of the institution on the 18th of February 2016. Written consent was obtained from all patients 18 years and above who agreed to participate in the study.

Data analysis

Analysis was done using the IBM SPSS software version 20 (IBM, Chicago, IL, USA). Data were presented in tables using frequency, mean and standard deviation (SD) and comparison between both groups done using the student t-test for quantitative variables and chi- square test for categorical variables. Fischer's exact test was used in comparing categorical outcome between both groups when the criteria for using chi-square test was not met. Confidence level was set at 95% and p value of < 0.05 was considered to be significant.

RESULTS

Seventy-four patients were assessed for eligibility into the study, 14 were excluded (10 did not meet the inclusion criteria, four did not give consent) and 60 were randomized equally into EOF and DOF groups respectively (Figure 1). The age of patients in the EOF group ranged from 18 – 64 years with a mean age of 36.7 ± 11.6 years while the age of patients in the DOF group ranged from 18 – 70 years with a mean age of 34.1±16.1 years (Table 1). The difference in the mean age between both groups was not statistically significant ($p = 0.476$). There was no significant difference between the sex of both groups ($p = 0.781$) with 20(66.7%) patients in the EOF group being males as against 21(70%) in the DOF group.

Generalized peritonitis secondary to typhoid ileal perforation was the commonest indication for surgery in both group accounting for eight (26.7%) cases in the EOF group and 14(46.7%) in the DOF group. Other indications are shown in Table 2. The difference in indications between both groups did not attain statistical significance ($p = 0.384$). Segmental ileal resection and ileo-ileal anastomosis was the commonest surgical procedure performed in

both groups accounting for 12(40%) and 16(53.3%) procedures performed in the EOF and DOF group respectively. The other surgical procedures performed are shown in Table 3.

Table 1: Patient demographics

Demography	EOF	DOF	p-value
Age (mean ± SD)	36.7 ± 15.6	34.10 ± 16.1	0.476*
Sex n (%)			
Male	20 (66.7)	21 (70.0)	0.781†
Female	10 (33.3)	9 (30.0)	
Nature of Surgery			
Elective	12 (40.0)	11 (36.7)	0.791†
Emergency	18 (60.0)	19 (63.3)	

* t-test †chi-squared test

Table 2: Indications for gastrointestinal anastomosis

Diagnosis	EOF n (%)	DOF n (%)	p-value
			0.318†
Generalized peritonitis secondary to typhoid perforation	8 (26.7)	14 (46.7)	
Colorectal cancer	7 (23.3)	4 (13.3)	
Gastric cancer	3 (10.0)	4 (13.3)	
Ventral hernia with iatrogenic bowel injury	1 (3.3)	0 (0.0)	
Penetrating abdominal injury	4 (13.3)	2 (6.6)	
Colostomy	3 (10.0)	1 (3.3)	
Rectal prolapse	1 (3.3)	0 (.0)	
Enterocutaneous fistula	1 (3.3)	2 (6.7)	
Strangulated inguinal hernia	0 (0.0)	1 (3.3)	
Duodenal cancer	0 (0.0)	1 (3.3)	
Ileal tumor	0 (0.0)	1 (3.3)	
Intestinal Obstruction secondary to post operative adhesions	2 (6.7)	0 (0.0)	
Total	30 (100)	30 (100)	

†chi- squared test

Table 3: Surgical procedures performed

Surgical procedure	EOF n(%)	DOF n(%)	p- value
			0.670†
Segmental ileal resection and ileo-ileal anastomosis	12 (40.0)	16 (53.3)	
Limited Right hemicolectomy	2 (6.7)	2 (6.7)	
Right hemicolectomy + ileotransverse anastomosis	8 (26.7)	5 (16.7)	
Subtotal gastrectomy + Roux-en-Y gastrojejunostomy	2 (6.7)	3 (10.0)	
Gastrojejunostomy	1 (3.3)	2 (6.7)	
Colostomy Reversal	3 (10.0)	1 (3.3)	
Altemeir's procedure	1 (3.3)	0 (0.0)	
Total Colectomy + ileo-rectal anastomosis	1 (3.3)	0 (0.0)	
Anterior Resection	0 (0.0)	1 (3.3)	

†chi-squared test

Table 4: Postoperative outcome measures

Outcome	**EOF**	**DOF**	**p-value**
Time to pass flatus (hrs)	42.6 ± 22.0	70.3 ± 23.3	*0.000**
Time to pass stool (hrs)	69.8 ± 37.0	89.5 ± 29.1	*0.026**
Time for return of bowel sounds (hrs)	31.4 ± 13.3	53.8 ± 21.7	*0.000**
LOPHS (days)	9.6 ± 4.8	13.9 ± 7.9	*0.021**
Anastomosis leak	0(0)	1(3.3)	*1.000*‡
Postoperative chest infection	0(0)	2(6.7)	*0.492*‡
SSI n(%)	8(27.6)	17(56.7)	*0.024*†
Vomiting	3 (10.0)	3 (10.0)	*1.000*‡
Abdominal distention	2 (6.7)	1 (3.3)	*1.000*‡

* t-test, †chi-squared test, ‡Fischer's exact, mean ± SD, n (%)

The time taken to pass flatus was 42.6 ± 22.0 hours in the EOF group and 70.3 ± 23.3 hours in the DOF group. The difference between both groups was statistically significant (*p=0.000*). The difference in the time taken to pass stool (*p=0.026*) and time for return of normal bowel sounds (*p=0.000*) between both groups were also statistically significant (Table 4). No patient in the EOF group had anastomotic leak compared to one patient in the control group. The difference in anastomotic leak rate between both groups was not statistically significant (*p=1.000*). There was also no significant difference in postoperative chest infection (*p=0.492*), abdominal distention (*p=1.000*) and vomiting (*p=1.000*) between both groups. SSI occurred in 8(27.6%) patients in the EOF group as against 17(56.7%) in the DOF. This difference was significant (*p= 0.024*). The LOPHS was 9.6 ± 4.8 days and 13.9±7.9 days in the EOF and DOF group respectively. This difference was also significant *(p=0.0021).*

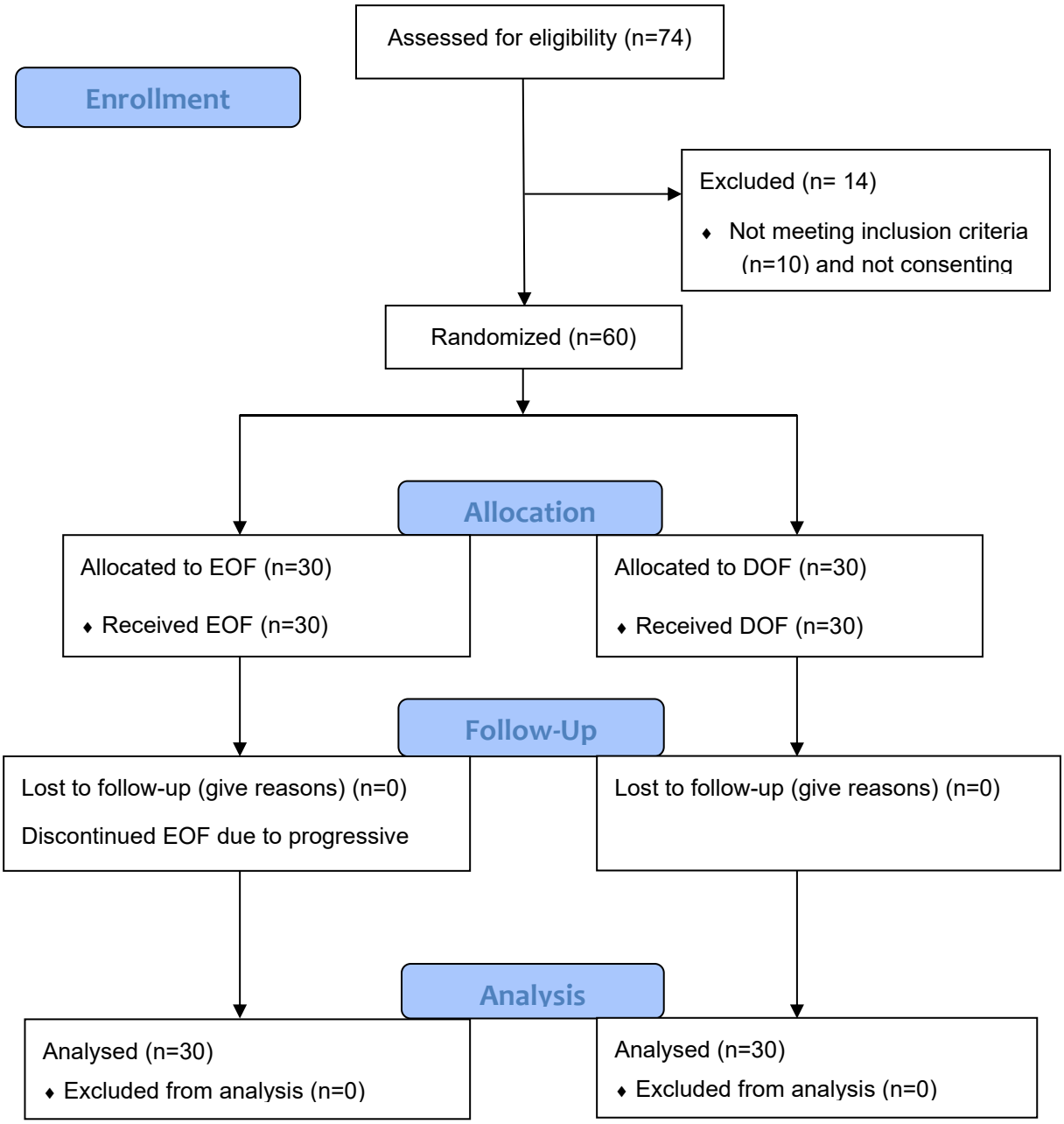

Figure 1: CONSORT flow chart of patient recruited into the study

DISCUSSION

The traditional approach of routinely placing all patients that have had gastrointestinal anastomosis on nil per oral and nasogastric tube drainage until return of normal bowel sound and passage of flatus have come under increased scrutiny in the ERAS era with some arguing that this practice is not based on proven scientific facts.[9] The trend is shifting to EOF because of its effect in reducing postoperative stress response, postoperative weight loss and enhancing the return of bowel motility.[6,14]

In this study, both EOF and DOF group were similar in terms of age distribution, sex and type of surgery performed thus allowing for comparison to be made between both groups. The mean age of patients in the EOF and DOF group was 36.7 ± 15.6 years and 34.1 ± 16.1 years respectively. This differs from that of Bendavid *et al.,*[18] in which the average age of

patients was 69 years in both group. It also differs from several other western studies in which the mean age of their patients were relatively higher.[17-19] This may be because our study was carried out in a developing country where the majority of the population is either young or middle aged and also because the most common indication for surgery in the western series differs from that of this study. However, in a similar study by Chartargee *et al.,*[19] in another developing country (India), the mean age was 38.2 years and 36.2 years in the EOF and DOF groups respectively, similar to the findings in this study.

The most common indication for surgery in this study was generalized peritonitis secondary to typhoid ileal perforation accounting for eight (26.7%) and 14(46.7%) patients in the EOF and DOF groups respectively. This is similar to findings by Lee *et al.,*[20] and other studies. In contrast, resection for colorectal cancer was the commonest indication for gastrointestinal anastomosis in a number of series from Europe and North America.[21,22] This is probably because most Western Countries no longer grapple with surgical complications of infectious diseases which is common in our study area.

The mean time for the passage of flatus in the EOF group was 42.6 hours and this was significantly less than the time to pass flatus in the DOF group (73 hours). Dag *et al.,*[23] reported a mean time of 41 hours and 78 hours for the EOF and DOF group respectively. Similar time was obtained by other researchers.[24,25] Ahmad *et al.,*[26] reported a shorter time of 33 hours and 58 hours for the EOF and DOF group respectively.[26] This is probably because most of their patients had ileostomy reversal and the surgery was less extensive. While several studies demonstrated a significant difference in time to pass flatus between both groups,[10,12,22] Davila-Perez *et al*.,[7] and some other studies demonstrated no significant difference between both groups.[16,18]

In a study conducted by Vaithiswaran *et al*.,[24] the mean time for return of bowel sounds was 31 hours and 46 hours for the study and control group respectively. This is similar to the time obtained in this study. Kumar *et al.,*[27] reported a shorter time for return of bowel sounds at about 23 hours and 44 hours for the study and control group respectively. However, their study recruited only patients for elective colonic anastomosis. In this study as in many others, the difference between both groups was statistically significant.[19,24,28] However, Davila-Perez *et al.,* did not demonstrate any significant difference.[7]

Patients in the EOF group passed stool 70 hours postoperatively as against those in the DOF group who passed stool 90 hours postoperatively. The difference between both groups was statistically significant. This significant difference was also reported by other studies.[23,28]

No patient in the EOF group developed anastomotic leakage. Yadav *et al.,*[29] also recorded a 0% leak rate among patients in the EOF group. The 3% anastomotic leak rate in the DOF group in this study is similar to those obtained in several other studies which showed a low anastomotic leakage in both the EOF and DOF group.[12,20] The difference in anastomotic leakage rate between both groups in this study was not statistically significant. This is in agreement with other published articles.[20,25]

About 57% of patient in the DOF group developed SSI. This figure is much higher than rates published by most studies which ranged from 15-30%.[7, 25,27,29] This may be due to the fact that most of these studies included only elective patients with minimal risk of peritoneal contamination. The 27.6% rate of SSI in the EOF group is also higher than rates published in other studies. The statistically significant difference in SSI rate observed between both groups in this study was corroborated by similar findings by other studies.[27,29,30]

The postoperative chest infection rate was low in both the EOF and DOF group and the difference between both groups did not attain statistical significance. Similar findings was obtained by Marwah *et al.,* and other workers.[10,25,31] However, Lee *et al.,* [20] reported a significant difference in postoperative pneumonia rate between patients commenced on early feeding and those managed using the DOF regime. Twenty-seven patients (90%) tolerated EOF with only three patients having repeated episodes of vomiting. This is similar to results obtained by most studies which

reported an average of 80 - 90% of patients that were able to take feeds within 24hrs of surgery without repeated episodes of vomiting.[10,17,23]

The LOPHS was significantly less in the EOF group than in the DOF group. This is perhaps an accurate pointer to the advantage of EOF over DOF. Vaithiswaran *et al.,*[24] also demonstrated a significant difference in the LOPHS between patients managed by EOF and those managed by DOF. Other studies also reported similar findings.[19,29]

This study however had some limitations, among which is the small sample size of 60 patients. This was to allow for the work to be completed within the stipulated time. A larger sample size as well as a multicentre study may be more informative. The time of return of normal bowel sound may not be completely reliable because of the frequency of auscultation (six hourly).

CONCLUSION

EOF led to a significant reduction in the time taken for return of normal bowel sounds, passage of flatus and passage of stool after gastrointestinal anastomosis when compared with DOF. The complication rate between both groups was similar except for a significant reduction in the rate of SSI in patients on early feeding. EOF also significantly shortens the LOPHS.

From the findings of this study, we recommend that EOF should be encouraged after gastrointestinal anastomosis as it does not lead to any adverse outcome but instead enhance return of bowel motility. We also suggest a larger multicentre study on this subject.

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Conflicts of interest
There are no conflicts of interest

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Key Messages
Early oral feeding after gastrointestinal anastomosis is practicable and does not lead to anastomotic leakage. It enhances the return of bowel motility and reduces the length of postoperative hospital stay. Complication rates are similar between patients commenced on early feeding