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A Comparative Study Between Early Versus Delayed Enteral Feeding After Surgical Management of Gut Perforations

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Abstract:
Background: *Traditionally, the postoperative management undergoing gastrointestinal surgery has been to keep them "nil per mouth" and provide gastric decompression via a nasogastric tube until the postoperative ileus resolves and bowel function resumes and to protect the anastomotic repair. But on the other hand "nil per mouth" i.e. delayed feeding causes reduced gastric emptying, altered upper GI dynamics, reduced substrate in the gut, reduced biosynthesis and also villous atrophy with immunological incompetence.*
Aim and objectives: *To compare the outcome of the early versus delayed enteral feeding with respect to of tolerance to feeding, serum albumin level, effects on recovery from postoperative paralytic ileus, return of bowel sounds (in days), wound infections, anastomotic leakage and length of hospital stay.*
Materials and Methods: *A prospective comparative study was conducted on 80 patients who underwent emergency surgical management for gut perforations in the Department of General Surgery, Fakhruddin Ali Ahmed Medical College & Hospital (FAAMCH), Barpeta, Assam 1st October 2021 to 30th September 2022 with first 40 cases given early enteral feeding and next 40 cases given delayed enteral feeding and the objectives are compared between the 2 groups.*
Results: *The most prevalent age group was found to be 17-26 years (35%), followed by 27-36 years (27.50%), and 37-46 years (17.50%) but no significant association was found between age groups. The most prevalent case was diagnosed to be duodenal perforations with 33 (82.5%) cases in the delayed enteral feeding group and 27 (67.5%) cases in the early enteral feeding group. 67 (83.8%) cases were tolerating to feeding, while 13 (16.2%) cases were not tolerating to feeding. Anastomic leakage was found in 1 (1.25%) case in the delayed enteral feeding group and none in the early enteral feeding group. Wound Infection was present in 22 (27.5%) cases. Higher proportion of cases in the delayed enteral feeding group had wound infection which was 16 (40%) cases. The duration of hospital stay was significantly higher in the delayed enteral feeding group (16.31±3.04 days) as compared to early enteral feeding group (9.03±2.60 days, as p<0.05 (significant).*
Conclusion :*early enteral feeding is a safe and effective intervention among gut perforations patients following surgical repair or anastomosis which promotes early recovery of patients avoiding post-surgical malnutrition.*
Keywords: *Early enteral feeding, Delayed enteral feeding, Gut perforation*

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I. Introduction

"Enteral feeding" refers to the delivery of enteral products through an enteral access device into a functional gastrointestinal tract[1]. This can be by mouth, nasogastric tube or by enterotomy tube.

Traditionally, the postoperative management undergoing gastrointestinal surgery has been to keep them "nil per mouth" and provide gastric decompression via a nasogastric tube until the postoperative ileus resolves and bowel function resumes and to protect the anastomotic repair[2]. But on the other hand "nil per mouth" causes reduced gastric emptying, altered upper GI dynamics, reduced substrate in the gut, reduced biosynthesis and also villous atrophy with immunological incompetence[3].

Delayed feeding can causes mucosal atrophy, bacterial translocations, diminishes nitrogen balance and decreases collagen contents in scar tissues which lead to postoperative complications.[4]

Early enteral nutrition is defined as all oral intake and any kind of tube feeding (gastric, duodenal or jejunal) containing calorie contents within 24 h postoperatively[5]. Early enteral feeding has significantbeneficial effects such as reduction in infectious complications, bacterial translocation, and severity of multiple organ dysfunction syndrome in surgical patients[6]. Early feeding preserves immune functions, mucosal proteins, digestive enzymes and IgA secretions[7]. Early feeding enhances early wound healing and reduces catabolic state, septic morbidity, surgical complications and length of hospital stay.[8]

The aim and objectives of this study is to compare the outcome of the early versus delayed enteral feeding with respect to-

- Tolerance to feeding
- Serum albumin level
- Effect on recovery from postoperative ileus
- Return of bowel sounds (in days)
- Wound infection
- Anastomotic leakage
- Duration of hospital stay

II. Materials And Methods

The present study was conducted in the Department of General Surgery, Fakhruddin Ali Ahmed Medical College & Hospital (FAAMCH), Barpeta, Assam.

Type of study: Prospective comparative study.

Duration of study: One year(1st October 2021 to 30th September 2022)

Study population: Patients who are diagnosed with gut perforations and undergone emergency surgical management are included in this study after taking written informed consent.

Sample size: A total of 80 patients who underwent emergency surgical management for gut perforations were taken during the study period fulfilling the inclusion and exclusion criteria and first 40 cases were given early enteral feeding and next 40 cases were given delayed enteral feeding.

Inclusion criteria:

- Age more than 12 years
- Patients with gut perforations undergoing emergency exploratory laparotomy
- Patients who consented for this study.

Exclusion criteria:

- Age less than 12 years
- Patients with malignancy with gut peroration
- Pregnancy
- Patients who donot give consent.

Method of collection of data:

This prospective comparative study comprises of 80 patients who underwent emergency surgical management for gut perforations.

In our study, the first 40 cases were included in the early enteral feeding group and enteral feeding was started within 24 hours of surgery irrespective of presence of bowel sounds in the form of clear liquids at the rate of 20 ml/hr intermittently. Around 150 ml of clear liquids like water and ORS were fed in first postoperative day and i.v. fluid was continued to maintain fluid volume. Later on 2nd postoperative day, the patients who were tolerate to feeding, the nasoenteric tube was removed and patients were started to fed orally. The proposed liquid oral diet was started at the rate of 30ml/hr, which was fed intermittently and around 650 ml of this form is continued. Subsequently, the patients were switched to oral soft diet and normal diet gradually.

The next 40 cases were included in the delayed enteral feeding group and enteral feeding was started 72 hours postoperatively irrespective of the presence bowel sounds.

In both the groups, tolerance was defined as the patients who were able to take diet through nasoenteric tube or orally without having nausea, vomiting, abdominal distension or abdominal cramps.

The results were analysed in terms of tolerance to feeding, serum albumin level, effects on recovery from postoperative paralytic ileus, return of bowel sounds (in days), wound infections, anastomotic leakage and length of hospital stay.

Statistical analysis:

All the data were compiled on Microsoft Excel spreadsheet version 2021 and analysed using IBM-SPSS version 26. Categorical data was expressed as frequency and proportion (percentages). For determining the statistical correlation in categorical data, a Chi-square test or Fisher Exact test was applied. To calculate significant mean difference for normally distributed continuous data, a student t-test was applied, whereas, for non-normal continuous data, the non-parametric test of Mann-Whitney U test was applied. P-value < 0.05 will be considered significant for all statistical comparisons.

III. Results And Observations:

1.Age distribution:

Out of 80 cases , the most prevalent age group was found to be 17-26 years (35%), followed by 27-36 years (27.50%), and 37-46 years (17.50%). No significant association was found between age and the groups, as p> 0.05.

	Early enteral Feeding group		**Delayed enteral Feeding group**		**Total**		
Age(Years)	**N**	**%**	**N**	**%**	**N**	**%**	**p-value**
17-26	17	42.50	11	27.50	28	35.00	0.0735
27-36	11	27.50	11	27.50	22	27.50	
37-46	5	12.50	9	22.50	14	17.50	
47-56	4	10.00	4	10.00	8	10.00	
57-66	3	7.50	4	10.00	7	8.75	
67-76	0	0.00	1	2.50	1	1.25	
Total	**40**	**100.00**	**40**	**100.00**	**80**	**100.00**	
Mean	**33±14**			**36±14**			

Table-1: Age distribution among the early enteral feeding group and delayed enteral feeding group

2. Sex distribution:

Out of 80 cases, 60 (75%) cases were males and 20 (25%) cases were females. In the early enteral feeding group 31 (77.5%) cases were males and in the delayed enteral feeding group 29 (72.5%) cases were males, as p<0.05 (significant).

		Early enteral Feeding	**Delayed enteral feeding**	**Total**	

		group		group				
		N	**%**	**N**	**%**	**N**	**%**	**p-value**
Sex	Male	31	77.50%	29	72.50%	60	75.0%	0.001
	Female	9	22.50%	11	27.50%	20	25.0%	

Table-2: Sex distribution among the early enteral feeding group and delayed enteral feeding group

3.Distribution among the early enteral feeding group and delayed enteral feeding group:

The most prevalent case was diagnosed to be duodenal perforations with 33 (82.5%) cases in the delayed enteral feeding group and 27 (67.5%) cases in the early enteral feeding group. Gastric perforations were present 8 (20.0%) cases in the early enteral feeding group and 4 (10.0%) cases in the delayed enteral feeding group. Ileal perforations (traumatic) were present 5 (12.5%) cases in the early enteral feeding group and 3 (7.5%) cases in the delayed enteral feeding Group, as p>0.05 (insignificant).

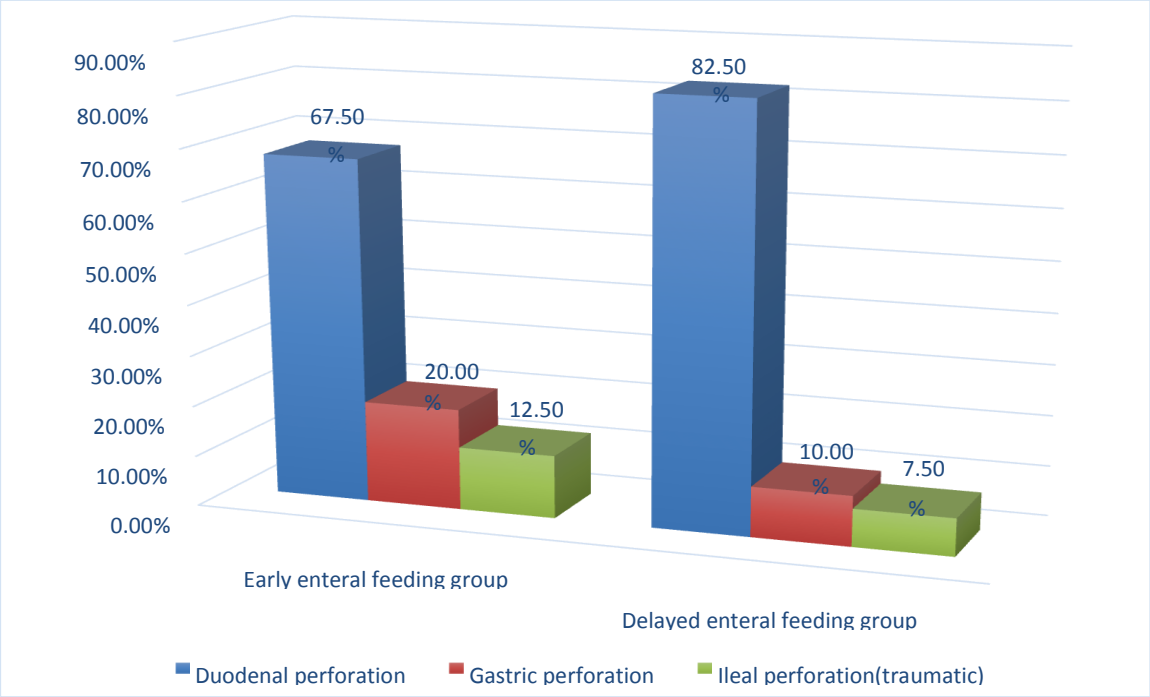

Figure 1: Showing case distribution among the early enteral feeding group and delayed enteral feeding group

4. **Distribution of types of operation among the early enteral feeding and delayed enteral feeding group:**

In the early enteral feeding, 37(92.50%) cases and 35 (87.50%) cases in the delayed enteral feeding group were perfomed with Modified Graham's omental patch repair. Ileoileal anastomosis was performed in 5 (12.50%) cases in the early enteral feeding group and 3 (7.50%) cases in the delayed enteral feeding group. In all the ileal perforation cases, resection and anastomosis was performed because of the larger size of the perforations and doubtful marginal viability.

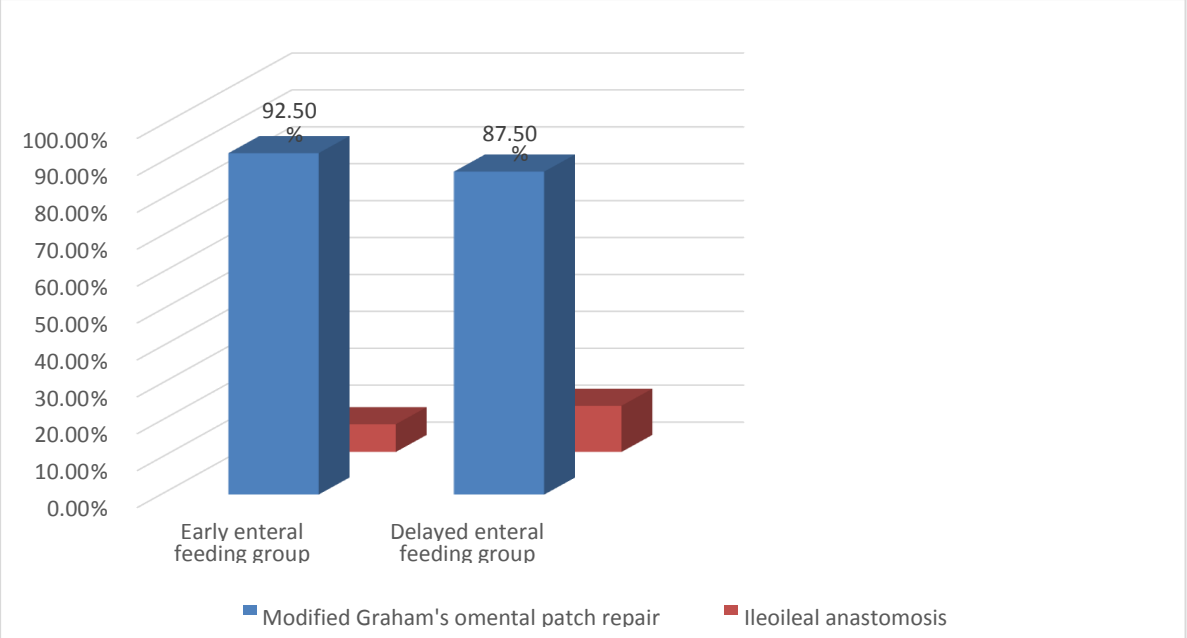

Figure 2: Showing distribution of types of operation among the early enteral and delayed enteral feeding group

5. Distribution of tolerance among the early enteral feeding group and delayed enteral feeding group:

Out of 80 cases, 67 (83.8%) cases were tolerating to feeding, while 13 (16.2%) cases were not tolerating to feeding, as p>0.05 (insignificant).

		Early enteral feeding		**Delayed enteral feeding**		**Total**		
		N	**%**	**N**	**%**	**N**	**%**	**p-value**
Tolerance	Tolerated	32	80	35	87.5	67	83.8	0.0736
	Non-Tolerated	8	20	5	12.5	13	16.2	

Table 3 : Showing distribution of tolerance among the early enteral feeding group and delayed enteral feeding group:

6. Evaluation of serum albumin level at preoperatively, postop day-2, postop day-4, and postop day-6 :

It was observed that the mean preoperative , post operative day 4, and post operative day 6 serum albumin was significantly higher in the early enteral feeding group when compared to delayed enteral feeding group, as p<0.05. Though, on post operative day 2, serum albumin level was higher in the early enteral feeding group, the difference was not statistically Significant, as p>0.05.

Serum albumin level	Early enteral feeding group		Delayed enteral feeding group		Total		
	Mean	SD	Mean	SD	Mean	SD	p-value
Preoperative s. albumin	2.7	1.06	2	0.78	2.33	1.02	0.023

Postoperative s.albumin day-2	1.86	1.07	1.49	0.1	1.66	0.83	0.743
Postoperative s.albumin day-4	2.54	1.15	2.2	0.98	2.43	1.06	0.034
Postoperative s.albumin day-6	3.34	1.49	2.35	1.87	3.18	1.71	0.017

Table 4: Evaluation of serum albumin level at preoperatively, postop day-2, postop day-4, and postop day-6

7. Distribution of postoperative paralytic ileus among the early enteral feeding group and delayed enteral feeding group :

Presence of paralytic ileus was statistically more prevalent in the delayed enteral feeding group, 12 (30%) cases as compared to the early enteral feeding group, 5

(12.5%) cases, as p<0.05 (significant).

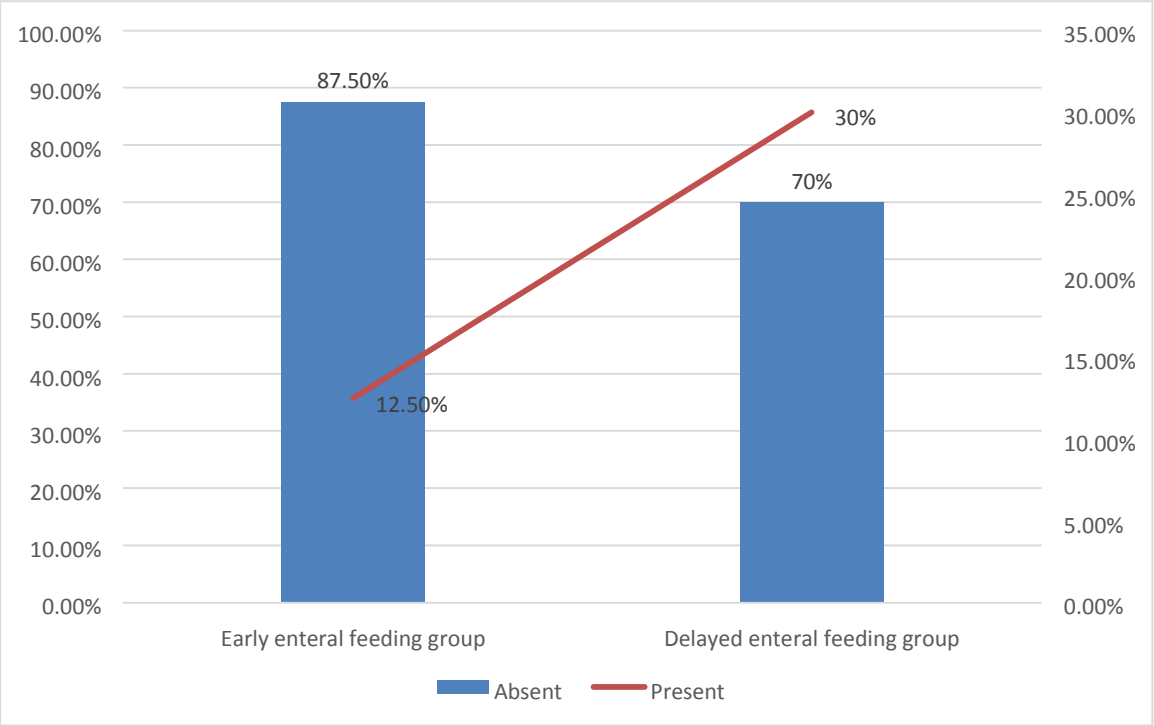

Figure 3: Showing distribution of postoperative paralytic ileus among the early enteral feeding group and delayed enteral feeding group

8. Return of Bowel sounds (in days)

In the early enteral feeding group, the bowel sounds returned between 2nd and 3rd postoperative day in majority of the cases (*n*=34) with 2.4 days (mean), where p=0.0318.

In the delayed enteral feeding group, the mean return of bowel sounds between 3rd and 4th postoperative day was=3.8 days, as p=0.0291.

	POD-1(*n*)	POD-2(*n*)	POD-3(*n*)	POD-4(*n*)	POD-5(*n*)	Total
Early enteral feeding group	3	24	10	3	0	40
Delaeyed enteral feeding group	0	5	12	16	7	40

Table-8: Showing return of bowel sounds (in days)

9. Distribution of wound infection rate among the early enteral feeding group and delayed enteral feeding group:
Wound Infection was present in 22 (27.5%) cases. Higher proportion of cases in the delayed enteral feeding group had wound infection which was 16 (40%) cases, as $p<0.05$ (significant).

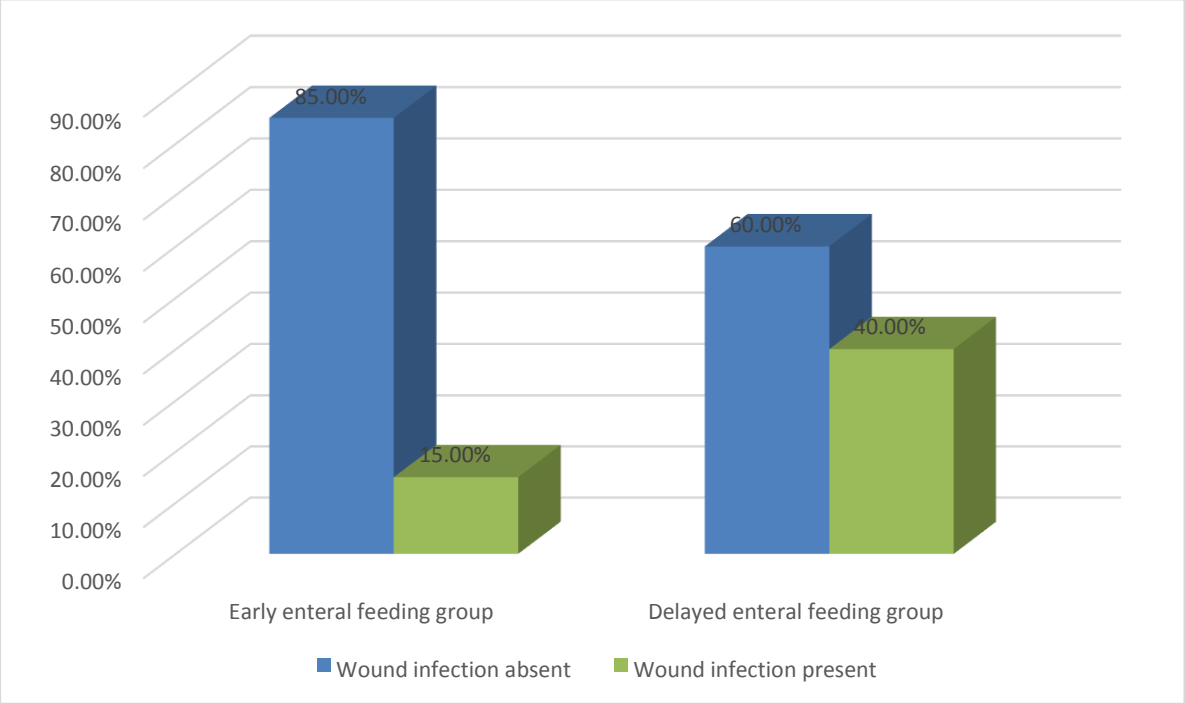

Figure 4: Showing distribution of wound infection rate among the early enteral and delayed enteral feeding group:

10. Distribution of anastomotic leakage among the early enteral feeding group and delayed enteral feeding group:
Anastomic Leakage was found in 1 (1.25%) case in the delayed enteral feeding group and none in the early enteral feeding Group, as $p>0.05$ (insignificant).

		Early enteral Feeding		**Delayed enteral Feeding**		**Total**		
		N	**%**	**N**	**%**	**N**	**%**	**p-value**
Anastomotic Leakage	Absent	40	100%	39	97.5%	79	98.75%	0.3141
	Present	0	0.0%	1	2.5%	1	1.25%	

Table 5: Distribution of anastomotic leakage among the early enteral feeding group and delayed enteral feeding group

11. Duration of hospital stay among the early enteral feeding group and delayed enteral feeding group:
The duration of hospital stay was significantly higher in the delayed enteral feeding group (16.31±3.04 days) as compared to early enteral feeding group (9.03±2.60 days, as $p<0.05$ (significant).

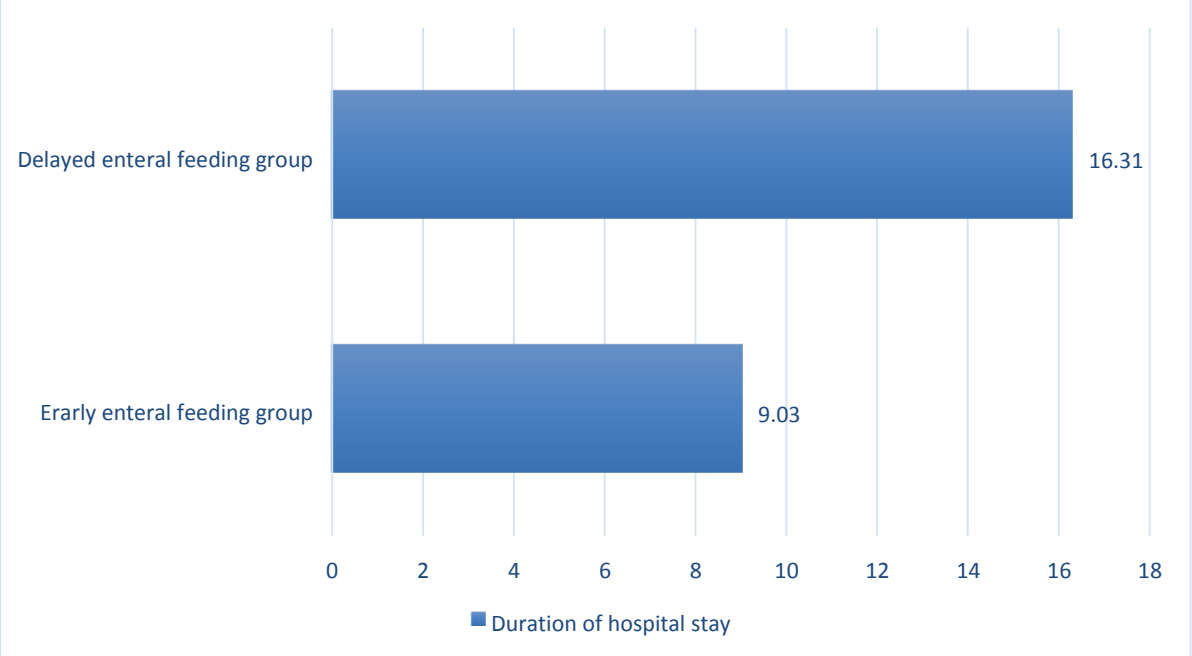

Figure 5: Showing duration of hospital stay among the early enteral feeding group and delayed enteral feeding group

IV. Discussion

In our study,out of 80 cases the most prevalent age group was found in between 17-26 years (35%) followed by 27-36 years (27.50%) and 37-46 years (17.50%)**.** The mean age in the early enteral feeding group was 33±14 years and in the delayed enteral feeding group was 36±14 years. This is similar to various studies in the past like ***Marwah et. al.***(2007) found that the mean age of 29.92 years were in early feeding group and 38 years were in late feeding group[9].***Chatterjee et. al.*** (2012) found that the mean age group was 38.18 years in early feeding group and 36.23 years in late feeding group[10]. ***Bajwa et. al.***(2017) also reported the mean age of the patients in early enteral feeding and delayed enteral feeding group was 38.1±12.10 and 36.13±13.15 years respectively[11].

Out of 80 cases, 60 (75%) were males and 20 (25%) were females. In the early enteral feeding group, 31 (77.5%) were males, and in the delayed enteral feeding group, 29 (72.5%) were males, as $p<0.05$ (significant). These findings were comparable to various studies like ***Marwah et. al.***(2007) found that the males were 64% in early feeding group and 80% in late feeding group[9]. ***Chatterjee et. al.*** (2012) found to be 70% males in early feeding group and 76.67% males in late feeding group[10].

Out of 80 cases, 67 (83.8%) cases were tolerating to feeding while 13 (16.2%) cases did not have tolerance to feeding. There was no significant association between tolerance and the study groups, as $p>0.05$. The findings of this study about tolerability were consistent with the studies done by ***Ortiz et. al.***(1996), ***Mahla et. al.***(2016), and ***Nematihonar et. al.*** (2018)[12,13,14].

Presence of paralytic ileus was statistically more prevalent in the delayed enteral feeding group, 12 (30%) cases as compared to the early enteral feeding Group 5 (12.5%) cases. Significant association was found between paralytic ileus and the study groups, as $p<0.05$; which is consistent with the study carried out by ***Boelens et. al.***(2014), ***Jiang et. al.***(2019), and ***RL kumar et. al.***(2020)[15,16,17].

Wound Infection was present in 22 (27.5%) cases. Higher proportion of patients in the delayed feeding group had wound infection, which was 16 (40%) cases, as $p<0.05$ (significant). This finding is consistent with the study performed by ***Kishore et. al.***(2014), ***Sheth et. al.***(2015), ***Li PF et.al.***(2020), and ***Ilyas khan et.al.***(2021);[18,19,5].

The anastomic leakage was found in 1 (1.25%) case in the delayed enteral feeding group and none in the early enteral feeding group, as $p>0.05$ (insignificant). ***Shoar et. al.***(2015) have reported that the anastomotic site leakage was 2(mean 2.7) in early oral feeding group and 5(mean 4.6) in late oral feeding group, where p value 0.417 and no significant difference was found, as $p>0.05$,[20].***Roy et. al.*** (2013) found that 3 patients (5.88%) out of 51 developed clinical evidence of anastomotic leakage and one out of 51 patients required re-exploration for clinically evident anastomotic leakage[21]. ***Thapa et. al.***(2011) also observed that out of 20 patients in early feeding group anastomotic site leakage was seen in 1 case, while 2 cases in late feeding group but cause of anastamotic leakage is not known[22].

The duration of hospital stay was significantly higher in the delayed enteral feeding group (16.31±3.04 days) as compared to early enteral feeding group (9.03±2.60 days, as $p<0.05$ (significant). This is similar to many other studies like like***Paul et. al.*** (2015)[23], ***Thapa et. al.*** (2011)[22], ***Patbamniya et. al.*** (2015)[24].

V. Conclusion

Early enteral feeding is almost equally well tolerated as of delayed enteral feeding. Early enteral feeding is significantly reduces the postoperative paralytic ileus, helps in significant gaining of postoperative serum albumin level (especially at the postoperative day-4 and postoperative day-6) and significantly reduces the postoperative wound infection. It also reduces the anastomotic leakage, which may be due to by increasing blood flow to the anastomotic site and increasing collagen contents in the anastomotic scar tissues. Early enteral feeding is significantly shortened the duration of hospital stay, which is cost-effective to the patients.

From this study, it can be concluded that early enteral feeding is a safe and effective intervention among gut perforations patients following surgical repair or anastomosis which promotes early recovery of patients avoiding post-surgical malnutrition. However, we need to establish more statistically significant outcome to further substantiate the study by enhancing larger multi-centric research study.

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