Routine use of feeding jejunostomy in pancreaticoduodenectomy: A metaanalysis

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Abstract

Aims and Objectives: The primary aim of our study was to evaluate morbidity and mortality following feeding jejunostomy in pancreaticoduodenectomy compared to the control group. We also evaluated individual complications like delayed gastric emptying; post operative pancreatic fistula, superficial and deep surgical site infection.

Material and Methods: The study was conducted according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement and MOOSE guidelines. Heterogeneity was measured using Q tests and I2.the random-effects model was used.

Results: Four studies including a total of 1639 patients were included in the analysis. A total of 843 patients were included in the feeding jejunostomy group and 796 patients included in the control group without feeding jejunostomy. Overall morbidity was significantly higher in the feeding jejunostomy group (\(P = .001\)). There was no significant difference in perioperative mortality between both the groups (\(P = .07\)). Delayed gastric emptying was significantly higher in the feeding jejunostomy group (\(P = .021\)). There was no significant difference in development of pancreatic fistula between the two groups. Deep surgical site infection was significantly higher in feeding jejunostomy group. (\(P = .013\)). Hospital stay was significantly more in feeding jejunostomy group (\(P < .0001\)). There was no significant difference between readmission, TPN requirement and time to start oral feed.

Conclusion: Feeding jejunostomy seems to be associated with increased morbidity and increased length of stay.

KEYWORDS
feeding jejunostomy, morbidity, mortality, pancreaticoduodenectomy

1 | BACKGROUND

Pancreaticoduodenectomy is the only treatment with curative chance in cancer of the distal bile duct, head of pancreas, periampullary and some of the duodenal cancers.\(^1\,^2\)

However, pancreaticoduodenectomy is still associated with very high morbidity and mortality. Though morbidity and mortality is reduced in high volume centres it still remains a significant problem after pancreaticoduodenectomy.\(^3\) The most frequent complications following pancreaticoduodenectomy are delayed gastric emptying and postoperative pancreatic fistula.\(^4\)

Postoperative nutrition following pancreaticoduodenectomy is still a debatable thing with some studies favouring parenteral
Some studies, however, suggest that enteral nutrition following pancreaticoduodenectomy is safe and well tolerated. For enteral nutrition after pancreaticoduodenectomy various feeding routes have been utilized and it is common practice to insert a feeding jejunostomy tube after pancreaticoduodenectomy. A few studies have shown that early oral nutrition is also safe after pancreaticoduodenectomy.

Some studies have raised concerns about the practice of inserting feeding jejunostomy during pancreaticoduodenectomy and have suggested they may be associated with increase morbidity and mortality after pancreaticoduodenectomy. However, there are no randomized control trials or metaanalysis available to study those concerns further.

2 | AIMS AND OBJECTIVES

The primary aim of our study was to evaluate morbidity and mortality following feeding jejunostomy in pancreaticoduodenectomy compared to the control group. We also evaluated individual complications like delayed gastric emptying; post operative pancreatic fistula, superficial and deep surgical site infection.

We also looked for time to start oral nutrition and requirement of total parenteral nutrition.

3 | MATERIALS AND METHODS

The study was conducted according to the PRISMA statement and MOOSE guidelines. The primary aim of our study was to evaluate morbidity and mortality following feeding jejunostomy in pancreaticoduodenectomy compared to the control group. We also evaluated individual complications like delayed gastric emptying; post operative pancreatic fistula, superficial and deep surgical site infection.

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3.1 | Study selection

We conducted a literature search as described by Gossen et al. Pubmed, Cochrane library, Embase, Google Scholar, Web of Science with keywords like “feeding jejunostomy in pancreaticoduodenectomy”; “enteral nutrition in pancreaticoduodenectomy”; “total parenteral nutrition in pancreaticoduodenectomy”; “morbidity and mortality following pancreaticoduodenectomy”. Two independent authors extracted the data (B.V. and H.P.). Types of studies included in the metaanalysis are described in Table 1. Discussions and mutual understanding resolved any disagreements. We selected studies published between 2010 and 2020, i.e. the last 10 years to include recent publications. Outcomes of interest were morbidity, mortality, delayed gastric emptying, post operative pancreatic fistula and total parenteral nutrition requirement.

3.2 | Inclusion criteria

- Studies comparing feeding jejunostomy in pancreaticoduodenectomy with controls
- Full text articles
- Studies comparing morbidities and mortalities between the two groups.

3.3 | Exclusion criteria

- Studies whose full texts can not be retrieved
- Conference abstracts
- Studies which did not have comparative groups
- Duplicate studies

3.4 | Statistical analysis

The metaanalysis was conducted using Review Manager 5.4. Heterogeneity was measured using Q tests and $I^2$, and $P < .10$ was determined as significant, the random-effects model was used. The odds ratio (OR) was calculated for dichotomous data, and weighted mean differences (WMD) were used for continuous variables. Both differences were presented with 95% CI. For continuous variables, if data were presented with medians and ranges, then we calculated the means and standard deviations according to Hozo et al. If the study presented the median and interquartile range, the median was treated as the mean, and the interquartile ranges were calculated using 1.35 SDs, as described in the Cochrane handbook.

3.5 | Assessment of bias

Characteristics of the studies are described in Table 1. Identified studies were broadly grouped into one of two types, either randomized...

| Study     | Publication year | Number of patients in study group | Number of patients in control group | Type of study                  |
|-----------|------------------|-----------------------------------|------------------------------------|-------------------------------|
| Waliye et al. | 2016             | 153                               | 103                                | Retrospective cohort          |
| Padusis et al. | 2014            | 623                               | 623                                | Retrospective propensity matched cohort |
| Li et al.   | 2018             | 33                                | 36                                 | Retrospective cohort          |
| Zhu et al.  | 2013             | 34                                | 34                                 | Prospective cohort            |
trials or cohort studies. Cohort studies were assessed for bias using the Newcastle-Ottawa Scale.\textsuperscript{10,12} It was decided to assess randomized trials based on the Cochrane Handbook.\textsuperscript{13} However, in the final analysis we could not find any randomized clinical trials fulfilling our inclusion criteria so the Newcastle-Ottawa Scale was used (Table 2). We evaluated publication bias by funnel plots for each parameter.

4 | RESULTS

4.1 | Literature review

Four studies, including a total of 1639 patients were included in the analysis.\textsuperscript{8,15-17} Details of the selection process are described...
in Figure 1. Study details are described in Table 1. A total of
843 patients were included in the feeding jejunostomy group and
796 patients included in the control group without feeding
ejunostomy.

4.2 Morbidity and mortality (Figures 2 and 3)
Morbidity is defined as grade 3,4 complications according to the
Clavien–Dindo classification.18
A total of 375 patients developed 90-day morbidity in the feeding
junostomy group, 293 patients developed morbidity in the control
group. Overall morbidity was significantly higher in feeding jejunostomy
group (odds ratio 1.39, \( P = .001 \)). (Figure 2).

Thirty patients died within 90 days in the feeding jejunostomy
groups, 16 patients died in the control group, however, there
was no significant difference between both the groups (\( P = .07 \))
(Figure 3).

4.3 Delayed gastric emptying and pancreatic
fistula (Figure 4)
There were 117 out of 222 patients who developed delayed gastric
emptying and 44/175 developed delayed gastric emptying out of the
data available in three studies.8,16,17 Delayed gastric emptying was
significantly higher in the feeding jejunostomy group (\( P = .021 \)).

Twenty-six out of 222 patients developed postoperative pancreatic
fistula (POPF) in the feeding jejunostomy group, and 18 patients
out of 175 patients developed POPF.8,16,17 There was no significant
difference in development of pancreatic fistula between the two
groups (\( P = .536 \)) (Figure 4).

4.4 Surgical site infection (Figure 5)
Surgical site infection (SSI) developed in 180 patients in the feeding
junostomy group and 154 patients developed SSI in the control
group. There was no significant difference in SSI rates between the
two groups (\( P = .193 \)).

Two studies15,16 evaluated deep surgical site infections. Deep
surgical site infection was significantly higher in the feeding
junostomy group (\( P = .01 \)) (Figure 5).

4.5 Hospital stay and readmission (Figure 6)
Hospital stay was significantly longer in the feeding jejunostomy group,
weighted mean difference of 2.094 days. (\( P < .0001 \)). There was no sig-
nificant difference in readmission (\( P = .536 \)) between the two groups.
4.6 | Time to start oral feed and total parenteral nutrition requirements (Figure 7)

Time to start oral feed was significantly longer in the feeding jejunostomy group (weighted mean difference of 2.4 days, \( P < .0001 \)).

There was no significant difference in TPN requirement between the two groups.

4.7 | Feeding jejunostomy tube related complications

Twenty-three patients out of the total 187 patients developed feeding jejunostomy tube related complications like tube dislodgement, peritonitis and leakage.

5 | DISCUSSION

Postoperative nutrition is one of the most important interventions to reduce morbidity and mortality following pancreaticoduodenectomy.\(^1\)

Enhanced recovery after surgery protocols is also gaining popularity in pancreaticoduodenectomy,\(^2\) which recommends early enteral nutrition following pancreaticoduodenectomy. However, the optimal route is still debated.

Intraoperative insertion of feeding jejunostomy is routine practice all around the world to provide enteral nutrition after pancreaticoduodenectomy, but recently a few studies\(^3,8,15-17\) have questioned this protocol and found that feeding jejunostomy is associated with increased morbidity and mortality following pancreaticoduodenectomy.

We think our study is the first metaanalysis to study morbidity and mortality associated with feeding jejunostomy.

In our metaanalysis, the feeding jejunostomy group was associated with significantly increased morbidity than the control group. There was no significant difference in mortality between the two groups.

In secondary analysis the feeding jejunostomy group was associated with significantly increased morbidity than the control group. There was no significant difference in mortality between the two groups.

In secondary analysis the feeding jejunostomy group was associated with increased risk of delayed gastric emptying, there was no difference in postoperative pancreatic fistula rates. There was no difference in overall surgical site infection rates, however deep surgical site infection rates were significantly higher in the feeding jejunostomy group.

Hospital stay was significantly more in the feeding jejunostomy group. There was no difference in readmission rates.

One of the key beliefs to insert feeding jejunostomy is that it decreases need for parentral nutrition but in our metaanalysis there was no difference in feeding jejunostomy group vs the control group. Time to start oral feed was also significantly longer than the control group.

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**FIGURE 3** (A) Forest plot of mortality between the two groups. (B) Funnel plot for mortality to estimate publication bias (odds ratio x axis and SE on Y axis)
### Figure 4

(A) Forest plot for delayed gastric emptying between the two groups. (B) Funnel plot for delayed gastric emptying between the two groups. (C) Forest plot of postoperative pancreatic fistula between the two groups. (D) Funnel plot of postoperative pancreatic fistula.
FIGURE 5  (A) Forest plot for surgical site infections (SSI) between the groups. (B) Funnel plot for SSI. (C) Forest plot for deep SSI. (D) Funnel plot for deep SSI.
Figure 6  (A) Forest plot for hospital stay between the groups. (B) Funnel plot for hospital stay. (C) Forest plot for readmissions. (D) Funnel plot for readmissions
FIGURE 7  (A) Forest plot for time to oral feed. (B) Funnel point for time to oral feed. (C) Forest plot for TPN requirement. (D) Funnel plot for TPN requirement
Specific complications are also associated with feeding jejunostomy like tube dislodgement, peritonitis and leaks. Around 12% patients developed complications specific to the feeding jejunostomy tube.

One of the key limitations of this metaanalysis is that very few studies are available and there is a lack of any randomized control trials. The positive point of our metaanalysis is that heterogeneity was not significant in more of the analysis. We did not find any randomized control trials comparing feeding jejunostomy vs no feeding jejunostomy. Proper randomized control trials comparing morbidity, mortality and risk benefit ratios are needed.

Another issue is that, as very few studies could be found in the last 10 years, potential selection bias cannot be ruled out. However, we evaluated publication bias in the form of funnel plots which suggested very little publication bias. We used funnel plots to evaluate publication bias but funnel plots also have their limitations due to the fewer number of studies.

Another limitation is that the included studies did not include nutritional factors, pathological factors and surgeons’ experience. So we could not be certain whether the feeding jejunostomy group included higher risk patients or whether the feeding jejunostomy group contained patient’s operated on by less experienced surgeons and if that contributes to higher morbidity in the feeding jejunostomy group or not.

In conclusion, feeding jejunostomy seems to be associated with increased morbidity, increased complications, and increased length of stay without any significant benefits. Randomized control trials need to be done to conclude this issue.

**COMPLIANCE WITH ETHICAL STANDARDS**

**CONFLICT OF INTEREST**

Authors declare no conflict on interests.

**ETHICAL APPROVAL**

This article does not contain any studies with human participants or animals performed by any of the authors.

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