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Jejunostomy Feeding Tube Placement in Gastrectomy Procedures: A Systematic Review

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Abstract

Many nutritional interventions have been developed to improve nutritional outcomes following upper gastrointestinal surgery. The aim of this systematic review was to investigate whether or not the routine use of intraoperative jejunostomy feeding tubes in partial and total gastrectomy procedures is warranted when assessing complications and nutritional benefits such as improved chemotherapy tolerance. An electronic search of MEDLINE, Web of Science, Embase and CINAHL databases was performed to identify studies which reported complications and/or post-operative outcomes of patients who received an intraoperative jejunostomy feeding tube in gastrectomy procedures. Five articles met the inclusion criteria (n = 636) with four retrospective cohort studies and one RCT. Studies varied in regards to the complications and nutritional outcomes reported. Jejunostomy feeding tube insertion may carry a risk of increased infectious complications but appears to reduce patient post-operative weight-loss and may improve chemotherapy tolerance. Due to the lack of high-quality studies, it is unclear if the routine use of an intraoperative jejunostomy feeding tube is indicated for all patients undergoing gastrectomy procedures or only those at a high-risk of post-operative malnutrition. More comprehensive research is recommended, particularly on the usefulness of home enteral nutrition post-gastrectomy.

Keywords

Gastrectomy, Jejunostomy, Feeding Jejunostomy Tube, Enteral Nutrition, Gastric Cancer

1. Introduction

Gastric cancer is the fourth most common cancer behind lung, breast and colorectal cancers, but is the second most common cause of death from cancer with 700,000 deaths annually [1]. Although almost two-thirds of cases occur in developing countries, it remains a common problem in developed nations. For example, Australia has an incident age-standardised rate of 8.5 per 100,000 and an age-standardised mortality rate of 4.5 per 100,000 [2]. The definitive treatment for gastric cancer is resection, which depending on the location of the lesion, would warrant either a partial or total gastrectomy [3]. The utilisation of perioperative chemotherapy in addition to surgery for adenocarcinoma has been shown to improve patient survival compared with surgery alone [4].

Given the disruption to the alimentary canal that these procedures cause, there is no surprise that postoperative recovery is affected significantly by the patients' nutritional status. Patients who have undergone gastric resection are susceptible to malnutrition due to higher metabolic requirements, reduced oral intake and symptoms such as early satiety and dumping [5] [6] [7]. They often experience difficulty meeting their nutritional requirements in the acute post-surgical phase and therefore, experience complications associated with poor nutritional status such as impaired wound healing, reduced immune function and ultimately increased postoperative mortality [8] [9]. Impaired nutritional status restricts a patient's ability to tolerate chemotherapy [10], clearly indicating a need to achieve satisfactory post-operative nutritional status to optimise patient outcomes.

Many nutritional interventions have been developed to improve nutritional outcomes following surgery such as the early introduction of oral intake, total parenteral nutrition (TPN), nasojejunal/nasoduodenal feeding, and jejunostomy tube feeding. Previous literature indicates that early enteral nutrition (EEN) is preferred over TPN following gastrectomy procedures [11] [12] [13] [14]. The effectiveness of postoperative EEN is attributed to its ability to maintain gastrointestinal tract integrity and enhance immunological function [15] [16] [17]. In addition, EEN as compared with TPN, is less costly, produces less infectious complications and is easier for nursing staff to administer [11] [12].

Jejunostomy feeding as a method of enteral nutritional support following surgical intervention has gradually gained wide acceptance since first being described by Busch in 1858 [18] and hence is often recommended in current guidelines [19] [20]. A jejunostomy feeding tube can be inserted intraoperatively at the time of resection. However, the utilisation of a jejunostomy feeding tube is not without complications such as tube leakages, tube site infections, and even tube-associated mortality [21]. The aim of the current systematic review is to investigate whether or not the routine use of an intraoperative feeding jejunostomy tube is warranted in adult patients undergoing total and partial gastrectomy. This will be determined by assessing post-operative patient outcomes and complications.

2. Materials and Methods

2.1. Information Sources and Search Strategy

A systematic review of the literature was conducted on the 20th of November 2016 via MEDLINE (1966 to November 2016), Web of Science (1980 to November 2016), Embase (1980 to November 2016) and CINAHL (1980 to November 2016) databases. The following search terms were used:

Term 1: "esophageal neoplasm" OR "stomach neoplasm" OR "gastrectomy" OR "esophagectomy",

AND

Term 2: "jejunostomy" OR "jejunal tube" OR "jejunal feeding tube" OR "j-tube".

Articles were filtered to include English texts and human studies only. Case reports were excluded.

Studies that addressed the use of jejunostomy feeding tubes intraoperatively during total and/or partial gastrectomy were reviewed and suitability assessed for inclusion within the systematic review. The reference lists of all included articles were reviewed to obtain any additional studies not found within the initial search.

2.2. Eligibility Criteria

Studies were eligible for inclusion if they included the use of intraoperative jejunostomy feeding tube following total and/or partial gastrectomy and reported complications and/or post-operative patient outcomes. Studies which included other feeding methods in addition to jejunostomy such as total parenteral nutrition were included. Articles that explored the use of a jejunostomy feeding tube insertion at laparoscopic staging or as a result of a complication were excluded. Studies were limited to an adult population.

2.3. Quality Assessment and Data Extraction

Two reviewers (KB and JL) independently appraised all suitable studies using a modified Heyland review tool on a scale of 0 - 11 [22]. The criteria used to assess methodological quality and scope for bias included grading the use and presence of: randomisation, blinding, intention to treat analysis, method of patient selection, whether or not the description of outcomes was defined and if there was a baseline comparison of groups. Where the reviewers scored an article differently, it was discussed until a consensus was reached. In situations where a consensus was not reached, it was referred to a third independent reviewer (SC) for a final decision. Articles which received a score of <3 were excluded. Levels of evidence were assigned as per the Centre of evidence-based medicine (CEBM) [23].

Data extraction was performed by two researchers (KB and JL). Extracted data included study design, patient characteristics, tube-related complications, overall complications, and post-operative nutritional outcomes.

2.4. Statistical Analysis

Due to the heterogenous nature of the articles, meta-analysis was unable to be performed.

3. Results

An initial search identified 762 articles, after duplicates were removed, relating to the insertion of intraoperative jejunostomy tubes for gastrectomy patients (Figure 1). The titles were screened for appropriateness and 84 full text articles were assessed for eligibility. Five articles met the criteria for eligibility.

Of the final 5 studies included, only one was a randomised control trial, with the other four being retrospective cohort reviews. The lack of high-quality data is demonstrated with four of the five studies carrying a CEBM level evidence of 4 (Tables 1-3). Two studies investigated jejunostomy tube outcomes in both partial and total gastrectomy patients [24] [25] while two studies investigated outcomes in total gastrectomy patients only [11] [26]. The study of Sun *et al.* compiled large amounts of partial and total gastrectomy patient data from the American College of Surgeons National Surgical Quality Improvement Program (NSQIP) database however outcomes were not differentiated based on procedure [27].

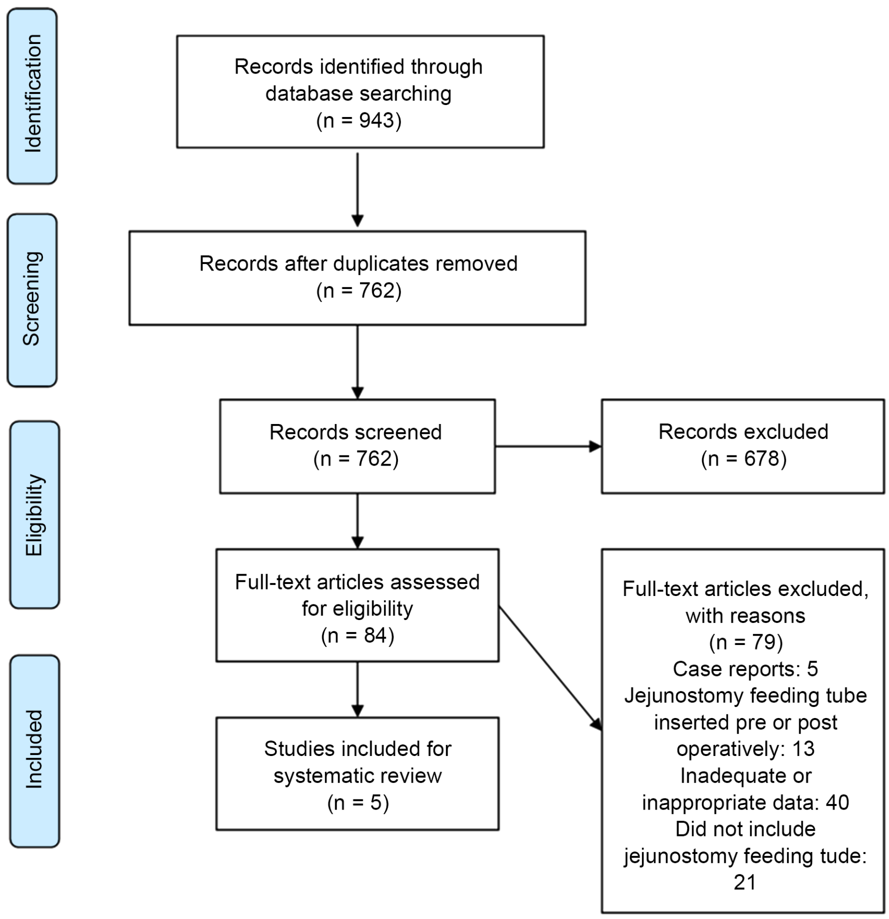

Figure 1. PRISMA.

Table 1. Studies isolating total gastrectomy data.

Author, date, study type, level of evidence, Heyland score	Patient group	Complications reported	Nutritional outcomes
Dann *et al.* 2015 Retrospective Cohort Study CEBM Level 4 Heyland Score (/11)	Total = 345 J-tube = 186 (53.9%) No J-tube = 159 (46.1%)	Any Complication: 57.5% JT vs. 45.9% No JT* Major Complication^: 26.3% JT vs. 23.3% No JT Infectious Complication: 38.7% JT vs. 25.8% No JT* Surgical Site Infection: 15.1% JT vs. 8.2% No JT Deep Intra-Abdominal Infection: 12.9% JT vs. 5.7% No JT* Reoperation: 13.4% JT vs. 8.8% No JT 30-Day Readmission: 15.6% JT vs. 17.0% No JT	Length of Stay (days): 14.4 (±9.9) JT vs. 11.4 (±8.8)* Adjuvant Chemotherapy: 55.9% JT vs. 56.8% No JT Adjuvant Radiation Therapy: 37.7% JT vs. 33.8% No JT Any Adjuvant Therapy: 56.5% JT vs. 56.8% No JT
Heylen *et al.* 1987 Prospective Randomised Control Trial CEBM Level 2 Heyland Score (/11): 5	Total = 20 J-tube = 10 (50%) TPN = 10 (50%)	JT: Catheter Complications: 0% Superficial Wound Abscess: 10% No Other Complications Reported TPN: Thrombosis: 10% Superficial Wound Abscess: 10% Deep Abscess: 10% No Other Complications Reported	Actual Calorie Intake vs. Prescribed Amount: JT: 83% of Intended Target TPN: Identical to Prescribed Amount Total Caloric Intake**: JT: 11,690 kcal/pt/8 days vs. TPN: 12,200 kcal/pt/8 days Weight Loss: JT: 3.7 kg vs. TPN: 5.1 kg* Mid-Upper Arm Circumference JT: −1.6 cm vs. TPN: −0.4 cm Blood Biochemistry at Day 8***: No Significant Difference between JT and TPN
Patel *et al.* 2013 Retrospective Cohort Study CEBM Level 4 Heyland Score (/11): 5	Total = 46 J-tube: 32 (69.6%) No J-tube: 14 (30.4%)	Any Complication: 53% JT vs. 43% No JT Infectious Complication: 34% JT vs. 14% No JT Major Complication^: 6% JT vs. 0% No JT Reoperation: 3% JT vs. 0% No JT Bleeding Requiring Packed RBC Transfusion: 0% JT and No JT Anastomotic Leak: 0% JT and 0% No JT 30-Day Readmission: 22% JT vs. 21% No JT	Length of Stay (days): 14 (8 - 30)[a] JT vs. 10 (5 - 15)[a] No JT* Albumin Pre-Operative: 3.4 (1.8 - 4.2)[a] JT vs. 3.2 (2.1 - 4.1)[a] No JT Albumin 30-Day: 2.9 (1.12 - 3.8)[a] JT vs. 2.7 (2.0 - 3.3)[a] No JT Albumin 60-Day: 3.2 (1.3 - 4.4)[a] JT vs. 2.7 (2.0 - 3.7)[a] No JT Albumin 90-Day: 3.5 (1.9 - 4.5)[a] JT vs. 3.2 (2.7 - 3.6)[a] No JT Received Adjuvant Therapy Post-Op: 66% JT vs. 57% No JT

Continued

Wu *et al.* 2011 Retrospective Cohort Study CEBM Level 4 Heyland Score (/11): 5	Total = 61 J-tube: 29 (47.5%) No J-tube: 32 (52.5%)	Nil Reported	Change in Body Weight^^: −7.1 kg ± 3.3 JT vs. 9.9 kg ± 3.1 No JT* Change in BMI^^: −2.4 ± 1.0 JT vs. −3.2 ± 0.9 No JT* At Risk of Undernutrition Post-Operatively (NRS ≥ 3)*: 24.1% JT vs. 65.6% No JT* Postoperative KPS Improvement: 58.6% JT vs. 21.9% No JT* Chemotherapy Endurance: 4.0 ± 2.0 Doses JT vs 3.0 ± 2.0 Doses No JT Chemotherapy Adverse Drug Reactions: Lower Tendency in JT Group Postoperative Total Lymphocyte Count ($\times 10^9$/L): 1.7 ± 0.6 JT vs. 1.5 ± 0.6 No JT Postoperative Hb (g/L): 118.9 ± 17.5 JT vs. 126.8 ± 17.8 No JT Postoperative Albumin (g/L): 42.8 ± 5.3 JT vs. 40.4 ± 5.6 No JT

JT = Jejunostomy Tube Group; No JT = Jejunostomy Free Group; *p-value < 0.05; **14% of global effective caloric support from peripheral venous infusion of glucose and/or sorbitol containing solutions; ***Blood biochemistry includes: albumin, transferring, thyroxin-binding pre-albumin, retinol-binding protein, liver function tests, haemoglobin, electrolyte determinations, total lymphocyte count; ^Major complication = Clavien Grade 3 - 5; [a]Mean (range); ^^1-week pre-op to 3 months post-op; NRS = Nutritional Risk Screening 2002; KPS = Karnofsky performance score; used to estimate patients' activities and quality of life.

3.1. Total Gastrectomy Patients

3.1.1. Jejunostomy vs. No Jejunostomy

Three retrospective cohort studies compared outcomes between total gastrectomy patients with and without a jejunostomy feeding tube (**Table 1**). Jejunostomy and jejunostomy-free patients of Dann *et al.* and Patel *et al.* were similar, however criteria for selection of jejunostomy tube insertion was not described [24] [25]. Dann *et al.* noted a statistically significant increase in any complication, infectious complications, and deep intra-abdominal infections in patients who received a jejunostomy tube [24]. These trends were also noted in the study of Patel *et al.*; however, the findings in that study were not statistically significant [25]. Both Patel and Dann also noted that jejunostomy tube placement was associated with increased infectious complications and overall postoperative complications respectively on multivariate regression analysis, independent of other variables such as TNM stage [24] [25]. The study of Wu *et al.* did not report on any complications [26].

Both Dann *et al.* and Patel *et al.* noted a statistically significant increase in length of hospital stay for patients with jejunostomy feeding tubes. Neither study noted any statistically significant differences between jejunostomy and jejunostomy-free patients regarding adjuvant therapy received [24] [25]. A trend towards higher albumin levels post-operatively in the jejunostomy feeding group was noted by Patel *et al.*; however, this was not statistically significant [25]. It is not clear when and if feeding through the jejunostomy tubes was initiated in the studies of Dann *et al.* and Patel *et al.*, making it difficult to assess the benefits of post-operative enteral nutrition via jejunostomy tube in total gastrectomy patients in those studies [24] [25].

This contrasts with the study of Wu *et al.*, where patients in the jejunostomy group were all fed from 72 hours postoperatively or onset of flatus. In addition, the jejunostomy group patients in Wu *et al.* underwent home enteral nutrition (HEN) for at least 3 months. Significant improvements in nutritional outcomes were noted when compared to jejunostomy free patients including reduced weight loss postoperatively, reduced risk of undernutrition postoperatively (as judged by the Nutritional Risk Screening 2002 tool), and postoperative improvement in Karnofsky performance score (an indicator of patient quality of life and activity). There was an increased tendency for jejunostomy patients to receive higher doses of chemotherapy and lower rates of adverse effects ($p > 0.05$). No significant differences were noted between patients at baseline [26].

3.1.2. Jejunostomy vs. Total Parenteral Nutrition

A small randomised control trial compared jejunostomy feeding with TPN in 20 patients following total gastrectomy (**Table 1**). Jejunostomy feeding resulted in no tube related complications. There was one case of thrombosis in the TPN group; however, it is unclear if this was a venous thrombosis related to the catheter. Results indicated comparable caloric intake between the two groups but there was significantly less weight loss in the jejunostomy feeding group (3.7 kg) compared with the TPN group (5.1 kg) when mean final body weights were compared ($p < 0.01$) [11]. Baseline patient BMI and mean body weight were not described. There was a statistically significant difference between mid-upper arm circumferences post-operatively with a decrease in 1.6 cm noted in the jejunostomy group compared to a decrease of 0.4 cm in the TPN group. The authors hypothesised that the difference in postoperative mid-upper arm circumference were due to increased salt losses in the stools of jejunostomy patients. There were no statistically significant differences in blood biochemistry between the two groups post-operatively (**Table 1**). Heylen *et al.* did note that there was an increased frequency of diarrhoea and abdominal cramps in the jejunostomy group; however, this was alleviated in most cases by altering the rate of infusion and adding loperamide to the feed [11].

3.2. Partial Gastrectomy Patients

Jejunostomy vs. No Jejunostomy

Two retrospective cohort studies compared outcomes between partial gastrectomy patients with and without a jejunostomy feeding tube (**Table 2**). As in the data presented for total gastrectomy patients, Dann *et al.* and Patel *et al.* noted a statistically significant increase in infectious complications in jejunostomy patients [24] [25]. Dann *et al.* demonstrated an increase in surgical site wound

Table 2. Studies isolating partial gastrectomy data.

Author, date, study type, level of evidence, Heyland score	Patient group	Complications reported	Nutritional outcomes
Dann *et al.* 2015 Retrospective Cohort Study CEBM Level 4 Heyland Score (/11): 5	Total = 492 J-tube group = 79 (16.1%) No J-tube = 413 (83.9%)	Any Complication: 35.4% JT vs. 34.1% No JT Major Complication^: 11.4% JT vs. 12.8% No JT Infectious Complication*: 27.8% JT vs. 16.9% No JT Surgical Site Infection: 12.7% JT vs. 4.6% No JT* Deep Intra-Abdominal Infection: 7.6% JT vs. 3.1% No JT Reoperation: 3.8% JT vs. 4.6% No JT 30-Day Readmission: 10.1% JT vs. 11.6% No JT	Length of Stay (days): 12.4 (±8.8) JT vs. 9.6 (±8.7) No JT* Adjuvant Chemotherapy: 52.0% JT vs. 51.0% No JT Adjuvant Radiation Therapy: 38.7% JT vs. 32.5% No JT Any Adjuvant Therapy: 52.0% JT vs. 51.8% No JT
Patel *et al.* 2013 Retrospective Cohort Study CEBM Level 4 Heyland Score (/11): 5	Total = 86 J-tube: 34 (39.5%) No J-tube: 52 (60.5%)	Any Complication: 65% JT vs. 40% No JT* Infectious Complication: 38% JT vs. 17% No JT* Major Complication^: 15% JT vs. 8% No JT Reoperation: 3% JT vs. 2% No JT Bleeding Requiring Packed RBC Transfusion: 3% JT vs. 0% No JT Anastomotic Leak: 0% JT vs. 2% No JT 30-Day Readmission: 6% JT vs. 15% No JT	Length of Stay (days): 13 (7 - 33)[a] JT vs. 11 (2 - 52)[a] No JT Albumin Pre-Operative: 3.5 (2.2 - 4.4)[a] JT vs. 3.5 (2.2 - 4.6)[a] No JT Albumin 30-Day: 3.3 (1.8 - 4.3)[a] JT vs. 3.2 (1.2 - 4.4)[a] No JT Albumin 60-Day: 3.7 (3.0 - 4.4)[a] JT vs. 3.5 (2.1 - 4.4)[a] No JT Albumin 90-Day: 3.4 (1.4 - 4.3)[a] JT vs. 3.4 (1.5 - 4.2)[a] No JT Received Adjuvant Therapy Post-Op: 56% JT vs. 52% No JT

JT = Jejunostomy Tube Group; No JT = Jejunostomy Free Group; *p-value < 0.05; ^Major complication = Clavien Grade 3 - 5; [a]Mean (range).

infections in jejunostomy patients, which remained independently associated with jejunostomy tube insertion on multivariate analysis ($p < 0.05$). Dann *et al.* found that jejunostomy patients had a longer hospital stay than those without a jejunostomy tube ($p < 0.05$) [24] and neither Dann *et al.* nor Patel *et al.* noted a difference in adjuvant therapy received between groups [24] [25]. Once more, it was not explained how patients were chosen to receive jejunostomy feeding tubes and when or if they were delivered feeds through the tube.

3.3. Mixed Partial and Total Gastrectomy Data

Jejunostomy vs. No Jejunostomy

Sun *et al.* utilised the largest, risk-adjusted, validated set of 30 day surgical outcomes in the United States to compare perioperative outcomes between gastrectomy patients who did or did not receive a jejunostomy feeding tube but the study did not differentiate outcomes based on the level of resection (*i.e.* partial vs. total gastrectomy) [27]. Of the 2980 patients, 71.4% underwent partial gastrectomy and 28.6% underwent total gastrectomy (Table 3). Only 24% of all patients received a jejunostomy tube, with the reasons for selection not described. Patients who received a jejunostomy tube were more likely to have recent weight loss, have undergone recent chemotherapy and radiotherapy, and more likely to have undergone total gastrectomy ($p < 0.05$) [27]. These factors may demonstrate that surgeons typically reserve the insertion of a jejunostomy feeding tube to patients expected to suffer from postoperative malnutrition or suffer from more advanced disease. However, Sun *et al.* state that after adjustment with propensity matching the groups were highly similar. Aside from a slightly longer operative time for jejunostomy patients, the authors noted no statistically significant differences in mortality, overall complications, or any of the secondary outcomes. Jejunostomy group patients did experience higher rates of urinary tract infections 6.4% to 3.4% ($p < 0.05$) [27]. The authors postulated that a potential longer duration of catheterisation to monitor fluid balance may have been

Table 3. Mixed partial and total gastrectomy data.

Author, date, study type, level of evidence, Heyland score	Patient group	Complications reported (selected)	Nutritional outcomes
Sun *et al.* 2015 Retrospective Cohort Study CEBM Level 4 Heyland Score (/11): 5	Total = 2980 Partial Gastrectomy: 71.4% Total Gastrectomy: 28.6% J-tube: 715 (24%) No J-tube: (76%)	30-Day Mortality: 5.8% JT vs. 3.7% No JT Overall Complication Rate: 38.8% JT vs. 36.1% No JT Major Complication Rate: 30.8% JT vs. 30.1% No JT Early Return to OR: 9.2% JT vs. 9.2% No JT Operative Time in Minutes: 233 (170 - 299)^b JT vs. 248 (194 - 306)^b No JT* Superficial SSI: 7.1% JT vs. 4.8% No JT Deep SSI: 1.4% JT vs. 1.8% No JT Organ Space SSI: 8.4% JT vs. 8.8% No JT Wound Dehiscence: 1.4% JT vs. 1.8% No JT Sepsis: 8.9% JT vs. 8.1% No JT Septic Shock: 7.4% JT vs. 5% No JT	Length of Stay in Days: JT: 10 (8 - 14)^b No JT: 9 (7 - 15)^b

JT = Jejunostomy Tube Group; No JT = Jejunostomy Free Group; *p-value < 0.05; OR = operating room; ^{b}median (IQR); SSI = Surgical site infection.

the cause. Nonetheless, the increased rate of UTI is not expected to be directly related to tube insertion and could be managed using standard catheter management practices. Similarly to Dann *et al.* and Patel *et al.*, time and duration of feed initiation was not discussed, making it difficult to assess the nutritional benefits of jejunostomy tube feeding postoperatively.

4. Discussion

Early postoperative feeding improves nutritional outcomes and hence overall morbidity and mortality in gastrointestinal surgery patients [28] [29]. A patient's postoperative nutritional status has also been demonstrated to be of great significance due to its impact on the tolerability of adjuvant therapy following gastric surgery, the delivery of which has been shown to improve patient survival [4]. Adverse effects of chemotherapy such as nausea and vomiting impair a patient's ability to maintain adequate caloric intake solely via oral intake. Enteral nutrition via jejunostomy tube thus offers a practical solution to meet a patient's nutritional needs and maximise their ability to receive chemotherapy with or without radiotherapy postoperatively.

This review assessed the risks and benefits of intraoperative jejunostomy feeding tube insertion and subsequent jejunostomy feeding for patients undergoing total or partial gastrectomy. Four of the five studies were retrospective in nature and therefore, at a high risk of bias. Outcomes reported by the studies were highly heterogenous and aside from the small RCT, many tube-related complications such as dislodgement, blockage, and leakage were not discussed.

Dann *et al.* and Patel *et al.* noted increased rates of infectious complications in partial gastrectomy patients who received a jejunostomy feeding tube, and Dann *et al.* also noted increased rates of any complication, infectious complications, and deep intra-abdominal infection in total gastrectomy patients who received a jejunostomy feeding tube ($p < 0.05$) [24] [25]. Although jejunostomy and jejunostomy-free groups were found to be highly similar at baseline in both studies, the reasons for selection for jejunostomy tube placement were not described. In addition, the time of initiation and duration of feeding were not mentioned. The study of Wu *et al.* represents the most likely indicator of the benefits of early enteral nutrition delivered via jejunostomy tube feeding as all jejunostomy patients were fed shortly after gastric resection and continued for 3 months via home enteral nutrition [26]. Notably, jejunostomy fed patients in this study observed lower rates of undernutrition postoperatively and greater postoperative improvements in Karonofsky performance scores when compared with jejunostomy free patients. The data of Sun *et al.*, by far the largest retrospective compilation of gastrectomy patient outcomes, noted no statistically significant differences in 30-day patient mortality, major complication rate, overall complication rate, or infection between jejunostomy and jejunostomy free patients [27]. The small RCT of Heylen *et al.* noted reduced weight loss in patients who received enteral feeding via jejunostomy tube compared to TPN; however, baseline patient characteristics were not described [11].

Due to the lower quality of many of the studies, it was unclear whether standard protocols were used to prevent and manage potentially avoidable complications. Tube-related complications are avoidable with high quality proactive clinical care, including following recommended tube-insertion methods, adequate hygiene and care of the tube and tube site, and consideration of prophylactic antibiotic treatment for infection control which is routinely used in percutaneous endoscopic gastrostomy insertion [30]. Future research is needed to validate protocols for managing preventable complications as discussed above. Overall, this systematic review was limited by the retrospective nature of most of the studies and the high risk of bias associated with them, potential differences in surgical technique, unclear selection criteria for jejunostomy insertion, and unclear or absent description of feed composition and rate of administration.

The findings of this systematic review are currently inconclusive and more stringent prospective research is needed to comprehensively answer the question of whether the jejunostomy feeding tube is the preferred means of postoperative nutritional support for gastrectomy patients and whether or not it should be indicated for all gastrectomy patients or only those at highest risk of postoperative malnutrition due to the risk of tube-related complications. Future studies need to ensure comparable baseline characteristics including disease staging, standardised protocols for jejunostomy feeding tube insertion and care of the tube, feeding regimens, and clear nutrition and tube-related complication outcome measures.

5. Conclusion

Overall, this systematic review was limited by the heterogeneity of the studies and their retrospective nature, making it difficult to generalise findings. Studies varied in regards to the complications and nutritional outcomes reported. Other limitations included unclear selection criteria for tube insertion, composition and rate of feeds. Jejunostomy feeding tubes continue to be an inexpensive method of ensuring early enteral nutrition. Jejunostomy feeding tubes may carry a risk of tube related complications, namely tube site infection; and the authors would recommend that these complications be managed proactively if this feeding method is utilised. Home enteral nutrition delivered via jejunostomy feeding tube has been shown to improve postoperative patient nutritional status and quality of life and may improve chemotherapy endurance. With this in mind, future RCTs assessing the risks and benefits of home enteral nutrition via jejunostomy following gastrectomy are recommended.

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