

Outcomes for jejunal interposition reconstruction compared with Roux-en-Y anastomosis: A meta-analysis

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Abstract

AIM: To compare the clinical outcomes between jejunal interposition reconstruction and Roux-en-Y anastomosis after total gastrectomy in patients with gastric cancer.

METHODS: A systematic literature search was conducted by two independent researchers on PubMed, EMBASE, the Cochrane Library, Google Scholar, and other English literature databases, as well as the Chinese Academic Journal, Chinese Biomedical Literature Database, and other Chinese literature databases using "Gastrectomy", "Roux-en-Y", and "Interposition" as keywords. Data extraction and verification were performed on the literature included in this study. RevMan 5.2 software was used for data processing. A fixed-effects model was applied in the absence of heterogeneity between studies. A random effects model was applied in the presence of heterogeneity between studies.

RESULTS: Ten studies with a total of 762 gastric cancer patients who underwent total gastrectomy were included in this study. Among them, 357 received jejunal interposition reconstruction after total gastrectomy, and 405 received Roux-en-Y anastomosis. Compared with Roux-en-Y anastomosis, jejunal interposition reconstruction significantly decreased the incidence of dumping syndrome (OR = 0.18, 95%CI: 0.10-0.31; $P < 0.001$), increased the prognostic nutritional index [weighted mean difference (WMD) = 6.02, 95%CI: 1.82-10.22; $P < 0.001$], and improved the degree of postoperative weight loss [WMD = 2.47, 95%CI: -3.19-(-1.75); $P < 0.001$]. However, there is no statistically significant difference in operative time, hospital stay, or incidence of reflux esophagitis.

CONCLUSION: Compared with Roux-en-Y anastomosis, patients who underwent jejunal interposition reconstruction after total gastrectomy had a lower risk of postoperative long-term complications and improved

life quality.

Key words: Gastric cancer; Total gastrostomy; Jejunal interposition reconstruction; Roux-en-Y anastomosis; Meta-analysis; Digestive tract reconstruction

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Core tip: This study compared the clinical outcomes between jejunal interposition reconstruction and Roux-en-Y anastomosis after total gastrostomy in patients with gastric cancer through systematic review and meta-analysis. We found compared with Roux-en-Y anastomosis, jejunal interposition reconstruction significantly decreased the incidence of dumping syndrome, increased the prognostic nutritional index, and improved the degree of postoperative weight loss. However, there is no statistically significant difference in operative time, hospital stay, or incidence of reflux esophagitis. Therefore, we conclude that patients who underwent jejunal interposition reconstruction after total gastrostomy had a lower risk of postoperative long-term complications and improved life quality.

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INTRODUCTION

To date, there are approximately 70 types of digestive tract reconstructions after total gastrostomy^[1]. Although operative technique is gradually improving, there is still no relatively ideal and standard surgical approach to digestive tract reconstruction after total gastrostomy. There are two main surgical approaches: esophagojejunal anastomosis and jejunal interposition reconstruction with preservation of the duodenum passage^[2]. However, which type of digestive tract reconstruction should be applied after total gastrostomy has long remained controversial among both domestic and foreign researchers^[3-9]. The main controversial issues focus on (1) the necessity of preserving the duodenum passage; and (2) the necessity of creating a gastric pouch and what form of pouch reconstruction better duplicates human physiological function. Because esophagojejunal anastomosis (Roux-en-Y anastomosis) can be relatively easily performed, the incidence of postoperative complications is lower^[10]; in addition, it can resolve possible reflux esophagitis relatively well and has been accepted by most surgeons and researchers. However, this procedure has not been fully accepted

in light of the poor postoperative quality of life caused by insufficient food intake and malabsorption in gastric cancer patients who have undergone Roux-en-Y reconstruction. Jejunal interposition reconstruction preserves the duodenum passage, in which food passes through the duodenum, stimulates the secretion of bile and pancreatic juice, and is fully mixed with chyme^[11]. It is beneficial for food digestion and absorption and the regulation of gastrointestinal hormone. This surgical approach enhances the postoperative digestion and absorption of nutrients, therefore improving the long-term quality of life in patients with gastric cancer. However, the complexity of surgical procedure and longer operative time would certainly increase the risk of the intraoperative procedure and of postoperative complications^[12]. Therefore, whether to apply jejunal interposition reconstruction has in recent years been a research topic of considerable interest in the surgical field of digestive tract reconstruction after total gastrostomy. This study performed a meta-analysis on the long-term postoperative complications and quality of life between these two digestive tract reconstructions; thus, it may provide medical evidence for choosing a reasonable surgical approach to digestive tract reconstruction after total gastrostomy in evidence-based practice.

MATERIALS AND METHODS

Data retrieval

Two researchers independently conducted a systematic literature search. "Gastrostomy", "Roux-en-Y", and "Interposition" were used as keywords to search the papers published in PubMed, EMBASE, the Cochrane Library, Google Scholar, and other English literature databases. "Gastrostomy", "Roux-en-Y", and "Interposition" were also used as keywords to search the papers published in the Chinese Academic Journal, Chinese Biomedical Literature Database, China Science and Technology Journal Database, and other Chinese literature databases. In addition, we explored the links to the "related articles" to expand the search to all abstracts, studies, and citation retrievals with related topics. The final date of database information retrieval was December 2013. We also retrieved the full texts from related publication groups.

Inclusion and exclusion criteria

Inclusion criteria were as follows: (1) the study design was a randomized controlled trial; (2) the study subjects were gastric cancer patients who underwent total gastrostomy; the study compared two digestive tract reconstruction approaches, Roux-en-Y anastomosis and jejunal interposition reconstruction; and (3) the assessment parameters included operative time, hospital stay, dumping syndrome, reflux esophagitis, prognostic nutritional index (PNI), and postoperative weight loss. Exclusion criteria were

as follows: (1) non-randomized controlled trials, retrospective or observational studies; (2) study of patients with non-primary gastric cancer or benign gastric tumor, or recurrent gastric cancer; (3) studies published in neither Chinese nor in English; (4) animal or molecular studies; and (5) duplicate publication or studies without detailed retrievable data.

Data extraction

Two researchers retrieved and browsed the titles and abstracts of studies independently. After excluding studies that obviously did not meet the inclusion criteria, they read the full texts of potentially included studies. Only studies published in English and Chinese were included in this study analysis. Data were extracted in accordance with the standard criteria table and cross-checked. For publications where the two researchers disagreed on inclusion in the analysis, the decision was made by thorough discussion or with assistance from a third researcher. The extracted data included the author, date of publication, time the study was conducted, sample size, study design, whether it was a multi-center study, operative time, hospital stay, dumping syndrome, reflux esophagitis, PNI, and postoperative weight loss. In the absence of sufficient information to extract the data from the original publications, the necessary data would be obtained from the corresponding author by email. If the corresponding author could not be reached, the studies were excluded from this analysis.

Evaluation of the literature quality

We used the Jadad scale to evaluate the quality of randomized controlled trials (RCTs) in accordance with the randomization, double-blinding, and numbers of withdrawals and dropouts from the study. We evaluated each study as follows: (1) a score of 2 indicates appropriately established randomization; a score of 1 indicates unclear randomization; and a score of 0 was given for inappropriate randomization; (2) an appropriate blocked randomization design was given a score of 2; a score of 1 was given for unclear design; and a score of 0 was given to an inappropriate or absent blocked randomization design; (3) an appropriately applied blinding design was given a score of 2; unclear blinding received a score of 1; and a score of 0 was given to RCTs without blinding design; and (4) a score of 1 was given to a study if it recorded the number and cause of withdrawals and dropouts. No report of withdrawals and dropouts was given a score of 0. A study with a Jadad scale score of 1-3 has lower quality, whereas scores of 4-7 represent higher-quality literature.

Statistical analysis

We used the RevMan 5.0 statistical software provided by the Cochrane collaboration network for analysis. The OR was used as a categorical variable to evaluate

the efficacy of the two digestive tract reconstruction approaches after total gastrostomy for gastric cancer for statistical analysis. The weighted mean difference (WMD) was used as a continuous variable to measure the effect size. The *Q*-test was used to evaluate the heterogeneity between studies. Heterogeneity was considered to be present if the *P*-value was greater than 0.1. The extent of heterogeneity between results was quantitatively analyzed. A fixed-effects model was applied in the absence of heterogeneity between studies. A random-effects model was applied in the presence of heterogeneity between studies. The ORs and corresponding 95%CIs were calculated afterward. The *P*-value of the overall effect was tested by the *Z*-test. Forest plots represented the pooled ORs and 95%CIs. A funnel plot was drawn to detect publication bias.

RESULTS

Literature retrieval and selection

The preliminary literature selection included 497 English studies and 147 Chinese studies. By browsing the titles and abstracts, we excluded 623 non-related studies and non-randomized controlled trials. The analysis preliminarily included 21 studies. We read the full texts of the studies and excluded studies that did not meet the inclusion criteria and those for which the data could not be extracted from the study results, indicated by a histogram or line graph. Ultimately, we included 10 studies^[13-22], of which 7 were English studies and 3 Chinese studies.

Evaluation of general characteristics and methodology in included studies

The ten RCT studies included a total of 762 cases that underwent digestive tract reconstruction after total gastrostomy. Among these cases, 357 underwent jejunal interposition reconstruction (PJI group), and 405 underwent Roux-en-Y anastomosis (R-Y group). All studies employed randomization, blocked randomization and blinding design. Follow-up studies were completed postoperatively in all 10 studies (Table 1). Five studies reported lost cases within the follow-up period. One study performed intention-to-treat analysis. The quality of the included RCTs was evaluated using the Jadad scale. The baseline data of the two groups are similar, presenting relatively high comparability. The methodological evaluation showed that the scores of all 10 studies were above 4, indicating high study quality.

Treatment effectiveness analysis

Operative time: Four studies reported operative time^[6,8,10,12]. Heterogeneity was present among the studies ($P < 0.01$, $I^2 = 97\%$), and thus a random-effects model was applied for the pooled analysis. The results showed no statistically significant difference

Table 1 Characteristics of the studies included

Ref.	Publication year	Case (n)		Randomization	Outcomes
		Roux-en-Y group	PJI group		
Ishigami <i>et al</i> ^[13]	2011	51	52	Yes	Operation time; length of hospital stay
Pan <i>et al</i> ^[14]	2008	87	45	Yes	Prognostic nutritional index; body mass change; reflux esophagitis incidence; incidence of dumping syndrome
Adachi <i>et al</i> ^[15]	2003	10	10	Yes	Operation time; length of hospital stay; incidence of dumping syndrome
Nakane <i>et al</i> ^[16]	2001	15	15	Yes	Reflux esophagitis incidence; incidence of dumping syndrome
Schwarz <i>et al</i> ^[17]	1996	30	30	Yes	Operation time
Nakane <i>et al</i> ^[18]	1995	10	10	Yes	Incidence of dumping syndrome
Zherlov <i>et al</i> ^[19]	2006	83	75	Yes	Operation time; incidence of dumping syndrome
Yang <i>et al</i> ^[20]	2006	15	16	Yes	Body mass change
Liu <i>et al</i> ^[21]	2005	74	74	Yes	Reflux esophagitis incidence; incidence of dumping syndrome
Lu <i>et al</i> ^[22]	2003	30	30	Yes	Prognostic nutritional index; body mass change

PJI: Jejunal interposition reconstruction.

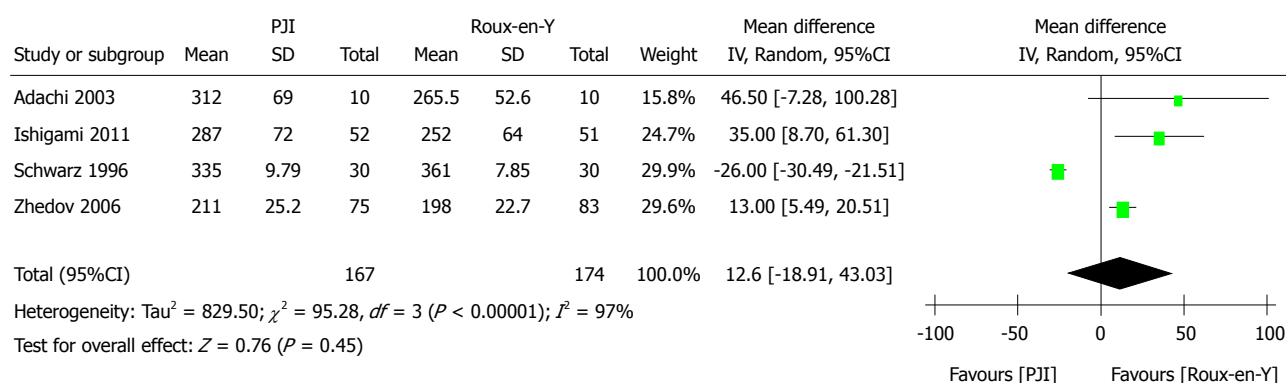


Figure 1 Forest plot of operative time between the two groups.

in operative time between the two groups (WMD = 12.06, 95%CI: -18.91-43.03, $P = 0.45$). The result is shown in Figure 1.

Hospital stay: Two studies reported hospital stay^[6,8]. Heterogeneity was present between the studies ($P = 0.04$, $I^2 = 76\%$), and thus a random-effects model was applied for the pooled analysis. The results showed no statistically significant difference in hospital stay between the two groups (WMD = 1.26, 95%CI: -8.44-10.95; $P = 0.80$).

Incidence of reflux esophagitis: Three studies reported the incidence of reflux esophagitis^[7,9,14]. No heterogeneity between studies was present ($P = 0.19$, $I^2 = 40\%$), and thus a fixed-effects model was applied for the pooled analysis. The results showed no statistically significant difference in incidence of reflux esophagitis between the two groups (OR = 0.58, 95%CI: 0.34-1.01; $P = 0.06$). The result is shown in Figure 2.

Incidence of dumping syndrome: Six studies^[7-9,11,12,14] reported the incidence of dumping

syndrome. No heterogeneity between studies was present ($P = 0.45$, $I^2 = 0\%$), and thus a fixed-effects model was applied for the pooled analysis. The results showed that compared with the R-Y group, the incidence of dumping syndrome was significantly lower in the PJI group (OR = 0.18, 95%CI: 0.10-0.31; $P < 0.001$). The result is shown in Figure 3.

Prognostic nutritional index: Two studies^[7,15] reported the prognostic nutritional index. Heterogeneity was present between the studies ($P = 0.002$, $I^2 = 90\%$), and thus a random-effects model was applied for the pooled analysis. The results showed that the prognostic nutritional index was significantly higher in the PJI group than in the R-Y group (WMD = 6.02, 95%CI: 1.82-10.22; $P < 0.01$). The result is shown in Figure 4A.

Postoperative weight loss: Three studies^[7,13,15] reported the postoperative weight loss. No heterogeneity was present among the studies ($P = 0.22$, $I^2 = 34\%$), and thus a fixed-effects model was applied for the pooled analysis. The results showed that postoperative weight loss was significantly

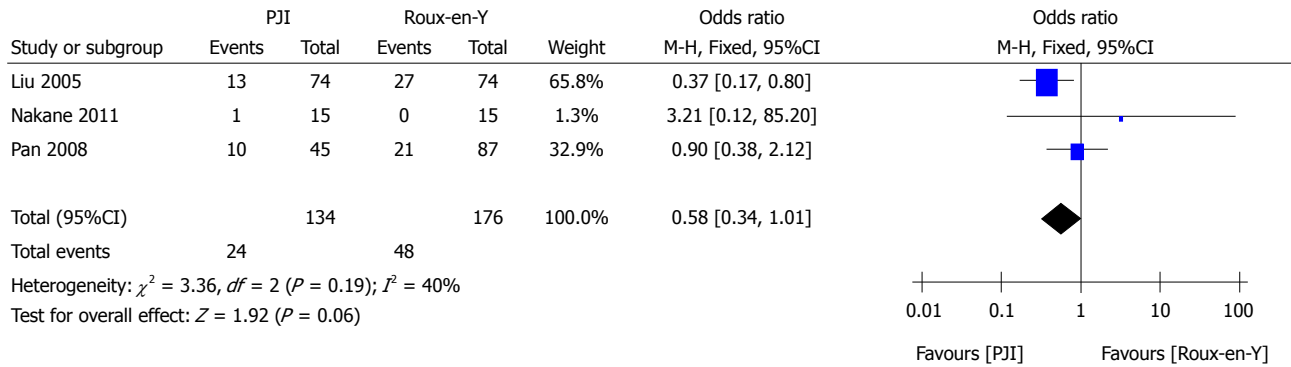


Figure 2 Forest plot of incidence of reflux esophagitis between the two groups.

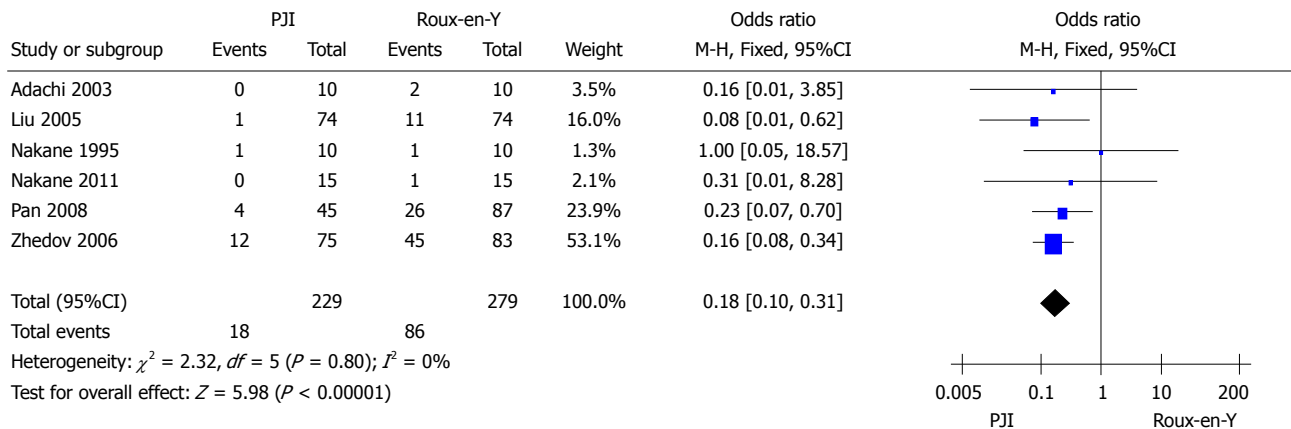


Figure 3 Forest plot of incidence of dumping syndrome between the two groups.

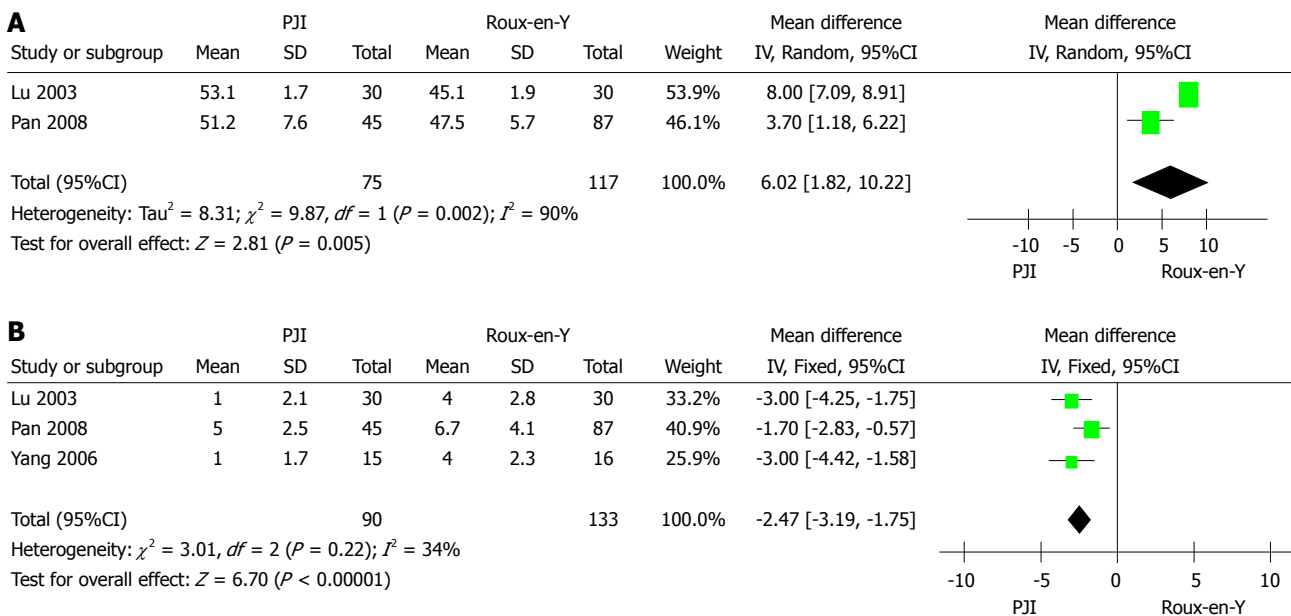


Figure 4 Forest plots of prognostic nutritional index (A) and postoperative weight loss (B) between the two groups.

improved in the PJI group compared with the R-Y group [WMD = $-(-2.47)$, 95%CI: -3.19 - (-1.75) ; $P < 0.01$]. The result is shown in Figure 4B.

Publication bias

The distribution of the funnel plot was relatively symmetrical in the incidence analysis of dumping

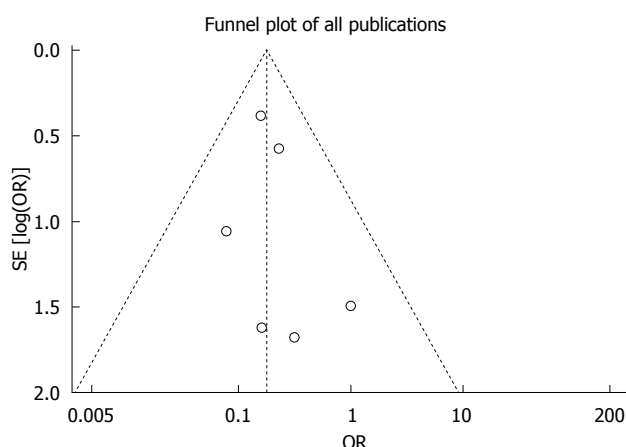


Figure 5 Funnel plot for publication bias.

syndrome, indicating that publication bias was relatively small, as shown in Figure 5. Regarding other measured parameters, fewer than 5 studies were included in this analysis; therefore, the funnel plot analysis was not performed and the possibility of publication bias cannot be ruled out.

DISCUSSION

This systematic analysis showed that compared with Roux-en-Y anastomosis, jejunal interposition reconstruction has a lower incidence of dumping syndrome, a higher prognostic nutritional index, and a lower postoperative weight loss. There was no statistically significant difference in operative time, hospital stay, or incidence of reflux esophagitis between the two reconstruction procedures ($P > 0.05$ for all).

This systematic analysis has certain limitations: (1) only a few studies were included in the studies; moreover, a certain study was conducted with a small sample size, both of which could affect the results of meta-analysis; (2) only a few measured parameters were described in those studies, which may affect the argument strength of the analysis; (3) we did not search for RCTs published in other languages, which may result in a biased distribution; and (4) when we performed the pooled analysis, a random-effects model was used for three measured parameters because of poor homogeneity among the studies. The random-effects model tends to draw conservative conclusions, which may affect the analytical results. Therefore, future clinical trials of digestive tract reconstructions after total gastrectomy should be reported using the "consolidated Standards of Reporting Trials" guidelines, which have been internationally accepted. We should pay more attention to studies of quality of life in gastric cancer patients, especially in those with advanced gastric cancer. Moreover, we should pay attention to the results of placebo-controlled clinical trials.

In conclusion, compared with Roux-en-Y anastomosis,

jejunal interposition reconstruction after total gastrectomy for gastric cancer could improve the long-term quality of life in patients. Moreover, it would not extend operative time or hospital stay. It is a safe and effective digestive tract reconstruction procedure.

COMMENTS

Background

To date, there are approximately 70 types of digestive tract reconstructions after total gastrectomy. Although operative technique is gradually improving, there is still no relatively ideal and standard surgical approach to digestive tract reconstruction after total gastrectomy.

Research frontiers

There are two main surgical approaches: esophagojejunal anastomosis and jejunal interposition reconstruction with preservation of the duodenum passage. In order to assess accurately the clinical outcomes of these two reconstruction methods, the authors strictly limited inclusion criteria and carried out a comprehensive meta-analysis. This will contribute to a more systematic and objective evaluation of these two methods in gastric cancer treatment.

Innovations and breakthroughs

This study performed a meta-analysis on the long-term postoperative complications and quality of life between these two digestive tract reconstructions; thus, it may provide medical evidence for choosing a reasonable surgical approach to digestive tract reconstruction after total gastrectomy in evidence-based practice.

Applications

Compared with Roux-en-Y anastomosis, gastric cancer patients who underwent jejunal interposition reconstruction after total gastrectomy had a lower risk of postoperative long-term complications, and their quality of life was significantly improved.

Peer-review

This is a well written article. As the author pointed out, the deflection of the case is seen, and most of parameters depend on the Chinese cases. The author should search articles written in other language, such as Russian, South Korean and Japanese.

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