

Systematic review of anastomotic complications of esophagojejunostomy after laparoscopic total gastrectomy

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Abstract

AIM: To investigate the anastomotic complications of

esophagojejunostomy (EJS) after laparoscopic total gastrectomy (LTG), we reviewed retrospective studies.

METHODS: A literature search was conducted in PubMed for studies published from January 1, 1994 through January 31, 2015. The search terms included "laparoscopic," "total gastrectomy," and "gastric cancer." First, we selected 16 non-randomized controlled trials (RCTs) comparing LTG with open total gastrectomy (OTG) and conducted an updated meta-analysis of anastomotic complications after total gastrectomy. The Newcastle-Ottawa scoring system (NOS) was used to assess the quality of the non-RCTs included in this study. Next, we reviewed anastomotic complications in 46 case studies of LTG to compare the various procedures for EJS.

RESULTS: The overall incidence of anastomotic leakage associated with EJS was 3.0% (30 of 984 patients) among LTG procedures and 2.1% (31 of 1500 patients) among OTG procedures in the 16 non-RCTs. The incidence of anastomotic leakage did not differ significantly between LTG and OTG (odds OR = 1.42, 95%CI: 0.86-2.33, $P = 0.17$, $I^2 = 0\%$). Anastomotic stenosis related to EJS was reported in 72 (2.9%) of 2484 patients, and the incidence was 3.2% among LTG procedures and 2.7% among OTG procedures. The incidence of anastomotic stenosis related to EJS was slightly, but not significantly, higher in LTG than in OTG (OR = 1.55, 95%CI: 0.94-2.54, $P = 0.08$, $I^2 = 0\%$). The various procedures for LTG were classified into six categories in the review of case studies of LTG. The incidence of EJS leakage was similar (1.1% to 3.2%), although the incidence of EJS stenosis was relatively high when the OrVil™ device was used (8.8%) compared with other procedures (1.0% to 3.6%).

CONCLUSION: The incidence of anastomotic complications associated with EJS was not different between LTG and OTG. Anastomotic stenosis was relatively common when the OrVil™ device was used.

Key words: Gastric cancer; Laparoscopic; Gastrectomy; Anastomosis; Complication

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Core tip: In this updated meta-analysis of non-randomized controlled trials comparing laparoscopic total gastrectomy (LTG) and open total gastrectomy, the incidence of anastomotic leakage was similar, and that of anastomotic stenosis was slightly, but not significantly, higher when LTG was performed. The incidence of anastomotic stenosis was relatively high for new procedures that utilize a trans-orally inserted anvil (OrVil™) in reported case series of LTG.

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INTRODUCTION

Laparoscopic distal gastrectomy (LDG) is an established minimally invasive procedure for the treatment of gastric cancer, particularly early-stage disease. Several meta-analyses of randomized controlled trials (RCTs) comparing LDG with conventional open distal gastrectomy (ODG) have reported the short-term advantages of LDG, such as less pain, less operative bleeding, and earlier recovery^[1-5]. Moreover, LDG was associated with fewer minor postoperative complications, such as wound infection and medical complications, compared with ODG in several meta-analyses, including non-RCTs^[6,7]. In contrast, no RCTs comparing laparoscopic total gastrectomy (LTG) with open total gastrectomy (OTG) have been reported, although one RCT compared laparoscopy-assisted gastrectomy including both distal and total gastrectomy with open gastrectomy^[8]. Esophagojejunostomy (EJS) after LTG is a complicated procedure requiring extensive experience and a skilled technique, which is a major reason why LTG is not as commonly performed as LDG. However, several meta-analyses of non-RCTs that included patients with mismatched clinical factors have been reported. First, in 2012, Haverkamp *et al.*^[9] published a meta-analysis of 8 non-RCTs, showing that LTG was associated with a longer operative time, less blood loss, and a shorter hospital stay than OTG. Postoperative complications did not differ between LTG and OTG in their meta-analysis. Shen *et al.*^[10] demonstrated that LTG was associated with a slightly, but not significantly, lower incidence of postoperative complications than OTG. Regarding individual complications, there were slightly

lower risks of wound infection and pneumonia with LTG. Chen *et al.*^[11] showed that postoperative medical complications were significantly less frequent with LTG than with OTG, but surgical complications were not. In two meta-analyses published in 2014, LTG was shown to result in a longer operative time, less blood loss, lower analgesic use, earlier passage of flatus, quicker resumption of oral intake, earlier hospital discharge, and fewer postoperative complications^[12,13]. Regarding individual complications, LTG was associated with fewer wound-related problems than OTG^[12].

This review focused on anastomotic complications of EJS after LTG. We conducted a meta-analysis of postoperative anastomotic complications of EJS, such as anastomotic leakage and stenosis, by analyzing the results of non-RCTs that compared LTG with OTG. In addition, we analyzed case series of EJS in conjunction with LTG and evaluated the different procedures used to perform EJS.

MATERIALS AND METHODS

Literature overview

First, to conduct this meta-analysis comparing anastomotic complications of EJS between LTG and OTG, a literature search was performed in PubMed for studies published from January 1, 1994 through January 31, 2015. The search terms included "laparoscopic," "total gastrectomy," and "gastric cancer." Reports in languages other than English, reviews, and meta-analyses were excluded. Twenty non-RCTs, but no RCTs, were found. To minimize bias in this meta-analysis of anastomotic complications, we excluded studies that included hand-assisted or robotic approaches, other diseases, and mismatched reconstruction procedures. Four studies were excluded from this meta-analysis for the following reasons. The text of a study by Du *et al.*^[14] was not available online; a study by Usui *et al.*^[15] included hand-assisted procedures; a study by Kwon *et al.*^[16] included robotic surgery; and a study by Mochiki *et al.*^[17] included jejunal pouch interposition reconstruction in OTG. The 16 selected non-RCTs are summarized in Table 1. LTG and OTG were compared with regard to anastomotic leakage or stenosis of the EJS.

The Newcastle-Ottawa scoring system (NOS) was used to assess the quality of the non-RCTs^[18]. With the NOS, the maximum scores are four points for selection, two for comparability (reconstruction method and the extent of lymphadenectomy), and three for outcome assessment. The studies included in this meta-analysis were of sufficient quality according to the NOS (Table 2).

Second, to review case series reporting anastomotic complications of EJS in LTG, a search of PubMed, performed as described above, yielded 53 case series reports (including more than 10 patients) of LTG that included reconstruction procedures and a results of postoperative anastomotic complications.

Table 1 Summary of non-randomized controlled trials comparing laparoscopic total gastrectomy and open total gastrectomy

Author	Year	Nation	n	Extent of LND ¹	Matched factors
Kim <i>et al</i> ^[27]	2008	South Korea	60	D1 + 8a, 9	1, 2, 3, 5, 6, 7
Topal <i>et al</i> ^[28]	2008	Belgium	60	D2	1, 2, 3, 4, 5, 6, 7
Kawamura <i>et al</i> ^[29]	2009	Japan	81	D2-No.10	1, 2, 3, 4, 6, 7
Sakuramoto <i>et al</i> ^[30]	2009	Japan	74	D1 + 8a, 9/D2-No.10	1, 2, 3, 4, 6, 7
Kim <i>et al</i> ^[31]	2011	South Korea	190	D2-No.10	1, 2, 3, 4, 5, 6, 7
Arrington <i>et al</i> ^[32]	2012	United States	50	D0/D1/D2-No.10	1, 2, 5, 6, 7
Eom <i>et al</i> ^[33]	2012	South Korea	448	D2-No.10	4, 6, 7
Siani <i>et al</i> ^[34]	2012	Italy	50	D2-No.10	1, 2, 5, 6, 7
Bo <i>et al</i> ^[35]	2013	China	234	D2-No.10	1, 2, 3, 5, 6, 7
Guan <i>et al</i> ^[36]	2013	China	97	D2	2, 5, 6, 7
Jeong <i>et al</i> ^[37]	2013	South Korea	244	D1 + No.8a, 9/D2	1, 2, 3, 4, 5, 7
Kim <i>et al</i> ^[38]	2013	South Korea	346	D2-No.10	1, 2, 3, 4, 5, 6, 7
Lee <i>et al</i> ^[39]	2013	South Korea	348	D2	1, 2, 4, 6, 7
Shim <i>et al</i> ^[40]	2013	South Korea	70	D1 + 8a, 9, 11p/D2	1, 2, 5, 6, 7
Lee <i>et al</i> ^[41]	2014	South Korea	84	D1 + No.8a, 9, 11p	1, 2, 5, 6, 7
Matsuda <i>et al</i> ^[42]	2015	Japan	48	D1 + No.8a, 9, 11p	2, 3, 4, 5, 6, 7

¹Based on Japanese gastric cancer treatment guidelines. 1, age; 2, sex; 3, body mass index; 4, ASA or comorbidity; 5, tumor stage; 6, extent of LND; 7, reconstruction method. LND: Lymph node dissection.

Table 2 Quality assessment of non-randomized controlled trials based on the Newcastle-Ottawa scoring system

Author	Selection Is the case definition adequate?	Representativeness of the cases	Selection of controls	Definition of controls	Comparability ¹ of cases and controls on the basis of the design or analysis	Exposure Ascertainment of exposure	Same method of ascertainment for cases and controls	Non-response rate
Kim <i>et al</i> ^[27]	*	*			**	*	*	*
Topal <i>et al</i> ^[28]	*	*			**	*	*	*
Kawamura <i>et al</i> ^[29]	*	*			**	*	*	*
Sakuramoto <i>et al</i> ^[30]	*	*			**	*	*	*
Kim <i>et al</i> ^[31]	*	*			**	*	*	*
Arrington <i>et al</i> ^[32]	*	*			**	*	*	*
Eom <i>et al</i> ^[33]	*	*			**	*	*	*
Siani <i>et al</i> ^[34]	*	*			**	*	*	*
Bo <i>et al</i> ^[35]	*	*			**	*	*	*
Guan <i>et al</i> ^[36]	*	*			**	*	*	*
Jeong <i>et al</i> ^[37]	*	*			*	*	*	*
Kim <i>et al</i> ^[38]	*	*			**	*	*	*
Lee <i>et al</i> ^[39]	*	*			**	*	*	*
Shim <i>et al</i> ^[40]	*	*			**	*	*	*
Lee <i>et al</i> ^[41]	*	*			**	*	*	*
Matsuda <i>et al</i> ^[42]	*	*			**	*	*	*

¹Controls selected on the basis of the extent of lymphadenectomy and reconstruction procedure (maximum, 2 stars).

Several studies partly included comparisons, such as comparisons between LTG and LPG or between different EJS procedures. However, 4 studies were excluded because they also included proximal gastrectomy or other diseases, and 3 studies were excluded because of a suspicion of overlapping data from the same institution. The remaining 46 studies were included in this review (Table 3). We classified anastomotic procedures into the following 6 categories: (1) extracorporeal reconstruction by a single stapling technique using a circular stapler; (2) intracorporeal reconstruction by a single stapling technique using a circular stapler; (3) intracorporeal reconstruction by a double (or hemi-double) stapling technique using a circular stapler with a trans-abdominally inserted

anvil (DST/HDST); (4) intracorporeal reconstruction by a double (or hemi-double) stapling technique using a circular stapler with a trans-orally inserted anvil (OrVil™) (DST/HDST by TOA); (5) intracorporeal reconstruction by side-to-side anastomosis using a linear stapler; and (6) intracorporeal reconstruction by functional end-to-end anastomosis using linear staplers.

Statistical analysis

Review Manager software, version 5.2 (Cochrane Collaboration, Oxford, United Kingdom), was used to perform this meta-analysis. For discontinuous variables, each postoperative complication was extracted from the trial report; odds ratios (ORs) were

Table 3 Summary of case series of esophagojejunostomy in laparoscopic total gastrectomy *n* (%)

Author	Year	Country	<i>n</i>	EJS leakage	EJS stenosis
Extracorporeal SST					
Hur <i>et al</i> ^[43]	2008	South Korea	18	0 (0)	0 (0)
Lee <i>et al</i> ^[44]	2009	South Korea	67	1 (1.5)	6 (9.0)
Kunisaki <i>et al</i> ^[45]	2011	Japan	15	1 (6.7)	0 (0)
Yoon <i>et al</i> ^[46]	2012	South Korea	65	3 (4.6)	3 (4.6)
Mou <i>et al</i> ^[47]	2013	China	12	0 (0)	0 (0)
Jung <i>et al</i> ^[48]	2013	South Korea	47	2 (4.3)	2 (4.3)
Li <i>et al</i> ^[49]	2014	China	108	1 (0.9)	0 (0)
Sahoo <i>et al</i> ^[50]	2014	India	47	0 (0)	0 (0)
Total			379	8 (2.1)	11 (2.9)
Intracorporeal SST with trans-abdominally inserted anvil					
Usui <i>et al</i> ^[51]	2008	Japan	15	0 (0)	0 (0)
Kinoshita <i>et al</i> ^[52]	2010	Japan	10	0 (0)	0 (0)
Lee <i>et al</i> ^[53]	2012	South Korea	88	3 (3.4)	0 (0)
Shim <i>et al</i> ^[54]	2013	South Korea	12	2 (17)	5 (42)
Kim <i>et al</i> ^[55]	2013	South Korea	36	0 (0)	0 (0)
Yoshikawa <i>et al</i> ^[56]	2013	Japan	20	0 (0)	0 (0)
Du <i>et al</i> ^[57]	2013	China	52	0 (0)	0 (0)
Total			233	5 (2.1)	5 (2.1)
Intracorporeal HDST/DST with trans-abdominally inserted anvil					
Omori <i>et al</i> ^[58]	2009	Japan	10	0 (0)	0 (0)
Nunobe <i>et al</i> ^[59]	2011	Japan	41	2 (4.9)	3 (7.3)
Shim <i>et al</i> ^[54]	2013	South Korea	14	1 (7.1)	1 (7.1)
Lafemina <i>et al</i> ^[60]	2013	United States	17	1 (5.9)	1 (5.9)
Muguruma <i>et al</i> ^[61]	2014	Japan	32	0 (0)	0 (0)
Zhao <i>et al</i> ^[62]	2014	China	26	0 (0)	0 (0)
Total			140	4 (2.9)	5 (3.6)
Intracorporeal HDST/DST with trans-orally inserted anvil					
Jeong <i>et al</i> ^[63]	2009	South Korea	16	0 (0)	0 (0)
Kachikwu <i>et al</i> ^[64]	2011	United States	16	0 (0)	3 (19)
Kunisaki <i>et al</i> ^[45]	2011	Japan	30	1 (3.3)	0 (0)
Marangoni <i>et al</i> ^[65]	2012	United Kingdom	13	0 (0)	0 (0)
Liao <i>et al</i> ^[66]	2013	China	27	1 (3.7)	1 (3.7)
Shim <i>et al</i> ^[54]	2013	South Korea	12	2 (17)	4 (33)
Xie <i>et al</i> ^[67]	2013	China	28	0 (0)	0 (0)
Zuiki <i>et al</i> ^[25]	2013	Japan	52	1 (1.9)	11 (21)
Hiyoshi <i>et al</i> ^[68]	2014	Japan	21	2 (9.5)	0 (0)
Total			215	7 (3.2)	19 (8.8)
Intracorporeal STSA					
Huscher <i>et al</i> ^[69]	2007	Italy	11	0 (0)	0 (0)
Inaba <i>et al</i> ^[70]	2010	Japan	53	2 (3.8)	0 (0)
Bracale <i>et al</i> ^[71]	2010	Italy	67	4 (6.0)	2 (3.0)
Tsujimoto <i>et al</i> ^[72]	2012	Japan	15	0 (0)	0 (0)
Nagai <i>et al</i> ^[73]	2013	Japan	94	2 (2.1)	0 (0)
Petersen <i>et al</i> ^[74]	2013	Denmark	30	3 (10)	0 (0)
Shim <i>et al</i> ^[54]	2013	South Korea	10	0 (0)	1 (10)
Morimoto <i>et al</i> ^[75]	2014	Japan	77	0 (0)	1 (1.3)
Yamamoto <i>et al</i> ^[76]	2014	Japan	52	1 (1.9)	0 (0)
Total			409	12 (2.9)	4 (1.0)
Intracorporeal FETEA					
Ziqiang <i>et al</i> ^[77]	2008	China	14	0 (0)	0 (0)
Kim <i>et al</i> ^[78]	2012	South Korea	124	3 (2.4)	6 (4.8)
Kim <i>et al</i> ^[79]	2013	South Korea	139	1 (0.7)	1 (0.7)
Ebihara <i>et al</i> ^[80]	2013	Japan	65	0 (0)	3 (4.6)
Hiyoshi <i>et al</i> ^[68]	2014	Japan	24	0 (0)	0 (0)
Tsunoda <i>et al</i> ^[81]	2014	Japan	97	1 (1.0)	0 (0)
Total			463	5 (1.1)	10 (2.2)

EJS: Esophagojejunostomy; SST: Single-stapling technique; DST: Double-stapling technique; HDST: Hemi-double stapling technique; STSA: Side-to-side anastomosis; FETEA: Functional end-to-end anastomosis.

calculated from the total number of patients and the observed numbers of events of interest in all groups using a random-effects model. In the tables of our results, squares indicate point estimates of ORs, with

95% confidential intervals (CIs) indicated by horizontal bars. The diamonds represent the summary ORs with 95% CIs from the included studies. *P* values < 0.05 were considered to indicate statistical significance.

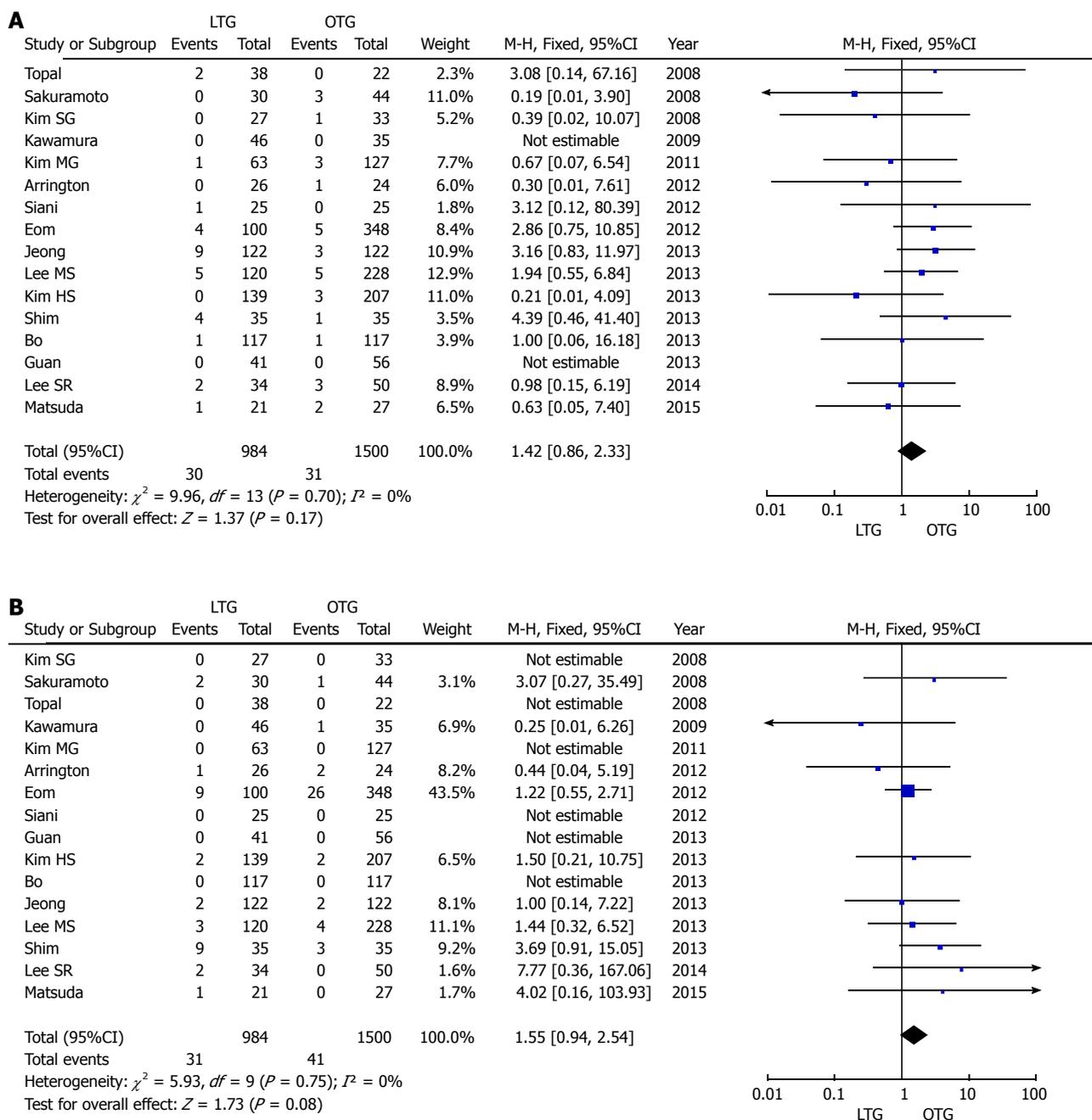


Figure 1 Outcomes of the meta-analysis comparing anastomotic leakage (A) and anastomotic stenosis (B). LTG: Laparoscopic total gastrectomy; OTG: Open total gastrectomy.

The I^2 statistic was used to quantitatively assess heterogeneity. Graphical exploration with funnel plots was used to evaluate publication bias. Publication bias was assessed on the basis of the funnel plot of the included studies.

RESULTS

This meta-analysis included a total of 2484 patients, 984 of whom underwent LTG and 1500 of whom underwent OTG. Anastomotic leakage of EJS was reported in 61 (2.5%) of 2484 patients in the 16 studies. The overall incidence of anastomotic leakage of EJS was 3.0% (30 of 984 patients) with LTG and

2.1% (31 of 1500 patients) with OTG in the 16 studies. The incidence of anastomotic leakage did not differ significantly between LTG and OTG (Figure 1A). Anastomotic stenosis of EJS was reported in 72 (2.9%) of the 2484 patients, and the incidence was 3.2% with LTG and 2.7% with OTG. The incidence of anastomotic stenosis of EJS was slightly, but not significantly, higher in LTG than in OTG (Figure 1B). Publication bias was assessed for each complication using the funnel plot of the included studies. No complications were associated with publication bias, and a symmetric distribution was maintained with all of the studies lying within the 95%CI (data not shown).

In the review of the case series, the overall incidence

of anastomotic leakage of EJS in the 46 studies was 2.2% (41 of 1839). The incidences of EJS leakage according to the anastomotic procedure are also shown in Table 3. The overall incidence of anastomotic stenosis of EJS was 2.9% (54 of 1839). The incidences of anastomotic stenosis according to the anastomotic procedure are also shown in Table 3. It was relatively common with the DST/HDST by TOA procedure.

DISCUSSION

In this updated meta-analysis, the incidence of anastomotic leakage of EJS did not differ significantly between LTG and OTG. This outcome was consistent with the findings of previous meta-analyses by Wang *et al.*^[12,19]. The incidence of anastomotic leakage of EJS after TG in our review was not higher than that in other studies of OTG, which have reported incidences of 1.0% to 2.1%^[20-22]. The Japanese National Clinical Database (NCD) of digestive surgery reported that the incidence of anastomotic leakage after total gastrectomy was 4.4% (881 of 20011) in 2011^[23]. Detailed information, specifically on LTG or OTG, was unavailable. Most of the leaks must have occurred at the EJS in that study. Diverse anastomotic procedures have been reported in studies of LTG. In our review, the incidence of anastomotic leakage of EJS was similar between the various procedures.

In our study, the incidence of anastomotic stenosis of EJS was slightly, but not significantly, higher with LTG than with OTG. One problem was that EJS stenosis was not clearly defined in many of the studies included in our analysis. EJS stenosis was not graded based on a standardized assessment, such as the Clavien-Dindo classification. Therefore, it was unclear whether endoscopic dilation or reoperation was performed in all of the patients diagnosed with EJS stenosis. Another problem was that EJS stenosis often occurred several weeks or months after LTG. Therefore, an accurate incidence of anastomotic stenosis was not shown among the short-term outcomes of LTG, and anastomotic stenosis was not mentioned in the NCD report. In our review of case-series studies, the incidence of anastomotic stenosis was higher among the procedures performed using the Orvil™ device. In a review by Umemura *et al.*^[24] comparing procedures used to perform EJS after LTG, the use of circular staplers was significantly associated with higher incidences of both anastomotic leakage (4.7%) and stenosis (8.3%) compared with the use of linear staplers (1.1% and 1.8%, respectively). Even in our analysis, linear stapler methods apparently reduced the risk of stenosis. An anastomotic site formed by a linear stapler could probably secure a wider diameter than one formed by a circular stapler^[24]. As another investigator insisted, the high incidence of anastomotic stenosis after DST/HDST may be explained by the following causes: excessive tension at the anastomotic site and focal ischemia at the site where the two staple

lines overlap^[25]. In the study of the Orvil™ device, which was associated with the highest incidence of anastomotic stenosis, the use of a circular stapler with a smaller size (21 mm) significantly increased the rate of EJS anastomosis compared with the use of a normal-sized stapler (25 mm)^[25]. To pass the anvil head of Orvil™ easily through the esophageal entrance, the smaller anvil was probably used in some cases in that study. In OTG, the use of a circular stapler with a small diameter (21 mm) was a significant risk factor for EJS stenosis^[26]. Both the DST/HDST procedure and the use of a smaller circular stapler could increase the stenosis in the EJS when the Orvil™ device is used. However, several studies on the use of Orvil™ have shown favorable results. Anastomotic complications may be closely associated with learning curves of surgeons^[25]. Therefore, they will probably decrease in any procedures as surgeons acquire more experience and improve their technical skills in performing EJS.

In addition, the value of meta-analyses of non-RCTs remains controversial, as non-RCTs often include groups of patients who are mismatched with respect to background characteristics. Our meta-analysis also had limitations despite the inclusion of studies in which the patients were matched as closely as possible. To draw definitive conclusions, prospective studies are needed to clarify the usefulness of LTG. A prospective phase II study of LTG or laparoscopic proximal gastrectomy has begun in Japan, with anastomotic leakage as the primary endpoint. The problems currently associated with EJS after LTG are an important concern. However, the postoperative outcomes of EJS are expected to improve in the future with increased experience and enhanced surgical skills.

In conclusion, the incidences of anastomotic complications of EJS were similar in this meta-analysis comparing LTG and OTG. In case studies of LTG, the incidence of anastomotic leakage of EJS was not different between various anastomotic procedures, although anastomotic stenosis was relatively common in the DST/HDST by TOA procedure.

COMMENTS

Background

Esophagojejunostomy (EJS) after laparoscopic total gastrectomy (LTG) is a complicated procedure requiring extensive experience and a skilled technique, which is a major reason why LTG is not as commonly performed as laparoscopic distal gastrectomy. No randomized controlled trials (RCTs) comparing LTG with open total gastrectomy (OTG) has been reported yet. Several meta-analyses of non-RCTs, including patients with mismatched clinical factors, have been reported.

Research frontiers

Anastomotic complication was a major issue in LTG. Various anastomotic procedures of EJS have been attempted for EJS in LTG. Anastomotic methods were roughly categorized into two groups; circular stapler method had been usually performed in OTG, and linear stapler method developed in LTG.

Innovations and breakthroughs

This meta-analysis of non-RCT of LTG vs OTG was updated, and several non-

RCTs were excluded due to including hand-assisted or robotic approaches, other diseases, and mismatched reconstruction procedures. Furthermore, we reviewed case series of LTG, and categorized various anastomotic methods of EJS into the following six procedures: (1) extracorporeal reconstruction by single stapling technique using a circular stapler; (2) intracorporeal reconstruction by single stapling technique using a circular stapler; (3) intracorporeal reconstruction by double (or hemi-double) stapling technique using a circular stapler with a trans-abdominally inserted anvil (DST/HDST); (4) intracorporeal reconstruction by double (or hemi-double) stapling technique using a circular stapler with a trans-orally inserted anvil (OrViTM) (DST/HDST by TOA); (5) intracorporeal reconstruction by side-to-side anastomosis using a linear stapler; and (6) intracorporeal reconstruction by functional end-to-end anastomosis using linear staplers.

Applications

The incidence of anastomotic leakage of EJS was similar between LTG and OTG, although that of anastomotic stenosis was slightly, but not significantly, higher with LTG than with OTG. In case series of LTG, the incidence of anastomotic leakage of EJS was not different in various anastomotic procedures, although anastomotic stenosis was slightly higher in the procedure of DST/HDST by TOA.

Terminology

Single stapling technique of EJS is the following procedure. The purse-string suture is placed in distal esophageal stump. The anvil head of a circular stapler is inserted into the esophageal lumen. The circular stapler is inserted into the distal limb of the jejunum. The circular stapler is combined with the anvil head, and EJS is performed. In double or hemi-double stapling technique, abdominal esophagus is cut by a linear stapler, and EJS is performed by a circular stapler. The anvil head is inserted trans-abdominally before esophageal transection. However, OrViTM is a device including a trans-orally inserted anvil. The anvil head of OrViTM connected with gastric tube is inserted through pharynx and esophageal entrance intraoperatively. Side-to-side anastomosis is performed peristaltically by a linear stapler. Functional end-to-end anastomosis is performed anti-peristaltically, and the entry hall is closed by a linear stapler.

Peer-review

This paper is an interesting article. Perhaps the only drawback is that there is not any RCT study, but it has been correctly referred.

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