

Comparison of the short-term outcomes between delta-shaped anastomosis and conventional Billroth I anastomosis after laparoscopic distal gastrectomy

A meta-analysis

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Abstract

Background: The conventional Billroth I anastomosis (cBIA) after laparoscopic distal gastrectomy (LDG) is performed through circular staple extracorporeally. Now, delta-shaped anastomosis (DA), which is performed using a linear stapler intracorporeally, becomes popular. We conducted a meta-analysis to compare the effectiveness and safety between the 2 techniques.

Methods: A systematic literature search was performed using PubMed, Ovid, and the Cochrane Library Central. Participants of any age and sex, who underwent DA, or cBIA after LDG, were considered following inclusion criteria.

Results: A total of 11 articles, published between 2010 and 2017, fulfilled the selection criteria. The total sample size of these studies was 2729 cases, including DA group 1008 cases and cBIA group 1721 cases. Compared to cBIA group, patients in DA group had less blood loss (mean deviation [MD] = -0.68, 95% confidence interval [CI] = -0.15 to -0.31, $P < .001$), fewer administration of analgesics (MD = -0.82, 95% CI = -1.58 to -0.05, $P = .04$), lower NRS score on POD 1 (MD = -0.84, 95% CI = -1.34 to -0.33, $P = .001$), lower NRS score on POD 3 (MD = -0.38, 95% CI = -0.50 to -0.26, $P < .001$). Furthermore, compared to cBIA group, obese patients in DA group had fewer total number of complications (MD = 0.46, 95% CI = 0.22 to 0.95, $P = .04$), shorter postoperative hospital stays (MD = -0.73, 95% CI = -1.18 to -0.28, $P = .001$), earlier first flatus (MD = -0.30, 95% CI = -0.50 to -0.10, $P = .004$), fewer administration of analgesics (MD = -1.08, 95% CI = -1.61 to -0.55, $P < .001$), lower NRS score on POD 1 (MD = -0.68, 95% CI = -0.99 to -0.37, $P < .001$) and lower NRS score on POD 3 (MD = -0.63, 95% CI = -0.86 to -0.40, $P < .001$).

Conclusions: Compared with cBIA, DA is a safe and feasible procedure, with similar surgical outcomes and postoperative complications. In terms of postoperative recovery, DA is less invasive with quicker resume than cBIA, especially for the obese patients.

Abbreviations: BMI = Body Mass Index, cBIA = conventional Billroth I anastomosis, CI = confidence interval, DA = delta-shaped anastomosis, LADG = laparoscopy-assisted distal gastrectomy, LDG = laparoscopic distal gastrectomy, MD = mean deviation, NOS = Newcastle–Ottawa scale, NRS = Numerical Rating Scale, OR = odds ratios, POD = postoperative day, SD = standard deviation, TLDG = totally laparoscopic distal gastrectomy.

Keywords: conventional billroth I anastomosis, delta-shaped anastomosis, gastric cancer, laparoscopic distal gastrectomy, meta-analysis

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1. Introduction

Gastric cancer is one of the most common malignant cancers according to statistics.^[1] The morbidity and mortality of gastric cancer are ranked fifth and third place, respectively, and the incidence of gastric cancer in Asia occupies the first in the world. At present, surgery is still the most effective treatment for gastric cancer. Despite the various methods of reconstruction, gastroduodenostomy is the only method that restores a physiological digestive tract and the first choice after distal gastrectomy in some institutes. Laparoscopy-assisted distal gastrectomy (LADG) with gastroduodenostomy for early gastric cancer was first described in 1994.^[2] The conventional Billroth I anastomosis (cBIA) after laparoscopic distal gastrectomy (LDG) is performed using a circular stapler extracorporeally. An increasing number of laparoscopic gastrectomies are being performed in East Asian countries, especially in Japan, Korea, and China where there is a high incidence of gastric cancer. After 20 years of rapid development, the laparoscopic technique has become the dominant method used in the treatment of gastric cancer owing to its wide horizon, minimal invasion, and rapid recovery. Recently, total laparoscopic distal gastrectomy (TLDG) including delta-shaped anastomosis (DA), which was first accomplished and reported by Kanaya in 2002,^[3] was performed in many large medical institutions worldwide.^[4] DA, which is performed using a linear stapler intracorporeally, then became popular. Herein, we performed a meta-analysis to compare the surgical outcomes and postoperative recovery between DA and cBIA after LDG for gastric cancer and determine the difference in patients with obesity.

2. Materials and methods

2.1. Literature search

The PRISMA statement guidelines were followed for conducting this meta-analysis and reporting the data.^[5] The PICOS scheme was followed for reporting the inclusion criteria. A systematic literature search was performed independently by 2 of the authors (Xue WB and Wang YB) using PubMed, EMBASE, and the Cochrane Library Central. We performed a computerized search to identify studies using the following terms: “totally laparoscopic,” “total laparoscopic,” “intracorporeal,” “delta,” “stomach neoplasm,” “gastric neoplasm,” “stomach cancer,” “gastric cancer,” “stomach carcinoma,” “gastric carcinoma,” “stomach tumor,” “stomach tumour,” “gastric tumour,” “gastric tumor,” “Billroth I,” and “gastroduodenostomy” on May 25, 2017. We did not consider conference abstracts because of the limited data reported in them.

2.2. Study selection

Two authors independently screened the titles and abstracts of the primary studies that were identified in the electronic search. Duplicate studies were excluded. The following inclusion criteria were set for this meta-analysis: studies comparing between DA and cBIA after LDG for gastric cancer; studies reporting at least 1 of the following perioperative outcomes, including operation time, blood loss, number of harvested lymph nodes, proximal margin, total number of complications, anastomotic leakage, anastomotic stricture, wound complication, postoperative hospital stay, time to first flatus, number of administration of analgesics, postoperative pain score (numerical rating scale [NRS] score on postoperative days [PODs] 1 and 3), and postoperative symptoms (i.e., reflux, dyspepsia,

dumping syndrome, postprandial discomfort, and diarrhea); and if more than 1 study was reported by the same institute, only the most recent or that with the highest level was included.

The following exclusion criteria were set: original studies assessing the outcomes of either DA or cBIA; review articles, letters, comments, and case reports; and (3) studies where it was impossible to retrieve or calculate the data of interest.

2.3. Data extraction

The same 2 authors extracted the following main data (Table 1): first author, year of publication, and study type; number and characteristics of the patients in both the DA and cBIA groups; and treatment outcomes, including operation time, blood loss, number of harvested lymph nodes, proximal margin, total number of complications, anastomotic leakage, anastomotic stricture, wound complication, postoperative hospital stay, time to first flatus, number of administration of analgesics, postoperative pain score, and postoperative symptoms. All relevant texts, tables, and figures were reviewed for data extraction. Discrepancies between the 2 reviewers were resolved by a consensus discussion; and the quality of the included studies was assessed using the Newcastle-Ottawa Scale (NOS).^[6] Studies achieving scores of ≥ 6 points were considered to be of a high quality and were included in the meta-analysis.

2.4. Risk of bias

The NOS was used to assess the quality of nonrandomized cohort studies. Funnel plots were constructed to assess the risk of publication bias across the series for all outcome measures.

2.5. Statistical analysis

The meta-analysis was performed using RevMan software version 5.3. Odds ratios were used as a summary measure of the efficacy for dichotomous data, and mean differences (MDs) between the groups were used for continuous variables. A 95% confidence interval (CI) was reported for both measures. If the study provided medians and interquartile ranges instead of means \pm standard deviations (SDs), the means \pm SDs were imputed, as described by Hozo et al.^[7] The fixed-effect model was used when no heterogeneity was detected among the studies, while the random-effect model was preferred for the studies with a high statistical heterogeneity. Statistical heterogeneity was evaluated using the I^2 statistic. I^2 values of 0% to 25%, 25% to 50%, and $>50\%$ were considered to indicate a low, moderate, and high heterogeneity, respectively. $P < .05$ was considered statistically significant.

3. Results

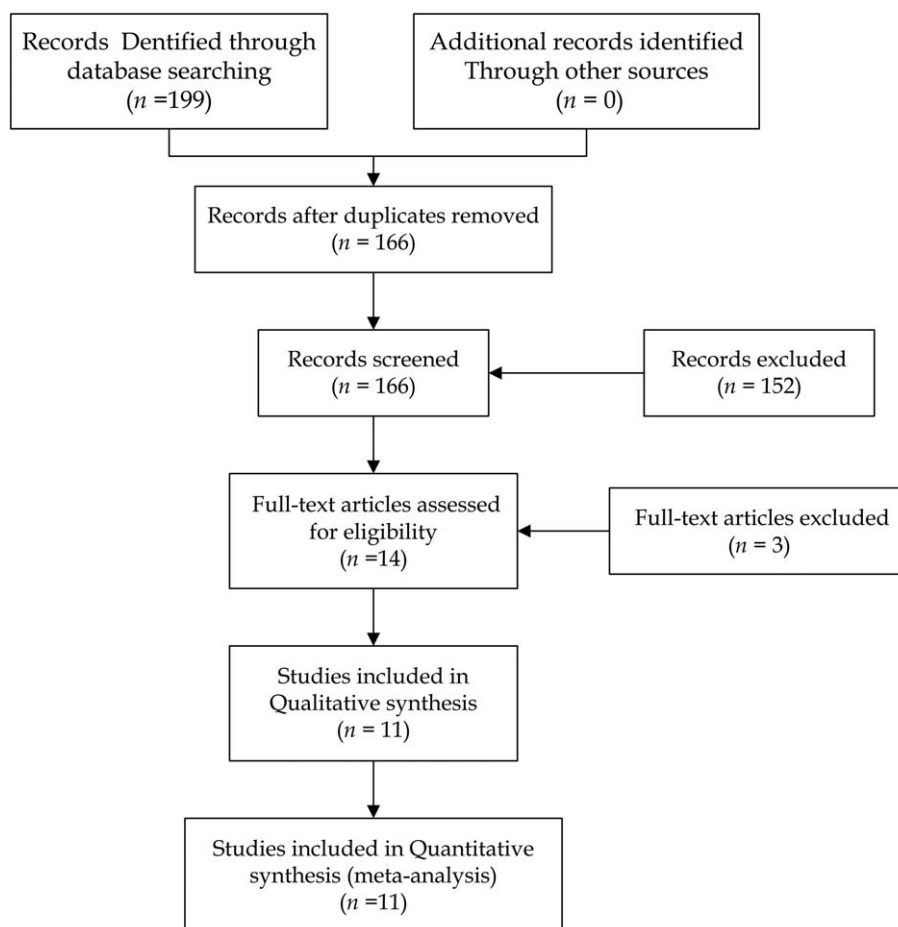
3.1. Study selection and characteristics

The literature search yielded 199 articles; after duplicate removal, 166 titles and abstracts were reviewed (Fig. 1). Of these, 152 articles were excluded for not meeting the inclusion criteria after the abstract review. The full texts of the 14 remaining articles were then reviewed. After screening, 3 articles were excluded because they included other laparoscopic reconstruction methods. Finally, a total of 11 retrospective studies,^[8–18] dated from 2004 to 2015, fulfilled the selection criteria and were therefore included in this meta-analysis, including a propensity-matched analysis.^[15]

Table 1**Clinical characteristics of included studies.**

Author and year	Country	Study time	Study design	Groups (cases)	Age (years)	Sex (M/F)	BMI (kg/m ²)	Tumor size (mm)	NOS score
Gao et al. 2017	China	2013 to 2015	Retrospective	DA(34) cBIA(83)	56.8±3.0 57.1±2.7	23/11 54/29	– –	– –	6
Jeong et al. 2014	Korea	2010 to 2014	retrospective	DA(42) cBIA(179)	58.4±10.9 62.7±11.2	22/20 114/65	24.8±3.4 24.1±3.1	21±11 23±13	6
Kim et al. 2011	Korea	2006 to 2009	retrospective	DA(180) cBIA(268)	55.8±11.7 56.7±11.5	115/65 184/84	24.2±2.9 24.2±4.0	– –	9
Kim et al. 2013	Korea	2009 to 2012	retrospective	DA(60) cBIA(106)	58.3±12.5 55.8±12.5	37/23 69/37	23.4±2.7 23.1±2.9	– –	9
Kim et al. 2010	Korea	2009 to 2010	retrospective	DA(239) cBIA(328)	56.6±12 55.4±11.2	155/84 198/130	24±3.2 23.1±2.7	30±17 28±15	6
Kinoshita et al. 2010	Japan	2007 to 2009	retrospective	DA(42) cBIA(41)	64.7±10.8 68.4±10.3	25/17 30/11	23.1±3.1 22.8±3.3	– –	9
Lee et al. 2014	Korea	2004 to 2011	retrospective	DA(138) cBIA(100)	62.4±9.7 56.0±11.2	87/51 47/53	24.2±3.1 22.6±2.0	21±11 20±13	9
Lin et al. 2016	China	2011 to 2014	retrospective	mDA(158) cBIA(484)	59.0±13.1 59.9±11.7	102/56 337/147	22.3±3.2 22.5±3.1	32±19 35±20	6
Park et al. 2016	Korea	2013 to 2014	retrospective	DA(41) cBIA(44)	61.7±10.8 62.2±10.5	23/18 24/20	24.3±2.9 23.4±2.9	22.1±12.7 23.9±11.3	9
Wang et al. 2014	China	2013 to 2014	retrospective	DA(50) cBIA(43)	64.0±8.9 61.2±13.3	34/16 28/15	23.0±4.4 22.3±3.8	– –	6
Zhang et al. 2015	China	2010 to 2014	retrospective	DA(24) cBIA(45)	64 (45–71) 66 (42–76)	16/8 31/14	– –	– –	6

BMI=body mass index, cBIA group=conventional billroth I anastomosis, DA=delta-shaped anastomosis, NOS=newcastle-ottawa scale.

**Figure 1.** Flowchart for selection of articles for the meta-analysis.

The characteristics of the included studies eligible for the meta-analysis are presented in Table 1. Six studies evaluated patients from Korea, 1 from Japan, and 4 from China. The 11 studies involved 2729 patients with sample sizes ranging from 69 to 642 patients. All 11 studies were considered to be of an adequate quality for the meta-analysis according to the NOS assessment (score of >6 points) (Table 1).

3.2. Surgical outcomes

3.2.1. Operative time. Ten of the 11 articles included in the meta-analysis reported data regarding operative time, and no statistically significant overall differences were observed (MD = -2.67, 95% CI = -15.69 to 10.34, $P = .69$) (Fig. 2A).

3.2.2. Blood loss. Eight of the included studies reported results regarding blood loss in both groups. An overall significant reduction in blood loss was observed in the DA group compared with that in the cBIA group (MD = -0.68, 95% CI = -0.15 to -0.31, $P < .001$) (Fig. 2B).

3.2.3. Number of harvested lymph nodes. Ten of the 11 articles included in the meta-analysis reported data regarding the number of harvested lymph nodes, and no statistically significant overall differences were observed (MD = 1.56, 95% CI = -0.82 to 3.93, $P = .20$) (Fig. 2C).

3.2.4. Proximal margin. Five of the 11 articles included in the meta-analysis reported data regarding proximal margin, and no statistically significant overall differences were observed (MD = -2.86, 95% CI = -9.69 to 3.97, $P = .41$) (Fig. 2D).

3.3. Postoperative complications

3.3.1. Total number of complications. All articles included in the meta-analysis reported data regarding total number of complications, and no statistically significant overall differences were observed (MD = 1.04, 95% CI = 0.78 to 1.38, $P = .78$) (Fig. 3A).

3.3.2. Anastomotic leakage. Eight of the 11 articles included in the meta-analysis reported data regarding anastomotic leakage, and no statistically significant overall differences were observed (MD = 1.93, 95% CI = 0.89 to 4.19, $P = .09$) (Fig. 3B).

3.3.3. Anastomotic stricture. Five of the 11 articles included in the meta-analysis reported data regarding anastomotic stricture, and no statistically significant overall differences were observed (MD = 0.37, 95% CI = 0.13 to 1.10, $P = .07$) (Fig. 3C).

3.3.4. Anastomotic hemorrhage. Five of the 11 articles included in the meta-analysis reported data regarding anastomotic hemorrhage, and no statistically significant overall differences were observed (MD = 0.41, 95% CI = 0.11 to 1.51, $P = .18$) (Fig. 3D).

3.3.5. Wound complication. Seven of the 11 articles included in the meta-analysis reported data regarding wound complication, and no statistically significant overall differences were observed (MD = 0.55, 95% CI = 0.25 to 1.20, $P = .13$) (Fig. 3E).

3.4. Postoperative recovery

3.4.1. Postoperative hospital stay. Eight of the 11 articles included in the meta-analysis reported data regarding postoperative hospital stay, and no statistically significant overall

differences were observed (MD = -0.50, 95% CI = -1.04 to 0.05, $P = .07$) (Fig. 4A).

3.4.2. Time to first flatus. Nine of the 11 articles included in the meta-analysis reported data regarding time to first flatus, and no statistically significant overall differences were observed (MD = -0.11, 95% CI = -0.27 to 0.05, $P = .17$) (Fig. 4B).

3.4.3. Number of administration of analgesics. Four of the 11 articles included in the meta-analysis reported data regarding the number of administration of analgesics. The DA group had a significantly fewer administration of analgesics than the cBIA group (MD = -0.82, 95% CI = -1.58 to -0.05, $P = .04$) (Fig. 4C).

3.4.4. NRS score on POD 1. Three of the 11 articles included in the meta-analysis reported data regarding the NRS score on POD 1. The DA group had a significantly lower NRS score on POD 1 than the cBIA group (MD = -0.84, 95% CI = -1.34 to -0.33, $P = .001$) (Fig. 4D).

3.4.5. NRS score on POD 3. Two of the 11 articles included in the meta-analysis reported data regarding the NRS score on POD 3. The DA group had a significantly lower NRS score on POD 3 than the cBIA group (MD = -0.38, 95% CI = -0.50 to -0.26, $P < .001$) (Fig. 4E).

3.5. Outcomes in the patients with obesity (according to the WHO Asia-Pacific Obesity classification, body mass index [BMI] of ≥ 25 kg/m²)

3.5.1. Total number of complications in the patients with obesity. Three of the 11 articles included in the meta-analysis reported data regarding the total number of complications in the patients with obesity. The DA group had a significantly fewer number of complications than the cBIA group (MD = 0.46, 95% CI = 0.22 to 0.95, $P = .04$) (Fig. 5A).

3.5.2. Postoperative hospital stay in the patients with obesity. Two of the 11 articles included in the meta-analysis reported data regarding postoperative hospital stay in the patients with obesity. The DA group had a significantly shorter postoperative hospital stay than the cBIA group (MD = -0.73, 95% CI = -1.18 to -0.28, $P = .001$) (Fig. 5B).

3.5.3. Time to first flatus in the patients with obesity. Two of the 11 articles included in the meta-analysis reported data regarding time to first flatus in the patients with obesity. The DA group had a significantly earlier time to first flatus than the cBIA group (MD = -0.30, 95% CI = -0.50 to -0.10, $P = .004$) (Fig. 5C).

3.5.4. Number of administration of analgesics in the patients with obesity. Three of the 11 articles included in the meta-analysis reported data regarding the number of administration of analgesics in the patients with obesity. The DA group had a significantly fewer administration of analgesics than the cBIA group (MD = -1.08, 95% CI = -1.61 to -0.55, $P < .001$) (Fig. 5D).

3.5.5. NRS score on POD 1 in the patients with obesity. Two of the 11 articles included in the meta-analysis reported data regarding the NRS score on POD 1 in the patients with obesity. The DA group had a significantly lower NRS score on POD 1 than the cBIA group (MD = -0.68, 95% CI = -0.99 to -0.37, $P < .001$) (Fig. 5E).

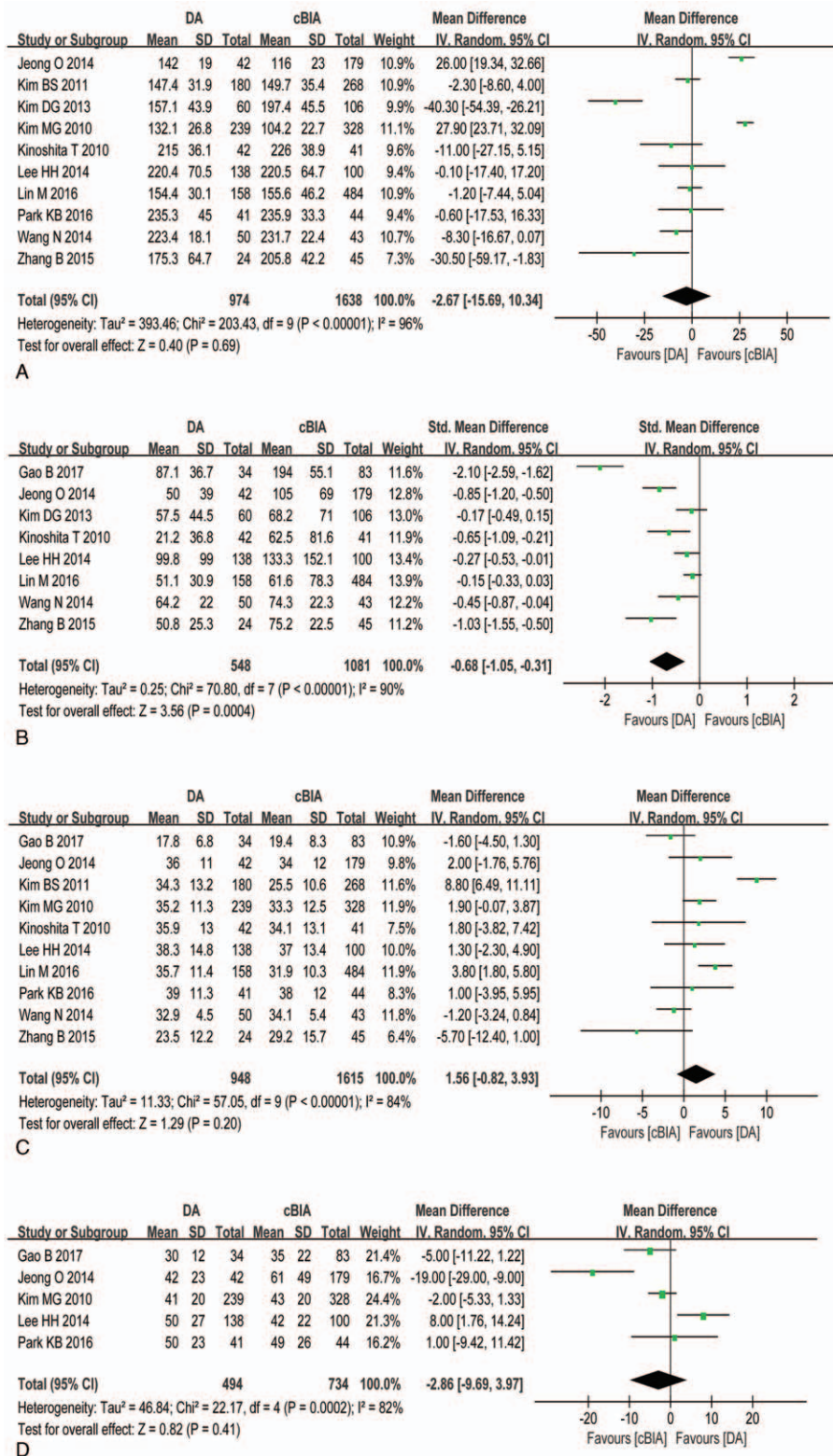


Figure 2. Meta-analysis Forest plot of surgical outcomes. (A) Operative time. (B) Blood loss. (C) Number of harvested lymph nodes. (D) Proximal margin. cBIA = conventional billroth I anastomosis, CI = confidence interval, DA = delta-shaped anastomosis, .

3.5.6. NRS score on POD 3 in the patients with obesity. Two of the 11 articles included in the meta-analysis reported data regarding the NRS score on POD 3 in the patients with obesity.

The DA group had a significantly lower NRS score on POD 3 than the cBIA group (MD = -0.63, 95% CI = -0.86 to -0.40, P < .001) (Fig. 5F).

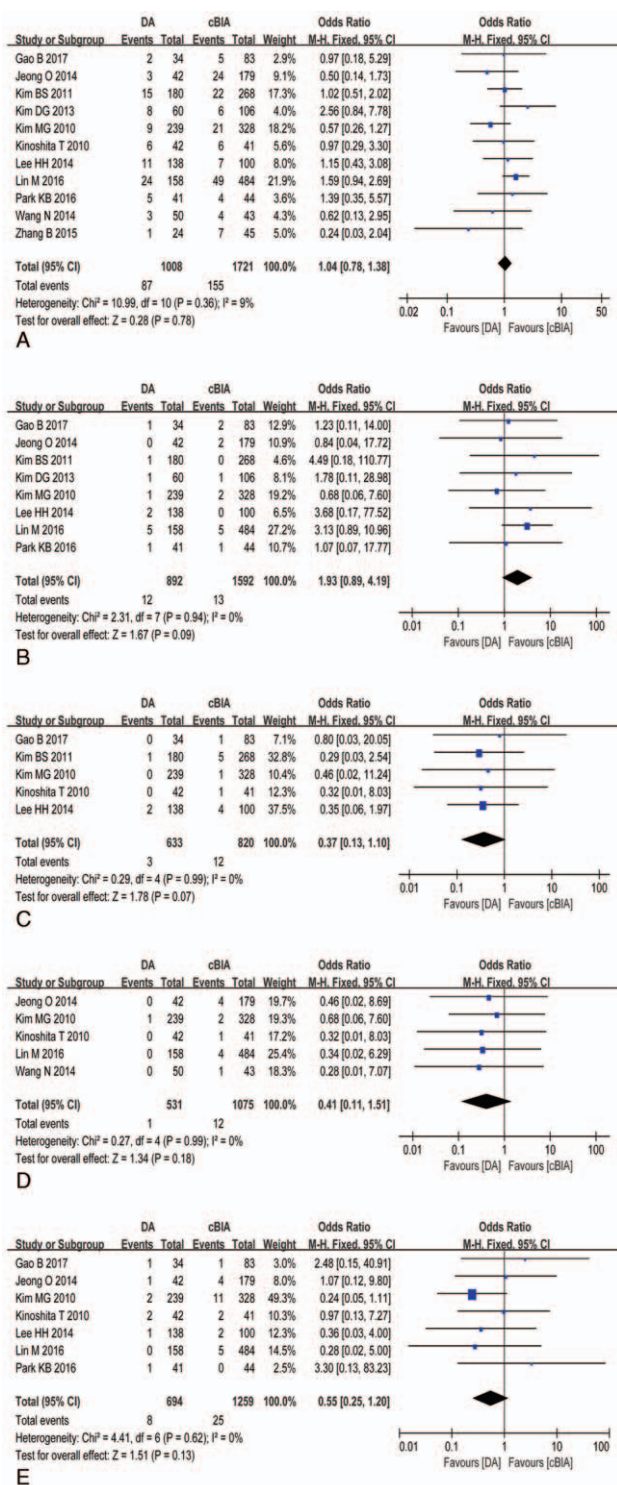


Figure 3. Meta-analysis Forest plots of postoperative complication. (A) Total complications, (B) Anastomotic leakage, (C) Anastomotic stricture, (D) Anastomosis haemorrhage, (E) Wound complication. cBIA=conventional bilroth I anastomosis, CI=confidence interval, DA=delta-shaped anastomosis.

3.6. Publication bias

Funnel plots were constructed for each outcome and showed symmetry, suggesting that the funnel plots for publication bias did not exhibit asymmetry (Fig. 6). Thus, no evidence of publication bias was detected.

4. Discussion

First reported in 1994, LDG has been developing vigorously for nearly 20 years, especially the total laparoscopic technique. With the development of laparoscopic instruments and the continuous accumulation of surgical experience in recent years, some intracorporeal gastrointestinal anastomosis techniques have been developed. The emergence of the DA method made intracorporeal gastroduodenostomy possible, which greatly promoted the development of TLDG. Although DA yielded the benefit of small wound size and early bowel recovery,^[19] some authors were concerned on the longer operation time and higher incidence of operative complications. Herein, we performed a meta-analysis to resolve the problem. To our knowledge, this is the first meta-analysis to compare the short-term outcomes between DA and cBIA after LDG, which included more than 10 articles from different journals.

According to the present meta-analysis, it took a similar amount of time to complete the 2 surgeries. However, the DA groups in a few studies in this analysis occurred at early stage with inexperienced operation. Nevertheless, the operative time in the DA group was not longer than that in the cBIA group. Gao et al^[8] discovered that surgeons who had mastered cBIA were able to grasp DA after performing 15 cases alone. Further, the procedure is easy to be learned by inexperienced surgeons.^[20] Therefore, the learning curve of DA is short for gastrointestinal surgeons. Similar sentiments were expressed by Jeong et al.^[9] Moreover, Kinoshita et al^[13] demonstrated that DA was performed within 15 minutes in most cases, including those in patients with obesity.

An advantage of cBIA is that surgeons can perform anastomosis as they would in open surgery. However, it leaves a mini laparotomy wound, and performing anastomosis in the narrow and restricted space is often difficult, leading to possible subsequent complications, especially in patients with obesity or a long anterior-to-posterior abdominal diameter.^[11] Moreover, several authors are concerned that extracorporeal anastomosis may result in tissue traction and injury.^[21,22] In 1 large retrospective study^[12] comparing DA with cBIA, patients with obesity were found to be more suitable for intracorporeal anastomosis with reduced postoperative complications. In open distal gastrectomy, LADG significantly reduced blood loss.^[23] In LADG, TLDG significantly reduced blood loss as well. The difference ranged from 10.1 to 107.9mL in this study.

The number of the retrieved lymph nodes and surgical resection margin are the major indicators of oncological surgical quality. There was no significant difference in the number of harvested lymph nodes between DA and cBIA. Although this meta-analysis found no statistically significant overall differences in the proximal margin between DA and cBIA, Jeong et al^[9] found that the proximal margins were longer in the cBIA group than in the DA group with a significant difference. During extracorporeal anastomosis, we can directly identify the tumor location and decide on the location of the gastric resection line by opening the stomach. Tumor localization was necessary when the tumor was located near the middle third of the stomach. Radiography and endoscopy were common methods for total laparoscopic gastrectomy.^[24]

In 2015, Kurita et al^[25] reported that the rate of overall morbidity in the distal gastrectomy population was 18.3%, and the surgical complications included surgical site infection in 4.3% of the patients and anastomotic leakage in 2.1%. According to this meta-analysis, although anastomotic leakage and anastomotic stricture had no significant differences between the DA group and

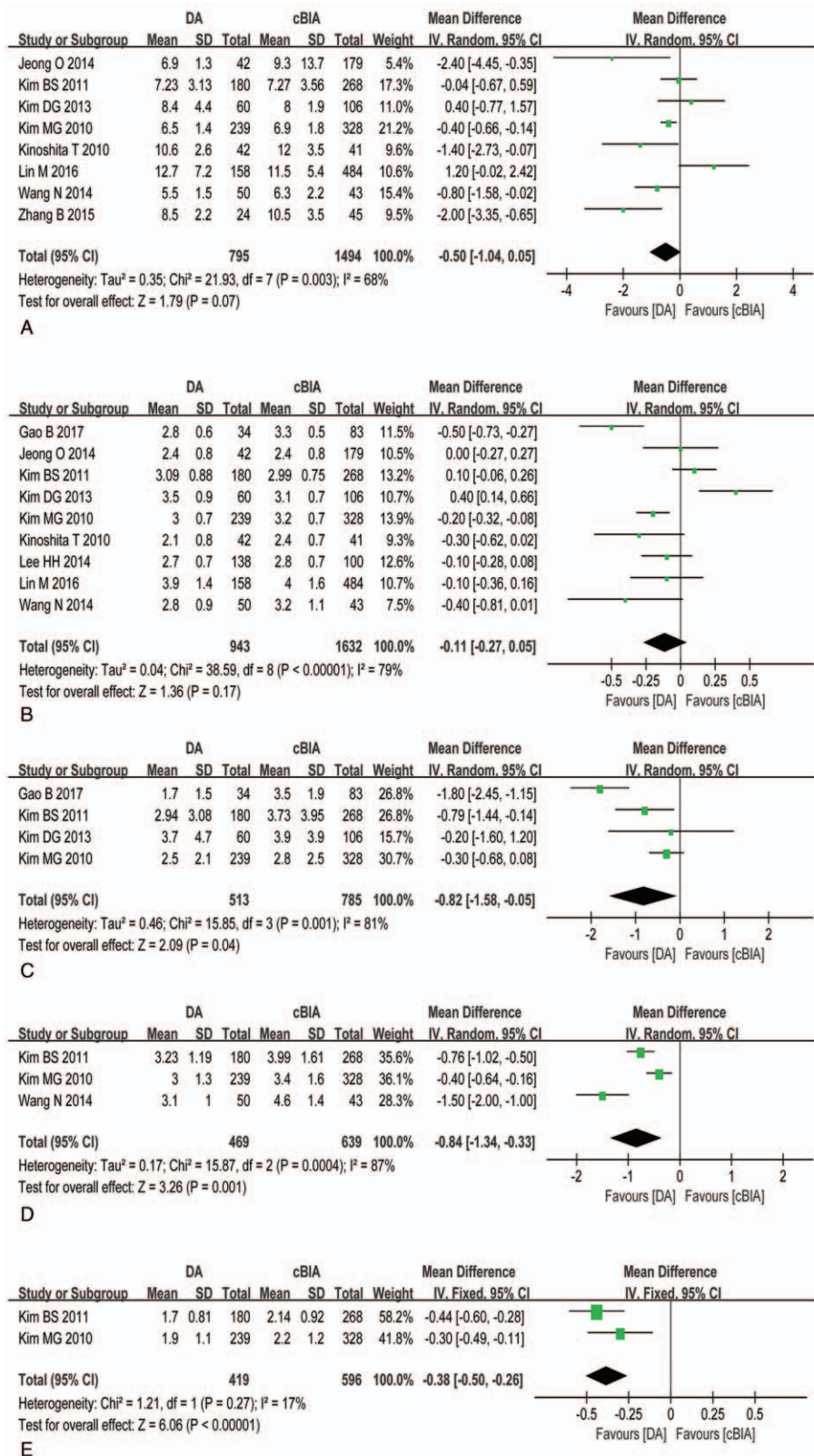


Figure 4. Meta-analysis Forest plots of postoperative recovery. (A) Postoperative hospital stays, (B) Time to first flatus, (C) Number of administration of analgesics, (D) NRS score on POD 1, (E) NRS score on POD 3. cBIA=conventional bilroth I anastomosis, CI=confidence interval, DA=delta-shaped anastomosis.

cBIA group, anastomotic leakage and stricture often occurred in the DA group and cBIA group, respectively. Utilization of the Endo-GIA stapler in DA would allow gastroduodenal anastomosis with a diameter of at least 30mm while avoiding stricture.

However, DA may affect the blood supply during cutting and result in leakage. Anastomotic hemorrhage occasionally occurs after cBIA because the intragastric hemorrhage is out of sight.^[9] Despite no significant difference between the 2, we found that anastomotic

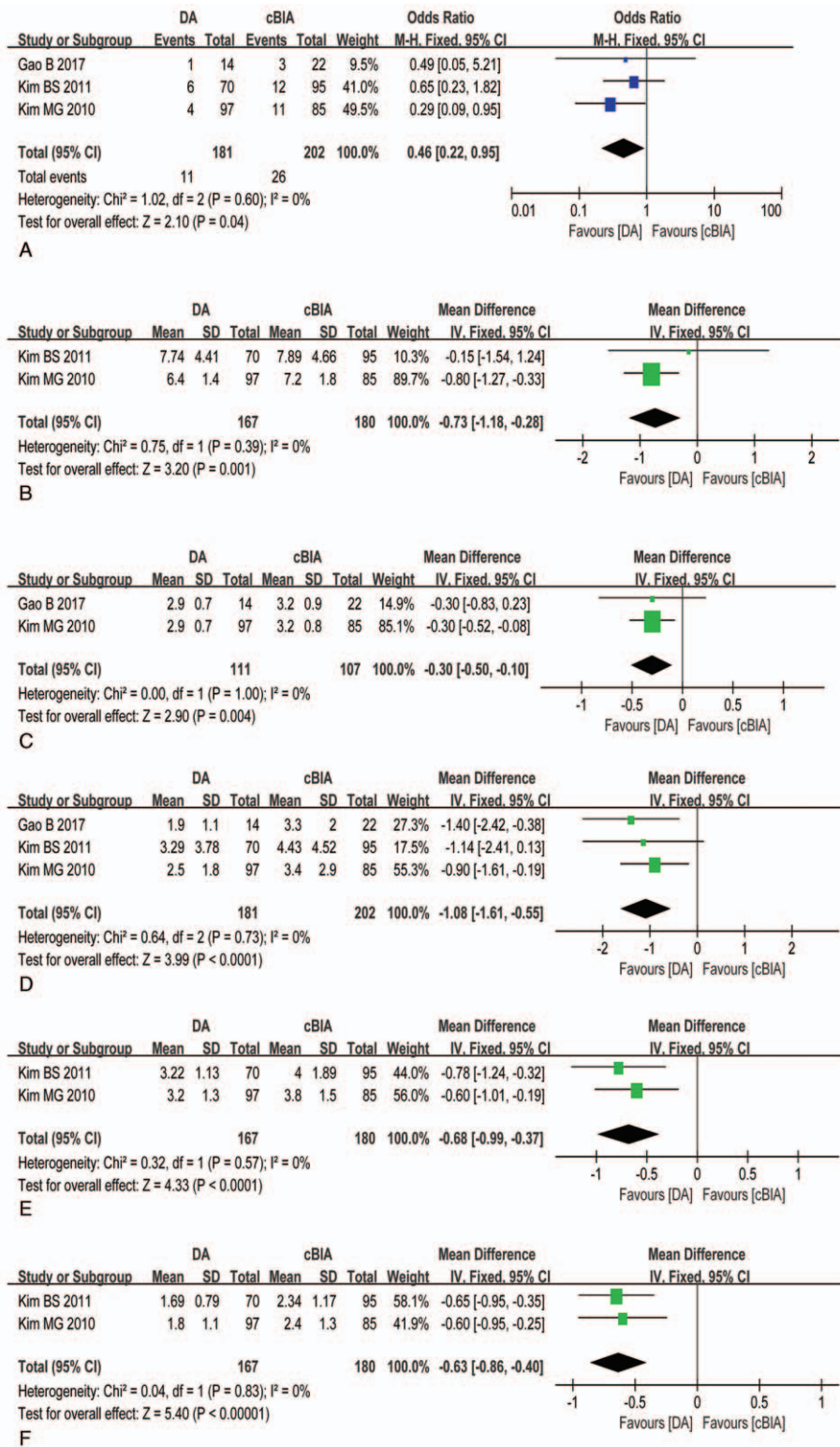


Figure 5. Meta-analysis Forest plots of the outcomes in the obesity. (A) Total complication, (B) Postoperative hospital stay, (C) Time to first flatus, (D) Number of administration of analgesics, (E) NRS score on POD 1, (F) NRS score on POD 3. cBIA=conventional bilroth I anastomosis, CI=confidence interval, DA=delta-shaped anastomosis.

hemorrhage rarely occurred in the DA group. During DA, hemorrhage of the anastomosis line can be directly found and dealt with before completing the anastomosis. In cBIA, the incision is fairly short, especially in patients with obesity, yielding difficulties

for the successful completion of extracorporeal anastomosis.^[26] Extension of the incision is often necessary to obtain a better view for secure anastomosis. However, longer incisions cause more wound complications.

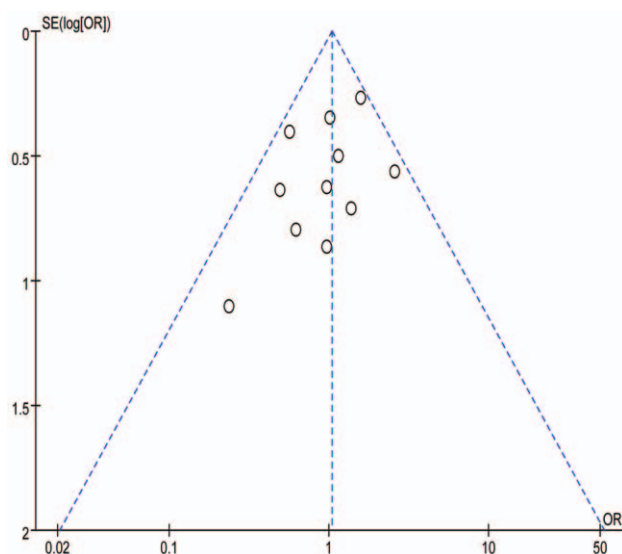


Figure 6. Funnel plot of total complication.

The recovery after DA was faster than that after cBIA. In DA, the postoperative hospital stays were shorter; the administration of analgesics was fewer; and the NRS scores on PODs 1 and 3 were lower. Although there was no significant difference in the time to first flatus between DA and cBIA, majority of the studies^[8,12,13,17] demonstrated that the time to first flatus was shorter in DA than in cBIA. Three of the included studies^[8,10,12] referred to the comparison in the patients with obesity. In the subgroup of the patients with obesity (BMI of ≥ 25 kg/m²), the advantage of DA was more significant (fewer complications, lower pain scores, fewer analgesic use, quicker bowel recovery, and shorter hospital stays).

Both Kim^[11] and Kinoshita^[13] described that the risk for dumping syndrome did not increase in the DA group. Kanaya et al^[20] demonstrated that the brief stasis of food may have been the result of duodenal twisting at the site of DA. However, the fact that reflux symptoms, which were observed endoscopically in 73.5% of the patients with DA,^[20] occurred slightly more frequently after DA than after cBIA might be because of the twisting.^[11]

Some limitations should be mentioned. First, no prospective randomized trials have been reported; therefore, future research studies should be directed at performing prospective randomized trials comparing DA with cBIA. Second, most studies included were published in the same magazine, which may cause a publication bias. Third, the results of the surgical clinical study may have been influenced by subjective factors, which may lead to heterogeneity among the studies. Comparisons of the surgical results would be influenced by the surgeons' experience. Comparisons of postoperative recovery would be influenced by postoperative management. Further, the various case volumes of the included studies may also lead to heterogeneity. Fourth, only few studies have investigated patients with obesity. Thus, the study results in the patients with obesity are not conclusive, and more research studies are needed to confirm the results. Fifth, some studies performed their research at the early stage after conducting the operation, which may be a contraindication to DA. Sixth, although DA has many advantages, it also has

limitations, including higher costs. Cost differences are owed mostly to the cost of the materials used in the operating room. Furthermore, all cases in our studies are from Japan, Korea and China; therefore, future research studies should be from Western countries.

5. Conclusions

The results of this meta-analysis of retrospective studies demonstrated that DA resulted in less blood loss and faster recovery than cBIA, especially in the patients with obesity; however, further research studies are needed to confirm the results. There was no difference in the operative time, number of harvested lymph nodes, proximal margin, and total number of complications. Future research studies should be directed in comparing the 2 techniques, also in terms of cost analyses, especially in a prospective randomized controlled manner.

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