Abstract

Aims: This Meta-analysis was conducted to compare the different reconstruction methods for gastric carcinoma following distal gastrectomy among Billroth I (BI), Billroth II (BII) and Roux-en-Y (RY).

Methods: PubMed, EMBASE, Science Citation Index Expanded and Cochrane library were searched from inception to November 2015. Characteristic data on perioperative period and long-term complications were collected, systemized and conducted with Review Manager version 5.3.2 (RevMan), of which, dichotomous variables were evaluated by odds ratio (OR), and continuous variables were merged using the mean difference (MD). Funnel figures were plotted to assess the publication bias.

Results: Thirty articles were included, RY had advantages in less incidence of reflux symptoms, including esophagitis (BI vs BII, P = 0.550; BII vs RY, P = 0.002; BI vs RY, P = 0.010), gastritis (BI vs BII P = 0.87; BII vs RY P < 0.00001; BI vs RY P = 0.0002) and bile refluxed (BI vs BII P < 0.00001; BII vs RY P < 0.00001; BI vs RY P < 0.0001). BI was performed in the shortest operation time (BI vs BII, P = 0.001; BII vs RY, P < 0.0001; BI vs RY, P < 0.00001).

Conclusion: RY reconstruction seems to be an effective alternative method to BI and BII reconstruction in fewer incidences of reflux symptoms for gastric carcinoma following distal gastrectomy. In addition, preponderance of evidence indicated BI reconstruction could be performed in the shortest time.

Keywords: Gastric Carcinoma; Reconstruction Method; Distal Gastrectomy; Meta-analysis

Introduction

According to global cancer statistics, it is estimated that there were 631,300 new gastric carcinoma cases for male all over the world, ranking the fourth of all cancer cases; and 320,300 for female, ranking at the fifth place, this situation is worse in Eastern Asia, South America and Eastern Europe [1]. In general, surgery was regarded as the only method that may cure gastric carcinoma, especially for early gastric carcinoma. For decades, the survival rate of gastric carcinoma has been improved [2], meanwhile it is important to improve the quality of life for carcinoma patients. Reconstruction method after gastrectomy is regarded as an important factor influencing the life quality [3-5]. Many surgeons regard RY reconstruction as the preferred method following distal gastrectomy for gastric carcinoma [6-7]. Nevertheless, BI and BII reconstruction are still widely performed by surgeons in eastern countries [8-10]. So evidence-based medicine is needed to compare the difference between the three reconstruction methods.

Although, similar Meta-analysis has been published for 4 years, we think that it may exist some mistakes and isn't in accordance with its conclusion [11]. The aim of this Meta-analysis is to summarize the evidence for reconstruction method for distal gastrectomy following...
Meta-Analysis and Systemic Review of Different Reconstruction Methods for Gastric Carcinoma Following Distal Gastrectomy

gastric carcinoma by its characteristic data on perioperative period and long-term complications, and hope to be a guideline for clinical practice.

Method

Literature Search
A systematic search was conducted in PubMed, EMBASE, Science Citation Index Expanded and Cochrane library (via wiley) from inception to November 2015. Keywords “reconstruction method” was used in combination with "gastric carcinoma" and "distal gastrectomy". Meta-analysis was performed according to PRISMA statement [12].

Inclusion criteria
1. At least two of the reconstruction methods were reported in the article; 2. Written in English ; 3. At least one of the following words (BMI, operation time, operation bleeding, flatus time, time of first diet, postoperative hospital days, total complication, wound infection, bleeding, dumping syndrome, esophagitis, gastritis, bile refluxed, anastomotic leakage, delayed gastric, mortality) or synonym presents; 4. The latest article was preferable for similar works; 5. Data were completely enough to obtain the mean difference (or odds rate [OR]) and the 95% confidence interval (CI); 6. Participants should be more than 10 in each group to decrease the accidental events; 7. All the involved articles had stated their ethical approval clearly and are in compliance with the Helsinki declaration.

Exclusion criteria
1. The surgery was not performed on human beings; 2. Other organs (part of pancreas, spleen) was resected; 3. Single arm research; 4. System review or case report; 5. Full articles couldn't be searched.

Data extraction and quality assessment
All data were extracted and dealt by two authors (Shuailong Yang and Fangfang Chen) independently. If they couldn’t reach an agreement, they would consult with the third author (Shuyi Wang). Cochrane Handbook version 5.3.2 was scored for random controlled trial (RCT) articles; meanwhile, Newcastle-Ottawa quality assessment scale was carried out for case control study (CCS) articles.

Statistical analysis
Review Manager Version 5.3.2 (The Cochrane Collaboration, Oxford, United Kingdom) was used to perform our Meta-analysis. Forest plots were made to compare the differences between each two of the groups, for most including publications are not RCTs, fixed effects were not a suitable choice for our analysis, so analysis model for all results were random effects. Dichotomous variables were evaluated by odds ratio (OR), and continuous variables were merged using the mean difference (MD). Funnel figures was plotted to assess the publication bias.

According to statistics, proper significance level would be established before scientific experiments. Generally, it is 0.05, and sometimes 0.01 is used to get a more effective persuasion. Analysis of variance is adopted to compare the significant difference among three groups, and if we want to know the difference between each two groups, changed arithmetic method or adjusted the significance level would be adopted [13-14]. Similarly, adjusting the significance level could be a method for the comparation among three groups, we need analyze for three times. So 0.017 (0.05 divided into three) is a suitable choice.

Results

Publication research results
Among 591 articles extracted, 517 articles were excluded as they were reviews, case report, only a reconstruction method, or limited number of participants, etc; 30 articles were not published in English; 14 articles could not get the full articles and failed to connect with the authors. As a result, 30 articles were included (8 RCTs and 22 CCSs), among which 6 articles were about BI, BII and RY (1 RCT and 5 CCSs), 18 articles compared BI with RY (5 RCTs and 13 CCSs), 3 articles had a comparison between BI and BII (1 RCT and 2 CCSs), for BII

Meta-Analysis and Systemic Review of Different Reconstruction Methods for Gastric Carcinoma Following Distal Gastrectomy

and RY, 1 RCT and 2 CCSs were mentioned (Table 1a and Table 1b). Moreover, relationship between reconstruction method and years of publications had been calculated with the result showing no significant difference (P = 0.550) (Table 2).

Table 1a: Parameters for publications.

<table>
<thead>
<tr>
<th>Articles</th>
<th>Reconstruction method</th>
<th>Design</th>
<th>Blind</th>
<th>Randomization</th>
<th>Experimental method</th>
<th>Follow up</th>
<th>Operation method</th>
<th>Country</th>
<th>Quality score</th>
</tr>
</thead>
<tbody>
<tr>
<td>Namikawa T 2010</td>
<td>BI 47</td>
<td>RY 38</td>
<td>--</td>
<td>Retrospective</td>
<td>Yes</td>
<td>No</td>
<td>Open</td>
<td>Japan</td>
<td>5</td>
</tr>
<tr>
<td>Shinoto K 2003</td>
<td>BI 43</td>
<td>RY 20</td>
<td>28</td>
<td>Retrospective</td>
<td>Yes</td>
<td>Yes</td>
<td>Unknown</td>
<td>Japan</td>
<td>7</td>
</tr>
<tr>
<td>Kim CH 2015</td>
<td>BI 165</td>
<td>RY 371</td>
<td>161</td>
<td>Retrospective</td>
<td>Yes</td>
<td>No</td>
<td>Laparoscopy</td>
<td>Korea</td>
<td>6</td>
</tr>
<tr>
<td>Kumagai K 2011</td>
<td>BI 329</td>
<td>RY 95</td>
<td>--</td>
<td>Retrospective</td>
<td>Yes</td>
<td>No</td>
<td>Laparoscopy</td>
<td>Japan</td>
<td>6</td>
</tr>
<tr>
<td>Chan DC 2007</td>
<td>BI --</td>
<td>RY 19</td>
<td>41</td>
<td>Retrospective</td>
<td>Yes</td>
<td>No</td>
<td>Unknown</td>
<td>China</td>
<td>5</td>
</tr>
<tr>
<td>Osugi H 2004</td>
<td>BI 25</td>
<td>RY 18</td>
<td>17</td>
<td>Retrospective</td>
<td>Yes</td>
<td>Yes</td>
<td>Open</td>
<td>Japan</td>
<td>6</td>
</tr>
<tr>
<td>Sah BK 2009</td>
<td>BI 626</td>
<td>RY --</td>
<td>183</td>
<td>Retrospective</td>
<td>Yes</td>
<td>No</td>
<td>Both</td>
<td>China</td>
<td>6</td>
</tr>
<tr>
<td>Fukuhara K 2002</td>
<td>BI 41</td>
<td>RY 29</td>
<td>22</td>
<td>Retrospective</td>
<td>Yes</td>
<td>No</td>
<td>Open</td>
<td>Japan</td>
<td>6</td>
</tr>
<tr>
<td>Nakagawara H 2003</td>
<td>BI 20</td>
<td>RY 17</td>
<td>22</td>
<td>Retrospective</td>
<td>Yes</td>
<td>Yes</td>
<td>Open</td>
<td>Japan</td>
<td>7</td>
</tr>
<tr>
<td>Kubo M 2002</td>
<td>BI 175</td>
<td>RY 93</td>
<td>--</td>
<td>Retrospective</td>
<td>Yes</td>
<td>Yes</td>
<td>Unknown</td>
<td>Japan</td>
<td>6</td>
</tr>
<tr>
<td>Nomura E 2011</td>
<td>BI 68</td>
<td>RY 43</td>
<td>--</td>
<td>Retrospective</td>
<td>Yes</td>
<td>No</td>
<td>Laparoscopy</td>
<td>Japan</td>
<td>5</td>
</tr>
<tr>
<td>Nunobu S 2007</td>
<td>BI 203</td>
<td>RY 182</td>
<td>--</td>
<td>Retrospective</td>
<td>Yes</td>
<td>Yes</td>
<td>Unknown</td>
<td>Japan</td>
<td>6</td>
</tr>
<tr>
<td>Kojima K 2008</td>
<td>BI 65</td>
<td>RY 68</td>
<td>--</td>
<td>Retrospective</td>
<td>Yes</td>
<td>Yes</td>
<td>Laparoscopy</td>
<td>Japan</td>
<td>7</td>
</tr>
<tr>
<td>Kim TG 2011</td>
<td>BI 72</td>
<td>RY 26</td>
<td>--</td>
<td>Retrospective</td>
<td>Yes</td>
<td>No</td>
<td>Both</td>
<td>Korea</td>
<td>6</td>
</tr>
<tr>
<td>Tanaka S 2011</td>
<td>BI 50</td>
<td>RY 51</td>
<td>--</td>
<td>Retrospective</td>
<td>Yes</td>
<td>No</td>
<td>Unknown</td>
<td>Japan</td>
<td>6</td>
</tr>
<tr>
<td>Inokuchi M 2013</td>
<td>BI 89</td>
<td>RY 83</td>
<td>--</td>
<td>Retrospective</td>
<td>Yes</td>
<td>No</td>
<td>Laparoscopy</td>
<td>Japan</td>
<td>5</td>
</tr>
<tr>
<td>Lee SW 2012</td>
<td>BI 248</td>
<td>RY 128</td>
<td>--</td>
<td>Retrospective</td>
<td>Yes</td>
<td>No</td>
<td>Laparoscopy</td>
<td>Japan</td>
<td>5</td>
</tr>
<tr>
<td>An JY 2013</td>
<td>BI 50</td>
<td>RY 50</td>
<td>--</td>
<td>Retrospective</td>
<td>Yes</td>
<td>No</td>
<td>Laparoscopy</td>
<td>Korea</td>
<td>5</td>
</tr>
<tr>
<td>Komatsu S 2013</td>
<td>BI 74</td>
<td>RY 43</td>
<td>--</td>
<td>Retrospective</td>
<td>Yes</td>
<td>Yes</td>
<td>Laparoscopy</td>
<td>Japan</td>
<td>7</td>
</tr>
<tr>
<td>Chen CJ 2012</td>
<td>BI --</td>
<td>RY 283</td>
<td>236</td>
<td>Retrospective</td>
<td>Yes</td>
<td>No</td>
<td>Unknown</td>
<td>China</td>
<td>5</td>
</tr>
<tr>
<td>Kyzer S 1997</td>
<td>BI 41</td>
<td>RY --</td>
<td>43</td>
<td>Retrospective</td>
<td>Yes</td>
<td>No</td>
<td>Open</td>
<td>Israel</td>
<td>6</td>
</tr>
<tr>
<td>Kang K 2011</td>
<td>BI 875</td>
<td>RY 384</td>
<td>--</td>
<td>Retrospective</td>
<td>Yes</td>
<td>Yes</td>
<td>Laparoscopy</td>
<td>Korea</td>
<td>6</td>
</tr>
</tbody>
</table>

*: Billroth II (B-II) with Braun anastomosis.

Meta-Analysis and Systemic Review of Different Reconstruction Methods for Gastric Carcinoma Following Distal Gastrectomy


During operation:

Eight articles mentioned about operation time and operation bleeding. For operation time, MD = -30.04, 95% CI: -41.73 — -18.35, P < 0.00001, I²= 73% (Figure 1a); and for operation bleeding, MD = -6.07, 95% CI: -23.37 — 11.24, P = 0.490, I² = 57%.

Thus, BI had shorter time than RY in operation time; however, result of operation bleeding showed no significant difference between BI and RY.

Postoperative:

Three articles reported the flatus time (MD = -0.16, 95% CI: -0.36 — 0.03, P = 0.090, I² = 52%), showed no significant difference. The results of Meta-analysis for time of first diet (MD = 0.05, 95% CI: -0.19 — 0.29, P = 0.670, I² = 44%) and postoperative hospital days (MD = -0.70, 95% CI: -2.82 — 1.42, P = 0.520, I² = 94%) were showed that they had no relationship with reconstruction method.

Among Esophagitis (OR = 1.95, 95% CI: 1.14 — 3.35, P = 0.010, I² = 53%) (Figure 1b), gastritis (OR = 5.36, 95% CI: 3.30 — 8.69, P < 0.00001, I² = 73%) (Figure 1c) and bile refluxed (OR= 3.89, 95% CI: 2.15 — 7 .05, P < 0.00001, I² = 70%) Figure 1d), all showed significant differences between BI and RY.

Meanwhile, the Meta result for the total complication (OR = 0.98, 95% CI: 0.50 — 1.91, P = 0.950, I² = 63%) did not show significant difference. Some researchers viewed a longer surgery time means an increasing rate of infection. While wound infection (OR = 1.19, 95% CI: 0.45 — 3.14, P = 0.720, I² = 0%) showed no difference between two groups. There is no difference on delayed gastric (OR= 0.51, 95% CI: 0.17 — 1.47, P= 0.210, I² = 27%) between the two groups.

<table>
<thead>
<tr>
<th>Parameters for publications.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ishikawa M 2005 [34]</td>
</tr>
<tr>
<td>Takiguchi S 2011 [35]</td>
</tr>
<tr>
<td>Hirao M 2013 [36]</td>
</tr>
<tr>
<td>Pacelli F 2013 [37]</td>
</tr>
</tbody>
</table>

*: Billroth II (B-II) with Braun anastomosis.

Table 1b: Parameters for publications.

Mantel-Haenszel chi-square test for publications numbers over time, P = 0.550.

Table 2: Relationship between reconstruction method and years of publications.
Figure 1: Meta results of BI vs. RY. a Operation time, BI reconstruction method was accomplished in a shorter time than RY (P<0.00001); b Esophagitis, Esophagitis seldom occurred after RY reconstruction than BI (P=0.010); c Gastritis, gastritis was easier to be seen after BI reconstruction than RY (P<0.00001); d Bile refluxed, bile refluxed was a less common complication for RY reconstruction than BI (P<0.00001); e BMI, surgeons were more inclined to perform RY reconstruction on those people who with a bigger BMI (P=0.007).

Meta-Analysis and Systemic Review of Different Reconstruction Methods for Gastric Carcinoma Following Distal Gastrectomy

Six publications analyzed dumping syndrome for the two reconstruction methods, and showed no difference (OR = 1.34, 95% CI: 0.68—2.64, P = 0.390, I² = 49%). Anastomotic leakage (OR = 2.03, 95% CI: 0.34—12.08, P = 0.440, I² = 36%), abdominal bleeding (OR = 1.38, 95% CI: 0.18 — 10.50, P = 0.760, I² = 0%) and mortality (OR = 1.11, 95% CI: 0.04 — 28.15, P = 0.950, I² was not applicable) all showed no difference between the two groups.

Others

Most included articles were retrospective studies, showing different results for preoperative BMI, thus, forest plot was made to certify it, and the Meta-analysis result is, MD = -0.66, 95% CI: -1.14—0.18, P = 0.007, I² = 59% (Figure 1e). And BI reconstruction seems to be performed on those patients who with smaller BMI.

Results of BI and BII

During operation

Five articles mentioned operation time including 1162 people in BI and 867 in BII, MD = -27.32, 95% CI: -37.70 — -16.95, P < 0.00001, I² = 57% (Figure 2a), showed that BI has shorter time than BII. And operation bleeding (MD = -79.40, 95% CI: -97.95 — -60.85, P < 0.00001, I² = 0%) (Figure 2b) also showed a significant difference between them.

Postoperative

BI reconstruction didn’t show any advantage between flatus time (OR = 0.23, 95% CI: -0.26 — 0.71, P = 0.36, I² = 93%) and time of first diet (MD = -0.02, 95% CI: -0.74 — 0.69, P = 0.950, I² = 92%) that BII reconstruction. However, as to postoperative hospital days (MD = -0.88, 95% CI: -1.47 — 0.29, P = 0.004, I² = 0%) (Figure 2c), it showed a significant difference between the two reconstruction methods.

There was no difference for total complication (OR = 0.64, 95% CI: -0.43 — 0.96, P = 0.03, I² = 52%) between BI and BII. And Meta-analysis result for wound infection (OR = 0.91, 95% CI 0.52 — 1.58, P = 0.73, I² = 0%) showed no difference between the two groups.

The result for bile refluxed (OR = 0.36, 95% CI: 0.21 — 0.61, P = 0.0002, I² = 43%) between BI and BII showed a significant difference (Figure 2d). Incidence between esophagitis (OR = 1.12, 95% CI: 0.78 — 1.62, P = 0.550, I² = 0%) and gastritis (OR = 0.53, 95% CI: 0.23 — 1.23, P = 0.140, I² = 57%) showed no difference.

Additionally, Meta-analysis result for dumping syndrome (OR = 0.81, 95% CI: 0.30 — 2.22, P = 0.680, I² = 0%), anastomotic leakage (OR = 0.64, 95% CI: 0.24 — 1.71, P = 0.370, I² = 19%), abdominal bleeding (OR = 0.57, 95% CI 0.16 — 2.04, P = 0.390, I² = 53%) and mortality (OR = 0.56, 95% CI 0.15 — 2.15, P = 0.400, I² = 13%) were all showed no difference between the two groups.

**Results of BI and RY**

**During operation**

Most researchers thought BI has shorter operation time than RY, but they didn’t make an agreement with Meta-analysis result, MD = -9.11, 95% CI: -24.03 — 5.80, P = 0.230, I² = 82%. And operative bleeding (MD = 24.27, 95% CI: -36.22 — 84.76, P = 0.430, I² = 92%) between the two groups showed no difference.

Postoperative

Result for the time of first diet (MD = 0.76, 95% CI: -0.41 — 1.93, P = 0.200, I² = 97%), postoperative hospital days (MD = 0.47, 95% CI: -2.25 — 3.18, P = 0.730, I² = 94%) and flatus time (MD = 0.28, 95% CI: 0.00 — 0.56, P = 0.050, I² = 63%) all showed no difference between BI and BII.

There was no difference for total complication (OR = 0.85, 95% CI 0.49 — 1.49, P = 0.570, I² = 0%) between two groups, and Meta-analysis result for wound infection (OR = 1.33, 95% CI 0.62 — 2.87, P = 0.46, I² = 0%) showed no relationship with reconstruction method.

Result for esophagitis (OR = 2.02, 95% CI: 1.29 — 3.16, P = 0.002, I² = 0%), gastritis (OR = 11.71, 95% CI: 2.51 — 54.70, P = 0.002, I² = 89%) and bile refluxed (OR = 12.32, 95% CI: 3.60 — 42.14, P < 0.0001, I² = 83%) showed a significant difference between BI and RY, so RY has the less incidence on esophagitis (Figure 3a), gastritis (Figure 3b) and Bile refluxed (Figure 3c).

Meta result on dumping syndrome (OR = 2.29, 95% CI: 0.74 — 7.08, P = 0.150, I² = 0%) showed no difference between two groups. Neither of reconstruction methods would increase the incidence on anastomotic leakage (OR =1.33, 95% CI: 0.59 — 3.01, P = 0.49, I² = 0%), bleeding (OR = 2.61, 95% CI: 0.64 — 10.67, P = 0.18, I² = 0%) or mortality (OR = 0.95, 95% CI 0.10 — 9.23, P = 0.96, I² = 0%).

**Results of BI, BII and RY**

As shown in Table 3, RY had least morbidity on esophagitis (BI vs BII, P = 0.550; BII vs RY, P = 0.002; BI vs RY, P = 0.010), gastritis (BI vs BII, P = 0.140; BII vs RY, P = 0.002; BI vs RY, P < 0.00001) and bile refluxed (BI vs BII, P = 0.0002; BII vs RY, P < 0.00001; BI vs RY, P < 0.0001).

---

Figure 3: Meta results of BII vs. RY. a) Esophagitis, Esophagitis seldom occurred after RY reconstruction than BII (P=0.002); b) Gastritis, gastritis was easier to be seen after BII reconstruction than RY (P=0.0002); c) Bile refluxed, bile refluxed was a less common complication for RY reconstruction than BII (P<0.0001).

Table 3: Meta results for three reconstruction methods.

<table>
<thead>
<tr>
<th></th>
<th>BI vs BII</th>
<th>BI vs BII</th>
<th>BII vs RY</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>BI</td>
<td>RY</td>
<td>P</td>
</tr>
<tr>
<td>Operation time</td>
<td>909</td>
<td>630</td>
<td>&lt;0.00001*</td>
</tr>
<tr>
<td>Operation bleeding</td>
<td>909</td>
<td>630</td>
<td>0.490</td>
</tr>
<tr>
<td>Flatus time</td>
<td>544</td>
<td>306</td>
<td>0.090</td>
</tr>
<tr>
<td>Time of first diet</td>
<td>733</td>
<td>499</td>
<td>0.670</td>
</tr>
<tr>
<td>Postoperative hospital days</td>
<td>870</td>
<td>593</td>
<td>0.520</td>
</tr>
<tr>
<td>Total complication</td>
<td>524</td>
<td>450</td>
<td>0.950</td>
</tr>
<tr>
<td>Wound infection</td>
<td>448</td>
<td>415</td>
<td>0.720</td>
</tr>
<tr>
<td>Abdominal bleeding</td>
<td>707</td>
<td>475</td>
<td>0.760</td>
</tr>
<tr>
<td>Dumping syndrome</td>
<td>624</td>
<td>732</td>
<td>0.320</td>
</tr>
<tr>
<td>Esophagitis</td>
<td>736</td>
<td>649</td>
<td>0.010*</td>
</tr>
<tr>
<td>Gastritis</td>
<td>1087</td>
<td>963</td>
<td>&lt;0.00001*</td>
</tr>
<tr>
<td>Bile refluxed</td>
<td>939</td>
<td>753</td>
<td>&lt;0.00001*</td>
</tr>
<tr>
<td>Anastomotic leakage</td>
<td>846</td>
<td>586</td>
<td>0.440</td>
</tr>
<tr>
<td>Delayed gastric</td>
<td>260</td>
<td>257</td>
<td>0.210</td>
</tr>
<tr>
<td>Mortality</td>
<td>332</td>
<td>283</td>
<td>0.950</td>
</tr>
</tbody>
</table>

* shows a significant difference

As the easiest reconstruction method, BI had the shortest operation time (BI vs BII, \( P < 0.00001 \); BII vs RY, \( P = 0.230 \); BI vs RY, \( P < 0.00001 \)). Besides, BI showed less coincidence of operation bleeding (\( P < 0.00001 \)) and less postoperative hospital days than BII, however, both of them showed no significant difference between BII vs RY and BI vs RY.

Discussion

According to recent publications, the average survival time of gastric carcinoma has been prolonged in the last twenty years, especially in developing countries. Surgery was considered as the only way may cure gastric carcinoma, and till now, measures have been taken to improve the gastric carcinoma patient’s survival time. For example, partial gastrectomy was popularized for early gastric carcinoma [37]; D2 lymph nodes dissection have prolonged the survival time for patients of advanced gastric carcinoma [38-40]; hyperthermic intraperitoneal chemotherapy helped patients to have more confidence on advanced gastric carcinoma [41].

Our results illustrated that RY reconstruction was an effective alternative to BI and BII reconstruction method for gastric carcinoma following distal gastrectomy with the least incidence of gastritis and bile refluxed. The reason was that BI reconstruction has a direct connection with residual gastric and duodenal. It is quite easy for bile flows from duodenal to gastric, and for BII reconstruction, exclusion of duodenal seems solved the problem of a shorter or fixed duodenal, but it also means bile erodes residual gastric easily. BII + Brown reconstruction method was considered to avoid bile refluxed, and should be discussed in our Meta-analysis, but it was showed only in two of all inclusion publications [4,10].

Patients with smaller BMI are tended to be performed BI reconstruction, for longer esophagus or longer duodenal seems more easily to be jointed. However, from the result, BI reconstruction doesn’t show any preponderance except the shortest operation time among three reconstruction methods, so BMI was not a factor affecting by the reconstruction method. But limited number of RCT articles might be a factor affecting the result of Meta-analysis, multicenter randomized controlled clinical studies (MRCT) are needed to get the best reconstruction method.

Stomal ulcer, postoperative cholelithiasis, Roux stasis syndrome was regarded as the disadvantage after RY reconstruction [42], however, based on the results, Roux stasis syndrome was showed no significant difference among three reconstruction methods. Additionally, the limited number of articles on stomal ulcer [8,35] and postoperative cholelithiasis [9,22,29] prevents us from conducting the Meta-analysis.

According to recent publications, reconstruction method might affect the duration of diabetes and influence the renal functions [43,44], but they didn’t meet an agreement, and what’s worse, there are no enough data for us to perform our research on evaluating the relationship between them.

Eight RCTs had been included, one was among BI, BII and RY; five were between BI and RY; and the rest were between the other groups (Table 2). The limited number of RCTs was few enough for us to perform Meta-analysis independently. So RCTs and CCSs were put together to complete our analysis, it might be the most important reason for significant heterogeneity in some of the research parameters, thus MRCT are needed to get the best reconstruction method. Many researchers thought Net Meta-analysis might suit to our analysis. However, only 5 articles compared the difference among BI, BII and RY, what’s more, their research subjects are different. Adding other two groups publications on different researching background might make our scientific problems more difficult and increase the significant heterogeneity obviously [45,46].
Our study illustrates parameters of different reconstruction methods during operation and short-term postoperation, but long-term complications (such as recurrences, distant metastases and survival rate) [26,33,35,36] of the patients with different reconstruction methods are rarely reported. Recently, a new reconstruction method which called delta-shaped anastomosis was performed for gastric carcinoma following distal gastrectomy during laparoscopic surgery. Research has been done to compare the delta-shaped anastomosis with other reconstruction methods, but it is still lack of evidence to evaluate this new reconstruction method owing to the limited number of the articles.

More and more minimally invasive surgery was performed, but in our included publications, few articles have mentioned it, which maybe most investigators pay more attention to mini-invasive surgery itself, so whether mini-invasive surgery has relationship with reconstruction method, more researches should be performed in the future.

Conclusion
In conclusion, RY reconstruction method seems to be an effective alternative method to BI and BII reconstruction in less incidence of reflux symptoms for gastric carcinoma following distal gastrectomy. To improve the quality life of the patients of gastric carcinoma, RY reconstruction could be widespread used in operation. Nevertheless, preponderance of evidence indicated BI reconstruction could be performed in the shortest time, so BI reconstruction method could be manipulated in exceptional cases.

Competing interests
The authors declare that they have no competing interests.

Acknowledgements
None.

Bibliography

Meta-Analysis and Systemic Review of Different Reconstruction Methods for Gastric Carcinoma Following Distal Gastrectomy


**Citation:** Bin Xiong., et al. "Meta-Analysis and Systemic Review of Different Reconstruction Methods for Gastric Carcinoma Following Distal Gastrectomy". *EC Cancer* 2.1 (2016): 52-63.