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Review

Braun enteroenterostomy reduces delayed gastric emptying: A systematic review and meta-analysis

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HIGHLIGHTS

- Braun enteroenterostomy reduces delayed gastric emptying following PD.
- Braun enteroenterostomy also reduces overall morbidity and length of hospital stay.
- No difference in other complications between BEE and traditional gastrojejunostomy.

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ABSTRACT

Background: It remains controversial whether the additional Braun enteroenterostomy (BEE) is necessary in decreasing delayed gastric emptying (DGE) following pancreaticoduodenectomy (PD). This meta-analysis aims to assess the efficacy of the additional BEE in reducing DGE after PD.

Methods: PubMed, EMBASE, Science Citation Index and The Cochrane Library were searched to identify relevant studies. Articles published before May 15, 2015 comparing BEE with traditional gastrojejunostomy during PD were selected. The evaluated end points consist of intro-operative outcomes as well as postoperative complications.

Results: Seven observational clinical studies that recruited 1401 patients were included. This meta-analysis indicated that the occurrence of DGE was lower in Braun group (odds ratio [OR], 0.30; 95% confidence interval [CI], 0.15 to 0.60; P = 0.0007). Overall morbidity (OR, 0.61; 95%CI, 0.47 to 0.80; P = 0.0003) and the length of hospital stay (LOS) (weighted mean difference [WMD], −1.80; 95%CI, −3.4 to −0.18; p = 0.03) were also in favor of the Braun group. However, Braun group had no advantage over Non-Braun group in terms of intra-operative blood loss, mortality, pancreatic fistula, bile Leakage and intra-abdominal abscess.

Conclusion: The additional of BEE plays an important role in reducing DGE, overall morbidity and LOS.

1. Introduction

Since its first performance by Codivilla [1] in 1898 and its later development by Whipple [2] in 1935, pancreaticoduodenectomy (PD) has served as the standard treatment for both malignant and benign diseases of pancreatic head and periampullary region for many years. With the advancement of surgical technology, the perioperative mortality of PD has significantly declined to below 5% [3]. However, the postoperative morbidity rate remains high (30%–50%) [4,5]. More recently, surgeons have placed much focus on the life-threatening complications such as pancreatic fistula, but yet, there seems to be scarce emphasis on the nonfatal complications. Apart from pancreatic fistula and postoperative hemorrhage, delayed gastric emptying (DGE) is one of the major troublesome complications after PD, the incidence of which ranges from 19% to 57% [6]. DGE is not fatal, but it can prolong the length of hospital stay (LOS), increase costs, and affect quality of life as well as nutritional status of patients [7]. Thus, it is of great importance to search for some more feasible and effective methods to reduce the incidence of DGE following PD.

Until now, surgeons have paid more attention to the post-operative morbidity associated with gastrojejunostomy (GJ). Several previous studies [8,9] indicated that the surgical technique factors of GJ were related to the incidence of DGE. Over one

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hundred years ago, Braun [10] introduced a modified technique of GJ, in which an anastomosis between the afferent and efferent limbs of jejunum distal to the gastroenterostomy was performed. Owing to an extra stoma, bile and food are more easily move down to the jejunum. As a result, this kind of modified GJ can decrease bile vomiting and bile reflux gastritis [11]. More recently, few articles [12,13] have focused on the influence of Braun enteroenterostomy (BEE) on the occurrence of DGE. However, no general agreement exists as to whether the additional BEE during PD is necessary in reducing DGE following PD. Therefore, it is needed to conduct a systematic and comprehensive analysis of those previous studies, and to evaluate the utility of performing BEE during this surgical procedure.

2. Methods

2.1. Inclusion and exclusion criteria

Studies met the following inclusion criteria were included: (1) clinical study and published in English, (2) the research object was the patients who underwent PD, (3) compare an additional BEE with traditional reconstruction of gastrojejunostomy, (4) provide the original data, including the incidence of DGE and other perioperative outcomes. Studies were excluded as follows: (1) abstracts, reviews, case reports and comments, (2) no control group, (3) lack appropriate data for extraction, (4) sample size was less than 20 patients.

2.2. Search strategies and study selection

PubMed, EMBASE, Science Citation Index and The Cochrane Library were searched to identify relevant studies. The search terms included “Braun enteroenterostomy”, “Braun”, “enteroenterostomy”, “delayed gastric emptying”, “pancreaticoduodenectomy”, and “gastrojejunostomy”. The references lists of selected studies were also searched to ensure that no potential studies were neglected. Two investigators (M.-Q.H. and M.L.) independently read the title and abstract of potentially eligible studies. The full texts of all eligible articles were then screened for detailed evaluation. Differences of opinion in the selection process were resolved by consensus. If failed to reach an agreement, the final decision would be made by a third investigator (B.-L.T.).

2.3. Outcome measures

The primary outcome was the occurrence of DGE, which was graded as grade A, grade B and grade C [6]. The secondary outcomes were overall morbidity, intra-operative blood loss, mortality, pancreatic fistula, bile leak, intra-abdominal abscess and the LOS.

2.4. Data extraction and quality assessment

Two researchers (M.-Q.H. and J.-Y.M.) independently extracted following data from all selected articles: first author, country, study period, study design, characteristics of enrolled patients, Definition of DGE, details of surgical procedure, intro-operative outcomes and postoperative complications. The quality of the extracted data was then adjudicated by a third researcher (B.-L.T.). The Newcastle-Ottawa scale (NOS) was conducted to evaluate the quality of the included studies [14]. The maximum “stars” obtained for “Selection”, “Comparability” and “Outcome” categories were 4, 2 and 3, respectively. A study which got at least 6 “stars” was considered high in quality [15].

2.5. Statistical analysis

Meta-analysis was carried out using Review Manager Version 5.3 software (The Cochrane Collaboration). Odds ratio (OR) and weighted mean difference (WMD) were chosen as summary statistic to dichotomous variables and continuous variables respectively. Both OR and WMD reported along with 95% confidence intervals (CI), with statistically significance set at $P < 0.05$. Heterogeneity was measured with χ^2 test and I^2 values. Low heterogeneity was defined as an $I^2 < 33\%$ [16]. Either random-effects model or fixed-effects model was used to calculate the combined outcomes according to heterogeneity. Furthermore, Sensitivity analysis and subgroup analysis were performed to explore the reasons for statistical heterogeneity, and to evaluate the impact of various types of design in the included trails. Publication bias was identified using funnel plot analyses [17].

3. Results

3.1. Literature search and study selection

Initially, a total of 791 articles were identified through literature search in PubMed, EMBASE, Science Citation Index and The Cochrane Library. We excluded 771 articles after screening titles and abstracts, in which 369 were duplicated and 402 were irrelevant. The remaining 20 articles were retrieved for more detailed evaluation. Among these 20 articles, 13 were excluded for various reasons as shown in the flow diagram (Fig. 1). Finally, seven appropriate studies were included for further analysis: three prospective observational clinical studies (OCS) [12,13,18] and four retrospective OCS [10,19–21].

3.2. Description of studies

The general characteristics were summarized in Table 1. A total of 1401 patients were enrolled: 875 in the Braun group and 526 in the Non-Braun group. The sample size of included studies ranged from 44 to 395 patients. No statistical difference was seen between Braun group and Non-Braun group in terms of age, sex and diabetes. The results of quality assessment were displayed in Table 2. All included references were high-quality studies, which got more than or equal to 6 “stars” based on the NOS criteria.

3.3. Definition of the complications

DGE was defined and graded by International Study Group of Pancreatic Surgery (ISGPS) criteria [6] as follows: grade A, unable to tolerate solid oral intake by the end of the postoperative day (POD) 7 and requiring nasogastric tube (NGT) between day 4 and 7 postoperatively; Grade B and Grade C were defined as inability to tolerate solid oral intake by the end of the POD 14 and POD 21, respectively. Overall morbidity was defined as total of perioperative complications. Mortality was defined as death within 30 days after surgery. Pancreatic fistula was defined according to International Study Group on Pancreatic Fistula (ISGPF) [5]. Other complications were defined based on Dind's report [22].

3.4. Meta-analysis of the perioperative outcomes

The results of meta-analysis of the operative outcomes and postoperative complications in all included studies were summarized in Table 3.

3.4.1. Delayed gastric emptying

All of the included studies reported DGE. The incidence of DGE