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ORIGINAL ARTICLE

A case-matched comparison and meta-analysis comparing pylorus-resecting pancreaticoduodenectomy with pylorus-preserving pancreaticoduodenectomy for the incidence of postoperative delayed gastric emptying

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Abstract

Objectives: This study was conducted to compare the incidences of delayed gastric emptying (DGE) following pylorus-resecting pancreaticoduodenectomy (PrPD) and pylorus-preserving pancreaticoduodenectomy (PpPD), respectively.

Methods: Data for 37 patients submitted to PrPD were compared with data for a matched number of patients submitted to PpPD during the same period. A meta-analysis of comparative studies of the two techniques was also carried out. The primary endpoint was the rate of DGE (grades A–C) defined according to the International Study Group of Pancreatic Surgery criteria.

Results: In the case-matched comparison, both overall DGE (six PrPD patients and 17 PpPD patients; $P = 0.006$) and clinically relevant DGE (one PrPD and eight PpPD patients; $P = 0.013$) occurred significantly less often in the PrPD group than in the PpPD group. Based on eight non-randomized clinical trials and two randomized clinical trials involving 804 subjects, the meta-analysis further confirmed a significant reduction in DGE with pooled odds ratios of 0.33 [95% confidence interval (CI) 0.17–0.63; $P < 0.001$] and 0.13 (95% CI 0.05–0.40; $P < 0.001$) for overall DGE and clinically relevant DGE, respectively. Other complications and mortality were similar in both groups.

Conclusions: Pylorus-resecting pancreaticoduodenectomy is a safe procedure associated with less severe and less frequent postoperative DGE than PpPD.

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Introduction

Pylorus-preserving pancreaticoduodenectomy (PpPD) is the mainstay of treatment for periampullary lesions. Compared with classic Whipple resection with antrectomy, PpPD can facilitate a better nutritional status and more favourable quality of life without differences in mortality, morbidity or oncologic outcomes.[1]

Delayed gastric emptying (DGE) is one of the most common postoperative complications after PpPD with reported incidences of 14–61%.[2] Although DGE is not life-threatening, it is associated with a longer duration of hospitalization and higher hospital costs.[3] Pylorus-resecting pancreaticoduodenectomy (PrPD), a procedure that includes resection of the duodenum and pyloric ring, was introduced as an alternative to PpPD in Japan in the 1990s and is intended to maintain gastric pooling ability and reduce the incidence of DGE. However, studies comparing rates of DGE between PrPD and PpPD have been relatively limited and have yielded conflicting results.[4–12] Therefore, the benefit of PrPD remains to be elucidated.

The aim of this study was to compare PrPD and PpPD in a case-matched comparison. In addition, in line with the PRISMA (*p*referred *r*eporting *i*tems for *s*ystematic reviews and

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meta-analyses) guidelines,[13] a meta-analysis of comparative studies of the two techniques was carried out to provide overall estimates of the incidences of DGE.

Materials and methods

Case-matched comparison

Pylorus-resecting pancreaticoduodenectomy was adopted in March 2011 at the First Affiliated Hospital of Xiamen University. To June 2014, 37 consecutive patients underwent PrPD for periampullary lesions at this institution. These 37 patients were matched with 37 patients submitted to PpPD during the same period. Patients were matched for baseline demographics, comorbidities, pancreatic texture, pancreatic duct size and pathology. The hospital records of these patients were reviewed retrospectively. The technique used for patients in the PpPD and PrPD groups was essentially similar to that described by Kawai *et al.*[7] All operations were performed by the same surgeons. The technique for pancreaticoduodenectomy was not standardized, and the selection of PrPD or PpPD was based on the decision of the operating surgeon in this retrospective study. End-to-side pancreaticojejunostomy and end-to-side hepaticojejunostomy were performed on the same proximal jejunal, which was brought through the transverse mesocolon in a retrocolic position in all patients. Gastrojejunostomy in PrPD or duodenojejunostomy in PpPD were performed using a two-layer anastomosis in an antecolic position. Appropriate informed consent was obtained from all patients. The study was approved by the Human Ethics Review Board of the local institution.

The primary endpoint of this study was DGE characterized according to the definition of the International Study Group of Pancreatic Surgery (ISGPS); DGE of Grade B or C was regarded as clinically relevant.[14] Primary DGE was defined as DGE occurring in the absence of other intra-abdominal complications.[15] Secondary endpoints included other complications, mortality (defined as any death occurring within 30 days of the date of operation or during the same hospital admission) and hospital length of stay (LoS).

All statistical analyses were performed using SPSS Statistics for Windows Version 11.0 (SPSS, Inc., Chicago, IL, USA). In comparisons between the two groups, categorical variables were compared with Fisher's exact test, continuous variables with Student's *t*-test, and non-parametric variables with the Mann–Whitney *U*-test. A two-tailed *P*-value of <0.05 was considered to indicate statistical significance.

Meta-analysis

A literature search was performed in PubMed for relevant publications from the time of the inception of the database to May 2014. The medical subject heading (MeSH) search terms were 'pylorus-resecting pancreaticoduodenectomy', 'pylorus-preserving pancreaticoduodenectomy', 'subtotal stomach-preserving pancreaticoduodenectomy' and 'delayed gastric emptying'. Only studies conducted in humans and published in English were considered for inclusion. The reference lists of all retrieved articles were manually searched for additional studies. Animal studies, case reports, reviews, studies including patients who underwent total pancreatectomy and central pancreatectomy or distal pancreatectomy, and those lacking control groups were excluded.

Two reviewers (BL and LW) independently extracted data on the following parameters from each study: first author; year of publication; study population characteristics; number of patients submitted to each procedure, and endpoints. All relevant text, tables and figures were reviewed for data extraction. Any discrepancies in inclusion were resolved by discussion between the reviewers.

The meta-analysis was performed using RevMan Version 5.1 (Cochrane Collaboration, Oxford, UK). Estimated effect measures were the odds ratio (OR) for dichotomous variables and the weighted mean difference (WMD) for continuous variables. Pooled estimates were presented with 95% confidence intervals (95% CI). The pooled effect was calculated using either the fixed-effects model or the random-effects model. Heterogeneity was evaluated using the I^2 statistic, with values over 50% indicating considerable heterogeneity. Publication bias was assessed visually using a funnel plot, based on the DGE result.

Results

Case-matched comparison

Perioperative variables across the two groups are shown in Table 1.

There was no postoperative in-hospital mortality in either group.

Both overall DGE (six PrPD patients and 17 PpPD patients; $P = 0.006$) and clinically relevant DGE (one PrPD and eight PpPD patients; $P = 0.013$) occurred significantly less often in the PrPD group than in the PpPD group. Primary DGE was recorded in two patients in the PrPD group and in eight in the PpPD group, which represents a significant difference ($P = 0.041$). No significant differences were observed in incidences of other postoperative complications between the two groups. One patient in the PpPD group underwent a reoperation as a result of intra-abdominal haemorrhage secondary to pancreatic fistula on postoperative day 12. Hospital LoS was significantly shorter after PrPD than after PpPD ($P = 0.017$).

Meta-analysis

A total of nine publications published between 2007 and 2014 matched the criteria for inclusion in the present meta-analysis and were therefore reviewed.[4–12] Fig. 1 demonstrates a flow diagram of the selection process. The characteristics of the studies included in the meta-analysis are summarized in Table 2. A total of 804 patients were included in the meta-analysis, of whom 433 (53.9%) underwent PrPD and 371 (46.1%) underwent PpPD. Table 3 shows the results by operation type for the outcome variables.