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REVIEW ARTICLE

The role of central pancreatectomy in pancreatic surgery: a systematic review and meta-analysis

Weidong Xiao[1*], Jisheng Zhu[1,*], Long Peng[2], Le Hong[1], Gen Sun[1] & Yong Li[1]

[1]Department of General Surgery, The First Affiliated Hospital of Nanchang University, and [2]Department of General Surgery, The Second Affiliated Hospital of Nanchang University, Nanchang, China

Abstract

Background: The aim of this systematic review and meta-analysis was to compare the clinical outcomes of central pancreatectomy (CP) with distal pancreatectomy (DP) and pancreaticoduodenectomy (PD).

Methods: A systematic literature research in PubMed/Medline, Embase and Cochrane Library was performed to identify articles reporting CP from January 1983 to November 2017.

Results: Fifty studies with 1305 patients undergoing CP were identified. The overall morbidity, mortality, pancreatic fistula (PF) rate and reoperation rate was 51%, 0.5%, 35% and 4% respectively. Endocrine and exocrine insufficiency were occurred in 4% and 5% of patients after CP. Meta-analysis of CP *versus* DP favored CP with regard to less blood loss (WMD = −143.4, P = 0.001), lower rates of endocrine (OR = 0.13, P < 0.001) and exocrine insufficiency (OR = 0.38, P < 0.001). CP was associated with higher morbidity and PF rate. In comparison with PD, CP had a lower risk of endocrine (OR = 0.14, P < 0.001) and exocrine insufficiency (OR = 0.14, P < 0.001), but a higher PF rate (OR = 1.6, P = 0.015).

Conclusions: CP maintains pancreatic endocrine and exocrine function better than DP and PD, but is associated with a higher PF rate.

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Correspondence

Weidong Xiao, Department of General Surgery, The First Affiliated Hospital of Nanchang University, No.17 Yongwai Zhengjie, Nanchang, Jiangxi, 330006, China. E-mail: frankxwd@126.com

Introduction

Pancreaticoduodenectomy (PD) and distal pancreatectomy (DP) are considered the standard procedures for the excision of tumors located in the pancreatic head or body-tail respectively. For tumors in the neck or proximal body of the pancreas, in particular benign and low grade-malignant lesions, pancreatic preserving surgery is attractive given the patients' excellent long term survival and the need to optimize the quality of life with regard to pancreatic function following surgical intervention. Tumor enucleation is limited to patients with tumors less than 3 cm and non-adherence to pancreatic main duct.[1] Moreover, the overall complication and pancreatic fistula (PF) rate after enucleation is reported to be as high as 63% and 57%, respectively.[2] Central pancreatectomy (CP) is considered an ideal procedure for benign or low grade malignant lesions located at the pancreatic neck and proximal body which are not suitable for enucleation.

Crippa *et al.* reported on 100 patients undergoing CP,[3] the morbidity and mortality was 58% and 0 respectively, whereas the pancreatic fistula (PF) rate was 44%. The incidence of new endocrine and exocrine insufficiency was 4% and 5% respectively with a median follow-up of 54 months. However, CP was associated with a higher morbidity rate and a longer postoperative hospital stay compared with DP. In another series of 100 consecutive patients, CP had a low risk of development of exocrine and endocrine insufficiency (6% and 2% respectively), however, the morbidity and mortality were 72% and 3% respectively, and the incidence of PF was up to 66%.[4] Therefore, the use of CP in pancreatic surgery is still debated because of higher morbidity and PF rate associated with this procedure.

*These authors contributed equally to this work.

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Iacono *et al.* conducted a systematic review of CP and meta-analysis of CP *versus* DP in 2013.[5] In this analysis (n = 636) the morbidity and mortality following CP was 45% and 0.8% respectively. The PF rate was found to be 41%. The incidence of endocrine and exocrine insufficiency was 5% and 10%, respectively. Although the meta-analysis indicated that CP was associated with a significantly higher morbidity and PF rate, patients undergoing CP had a lower risk of developing endocrine failure in comparison to patients who underwent DP. The risk of developing exocrine insufficiency was also lower after CP, but the difference was not statistically significant. However, the meta-analysis previously performed, only focused on the comparison of CP and DP, and its literature search was limited to December 2010. Moreover, additional new data published during the past seven years, especially regarding the laparoscopic and robotically-assisted CP, may update previous results. As such, a new meta-analysis that will account for all these developments may be warranted. The objective of this systematic review and meta-analysis was to compare the clinical outcomes of CP *versus* DP or PD.

Methods

Data sources and searches

A systematic review of the literature was performed to identify all studies involving data on outcomes of CP published from January 1983 to November 2017. PubMed/Medline, Embase and Cochrane Library were searched with the following search terms: "central pancreatectomy", "middle segment pancreatectomy", "medial pancreatectomy", "segmental pancreatectomy", "median pancreatectomy", "central *versus* distal pancreatectomy" and "central pancreatectomy *versus* pancreaticoduodenectomy". "laparoscopic", "robotic", "robotic-assisted" and "DaVinci" were searched in various combinations with the upper listed terms for minimally invasive central pancreatectomy (MICP). The search was limited to publications in English. References of the acquired articles were manually searched for additional studies.

Inclusion and exclusion criteria

To minimize heterogeneity among studies, only studies involving more than ten patients undergoing open central pancreatectomy (OCP) and studies involving more than five patients undergoing laparoscopic or robotically-assisted CP were included in the systematic review.

For inclusion in the meta-analysis, a study had to meet the following criteria: (i) comparative study of CP *versus* DP or PD, including randomized controlled trials (RCTs) or observational clinical studies (OCSs); (ii) description of at least one of the outcomes of interest.

Abstracts, letters, editorials, expert opinions, reviews without original data and case reports were excluded in the systematic review. Studies which were lacking a control group were excluded from the meta-analysis. When multiple articles were published by the same authors and/or institution, and no difference in the study period was described, the publication year, study quality and sample size were considered, and only the largest sample size or highest quality study was selected.

Data extraction and quality assessment

Two reviewers (WD Xiao and JS Zhu) independently evaluated the data for quality by using the following data points: first author, year of publication, characteristics of the study population, study design; number of subjects; intraoperative, postoperative and long-term outcomes. Inconsistencies were resolved through discussion until a consensus was reached or based on the assessment by a third reviewer (Y Li) who was included in the discussion. The Newcastle–Ottawa Scale (NOS) was used to evaluate the quality of non-randomized studies. The total scaled scores range from 0 to 9, and studies with scores higher than six were deemed to have qualified.

Outcomes of interest

The following data were extracted from all of the eligible studies: intraoperative outcomes (operative time and estimated blood loss), postoperative outcomes (morbidity, PF, reoperation, length of hospital stay and mortality) and long-term outcomes (endocrine and exocrine insufficiency).

Statistical analysis

Descriptive analyses were used for all studies that involved in systematic review. Frequency distributions were calculated for the type of pathologies, the methods of reconstruction of distal stump, morbidity and mortality. In comparative studies, the significance of differences was evaluated by Chi-square test or Fisher's exact test for categorical variables.

Meta-analysis was performed using Stata SE 12.0 software. Dichotomous and continuous variables were estimated based on the odds ratios (OR) and the weighted mean difference (WMD) with a 95% confidence interval (95% CI) respectively. Heterogeneity was evaluated using the Chi-square test, and $P < 0.100$ was considered significant. I^2 values were used for the evaluation of statistical heterogeneity; an I^2 value of 50% or more indicated the presence of heterogeneity. A fixed-effect model was initially performed for all outcomes. If the results indicated significant study heterogeneity, a random effect analysis was used. The results were displayed graphically using forest plots.

Publication bias was examined by a funnel plot of the log OR against its standard error using Begg's test, and the degree of asymmetry was tested statistically using Egger's unweighted regression asymmetry test.

Results

Systematic review

The results of the search are shown in Fig. 1. Fifty studies with 1305 patients, including 1114 OCPs[3,4,6–42] and 191 MICPs[38,39,43–51]

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