Minimally invasive spleen-preserving distal pancreatectomy: Does splenic vessel preservation have better postoperative outcomes? A systematic review and meta-analysis

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BACKGROUND: Minimally invasive spleen-preserving distal pancreatectomy (SPDP) can be performed with either splenic vessel preservation (SVP) or resection [Warshaw procedure (WP)]. The aim of this study was to evaluate the postoperative clinical outcomes of patients undergoing both methods.

DATA SOURCES: Database search of PubMed, Embase, Scopus, Cochrane, and Google Scholar was performed (2000-2014); key bibliographies were reviewed. Qualified studies comparing patients undergoing SPDP with either SVP or WP, and assessing postoperative complications were included. Calculated pooled risk ratio (RR) with the corresponding 95% confidence interval (CI) by random effects methods were used in the meta-analyses.

RESULTS: The search yielded 215 studies, of which only 14 observational studies met our selection criteria. The studies included 943 patients in total; 652 (69%) underwent SVP and 291 (31%) underwent WP. Overall, there was a lower incidence of splenic infarction (RR=0.17; 95% CI: 0.09-0.33; *P*<0.001), gastric varices (RR=0.16; 95% CI: 0.05-0.51; *P*=0.002), and intra/postoperative splenectomy (RR=0.20; 95% CI: 0.08-0.49; *P*<0.001) in the SVP group. There was no difference in incidence of pancreatic fistula (WP vs SVP, 23.6% vs 22.9%; *P*=0.37), length of hospital stay, operative time or blood loss. There was moderate cross-study heterogeneity.

CONCLUSIONS: SVP is a safe, efficient and feasible technique that may be used to preserve the spleen. WP may be more suitable for large tumors close to the splenic hilum or those associated with splenomegaly. Randomized clinical trials are justified to examine the long-term benefits of SVP-SPDP.

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KEY WORDS: splenic infarction; spleen-preserving distal pancreatectomy; splenic vessel preservation; Warshaw procedure; gastric varices

Introduction

Over the last two decades, minimally invasive pancreatic resections especially in general and distal pancreatectomy, have become increasingly popular owing to the improvements in necessary surgical skills and equipment.[1-8] Spleen preservation during laparoscopic distal pancreatectomy remains controversial owing to tediousness of techniques needed to do it.[9-11] In patients with adenocarcinoma of the pancreas, distal pancreatectomy with splenectomy is recommended to assure that an adequate oncologic margins and lymph node clearance has been achieved.[12-15] However, for patients with benign or low-grade malignant tumors in the body/tail of the pancreas, proponents of this technique argue that conservation of the spleen preserves immune function and eliminates the risk of overwhelming post-splenectomy infection and other complications related to the splenectomy procedure itself.[16-20] Moreover, some authors

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reported that splenectomy has a negative influence on long-term survival along with an increased risk of lung and ovarian cancers.[21-24]

Established surgical techniques to preserve the spleen include Warshaw procedure (WP) where the technique described includes ligation of splenic vessels with the preservation of the short gastric and left gastroepiploic vessels.[25, 26] Another method, splenic vessel preservation (SVP), where sparing of the splenic vessels without ligation is performed, with meticulous ligation of small pancreatic branches, also known to some as Kimura procedure; this later technique is thought to provide better blood supply to the retained spleen.[27, 28]

In recent years, as opposed to SVP, WP has gained favor of many surgeons, particularly in laparoscopic resections.[5, 29-31] However, concern remains due to the higher incidence of splenic infarction and gastric varices with a theoretical risk of gastrointestinal bleeding during follow-up.[31-33] The aim of this study was to review the literature with meta-analysis of pooled data to compare short- and long-term outcomes between WP and SVP.

Methods

Literature search and study selection

A comprehensive online search of PubMed, Embase, Scopus, Google Scholar and the Cochrane database was performed for all published articles in the English language evaluating short- and long-term postoperative outcomes following spleen-preserving distal pancreatectomy (SPDP) with or without SVP between 2000 and 2014. The search was conducted using the following MeSH terms: "distal pancreatectomy", "spleen-preserving distal pancreatectomy", "left pancreatic resection", "Warshaw procedure", "Kimura procedure", "splenic vessel preservation", and "splenic vessel resection". The related-articles function was used to expand the search from each relevant study identified. All citations and abstracts identified were thoroughly reviewed. The latest search was performed on November 11, 2014. Bibliographies of retrieved papers were further screened for any additional eligible literature. The primary end-point for comparison was postoperative splenic infarction and gastric varices. Secondary end-points included operative outcomes and other complications as pancreatic fistula and the need for intra-/postoperative splenectomy. When an article reported more than one pancreatic procedure, data relating to SPDP only was included in the analysis.

Surgical procedure

All included studies used a minimally invasive approach for performing SVP and WP, which included: laparoscopic, hand-assisted, robotic assisted laparoscopic or totally robotic techniques. Depending on preoperative imaging or intraoperative circumstances, the surgeon opted for one or the other technique or converted to open procedure.

SVP-SPDP

After the pancreas was dissected, the splenic vessels were mobilized with meticulous ligation of the pancreatic branches. Some of the included studies explained that the intention to treat was always SVP, but intraoperatively, decision to change from SVP to WP was taken due to several reasons including, a large sized tumor distorting or compressing the vessels or there was no possibility for dissection of the pancreas from the splenic vessels. Moreover, presence of intraoperative bleeding could lead to this decision.

WP-SPDP

To maintain blood supply to the spleen through the short gastric vessels after division of the greater omentum, care was taken not to divide the splenocolic and gastrosplenic ligament. An initial trial of temporarily clamping the splenic vessels for a couple of minutes while observing for any rapid change in splenic color was pursued. If the spleen remained viable, even with a dark red color, the clamp was then removed and the vessels ligated or transected; splenic vessels were managed apart from the splenic hilum to avoid damage to the splenic pedicle.

Inclusion and exclusion criteria

In order to be included in the analysis, studies had to: (i) Compare the outcome measures mentioned above between patients who had SVP-SPDP and WP-SPDP; (ii) Report on at least one of the outcomes of interest mentioned above. When the same institution reported two studies, we either included the one of better quality (larger sample size, the most recent publication), or both if the studies described different patient cohorts.

Studies were excluded from analysis if: (1) They were either non-comparative studies or case series; (2) The outcomes of interest were not reported for the two techniques; (3) There was significant overlap among authors, centers or patient cohorts evaluated.

Data extraction and quality assessment

Two reviewers (Elabbasy F and Gadde R) independently extracted the following data from each study: study characteristics (first author, year of publication,