

Clinical efficacy of spleen-preserving distal pancreatectomy with or without splenic vessel preservation

A Meta-analysis

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Abstract

Objective: The meta-analysis was performed to investigate the clinical efficacy of spleen-preserving distal pancreatectomy with splenic vessel preservation (SPDP-SVP) and spleen-preserving distal pancreatectomy with splenic vessel resection (SPDP-SVR).

Methods: Potential articles were searched on the databases of Pubmed, Embase, and Chinese National Knowledge Infrastructure (CNKI) from January 1988 until March 2017. Weight mean difference (WMD) with 95% confidence interval (CI) was applied to compare the efficacy of SPDP-SVP and SPDP-SVR. Odds ratio (OR) with 95% CI was calculated to figure out the risks for complications. $P < .05$ or $I^2 > 50\%$ indicated significant heterogeneity. The random-effects model is used to pool data if significant heterogeneity exists; otherwise, the fixed-effects model is used. Publication bias was evaluated by Begg's funnel plot.

Results: Thirteen eligible articles were obtained in the meta-analysis. SPDP-SVP seemed to relate with reduced operative time and blood loss, prolonged hospital stay, and less complications; however, the effects were not statistically significant. Meanwhile, we found that SPDP-SVP was closely related with the reduced rate of splenic infarction and gastric varices (OR=0.16, 95% CI=0.09–0.29; OR=0.08, 95% CI=0.02–0.35). No publication bias was observed in the analysis ($P = .636$).

Conclusions: SPDP-SVP seems to show superiority than SPDP-SVR in reducing the rate of splenic infarction and gastric varices.

Abbreviations: CI = confidence interval, CNKI = Chinese National Knowledge Infrastructure, OR = odds ratio, RCT = randomized controlled trial, SPDP = spleen-preserving distal pancreatectomy, SVP = splenic vessel preservation, SVR = splenic vessel resection, WMD = weight mean difference.

Keywords: meta-analysis, splenic vessel preservation, splenic vessel resection

1. Introduction

Distal pancreatectomy with splenectomy has been demonstrated to be an effective therapy for managing benign or low-grade malignant lesions in the body or tail of the pancreas.^[1] However, splenectomy is usually related with high risk of sepsis and poor survival.^[2] Hence, spleen-preserving distal pancreatectomy (SPDP) is frequently applied to decrease the occurrence of sepsis and improve patients' survival.^[3]

Two surgical techniques for SPDP have been described. Spleen-preserving distal pancreatectomy with splenic vessel preservation (SPDP-SVP) preserves the main splenic artery and vein and excises

the tail of the pancreas and those small, short vascular connections to the body.^[4,5] For this technique, a small breakage in the splenic vessels could result in massive intraoperative bleeding, which makes SPDP difficult. To control bleeding from the main splenic vessels, combined splenectomy is always suggested. Another one is spleen-preserving distal pancreatectomy with splenic vessel resection (SPDP-SVR). It involves resection of the splenic vein and artery before distal pancreatectomy, and conservation of the short splenicocolic and gastric vessels to keep normal blood flow of spleen. During the procedure, not only the 2 main splenic vessels need to be controlled, but also fine resection near the splenic hilum is always required. Moreover, the risks of perigastric varices and spleen-related morbidities should be beware.^[6,7] Up to now, the superiority of SPDP-SVP or SPDP-SVR in managing the pancreatic lesions is still debatable.

The current meta-analysis was initiated to compare the clinical efficacy between SPDP-SVP and SPDP-SVR in the management of the pancreatic lesions. In the analysis, laparoscopic, robotic and open surgery SPDP were all considered. The outcome contributes to improving the treatment of patients with benign or low-grade malignant lesions in the body or tail of the pancreas.

2. Methods

2.1. Search strategy

We searched Pubmed, Embase, and Chinese National Knowledge Infrastructure (CNKI) databases for potential articles from

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January 1988 until March 2017. The search terms included distal pancreatectomy, spleen, vessel, preservation/conservation, and Kimura technique. The references of obtained articles were manually searched to identify possible studies.

2.2. Inclusion and exclusion criteria

These obtained articles were selected according to inclusion criteria and exclusion criteria. The studies comparing the clinical efficacy of SPDP-SVP and SPDP-SVR will be considered in the current meta-analysis, whatever approach (robotic-assisted, laparoscopic, or open) was used. For the studies with overlapped data, the recent published one was selected.

The exclusion criteria were as follows: review articles; case reports; the studies only focused on the clinical efficacy of SPDP-SVP or SPDP-SVR and not compared SPDP-SVP and SPDP-SVR; and the articles not reported available data.

2.3. Data extraction

Two authors were responsible for extracting data from included articles. The data were: name of first author, publication year, country, sample size, study design (retrospective, prospective, or randomized controlled trial), surgery type (robotic-assisted, laparoscopic, or open), operative time, blood loss, hospital time, overall complications (minor complications and major complications), pancreatic fistula, splenic infarction, and gastric varices of each group. Minor complication is graded as Dindo grades I-II and major complication is listed as Dindo grades III-IV. The debatable issues were discussed with a third author.

2.4. Statistical analysis

The current meta-analysis was performed with Stata 12.0 software. Weight mean difference (WMD) for continuous outcomes and odds ratios (ORs) for dichotomous outcome are provided. WMD with 95% confidence interval (CI) was used to figure out the influences of SPDP-SVP in operative time, blood loss, and hospital stay, compared with SPDP-SVR. OR with 95% CI was calculated to represent the risks for overall complications. $P < .05$ or $I^2 > 50\%$ indicated significant heterogeneity. The random-effects model is used to pool data if significant heterogeneity exists; otherwise, the fixed-effects model is used. Sensitivity analysis was performed to evaluate the robustness of

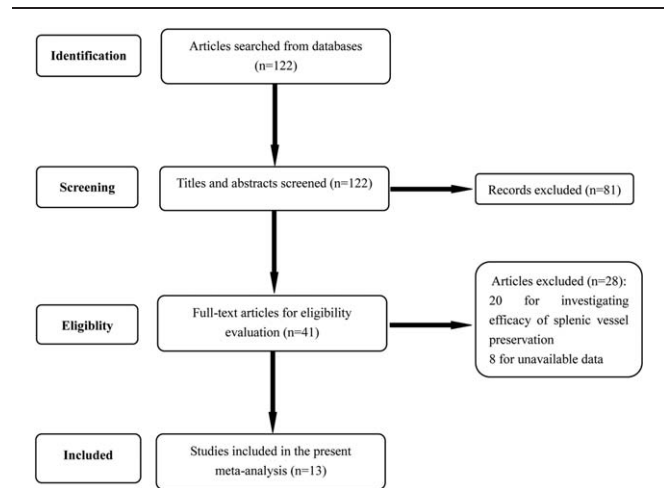


Figure 1. Articles selection process. 13 eligible articles were included in the present meta-analysis.

overall results. Possible publication bias was evaluated by Begg's funnel plot and Egger's regression analysis.

3. Results

3.1. Selection of eligible articles

We carefully selected the obtained articles according to the inclusion and exclusion criteria. At last, 13 eligible articles were obtained.^[8–18,28,29] About 122 relevant articles were obtained after rough search. And 81 articles were excluded after screening titles and abstract. For the remaining 41 articles, 31 articles were removed for not comparing the efficacy of SPDP-SVP and SPDP-SVR ($n=20$) and unavailable data ($n=8$). The selection process was exhibited in Figure 1. The detailed information of included articles was listed in Table 1.^[8–18,28,29]

3.2. Comparison in operative time, blood loss, hospital stay, and complications (overall complications, pancreatic fistula, splenic infarction, and gastric varices) between SPDP-SVP and SPDP-SVR

Random-effects model was used to comparing the efficacy of SPDP-SVP and SPDP-SVR in operative time, blood loss, and

Table 1

Basic information of included studies.^[8–18,28,29]

Author	Year	Country	Design	Sample size	Type of surgery	NOS score
Adam ^[8]	2013	Spain	Retrospective	55 vs 85	Laparoscopic	9
Zhou et al ^[9]	2014	China	Retrospective	206 vs 40	Laparoscopic	6
Worhunsky ^[10]	2014	America	Prospective	19 vs 31	Laparoscopic	9
Ly ^[11]	2013	China	Retrospective	12 vs 8	Laparoscopic	9
Hwang ^[12]	2013	South Korea	Retrospective	17 vs 4	Robotic	9
Butturini ^[13]	2012	Italy	Retrospective	36 vs 7	Laparoscopic	6
Gui ^[14]	2013	China	Retrospective	20 vs 12	Open	7
Yang ^[15]	2016	China	Retrospective	15 vs 5	Laparoscopic	7
Hu ^[16]	2014	China	Retrospective	28 vs 17	Laparoscopic	7
Fernandez-Cruz ^[17]	2004	Spain	Prospective	11 vs 8	Laparoscopic	7
Matsushima ^[29]	2014	Japan	Retrospective	7 vs 17	Laparoscopic	7
Beane ^[28]	2011	Indian	Retrospective	45 vs 41	Complex	8
Baldwin ^[18]	2011	America	Retrospective	5 vs 4	Laparoscopic	6

Complex indicates open, laparoscopic, and robotic techniques are all used.

Table 2
Pooled results of operative time, blood loss, and hospital stay.

Variables	WMD	95% CI	$P_{\text{heterogeneity}}$	I^2	Model
Operative time	-1.09	-27.08, 24.90	0.000	76.0%	Random
Blood loss	-40.28	-152.29, 71.74	0.000	79.7%	Random
Hospital stay	0.21	-0.71, 1.12	0.017	58.8%	Random

CI=confidence interval, WMD=weighted mean difference.

hospital stay (Table 2, Figs. 2–4). We found that SPDP-SVP seemed to reduce the operative time and blood loss, compared to SPDP-SVR (WMD: -1.09 and -40.28); however, the effects were not statistically significant. Meanwhile, SPDP-SVP seemed to relate with prolonged hospital stay (WMD: 0.21, 95% CI: -0.71, 1.12), but the relationship was not statistically significant.

In addition, the outcome indicated that SPDP-SVP was related with less overall complications (OR: 0.97, 95% CI: 0.73, 1.28) and the relationship was not statistically significant (Table 3, Fig. 5). Meanwhile, we found that SPDP-SVP was closely related with the reduced rate of splenic infarction and gastric varices (OR=0.16, 95% CI=0.09–0.29; OR=0.08, 95% CI=0.02–0.35) (Fig. 6).

3.3. Sensitivity analysis

Sensitivity analysis was performed to assess the robustness of pooled outcome. The analysis suggested the pooled outcome was robust.

3.4. Publication bias detection

Begg’s funnel plot and Egger’s regression analysis were adopted to evaluate the possible publication bias. No publication bias was observed in the current meta-analysis ($P=.636$, complications analysis) (Fig. 7).

4. Discussion

Distal pancreatectomy for malignant tumors of the tail or body of the pancreas needs a splenectomy. Whereas, splenectomy usually results in postsplenectomy infection in 1% to 5% patients and cause 50% of mortality rate.^[19] Besides, it may increase the postoperative platelet count.^[20] In 1943, Mallet-Guy and Vachon firstly described SPDP technique.^[21] It is commonly applied in patients with benign or low-grade malignant tumors in the body and tail of the pancreas. In 1994, Soper et al^[22] developed an animal model for laparoscopic distal pancreatectomy, which is demonstrated to be safe and effective. In 1996, Gagner et al^[23] suggested a spleen-preserving laparoscopic distal pancreatectomy procedure with preserving splenic artery and vein, which was performed in patients with cystic tumors, neuroendocrine tumors, and chronic pancreatitis. In 1999, Vezakis et al^[24] demonstrated that spleen-preserving laparoscopic distal pancreatectomy could be performed with splenic vessel resection as well.

As for SPDP-SVP, it could conserve the splenic artery and vein, maintain the blood supply to spleen, and ultimately reduce the risks of abscess formation and splenic necrosis. However, SPDP-SVP is time-consuming. Moreover, the technique is difficult because of delicately dissecting the small branches of splenic vessels. During

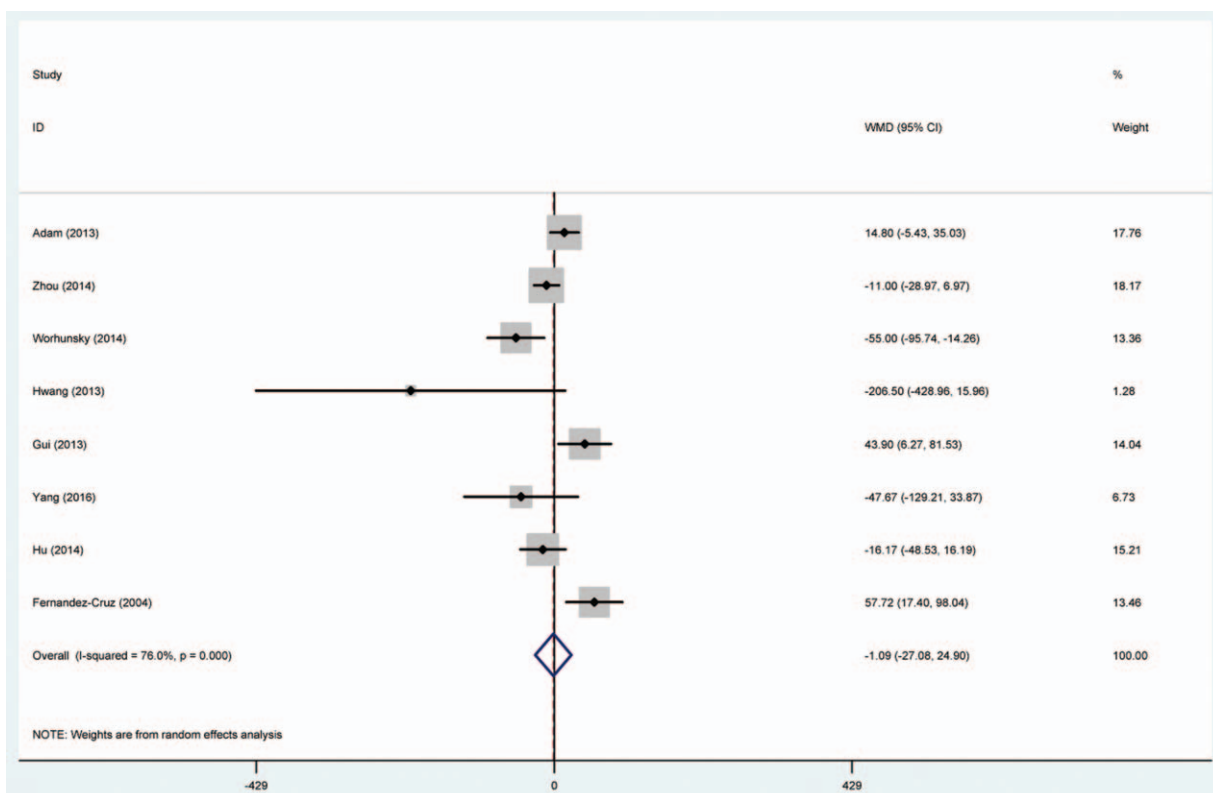


Figure 2. Comparison between SPDP-SVP and SPDP-SVR in operative time.

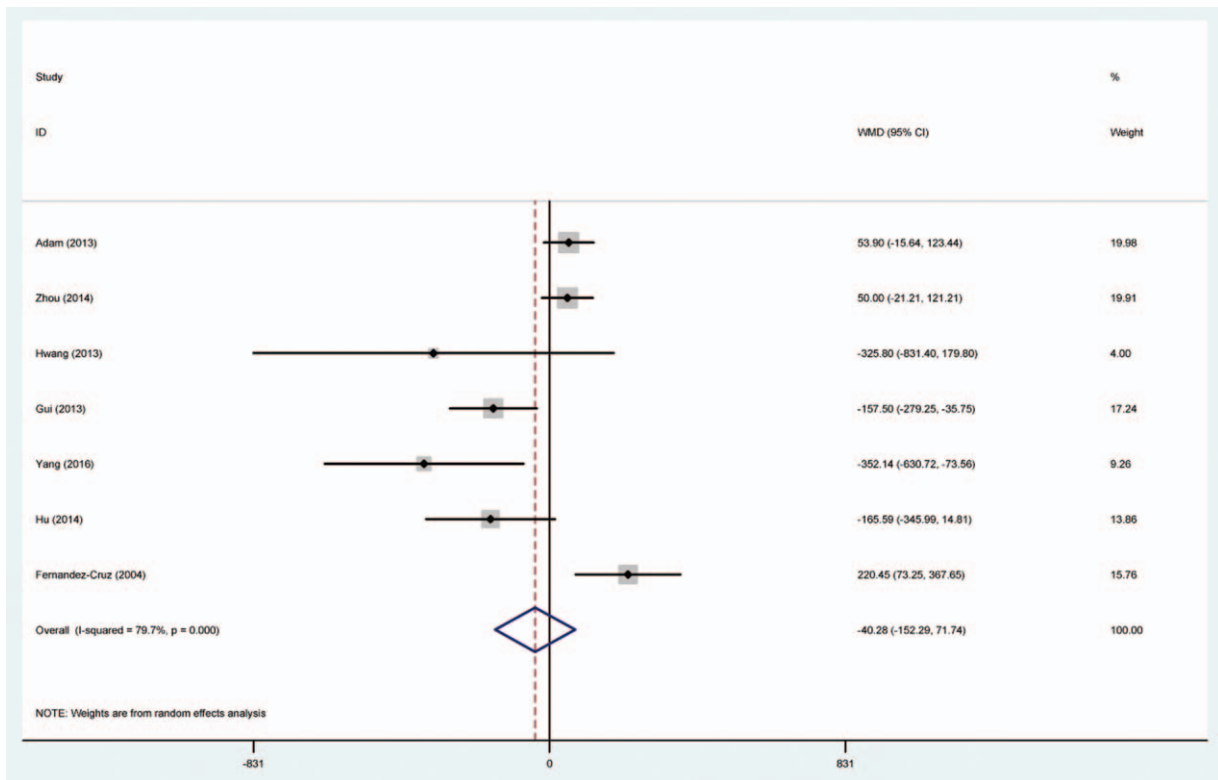


Figure 3. Comparison between SPDP-SVP and SPDP-SVR in blood loss.

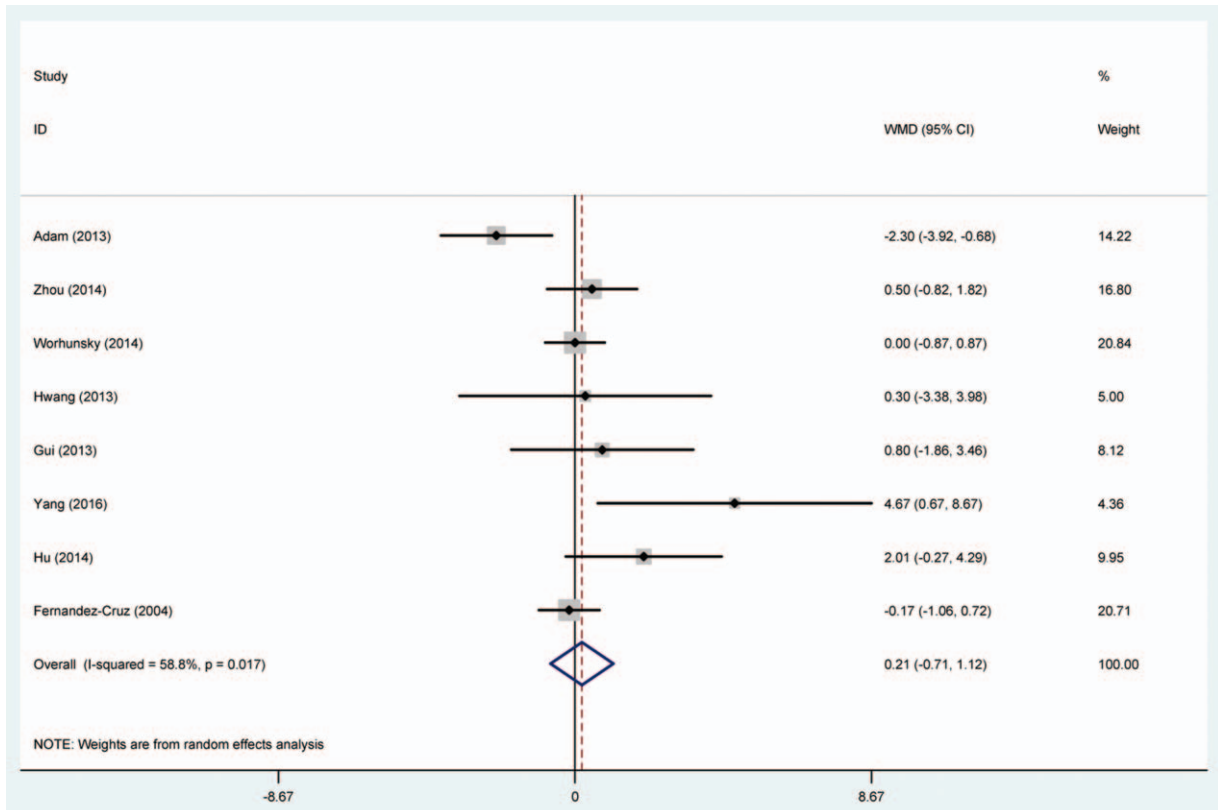


Figure 4. Comparison between SPDP-SVP and SPDP-SVR in hospital stay.

Table 3
Pooled result of complications.

Variables	OR	95% CI	<i>P</i> _{heterogeneity}	<i>I</i> ²	Model
Complications	0.97	0.73, 1.28	0.767	0.0%	Fixed

CI=confidence interval, OR=odds ratio.

SPDP-SVR procedure, dissecting the splenic vessels may be difficult when large tumors compress and distort the course of the vessels. SPDP-SVR has been demonstrated to be faster and less technically demanding compared with SPDP-SVP.^[25-27]

In recent years, more attention has been paid to compare the clinical efficacy of SPDP-SVP and SPDP-SVR in managing the pancreatic lesions. Adam et al^[8] thought that the short-term benefits of SPDP-SVP compared with SPDP-SVR may lead to an increased preference for this technique. In the study of Zhou et al,^[9] there were no significant differences between SPDP-SVP and SPDP-SVR groups in blood loss and operative time. However, the rates of splenic infarction were 16.0% in the SPDP-SVP group and 52.5% in the SPDP-SVR group at 3 days after surgery. At 6 months, the rates of gastric varices were 1.9% in the SPDP-SVP group and 35% in the SPDP-SVR group. These data also indicated the superiority of SPDP-SVP than SPDP-SVR. Beane et al^[28] reported that SPDP-SVP procedure was related with less blood loss than SPDP-SVR. In addition, SPDP-SVP resulted in fewer grade B or C pancreatic fistulas and splenic infarctions, and shorter post-operative length of stay. They concluded that SPDP-SVP was preferred when SPDP was performed. On the contrary, the study by Matsushima et al^[29] suggested that SPDP-SVR (Warshaw) could be used as the more

appropriate procedure in cases whose tumors are relatively large or close to the splenic vessels.

In the current meta-analysis, we found that SPDP-SVP seemed to reduce operative time and blood loss compared to SPDP-SVR; however, the effects were not statistically significant. Besides, SPDP-SVP was related with prolonged hospital stay (WMD: 0.21), but the relationship was not statistically obvious. Meanwhile, we found that SVP was related with less complications (RR: 0.97, 95% CI: 0.73, 1.28) and the relationship was not statistically significant. Moreover, we found that SPDP-SVP was closely related with the reduced rate of splenic infarction and gastric varices (OR=0.16, 95% CI=0.09-0.29; OR=0.08, 95% CI=0.02-0.35). The results were calculated based on 13 articles and they were credible. One meta-analysis by Tang et al^[30] reported that operative time, blood loss, postoperative complications, pancreatic fistula rates, and hospital stays were comparable between SPDP-SVP and SPDP-SVR. However, SPDP-SVR was related with higher incidence rates of splenic ischemia and gastric/perigastric varices. Another meta-analysis by Partelli et al^[31] concluded that the 2 procedures were comparable in terms of intraoperative blood loss and rate of pancreatic fistula. SPDP-SVR did not affect the risk of perigastric collateral vessels and submucosal varices. Compared with the 2 meta-analyses, the selected articles were searched on CNKI database and much more Chinese population was analyzed, which may contribute to obtaining much more comprehensive conclusion. In the analysis, both of overall complications and every complication were investigated, which may help for obtaining much more clear conclusions.

However, there existed limitations in the analysis. First, there existed significant heterogeneity in the analysis of operative time,

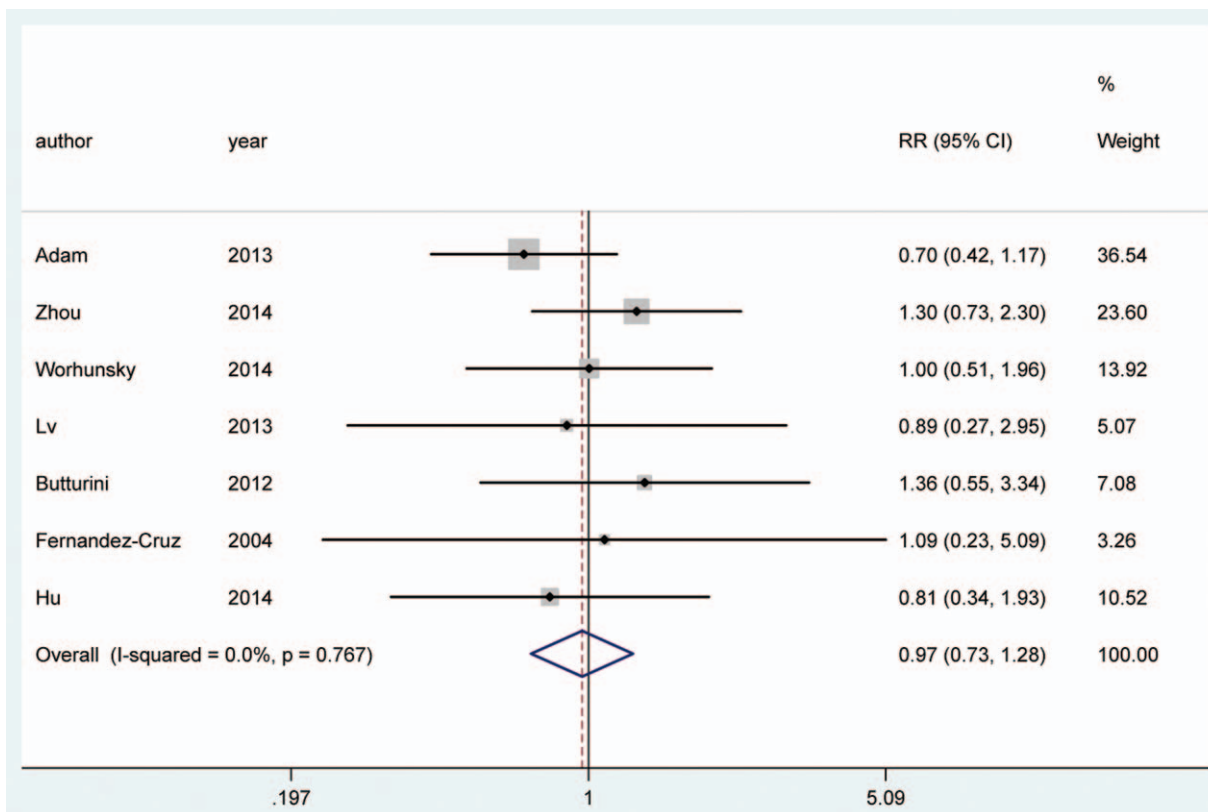


Figure 5. Comparison between SPDP-SVP and SPDP-SVR in complications.

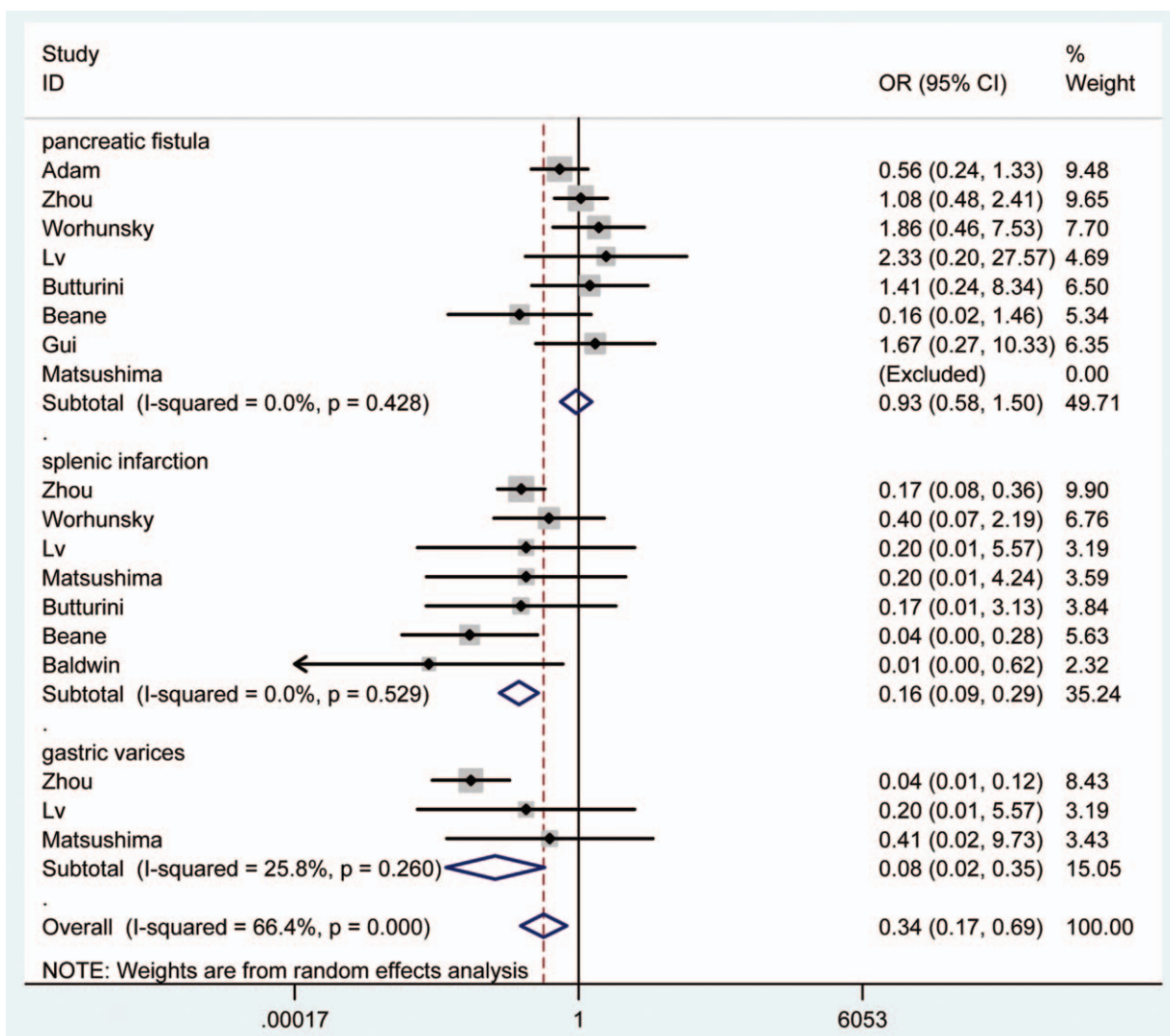


Figure 6. Comparison between SPDP-SVP and SPDP-SVR in pancreatic fistula, splenic infarction and gastric varices.

blood loss and hospital time, which might result from the differences in characteristics of patients and operation manipulation. Second, specific type of complications was not analyzed in the current analysis because of the lack of sufficient data. Third,

most studies were conducted with retrospective design in addition of 2 studies (Worhunsky et al^[10] and Fernandez-Cruz et al^[17]). Meanwhile, no selected studies were designed as randomized controlled trials (RCTs). The doctors must respect the intention of patients and informed consent must be signed by patients before surgery, which may be one reason for no RCTs.

In conclusion, SPDP-SVP seems to show superiority than SPDP-SVR for patients with benign or low-grade malignant tumors in the body and tail of the pancreas. It shows close relationship with reduced rate of splenic infarction and gastric varices.

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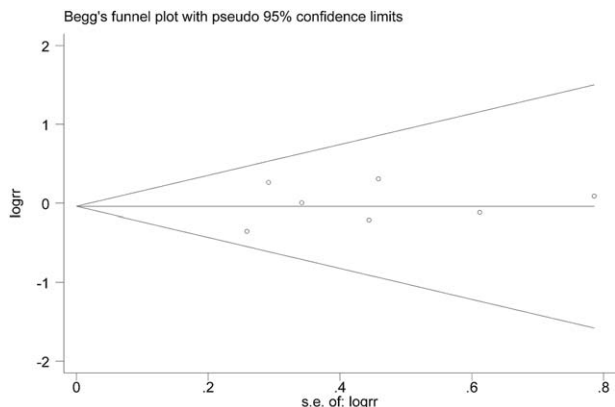


Figure 7. Begg's funnel plot.

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