

# World Journal of *Gastrointestinal Surgery*

*World J Gastrointest Surg* 2018 November 27; 10(8): 84-94





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*World Journal of Gastrointestinal Surgery* is now abstracted and indexed in Emerging Sources Citation Index (Web of Science), PubMed, PubMed Central, China National Knowledge Infrastructure (CNKI), and Superstar Journals Database.

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**NAME OF JOURNAL**  
*World Journal of Gastrointestinal Surgery*

**ISSN**  
 ISSN 1948-9366 (online)

**LAUNCH DATE**  
 November 30, 2009

**FREQUENCY**  
 Monthly

**EDITORIAL BOARD MEMBERS**  
 All editorial board members resources online at <http://www.wjgnet.com/1948-9366/editorialboard.htm>

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**PUBLISHER**  
 Baishideng Publishing Group Inc  
 7901 Stoneridge Drive, Suite 501,  
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**PUBLICATION DATE**  
 November 27, 2018

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**ONLINE SUBMISSION**  
<http://www.wjgnet.com/esps/>

## Retrospective Study

**Male gender and increased body mass index independently predicts clinically relevant morbidity after spleen-preserving distal pancreatectomy**

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**Author contributions:** All authors helped to perform the research and to write the manuscript; Dumitrascu T, Aiordachioae A, Eftimie M and Dima S contributed to drafting conception and design; Dumitrascu T and Aiordachioae A contributed to data analysis; Dumitrascu T, Stroescu C, Ionescu M and Popescu I contributed to performing procedures.

**Institutional review board statement:** This study was retrospective, and no interference with patients' treatment was made. Thus, the approval by the Ethics Committee of the Fundeni Clinical Institute was waived.

**Informed consent statement:** Patients were not required to give informed consent to the study because the analysis used anonymous retrospective clinical data that were obtained after each patient agreed to treatment by written consent.

**Conflict-of-interest statement:** All authors declare no conflicts-of-interest related to this article.

**Data sharing statement:** No additional data are available.

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**Manuscript source:** Invited manuscript

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**Received:** August 1, 2018

**Peer-review started:** August 1, 2018

**First decision:** August 24, 2018

**Revised:** September 24, 2018

**Accepted:** November 4, 2018

**Article in press:** November 4, 2018

**Published online:** November 27, 2018

**Abstract****AIM**

To identify risk factors for clinically relevant complications after spleen-preserving distal pancreatectomy (SPDP). No previous studies explored potential predictors of morbidity after SPDP.

**METHODS**

The data of 41 patients who underwent a SPDP in a single surgical center between 2000 and 2015 were retrospectively reviewed from a prospectively maintained electronic database established in our Department of Surgery. The database included demographic, clinical, bioumoral, pathological, intraoperative and postoperative parameters. Uni- and multivariate ana-

lyses were performed to assess potential predictors of clinically relevant morbidity. Postoperative morbidity was defined as in-hospital complications and mortality was assessed at 90 d. Clinically relevant morbidity was defined as complication  $\geq$  grade 2 Dindo.

### RESULTS

Overall morbidity rate was 34.1% (14 patients): grade I (6 patients, 14.6%), grade II (2 patients, 4.8%), grade IIIa (1 patient, 2.4%), and grade IIIb (5 patients, 12.2%). A number of 5 patients (12.2%) required re-laparotomy for postoperative complications. There was no postoperative mortality. Thus, at least one clinically relevant complication occurred in 8 patients (19.5%). Univariate analysis identified male gender ( $P = 0.034$ ), increased body mass index ( $P = 0.002$ ) and neuroendocrine pathology ( $P = 0.013$ ) as statistically significant risk factors. Multivariate analysis identified male gender [odds ratio (OR): 1.29, 95%CI: 1.07-1.55,  $P = 0.005$ ] and increased body mass index (OR: 23.18, 95%CI: 1.72-310.96,  $P = 0.018$ ) as the only independent risk factors of clinically relevant morbidity after SPDP.

### CONCLUSION

Male gender and increased body mass index are independently associated with increased risk of clinically relevant morbidity after SPDP. These findings may assist a surgeon in clinical decision-making to better select patients suitable for SPDP.

**Key words:** Spleen-preserving distal pancreatectomy; Morbidity; Male gender; Body mass index

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**Core tip:** No previous studies explored potential predictors of morbidity after spleen-preserving distal pancreatectomy (SPDP). The study aims to identify risk factors for clinically relevant complications after SPDP. Data of 41 patients with SPDP were reviewed and uni- and multivariate analyses were performed to assess potential predictors of clinically relevant morbidity, defined as complication  $\geq$  grade 2 Dindo. The rate of clinically relevant complications was 19.5%. Male gender [odds ratio (OR): 1.29, 95%CI: 1.07-1.55,  $P = 0.005$ ] and increased body mass index (OR: 23.18, 95%CI: 1.72-310.96,  $P = 0.018$ ) were found as independent risk factors of clinically relevant morbidity after SPDP. These findings may assist a surgeon in clinical decision-making to better select patients suitable for SPDP.

Dumitrascu T, Eftimie M, Aiordachioae A, Stroescu C, Dima S, Ionescu M, Popescu I. Male gender and increased body mass index independently predicts clinically relevant morbidity after spleen-preserving distal pancreatectomy. *World J Gastrointest Surg* 2018; 10(8): 84-89 Available from: URL: <http://www.wjgnet.com/1948-9366/full/v10/i8/84.htm> DOI: <http://dx.doi.org/10.4240/wjgs.v10.i8.84>

## INTRODUCTION

Pancreatic resections are widely considered to have increased risk of postoperative complications<sup>[1]</sup>. Although distal pancreatectomies (DP) are less complicated surgical procedures compared with pancreatico-duodenectomies, however, morbidity rates are still high: 27.2%-50.2%<sup>[2-8]</sup>.

DP can be performed with or without splenectomy, mainly depending on the type of pathology (benign or malignant) and surgeon's expertise. Recent meta-analyses have shown that preservation of spleen during DP was associated with decreased rates of intra-abdominal abscesses<sup>[9,10]</sup>, infectious complications<sup>[11]</sup>, overall<sup>[11]</sup> or clinically relevant<sup>[10]</sup> pancreatic fistula and overall morbidity<sup>[11]</sup>, particularly when the splenic vessels are preserved<sup>[9-11]</sup>.

Thus, it appears that there are some differences of morbidity between DP with and without splenectomy<sup>[9-11]</sup> and identification of potential predictors of morbidity in the subgroup of patients with spleen-preserving distal pancreatectomy (SPDP) would be a topic of interest. To date, several studies have explored potential predictors of postoperative complications after DP, but none included only patients with SPDP<sup>[2-8,12-26]</sup>.

The study aims to assess risk factors for clinically relevant complications after SPDP with spleen vessels preservation, in a single center experience.

## MATERIALS AND METHODS

### Study design

Between January 1, 2000, and December 31, 2015, a number of 41 SPDP were performed in our Department of Surgery. Data were retrospectively analyzed from a prospectively gathered electronic database and included demographic, clinical, bioumoral, pathological, intraoperative and postoperative parameters, as shown in Table 1.

### Surgical technique

Our technique of SPDP with splenic vessel preservation was described elsewhere<sup>[27]</sup>. Six patients (14.6%) underwent minimally invasive SPDP (2 laparoscopic and 4 robotic).

### Outcomes

The final pathological examination included 16 patients with neuroendocrine tumors (39%), 9 patients with serous/mucinous cystadenoma (22%), 6 patients with solid pseudopapillary tumors (14%), 5 patients with nodular chronic pancreatitis (12%), 4 patients with malignant pathology (10%) and one patient with pancreatic trauma (2%).

Postoperative morbidity was defined as in-hospital complications and mortality was assessed at 90 d. A complication  $\geq$  grade 2 was considered clinically relevant, according to Dindo-Clavien classification.

**Table 1** Demographic, clinical, biomoral, intraoperative and pathology data of 41 patients with spleen-preserving distal pancreatectomy: A comparative analysis between patients with and without clinically relevant postoperative complications

Parameter	All patients	No complications (33 patients)	Clinically relevant complications (8 patients)	P value
Male gender	12 (29.3%)	7 (21.2%)	5 (62.5%)	0.03 <sup>1</sup>
Age, yr	41 (18–76)	39 (18–76)	51 (34–66)	0.067 <sup>2</sup>
Charlson comorbidity index	0 (0–4)	0 (0–4)	1.5 (0–3)	0.157 <sup>2</sup>
Body mass index, kg/m <sup>2</sup>	25 (19–42)	24 (19–37)	34.5 (24–42)	0.002 <sup>2</sup>
Overweight and obesity	22 (53.6%)	15 (45.4%)	7 (87.5%)	0.049 <sup>1</sup>
Overweight	8 (19.5%)	7 (21.2%)	1 (12.5%)	1 <sup>1</sup>
Obesity	14 (34.1%)	8 (24.2%)	6 (75%)	0.012 <sup>1</sup>
Diabetes mellitus	1 (2.4%)	0	1 (12.5%)	0.195 <sup>1</sup>
Chronic pancreatitis	6 (14.6%)	5 (15.1%)	1 (12.5%)	1 <sup>1</sup>
Preoperative leucocytes number <sup>3</sup> , / $\mu$ L	7700 (4900–15300)	7700 (4900–15300)	7300 (5200–9200)	0.961 <sup>2</sup>
Preoperative neutrophil number <sup>3</sup> , / $\mu$ L	4900 (2800–13200)	4900 (2800–13200)	4050 (3500–6400)	0.759 <sup>2</sup>
Preoperative lymphocyte number <sup>3</sup> , / $\mu$ L	1800 (1000–3300)	1600 (1000–3300)	2200 (1100–2900)	0.291 <sup>2</sup>
Preoperative neutrophil-to-lymphocyte ratio <sup>3</sup>	2.9 (1.2–8.4)	2.9 (1.2–8.4)	2.2 (1.6–5.8)	0.137 <sup>2</sup>
Preoperative platelet number <sup>3</sup> , / $\mu$ L	262500 (161000–464000)	264000 (161000–410000)	258000 (170000–464000)	0.735 <sup>2</sup>
Preoperative platelet-to-lymphocyte ratio <sup>3</sup>	134 (55.4–372.7)	134 (55.4–372.7)	141.9 (85–372.7)	0.550 <sup>2</sup>
ASA score 3	6 (14.6%)	4 (12.1%)	2 (25%)	0.577 <sup>1</sup>
Minimally invasive approach	6 (14.6%)	4 (12.1%)	2 (25%)	0.577 <sup>1</sup>
Soft pancreas texture	35 (85.3%)	28 (84.8%)	7 (87.5%)	1 <sup>1</sup>
Associated procedures	5 (12.2%)	4 (12.1%)	1 (12.5%)	1 <sup>1</sup>
Operative time, min	150 (70–330)	150 (70–320)	185 (120–330)	0.067 <sup>2</sup>
Estimated blood loss, mL	150 (50–600)	150 (50–600)	175 (50–300)	0.550 <sup>2</sup>
Intraoperative blood transfusions	1 (2.4%)	1 (3%)	0	1 <sup>1</sup>
Tumor diameter, cm	3.5 (0.4–14)	3 (0.4–14)	2.75 (0.4–3.5)	0.060 <sup>2</sup>
Length of resected pancreas, cm	9 (6–12)	9 (6–12)	8.5 (8–12)	0.784 <sup>2</sup>
Malignant pathology	4 (2.4%)	3 (9.1%)	1 (12.5%)	1 <sup>1</sup>
Neuroendocrine pathology	18	11	7	0.013 <sup>1</sup>

<sup>1</sup>Fisher's exact test (two-tailed); <sup>2</sup>Mann-Whitney test (two-tailed); <sup>3</sup>Assessed no more than one week prior to surgery. ASA: American Society of Anesthesiologists.

Postoperative pancreatic fistulae, hemorrhage and delayed gastric emptying were classified according to the International Study Group of Pancreatic Surgery definitions.

The patients were stratified according to the World Health Organization definitions for underweight [body mass index (BMI) < 18.5 kg/m<sup>2</sup>], normal weight (BMI: 18.5–24.9 kg/m<sup>2</sup>), overweight (BMI: 25–29.9 kg/m<sup>2</sup>) and obesity (BMI  $\geq$  30 kg/m<sup>2</sup>).

### Statistical analysis

Data are expressed as number (percentage) for categorical variables and median (range) for continuous variables. Fisher's exact test (two-tailed) and Mann-Whitney test (two-tailed) were used to compare categorical and continuous variables, respectively. Potential predictors of clinically relevant morbidity were tested in univariate analysis, and risk factors with *P*-values < 0.1 were included in a multivariate binary logistic regression model with the forwarding stepwise method.

*P*-values < 0.05 were considered statistically significant. Statistical analyses were performed with SPSS (Statistical Packages for Social Sciences) version 20.0 software (SPSS Inc., Chicago, IL, United States).

## RESULTS

### Morbidity

Overall morbidity rate was 34.1% (14 patients): grade

I (6 patients, 14.6%), grade II (2 patients, 4.8%), grade IIIa (1 patient, 2.4%), and grade IIIb (5 patients, 12.2%). A number of 5 patients (12.2%) required re-laparotomy for postoperative complications. There was no postoperative mortality. Thus, 8 patients (19.5%) developed clinically significant morbidity.

Postoperative pancreatic fistula was observed in 13 patients (31.7%): grade A (6 patients, 14.6%), grade B (5 patients, 12.2%), and grade C (2 patients, 4.8%).

Postoperative delayed gastric emptying was observed in 5 patients (12.2%): grade A (2 patients, 4.8%), grade B (2 patients, 4.8%), and grade C (1 patient, 2.4%).

Postoperative hemorrhage was observed in 5 patients (12.2%): grade B (1 patient, 2.4%), and grade C (4 patients, 10%).

Other complications included intra-abdominal abscess, wound infection and splenic vessels thrombosis (one patient each, 2.4%).

Patients who developed clinically significant postoperative complications required postoperative blood transfusion in high percent (6 patients, 75%), while no patients from the group without complications needed a blood transfusion (*P* < 0.001).

Overall median hospital stay was 8 d (5–45 d) and was significantly higher for patients with clinically significant morbidity (25 d, range 8–45 d), compared with patients without complications (7 d, range 5–24 d)

( $P < 0.001$ ).

### Uni- and multivariate analysis of predictors of clinically relevant morbidity after SPDP

Univariate analysis identified male gender ( $P = 0.034$ ), increased BMI ( $P = 0.002$ ) and neuroendocrine pathology ( $P = 0.013$ ) as statistically significant risk factors. Furthermore, the multivariate analysis also included age, operative time and tumor diameter ( $P$ -values  $< 0.1$ ) (Table 1).

Multivariate analysis identified male gender [odds ratio (OR): 1.29, 95%CI: 1.07-1.55,  $P = 0.005$ ] and increased BMI (OR: 23.18, 95%CI: 1.72-310.96,  $P = 0.018$ ) as the only independent risk factors.

## DISCUSSION

Morbidity rates after SPDP without splenic vessels removal vary between 18% and 71%<sup>[10,28]</sup> and pancreatic fistula represents the most frequent complication: 7.6%-40%<sup>[28]</sup>. Furthermore, pancreatic fistula is considered a risk factor for compromised patency of spleen vessels after SPDP and late complications such left portal hypertension<sup>[29]</sup>.

Severe or clinically relevant complications after SPDP occur in 11.6%-18% of patients<sup>[8,21,24]</sup>. In the present cohort overall, clinically relevant morbidity and pancreatic fistula rates were 34.1%, 19.5%, and 31.7%, respectively.

Male gender<sup>[3,15,21]</sup> or increased BMI<sup>[3,14,15,18,24]</sup> were previously found independent risk factors of overall morbidity or pancreatic fistulae in few studies including all together DP with and without splenectomy. However, most studies failed to demonstrate any correlation of male gender<sup>[2,6-8,14,16-20,22-26]</sup> or increased BMI<sup>[2,8,16,17,19,21-23,25,26]</sup> with morbidity after DP. In the present study, male gender and increased BMI was found the only independent risk factors for clinically relevant morbidity after SPDP.

Age<sup>[2,3,6-8,13,15-18,20-22,25,26]</sup>, diabetes<sup>[3,6,8,13-16,19,23,25,26]</sup>, chronic pancreatitis<sup>[2,6,15,16,19,26]</sup>, American Society of Anesthesiologists (ASA) score<sup>[3,13,14,16,18,20,23,24]</sup>, blood loss<sup>[7,12-14,17,19,20,22,26]</sup>, operative time<sup>[2,3,12,13,15,19,21,22,26]</sup>, soft pancreas texture<sup>[14,22,23]</sup>, pathology<sup>[3,6-8,13,15,18,21-26]</sup> and type of approach (open or minimally invasive)<sup>[14,15]</sup> does not appear to be independent risk factors of overall morbidity or pancreatic fistulae after DP in most published studies, as it was the case in the present study.

However, few studies identified age<sup>[14,19,23]</sup>, chronic pancreatitis<sup>[13]</sup>, ASA score<sup>[8]</sup>, increased operative time<sup>[7,16,20]</sup>, blood loss<sup>[18,21,23,25]</sup>, soft pancreas texture<sup>[18]</sup>, neuroendocrine pathology<sup>[14]</sup> and laparoscopic approach<sup>[25]</sup> as independent risk factor for postoperative complications after DP.

It is worth mentioning that a meta-analysis has shown that laparoscopic DP has been associated with significantly decreased morbidity rates, compared with

the open approach<sup>[30]</sup>.

Several studies have associated neuroendocrine pathology with an increased risk of postoperative complications (including pancreatic fistulae) after pancreatic resections<sup>[14,18,31]</sup>. In the present study patients with neuroendocrine pathology have had increased risk of clinically relevant complications only in univariate analysis.

Nevertheless, a recent meta-analysis has shown that soft pancreas texture, increased BMI, blood loss or operative time are high-risk factors for pancreatic fistulae occurrence after DP<sup>[32]</sup>.

The present study also explored the potential predictive value of surrogates of inflammatory markers such as the neutrophil-to-lymphocyte ratio or platelet-to-lymphocyte ratio for morbidity after SPDP but failed to identify any correlation. These inflammatory markers were previously demonstrated to predict morbidity after major surgery such as liver resections<sup>[33]</sup> but not for pancreatic resections<sup>[34]</sup>.

The results of the present study should be regarded with caution because there are a limited number of patients.

In conclusion, male gender and increased body mass index are independently associated with increased risk of clinically relevant morbidity after SPDP. Thus, the results of the present study may assist a surgeon in clinical decision-making to better select patients suitable for SPDP.

## ARTICLE HIGHLIGHTS

### Research background

Many studies have explored potential predictors of morbidity after distal pancreatectomy. All the reported studies included both patients with and without spleen preservation. Some studies have suggested that there might be some differences in outcomes between the patients with distal pancreatectomy, with and without spleen preservation. To date, there is no study to explore potential predictors of postoperative morbidity in a group of patients with only spleen-preserving distal pancreatectomy. The aim of the study is to identify risk factors for clinically relevant morbidity after spleen-preserving distal pancreatectomy in a single surgical center experience.

### Research motivation

Morbidity after spleen-preserving distal pancreatectomy remains a significant concern and preservation of the spleen during distal pancreatectomy might sometimes be technically challenging. Thus, identification of potential predictors of clinically relevant morbidity in patients with spleen-preserving distal pancreatectomy would be of interest for clinical practice to better select the patients for this type of surgical procedure.

### Research objectives

The primary objective of the study was to explore potential predictors of clinically relevant morbidity after spleen-preserving distal pancreatectomy in a single surgical center experience.

### Research methods

It was a retrospective analysis reviewing the data of 41 consecutive patients who underwent spleen-preserving distal pancreatectomy with spleen vessel preservation between 2000 and 2015 in our Department of Surgery. Appropriate statistical tests were used to compare potential risk factors between the groups

of patients with and without clinically relevant morbidity after spleen-preserving distal pancreatectomy, in uni- and multivariate analyses.

### Research results

To the best of our knowledge, this is the first study exploring potential predictors of clinically relevant morbidity in patients with spleen-preserving distal pancreatectomy. The study found male gender and increased body mass index as independent predictors of clinically relevant morbidity after spleen-preserving distal pancreatectomy.

### Research conclusions

This is the first study that identifies male gender and increased body mass index as risk factors of clinically relevant morbidity in a group of patients with only spleen-preserving distal pancreatectomy. Patient-related factors such as gender and body mass index should be taken into consideration when a spleen-preserving distal pancreatectomy is proposed. The data provided in the present study can be used for clinical decision-making, particularly when preservation of the spleen during distal pancreatectomy is technically demanding.

### Research perspectives

Preoperative evaluation of patients suitable for a spleen-preserving distal pancreatectomy is of utmost importance. The impact of male gender and body mass index on postoperative outcome after spleen-preserving distal pancreatectomy remains to be explored in future studies including more substantial number of patients.

## REFERENCES

- 1 **Popescu I**, Dumitrașcu T. [Pancreatoduodenectomy--past, present and future]. *Chirurgia* (Bucur) 2011; **106**: 287-296 [PMID: 21853734]
- 2 **Diener MK**, Seiler CM, Rossion I, Kleeff J, Glanemann M, Butturini G, Tomazic A, Bruns CJ, Busch OR, Farkas S, Belyaev O, Neoptolemos JP, Halloran C, Keck T, Niedergethmann M, Gellert K, Witzigmann H, Kollmar O, Langer P, Steger U, Neudecker J, Berrevoet F, Ganzer A, Heiss MM, Luntz SP, Bruckner T, Kieser M, Büchler MW. Efficacy of stapler versus hand-sewn closure after distal pancreatectomy (DISPACT): a randomised, controlled multicentre trial. *Lancet* 2011; **377**: 1514-1522 [PMID: 21529927 DOI: 10.1016/S0140-6736(11)60237-7]
- 3 **Kelly KJ**, Greenblatt DY, Wan Y, Rettammel RJ, Winslow E, Cho CS, Weber SM. Risk stratification for distal pancreatectomy utilizing ACS-NSQIP: preoperative factors predict morbidity and mortality. *J Gastrointest Surg* 2011; **15**: 250-259, discussion 259-discussion 261 [PMID: 21161427 DOI: 10.1007/s11605-010-1390-9]
- 4 **Lee MK 4<sup>th</sup>**, Lewis SW, Strasberg SM, Hall BL, Allendorf JD, Beane JD, Behrman RW, Callery MP, Christein JD, Drebin JA, Epelboym I, He J, Pitt HA, Winslow E, Wolfgang C, Vollmer CM Jr. Defining the post-operative morbidity index for distal pancreatectomy. *HPB* (Oxford) 2014; **16**: 915-923 [PMID: 24931404 DOI: 10.1111/hpb.12293]
- 5 **Lee SY**, Allen PJ, Sadot E, D'Angelica MI, DeMatteo RP, Fong Y, Jarnagin WR, Kingham TP. Distal pancreatectomy: a single institution's experience in open, laparoscopic, and robotic approaches. *J Am Coll Surg* 2015; **220**: 18-27 [PMID: 25456783 DOI: 10.1016/j.jamcollsurg.2014.10.004]
- 6 **Nathan H**, Cameron JL, Goodwin CR, Seth AK, Edil BH, Wolfgang CL, Pawlik TM, Schulick RD, Choti MA. Risk factors for pancreatic leak after distal pancreatectomy. *Ann Surg* 2009; **250**: 277-281 [PMID: 19638926 DOI: 10.1097/SLA.0b013e3181ae34be]
- 7 **Reeh M**, Nentwich MF, Bogoevski D, Koenig AM, Gebauer F, Tachezy M, Izbicki JR, Bockhorn M. High surgical morbidity following distal pancreatectomy: still an unsolved problem. *World J Surg* 2011; **35**: 1110-1117 [PMID: 21387132 DOI: 10.1007/s00268-011-1022-x]
- 8 **Tseng WH**, Canter RJ, Bold RJ. Perioperative outcomes for open distal pancreatectomy: current benchmarks for comparison. *J Gastrointest Surg* 2011; **15**: 2053-2058 [PMID: 21938560 DOI: 10.1007/s11605-011-1677-5]
- 9 **He Z**, Qian D, Hua J, Gong J, Lin S, Song Z. Clinical comparison of distal pancreatectomy with or without splenectomy: a meta-analysis. *PLoS One* 2014; **9**: e91593 [PMID: 24682038 DOI: 10.1371/journal.pone.0091593]
- 10 **Pendola F**, Gadde R, Ripat C, Sharma R, Picado O, Lobo L, Sleeman D, Livingstone AS, Merchant N, Yakoub D. Distal pancreatectomy for benign and low grade malignant tumors: Short-term postoperative outcomes of spleen preservation-A systematic review and update meta-analysis. *J Surg Oncol* 2017; **115**: 137-143 [PMID: 28133818 DOI: 10.1002/jso.24507]
- 11 **Shi N**, Liu SL, Li YT, You L, Dai MH, Zhao YP. Splenic Preservation Versus Splenectomy During Distal Pancreatectomy: A Systematic Review and Meta-analysis. *Ann Surg Oncol* 2016; **23**: 365-374 [PMID: 26493758 DOI: 10.1245/s10434-015-4870-z]
- 12 **Bilimoria MM**, Cormier JN, Mun Y, Lee JE, Evans DB, Pisters PW. Pancreatic leak after left pancreatectomy is reduced following main pancreatic duct ligation. *Br J Surg* 2003; **90**: 190-196 [PMID: 12555295 DOI: 10.1002/bjs.4032]
- 13 **Distler M**, Kersting S, Rückert F, Kross P, Saeger HD, Weitz J, Grützmann R. Chronic pancreatitis of the pancreatic remnant is an independent risk factor for pancreatic fistula after distal pancreatectomy. *BMC Surg* 2014; **14**: 54 [PMID: 25127883 DOI: 10.1186/1471-2482-14-54]
- 14 **Ecker BL**, McMillan MT, Allegrini V, Bassi C, Beane JD, Beckman RM, Behrman SW, Dickson EJ, Callery MP, Christein JD, Drebin JA, Hollis RH, House MG, Jamieson NB, Javed AA, Kent TS, Kluger MD, Kowalsky SJ, Maggino L, Malleo G, Valero V 3rd, Velu LKP, Watkins AA, Wolfgang CL, Zureikat AH, Vollmer CM Jr. Risk Factors and Mitigation Strategies for Pancreatic Fistula After Distal Pancreatectomy: Analysis of 2026 Resections From the International, Multi-institutional Distal Pancreatectomy Study Group. *Ann Surg* 2017; Epub ahead of print [PMID: 28857813 DOI: 10.1097/SLA.0000000000002491]
- 15 **Ferrone CR**, Warshaw AL, Rattner DW, Berger D, Zheng H, Rawal B, Rodriguez R, Thayer SP, Fernandez-del Castillo C. Pancreatic fistula rates after 462 distal pancreatectomies: staplers do not decrease fistula rates. *J Gastrointest Surg* 2008; **12**: 1691-7; discussion 1697-8 [PMID: 18704597 DOI: 10.1007/s11605-008-0636-2]
- 16 **Goh BK**, Tan YM, Chung YF, Cheow PC, Ong HS, Chan WH, Chow PK, Soo KC, Wong WK, Ooi LL. Critical appraisal of 232 consecutive distal pancreatectomies with emphasis on risk factors, outcome, and management of the postoperative pancreatic fistula: a 21-year experience at a single institution. *Arch Surg* 2008; **143**: 956-965 [PMID: 18936374 DOI: 10.1001/archsurg.143.10.956]
- 17 **Harris LJ**, Abdollahi H, Newhook T, Sauter PK, Crawford AG, Chojnacki KA, Rosato EL, Kennedy EP, Yeo CJ, Berger AC. Optimal technical management of stump closure following distal pancreatectomy: a retrospective review of 215 cases. *J Gastrointest Surg* 2010; **14**: 998-1005 [PMID: 20306151 DOI: 10.1007/s11605-010-1185-z]
- 18 **Hashimoto Y**, Traverso LW. After distal pancreatectomy pancreatic leakage from the stump of the pancreas may be due to drain failure or pancreatic ductal back pressure. *J Gastrointest Surg* 2012; **16**: 993-1003 [PMID: 22392088 DOI: 10.1007/s11605-012-1849-y]
- 19 **Hassenpflug M**, Hinz U, Strobel O, Volpert J, Knebel P, Diener MK, Doerr-Harim C, Werner J, Hackert T, Büchler MW. Teres Ligament Patch Reduces Relevant Morbidity After Distal Pancreatectomy (the DISCOVER Randomized Controlled Trial). *Ann Surg* 2016; **264**: 723-730 [PMID: 27455155 DOI: 10.1097/SLA.0000000000001913]
- 20 **Kleeff J**, Diener MK, Z'graggen K, Hinz U, Wagner M, Bachmann J, Zehetner J, Müller MW, Friess H, Büchler MW. Distal pancreatectomy: risk factors for surgical failure in 302 consecutive cases. *Ann Surg* 2007; **245**: 573-582 [PMID: 17414606 DOI: 10.1097/01.sla.0000251438.43135.fb]
- 21 **Malleo G**, Salvia R, Mascetta G, Esposito A, Landoni L, Casetti

- L, Maggino L, Bassi C, Butturini G. Assessment of a complication risk score and study of complication profile in laparoscopic distal pancreatectomy. *J Gastrointest Surg* 2014; **18**: 2009-2015 [PMID: 25238815 DOI: 10.1007/s11605-014-2651-9]
- 22 **Mendoza AS 3rd**, Han HS, Ahn S, Yoon YS, Cho JY, Choi Y. Predictive factors associated with postoperative pancreatic fistula after laparoscopic distal pancreatectomy: a 10-year single-institution experience. *Surg Endosc* 2016; **30**: 649-656 [PMID: 26091993 DOI: 10.1007/s00464-015-4255-1]
- 23 **Sahakyan MA**, Røsok BI, Kazaryan AM, Barkhatov L, Lai X, Kleive D, Ignjatovic D, Labori KJ, Edwin B. Impact of obesity on surgical outcomes of laparoscopic distal pancreatectomy: A Norwegian single-center study. *Surgery* 2016; **160**: 1271-1278 [PMID: 27498300 DOI: 10.1016/j.surg.2016.05.046]
- 24 **Seeliger H**, Christians S, Angele MK, Kleespies A, Eichhorn ME, Ischenko I, Boeck S, Heinemann V, Jauch KW, Bruns CJ. Risk factors for surgical complications in distal pancreatectomy. *Am J Surg* 2010; **200**: 311-317 [PMID: 20381788 DOI: 10.1016/j.amjsurg.2009.10.022]
- 25 **Sell NM**, Pucci MJ, Gabale S, Leiby BE, Rosato EL, Winter JM, Yeo CJ, Lavu H. The influence of transection site on the development of pancreatic fistula in patients undergoing distal pancreatectomy: A review of 294 consecutive cases. *Surgery* 2015; **157**: 1080-1087 [PMID: 25791028 DOI: 10.1016/j.surg.2015.01.014]
- 26 **Sierzega M**, Niekowal B, Kulig J, Popiela T. Nutritional status affects the rate of pancreatic fistula after distal pancreatectomy: a multivariate analysis of 132 patients. *J Am Coll Surg* 2007; **205**: 52-59 [PMID: 17617332 DOI: 10.1016/j.jamcollsurg.2007.02.077]
- 27 **Dumitrascu T**, Scarlat A, Ionescu M, Popescu I. Central pancreatectomy versus spleen-preserving distal pancreatectomy: a comparative analysis of early and late postoperative outcomes. *Dig Surg* 2012; **29**: 400-407 [PMID: 23128466 DOI: 10.1159/000343927]
- 28 **Dumitrascu T**, Dima S, Stroescu C, Scarlat A, Ionescu M, Popescu I. Clinical value of spleen-preserving distal pancreatectomy: a case-matched analysis with a special emphasis on the postoperative systemic inflammatory response. *J Hepatobiliary Pancreat Sci* 2014; **21**: 654-662 [PMID: 24799122 DOI: 10.1002/jhbp.110]
- 29 **Yoon YS**, Lee KH, Han HS, Cho JY, Ahn KS. Patency of splenic vessels after laparoscopic spleen and splenic vessel-preserving distal pancreatectomy. *Br J Surg* 2009; **96**: 633-640 [PMID: 19434700 DOI: 10.1002/bjs.6609]
- 30 **Venkat R**, Edil BH, Schulick RD, Lidor AO, Makary MA, Wolfgang CL. Laparoscopic distal pancreatectomy is associated with significantly less overall morbidity compared to the open technique: a systematic review and meta-analysis. *Ann Surg* 2012; **255**: 1048-1059 [PMID: 22511003 DOI: 10.1097/SLA.0b013e318251ee09]
- 31 **Atema JJ**, Jilesen AP, Busch OR, van Gulik TM, Gouma DJ, Nieveen van Dijkum EJ. Pancreatic fistulae after pancreatic resections for neuroendocrine tumours compared with resections for other lesions. *HPB (Oxford)* 2015; **17**: 38-45 [PMID: 25041879 DOI: 10.1111/hpb.12319]
- 32 **Peng YP**, Zhu XL, Yin LD, Zhu Y, Wei JS, Wu JL, Miao Y. Risk factors of postoperative pancreatic fistula in patients after distal pancreatectomy: a systematic review and meta-analysis. *Sci Rep* 2017; **7**: 185 [PMID: 28298641 DOI: 10.1038/s41598-017-00311-8]
- 33 **Dumitrascu T**, Brasoveanu V, Stroescu C, Ionescu M, Popescu I. Major hepatectomies for perihilar cholangiocarcinoma: Predictors for clinically relevant postoperative complications using the International Study Group of Liver Surgery definitions. *Asian J Surg* 2016; **39**: 81-89 [PMID: 26103932 DOI: 10.1016/j.asjsur.2015.04.007]
- 34 **Solaini L**, Atmaja BT, Watt J, Arumugam P, Hutchins RR, Abraham AT, Bhattacharya S, Kocher HM. Limited utility of inflammatory markers in the early detection of postoperative inflammatory complications after pancreatic resection: Cohort study and meta-analyses. *Int J Surg* 2015; **17**: 41-47 [PMID: 25779213 DOI: 10.1016/j.ijssu.2015.03.009]

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