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Original article

Surgical approach and postoperative outcomes after left pancreatectomy (Spandispan prospective project)

Tipo de abordaje y complicaciones postoperatorias tras pancreatectomia izquierda (estudio prospectivo Spandispan)

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ABSTRACT

Introduction: Left pancreatectomy (LP) is a surgical technique with low mortality but high morbidity (30%), particularly pancreatic fistula (PF). Its minimally invasive (MI) approach has become popular, but its implementation in Spain remains unknown. We present a national multicentre study on LP to determine morbidity-mortality, PF incidence, and the percentage of MI approach.
Methods: A descriptive, observational, prospective, and multicentre study on LP. Study period: 02/01/2022–02/28/2023. Inclusion criteria: Elective LP. Exclusion criteria: LP following pancreaticoduodenectomy, with celiac trunk resection, or performed as an emergency. Major complications (MC): Clavien–Dindo ≥ IIIA.
Results: A total of 41 centres participated, including 313 patients. Women accounted for 53.4%. Mean age: 63.4 years. The most common indications for LP were neuroendocrine tumours (32.6%), pancreatic adenocarcinoma (28%), and IPMN (15.7%). The surgical approach was laparoscopic (53%), open (30.7%), and robotic (16.3%). The most frequently performed techniques were distal splenopancreatectomy (72.2%) and radical antegrade modular pancreatosplenectomy (RAMPS) (14.4%). Complications occurred in 57.5% of patients, with 21.1% classified as MC. The most frequent was PF (38.3%), with 52.5% of PFs classified as B–C (20.1% of the total). The 90-day mortality rate was 1.6%. The use of a protective sleeve and the absence of drains were associated with the absence of PF in multivariate analysis.
Conclusion: In our series, the MI approach was significantly higher than expected (70%). The MC rate was 21.1%, and mortality was 1.6%, confirming that LP is a procedure with low mortality but high morbidity.

RESUMEN

Palabras clave:
Pancreatectomía izquierda
Pancreatectomía distal
FP
Resultados

Introducción: La pancreatectomía izquierda (PI) es una técnica quirúrgica de baja mortalidad. pero alta morbilidad (30%), especialmente la fístula pancreática (FP). Su realización por abordaje mínimamente invasivo (MI) se ha popularizado, pero su implantación en España es desconocida. Presentamos un estudio multicéntrico nacional de PI para determinar morbi-mortalidad, FP y porcentaje de abordaje MI.
Métodos: Estudio descriptivo, observacional, prospectivo y multicéntrico de PI. Periodo estudio: 1/02/2022–28/02/2023. Criterios de inclusión: PI realizada de forma programada. Criterios de exclusión: PI tras duodenopancreatectomía cefálica, con resección tronco celiaco o urgente. Complicaciones mayores (CM): Clavien–Dindo ≥ IIIA.
Resultados: Participaron 41 centros, incluyendo 313 pacientes. El 53,4% fueron mujeres. Edad media: 63,4 años. La PI se realizó más frecuentemente por tumor neuroendocrino (32,6%), adenocarcinoma pancreático (28%) y tumor Papilar Mucinoso Intraductal (TPMI) (15,7%). El abordaje fue laparoscópico (53%), laparotómico (30,7%) y robótico (16,3%). Las técnicas más frecuentes realizadas fueron esplenopancreatectomía corporocaudal (72,2%) y esplenopancreatectomía radical modular anterógrada (RAMPS)(14,4%). El 57,5% de los pacientes presentaron complicaciones, y la tasa de CM fue 21,1%. La complicación más frecuente fue la FP (38,3%). Un 52.5% de las FP fueron B–C(20.1% del total). La mortalidad a 90 días fue del 1,6%. El uso de funda protectora y la no utilización de drenajes se relacionó en el análisis multivariante con la ausencia de FP.
Conclusión: En nuestra serie el abordaje MI es muy superior al esperado (70%). La tasa de CM es del 21,1% y la mortalidad del 1.6%, confirmando que la PI es una intervención de baja mortalidad y alta morbilidad.

Introduction

Left pancreatectomy (LP), with or without splenectomy, is the surgical technique used in the treatment of benign and malignant tumours located in the body and tail of the pancreas. Fewer patients undergo LP than those treated for tumours in the head of the pancreas because corporocaudal lesions have a lower incidence and present clinically in more advanced stages, which often prevents resection.[1]

It is a procedure with low mortality, but it carries a high morbidity due to the high rate of postoperative PF (>30%).[2] The development and implementation of the minimally invasive (MI) approach (laparoscopic/robotic), compared to the laparotomy, represented a true revolution in pancreatic surgery and is now considered the approach of choice.[3] Although the experience gained with the MI approach suggested a decrease in postoperative complications, hospital stay, and associated costs, multiple studies[4,5] show similar morbidity between laparoscopy and laparotomy. Furthermore, implementation is lower than expected, especially in malignant pathologies.[6–9]

There is extensive published literature on LP, case series, comparative studies between approaches, and even some meta-analyses.[10–12] However, none of these studies address the usual clinical practice of the centres, including the surgeon's decision regarding the surgical approach, their capacity, and management in minimally invasive (MI) surgery.

We conducted this multicentre, prospective study on LP with the primary objective of evaluating the results of routine clinical practice in Spain, focusing on 90-day postoperative complications, particularly the PF rate, and whether the approach influences their occurrence.

Methods

Population

A descriptive, observational, multicentre, prospective snapshot study was conducted. All patients undergoing LP at the 41 participating centres were included, from February 1, 2022, to January 31, 2023. Inclusion criteria were: LP procedures for both benign and malignant lesions during the described period, and patients over 18 years of age. Urgent procedures, celiac trunk resections, or post-pancreatic duodenectomy procedures were excluded (Fig. 1). The study was conducted in accordance with the Declaration of Helsinki (2013) and with the approval of the Ethics Committee for Drug Research of the Department of Health 19 (Ref. CEIm: 2021-078). The work was conducted in accordance with the STROBE guidelines.[13]

The project was distributed to national healthcare centres via email if they had participated in the AEC/IHPBA Pancreatic Surgery Survey, published in 2019 in order to determine the characteristics of Pancreatic Surgery Units in Spain[14] Each centre selected a principal investigator responsible for data collection and communication with the study coordinator. A REDCap database was created, and complete data was mandatory for patient inclusion. Data were collected prospectively after informing the patient about the purpose of the project and obtaining their informed consent. Complications were recorded using medical and nursing notes.

Variables

Study variables included demographic data: body mass index (BMI); comorbidities; medical and surgical history; Charlson score

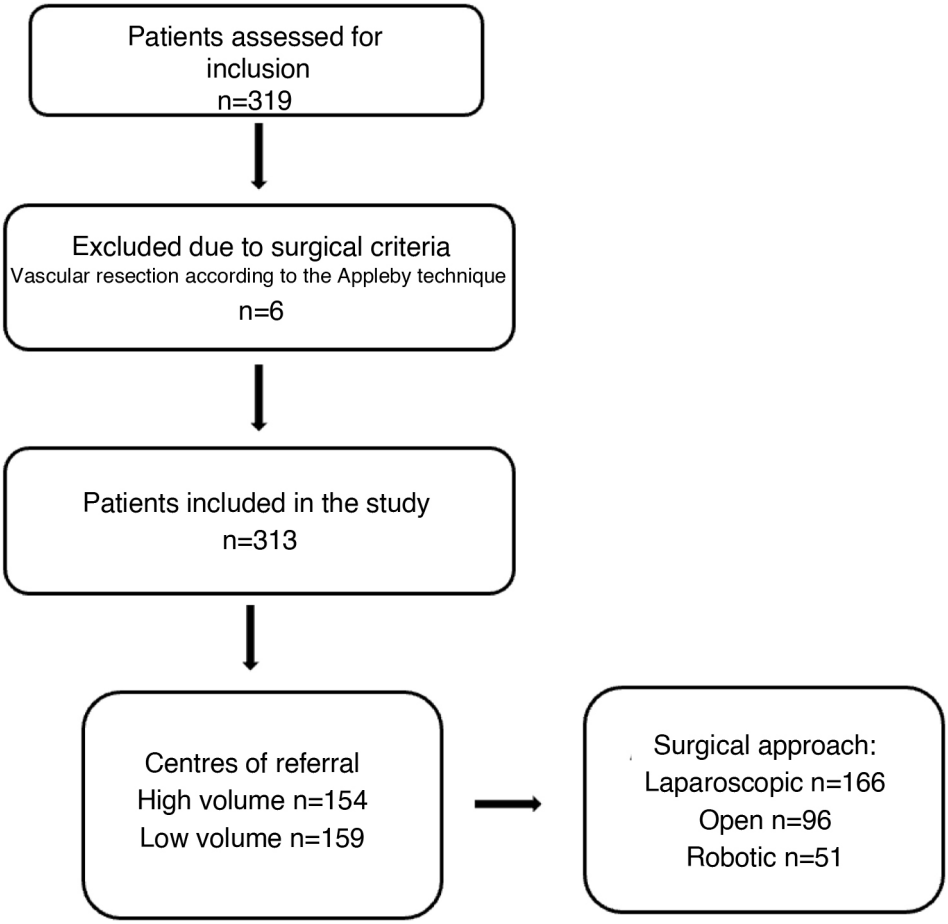

Fig. 1. Flow diagram of patient selection in the study.

and American Society of Anaesthesiologists (ASA) classification[15] surgical approaches (open/laparoscopic/robotic); conversion defined as the change from MI to laparotomy; spleen preservation and the technique used (Warshaw or Kimura); associated organ resection defined as the resection of at least one additional organ excluding the spleen; intraoperative blood loss and transfusion; and postoperative data: morbidity and mortality, with complications assessed at 90 days using the Clavien-Dindo classification, considering major complications (MC) those defined as ≥ IIIA Clavien–Dindo[16] and the Comprehensive Complication Index (CCI).

Complications specific to pancreatic surgery (delayed gastric emptying, bleeding, and pancreatic fistula) were defined according to the International Study Group on Pancreatic Surgery (ISGPS) guidelines.[17–19] Resection margins were classified according to the Royal College of Pathologists definitions: R0 (tumour margin ≥ 1 mm), R1 (tumour margin < 1 mm), and R2 (macroscopically positive margin).[20] We staged invasive tumours according to the TNM classification (8th ed.).[21] The recorded histological data were tumour size, resection margin (R), and the size of the resected pancreas. Reoperation was defined as any unscheduled surgical, endoscopic, or radiological intervention related to pancreatic resection. Hospital stay (in days) was recorded, as well as readmissions during the first 90 days after surgery. HPB units were defined as high volume if they performed more than 10 PD per year according to the criteria of Van der Heijde et al.[22]

Statistical analysis

Data analysis was performed using SPSS® statistical software. Proportions were calculated for qualitative variables, and measures of central tendency (mean) and measures of dispersion (standard deviation) were calculated for quantitative variables. The following tests were used for bivariate analysis: for variables with a normal distribution, the chi-square test and the Student t-test; and for variables that did not follow a normal distribution, the Mann–Whitney test and the Kruskal–Wallis test. Logistic regression analysis was performed to determine which factors could influence the development of both MC and PF. Variables that reached statistical significance in the univariate logistic regression analysis were included in the multivariate logistic regression analysis. Odds ratios with their 95% confidence limits were calculated. The statistical significance level used for contrasts was 5% ($p < .05$).

Results

Demographic and preoperative data

A total of 313 patients who underwent LP (Table 1) were included in the study period. They were operated on in high (126) and low volume (187) centres. 46.6% were men and 53.4% were women, with a mean age of 63.37 ± 13.33 years. After pre-anaesthetic assessment, the patients were mostly ASA-II (47.6%), with the rest being ASA-III (45.05%) and ASA-I (5.43%). When assessing ASA based on the centre's volume, we observed that, with statistically significant results ($p < .038$), high volume centres had a higher percentage of patients with ASA III anaesthetic risk (51.6%), while low volume centres had more patients with ASA I and IV (6.95% and 3.21%, respectively). A total of 75.7% of the patients had comorbidities, with hypertension (40.9%) and diabetes mellitus (26.5%) being the most common. The mean BMI recorded was 27.45 ± 6.04, and the mean Charlson Index was 13.62 ± 21.94.

The tumour was most frequently located in the tail of the pancreas (40.6%) and the body of the pancreas (27.5%). The most frequently suspected diagnosis was neuroendocrine tumour (32.6%), followed by adenocarcinoma (28%); intraductal papillary mucinous tumour

Table 1
Pre, intra and postoperative results.

Variables	Total
Patients	313
Age	63.36
Gender n (%)	
Man	146 (46.6%)
Woman	167 (53.4%)
Centre volume	
High	126 (40.2%)
Low	187 (59.7%)
ASA n (%)	
I	17 (5.4%)
II	149 (47.6%)
III	141 (45%)
IV	6 (1.9%)
BMI	27.45
Comorbidities	
Yes	234 (75.7%)
No	75 (24.3%)
Charlson index	4.4
Surgical approach	
Open	96 (30.7%)
Laparoscopic	166 (53.0%)
Robotic	51 (16.3%)
Conversion	
Yes	23 (10.6%)
No	194 (89.4%)
Surgical technique	
Corporocaudal splenopancreatoctomy	226 (72.2%)
Splenic preservation techniques*	42 (13.42%)
RAMPS	45 (14.4%)
Min time in surgery	247.07
Blood loss ml	218.58
Intraoperative transfusion	
Yes	20 (6.4%)
No	293 (93.6%)
Resection of other organs	
Yes	90 (28.8%)
No	223 (71.2%)
Surgical drainage	
Yes	282 (90.1%)
No	31 (9.9%)
CD I complication	86 (27.5%)
CD II complication	59 (18.8%)
CD IIIA complication	48 (15.3%)
CD IIIB complication	14 (4.5%)
CD IVA complication	8 (2.6%)
CD IVB complication	1 (.3%)
CD V complication	3 (1%)
Major complication	66 (21.1%)
CCI	13.62
Pancreatic fistula	120 (38.3%)
Pancreatic fistula grades	
Grade A	57 (47.5%)
Grade B	53 (44.2%)
Grade C	10 (8.3%)
Delayed gastric emptying	9 (2.9%)
Delayed gastric emptying grades	
GradE A	6 (66.7%)
GradE B	3 (33.3%)
Haemorrhage	17 (5.4%)
Haemorrhage grades	
Grade A	4 (23.5%)
Grade B	10 (58.8%)
Grade C	3 (17.6%)
Reintervention	26 (8%)
Radiology	5 (1.6%)
Endoscopic	5 (1.6%)
Surgical	22 (7%)
Resection margin	
R0	287 (92%)
R1	24 (7.7%)
R2	1 (.3%).
Death on admission	3 (1%)
Death at 90 days	5 (1.6%)
Hospital stay	10.59
Readmission	69 (22%)

* Splenic preservation techniques: *Kimura technique and Warshaw technique.*

(IPMTU) (15.7%); mucinous cystic neoplasm (10.2%); serous cystadenoma (2.6%); pancreatic metastasis (2.6%); solid pseudopapillary tumour (1.9%), and pancreatic pseudocyst (.6%).

Surgical data

Fifty-three percent of patients underwent laparoscopic surgery, 30.7% underwent open surgery, and 16.3% underwent robotic surgery. The most common surgical technique was left pancreatectomy (72.2%), followed by radical antegrade modular pancreatic splenopancreatectomy (RAMPS) (14.4%). The conversion rate for the MI approach in the series was 7.3%.

In the study of the type of approach according to the surgical technique (Table 2), the laparoscopic approach was the most commonly used, both in IP (118 cases), spleen-preserving techniques (27 cases), and RAMPS (21 cases). Furthermore, when examining the distribution of the type of approach based on the surgical techniques used, statistically significant differences were found (p = .008).

The consistency of the pancreas was described as hard and soft in 130 and 183 patients, respectively. Among the different options for sectioning the stump, we found the use of staplers in 85.3% of patients, followed by suturing in 8.3%, and energy systems in 6.4% of cases. In 51.4%, the staplers used reinforcement sleeves. After sectioning, the stump was protected with epiploplasty or sealant in 17 (5.4%) and 89 patients (28.4%).

After the procedure, 282 patients had surgical drains; the mean in our sample was 1.01 ± 0.467. The mean operative time was 247 min, the blood loss recorded in the database was 218 ml, and 20 patients (6.4%) required intraoperative transfusion.

Postoperative data

Postoperatively, 180 patients (57.5%) experienced complications; 21.1% of these patients had MC. The ICC was calculated, yielding a mean of 13.6. The most frequent complication was PF in 38.3% of patients, with the following grades: biochemical fistula (47.5%), B (44.2%), and C (8.3%). 20.1% of patients had type B–C PF. The mean duration of PF was 23.67 ± 24.11 days. Among other complications specific to LP, 2.9% experienced delayed gastric emptying and 5.4% experienced post-pancreatectomy haemorrhage.

We found no statistically significant differences in the occurrence of pancreatic fistula (PF) based on the surgical approaches used (p = .219). We also compared the incidence of MC according to the type of surgical approach, observing the following distribution: 33 (50%) patients with the laparoscopic approach had MC, followed by 25 patients (38%) with the open approach, and 8 patients (12%) with the robotic approach, with no statistically significant differences (p = 0.293) (Tables 3 and 4).

The reoperation and readmission rates were 8% and 22%. When comparing surgical approaches, we found no differences in the readmission rate (23.3% MI vs. 19.8% open, p = .813), the 90-day mortality rate (p = .258), or the mortality rate during admission (p = .522). However, the results for hospital stay were significant depending on the surgical approach used (9.42 days laparoscopic vs.

Table 2
Cross-tabulation between surgical approach and surgical techniques.

Surgical techniques	Surgical approaches			*p*
	Open	Laparoscopic	Robotic	.008*
Corporocaudal splenopancreatoctomy	74 (32.7%)	118 (52.2%)	34 (15.0%)	
Splenic preservation technique*	3 (7.14%)	27 (64.28%)	12 (28.57%)	
RAMPS	19 (42.2%)	21 (46.7%)	5 (11.1%)	

* Splenic preservation techniques: *Kimura technique and Warshaw technique.*

Table 3
Relationship between the major complication variable and the variables under study.

	Yes major complication Mean ± standard Deviation/ n (%)	No major complication Mean ± standard Deviation/ n (%)	*p*
Age	61.86 ± 13.01	63.78 ± 13.41	.211
Sex (Man/Woman)	32/34(48.5%/51.5%)	114/133(46.2%/53.8%)	.736
BMI	28.54 ± 4.68	27.16 ± 6.33	.092
Anaesthetic risk (ASA)			.976
I	3 (4.5%)	14 (5.7%)	
II	32(48.5%)	117 (47.4%)	
III	30 (45.5%)	111 (44.9%)	
IV	1 (1.5%)	5 (2%)	
Charlson index	5.48 ± 11.85	4.19 ± 5.37	.423
Comorbidities	52 (80%)	182 (74.6%)	.366
Previous hepatic surgery	3 (4.5%)	1 (.4%)	.031*
Tumour size in images (mm)	41.83 ± 26.87	33.29 ± 31.24	.001*
Surgical approach			.293
Open	25 (37.9%)	71 (28.7%)	
Laparoscopic	33 (50%)	133 (53.8%)	
Robotic	8 (12.1%)	43 (17.4%)	
Conversion	4 (9.8%)	19 (10.8%)	0.846
Surgical technique			0.604
Corporocaudal splenopancreatectomy	52 (58.8%)	174 (70.4%)	
Kimura technique	6 (9.1%)	29 (11.7%)	
Warshaw technique	1 (1.5%)	6 (2.4%)	
RAMPS	7 (10.6%)	38 (15.4%)	
SeALANT	28 (42.4%)	61 (24.7%)	.005*
Operating time (min)	261.97 ± 97.96	243 ± 88.94	.138
Blood loss (ml)	312.80 ± 365.02	193 ± 248.28	.001*
Intraoperative transfusion	8 (12.1%)	12 (4.9%)	.032*

Table 4
Relationship between the pancreatic fistula variable and the variables under study.

	Yes pancreatic fistula Mean ± standard Deviation/ n (%)	No pancreatic fistula Mean ± standard Deviation/ n (%)	*p*
AGE	62.58 ± 12.49	63.87 ± 13.84	.223
Sex (MAN/WOMAN)	65/55(54.2%/45.8%)	81/112(42%/58%)	.037
BMI	28.88 ± 6.89	26.56 ± 5.28	.000
Anaesthetic risk (ASA)			.482
I	7 (5.8%)	10 (5.2%)	
II	53 (44.2%)	96 (49.7%)	
III	59 (49.2%)	82 (42.5%)	
IV	1 (.8%)	5 (2.6%)	
Charlson index	4,70 ± 8.97	4.31 ± 5.95	.915
Comorbidities	96 (80%)	138 (73%)	.163
Tumour size in images (mm)	33.56 ± 24.85	36.04 ± 33.61	.984
Surgical approach			.219
Open	36 (30%)	60 (31.1%)	
Laparoscopic	59 (49.2%)	107 (55.4%)	
Robotic	25 (20.8%)	26 (13.5%)	
Conversion	9 (10.7%)	14 (10.5%)	.965
Surgical technique			.040*
Corporocaudal splenopancreatectomy	92 (76.7%)	134 (69.4%)	
Kimura technique	15 (12.5%)	20 (10.4%)	
Warshaw technique	4 (3.3%)	3 (1.6%)	
RAMPS	9 (7.5%)	36 (18.7%)	
Pancreas consistency			.664
Hard	48 (40%)	82 (42.5%)	
Soft	72 (60%)	111 (57.5%)	
Stump closure stapler	104 (86.7%)	174 (90.2%)	.341
Stump closure suture	14 (11.7%)	12 (6.2%)	.089
Stump closure energy system	11 (9.2%)	9 (4.7%)	.113
Sleeve on stapler	45 (43.3%)	98 (56.3%)	.035*
Epiploplasty	6 (5%)	11 (5.7%)	.791
Sealant	40 (33.3%)	49 (25.4%)	.130
Operating time (min)	248.63 ± 92.77	246.10 ± 90.24	.759
Blood loss (ml)	233.92 ± 214.43	209 ± 314.99	.003*
Intraoperative transfusion	8 (6.7%)	12 (6.2%)	.875
Surgical drains	116 (96.7%)	166 (86%)	.002*

Table 5
Univariate and multivariate analysis of major complications and pancreatic fistula.

	Univariate analysis OF MC		Multivariate analysis OF MC	
	OR (95% CI)	*p*	OR (95% CI)	*p*
Previous hepatic surgery	11.714 (1.198–114.53)	.034*	.002 (.000–2.282)	.082
Tumour size (mm) in images	1.008 (1.000–1.016)	.051	1.021 (.984–1.047)	.124
Sealant	2.247 (1.274–3.962)	.005*	2.182 (.364–13.00)	.393
Blood loss in ml	1.001 (1.000–1.002)	.005*	1.001 (1.000–1.002)	.079
Intraoperative transfusion	2.701 (1.056–6.912)	.038*	1.718 (.58–51.117)	.755
	Univariate analysis OF PF		Multivariate analysis OF PF	
	OR (95% IC)	*p*	OR (95% CI)	*p*
Male sex	1.634 (1.033–2.586)	.036*	1.544 (.916–2.600)	.103
BMI	1.072 (1.028–1.118)	.001*	1.051 (.971–1.139)	.216
Ramps surgical technique	.364 (.167–.792)	.011*	1.215 (.543–2.716)	.636
Sleeve on stapler	.591 (.362–.966)	.036*	.317 (.103–.974)	.045*
Blood loss in ml	1.00 (1.000–1.001)	.448	.999 (.997–1.001)	.212
Surgical drain	4.717 (1.607–13.841)	.005*	36.058 (3.32–391.53)	.001*

13 days open) ($p < .001$). The mortality rate during hospitalisation was 1%, while the 90-day mortality rate after surgery was 1.6%.

Logistic regression analysis of MC and PF

In the univariate analysis of the development of MC, we found that the following variables reached statistical significance (Table 5): history of previous liver surgery; sealant use; blood loss, and intraoperative transfusion. However, when performing the multivariate analysis, none reached statistical significance, and we were unable to demonstrate that any of the variables studied were related to the development of MC.

Regarding factors associated with the development of PF, univariate analysis demonstrated statistical significance for sex; BMI; RAMPS surgical technique; use of a stapler sheath, and surgical drain placement. This significance was maintained when multivariate analysis was performed on two variables: the use of a stapler sheath and surgical drain placement (Table 5). We can state that in our series, the use of a stapler sheath ($p = .045$; OR .317; 95% CI .103–.974) protects against the development of PF, whereas the use of surgical drains is associated with a higher risk of PF ($p = .001$; OR 36.572; 95% CI 4.772–280.307).

Analysis based on centre volume

Of the 313 patients treated, 126 were from high-volume centres (>10 left pancreatectomies/year) and 187 were from low- to medium-volume centres (≤10). Statistically significant differences

were found in ASA classification (51.6% vs 40.6% of ASA III patients in high-volume vs low-medium volume centres, p = .038), minimally invasive approach rate (76.9% vs 63.6%, p = .046), blood loss (150 ml [100;300] vs 100 ml [0.00;288], p = .003), major complication rate (14.4 vs 25.7%, p = .023), and clinically relevant fistula rate (B–C) (13.5% vs 24.6%, p = .024).

Discussion

On a national level, there are very few publications providing data on 90-day morbidity and mortality and the percentage of laparoscopic surgery in LP. This multicentre study included a large percentage of the units that perform pancreatic surgery in Spain, thus being able to recruit a significant sample size, providing detailed, representative, and reliable information on LP nationally. The data show that the percentage of MI surgery in LP was 70%; in other series from the United Kingdom and Norway, the figures for laparoscopic LP were 40% and 60%, respectively.[23–25] In the European multicentre study by Giani et al.[26] on LP performed using the MI approach, a laparoscopic LP rate of 81.9% and robotic LP rate of 18.1% was observed; in our series, the rate was 23.5%, which is quite remarkable considering the limited access to robotic surgery in Spain.

In surgery, one of the key factors is postoperative outcomes. The most common postoperative complication was PF in 38.4% of cases. Of patients with PF, the complication was grade B and grade C in 44.2% and 8.3%, respectively. The MC rate in this study was 21.1%. In other series,[26] the results are similar to those obtained, with a 25% MC rate and a PF rate ranging from 31% to 39%, even reaching 61% in some series conducted in high-volume centres.[27] This data is important because one of the weaknesses of multicentre studies can be the differences between centres. However, despite the participation of a large number of high- and low-volume hospitals, we obtained results similar to those published to date by other groups.

In the multicentre LEOPARD study, 108 patients with left-sided pancreatic lesions were included to compare the approaches performed. They concluded that the MI approach was associated with longer operations and less blood loss; however, there were no differences in the complication rate.[10] In our series, we also found no differences when comparing MC between the different approaches (p = .293).

We also observed no significant differences when relating PF to the type of surgical approach (p = .219). In the study by Mehrabi A et al.,[4] they conducted a systematic review and meta-analysis comparing the open approach with the laparoscopic approach, finding no differences in the PF rate between the two groups (p = .46). Chong E et al.,[28] in their review of 1,831 patients on the risk factors associated with PF, also found no significant differences in PF when comparing the MI approach with the open approach (p = .12).

It is noteworthy that in our study, we observed that the use of a stapler sheath for pancreatic transection provides statistically significant protection against developing postoperative PF. Therefore, those in whom the pancreas was not transcribed with a stapler sheath have a 3.15 times greater risk of developing PF. Even so, there is insufficient scientific evidence to recommend their routine use. Regarding the use of surgical drains, we observed that they pose a 36.57 times greater risk of developing PF, with statistically significant results, although with the limitation that only 10% of patients did not have a drain. Behrman et al.[29] studied 706 patients with IP with or without prophylactic abdominal drainage and observed a greater development of PF in those with a drain.

However, it was the multicentre randomised clinical trial PANDORINA that definitively demonstrated the safety of not leaving a drain after LP and that it is associated with a lower development of MCl.[27]

It is important to note that although this study did not focus specifically on centre volume, we observed that postoperative outcomes varied significantly by this variable. High-volume centres had a lower rate of major complications and a lower incidence of grade B–C pancreatic fistula compared with low-volume centres, consistent with recent studies linking centre volume with improved surgical outcomes.[30,31] Furthermore, these centres more frequently used minimally invasive techniques, such as laparoscopy and robotic surgery, which may have contributed to less blood loss and faster recovery[32] Although this was not a primary focus of our study, it reinforces the idea that centres with higher volume and experience may have improved postoperative outcomes, a factor to consider in future research on the morbidity and mortality and management of left pancreatectomy.

One of the main limitations of our study, common in multicentre studies, is the potential for selection or reporting bias due to the different surgical criteria and indications. Although this study shows a trend toward better outcomes in high-volume centres, it is important to note that it has not controlled for other factors that could also influence the results, such as the individual experience of the surgeons or the centre's infrastructure. However, our findings reinforce the idea that a higher volume of procedures may be associated with better postoperative outcomes. The quality of the outcome measure is limited by potential heterogeneity between centres (multimodal rehabilitation protocols, the existence of specialized units, the availability of robotic surgery), surgical indication, procedure execution, and postoperative management. Its strengths are its prospective nature, the inclusion of all possible approaches, and the participation of a large number of centres, which allows for obtaining representative and detailed information on the actual treatment of PIs nationwide.

To conclude, this study represents the first multicentre prospective series of left pancreatectomy (LP) performed in Spain. Left pancreatectomy, performed mostly via a minimally invasive approach, has a low mortality rate but significant morbidity, with pancreatic fistula being the most common complication. The use of a stapler sheath is associated with a lower incidence of this complication, while the placement of surgical drains appears to increase it. These findings could guide future surgical strategies to reduce postoperative morbidity. However, the study has limitations inherent to its observational design, such as the potential variability in surgical techniques between centres and the lack of randomisation, which should be taken into account when interpreting the results.

Declaration of competing interest

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