Original Article

Evaluation of central versus distal pancreatectomy in management of pancreatic body tumours: A combined retrospective and prospective study

Ali Salem, Amgad Fouad, Tarek Salah, Mohamed Elyamany and Mohamed El Dosoky

Gastroenterology Surgical Centre, Mansoura University, Egypt.

ABSTRACT

Background: Central pancreatectomy is a promising surgical option for patients with benign and low-grade neoplasms affecting the pancreatic body/neck region, as it preserves more pancreatic parenchyma than distal pancreatectomy. However, dealing with two pancreatic stumps carries an increased potential for pancreatic fistula. That is why we conducted this investigation to compare the previous two techniques (central vs. distal pancreatectomy) in patients with such neoplasms.

Patients and Methods: Seventy patients were enrolled in our combined prospective and retrospective trial. Group A included 35 central pancreatectomy patients, while Group B included 35 distal pancreatectomy patients.

Results: Central pancreatectomy was associated with a prolonged operative time compared to the distal procedure. Tumor size and pathology did not differ between the two groups. However, the length of the resected pancreatic tissue was shorter in Group A. Patients in the same group had longer ICU stays, hospitalization periods, and longer duration till oral intake. However, the incidence of pancreatic fistula was comparable between the two groups (22.9% vs. 25.7% in the two groups, respectively). Other complications, including hemorrhage and wound infection, did not differ between the two groups. Mortality occurred in only one patient in Group A due to secondary hemorrhage. Both endocrine and exocrine insufficiencies were more encountered after distal pancreatectomy compared to the central one.

Conclusion: Central pancreatectomy is associated with significantly better postoperative pancreatic endocrine and exocrine functions without increased complication rates compared to distal pancreatectomy.

Key Words: Central pancreatectomy, distal pancreatectomy, outcomes.

Received: 20 February 2024, **Accepted:** 2 March 2024, **Publish:** 7 July 2024

Corresponding Author: Mohamed El Dosoky, MD, Gastroenterology Surgical Centre, Mansoura University, Egypt. **Tel.:** +01002671119, **E-mail:** msdesoky@mans.edu.eg

ISSN: 1110-1121, July 2024, Vol. 43, No. 3: 876-884, © The Egyptian Journal of Surgery

INTRODUCTION

Benign and borderline pancreatic neoplasms are uncommon in the surgical practice, and they are usually managed by surgical resection[1]. When such tumors are diagnosed in the pancreatic body/neck region, they are usually treated by either distal pancreatectomy or enucleation based on lesion size and relation with the pancreatic duct[2].

Surgical and technical advances led to a significant decline in pancreatic resection-associated mortality (less than 3%). Nonetheless, postoperative morbidity remains high (18–52%[3]. Organ-sparing resections like enucleation and central pancreatectomy are suitable options for such neoplasms when they are located in the pancreatic body or neck[4]. By preserving more pancreatic parenchyma compared to classic extended resections (distal pancreatectomy), it is suggested to have less postoperative morbidity, especially metabolic consequences[5].

Central (mid or segmental) pancreatectomy was originally described by Guillemin and Bessot in 1957[6]. Later on, the procedure was applied for many benign and borderline neoplasms affecting the pancreatic neck/body[7]. That procedure has multiple advantages, including preservation of the pancreatic parenchyma, leading to a decreased incidence of postoperative new-onset diabetes[4]. Additionally, the preservation of the spleen guards against post-splenectomy complications[8,9].

However, pancreatic surgeons show some reluctance to perform that procedure secondary to numerous causes[9,10]. First of all, the preoperative diagnosis with benign or borderline lesions may be uncertain. Also, the resection procedure is more technically challenging compared to distal pancreatectomy. Furthermore, the presence of two pancreatic stumps poses an increased potential risk for ‘postoperative pancreatic fistula‘ (POPF)[11,12].

The results of central versus distal pancreatectomy in Egyptian individuals with benign and borderline

DOI: 10.21608/EJSUR.2024.357139

pancreatic neoplasms have not been extensively studied. For this reason, we carried out the current investigation to determine which strategy provides superior postoperative results in these cases.

PATIENTS AND METHODS:

This is a combined prospective and retrospective non-randomized trial that was conducted at Mansoura University Gastrointestinal Surgical Center (GISC). The study was designed for patients aged between 15 and 70 years diagnosed with benign or borderline neoplasms located in the pancreatic neck/body. We excluded patients with high-grade neoplasms, liver cirrhosis, pancreatitis, cholangitis, pregnancy, or who cannot tolerate general anesthesia and major surgery.

The retrospective part of the study included patients who had central or distal pancreatectomy in our center between January 2010 and December 2019. The data of these patients were reviewed, and they were called for follow-up. The prospective part of the study included patients who underwent either of the same two procedures between January 2020 and December 2020. They were followed for one year after the operation.

Seventy patients were eligible for our study, and they were divided into two groups; Group A (n=35), who underwent central pancreatectomy, and Group B (n=35), who underwent distal pancreatectomy. The retrospective part included 29 distal pancreatectomy patients and 27 central pancreatectomy ones, while the prospective part included six distal pancreatectomy patients in addition to eight central pancreatectomy ones.

Patient evaluation included history taking (focusing on complaints and their duration), clinical examination (focusing on local abdominal examination), standard preoperative laboratory investigations, and an upper gastrointestinal endoscopy. Additionally, the radiological diagnosis was done by pelviabdominal ultrasound, which was confirmed by triphasic abdominal computed tomography. All patients signed a written consent explaining the aim of the surgical procedure with its benefits and potential complications.

The choice of the surgical procedure was dependent on the operator's experience and choice. In Group A, abdominal exploration was done via extended left subcostal, rooftop, or left subcostal incisions. The lesser sac was accessed by dividing the greater omentum while preserving the gastroepiploic vessels. The inferior border of the pancreas was mobilized and dissected from the underlying portal confluence till nylon tape was passed between the pancreas and the underlying portal confluence. The process was repeated distal to the mass to separate the distal pancreas from the underlying splenic vasculature.

The pancreatic mass was separated from the underlying splenic vessels, while the splenic artery was preserved at the upper pancreatic border. The pancreas was divided by diathermy with a 5 to 10 mm gross safety margin, and care was taken not to injure the underlying vessels. After extracting the surgical specimen, we closed the proximal pancreatic stump with sutures, whereas the distal stump was freed for one or two cm from the underlying splenic vessels, preparing for anastomosis.

The pancreatic stump was connected either to the jejunum (pancreaticojejunostomy) in a Roux-en-y configuration or to the stomach (pancreaticogastrostomy). The decision was operator-dependent. The method of pancreatic anastomosis was performed according to the pancreatic duct. If the pancreatic duct was large, the 'duct to mucosa' technique was done, but if the duct was small, the invagination technique was performed. After good wash and hemostasis, two drains were inserted, the right at the Morrison pouch and the left at the lesser sac.

In Group B, the procedure was performed through a left subcostal or midline incisions. The lesser sac was accessed as done in Group A. The celiac trunk was identified, then the splenic artery was ligated and divided. After medial retraction of the spleen, the lienorenal and lienophrenic ligaments were divided. The spleen, with its vessels and pancreatic tail, was dissected from the posterior abdominal wall till reaching the pancreatic neck just proximal to the neoplasm. The splenic vein was divided and closed with prolene 4/0 sutures. The pancreatic parenchyma was divided using diathermy or scalpel. Then, the pancreatic duct was identified and closed. After that, the stump was reinforced with sutures. One drain was inserted in the lesser sac, and the abdominal wall was closed in layers.

Patients were transferred to the ICU if they required intensive monitoring. Otherwise, they were transferred to the internal ward. Early ambulation was encouraged, and oral fluids were allowed if the patient passed flatus with a sound abdominal examination. Any postoperative complications encountered were recorded. POPF was defined according to Bassi *et al*.[13].

After discharge, follow-up visits were arranged for all cases. During these visits, clinical, laboratory, and radiological assessments were done. Exocrine insufficiency was diagnosed when the patient developed fatty stool, diarrhea, and weight loss, while endocrine insufficiency was established based on postprandial blood glucose levels[14].

Study outcomes included operative time, blood loss, the hospitalization period, postoperative complications (mainly POPF, endocrine, and exocrine insufficiency), and mortality.

Sample size calculation

According to the findings published by Balzano *et al*., the duration of hospitalization was found to be 13.5 days (±6.3) in the central pancreatectomy group versus 11.5 days (±3.6) in the distal pancreatectomy group[15]. That difference was taken to estimate our sample size, which required 35 patients in each of our groups to achieve 80% study power and 95% significance level.

Statistical analysis

Our data analysis process was employed using the SPSS program (version 26 for MacOS). The chi-square test was used to compare categorical variables. The Mann-Whitney test was utilized to compare medians, and the student t-test was employed to compare means. *P values* below 0.05 were regarded as significant.

RESULTS:

Preoperative basic demographic and clinical data are shown in (Table 1). Age, sex, body mass index (BMI), the prevalence of smoking, and the distribution of medical comorbidities revealed no differences when comparing the study groups. Most patients reported abdominal pain, while others reported significant weight loss. The pancreatic neoplasms were accidentally discovered in 5.7% of Group A cases and 20% of Group B cases. The duration of the previous manifestations had a median value of two months in both groups.

Table 1: Preoperative demographic and clinical data

	Group A [Central] (*n*=35)	Group B [Distal] (*n*=35)	Test of significance
Age (years)	47 (15–70)	41 (15–60)	*P*=0.052
Sex			
Male	9 (25.7%)	12 (34.3%)	*P*=0.434
Female	26 (74.3%)	23 (65.7%)	
BMI (kg/m^2)	30.56±3.19	28.84±5.64	*P*=0.120
Smoking	2 (5.7%)	4 (11.4%)	*P*=0.393
Diabetes mellitus	5 (14.3%)	6 (17.1%)	*P*=0.743
Hypertension	6 (17.1%)	6 (17.1%)	*P*=1
Duration of symptoms (months)	2 (1–12)	2 (1–10)	*P*=0.331
Accidental discovery	2 (5.7%)	7 (20%)	*P*=0.074
Pain	28 (80%)	24 (68.6%)	*P*=0.274
Weight loss	2 (5.7%)	6 (17.1%)	*P*=0.133

The incision type was significantly different between the two procedures (*P<0.001*), as the rooftop incision was the most common one in Group A, while the left subcostal incision was done for the majority of Group B cases. Regarding the pancreatic parenchymal texture, it was comparable between the two groups, as most cases in the two groups had a firm pancreatic texture. All patients in Group B underwent concomitant splenectomy, whereas no patient in the other group had splenectomy.

The proximal pancreatic stump was closed manually (hand sewn) in 97.1% and 94.3% of cases in Groups A and B, respectively. The remaining cases had their proximal stumps closed by a surgical stapler. Regarding the distal pancreatic stump (which was present only in Group A), it was closed in four cases (11.43%), while the remaining 31 cases had pancreatico-enteric anastomosis. Thirty cases underwent pancreaticojejunostomy, whereas only one patient had pancreaticogastrostomy.

The distal stump duct diameter ranged between one and five cm (median =1 ml). The pancreatico-enteric anastomosis was created in either an invagination or ‘duct-to-mucosa‘ fashions (48.4% and 51.6%, respectively).

In Groups A and B, the mean duration of the operation was 3.88 and 3.37 h, respectively. There was a noteworthy increase in this duration when the central pancreatectomy method was performed (*P=0.006*). Nevertheless, there were no appreciable differences between our groups in terms of intraoperative blood loss or the requirement for blood transfusions (Table 2).

Table 2: Operative data

	Group A [Central] (*n*=35)	Group B [Distal] (*n*=35)	Test of significance
Incision			*P*<0.001*
Midline	0 (0%)	1 (2.9%)	
Left subcostal	1 (2.9%)	34 (97.1%)	
Rooftop	14 (40%)	0 (0%)	
Extended right subcostal	13 (37.1%)	0 (0%)	
Extended left subcostal	7 (20%)	0 (0%)	
Pancreas texture			*P*<0.001*
Hard	13 (37.1%)	16 (45.7%)	
Firm	18 (51.4%)	17 (48.6%)	
Soft	4 (11.4%)	2 (5.7%)	
Mass size (cm)	5 (2–14)	7 (2–15)	*P*=0.113
Associated splenectomy	0 (0%)	35 (100%)	*P*<0.001*
Proximal stump closure			*P*=0.555
Hand sewn	34 (97.1%)	33 (94.3%)	
Stapled	1 (2.9%)	2 (5.7%)	
Distal stump duct size	1 (1–5)		
Distal stump reconstruction			
Pancreaticogastrostomy	1 (2.9%)		
Pancreaticojejunostomy	30 (85.7%)		
Closed	4 (11.4%)		
Suture method			
Invagination	15 (48.4%)		
Duct to mucosa	16 (51.6%)		
Operative time	3.88±0.67	3.37±0.83	*P*=0.006*
Blood loss	250 (100–800)	300 (100–1000)	*P*=0.156
Blood transfusion	2 (5.7%)	3 (8.6%)	*P*=0.643

Tumor type did not significantly differ between the two groups (*P=0.621*). The solid pseudopapillary tumor was the most common type, followed by serous neoplasms and mucinous cystic neoplasms. Other pathologies included endocrine tumors, neuroendocrine tumors, simple pancreatic cysts, pseudo pancreatic cysts, and chronic pancreatitis.

The resected pancreatic length showed a significant decrease in Group A. Proximal and distal surgical margins were free in all cases. No vascular or perineural invasion was detected in the current study (Table 3).

Table 3: Postoperative pathology

	Group A [Central] (*n*=35)	Group B [Distal] (*n*=35)	Test of significance
Tumor type			*P*=0.621
Solid pseudopapillary tumor	12 (34.3%)	12 (34.3%)	
Mucinous cystic neoplasm	4 (11.4%)	7 (20%)	
Serous neoplasm	7 (20%)	5 (14.3%)	
Pancreatic endocrine tumour	2 (5.7%)	1 (2.9%)	
Pancreatic neuroendocrine tumour	5 (14.3%)	1 (2.9%)	
Simple pancreatic cyst	3 (8.6%)	5 (14.3%)	
Pseudopancreatic cyst	1 (2.9%)	2 (5.7%)	
Chronic pancreatitis	1 (2.9%)	2 (5.7%)	

Resected pancreas length	7 (4–16)	8 (5–18)	*P*=0.015*
Proximal safety margin			*P*=0.1
Free	35 (100%)	35 (100%)	
Infiltrated	0 (0%)	0 (0%)	
Distal safety margin			--------
Free	35 (100%)		
Infiltrated	0 (0%)		

Central pancreatectomy was associated with a significant increase in ICU admission (51.4% vs. 22.9% in Group B – *P=0.013*). However, the duration of ICU stay did not differ between the two groups (*P=0.832*). The duration of hospitalization increased significantly in Group A, and oral intake was more delayed in the same group compared to Group B. Additionally, the day-to-drain removal showed a significant delay in the central pancreatectomy group. Reexploration was needed in only one case in Group A (2.9%). In-hospital mortality was encountered in one case in Group A (2.9%) versus no cases in Group B, with no significant difference between the two groups.

Between the two surgical approaches, the incidence of complications was statistically comparable, occurring in 45.7% and 42.9% of patients in Groups A and B, respectively. POPF was encountered in 22.9% and 25.9% of cases in the same groups, respectively, which was statistically comparable between the two groups (*P=0.780*). These fistulas were detected 1 and 1.5 days following the operation in the same two groups, respectively. Its amount had median values of 200 and 150 cm per day in the same two groups. It was managed conservatively in all of these cases.

Postoperative collection occurred in 17.1% and 14.3% of cases in groups A and B, respectively. Two groups in Group A, in addition to one case in Group B, required tube drainage. The remaining cases were managed conservatively.

Wound infection occurred in 11.4% and 17.1% of cases in Groups A and B, respectively, and it was managed by drainage in 100% and 83.3% of cases in the same two groups, respectively. Only one case was managed conservatively in Group B. Postoperative hemorrhage occurred in 5.7% of cases in Group A; one case was conservatively managed, whereas the other case was managed by surgical exploration. No cases in group B developed this complication (Table 4).

Table 4: Postoperative data

	Group A [Central] (*n*=35)	Group B [Distal] (*n*=35)	Test of significance
ICU admission	18 (51.4%)	8 (22.9%)	*P*=0.013*
ICU Stay	1 (1–36)	1.5 (1–13)	*P*=0.832
Hospital stay	7 (5–41)	6 (4–40)	*P*=0.016*
Oral start	4 (2–10)	3 (2–14)	*P*=0.014*
Drain removal	6 (3–37)	5 (4–14)	*P*=0.012*
Re exploration	1 (2.9%)	0 (0%)	*P*=0.314
In hospital mortality	1 (2.9%)	0 (0%)	*P*=0.734
Complications	16 (45.7%)	15 (42.9%)	*P*=0.810
POPF	8 (22.9%)	9 (25.7%)	*P*=0.780
Onset	1.5 (1–4)	1 (1–2)	*P*=0.409
Amount	200 (40–800)	150 (50–300)	*P*=0.560
POPF conservative	8 (100%)	9 (100%)	*P*=0.780
Collection	6 (17.1%)	5 (14.3%)	*P*=0.734
Collection management			*P*=0.621
Conservative	4 (66.7%)	4 (80%)	
Tube drain	2 (33.3%)	1 (20%)	
Wound infection	4 (11.4%)	6 (17.1%)	*P*=0.734
Wound infection management			*P*=0.389
Conservative	0 (0%)	1 (16.7%)	

Drainage	4 (100%)	5 (83.3%)	
Internal hemorrhage	2 (5.7%)	0 (0%)	*P*=0.734
Internal hemorrhage management			
Conservative	1 (50%)		
Exploration	1 (50%)		

The incidence of both endocrine and exocrine deficiencies showed a significant increase in Group A compared to the other group. In patients without pre-existing diabetes, endocrine insufficiency was reported in 6.67% and 34.48% of cases in Groups A and B, respectively. In the whole study population, exocrine insufficiency was encountered in 2.9% and 22.9% of cases in the same two groups, respectively (Table 5).

Table 5: Incidence of endocrine and exocrine insufficiency

	Group A [Central]	Group B [Distal]	Test of significance
Endocrine insufficiency	2/30 (6.67%)	10/29 (34.48%)	*P*=0.022*
Exocrine insufficiency	1/35 (2.9%)	8/35 (22.9%)	*P*=0.012*

DISCUSSION

The current study was conducted in An Egyptian tertiary surgical center aiming to compare the outcomes of central versus distal pancreatectomy in patients with pancreatic body/neck benign or low malignant neoplasms. Despite the non-randomized nature of our study, the reader could notice the statistically comparable preoperative findings between our two groups. That should decrease the risk of any bias skewing our findings in favor of one group over the other.

In our study, we noticed a significant difference between the two groups regarding the incision performed for the procedure. Starting with the distal resection, most surgeons prefer to do it through the left subcostal incision, as performed in our study, when the open approach is planned. However, in the central pancreatectomy group, the surgeon needed a wider incision for easier access to the abdomen. This helped to accurately dissect the pancreatic segment carrying the neoplasm from the underlying splenic vasculature. Also, this could provide a wider field suitable for creating a proper pancreatic anastomosis. This could explain the need for rooftop, extended left subcostal, and extended right subcostal incisions in group A rather than the other group.

Our findings revealed prolonged operative time in association with the central pancreatectomy approach. Of course, it is reasonable that the operation requiring both extirpative and reconstruction phases will need more operative time compared to an operation with an extirpative component only. That concept was also confirmed by numerous previous studies[16–19].

Nonetheless, Du *et al*. reported that central pancreatectomy did not lead to a significant prolongation of the operative time, which had mean values of 222.1 and 202 min in the central and distal groups, respectively[20]. Differences between studies could be due to different surgical experiences, tumor criteria, surgical approach, and types of operation performed (spleen preservation or not in the distal group or concomitant visceral resection in either of the two groups).

Our findings showed comparable intraoperative blood loss between the two surgical procedures (*P=0.156*). Contrarily, a previous similar study noted a significant increase in the amount of intraoperative blood loss (*P=0.025*) in association with the central pancreatectomy procedure (526.9 vs 316.1 ml in the distal pancreatectomy group)[20].

In our study, the length of the resected pancreas significantly decreased in association with the central resection procedure (*P=0.015*). In another previous research, the length of the resected pancreas showed a significant decline with the central pancreatectomy procedure. It ranged between 4 and 9 cm compared to 6 and 12 cm in the distal resection group (*P<0.001*)[21]. Other studies confirmed the previous findings[22,23]. That indicates that more normal pancreatic tissue is removed during the distal resection procedure.

Jones reported a significant association between the length of the resected pancreas and the development of postoperative diabetes mellitus[24], and that should explain our findings regarding the increased incidence of endocrine insufficiency with the distal resection procedure, which yields less pancreatic remnant. This will be handled later on in this discussion.

We noticed a significant increase in postoperative ICU admission in the distal pancreatectomy group.

This was not due to the increased morbidity in the former group. Nonetheless, the anesthesia team was keen regarding that relatively newly performed major procedure that required prolonged operative time. Therefore, most of these cases were kept at the ICU for only one night for observation.

Our findings showed a comparable incidence of postoperative morbidity in both groups. Likewise, according to Dumitrascu *et al*., there was no discernible difference in the percentage of cases in the distal and central resection groups that experienced postoperative morbidity, which occurred in 50% and 40% of cases, respectively (*P=0.564*)[21]. Shikano *et al*. reported similar findings[25]. Contrarily, others reported a significant increase in postoperative morbidity in association with the central resection procedure (68.7% vs. 23% of distal resection cases – *P=0.003*). Nonetheless, no mortality was reported in the previous study despite the high morbidity rates[26].

In our study, postoperative bleeding was encountered in two cases in the central pancreatectomy group (5.7%), with no cases in the distal resection. That posed no significant difference in statistical analysis. According to a different study, participants in the distal and central pancreatectomy groups experienced the same complication at rates of 2.8% and 3.8%, respectively (*P>0.05*)[20]. Contrarily, another study reported a significant increase in the incidence of postoperative bleeding in the central pancreatectomy group (18.7% vs. 0% in the distal pancreatectomy group – *P=0.022*)[26].

The incidence of POPF did not statistically differ between our two groups. In a previous similar study, the same complication was encountered in 42% and 31% of patients in the central and distal groups, respectively, which was comparable in statistical analysis[20]. Cataldegirmen *et al*. also reported a comparable incidence of the same adverse event between the two surgical approaches[9]. On the other hand, other studies comparing central pancreatectomy to distal pancreatectomy have shown a significantly increased rate of postoperative pancreatic fistulae after central pancreatectomy[18,19,27], which contradicts our findings.

In our study, reoperation was needed in only one patient (2.9%) in the central pancreatectomy group, who developed a secondary hemorrhage and needed exploration. A previous meta-analysis also noted no significant difference between the two procedures regarding reoperation rates (*P=0.781*), which was needed in 2.4% and 5.9% of cases in the central and distal groups, respectively[28].

In our study, the oral start was significantly delayed in Group A compared to Group B (4 vs. 3 days, respectively – *P=0.014*). We preferred to delay oral intake in the former group to give the bowel a chance to rest, especially in the presence of two anastomoses (one between the pancreas and the bowel, and the other is the enteroenterostomy).

In the current study, central pancreatectomy led to a significant increase in hospitalization period compared to the distal procedure. It is expected to find some delay in the discharge of central pancreatectomy cases, especially with the delayed oral intake and drain removal compared to the distal group. In agreement with the previous findings, Iacono *et al*. reported that the length of stay showed a significant increase in the central pancreatectomy group (17 vs. 15 days in the distal resection group – *P<0.001*)[28]. However, another study reported comparable hospitalization periods between the two approaches[29].

Our findings revealed the increased incidence of endocrine insufficiency in the distal pancreatectomy group compared to the central procedure (*P=0.022*). That could be explained by more preservation of the pancreatic parenchyma, especially the tail region, in the central pancreatectomy procedure[30,31]. Multiple studies have confirmed the superiority of the central pancreatectomy procedure over the distal one regarding postoperative endocrine function[5,25,32]. For instance, Du and his associates reported that only one patient (2.8%) in the central pancreatectomy group vs five (21.7%) in the distal pancreatectomy group developed diabetes postoperatively (*P<0.05*)[20].

In the current study, postoperative exocrine insufficiency increased significantly with the distal resection procedure (*P=0.012*). Du *et al*. reported the incidence of the same complication in 21.7% of distal pancreatectomy cases compared to no cases in the central pancreatectomy group (*P<0.01*)[20]. Cataldegirmen *et al*. reported similar findings[9].

During the scheduled follow-up period, we did not encounter any cases with recurrence in the current study. Another study also reported no recurrence in their 36 central pancreatectomy and 23 distal pancreatectomy cases during the scheduled follow-up (4–72 months)[20].

There are several restrictions on our investigation. The investigation was conducted at a single center with a rather limited sample size. This should motivate the surgeons to carry out additional studies involving a greater number of cases from various surgical pancreatic facilities.

CONCLUSION

Central pancreatectomy is associated with a significant beneficial impact on postoperative pancreatic endocrine and exocrine functions without an increased complication rate compared to traditional resection procedures like distal pancreatectomy. However, it should be carefully selected for patients with benign or borderline pancreatic neck/body lesions and performed in tertiary centers by high-volume surgeons.

CONFLICT OF INTEREST

Nil.

REFERENCES

1. Souche R, Hobeika C, Hain E, Gaujoux S. Surgical management of neuroendocrine tumours of the pancreas. J Clin Med 2020; 9:9. https://doi.org/10.3390/jcm9092993

2. Mahseeri M, Alqaiseieh A, Alkhader D, Halbony H, Albreazat M, Abualhaj S. Central pancreatectomy for solid pseudopapillary neoplasm: A pancreatic-preserving procedure. Int J Surg Case Rep 2021; 79:91-93. https://doi.org/10.1016/j.ijscr.2021.01.009

3. Cameron JL, Riall TS, Coleman J, Belcher KA. One thousand consecutive pancreaticoduodenectomies. Ann Surg. 2006; 244:10-15. https://doi.org/10.1097/01.sla.0000217673.04165.ea

4. Klotz R, Schilling C, Kuner C, Hinz U, Klaiber U, Holze M, *et al*. Central pancreatectomy prevents postoperative diabetes. J Hepatobiliary Pancreat Sci 2023; 30:951-961. https://doi.org/10.1002/jhbp.1296

5. Müller MW, Friess H, Kleeff J, Hinz U, Wente MN, Paramythiotis D, *et al*. Middle segmental pancreatic resection: An option to treat benign pancreatic body lesions. Ann Surg 2006; 244:909-918; discussion 18-20. https://doi.org/10.1097/01.sla.0000247970.43080.23

6. Guillemin P, Bessot M. [Chronic calcifying pancreatitis in renal tuberculosis: pancreatojejunostomy using an original technic]. Mem Acad Chir 1957; 83:869-871.

7. Letton AH, Wilson JP. Traumatic severance of pancreas treated by Roux-Y anastomosis. Surg Gynecol Obstet 1959; 109:473-478.

8. Carrère N, Abid S, Julio CH, Bloom E, Pradère B. Spleen-preserving distal pancreatectomy with excision of splenic artery and vein: a case-matched comparison with conventional distal pancreatectomy with splenectomy. World J Surg 2007; 31:375-382. https://doi.org/10.1007/s00268-006-0425-6

9. Cataldegirmen G, Schneider CG, Bogoevski D, Koenig A, Kaifi JT, Bockhorn M, *et al*. Extended central pancreatic resection as an alternative for extended left or extended right resection for appropriate pancreatic neoplasms. Surgery 2010; 147(3):331-338. https://doi.org/10.1016/j.surg.2009.10.027

10. Sauvanet A, Partensky C, Sastre B, Gigot JF, Fagniez PL, Tuech JJ, *et al*. Medial pancreatectomy: a multi-institutional retrospective study of 53 patients by the French Pancreas Club. Surgery 2002; 132:836-843. https://doi.org/10.1067/msy.2002.127552

11. Adham M, Giunippero A, Hervieu V, Courbière M, Partensky C. Central pancreatectomy: single-center experience of 50 cases. Arch Surg 2008; 143:175-180; discussion 80-1. https://doi.org/10.1001/archsurg.2007.52

12. Kvashilava A, Kobalava B, Giorgobiani G. Laparoscopic central pancreatectomy with pancreaticogastrostomy: our initial experience. Cureus 2022; 14:e24542. https://doi.org/10.7759/cureus.24542

13. Bassi C, Dervenis C, Butturini G, Fingerhut A, Yeo C, Izbicki J, *et al*. Postoperative pancreatic fistula: an international study group (ISGPF) definition. Surgery 2005; 138:8-13. https://doi.org/10.1016/j.surg.2005.05.001

14. P SK, Harikrishnan S, Satyanesan J. Central Pancreatectomy for central pancreatic lesions: a single-institution experience. Cureus 2021; 13:e16108. https://doi.org/10.7759/cureus.16108

15. Balzano G, Zerbi A, Veronesi P, Cristallo M, Di Carlo V. Surgical treatment of benign and borderline neoplasms of the pancreatic body. Dig Surg 2003; 20:506-510. https://doi.org/10.1159/000073646

16. Crippa S, Bassi C, Warshaw AL, Falconi M, Partelli S, Thayer SP, *et al*. Middle pancreatectomy: indications, short- and long-term operative outcomes. Ann Surg. 2007; 246:69-76. https://doi.org/10.1097/01.sla.0000262790.51512.57

17. Kang CM, Lee JM, Kim MW, Yoon DS, Park JS, Lee WJ. Experiences in central pancreatectomy. Dig Surg 2011; 28:57-62. https://doi.org/10.1159/000322407

18. Su CH, Shyr YM, Lui WY, P'Eng FK. Surgical treatment for serous cystadenoma of pancreas--segmental pancreatectomy or conventional resection? Hepatogastroenterology 2004; 51:595-598.

19. Yamaguchi K, Yokohata K, Ohkido M, Watanabe M, Ogawa Y, Chijiiwa K, *et al*. Which is less invasive--distal pancreatectomy or segmental resection? Int Surg 2000; 85:297-302.

20. Du ZY, Chen S, Han BS, Shen BY, Liu YB, Peng CH. Middle segmental pancreatectomy: a safe and organ-preserving option for benign and low-grade malignant lesions. World J Gastroenterol 2013; 19:1458-1465. https://doi.org/10.3748/wjg.v19.i9.1458

21. 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. https://doi.org/10.1159/000343927

22. DiNorcia J, Ahmed L, Lee MK, Reavey PL, Yakaitis EA, Lee JA, *et al*. Better preservation of endocrine function after central versus distal pancreatectomy for mid-gland lesions. Surgery 2010; 148:1247-1254; discussion 54-6. https://doi.org/10.1016/j.surg.2010.09.003

23. Ocuin LM, Sarmiento JM, Staley CA, Galloway JR, Johnson CD, Wood WC, *et al*. Comparison of central and extended left pancreatectomy for lesions of the pancreatic neck. Ann Surg Oncol 2008; 15:2096-2103. https://doi.org/10.1245/s10434-008-9987-x

24. Jones RC. Management of pancreatic trauma. Ann Surg 1978; 187:555-564. https://doi.org/10.1097/00000658-197805000-00015

25. Shikano T, Nakao A, Kodera Y, Yamada S, Fujii T, Sugimoto H, *et al*. Middle pancreatectomy: safety and long-term results. Surgery 2010; 147:21-29. https://doi.org/10.1016/j.surg.2009.04.036

26. Lv A, Qian HG, Qiu H, Wu JH, Hao CY. Is central pancreatectomy truly recommendable? A 9-year single-center experience. Dig Surg 2018; 35:532-538. https://doi.org/10.1159/000485806

27. Pratt W, Maithel SK, Vanounou T, Callery MP, Vollmer CM Jr Postoperative pancreatic fistulas are not equivalent after proximal, distal, and central pancreatectomy. J Gastrointest Surg 2006; 10:1264-1278; discussion 78-9. https://doi.org/10.1016/j.gassur.2006.07.011

28. Iacono C, Verlato G, Ruzzenente A, Campagnaro T, Bacchelli C, Valdegamberi A, *et al*. Systematic review of central pancreatectomy and meta-analysis of central versus distal pancreatectomy. Br J Surg 2013; 100:873-885. https://doi.org/10.1002/bjs.9136

29. Lee SE, Jang JY, Hwang DW, Lee KU, Kim SW. Clinical efficacy of organ-preserving pancreatectomy for benign or low-grade malignant potential lesion. J Korean Med Sci. 2010; 25:97-103. https://doi.org/10.3346/jkms.2010.25.1.97

30. Yasuda H, Takada T, Toyota N, Amano H, Yoshida M, Takada Y, *et al*. Limited pancreatectomy: significance of postoperative maintenance of pancreatic exocrine function. J Hepatobiliary Pancreat Surg. 2000; 7:466-472. https://doi.org/10.1007/s005340070016

31. Sperti C, Pasquali C, Ferronato A, Pedrazzoli S. Median pancreatectomy for tumors of the neck and body of the pancreas. J Am Coll Surg 2000; 190:711-716. https://doi.org/10.1016/s1072-7515(00)00286-6

32. Hirono S, Tani M, Kawai M, Ina S, Nishioka R, Miyazawa M, *et al*. A central pancreatectomy for benign or low-grade malignant neoplasms. J Gastrointest Surg. 2009; 13:1659-1665. https://doi.org/10.1007/s11605-009-0934-3