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Original Research

Laparoscopic versus open pancreaticoduodenectomy combined with uncinated process approach: A comparative study evaluating perioperative outcomes (Retrospective cohort study)

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ABSTRACT

Background: Few studies on the uncinate process–first approach in laparoscopic pancreaticoduodenectomy (LPD) have been reported. The aim of this study is to compare the perioperative outcomes of LPD to open pancreaticoduodenectomy (OPD) in terms of feasibility, safety, and efficacy using the uncinate process–first approach.

Materials and methods: This retrospective study included 102 patients who underwent pancreaticoduodenectomy between 2013 and 2017. Patients were divided into two groups based on the surgical approach: the laparoscopic surgery group (n = 47) and open surgery group (n = 55). The clinical characteristics and intra- and post-operative data were retrospectively analysed.

Results: LPD was performed successfully in all 47 patients. The mean operation time was significantly longer in the LPD group (410 ± 68 min) than in the OPD group (245 ± 70 min; $P < 0.05$). LPD produced significantly less intraoperative blood loss (210 ± 46 mL vs 420 ± 50 mL, $P < 0.05$), shorter first flatus time (1.5 d vs 4 d, $P < 0.05$) and shorter diet start time (2 d vs 5 d, $P < 0.05$). The total hospital stay was significantly shorter in the LPD group, with a median of 13 ± 4 days versus 18 ± 5.5 days in the OPD group ($P < 0.05$). The post-operative complication rates of the LPD group and OPD group were 21.3% and 27.3%, respectively ($P > 0.05$). The rate of category I–II complications and rate of category III–IV complications did not significantly differ ($P > 0.05$). Pancreatic fistulae occurred in 6 patients (12.8%) in the LPD group and 8 patients (14.5%) in the OPD group ($P = 0.67$). Delayed gastric emptying occurred in 2 patients (4.26%) in the LPD group and 2 patients in the OPD group (3.63%; $P = 0.79$). Postpancreatectomy haemorrhage was not significantly different between the groups (2.13% vs 3.63%; $P = 0.66$).

Conclusion: LPD with the uncinate process–first approach combines the benefits of laparoscopy with a low risk of postoperative complications and high rate of curative resection.

1. Background

Pancreaticoduodenectomy (PD) remains the only potentially curative therapy for periampullary malignancies, including, most commonly, pancreatic adenocarcinoma [1]. Gagner and Pomp [2] first reported laparoscopic pancreaticoduodenectomy (LPD) in 1994; however, the acceptance of LPD was considerably slowed by both the inherent technical limitations of laparoscopic procedures and the need for surgeons to learn advanced laparoscopic techniques. Recent advances in laparoscopic procedures, technological innovations, and surgeons' passion to pursue LPD have all contributed to the increased popularity and acceptance of LPD. The technical aspects of this complex operation continue to challenge pancreatic surgeons, and this has resulted in a number of modifications over the years [3]. More recently, the uncinate process–first technique has been used in open pancreaticoduodenectomy [4]. Approaching the uncinate process first can help in the early recognition of vascular anomalies that may be encountered during pancreaticoduodenectomy, and may alter the course of the resection [5].

Though the uncinate process–first approach has been recently described [4], we have been using this approach as our "standard approach" for many years. To the best of our knowledge, few studies regarding the uncinate process–first approach in LPD have been reported. In this study, we compared the operative parameters and postoperative

Abbreviations: LPD, laparoscopic pancreaticoduodenectomy; OPD, open pancreaticoduodenectomy; SMV, superior mesenteric vein; PV, portal vein; SMA, superior mesenteric artery; ASA, American Society of Anesthesiologists; IPDA, inferior pancreaticoduodenal artery

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outcomes of LPD versus OPD combined with the uncinate process–first approach.

2. Methods

We identified 102 patients having undergone pancreaticoduodenectomy with a pathologically confirmed diagnosis of periampullary tumors, bile duct carcinoma, intra-ductal papillary mucinous neoplasms and pancreatic head cancer between January 2013 and May 2017. Patients with resectable tumors with no evidence of vascular invasion on preoperative imaging were included. Exclusion criteria consisted of histories of abdomen surgery or borderline malignant histology. Patients were divided into 2 groups: those undergoing LPD (n = 47) combined with the uncinate process–first approach and those undergoing OPD (n = 55) combined with the uncinate process–first approach. All patients were discussed in a multidisciplinary tumour board, and the choice of surgical approach either by open or by laparoscopic technique depended on the arbitrary referral of the patients to either a consistently laparoscopy- or open-favouring surgeon at our institution. All patients were thoroughly evaluated preoperatively by complete haematologic investigations, triple-phase helical computed tomography (CT), upper gastrointestinal endoscopy, and biopsy of ampullary lesions.

Descriptive data were collected. Preoperative variables included age, gender, and indication for surgery. Complications were recorded using the Clavien-Dindo classification system. Pancreatic fistulae, delayed gastric emptying, and postpancreatectomy haemorrhage were defined according to the International Study Group of Pancreatic Surgery definitions. Data collection included patient characteristics, operative details, morbidity and mortality, postoperative hospital stay, and pathological findings. Oncologic outcomes were analysed for all patients, including tumour size (maximum dimension, cm), total number of lymph nodes, and margin status.

The work has been reported in line with the STROCSS criteria [19].

2.1. Operative technique

Patients were placed in the supine position with legs apart. With the patient under general anaesthesia, a pneumoperitoneum with a pressure of 14 mmHg CO_2 was established. Basically, five trocars (three 5 mm and two 10 mm trocars) were inserted in the upper abdominal quadrant. We used a supraumbilical cutdown in patients to establish pneumoperitoneum, with a 5-mm port and a 10-mm port in the right upper and right flank quadrants and a 5-mm port in each of the left upper and left flank quadrants. The technique was similar to that described by Nagakawa and Wang et al. [6,7]. The gastrocolic ligament was dissected below the gastroepiploic vessels using an ultrasonic dissector (Harmonic Scalpel, Ethicon Endo-Surgery, Cincinnati, OH, United States), and then the left and right colonic flexures were also dissected. The right gastroepiploic vessels were identified, ligated with Hem-o-lok clips, and then transected using an ultrasonic dissector. The superior mesenteric vein (SMV) was identified by following the Henle's trunk at the inferior border of the pancreas. At the inferior border of the pancreas, a tunnel was carefully created between the pancreatic neck and the SMV or portal vein (PV). At the superior border of the pancreas, the common hepatic artery and the gastroduodenal and right gastric arteries were identified and isolated from posterior to anterior. The arteries were clipped and divided, and the process was continued to isolate the proper hepatic artery and common bile duct along the PV. The Kocher manoeuver was performed up to the anterior portion of the aorta. The jejunum was transected 15 cm distal from the Treitz ligament using an endoscopic linear stapler (Endocutter 60 stapler, white cartridge; Ethicon Endo-Surgery, Cincinnati, OH, United States). The mesentery was divided along the jejunum toward the superior mesenteric artery (SMA) across the inferior border of the duodenum. The uncinate process was then exposed at the left posterior aspect of the SMA. The connective tissue at the posterior aspect of the SMA was not dissected. The uncinate process was dissected using ultrasonic dissector along the surface of the pancreatic parenchyma when the jejunum was retracted to the right. This provided access to several branches of the inferior pancreaticoduodenal artery (IPDA), which were exposed and clipped. The first jejunal artery connected to the IPDA was preserved. The proximal jejunum was pulled to the right behind the SMV. The uncinate process was dissected along the adventitia of the SMA, with the large tributary vessels ligated or clipped. Next, the stomach was divided proximal to the antrum with an endoscopic linear stapler (Endocutter 60 stapler, golden cartridge; Ethicon Endo-Surgery, Cincinnati, OH, United States). The pancreatic neck parenchyma was divided with ultrasonic dissector. Retrograde cholecystectomy and a common hepatic bile duct transection were then performed. The specimen was placed in a bag for retrieval.

The reconstruction was performed in the following order: pancreatojejunostomy, hepaticojejunostomy, and gastrojejunostomy. An end-to-side pancreaticojejunostomy(duct-to-mucosa) was fashioned first using an interrupted 5-0 PDS (Ethicon Ltd, Edinburgh, UK). An end-to-side choledochojejunostomy was fashioned with a continuous single layer using Vicryl 4-0 (Ethicon, Inc., Somerville, NJ). The gastrojejunostomy was performed antecolically using a stapled technique (Endocutter 60 stapler, blue cartridge; Ethicon Endo-Surgery, Cincinnati, OH, United States).

2.2. Statistical analysis

All results are expressed as median and range values. Continuous variables were analysed using the Mann–Whitney *U* test, whereas categorical variables were analysed using the chi-squared and or Fisher's exact test. A p value < 0.05 was considered significant. All statistical analyses were performed using SPSS software for Windows (version 18; SPSS, Inc., Chicago, IL, United States).

3. Results

In the study period, a total of 102 patients underwent PD at our institution. OPD and LPD were performed in 47 (46%) and 55 (54%) patients, respectively. Table 1 shows patients' information, including age, sex, BMI, and American Society of Anesthesiologists (ASA) score for the two groups. No significant differences in any of these parameters were found between the groups.

Comparative analysis of patient demographics and intraoperative results are summarized in Table 2. Mean operation time was significantly longer in the LPD group (410 ± 68 min) than in the OPD group (245 ± 70 min; P $<$ 0.05). LPD produced significantly less intraoperative blood loss (210 ± 46 mL vs 420 ± 50 mL, P $<$ 0.05), shorter first flatus time (1.5 d vs 4 d, P $<$ 0.05) and shorter diet start time (2 d vs 5 d, P $<$ 0.05). The total hospital stay was significantly shorter in the LPD group with a median of 13 ± 4days versus 18 ± 5.5days in the OPD group (P $<$ 0.05).

The postoperative complication rates of the LPD group and OPD

Table 1
Clinical demographics of the patients.

Characteristic	LPD(n = 47)	OPD(n = 55)	P value
Age, mean ± SD,years	63 ± 12	66 ± 15	0.812
Sex (F/M)	21/26	21/34	0.154
ASA, mean ± SD	1.5 ± 1	1.5 ± 1	
TBIL, mean ± SD,IU/L	129 ± 21	142 ± 42	0.375
BMI,mean ± SD,Kg/m^2	24 ± 3	22.7 ± 3.3	0.293
CA19-9, mean ± SD,U/L	232.6 ± 67.9	194.8 ± 58.9	0.146
Diabetes	14(29.8%)	20(36.3%)	0.078
Hypertension	14(29.8%)	18(32.7%)	0.132

F: female, M: male, TBIL: total bilirubin, CA 19-9: carbohydrate antigen.