

Laparoscopic No-Touch Pancreaticoduodenectomy

Kopchak Volodymyr, Kopchak Kostiantyn, Duvalko Oleksandr, Khomyak Igor, Kvasivka Oleksandr, Andronik Serhii, Pererva Ludmila, Khanenko Vasiliy, Zubkov Oleksiy, Davidenko Nina, Romaniv Yaroslav

Department of Pancreatic Surgery, National Institute of Surgery and Transplantology NAMS of Ukraine, 30 Heroiv Sevastopolya str., Kyiv, Ukraine

ABSTRACT

Objective One of the techniques, becoming more and more popular in open pancreatic surgery is no-touch PD. Laparoscopic access could bring some advantages to pancreatic resections. The aim of the present study was to determine possibility and safety of laparoscopic no-touch Pancreaticoduodenectomy in patients with periampullary tumors. **Methods** In the period 2013-2014 we performed 31 no-touch pancreaticoduodenectomy in the National institute of surgery and transplant ology NAMS of Ukraine. Of these patients 7 were selected for laparoscopic no-touch pancreaticoduodenectomy. **Results** Conversion rate was 42.8%. We analyzed the results of 4 successful laparoscopic pancreaticoduodenectomy. The mean duration of surgery was 443 ± 44 minutes (from 370 to 490 minutes). The mean blood loss was 650 ± 269 mL (from 300 to 1000 mL). In 3 patients (75.0%) postoperative complications were recorded in the form of pancreatic fistula grade B. Mortality was zero. After histological evaluation in all patients R0 resection was achieved. One patient died 3 months after the surgery from the reasons neither connected to the surgery, nor the disease. 1 patient has been alive for 11 months being diagnosed a metastatic disease on the 9-th month. 2 patients are alive without signs of recurrence (20 months and 14 months). Our preliminary results show, that no-touch technique could be done from laparoscopic access in a selected group of patients. Potential advantage is fast rehabilitation of patients with early start of adjuvant chemotherapy. That could be achieved in patients with uncomplicated postoperative period.

INTRODUCTION

Since Gardner did the first pancreaticoduodenectomy from laparoscopic access (LPD), much efforts have been done to implement laparoscopic techniques in to surgery of pancreatic tumors [1-3]. The main goal of the researchers was to prove the safety of the laparoscopic technique in terms of postoperative complications [4], mortality and oncological principles [5]. That's why the majority of the publications were devoted to the possibilities of LPD to do the same procedure, as the open one. That leads to some questionable assertions, coming from laparoscopic groups: while in open surgery the lymphatic dissection is more or less standard, LPD is usually done with radical lymph node dissection, just to show the possibilities of the technique [6, 7].

This situation resulted in the fact, that laparoscopic teams are repeating new or standard techniques of PD, already proposed by other researchers.

One of the techniques, becoming more and more popular in open pancreatic surgery is no-touch PD. Coming from the East to the West, it shows potential oncological benefit in selected patients. There is still no strong evidence of the benefit of the procedure, in comparison with the standard. According to our experience, no-touch procedure is preferable in a selected group of patients.

The aim of the present study was to determine possibility and safety of laparoscopic no-touch PD in patients with periampullary tumors.

PATIENTS AND METHODS

In the period 2013-2014 we performed 31 no-touch PD in the National institute of surgery and transplantology NAMS of Ukraine. There were male 16 and 15 female patients, aged from 37 to 77 years.

There were 7 patients selected for laparoscopic no-touch PD. Inclusion criteria at the learning stage were periampullary tumors without any potential contact to the main arterial and venous vessels, no signs of lymph node enlargement, no previous surgery on the upper level of the abdomen, no history of acute pancreatitis [8, 9]. We did not use the procedure on obese patients.

In 3 patients operation was converted to the open surgery. In all cases conversion was done at the early stage of the procedure, soon after laparoscopy. In all cases the reason of conversion was perifocal inflammation (due to

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Correspondence Kvasivka Oleksandr
Department of Pancreatic Surgery
National institute of surgery and transplantology NAMS of Ukraine
30 Heroiv Sevastopolya str., Kyiv
Ukraine
Phone + 380977390845
E-mail dr.kvasivka@yahoo.com

preoperative biliary stenting) with complicated dissection of the main structures.

The LPD group consisted of 4 patients. There were 2 male and 2 female patients aged from 36 to 63 years (mean age was 53+10 years).

Tumors were localized in the ampulla of Vater in 1 patient, in pancreatic head- in 1 patient and in intrapancreatic portion of distal bile duct- in 2 patients.

In all patients preoperative endobiliary drainage was placed. No neoadjuvant therapy was used in this group of patients.

Technique of the Open No-Touch PD

Laparotomy was done through bilateral subcostal incision. After exploration of the peritoneal cavity for absence of liver metastases and peritoneal seeding we started mobilization of the structures. We always started from the wide mobilization of the right colon and opening of the gastrocolic ligament. After this procedures we ligated Henle's gastrocolic trunk vein at the communicating point to the superior mesenteric vein (SMV). SMV then was dissected and looped. We proceeded to the dissection and looping of the elements of the hepatoduodenal ligament, leaving the soft tissue with lymph nodes on the pancreaticoduodenal complex. Gastroduodenal artery was ligated and transected. We try to make tunnel between the neck of the pancreas and portal vein in all patients before starting the transaction of the structures. Then, we divided the stomach or duodenum, pancreas, choledochus, and jejunum (about 15.0 cm from the Treitz's ligament). We ligated or sutured the cut ends of the pancreatic duct and bile duct to prevent dissemination. Thereafter, we ligated the portal vein branches, such as the posterior superior pancreatoduodenal vein, anterior inferior pancreatoduodenal vein, and posterior inferiorpancreatoduodenal vein, to isolate the portal vein. We did not perform kocherization until the drainage vascular vessels were ligated. We then removed the pancreatic head from its posterior (kocherization), which resulted in removal of the pancreatic head, duodenum, gastric antrum, choledochus, and gallbladder, as it was primary reported for pancreatic cancer by Hirota and Ogawa [10], and for periampullary cancer by Kobayashi *et al.* [11]. For Kocher maneur we used both standard direction and reversed kocherization (from the right to the left).

Reconstruction in all patients was made on the one loop after Child with formation of gastro-/duodeno-enterostomy in antecolic position.

Technique of the Laparoscopic PD

We have used the standard port placement [12]. We started the procedure from the dissection of the hepatoduodenal ligament. Lymph nodes of the 12 group were moved to the main hepatic duct. Cystic artery was clipped and transected. Cystic duct was identified and dissected to the common hepatic duct. We did not complete cholecystectomy on this stage of the procedure

for better traction, using gallbladder. Hepatic duct was transected just above its connection with the cystic duct. Before transection, distal part was clipped or taped and proximal part was temporary clipped with "bulldog". Gastroduodenal artery was clipped and transected.

We proceeded with the transecting of the gastrocolic and hepatocolic ligaments and opening the anterior surface of the pancreatic head and duodenum. In all cases we proceeded with mobilization and transection of the duodenum 4 cm from the pylorus. This procedure led to the clear visualization of the portal vein in its supra-pancreatic part. After mobilization of the lower margin of the pancreas and visualization of the superior mesenteric vein we proceeded with making the tunnel between pancreatic neck and portosplenomesenterial confluence and transection of the pancreas. We transected the pancreas with the ultrasound shears.

The next step was mobilization and transection of the proximal jejunal loop and transferring it to the supracolic position. Then we performed transection of the small venous branches from the superior mesenteric vein. The final step was transection of the meso-pancreas and Kocher maneuver. It was done with the help of the lateral traction of the proximal jejunal loop from the left- inferior to right- superior route.

Strategy of reconstruction did not differ from the standard PD. In cases of small pancreatic duct and soft pancreas we used open reconstruction with external drainage of the main pancreatic duct.

Statistical Methods

Mean, SEM, 95% confidence intervals (95% CI) and frequencies were used as descriptive statistics.

Follow Up

In all patients following check-ups were done in our out-patient clinic every 3 months after surgery. The following check-ups included physical examination, serum tumor markers and contrast-enhanced computed tomography.

RESULTS

Conversion rate was 42.8%. In all patients conversion was done in the early stages of the procedure (from 23 to 34 minutes of the operation) due to the perifocal inflammation and high risk of iatrogenic trauma.

The mean duration of surgery was 443 ± 44 minutes (from 370 to 490 minutes). The mean blood loss was 650 ± 269 mL (from 300 to 1000 mL). In 3 patients (75.0%) postoperative complications were recorded in the form of pancreatic fistula grade B [13]. Mortality was zero. The results of 4 successful laparoscopic PD are summarized in the **Table 1**. After histological evaluation in all patients R0 resection was achieved. One patient died 3 months after the surgery from the reasons neither connected to the surgery, nor the disease. 1 patient has been alive for 13 months being diagnosed a metastatic disease on the 9-th

Table 1. The results of 4 successful laparoscopic PD.

Number of Case	Sex	Age (y)	Diagnosis	Duration of Surgery (min)	Intraoperative Blood Lose (ml)	Type of Reconstruction	Type of Pancreaticojejunostomy	Structure of the Pancreas	Pancreatic Duct <3 mm	Postoperative Complication	Postoperative Hospital Stay (d)	Chemotherapy	Long term Results
No.1	F	56	Adenocarcinoma of distal bile duct pT ₂ N ₀ M ₀	370	800	Open	End-to-side extramucosal with external drainage of MPD	Soft	+	Pancreatic fistula, grade B	21	+	Alive without signs of recurrence (20 month)
No.2	M	63	Pancreatic adenocarcinoma pT ₂ N ₀ M ₀	460	500	Open	End-to-side duct to mucosa	Soft	-	Pancreatic fistula, grade B	12	+	Died 3 months after surgery from the reasons not connected to surgery
No.3	F	36	Adenocarcinoma of ampoula of Vater pT ₂ N ₀ M ₀	450	300	Totally laparoscopic	Double layer	Soft	+	-	8	+	Alive without signs of recurrence (14 month)
No.4	M	57	Adenocarcinoma of distal bile duct pT ₃ N ₀ M ₀	490	1000	Totally laparoscopic	End-to-side extramucosal with external drainage of MPD	Soft	+	Pancreatic fistula, grade B	46	-	Metastatic disease on the 9-th month after surgery (without chemotherapy). Alive 12 months after surgery.
Averages	-	53	-	442.5	650	-	-	-	-	-	21.75	-	-

month. 2 patients are alive without signs of recurrence (20 months and 14 months).

DISCUSSION

We represent our first experience in laparoscopic no-touch pancreaticoduodenal resection. No strong evidence is available for advantages of both no-touch and laparoscopic techniques of PD. Potential benefit of the no-touch PD in selected patients was shown in some single center trials [10, 19]. In our experience no-touch technique could be done at least as good, as standard procedure. The main advantage of the procedure is the increase of the postoperative survival. In comparison with decrease of rates of intraoperative tumor dissemination that may occur during Kocher maneuver.

Our preliminary results show, that no-touch technique could be done from laparoscopic access in a selected group of patients. Potential advantage is fast rehabilitation of patients with early start of adjuvant chemotherapy. That could be achieved in patients with uncomplicated postoperative period.

In our group rate of postoperative pancreatic fistula was extremely high [14]. This was, in our opinion, due to the patients selection- they had soft pancreatic tissue and small main pancreatic duct, which are risk factors for postoperative pancreatic fistula. Rates of pancreatic fistula in patients with such risk factors may be as high as 28.3% [15].

The difference from the open procedure is the absence of closure of the main pancreatic duct during transection of the pancreas. It could be potentially done with the use of staplers, clipping the main pancreatic duct during dissection or by putting additional suture on the duct. The necessity of such procedure is questionable, so we did not pay much attention to that.

Another difference is the direction of Kocherization. In laparoscopic surgery standard reversed Kocherization was not convenient. But all venous branches could be cut before the Kocher maneuver and the meso-pancreas is also transected during the early stage of the procedure [16].

We have no experience of early clipping of the IPDA in laparoscopic surgery. In open surgery early ligation of IPDA, described by Ishizaki Y [17], isn't done according to the standard, but to the surgeon's preference. Probably, this technique could be worked out also for no-touch laparoscopic PD.

In this study we don't analyze the long- term results. In our small group patients with different morphology and tumor stage are analyzed. It was proved previously that the long-term results of laparoscopic PD could be at least as good as in open surgery [18].

CONCLUSION

No-touch technique could be done from laparoscopic access in a selected group of patients. Potential advantage is fast rehabilitation of patients with early start of adjuvant chemotherapy.

Authors' Contributions

VMK and KVK conceived and designed the study. OVD, IVK, OOK, KVK, LOP, VVK were responsible for data collection and writing the article. SVA, OOO, NHD, YVR have made major contribution to analysis and interpretation. All authors have read, edited and approved the final manuscript.

Competing Interests

The authors declare that they have no competing interests.

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