

Laparoscopic middle pancreatectomy

Xingjun Guo, Renyi Qin (✉)

Department of Biliary-Pancreatic Surgery, The Affiliated Tongji Hospital, Tongji Medical College, Huazhong University of Science and Technology, Wuhan 430030, China

Abstract

Pancreaticoduodenectomy and distal pancreatectomy are the traditional surgical treatments of tumors in the neck or body of the pancreas. Although resecting the lesions successfully, these procedures can also, however, lead the substantial loss of normal pancreatic parenchyma, causing endocrine and exocrine function disorder. The combination of distal pancreatectomy with splenectomy increased the risk of thrombosis sometimes. So the surgical trauma is too great, especially for benign and lower malignant tumors located in the neck or body of the pancreas. While, middle pancreatectomy may decrease operative trauma with the excision of these lesions, and can maximize the retention of pancreatic parenchyma, and maintain pancreatic endocrine and exocrine function integrity. The procedure is interesting but rarely performed. With the application and development of minimally invasive surgical techniques, laparoscopic and robotic middle pancreatectomy are available now. Researches about laparoscopic and robotic middle pancreatectomy are presented, with decreased morbidity, reduced operation time and hospital stay. There is only a few reports on the two procedures, but the security and effectiveness of them are suggested.

Key words: laparoscopic; middle pancreatectomy; minimally invasive surgery

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Middle pancreatectomy spares the parenchyma and adjacent organs, and is indicated for small tumors deeply located in the pancreatic body, which are difficult to enucleate. Other lesions such as pancreatic trauma or arteriovenous malformations are also candidate targets^[1]. Middle pancreatectomy is a rarely performed but interesting procedure, and the surgical purpose is to achieve radical removal while preserving full exocrine and endocrine pancreatic function. A minimally invasive approach for this procedure has not been widely described in the literature, and only a few reports on laparoscopic and robotic middle pancreatectomy are available.

Rotellar *et al*^[2] described 9 consecutive patients with benign or low malignant potential lesions in the pancreatic neck or body, who underwent surgery from March 2005 to October 2007. Laparoscopic middle pancreatectomy is feasible and safe. Duct-to-mucosa pancreaticojejunostomy can be performed safely using this approach. The method of pancreatic transection seems to be a determinant of the incidence of cephalic stump fistulas^[2]. Giulianotti *et al*^[3] reported that robot-assisted laparoscopic middle pancreatectomy presents an

interesting, less-invasive option for resection of benign tumors of the neck and proximal body of the pancreas. In benign disease, it allows for the preservation of functional pancreatic parenchyma and reduces operative trauma^[3]. Rotellar and Pardo reported that laparoscopic middle pancreatectomy minimizes the procedure and maximizes the benefit^[4].

Dokmak *et al*^[5] reported the case of a 45-year-old woman diagnosed with branch duct intraductal papillary mucinous neoplasia (IPMN) at the pancreatic neck, which was discovered after numerous attacks of acute pancreatitis. The patient underwent pure laparoscopic middle pancreatectomy with right-to-left dissection and one-layer pancreatogastric anastomosis. Operative time was 160 min, with 20 mL of blood loss. A frozen section showed negative margins on both sides. The postoperative course was uneventful, with 15 days in the hospital. Histology confirmed the diagnosis of branch duct IPMN with moderate dysplasia and negative margins. The patient was symptom-free 6 months after surgery. Our results and the data in the literature suggest that the laparoscopic approach is indicated for

middle pancreatectomy because there are no technical or oncological contraindications and the outcome is similar to that with the open approach [5]. Ishii *et al* [6] reported two cases in which physiological reconstructive procedures were performed. The reconstructive procedures included pancreatic duct-to-duct anastomosis and parenchymal sutures with absorbable monofilament interrupted stitches [6].

Zhang *et al* [7] described 10 patients ≥ 60 years old who underwent robot-assisted middle pancreatectomy from 2012 to 2015. All 10 cases were of benign or low-grade malignant lesions. The mean operative time was 175.00 min. The mean blood loss was 113.00 mL, with no blood transfusion needed. Postoperative fistulas developed in 5 patients; there were 2 Grade A fistulas and 3 grade B fistulas. Postoperative complications occurred in 3 patients, including 2 with Grade 1 or 2 complication and 1 with Grade 3 complication. There was no reoperation or postoperative mortality. The mean hospital stay was 19.91 days. After a median follow-up of 23 months, new onset diabetes mellitus developed in 1 patient. None had deterioration of previously diagnosed diabetes or exocrine insufficiency, and there was no case of tumor recurrence. The authors concluded that robot-assisted middle pancreatectomy was safe and feasible for elderly people. There was a low risk of exocrine or endocrine dysfunction, with a positive effect on long-term outcomes. The incidence of postoperative pancreatic fistula (POPF) was relatively high, but adverse outcomes could be prevented with careful perioperative management [7].

Addeo *et al* [8] reported the case of a 26-year-old man who underwent middle pancreatectomy for a 2-cm pancreatic neuroendocrine tumor. After transection of the pancreatic neck by endoscopic stapler, the body of the pancreas was progressively liberated right-to-left from the splenic vessel axis and clips were used to secure the small splenic arterial and venous branches. On the left side, the pancreatic body was transected distally using a harmonic scalpel. Pancreaticoenteric reconstruction was achieved with double purse-string telescoped pancreaticogastrostomy. A small seromuscular incision was made on the posterior gastric wall and 2 concentric purse-string sutures were applied. Through an anterior gastrostomy, the pancreatic body was telescoped into the gastric lumen and the 2 double purse-strings were tied. A final inner layer between the gastric mucosa and pancreatic serosa was fashioned through the anterior gastrostomy [8].

Chen *et al* [9] reported a prospective randomized controlled trial comparing the short-term outcomes of robot-assisted laparoscopic middle pancreatectomy (RA-MP) with open middle pancreatectomy (OMP). A total of 100 patients were included in the study to analyze primary and secondary endpoints. Demographic characteristics

and pathological parameters were similar in both groups. Furthermore, length of hospital stay was significantly shorter (15.6 vs. 21.7 days, $P = 0.002$), median operative time was reduced (160 vs. 193 min, $P = 0.002$), median blood loss was lesser (50 vs. 200 mL, $P < 0.001$), the rate of clinical POPF was lower (18 vs. 36.0%, $P = 0.043$), nutritional recovery was better, return to usual activity was expedited (3.1 vs. 4.6 days, $P < 0.001$), and resumption of bowel movements was faster (3.5 vs. 5.0 days, $P < 0.001$) in the RA-MP group, compared to the OMP group. RA-MP was associated with significantly shorter length of stay, reduced operative time, lesser blood loss, lower clinical POPF rate, and expedited postoperative recovery, compared to OMP [9].

Middle pancreatectomy is a rarely performed but interesting procedure, and is indicated in cases of benign or low-grade malignant tumors located in the pancreatic neck or proximal body, where the surgical purpose is to achieve radical removal while preserving full exocrine and endocrine pancreatic function. A minimally invasive approach for this procedure has not been widely described in the literature, and only a few reports on laparoscopic and robotic middle pancreatectomy are available.

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