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REVIEW ARTICLE

Current status of laparoscopic pancreaticoduodenectomy and pancreatectomy

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Summary This review describes the recent advances in, and current status of, minimally invasive pancreatic surgery (MIPS). Typical MIPS procedures are laparoscopic pancreaticoduodenectomy (LPD), laparoscopic distal pancreatectomy (LDP), laparoscopic central pancreatectomy (LCP), and laparoscopic total pancreatectomy (LTP). Some retrospective studies comparing LPD or LDP and open procedures have demonstrated the safety and feasibility as well as the intraoperative outcomes and postoperative recovery of these procedures. In contrast, LCP and LTP have not been widely accepted as common laparoscopic procedures owing to their complicated reconstruction and limited indications. Nevertheless, our concise review reveals that LCP and LTP performed by expert laparoscopic surgeons can result in good short-term and long-term outcomes. Moreover, as surgeons' experience with laparoscopic techniques continues to grow around the world, new innovations and breakthroughs in MIPS will evolve. Well-designed and suitably powered randomized controlled trials of LPD, LDP, LCP, and LTP are now warranted to demonstrate the superiority of these procedures.

1. Introduction

Minimally invasive laparoscopic pancreatectomy (MIPS) is technically challenging due to the anatomical location of the pancreas and the surrounding major vasculature. In addition, many surgeons have encountered severe postoperative complications after open pancreatic resection. As a result, the adoption of MIPS has been slower compared

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with that of other abdominal procedures.[1] As surgeons become more adept at advanced laparoscopic procedures, there is increasing evidence demonstrating not only the safety and feasibility of MIPS, but also the significant advantages in postoperative recovery and the long-term survival rate, which is equivalent to that of open pancreatic resection.[2]

In this paper, we have reviewed recent advances in MIPS procedures, such as laparoscopic pancreaticoduodenectomy (LPD), laparoscopic distal pancreatectomy (LDP), laparoscopic central pancreatectomy (LCP), and laparoscopic total pancreatectomy (LTP). Since some recent articles have already reviewed LPD and LDP in detail, we have summarized the current status of LPD and LDP and examined LCP and LTP more precisely.

2. Methods

2.1. Definitions of each surgical procedure

We examined LPD, LDP, LCP, and LTP for pancreatobiliary diseases using laparoscopic procedures. Each reconstruction had to be performed intracorporeally under pneumoperitoneum to satisfy the determination of a totally laparoscopic procedure. We provided an overview of each procedure and described the associated indications, intraoperative outcomes, postoperative outcomes, and oncologic outcomes. In addition, we assessed meta-analyses of LPD and LDP and conducted the first literature review of LTP.

2.2. Search strategy

This review included only English articles identified by the terms "laparoscopic pancreaticoduodenectomy," "laparoscopic distal pancreatectomy," "laparoscopic central pancreatectomy," or "laparoscopic total pancreatectomy" in the PubMed online database. On March 20, 2016, a final search of PubMed was performed, and we selected meta-analyses of LPD and LDP. To date, there have been no meta-analyses for LCP and LTP; therefore, we selected all the existing case reports and literature reviews.

2.3. Analysis of each surgical procedure

We collected and analyzed meta-analyses of LPD and LDP. We also summarized the case reports and literature reviews relating to LCP and LTP.

3. Results

3.1. LPD

3.1.1. Overview of LPD

Pancreaticoduodenectomy is a curative surgical procedure for hepatobiliary and pancreatic neoplasms and is highly demanding, even in the hands of skilled surgeons with specific training.[3,4] Gagner and Pomp[5] first reported regarding 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. As of 2015, 746 patients had undergone LPD globally, and in over 50% of the cases, pylorus preservation was used.[6]

The main problems with LPD compared with open pancreaticoduodenectomy (OPD) relate to the intraoperative outcomes, postoperative outcomes, and oncologic outcomes. Notwithstanding, although there have been no randomized controlled trials (RCTs) comparing LPD and OPD, there are some review articles addressing this comparison.[4,6] Based on these articles, we present some notable points about LPD.

3.1.2. Indications for LPD

Apart from the traditional contraindications of laparoscopic procedures, the contraindications of LPD are patients who require concomitant vessel reconstruction or anatomical hepatectomy[6] because these cases are presumed to have high complication and mortality rates; however, there have been no reports of such a case series. The earliest case series of LPD involved patients with small, benign, or low-grade tumors of the pancreatic head, duodenal ampulla, and distal common bile duct. Recent case series of LPD also involved typical patients with carcinomas located at the distal bile duct, the pancreatic head and uncinate process of the pancreas, and the duodenum and duodenal ampulla.[7,8] Patients with mucinous cystic neoplasms and intraductal papillary mucinous neoplasms (IPMN) are also good candidates for LPD.[9]

3.1.3. Intraoperative outcomes

Complete achievement of LPD is still relatively difficult owing mainly to tumor adherence and invasion into the portal vein, unexpected bleeding, obesity, and severe pancreatitis. The conversion rate to OPD is reported as 9.1%.[6] According to a systematic literature review of LPD by Boggi et al,[6] the weighted averages of operative time and intraoperative blood loss were 464.3 minutes and 320.7 mL, respectively. Furthermore, another meta-analysis showed that LPD provides a decrease in intraoperative blood loss with a mean difference of 361.93 mL.[4]

3.1.4. Postoperative outcomes

Information on morbidity is a very important outcome of LPD, and Boggi et al[6] reported that the morbidity rate of LPD was 41.2%. However, the meta-analysis revealed no statistical difference between LPD and OPD, including postoperative pancreatic fistula (POPF) [odds ratio (OR) = 0.96, 95% confidence interval (CI) = 0.65−1.44, $p = 0.86$, $I^2 = 0\%$] and delayed gastric emptying (OR = 0.99, 95% CI = 0.62−1.56, $p = 0.96$, $I^2 = 0\%$).[4] The mortality rate in the literature review was reported as 1.9%,[6] and the meta-analysis also showed that there was no significant statistical difference in mortality between LPD and OPD (OR = 0.82, 95% CI = 0.37−1.85, $p = 0.64$, $I^2 = 0\%$).[4]

With regard to hospital stay, in a recent study comparing 108 LPD and 214 OPD cases well matched for pathologic parameters, Croome et al[10] reported a significantly shorter length of hospital stay in the LPD group (6 days vs. 9 days,

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