Advances in Surgery 49 (2015) 143–156
ADVANCES IN SURGERY

Laparoscopic Pancreaticoduodenectomy

Is It an Effective Procedure for Pancreatic Ductal Adenocarcinoma?

May C. Tee, MD, MPH, Michael L. Kendrick, MD, Michael B. Farnell, MD*

Section of Hepato-Pancreatic-Biliary Surgery, Division of Subspecialty General Surgery, Department of Surgery, Mayo Clinic, 200 First Street Southwest, Rochester, MN 55905, USA

Keywords

• Laparoscopic pancreaticoduodenectomy/Whipple procedure
• Oncologic outcomes • Technical safety

Key points

- Laparoscopic pancreaticoduodenectomy is a safe procedure with comparable perioperative morbidity and mortality to open pancreaticoduodenectomy.
- Evidence consistently shows decreased length of hospital stay and less blood loss with laparoscopic compared with open pancreaticoduodenectomy.
- Short-term oncologic outcomes following laparoscopic pancreaticoduodenectomy are equivalent and possibly superior to open pancreaticoduodenectomy.
- Long-term oncologic outcomes following laparoscopic pancreaticoduodenectomy are equivalent with no difference in overall survival and possibly improved disease-free survival with laparoscopic compared with open pancreaticoduodenectomy.

INTRODUCTION

Evolution of laparoscopic pancreaticoduodenectomy

Since the first reported pancreaticoduodenectomy (PD) by Whipple in 1935 [1], several advances have been observed with standard open PD [2,3] and minimally invasive approaches to pancreatic surgery [4]. Although laparoscopy has been performed on nearly every abdominal organ, the first minimally

The authors have nothing to disclose.

*Corresponding author. *E-mail address*: mfarnell@mayo.edu

0065-3411/15/$ – see front matter
http://dx.doi.org/10.1016/j.yasu.2015.03.003

invasive PD was not reported until 1994 by Gagner and Pomp [5]. The first laparoscopic PD was performed electively in Canada on a patient with pancreatic divisum and chronic pancreatitis [5]. Operative time was more than 10 hours and length of stay was 30 days because of a postoperative course that was complicated by jejunal ulceration and delayed gastric emptying [5]. This laparoscopic PD was subsequently followed by a case series (n = 23 of laparoscopic pancreatectomies, 10 of which were laparoscopic PD) that reported a 40% conversion rate, average operative time of 8.5 hours, and length of stay of 22 days [6]. No clear benefit of laparoscopic PD was demonstrated, leading the authors to conclude that there was minimal value added of laparoscopic compared with open PD [6].

Subsequent groups have since supported the safety and efficacy of totally laparoscopic PD (TLPD) [7–9]. Palanivelu and colleagues [9] reported a retrospective case series of 42 patients undergoing elective TLPD and demonstrated a mean operative time of 370 minutes, 10.2-day length of stay, 30% perioperative morbidity, 2% perioperative mortality, and a 5-year overall survival of 30% in patients with pancreatic malignancy. This engendered enthusiasm and larger case series were subsequently reported [7–9]. Kendrick and Cusati [8] reviewed 62 patients undergoing laparoscopic PD for all indications and reported a mean operative time of 368 minutes, 10-day median length of stay, 18% pancreatic fistula rate, and 1.6% mortality. In a comparative review of 53 patients undergoing laparoscopic PD, Asbun and Stauffer [7] reported a mean operative time of 541 minutes, 8-day mean length of stay, 24.5% major perioperative morbidity, and 5.7% perioperative mortality. Significant differences identified were a shorter length of stay (8 days laparoscopic vs 12 days open, $P<.001$) and greater operative time (541 minutes laparoscopic vs 401 minutes open, $P<.001$) for laparoscopic PD compared with open PD [7].

Currently, the definition of minimally invasive pancreatectomy is heterogeneous and encompasses TLPD, laparoscopic-assisted, robotic-assisted, and robotic pancreatectomy [10,11]. Meta-analyses have combined the experiences of TLPD and robotic PD, pooling 6 studies (n = 542 total subjects) in an overall evaluation of minimally invasive PD [11]. Minimally invasive PD was associated with decreased intraoperative blood loss (weighted mean difference of 1460 mL, $P<.001$), but longer operating times (weighted mean difference of 131 minutes, $P = .003$). There was also an associated decrease in length of hospital stay with minimally invasive compared with open PD (weighted mean difference of 3.7 days, $P = .02$). Thus, the safety of minimally invasive approaches to PD has been demonstrated by several groups, although potential oncologic benefits to this approach have only been recently described.

Technique of laparoscopic pancreaticoduodenectomy

The techniques of TLPD with and without vein resection have been previously described [8,12]. These steps are summarized in Box 1. Suggested trocar placement for TLPD is illustrated in Fig. 1.