Editorial Commentary



# Can we overcome surgical difficulties of laparoscopic panceaticoduodenectomy by improving our learning curve?

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*Provenance:* This is an invited article commissioned by the Editor-in-Chief Giovanni Battista Levi Sandri (Division of General Surgery, Santa Scolatisca Hospital, Cassino, Lazio, Italy).

*Comment on:* Nagakawa Y, Nakamura Y, Honda G, *et al.* Learning curve and surgical factors influencing the surgical outcomes during the initial experience with laparoscopic pancreaticoduodenectomy. J Hepatobiliary Pancreat Sci 2018;25:498-507.

Received: 02 April 2019; Accepted: 10 April 2019; Published: 16 April 2019.

doi: 10.21037/ls.2019.04.02

**View this article at:** http://dx.doi.org/10.21037/ls.2019.04.02

Minimally invasive laparoscopic pancreatectomy is still a technically challenging procedure due to the anatomical location of the pancreas and surrounding major vasculature. Laparoscopic pancreaticoduodenectomy (LPD) is one of the most complex procedures in gastroenterological surgery, requiring extensive lymph node dissection and complex reconstructive anastomoses. Although Gagner and Pomp first reported about LPD in 1994, acceptance was slowed by the inherent technical limitations of advanced laparoscopic skills (1). Recently, global performance rates of LPD have increased; however, feasibility and safety of LPD remain controversial.

Several factors may influence the difficulty of LPD, including patient anatomy, tumor characteristics, and surgical methodology. Learning curve is one factor that may affect surgical outcomes and postoperative complications. Few reports have described the relationship between the learning curve for LPD performance and surgical outcomes. Speicher *et al.* observed a significant reduction in operating time in the first ten LPD cases, and operating time and blood loss were consistently lower for LPD procedures than for open pancreaticoduodenectomy (OPD) (2). Kuroki *et al.* also revealed that surgeons reach a learning curve plateau after performing ten LPD procedures, with regard to operating time and blood loss (3).

We have recently read, with great interest, an article by Nagakawa *et al.*, entitled "*Learning curve and surgical factors influencing the surgical outcomes during the initial experience with laparoscopic pancreaticoduodenectomy*," published in the journal, *J Hepatobiliary Pancreat Sci* (4). The authors investigated the first 50 consecutive LPD procedures performed by three hepatopancreatobiliary (HPB) surgeons, for a total of 150 cases, and calculated each surgeon's learning curve by cumulative sum (CUSUM) analysis. Among patients enrolled in this study, 99 (66%) underwent LPD in combination with mini-laparotomy for the pancreatojejunostomy segment, and another 51 (34%) underwent a completely laparoscopic procedure. Most of the HPB surgeons who participated in this study remain uncertain of intracorporeal pancreatojejunostomy because they have experienced severe complications resulting from postoperative pancreatic fistulas (POPF). However, there is no clear evidence to support the efficacy of pancreatojejunostomy via mini-laparotomy during LPD for reducing POPF. POPF is considered the Achilles' heel of pancreaticoduodenectomy (PD), representing an organ-related rather than an approach-related complication; therefore, current evidence suggests that neither LPD nor robotic PD can significantly reduce the rate of POPF, compared to POPF rates following OPD (5).

In the article by Nagakawa *et al.*, the authors clarify a significant negative correlation between the number of procedures performed and resection time ($r^2$=0.24, P<0.01) and blood loss ($r^2$=0.32, P<0.01) (4). The learning curve for both resection time and blood loss, identified by CUSUM analysis, consists of three phases (initial, plateau, and stable), which help to mature the surgeon's LPD technique. The authors separate these phases into an introductory period (each surgeon's first 30 cases comprise the initial and plateau phases, total n=90) and stable period (each surgeon's final 20 cases, n=60). Operating time (565 *vs.* 549 min, P=0.03), resection time (331 *vs.* 291 min, P=0.01), and blood loss (278 *vs.* 227 min, P<0.01) were all significantly higher during the introductory phase than during the stable phase (4). These results suggest that surgeons have to experience at least 30 LPD cases before operating time and blood loss are stabilized.

Regarding the LPD procedure's level of difficulty, we usually presume that lymph node dissection may influence surgical outcomes, including resection time and blood loss. According to the article by Nagakawa *et al.*, lymph node dissection significantly prolonged resection time during the introductory phase (388 *vs.* 296 min, P<0.01), however, there was no significant difference between LPD with and without lymph node dissection during the stable phase (310 *vs.* 290 min, P=0.51) (4). Neither was there a significant difference in blood loss between groups in either period. These results suggest that various hepatobiliary diseases, including pancreatic ductal adenocarcinoma, are good candidates for LPD, without requiring concomitant vessel reconstruction or anatomical hepatectomy (6). Therefore, LPD indication can be extended from low-grade malignant pancreatic tumors to pancreatobiliary cancers for surgeons who have performed more than 30 LPD procedures. However, individual patient characteristics should be considered, as some characteristics will make it difficult to smoothly perform an LPD procedure.

In this article by Nagakawa *et al.*, univariate analysis showed that massive blood loss during the introductory phase is associated with a high volume of visceral fat and increased depth of the duodenum and hepatoduodenal ligament (4). Some recent reports have indicated that visceral fat can increase the difficulty of performing laparoscopic surgery (7,8). Multivariate analyses also revealed that the presence of concomitant pancreatitis affects both resection time and blood loss during the introductory and stable phases. Pancreatitis can cause severe adhesions around the major vessels; therefore, LDP procedures on patients with pancreatitis should be avoided during the introductory phase.

To overcome the surgical difficulties associated with LPD procedures, Nagakawa *et al.* states that even surgeons who specialize in HPB require at least 30 LPD cases before their surgical performance stabilizes (4). At the beginning of the introductory phase, lymph node dissection may prolong the resection time as it requires an advanced technique; however, there is no clear correlation between resection time and surgical outcome. Surgeons should therefore perform laparoscopic lymph node dissection following proper patient selection criteria and should mature their laparoscopic techniques. When LPD is performed on patients with high visceral fat volume and concomitant pancreatitis due to occlusion of the pancreatic duct, surgeons have to carefully perform LPD so as not to damage major vessels. Regarding the long-term oncological outcome of LPD for pancreatic ductal adenocarcinoma and other malignancies, LPD and OPD share similar overall survival rates. LPD is also associated with longer disease-free survival rates when compared with OPD (6,9). Therefore, LPD will be a minimally invasive alternative to OPD in the near future.

## Acknowledgements

None.

## Footnote

*Conflicts of Interest:* The authors have no conflicts of interest to declare.

## References

1. Gagner M, Pomp A. Laparoscopic pylorus-preserving pancreatoduodenectomy. Surg Endosc 1994;8:408-10.
2. Speicher PJ, Nussbaum DP, White RR, et al. Defining the learning curve for team-based laparoscopic pancreaticoduodenectomy. Ann Surg Oncol 2014;21:4014-9.
3. Kuroki T, Kitasato A, Adachi T, et al. Learning Curve for Laparoscopic Pancreaticoduodenectomy: A Single Surgeon's Experience with Consecutive Patients. Hepatogastroenterology 2014;61:838-41.
4. Nagakawa Y, Nakamura Y, Honda G, et al. Learning curve and surgical factors influencing the surgical outcomes during the initial experience with laparoscopic pancreaticoduodenectomy. J Hepatobiliary Pancreat Sci 2018;25:498-507.
5. Ricci C, Casadei R, Taffurelli G, et al. Minimally Invasive Pancreaticoduodenectomy: What is the Best "Choice"? A Systematic Review and Network Meta-analysis of Non-randomized Comparative Studies. World J Surg 2018;42:788-805.
6. Umemura A, Nitta H, Takahara T, et al. Current

 

status of laparoscopic pancreaticoduodenectomy and pancreatectomy. Asian J Surg 2018;41:106-14.
7. Park BK, Park JW, Ryoo SB, et al. Effect of Visceral Obesity on Surgical Outcomes of Patients Undergoing Laparoscopic Colorectal Surgery. World J Surg 2015;39:2343-53.
8. Umemura A, Suto T, Nakamura S, et al. Comparison of Single-Incision Laparoscopic Cholecystectomy versus Needlescopic Cholecystectomy: A Single Institutional Randomized Clinical Trial. Dig Surg 2019;36:53-8.
9. Peng L, Zhou Z, Cao Z, et al. Long-Term Oncological Outcomes in Laparoscopic Versus Open Pancreaticoduodenectomy for Pancreatic Cancer: A Systematic Review and Meta-Analysis. J Laparoendosc Adv Surg Tech A 2019. [Epub ahead of print].

doi: 10.21037/ls.2019.04.02
**Cite this article as:** Umemura A, Nitta H, Takahara T, Hasegawa Y, Sasaki A. Can we overcome surgical difficulties of laparoscopic panceaticoduodenectomy by improving our learning curve? Laparosc Surg 2019;3:15.

 