

# Indications for minimally invasive pancreatic surgery: are there any oncological benefits?

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## ABSTRACT

Currently, surgery in combination with systemic treatment is associated with the best survival outcome in patients with pancreatic adenocarcinomas. The open surgical approach is considered the standard method of choice, with acceptable mortality rates of less than 3 to 5% in high-volume centers. However, it is still associated with an unacceptably high rate of morbidity, mainly due to the occurrence of pancreatic fistula. Minimally invasive surgery, with its advantages over open surgery in other surgical fields, offered hope for patients with PA for a lower complication rate and better overall survival compared with a higher percentage of patients receiving adjuvant systemic chemotherapy. Anatomical considerations and limitations of laparoscopic technology resulted in the acceptance of laparoscopic modality in pancreatic surgery, where the reconstruction phase was not needed. The laparoscopic technique is applicable for left-sided pancreatic resections and has been adopted worldwide with results comparable to those of open surgery. The complexity of pancreatic head resection has resulted in the adoption of laparoscopic techniques in a relatively low number of centers worldwide, performed by a small number of highly skilled surgeons. If a surgical method is not reproducible and acceptable worldwide, it is difficult to state that it is equivalent to well-established open surgical procedures. Advances in technology have resulted in the development of robotic surgery platforms. The robotic surgery platform, with its stability combined with the three-dimensional, magnified high-definition vision, increased degrees of freedom of the instruments, and tremor filtering, allows

for the same movements as open surgery. Thus, despite their relatively young age, robotic platforms have been accepted as a minimally invasive surgical method that enables all types of pancreatic surgical procedures including pancreatic head resection. The main limitations of the worldwide acceptance of robotic platforms are associated with higher costs and steep learning curves. Despite the possibility of using a high-tech tool, surgeons should focus primarily on patient well-being and achieve the best possible results regardless of the surgical method used. The new method can be applied as the new method of choice only when producing the same or better results than the standard open surgical approach. In the literature, several parameters have been used to compare the effectiveness and applicability of different methods. Most often used are the time of surgery, blood loss, rate of conversion, postoperative pain, complication rate, mortality rate, oncological outcomes, and aesthetic effect. The authors opined that the main factors to be considered when comparing different methods are the rate of complications, mortality rate, and oncological outcomes. These factors profoundly influence patients' well-being and long-term survival. In 2016, de Roojis published a meta-analysis in which outcomes after MIPS seemed promising in comparative cohort studies, despite the presence of bias, whereas registry studies reported higher mortality in low-volume centers. The authors concluded that the introduction of MIPS should be closely monitored and performed only within structured training programs in high-volume centers. If we look at the data comparing open pancreatic surgery (OPS) to minimally invasive pancreatic surgery (MIPS), the rate of surgical site com-

plications (88 (44.4%) vs. 87 (43.9%);  $P > .99$ ) was similar, whereas the rate of non-surgical site complications (35 (17.7%) vs. 56 (28.3%);  $P = .02$ ) differed in favor of MIPS. MIPS was associated with a higher rate of clinically relevant pancreatic fistula (22.2% vs. 12.6% after OPS ( $P = .02$ )) and a lower rate of delayed gastric emptying (5.6% vs. 24.7%;  $P < .001$ ). Another study showed that outcomes in MIPS are equal to or more beneficial compared to the open approach when applied to elderly and obese patients. A series of 500 robotic pancreatoduodenectomies showed that robotic pancreatic surgery is associated with a low complication rate (Clavien score  $> 2$ , less than 24%) and clinically relevant postoperative pancreatic fistula in 7.8% and 30- and 90-day mortality rates of 1.4% and 3.1%, respectively. Even in patients with periampullary carcinoma, MIPS is not inferior in terms of short-term morbidity or mortality. In 2018, van Hilst et al. showed that in patients with PDAC, MIPS was associated with comparable survival, R0 resection, and use of adjuvant chemotherapy, but a lower lymph node yield, as compared to OPS. The DIPLOMA trial reported comparable survival rates after MIPS and OPS for PDAC. However, the opposing differences in R0 resection rate, resection of Gerota's fascia, and lymph node retrieval strengthen the need for randomized trials to confirm the oncological safety of MIPS. The LEOPARD trial showed that MIPS was associated with a reduced time to functional recovery. MIPS was associated with less delayed gastric emptying and a better quality of life without increasing costs; however, the overall rate of complications was not reduced. A recently published meta-analysis showed that laparoscopic pancreatoduodenectomy (LPD) is associated with non-inferior short-term surgical outcomes and oncologic adequacy compared to open resection when performed by experienced surgeons at large centers. Comparable results were reported by Uijterwijk et al. Robotic pancreatoduodenectomy (RPD) is a safe and feasible surgical treatment for malignant or benign disease of the pancreatic head and periampullary region, with comparable results in terms of surgical radicality, including R0 curative resection and the number of harvested lymph nodes with OPD. Long-term surgical and oncological outcomes of MIPS for

distal cholangiocarcinoma are acceptable compared with those of OPD. Surgical outcomes seem to favor RPD over LPD, but more data are needed. In conclusion, open resection remains the cornerstone of pancreatic surgery. Most surgical communities appreciate the adoption of MIPS as the method of choice for a selected population of patients. It is safe and oncologically comparable to open surgery if performed in a high-volume center with experienced surgeons following standardization of operative procedure protocols. However, to establish the role of new minimally invasive modalities, further high-quality evidence is required.

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