

ORIGINAL ARTICLE

Minimally invasive pancreatoduodenectomy

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Abstract

Background: Minimally invasive pancreatoduodenectomy (MIPD) is increasingly performed with several institutional series and comparative studies reported. The aim was to conduct an assessment of the best-evidence and expert opinion on the current status and future challenges of MIPD.

Methods: A systematic review of the literature was performed and best-evidence presented at a State-of-the-Art conference on Minimally Invasive Pancreatic Resection. Expert panel discussion and audience response activity was used to assess perceived value and future direction.

Results: From 582 studies, 26 comparative trials of MIPD and open pancreatoduodenectomy (OPD) were assessed for perioperative outcomes. There were no randomized controlled trials and all available comparative studies were determined of low quality. Several observational and case-matched studies demonstrate longer operative times, but less estimated blood loss and shorter length of hospital stay for MIPD. Registry-based studies demonstrate increased mortality rates after MIPD in low-volume centers. Oncologic assessment demonstrates comparable outcomes of MIPD. Expert opinion supports ongoing evaluation of MIPD.

Conclusion: MIPD appears to provide similar perioperative and oncologic outcomes in selected patients, when performed at experienced, high-volume centers. Its overall role in pancreatoduodenectomy needs to be better defined. Improved training opportunities, registry participation and prospective evaluation are needed.

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Introduction

Pancreatoduodenectomy, arguably the most complex pancreatic operation, requires not only a demanding resection of the pancreatic head, bile duct and intestine, but also entails a challenging reconstruction where major morbidity and mortality may result from anastomotic failure or hemorrhage. Despite several advances in patient selection, surgical technique, and postoperative care, morbidity occurs in up to 40% of patients undergoing open pancreatoduodenectomy (OPD). Minimally invasive approaches are expected to reduce the morbidity of pancreatotomy through typical advantages such as less blood

loss, pain, wound morbidity, and shorter hospital stay, and time to recovery.

For distal pancreatectomy, there has been a relatively steady adoption of minimally invasive approaches and several large comparative studies and meta-analyses now suggest advantages over open approaches.^{1,2} Minimally invasive pancreatoduodenectomy (MIPD) is more challenging requiring advanced skills of both resection and reconstruction. Thus, despite its initial description in 1994 by Gagner and Pomp,³ MIPD gathered little enthusiasm over the ensuing decade. With recent improvements in optics, surgical instruments and an increased dissemination of advanced minimally invasive skills, MIPD is now more feasible. Multiple centers across the world have now incorporated this approach into their practice, with several studies reporting similar or favorable outcomes compared to OPD.

Presented at the IHPBA State of the Art Conference on Minimally Invasive Pancreatic Resection, April 20–23, 2016, Sao Paulo, Brazil.

Several ongoing impediments limiting a more rapid and widespread adoption of MIPD include: the predominance of pancreatic surgeons lacking advanced laparoscopic skills, few supervised training opportunities, and the absence of data supporting clear superiority over OPD. Despite these limitations, the suspected benefits sustain a continued global interest in MIPD.

With a desire to assess the best-evidence, current value, and future challenges of MIPD, the first State-of-the-Art conference on Minimally Invasive Pancreatic Resection (MIPR) was organized. This was held in conjunction with the International Hepato-Pancreato-Biliary Association (IHPBA) World Congress in Sao Paulo, Brazil on April 20th, 2016, where experts from around the world gathered to review and discuss MIPR.⁴ As part of this day-long conference, attended by over 400 surgeons, a session was devoted specifically to MIPD and focused on three key areas: (i) perioperative outcomes of MIPD compared to OPD; (ii) oncologic outcomes of MIPD for pancreatic ductal adenocarcinoma compared to OPD; and (iii) advantages and disadvantages of open and minimally invasive approaches for pancreatoduodenectomy. The session closed with a panel discussion addressing current status, barriers to progress, and future considerations of MIPD.

Methods

To assess best level of evidence, a systematic search was performed in PubMed, Embase and Cochrane Library for original research publications of laparoscopic or robotic versus open pancreatic resection published before March 22, 2016. Terms (restricted to title and abstract) used for the literature search focused on the procedure and approach such as pancreatectom* OR pancreatic resection OR Whipple OR pancreaticoduodenectom* OR pancreatoduodenectomy* AND laparoscop* OR robotic OR robot-assisted OR minimally invasive OR hybrid. Review was performed according to the Preferred Reporting Items for Systematic Reviews and Meta-Analysis (PRISMA) guidelines.⁵ All titles, abstracts and full-text articles were screened by two authors independently (JvH and TdR). In the event of overlapping cohorts, the most recent and complete data set was included. Inclusion criteria were manuscripts written in English, comparing minimally invasive to open approach for pancreatoduodenectomy, and those with >10 patients per study group. For studies evaluating cancer outcomes, only studies with data exclusive for pancreatic ductal adenocarcinoma were included to avoid confounding of oncologic outcomes when data is pooled for multiple tumor types. Data extraction focused on study characteristics and perioperative outcomes, including oncologic outcomes. For evaluation of perioperative outcomes, preference was given to the pancreas-specific complications according to the International Study Group on Pancreatic Surgery definitions.^{6–8}

An overview of the MIPD session from the conference is provided in [Table 1](#). This began with objective presentations of

the relevant data that had been accrued to date on the comparative outcomes (as above). Then, four experienced surgeons with expertise in a specific approach (laparoscopic, laparoscopic resection with open reconstruction, robotic or open) were selected to provide expert opinion in lecture format. Both clinical evidence and personal experience were discussed with regard to the pros and cons of each approach. A summary of these viewpoints is reported.

A panel of pancreatic surgeons with extensive experience in open, minimally invasive or both approaches was selected to discuss the current value, experience and future considerations of MIPD. Several key questions were first presented to all conference attendees. Responses were recorded and presented for discussion using an audience response system. The panel of experts then provided additional insight and discussion for each topic.

Results

Literature review: perioperative outcomes

Of 582 studies identified, 26 (17 observational, 9 case-matched) studies met all inclusion criteria. There were no randomized controlled trials. The methodologic quality of all studies was determined to be low (Newcastle–Ottawa scale <6). Institutional

Table 1 Overview of the session on minimally invasive pancreatoduodenectomy from the First International State-of-the-Art Conference on Minimally Invasive Pancreatic Resection

| Minimally invasive pancreatoduodenectomy | |
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| Session leader: Ugo Boggi, MD (Pisa, Italy) | Introduction |
| R. Matthew Walsh, MD (Cleveland, USA) | Perioperative outcomes of minimally invasive Whipple |
| Michael Kendrick, MD (Rochester, USA) | Cancer outcomes for minimally invasive Whipple |
| Herb Zeh, MD (Pittsburgh, USA) | Pro/con Robotic Approach |
| Steven Hughes, MD (Gainesville, USA) | Pro/con Laparoscopic Approach |
| Yoshiharu Nakamura, MD (Tokyo, Japan) | Pro/con Hybrid Approach |
| Charles Vollmer, MD (Philadelphia, USA) | Pro/con Open Approach |
| Panel moderator | Horacio Asbun, MD (Jacksonville, USA) |
| Panel | Herb Zeh, MD (Pittsburgh, USA) |
| | Michael Farnell, MD (Rochester, USA) |
| | Chinnusamy Palanivelu, MD (Coimbatore, India) |
| | Thilo Hackert, MD (Heidelberg, Germany) |
| | Richard Schulick, MD (Aurora, USA) |
| | Mark Callery, MD (Boston, USA) |
| | John Martinie, MD (Charlotte, USA) |

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