French Editorial Commentary from the ACHBPT

Feasibility and outcomes of robotic partial pancreatoduodenectomy

Antoine Rouault[1]^, Yasmina Richa[2], Mehdi El Amrani[1]

[1]Department of Digestive Surgery and Transplantation, Lille University Hospital, Lille, France; [2]School of Medicine, University College Cork, Cork, Ireland

Correspondence to: Antoine Rouault, MD. Department of Digestive Surgery and Transplantation, Lille University Hospital, Michel Polonowski Street, Lille 59000, France. Email: a.rouault@outlook.com.

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We read with great interest the randomized controlled trial (RCT) by Klotz *et al.* (1), which is the first to compare the 90-day postoperative morbidity of minimally invasive robotic partial pancreatoduodenectomy (RPD) to that of the current gold standard, open partial pancreatoduodenectomy (OPD) for all indications. This study arises in the context of a significant increase in surgical indications for robotic-assisted procedures. The absence of clear recommendations or high-level evidence on RPDs prompted Klotz *et al.* to conduct this phase 2b RCT to directly compare RPD to OPD.

From June 2020 to February 2022, 81 patients were included and randomized to either the RPD arm (n=41) or the OPD arm (n=40) at an expert pancreatic surgery center in Heidelberg, Germany. After excluding patients with borderline or unresectable tumors, those with an American Society of Anesthesiology (ASA) score >3, and cases in which no pancreatoduodenectomy (PD) was perform, 29 patients in the OPD arm and 33 patients in the RPD arm were analyzed using a modified intention-to-treat analysis. The primary outcome was the cumulative morbidity rate at 90 days according to the Comprehensive Complication Index (CCI). Secondary outcomes included operative time, intraoperative blood loss, and rate of pancreatic-specific complications among others. The two groups were comparable in terms of general characteristics, pancreatic features (such as the texture of pancreas and the size of pancreatic duct at the transection site), tumor subtype, and extent of resection.

The intention-to-treat analysis for the primary outcome showed no significant difference in 90-day mortality between the two groups (34.02±23.48 *vs.* 36.45±27.65, P=0.71). Regarding secondary outcomes, the authors highlighted a clinically significant delayed gastric emptying (DGE) grades B and C in the RPD arm compared to the OPD arm (34% *vs.* 6%, P=0.005). As expected, the operative time was shorter in the OPD compared to the RPD arm. Moreover, the lengths of intensive care unit stay and total hospital stay, and the rate of postoperative mortality were comparable between the two groups. Regarding histopathology results, the R1 resection rate was higher in the RPD arm compared to the control group but the difference was not significant (18% *vs.* 0%, P=0.15).

This long-awaited phase II trial (1) focused on a rapidly evolving surgical approach. Its significance is substantial for several reasons: (I) it is the first RCT to compare robotic-assisted to open surgery following four RCTs that only evaluated the laparoscopic approach; (II) it evaluates the minimally invasive approach for a procedure with significant morbidity and mortality; and (III) it aims to improve postoperative outcomes for a procedure often performed for pancreatic cancer, one of the most aggressive types of cancers.

PDs in each group were performed by surgeons who demonstrated sufficient proficiency. Two surgeons proficient in RPDs performed both procedures, while thirteen other

^ ORCID: 0009-0005-2905-834X.

surgeons only performed OPDs. Sufficient proficiency in each procedure was defined by Klotz *et al.* as having conducted ≥40 RPDs or OPDs. The learning curve for RPD is described as requiring fewer procedures compared to laparoscopic surgery. However, the threshold for sufficient proficiency remains controversial in the literature (2,3) as it is highly variable from one surgeon or team to another, and particularly concerning desired outcomes such as reduction in operative time and conversion rate.

Additionally, five patients in each group underwent PD with vascular resection, although the extent of resection was not detailed in the article. Therefore, while the threshold of 40 is likely valid for a standard PD, it should probably be increased for those requiring vascular resection due to the added complexity involved. Moreover, one of the exclusion criteria defined by the authors is a borderline or unresectable carcinoma of the pancreatic head, as defined by the National Comprehensive Cancer Network guidelines (NCCN). However, according to the pancreatic adenocarcinoma NCCN guidelines in 2019, tumors with veinous involvement are classified as borderline and those with arterial involvement are classified as unresectable. Furthermore, 6 out of 19 RPDs included in the analysis were converted to an open approach, potentially highlighting the difficulty of these cases. These observations are further supported by the rate of blood loss in both groups, which could be attributed to the need for venous resection in 17.2% of patients in the RPD group and 9.1% in the OPD group. Hence, it seems that some cases included in this trial were complex and could have been excluded, as the tumors were likely classified as borderline or unresectable from the outset, making them unsuitable for the robotic approach.

Regarding postoperative outcomes, the results were comparable between the two groups in terms of pancreatic fistula rate, bile fistula rate, and post-PD hemorrhage. However, the rates of these complications were higher in the RPD group compared to the control, although the difference was not statistically significant. The most striking result is the rate of gastroparesis after RPD, which may explain the prolonged length of stay in this group. According to the authors, this result is explained by the routinely performed mechanical gastrojejunostomy in RPD. The rate of gastroparesis after RPD varies between 4.5% and 56% (4). Jung *et al.* have reported a higher rate of gastroparesis with mechanical compared to manual gastrojejunostomy (5). Mao *et al.* have suggested that performing a gastrojejunostomy by mini laparotomy in an ante-colic, anti-peristaltic, and infra-mesocolic position would significantly reduce the rate of post-RPD gastroparesis (4). This approach aims to create a vertical anastomosis to ensure optimal gastric emptying and to distance the gastrojejunostomy site from possible inflammation caused by potential pancreatic fistula formation. Another surprising element in this study is the postoperative mortality rate in the OPD group (9%), which may indicate a lack of homogeneity in terms of resectability between the two groups.

Regarding oncological criteria, the R0 resection rate was comparable between the two groups while the R1 resection rate was higher in the RPD arm. The majority of patients in this trial had pancreatic adenocarcinoma. However, conclusions specific to this subtype of pancreatic cancer cannot be drawn without a randomized trial focused solely on this indication.

RPD shows promise as an approach for certain patients, particularly when performed at expert centers by experienced surgeons. While the results of this trial are encouraging, a larger multicenter trial is needed to further evaluate the advantages and limitations of RPD.

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Footnote

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