



Comment on: “A comparison of outcomes between open, laparoscopic and robotic pancreaticoduodenectomy”, Zimmerman *et al.*, 2017, HPB

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Minimally invasive (MI) surgery has gradually increased during the past 3 decades. MI surgery is now the gold standard in colorectal surgery and becomes a standard in gastric and oesophagus surgery (1-4). The first description of laparoscopic pancreaticoduodenectomy (LPD) dates to the 90's and robotic pancreaticoduodenectomy (RPD) in 2003 (5-7). While many studies have shown potential interest for this procedure, LPD remains an uncommon procedure. Only one randomized clinical monocentric trial comparing LPD *vs.* open pancreaticoduodenectomy (OPD) has been conducted during the 25 past years (8). Zimmerman *et al.* propose the first retrospective review from NSQIP database comparing both laparoscopic LPD and RPD with OPD. Parts of their findings are similar to previous reports. They concluded that LPD and RPD had both a longer operative time but a shorter length of stay compared to OPD. LPD was performed in patients with better general health condition and was associated to less morbidity (less surgical site infection) but the patients were more likely to require percutaneous drain placement. RPD was performed in patients with less disseminated cancer compared to OPD and LPD. RPD was associated with less perioperative bleeding compared to OPD, higher rate of surgical site infection and lower rate of conversion compared to LPD.

In 2014, Croome *et al.* published the most encouraging study in favor of LPD *vs.* OPD (9). They reported impressive results comparing 108 LPD to 214 OPD: same operative time, significant lesser blood and blood

transfusion rates, with the same rate of vein resection and for same tumor size. Outcomes were significantly favorable to LPD with regards to delayed gastric emptying, length of hospital stay and recurrence free survival. However, more recent studies are less optimistic on the oncological outcomes reporting no difference on the overall survival (10-12). Despite those positive outcomes, the lack of spreading of LPD could be explained by the low number of surgeons skilled to this procedure. The majority of the studies reports LPD performed only by one single surgeon and no conclusion can be done on the reproducibility of the procedure. In fact, the impressive results reported by Croome have not been confirmed by recent studies. Adam *et al.* in 2015 reported the results of a large study population of more than 7,000 patients, revealing on multivariable analysis that laparoscopic approach was an independent factor influencing 30 days mortality, especially in low volume center where less than 10 LPD were performed in two years (13). Moreover, in this study 90% of patients were operated in these conditions. They concluded that at least 80 procedures are required to eliminate this over risk. In the same way, a study performed from a national American registry showed the same results with 96% of patients operated in centers performing less 10 procedures, but with a lower number of required procedures to eliminate this over risk (14). Regarding morbidity, Dokmak *et al.* in 2015 compared 46 LPD to 46 OPD and showed that LPD was associated with more bleeding and pancreatic fistula with a longer operative

time (15). In 2016, a meta-analysis clearly confirmed that MI PD has a longer operative time than the open approach (16).

A recent study from a national American cohort brings new robust information due to its recent period and the number of procedures included (1,002 OPD *vs.* 334 MI PD) (17). Despite the retrospective character of the study, the propensity score used, allow to increase its power. A first reading of the study brings to a positive attitude towards laparoscopic approach: same postoperative 30 days mortality and morbidity with a lower length of hospital stay when you categorized it before and after 14 days. A second reading should bring a critical attitude towards laparoscopic approach. In fact, the two groups were not comparable. In LPD group, the patients were significantly younger, white people and with less weight loss and the surgery was shorter. Regarding postoperative course, no significant difference was found in terms of return to operating room, delayed gastric emptying, length of hospital-stay when continuous variable and not categorized variable was used. The only significant difference was a higher rate of hospital readmission in LPD group. Finally, Palanivelu *et al.* published in 2017 the results of the first randomized clinical trial comparing 32 LPD and 32 OPD for periampullary tumors (8). They confirmed longer operative time, shorter hospital-stay and lower blood loss for LPD but found similar overall morbidity and mortality compared to OPD.

Although RPD is less developed than LPD, surgical teams interested in have studied its impact on the outcomes of PD. In 2013, Zureikat *et al.* brought descriptive results on the feasibility and safety of robotic surgical approach, including 132 PD (18). They reported a probably minor conversion rate (8%) than laparoscopic approach and acceptable 90 days mortality (3.8 %) and major morbidity (21 %). This study brought also two important findings: a linear decrease in the operative time and a rate of complication significantly decreasing after 100 procedures. Using the same database as Zimmerman, Nassour *et al.* analyzed the outcomes of LPD versus RPD (19). They showed no difference in terms of operative time, 30-day overall morbidity and mortality, reoperation rate and length of hospital-stay. The lower conversion rate was in favor of robotic approach: (11.4% *vs.* 26%), but the oncologic characteristics of the patients were not comparable (less preoperative radiotherapy, vascular and multivisceral resections...).

Currently, MI PD has not reach the stage of acceptance and the volume of pancreatic surgery brake the spread

of MI approach (centralization only in UK, Netherlands and Denmark). The robotic approach still increases the cost but could help the achievement of MI PD. The spreading of MI approach in pancreatic surgery will required randomized clinical trial to robustly demonstrate its superiority or at least its equivalence to open approach. This fact needs to standardize the procedure, probably by a better centralization in expert centers both specialized in pancreatic and MI surgery and the establishment of program-training for residents in these expert centers.

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