# Reducing conversion in minimally invasive distal pancreatectomy: patient selection, training, and robotics

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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:* Casadei R, Ricci C, Pacilio CA, *et al.* Laparoscopic distal pancreatectomy: which factors are related to open conversion? Lessons learned from 68 consecutive procedures in a high-volume pancreatic center. Surg Endosc 2018;32:3839-45.

Received: 17 February 2019; Accepted: 25 February 2019; Published: 19 March 2019.

doi: 10.21037/ls.2019.02.05

**View this article at:** http://dx.doi.org/10.21037/ls.2019.02.05

Minimally invasive surgery (MIS) has become the preferred approach to distal pancreatectomy at many high-volume institutions, but only accounts for 15% of distal pancreatectomies performed in the United States (1,2). This approach is used for a variety of histologies, including malignancy (3-5). As with all minimally invasive procedures, there is a risk of conversion to an open procedure, which rises with the complexity of the procedure. The conversion rate for MIS distal pancreatectomy varies in the literature from 3–31% for laparoscopic procedures (6).

In a recent paper, "*Laparoscopic distal pancreatectomy: which factors are related to open conversion? Lessons learned from 68 consecutive procedures in a high-volume pancreas center*", Casadei and his colleagues describe their outcomes for distal pancreatectomies from 2004–2016 (7). Of note, a laparoscopic approach was attempted in 43% of all distal pancreatectomies at their institution during the study period. They reported a 19% conversion to open rate, which is well within the previously reported range, as were their other complication rates. Regression analysis revealed that the only factor associated with conversion was pancreatic transection to the right of the portal vein. In fact, odds of conversion to open were nearly 10 times higher in this group. There was also a trend towards higher conversion rates with suspicion for malignancy. More difficult cases are not always attempted in a MIS fashion due to risk of conversion. Subtotal distal pancreatectomy and distal pancreatectomy for malignancy are typically considered more difficult/complex procedures, so these risk factors for conversion to open are logical. Based on these results, one might seriously question attempting a laparoscopic distal pancreatectomy for cancer when need for transection to the right of the portal vein (subtotal distal pancreatectomy) is anticipated. When an MIS approach is chosen for these procedures, the surgeon should counsel the patient of the higher likelihood of conversion to open surgery.

In this paper, the authors question if a robotic approach could potentially overcome the limitations of the laparoscopic equipment during subtotal distal pancreatectomy. The vast majority of MIS distal pancreatectomies in the United States are performed laparoscopically (8). Comparisons of robotic and laparoscopic distal pancreatectomy show outcomes are generally similar, including length of hospital stay, 30-day readmission rate, and overall survival (8). The conversion to open rate, however, tends to be higher for laparoscopic compared to robotic procedures (8-10). The conversion to open rate for robotic distal pancreatectomy ranges from 0–38% (6), but averages 7–8% (9,10). The higher conversion rate for the laparoscopic approach has been found both for malignancy, and in cohorts with mixed indications for surgery. Tumor proximity to major vessels is the most common reason for conversion to open surgery, as would be the case during a subtotal distal pancreatectomy (11). This particular reason for conversion tends to be more common for laparoscopic *vs.* robotic cases (29% *vs.* 14%) (11).

Casadei *et al.* imply that conversion to open is negative, but do not directly compare the post-operative outcomes of their patients who underwent an MIS completed distal pancreatectomy to those who were converted to open (7). A study of the American College of Surgeons-National Surgical Quality Improvement Program identified 1,200 patients who underwent MIS distal pancreatectomy in 2014–2015 (12). In the unadjusted analysis, the patients who underwent conversion to open surgery experienced higher overall morbidity, including serious morbidity, and mortality compared to those who had the operation completed in an MIS fashion. After propensity score matching, risk for overall morbidity and serious morbidity remained higher for the converted to open cohort. Features associated with conversion included male gender, higher body mass index, diabetes, smoking, and qualities pertaining to malignancy (>10% pre-operative weight loss, neoadjuvant chemotherapy, and neoadjuvant radiation) (12). Others have also reported male gender and malignancy as risk factors for conversion to open (11,13).

These data should not discourage the general practice of MIS distal pancreatectomy. A recently published Dutch randomized trial of MIS versus open distal pancreatectomy in fact supports an MIS approach as the standard of care for those with tumors <8 cm without vascular involvement (14). The authors found that functional recovery was faster in the MIS group *vs.* open by 2 days, with better quality of life in the early post-operative period. Again, the vast majority of the MIS operations in this study were laparoscopic (42/47, 89%), and 8% converted to an open procedure. In a large European cohort study of distal pancreatectomies only for adenocarcinoma, conversion to open was 19% (15). Importantly, they found that R0 resection was actually higher in the MIS group, and that overall survival was similar between MIS and open groups.

The conversion to open rate, as well as the patient length of hospitalization is inversely related to surgeon training and experience (13,16). The Dutch initiated a national training program when it was noted that the rate of MIS distal pancreatectomy had stagnated, and conversion to open rates remained >30%. Training consisted of technique description, video training, and on-site proctoring, with a total of ~8 hours of instruction. Patient outcomes were compared to a historical control. Despite the fact that patients treated after training had larger tumors and a higher number of adenocarcinomas, the odds of completing a distal pancreatectomy in a minimally invasive fashion increased 10-fold (16). Rate of conversion is also decreased for surgeons with >1-year experience, and those who have performed >15 operative cases (13). The learning curve as it relates to operative time for laparoscopic and robotic distal pancreatectomy has been reported to be 10–20 procedures (17-20). It has been suggested that learning curve is faster for operative novices with robotics compared to laparoscopy, and that fewer errors are made with robotics compared to laparoscopy for experienced surgeons performing simple tasks (21,22). Head to head comparisons of skills acquisition as they pertain to distal pancreatectomy, though, have not been made. As such, the best approach is likely the one with which the operative surgeon has the greatest comfort.

## Acknowledgements

None.

## Footnote

*Conflicts of Interest:* C Stewart has received professional honoraria from Verb Surgical, unrelated to this manuscript. Y Fong is a scientific consultant to Medtronics, Johnson & Johnson, Olympus, Avra Robotics, and Perfint Robotics, all unrelated to this manuscript.

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doi: 10.21037/ls.2019.02.05
**Cite this article as:** Stewart C, Fong Y. Reducing conversion in minimally invasive distal pancreatectomy: patient selection, training, and robotics. Laparosc Surg 2019;3:11.

 