Original Article

Laparoscopic pancreaticojejunal anastomosis using knotless barbed absorbable sutures are simple, safe and effective: an experience with 34 procedures

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Background: The aim of our article is to present the technique of laparoscopic pancreaticojejunostomy that is currently used in our center.

Methods: For the purpose of the study we analysed a retrospective series of 34 consecutive cases of laparoscopic pancreaticoduodenectomies operated between January 2016 and April 2019. The standard of care for patients requiring a pancreaticoduodenectomy in our practice is a Child reconstruction in which the pancreaticojejunostomy is an end-to-side anastomosis with a lost stent in the Wirsung duct. The anastomosis is performed using an anterior and a posterior running suture using a 3/0 resorbable V-Loc making sure that one passage of each running suture is through the Wirsung duct. We mainly assessed the number of anastomotic leaks, but also the time required to perform the anastomoses and the need for conversion to another type of anastomosis.

Results: There were 73.53% (25/34) soft pancreases and 26.47% (9/34) firm pancreases. The size of the Wirsung duct was 1 mm in 11.76% (4/34) of the patients, 2 mm in 17.65% (6/34) of the patients, 3–4 mm in 55.88% (19/34) of the patients and above 4 mm in 14.71% (5/34) of the cases. A 26.47% (9/34) leak rate was recorded with 17.65% (6/34) type A fistulas and 8.82% (3/34) type B fistulas. There were no conversions to other types of anastomoses, no biliary fistulas or stenoses, no hemorrhagic complications and only one conversion to laparotomy. The time required to perform the anastomosis was 17.3±6.7 minutes (range, 10.6–24 minutes).

Conclusions: This is an easy to perform, safe and effective anastomosis in terms of time in the hands of hepato-bilio-pancreatic surgeons with experience in laparoscopy (laparoscopic hepato-bilio-pancreatic surgeons).

Keywords: Pancreaticoduodenectomy; pancreaticojejunostomy; laparoscopy; barbed sutures

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Introduction

Since the first description of a laparoscopic pancreas resection by Gagner *et al.* (1) in 1994 minimally invasive pancreaticoduodenectomy has drawn a lot of attention. Most of the studies show that in the hands of experienced laparoscopic surgeons the procedure is technically feasible and just as safe as open pancreaticoduodenectomy but longer follow-up intervals and larger series are probably required to assess whether they have similar oncologic outcomes (2-4) and the increased use of robotic surgery augments the feasibility of complete minimally invasive pancreaticoduodenectomy (5).

Over time most of the important issues addressing the actual resection step of the procedure have been addressed, with most of the authors agreeing that an artery first approach is recommended and is one of the advantages of the laparoscopic approach (6,7). We have previously described our artery-first approach to pancreaticoduodenectomy (6) and the aim of the current article is to focus on the pancreaticojejunostomy technique.

An extensive review of the literature shows that current studies focus on two aspects that might be causes for pancreatic fistulas—the type of anastomosis used (duct-to-mucosa or invaginating anastomosis) (8-10) and the texture of pancreas (5,11,12). In our case the reconstruction is performed using a barbed suture end-to-side pancreaticojejunostomy and the aim of our study was to verify the effectiveness of this type of anastomosis.

Methods

Description of the technique

The patient is positioned in a semi-Fowler's position with legs apart. Under general anesthesia, using a Veress needle (Ethicon Endo-Surgery Inc., Cincinnati, OH) inserted in the left hypochondriac region the pneumoperitoneum is induced at a pressure of 14 mm Hg and the trocars are inserted under direct vision. The surgeon is placed between the patient's legs, with an assistant on each side, as shown in *Figure 1*. The trocar positioning used by our team has been previously described in our previous article describing our artery-first approach (6).

The pancreaticojejunostomy is performed in an end-to-side manner (*Video 1*). The Wirsung duct is catheterized before the anastomosis using an adapted silicone drain, depending on the size of the duct (*Figures 2,3*). The

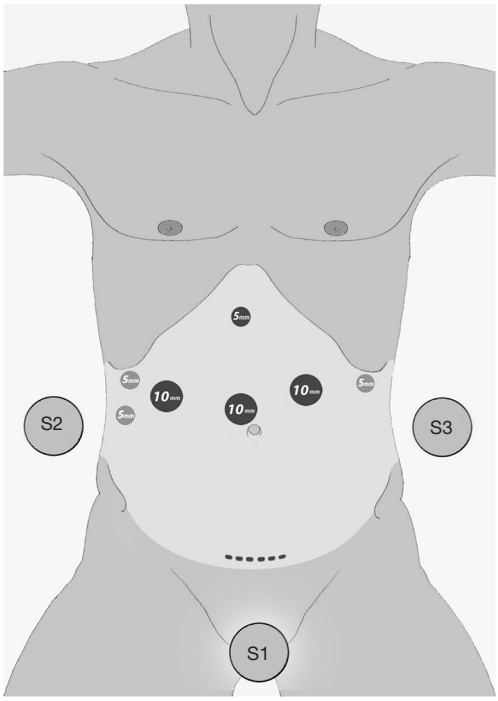

Figure 1 Trocar positioning—S1—main operating surgeon, S2—assistant 1, S3—assistant 2 (darker color shows the trocars used, lighter colors shows the trocars used for other stages of a pure laparoscopic pancreaticoduodenectomy).

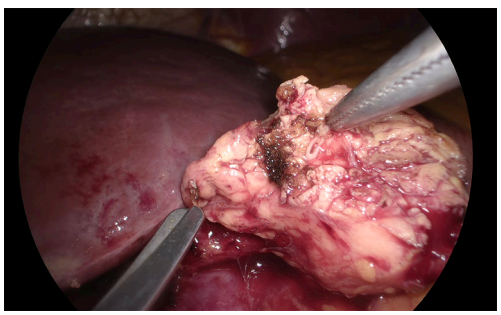

Figure 2 Wirsung duct identification.

anastomosis is done by performing a posterior and an anterior full-thickness running suture with a resorbable, barbed, self-locking 3/0 V-Loc ® suture (Covidien, USA), as shown in *Figures 3-8*.

At the end of the reconstruction the greater omentum is positioned posterior to the pancreaticojejunostomy in order to isolate the anastomosis from the mesenteric vessels. We prefer to systematically use 2 Penrose drains, one guarding the pancreaticojejunostomy, which exits the abdomen

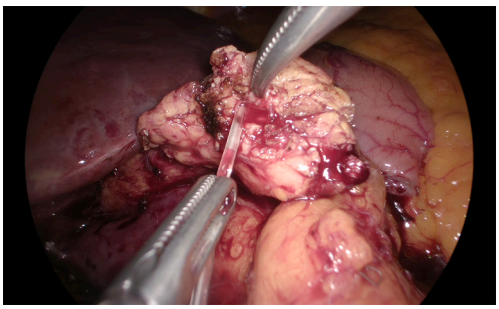

Figure 3 Wirsung duct cannulation using a silicone drain.

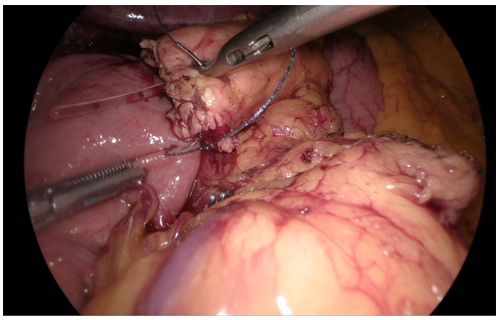

Figure 4 Pancreaticojejunostomy technique—completed posterior running suture (full thickness through both pancreas and jejunum).

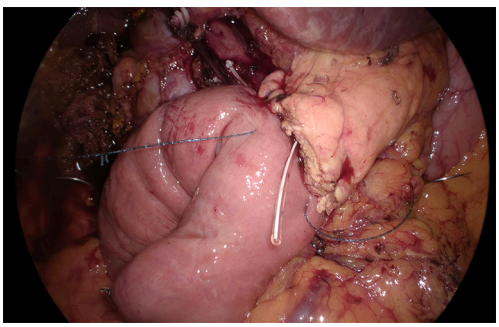

Figure 5 Pancreaticojejunostomy technique—anterior full thickness running suture.

through the left lateral-most 10 mm trocar and one guarding the hepaticojejunal anastomosis, exiting through the right lateral-most 5 mm trocar.

For the purpose of the study we analyzed a retrospective series of 34 consecutive cases of laparoscopic pancreaticoduodenectomies operated between January 2016 and April 2019. The written informed consent was obtained from the patients for publication of this study and any accompanying images.

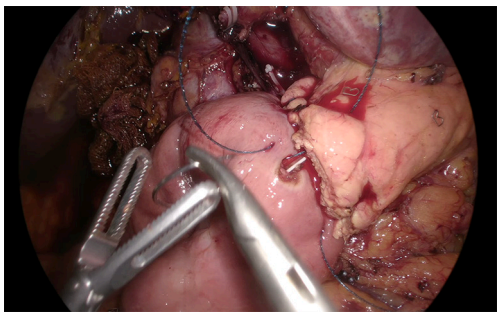

Figure 6 Pancreaticojejunostomy technique—passage of the needle through the Wirsung duct.

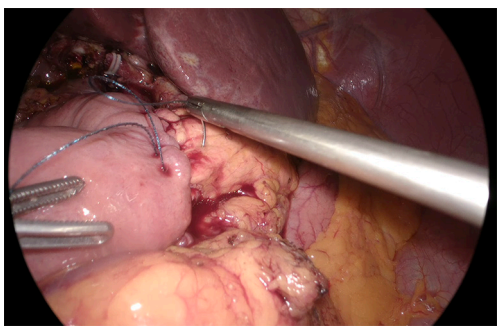

Figure 7 Pancreaticojejunostomy technique—completed anterior running suture with a corner stitch passing further than the last posterior stitch (full thickness through both pancreas and jejunum).

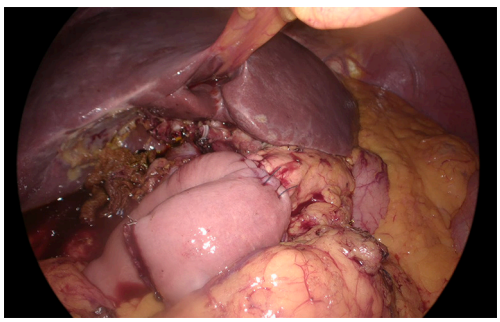

Figure 8 Pancreaticojejunostomy technique—final aspect of the anastomosis.

Results

In total, a number of 19 (55.88%) women and 15 (44.12%) men were enrolled in the study.

We recorded a 9 (26.47%) leak rate with 6 (17.65%) type A fistulas and 3 (8.82%) type B fistulas. No type C fistulas and no

deaths were recorded due to postoperative complications.

There were 25 (73.53%) soft pancreases and 9 (26.47%) firm pancreases. The size of the Wirsung duct was 1 mm in 4 (11.76%) of the patients, 2 mm in 6 (17.65%) of the patients, 3–4 mm in 19 (55.88%) of the patients and above 4 mm in 5 (14.71%) of the cases. There were no conversions to other types of anastomoses, no biliary fistulas or stenoses, no hemorrhagic complications and only one conversion to laparotomy. The time required to perform the anastomosis was 17.3±6.7 minutes (range, 10.6–24 minutes).

From a point of view of the pathology results we found:

(I) 24 (70.59%) pancreatic ductal adenocarcinomas;
(II) 4 (11.76%) distal cholangiocarcinomas;
(III) 2 (5.88%) pseudotumoral chronic pancreatitis;
(IV) 1 (2.94%) ampuloma;
(V) 1 (2.94%) cystic dystrophy of the duodenal wall;
(VI) 1 (2.94%) duodenal adenocarcinoma;
(VII) 1 (2.94%) duodenal sarcoma.

Discussion

Laparoscopic pancreaticoduodenectomy has been a reason for debate ever since the first article describing it in 1994, when even authors conclude that despite it being feasible from a technical view, unlike other minimally invasive procedures it might not bring a major benefit in terms of morbidity and mortality (1). Nowadays, more and more studies agree on the fact that compared with open pancreaticoduodenectomy, the minimally invasive procedure has similar complication rates (2,4,13) whilst bringing advantages such as better assessment of resectability through a posterior artery-first approach (6,14) and an optimized intraoperative assessment of anatomic aberrations (7,14). A separate question whose answer would require larger randomized control trials is the question of the oncologic quality of resection (2-4). From our point of view such randomized control trials are difficult to be performed because groups performing open pancreaticoduodenectomy are convinced of the superiority of it and vice versa for the groups performing the same procedure minimally invasive.

The purpose of this paper is to present the technique we use for our pancreaticojejunostomies. Two out of the three anastomoses required for the reconstruction of the continuity of the digestive tract after pancreaticoduodenectomy—the pancreaticojejunostomy and the gastro-jejunostomy are based on the use of barbed, self-locking sutures. Out of these two anastomoses the pancreaticojejunostomy is the most complication prone and has raised most of the debates in literature (8-10). The reasons why we prefer using such sutures are as follows: our previous experience in using them for other digestive tract anastomoses (15,16), our experience in laparoscopic pancreaticoduodenectomy (4,6) and an extensive review of the literature showing that our type of anastomosis using barbed sutures is feasible and safe for patients regardless of the texture of the pancreatic stump (9-12).

The concern that pancreatic fistulas might arise as a complication depending on the type of pancreaticojejunostomies has been approached by Kennedy *et al.* (10) in a study comparing the two most spread techniques for pancreaticojejunostomy, the duct-to-mucosa anastomosis and the invaginating or "dunking" pancreaticojejunostomy. Besides their own experience Kennedy *et al.* quote two large randomized control trials comparing these anastomotic techniques, the Berger trial and the Bassi trial because of the significant differences between the results of the two studies. In the first trial Bassi *et al.* (8) report on a group of 144 patients that they found no significant difference between the rate of complications of the two types of anastomosis while in the study published by Berger *et al.* (9) significantly fewer pancreatic fistulas are reported when using the invaginating pancreaticojejunostomy.

A secondary outcome of the Berger trial shows a higher rate of pancreatic fistulas in the case of patients with softer glands compared to harder glands (9). Regarding the consistency of the pancreatic stump another study by Battal *et al.*, assessing the difficulties encountered when switching from open to laparoscopic pancreaticoduodenectomy, come to a somewhat counterintuitive conclusion that because of the consistency of the gland, older fit patients are more appropriate for total laparoscopic reconstruction than younger patients (5). As you can very well see from the data presented above, most of the pancreases in our study were soft 73.53% (25/34) and despite that we recorded a 26.47% (9/34) leak rate with 17.65% (6/34) type A fistulas and 8.82% (3/34) type B fistulas an no (0) type C fistulas. The overall number of fistulas we had is completely comparable with the leak rates found in a meta-analysis by Lyu *et al.* comparing duct-to-mucosa anastomosis to the invagination anastomosis, showing that there is no difference between them in terms of postoperative fistulas and other clinically relevant complications (17). One very important aspect in our case is the fact that we had 0 type C fistulas and no mortality.

We consider that protection of the vessels by the

interposition of the greater omentum between them and the pancreaticojejunostomy and the systematic drainage of the abdomen using two Penrose drains are extremely important in case complications arise, despite the lack of evidence-based data on these two subjects.

Conclusions

In our experience minimally invasive pancreaticojejunostomy using barbed self-locking sutures is feasible and safe for the patient in the hands of experienced laparoscopic surgeons (laparoscopic hepato-bilio-pancreatic surgeons).

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Footnote

Provenance and Peer Review: This article was commissioned by the Guest Editor (Edoardo Rosso) for the series "Mini-invasive pancreaticoduodenectomy: are we moving from a "feasible" intervention to be considered the standard?" published in *Laparoscopic Surgery*. The article has undergone external peer review.

Conflicts of Interest: All authors have completed the ICMJE uniform disclosure form (available at http://dx.doi.org/10.21037/ls.2020.03.07). The series "Mini-invasive pancreaticoduodenectomy: are we moving from a "feasible" intervention to be considered the standard?" was commissioned by the editorial office without any funding or sponsorship. The authors have no other conflicts of interest to declare.

Ethical Statement: The authors are accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved. The study was conducted in accordance with the Declaration of Helsinki (as revised in 2013). The study was approved by institutional ethics committee. The written informed consent was obtained from the patients for publication of this study and any accompanying images.

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