



Should obesity be considered a contraindication to mini-invasive pancreaticoduodenectomy?

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Abstract: Obesity is expanding worldwide. In parallel, surgery keeps evolving and improving while mini-invasive surgery is now concerning many different fields if not all. While obese patients may be more challenging to operate on, surgeons should not deny the mini-invasive approach in spite of the potential difficulties linked to increased adiposity, especially in case of complex procedures. We discuss here the challenges of laparoscopic pancreaticoduodenectomy (LPD) in such patients, with the advantages it can offer as well as the inconveniences it can struggle on.

Keywords: Pancreatic surgery; obesity; Wirsung duct; pancreaticogastrostomy; laparoscopy

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Introduction

Obesity is a growing problem worldwide. The prevalence of obesity has doubled since 1980 to an extent that almost a third of the world's population is now considered as overweight or obese. Up to date, over 600 million people meet the criteria for obesity (1). The obesity epidemic has several implications for the pancreatic surgeon.

Patient selection and workup

First, obesity has been shown to increase the risk of several cancers including those of the pancreas (2). The prevalence of pancreatic cancer has doubled in France over the last 20 years while mortality has remained stable (3). Although obesity alone cannot explain this change in the epidemiology of pancreatic cancer, there is an evident causal relationship between the epidemic of obesity and the increase in the prevalence of pancreatic cancer (3). Furthermore, obese patients represent a major challenge for any complex abdominal procedure and even more for the pancreaticoduodenectomy (PD). Indeed, several reasons can explain this: the difficulty in the identification of

anatomical landmarks, buried in the adipose tissue; the fatty infiltration of the pancreas that carries an increased risk of leak; challenges in anesthesia and in the management of obesity-related comorbidities such as diabetes, hypertension or sleep apnea syndrome after surgery; and the increased risk of abdominal wall complications (4). However, there is a large amount of evidence in favor of a protective effect of obesity against post-operative complications in patients with no metabolic comorbidities and good nutritional status, the so-called obesity paradox (5). Knowing that it is important to evaluate the patient's body composition before any major surgery as there is also evidence that sarcopenia is a major determinant of postoperative complications and long-term mortality (6). The combination of obesity and sarcopenia leads to the highest risk of complications and mortality in any major surgery (7).

Pre-operation preparation

Although PD is one of the most complex surgery, more and more surgeons are seduced by the mini-invasive approach. Its feasibility had been demonstrated by expert centers,

and its morbidity has been shown to be lower compared to the conventional approach (8). In the recent meta-analysis of Yan *et al.*, major complications, reoperation rate, R0 resection and postoperative mortality were all comparable between the two approaches (9). Additionally, intraoperative blood loss and transfusion, length of hospital stay and overall incidences of leaks, delayed gastric emptying and wound infection were all significantly lower in the mini-invasive approach. Another meta-analysis by Kamarajah *et al.* found similar results (10).

Because of the widespread obesity in the general population, pancreatic surgeons will be confronted to extend the indication of the mini-invasive approach to this category of patients. From the standpoint of the pancreatic surgeon, the obese patient undergoing pancreatic resection has a few particularities that need to be considered:

- (I) Once the indication for surgery is confirmed, the patient should undergo a thorough metabolic and nutritional workup to identify and compensate for any metabolic comorbidity as well as the presence of sarcopenia. The use of CT scan is essential in measuring the psoas muscle area and in the analysis of muscular fatty infiltration (11).
- (II) The specific distribution of fat should also be investigated: visceral versus peripheral distribution through the measure of the retroperitoneal fat on CT scan at the level of the left renal vein (12), subcutaneous versus visceral distribution through the measure of the fatty area at the level of the L4–L5 vertebral body (13), etc.
- (III) The fatty infiltration of the pancreas and the diameter of the main pancreatic duct should also be checked on CT scan.

Obese patients are more difficult to operate on not only because fat tissue induces a more complex dissection of anatomical structures but also because retroperitoneal structures can be challenging to reach especially when obesity has a central distribution. However, dissection can be easier under laparoscopy as it offers a better view and it avoids complications linked to a wide-open approach. Indeed, in obese individuals, the risk of abdominal wall complications is increased (14). In large-volume centers, improved outcomes after laparoscopic pancreaticoduodenectomy (LPD) have extended the selection criteria for surgery. This led to the inclusion of more obese and elderly patients. However, the laparoscopic approach has its specific particularities in the setting of obesity. While obesity is defined by the body mass index

(BMI), the latter does not take into account the distribution of fat. Indeed, one individual may have a high BMI in the range of morbid obesity while showing a peripheral distribution of fat that does not hamper the surgical dissection. In such cases, organs are not infiltrated by fat and visceral adipose tissue is not hypertrophic, these patients might be considered as lean patients. On the other hand, patients with central adiposity distribution along metabolic comorbidities should undergo a thorough diagnostic workup as discussed above. In patients without sarcopenia, a preoperative controlled weight loss over 2 to 3 weeks, the use of immunonutrition and omega-3 fatty acids may result in better control of comorbidities, in reduced low-grade systemic inflammation and in decreased fatty infiltration of the liver. This approach should always keep in mind that patients might be candidates to neoadjuvant chemotherapy.

Procedure, tips, tricks and pitfalls

The presence of a fatty pancreas should warn the surgeon to use a maximum of precautions in order to reduce the risk of anastomotic complications. As a soft, fatty pancreas along a small main pancreatic duct are known risk factors for an anastomotic leak, other strategies must be used in such a setting. One interesting concept is the invagination of the pancreas in a hollow viscus. While Peng *et al.* reported this technique for the pancreaticojejunostomy but he described the use of interrupted sutures across the pancreatic parenchyma to fashion the anastomosis. This technique does not resolve the suture problem in the setting of the soft pancreas as the thread may still cut the pancreatic parenchyma (15). Another major problem of the Peng's technique is the anastomotic tension generated by a heavy jejunal mesentery that may lead to the desinvagination of the pancreatic stump, especially in the obese patient having a thick mesentery. Two technical artifices have been reported to fix these issues. First, choosing the stomach to invaginate the pancreas seems more appropriate as the latter stands in front of the pancreas (16). This facilitates the passage of the pancreas through the posterior wall of the stomach decreasing the tension on the anastomosis. The second and more innovating point, is the use of two concentric purse strings on the stomach to keep the pancreas in place, avoiding any problems related to the use of sutures across a fragile and soft pancreatic stump (17). In laparoscopy, the use of the concentric purse strings technique is particularly effective and easy compared to

the standard technique (18). A few technical details are to be respected: a large mobilization of the pancreatic stump toward the left allowing the invagination of 4 to 6 cm of the pancreas into the stomach, as well as a careful application of the tension on the purse strings avoiding the risk of acute ischemic pancreatitis. To the scope, the use of barbed sutures may render the task easier under laparoscopy. The use of this technique, first described by Bachellier in Strasbourg, has dramatically lowered the rate of pancreatic leaks in PD (17). This is of mainstay importance as such complication performed laparoscopically may lead to a wider intraperitoneal diffusion of pancreatic fluid. This is also why, the use of the pancreaticogastrostomy with the double purse strings technique is a cornerstone of the LPD, especially in obese patients.

Moreover, the laparoscopic technique offers the possibility to easily change the field of view to identify key structures during the dissection such as the superior mesenteric artery (SMA). Doing so, the mesopancreas and the uncinate process can be safely dissected, allowing complete removal of all surrounding tissues of the SMA according to the oncological principles of radicality. The pancreaticoduodenal arteries can also be safely identified and secured using clips or sutures during the dissection under laparoscopy.

Another interesting and well-known advantage of the laparoscopic approach is the possibility to evaluate the oncological resectability in case of a tumor judged as having a limited resectability preoperatively. This might avoid a large open laparotomy with all its inherent disadvantages which are even more deleterious in the obese patient (19).

The need for venous vascular resection may complicate the PD rendering the laparoscopic approach particularly challenging. In this setting, the rule of the artery first approach, leaving the specimen connected only to the mesenterico-portal axis, should be respected and the vascular reconstruction should be performed laparoscopically as in the standard open technique. One challenge under laparoscopy may be the approximation of the two vessels extremities, constraining the surgeon to use a venous graft. However, this should be reserved for dedicated surgeons with hands-on experience in both, laparoscopy and pancreatic surgery (20).

The other parts of the procedure, including the dissection of the liver pedicle, the mobilization of the head of the pancreas, the division of the stomach and proximal jejunum as well as the fashioning of the bilio-digestive anastomosis and gastro-jejunosomy are easier and not as

challenging as the division of the mesopancreas. Again, the pancreaticogastrostomy with double purse strings technique is not only safe but it is also particularly adapted to the laparoscopic technique.

Conclusions

PD has become a common procedure and with the current epidemic of obesity, the pancreatic surgeon is more and more confronted with obese patients in need for pancreatic surgery. The use of the laparoscopic approach may offer interesting advantages over the standard laparotomy. However, the learning curve is long and thus LPD might be reserved for high volume centers. This is even truer in the case of venous resection, requiring more advanced laparoscopic skills. In the foreseeable future, the laparoscopic techniques including the use of the Da Vinci robot will probably be used more and more frequently in pancreatic surgery.

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References

1. Chooi YC, Ding C, Magkos F. The epidemiology of obesity. *Metabolism* 2019;92:6-10.
2. Arnold M, Pandeya N, Byrnes G, et al. Global burden of cancer attributable to high body-mass index in 2012: a population-based study. *Lancet Oncol* 2015;16:36-46.
3. Drouillard A, Manfredi S, Lepage C, et al. Epidemiology of pancreatic cancer. *Bull Cancer* 2018;105:63-9.
4. Ri M, Aikou S, Seto Y. Obesity as a surgical risk factor. *Ann Gastroenterol Surg* 2018;2:13-21.
5. Mullen JT, Moorman DW, Davenport DL. The obesity paradox: body mass index and outcomes in patients undergoing nonbariatric general surgery. *Ann Surg* 2009;250:166-72.
6. Englesbe MJ, Patel SP, He K, et al. Sarcopenia and mortality after liver transplantation. *J Am Coll Surg* 2010;211:271-8.
7. Simonsen C, de Heer P, Bjerre ED, et al. Sarcopenia and postoperative complication risk in gastrointestinal surgical oncology: a meta-analysis. *Ann Surg* 2018;268:58-69.
8. Poves I, Burdío F, Morató O, et al. Comparison of perioperative outcomes between laparoscopic and open approach for pancreatoduodenectomy: the PADULAP randomized controlled trial. *Ann Surg* 2018;268:731-9.
9. Yan JF, Pan Y, Chen K, et al. Minimally invasive pancreatoduodenectomy is associated with lower morbidity compared to open pancreatoduodenectomy: an updated meta-analysis of randomized controlled trials and high-quality nonrandomized studies. *Medicine (Baltimore)* 2019;98:e16730.
10. Kamarajah SK, Bundred JR, Marc OS, et al. A systematic review and network meta-analysis of different surgical approaches for pancreaticoduodenectomy. *HPB (Oxford)* 2019. [Epub ahead of print].
11. Golse N, Bucur PO, Ciaccio O, et al. A new definition of sarcopenia in patients with cirrhosis undergoing liver transplantation. *Liver Transpl* 2017;23:143-54.
12. Favre G, Grangeon-Chapon C, Raffaelli C, et al. Perirenal fat thickness measured with computed tomography is a reliable estimate of perirenal fat mass. *PLoS One* 2017;12:e0175561.
13. Yoshizumi T, Nakamura T, Yamane M, et al. Abdominal fat: standardized technique for measurement at CT. *Radiology* 1999;211:283-6.
14. Gurnathan U, Rapchuk IL, Dickfos M, et al. Association of obesity with septic complications after major abdominal surgery: a secondary analysis of the RELIEF randomized clinical trial. *JAMA Netw Open* 2019;2:e1916345.
15. Peng SY, Wang JW, Li JT, et al. Binding pancreaticojejunostomy—a safe and reliable anastomosis procedure. *HPB (Oxford)* 2004;6:154-60.
16. Waugh JM, Clagett OT. Resection of the duodenum and head of the pancreas for carcinoma; an analysis of thirty cases. *Surgery* 1946;20:224-32.
17. Addeo P, Rosso E, Fuchshuber P, et al. Double purse-string telescoped pancreaticogastrostomy: an expedient, safe, and easy technique. *J Am Coll Surg* 2013;216:e27-33.
18. Matsuda M, Haruta S, Shinohara H, et al. Pancreaticogastrostomy in pure laparoscopic pancreaticoduodenectomy—a novel pancreatic-gastric anastomosis technique. *BMC Surg* 2015;15:80.
19. Fong ZV, Alvino DML, Fernández-Del Castillo C, et al. Reappraisal of staging laparoscopy for patients with pancreatic adenocarcinoma: a contemporary analysis of 1001 patients. *Ann Surg Oncol* 2017;24:3203-11.
20. Kendrick ML, Sclabas GM. Major venous resection during total laparoscopic pancreaticoduodenectomy. *HPB (Oxford)* 2011;13:454-8.

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