The roles and future possibilities of reinforcing materials in distal pancreatectomy

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May I have your views about recent surgical techniques, advancement in safety, and other topics in the area of pancreaticobiliary surgery?

Surgical techniques for the pancreas and the biliary tract have advanced greatly in recent years. Particularly, the perioperative mortality from pancreateoduodenectomy (PD) has been markedly improving. I remember that, a decade ago, PD was believed to be a horrible procedure among patients. Actually, some 10% of the perioperative mortality was reported from foreign countries in those days.

In general, a frequency exceeding 10% is unacceptable as perioperative mortality. These days, it seems to be a consensus that a safe operation should have perioperative mortality reduced to less than 5%, preferably about 1 to 3%. I understand that the so-called high-volume centers in Japan set their target perioperative mortality from PD to less than 1%

In 2009, the Japan’s largest study of cumulative cases was conducted by the Japanese Society of Pancreatic Surgery (on-duty chairperson: Professor Yamaue of Wakayama Medical University). As a result of analyzing clinical data on 2,500-plus patients undergoing PD at multiple institutions across the nation, a perioperative mortality of 1.2% was identified.

Aside from the advancement of surgical techniques, such improvement is considered to have been extensively encouraged by multimodality therapy comprised of IVR, endoscopic procedures, intensive care, etc. as management of complications was systematized. There have been many eminent surgeons including my predecessors. Although there were technological innovations as a whole, I do not think our techniques are at a much higher level than before. I assume that, after all, such improvement suggests the progress of systematization in multimodality therapy as team-based practice. Moreover, I suppose that this also prompted improvements in peripheral devices for coagulation, incision, etc. and operation-related equipment (automatic suture instruments, ligatures, sutures, etc.).

Thus, except for very specific cases, I explain to my patients about the operation they will undergo, confidently saying, “it is a safe procedure, and you will be able to go home in good shape”.

May I have your overall opinions on pancreatic surgical procedures?

Since the pancreas is a special organ that secretes the digestive juice, it must be handled with an especially gentle manner as compared to other organs. Specifically, in the case of anastomosis between the pancreatic duct and the digestive tract, anastomotic failure, if any, requires the surgeon to thoroughly manage it with drainage, etc., and maintain postoperative pancreatic functions in stable condition, considering the possible development of pancreatic duct stenosis in the long term. On the other hand, complete removal of the lesion(s) should always be aimed at from the viewpoint of radical treatment for cancer, given that pancreatic surgery often deals with malignancy. What matters most is to balance between radical cure and low invasiveness in the treatment of the organ.

Could you tell me about the current status of operations for pancreatic diseases and future problems with them? What efforts are currently made to solve those problems?

In general, operations for cancer and those for the so-called borderline malignancies (IPMN, MCN, SPN, etc.) or benign diseases have standpoints significantly different from each other.

In the case of radical surgery for cancer, (pylorius-preserving) pancreateoduodenectomy (PD) is indicated to pancreas head cancer, while distal pancreatectomy (DP) is still performed for pancreas body/tail cancer regardless of whether the lesion(s) exist in the body or tail. In PD for pancreas head cancer, both removal and reconstruction are required, and the status of oncological resection determines the prognosis of cancer patient. However, the majority of postoperative complications (anastomotic failure, intraabdominal abscess, etc.) are attributable to the reconstruction site, and the prognosis of cancer has been found to deteriorate in patients suffering from postoperative complications. Among such complications, anastomotic failure between the pancreas and the digestive tract and delayed gastric emptying (DGE) are most frequent,
and yet to be settled. Although improvements in anastomosis techniques as well as in the arrangement of the digestive tract have been made, no ultimate solution for these two problems has been identified.

In DP for pancreas body/tail cancer, the greatest complication is pancreatic fistula (PF) at the stump. Solving this problem will mean DP become as a perfect operation. The healing condition of the pancreatic stump directly affects the patient’s postoperative course. Once any problem occurs in stump healing, placement of a drainage tube cannot be avoided even if the patient is in good shape, resulting in a prolonged hospital stay. Thus, there are significant differences in the details and severity of complications between pancreatic surgery on the head and that on the body/tail.

Various improvements have also been made in methods for processing the pancreatic stump. Among them are the abolition of fish-mouth suture, the employment of atraumatic monofilament sutures, and, more recently, the increasing use of staplers. Additionally, organ-preserving surgery for borderline malignancies and benign diseases are intended to maintain postoperative physiological functions as much as possible by preserving the pancreatic parenchyma, the duodenum or the spleen. In this mode of surgery, the presence of multiple resection surfaces on the pancreas and multiple reconstruction sites between the pancreas and the digestive tract still raises the big problem: pancreatic fistula. Since the incidence of the leakage is higher than in PD, more surgeons actually tend not to select this mode even though its original concept is excellent.

In pancreatic surgery, after all, taking measures against pancreatic fistula is very important irrespective of the mode of surgery. A surgical or anastomosis/suture technique that never causes pancreatic fistula, if established, will be regarded as a tremendous technical breakthrough.

Q4 What do you think about the potentials of laparoscopic procedures in pancreatic surgery?

I think that endoscopic surgery should be actively introduced to the area of pancreatic surgery, too. However, this issue also depends on how much the patient prefers it. In current practice, I feel that only a handful of patients will select laparoscopic surgery even if I explain to them that they can use it to remove the lesion(s) in the same manner. I suppose they probably have an impression that pancreatic surgery is troublesome.

Recently, laparoscopic surgery for digestive tract cancer has been known among people, including those celebrities who chose to undergo an endoscopic operation. I think it is a trend of the times that laparoscopic techniques will also be introduced to pancreaticobiliary operations, which were previously considered as a challenge. In fact, when I performed laparoscopy-related surgery on the pancreas in a limited number of patients, they showed excellent outcomes postoperatively.

Q5 Could you tell me about your technical experiences with distal pancreatectomy?

Previously, it is common practice to close the pancreatic stump like a fish mouth after distal pancreatectomy. Actually, I saw a number of surgeons stitching like that. I even have heard an idea that drainage of a pancreatic stump is performed through a sterilized condom that covers the stump and comes out of the skin. Suture was performed using a separate-type traumatic needle and silken threads.

Later, fish-mouth suture was denied, and a method for vertically cutting the pancreas, interruptedly suturing the stump, and doubly ligate the pancreatic duct was employed. Other methods were also reported, including one for crushing and sucking the pancreatic parenchyma with CUSA® and meticulously ligating the peripheral pancreatic duct, and one using an ultrasonic coagulation/incision device to resect the lesion(s).

As for me, I used to resect the pancreas vertically with an electric cautery, and suture the stump with nonabsorbable monofilament sutures. After triserial staplers became available, I gradually adopted pancreatic resection with such a stapler. Since the Neoveil® tube type was released in 2006, I have consistently used the combination of a triserial stapler and the Neoveil® tube type to resect the pancreas.

1. Attachment of Neoveil®

Set “large” to the cartridge side and “small” to the anvil side, respectively, and attach Neoveil® so that the green nonwoven fabric comes to the stapling side (inside), or the elastic knit and seams do not come to inside.

2. Fire-cut

Hold the shaft of the automatic suture instrument in place, and fire the stapler gently.

3. Knit recovery

Recover the thread and knit before releasing the suture instrument.

4. Detachment procedure

If the edge of the nonwoven fabric is connected, cut it off with scissors, etc.

*I See the instruction for use for details about how to use Neoveil®.

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May I have your views about the types and roles of hemostatic/reinforcing materials used in pancreatic surgery?

Limitedly saying about the resection surface of the pancreas in contrast to sheet-like fibrin products used in liver resection, I actually feel that pancreatic fistula cannot be prevented by any additional means. Pancreatic fistula still occurred when I applied a sheet-like fibrin product and fibrin paste to the resection surface of the pancreas so that it was covered with a layered structure of fibrin, and completed the operation with the resection surface kept dry. I would have named the procedure the “mille-feuille method” if it had produced an excellent result (Laughing). I think other types of hemostats, such as powder, are also applicable.

Although such hemostatic/reinforcing materials seem to be very useful in digestive surgery as a whole, they have not become a breakthrough particularly in the area of pancreatic surgery.

Cutting the pancreas using a stapler with a polyglactin sheet placed in-between appears to have been performed for a long time. Neoveil® was introduced as an extension of this method. Based on my sense, I appreciate the feeling of the pancreatic stump being tightly sealed. More specifically, a rather abrupt or rough sense cannot be eliminated with a stapler alone. It is such a sense that pressure from a compressing seat transmits insensitively. In contrast, Neoveil® serves as a cushion to tighten up gradually, not pressing abruptly like a machine. I think this process promotes conservation of the serous membrane of the pancreas.

Do you have any requests regarding future improvements of Neoveil® as a reinforcing material?

I feel that patients who developed complications associated with the pancreatic stump with this method are often those with the so-called host defense being deteriorated, including long-term steroid users, elderly people and severe diabetics. While excellent results have been produced in patients free of comorbidity, complications attributable to this method are currently being analyzed. For example, even a suture is reported to have become more resistant to bacterial invasion after modification of its coating. In view of Neoveil®’s future, I strongly request that certain antimicrobial processing be applied to it.

In distal pancreatectomy, particularly with the resection line set left to the midline, splenic artery are often buried in the pancreas. Under such a condition, picking-up this artery prior to transection of the pancreas will affect the continuousness of the pancreatic serosa. I think it is better to cut the pancreatic parenchyma and the artery together. Of course, it is the best that splenic artery exist apart from the pancreas, allowing the preprocessing of this artery without difficulty. As for splenic vein, I feel that they do not require any such preprocessing when I choose resection with a stapler. This is because splenic vein are covered with a membrane on the posterior surface of the pancreas, and, if they were removed and ligated, the pancreatic parenchyma would be exposed. As I already said, I think it is most important that the pancreatic serosa and its surrounding fibrous tissue are smoothly sealed continuously with the pancreatic stump.

Another point is the thickness of the pancreas. Normally, its portion right to the portal vein has a thicker parenchyma, which hampers the application of the above method.

During pancreatic resection with a stapler, I particularly take care to gradually proceed in the firing manipulation, and never to move the stapler shaft during the transection. Even a slight move of the hand is amplified at the stapler tip, possibly imposing an excessive burden on the tissue surrounding the stapler.