

ORIGINAL ARTICLE

Primary Closure and Serosal Patch of the Pancreatic Stump is an Alternative in Selected Patients Undergoing Pancreaticoduodenectomy

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ABSTRACT

Objective Post-operative pancreatic fistula after pancreaticoduodenectomy is a common complication leading to increased morbidity and mortality. We present a modification to the technique of no pancreatic anastomosis, with primary closure of the pancreatic stump combined with a serosal patch. This technique should be considered in operations where a safe anastomosis cannot be achieved. **Methods** A retrospective analysis of patients' files who underwent pancreaticoduodenectomy for periampullary benign or malignant lesions between 2002 and 2014 in one medical center. **Results** Fourteen (12.6%) of 111 patients who underwent pancreaticoduodenectomy were in need of primary closure and serosal patch. Postoperative pancreatic fistula was diagnosed in 3 (21.4%) patients. All postoperative fistulas were grade A. Pancreatic endocrine function was preserved in all patients. In 10 (71.4%) patients the pancreatic exocrine function was lost and pancreatic enzyme supplements were added to their diet. No acute or chronic pancreatitis developed during the follow up period. **Conclusions** Primary closure and serosal patch should be considered in cases where a safe anastomosis cannot be achieved. In the 14 patients described here, it proved to be safe and efficient in reducing the severity of postoperative pancreatic fistula.

INTRODUCTION

One of the most serious complications following pancreatic resection is the development of postoperative pancreatic fistula. Digestive pancreatic enzymes leak out of the pancreatic ductal system into the peripancreatic space or the peritoneal cavity, resulting in abdominal pain, prolonged paralytic ileus and infections, which in turn may lead to prolonged hospitalization. Leakage and fistulisation have been related to a 90-day mortality of 5% [1]. The reported incidence of postoperative pancreatic fistula after pancreaticoduodenectomy is 26.7%, and for distal pancreatectomy, 13-31% [2, 3].

Our approach in dealing with the pancreatic stump after pancreaticoduodenectomy is by convention, either pancreaticojejunostomy or pancreaticogastrostomy. Yet in some cases, due to technical difficulties such as edema, fragile pancreatic parenchyma, or small diameter of the pancreatic duct, we decided to perform primary closure instead. We previously described our experience with serosal patch following distal pancreatectomy in injured

patients, this technique proved to be beneficial in avoiding significant postoperative pancreatic fistula [4]. In this study, we review our experience with primary closure and serosal patch following pancreaticoduodenectomy.

PATIENTS AND METHODS

Study Design

We retrospectively reviewed files of patients who had undergone pancreaticoduodenectomy for adenocarcinoma of the pancreas and other periampullary tumors between January 2002 and December 2014, at our medical center. Patients who had undergone primary closure and serosal patch were identified. Medical files were reviewed for age, fistula rate and type according to ISGPF, perioperative mortality, endocrine and exocrine insufficiency [5]. This study was authorized by the Medical Center's Ethical Committee for Human Research.

Indication and Surgical Technical Data

The decision to prefer primary closure and serosal patch over a pancreatico-intestinal anastomosis was based on the surgeons' perception that such an anastomosis would be suboptimal. This was usually due to technical difficulties encountered during the operation such as edema, fragile pancreatic parenchyma, or small diameter of the pancreatic duct (<3mm).

Primary closure is achieved by ligating the orifice of the pancreatic duct (Wirsung canal) with a #4/0 no absorbable monofilament polypropylene suture. Three "U" shaped sutures using #0/0 no absorbable braided silk are placed

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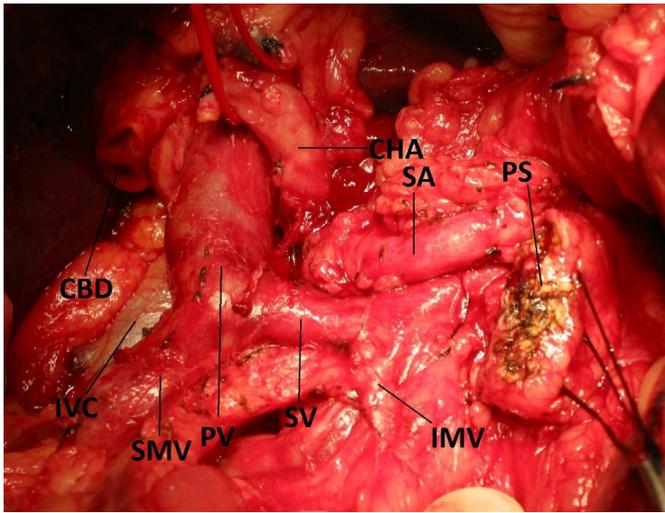


Figure 1. Primary closure of the pancreatic stump. PS pancreatic stump; SA splenic artery; CHA common hepatic artery; IMV inferior mesenteric vein; SV splenic vein; PV portal vein; SMV superior mesenteric vein; IVC inferior vena cava; CBD common bile duct

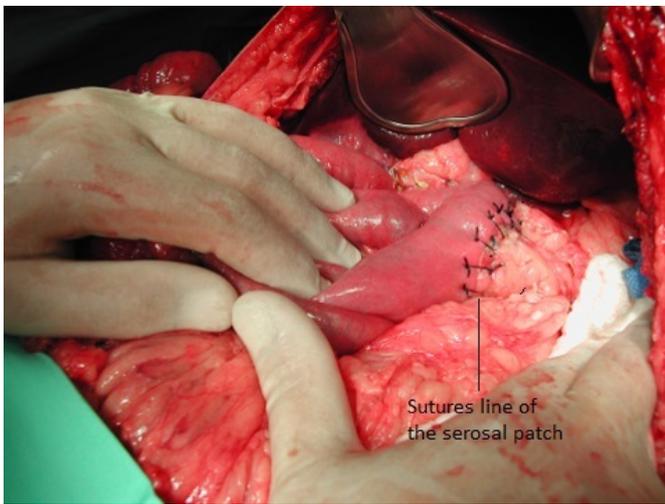


Figure 2. Serosal patch of the pancreatic stump.

on the stump in order to close the surrounding canaliculi. Attention has to be paid in order not to tear or cause ischemia of the parenchyma with tensely tied sutures (**Figure 1**). The serosal patch is most commonly created by approximating the pancreatic stump to the seromuscular layer of the jejunum using #2/0 nonabsorbable braided silk sutures (**Figure 2**). A Jackson-Pratt 10 Fr closed-suction drain (Jackson-Pratt® Cardinal Health, Dublin, OH) is placed near the pancreatic stump. Following operation, drainage fluid was analyzed daily for amylase levels.

RESULTS

One hundred and eleven patients underwent pancreaticoduodenectomy, all of whom were operated by one of the authors [RA]. Of these, 14 had primary closure and serosal patch. Age range was 23-80 years. Mean follow-up period in these 14 patients was 14.4 months (range 5-28 months). Following the operation there were no perioperative deaths. In three out of 14 patients, fluid collected from their drains revealed elevated levels of amylase (more than three times that of the serum levels). This drainage ceased spontaneously within 4 to

12 days after the operation in all three patients and drains were removed before discharge. During the follow-up period all of the patients remained alive. None of them developed pancreatitis. Ten patients (71.4%) needed to add pancreatic enzyme supplement to their diets. None of the patients developed new onset diabetes mellitus. Those who were diabetic before the operation did not need supplemental treatment to control hyperglycaemia.

DISCUSSION

Since pancreaticoduodenectomy was first mentioned in the literature, several procedures for draining the pancreatic stump have been described. Pancreatico-intestinal anastomotic techniques, stents, and perioperative octreotide have been all championed by different authors as methods to decrease the incidence of postoperative pancreatic fistula. However, postoperative pancreatic fistula is still the "Achilles' heel" of the operation. Meticulous surgical technique and attention to detail remain the cornerstones in decreasing pancreatic leak and postoperative pancreatic fistula formation.

In the early years, ligation of the pancreatic duct was a common practice. The logic behind ligation, also known as the obliteration method, was to avoid a technically difficult anastomosis. Proponents of this technique observed that endocrine function of the pancreatic remnant was conserved while exocrine function, destroyed by distal obstruction of the pancreatic duct, could be supplemented with oral pancreatic enzymes. Nevertheless, the obliteration method fell into disfavor due to very high rates of postoperative pancreatic fistula formation: 80%, compared to 26.7% or less, following pancreatico-intestinal anastomosis [2, 6-8]. The obliteration method has been reserved for a select group of patients with pancreatic parenchyma which does not hold sutures well [9].

According to an international study group (ISGPF) of pancreatic surgeons: POPF defined as drain output of any volume occurring on or after post-operative day 3 with amylase content at least three times that of serum amylase levels, with three grades of severity A, B, C: Grade A is a transient fistula that does not have any clinical impact, does not delay hospital discharge, Grade B requires a change in clinical management and leads to a delay in hospital discharge or to a readmission and Grade C is the most severe and requires a major change in clinical management and causes a major increase in hospitalization time as well as increased rates of complications and the possibility of mortality [5].

There were various causes that led us to perform primary closure and serosal patch of the pancreatic stump including friable pancreatic parenchyma, small diameter of the pancreatic duct (<3mm), hemodynamic instability and bowel edema. It may be that in some of these cases other surgeons would have preferred to perform an anastomosis, regardless of the technical difficulties involved. In the current series, following primary closure and serosal patch, only three patients developed a postoperative grade

A pancreatic fistula according to the ISGPF classification. This was achieved despite the fact that it was performed in patients in whom we assumed that a pancreatico-intestinal anastomosis would have led to an unreasonably high rate of a clinically significant postoperative pancreatic fistula (e.g. grade B and C fistulas). This result also compares well to the overall incidence of fistula formation following pancreaticoduodenectomy reported in the literature which is 26.7%; 2-5% of which are of grade C severity [2, 10, 11].

The pancreatic endocrine function was preserved in all patients in our series. This can be explained because the alpha and beta cells are located predominately in the tail of the pancreas [12] and pancreatic endocrine function can be maintained if 50% of alpha and beta cells are preserved [13].

Following operations in which a pancreatico-intestinal anastomosis is performed, the incidence of symptomatic exocrine insufficiency is, 9-20% [14-17]. Exocrine insufficiency following these operations is thought to be caused by pancreatic duct stenosis which leads to parenchymal inflammation and fibrosis. In our series, 71.4% patients developed symptomatic exocrine insufficiency. Most of these patients suffered from bloating and mild diarrhea following meals which were effectively alleviated by pancreatic enzyme supplementation. Despite the high rate of exocrine insufficiency which developed in these patients, we thought this was preferable to the morbidity of grade B and C fistulas which might have developed if an intent was made to anastomose the pancreatic stump.

The major limitation of this study is that the current series is relatively small. We cannot assess the real incidence of grade B and C fistula relying on this series alone. Nevertheless, the experience described in this study, showing low proportion of fistula formation with serosal patch, cannot be explained only by chance when compared to the experience gained with the obliteration method.

CONCLUSION

In conclusion, primary closure with serosal patch proved to be safer than historical controls treated only with primary closure of the pancreatic duct. This method should be considered legitimate in patients in whom a pancreatico-intestinal anastomosis is thought to be unsafe and with a high probability of postoperative pancreatic leak.

Conflict of interest

The authors have no conflict of interest to declare.

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