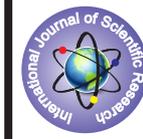# Standardizing a technique of end-to-side pancreaticojejunostomy— early postoperative outcomes in consecutive 60 cases

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ABSTRACT

Introduction: Pancreatico-jejunostomy is the work horse of pancreatic surgery. Pancreatic fistula after pancreaticoduodenectomy represents a critical trigger of potentially life-threatening complications and is also associated with markedly prolonged hospitalization. Many arguments have been proposed for the method to anastomose the pancreatic stump with the gastrointestinal tract, such as invagination vs. duct-to-mucosa.

Aims and objectives: The authors report their experience with a particular end to side duct to mucosa PJ technique, adopted/ modified from original technique described by M. W. Buchler, H. Friess, Department of general surgery, University of Heidelberg, Germany (15). The results of early postoperative outcomes have been evaluated.

Material and methods: Anastomoses were performed by two surgeons trained at Heidelberg University, Germany. From January 2006- June 2013, 60 patients (34 males & 26 females) underwent an end-to-side duct to mucosa pancreaticojejunostomy using standardized PJ technique as a part of Whipple procedure. The diseases of the all patients were malignant. 10-12 PDS 4-0 sutures were used for all layers.

Results : Majority of the patients were in 4th -5th decade. Classical and pylorus preserving Whipple procedure's were done in 38 and 22 patients respectively. Preoperative biliary stenting was done in 16 patients. Average time taken for Whipple procedure was 250 minutes and that for pancreatico-jejunostomy was 45 minutes. Only two patients (3.3 %) had minor pancreatic leaks which subsided in 10 days with conservative management. Wound infections developed in 10 patients and LRTI in 11 patients. No peri-operative mortality occurred.

Conclusions: The described technique of end to side duct to mucosa pancreaticojejunostomy is simple, easy to perform with least fistula rate. When performed by experienced hands using a standardized technique and protocol, it is associated with least morbidity and mortality irrespective of the texture of pancreas and size of the pancreatic duct. There was no mortality in our study. Except for wound infection there is no significant difference in total complication rate in patients with pre-op biliary stents.

Introduction

Surgical resection by means of pancreatico-duodenectomy is the procedure of choice and provides the only chance of cure for patients with peri-ampullary and pancreatichead carcinoma [1-3]. With the advances in surgical technique and perioperative care, the mortality rates have reduced to less than 1% in high volume centres [4-5]. The morbidity rates still remain high around 30-40%, most common being pancreatic fistula, biliary fistula, intra-abdominal sepsis, wound infection, sepsis, delayed gastric emptying, leading to prolonged hospitalization and increased treatment costs [6-9]. Leakage from pancreatico-enteric anastomoses with the development of pancreatic fistula is the single most important cause of morbidity and sometimes mortality [10].

The best pancreatic anastomosis technique after pancreatico-duodenectomy (PD) is still debated. Pancreatico-jejunostomy (PJ) is the commonly preferred method of anastomosis but the incidence of pancreatic fistula does not seem different according to the many techniques proposed for the reconstruction of pancreatic digestive continuity [11-14] However, it is perhaps the technique of anastomosis that is more important over other known factors that influence the formation of a pancreatic fistula after pancreatic head resection [15]. This report describes the end to side pancreatico-jejunostomy technique with minimal modification in the original technique described by Buchler and Friess, University of Heidelberg [15]. Early postoperative outcomes also evaluated.

Materials and methods

We included 60 consecutive patients who underwent PD in one surgical oncology unit at Kidwai memorial institute of oncology from January 2006 to June 2013. All PD's were followed by reconstruction with end to side PJ + end to side hepatico- jejunostomy (HJ)+ end to side gastro- jejunostomy (GJ). Feeding jejunostomy (FJ) was done in patients with soft pancreas and narrow pancreatic duct. All PD's and anastomoses were performed by two surgeons trained at Heidelberg University, Germany. The anastomoses were performed using 4-0 PDS. Majority of the patients were in 4th-5th decade. The diseases of the all patients were malignant. Preoperative biliary drainage (stenting) was done in patients in whom i) Definitive surgery had to be delayed by > 14 days ii) Very high hyperbilirubinemia > 20 mg%; in which case surgery is deferred by 6 weeks. In preoperative stenting only plastic stent were used which were inserted endoscopically. Stent was sent for culture post operatively.

Surgical technique

Division of the pancreatic neck: The pancreas is transected sharply at the neck anterior to the superior mesenteric/portal vein to have a neat vertical transection. After the pancreaticoduodenectomy, any bleedings from the cut surface of the pancreatic stump were stopped using bipolar electrical coagulation or absorbable sutures (PDS 4-0). Then the pancreatic remnant was mobilized 2 to 3 cm from the splenic vein and the surrounding tissues. An Infant feeding tube was introduced into the main pancreatic duct to ensure its patency. The mobilization is carried out in a completely avascular plane and the vascularity of pancreatic remnant is well preserved.

Pancreatico-jejunal anastomosis

Step 1: Anterior ductal sutures: The first step involves placement of

three to four sutures (depending on main pancreatic duct size) on the anterior wall of the duct. The sutures traverse the full thickness of the pancreatic parenchyma, the needle passing from the anterior pancreatic surface and coming out from the anterior duct wall (outside in ductal stitches) (Fig. 1).
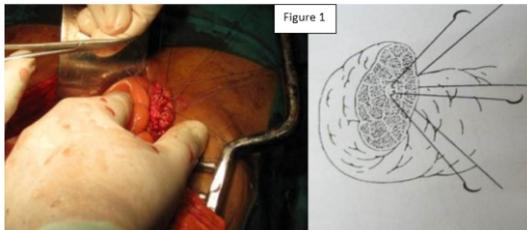

Step 2: Posterior ductal sutures: The second step involves a similar placement of sutures on the posterior wall of the duct. The sutures traverse the full thickness of the pancreatic parenchyma, the needle passing from the posterior wall of the duct and coming out from the posterior pancreatic surface (inside out ductal stitches) (Fig. 2). The anterior and posterior ductal sutures are kept intact in different layers separated by a sheet of operation towel.
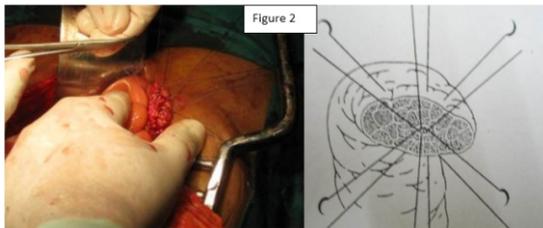
Step 3: Posterior outer layer: The jejunal loop is brought into the supra-colic compartment adjacent to the pancreatic remnant through an opening made in the transverse colon, avoiding any tension. Interrupted sutures are placed 4-5 mm apart beginning on the posterior aspect of the mobilized pancreatic parenchyma and passing through the seromuscular side wall of the jejunal loop. These interrupted sutures are all tied at the end one after the other ensuring a tension free approximation of jejunum to the posterior pancreatic capsule.(Fig. 3)


Step 4: Posterior inner layer: The jejunum is opened just smaller in length than the supero-inferior extent of the pancreatic remnant. Interrupted sutures are placed traversing the posterior cut margin of the pancreas and passing through the full thickness of the posterior wall of the now opened jejunum. The sutures are started from one end to the other including the posterior ductal sutures placed in step 2 which are also passed through the full thickness of the posterior wall of the opened jejunum, thus anastomosing the posterior wall of the pancreatic duct to the jejunal mucosa posteriorly (Fig. 4).
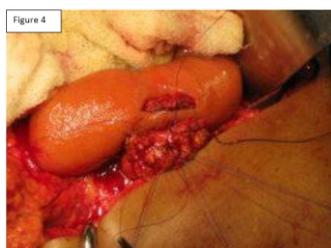

Step 5: Anterior inner layer: Similar to step 4 interrupted sutures including the anterior ductal sutures placed in step1 are placed and anterior cut surface of pancreatic remnant along with the anterior

wall of the pancreatic duct is anastomosed to the jejunal mucosa anteriorly (Fig. 5)
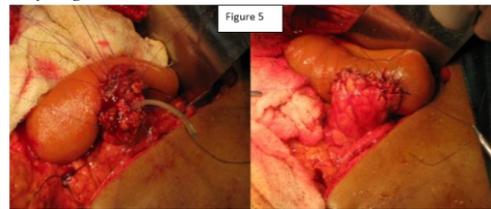
Step 6: Anterior outer layer: Similar to step 3 interrupted sutures are placed traversing on the anterior aspect of the mobilized pancreatic parenchyma and passing through the seromuscular side wall ofthe jejunal loop ensuring a tension free approximation of jejunum to the anterior pancreatic capsule.(Fig. 6)
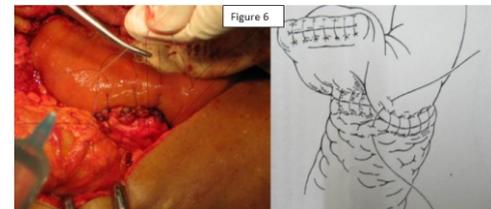
The completed anastomosis is an end to side duct to mucosa vascular, tension free and a water tight anastomosis. The HJ is end to side anastomoses done with PDS 4-0 sutures using the parachuting technique. The GJ is end to side anastomoses done using PDS 4-0 sutures with an outer seromuscular and inner full thickness layer.

Postoperative care
All patients had two abdominal drains placed at the time of operation in close proximity to the pancreatic anastomosis. All the patients were shifted to the surgical ICU. Appropriate broad spectrum antibiotics, proton pump inhibitors, analgesics were given. Octreotide was not used. The nasogastric tube was left in place until postoperative day 5 to protect the gastrojejunostomy (GJ) and PJ. In patients in whom feeding jejunostomy was done, feeds were started through the FJ tube on POD-1. Nasogastric tube was removed after 72 hours and orally sips of clear liquids started. The abdominal drains were removed once the patient has passed stools and drain fluid was clear serous and less than 50 ml/day.

RESULTS
Patient's characteristics
A total of 60 patients underwent PD with PJ anastomoses using the described technique of end-to-side duct to mucosa PJ with male preponderance with a ratio of 1.3:1 (34 males, 26 females). The median age in the study population was higher among men as 58.6 (40-78) years versus 56.5 (42-73) years, statistical comparable. Most common comorbidity was hypertension (n=18) followed by diabetes (n=17), COPD (n=7) and mild anaemia (n=10). Majority of the patients were presented with painless progressive jaundice (n=32), followed by nonspecific pain abdomen (n=11), intermittent vomiting (n=6). Ten patients (16%) were diagnosed asymptomatic carcinoma head of pancreas during evaluation for the vague abdominal symptoms.

Pre-operative assessment
All patients were assessed for the liver function test and renal function rest followed by underwent triple phase contrast enhanced computerized tomography to define the feasibility of resection of the disease. Total bilirubin was normal in 15 patients, >1.5-10 mg in 21 patients, >11-20 mg in 8 patients, >20 in 16 patients. Sixteen patients (26%) were underwent preoperative biliary stenting under guidance of ERCP due to raised serum bilirubin(n=8), signs of cholangitis(n=3) poor nutritional status (n=3) and abnormal coagulation profile(n=2). The indications for PD were Periampullary (n=31), Head pancreas (n=17), Terminal CBD (n=9), Duodenal carcinoma (n=3).

Operative characteristics

Classical and pylorus preserving Whipple's procedure were done in 38 and 22 patients respectively. Thirty-six patients had firm pancreas and 24 patients had soft pancreatic remnant. Small non dilated duct (less than or equal to 3 mm) was found in 19 patients. Average time taken for Whipple procedure was 210-270 minutes and that for PJ was 45 min. The mean ICU stay was 2.7±0.9 days.

Post-operative recovery and morbidity

The mean hospital stay was 11.6±2.8 days(range: 9-20 days). Naso-jejunal tube blocked after 72 hours in almost all patients and liquids started through tube which was placed in the efferent loop of jejunum. Minor pancreatic leak occurred in 2 patients (3.3 %). Both the patients had soft friable pancreas with narrow pancreatic ducts. Drain fluid was darkish brown with volume < 20 ml/ day in one patient and < 50 ml/ day in the other. Amylase of drain fluid was approximately 2500 u in both the patients. It subsided in 10 days with conservative management. Antibiotics were given according to culture sensitivity. Wound infections occurred in 10 patients, 8 patients having undergone pre-operative CBD stenting. Most common organism in the culture was E. Coli. LRTI occurred in 11 patients. There was no perioperative mortality. Average hospital stay was 11.2 days (range: 9-20 days)

DISCUSSION

Recent meta-analyses show no statistically significant differences among different pancreatic reconstructions after PD [12-14]. The successful management of pancreatic anastomoses may depend more on meticulous surgical techniques, surgical volume, and other management parameters rather than on the type of technique used. The technique of anastomosis is more important over other known factors that influence the formation of a pancreatic fistula after pancreatic head resection. The technique described ensures a tension free anastomosis with an excellent blood supply and allows unobstructed flow of pancreatic juice from the pancreas into the jejunal loop.

The mode of division of pancreas during PD using knife/ electrocautery / harmonic is controversial and remains an individual decision all over the world. The vascularity of the pancreatic remnant is well preserved after PD done with meticulous tissue handling, irrespective of the technique used.

PJ has been the most commonly used method of pancreatico-enteric anastomosis after PD [16-18]. The jejunum is a logical choice for a pancreaticoenteric anastomosis due to its generous blood supply and mobile mesentery. Yet during the past 30 years, this technique has consistently been reported to yield on an average a 10% fistula rate (range 2 to 19%) [19]. Apart from the different positions of the jejunal loop (antecolic, retrocolic, or retromesenteric) and other variations, such as isolated Roux loop PJ, the anastomosis can be performed as an end to- end anastomosis with invagination of the pancreatic stump in the jejunum or as end to side anastomosis with or without duct to mucosa suturing [19]. Duct to mucosa PJ anastomosis allows direct contact of the pancreatic duct with jejunal mucosa, preventing direct contact of the pancreatic juice with the cut end of the pancreas and thus helping healing of the mucosa and protecting the anastomosis by embedding the pancreatic remnant under jejunal serosa [20– 22].

Therefore, duct-to-mucosa anastomosis is theoretically more rational technique to avoid pancreatic fistulae. Since it is technically difficult to perform, duct to mucosa PJ anastomosis was previously recommended for patients with dilated pancreatic duct, whereas in recent years this technique has been preferred regardless of the diameter of the pancreatic duct [23]. Reviewing various techniques in the literatures published over the last decade, Poon et al., found that the duct-to-mucosa anastomosis was safer technique than invagination anastomosis [24]. Marcus et al., found that duct-to-mucosa anastomosis was associated with a low pancreatic fistula rate in low-risk patients with a dilated pancreatic duct or a fibrotic pancreas, whereas end-to-end invagination technique was a safer in high-risk patients with small ducts or a soft friable pancreas [25]. Suzuki et al. selected various PJ techniques according to the pancreatic texture and duct size and obtained an overall pancreatic leakage rate of 8% [26]. The patients who developed pancreatic fistulae were all with a small duct and a soft pancreas. In that series, the incidence of pancreatic leakage rate was 6.25% in patients who underwent a duct to mucosa PJ anastomosis compared to 19.6% in invagination group [26].

However a prospective RCT by Bassi et al. revealed no significant difference in the morbidity and PF rate between duct to mucosa anastomosis and single-layer end-to-side PJ [27]. A number of studies have reported excellent results with PJ and some trials comparing PJ and PG have failed to demonstrate benefit of one method over the other.

Thus while no universal consensus exists, an end to side PJ method adapted here ensures that the jejunum and the pancreas, are lying in an anatomical position in the same plane without any tension requiring less pancreatic remnant mobilization. We use very fine monofilament 4-0 PDS sutures, about 14-16 in number tying them one after the other after taking all the sutures in each layer(7-8 sutures per layer) ensuring that the pancreatic capsule, pancreatic parenchyma, and the pancreatic duct are traumatized in the least and allowing free flow of pancreatic juice into the jejunum. Even the smallest diameter pancreatic ducts can be anastomosed without the need for stenting the anastomoses and without using any optical magnification. Some of the major series of pancreatico-jejunostomy after pancreatico-duodenectomy are listed in Table 1[1,12, 13,15, 25, 28-35]. Our results with the described technique are equally comparable with the results of mentioned series with a pancreatic fistula rate of 3.3 % and no peri- operative mortality.

Various studies have shown that although the use of a preoperative biliary stent increases the postoperative wound infection rate by about 5%, there is no overwhelming evidence that it either promotes or protects from the other complications (36).

Conclusion

The described technique of end to side duct to mucosa pancreatico-jejunostomy is simple, easy to perform with a least pancreatic fistula rate. When performed by experienced hands using a standardized technique and protocol, it is associated with least morbidity and mortality irrespective of the texture of pancreas and size of the pancreatic duct. There was no mortality in our study. Except for wound infection there is no significant difference in total complication rate in patients with pre-op biliary stents.

Author's contribution

(I)Conception and design: CS, VK, JG, MVK; (II) Administrative support: MVK, CR,SK; (III) Provision of study materials and patients: CS,VK, CR, MVK; (IV) Collection and assembly of data: VK, JG, CS, MVK; (V) Data analysis and interpretation: VK, JG, CS, MVK; (VI) Manuscript writing: All authors; (VII) Final approval of manuscript: All authors.

Conflict of interest

All authors declared that they have no conflict of interest.

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