

# Pancreatoduodenectomy with a novel pancreato-jejunal anastomosis by the single layer long parenchymal traverse technique: a technical note with perioperative outcome

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## Abstract

### Introduction

Pancreatoduodenectomy (PD) is the standard of care for localized tumours of the head of the pancreas. The anastomosis between the remnant pancreas and the intestine is a high-risk anastomosis.

This study reports on the outcome of a new technique for an end to side, duct to mucosa pancreaticojejunostomy.

### Patients and methods

Conventional pancreaticoduodenectomy was performed by an individual surgeon between the period of 2013-2014 and 2017- 2019 on 26 patients were included for the study. The postoperative pancreatic fistula (POPF) rate was observed with pancreatic leakage grouped according to 2016 ISGPS guidelines.

### Results

There were 26 patients, 9 women and 17 men who underwent pancreatoduodenectomy with pancreato-enteric anastomosis by this new method. The mean age of the patients ranged from 56.7 to 56.8 years. Adenocarcinoma of the ampulla was the most frequent indication (n=10). Post-operatively, 9 (35%) had POPF and one (4%) required a re-exploration. POPF Type A was common (n=8) and did not require any interventions, where Type C was observed in 1 (4%). The consistency of the gland or the duct size did not show any significant difference with the fistula rate.

### Conclusion

The new single layer interrupted pancreatojejunal anastomosis with a long parenchymal traverse technique is safe with acceptable outcomes.

### Introduction

Pancreatoduodenectomy [PD] is the standard of care for patients with localized tumours of the head of the pancreas, distal bile duct or ampulla [1]. The first reported case of a one-stage pancreaticoduodenectomy for carcinoma of the head of the pancreas was done in 1945 by Dr Allen Whipple (2). The last two decades have seen this procedure be reported safely with low operative mortality rates in many high volume centres [3,4]. However, postoperative morbidity after PD remains high with the pancreato-enteric anastomosis being a major source of complications accounts for about 5% to 30% of the cases (5,6,7). Various modifications of the pancreaticojejunostomy like binding pancreaticojejunostomy, inverted mattress pancreaticojejunostomy, papillary-like pancreaticojejunostomy have shown a benefit, yet none has become the standard and foolproof method in reducing the incidence of POPF (8,9,10). Therefore this short paper describes the transcription of a new technique used in Manchester, the UK which is an end to side, duct to mucosa pancreaticojejunostomy with an insertion of a transanastomotic silicone stent.

### Methods and Material

This is a case series of pancreaticoduodenectomies (PD) performed by an individual surgeon (AD) at Teaching Hospital Peradeniya, a tertiary care hospital in the district of Kandy, Sri Lanka, during the period 2013-2014 and 2017-2019. These were conventional pancreaticoduodenectomies (Whipple's Procedure) with a novel anastomotic technique used for pancreaticojejunostomy (P-J). 26 surgeries were carried during this period. The postoperative pancreatic fistula was assessed according to the system proposed by the International Study Group for Pancreas Surgery [11].

### A new technique of P-J anastomosis

Resection was done with the standard technique. At reconstruction, pancreatojejunosomy was undertaken with a single layer interrupted anastomosis technique using 4-0 or 5-0 absorbable sutures over a 10cm segment of infant feeding tube used as a trans-anastomotic stent. The sutures were placed individually with each one taking a large "bite" of pancreatic parenchyma. This is the long parenchymal traverse technique which allows the suture material a long

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**Figure 1.** Suture placement of the anterior layer



**Figure 2 .** Suture placement of the anterior and the posterior layers



**Figure 3.** Silastic stent placement after completion of the posterior layer



**Figure 4 .** Completion of the anastomosis

traverse through the pancreatic parenchyma (see figure 1 and 2). Initially, the pancreatic duct and the parenchyma were arbitrarily divided into anterior and posterior layers. Anterior layer sutures go through the full parenchyma of the pancreas about 1-2 cm from the parenchymal cut end and out through the inner aspect of the duct traversing through the parenchyma catching a thick chunk of pancreatic tissue and coming out about 2-3mm through the cut end of the pancreatic duct. If the duct is very small it is dilated by using the tip of a mosquito for proper visualisation and the anterior layer sutures are placed with double-ended suture material with traversing the duct first and coming out from the parenchyma in a reverse pattern, thereby making sure the duct is properly incorporated to the stitch. Usually, the 16mm round body half circle needle is used for the smaller ducts. The needles are left as it is for the continuation of the anastomosis later on a suture guide. Four to five stitches were put across the anterior layer of the pancreatic parenchyma (Figure 1). The number of sutures for the anterior layer depended on the size of the pancreatic duct and the size of the pancreatic stump.

Note that the defect in the jejunum is made to match the pancreatic duct. Using the diathermy, a puncture hole was

made on the anti-mesenteric border of the jejunal loop, and the protruding excessive mucosa was trimmed out (Figure 1).

In the posterior layer, the suture would go through pancreatic duct initially and traversing through the parenchyma similarly explained formerly. The stitch starts from the ductal side and comes out from the posterior aspect of the pancreas. Once it has traversed the pancreas the needle would go through the jejunal wall with a thick bite of the seromuscular layer and coming out catching the mucosa just at the jejunostomy opening. The stitch on the jejuna loop should catch more of the seromuscular layer (1-2cm) and a little (2-3 mm) of the mucosa. The posterior layer will again have another 4-5 sutures to incorporate the posterior aspect of the anastomosis (Figure 2). Once it was done the two ends of the jejunum and pancreas was brought together pulling on the sutures of the posterior layer as a parachuting technique (Figure 3). This was done gently and the sutures are kept without getting entangled or cutting into the pancreatic parenchyma. Once its parachuted and the ends are approximated closely the sutures will be tied and the knots will be placed inside the anastomosis (Figure 3). Once all the knots are done in the posterior layer the excessive thread is trimmed out with a very short stub.

Then a small 10 cm feeding tube with appropriate size was put across the PJ as an anastomotic stent. Next, the suture layer which is placed in the anterior layer of the pancreas was taken across one by one through the jejunal side. The suture will pass through the jejunal mucosa catching 2-3mm, and through the jejunal wall catching about a 1-2cm of the seromuscular layer.

Once all the anterior layer sutures were put the knots are applied with having the knot on the serosal side, buttressing on to the serosa of the jejunum (Figure 4).

## Results

There were 26 patients, 9 women and 17 men. The median age of the patients 58.5 and ranged from 18 to 77 years.

Out of them, 9 had POPF giving a 36% POPF rate, and only one required a re-exploration. This was due to a blocked drain and resulting in a collection which needed drainage, categorized to a type C POPF (4%). Eight of the POPF were just biochemical leaks or type A (32%), not requiring any interventions and all of them were haemodynamically stable. There was one death in the peri-operative period due to pneumonia giving a mortality of 3.8%.

We categorized the consistency of the gland into soft and firm, where there were 12 soft and 14 firm pancreases. There was no statistically significant difference in the POPF rate between the soft and firm pancreas ( $p=0.2177$ ).

The duct size was divided to a small size if it is less than 4 mm and the larger diameter anything more than 4mm. The different size of the pancreatic duct did not show any statistically significant difference with the fistula rate ( $p=1.0000$ ).

The correlations between the duct size and the rate of POPF and the consistency of the gland and the rate of POPF were checked. While the size of the duct had a small negative correlation with the rate of POPF (-0.081), the parenchymal consistency had a positive correlation (0.299) with POPF rate. There was no bile leak or leaks from gastrojejunostomy.

There were 9 patients where preoperative biliary drainage was done, most of them with external biliary drainage. Drainage was done if the bilirubin levels were above 250 or due to sepsis. There was one perioperative death due to aciternobacter pneumonia during the perioperative period.

## Discussion

This is a case series of 26 patients who have undergone pancreaticoduodenectomy for neoplastic lesions and analysis of postoperative pancreatic fistula (POPF) rate with a new technique. It is our understanding that this technique has not

been described in the literature. This also has a resemblance to Blumgart's technique of pancreaticojejunostomy [12] thus likely to be practised by many surgeons worldwide.

This case series is single surgeon experience in a tertiary care referral centre for HPB in Sri Lanka. In this series, we observe a slightly higher number of patients with POPF (36%) in comparison with other P-J techniques (13,14,15). They were all type A or biochemical leaks. These didn't alter the clinical outcome or the course of management of these patients. There was one required intervention due to a blocked drain, which required drainage of a collection. We have not analysed the number of days in the hospital, there was no difference between the two groups with POPF and another group. The hospital stays varied mainly due to patient's social circumstances.

A commonly observed problem in P-J is that sutures cut through the pancreatic tissue thus leading to dehiscence in the anastomosis, especially in soft pancreatic parenchyma. Therefore an adequate part of the pancreatic duct which is much stronger must get incorporated into the anastomosis. This practice is one of the main essences of this technique. The interrupted sutures are well placed before any of the stitches are tied enabling a good visualization of each stitch making sure that an adequate amount of ductal tissue is incorporated into the anastomosis. The long parenchyma traversing stitch with the duct will snug the stitches well to the jejunum, thus making the anastomosis watertight.

One of the advantages of this technique is that it uses a lesser number of stitches in an interrupted single layer fashion. The usage of a higher number of stitches causes more trauma to the parenchyma thus inducing more inflammation and oedema. Therefore, the lesser number of stitches, usually about 6-8, should minimize the inflammation (16). Besides, the extra number of stitches makes it more ischaemic and will affect healing. With this technique, we were able to overcome or minimize that issue.

The major component of the effluent or output from P-J anastomotic leak usually results from the jejunal side. Especially in a pancreatic leak, if there is dehiscence in the anastomosis the output from the fistula will be quite high. Combination of high output and digestive pancreatic enzymes will adversely affect the POPF healing. In this new technique, the jejunal side will only have a puncture wound which is around 3-5 mm which has the advantage of early closure even if there is a leak. The silastin trans-anastomotic stent will also aid the healing by maintaining the continuity of the pancreatic duct and the jejunum and also acting as a bridge across the anastomosis.

In conclusion, the advantage of this new technique is that it can be safely used in varying consistencies of the gland and varying sizes of the pancreatic duct. Therefore we recommend this technique as a safe and relatively easy procedure with minimal POPF rate.

All authors disclose no conflict of interest. The study was conducted in accordance with the ethical standards of the relevant institutional or national ethics committee and the Helsinki Declaration of 1975, as revised in 2000.

## References

1. Cameron JL, Riall TS, Coleman J, Belcher KA. One Thousand Consecutive Pancreaticoduodenectomies. *Ann Surg* 2006;244:10-15  
<https://doi.org/10.1097/01.sla.0000217673.04165.ea>
2. Whipple AO. Pancreaticoduodenectomy for islet carcinoma: a five-year follow-up. *Ann Surg* 1945; 121:847-52.  
<https://doi.org/10.1097/00000658-194506000-00008>
3. Mcphee JT, Hill JS, Whalen GF, Zayaruzny M, Litwin DE, Sullivan ME et al. Perioperative mortality for pancreatectomy: a national perspective. *Ann Surg* 2007; 246:246-53.  
<https://doi.org/10.1097/01.sla.0000259993.17350.3a>
4. Birkmeyer JD, Siewers AE, Finlayson EV, Stukel TA, Lucas FL, Batista I et al. Hospital volume and surgical mortality in the United States. *New Engl J Med.* 2002;346:1128-37.  
<https://doi.org/10.1056/NEJMsa012337>
5. Gouma DJ, van Geenen RC, van Gulik TM, de Haan RJ, de Wit LT, Busch OR, Obertop H. Rates of Complications and Death after Pancreaticoduodenectomy: Risk Factors and the Impact of Hospital Volume. *Ann Surg* 2000; 232:786-795.  
<https://doi.org/10.1097/00000658-200012000-00007>
6. Blumgart, L. H., & Belghiti, J. (2000). *Surgery of the liver, biliary tract, and pancreas* (3rd ed.). New York: Saunders Elsevier.
7. Bassi, C., Butturini, G., Molinari, E., Mascetta, G., Salvia, R., Falconi, M., ... Pederzoli, P. (2004). Pancreatic Fistula Rate after Pancreatic Resection. *Digestive Surgery*, 21(1), 54-59.  
<https://doi.org/10.1159/000075943>
8. Kim, J.M., Hong, J.B., Shin, W.Y., Choe, Y.-M., Lee, G.Y. and Ahn, S.I., 2014. Preliminary results of binding pancreaticojejunostomy. *Korean Journal of Hepato-Biliary-Pancreatic Surgery*, 18(1), p.21.  
<https://doi.org/10.14701/kjhbps.2014.18.1.21>
9. Choi, Y.Y., Kim, S.G., Hwang, Y.J. and Kwon, H.J., 2017. Effect of end-to-side inverted mattress pancreaticojejunostomy following central pancreatectomy on the prevention of pancreatic fistula. *Annals of Surgical Treatment and Research*, 93(5), p.246.  
<https://doi.org/10.4174/astr.2017.93.5.246>
10. Zhang, B., Xu, J., Liu, C., Long, J., Liu, L., Xu, Y., Wu, C., Luo, G., Ni, Q., Li, M. and Yu, X., 2013. Application of Papillary-Like Main Pancreatic Duct Invaginated" Pancreaticojejunostomy for Normal Soft Pancreas Cases. *Scientific Reports*, 3(1).  
<https://doi.org/10.1038/srep02068>
11. Bassi C, Marchegiani G, Dervenis C, et al. The 2016 update of the International Study Group (ISGPS) definition and grading of postoperative pancreatic fistula: 11 years after. *Surgery*. 2017;161:584-591. PMID: 28040257.
12. Wang, S.-E., Chen, S.-C., Shyr, B.-U., & Shyr, Y.-M. (2016). Comparison of Modified Blumgart pancreaticojejunostomy and pancreaticogastrostomy after pancreaticoduodenectomy. *Hpb*, 18(3), 229-235.  
<https://doi.org/10.1016/j.hpb.2015.09.007>
13. Blumgart, L. H., & Belghiti, J. (2000). *Surgery of the liver, biliary tract, and pancreas* (3rd ed.). New York: Saunders Elsevier.
14. Bassi, C., Butturini, G., Molinari, E., Mascetta, G., Salvia, R., Falconi, M., ... Pederzoli, P. (2004). Pancreatic Fistula Rate after Pancreatic Resection. *Digestive Surgery*, 21(1), 54-59.  
<https://doi.org/10.1159/000075943>
15. Crippa, S., Cirocchi, R., Randolph, J., Partelli, S., Belfiori, G., Piccioli, A., Falconi, M. (2016). Pancreaticojejunostomy is comparable to pancreaticogastrostomy after pancreaticoduodenectomy: an updated meta-analysis of randomized controlled trials. *Langenbecks Archives of Surgery*, 401(4), 427-437.  
<https://doi.org/10.1007/s00423-016-1418-z>
16. Sun, Y.-L., Zhao, Y.-L., Li, W.-Q., Zhu, R.-T., Wang, W.-J., Li, J., Huang, S. and Ma, X.-X., 2017. Total closure of pancreatic section for end-to-side pancreaticojejunostomy decreases incidence of pancreatic fistula in pancreaticoduodenectomy. *Hepatobiliary & Pancreatic Diseases International*, 16(3), pp.310-314.  
[https://doi.org/10.1016/S1499-3872\(17\)60010-9](https://doi.org/10.1016/S1499-3872(17)60010-9)