Pancreatic stump management following Pancreatico-duodenectomy- tertiary centre experience.

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Introduction:
Currently, only a few patients with pancreatic cancer are candidates for surgical resection, the only potentially curative therapy. In most patients, accurate preoperative staging of periampullary and pancreatic cancer is achieved by multidetector CT with three dimensional reconstruction. A resectable tumour is characterized by lack of evidence of metastatic disease, a clear tissue (fat) plane between the tumour and visceral arteries (celiac axis and superior mesenteric artery), and less than or equal to 180-degree-circumferential involvement of the superior mesenteric vein-portal vein confluence.

Surgical resection remains the only potentially curative therapy for periampullary and pancreatic cancer. Only a few patients currently diagnosed with pancreatic cancer are candidates for curative resection Approaches for resection are based on tumour location and extent. Resection of right-sided tumours typically requires pancreaticoduodenectomy. In many instances, preoperative biliary decompression is unnecessary and may result in increased postoperative complications.

Background:
Pancreatic stump anastomosis is the Achilles heel after Whipple's Procedure. The morbidity (40-60%) and mortality following Whipple Procedure is related to the outcome of anastomosis. Effects to improvise the anastomostic techniques and thereby outcome of Whipple procedure is still evolving. Though many randomized and prospective studies are available till date no simple best technique had been recommended.

Aim of the study:
Primary aim is to analyse the outcome of pancreatic stump anastomosis of various types in relation to major and minor morbidities and mortality. Secondary end point of the study is to analyse and compare Isolated PJ technique outcome to conventional methods. The aftermath of a pancreatic leak can be devastating, particularly when it results in retroperitoneal sepsis. This is found to be a major cause
of mortality in whipples procedure [1]. Mere occlusion of the duct has Mere occlusion of the duct has been shown to result in higher fistula rates, along with increasing the risk of

pancreatic exocrine and endocrine insufficiency. Drainage of the pancreatic remnant to the gastrointestinal tract is an important step, but it runs the risk of anastomotic breakdown. The pancreaticoenteric anastomosis has grabbed the attention of surgeons, causing a search for a more reliable technique to avoid this dreaded complication of anastomotic leak . Several techniques have been described, and the literature will
continue to report novel techniques promising to be even safer. Rather than
the choice of anastomotic technique, however, the successful management
of the pancreatic anastomosis depends more on the surgeon's meticulous
execution of the technique with which he or she is familiar [2]

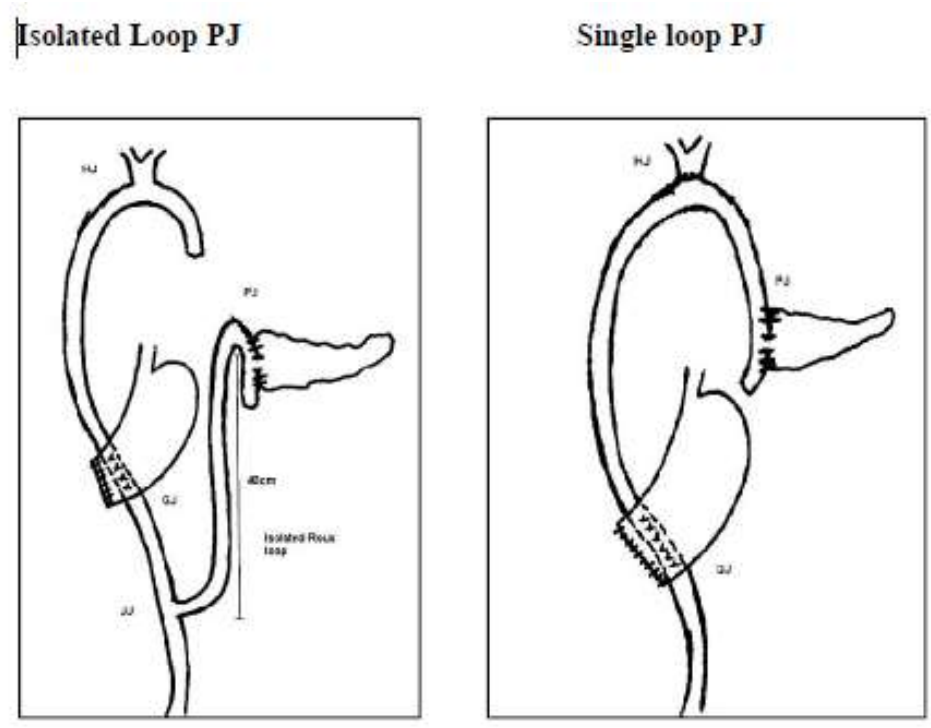
Techniques in Pancreatic stump management:
As long as the basic rules of a safe anastomosis are followed, including careful handling of the pancreatic tissues, a tension-free approximation, ensuring good blood supply, and no distal obstruction, any pancreaticoenteric anastomotic technique can have a good outcome. One of the most commonly employed technique is a pancreaticojejunal anastomosis. This anastomosis is done by invaginating the transected pancreas into the end of the jejunum, also known as dunking method ; another variation is to anastomose the pancreatic duct directly to an opening in the jejunum, called the duct-to-mucosa technique. Another technique is to anastomose the pancreatic stump to the stomach. Proponents of the pancreaticogastrostomy cite various reasons[3] First, it is easier to perform, because of the close proximity of the stomach to the pancreas. Second, rich gastric blood supply makes this anastomosis less prone to ischemia. Third, because the exocrine enzymes encounter an acidic environment, the leak rate is theoretically lower as the enzymes do not get activated. The last statement has been disproved, however. In a prospective randomized trial comparing pancreaticojejunostomy with pancreaticogastrostomy, the leak rates were not significantly different [pancreaticojejunostomy 11%; pancreaticogastrostomy 12%)[4,5].Yeo et al has concluded that pancreatic fistula is a common complication after pancreaticoduodenectomy, with an incidence most strongly associated with surgical volume and underlying disease and the data do not support the hypothesis that pancreaticogastrostomy is safer than pancreaticojejunuostomy or is associated with a lower incidence of pancreatic fistula.

In a meta analysis by Wente MN and Shrikande SV et al [6],they concluded that all non randomized observational clinical studies have reported superiority of pancreaticogastrostomy over pancreaticojejunostomy but all randomized controlled studies has shown equally good results. In a study by H Ramesh et al results suggested that pancreaticogastrostomy deserves wider application [7]. In another prospective randomized trial Bassi et al has showed that both type of anastamosis does not influence significantly the risk of overall complications or the incidence of pancreatic fistula. However, significant decreases in the risk of associated complications, biliary fistulas, postoperative collections and DGE were observed using pancreatico gastrostomy. A Chinese meta analysis of all four randomized controlled trials has evidence suggesting that pancreaticogastrostomy is better than pancreaticojejunostomy after pancreaticoduodenectomy.

Isolated loop Pancreaticojejunostomy:
An ideal reconstructive technique should not only minimize the risk of Pancreatic fistula formation, but should also ensure that, should a pancreatic fistula form, its complications are prevented or minimized. An isolated jejunal loop for Pancreatico enteric anastomosis is theoretically expected to achieve these desired endpoints. Previous studies, using an isolated jejunal loop for pancreatoenteric anastomosis can minimize the risk of Pancreatic Fistula, although its effect in terms of reducing pancreatic fistula related morbidity is not clear.[8-14]

Advocates of this technique believe that diverting bile away from the pancreaticojejunostomy site minimizes the pancreatic enzyme activation and hence reduces the risk of pancreato enteric anastomotic fistula[15].Another argument cited in favour of using a Roux loop in Pancreaticojejunostomy relies on the belief that, if a pancreato enteric anastomotic fistula forms, it will be a 'pure' pancreatic fistula and these fistulae cause lesser complications compared with complex PF, in which the bile activates the pancreatic juice, with further repercussions. The isolated Roux loop pancreaticojejunal end-to-side anastomosis was initially described by Funovics et al.[16] who described 48 patients with double Roux loops to separate the pancreatic and hepatic anastomoses, which resulted in a pancreatic fistula rate of 18.6% but a mortality of only 2%. Sutton CD et al in 2004 reported a series of 61 patients with zero postoperative pancreaticoenteric leaks and mortality rate of 5%.[17].However, recent studies have not borne out this promise of better results .In a recent randomised controlled trial, El Nakeeb et al analysed 90 patients randomly assigned to isolated Roux loop pancreaticojejunostomy with those of pancreaticogastrostomy after pancreaticoduodonectomy. They concluded that Isolated loop Pancreaticojejunal anastomosis was not associated with a lower rate of post operative pancreatic fistula , but was associated with a decrease in the incidence of postoperative steatorrhea and the technique allowed for early oral feeding and the maintenance of oral feeding even if post operative pancreatic fistula developed.[18]

Operative details of isolated Roux loop pancreaticojejunal anastomosis:
A 40-cm long isolated loop of jejunum is fashioned and passed in the retrocolic plane through the mesocolon for pancreaticojejunal anastomosis . The anastomosis is done by a duct to mucosa technique or a dunking technique using 3.0/4.0 prolene interrupted sutures for the anastomosis.



Materials and methods:

Retrospective analysis of prospectively collected data from Department of Surgical Gastroenterology, Government Villupuram medical college hospital, Government Coimbatore medical, College Hospital and Rajiv Gandhi government hospital,Chennai, from 2016 to 2024 march on patients underwent Whipple procedure done – 108 patients have undergone Whipple procedure. Preoperative, Intraoperative and postoperative variables were taken for this study. All patients admitted with a diagnosis of periampullary carcinoma or carcinoma head of pancreas were evaluated by imaging studies and those patients found to have resectable disease were selected for study. All data were collected prospectively and the clinical parameters were noted in a proforma. Details noted included age, gender, chief complaints, co-morbid illness, nature of diet, habit of smoking and alcohol consumption were also noted. Findings on physical examination such as jaundice, pallor, pedal edema and other signs of liver failure if present were noted. Clinical examination of the abdomen was done to look for a palpable gallbladder, hepatomegaly and free fluid. A per rectal examination to rule out any possibility of rectal deposits. Basic biochemical and hematologic investigations including a complete blood count, Renal function tests and Liver function tests were noted. Coagulation profile and serum tumour marker study was done for all patients. After an initial ultrasonogram of abdomen, an upper GI endoscopy and contrast enhanced computerised tomography was done for all patients.

Reconstruction pancreaticoenteric anastamosis was done either in the form of a pancreaticogastrostomy , pancreaticojejunostomy or isolated loop pancreatico jejunostomy as per the choice of operating surgeon. Patients underwent Pancreatic stump anastomosis have been categorised into three groups.

A- Pancreatico Gastrostomy (PG)
B- Pancreatico Jejunostomy (PJ)
C- Isolated Pancreatico jejunostomy (IPJ)

C group later categorised into Dunking type(C1) and Duct to mucosa(C2) type. Major complications like leak (Major/Minor), Hemorrhage (Early/late), DGE (Primary and secondary), Intra-abdominal abscess have been taken in relation to anastomotic techniques. Minor morbidities like Pneumonitis, UTI, wound infection also taken into account. Mortality also related to type of anastomosis.

Statistical analysis:

The data collected in the proforma were entered in an excel sheet of Microsoft Office software and inference obtained after statistical analysis. The mean and standard deviation were reported for continuous variables and for categorical variables proportions were computed. To compare and find the statistical significance between the two group proportions chi square test was used and to compare between the two group means independent t-test was used. The P-values <0.05 were considered to indicate statistical significance.

Figure 1: CECT Abdomen showing Periampullary cancer

Figure 2: Pancreatic Remnant after Specimen removal

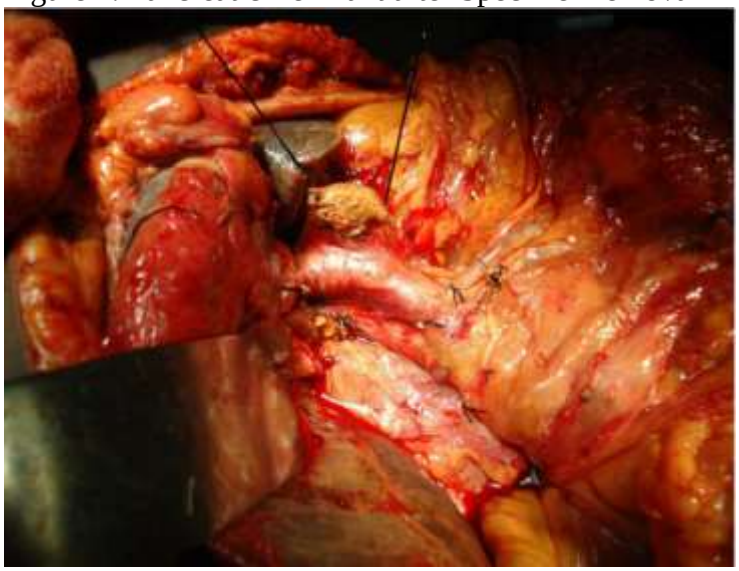
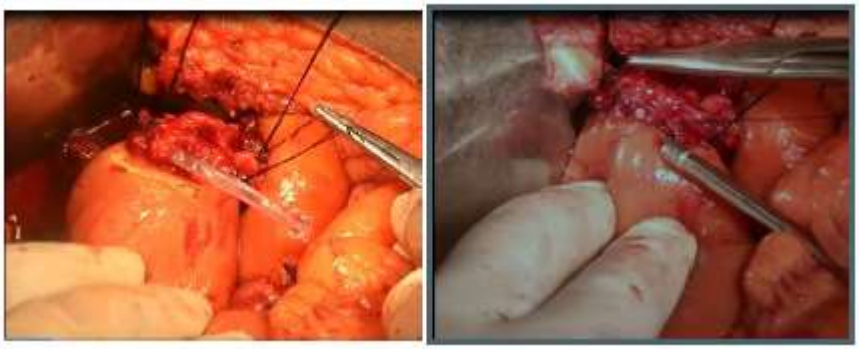


Figure 3: Pancreatico gastrostomy

Figure 4: After Pancreatico gastrostomy

Figure 5: Isolated loop Technique



Results :

Among the one hundred and thirty eight patients included in the study 62% were male and 38% were female patients. The minimum age was 30 and maximum age was 72 with a mean age of 51.7 .On clinical presentation 90% had jaundice, 86% had abdominal pain, 84% had weight loss, 56% had pruritus, 11% had fever, 12% had cholangitis and 28% had other symptoms such as nausea, vomiting, loss of appetite and constipation.

On examination, 81.15% were icteric and 27.53% had pallor. Gallbladder was palpable in 71.01% of patients and liver was palpable in 40.57% of patients. Liver echoes were found to be normal in 92% of patients. Intrahepatic biliary radical dilatation was found in 96% and Common bile duct was dilated in 92% of the patients.

Findings	Frequency	Percentage
Icterus	112	81.15
Pallor	38	27.53
Palpable gallbladder	98	71.01
Hepatomegally	56	40.57

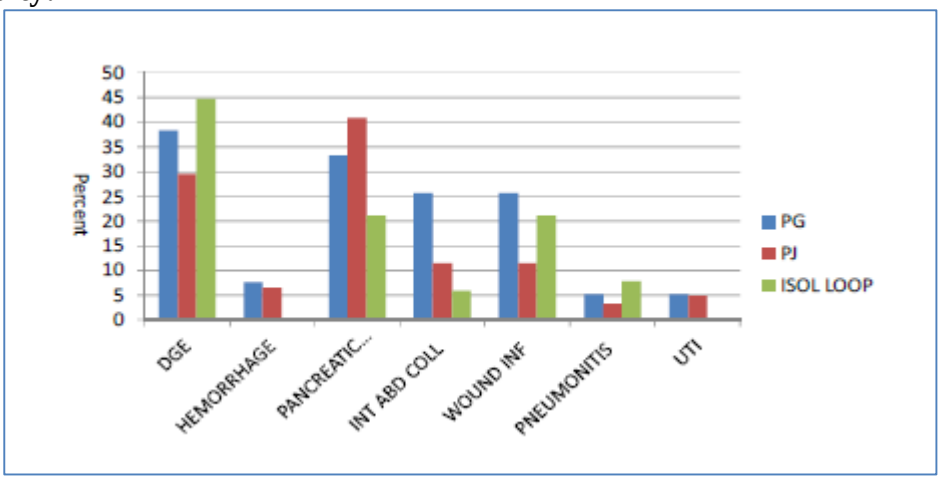
Periampullary 102 (79.68%), Pancreatic cancer 15 (11.7%) Distal CBD growth 6 (6%) and duodenal growth 5 cases were analysed. Among them after pancreatico dudoenectomy- PG (A)-done for 40 cases. PJ(B)- done for 60 cases and Isolated PJ (C) done for 38 cases. DGE is the most common complication 44% (57). Overall complications include- pancreatic leak-30.96%, haemorrhage- 5.4%, Intra abdominal collection-5%. Minor complications are 31% collectively. When comparing between the three groups undergoing pancreaticogastrostomy , pancreaticojejunostomy and isolated loop pancreaticojejunostomy ,the incidence of delayed gastric emptying in the PG group was 38.46% , the incidence in the PJ group was 40.98% and in the isolated loop pancreaticojejunostomy group was 44.73%.The incidence of haemorrhage was 7.6% in the PG group, 6.5% in the PJ group and nil in the isolated PJ group . When comparing the incidence of leak between the three groups it was about 33% in the PG and 29.5% in the PJ group and 15.78% in isolated PJ group. The incidence of intra abdominal collection

in the PG group was 7[17.9%], in the PJ group it was7[11.4%] and in the isolated PJ group was 5 [13.15%].The mean duration of nasogastric tube removal was 7.5 days in the PG group and 7.8 days in the PJ group and 7.0 in Isolated PJ group. The mean postoperative hospital stay was 12.6 days in the PG group and 13.1 days in the PJ group and 11.2 in isolated PJ group. The mortality in the patients who underwent pancreaticogastrostomy was 5.1% ,in the pancreaticojejunostomy group was 4.9 %and 4.8 %in isolated loop PJ .The overall mortality rate was 5.79%.

Procedure	PG group (A)	PJ group (B)	Isolated PJ Group
Total number of surgeries	39	61	38
Haemorrhage	7.6%	6.5%	Nil
Pancreatic leak	33%	29.6%	15.78%
Delayed gastric emptying (DGE)	38.46%	29.5%	15.78%

Intra-abdominal collection	7 (17.95%)	7 (11.4%)	5 (13.5%)
Mortality	5.1%	4.9%	4.8%
Post op hospital stay	12.6 days	13.1 days	11.2 days

Morbidity:



Discussion:

In contrast to published prospective studies we have analysed the outcome of isolated PJ anastomosis and also compared it with Conventional PG and PJ methods. In our study though we found no overall difference in the morbidities between the techniques, severity of complications is lesser with isolated loop technique like Grade A leak. Pancreatic leak occurred in 39 patients with grade A leak in 20(15.62%), grade B leak in 12(9.37%) and grade C leak in 7(5.46%) patients. All patients with pancreatic leak were managed by non-operative means. Grade A leaks were managed conservatively and grade B leaks required supportive care in the postoperative ward with drainage tube retained for a prolonged period and grade C leaks were managed aggressively in the ICU with one or more image guided percutaneous drainage tubes and nutritional support .We have not reoperated for a suspected leak. We also observed that it has demerits like long operating hours and increased incidence of DGE . In the subgroup analysis between Dunking method(C1)and Duct to mucosa(C2) anastomosis technique there is no difference between the techniques. Mortality is comparatively lesser than other methods but it has no statistical difference.

Conclusion:

Among various techniques of pancreas stump reconstruction (PG/PJ /Isolated PJ) none of them showed statistical significant morbidity or mortality of the existing standard. But isolated loop PJ has had statistically significant lower grade leak and increased DGE. Subgroup analysis within the isolated loop has no difference in outcome. Pancreatic stump management has to be individualised. Surgeon should be familiar with all techniques. Isolated loop PJ can be done for well-preserved young patients.

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