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Original Article

Blumgart versus conventional anastomosis for pancreatojejunostomy after pancreaticoduodenectomy - What will we choose?

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Abstract:

Background: Pancreatic leakage is a major cause of postoperative mortality and morbidity after pancreaticoduodenectomy (PD). A recent study introduced Blumgart anastomosis (BA), which minimizes severe complications after PD. This study compares BA with conventional anastomosis (CA) for pancreaticojejunostomy (PJ) after PD in the Department of Surgical Gastroenterology, Sheikh Russel National Gastroliver Institute and Hospital.

Methods: This retrospective observational study includes 20 patients who underwent PD between November 2020 to November 2021. The patients were divided into two groups according to the anastomosis type. Of them, 10 patients underwent anastomosis using CA (group A, conventional anastomosis including Dunking and Duct to mucosa) and 10 underwent anastomosis using BA (group B, Blumgart anastomosis). The methods were compared in context of postoperative pancreatic fistula (POPF), post pancreatectomy hemorrhage (PPH), and delayed gastric emptying (DGE) to see the overall outcome of two techniques.

Results: Mean duration of operation time was significantly shorter in group B (373.1±102.0 versus 256.4±58.5 min, p<.05), and the number of intraoperative transfusion units (mean) was less in group B (2.5±1.4 versus 1.7±1.5 unit). Statistically significant difference was also observed between groups A and B in the incidence of postoperative pancreatic fistula (POPF) (30.0% versus 10.0%, p=034.) and PPH (50% versus 30%, P=0.0643), DGE (30% versus 40%, p=0.124) was not statistically significant. The length of postoperative hospital stay (mean) was not statistically different between groups A and B (12.0±6.3 versus 10±7.2 days, p=0.08). There was one mortality which was observed in Group-A.

Conclusions: BA after PD was associated with a decreased risk POPF, DGE and PPH. Therefore, the results of this study suggest that BA-type PJ is superior to CA-type PJ in terms of postoperative complications.

Key words: *Blumgart, conventional anastomosis, pancreatojejunostomy*

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Introduction

Since the first pancreaticoduodenectomy (PD) was reported by Whipple and colleagues in 1935, PD has been regarded as the standard surgical procedure for patients with either benign or malignant disease of the pancreatic head or periampullary region.[1] Pancreaticoduodenectomy (PD) is a major surgical procedure that includes removal of the head of the pancreas, duodenum and proximal jejunum with (Whipple's) or without distal stomach (pylorus preserving) along with regional lymph nodes.[2] This surgical method is considered one of the most challenging and complex abdominal operations.

Management of the pancreatic remnant is a major task during the reconstructive phase of PD. One of the crucial step of reconstruction of post PD is anastomosis of the pancreatic remnant either with the jejunum (pancreatojejunostomy, PJ) or with the stomach (pancreaticogastrostomy, PG). Pancreatic fistula (PF) is a major cause of postoperative complications after PD and a potentially serious, life threatening event associated with intra-abdominal fluid collection or abscess and need occasional reoperation. At high-volume hospitals, deaths after pancreatic resection have recently decreased to less than 5%, but the morbidity remains high, ranging from 30% to 50%. Postoperative pancreatic fistulas (POPF) and delayed gastric emptying (DGE) are the major complications observed after PD.[3] Although various techniques of pancreatojejunostomy (PJ) have been attempted to decrease postoperative deaths and morbidity, there is still no standard technique to decrease the incidence of pancreatic leakage, especially in patients with a soft pancreas.

A new technique was first described by Blumgart in 2000.[4] This technique involves duct-to-mucosa anastomosis and four transpancreatic U-sutures. It was originally introduced by Dr. Leslie Blumgart and reported by Grobmyer et al. at Memorial Sloan Kettering Cancer Center. It is important to understand that the four most important factors in construction of a PJ include a tension-free anastomosis, good vascularity, no laceration of the pancreatic parenchyma, and good approximation of the pancreas and jejunum.[4] Excellent results have been reported for Blumgart's technique which helps to achieve all the four above.

Anastomosis Technique

The conventional anastomotic techniques include Dunking and Duct to mucosa anastomosis. Blumgart anastomosis is a new transpancreatic U-suture technique with modification of duct-to-mucosa anastomosis. This technique includes placement of four to six transpancreatic sutures and jejunal seromuscular sutures to approximate the pancreas and the jejunum using non-absorbable sutures. A suture was placed through the whole pancreatic parenchyma from front to back. A seromuscular bite with vertical mattress over the jejunum was taken as the posterior outer layer, and the same suture reverted back to front through the whole pancreas again to complete the U-suture. These transpancreatic U-sutures were completed by placing the needle on the anterior seromuscular wall of the jejunum to create an anterior outer layer after constructing duct-to-mucosa anastomosis. Then, the pancreatic remnant totally covered with jejunal serosa. Pancreatic duct stents were not routinely inserted, but were used at the discretion of the surgeon.

Operational definitions:

Major complications after PD include postoperative pancreatic fistula (POPF), post pancreatectomy hemorrhage (PPH) and delayed gastric emptying (DGE). POPF was defined and graded according to the International Study Group on Pancreatic Fistulas (ISGPF). The ISGPF proposed the clinical grading system of POPF by severity grades A, B, and C, with grade A being least severe and grade C being most severe. This grading system of POPF was based on parameters, such as clinical condition, treatment used, imaging study results, persistent drainage, reoperation, death, infection signs and readmission. PPH and DGE were defined and graded according to the International Study Group on Pancreatic Surgery (ISGPS). Three different grades of PPH (grades A, B, and C) were defined according to the time of onset, site of bleeding, severity and clinical effect. The mild, moderate and severe forms of DGE after pancreatic resection were classified into grades A, B and C respectively, based on their clinical effect, on the clinical course and on postoperative management.

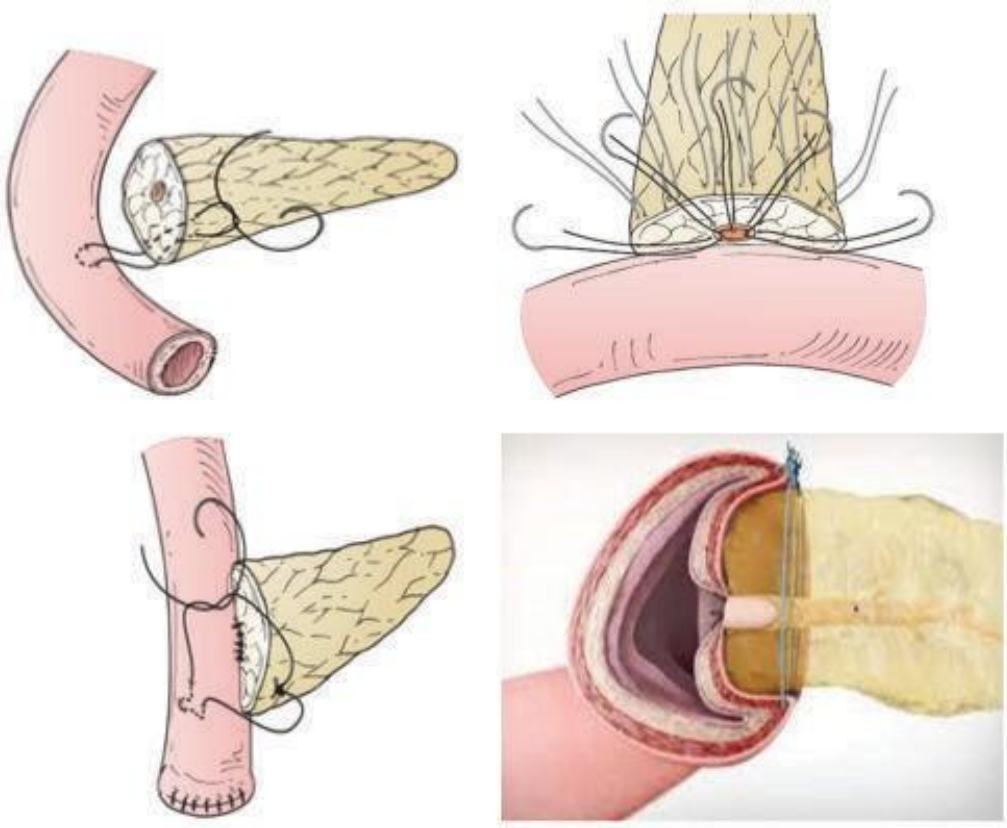

Fig.-1: *Blumgart Technique*

POPF GRADE:

No fistula	Drainage amylase on or after postoperative day 3 is not three times than upper normal serum amylase value
Grade-A	No specific treatment was required even though drainage amylase on or after postoperative day 3 is three times than upper normal serum amylase value
Grade-B	Requires a change in management or adjustment of clinical pathway (antibiotics, total parenteral nutrition, or repositioning of drainage tubes)
Grade-C	Requires major charge in the clinical pathway; clinical intervention is aggressive and often in the ICU setting

DGE GRADE:

ISGPS DGE grade	Nasogastric tube needed	Unable to tolerate solid diet by POD
A	4–7 d or reinsertion after POD 3	7
B	8–14 d or reinsertion after POD 7	14
C	>14 d or reinsertion after POD 14	21

PPH GRADE:

Grade	Timing , Location and severity of bleeding	Clinical condition	Investigation
A	Early, intra- or extraluminal mild	Well Blood count,	Observation, Ultrasonography CT Scan
B	Early, intra- or extraluminal, severe or Late, intra- or extraluminal, mild	Often well/ intermediate, very rarely life-threatening	Observation, Blood count, Ultrasonography CT scan
C	Late, intra- or Extraluminal, severe life-threatening	Severely impaired, Endoscopy	Angiography CT scan

Materials and Methods:

Study Design: This was a cross sectional retrospective comparative study. Purposive sampling technique was used. The study population was divided into two groups. Group A- The conventional anastomotic (CA) group and Group-B the Blumgart anastomotic group (BA). Each group had 10 patients. All PD were performed by a single experienced surgeon in the Department of Surgical gastroenterology, Sheikh Russel National Gastroliver Institute and Hospital from November 2020 to November 2021.The 2 groups were compared in terms of POPF, PPH and DGE to see the overall outcome of two techniques. An enhanced recovery (ERAS) protocol was followed for all the patients. Post operatively drain fluid amylase was measured to identify POPF. Drain fluid collection and patients's haemodynamic status and faecal condition were also monitored for PPH. DGE were identified and classified according to International Study Group on Pancreatic Surgery (ISGPS) classification of DGE.

Statistical analysis

Comparisons between the two groups were made using the t- test for continuous variables and the Fisher's exact test for categorical variables, which are presented as frequency or percentage. Continuous variables are presented as Mean±SD. Statistical significance was set at $p<0.05$. Statistical data were calculated by SPSS version 23.0 (IBM SPSS Statistics, IBM Corporation, Chicago, IL, USA).

Results:

A total of 20 patients were included in the present study. Of these, 10 underwent CA (group A) and 10 patients underwent BA (group B). There was no significant difference in the clinical and demographic characteristics.

Table-I

Showing demographic characteristics of study population

	Conventional Anastomosis (n=10)	Blumgart Anastomosis (n=10)
Age (years)	56 ±10.67	59 ±8.06
Sex		
Male	8(80%)	7(70.0%)
Female	2(20%)	3(30.0%)

n: number, %: percentage.

Table-II

Disease and preoperative intervention

	Conventional Anastomosis (n=10)	Blumgart Anastomosis (n=10)
Diagnosis		
Ca head of pancreas	2(20%)	1(10.0%)
Periampullary carcinoma	8(80%)	9(90.0%)
Previous intervention	2(20.0%)	1(10.0%)

(Biliary stenting, PTBD)
n: number, %: percentage.

Table-III
Operative data

	Group-A	Group-B	P Value
Duration of operation (min)	373.1±102.0	256.4±58.5	0.032
Intraoperative Blood Transfusion(Units)	2.5±1.4	1.7±1.5	0.065
Length of post-operative hospital stay(Days)	12.0±6.3	10±7.2	0.08

P value was calculated from Fisher's exact test
Data about the surgical procedures are shown in this table. There were significant difference in mean duration of operation between the two groups. Mean duration of operation was significantly shorter in group B (473.1±102.0 versus 386.4±58.5 min, p<.05), and the number of intraoperative transfusion units (mean) was less required in group B (2.5±1.4 versus 1.7±1.5 unit). The lengths of postoperative hospital stay (mean) was longer in group A (9.0±6.3 versus 7.4±7.2 days, p=0.08) but it was not statistically significant.

Table-IV
Postoperative Complications

	Group-A (n=10)	Group-B (n=10)	p-Value
POPF			
A	3(30.0%)	1(10.0%)	0.034
B	1(10.0%)	0	
C	0	0	
Total	4(40.0%)	1(10.0%)	
PPH			
A	4(40.0%)	1(10.0%)	
B	1(10.0%)	2(20.0%)	0.0643
C	0	0	
Total	5(50.0%)	3(30.0 %)	
DGE			
A	2(20.0%)	2(20.0%)	
B	1(10.0%)	0	0.124
C	0	0	
Total	3(30.0%)	2(40.0%)	

POPF: Postoperative pancreatic fistula; PPH: Post Pancreatectomy Hemorrhage; DGE: Delayed Gastric emptying; n: number; P value was calculated from Fisher's exact test.
Postoperative complications are showed in this table-3. A difference was found in the incidence of POPF (30.0% versus 10.0%, p=0.034) which was statistically significant. DGE and PPH were more in group A but the difference was not statistically significant. There was one mortality which was observed in Group-A.

Discussion:

The pancreatic anastomosis after pancreatico-duodenectomy (PD) still remains the main challenge for the pancreatic surgeon. In the last 30 years, the surgeons constantly attempted to find out the "optimal" technical solutions for pancreatic remnant management.[5] Nevertheless, many surgeons continue to propose different techniques of pancreatic anastomosis to search for the best reconstruction after PD. Recently, a relative "novel" type of duct to mucosa called "Blumgart anastomosis" (BA) has gained popularity. Several retrospective studies have proven BA efficacy in avoiding clinically relevant pancreatic fistula (POPF).[6,7,8]

Though the clinico-demographic study is similar in both groups in this study but mean operative time was

significantly lower in Group-B. Intraoperative blood transfusion was less required in Blumgart group but statistically it was not significant. Kleespies et al. in his study reveals similar results. Moreover, our study showed that length of hospital stay is shorter in this group.[9]

Pancreatic fistula can lead to serious complications such as intraperitoneal infection, postoperative hemorrhage, and death.[10] Strategies to reduce the incidence of pancreatic fistula have become a key research focus for surgeons. This study recognized that the PJ anastomosis is an important and key procedure.

In our study, we found lower incidence of POPF and DGE in Blumgart group which is significant. In the first publication about the Blumgart anastomosis 187 patients who underwent a pancreatic head resection were examined. The authors reported 1.6% mortality and a very low POPF rate (grade B + grade C) of 6.9%.[11] Kleespies et al. compared the Blumgart technique with the modified Cattel-Warren anastomosis. After Blumgart anastomosis the study shows a significantly lower rate of POPF, reduced duration of the operation, reduced postoperative hemorrhage, reduced length of stay on intermediate care units and less surgical and general complications

.[9] Li came to similar results with a lower rate of POPF and general complications by the Blumgart anastomosis.[12] A recent study shows the potential of the Blumgart anastomosis to reduce adverse complications and POPF over the duct-to-mucosa anastomosis. Besides adverse complications and the 90 day mortality were less in this Blumgart pancreatojejunostomy technique.[14] The analysis of the data of this study shows, that the Blumgart anastomosis could reduce the rate of POPF. The superiority of the technique is particularly shown for soft pancreatic parenchyma and reduction of duration of the operation.

Our study has some limitations. First, it was a retrospective single-center study. Second, it was based on a small sample size. Third, these patients were homogenously distributed.

Conclusion:

Despite some limitations, this study clarifies that BA anastomoses could reduce the risk of POPF. Overall morbidity rate like DGE, PPH or long postoperative stay could be decreased by adopting this reconstruction technique. However, these results need to be confirmed in further and well-structured studies conducted in in future.

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