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Original Article

Condition of Pancreas and Pancreatic Marker Following Modified Blumgart Pancreaticojejunostomy in Pancreaticoduodenectomy

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ABSTRACT

Introduction: *Pancreaticoduodenectomy (PD) is a complex surgical procedure primarily used to treat pancreatic and periampullary tumors. The Modified Blumgart Pancreaticojejunostomy (PJ) technique has emerged as a promising approach to minimize the incidence of POPF by enhancing the stability of pancreatic anastomosis. This study aims to assess the biochemical markers, particularly serum and drain fluid amylase levels, in the early postoperative period.* ***Methods & Materials:*** *This Cross-sectional Observational study was conducted among the indoor patients of surgery units in Dhaka Medical College & Hospital, Dhaka, from January 2023 to December 2023. All patients who experienced Pancreatoduodenectomy in the Surgery department of Dhaka Medical College & Hospital during the study period were considered as the study population.* ***Result:*** *This study involved 30 patients, with most (36.6%) aged between 40-50 years and a male predominance (63.3%). Pancreatic texture was hard in 53.3% of cases, while 46.6% had a soft texture. The majority (63.3%) had a pancreatic duct diameter of 6-8 mm. Postoperatively, serum amylase levels were normal in all patients, but 13.3% exhibited a significant rise in drain fluid amylase, indicating potential pancreatic fistula.* ***Conclusion:*** *In this study on the condition of the pancreas and pancreatic markers following Modified Blumgart Pancreaticojejunostomy in pancreaticoduodenectomy, 53.3% of patients had a hard pancreatic texture, and 63.3% had a duct diameter of 6-8 mm—both key factors affecting postoperative outcomes. A significant rise in drain fluid amylase, suggestive of pancreatic fistula, was observed in 13.3% of patients by postoperative day 3.*

Keywords: *Modified Blumgart Pancreaticojejunostomy, Pancreas, Serum Amylase, Drain Fluid Amylase*

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INTRODUCTION

Pancreaticoduodenectomy (PD) is the standard surgical procedure for treating pancreatic and periampullary malignancies [1-3]. Allen Oldfather Whipple standardized this procedure in 1940 [4]. Since then, various techniques have been developed to enhance its safety [5,6]. In the classical PD approach, the pancreatic head, distal stomach, duodenum, proximal jejunum, gallbladder, and distal common bile duct are resected. This is followed by three key anastomoses: pancreaticojejunostomy (PJ), hepaticojejunostomy, and gastrojejunostomy. Among these, PJ is considered the most critical and prone to leakage, often referred to as the "Achilles' heel" of the procedure [7]. To mitigate the risks associated with PJ, several technical modifications have been introduced, including the use of internal/external pancreatic stents, performing pancreaticogastrostomy (PG), and reinforcing the anastomosis [4, 8]. Over 80 different PJ techniques have been described in the literature [5]. Despite these advancements, postoperative complications remain common following PD, even in specialized centers. These complications include postoperative pancreatic fistula (POPF), intra-abdominal hemorrhage, abscess formation, bile leakage, wound dehiscence, and surgical site infections, with POPF being the most serious, occurring in 10-30% of cases [7-10]. Many other complications are secondary to POPF [11]. The mortality rate after PD is 2-4%, with the outcome heavily influenced by the development of POPF [12]. To reduce these complications and mortality rates, adopting safer surgical techniques is crucial [12]. Factors influencing pancreatic anastomosis include gland texture, duct diameter, nutritional status, intraoperative blood loss, meticulous surgical technique, suture type, administration of octreotide, and the surgeon's experience [4-6]. Given the significant impact of anastomotic technique on POPF, various PJ techniques, such as the dunking and duct-to-mucosa procedures, have been developed, with studies showing favorable outcomes and no significant differences in POPF rates [6, 8]. However, most of these techniques generate shearing forces on the pancreatic remnant due to tangential suture placement, which is a major contributor to POPF [9]. To address this issue, Blumgart and colleagues introduced a new

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PJ technique in 2000, using transpancreatic mattress sutures [5-8]. This technique was later modified by reducing the number of transfixing sutures and altering the knotting method, resulting in what is known as the Modified Blumgart Technique (MBT). MBT employs multiple monofilament mattress sutures passed through the pancreatic parenchyma, thereby eliminating shearing forces [11]. The literature indicates that when key factors are adequately addressed, the incidence of POPF with MBT is significantly reduced to less than 10% [2-4]. This study aimed to evaluate the condition of the pancreas and pancreatic markers following Modified Blumgart Pancreaticojejunostomy in pancreaticoduodenectomy.

METHODS & MATERIALS

This Cross-sectional Observational study was conducted among the indoor patients of surgery units in Dhaka Medical College & Hospital, Dhaka, from January 2023 to December 2023. All patients who experienced Pancreatoduodenectomy in the Surgery department of Dhaka Medical College & Hospital during the study period were considered as the study population. A total of 30 patients were selected as study subjects by purposive sampling technique. Consent from patients and relevant authorities was taken. Acquisition of information regarding particulars of the patient, history, clinical examination findings, preoperative investigations, operation notes, and histopathological findings of resected specimens were collected by a preformed data collection sheet. Univariate and multivariate analysis of the data was carried out using a statistical analysis software program. A descriptive analysis of continuous variables was carried out and presented as the means ± SD.

Inclusion criteria:

- Patients received Modified Blumgart Anastomosis after pancreatoduodenectomy for various reasons.
- Age between 40 to 75 years.

Exclusion criteria:

- Patients required liver resection with PD.
- Patients required pancreaticogastrostomy or duct-to-mucosa anastomosis.
- Patient with concomitant other malignancy.
- The patient has a history of previous upper GIT resection surgeries.

RESULTS

Table – I: Distribution of patients according to age (years) (*n*=30)

Age group (in years)	n	%
40 – 50	11	36.6
51 – 60	8	26.6
61 – 70	10	33.3
71 – 75	1	3.3
Mean age ±SD (in years)	20.00±10.00	
Age range (in years)	40 - 75	

It was observed that most of the patients were between 40 – 50 years (36.6%) and next most were 61 – 70 years (33.3%) of age [Table I].

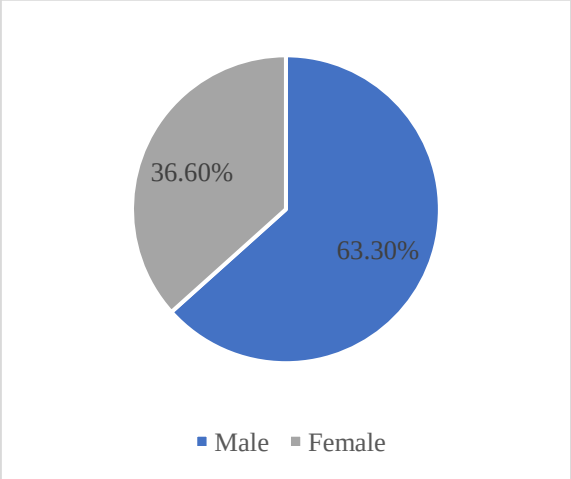

Figure – 1: Distribution of patients according to sex (*n*=30)

Figure 1 shows that out of 30 patients, 63.3% were male, and rest 36.6% were female. The male-to-female ratio was 3:2.

Table – II: Distribution of patient according to pancreatic texture (*n*=30)

Pancreatic texture	n	%
Soft	14	46.6
Hard	16	53.3

In this study, 53.3% of patients had soft pancreatic texture, while the rest had hard 46.6% [Table II].

Table – III: Distribution of patients according to pancreatic duct diameter (*n*=30)

Diameter	n	%
3-5	06	20.0
6-8	19	63.3
9-12	05	16.6

In this study, among 30 patients, 19 (63.3%) patients have duct diameters between 6-8 mm [Table 3].

Table – IV: Distribution of patients according to serum amylase and drain fluid amylase at day 3 postoperatively (*n*=30)

Investigation	Test Result	
Serum Amylase	< 40 unit/L (normal)	> 40 unit/L
	30 (100%)	0
Drain Fluid Amylase	< 3 fold rise of that of Serum Amylase	> 3-fold rise of that of Serum Amylase
	26 (86.6%)	04 (13.3%)

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It was observed that in 04 (13.3%) patients, there was a significant rise of drain fluid amylase on day 3 postoperatively [Table IV].

DISCUSSION

By definition, it is one of the most important factors responsible for postoperative morbidity and mortality. It is often associated with abscess formation eventually with abdominal sepsis or life-threatening erosional bleeding. Clinically relevant postoperative pancreatic fistula (POPF) can lead to extended hospital stays and longer durations in intermediate care units, impacting overall treatment costs [12]. Identified risk factors for POPF include soft pancreatic parenchyma, pancreatic lesions absent of pancreatitis, a small pancreatic duct diameter (<3 mm), and significant blood loss (>500 mL) [13-15]. Additionally, a high body mass index (BMI) is considered a risk factor, likely due to pancreatic steatosis frequently observed in obese individuals [13, 16-18]. Advanced age may also contribute to pancreatic steatosis [17]. While earlier studies suggested that increasing age was a risk factor for POPF, this has not been confirmed in more recent research [19,20,21]. Some authors also cite male gender as a potential risk factor [13, 21-22]. Pancreatic texture and duct diameter are key factors affecting postoperative outcomes, particularly in pancreaticojejunostomy (PJ) anastomosis. In this study, 53.3% of patients had a hard pancreatic texture, while 46.6% had a soft texture. This is consistent with previous studies, which highlight that a soft pancreatic texture is more prone to complications such as postoperative pancreatic fistula (POPF). Bassi et al. reported that soft pancreatic tissue poses challenges in creating a secure anastomosis, leading to an increased risk of POPF due to the difficulty in suture handling [23]. In contrast, patients with hard pancreatic tissue have been shown to experience fewer incidences of POPF, as seen in the findings of De Oliveira et al. [24]. Pancreatic duct diameter is another crucial factor influencing postoperative complications. In this study, 63.3% of patients had a duct diameter between 6-8 mm. Prior studies have shown that smaller duct diameters (≤3 mm) are associated with higher rates of POPF. Conversely, larger duct diameters (6-12 mm) are associated with lower complication rates, as they make the anastomosis technically easier and more secure [25]. Postoperative monitoring of serum and drain fluid amylase levels is a key indicator of early pancreatic leakage. In this study, 13.3% of patients exhibited a significant rise in drain fluid amylase (> 3-fold increase compared to serum amylase) on postoperative day 3, which is a known marker for the development of POPF. This observation is consistent with the results of another author who found a similar incidence of elevated drain fluid amylase as a predictor of POPF in 10-20% of cases [26]. Additionally, all patients in this study had normal serum amylase levels, supporting the notion that drain fluid amylase is a more reliable indicator of pancreatic leakage than serum levels.

Limitations of The Study

The study was carried out in a single hospital with a small sample size. So, the results may not represent the whole community.

CONCLUSION

In this study on the condition of the pancreas and pancreatic markers following Modified Blumgart Pancreaticojejunostomy in pancreaticoduodenectomy, 53.3% of patients had a hard pancreatic texture, and 63.3% had a duct diameter of 6-8 mm—both key factors affecting postoperative outcomes. A significant rise in drain fluid amylase, suggestive of pancreatic fistula, was observed in 13.3% of patients by postoperative day 3. These findings emphasize the importance of assessing pancreatic texture, and duct size, and monitoring pancreatic markers for predicting and managing postoperative complications effectively.

RECOMMENDATION

Based on the findings regarding pancreatic texture, duct size, and postoperative pancreatic markers, it is recommended that surgeons consider these factors carefully when performing Modified Blumgart Pancreaticojejunostomy in pancreaticoduodenectomy. Regular monitoring of drain fluid amylase levels is crucial for early detection of pancreatic fistula. Further research with larger sample sizes is suggested to confirm these findings and refine strategies for minimizing postoperative complications.

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Ethical approval: The study was approved by the Institutional Ethics Committee

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