

Outcomes of Pylorus-Preserving Pancreaticoduodenectomy for Periapillary Carcinoma in a Hepatobiliary Unit of A Military Hospital

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ABSTRACT

Objective: To evaluate the outcome of pylorus-preserving pancreaticoduodenectomy for periapillary carcinoma in the hepatobiliary unit.

Study Design: Prospective analytical study

Place and Duration of study: Pak-Emirates Military Hospital, Rawalpindi, Pakistan, from Jun 23 to Feb 24

Methodology: Fifty-five consecutive patients with periapillary carcinoma underwent PPPD or Whipple procedure. A non-probability consecutive sampling technique was applied. Data were collected on the patients' demographics, intraoperative factors, pathology, and postoperative outcomes, including blood loss, hospital stay, complications, mortality, and weight changes.

Results: Of the 55 patients, 58.18% were male. Their mean preoperative weight was 70.07 ± 7.91 kg, and their mean age was 59.32 ± 7.03 years. Groups A and B had substantially different intraoperative blood loss ($p < 0.05$) and procedure durations (244.28 ± 44.59 ml; 337.86 ± 32.92 min) and 351.48 ± 48.57 ml; 342.22 ± 49.33 min). Relaparotomy, delayed stomach emptying, and positive resection margins were among the post-surgery complications rates that did not significantly differ between groups ($p > 0.05$). Group-A's mortality rate was 17.8%, whereas Group-B's was 11.11% ($p = 0.478$).

Conclusion: Our findings suggest that, in cases with periapillary malignancy, pylorus-preserving pancreaticoduodenectomy is a preferable option to the Whipple approach, since it minimizes perioperative problems and enhances postoperative quality of life. To improve surgical methods and patient selection, further research is required.

Keywords: Complications, Mortality, Outcome, Periapillary Carcinoma, Pylorus-preserving pancreaticoduodenectomy, Whipple procedure

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INTRODUCTION

The phrase "periapillary carcinoma" frequently defines neoplasms that arise from the CBD, duodenum, and head of pancreas.¹ The optimal surgical technique for cancer affecting the pancreas is pancreaticoduodenectomy.

Partial pancreaticoduodenectomy was initially described by surgeon Dr. Walther Kausch in 1909, who is recognized historically for having invented the technique.² Whipple et al., improved and popularized this process in 1935. The CBD, head of the pancreas, duodenum, and gallbladder are excised in one piece during the Whipple surgery, and the gastrointestinal tract is then reconstructed.³ The Whipple technique is linked with significant rates of morbidity and death, despite its effectiveness in attaining oncological clearance. These complications are mostly related to

pancreaticoduodenal leak, delayed stomach emptying, postoperative hemorrhage, and anastomotic strictures.⁴

A different surgical technique known as the PPPD was developed as an answer to these concerns. Pylorus-preserving pancreaticoduodenectomy (PPPD) is a noteworthy surgical treatment that preserves the integrity of the pyloric area while accomplishing radical resection. Because of its potential to shorten hospital stays and lower postoperative mortality, this novel surgical technique has garnered a lot of interest.⁵ Originally proposed by Watson in 1944, PPPD is an enhanced version of the Conventional Whipple operation. It differs from the Whipple operation in that it concentrates on maintaining the pylorus and the first portion of the duodenum.⁶ Studies conducted in the past have shown that pancreaticoduodenectomy with the pylorus preserved can improve gastrointestinal function over the long run. Among these benefits include higher weight gain following surgery, a lower frequency of peptic ulcers, and a

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lower incidence of dumping syndrome. The pylorus-preserving method also reduces intraoperative blood loss and shortens operating times by improving the procedure.⁷

Despite its theoretical advantages, the PPPD's adoption has been tempered by conflicting evidence regarding its oncological efficacy and comparative outcomes with the standard Whipple procedure. While some studies have reported comparable oncological outcomes and similar rates of delayed gastric emptying with the PPPD, there is no significant difference between duration of operation, blood loss, length of hospital stay, and post-operative weight loss.⁸

In patients having surgical resection for periampullary cancer, this cross-sectional research compares the perioperative and long-term results of the PPPD to the conventional Whipple surgery.

METHODOLOGY

This prospective analytical study was carried out at Pak-Emirates Military Hospital, Rawalpindi, Pakistan, from June 23 to Feb 24. The Ethical Research Committee (ERC) of the Institute has authorized the conduct of this research under ERC No. A/28/ERC/548/23. Using the WHO sample size calculator and data from a previous study, the research sample size was set at 5 people with a 95% confidence level, a 5% margin of error, and an estimated incidence rate of periampullary malignancies of 2.9 cases per million population.⁹ Using an appropriate non-probability selection technique, participants were selected.

Inclusion Criteria: Patients of either gender aged ≥ 18 years with histologically confirmed periampullary carcinoma, who underwent standard Whipple pancreaticoduodenectomy or pylorus-preserving pancreaticoduodenectomy (PPPD). Availability of complete medical records, including preoperative assessment, operative details, and postoperative follow-up data. Patients treated within the predefined study period to ensure comparable follow-up duration and treatment protocols. Patients with adequate physical and cognitive capacity to undergo follow-up assessments and complete quality-of-life questionnaires.

Exclusion Criteria: Those with significant illnesses, such as inoperable tumors, metastatic illnesses, or other major medical issues, that might have an impact on their prognosis or the outcome of their surgery.

Patients who have had significant abdominal surgery in the past are excluded because their surgical approach and results may be affected.

Surgically splitting the duodenum 2 cm distal to the pylorus and excising all duodenum distal to this point is the conventional approach for pylorus-preserving resection. It also involves resecting the head, neck, and pancreatic uncinate process (beneath the superior mesenteric vein, lateral to the mesenteric-portal vein axis, flush with the superior mesenteric artery), as well as excising the gallbladder and common bile duct proximal to the cystic duct junction. Finally, the periampullary tumor is excised. Usually, a distal gastrectomy of 20% to 40% is carried after following the first resection. The procedure then involves an end-to-side invaginated pancreaticojejunostomy, an end-to-side hepaticojejunostomy, and either a side-to-side gastroenterostomy or an end-to-side pylorus-jejunojejunostomy downstream. Patients adhere to a standardized care pathway after surgery. For seven days, octreotide and prophylactic histamine H₂-receptor antagonists were given to avoid stress ulcers. The pancreaticojejunostomy and hepaticojejunostomy sites had drains inserted, and they were taken out after postoperative day 10 or if the amylase concentration was less than 300 U/L, which is less than twice the serum concentration, and the output was less than 50 mL per day.

The diagnosis of pancreatic fistula was made on the basis of either the daily outflow of more than 50 milliliters of amylase-rich fluid after day 10 or pancreatic anastomotic disruption verified by radiography. More than 50 mL of bilirubin-rich discharge per day after the tenth post-operative day was indicative of a biliary fistula. Postoperative hemorrhage was defined as needing more than two units of red blood cells within 24 hours or necessitating re-laparotomy due to bleeding. The nasogastric tube was removed when the amount of aspirate produced each day fell below 200 milliliters. Patients who required nasogastric intubation for more than ten days or who were unable to take a regular meal by the fourteenth postoperative day were diagnosed with delayed gastric emptying. Assessments were made of the patient's demographics, intraoperative factors, histopathological findings, and postoperative status. Blood loss, length of hospital stays, a delayed emptying of the stomach, intraoperative and

postoperative problems, inpatient mortality, and variations in weight were among the data that were noted upon release. Every three months following discharge, follow-up assessments were carried out, and if a suspected return of the disease, CT or MRI scans were carried out.

Patients were divided into two groups: Group-A (Standard Whipple group) and Group-B (PPPD group) as detailed in the Figure.

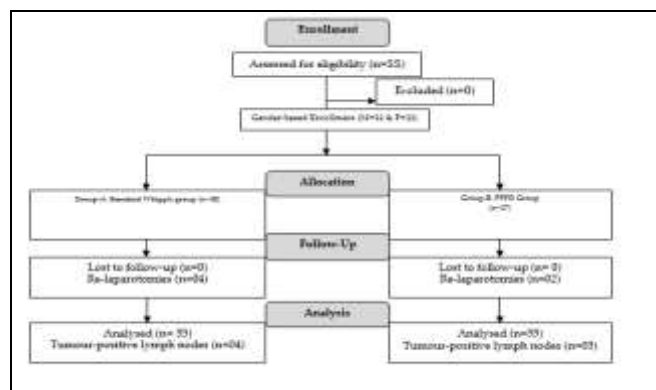


Figure: Patient Flow Diagram

Demographic, clinical, and pathological features will be summarized using descriptive statistics. Continuous variables will be shown as means with standard deviations or medians with interquartile ranges, while categorical variables will be provided as frequencies and percentages. Whereas the independent samples t-test examines continuous variables, the chi-square test compares categorical variables. IBM's Statistical Package for the Social Sciences (SPSS) version 26.00 was used for data analysis, and both descriptive and inferential statistical methods were used to thoroughly examine study variables. The p value ≤ 0.05 was considered as significant.

RESULTS

Total participants included in the study were 55 with male constituting 32 (58.18%) and female 23(41.81%), showing a minor male majority among the 55 individuals who participated in this study. Mean Age of the participants was 59.32 ± 7.03 years with Group-A having 60.46 ± 10.94 years while Group-B having 58.15 ± 6.30 years. Prior to surgery, the patients weighed with mean of 70.07 ± 7.91 kg. Table I provides specifics on the preoperative and demographic features of the research group.

The mean intraoperative blood loss was 244.28 ± 44.59 milliliters in Group-A and 351.48 ± 48.57

milliliters in Group-B. There was a statistically significant distinction between the two groups, as evidenced by the observed p -value of less than 0.05. In the same way, Group-A's mean procedure length was 337.86 ± 32.92 minutes, while Group-B's mean procedure duration was 342.22 ± 49.33 minutes. As seen in Table-II, the p -value, less than 0.05, once again indicated a statistically significant distinction between the groups.

Table-I: Demographic details, Pre-Operative Characteristics of study (n=55)

Variables	Total n=55	Group-A n=28	Group-B n=27	p-Value
Age (years) Mean + SD	59.32 ± 7.03	60.46 ± 10.94	58.15 ± 6.30	<0.001
Gender	Male	32 (58.18%)	17 (60.71%)	0.698
	Female	23 (41.81%)	15 (55.55%)	
Weight (Kgs) Mean + SD	70.07 ± 7.91	67.75 ± 6.53	72.48 ± 8.59	<0.001

Table -II: Per-Operative Findings (n=55)

Variables	Total n=55 Mean + SD	Group-A n=28 Mean + SD	Group-B n=27 Mean + SD	p-Value
Operation Time (mins)	340.00 ± 41.45	337.86 ± 32.92	342.22 ± 49.33	<0.001
Intraoperative (Blood Loss mL)	269.91 ± 71.09	244.28 ± 44.59	351.48 ± 48.57	<0.001

Table-III shows that there were no significant differences between the two groups' particular procedure-related or overall postoperative problems. While there were two patients in Group-B and four in Group-A who needed re-laparotomies, the difference was not statistically significant ($p = 0.41$). In a similar vein, there was no discernible difference in the frequency of delayed stomach emptying between the two groups ($p = 0.152$), with 10 patients in Group-A and 5 in Group-B afflicted. 10.7% of Group-A patients and 7.4% of Group-B patients had tumor-positive resection margins; nevertheless, there was no discernible difference between the two groups ($p = 0.670$). Interestingly, most of the positive margins were not on the pancreatic remnant but rather in the vicinity of the circumferential pancreatic resection region. Furthermore, 4 patients in Group-A and 3 in Group-B had tumor-positive lymph nodes, although there was no discernible difference between the two groups ($p = 0.413$). Groups A and B had death rates of 17.8% and 11.1%, respectively, with no significant statistical variation ($p = 0.478$).

DISCUSSION

The present study confirms that operating times of the two procedures in this research were similar. The mean blood loss for the two groups did not differ significantly (Table-II). Much less blood was lost during this procedure, which was a remarkable factor

similar to reports of other studies.⁸ In this study, the total surgical fatality rate was 14.5%. While Trans *et al.*, found a mortality rate of 5.3%,⁸ multicenter studies frequently indicate greater fatality rates, such as 17.2% in the United States.⁹

Table-III : Outcomes of surgical procedure (n=55)

Variables	Group-A (n=28)	Group-B (n=27)	p-value
Delayed Gastric Emptying	5(17.8%)	11(40.7%)	0.062
Pancreatic fistula	5 (17.8%)	7(25.92%)	0.469
Biliary Fistula	6(21.4%)	5(18.5%)	0.787
Tumor size cm	3.64 ± 0.38	3.68 ± 0.30	<0.001
Margin status	01 (3.57%)	00(0%)	0.322
Lymph node status positive	04 (14.3%)	2(7.4%)	0.413
Re-laparotomy	04 (14.3%)	02(7.4%)	0.413
Mortality	05 (17.8%)	03(11.11%)	0.478

Prolonged hospital stays, higher morbidity, and delayed stomach emptying have all been associated with PPPD; this has been systematically reviewed by Gady *et al.*¹¹ Some people choose not to undergo the PPPD operation because of the incidence of delayed stomach emptying, which varies from 25% to 70% as reported by Mahrokhi *et al.*¹² The study found that there was a substantial difference in the incidence of delayed stomach emptying between the two groups: 5 patients (17.8%) in Group-A and 11 patients (40.74%) in Group-B.

Another study by Arjunan *et al.*, indicated that a decreased occurrence of delayed stomach emptying is linked to the minimally invasive robotic method for PPPD.¹³ While Maharjan *et al.*, reported no difference in severity and incidence of DGE between PPPD and Whipple surgery.¹⁴

Kumar *et al.* described that positive duodenal resection margins are a potential concern associated with PPPD for pancreatic tumor resection,¹⁵ which might result in reduced survival rates. In this study, there was one patient in Group-A with a positive resection margin, whereas there were none in the PPPD group (Group-B). Despite the presence of positive resection margins, we observed no significant differences in survival outcomes. Based on research conducted by Ong *et al.*, who compared PPPD and Whipple, our survival rates are very similar.¹⁶ Notably, studies like Justo *et al.*, highlighted a different perspective of the study as compared to this research, in which in-hospital mortality was included in our survival rate calculation. There were no significant differences in surgical duration, blood loss, length of

hospital stay, or postoperative weight loss, which is in line with findings from other studies.¹⁷

The cross-sectional study's results shed important light on the differences in the surgical therapy of periampullary cancer using the usual Whipple operation and pylorus-preserving pancreaticoduodenectomy (PPPD). Many findings of the study endorse the outcomes highlighted in the study by Oh *et al.*¹⁸ Several interesting findings from our investigation need debate. First off, there were notable variations in the perioperative results even though both surgical techniques produced equivalent percentages of R0 resection and lymph node yield, indicating comparable oncological effectiveness. In comparison to the Whipple group, the PPPD group showed greater rates of delayed gastric emptying and lower rates of pancreatic fistula, postoperative hemorrhage, and re-laparotomies. These findings might indicate possible benefits in terms of decreased morbidity and mortality.

LIMITATION OF STUDY

The study was limited by its small sample size, single-center design, and relatively short follow-up, restricting subgroup analyses, generalizability, and assessment of long-term oncological outcomes. Larger multicenter studies with longer follow-up are warranted to provide stronger evidence regarding optimal surgical management of periampullary carcinoma.

CONCLUSION

Finally, our research adds to the increasing amount of data that suggests pylorus-preserving pancreaticoduodenectomy is a good substitute for the Whipple technique for treating periampullary cancer. For patients having resection for this difficult cancer, the PPPD is a viable surgical alternative by reducing perioperative problems and enhancing postoperative quality of life. Nonetheless, more investigation is required to enhance patient selection standards and improve surgical methods to optimize the advantages of the PPPD while reducing any disadvantages.

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Authors' Contribution

Following authors have made substantial contributions to the manuscript as under:

MUS & NMW: Data acquisition, data analysis, critical review, approval of the final version to be published.

H & TMK: Study design, data interpretation, drafting the manuscript, critical review, approval of the final version to be published.

SDH & AM: Conception, data acquisition, drafting the manuscript, approval of the final version to be published.

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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