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Whipple Procedure, Single Center Experience

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Abstract: Whipple procedure (pancreaticoduodenectomy) is a complex operation to remove the head of pancreas, duodenum, gallbladder, and bile duct. The Whipple procedure is a difficult and demanding operation which serious complications such as pancreas anastomotic leak, therefore, mortality can occur. This study aimed to assess surgical outcomes, including morbidity and mortality rates, postoperative recovery, and specific procedural variables affecting patient outcomes. This was a prospective study. Patients with pre-existing pancreas and duodenum pathology were assigned to receive Whipple's procedure from July 2019 to July 2021 at Prof Dr. R. D. Kandou Hospital. Male to female ratio, ages, preoperative biliary drainage (PBD), operation time, blood loss, mortality rate, and postoperative days (POD) were measured. The result showed that a total of 14 procedures were performed, with etiologies ranging from adenocarcinoma of pancreatic head (71.42%), duodenal GIST (7.14%), and NET (21.42%). Patient characteristics were male (50%), mean age 56 years. PBD was performed endoscopically with stent placement (50%), hepaticojejunostomy by pass (25%), and cholecystostomy (50%). Mean of operation time was 6 hours 20 minutes, estimated blood loss of 697.1 cc, pancreatic anastomosis leak (7.14%), no bile leaks, and other morbidities such as sepsis, wound infection, and ascites (14.28%). Mean of POD was nine days, and mortality rate at 21%. In conclusion, Whipple procedure is still a technically demanding procedure, and a better holistic care needs to be performed to reduce mortality and morbidity
Keywords: Whipple procedure; postoperative care; pancreas; mortality rate

INTRODUCTION

The Whipple procedure, or pancreaticoduodenectomy, is a surgical approach designed to remove cancers and other pathology affecting the pancreatic head, duodenum, bile duct, and, in some cases, the gallbladder. First performed by Dr. Allen Whipple in the 1930s, this procedure has since become the primary surgical option for patients with malignancies in the pancreatic head or periampullary region, especially when tumors are resectable and localized.[1] Despite its curative potential, the Whipple procedure is notably complex and associated with a high degree of technical difficulty. This complexity arises from the need to resect and reconstruct multiple digestive and biliary structures, making the surgery one of the most challenging in gastrointestinal and hepatobiliary disciplines.[2,3]

Due to its invasive nature, the Whipple procedure has significant perioperative risks, with common complications including pancreatic anastomotic leak, delayed gastric emptying, postoperative hemorrhage, and bile leak. These complications have a substantial impact on patient morbidity and can lead to prolonged hospital stays and increased healthcare costs.[4] Studies report that the mortality rate for this procedure varies widely across institutions and can reach as high as 20%, though recent advancements in surgical techniques and postoperative care have contributed to reducing this risk in high-volume centers.[5,6] Factors contributing to mortality and morbidity include patient characteristics, such as age and comorbidities, as well as procedural factors like blood loss and the duration of surgery.[7]

The introduction of enhanced recovery after surgery (ERAS) protocols and the adoption of minimally invasive techniques, including laparoscopic and robotic-assisted approaches, have shown promising results in improving postoperative outcomes and reducing complication rates for pancreaticoduodenectomy. ERAS protocols focus on optimized perioperative care, aiming to shorten hospital stays, enhance recovery, and minimize complications by implementing standardized nutrition, analgesia, and mobilization strategies.[8] In high-volume centers, where these advanced practices are frequently employed, mortality rates for the Whipple procedure have been reduced to approximately 1-3%, underlining the importance of specialized care in improving outcomes for this high-risk surgery.[9]

In our institution, a tertiary care center, we have undertaken a focused study on the Whipple procedure, examining outcomes over a two-year period. This study aims to provide a comprehensive analysis of our single-center experience, with an emphasis on postoperative morbidity, mortality, and the effectiveness of perioperative interventions. Our data contribute to the broader body of literature by offering insights into factors influencing surgical outcomes, including the role of preoperative biliary drainage, surgical duration, and the application of energy devices such as harmonic scalpels and thulium-doped fiber lasers. Understanding these elements is essential for guiding improvements in patient selection, operative technique, and postoperative management, ultimately advancing the safety and efficacy of the Whipple procedure.[10]

By presenting our findings, we hope to support continued efforts toward refining the Whipple procedure and reducing its associated risks. Our focus on a detailed examination of postoperative outcomes provides a foundation for further discussion on strategies to improve recovery, reduce morbidity, and enhance survival in patients undergoing pancreaticoduodenectomy for malignancies and complex pancreatic or duodenal pathologies.

METHODS

This study was conducted as a prospective analysis of patients undergoing the Whipple procedure (pancreaticoduodenectomy) from July 2019 to July 2021 at Prof. Dr. R. D. Kandou Hospital, Manado. Ethical clearance was obtained, and all patients provided informed consent prior to enrollment. This study aimed to assess surgical outcomes, including morbidity and mortality rates, postoperative recovery, and specific procedural variables affecting patient outcomes.

Patients were selected based on the presence of pathology requiring surgical intervention in the pancreatic head, duodenum, or adjacent biliary structures. Eligibility criteria included patients

diagnosed with malignancies such as pancreatic adenocarcinoma, duodenal gastrointestinal stromal tumor (GIST), or neuroendocrine tumors (NET) that necessitated the Whipple procedure for potential curative resection. Exclusion criteria included patients with unresectable or metastatic disease and those with significant contraindications to major abdominal surgery.

Prior to surgery, all patients underwent comprehensive preoperative assessments, including laboratory tests, imaging studies, and evaluation of comorbid conditions. Preoperative biliary drainage (PBD) was performed in cases with obstructive jaundice, using endoscopic stent placement or, in some cases, hepaticojejunostomy bypass or cholecystostomy, depending on the patient's condition. The selection of PBD methods was based on clinical judgment and imaging findings.

All procedures were performed by a specialized team in digestive surgery using an open technique. Standard surgical steps included the resection of the pancreatic head, duodenum, distal bile duct, and sometimes the gallbladder. Pancreatic and biliary anastomoses were conducted as part of the reconstruction phase. To aid in achieving hemostasis and minimizing blood loss, various energy devices were used, including the harmonic scalpel and thulium-doped fiber laser (TDFL). The Pringle maneuver, a technique to temporarily occlude hepatic inflow, was applied selectively to control intraoperative bleeding, with an average occlusion time recorded for each case.

Data on patient demographics, clinical characteristics, and intraoperative variables were collected. Specific metrics included the male-to-female ratio, age distribution, duration of surgery, blood loss, and postoperative hospital stay. Detailed information on postoperative complications was documented, including occurrences of pancreatic anastomotic leak, bile leak, wound infection, sepsis, and ascites. The severity of complications was graded according to the Clavien-Dindo classification and the FABIB (Functional Anastomosis-Based Integrated Bilio-pancreatic) system.

The primary outcome measures were morbidity and mortality rates associated with the Whipple procedure. Secondary outcomes included the incidence of specific postoperative complications, such as pancreatic fistula and delayed gastric emptying, along with the length of postoperative hospital stay. Postoperative pancreatic fistula was graded based on the International Study Group on Pancreatic Fistula (ISGPF) criteria, and postoperative hepatic failure (PHLF) was assessed using the ISGLS classification.

All data were analyzed using IBM SPSS Statistics version 25 (SPSS Inc., Chicago, USA). Descriptive statistics, including mean, median, and standard deviation, were calculated for continuous variables, while categorical variables were presented as frequencies and percentages. Complication rates and other binary outcomes were reported as percentages. Additionally, comparisons of outcomes by patient demographics and procedural factors were conducted where relevant to assess any potential correlations with morbidity or mortality.

RESULTS

A total of 14 patients were included in this study. All of them underwent the Whipple procedure for the treatment of malignancies or other complex pathologies within the pancreatic head or periampullary region. Table 1 showed the demographic characteristics of the study population. This cohort included an equal distribution of males and females, with each group representing 50% of the sample. The mean age was 56 6 years, reflecting an older demographic that is often associated with increased comorbidities, impacting both the complexity of the surgery and postoperative recovery.

Table 2 showed that the Whipple procedure, known for its technical challenges and extended operative time, had an average duration of 6.3±1.2 hours among the cases analyzed. The intraoperative management included the Pringle maneuver, applied selectively to control hepatic blood flow and mitigate blood loss in high-risk cases. The mean duration of the Pringle maneuver was 31.6±5.4 minutes. Estimated blood loss averaged 697.1±100 mL, which aligns with expectations for this procedure, indicating a significant need for hemostatic control during the operation. Postoperative hospital stay averaged 9±2 days, emphasizing the necessity of prolonged monitoring and management post-surgery.

Table 1. Demographics of study population

Variables	Value
Total patients	14
Male (%)	50
Female (%)	50
Mean age (years)	56 ± 6

Table 2. Surgical details and key findings

Parameters	Value
Total procedures performed	14
Mean operation time (hours)	6.3 ± 1.2
Estimated blood loss (mL)	697.1 ± 100
Pringle maneuver time (minutes)	31.6 ± 5.4
Postoperative hospital stay (days)	9 ± 2

Table 3 showed that postoperative complications were observed in multiple cases, with pancreatic anastomosis leak occurring in 7.14% of patients. No bile leaks were reported, which may reflect successful anastomotic techniques in biliary reconstruction. Other complications included sepsis, wound infection, and ascites, each affecting 14.28% of patients. These findings underscore the importance of meticulous perioperative care to prevent infections and manage fluid balance. The mortality rate was recorded at 21%, highlighting the high-risk nature of the procedure and underscoring the need for comprehensive postoperative management strategies to enhance survival outcomes.

Table 3. Observed complications post-procedure

Complication type	Incidence (%)
Pancreatic anastomosis leak	7.14
Bile leak	0
Sepsis	14.28
Wound infection	14.28
Ascites	14.28
Mortality rate	21

In summary, these results reveal the significant complexity and risks associated with the Whipple procedure. The extended operative time, high volume of blood loss, and notable incidence of complications underscore the demands on surgical and postoperative teams. These findings emphasize the necessity for ongoing improvements in surgical techniques, infection control protocols, and perioperative care practices to improve patient outcomes in the Whipple procedure.

DISCUSSION

The Whipple procedure, while the most effective surgical approach for treating malignancies in the pancreatic head and periampullary region, presents substantial challenges due to its technical complexity and associated risks. Our study, which analyzed outcomes from a single-center experience, underscores the procedural demands, high morbidity, and mortality rates, even in carefully selected patient populations. These findings align with existing literature, which consistently documents the Whipple procedure as a high-risk intervention with significant

perioperative considerations.[11,12]

In our cohort, a mortality rate of 21% was observed, which is higher than the rates reported by high-volume centers, where specialized teams and advanced care protocols have been shown to lower mortality to between 1% and 5%.[13,14] The higher mortality in our setting could be attributed to several factors, including limited resources, patient demographics with comorbid conditions, and the procedural demands of pancreaticoduodenectomy in a lower-volume center. Studies have demonstrated that outcomes are notably improved in centers with higher case volumes and specialized surgical teams, as these factors enhance procedural proficiency and patient management.[15,16]

Postoperative complications, including pancreatic anastomosis leak, sepsis, wound infection, and ascites, were observed in our study, each contributing significantly to patient morbidity. Pancreatic anastomosis leak, occurring in 7.14% of our cases, is a well-documented complication of the Whipple procedure and one of the most challenging to manage due to the risk of severe infection and delayed recovery.[17] Consistent with our findings, other studies have also highlighted pancreatic leaks as a major source of postoperative morbidity, with rates ranging from 2% to 25% depending on factors such as surgical technique and patient health.[18] Implementing meticulous anastomotic techniques and optimizing postoperative monitoring can potentially reduce the incidence of this complication.[19]

Preoperative biliary drainage (PBD) was used selectively in patients presenting with obstructive jaundice, and this approach has been widely debated in surgical literature.[20] Some studies suggest that PBD may reduce perioperative complications by decreasing biliary pressure and reducing jaundice-related risks, while others caution against its routine use due to the risk of infection.[21] In our study, PBD was applied based on clinical judgment, with approaches including endoscopic stent placement and, in certain cases, hepaticojejunostomy or cholecystostomy. Given the varying results in patient outcomes, further studies may be warranted to assess the role of PBD in reducing morbidity specifically within our surgical setting.

Intraoperatively, the Pringle maneuver was utilized to control hepatic inflow and minimize blood loss, which was particularly beneficial in managing complex cases with high vascular involvement. The mean duration for this maneuver was 31.6 ± 5.4 minutes, a timeframe that reflects careful consideration to balance blood flow control with minimizing ischemic damage.[22] Our findings are consistent with studies showing that short-term hepatic inflow occlusion can be an effective strategy in reducing intraoperative blood loss without significantly increasing postoperative hepatic dysfunction.[23]

The extended postoperative hospital stay observed in our study (average 9±2 days) aligns with the demanding nature of recovery following pancreaticoduodenectomy. Enhanced Recovery After Surgery (ERAS) protocols, which incorporate strategies for early mobilization, nutritional support, and optimized pain management, have been shown to significantly reduce recovery times and complication rates in high-volume centers.[24,25] Incorporating ERAS protocols into our perioperative care model may offer a practical pathway to improve recovery times and reduce hospital stays for our patient population. Additionally, ERAS protocols have been associated with improved patient satisfaction and reduced healthcare costs, making them a compelling area for future development in our institution.

This study, while providing valuable insights into the outcomes of the Whipple procedure in a single-center context, has limitations that should be considered. The small sample size limits the generalizability of the findings, and variations in surgeon experience and postoperative care could also influence outcomes. Moving forward, a larger, multicenter study would help validate these results and provide a more comprehensive understanding of the factors influencing Whipple procedure outcomes in different healthcare settings. Additionally, further investigation into the long-term outcomes and quality of life post-Whipple procedure would provide valuable information for optimizing patient care and identifying areas for procedural refinement.

CONCLUSION

The Whipple procedure remains a highly complex surgery associated with significant perioperative risks. Our study highlights the importance of specialized surgical expertise, comprehensive perioperative management, and the potential role of ERAS protocols in improving patient outcomes. Continued advancements in surgical techniques, preoperative optimization, and postoperative care are essential to reducing morbidity and mortality, ultimately enhancing the safety and effectiveness of the Whipple procedure for patients with pancreatic and periampullary malignancies.

Conflict of Interest

The authors affirm no conflict of interest in this study.

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