

Pylorus-Preserving Pancreaticoduodenectomy: Evaluation of 50 Cases

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Abstract

Introduction: Pancreaticoduodenectomy is the procedure of choice for periampullary neoplasms. It is considered as a major surgical procedure. It is associated with relatively higher postoperative mortality and morbidity rate, however, with development of technology, proper patient selection, meticulous operative technique, appropriate postoperative care, morbidity and mortality rate has decreased subsequently. Up to the 1970s, the operative mortality rate after pancreaticoduodenectomy approached 20% but it has been reduced to less than 5% in recent reports. This study is designed to evaluate the postoperative outcomes of pylorus-preserving pancreaticoduodenectomy procedure in our set up.

Objective: To evaluate the outcome of the pylorus-preserving pancreaticoduodenectomy procedure with the intention to measure operation time and per-operative bleeding, observing postoperative anastomotic leakage and gastric emptying time. To find out postoperative wound infection and complications to detect the dumping syndrome.

Materials and Methods: A prospective observational study was carried out in the Department of Hepatobiliary Surgery, Combined Military Hospital, Dhaka from July 2013 to January 2017. Fifty patients who underwent pylorus-preserving pancreaticoduodenectomy procedure were included in this study.

Results: Out of 50 postoperative patients, 12(24%) patients developed complications. Of these patients, 3(6%) developed wound infection, 2(4%) developed bile leakage and 2(4%) developed postoperative haemorrhage. Pancreatic fistula, vomiting, delayed gastric emptying and abdominal collection all were 1(2%) each. Postoperative mortality was 3(6%).

Conclusion: The present study demonstrated the development of postoperative complications after pylorus-preserving pancreaticoduodenectomy is as similar as published in different studies. Better outcome can be achieved with meticulous pre-operative evaluation of risk factors and per-operative skill maneuvering.

Key-words: Pancreatico-duodenectomy, Pylorus-Preserving Pancreaticoduodenectomy, Periampullary neoplasms.

Introduction

A periampullary neoplasm is a group of malignant neoplasms arising within 1.5 cm of the ampulla of Vater consisting of ampullary carcinoma, lower bile duct carcinoma, duodenal carcinoma and carcinoma head of the pancreas. Pancreaticoduodenectomy is the procedure of choice for periampullary neoplasms. It is considered as a major surgical procedure. It is associated with relatively higher postoperative mortality and morbidity rate^{1,2}.

The first successful pancreaticoduodenectomy was performed by the German surgeon Kausch³ in 1912. After that Whipple et al⁴ reported pancreaticoduodenectomy resection for ampullary cancer in 1935. Morbidity and mortality rate after Pancreaticoduodenectomy was higher in the initial period, however with development of technology, proper patient selection, meticulous operative technique, appropriate postoperative care, morbidity and mortality rate has decreased subsequently. Up to the 1970s, the operative mortality rate after pancreaticoduodenectomy approached 20% but it has been reduced to less than 5% in recent reports^{5,6}.

Major complications of pancreaticoduodenectomy include, Pancreaticojejunostomy anastomotic leakage, postoperative haemorrhage, intra-abdominal abscess, delayed gastric emptying and wound infection. Among them, pancreatic leakage is a dreadful complication that may endanger the patient's life, leads to a prolonged hospital stay and increase mortality⁷. Conventional pancreaticoduodenectomy involves a distal gastrectomy with the removal of the pancreatic head, duodenum, first 15 cm of the jejunum, common bile duct and gallbladder. A modification of the conventional procedure, pylorus-preserving pancreaticoduodenectomy preserves the gastric antrum, pylorus, and the proximal 2 to 3 cm of the duodenum which is anastomosed to the jejunum to restore gastrointestinal continuity. This procedure was initially done by the British surgeon Kenneth Watson in 1943 for a patient with carcinoma of the ampulla of Vater⁸ and then reintroduced by Traverso and Longmire at University of California, Los Angeles for a patient who required a Whipple procedure for chronic pancreatitis⁹.

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The authors summarized that preservation of gastric emptying may be more physiologic and since it was performed for pancreatitis, the additional gastric tissue and pre-pyloric lymph nodes would not be needed for staging purposes. Since the rapid adoption of this modification, it has been applied to both benign and malignant disease.

Pylorus-preserving pancreaticoduodenectomy may decrease the incidence of postoperative dumping, marginal ulceration and bile reflux gastritis that can occur in many patients undergoing partial gastrectomy which is employed in the conventional pancreaticoduodenectomy technique. The incidence of delayed gastric emptying following either standard or pylorus-preserving pancreaticoduodenectomy is about 15%. Several randomized trials and a meta-analysis have demonstrated that pylorus-preserving pancreaticoduodenectomy has similar long-term survival and outcomes as a conventional pancreaticoduodenectomy, but is associated with shorter operative times and blood loss¹⁰. The lowest perioperative mortality rates and best long-term cancer outcomes for pancreaticoduodenectomy occur at high-volume centres^{10,11}. In experienced hands, the median operative time is about five hours, with a median blood loss of 350 mL and perioperative mortality of less than 4 percent¹².

Identification of risk factors responsible for the occurrence of complication is important. Several studies have demonstrated different risk factors for complications of pancreaticoduodenectomy. Poon et al described the risk factors for pancreatic anastomotic leakage in their study. Male sex, soft pancreatic remnant, preoperative radiation, diameter of main the pancreatic duct with high pancreatic juice secretion, duration of jaundice, creatine clearance and intraoperative blood loss are risk factors¹³. They conveniently divided into disease factors (pancreatic texture, pancreatic pathology, pancreatic duct size, pancreatic juice output), procedure-related factors (intraoperative blood loss, operative techniques) and patient factors (age, sex, comorbid illness, jaundice) for postoperative complications. Zhu et al described the soft texture and early postoperative haemorrhage increased rate of pancreatic fistula¹⁴. But Muscari et al described age more than 70 years and main pancreatic duct diameter less than 3 mm are independent risk factors for complications¹⁵. There are very few reported studies on this background in Bangladesh as such the study is undertaken to understand the postoperative complications after pylorus-preserving pancreaticoduodenectomy in our setting.

Materials and Methods

A prospective observational study was carried out in the Department of Hepatobiliary Surgery, Combined Military Hospital, Dhaka from July 2013 to January 2017. Fifty patients

who underwent pylorus-preserving pancreaticoduodenectomy procedure were included in this study. The variables for the evaluation of the postoperative outcome were taken as postoperative biliary leakage, postoperative haemorrhage, wound infection, pancreatic fistula, vomiting, delayed gastric emptying and mortality. Data were analyzed by SPSS for Windows version 19.0. Univariate analysis was performed by chi-square and multivariate analysis was performed by logistic regression where P- value <0.05 was significant.

Inclusion criteria: The patients undergoing successful pylorus-preserving pancreaticoduodenectomy procedure were included on the basis of per-operative feasibility for a Peri-ampullary tumour, Pancreatic head tumour, Distal CBD tumour, Duodenal neoplasia, Pancreatic headstone etc.

Exclusion criteria:

- Patients with per-operative findings of distant metastasis,
- Patients with peripyloric lymph nodes involvement,
- Patients with lesions other than pancreatic or periampullary adenocarcinoma were excluded.

Results

A total 50 cases were analyzed in this series that fulfilled the selective criteria. Among them, 28 were male and 22 female. The mean age of patients was 59 years with a range of 42 to 74 years. Mean BMI was 22 kg/m².

Table-I: Indications of surgery (n=50)

| Indications | Frequency | Percentage |
|---------------------------|-----------|------------|
| Periampullary tumour | 21 | 42 |
| Lower bile duct carcinoma | 10 | 20 |
| Pancreatic head tumour | 09 | 18 |
| Duodenal neoplasia | 04 | 8 |
| Pancreatic head stone | 06 | 12 |

Table-II: Per-operative findings (n=50)

| Per-operative findings | Mean |
|-------------------------------|-------------|
| Operative time (hours) | 3.2 ± 1.1 |
| Per-operative blood loss (ml) | 330 ± 150 |
| Blood transfusion (units) | 2.61 ± 0.58 |

Table-III: Postoperative outcome of the patients (n=50)

| Outcome of operation | Patients (n=50) | % |
|----------------------------|-----------------|----|
| Uneventful | 38 | 76 |
| Complications | 12 | 24 |
| Bile leakage | 2 | 4 |
| Postoperative haemorrhage | 2 | 4 |
| Pancreatic fistula | 2 | 4 |
| Vomiting | 1 | 2 |
| Delayed gastric emptying | 0 | 0 |
| Wound infection | 3 | 6 |
| Intra-abdominal collection | 1 | 2 |
| Postoperative diarrhoea | 0 | 0 |
| Mortality | 3 | 6 |

Table-I shows the indication of pancreaticoduodenectomy done in this study. The most common indication of pancreaticoduodenectomy was periampullary tumour (42%). The lower bile duct carcinoma was 20%, carcinoma head of pancreas was 18%, duodenal neoplasia was in 8% and pancreatic head stone was 12% patients.

Table-II shows per-operative data of all 50 patients. The mean operative time was 3.2 hours with a range of 2.5 to 5 hours. The mean per-operative blood loss was 330 ml with a range of 100-600 ml and mean blood transfusion was needed 2.61 units with a range of 2-4 units.

Table-III shows the postoperative outcome of patients. Twelve (24%) patients developed postoperative complications. There was three (6%) postoperative mortality in this series. Three (6%) patients developed wound infection and one (2%) patient intra-abdominal collection. Two (4%) patients developed bile leakage, two (4%) patients developed postoperative haemorrhage and two (4%) patient developed pancreatic fistula. None of the patients developed delayed gastric emptying.

Discussion

Because of the complexity and difficulty, pancreaticoduodenectomy continues to be a challenging operation which requires large area excision which takes more time and may cause injury to other organs. In addition, patients usually suffer from some diseases before the operation such as severe obstructive jaundice and malnutrition, DM, thereby leading to the occurrence of postoperative complications and even threaten the patients' life. A recent improvement in surgical technique, anesthesiology, intensive care management, nutritional support and interventional radiology, mortality have dramatically reduced^{5,16}.

Recently the operative mortality after pancreaticoduodenectomy has significantly declined to 0 to 5% while the incidence of postoperative morbidity remains high ranging from 30 to 50%^{11,17}. In contrast, this study shows morbidity 24% and there was 2% mortality which was similar with that of others results. Multicenter studies are often associated with a higher mortality rate, ranging from 5% in Italy to 10% in France and 17.2% in the United States¹⁵⁻¹⁸.

Pylorus Preserving Pancreaticoduodenectomy (PPPD) is associated with a reduced operation time, less blood loss, shorter hospital stay, and a more physiological food passage. Two randomized studies reported a shorter operation time and less blood loss, fewer transfusions and a lower morbidity for the PPPD^{16,18}. In this study, the duration of the

operation was 3.2±1.1 hours and the median blood loss was 330±150 ml (Table-II). Compared with reports from other studies, there are only small differences.

The most common complication after pancreaticoduodenectomy is the leakage of the pancreaticojejunostomy anastomosis in 6-24%, others haemorrhage in 3-16%, intra-abdominal abscesses in 2-9%, wound infection in 2-8% and delayed gastric emptying in 2-14%^{10,11,19}. But in this study, the most common complication found was wound infection in 6%. It may be due to delayed hospital attention. A prolonged illness may cause deterioration of nutritional status and disease process. Hospital environment, preoperative biliary drainage and lacking knowledge of sterility and hygiene also affect on this. Herzog and co-workers^{7,19} reported a higher rate of postoperative complications in patients with multiresistant bacteria in the bile. Sudo et al^{18,19} showed that sensitivity to cefazolin was lower in patients after internal and external preoperative biliary drainage (PBD) compared with findings in a no-PBD group. Bacterial resistance to prophylactic antibiotics was also an independent risk factor for postoperative abdominal infectious complications¹⁹. Adam et al, Povoski et al, Sohn et al and Pisters et al mentioned that biliary decompression by Endoscopic retrograde cholangiopancreatography (ERCP) and stenting increased the risk of infectious complications^{12,20}.

This study shows pancreatic leakage was 4%, this may be due to meticulous dissection, duct to mucosal anastomosis and postoperative strategy as nutritional support, fluid and electrolyte balance was maintained. Poon et al, Bartoli et al, Greene et al and Howard et al demonstrated that duct to mucosa anastomosis was safer and superior to darning anastomosis in term of anastomotic patency and functions^{5,21}. Marcus et al found that duct to mucosa anastomosis was associated with a low pancreatic fistula rate in low-risk patients with dilated pancreatic duct or firm fibrotic pancreas, whereas end-to-end invagination technique was safer in high-risk patients with small ducts or soft friable pancreas^{20,21}.

PPPD has been associated with delayed gastric emptying, an increase in morbidity and prolonged hospital stay. Warsaw and Torchiana²² first reported this phenomenon after their initial study of 8 patients in 1978. According to the literature, the incidence of delayed gastric emptying is estimated to range between 25% and 70%²³. The incidence of delayed gastric emptying in this study was 2%. Several factors are thought to play a role in the pathophysiology of delayed gastric emptying. A correlation between delayed gastric emptying and intra-abdominal complications was reported previously²⁴. Gastric dysrhythmias, disruption of

gastroduodenal neural connections, ischemia of the pyloric muscle, and ligation of the right gastric artery all have been related to delay gastric emptying²⁵. Resection of the duodenum, the primary production site of most gastrointestinal hormones, might also play a role in the pathogenesis of this complication.

Limitations of the Study

1. The study was done on a very small sample size with narrow study period; finding thus obtained may not represent the whole picture, 2. This was a single institution study that might not reflect the whole population, 3. No randomization or blinded method was employed in the current study. This X might probably give rise to sampling error and bias, 4. Delayed complications and long-term outcome of surgery could not be ascertained in the study, 5. This study also lacks enough demographic, clinical and biochemical data also.

Conclusion

The findings of the present study demonstrated the development of postoperative complications after pylorus-preserving pancreaticoduodenectomy which is as similar as other centres published in different studies. It may be concluded that if the preoperative evaluation of risk factors and adequate preparation; perioperative meticulous maneuvering and postoperative adequate nutritional support and care is maintained, similar and better postoperative outcome of PPPD can be achieved.

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