

Whipple's procedure: Yesterday and today

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ABSTRACT

Aims: This article is a case series with respect to the four year experience of Whipple's procedure at Government Medical College and Hospital Nagpur. In this study, we have studied the demographic details of the patients, various indications for Whipple's procedure, the co-factors which affect the procedure its outcome and causes of morbidity and mortality among operated patients. **Methods:** This study was performed by collecting data about patients undergoing Whipple's procedure from operation theatres and medical record section. Those patients, whose tumor was unresectable and undergone palliative surgical procedures were excluded from the study. **Results:** From May 2011 till May 2015, 51 cases were collected and analyzed. Adenocarcinoma pancreas was the most common indication for the procedure. 18 out of 33 patients presented with jaundice had undergone preoperative biliary stenting. Mean

operation time was less in patients in whom ultrasonic scalpel was used and who had not undergone preoperative stenting. The most prevalent cause of reoperation was hemorrhage. Major postoperative morbidity of these patients was due to pneumonia (23.4%). Minor post-operative complications were wound infection and delayed gastric emptying. **Conclusion:** In this study, we have concluded that usage of ultrasonic scalpel, avoidance of preoperative stenting experience of surgeon and supporting staff has led to decrease in operative duration and blood loss. Pulmonary complications and septicemia secondary to anastomotic leakage are the most common causes of morbidity and mortality.

Keywords: Biliary stenting, Pancreatic cancer, Periapillary carcinoma, Whipple procedure

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INTRODUCTION

Pancreatic cancer is one of the most important causes of death in eastern countries and the fourth cause of death from cancer in the western hemisphere. Since the organ is situated in retroperitoneum many patients come to

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the hospital in an advanced stage. The five year survival rate of patients who undergo Whipple's procedure is 10–25% [1]. Surgery is the cornerstone of treatment of these patients with biliary stenting and chemotherapy playing a supportive role. Whipple's procedure is also performed for non-malignant indications for relief of obstructive jaundice, pain or vomiting.

Predisposing factors

The most important risk factor of pancreatic malignancy is smoking. The risk is directly proportional to the number of pack years. Other less significant risk factors are chronic pancreatitis, diabetes, obesity and occupational exposure. Hereditary risk factors are Familial Pancreatitis, Peutz Jeghers syndrome, Familial atypical mole and multiple melanoma syndrome, cystic fibrosis [2].

History

IN 1898, Codinivillan performed the procedure in which he removed duodenum, distal stomach, distal bile duct and part of pancreas. Roux-en-Y gastrojejunostomy and choledochojejunostomy was done. Serous drainage of wound on day-5 required evacuation of milky clots and the patient died at 18th day from cachexia resulting from steatorrhea. In 1912, Walter Kausch performed a pancreaticoduodenectomy after resection of duodenum en bloc with a large portion of pancreas. Allen O Whipple described the procedure of pancreaticoduodenectomy in the year 1935. He modified the procedure done by Allessandro Codinivillan in Italy and Walter Keusch in Germany. In 1940, Whipple performed the first one stage procedure for complete excision of head of pancreas and whole of duodenum [3].

MATERIALS AND METHODS

Data regarding the surgery was taken from the medical records of Government Medical College and Hospital Nagpur. Data related to the 'pancreaticoduodenectomy' or 'Whipple' procedures were collected according to the pro forma designed for the study. The parameters and variables of the study were patient demographic data, presenting symptoms, physical signs, past medical history, preoperative stenting details, weight loss, intra-operative duration and difficulties, postoperative course and complications, pathology, causes of post-operative death, cause of re-exploration, and cause of readmission. Cases in which superior mesenteric artery was invaded, extensive portal vein involvement was there or had distal metastasis were considered as unresectable hence excluded from the study [4]. None of the patients received neoadjuvant therapy. All patients underwent Whipple's procedure through rooftop incision by open resection of specimen and triple anastomosis. All patients underwent pancreaticojejunostomy and duct to mucosal anastomosis.

RESULTS

A number of 51 procedures were performed from May 2011 till May 2015. As a mean, our center performs 12.75 procedures per year. Majority of the patients were belonging to age group of 60–70 years (35.3%) and 50–60 years. (25.5%). Out of 51 patients 19 were females. Table 1 gives the age distribution.

Mode of presentation: The most common presenting symptom was abdominal pain 35 (68.6%), next being jaundice 33 (64.7%). Other symptoms in order of frequency are anorexia, nausea, vomiting, and fever and weight loss.

Diagnostic investigation: computed tomography scan of abdomen was done in all patients. Histopathological diagnosis was made based on endoscopic biopsy in 12 (23.52%) endoscopic ultrasound guided FNAC in 10(19.6%) and USG guided FNAC in 12 (23.52%) patients.

Preoperative stenting : Out of the 33 patients who presented with jaundice 18 underwent endoscopic retrograde biliary stenting. No other stenting technique like percutaneous or endonasal biliary drainage was performed. Stenting was based on radiological finding of dilated common bile duct and biliary radicals and not on serum bilirubin levels.

Pathology: 14.8% of cases had benign lesions, but the main indication for pancreaticoduodenectomy was malignancy. In this study, the most common pathology was adenocarcinoma. Table 2 gives the distribution of histological diagnosis

Operation course

The mean operation time was 270 min and mean operative time for Whipples procedure performed without ultrasonic scalpel was 295 min while that with ultrasonic scalpel was 250 min. Intra-operative blood transfusion was approximately 2.47 pack cells each operation with mean requirement of blood in the initial group without ultrasonic scalpel was 2.9 pack cells and with ultrasonic scalpel was 2.1 pack cells. Out of 33 patients with jaundice 18 underwent stenting preoperatively and they had an increased mean operative duration of 310 min compared to mean of the whole study due to fibrosis and hence difficult handling of tissues.

Postoperative Course

Postoperatively, the mean duration of hospital stay was 14.9 days. The incidence of major complications and the incidence of minor complications are given in Table 3 and Table 4, respectively.

Re-exploration

Out of 51 patients 18 underwent re-exploration. The most common cause for re-exploration was hemorrhage. Other causes of re-exploration were biliary leakage, pancreatic leakage and intra-abdominal sepsis. Table 5 gives the distribution of causes of re-exploration.

Mortality

Out of 51 patients 13 succumbed due to various causes. Most common cause of mortality was septicemic shock. Table 6 gives the distribution of cause of mortality.

Table 1: Age distribution

Age Group in Years	Number of Patients	Percentage
10-20	4	7.84%
20-30	3	5.88%
30-40	5	9.8%
40-50	8	15.68%
50-60	13	25.49%
60-70	18	35.29%

Table 2: Distribution of histological diagnosis

Histological diagnosis	No. of patients	%age
Adenocarcinoma of pancreas	20	39.21%
Adenocarcinoma of duodenum	14	27.45%
Solid Pseudo papillary neoplasm of pancreas	4	7.8%
Cholangiocarcinoma of terminal CBD	6	11.76%
Chronic pancreatitis	4	7.8%
Serous adenoma of pancreas	3	5.88%

Table 3: Incidence of major complications

Complication	No. of patients	Percentage
Pancreatic Leak	9	17.64%
Biliary Leak	7	13.72%
Gastrojejunal Leak	4	7.8%
Hemorrhage	10	19.6%
Pneumonia	12	23.52%
Intraabdominal sepsis	6	11.76%

Table 4: Incidence of minor complications

Complication	No. of patients	Percentage
Delayed gastric emptying	18	35.29%
Vomiting	16	31.37%
Abdominal discomfort	17	33.33%
Wound Infection	20	39.21%

Table 5: Cause of re-exploration

Cause of re-exploration	No. of patients	Percentage	No. of patients who expired after re-exploration
Hemorrhage	6	33.3%	3
Biliary leak	3	16.6%	3
Gastrojejunal leak	2	11.1%	0
Pancreatic Leak	4	22.4%	3
Abdominal sepsis	3	16.6%	0
Total	18	100%	9

Table 6: Distribution of cause of mortality

Cause of mortality	No. of patients	Percentage
Septicemic shock due to pancreatic leak, biliary leak	7	53.86%
Hemorrhage	3	23.07%
Respiratory complications	3	23.07%
Total	13	100%

DISCUSSION

Pancreatic malignancy is the fourth most common fatal malignancy in the United States [5] and 6th most common fatal malignancy in Europe [6]. Pancreas is located in retroperitoneum hence masses are appreciated late hence large number of patients are recognized late and in an inoperable condition. Pancreaticoduodenectomy is a surgical modality to treat these tumors and has seen significant variations over the past few years. Initially, the procedure was long duration and was associated with more number of blood transfusions during the procedure. In the recent years, with the advent of ultrasonic scalpel, there has been a decrease in the duration of the surgery and requirement of blood. This has also led to another change in the surgeons approach towards pancreaticoduodenectomy. Earlier surgeons used to get histological diagnosis done preoperatively but now with clinical and radiological diagnosis surgeons are ready to do the surgery due to enhancement of experience of surgeons and supporting staff. This change in approach is working in favor of patients as they are now less prone to the ascending infections involved in endoscopic techniques or peritoneal seeding in transcoelomic techniques of tissue sampling.

In this study, we have observed that age group of patients undergoing this surgery is most commonly 60–70 years. Our youngest patient was 17 years. old who underwent the surgery for solid pseudopapillary neoplasm of pancreas. The most common presenting

complaint was pain abdomen followed by jaundice. Endoscopic route was employed to get histological specimen in 22 out of 51 cases while in 12 cases transcoelomic route was employed, 16 cases were operated without any histological evidence suggesting the latest trend among surgeons. 18 out of 33 patients who had jaundice underwent preoperative biliary stenting. Stenting was associated with decreased bilirubin levels at the time of surgery hence was associated with a favorable coagulation profile [7], but increased difficulty in surgery and prolonged time for resection of specimen. Endoscopic retrograde biliary drainage was the only kind of stenting done in all patients with jaundice without any criterion of bilirubin levels. All patients were operated through a rooftop i.e., bilateral subcostal incision. Intraoperative bile culture studies are an exact way of deciding whether preoperative stenting has adversely affected the patient's pathological anatomy but it was not done at our center. But it was routinely observed that stented patients had more fibrosis hence difficult and prolonged dissection with a mean operating time of 330 min as compared to the rest of 310 min. Usage of ultrasonic scalpel in the later two years of the study has lead to a decrease in the mean duration of surgery to 280 min compared to previous cases with a mean duration of 335 min. Usage of ultrasonic scalpel has also lead to decrease in the quantity of blood required during the surgery from a mean of 2.8 pints to 2.1 pints. Postoperatively most common major complication was pneumonia (25.5%) which is probably attributable to prolonged duration for which patient was kept under anesthesia. Hemorrhage was the next most common complication which accounted for 23.4%. Post pancreatectomy hemorrhage has been defined by ISGPS based on 3 parameters : onset, location and severity of bleeding into 3 grades A B and C. Out of 11 patients who had hemorrhage 6 were re-explored due to worsening of clinical condition not responding to conservative management .

Pancreatic leak was seen in 19.1% of patients

ISGPF Definition: "Output via an operatively placed drain (or a subsequently placed percutaneous drain) of any measurable volume of drain fluid on or after postoperative day-3, with an amylase content greater than 3 times the upper normal serum value"[8].

Four out of nine patients who belonged to grade 3 were re-explored for pancreatic leakage. Bile leakage was seen in 14.9% of the patients. Bile leakage was defined as major if it was >50 ml/day from abdominal drain with drain fluid bilirubin levels more than that of serum bilirubin levels and minor if <50 ml/day or if the patient had any interventional or radiological evidences of biliary peritonitis [9]. Three out of seven patients with bile leakage were re-explored as they were having major leakage leading to peritonitis and sepsis. Intraabdominal sepsis as defined by local signs of infection or systemic signs such as fever, tachycardia, leukocytosis or computed tomography scan of abdomen revealed intra-abdominal

sepsis. Intra-abdominal sepsis was seen in 10.6% of the patients. Three out of five patients with intra-abdominal sepsis could not be managed conservatively hence re-explored. Gastrojejunal leak was identified among four patients by clinical signs of tachycardia and increased drain output and dye studies. Two patients were managed conservatively and two were re-explored. Among minor complications wound infection was most common seen in 42.5% followed by delayed gastric emptying in 38.29% of the patients. Delayed gastric emptying is defined as removal of Ryle's tube after day-5 or inability to start the patient on fully oral diet after day 7 [10].

Out of 51 patients included in the study 13 succumbed due to various causes. Septicemic shock due to biliary leak and pancreatic leak was the most common cause accounting for 7 out of 13 patients. Three patients initially had bile leak and 3 had pancreatic leak but patients gradually developed leak from both sites thereby suggesting the toxic nature of leak contents causing disruption of other anastomosis. Three patients died due to hemorrhage. Three patients died due to respiratory complications

CONCLUSION

Through this study we have understood that preoperative stenting should be avoided as far as possible as it leads to difficulty in resecting the tumor due to fibrosis and altered pathoanatomy thereby prolonging the duration of surgery. The usage of equipment like ultrasonic scalpel has led to decrease in blood loss and duration of surgery. Endoscopic means of histological diagnosis like endoscopic biopsy and endoscopic ultrasound guided FNAC were preferred rather than transcoelomic approach. Pneumonia and hemorrhage are the most common major complications while wound infection and delayed gastric emptying are the most common minor complications. It can be concluded that though Whipple's procedure is an extensive surgical procedure with high mortality and morbidity, however with proper preoperative workup and preparation, proper surgical technique, usage of modern equipment like ultrasonic scalpel, intensive postoperative care, good antibiotic coverage, this procedure can be performed in patients with pancreatic and duodenal adenocarcinoma and other distal lesions which cause obstructive jaundice with reasonably good outcomes.

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Guarantor

The corresponding author is the guarantor of submission.

Conflict of Interest

Authors declare no conflict of interest.

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