

Original Research Article

Post-Operative Complications and Their Management After Pancreaticoduodenectomy: A Single Centre Experience**Ram Daga^{1*}, Nishant Jangir², Lokesh Yadav², B. D. Soni², Randhir Rao³, Surendra Gupta³, Girish Chauhan³**¹*Associate Professor and Head, Surgical Gastroenterology Unit, Sawai Man Singh Medical College and Attached Hospital, Jaipur, Rajasthan, India*²*Senior Resident, Surgical Gastroenterology Unit, Sawai Man Singh Medical College and Attached Hospital, Jaipur, Rajasthan, India*³*Senior Specialist Medical Officer, Surgical Gastroenterology Unit, Sawai Man Singh Medical College and Attached Hospital, Jaipur, Rajasthan, India*

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Abstract

Objectives: To evaluate post-operative complications and their management after Pancreaticoduodenectomy (PD) at Surgical Gastroenterology department at Government Medical College Hospital in North India. **Materials and Methods:** Retrospective analysis of database of Pancreaticoduodenectomy patients was done. Main demographic variables, indications of surgery and early postoperative complications and their management were evaluated. Statistical analysis was done with the help of Microsoft excel software. **Results:** A total of 176 Patients underwent PD from January 2013 to December 2018. 162 patients underwent open PD and 14 underwent laparoscopic/ laparoscopic assisted PD. 128 operations were done for periampullary carcinoma, 16 for carcinoma head of pancreas, 7 for neuroendocrine tumor, 7 for cystic tumor of pancreas, 4 for duodenal carcinoma, 3 for cholangiocarcinoma, 2 for GIST, 1 for carcinoma stomach, 2 for carcinoma Gallbladder with ampullary carcinoma (dual malignancy) and 2 for tubercular CBD stricture and 4 for chronic pancreatitis. Overall mortality was 4.5% (8 patients). Most common morbidity was surgical site infection (21%). Post-operative pancreatic fistula (POPF) rate was 16% (28 pt.), of which 21 patients has type A POPF, 5 patients has type B POPF and 2 patient has type C POPF. Incidence of DGE and post-operative bleed was 14.7% and 3.4% respectively. **Conclusion:** With adequate surgical expertise, improved perioperative care and multispecialty approach, pancreaticoduodenectomy now can be performed with low morbidity and mortality in present era of surgical advancement and nihilistic view regarding this surgery prevalent in some developing countries should be abandoned. Internal stenting may be useful in decreasing POPF rates, all measures should be taken to control preoperative cholangitis to decrease postoperative sepsis and mortality and levosulpiride may be helpful in early recovery of bowel function and oral intake.

Keywords: Pancreaticoduodenectomy, Whipples Operation, Complications, Postoperative Outcomes.

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Introduction

Whipples operation or Pancreaticoduodenectomy is extremely complex surgical procedures which requires the highest level of surgical expertise as it includes the anastomosis of entirely different kind of tissues (small bowel, pancreas and bile ducts). After the initial description of first pancreatic head resection by Kausach in 1912 and description of 3 cases by Whipples in 1935 this procedure is now more than 100 years old. In evolution of the procedure, it underwent several modifications like from two stage to one stage in early phase, attempts to expertise the pancreatic stump management with different kind of pancreatico-enteric anastomosis in mid phase and meticulous techniques and reducing morbidity in later phase. Although mortality is reduced < 5% in most high-volume centers, the procedure is still associated with significant postoperative morbidity, (range- 30% to 60%) even in modern era of surgical advancement[1]. Major postoperative complications from this procedure include pancreatic anastomotic failure, postoperative haemorrhage, intra-

abdominal collection and abscess, delayed gastric emptying, and complications related to the surgical site: such as infection and wound dehiscence. After the standardisation of definitions of major complication of pancreaticoduodenectomy (pancreatic fistula[2], postoperative bleed[3], delayed gastric emptying[4]) by ISGPS in last decade, available data became comparable for post-operative complication among various centres. Surgical gastroenterology unit came into existence in our hospital in 2012 which is a tertiary care government teaching institute in north India. We analysed retrospectively our database from January 2013 to December 2018 and discussing here post-operative complications and their management in 176 patients who underwent Whipples pancreaticoduodenectomy in this duration at our centre.

Materials and Methods

Data collection was done by retrospective analysis of prospectively maintained medical records (including preoperative, intraoperative, postoperative and follow up records) as well as active follow up (by personal contact). All patients were included who underwent PD between January 2013 to December 2018.

Data examined comprised 1) demographics, (2) preoperative presenting symptoms, blood investigation and preoperative biliary

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drainage, (3) post-operative complication and hospital course (4) Histo-pathology report.

Surgical Technique

We do standard preoperative work of patient with special emphasis on prehabilitation i.e. smoking cessation, incentive spirometry, regular walk from first OPD visit and high-quality image based (pancreatic protocol CT scan with multiplanar reconstruction) patient selection and preoperative planning.

All patients received prophylactic antibiotics at time of intubation. We used an upper midline incision most of time. The peritoneum and liver were assessed for the presence of metastasis and the tumor was assessed for resectability. After standard resection, in reconstruction most commonly we used end-to-side pancreaticojejunostomy in 2 layers over an internal stent (Infant feeding tube 5-8 Fr.). Outer layer by interrupted non-absorbable (Prolene 4/0) sutures, approx. 1 centimetre from cut end of pancreas anastomosing pancreatic parenchyma and capsule with seromuscular layer of jejunum while inner duct to mucosa anastomosis was performed by interrupted absorbable monofilament sutures (PDS 5/0). In cases, of small pancreatic ducts 4-5 sutures and in dilated ducts; 6-8 sutures were used. Then end-to-side hepaticojejunostomy and gastrojejunostomy was performed with same loop distal to PJ. In all patients 2 abdominal drains were placed, one in morrisons pouch and another near pancreatic anastomosis. We have also used Blumgart's

technique for pancreatico-jejunostomy in 29 patients and dunking technique and buchler's technique in few patients.

Post operatively patients were shifted to post-operative ICU. Intravenous fluid management was guided by vitals, electrolytes and hourly urine output monitoring. Invasive monitoring was usually not required. We follow ERAS protocol for pancreatic surgeries. Nasogastric tube was removed just after OT and oral sips were allowed on post-operative day 1. Patients were mobilized and incentive spirometry was started on POD1. Drain fluid amylase was sent on POD 3 and oral liquids were allowed as soon as patient started accepting orally. IV antibiotics were continued till POD 5 or longer if required. Uncomplicated patients were shifted to ward usually on POD3. We have stopped routine creation of feeding Jejunostomy since 2016, and now we create feeding Jejunostomy in selected patients with soft/ friable pancreas or patients with uncontrolled cholangitis.

Results

A total of 176 Patients underwent PD from January 2013 to December 2018. 110 were male and 66 were female. 162 patients underwent open PD and 14 underwent laparoscopic/ laparoscopic assisted PD. Mean age of patient undergoing pancreaticoduodenectomy was 51.7 years. Most common symptom for which patient seeks medical help was jaundice (84.6%) followed by pain abdomen (68.1%), weight loss (66.4%) and pruritus (51%). Major demographic variables are summarized in table 1.

Table 1: Major demographic variables of patients underwent pancreaticoduodenectomy

Demographic variable	Value
Age	51.7± 22.5
Sex	
Male	110 (62.5%)
Female	66 (37.5%)
Symptoms	
Jaundice	149 (84.6%)
Pain abdomen	120 (68.1%)
Weight loss	117 (66.4%)
Pruritus	91 (51%)
vomiting	45 (25.5%)
GI bleed	16 (9%)
Cholangitis	35 (19.9%)

Regarding the indications behind this procedure for our patients, the commonest indication revealed by final histopathology report were periampullary tumors (72.7%) from which ampullary (60.2%) was

most common. Pancreatic ductal adenocarcinoma constitutes 9% of total. 3.4% of patients were operated for benign indications. Final histopathological findings were summarized in table 2.

Table 2: Histopathology of tumors resected by the pancreatico duodenectomy

Histopathology	No. of patient (%)
Periampullary	128 (72.7%)
Ampulla	106 (60.2%)
Distal CBD	14 (8%)
Duodenal	8 (4.5%)
Pancreatic ductal adenocarcinoma (PDAC)	16 (9%)
Neuro-endocrine tumor(including insulinoma)	7 (4%)
Cystic tumor of pancreas	7 (4%)
Duodenal adenocarcinoma	4 (2.2%)
Cholangiocarcinoma	3 (1.7%)
GIST	2 (1.1%)
Carcinoma GB with periampullary (dual malignancy)	2 (1.1%)
Ca. Stomach	1 (0.6%)
Tubercular stricture of lower CBD	2 (1.1%)
Chronic pancreatitis	4 (2.2%)

125(71%) patients underwent Preoperative biliary drainage. The overall morbidity of procedure was 36.3%. Most common complication was surgical site infection (21%). Pancreatic fistula rate in this study was 16%. Out of which 21 patients has type A POPF, 5 patient has type B POPF and 2 patient has type C POPF. Delayed

gastric emptying was observed in 14.7% of patients. Most of them has grade A (18/26) DGE, 6 patients has a grade B DGE and 2 patient has grade C DGE. Sepsis developed in 7 patients (4%). 6 (3.4%) patients have post-operative haemorrhage 3 of them were managed with blood transfusion alone,1 required angiographic

embolization and 2 required re exploration. Re-explorations were done in total 3 patients (1.7%), 2 of them for post-operative haemorrhage and one for pancreatic fistula. Major post-operative events are summarized in table 3.

Table 3: Postoperative course after pancreaticoduodenectomy

Post-operative event	No. of patient (%)
Mean duration of hospital stay	7.5 days (5-40 days)
Morbidity	64 (36.3%)
Surgical site infection	37 (21%)
POPF	28 (16%)
Grade A	21
Grade B	5
Grade C	2
DGE	26 (14.7%)
Grade A	18
Grade B	6
Grade C	2
Sepsis	7 (4%)
Bleed	6 (3.4%)
Intra-abdominal collection	5 (2.8%)
Re-exploration	3 (1.7%)
Bleed	2
POPF	1

The 30-day mortality of pancreaticoduodenectomy was 4.5%. Most common cause of mortality was sepsis (4/8). Cause of mortality was summarized in figure 1.

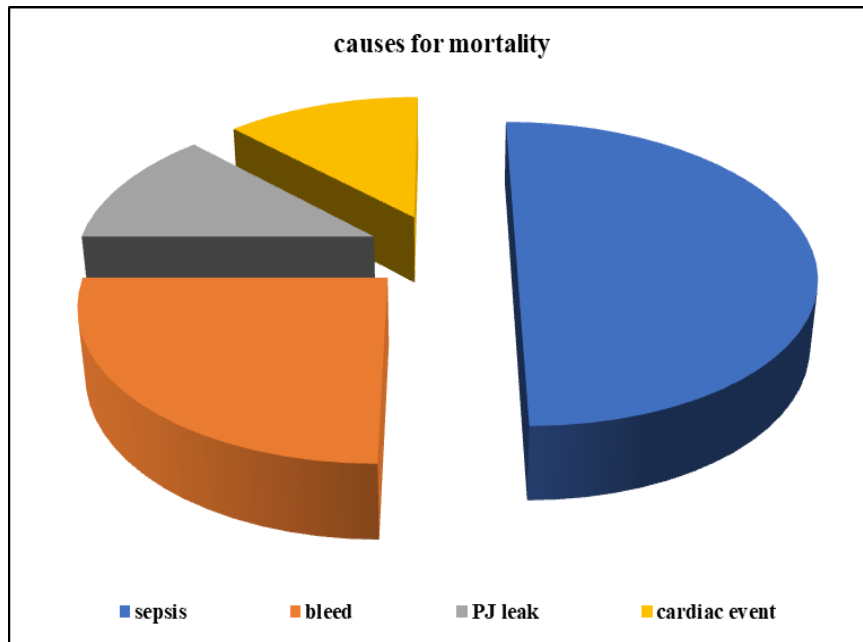


Fig 1: Causes for mortality

Pathologic Staging

166/170 (97.6%) resections were R0, resection and 4 (2.4%) were R1. Most common T stage was T2. 60 % were node negative, 34%

were in N1 stage and 6% in N2 stage. T stage is summarized in figure 2.

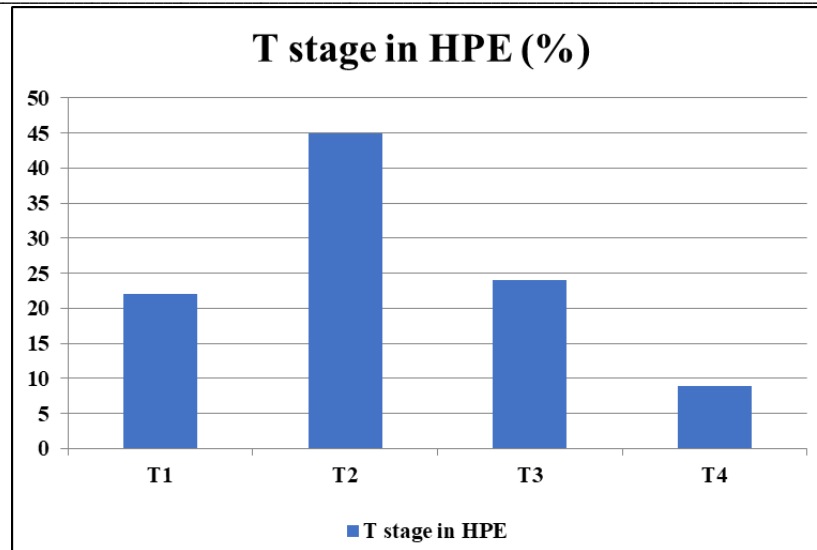


Fig 2: T stage of resected tumour after pancreaticoduodenectomy

Discussion

Pancreaticoduodenectomy is a complex surgical procedure with inherent high complication rates. Although, morbidity and mortality have improved in last 2 decades but the prevalence of postoperative complications is still high, even largest series[5] to our knowledge has an overall complication rate of 45%, our results are better in terms of post-operative complication rates except for surgical site infections.

Post-operative pancreatic fistula (POPF) is most dreaded complication of pancreaticoduodenectomy. In our patients, Post-operative pancreatic fistula (POPF) rate was 16% (28/176). Most of them has type A POPF (21/28), 5 patients have type B POPF and 2 patient has type C POPF. The rate POPF (synonym: anastomotic leak/anastomotic failure) is variable among the centres that ranging from 13 to 35%[6,7]. Type A POPF are now considered only biochemical leak[8] and actual POPF rate in this study was 3.97% (7/176). We have performed pancreatic anastomosis with almost all techniques demonstrated previously. Although subgroup analysis was not performed surgeon did not find any significant difference between these techniques. There are multiple factors that may have effect on the POPF rate including surgeons learning curve[9], pathology of the tumour (malignant or benign), malnutrition, pancreatic duct size, soft pancreas, operative time, blood loss and BMI[10]. Several methods have been advocated to prevent the POPF, but none are perfect, however, the use of loop or surgical microscope results in a significant reduction in pancreatic leak[11]. We are selectively using surgical loop in some of our patients with very small pancreatic duct. Although internal stents have not shown any impact on POPF rates, but we are using small infant feeding tube in majority of our patients as internal stents. In our series 3 out of 5 grade B POPF were managed conservatively with keeping drain for longer duration, longer duration of antibiotics with nutritional support. 2 out of 5 patients required one or more US guided percutaneous catheter drain insertion. One patient with grade C POPF was managed with re-exploration and drains were placed without any attempt of redoing the anastomosis and the patient survived. One patient was lost as a consequences of grade C POPF leading to refractory hypotension and multiorgan dysfunction.

Most common complication after pancreaticoduodenectomy was wound infection including superficial, deep infections, and dehiscence with the rate of 21%. This result is higher than the results of published data of other countries, e.g., studies in the USA have

reported the wound infection rates as 7–13.3%[12], while a study in Germany has reported 7.2%[5]. The high rate of wound infection might be partly explained by high preoperative biliary stenting rate in our patients. 32 out of 37 patients has superficial SSI and was managed conservatively with higher antibiotics, 4 of them were managed with vacuum dressings for wound dehiscence. The rate of deep space infection (intra-abdominal collection) was 2.8%; 3 of them were treated by percutaneous catheter under ultrasonography guidance and 2 of them were treated with antibiotics alone; none of them required a reoperation.

Post-operative haemorrhage is another serious complication. In our study, 6 patients (3.4%) suffered from intra-abdominal bleeding postoperatively, which is similar to that have been reported from some other centres, which ranged from 0.7% to 25%[6,12,13]. Post-operative haemorrhage can be early (≤ 24 hours after the end of the index operation) or late (> 24 hours). The location can be intraluminal or extraluminal and the severity of bleeding may be either mild or severe[3]. One of our patients died because of early massive haemorrhage. 5 out of 6 patients have late (> 24 hour) haemorrhage and presented with haemorrhagic drain output with fall in Hb. Two patients with late haemorrhage managed conservatively with blood transfusion and supportive measures. CT angiography was done in all patients with late post-operative haemorrhage. One patient had bleed from first jejunal artery which was localized on CT angiography and was successfully embolized. In our study we lost two patients (2/6) due to intra-abdominal haemorrhage and who required a re-exploration and bleeding site was not localised.

Delayed gastric emptying (DGE) is also among common complication after pancreaticoduodenectomy ranges from 15 to 57%[5,14]. Causes for delayed gastric emptying is not completely understood and is multifactorial[15] In our study only 14.7% patient had DGE, of which most patient has grade A DGE and only 2 patients had Grade C DGE. Although exact DGE rates cannot be make out in our study as we are using levosulpiride (a benzamide antipsychotic drug, used as a prokinetic agent) in early postoperative period in most of our patients for last two years. We have opinion from our experience that it is helpful in early recovery of bowel activity in Indian patients and can affect DGE rates. Both patient with grade C DGE was managed conservatively with reinsertion of nasogastric tube. Both of them required a longer hospital stay (30 and 40 day) and feeding with Feeding Jejunostomy tube and were

evaluated with CECT abdomen and UGI endoscopy which were normal. DGE gradually improved after a period of 30-40 days.

Only three patients out of 176 required a re-exploration in our study. Most common cause for re-exploration was post-operative haemorrhage (two patients) and one patient was reexplored for pancreatic fistula in which drains were placed without any attempt of redoing the anastomosis as mentioned above.

The overall perioperative mortality rate was 4.5% in our patients, which is close to <5% rate reported by other centres. Most common cause of mortality was sepsis (4/8), other causes of mortality were postoperative bleeding (2/8), grade C POPF (1/8) and cardiac event (1/8). Sepsis is serious concern in already nutritionally compromised patients, even larger series also shown that sepsis is cause of mortality in more than 50% of patients⁵. In our study 6 out of 7 patients of sepsis were those whom cholangitis was not completely resolved before surgery; even after multiple attempts of preoperative biliary drainage either endoscopic or percutaneous and antibiotic therapy. Out of these 6 patients, 3 patient sepsis deteriorated after surgery and died and in 3 patients sepsis improved after surgery. This suggest preoperative cholangitis is an important source of sepsis postoperatively and can lead to mortality.

Conclusion: With adequate surgical expertise, improved perioperative care and multispecialty approach, pancreaticoduodenectomy now can be performed with low morbidity and mortality in present era of surgical advancement and nihilistic view regarding this surgery prevalent in some developing countries should be abandoned. Though we do not have comparative data but in our opinion, Internal stenting may be useful in decreasing POPF rates, all measures should be taken to control preoperative cholangitis to decrease postoperative sepsis and mortality, however it may not be possible all the time and Levosulpiride may be helpful in early recovery of bowel function and oral intake.

References

1. El Nakeeb A, Askar W, Atef E et al. Trends and outcomes of pancreaticoduodenectomy for periampullary tumors: A 25-year single-center study of 1000 consecutive cases. *World J Gastroenterol.* 2017; 23(38):7025-36.
2. Bassi C, Dervenis C, Butturini G et al. Postoperative pancreatic fistula: An international study group (ISGPF) definition. *Surgery.* 2005; 138(1):8-13.
3. Wente MN, Veit JA, Bassi C et al. Postpancreatectomy hemorrhage (PPH)-An International Study Group of Pancreatic Surgery (ISGPS) definition. *Surgery.* 2007; 142(1):20-5.
4. Wente MN, Bassi C, Dervenis C et al. Delayed gastric emptying (DGE) after pancreatic surgery: A suggested definition by the International Study Group of Pancreatic Surgery (ISGPS). *Surgery.* 2007; 142(5):761-8.
5. Cameron JL, He J. Two thousand consecutive pancreaticoduodenectomies. In: *Journal of the American College of Surgeons.* Elsevier Inc. 2015; 220:530-6.
6. Jakhmola CK, Kumar A. Whipple's pancreaticoduodenectomy: Outcomes at a tertiary care hospital. *Med J Armed Forces India.* 2014; 70(4):321-6.
7. Karim SAM, Abdulla KS, Abdulkarim QH, Rahim FH. The outcomes and complications of pancreaticoduodenectomy (Whipple procedure): Cross sectional study. *Int J Surg.* 2018; 52:383-7.
8. Bassi C, Marchegiani G, Dervenis C et al. The 2016 update of the International Study Group (ISGPS) definition and grading of postoperative pancreatic fistula: 11 Years After. *Surg (United States).* 2017; 161(3):584-91.
9. Fisher WE, Hodges SE, Wu MF, Hilsenbeck SG, Brunicaudi FC. Assessment of the learning curve for pancreaticoduodenectomy. *Am J Surg.* 2012; 203(6):684-90.
10. Tsai S, Choti MA, Assumpcao L et al. Impact of obesity on perioperative outcomes and survival following pancreaticoduodenectomy for pancreatic cancer: A large single-institution study. *J Gastrointest Surg.* 2010; 14(7):1143-50.
11. Wada K, Traverso LW. Pancreatic anastomotic leak after the Whipple procedure is reduced using the surgical microscope. *Surgery.* 2006; 139(6):735-742.
12. Fernández-Del Castillo C, Morales-Oyarvide V, McGrath D et al. Evolution of the Whipple procedure at the Massachusetts General Hospital. *Surg (United States).* 2012; 152(3Suppl.). doi:10.1016/j.surg.2012.05.022
13. Wente MN, Shrikhande SV, Kleeff J et al. Management of early hemorrhage from pancreatic anastomoses after pancreaticoduodenectomy. *Dig Surg.* 2006; 23(4):203-8.
14. Richter A, Niedergethmann M, Sturm JW, Lorenz D, Post S, Trede M. Long-term results of partial pancreaticoduodenectomy for ductal adenocarcinoma of the pancreatic head: 25-Year experience. *World J Surg.* 2003; 27(3):324-9.
15. Hocking MP, Harrison WD, Sninsky CA. Gastric dysrhythmias following pylorus-preserving pancreaticoduodenectomy - Possible mechanism for early delayed gastric emptying. *Dig Dis Sci.* 1990; 35(10):1226-30.

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