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ORIGINAL ARTICLE

DELAYED GASTRIC EMPTYING AFTER ANCREATICODUODENECTOMY

Mohamed Kassem, Maher Elzeiny
GIT Surgical Unit, General Surgery Department, Faculty of Medicine, University of Alexandria, Egypt

Correspondence to: Mohamed Kassem, Email: dr_m_kassem@yahoo.com

Abstract

Background/Purpose: Pancreaticoduodenectomy (PD) is the standard treatment for operable adenocarcinomas of the head of the pancreas, as well as for other periampullary tumors. Pylorus preserving pancreaticoduodenectomy (PPPD) is generally accepted as a standard operation for periampullary lesions. They encompass four different types of cancers: ampullary (ampulla of Vater), biliary (intrapancreatic distal part of the bile duct), pancreatic (head-uncinate process), and duodenal (from the second portion). Delayed gastric emptying (DGE) is one of the most common postoperative morbidities with rates of 15%-40%.

The aim of this work to find out which factors influence the development of DGE after the standard PD and PPPD.

Methods: This prospective study was carried out on 60 patients from November 2008 to February 2012. The operations were done in the Surgery Unit of the Gastrointestinal Tract, at the Faculty of Medicine, Alexandria, Egypt. They were divided into 2 groups according to the type of operation which was PD and PPPD (each 30 patients).

Results: DGE was the commonest postoperative complication occurred in 23 patients (42.6%). DGE was found in 7 patients (26.9%) out of 26 patients with antecolic fashion and in 16 patients (57.7%) out of 28 patients with retrocolic fashion.

Conclusion: DGE is the commonest postoperative complication after the standard PD and PPPD and can be reduced by certain measures during the operation:

1. Preserving the right gastric artery and the associated nerves along the pylorus.
2. Gastrojejunostomy better done in an antecolic fashion.
3. Duodenojejunostomy is anastomosed better end-to-side.

Keywords: Antecolic, Retrocolic, duodenojejunostomy.

INTRODUCTION

Pancreaticoduodenectomy (Whipple procedure, PD) is the standard treatment for operable adenocarcinomas of the head of the pancreas, as well as for other periampullary tumors and in some cases of chronic pancreatitis.[1] One of the most common postoperative morbidities following pancreatic resection is delayed

gastric emptying (DGE) with rates of 15%-40% and associated with increased postoperative morbidity and mortality.[2]

Advances in surgical skills and postoperative care have resulted in mortality rates of less than 5%.[3,4] The operation classically involves removal of the pylorus and antrum; however, surgeons have used a pylorus-preserving Whipple procedure (first reported by Watson and then brought to renewed popularity by Traverso and Longmire).[5,6]

Pylorus-preserving Pancreaticoduodenectomy (PPPD) is more physiological in concept and is easier to perform technically, and it has been proved to be as effective as the standard Whipple procedure. PPPD is generally accepted as a standard operation for periampullary lesions. PPPD, in comparison to the standard pancreaticoduodenectomy with hemigastrectomy, is reported to improve quality of life, nutritional status and without any difference in operative morbidity and mortality.[5,6] DGE was defined as either 1) nasogastric tube decompression for >10 days and one of the following criteria: a) emesis after nasogastric tube removal, b) postoperative use of prokinetic agents after postoperative day 10, c) reinsertion of a nasogastric tube, or d) failure to progress with diet; or 2) nasogastric tube decompression for <10 days and 2 of the 4 criteria.[7,8]

Whether the standard PD and the PPPD are performed, it does not influence the rate of this complication, each method continues to have gastroparesis as a postoperative problem secondary to vagal injuries. The International Study Group of Pancreatic Surgery (ISGPS), which classified DGE in three grades depending on the period of the nasogastric (NG) tube was maintained and/or the time it was reinserted plus the day the patient proceeds to solid food intake.[8] Grade A represents cases of NG tube remainance between days 4 and 7, or when the tube is reinserted, due to vomiting, when taken out. DGE is considered as grade B, when the NG tube remains in place between days 8 and 14, finally, grade C includes those patients who retain NG tube, or to whom it is reinserted after postoperative day 14 and cannot proceed to solid food intake till day 21.[8-12]

This work was done to find out which factors influence the development of DGE after the standard PD and PPPD for pancreatic head and periampullary tumors and its management.

PATIENTS AND METHODS

Patients

This prospective study was carried out from November 2008 to February 2012. The operations were done in the Surgery Unit of the Gastrointestinal Tract, at the Main Alexandria University Hospital, Faculty of Medicine, Alexandria University, Egypt. This prospective randomized controlled study was approved by the Research Ethics Committee of the hospital and informed consent was obtained from all patients.

The present study included 60 consecutive patients. Patients were divided into two groups:

Group A: Thirty patients underwent the standard PD. The patients were divided into two subgroups:

- ***Subgroup A1:*** 15 patients underwent pancreaticogastrostomy (PG) for pancreatic reconstruction.
- ***Subgroup A2:*** 15 patients underwent pancreaticojejunostomy (PJ) for pancreatic reconstruction.

Group B: Thirty patients underwent the PPPD. The patients were divided into two subgroups:

- ***Subgroup B1:*** 15 patients underwent PG for pancreatic reconstruction.
- ***Subgroup B2:*** 15 patients underwent PJ for pancreatic reconstruction.

Duodenojejunostomy (DJ) was anastomosed either end-to-end (Billroth I type reconstruction) or end-to-side (Roux-en Y type reconstruction), each type involved fifteen patients.

Gastric Reconstruction:

- Antecolic and retrocolic fashions were done, each type involved thirty patients.
- The randomization protocol involved assignment of the 60 patients to one of the two reconstruction methods, the antecolic route and the retrocolic route; randomization took place during surgery before reconstruction.

Methods

Preoperatively all patients were subjected to the following: Clinical assessment including, personal data and history taking (history of pancreatitis, diabetes mellitus, alcohol intake, cigarette smoking and jaundice) and clinical examination. Laboratory investigations including routine laboratory work up and serological markers [CA 19-9 was performed serially before and after operation (value of 37 U/ml was used as upper limit of normal value)]. Biopsy: US or CT guided or during ERCP when required.

Operative procedure:

- ***Standard PD:*** No more than distal 40% of the stomach (including the antrum) was divided.
- ***With PPPD:*** The first 2 cm of the duodenum was preserved along with the pylorus. The right gastric artery and the associated nerves along the pylorus

were preserved. Preservation of this neurovascular supply and the proximal part of the duodenum (which contains the pacemaker of the small intestine) help with postoperative motility.

- ***Reconstruction:***

  Pancreatic anastomosis which was done either:

  a) Pancreaticojejunostomy:
     1) Mucosa to mucosa, if the pancreatic duct was dilated.
     2) Dunking method. When the pancreatic duct was not dilated and/or soft pancreatic substance.

  b) Pancreaticogastrostomy:
     1) Mucosa to mucosa, if the pancreatic duct was dilated.
     2) Implantation method.

Hepaticojejunostomy

Gastrojejunostomy or duodenojejunostomy

Postoperative follow up:

Study of gastric emptying:

- ***From day 1:*** daily nasogastric fluid estimation.
- ***From day 7 to day 14:*** gastrograffin follow through in established cases of delayed gastric emptying which is defined as follows:

  A. The need for a postoperative nasogastric tube for 10 days or longer plus one of the following:
     - Emesis after nasogastric tube removal.
     - Reinsertion of a nasogastric tube.
     - Failure to progress with diet.

  B. Or nasogastric tube in place less than 10 days plus two of the last 3 conditions.

RESULTS

Clinical parameters of the patients

There was no significant difference in the mean age of the groups (F=0.616, p=.607) and also in the sex distribution among the different subgroups (X2=5.158, p=.161) (Table I).

Table I. Age (year) and sex distribution in both studied groups.

	Group A		**Group B**	
	PD group (n=30)		**PPPD group** (n=30)	
	A1	**A2**	**B1**	**B2**
	With PJ (n=15)	**With PG (n=15)**	**With PJ (n=15)**	**With PG (n=15)**
Age (years)				
Min	40	52	48	50
Max	75	68	72	72
Mean	59.87	60.0	62.67	60.93
SD	7.75	4.64	6.21	6.46
F ratio			0.616	
p value			.607 NS	
Sex				
Males	8 (53.3%)	12 (80.0%)	8 (53.3%)	6 (40.0%)
Females	7 (46.7%)	3 (20.0%)	7 (46.7%)	9 (60.0%)
X^2			5.158	
p value			.161	

NS: Not significant.

There was no significant different in the preoperative presenting symptoms (Table II).

Table II. The presenting symptoms and physical signs in the studied cases.

	Group A (PD group) (n=30)						Group B (PPPD group) (n=30)						Total (n=60)	
	PJ (n=15)		PG (n=15)		Total (n=30)		PJ (n=15)		PG (n=15)		Total (n=30)			
	n	%	n	%	n	%	n	%	n	%	n	%	n	%
Symptoms														
Jaundice	14	93.3	12	80.0	26	86.6	11	73.3	13	86.6	24	80.0	50	83.3
Abdominal pain	11	73.3	9	60.0	20	55.5	7	46.6	8	53.3	16	58.3	36	60.0
Weight loss	10	66.6	8	53.3	18	60.0	8	53.3	6	40.3	14	46.6	32	53.3
ANV	4	26.6	8	53.3	14	46.4	10	68.6	8	53.3	18	60.0	32	53.3
Mean duration of symptoms (months)	2.3 ± 0.15		2.1 ± 0.23		2.2 ± 0.91		2.4 ± 0.81		2.3 ± 0.74		2.1 ± 0.59		2.3 ± 0.76	
Physical signs														
Jaundice	14	93.3	12	80.0	26	86.6	11	73.3	13	86.6	24	80.0	50	83.3
Hepatomegaly	4	26.6	4	26.6	8	26.6	6	40.0	4	26.6	10	33.3	18	30.0
Palpable GB	5	33.3	7	46.6	12	60.0	5	33.3	3	20.0	8	26.6	20	33.3

ANV: Anorexia, nausea and vomiting.
GB: Gall bladder.

Preoperative comorbidity

Diabetes mellitus was discovered within 3-5 years before diagnosis of malignant obstructive jaundice. Two patients 6.6% of the PPPD group had previously undergone open cholecystectomy. There was no significant difference in the preoperative risk factors between the groups. The data are summarized in (Table III).

Preoperative laboratory investigations:

The all preoperative laboratory findings (hemoglobin, liver enzymes, albumin, urea, creatinine, protrhombin activity and fasting blood sugar) were normal; there were no significant difference in the groups (Table IV).

Table III. Preoperative comorbidity.

	Group A (PD group) (n=30)						Group B (PPPD group) (n=30)						Total (n=60)	
	PJ (n=15)		PG (n=15)		Total (n=30)		PJ (n=15)		PG (n=15)		Total (n=30)			
	n	%	n	%	n	%	n	%	n	%	n	%	n	%
Hypertension	6	40.0	4	26.6	10	33.3	3	20.0	7	46.6	10	33.3	20	33.3
Diabetes mellitus	1	6.6	1	6.6	2	6.6	4	26.6	2	13.3	6	20.0	8	13.3
Smoking	8	53.3	4	26.6	12	40.0	6	40.0	8	60.0	14	46.6	26	43.3
COPD	3	20.0	1	6.6	4	13.3	2	13.3	1	6.6	3	10.0	7	11.6
Peptic ulcer	0	0.0	0	0.0	0	0.0	1	6.6	0	0.0	1	3.3	1	1.6
Pancreatitis	1	6.6	0	0.0	1	3.3	0	0.0	0	0.0	0	0.0	1	1.6
Prior abdominal surgery	0	0.0	0	0.0	0	0.0	0	0.0	2	13.3	2	6.6	2	3.3

COPD: Chronic obstructive pulmonary disease.

Table IV. Preoperative investigation and hospital stay parameters.

	Group A (PD group) (n=30)	Group B (PPPD group) (n=30)	p value
Bilirubin (mg %)			
- Total	13.8 ± 4.6	12.8 ± 3.8	0.35
- Direct	11.2 ± 3.6	9.6 ± 2.1	0.41
CA 19-9 (U/ml)	235.7 ± 47.1	429.2 ± 93.4	0.001*
Preoperative hospital stay (days)	14.67 ± 6.08	12.80 ± 4.46	0.103

Imaging

Ultrasonography, Multislice CT, ERCP (Table V) and/or MRCP (Table VI).

Table V. ERCP findings in both studied groups.

	Group A (PD group) (n=30)		Group B (PPPD group) (n=30)		Total (n=60)		p value
	n	%	n	%	n	%	
Number of patients	28	93.3	24	80.0	52	86.7	0.21
CBD dilatation with lower end stricture	28	93.3	24	80.0	52	86.7	0.11
PD stenosis or obstruction	12	40.0	14	46.7	27	43.3	0.25
Stent	10	33.3	6	20.0	16	26.6	0.10
ERCP combined with MRCP	14	46.7	18	60.0	32	53.3	0.11
ERCP only (without MRCP)	14	46.7	6	20.0	20	33.3	0.032*
ERCP guided biopsy	10	33.3	8	26.7	18	30.0	0.15

Table VI. MRCP findings in both studied groups.

	Group A (PD group) (n=30)		Group B (PPPD group) (n=30)		Total (n=60)		p value
	n	%	n	%	n	%	
Number of patients	16	53.3	24	80.0	40	66.7	0.003*
CBD dilatation with distal end stricture	16	53.3	24	80.0	40	66.7	0.003*
PD stenosis or obstruction	12	40.0	14	46.7	26	43.3	0.21
MRCP only	2	6.7	6	20.0	8	13.3	0.31

Postoperative complications

14 patients (46.6%) of PD group and 16 patients (53.3%) of PPPD group had postoperative complications (Table VII), some patients presented with more than one complication.

DGE was the commonest complication (n=23, 42.6%) after PD and PPPD groups. In PD group 13 patients (48.1%) had DGE. A1 group 8 patients (61.5%) were affected while in A2 group 5 patients (35.7%) were affected. In PPPD group 10 patients (37%) had DGE. B1 group 6 patients (43.3%) were affected while in B2 group 4 patients (30.8%) were affected. It occurred in 8 patients (57.1%) after end-to-end DJ and in 2 patients (15.0%) after end-to-side DJ. There was a significant increased incidence of DGE in patients with end-to-end DJ when compared with end-to-side DJ (P= 0.024) (Table VIII). The incidence of DGE in PD group when compared with PPPD group was non-significant (P=0.090). The incidence in PJ group compared with PG group in both PD and PPPD groups respectively was non-significant (P=0.642, Table IX).

Table VII. Postoperative complications*.

	Group A (PD group) (n=30)		Group B (PPPD group) (n=30)		Total (n=60)		p value
	n	%	n	%	n	%	
Wound infection	10	33.3	10	33.3	20	33.3	-
Minor pancreatic leakage	10	33.3	8	26.6	18	30.0	0.69
Pancreatic fistula (major leakage)	3	10	2	6.7	5	8.3	-
Upper gastrointestinal hemorrhage	2	6.7	-	-	2	3.3	-
Biliary leakage	-	-	2	6.7	2	3.3	-
Intra-abdominal abscess	1	3.3	-	-	1	1.6	-
Cholangitis	6	20.0	2	6.7	8	13.3	-
Pneumonia	2	6.7	4	13.3	6	10.0	-
Urinary tract infection	8	26.7	6	20.0	14	23.3	0.19
Gastric outlet obstruction	1	3.3	-	-	1	1.6	-

*Multiple complications per patient possible.

Table VIII. DGE comparing after PPPD end-to-end and end-to-side anastomosis*.

	DJ with end-to-end (n=14)	DJ with end-to-side (n=13)	p value
DGE	8 (57.1%)	2 (15.0%)	X2=5.04 P=0.024*

*3 patients with major complications were excluded.

Table IX. DGE comparing PD and PPPD groups*.

	Group A (PD group) (n=27)						Group B (PPPD group) (n=27)						Total (n=60)	
	PJ (n=13)		PG (n=14)		Total (n=27)		PJ (n=14)		PG (n=13)		Total (n=27)			
	n	%	n	%	n	%	n	%	n	%	n	%	N	%
DGE	8	61.5	5	35.7	13	48.1	6	43.3	4	30.8	10	37.0	23	42.6
Chi square	0.94		0.07		0.22									
P value	0.331		0.785		0.642									

*6 patients with major complications were excluded (patients who are not able to eat for reasons other than impaired gastric emptying).

When adding PJ in both groups and compare it to PG in both groups: X2=2.86, P=0.090.

Delayed gastric emptying was found in 7 patients (26.9%) in 26 patients with antecolic fashion and in 16 patients (57.7%) in 28 patients with retrocolic fashion. There was a significant increased incidence of DGE in patients with retrocolic fashion compared with antecolic fashion (P= 0.024) (Table X). Nineteen patients with DGE (19/23, 82.6%) suffered from other postoperative complications, so the presence of postoperative complications especially the intra-abdominal complications was found to be risk factor for the development of DGE (may prevent patients from eat or as the result of local inflammation and sepsis).

Table X. DGE comparing antecolic and retrocolic fashions*.

	Reconstruction in antecolic fashion (n=26)	Reconstruction in a retrocolic fashion (n=28)	p value
DGE	7 (26.9%)	16 (57.7%)	X2=5.04 P=0.024*

*6 patients with major complications were excluded.

Daily nasogastric fluid estimation followed by upper endoscopy and/or gastrograffin follows through from day 7 to day 14 in established cases of DGE (23 patients, 42.6%). All patients of DGE were treated conservatively by prolonged nasogastric suction, correction of any electrolyte disturbance if present, and pharmacologic treatment with prokinetic medications (metoclopramide hydrochloride) and proton pump inhibitors. All patients were discharged from the hospital tolerating oral solid intake except six patients with major complications (5 patients with major pancreatic leakage and one patient suffered from kink of the efferent loop, and so pancreatic fistula and abscess).

Wound infection was the second common complication occurred in 20 patients of both groups. Minor pancreatic leakage was the third common complications occurred in 10 patients of PD group and in 8 patients of PPPD group. Spontaneous closure occurred after conservative treatment by PTN and peptides capable of inhibiting pancreatic secretion such as somatostatin. The pancreatic leakage occurred after PG was easily controlled than those occurred after PJ.

Pancreatic fistula (major pancreatic leakage) occurred in 5 patients (8.3%): 3 patients (10%) after PD group and 2 patients (6.7%) after PPPD group (the five patients with pancreatic stump reconstruction with the jejunum). In the 5 patients continued drainage by the peripancreatic drains placed intraoperatively, TPN, and somatostatin were done. One patient showed efferent loop obstruction due to kink and so pancreatic fistula and intraabdominal abscess were found that needed re-exploration. Two patients (6.7%) showed upper gastrointestinal hemorrhage, one of them was controlled conservatively and the other needed re-exploration where the anastomatic line at gastrojejunostomy was the cause of bleeding and was controlled by over-sewing sutures. Biliary leakage occurred in 2 patients only of PD group and was easily controlled by conservative treatment (Table VII).

Postoperative hospital stay:

The range of postoperative hospital stay in patients who developed complications in PD group was 40 to 60 days with a median of 45 days and a mean of 47.5 ± 5.97 days and in PPPD group the range was 35 to 55 days with a median of 45 days and a mean of 46.88 ± 7.53 days. The range of postoperative hospital stay who did not develop complications in PD group was 24 to 30 days with a median of 28 days and a mean of 27.71 ± 2.87 days and in PPPD group the range was 15 to 30 days with a median of 26 days and a mean of 26.43 ± 5.56 days. The hospital stay in patients who developed complications in PD and PPPD groups was significantly longer (p=0.0001*, and p=0.0003* respectively) than patients who had no complications (Table XI).

Table XI. Postoperative hospital stay (days).

	Group A		Group B
	PD group (n=30)		PPPD group (n=30)
Patients who developed complications			
Min - Max	40 - 60		35 – 55
Mean ± SD	47.5 ± 5.97		46.88 ± 7.53
Median	45		45
t test		0.981	
p value		0.877 NS	
Patients without complications			
Min - Max	24 – 30		15 – 30
Mean ± SD	27.71 ± 2.87		26.43 ± 5.56
Median	28		26
t test		1.453	
p value		0.742 NS	

NS: Not significant.

DISCUSSION

Yeo et al[13] had reported a prospective randomized trial of PG (n=73) versus PJ (n=72) groups between May 1993 and January 1995, the finding for the 145 patients were analyzed in the prospective trial at Johns Hopkins Hospital. There were 33 (45%) male and 40 (55%) female in PG group and 38 (53%) male and 34 (47%) female in PJ group. The mean age was 62.5 ± 1.7 and 62.4 and PJ respectively.

The indications for surgery in the literatures conform with results obtained in this study as cancer head pancreas was the commonest indication for surgery followed by periampullary carcinoma and lastly, chronic pancreatitis.[14-16]

In a respective study by Gvalani[17] had reported fourteen patients underwent pancreaticoduodenectomy, in the first 8 patients PJ was performed and in the subsequent 6 patients PG was performed. Jaundice was the commonest symptom being reported in 5 patients (60%) of PJ group and 4 patients (67%) of PG group. Abdominal pain was the second common presenting symptom in 3 (37%) and 2 (33%) patients of PJ and PG groups respectively. Weight loss, anorexia and vomiting were the third clinical presentation.

Aranha et al[18] reported that history non-insulin dependent DM was present in 4.6% of patients (7/152) underwent pancreaticogastrostomy (diabetes was discovered with 3 years before diagnosis).

Takano et al[19] had reported the preoperative parameters in PJ an PG groups, noted that: There was no significant difference between preoperative laboratory variables included, haemoglobin, liver enzymes, total bilirubin, albumin and fasting blood sugar.

In our study serum levels of alkaline phosphatase and bilirubin (total and direct) were significantly elevated. In combining these data we might be able to conclude that if the patient is complaining of abdominal pain, anorexia, weight loss, jaundice and higher levels of alkaline phosphatase, we should examine the pancreas for cancer. CT, ERCP and MRCP results in the literatures[20-23] conform to the results in our study.

DGE was the commonest complication after pancreaticodoudenal resection. It decreases the patient comfort, increases the risk of aspiration pneumonia, prolongs hospital stay and increases medical costs.

The association of DGE and PPPD had hampered its adoption by some centers.[24] DGE prolonged hospital stay, when compared with PD.(25) Other studies had no difference in DGE,[26] and considerable debate about the incidence and prevention of this complication has continued.[27-29]

A wide range of causative mechanisms has been proposed to be the etiology for the occurrence of DGE. These include (1) absence of hormonal stimulation (motilin) leading to gastric atony which is predominantly synthesized in the enterochromaffin cells of the duodenum,[30;31] (2) ischaemia of the pylorus and antrum after ligation of the right gastric and gastroduodenal arteries,[32] (3) disruption of the gastroduodenal neural connections, gastric atony due to vagotomy or resection of the duodenal pacemaker,[33] (4) post-operative pylorospam,[34] and (5) gastroparesis secondary to postoperative intra-abdominal complications (anastomotic leakage, abscess or local inflammation).[33-35] Other functional abnormalities include pancreatic fibrosis,[36] postoperative cholangitis,[37] postoperative pancreatitis,[33] alteration of the endocrinologic millieau, and tortion or angulation of the reconstructed alimentary tract.[38]

The results in the literatures[39-42] conformed the results in our study. They reported that the incidence of DGE after Billroth I type reconstruction was higher than Roux-en Y reconstruction.

The incidence of DGE in Billroth I type reconstruction was reported to range from 32% to 72%. It was reported that the reason for the higher rate of DGE in Billroth I type reconstruction was that the stomach was anastomosed closely to the pancreato- and hepaticojejunostomy in the limited room of the upper quadrant of the abdomen.[43] But with end to side anastomosis (duodenojejunostomy) a distance from the area prevented the promotion of DGE by local inflammation due to leakage or existing hematoma.[44] They reported that to prevent DGE was to put the stomach at as straight and vertical a position as possible. With this arrangement, the food is emptied smoothly passed from the stomach to the jejunum by gravity, although the stomach is atonic and without peristalsis.[45] However, if a Billroth I type reconstruction is performed, it is difficult to put the stomach at a vertical position because of the performance of a choledochojejunostomy.[46]

In our study there was a significant decreased incidence of DGE in patients with antecolic fashion compared with retrocolic fashion (P=0.024).

Lytras et al,[47] conformed our study and reported that a significant lower incidence of DGE after antecolic compared with retrocolic duodenojejustomy (5 vs. 50% respectively, P=0.0014).

The results in the literatures[26;39;42;43] conforms the results in our study. They speculated that retromesentric passage of afferent jejunum can cause mechanical outflow obstruction due angulation or torsion with congestion and loop edema. This can in turn retard the recovery of jejunal peristalsis at the site of anastomosis with the stomach and result in DGE.

In contrast to our study Chijiiwa et al,[48] reported that the incidence DGE was lower with the antecolic route

than with the vertical retrocolic route, but the difference was not significant (P=0.34).

In agreement with our study, Delcore et al[49] stated that the mean length of hospitalization was 22 days. But most of the literatures[50-53] described a shorter hospital stay while complications prolonged hospitalization markedly.

Conclusion and Recommendations:

- PD and PPPD have evolved as a safe and effective therapeutic option for the management of malignancy of the pancreatic head and periampullary region.
- DGE is the commonest postoperative complication after the standard PD and PPPD (with no significant difference between them). This can be reduced by certain measures during the operation:
    1) Preserving the right gastric artery and the associated nerves along the pylorus.
    2) Preservation of duodenal pacemaker which is located 0.5 to 1 cm distal from pylorus.
    3) Duodenojejunostomy is anastomosed better end-to-side and antecolic.
    4) Gastrojejunostomy better done in an antecolic fashion.
- The presence of postoperative complications might be responsible for the occurrence of DGE.
- Daily nasogastric fluid estimation followed by upper GIT endoscopy and/or gastrograffin follow through is done in established cases of DGE. All patients of DGE were treated conservatively.

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