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Incidence and Management of Delayed Gastric Emptying after Pylorus-Preserving Pancreatoduodenectomy in Management of Periampullary Cancer: A Single Center Study

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Abstract

Background: Pancreatic cancer is the 4th cause of cancer-related. Complete resection is the curative option but pancreatic surgery is a complex surgery.

Pancreaticoduodenectomy is the treatment of choice for pancreatic tumors but delayed gastric emptying is a common after pylorus preserving pancreatico-duodenectomy and may lead to patient discomfort, prolonged hospitalization, and increased hospital costs.

Aim of Study: This study aims to assess the incidence and management of delayed gastric emptying in management of periampullary cancer.

Patients and Methods: This was a prospective cross-sectional study conducted on 20 patients with pancreatic head or periampullary carcinoma managed via ppPD whom suffered from delayed gastric emptying during the period from 1st of November 2020 to the 31st of October 2021 at department of Hepato-Pancreato-Biliary Surgery, National Liver Institute, Menoufyia University.

All patients were evaluated preoperatively and followed-up postoperatively when DGE developed for its signs, diagnosis and possible managements.

Data were fed to the computer using IBM SPSS software package version 20.0.

Results: Our results revealed a non-significant demographic data, comordinities, viral infection, laboratory investigations "pre or post-operative", operative findings and postoperative outcomes and hospital stay. But predominance of male gender, pathologic grade II, and the significance of radiologic investigations in diagnosis (U/S, CT, MRCP), response of DGE to conservative management.

Conclusion: Diagnosis of DGE should be early post-operative which is commonly presented by GIT symptoms and successfully treated conservatively.

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Key Words: *DGE: Delayed Gastric Emptying – PD: Pancreaticoduodenectomy – ppPD: Pylorus preserving pancreaticoduodenectomy.*

Introduction

PANCREATIC cancer is currently the fourth leading cause of cancer-related deaths in men and women and has one of the lowest 5-year relative survival rates among all cancer sites 8% at all stages. Pancreatic cancer deaths are even projected to increase dramatically to become the second leading cause of death from cancer before 2030; these data illustrate the fatal prognosis of the disease **[1]**.

Complete tumor resection is the only potentially curative option for pancreatic cancer patients, and the resection of precursor lesions should be performed at the correct point of time to achieve long-term survival. Pancreatic surgery is a complex, technical procedure regarding diagnostic, surgical, and perioperative aspects. Its centralization in specialized institutions has led to acceptable mortality rates below 5% **[2]**.

Pancreaticoduodenectomy (PD) is the treatment of choice for various benign and malignant tumors of the pancreatic head or the periampullary region. First described by Walther Kausch in Germany in 1909, PD was later refined by Allen O. Whipple in the United States. The classic Whipple procedure, as it is still performed today, involves en bloc resection of the pancreatic head, the duodenum, the distal common bile duct, the gallbladder, and the distal stomach together with the adjacent lymph-nodes, followed by reconstruction of the gastrointestinal route **[3]**.

In 1944, Watson modified the classic Whipple procedure towards a pylorus-preserving PD in a patient with carcinoma of the papilla of Vater. Then a few years later, Traverso and Longmire popularized the preservation of the pylorus in patients with chronic pancreatitis and duodenal cancer. Since then, pylorus-preserving PD has gained popularity over the classic Whipple procedure in many centers and has been the procedure of choice in the management of pancreatic head and periampullary lesion **[4]**.

Delayed gastric emptying (DGE) is one of the most common complications after Pylorus preserving pancreaticoduodenectomy (ppPD) and is a potentially serious event that may lead to patient discomfort, prolonged hospitalization, and increased hospital costs. DGE is a complex phenomenon with a multifactorial genesis and is believed to be associated with other major intra-abdominal complications, including pancreatic fistula and infected collections **[5]**.

In 2007, the International Study Group of Pancreatic Surgery (ISGPS) proposed a consensus definition of DGE based on severity and clinical impact which classify severity into three grades (A, B and C) according to (1) How long nasogastric (NG) tube required, (2) Time to tolerate solid oral intake, and (3) Vomiting and gastric distention. Hence, the intra-abdominal complications, post-ppPD, are the most effective risk factor for DGE. Other techniques, such as pancreatic-stent insertion or pancreatic- gastro stomy were carried out to decrease pancreatic fistulae **[6]**.

Other non-technical considerations include early enteral feeding and the use of prokinetic drugs as erythromycin and proton-pump inhibitors. So, we highlight the incidence and management of delayed gastric emptying after pylorus-preserving Pancreaticoduodenectomy in management of periampullary cancer in this work **[7]**.

This study aimed to assess the incidence and management of delayed gastric emptying as one of the most common complications following ppPD in management of periampullary cancer at the department of Hepato-Pancreato-Biliary (HPB) Surgery, National liver institute, Menoufyia University, in a prospective study for one year.

Patients and Methods

This is a prospective cross-sectional study was carried out on 20 patients with pancreatic tumors "head and periampullary" admitted to the Department of Hepato-pancreato-billary Surgery, National liver Institute, Minoufyia University and managed via pylorus preserving pancreatico-duodenectomy and suffering from delayed gastric emptying.

All patients with respectable cancer head of the pancreas (stage 1A,1B, 2A) and/or periampullary carcinoma stage 1A, 1B, 2A, and 2B we included in this study while the following cases were excluded from the study:

- Patients with residual disease or infiltrated surgical resection margin due to the effect of residual malignancy over the general condition and nutritional state.
- Patients with a postoperative complication that required prolonged NPO state and TPN as: Enteric fistula or alimentary tract bleeding managed by conservation or required a second look exploration, cardiopulmonary or anesthesia-related complication.
- Patients underwent this procedure previously.
- Diabetic patient due to potential associated diabetic gastropathy that might interrupt the study result.

All participants included in the study were subjected to the followings:

1- Written or informed consent.

2- Full history taking including: Personal history"Name, age, sex, weight, smoking, profession and marital status", medical history "Comorbidities as Liver cirrhosis, HCV, IHD, CHF, hypertension and COPD", past history of "PTC or ERCP preoperative, Postoperative complication "Drains daily output and nature of drained material, Postoperative fasting period and how long NG needed, Postoperative vomiting frequency and effect of prokinetics, anti-emetic, and if required NG decompression, the period needed to tolerated solid food postoperatively".

3- Laboratory investigations including:

- Complete Blood Count (CBC) including: Hb, WBC and platelet.
- Liver function tests including: Serum bilirubin, serum albumin, ALT, AST and ALK.
- Viral tests including: HCV Ab and HBs Ag.
- Renal function tests including: Creatinine and urea.
- Blood tests including: Prothrombin time, activity and INR.
- Serum electrolytesincluding: Serum Na and K.
- C-reactive protein.

4- Post operative's radiological examination including: The abdominal US, CT abdomen with contrast, Upper GI endoscopy.

5- Preoperative Management: Correction of associated obstructive jaundice via either endoscopic or percutaneous management. Correction of general condition of the patient regarding the nutritional status and associated co-morbidities.

6- Follow-up for morbidity and mortality, quality of life and nutritional status.

Data were analyzed using IBM SPSS software package version 20.0 (Belmont, Calf, 2013). Data were collected in tables then analyzed in regarding to Chi square (X^2) and *p*-value less than 0.05 were considered significant.

Results

This study was conducted on 20 patients of pancreatic head or peri-ampullary carcinoma at Hepato-pancreato-billary Surgical Department of the National liver Institute, Minoufyia University and managed via pylorus preserving pancreaticoduodenectomy and suffering from delayed gastric emptying, during the period from 1st of November 2020 to 31th October 2021.

The mean age of patients of the groups ranged between 41-72 years with a mean age of 57.45±8.94 years. The mean age of patients of grade I was 70±0.0 years while of patients of grade II was 56.5±9.08 years and patients of grade III it was 63±0.0 years and statistical analysis revealed non-significant difference between all patients regarding age (*p*=0.490), (Table 1).

Fifteen of patients in our study were males (15/20, 75%) and fife patients were females (5/20, 25%). In patients with grade I 100% were males; while in grade II 72.2% were males and 27.8% were females and in grade III 100% of patients were males. The statistical analysis revealed the predominance of males in all groups (*p*=0.01, 0.001, 0.01, 0.001 respectively), (Table 1, Fig. 1).

Eighteen of cases of the study (18/20, 90%) were classified as pathological grade II while one case was classified as pathological grade I and another one case was classified as phathological grade III. The statistical analysis revealed the significant presence of pathological grade II in our cases (*p*=0.001), (Table 2, Fig. 2).

Regarding co-morbidities, hypertension was present in thirteen cases (13/20, 65%); while diabetes mellitus was present in only two cases (2/20, 10%) and cardiac diseases were present in three cases (3/20, 15%). The statistical analysis revealed the presence of hypertension in a significant manner in our cases (*p*=0.021), (Table 3).

Regarding medical treatment given for patients of our study; GIT symptoms treate significantly with Nexium (100%), Gast-reg (70%), Flagyl (60%), (*p*=0.00, 0.01, 0.037 respectively), while insignificantly response to primperan (50%) and Danset (30%) (*p*=1.0 and 0.331 respectively). While insignificant number of cases needed antibiotics in the form of Maxipime (15%) and Claforan (20%) (*p*=0.312 and 0.224 respectively. Also, a significant number of cases needed anticoagulants in the form of Clexan (70%) (*p*=0.023), but collectively medical treatment given to patients give a significant response (65%) (*p*=0.02), (Table 4).

As correlating viral infection with the presence of pancreatic tumors; there were no significant correlation between the presence of HCV post-sovaldi (55%), HBsAg (15%), HBV (10%) and HIN (10%) (*p*=0.558, 0.907, 0.907 and 0.907 respectively), (Table 5).

Laboratory investigation done for cases of the study "Creatinine, AST, ALT, Direct bilirubin, Total bilirubin, PT and INR" revealed a non-significant elevation in relation to pathologic grades of cases of the studied groups (*p*>0.05), (Table 6).

Ultrasonographic examination of cases of the study revealed the presence of significant number of cases with hepatomegaly (65%) [78.6% of them the enlargement was homogenously while 21.4% showed nodular enlargement of the liver] and 34% of the cases showed that the liver was in the average size (*p*=0.021). By U/S the intrahepatic biliary radicals dilatation (IHBRD) didn't detected in any cases of the study (*p*=0.001); while common bile duct dilatation (CBD) was detected in a significant number of cases (90%) (0.001) this was presented (Table 7, Fig. 3).

CT examination of cases of the study revealed a presence of significant number of cases with CBD dilatation (90%) and a significant number of cases with IHBRD 90% (*p*=0.01 for each) with a non-significant difference between cases regarding the presence of pancreatic head mass (50%), periampullary mass (50%) or dilated pancreatic duct (10%) (*p*=1.0, 1.0 and 0.976 respectively), (Table 8).

MRCP examination of cases of the study revealed a presence of a non-significant number of

cases with CBD dilatation (55%), and a non-significant number of cases with IHBRD 50% with also a non-significant number of cases with ampullary mass (10%) (p=0.213, 1.0 and 0.967 respectively), (Table 9).

Intra-operatively the mean operative time for all cases was 381±58.5min and the statistical analysis revealed significant increase in the operative time with the progression of the pathological grade (mean = 280min, 378.75min and 510min respectively; p=0.032). The mean blood loss during operations for all cases was 295±98.5 CC and the statistical analysis revealed significant increase in the amount of blood loss during operations with the progression of the pathological grade (mean = 200 CC, 287.5 CC and 500 CC respectively; p=0.031), (Table 10, Fig. 4).

As a general rule the need for blood transfusion and/or plasma transfusion was not needed in a significant manner (35% for both) but with the advanced phathologic grade the need for both was significantly need in a good number of cases (Table 10, Fig. 5).

Post-operatively, the mean period of Ryle positioning was 3.5±0.83 days and this period increased with advancement in pathologic grade but in a non-significant manner (p=0.229). The mean period of oral feeding was 4.05±0.89 days and this period increased with advancement in pathologic grade but in a non-significant manner (p=0.350); also the mean length of the period of delayed gastric emptying was 1.75±1.55 days which increased with progress in pathologic grade but in a non-significant manner (p=0.074). Vomiting as a post-operative symptom affecting a significant number of cases (70%) (p=0.021) with increase with advancement in pathologic grade but in a non-significant manner (p=0.241), (Table 11).

During the early postoperative period; chest infections occurred in five patients (25%) four of them belonged to grade II and only one belonged to grade I and the statistical analysis revealed non-significant occurrence of chest infection in our group of patients (p=0.228). While abdominal infections occurred in only one patient (5%) belonged to grade II and the statistical analysis revealed non-significant occurrence of abdominal infection in our group of patients (p=0.967). In addition, wound infection occurred in four patients (20%) all of them belonged to grade II and the statistical analysis revealed non-significant occurrence of wound infection in our group of patients (p=0.321). Wound leak occurred in five patients (25%) all of them belonged to grade II and the statistical analysis revealed non-significant occurrence of wound leak in our group of patients (p=0.312), (Table 12).

When we investigate our patients on discharge, and the statistical analysis between pathologic grades revealed a non-significant changes between pathologic grades regarding discharge investigations that included Hb concentration, WBCs, platelets, serum creatinine, AST, ALT, direct bilirubin, total bilirubin, prothrombin time, INR, serum sodium, serum potassium and C-Reactive Protein, (p-value of all were >0.05), (Table 13).

Patients of our study stay in the ICU postoperatively a period ranged from 3-13 days with a mean of 6.2±4.8 days, while the ICU stay was longer in pathologic grade II (5.56±2.97 days) but patients with different pathologic grade didn't show significance difference regarding ICU stay (p=0.088). Also, regarding postoperative hospital stay in our patients it was ranged from 8-15 days with a mean of 9.9±3.02 days, and in spite of its increase with the aadvanced pathologic grade but there was no significant difference between those grade regarding hospital stay in our study (p=0.062), (Table 14).

Table (1): Demographic data in relation to pathologic grades of the studied patients.

	Pathology			Total
	Grade I	Grade II	Grade III	
Age (year):				
Mean ± S.D.	70.00±0.0	56.50±9.08	63.00±0.0	57.45±8.94
Range	70.0-70.0	41.0-72.0	63.0-63.0	41.0-72.0
p	0.490			
Sex:	No. (%)	No. (%)	No. (%)	No. (%)
Male	1 (100)	13 (72.2%)	1 (100%)	15 (75%)
Female	0 (0.0)	5 (27.8%)	0 (0%)	5 (25%)
p	0.001	0.01	0.001	0.01

p Significant if ≤0.05.

Table (2): Pathologic grades of the studied patients.

Pathologic grade	Studied patients (n=20)		*p*
	No.	%	
Grade I	1	5	0.001
Grade II	18	90	(S)
Grade III	1	5	

p Significant if ≤0.05.

Table (3): Clinical data of the studied patients.

Variables	Studied patients (n=20)		*p*
	No.	%	
HTN (mmHg):			
No	7	35.0	0.021 (S)
Yes	13	65.0	
DM (mg/dL):			
No	18	90.0	
Yes	2	10.0	
Cardiac Disease:			
No	17	85.0	
Yes	3	15.0	

Table (4): Treatment taken of the studied patients.

Variables	Studied patients (n=20)		*p*
	No.	%	
Nexium (mg):			
Yes	20	100.0	0.000 (S)
Gast-reg (mg):			
No	3	15.0	0.01 (S)
Yes	17	85.0	
Tavanic (mg):			
No	17	85.0	0.312 (NS)
Yes	3	15.0	
Maxipime (mg):			
No	17	85.0	0.312 (NS)
Yes	3	15.0	
Flagyl (mg):			
No	8	40.0	0.037 (S)
Yes	12	60.0	
Dexan (mg):			
No	6	30.0	0.023 (S)
Yes	14	70.0	
Claforan (mg):			
No	16	80.0	0.224 (NS)
Yes	4	20.0	
Primperan (mg):			
No	10	50.0	1.0 (NS)
Yes	10	50.0	
Danset (mg):			
No	14	70.0	0.331 (NS)
Yes	6	30.0	
Response:			
Negative	7	35.0	0.02 (S)
Positive	13	65.0	

Table (5): Viruses in relation to pathology grades of the studied patients.

Variables	Pathologic grade			Total (n=20)	*p*-Value
	Grade I	Grade II	Grade III		
HCV post Sovaldi:					
No	0 (0.0%)	8 (44.4%)	1 (100%)	9 (45%)	0.558
Yes	1 (100%)	10 (55.6%)	0 (0%)	11 (55%)	(NS)
HBsAg:					
No	1 (100%)	15 (83.3%)	1 (100%)	17 (85%)	0.907
Yes	0 (0.0%)	3 (16.87)	0 (0%)	3 (15%)	(NS)
HIV:					
No	1 (100%)	16 (88.9%)	1 (100%)	18 (90%)	0.967
Yes	0 (0.0%)	2 (11.1%)	0 (0%)	2 (10%)	(NS)
HBV:					
No	1 (100%)	16 (88.9%)	1 (100%)	18 (90%)	0.967
Yes	0 (0.0%)	2 (11.1%)	0 (0%)	2 (10%)	(NS)

HCV : Hepatitis-C virus.
HBsAg : Hepatitis-B surface antigen.
HIV : Human immunodeficiency virus.
HBV : Hepatitis-B virus.
p Is significant if ≤0.05.

Table (6): Laboratory investigations in relation to pathologic grades of the studied patients.

Variables	Pathologic grades (Mean±S.D)			Total (n=20)	*p*-Value
	Grade I	Grade II	Grade III		
Create (mg/dL)	0.90±0.0	0.92±0.24	0.80±0.0	0.92±0.23	0.966
AST (U/L)	42.00±0.0	72.00±32.52	59.00±0.0	68.40±31.39	0.772
ALT (U/L)	46.00±0.0	63.75±43.13	80.00±0.0	63.10±40.30	0.952
D. Bil (mg/dL)	2.50±0.0	3.64±4.69	0.90±0.0	3.58±4.51	0.911
T. Bil (mg/dL)	3.10±0.0	5.46±5.43	2.80±0.0	5.58±5.76	0.783
PT (Sec.)	14.00±0.0	22.47±27.82	11.30±0.0	20.45±25.07	0.927
INR	1.02±0.0	1.11±0.14	0.96±0.0	1.11±0.14	0.587

AST : Aspartate aminotransferase.
ALT : Alanine transaminase.
PT : Prothrombin time.
INR : International Normalized Ratio.
T.Bil : Total bilirubin.
D.Bil : Direct bilirubin.
p is significant if ≤ 0.05.

Table (7): Pathology grades in relation to U/S of the studied patients.

Variables	Pathology			Total (n=20)	*p*-Value
	Grade I	Grade II	Grade III		
Hepatomegaly:					
Negative	1 (100%)	5 (27.8%)	0 (0%)	6 (35%)	0.021
Positive	0 (0.0%)	13 (72.2%)	1 (100%)	14 (65%)	(S)
IHBRD:					
Negative	1 (100%)	18 (100%)	1 (100%)	20 (100%)	0.000
Positive	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	(S)
CBD:					
Negative	1 (100%)	0 (0.0%)	1 (100%)	2 (10%)	0.001
Positive	0 (0.0%)	18 (100%)	0 (0.0%)	18 (90%)	(S)

IHBRD: Intrahepatic Biliary Radicle Dilatation.
CBD : Common bile duct.

Table (8): Pathologic grades in relation to CT of the studied patients.

Variables	Pathologic grades			Total (n=20)	*p*-Value
	Grade I	Grade II	Grade III		
CBD:					
Negative	0 (0.0%)	2 (6%)	0 (0.0%)	2 (10%)	0.01
Positive	1 (100%)	16 (94%)	1 (100%)	18 (90%)	(S)
IHBRD:					
Negative	0 (0.0%)	2 (6%)	0 (0.0%)	2 (10%)	0.01
Positive	1 (100%)	16 (94%)	1 (100%)	18 (90%)	(S)
Pancreatic head mass:					
Negative	1 (100%)	9 (50%)	0 (0.0%)	10 (50%)	1.0
Positive	0 (0.0%)	9 (50%)	1 (100%)	10 (50%)	(NS)
Pancreatic ampullary mass:					
Negative	0 (0.0%)	9 (50%)	1 (100%)	10 (50%)	1.0
Positive	1 (100%)	9 (50%)	0 (0.0%)	10 (50%)	(NS)
Dilated pancreatic duct:					
Negative	1 (100%)	16 (88%)	1 (100%)	18 (90%)	0.976
Positive	0 (0.0%)	2 (13%)	0 (0.0%)	2 (10%)	(NS)

IHBRD: Intrahepatic Biliary Radicle Dilatation.

CBD : Common bile duct.

p : Is significant if ≤0.05.

Table (9): MRCP findings in relation to pathologic grades of the studied patients.

MRCP findings	Pathologic grades			Total (n=20)	*p*-Value
	Grade I	Grade II	Grade III		
CBD:					
Negative	1 (100%)	8 (44%)	0 (0.0%)	9 (45%)	0.213
Positive	0 (0.0%)	10 (56%)	1 (100%)	11 (55%)	(NS)
IHBRD:					
Negative	1 (100%)	9 (50%)	0 (0.0%)	10 (50%)	1.0
Positive	0 (0.0%)	9 (50%)	1 (100%)	10 (50%)	(NS)
Ampullary mass:					
Negative	1 (100%)	16 (94%)	1(100%)	18 (90%)	0.967
Positive	0 (0.0%)	2 (6%)	0 (0.0%)	2 (10%)	(NS)

IHBRD: Intrahepatic Biliary Radicle Dilatation.

CBD : Common bile duct.

p : Is significant if ≤0.05.

Table (10): Intra-operative findings in relation to pathologic grades of the studied patients.

Variables	Pathologic grade (Mean±S.D)			Total (Mean±SD)	*p*-Value
	Grade I	Grade II	Grade III		
- Operative time (min)	280.0±0.0	378.75±50.0	510.0±0.0	381.0±58.5	0.032 (S)
- Blood loss (CC)	200.0±0.0	287.5±86.6	500.0±0.0	295.0±98.5	0.031 (S)
	No. (%)	No. (%)	No. (%)	Total (n=20)	*p*
Plasma transfusion:					
Negative	1 (100%)	12 (66.7%)	0 (0.0%)	13 (65%)	0.021
Positive	0 (0.0%)	6 (33.3%)	1 (100%)	7 (35%)	(S)
Blood transfusion:					
Negative	1 (100%)	12 (66.7%)	0 (0.0%)	13 (65%)	0.021
Positive	0 (0.0%)	6 (33.3%)	1 (100%)	7 (35%)	(S)

p : Is significant if ≤0.05.

Table (11): Post-operative data in relation to delayed gastric emptying of the studied patients.

Variables	Pathologic grades			Total	*p*-Value
	Grade I	Grade II	Grade III		
Time of Ryle removal (days):					
Mean±SD	3.00±0.0	3.50±0.82	5.00±0.0	3.50±0.83	0.229
Time of oral feeding (days):					
Mean±SD	3.00±0.0	4.13±0.89	5.00±0.0	4.05±0.89	0.350
Length of DGE (days):					
Mean±SD	0.00±0.0	1.50±1.37	3.00±0.0	1.75±1.55	0.074
Vomiting:	No. (%)	No. (%)	No. (%)	No. (%)	
No	1 (100%)	5 (27.8%)	0 (0.0%)	6 (30%)	0.304
Yes	0 (0.0%)	13 (72.2%)	1 (100%)	14 (70%)	

DGE: Delayed gastric emptying. *p* : Is significant if ≤0.05.

Table (12): Postoperative complications regarding pathologic grades of the studied patients.

Postoperative complication	Pathologic grades			Total	*p*-Value
	Grade I	Grade II	Grade III		
Chest infection:					
Negative	0 (0.0%)	14 (77.8%)	1 (100%)	15 (75%)	0.228
Positive	1 (100%)	4 (22.2%)	0 (0.0%)	5 (25%)	(NS)
Abd. Infection:					
Negative	1 (100%)	17 (94.4%)	1 (100%)	19 (95%)	0.967
Positive	0 (0.0%)	1 (5.6%)	0 (0.0%)	1 (5%)	(NS)
Wound infection:					
Negative	1 (100%)	14 (77.8%)	1 (100%)	16 (80%)	0.321
Positive	0 (0.0%)	4 (22.2%)	0 (0.0%)	4 (20%)	(NS)
Leak infection:					
Negative	1 (100%)	13 (72.2%)	1 (100%)	15 (75%)	0.312
Positive	0 (0.0%)	5 (27.8%)	0 (0.0%)	5 (25%)	(NS)

Abd. Infection: Abdominal infection.

p : Is significant if ≤0.05.

Table (13): Laboratory investigation on discharge in relation to pathologic grades of the studied patients.

Variables	Pathologic grades (Mean±S.D)			Total (Mean±SD)	*p*-Value
	Grade I	Grade II	Grade III		
- Hb (g/dl):	11.8±0.0	10.39±0.77	9.1±0.0	10.32±0.86	0.076
- WBC (10^3/cc):	10.4±0.0	9.13±5.51	11.8±0.0	9.46±6.00	0.970
- Platelet (103/cc):	199±0.0	241.25±57.26	312±0.0	239.6±56.78	0.475
- Creatinine (mg/dL):	1.2±0.0	0.71±0.51	0.0±0.0	0.71±0.50	0.406
- AST (U/dL):	42±0.0	40.56±0.96	44±0.0	40.75±1.21	0.423
- ALT(U/dL):	35±0.0	38.56±1.46	40±0.0	38.55±1.61	0.079
- D. bilirubin (mg/dL):	1.0±0.0	1.81±1.24	0.49±0.0	1.6±1.19	0.507
- T. bilirubin (mg/dL):	2.3±0.0	3.24±2.71	1.5±0.0	3.01±2.52	0.880
- PT (Sec.):	11.9±0.0	11.81±0.13	11.7±0.0	11.8±0.13	0.731
- INR:	1.8±0.0	1.73±0.12	1.7±0.0	1.73±0.11	0.912
- Na+ (mmol/dL):	130±0.0	134.31±2.85	132±0.0	133.6±2.95	0.175
- K+ (mmol/dL):	3.2±0.0	3.63±0.23	3.2±0.0	3.55±0.26	0.056
- CRP (mg/dL):	30.2±0.0	30.38±0.19	30.4±0.0	30.39±0.20	0.384

Hb : Hemoglobin.
WBC : White Blood Cells.
D. Bil : Direct Bilirubin.
T. Bil : Total bilirubin.
AST : Aspartate aminotransferase.
ALT : Alanine transaminase.
PT : Prothrombin time.
INR : International Normalization Ratio.
CRP : C-Reactive Protein.
p : Is significant if ≤0.05.

Table (14): ICU and hospital stays of the studied patients regarding phathologic grades.

Variables	Pathologic grades			Total	*p*-Value
	Grade I	Grade II	Grade III		
ICU stay (days):					
Mean±SD	3.0±0.0	5.56±2.97	4.0±0.0	6.2±4.8	0.088
Range	3.0-3.0	3.0-13.0	4.0-4.0	3.0-13.0	
Hospital stays (days):					
Mean±SD	8.0±0.0	9.31±0.95	11.0±0.0	9.9±3.02	0.062
Range	8.0-8.0	8.0-15.0	11.0-11.0	8.0-25.0	

ICU: Intensive Care Unit.
p : Is significant if ≤0.05.

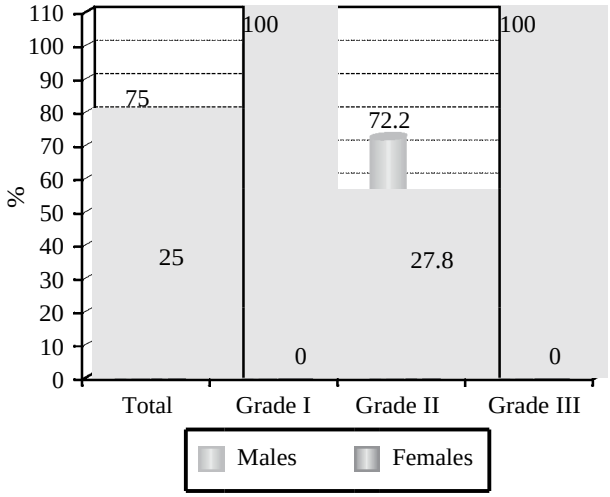

Fig. (1): Sex distribution in relation to pathologic grades of the studied patients.

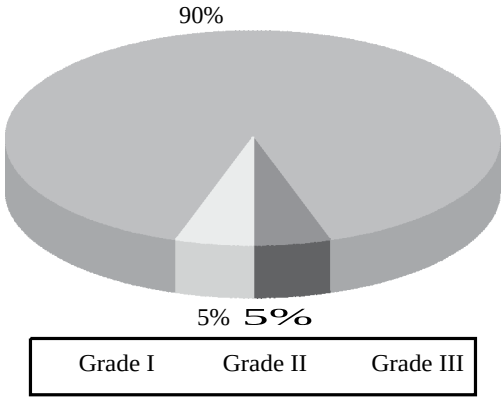

Fig. (2): Pathologic grades of the studied patients.

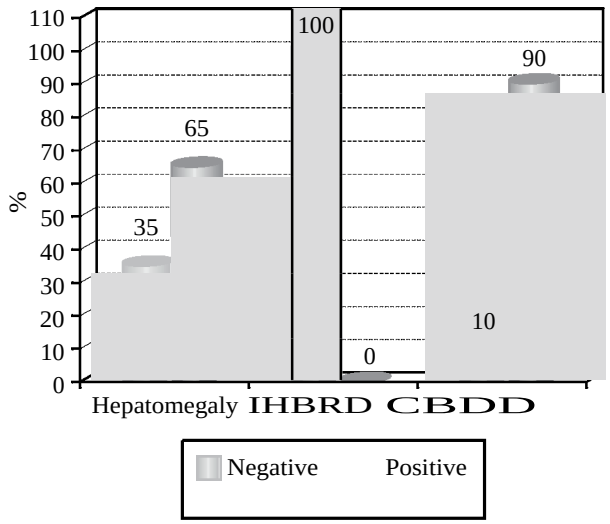

Fig. (3): Ultrasonographic findings in cases of the study.

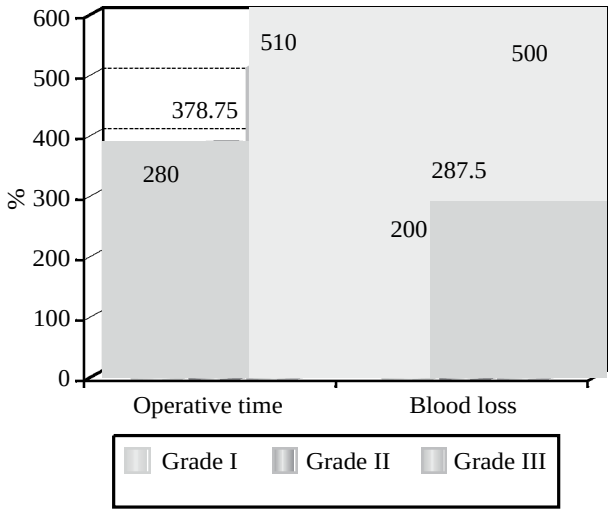

Fig. (4): Intraoperative findings in cases of the study.

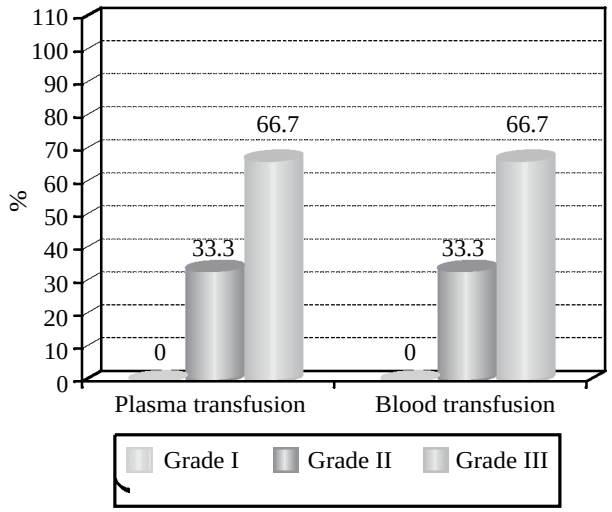

Fig. (5): Intraoperative need for blood and/or plasma transfusion in studied casse.

Discussion

Pancreatic carcinoma is an aggressive malignancy, resulting in a poor prognosis. This is reflected by a 5-year survival <6% and a median survival of <6 months. At present, surgical resection is the best method of treatment for periampullary and pancreatic carcinomas. However, high rates of postoperative complications remain significant causes of mortality and significantly prolonged hospitalizations **[8]**.

Partial pancreaticoduodenectomy (PD) is considered standard therapy for resectable malignant neoplasms of the pancreatic head, distal common bile duct and papilla of Vater as well as precursors with malignant potential, such as intra-ductal papillary mucinous neoplasia (IPMN). The classical partial pancreaticoduodenectomy with resection of the distal stomach was modified by Traverso in the 1970s by introducing the pyloruspreserving technique (pylorus-preserving partial pancreaticoduodenectomy ppPD) **[9,10,11]**.

Delayed gastric emptying (DGE) is one of the most frequentcomplications after pancreaticoduodenectomy with reported incidences of 20-40%. In addition, DGE is a troublesomecomplication because it lengthens the hospital stay, increases costs, and may require enteral or parenteral feeding. Some reports denoting that the incidence of DGE is higher in patients who undermwent PpPD than in those who underwent Whipple's operation. The increased DGE rates after PpPD were thought to be due to pylorospasm, although the precise pathophysiological mechanisms causing DGE are not yet well known **[3]**.

Although DGE is not a lethal complication, it is associated with reduced quality of life and prolonged length of hospital stay **[12]**. Severe cases may even lead to delayed initiation of subsequent therapeutic measures such as adjuvant chemotherapy **[11,13,14]**.

This study aimed to assess the incidence and management of delayed gastric emptying, as one of the most common complications following PPPD in management of peri-ampullary cancer at the Department of Hepato-Pancreato-Biliary (HPB) Surgery, National liver institute, Menuofyia University. It carried out during one year from the 1st of November 2020 to the 31st of October 2021.

This was a prospective cross sectional study that carried out on twenty patients with pancreatic head or periampullary carcinoma managed via ppPD whom suffered from delayed gastric emptying (DGE) was classified regarding (a) the duration of naso-gastric tube >3 days and/or need for reinsertion of NG tube or need for prokinitic agent, and (b) the postoperative day when oral intake of solid food was tolerated after pancreatic resection.

Our results revealed that the age of the patients was in the 5th to 7th decades of life without any difference in the age regarding the pathological grade with a a male predominance than females.

Lee and his colleagues, (2021), found in their study that the mean age of the patient was in the 7th decade of life with predominance of male affection by pancreatic cancer which run in lines with our results **[3]**.

Cai and his coworkers, (2020), found in their study that patients age was in the 7th decade of

life which was in agree with our results BUT without any sex predominance which conflicting with our results **[10]**.

Dua and his coworkers, (2018), found in their study that the mean age of patients was between 5^{th} and 7^{th} decades of life which runs in line with our results BUT without significant predominance in the gender which disagree with our results **[15]**.

Klaiber and his coworkers, (2018), found in their study that the mean age of patients was in the 7^{th} decades of life with a male predominance which runs in line with our results **[16]**.

Noorani and his colleagues, (2016), found in their study the mean age was in the 5th decade of life with predominance of male gender which was in agree with our results **[17]**.

In our study the most common phathologic grade was grade II that present in a significant manner.

Noorani and his coworkers, (2016), found in their study that the common presenting grade was I and II (33.3% for each) which run in lines with our results **[17]**.

Lee and his colleagues, (2021), found in their study that the mean grade III (C) was the most common presenting grade in their study which conflicting with our results **[3]**.

In our study there was no specific comorbidity that accompanying the occurrence of pancreatic cancer even in the presence of hypertension in a significant manner this is because the number of patients in our study was so limited (20 patients) that we can not belt on this significance.

Lee and his colleagues, (2021), in their study showed that the incidence of hypertension (HTN) was 29.4%, and the incidence of diabetes mellitus was (23.5%), and only 2.0% had heart diseases which run in lines with our results. Also, Zhao and his coworkers, (2018), showed that their cases of pancreatic cancer were associated with Hypertension (17.2%), CHD (10.3%) and Diabetes (7.8%) which also run inline with our results in the manner of comorbidities but conflicting with our results in the manner of percentage of occurrence this may be due to the difference with our study in the number of cases **[3,7]**.

Dua and his coworkers, (2018), found in their study that diabetes mellitus occurred in 16% cases of the study which run in lines with our results **[15]**.

Klaiber and his coworkers, (2018), found in their study that diabetes mellitus was present in 26.8% of cases which runs in line with our results **[16]**.

The patients of our study presented with GIT symptoms that showed significant response to conservative management in the form of proton-pump inhibitors "Nexium", prokinetics of GIT "Gast-Reg" and GIT disinfectants "Flagyl". While it showed non-significant response to anti-emetics "Primperan and/or Danset". Also the infective symptoms didn't show significant response to a specific antibiotics used "Claforan".

Cai and his coworkers, (2020), found in their study that all patients of their study respond well to proton pump inhibitors and prokinetic drugs for treatment of GIT symptoms (DGE) after operation which was in agreement with our results **[10]**.

In our study, the results showed a non-significant correlation between pancreatic cancer and different viral infections HIV, HBsAg, HCV even post-therapy with Sovaldi.

Studying of our cases revealed non-significant findings in investigations either pre-operative or post-operative "Renal function, liver functions and/or coagulation profile".

Cai and his coworkers, (2020), found in their study found non-significant finding in the investigations of the patients "liver functions, blood picture" which was in agreement with our results **[10]**.

Duan and his colleagues, (2021), found in their study that post-operatively there was increase in the renal function tests which significantly related with occurrence of post-operative complications which disagree with our results **[18]**.

In contrast Miyazaki and his coworkers, (2017), found in their study marked elevation of serum AST and ALT postoperatively **[19]**. Also, in a study by Futagawa and his colleagues, (2019), detected increased serum AST but interpreted as an index of hepatic fibrosis **[20]**.

Nishio and his colleagues, (2019), found in their study elevated serum bilirubin (total and direct) post-duodeno-pancreatectomy whose complaining of DGE and this conflicting with what we found in our results **[21]**.

Ultrasonographic examination (U/S) in our study significantly revealed hepatomegally and common bile duct dilatation with a non-significant

detection of intrahepatic bilary ducts dilatation. Computed tomography (CT) in our results significantly revealed and common bile duct dilatation and intrahepatic bilary ducts dilatation, but failed to signify pancreatic mass whether periampulary or head mass and also failed to signify the presence of pancreatic duct dilatation. Magnetic resonance cholangiopancreatography (MRCP) failed in our study to signify hepatomegally, common bile duct dilatation and/or intrahepatic bilary ducts dilatation.

During operations; there were significant increase of operative time (381±58.5min), blood loss (295±98.5cc), the need for blood and/or plasma transfusion with the advanced phathologic grades but even with these results we can not relay on them as these variable depends on many factors as surgeon's experience, manipulation of tissues during operation and the state of invasion of the tumor when dissected intraoperatively.

Lee and his colleagues, (2021), found in their study that the mean operative time was 4747.5±58.7 min and the mean blood loss was 725.1±343.2 cc which exceeded and conflicting with our results BUT the blood transfusion needed in 21.5% of their cases which run in lines with our results **[3]**.

Cai and his coworkers, (2020), found in their study that operative time mean was 358.6±83min and the operative blood loss was about 463.7± 236.3cc which run in lines with what we found in our study **[10]**.

Also, our results were congruence with Zhao and his colleagues, (2018), who found that no statistically significant differences were observed prior to surgery in various indices, including the duration of surgery and intra-operative hemorrhage **[7]**.

Post-operatively, there was non-significance between pathologic grades regarding the presence of vomiting, the length of period of DGE, the time needed for the presence of Ryle tube or the post-operative time needed to start oral feeding.

Lee and his colleagues, (2021), found in their study that they need to insert NGT for 2.5±1.3 days and needed 5±1.5 days to start solid oral feeding which run in lines with our results **[3]**.

Cai and his coworkers, (2020), found in their study that patients needed about three days to remove NG tube which was in agree with our results and about 5 days post-operatively to start oral feeding which run in lines with our results **[10]**.

Noorani and his coworkers, (2016), found in their study that fistula was commonly complicate surgery which run in lines with our results **[17]**.

Dua and his coworkers, (2018), found in their study that patients needed about 7.5 days post-operatively to start oral feeding which exceeded what we found in our study thus conflicting with our results **[15]**.

In our study the common post-operative complications found were chest infection, abdominal infection, wound infections as well as wound leak with non-significant difference between pathologic grades.

Lee and his colleagues, (2021), found in their study that the most common found post-operative complications included wound leak "pancreatic fistula, chyle, bile" and intra-abdominal collection which run in lines with our study **[3]**.

Cai and his coworkers, (2020), found in their study the commonly occurred post-operative complications were wound leakage "pancreatic fistula, bile", intra-abdominal infection which run in lines with what we found in our study **[10]**.

Klaiber and his coworkers, (2018), found in their study that the most commonly predicted complications were intra-abdominal collection, wound infection, bile leak and chest infection which runs in line with our results **[16]**.

The Intensive care unit stay tome was 6.2±4.8 days and the total hospital stay was 9.9±3.02 days without significant difference between both times in different pathologic grades.

Lee and his colleagues, (2021), found in their study that the mean postoperative hospital stay was 26.6±17.2 days which conflicting with what we found in our study but the difference may be due to post-operative complications and the period for its management. Also, they found a mortality rate of 3.6% which disagree with what we found in our results **[3]**.

Cai and his coworkers, (2020), found in their study that total hospital stay was 16.4±7.68 day which exceeded and conflicting with our study **[10]**.

Noorani and his colleagues, (2016), found in their study that the mean post-operative hospital stay was 21.6 days which conflicting with our results **[17]**.

Mohammed and his coworkers, (2017), found no significant relation between DGE and The ICU in their study and no significant relation between ICU and the pathologic grade of the patients which run in lines with our findings. Also, they detect the total hospital stay of 12 days for their patients with DGE which also agree with what we found in this study **[22]**.

Conclusion:

We can conclude that diagnosis of DGE should be early post-operative to enable early care. DGE commonly presented by GIT symptoms especially vomiting and can be treated successfully by conservation.

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دراسة مستقبلية لمعدل حدوث وعلاج تأخر التصريف المعدى ما بعد إستئصال رأس البنكرياس والإثنى عشر (جزئيا) فى علاج سرطان البنكرياس والمنطقة الأمولية: دراسة أحادية لمركز

مقدمة : يعد سرطان البنكرياس الرابع بين السرطانات المؤدية لحدوث الوفاة ولهذا فالاستئصال الكامل هو الخيار العلاجى الوحيد ولكنه يتصادم مع صعوبة جراحة البنكرياس. ولأن الجراحة هى الخيار الجراحى فإن تأخير التصريف المعدى يحدث عامة بعد العمليات مما يؤدق المريض ويزيد المكث بالمستشفى إضافة إلى زيادة التكلفة.

الهدف من البحث : هدفت هذه الدراسة لتقييم معدل حدوث تأخر إفراغ المعدة وعلاجه فى حالات سرطان البنكرياس المحيط بالمنطقة الأمبولية.

المرضى وطرق العلاج : تمت هذه الدراسة المستقبلية على عشرين مريضاً يعانون من سرطان البنكرياس فى منطقة الرأس أو المنطقة الأمبولية بعلاجهم بالحفاظ على بوابة المعدة مع تعيين هؤلاء الذين يعانون من تأخر التصريف المعدى وعددهم وكيفية علاجهم خلال عام كامل بقسم جراحة الكبد والبنكرياس بمعهد الكبد القومى بالمنوفية بمصر، ولقد تم تقييم الحالات قبل العمليات وتم متابعتهم بعدها لتشخيص تأخير التصريف المعدى وطرق العلاج المحتملة.

النتائج : أثبتت النتائج عدم وجود فارق إحصائى واضح للبيانات العامة للمرضى، الأمراض المصاحبة، الإلتهابات الفيروسية، الفحوصات المعملية قبل وبعد العملية ما تم إيجاده أثناء العملية أو بعد العملية لكن لوحظ زيادة المرض فى الذكور مع زيادة النوع الثانى للمرض وكذا تبين أن تأخير التصريف المعدى يستجيب بصورة جيدة للعلاج التحفظى.

الاستنتاجات : من الدراسة يمكننا استنتاج أن تأخير التصريف المعدى بعد عمليات الحفاظ على بوابة المعدة يجب أن يشخص مبكراً حتى يتم علاجه بصورة سريعة.