

CASE SERIES

Omental Roll up Technique in Pancreaticojejunostomy (In Whipple/ Traverso Procedure) Decreases the Formation of Pancreatic Fistula – A Prospective Consecutive Case Series

Xenaki Sofia, Andreou Alexandros, Athanasakis Elias, Daskalaki Anna, Chalkiadakis George, Chrysos Emmanuel

Department of General Surgery, University Hospital of Heraklion – Crete, Greece

ABSTRACT

Objectives Pancreaticoduodenectomy or Whipple procedure remains the procedure of choice that obtains long survival in pancreatic-head cancer. Few studies have been published describing the benefits of wrapping the omentum around the anastomosis. In our prospective consecutive case series study we compare the frequency of pancreatic fistula formation between patients who underwent omental roll up of the pancreatojejunostomy and the ones who have not. **Methods** Twenty-two patients underwent pancreaticoduodenectomy in our department within six years. The patients were divided into two groups. The first group (n=7) underwent PDE without using the omental flap technique and the second group (n=15), underwent PDE using the omental roll-up technique. The perioperative as well as the postoperative outcome were compared. A prospective consecutive case series was conducted. The pancreatic fistula were detected by measuring the amylase levels from the abdominal drain fluid on the 2nd and 4th postoperative day. **Results** Four patients from Group A developed pancreatic fistula in comparison with two patients from Group B who underwent PDE with the roll up technique. Moreover, one patient from each group presented with postoperative bleeding. **Conclusions** Wrapping of the omentum is in favor of benefit the reduction of pancreatic fistula after pancreaticoduodenectomies. However, more randomized controlled studies are needed.

INTRODUCTION

Pancreaticoduodenectomy (PDE) or Whipple procedure (WP) remains the procedure of choice and the only therapeutic option that obtains long survival in pancreatic-head cancer. It is currently performed at specialized centers and carries a mortality of less than 5%. Despite the evolution in surgery the morbidity rates remain high, ranging from 30% to 65%. Because of improvements in the surgical technique and perioperative care its mortality has fallen dramatically to 5%. The three most common complications following a WP are the formation of pancreatic fistula ranging from 5% to 53%, delayed gastric emptying with a 25% rate as well as postoperative bleeding ranging from 1% to 10%.

Few studies have been published describing the benefits of wrapping the omentum around the anastomosis. Quite recently in 2014 a meta-analysis and systematic review of the literature, concluded that there is no clear evidence

that omental wrapping can prevent pancreatic fistulas after WP.

In our prospective consecutive case series study we compare the frequency of pancreatic fistula formation between patients undergone omental roll up of the pancreatojejunostomy and the ones who have not.

MATERIALS AND METHODS

Study Group

From January 2010 to May 2016, twenty-two (n=22) patients underwent pancreaticoduodenectomy (PDE) in our department. Seventeen patients underwent surgery due to adenocarcinoma of the pancreas and five patients due to carcinoma of the Vater. The patients were divided into two groups. The first group consisting of seven patients (n=7) underwent PDE without using the omental flap technique, within a period of time from January 2010 till December 2011. The second group consisting of fifteen patients (n=15), underwent PDE using the omental roll-up technique, within a period of time between January 2012 and May 2016. The perioperative as well as the postoperative outcome of these two groups were compared. A prospective consecutive case series was conducted.

Parameters Measured

Preoperatively the patients underwent a full check up with lab results as well as ECG (echocardiogram), chest

Received October 31st, 2016 - Accepted December 14th, 2016
Keywords Omental flap, Roll up, Pancreatic cancer, fistula, Whipple procedure
Abbreviations PDE Pancreaticoduodenectomy; PF Pancreatic fistula, POD Post operative day; WP Whipple procedure
Correspondence Sofia Xenaki
Department of General Surgery
University Hospital of Heraklion – Crete
Greece
Tel 0030 2810392676
Fax 0030 2810542063
E-mail sofiaabecks@yahoo.gr

X-ray, spirometry and CT scan of chest and abdomen. Moreover albumin levels and cancer markers (CEA, Ca 19-9, aFP) were measured in all 22 of the patients. The nutritional status of the patients was evaluated.

Perioperatively blood tests were measured to evaluate the need for blood transfusion as well as to check the levels of the electrolytes and the renal/liver function. Furthermore, the pancreatic tissue was evaluated as hard or soft by the surgeon with palpation. The pancreatic duct was also measured and evaluated as dilated (diameter >3 mm) or not dilated (diameter <3 mm). Moreover, the bile duct was measured and evaluated as dilated or not. The infusion of somatulin analogue was also evaluated.

Postoperatively blood tests were counted daily as well as the amylase levels of the fluid coming out of the drainage on the 2nd and 4th postoperative day. The wound was evaluated as well as the nutritional status. Postoperatively all the patients remained in the (Intensive Care Unit) ICU for monitoring. According to our protocol, amylase levels from the abdominal drain fluid were measured on the 2nd and 4th postoperative day. The drain was removed on the 5th - 7th postoperative day when no fistula was detected. Otherwise the drainage was maintained intact. On the 5th - 7th postoperative day the patients underwent upper gastrointestinal tract pacification with water-soluble contrast to visualize a potential anastomotic leak.

Surgical Procedure

Preoperatively all the patients received prophylactic antibiotic therapy as well as intestinal preparation, intravenous hydration and respiratory physiotherapy. Right before the surgery, epidural analgesia was conducted, a urine catheter and a nasogastric tube were placed as well as a central venous catheter and an arterial catheter. Intraoperatively the patients underwent Traverso procedure as described in the literature. A Kocher-Chevron incision was conducted 2cm below the costal margin. Cholecystectomy was performed as well as excision of the head and neck of the pancreas and duodenectomy removing the 2nd, 3rd and 4th part of the duodenum. The hepatic artery, the portal vein, the celiac trunk and the superior mesenteric artery were routinely skeletonized. The pylorus was preserved as well as 2 cm of the 1st part of the duodenum. Later on, the jejunum helix was mobilized and three anastomosis were conducted: an endsided pancreatojejunostomy, an endsided choledochojejunostomy as well as an endsided duodenojejunostomy. The nasogastric tube was inspected within the stomach and was set with a stitch on patients' nose. A feeding jejunostomy was performed using either a Folley catheter or a jejunostomy set when available. Before closing, an abdominal drain was placed through the hiatus of Winslow near the right side of the pancreatojejunostomy.

Omental Roll-Up Technique

After performing all three of the anastomosis and the peritoneal cavity was washed up with water for

injection, the greater omentum, which was detached from the colon to reveal the lesser epiploic sac, was divided using a Ligasure Precise, longitudinally up to the left gastroepiploic vessels which were systematically preserved (**Figure 1**). The flap which was evaluated viable, was then mobilized and placed circumferentially anteriorly on the pancreatojejunostomy and fixed by three non-absorbable sutures (**Figures 2ab**).

RESULTS

Patients' Characteristics

The 1st group (Group A) consisted of seven patients, five of which were males and two of which were females. The 2nd group (Group B) consisted of fifteen patients - eight of which were males and seven were females. All patients aged >45 years old. ASA score was 1 in eighteen patients (four from Group A and fourteen from Group B), 2 in three patients (two from Group A and one from Group B) and 3 in one patient (from Group A) (**Table 1**). Eighteen patients were malnourished (Albumin level was counted preoperatively as well as BMI) (four from Group A and fourteen from Group B) while four patients were overweight (30>BMI>25) (three from Group A and one from Group B). The diameter of Wirsung duct was dilated >3 mm in eleven patients (two from Group A and nine from Group B) while normal in the other eleven study patients. Two patients from Group A and five patients from Group B had a fatty pancreas. All of the twenty two patients preoperatively were infused with prophylactic antibiotic Ertapenem 2gr and received intravenous hydration and bowel preparation with cathartics. Furthermore preoperative biliary drainage was performed in twelve patients in total (five from Group A and seven from Group B). Nineteen patients had a hard pancreatic tissue (six from Group A and thirteen from Group B) while three patients has a soft pancreas (one from Group A and two from Group B). Somatulin analogue was infused perioperatively in twenty one of the patients while one patient from study Group B received no analogue. All of the twenty two patients postoperatively carried a feeding jejunostomy. None of the patients required portal vein or arterial resection. None of the patients either from Group A or from Group B received preoperative chemotherapy.

Postoperative Results

All of the twenty two patients remained postoperatively routinely in the Intensive Care Unit (ICU) for 24 hour-monitoring. Overall morbidity in the Group A was measured 71.4% and in the Group B it was counted 26.6%. In details, four patients from Group A developed pancreatic fistula versus two patients from Group B (**Table 2**). The pancreatic fistula were detected by measuring the amylase levels from the abdominal drain fluid on the 2nd and 4th postoperative day. The amylase levels (u/L) are presented in **Table 3**. Four patients from Group A developed pancreatic fistula in comparison with two patients from Group B who underwent PDE with the roll up technique. Moreover, one patient from each group

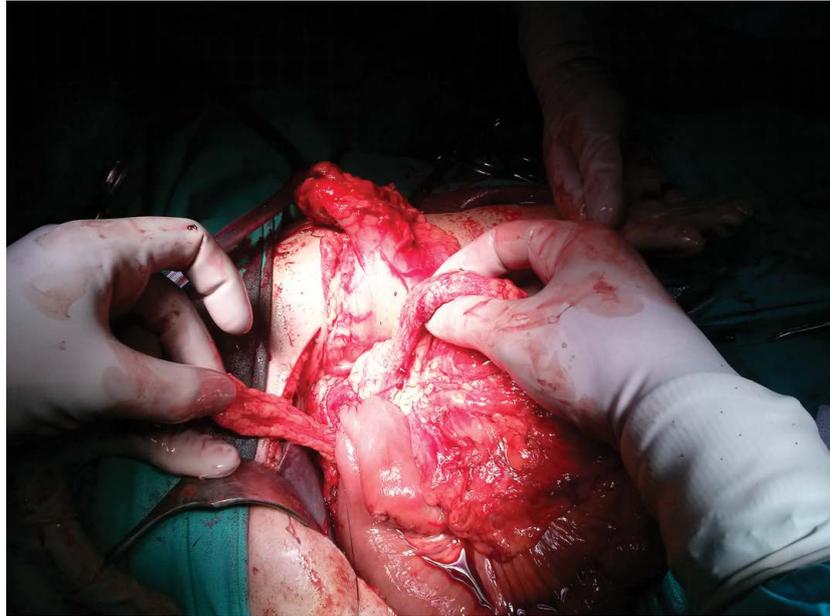


Figure 1. Omental Flaps.

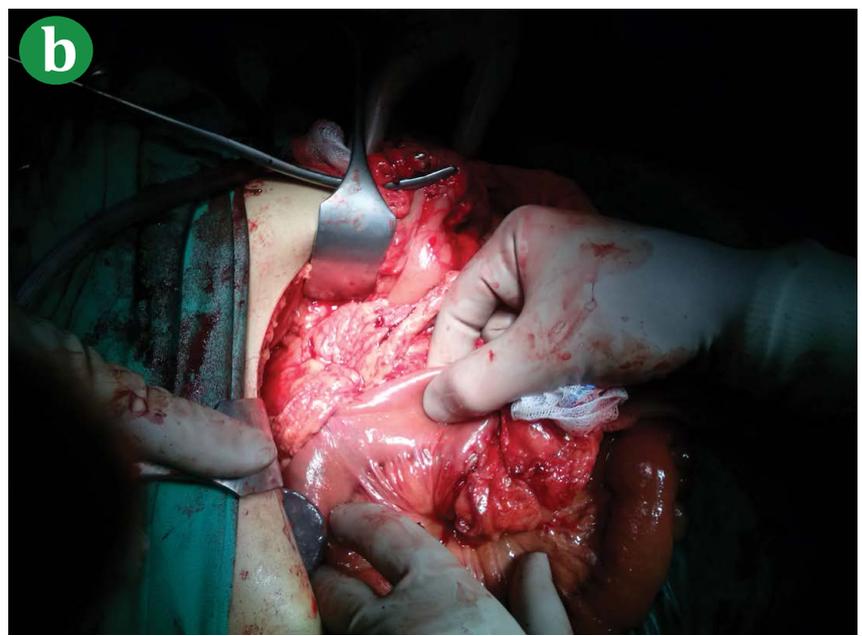


Figure 2(ab). Roll up in pancreaticojejunostomy.

appeared with postoperative bleeding due to splenic vessels and passed away. None of the patients presented with delayed gastric emptying as proved with undergoing upper gastrointestinal tract opacification with water-soluble contrast to visualize a potential anastomotic leak. One patient from each group developed intra abdominal collection as appeared in the abdominal ultrasound and was imbibed (absorbed) on the 6th POD on both cases. Perianastomotic collection was observed on the 4th POD in two patients of Group B versus four patients from Group A. These patients were the ones who developed pancreatic fistula. Dysfunction of the feeding jejunostomy was observed. The jejunostomy was either removed or kept closed. Most patients were discharged within 12 days postoperatively.

The univariate analysis revealed that patients who underwent PDE using the omental flap technique appeared

to develop less postoperative complications specifically lower percentage of pancreatic fistula or anastomotic leaks and less days of hospitalization.

DISCUSSION

The great omentum could be characterized as the “Knight of the Abdominal Cavity” since it has several advantages and offers plenty of benefits. In details the omentum offers the benefits of proper vascularization, neovascularization, prothrombin activation, fluid absorbance, formation of adhesions around the anastomosis offering protection as well as protection against infections and acceleration of the healing process [1, 2, 3]. First described by Moriura *et al.* in 1994, wrapping in pancreatic surgery involves the use of the omentum or the falciparum ligament to wrap the pancreaticojejunostomy as well as local retroperitoneal vessels [3, 4, 5]. This technique mostly

Table 1. Patients' characteristics.

	GROUP A (n=7)	GROUP B (n=15)
Age:		
> 45, <60	6	10
> 60	1	5
Gender:		
Male	5	8
Female	2	7
ASA score:		
1	4	14
2	2	1
3	1	0
Albumin:		
> 3.5g/dl	1	3
< 3.5g/dl	6	12
BMI:		
>25	4	14
>30	3	1
Wirsung duct diameter:		
> 3mm	2	9
< 3mm	5	6
Pancreatic tissue:		
Hard	6	13
Soft	1	2
Fatty	2	5
Non fatty	5	10
Prophylactic Antibiotics:		
Yes (Ertapenem 2gr)	7	15
No	0	0
Preoperative Hydration:		
Yes	7	15
No	0	0
Bowel cathartics:		
Yes	7	15
No	0	0
Preoperative Biliary Drainage:		
Yes	5	7
No	2	5
Somatulin Analogue:		
Yes	7	14
No	0	1
Postoperative feeding jejunostomy:		
Yes	7	15
No	0	0
Preoperative Neoadjuvant Chemotherapy:		
Yes	0	0
No	7	15
Vessels resection:		
Yes	0	0
No	7	15
Perioperative Transfusion:		
Yes	5	10
No	2	5
Diagnosis:		
Pancreatic Adenocarcinoma	5	12
Carcinoma of the Vater	2	3

popular in Asia rather than in Europe or in USA, offers two purposes; Firstly, it reduces the rate of postoperative hemorrhage avoiding the slipping of vascular ligatures due to the action of pancreatic juices. Secondly, this technique decreases the formation of pancreatic fistula around the pancreaticojejunostomy preventing serious complications [2, 4, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16]. Of course, many studies are in progress since no clear evidence exists at present, proving the benefits of this technique.

Pancreatic fistula formation is the most serious complication following PDE. It is accompanied by a high

rate of mortality that ranges from 8% to 28%. Its direct and indirect morbidity rates are also high as it causes intra-abdominal infection often accompanied by bleeding of the great abdominal vessels in 16-40% of the patients [2, 5, 6, 7, 17, 12]. Factors that may lead to formation of pancreatic fistula are small pancreatic duct (diameter <3 mm), soft pancreatic parenchyma, postoperative bleeding, heart disease, advanced age and need for transfusion perioperatively [2, 6, 12, 16].

Many technical variations have been tested in order to create a safe anastomosis between the pancreas and the jejunum just to avoid the formation of pancreatic fistula; various types of pancreaticojejunostomy like end-to-end/end-sided/nucleation of the pancreas or duct to mucosa anastomosis or even the use tutors/biological adhesives, duct occlusion, external drainage and many more [2, 7, 12, 15, 16, 17]. One of the above techniques which are quite promising is the wrapping of the omentum.

The wrapping technique involves the use of the omentum surrounding the pancreaticojejunostomy offering two main benefits: 1) placing the omentum around the pancreaticojejunostomy may form a barrier to avoid the formation of pancreatic fistula and 2) the omentum may protect the surrounding organs against the autolytic effect and proteolytic activity of the pancreatic

Table 2. Postoperative results.

	GROUP A (n=7)	GROUP B (n=15)
ICU stay:		
Yes	7	15
No	0	0
Overall Morbidity:	5 pts 71.4%	4 pts 26.6%
Pancreatic Fistula:		
Yes	4	2
No	3	13
Postoperative Bleeding:		
Yes	1	1
No	6	14
Delayed Gastric Emptying:		
Yes	0	0
No	7	15
Perianastomotic collection:		
Yes	4	2
No	3	14
Intra abdominal Collection:		
Yes	1	1
No	6	14
Relaparotomy:		
Yes	1	1
No	6	14
Jejunostomy dysfunction:		
Yes.	3	4
No	4	11
Hospital stay:		
< 12 days	4	12
> 12 days	3	3
Deaths:		
Yes	1	1
No	6	14

Table 3. Amylase levels from the abdominal drain fluid as counted on the 2nd and 4th postoperative day (POD).

Group A (n=7)	2 nd POD	4 th POD
Patient 1	85 u/L	440 u/L
Patient 2	12 u/L	50 u/L
Patient 3	2814 u/L	14058 u/L
Patient 4	80 u/L	5 u/L
Patient 5	3025 u/L	18 u/L
Patient 6	5690 u/L	1800 u/L
Patient 7	4 u/L	2 u/L
Group B (n=15)	2 nd POD	4 th POD
Patient 1	20023 u/L	14058 u/L
Patient 2	203 u/L	60 u/L
Patient 3	247 u/L	10 u/L
Patient 4	165 u/L	15 u/L
Patient 5	80 u/L	2 u/L
Patient 6	8 u/L	7 u/L
Patient 7	45 u/L	4 u/L
Patient 8	7 u/L	6 u/L
Patient 9	10 u/L	6 u/L
Patient 10	10 u/L	7 u/L
Patient 11	140 u/L	60 u/L
Patient 12	36000 u/L	20300 u/L
Patient 13	54 u/L	0 u/L
Patient 14	0 u/L	0 u/L
Patient 15	12 u/L	5 u/L

fluids (which are rich in trypsin and elastase), especially the local vessels like gastroduodenal artery, portal vein, hepatic artery and celiac trunk [2, 6, 10, 14, 15, 16, 17].

The use of the omentum has been previously described in the gastrointestinal trunk especially in colorectal anastomosis or anastomosis of the small intestine with many benefits [3]. The omental wrapping in pancreaticojejunostomy has been described in recent studies.

In their retrospective series of 54 pancreaticoduodenectomies, Kurosaki *et al.* in 2004 used the omentum to protect vessels, placing it in the retroperitoneum and behind the pancreaticojejunostomy. The pancreatic fistula rate was 9.3% and there was no bleeding [17].

In 2005, Maeda *et al.* conducted a prospective series of 100 pancreaticoduodenectomies reporting a technique, dividing the greater omentum in order to create a flap that is positioned in front of the vessels (portal vein and hepatic artery) and behind the anastomosis in contact with the posterior face of the pancreaticojejunostomy and the hepaticojejunostomy without covering the front face of the pancreaticojejunostomy, covering and protecting arterial stumps such as the gastroduodenal artery stump. In the article, the authors stress the need to ensure that the stomach is not torsioned. They fix the flap only if it is deemed necessary and perform Doppler ultrasound during and after surgery to ensure proper portal flow. In this study, the pancreatic fistula rate was 15% and the post-operative bleeding rate was 1%. The only patient who presented bleeding had a body mass index of 15, and

the omentum was extremely thin. The authors concluded that wrapping is effective for preventing bleeding but not for diminishing pancreatic fistula [6].

One year later, in 2006, Kapoor *et al.* presented a prospective series of 77 pancreaticoduodenectomies, in 25 of which a double omental flap was used: one wrap to cover pancreaticojejunostomy, and the other covering the duodenojejunostomy. No complications were reported. The pancreatic fistula rate was similar in the wrapping and non-wrapping groups, but the fistulas were less severe in patients with wrapping. The rates of bleeding and mortality were similar in the two groups, but there was no mortality related to post-operative bleeding in the wrapping group [7].

In 2011 Mimatsu *et al.* performed a prospective study (20 pancreatoduodenectomies) in which the omentum and FL were used together to protect vessels and the pancreatogastrostomy. They obtained a pancreatic fistula rate of 10% and no post-operative bleeding was recorded. Nor were there any complications associated with the double wrapping [18].

In 2012, Tani *et al.* conducted a multi-centre retrospective study of 2597 patients who underwent pancreatic surgery. Wrapping with omentum and/or Falci-parum Ligament, was performed in 918 patients. Wrapping patients had a longer operative time, a higher PF rate, more severe fistulas and more wound infection. Interestingly, the amylase level in the drainage was lower in the group with wrapping. The location of the wrapping (vessel protection or peri-anastomotic) did not change the complication rate, which was higher in the group with wrapping in all cases. Wrapping did not decrease the post-operative bleeding rate [14].

Within the same year, three more studies were conducted. Choi *et al.* presented a retrospective series of 68 pancreaticoduodenectomies, dividing the patients into two non-randomized but comparable groups. In the first group, an omental flap was wrapped around the pancreaticojejunostomy to protect the anastomosis and to decrease the rate of pancreatic fistula, and also to protect retroperitoneal vessels. In the second group, the omental roll was not used. The overall pancreatic fistula rate for the series was high (42.3%). The group of patients who underwent omental wrapping of the pancreaticojejunostomy showed a significantly lower rate of fistulas (20.7% versus 59%), less severe fistulas (grade A) and shorter hospital stay. There was no difference in post-operative bleeding rate [12]. Also Rosso *et al.* presented a prospective series of 61 pancreaticoduodenectomies in which there were compared 33 patients with a double omental flap versus 28 patients without wrapping. The double flap protected regional vessels and pancreaticojejunostomy anastomosis. Morbidity rate was 27.8% and the pancreatic fistula rate was 13.1%. The omental flap group presented a reduced rate of relaparotomy (10.7% versus 0%) and perianastomotic collections, but more pleural effusions [19]. Matsuda *et al.* published a retrospective series of 229

patients, in 157 of which an omental flap was performed to protect regional vessels. The overall pancreatic fistula rate was 35.4% and the post-operative bleeding rate was 3.9%. The rate of bleeding in the group without the flap was 8.3%, compared with 1.9% in the group with the flap [5].

CONCLUSION

To summarize, the great omentum represents the “Knight of the Abdominal Cavity” and is characterized by many advantages. Its use in visceral surgery is undoubtedly, beneficial. The wrapping of the omentum, however, in oncologic pancreatic surgery is scarce. In bibliography, few studies have been reported. These studies are retrospective and prospective and not randomized. Thus there are no control groups, so their level of evidence is low. Different types of pancreatic surgery are also mixed up as well as various wrapping techniques, making it difficult to compare the results.

In the existing bibliography, wrapping of the omentum is in favor of the reduction pancreatic fistula after pancreaticoduodenectomies. However, more randomized controlled studies are needed.

Conflict of Interest

The authors declare that they have no conflict of interest.

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