

Modified Whipple–Child pancreaticoduodenectomy with anastomosis on jejunal loop in continuity. Presentation of surgical technique and preliminary observations on 45 patients

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Abstract

Introduction: Cephalic pancreaticoduodenectomy (CPD) is the only current treatment method that can provide long-term survival in patients with periampullary tumors. **Case presentation:** This study is a prospective study conducted between 2010 and 2016 in Hepato-Biliary-Pancreatic Center of "Victor Babeș" University of Medicine and Pharmacy, Timișoara, Romania, where 57 modified Whipple–Child CPDs with anastomoses on jejunal loop in continuity were performed, in patients with periampullary tumors. Twelve patients, who had undergone prior biliodigestive derivations or biliary drainage using endoscopic retrograde cholangio-pancreatography (ERCP), with stenting of the common bile duct, were excluded from the study. In 45 patients with modified Whipple–Child CPDs with anastomosis on jejunal loop in continuity, which were included in the study, overall morbidity rate was 22.22%. Postoperative mortality (within 30 days after the surgery) was 6.66% and six months and one year survival rates, excluding the four patients who died postoperatively, were 91.11% and 80%, respectively, with a median survival of 32 months. The mean operative time was 300 minutes, ranging between 240 and 390 minutes. **Conclusions:** Modified Whipple–Child CPD with anastomoses on jejunal loop in continuity seems to be a therapeutic method promising a decreased overall morbidity rate and a good quality of life and offering a distant survival rate, which is consistent, so far, with data reported in the literature.

Keywords: pancreaticoduodenectomy, loop in continuity, morbidity, anastomoses.

Introduction

Cephalic pancreaticoduodenectomy (CPD) is the only current treatment method that can provide long-term survival in patients with periampullary tumors. Since 1935, when the first one stage pancreaticoduodenectomy was reported by Whipple *et al.* [1], this procedure has suffered over the years many changes that have generated scientific discussion about their benefits in reducing morbidity and improving quality of life [2, 3].

In this context, starting from the procedure imagined by Whipple and modified by Child, in 1948, we tried to make our own technique, characterized by simplicity and respecting both, oncological criteria and restoration of digestive anastomoses as anatomically and functional as possible [1–3].

Aim

The aim of the study is to analyze the relevance of the proposed method and to compare the results with data reported in the international literature, in order to establish its potential benefits.

Patients and Surgical Technique

This study is a prospective study conducted between 2010 and 2016 in Hepato-Biliary-Pancreatic Center (HBPC) of "Victor Babeș" University of Medicine and Pharmacy, Timișoara from Emergency City Hospital, Timișoara, Romania, where 57 modified Whipple–Child CPDs with anastomoses on jejunal loop in continuity were performed, in patients with periampullary tumors. Four patients with prior biliodigestive derivations and eight patients with biliary drainage performed by endoscopic retrograde cholangio-pancreatography (ERCP), with stenting of the common bile duct, were excluded from the study.

For the 45 selected patients, the presence of single resectable liver metastases (two cases) or the presence of hepatic artery anomalies (six cases) were not considered contraindications to surgery. In none of these cases, the tumor invaded the superior mesenteric artery or celiac trunk.

The general principles underlying the modification of Whipple–Child procedure aimed to create a simple procedure with oncological radicality that combine techniques with scientifically proven benefits regarding

the decrease of postoperative complications and increase of life quality.

Technical principles of our proposed method are:

- free internal biliary drainage since the beginning, by cross-sectioning of the main bile duct immediately after cholecystectomy;

- fewer anastomoses (three);

- restoration of digestive continuity as anatomically and physiologically as possible;

- realization of anastomoses on jejunal loop in continuity, following the sequence: pancreas, bile duct (transmesocolic) and stomach (precolic);

- realization of pancreaticojejunal anastomosis in end-to-end manner, by invagination (Figure 1);

- the anastomosis between common bile duct and jejunal loop is created in end-to-side manner, at about 20–25 cm away from the pancreaticojejunal anastomosis (Figure 2);

- hemigastrectomy with Hoffmeister–Finsterer type gastrojejunal anastomosis on precolic loop, performed at least 50 cm away from the biliary anastomosis; we also created an antireflux mounting, rising the afferent loop on lesser curvature up to the cardia, thus excluding the biliary and pancreatic anastomosis from the digestive circuit and avoiding afferent loop syndrome (Figure 3);

- routine ablation of mesopancreas, including the cases of right or common hepatic artery anomalies (Figures 4 and 5);

- transverse colon suspension to avoid ptosis and compression on afferent loop.

All patients were followed for postoperative progression, in order to identify and treat any complications. At discharge, patients were followed by periodic controls, at least one year or until death, at three months in the first six months, then every six months for the first two years and annually there after, in order to detect possible recurrences, to calculate survival curves and follow quality of life after CPD.

All patients were included in a database and statistical processing of data was made using GraphPad Prism 5.0 Trial Version (Public Domain). Statistical estimation of the results was performed using decision criteria: $p < 0.05$

– statistically significant; $p > 0.05$ – statistically non-significant (NS).

In the 45 patients included in the study, where modified Whipple–Child CPD was performed, the over all morbidity rate was 22.22%, registering a total often complications:

- postoperative hemoperitoneum in three (6.66%) cases, requiring reinterventions in order to achieve hemostasis; in two cases, it was a bleeding from the mesentery of the first jejunal loop, requiring hemostasis and determining routine drainage of Douglas space for further interventions; in the third case, it was a bleeding of a small vein tributary to portal vein that was not observed during CPD and required ligation;

- biliary fistula in two (4.44%) patients, one developing a postoperative biloma, drained through ultrasound-guided puncture and the other one developing a biliary leakage that required a longer maintenance of subhepatic drainage;

- intra-abdominal abscess in one (2.22%) patient, treated conservatively by ultrasound-guided puncture and antibiotics;

- type C pancreatic fistula in one (2.22%) patient with pancreatic stump necrosis, followed by patient's death due to multiple organ failure;

- multiple organ failure in one (2.22%) patient, followed by death of the patient;

- acute myocardial infarction developed in the first 24 hours postoperatively in one (2.22%) case, resulting in death of the patient;

- strangled incisional hernia in one (2.22%) patient, with history of surgery in the lower abdomen, requiring surgery to repair the incisional hernia.

Mean operative time was 300 minutes, ranging between 240 and 390 minutes.

Postoperative mortality rate was 6.66% and six months and one year survival rate, excluding the three patients that died postoperatively, was 91.11% and 80% respectively, with a median survival of 32 months.

Regarding the quality of life, two of the patients had dyspeptic disorders within three months after surgery, which were resolved conservatively six months postoperatively, without requiring other therapeutic intervention.

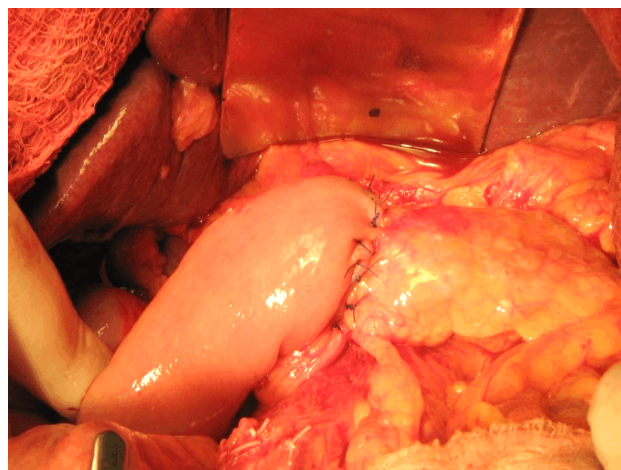


Figure 1 – Pancreaticojejunal anastomosis in end-to-end manner, by invagination.

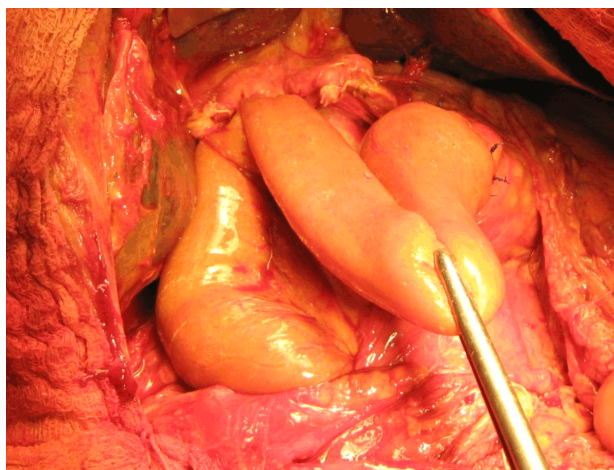


Figure 2 – Anastomosis between common bile duct and jejunal loop.

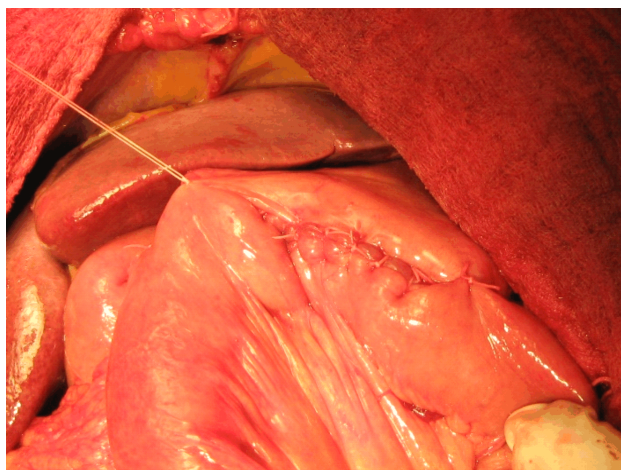


Figure 3 – Gastrojejunal anastomosis on precolic loop.

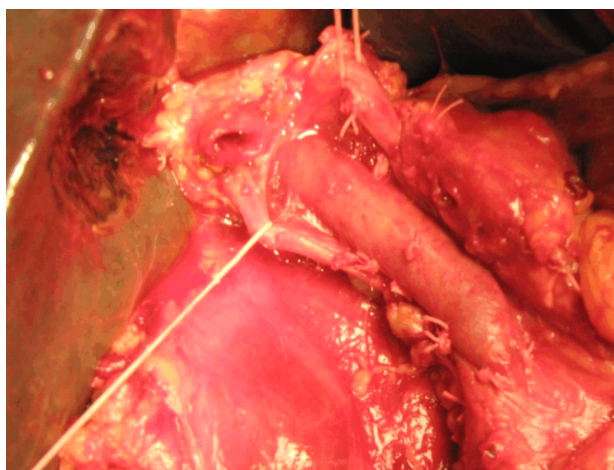


Figure 4 – Mesopancreas resection in one patient with right hepatic artery originated from superior mesenteric artery.

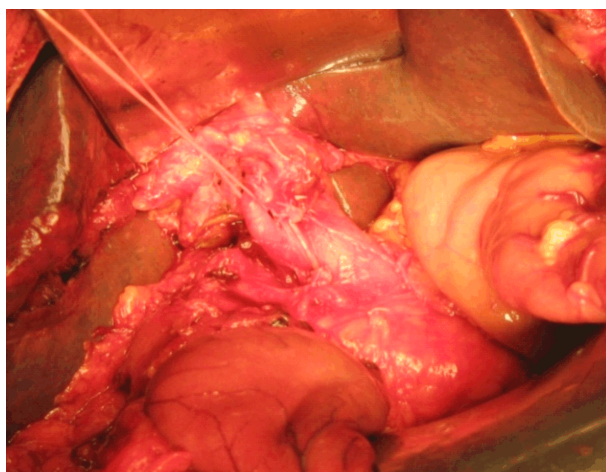


Figure 5 – Mesopancreas resection in one patient with common hepatic artery originated from superior mesenteric artery.

Discussion

Although CPD remains the only treatment modality that can provide long-term survival in patients with malignant periampullary tumors, it is still practiced by a small number of hospitals in Romania [4], fact explained on one hand by the number of patients with periampullary tumors diagnosed in advanced stages, and, on the other hand, by the complexity and extent of this procedure.

Morbidity and postoperative mortality rates achieved in our study, 22.22% and 6.66% respectively, are comparable to those published in the literature (Table 1), although, according to existing studies, low volume centers (less than 10/year) have extremely poor results [4–6].

In a randomized multicenter trial conducted on 329 patients with CPD, Topal *et al.* [7] reported a postoperative morbidity rate of 60.48% ($p < 0.0001$), complications occurring in 199 cases. In the same study, the rate of biliary fistula was 19.75% ($p = 0.012$) and the rate of pancreatic fistula was 13.98% ($p = 0.0256$) (Table 1).

In a multicenter study conducted on 1325 patients with CPD, Addeo *et al.* [8] found a postoperative morbidity

rate of 54.41% ($p < 0.0001$) and a mortality rate of 3.77% ($p = 0.3223$, NS). Regarding the rate of pancreatic fistula, our results and those reported in this study are statistically different ($p = 0.0215$) – 2.22% vs. 14.26% (Table 1).

Another study that confirm the previously mentioned facts is that of Bassi *et al.* [9], conducted on 151 patients, where the morbidity rate ($p = 0.1418$, NS) did not show significant differences compared to our results. Regarding the pancreatic leakage, their rate is significantly higher ($p = 0.0239$) than that reported in our study. However, postoperative mortality in Bassi *et al.* study is significantly lower ($p = 0.0124$). A possible explanation is the fact that two of the three deaths recorded in our group were not related to surgery, one case of acute myocardial infarction developed postoperatively, and in one case a worsening of preexisting hepatorenal impairment, which did not constitute, in our study, a contraindication for CPD (Table 1).

Myocardial infarction occurred in a known coronary patient. After this incident, we modified pain therapy by mild postoperative sedation, major analgesic administration on the automatic syringe, and routine application of nitroglycerin patches, subsequently avoiding myocardial infarction in other patients.

Death following the onset of multiple organ dysfunction syndrome, immediately after the surgery, occurred in a patient with hepatorenal impairment that we considered to be compensated, with serum creatinine values of less than 3 mg%. This led to a change in the strategy of CPD as first intention treatment, in the case of preexisting renal insufficiency.

Regarding bleeding after CPD, in a study on 107 patients treated between January 2005 and December 2008, Mañas-Gómez *et al.* [10] reported a rate of postoperative bleeding that required therapeutic intervention of 16.82% ($p = 0.0976$, NS). In our study, hemoperitoneum was the most common postoperative complication, found in 6.66% of cases.

Although the distant survival needs to be further analyzed by monitoring the patients and calculating of the survival curves at three and five years, the results at six months and one year are encouraging, underlining the

fact that the proposed procedure, satisfy the radicality criteria. Klein *et al.* [11], in a study conducted on 143

patients with ampullary carcinomas, found a one year survival rate of 79% ($p=0.8877$, NS).

Table 1 – Comparison of our results with major international studies

	Our study (n=45)	Topal <i>et al.</i> (2013) [7] (n=329)	<i>p</i> -value	Addeo <i>et al.</i> (2014) [8] (n=1325)	<i>p</i> -value	Bassi <i>et al.</i> (2005) [9] (n=151)	<i>p</i> -value
	Percent	Percent		Percent		Percent	
General morbidity	22.22%	60.48%	<0.0001	54.41%	<0.0001	33.77%	0.1418
Pancreatic leakage	2.22%	13.98%	0.0256	14.26%	0.0215	14.56%	0.0239
Biliary leakage	4.44%	19.75%	0.012	–	–	–	–
Mortality	6.66%	–	–	3.77%	0.3323	0.66%	0.0124

The drainage of the remaining pancreatic stump, either by pancreaticojejunal anastomosis or by pancreaticogastric anastomosis, is a topic highly discussed and disputed in the literature [7–9, 12]. On the one hand, there are studies that support the superiority of pancreaticogastric anastomosis regarding the rate of postoperative complications [7–9], while others point out that both methods yield equally good results, especially in randomized trials [12]. We have opted for a termino-terminal pancreaticojejunal anastomosis with invagination, considering it the safest method, as demonstrated by the extremely low rate of pancreatic fistula. At the same time, we consider that this type of anastomosis also allows an easier resolution of the complications, when reintervention is required. In addition, by performing the pancreaticojejunal anastomosis, we reduced the risk of upper gastrointestinal bleeding, more commonly encountered after pancreaticogastric anastomosis. We did not record any cases of gastrointestinal bleeding in the studied group. In a study of 36 cases of pancreaticoduodenectomy with pancreaticogastric anastomosis, Yu *et al.* [13] had a 5.6% rate for gastrointestinal bleeding.

Our method of restoring digestive continuity derives from the principle of achieving as few anastomoses as possible, and subsequently decreasing the risk of postoperative complications. Unlike the “Y” assembly, our method presents fewer anastomoses, thus reducing both the degree of intraoperative contamination and the risk of complications. A particularly important aspect of the proposed intervention is represented by gastrojejunal anastomosis and especially the antireflux procedure, by raising the afferent loop on the small gastric curvature, up to the level of the cardia. On one hand, it decreases the risk of afferent loop syndrome and delayed gastric outlet syndrome and, on the other hand, excludes biliary and pancreatic anastomosis from the digestive circuit, thus creating a physiological circuit and reducing the risk of leakage.

Although it complicates the surgical procedure, routine ablation of mesopancreas, even in cases of aberrant hepatic arteries, comes to support a goal of CPD, namely oncological radicalism [14–16].

The mean operative time for the studied patients is consistent with the data from the literature [17], but we tried for each and every case to shorten operative time less than 5–6 hours, knowing the fact that longer operative time is associated with more suppurative complications, higher bleeding risk and postoperative respiratory insufficiency.

Conclusions

Modified Whipple–Child cephalic pancreaticoduodenectomy seems to be a therapeutic method that promises a decreased overall morbidity rate and a good quality of life and, in the same time, offers a distant survival rate, which is consistent, so far, with data reported in the literature.

Conflict of interests

The authors declare that they have no conflict of interests.

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