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Surgical Strategy in Patients with Complete Transposition of Internal Organs in Cancer of the Biliopancreatoduodenal Zone

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Aim: to present two clinical cases of successful surgical treatment of patients with a combination of complete transposition of internal organs and cancer of the biliopancreatoduodenal zone.
Key points. A 65-year-old man underwent gastropancreatoduodenal resection for cancer of the large duodenal papilla. In addition to the *situs vicserum inversus*, this patient revealed a special variant of vascular anatomy, namely: separate separation of the left and right hepatic arteries from the ventral trunk. A 70-year-old man, in addition to complete transposition of internal organs, had a combination of cancer of the terminal part of the common bile duct and heterotaxy syndrome in the form of polysplenia, aplasia of the hepatic segment of the inferior vena cava, agenesis of the dorsal pancreatic rudiment ("short" pancreas), intrapancreatic course of the right hepatic artery extending from the superior mesenteric arteries, rotational abnormalities of intestinal development. This patient underwent a total pancreatectomy. In both cases, the main difficulties in mobilizing the pancreatoduodenal complex arose due to anatomical disorientation and the absence of standard (familiar) topographic and anatomical landmarks for the surgeon.
Conclusion. In all patients with tumors of the biliopancreatoduodenal zone, a detailed assessment of the vascular anatomy of this area is required before surgery, with the study of the course of the main visceral vessels and their large branches using multispiral computed tomography in vascular mode. If heterotaxy syndrome is suspected, additional examination is necessary to identify hidden developmental anomalies, which allows surgeons to be prepared for an unusual situation. Gastropancreatoduodenal resection or total pancreatectomy in *situs viscerum inversus* is a technically complex intervention and should be performed in large multidisciplinary medical institutions, and the operating team should have extensive experience in operations on the organs of the biliopancreatoduodenal zone.
Keywords: cancer, complete transposition of internal organs, gastropancreatoduodenal resection, pancreatectomy, vascular anomalies
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Хирургическая стратегия у пациентов с полной транспозицией внутренних органов при раке билиопанкреатодуоденальной зоны

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Цель: представить два клинических наблюдения успешного хирургического лечения пациентов с сочетанием полной транспозиции внутренних органов и рака билиопанкреатодуоденальной зоны.
Основные положения. Мужчине 65 лет выполнена гастропанкреатодуоденальная резекция по поводу рака большого дуоденального сосочка. Помимо *situs vicserum inversus* у данного пациента выявлен особый вариант сосудистой анатомии: раздельное отхождение левой и правой печеночных артерий от чревного ствола. У мужчины 70 лет помимо полной транспозиции внутренних органов имелось сочетание рака терминального отдела общего желчного протока и синдрома гетеротаксии в виде полисплении, аплазии печеночного сег-

мента нижней полой вены, агенезии дорсального зачатка поджелудочной железы («короткая» поджелудочная железа), интрапанкреатического хода правой печеночной артерии, отходящей от верхней брыжеечной артерии, ротационных аномалий развития кишечника. У данного пациента выполнена тотальная панкреатэктомия. В обоих случаях основные сложности при мобилизации панкреатодуоденального комплекса возникли вследствие анатомической дезориентации и отсутствия стандартных (привычных) для хирурга топографо-анатомических ориентиров. У всех пациентов с опухолями билиопанкреатодуоденальной зоны до операции обязательна детальная оценка сосудистой анатомии данной области с изучением хода основных висцеральных сосудов и их крупных ветвей с помощью мультиспиральной компьютерной томографии в сосудистом режиме.

Заключение. При подозрении на синдром гетеротаксии необходимо дообследование на предмет выявления скрытых аномалий развития, что позволяет хирургам быть готовыми к нестандартной ситуации. Гастропанкреатодуоденальная резекция, или тотальная панкреатэктомия, при *situs viscerum inversus* является технически сложным вмешательством и должна выполняться в крупных многопрофильных медицинских учреждениях, а операционная бригада — иметь большой опыт операций на органах билиопанкреатодуоденальной зоны.

Ключевые слова: рак, полная транспозиция внутренних органов, гастропанкреатодуоденальная резекция, панкреатэктомия, сосудистые аномалии

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Introduction

Tumor of the biliopancreatoduodenal area or periampullary carcinoma is a widely used term for a group of malignancies including major duodenal papilla cancer, terminal common bile duct cancer, pancreatic cancer, and duodenal cancer. Currently, the only method that allows to achieve a cure or prolong the life of patients with this disease is surgical — pancreatoduodenectomy (PD). At the same time, the five-year survival rate is from 18 to 67 %, which significantly distinguishes this group of malignant neoplasms from pancreatic cancer, where the prognosis is unfavorable [1]. Radical surgeries for malignant tumors of the biliopancreatoduodenal area are still the most complex surgical interventions that require sufficient technical training and experience of surgeons. In some situations, a rather difficult operation in itself can become even more complicated. These cases include the presence of various anatomical anomalies. Among them, the syndrome of complete transposition of internal organs (situs inversus totalis) is a rare variant of congenital anatomy, occurring in 1 case per 25,000 population [2]. Any operation in such patients is extremely difficult due to the lack of standard topographic and anatomical landmarks and practical experience of such operations. As examples demonstrating the complexity and non-standard performance of radical operations for cancer of the major duodenal papilla and terminal common bile duct in patients with complete organ repositioning and various vascular anomalies, we present our own clinical cases.

Clinical case No. 1

Patient K., 65-years-old male, with *situs inversus totalis*, was hospitalized in the Department of Liver and Pancreatic Surgery of the Cancer Center for additional examination and treatment for cancer of the major duodenal papilla. Earlier in another clinic, percutaneous transhepatic cholecystostomy under ultrasound control was performed for obstructive jaundice. Concomitant diseases include type 2 diabetes mellitus and myocardial infarction in 2001.

According to fibrogastroduodenoscopy (FGDS), the area of the major duodenal papilla was distinctly increased in volume, it filled ½ of the intestinal lumen. A biopsy was taken, histological examination revealed a moderately differentiated adenocarcinoma.

Contrast-enhanced computed tomography (CT) of the chest and abdomen confirmed the patient's *situs viscerum inversus totalis* syndrome. In the projection of the major duodenal papilla, a hypervascular focus of a solid structure was revealed, visualized more clearly in the arterial phase, 18 × 20 × 31 mm in size. In addition, there was a special variant of the blood supply to the liver: trifurcation of the celiac trunk to the splenic, common hepatic and right hepatic arteries. The left hepatic artery is a continuation of the common hepatic artery after the origin of the gastroduodenal artery (Fig. 1).

Biochemical blood test at admission: bilirubin — 130 umol/L (436 umol/L before cholangiostomy), glucose — 13.8 mmol/L, urea — 8.8 mmol/L, AST — 74 U/L, ALT — 70 U/L.

As part of the preoperative preparation, the patient underwent detoxification, hepatotropic, hypoglycemic therapy. The patient's condition was stabilized: the level of total bilirubin decreased to 40 umol/L, diabetes mellitus was compensated by

Figure 1. Computed tomography of abdominal organs with intravenous contrast, 3D-reconstruction in vascular mode. Separate separation of the left and right hepatic arteries from the abdominal trunk

Рисунок 1. Компьютерная томограмма органов брюшной полости с внутривенным контрастированием, 3D-реконструкция в сосудистом режиме. Раздельное отхождение левой и правой печеночных артерий от чревного ствола

medication (the level of glycated hemoglobin was less than 7.5 %).

The patient was operated on, an upper median laparotomy was performed. On examination, there was no effusion in the abdominal cavity and no carcinomatosis. The liver, located on the left, had no signs of focal lesions, the size of gallbladder was reduced, it's wall was thickened up to 0.8 cm, there was drainage in the lumen. The stomach, spleen, as well as loops of the small and large intestine appeared unremarkable. The revision revealed a major duodenal papilla tumor with thickening of the duodenal wall and invasion into the pancreatic head. There were no signs of involvement of the main vessels in the tumor, no data for distant metastasis. Taking into account the results of the revision of the abdominal organs, it was decided to perform a gastropancreatoduodenal resection.

Mobilization of the pancreatoduodenal complex started with access to the superior mesenteric vessels. An inferior artery-first approach (mesenteric approach) was performed. There were no signs of tumor invasion into the superior mesenteric vessels. The hilum of the liver was mobilized, dissection of the hepatoduodenal ligament, celiac trunk, lateral semicircle of the superior mesenteric artery and aortocaval window was performed. During the mobilization of the gastropancreatoduodenal complex, a rare variant of the blood supply to the liver, described by CT scan of the abdominal organs with contrast enhancement, was confirmed — a separate discharge of the left and right hepatic arteries from the celiac trunk. The gallbladder was separated from the liver, the common hepatic duct was exposed, expanded to 1 cm in diameter and transected. Its proximal part was temporarily clamped with bulldog forceps, the distal part — ligated. The duodenum was mobilized by Kocher, the distal third of the stomach — with the greater and lesser omentum. The stomach was transected with a stapling linear apparatus. The gastroduodenal artery arising from the right hepatic artery is ligated, transected. The jejunum at a distance of 15 cm from the ligament of Treitz (at the level of the 2nd jejunal artery) was sutured and transected with a linear suturing device, rotated to the left. The "tunnel" was formed under the isthmus of the pancreas over the portal vein. The pancreas was transected, the ligament of the uncinate pancreas was mobilized and cut off using the Ligasure apparatus. The preparation was removed (Fig. 2).

Taking into account the characteristics of the pancreatic stump (pancreatic duct — 4 mm, dense fibrous gland, distance of mobilization of the gland from the cut — 2 cm), a pancreatic-jejunal anastomosis according to Buchler was formed (duct-to-mucosa, without stenting) (Fig. 3).

At 15 cm from the pancreato-jejunal anastomosis, a hepatico-jejunal anastomosis was formed with a continuous single-row suture. On a separate loop (according to Ligidacis), a gastro-entero anastomosis with an entero-entero anastomosis "side-to-side" was formed. A probe for decompression was installed in the stomach stump, the second one, for feeding, was placed distally to the interintestinal anastomosis. Two safety drains were connected to the area of pancreato-jejunal anastomosis, the wound of the anterior abdominal wall was sutured in layers. The total operation time was 370 minutes, intraoperative blood loss was 350 ml.

A macroscopic specimen in a single complex was sent for pathological and histological examination: the distal part of the stomach with the greater and part of the lesser omentum (along the greater curvature — 5 cm, along the lesser curvature — 3 cm); duodenum with part of the jejunum, total length 27 cm; head of the pancreas with isthmus and uncinate process 5 × 4 × 3 cm; common bile duct 7 cm long, 1.5 cm in diameter; gallbladder 8 × 4 × 3 cm. Macroscopically, there was no germination of the serous membrane of the wall of the duodenum, ingrowth into the head of

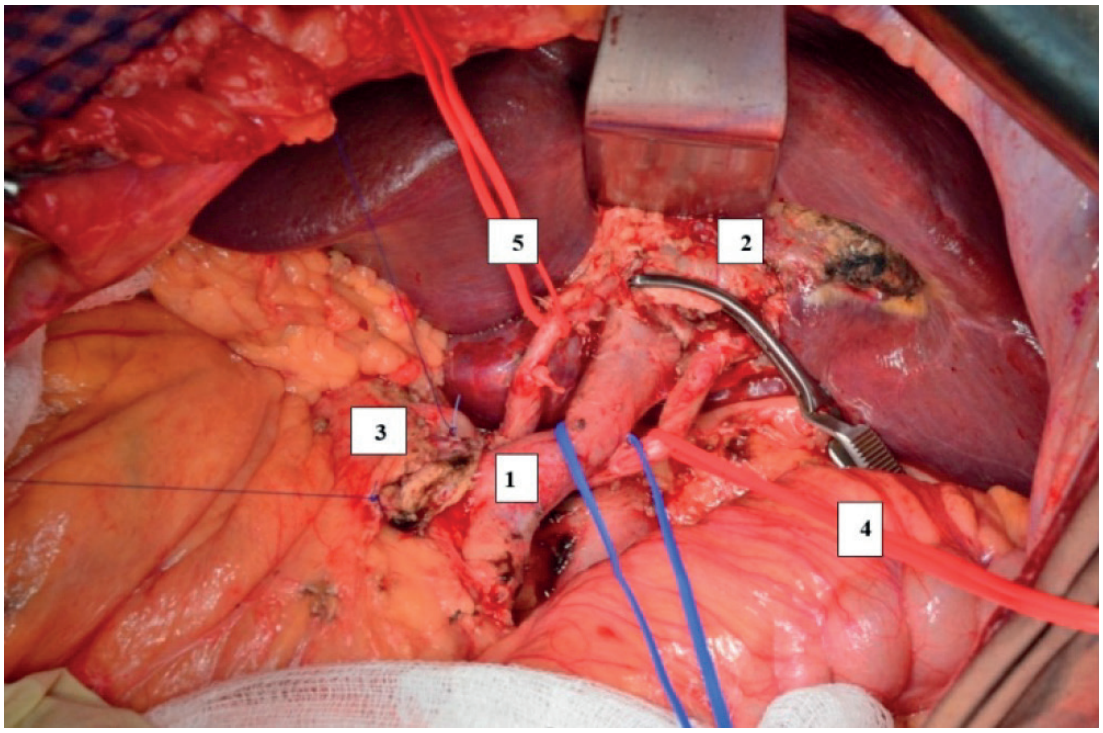

Figure 2. Intraoperative photo after removal of the organocomplex. 1 — portal vein; 2 — common hepatic duct; 3 — pancreatic stump; 4 — right hepatic artery; 5 — left hepatic artery

Рисунок 2. Интраоперационное фото после удаления органокомплекса. 1 — воротная вена; 2 — общий печеночный проток; 3 — культя поджелудочной железы; 4 — правая печеночная артерия; 5 — левая печеночная артерия

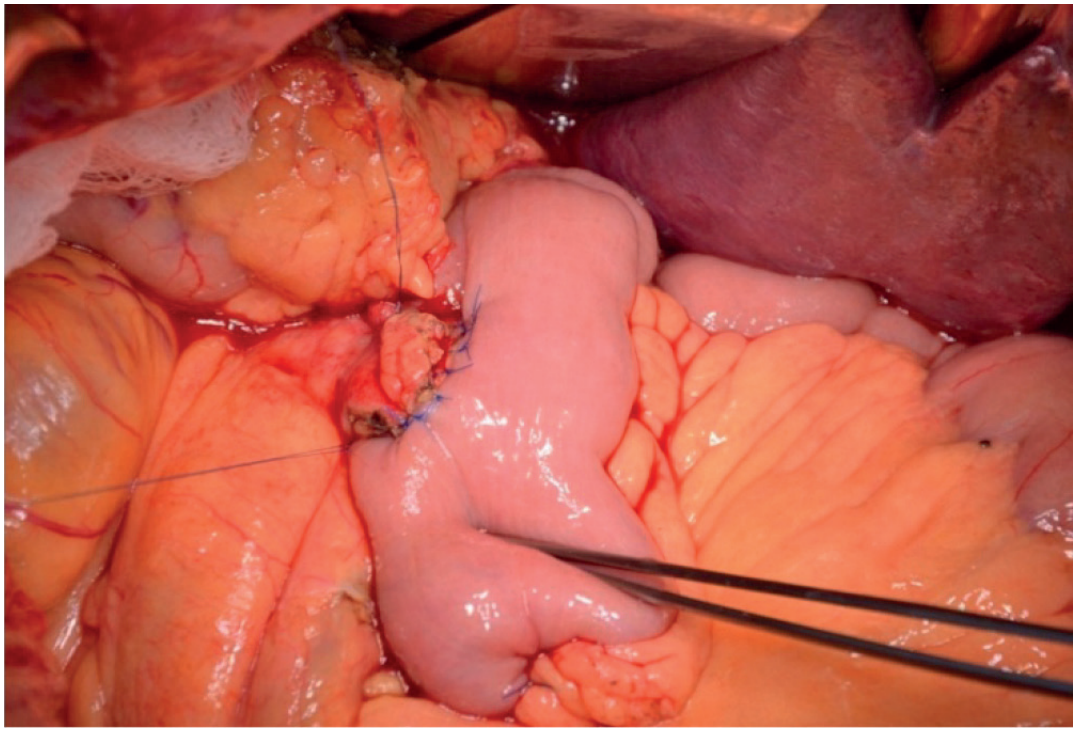

Figure 3. Intraoperative photo of pancreato-jejunal anastomosis formation by Buchler

Рисунок 3. Интраоперационное фото формирования панкреатоеюноанастомоза по Buchler

the pancreas. Microscopic examination in the area of the major duodenal papilla revealed the growth of adenocarcinoma with the formation of tubular structures throughout the tumor node. The tumor infiltrated the mucosa and submucosa of the duodenum, without growing into the muscular and serous membrane of the intestine, pancreatic tissue. No signs of metastatic lesion were found in all isolated regional lymph nodes.

Thus, the patient had ampullary adenocarcinoma, intestinal type, T2N0M0 G1 R0. Lymphovascular and perineural invasion was not detected, the number of lymph nodes with metastatic lesions was 0. The postoperative period was uneventful, the patient was discharged in a satisfactory condition on the 10th day after the operation. At the moment, the observation period is 34 months, there are no signs of recurrence of the disease.

Clinical case No. 2

A 70-year-old man with reverse transposition of the internal organs was hospitalized in the Department of Surgery of the Scientific and Clinical Center for Specialized Medical Care and Medical Technologies for examination and treatment for a tumor of the terminal common bile duct, obstructive jaundice. The duration of jaundice was 3 weeks before admission to the hospital.

The patient was comprehensively examined. In a biochemical blood test: an increase in total bilirubin — to 85.2 mmol/L (due to direct one — 58.1 mmol/L), ALT — 129 U/L, AST — 69 U/L, GGTP — 1065 U/L. ECG (01.20.2020) — dextrocardia, sinus rhythm, heart rate 69 per minute, changes in the myocardium of a hypertrophied left ventricle.

Contrast-enhanced CT revealed a hypovascular tumor with a maximum dimension of 2.5 cm in the intrapancreatic part of the terminal common bile duct. In addition, a syndrome of heterotaxy was revealed in the form of aplasia of the hepatic segment of the inferior vena cava (replaced by an unpaired vein), agenesis of the dorsal pancreatic rudiment ("short" pancreas, absence of the distal part), intrapancreatic course of the right hepatic artery arising from the superior mesenteric, polysplenia (five additional lobules of the spleen, next to the main organ), rotational anomalies in the development of the intestine (Fig. 4, 5).

The patient was operated on; pancreatectomy and cholecystectomy were performed. The course of the operation: median laparotomy, the position of the operating surgeon — to the right of the patient. V–VIII segments of the right lobe of the liver were located in the left subdiaphragmatic space. The left lobe of the liver was hypotrophic, located in the subdiaphragmatic space on the right. There were multiple embryonic adhesions that made visualization difficult. The duodenum and the head

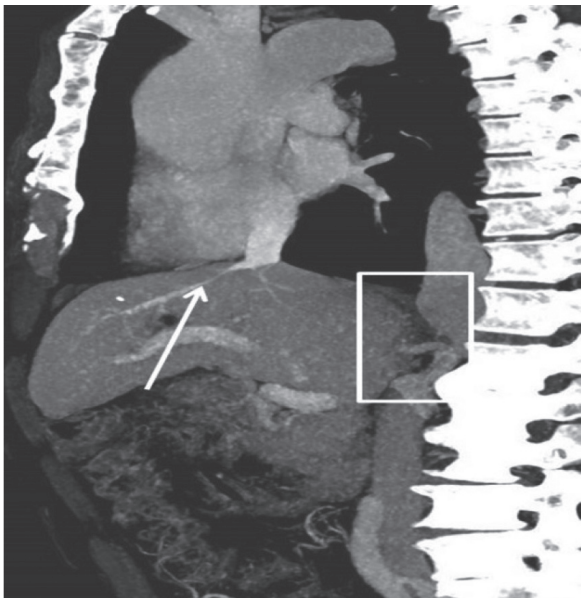

Figure 4. Computed tomography of abdominal organs with intravenous contrast, sagittal reconstruction. Aplasia of the segment of the inferior vena cava (rectangular selection), typical location of the hepatic vein (arrow)

Рисунок 4. Компьютерная томограмма органов брюшной полости с внутривенным контрастированием, сагиттальная реконструкция. Аплазия сегмента нижней полой вены (прямоугольное выделение), типичное расположение печеночной вены (стрелка)

of the pancreas located on the left were mobilized. Pancreatic head had no visible narrowing, transited into the body, making a single formation, 6 × 4 × 4 cm in size. The tail of the pancreas, the uncinate process were absent. A dense tumor, about 3 cm in diameter, was palpated in the region of the head. The gallbladder was stretched and tense. After it had been punctured, about 100 ml of concentrated bile was aspirated. Soft tissue dissection of the hepatoduodenal ligament was performed. The common bile duct was dilated to 1.8 cm. A cholecystectomy was performed, the common hepatic duct was transected. The right hepatic artery originated from the superior mesenteric artery, consistent with preoperative CT findings. Arterial blood supply to the pancreas was carried out by small arterial trunks extending from the right hepatic artery, which transited in the parenchyma of the pancreatic head. The splenic artery did not participate in the blood supply to the pancreas. Small arterial trunks extending from the right hepatic artery were ligated via posterior access. Arteriolysis of the right hepatic artery and the left semicircle of the superior mesenteric artery was performed. Small venous trunks going into the superior mesenteric vein were ligated and transected. Mobilization of the head and the supposed body of

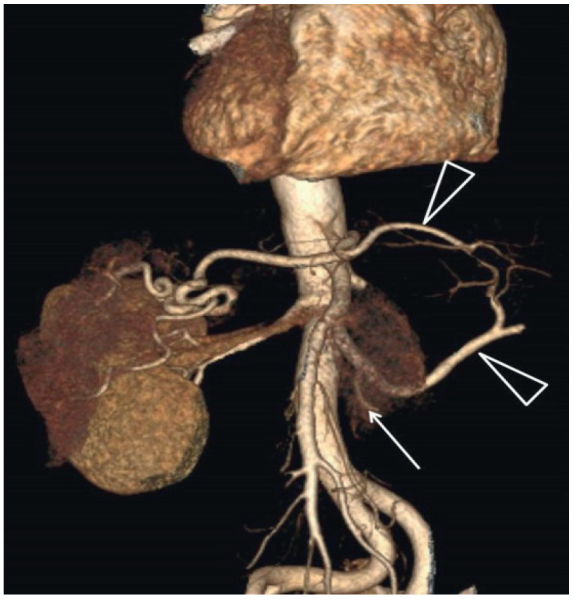

Figure 5. Computed tomography of abdominal organs with intravenous contrast, volumetric imaging (VR-reconstruction). Two hepatic arteries (triangular arrows): the right one departs from the superior mesenteric artery, the left one — from the abdominal trunk. The gastro-duodenal artery departs from the right hepatic artery (arrow)

Рисунок 5. Компьютерная томограмма органов брюшной полости с внутривенным контрастированием, объемное отображение (VR-реконструкция). Две печеночные артерии (треугольные стрелки): правая отходит от верхней брыжеечной артерии, левая — от чревного ствола. желудочно-двенадцатиперстная артерия отходит от правой печеночной артерии (стрелка)

the pancreas was completed. The proximal branch of the jejunum and the lower horizontal branch of the duodenum were mobilized and driven to the left under the superior mesenteric vein. The left hepatic artery, originated from the celiac trunk, was dissected, its pulsation was preserved, despite the narrowing of the celiac trunk determined by CT. Around the mouth of the celiac trunk there was a group of lymph nodes, 1.2 cm in diameter, they were dissected. The splenic artery and vein were preserved. The stomach was mobilized, transected at the border of the middle and lower thirds with the preservation of the left gastric artery. The preparation, consisting of 1/3 of the stomach, duodenal and proximal loop of the jejunum, pancreas, common bile duct, was removed en bloc. Reconstruction of the gastrointestinal tract was carried out by anastomosing the common hepatic duct and the remaining part of the stomach with a loop of the jejunum using the end-to-side method (Fig. 6). Operation duration — 360 minutes, blood loss — 400 ml.

The postoperative period was without complications. On the third day the drainages were removed from the abdominal cavity, on the 10th day the patient was discharged in a satisfactory condition.

Microscopic examination revealed an intraductal papillary tumor of the intrapancreatic part of the common bile duct of the intestinal type, associated with a microfocus of a highly differentiated invasive carcinoma, with invasion into the submucosal layer to a depth of 0.5 mm. No signs of tumor growth were found in the resection margins; there were no signs of tumor growth in the studied 15 lymph nodes. The stage of the disease was established: T1N0M0, G1, R0.

On selected insulin therapy (insulin glargine — 10 units subcutaneously, 1 time per day; and soluble insulin (human genetically engineered) — 4 units subcutaneously, 3 times a day before breakfast, lunch, dinner), the target level of glycated hemoglobin is less than 7.5 %. Glycemic profile (4-fold blood sampling for glucose): sample 1 — 6.2 mmol/L, sample 2 — 3.7 mmol/L, sample 3 — 8 mmol/L, sample 4 — 6 mmol/L. The patient is recommended to undergo monotherapy (capecitabine 1250 mg/m^2 2 times a day on the 1st and 14th days, every 21 days for 6 months).

At present, the follow-up period is 32 months, and no signs of disease recurrence have been identified.

Discussion

The combination of malignant neoplasms of the biliopancreatoduodenal zone with complete transposition of organs in world literature is represented by only a few cases. We conducted a literature search on the MEDLINE network, the search query was ("pancreas" or "pancreaticoduodenectomy" or "pancreatectomy" or "pancreatic neoplasms" or "common bile duct neoplasms") and "situs inversus". A description of only 14 cases of pancreaticoduodenal resection with a reverse arrangement of organs was found, and only one of them had concomitant manifestations of the heterotaxy syndrome, while agenesis of the dorsal pancreatic rudiment was not observed [3–15]. The clinical case No. 1 presented by us is the third case of GPDR performed in case of LDS adenocarcinoma in a patient with complete transposition of internal organs [5, 15].

Heterotaxia is a complex genetically determined syndrome that combines various abnormal malformations of the abdominal and thoracic organs and develops as a result of a defect in lateralization during early embryogenesis with an approximate frequency of 1 case per 10–40 thousand [2]. With heterotaxy, various variants of anomalies are possible and there is no single description of them. In some cases, agenesis of the dorsal pancreatic

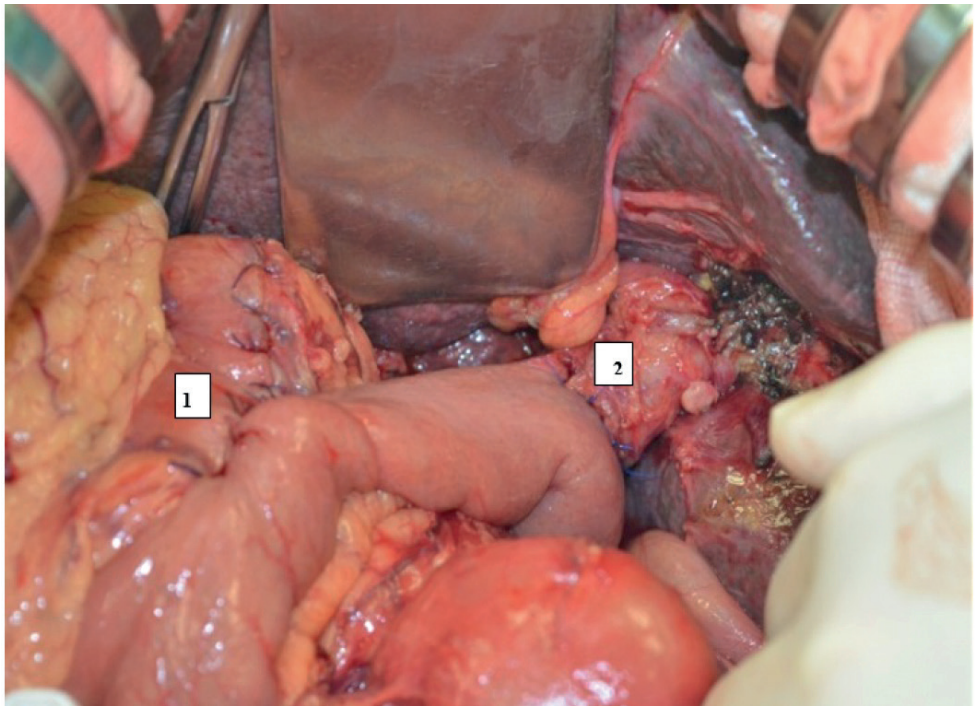

Figure 6. Intraoperative photo. A complete view of the reconstructive stage after total pancreatectomy. 1 — gastroenteral anastomosis, 2 — hepatic-jejunal anastomosis

Рисунок 6. Интраоперационное фото. Законченный вид реконструктивного этапа после тотальной панкреатэктомии. 1 — гастроэнтероанастомоз, 2 — гепатикоеюноанастомоз

rudiment may be observed, however, the absence of the body and tail of the pancreas may be isolated and not combined with other anomalies. In a systematic review by J. Cienfuegos et al. (2016), devoted to agenesis of the dorsal part of the pancreas, a description of 53 patients is presented. None of these cases had total organ transposition with dextrocardia. Pancreatic cancer was diagnosed in 7 patients and ampullar carcinoma — in 2, total pancreatectomy was performed in all 9 cases [16].

In clinical case No. 2, the patient had a combination of such extremely rare developmental anomalies as complete transposition of organs (situs inversus totalis) and heterotaxy syndrome, manifested in the form of polysplenia, aplasia of the hepatic segment of the inferior vena cava, agenesis of the dorsal pancreatic rudiment ("short" pancreas iron), intrapancreatic course of the right hepatic artery, departing from the superior mesenteric artery, rotational anomalies in the development of the intestine. We did not find similar observations in foreign and domestic literature.

Despite a detailed study of the vascular anatomy before surgery, during the operation, the main difficulties arose during the mobilization of the pancreatoduodenal complex due to anatomical disorientation and the lack of standard (habitual) topographic and anatomical landmarks for the surgeon. The most difficult step was the isolation of the right hepatic artery with the preservation of its blood flow, located in the parenchyma of the pancreas.

In the published observations of other authors [3–15], the minimum time of surgical interventions was 9 hours or more. In our cases, the duration of surgical interventions was about 6 hours. In part, this can be associated with a preliminary detailed analysis of the developmental anomalies detected on multislice computed tomography, the patient's asthenic body type, as well as with sufficient experience in performing similar, but standard operations by members of the operating teams (a total number of more than 800 operations).

There were no peculiarities in the conduct of anesthesia or in the course of the postoperative period.

Conclusion

Performing gastropancreatoduodenal resection or total pancreatectomy for *situs viscerum inversus* is a technically complex but feasible intervention

that requires the utmost concentration of attention from the operating surgical team. Successful operation is possible with a thorough preoperative examination, including a detailed study of individual anatomy (multispiral computed tomography in the vascular mode) and preoperative planning of surgical intervention. Clarification of vascular anatomy at the preoperative stage in each specific case allows minimizing the risks of intraoperative complications. Such surgical interventions should be performed in large multidisciplinary medical centers, and the operating team should have extensive experience in operations on the organs of the biliopancreatoduodenal area.

References / Литература

1. *Yamamoto T., Yagi S., Kinoshita H., Sakamoto Y., Okada K., Kenji Uryuhara K., et al.* Long-term survival after resection of pancreatic cancer: A single-center retrospective analysis. *World J Gastroenterol*. 2015;21(1):262–8. DOI: 10.3748/wjg.v21.i1.262
2. *Lambert T.E., Kuller J., Small M., Rhee E., Barker P.* Abnormalities of fetal situs: An overview and literature review. *Obstet Gynecol Surv*. 2016;71(1):33–8. DOI: 10.1097/OGX.0000000000000262
3. *Sakaguchi O., Kamio H., Sakurai H., Kumagai K., Kobayashi E., Kakita N., et al.* Pancreas head carcinoma associated with situs inversus viscerum totalis. *Nihon Geka Gakkai Zasshi*. 1985;86(1):111–5.
4. *Organ B.C., Skandalakis L.J., Gray S.W., Skandalakis J.E.* Cancer of bile duct with situs inversus. *Arch Surg*. 1991;126(9):1150–3. DOI: 10.1001/archsurg.1991.01410330112017
5. *Bilimoria M.M., Parsons W.G., Small W. Jr., Talamonti M.S.* Pancreaticoduodenectomy in a patient with ampullary carcinoma and situs inversus. *Surgery*. 2001;130(3):521–4. DOI: 10.1067/msy.2001.113377
6. *Tsunoda S., Miyashita T., Murata M.* Pancreaticoduodenectomy for common bile duct cancer in a patient with situs inversus totalis: A case report. *Int Surg*. 2006;91(1):24–7.
7. *Macafee D.A., Armstrong D., Hall R.I., Dhingsa R., Zaitoun A.M., Lobo D.N.* Pancreaticoduodenectomy with a "twist": The challenges of pancreatic resection in the presence of situs inversus totalis and situs ambiguus. *Eur J Surg Oncol*. 2007;33(4):524–7. DOI: 10.1016/j.ejso.2006.09.029
8. *Sceusi E.L., Wray C.J.* Pancreatic adenocarcinoma in a patient with situs inversus: A case report of this rare coincidence. *World J Surg Oncol*. 2009;18(7):98. DOI: 10.1186/1477-7819-7-98
9. *Maruyama Y., Horiuchi H., Okabe Y., Kawahara R., Uchida S., Sakai T., et al.* Perioperative challenges associated with a pancreaticoduodenectomy and distal pancreatectomy for pancreatic cancer in patients with situs inversus totalis: Report of two cases. *Surg Today*. 2010;40(1):79–82. DOI: 10.1007/s00595-009-4064-z
10. *Mohandas S., Dickson-Lowe R., Karanjia N.* Intraductal papillary mucinous neoplasm (IPMN) of the pancreas with situs inversus totalis – Case report with review of literature. *J Gastrointest Cancer*. 2012;43(1):136–8. DOI: 10.1007/s12029-011-9352-3
11. *Benhammane H., Kharmoum S., Terraz S., Berney T., Nguyen-Tang T., Genevay M., et al.* Common bile duct adenocarcinoma in a patient with situs inversus totalis: Report of a rare case. *BMC Res Notes*. 2012;5:681. DOI: 10.1186/1756-0500-5-681
12. *Kyuno D., Kimura Y., Imamura M., Uchiyama M., Ishii M., Meguro M., et al.* Pancreaticoduodenectomy for biliary tract carcinoma with situs inversus totalis: Difficulties and technical notes based on two cases. *World J Surg Oncol*. 2013;11:312. DOI: 10.1186/1477-7819-11-312
13. *Khatsiev B., Baichorov E., Kuzminov A.* Pancreatic adenocarcinoma in a pregnant patient with situs inversus: A case report. *International Journal of Biomedicine*. 2014;4(2):107–8.
14. *Chen C., Yi X., He Y., Cai S., Gu G., Sun C., et al.* Pancreatic head cancer involving variant common hepatic artery with situs inversus totalis. *ANZ J Surg*. 2018;88(5):506–8. DOI: 10.1111/ans.13431
15. *Guo C.X., Chen W., Yao W.Y., Li G.G., Zhang Q., Chen Y.W., et al.* The first report of laparoscopic pancreaticoduodenectomy for primary duodenal carcinoma in a patient with situs inversus totalis: Report of a rare case. *Surg Laparosc Endosc Percutan Tech*. 2019;29(3):29–33. DOI: 10.1097/SLE.0000000000000659
16. *Cienfuegos J., Rotellar F., Salguero J., Benito A., Solórzano J.L., Sangro B.* Agenesis of the dorsal pancreas: Systematic review of a clinical challenge. *Rev Esp Enferm Dig*. 2016;108(8):479–84. DOI: 10.17235/reed.2016.4474/2016

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