DOI: 10.15825/1995-1191-2023-1-24-30

ORIGINAL PANCREAS TRANSPLANT TECHNIQUE IN TERMS OF PREVENTION OF INTRA-ABDOMINAL PURULENT COMPLICATIONS

V.L. Korobka, R.V. Korobka, A.M. Shapovalov, M.Yu. Kostrykin, E.S. Pak
Rostov Regional Clinical Hospital, Rostov on Don, Russian Federation

A clinical case of pancreas transplantation (PTx) based on an original technique is presented. The applied technique made it possible to prevent the spread and involvement of the abdominal organs in an inflammatory process caused by postoperative graft pancreatitis, and to preserve the pancreas graft.

Keywords: pancreas transplantation.

INTRODUCTION

Pancreas transplantation (PTx) is one of the complicated sections of surgery due to the greater frequency and number of specific complications in comparison with transplantation of other solid organs [1–4]. Preservation of a fully functioning graft remains a pressing issue in this type of transplantation due to both post-transplant problems associated mainly with exocrine secretion and decreased microcirculation, and surgical complications, because they often lead to graft loss [5–7].

According to various literature sources, 30–40% of pancreas recipients develop surgical complications, and in the early postoperative period, graft loss occurs in 5–8% of cases because of intra-abdominal infectious complications, which are the result of duodenal anastomosis suture failure or graft pancreatitis [2, 4, 8]. This problem is caused by the fact that most transplantation centers still use the technique of intra-abdominal placement of the pancreas graft [9–12]. Infectious complications are the factors that aggravate the structure of the causes and increase post-transplant mortality rates [3, 13].

Occurrence of these problems in the postoperative period not only leads to unsatisfactory PTx outcomes, but also, to a certain extent, aggravates the issue of organ donor pool shortage.

To exclude intra-abdominal purulent complications, our clinic developed and put into practice an original PTx technique.

We present our own clinical observation of a patient in whom PTx was performed according to the original technique.

CLINICAL OBSERVATION

Patient B, female, 34 years old, with disability group 2, on July 17, 2018 presented with complaints of general weakness, increased blood pressure up to 240/115 mm Hg. Her past medical history shows that she has been suffering from type 1 diabetes mellitus for 2 years and 10 months. She has had kidney pathology for more than 4 years. Since February 13, 2018, she has been receiving renal replacement therapy three times a week. Since that time, she has been on the kidney transplant waiting list. In addition, she has proliferative diabetic retinopathy, myopia of the right eye, vitrectomy with vitreous tamponade of the left eye and secondary glaucoma.

On admission, his condition was moderately severe. Diuresis was up to 600 ml per day. There was an arteriovenous (AV) fistula on her left forearm (the last dialysis procedure was on July 17, 2018).

Preoperative diagnosis: type 1 diabetes mellitus, stage 5 chronic kidney disease (CKD), chronic renal failure (end stage), azotemia, stage 3 diabetic nephropathy, renal replacement therapy; long-term hemodialysis since February 13, 2018. Stage 2 Symptomatic (nephrogenic) hypertension, risk 3. FC 2 CHF. Stage 1 diabetic angiopathy of the lower extremities. Proliferative diabetic retinopathy, myopia of the right eye. Corneal leukoma in the left eye. Axonal sensorimotor distal mixed polyneuropathy of upper and lower extremities. Somatogenic asthenia.

The council of doctors decided to perform a surgical intervention on July 17, 2018, involving pancreaticoduodenal and kidney transplantation.

Description of the original technique of pancreas transplantation

At the first stage, the pre-transplant stage, the pancreas graft was prepared. The donor duodenum was sutured on both sides and arterial reconstruction of the splenic and superior mesenteric arteries was performed using a donor Y-shaped vascular insert (Fig. 1).

Corresponding author: Vyacheslav Korobka. Address: 170, Blagodatnaya str., Rostov on Don, 344015, Russian Federation. Phone: (863) 297-02-80. E-mail: rokb@aaanet.ru

In the recipient, the right retroperitoneal space was entered by a modified extraperitoneal Gibson access from the symphysis laterally and upwards parallel to the inguinal ligament [14], thus gaining access to the iliac vessels (Fig. 2).

The graft was placed in the right iliac fossa in an inverted position (with the head of the pancreas downward and the dorsal surface forward) along the wing of ilium. A venous anastomosis between the portal vein of the graft and the recipient's right iliac vein and an arterial anastomosis between the Y-shaped vascular insert and the recipient's right common iliac artery were formed according to the standard technique (Fig. 3).

Through a 6 cm peritoneal incision, we gained access to the small bowel, whose loop was removed from the abdominal cavity into the wound. Using the Roux technique, a 20 cm long section of the bowel was excluded from digestion; continuity of the gastrointestinal tract was restored by forming an end-to-side small-intestinal anastomosis, the free end of the bowel was sutured (Fig. 4).

At the next stage of the operation, we formed a side-to-side interintestinal anastomosis between the donor duodenum and the free end of the recipient's small bowel (Fig. 5).

At the final stage, the surgical intervention area was drained with two tubular silicone drains placed above and below the pancreas graft; the wound was sutured layer by layer (Fig. 6).

During the postoperative period, the patient underwent dynamic follow-up of the main laboratory indicators with a focus on plasma glucose and glycosylated hemoglobin levels.

Drug therapy in the postoperative period

Immunosuppressive therapy administered included: tacrolimus (1–24 days postoperatively) in an average daily dose of 4.69 mg (95% CI 4.27–5.11); mycophenolic acid (3–24 days postoperatively) in a dose of 720 mg per day. Along with this, the patient received methylprednisolone hormonal therapy (1–5 days postoperatively) at a mean daily dose of 123.75 mg (95% CI 89.74–157.76), then later (6–24 days postoperatively) at a dose of 16 mg per day.

Antibacterial therapy included a combination of carbapenems and synthetic antibacterials for 10 days – doripenem 1.5 g per day and metronidazole 15 mg per day, respectively, meropenem 2.0 g per day for 8 days.

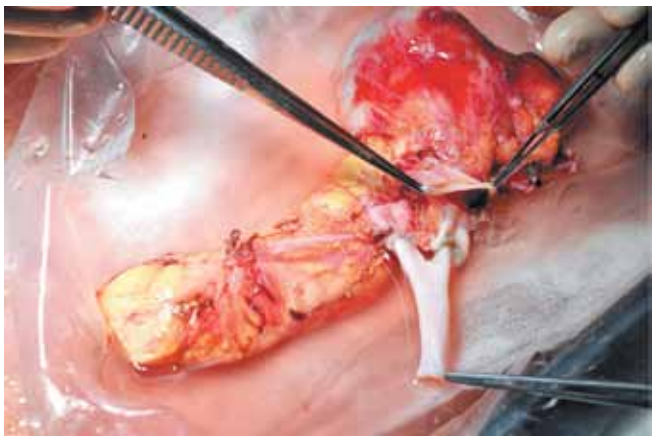

Fig. 1. Stage of pretransplant preparation of pancreas graft

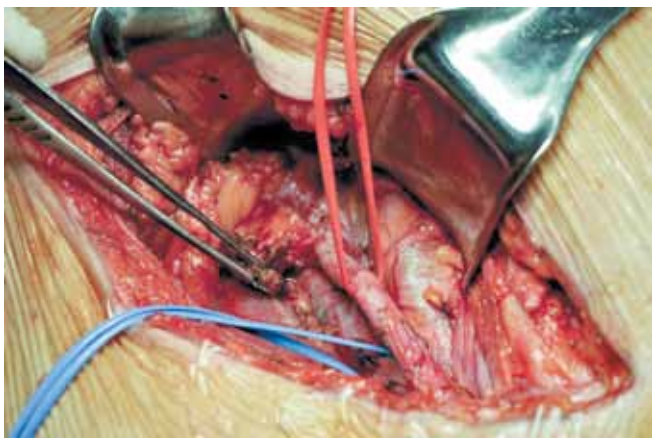

Fig. 2. View of access to the iliac arteries

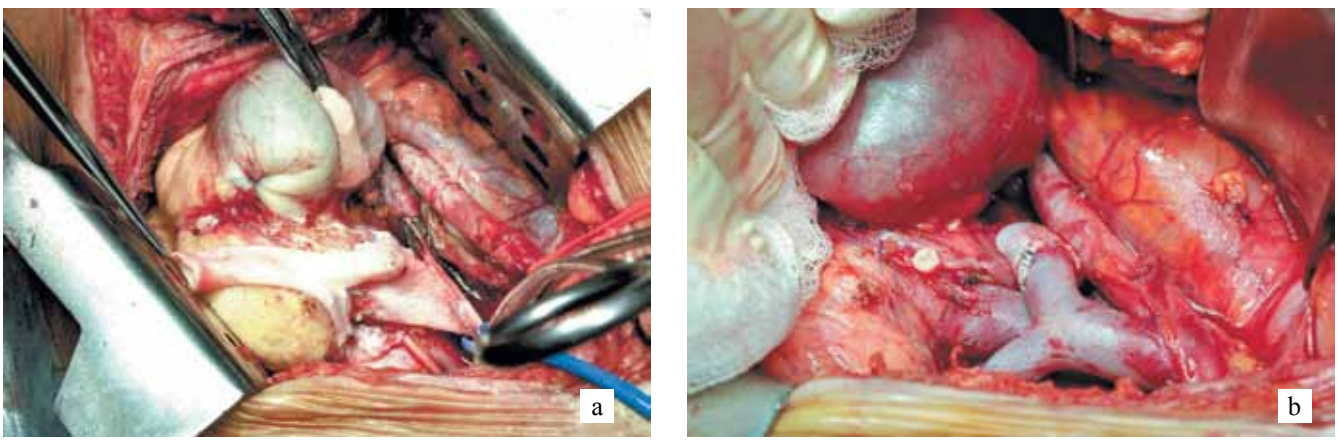

Fig. 3. Stage of vascular reconstruction of pancreas graft. a, formation of venous anastomosis; b, view of arterial anastomosis

Hypoglycemic episodes that occurred (Fig. 7) were corrected by insulin administration. The mean dose of insulin administered during the entire postoperative period was 4.66 units (95% CI 3.48–5.84).

RESULTS

In the first three days after surgery, during dynamic ultrasound examination of the pancreas graft, its longitudinal dimensions varied from 79 to 93 mm (86.0 ± 5.5 mm), transverse dimensions varied from 29 to 34 cm (31.2 ± 2.5 mm). Parenchymal echogenicity remained normal; echo pattern was homogeneous. Blood flow velocities in the vascular anastomosis zone and in the artery were within admissible values. Venous anastomosis: V_{max}, 105.7 ± 14.4 cm/s; arterial anastomosis: V_{max}, 148.3 ± 25.8 cm/s; Ri, 0.77 ± 0.06. Pancreas artery 1: V_{max}, 67.3 ± 15.2 cm/s; Ri, 0.70 ± 0.04; pancreas artery 2: V_{max}, 57.3 ± 9.8 cm/s; Ri, 0.75 ± 0.11. Visualized sizes of fluid accumulations along the graft bed ranged from 14 to 37 mm (27.0 ± 8.4 mm), in the transverse direction, from 6 to 14 mm (12.3 ± 6.8 mm). The daily volume of serous hemorrhagic exudate discharged through the drains installed in the graft bed did not exceed 220 ml (170.0 ± 55.7 ml).

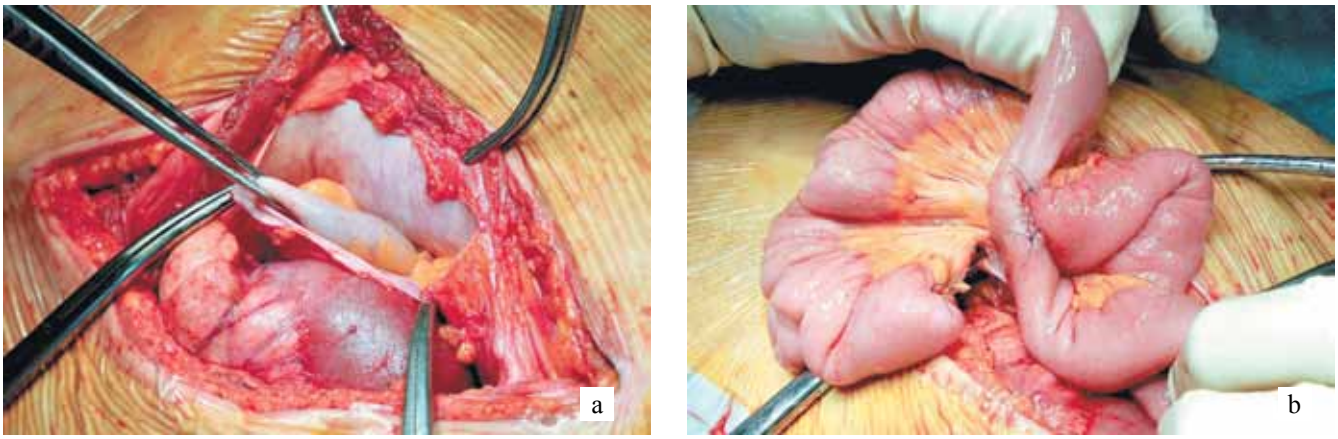

Fig. 4. The stage of preparation of the small bowel loop. a, peritoneum opening; b, view of the loop disconnected from digestion by Roux-en-Y bypass

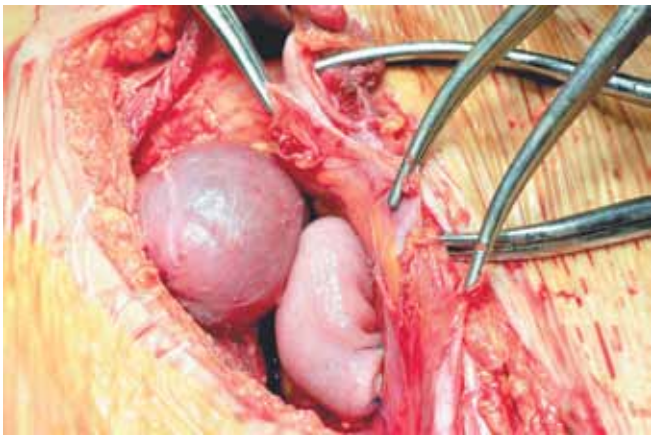

Fig. 5. View of formed anastomosis between recipient's small bowel loop and donor's duodenum

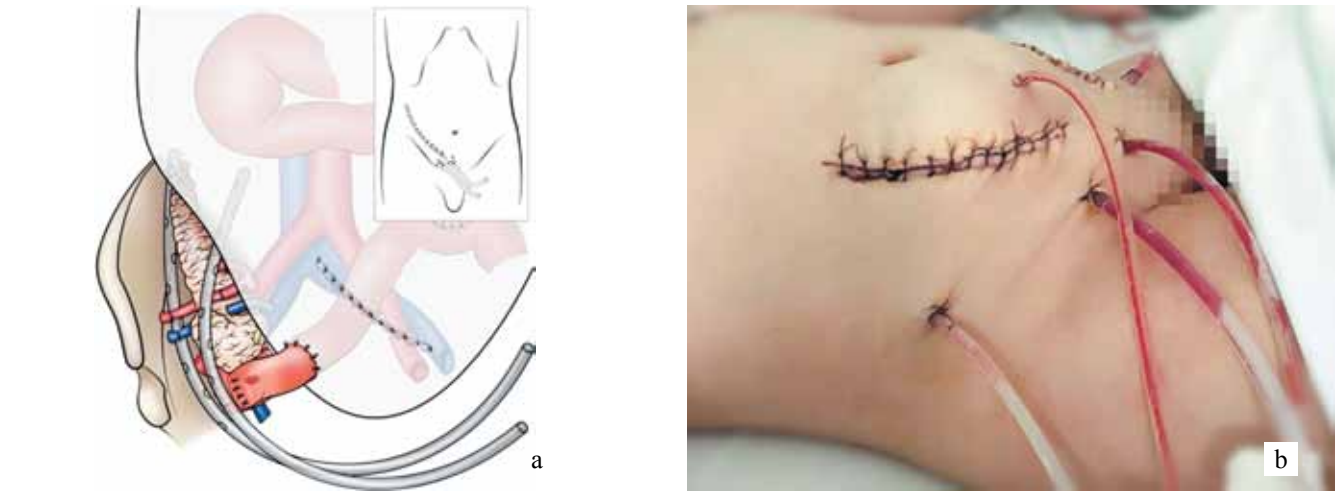

Fig. 6. General view of the operation. a, schematic representation of pancreas transplantation according to the original technique; on the right: drainage of the intervention area; b, drainage of the surgical intervention area

From day 4 to day 7 after the operation, ultrasound examination of the pancreas graft showed that its longitudinal dimensions varied from 80 to 89 mm (85.0 ± 2.0 mm), transverse dimensions varied from 34 to 40 cm (36.8 ± 2.0 mm). Parenchymal echogenicity was medium, echo pattern was heterogeneous. Blood flow velocities in the vascular anastomosis zone and in the artery had the following characteristics. Venous anastomosis: V_{max} – 95.3 ± 20.6 cm/s; arterial anastomosis: V_{max}, 132.5 ± 20.2; Ri, 0.72 ± 0.03. Pancreas artery 1: V_{max}, 70.5 ± 13.4 cm/s; Ri, 0.69 ± 0.02; pancreas artery 2: V_{max}, 69.8 ± 12.2 cm/s; Ri, 0.65 ± 0.04. The size of fluid accumulations along the graft bed ranged from 28 to 49 mm (37.1 ± 7.5 mm), in the transverse direction, from 12 to 37 mm (22.9 ± 11.8 mm). It should be said that during this period, the volume of exudate flowing daily from the graft bed through the drains increased by almost one and a half times – 383.6 ± 47.6 ml – and its character changed to purulent.

Ultrasound examination of the pancreas graft showed that from day 18 to day 23, the echogenicity of the gland parenchyma returned to normal, echo pattern became homogeneous. Longitudinal dimensions of the graft ranged from 72 to 80 mm (80.4 ± 5.1 mm), transverse dimensions ranged from 22 to 40 cm (33.3 ± 5.9 mm). Blood flow velocities in the vascular anastomosis zone and in the artery had the following characteristics. Venous anastomosis: V_{max}, 118.6 ± 15.2 cm/s; arterial anastomosis: V_{max}, 107.0 ± 1.7; Ri, 0.82 ± 0.05. Pancreas artery 1: V_{max}, 60.5 ± 2.0 cm/s; Ri, 0.65 ± 0.09; pancreas artery 2: V_{max}, 53.6 ± 8.2 cm/s; Ri, 0.72 ± 0.06. The size of fluid accumulations along the graft bed varied from 0 to 9 mm (3.4 ± 2.6 mm), in transverse direction – from 0 to 5 mm (1.8 ± 0.4 mm). It should be noted that in this time interval, the daily volume of exudate flowing through the drains significantly decreased (20.3 ± 1.7 ml), and its volume through the abdominal cavity drain did not exceed 50 ml of serous discharge. By day 24, the drains were completely removed.

Before the patient was discharged from the hospital (day 24 after surgery), she underwent ultrasound scan of the graft and abdominal CT angiography scan.

Triplex ultrasound scan protocol. Position of the pancreas graft in the iliac area on the right side. Size: 72 × 22 mm. Echogenicity is normal, echo pattern is homogeneous. Venous anastomosis: in the anastomosis area V_{max}, 100 cm/s; distally, 24 cm/s. Arterial anastomosis: with external iliac artery V_{max}, 90/22; Ri, 0.75. Graft artery 1: V_{max}, 69/14 cm/s; Ri, 0.79; graft artery 2: V_{max}, 48/9 cm/s; Ri, 0.8.

Abdominal CT scan protocol. Abdominal and retroperitoneal CT scan with bolus contrasting revealed: condition after kidney transplantation, pancreas transplantation. The renal graft is visualized in the left iliac region, measuring 103 × 53 × 75 mm. The parenchyma is uniformly contrasted. The artery supplying the graft is not narrowed. The excretory function of the kidney was preserved. In the right iliac region, the pancreatic graft is visualized, measuring 32 × 16 × 52 mm. The duct of Wirsung is up to 3.5 mm in diameter. The arterial vessel

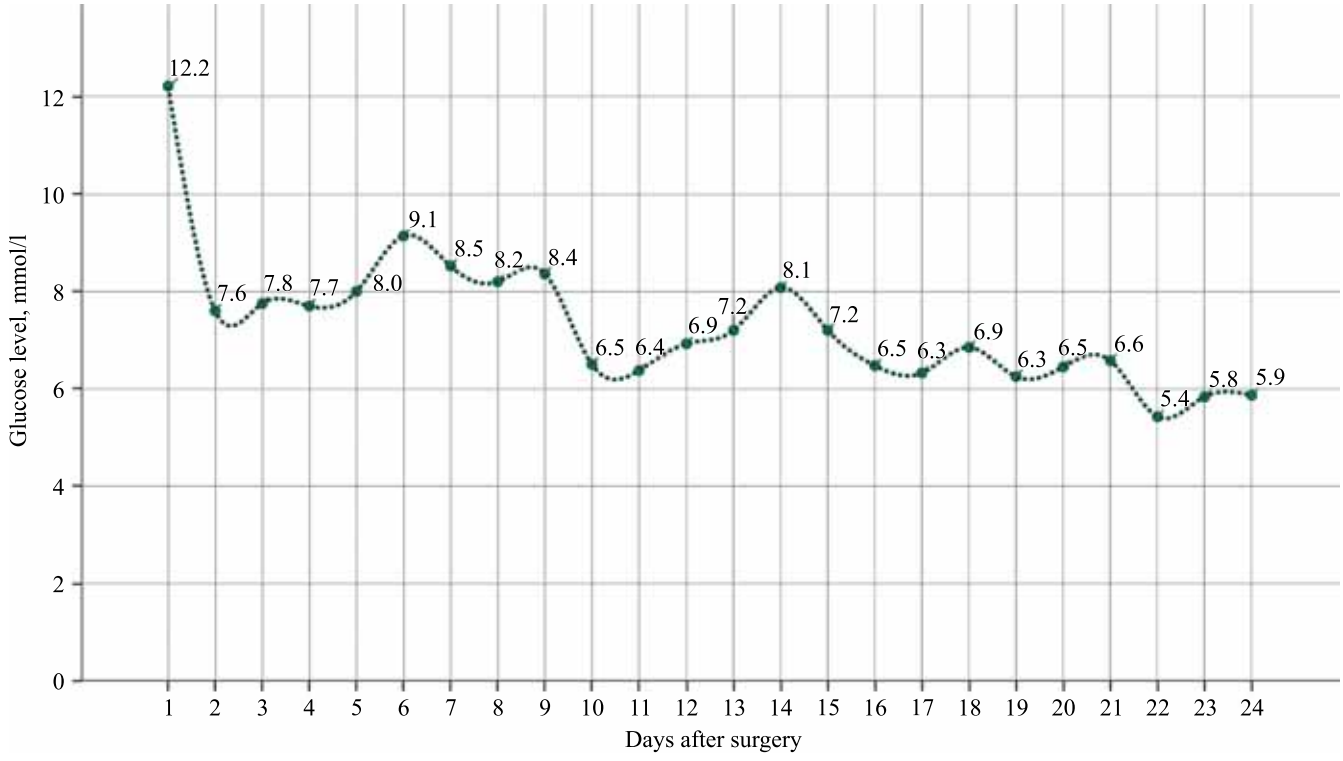

Fig. 7. Glycemia in the postoperative period

feeding the graft is visualized, its diameter in the anastomosis area with external iliac artery is up to 12 mm, the diameter of the artery is 5.5 mm. In the course of surgical intervention, there was a slight accumulation (up to 2 mm in thickness) of fluid over a distance of about 30 mm in the right iliac region.

The liver was not enlarged, the craniocaudal dimension was 148 mm. The liver parenchyma irregularly accumulates the contrast agent due to areas of hyperperfusion. Intrahepatic bile ducts and choledochus were not enlarged. The pancreas was not enlarged, with the following size: head 21 mm, body 12 mm, tail 16 mm; the duct of Wirsung was not dilated. Spleen was not enlarged in size, the structure was homogeneous. Adrenal glands were Y-shaped, located typically, not enlarged in size, and had a homogeneous structure. The kidneys were reduced in size, and parenchyma was sharply thinned. Renal excretory function was not visualized at 5 minutes. The loops of the large and partially small bowel were bloated with contents and gas. There were no pathological accumulations of fluid in the free abdominal cavity.

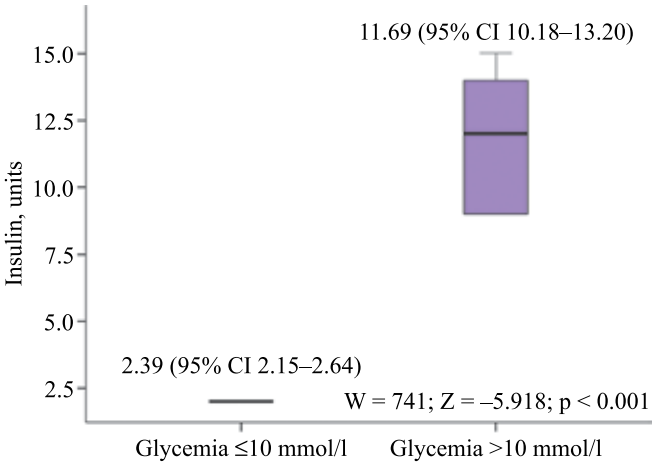

Fig. 8. Mean daily doses of insulin administered at minimum and maximum blood glucose elevations. 95% CI, confidence interval for the mean; p, significance of differences between indicators

As already noted, the patient had hypoglycemic episodes during the early postoperative period. The average glycemic level for the entire period of inpatient treatment was 7.52 mmol/l (95% CI 7.14–7.90). Elevated blood glucose levels were registered from day 5 to day 9 and from day 13 to day 15 (Fig. 7), which, of course, required adjusting the therapy and increased insulin doses, which we administered in such cases via an infusion machine (Fig. 8). The mean insulin dose administered during the entire postoperative period was 4.76 IU (95% CI 3.55–5.98).

On August 10, 2018, the patient was discharged from the hospital for outpatient treatment in a satisfactory condition, with recommendations on the timing of nephrologist monitoring and immunosuppressive therapy control.

At 4 years and 1 month after the operation, the patient's condition was satisfactory, she was socially

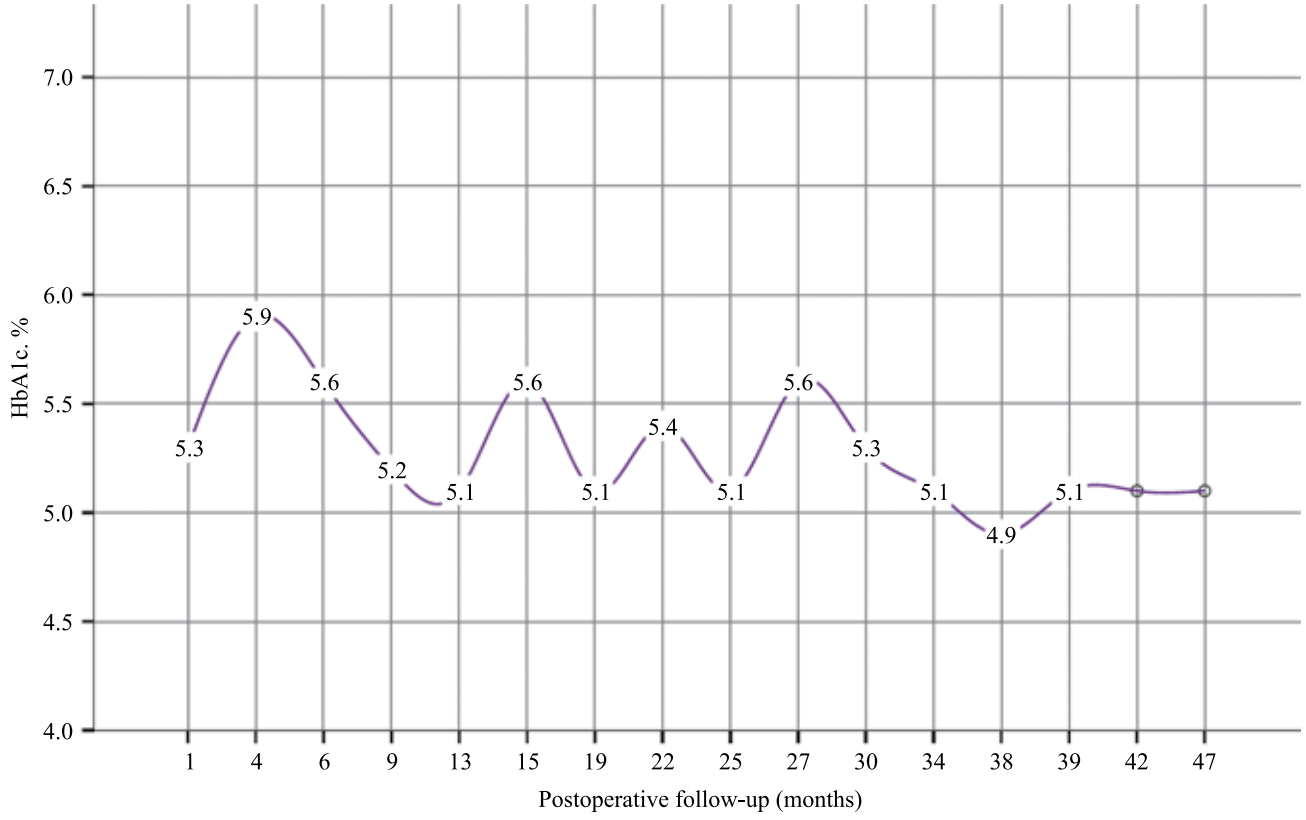

Fig. 9. Glycosylated hemoglobin in the long term after surgery

adapted, and there were no signs of graft dysfunction. The level of compensation for diabetes mellitus was regularly monitored (target laboratory values were achieved) (Fig. 9).

CONCLUSION

The presented clinical case clearly showed that the PTx technique developed by us can solve a number of urgent problems – graft preservation in case of purulent complications, and nonproliferation of purulent processes in the abdominal cavity. In spite of the fact that for 14 days, we noted inflammatory purulent discharge from the pancreas graft bed through the drains, which we regarded as acute graft pancreatitis, we were able to stop this complication with the help of conservative measures.

It should be noted that dynamic abdominal ultrasound examination during the whole post-transplant period showed complete intactness of abdominal organs in relation to inflammatory and purulent processes observed in the pancreas graft localization area. With a high probability, this condition could lead to more severe consequences. However, measures taken in advance (in terms of surgical tactics and transplantation technique) allowed to prevent graft loss and prevent the spread of purulent inflammation into the abdominal cavity and retroperitoneal space.

The surgical technique used allowed us to stop purulent inflammation in the transplant location area without repeated surgical intervention. This is especially important for this category of patients. The technique also allowed to obtain a long-term transplant effect.

Two pancreas and kidney transplants have been successfully performed in the surgical center using the original technique. The postoperative period was uneventful, the patients were discharged on days 13 and 17.

The authors declare no conflict of interest.

REFERENCES

1. *Khubutiya MSh, Pinchuk AV, Dmitriev IV i dr.* Sochetannaya transplantatsiya pochki i podzheludochnoy zhelezy: rannie posleoperatsionnye oslozhneniya. *Vestnik transplantologii i iskusstvennykh organov*. 2014; 16 (2): 24–29.
2. *Pieroni E, Napoli N, Lombardo C et al.* Duodenal graft complications requiring duodenectomy after pancreas and pancreas – kidney transplantation. *Am J Transplant*. 2018; 18: 1388–1396.
3. *Ferrer-Fàbrega J, Cano-Vargas B, Ventura-Aguiar P et al*. Early intestinal complications following pancreas transplantation: lessons learned from over 300 cases – a retrospective single-center study. *Transplant International*. 2021; 34 (1): 139–152.
4. *Fleetwood VA, Falls C, Ohman J et al*. Post-pancreatic transplant enteric leaks: The role of the salvage operation. *Am J Transplant*. 2022; 22: 2052–2063.
5. *Maupoey Ibáñez J, Boscà Robledo A, López-Andujar R*. Late complications of pancreas transplant. *World J Transplant*. 2020; 10 (12): 404–414.
6. *Berger L, Bialobrzecka M, Schenker P et al*. Complications after pancreas transplantation. *Transplantation*. 2018; 102 (S): 753
7. *Moya-Herraiz A, Muñoz-Bellvis L, Ferrer-Fábrega J et al*. Estudio cooperativo del Grupo Español de Trasplante de Páncreas (GETP): complicaciones quirúrgicas. *Cir Esp*. 2015; 93: 300–306.
8. *Humar A, Kandaswamy R, Granger D et al*. Decreased surgical risks of pancreas transplantation in the modern era. *Annals of Surgery*. 2000; 231 (2): 269–275.
9. *Gautier SV, Tsirul'nikova OM, Poptsov VN i dr.* Pervyy opyt odnomomentnoy transplantatsii pecheni i podzheludochnoy zhelezy v Rossii. *Annaly khirurgicheskoy gepatologii*. 2011; 16 (1): 28–32.
10. *Usova EV, Kaabak MM, Chzhao AV*. Transplantatsiya podzheludochnoy zhelezy. *Transplantologiya*. 2015; 1: 23–40.
11. *Dmitriev IV.* Khirurgicheskie aspekty transplantatsii podzheludochnoy zhelezy: otvedenie ekzokrinnogo sekreta transplantata. Chast' 1. Khirurgiya. *Zhurnal im. N.I. Pirogova*. 2020; 7: 107–110.
12. *Ferrer J, Molina V, Rull R et al*. Trasplante de páncreas: ventajas de la posición retroperitoneal del injerto. *Cir Esp*. 2017; 95: 513–520.
13. *Yang WH, Ou ChH*. A muscle-sparing modified Gibson incision for hand-assisted retroperitoneoscopic nephroureterectomy and bladder cuff excision – an approach through a window behind the rectus abdominis muscle. *Urology*. 2012; 79 (2): 470–474.

The article was submitted to the journal on 09.09.2022