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Prosthetic repair of the anterior abdominal wall in patients after solid organ transplantation: The experience of N.V. Sklifosovsky Research Institute for Emergency Medicine

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Rationale. *The postoperative ventral hernia is seen in 1.6-34.8% of patients undergoing organ transplantation that determines the urgency of this problem.*

The objective *was to improve the treatment of patients with postoperative ventral hernia after organ transplantation.*

Material and methods. *From 2006 to 2017, 36 patients underwent surgery with synthetic material application for postoperative ventral hernias after organ transplantation. There were 15 women (41.7%) and 21 men (58.3 %). The median age was 55 years [44.5; 59]; the median body mass index was 30 kg/m^2 [27.1; 33.2].*

Results. *The postoperative period was uneventful in 13 patients (36.1%). Twenty three patients (63.9%) developed complications of varied severity, including 13 patients (56.5%), in whom the revealed complications were not considered the indications to a targeted therapy (Grade I), 3*

patients (13.1%) in whom the complications regressed after the drug therapy had been corrected (Grade II), 7 (30.4%) patients in whom complications were cured using mini-invasive surgical techniques (Grade IIIa).

Conclusions. *The prosthetic hernia repair demonstrated a high efficacy and safety as the treatment for postoperative ventral hernia in patients after solid organ transplantation.*

Keywords: prosthetic repair of hernia, surgical complications, solid organ transplantation

Introduction

Transplantation of solid organs is a method of choice in the treatment of patients suffering from a number of end-stage chronic diseases [1-3]. In the recent decade, positive changes have been seen in the field of organ transplantation in the Russian Federation after a long period of stagnation in the early 2000s. So, in 2014, more than 1500 organ transplants were performed; and according to the Russian Transplant Society Registry (2014-2015), the annual increment was more than 150-200 surgical interventions. In the structure of performed transplants, the kidney transplantation made 67.4%, transplantation of extrarenal organs accounted for 32.6% [4, 5]. This can be explained by a persisting shortage of donor material, which, in turn, encourages the surgeons to continually expand the acceptability criteria to donor organs for transplantation. The increased number of performed transplants has led to the increase in the incidence of surgical complications, including postoperative ventral hernias (POVH).

According to the world literature, POVH develops in 1.6-18% of patients after kidney transplantation, in 1.7-32.4% after liver transplantation, and in 13-34.8% of patients after simultaneous kidney and pancreas

transplantation [6, 7]. It should also be noted that according to numerous studies, the incidence of POVH in the population of patients receiving immunosuppressive therapy (IST) is 12-17.3% higher than in general surgery patients, the difference being statistically significant [8-11].

Along with the well-known causes of the anterior abdominal wall hernias, the increased number of hernias in the patients after organ transplantation can be explained by the elevation of intra-abdominal pressure due to the graft-associated increase of the abdominal cavity volume, the tissue atrophy, and diminishing reparative processes in tissues due to a continuous IST [12-15].

E.S. Judd (1912) and C.L. Gibson (1920) were the first to describe the technique of the anterior abdominal wall reconstruction using local tissues after the mobilization of the hernial defect. However, today it becomes clear that hernia repair with local tissues, particularly for large and gigantic hernias, does not allow keeping musculo-aponeurotic structures in a close contact for the period of time long enough to be sufficient for the formation of a complete ("matured") postoperative scar. A large number of studies have been performed so far to investigate the results of tension hernia repair that were found to be unsatisfactory. Relapses of the disease have been seen in more than 50% of patients. Thus, it can be stated that the surgical technique of repair with local tissues has long lost its leading position in herniology and is, in fact, only a historical interest [16, 17].

The wide implementation of endoprosthetics made it possible to solve a number of acute problems in modern herniology, such as the possibility to perform hernia repair in anatomical tissue deficiency, and to reduce the recurrence rate of the disease to 5% [18]. However, a number of authors indicate a high risk of purulent complications associated with the presence of

a foreign body (the implant) in the immunodeficient patients receiving immunosuppression after organ transplantation[19, 20].

The objective was to retrospectively analyze the results of POVH surgical treatment using synthetic implants (SI) in patients after solid organ transplantation, and to assess the safety and efficacy of using SI in this patient population.

Material and methods

In the period from 1999 to 2017, 1435 solid organ transplants were performed in the N.V.Sklifosovsky Research Institute for Emergency Medicine, including 950 kidney transplants (66.2%), 435 liver transplants (30.3%), 50 simultaneous pancreas and kidney transplants (3.4%). The long-term postoperative period was complicated by the POVH development in 46 patients (3.2%). A prosthetic repair using synthetic materials was performed in 36 patients, including 17 (47.2%) of them after kidney transplantation, 18 (50.0%) after liver transplantation, 1 (2.7%) after simultaneous pancreas and kidney transplantation. The patient distribution by gender and age was the following: there were 15 women (41.7%), and 21 men (58.3%) aged from 23 to 67 years old. The median age was 55 years [44.5, 59], the median body mass index *(*BMI) was 30 kg/m^2 [27.1, 33.2]. In most cases, BMI exceeded normal range. Thus, only 8 patients (22.2%) had BMI consistent with normal values, 9 (25.0%) were overweight (pre-obesity), 13 (36.1%) had Class 1 obesity, and 6 (16.7%) had Class II obesity. The time of POVH occurrence after transplantation ranged from 1 to 48 months, the median was 7.5 months [6, 12]. IST was given to all patients in various combinations: as monotherapy with calcineurin (CNI) inhibitors to 13 patients, as bi-component therapy (CNI + mycophenolate drugs or mTor inhibitors) to 5, or

as a standard three-component therapy (supplemented with glucocorticoids) to 18 patients. According to the SWR classification (J.P. Chevrel, A.M. Rath, 1999), the patient distribution was as follows: those with a midline hernia (M) (n=16), with a lateral one (L) (n=16), those with a combined location of hernial gate (M, L) (n=4). The hernial gate width was up to 5 cm (W1) in 5 patients, up to 5-10 cm (W2) in 19, and over 10 cm (W3) in 12 patients. As for the number of recurrences, 32 patients had no recurrences (R0), a recurrent POVH (R1) was seen in 3 patients, a repeated recurrence (R2) was seen in 1.

All patients underwent an open surgery. Polypropylene SIs from various manufacturers were used; their common characteristics were a light weight (from 35 to 50 g/m^2), and macroporosity (pore sizes from 1 to 2 mm). With regard to the SI placement technique, the patients were divided into two groups: the sublay, and inlay techniques were used in 22 patients (61.1%), and 14 (38.9%) patients, respectively. The sublay technique implying the subaponeurotic placement of SI is generally used in the treatment of small- and medium-sized POVH, when the width of the hernial gate does not exceed 10 cm (Fig. 1).

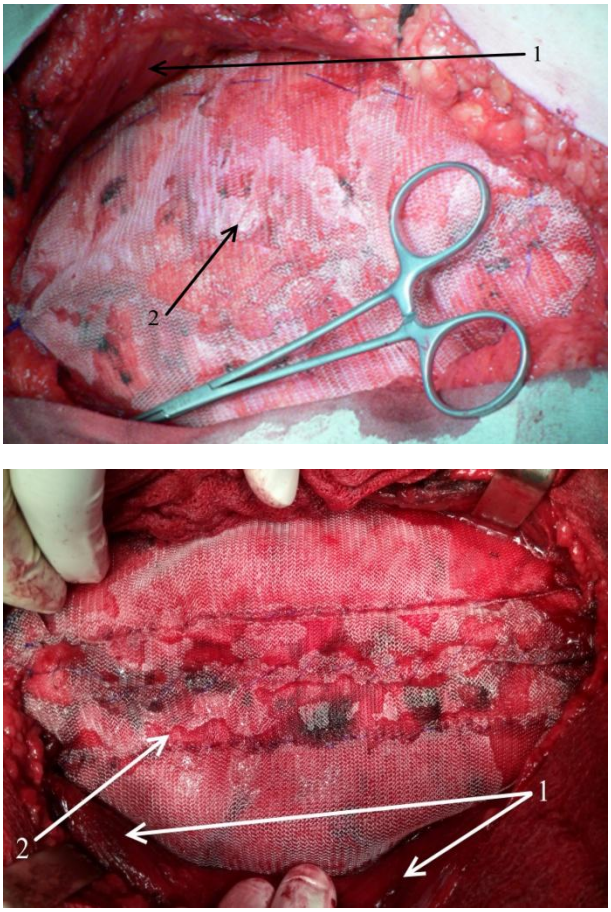

Fig. 1. Intraoperative photos of reconstructive surgery for hernia using a synthetic implant: 1. Rectus abdominis; 2. Synthetic implant

In such cases, the SI was positioned in the retro-muscular space on the posterior plane of the joint sheath of the rectus muscles with the subsequent repair of the aponeurotic structures above it. For lateral hernias, the endoprosthesis was placed between the transverse and internal oblique muscles of the abdomen or the external oblique and internal oblique muscles of the abdomen. The inlay technique of the SI positioning was used as the method of choice for the treatment of large and giant hernias to avoid the intra-abdominal hypertension syndrome. With this repair technique, the prosthetic material was fixed to the edges of the aponeurosis in such a way

that the volume of abdominal cavity was changed only slightly or not at all (Fig. 2). The space over the mesh was drained using the Redon drainage. In patients with severe obesity, the postoperative wound closure was supplemented with the single-lumen drainage placement into subcutaneous fat. In the postoperative period, all patients received the antibiotic therapy with cephalosporins of the 3rd generation for the first 5-7 days; the drainage tubes were removed after 3-5 days.

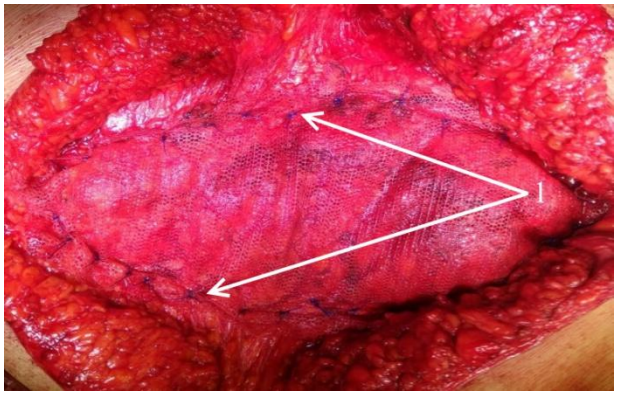

Fig. 2. Intraoperative photo of the corrective hernia repair using a synthetic implant: 1. The synthetic implant fixed to the edges of the aponeurosis

Early surgical complications after prosthetic repair of the anterior abdominal wall in patients after organ transplantation were categorized using Clavien-Dindo Classification of Surgical Complications (2009). According to this Classification, Grade I complications imply the events that require no treatment; Grade II refers to complications requiring only pharmacological treatment. Grade IIIa includes complications to be treated using invasive techniques (radiotherapy, endoscopic, or surgical interventions) not under general anesthesia; Grade IIIb complications are defined as those requiring treatment under general anesthesia. Grade IV includes complications

potentially threatening the graft, or life-threatening complications: implying the graft loss (Grade IVa), the death of a patient (Grade IVb).

Ultrasonography (US) monitoring was performed using Phillips U22 Unit (Netherlands) with convex (2-5 MHz) and linear transducers (5-10 MHz), the US examinations being made on the 3rd, 5th-7th days of the uncomplicated postoperative period. In case of a complicated course, additional US-examinations were performed on indications to assess the effect of the therapy. The US examination allows the identification and evaluation of pathological foci (seroma, hematoma, infiltrate), their size, location, and configuration. Seromas were defined as "small" when the volume of fluid collections was 20 cm^3 or less, an as "large" when their volume reached 21 cm^3 or more.

The follow-up period for the patients after prosthetic repair of the anterior abdominal wall with SI was from 6 to 48 months.

The statistical analysis and data processing were made using statistical software package Statistica for Windows v. 10.0, StatSoft Inc. (USA). The normal distribution of data was verified using the Shapiro-Wilk normality test. The Pearson Chi-square test was used when comparing the groups by qualitative characteristics; and the two-tiled Fisher's exact test was used for qualitative binary data. The differences were considered statistically significant at $p < 0.05$.

Results and discussion

The postoperative course was uneventful in 13 patients (36.1%). Twenty three patients (63.9%) developed 31 complications of various severity; 13 (56.5%) of those patients were diagnosed with postoperative complications requiring no treatment and qualified as Grade I by Clavien-

Dindo Classification. In 3 patients (13.1%), the treatment of complications (Grade II) was limited to the correction of medical therapy. Five patients (21.7%) had 10 wound complications that required the treatment with minimally invasive puncture-drainage techniques under local anesthesia, and were qualified as Grade IIIa complications. The combined Grade II and IIIa complications (total n=5) were seen in 2 patients (8.7%). There were no Grade IIIb or IV complications in our series.

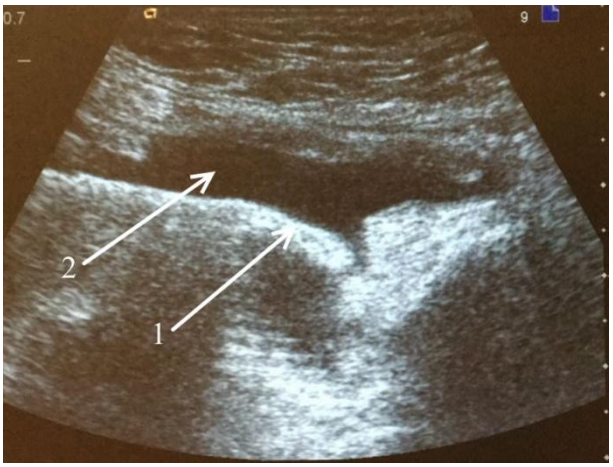

Fig. 3. Ultrasonography of the anterior abdominal wall soft tissues after the prosthetic repair: 1. The synthetic implant; 2. Area of fluid in the over-the-mesh space

Seroma was developed in 21 patients (91.3%). Seromas were assessed by the US exam as "small" in 14 cases (66.7%) representing narrow linear fluid areas that spontaneously resolved on the 7-10th postoperative day (Grade I complications). "Large" seromas formed in 7 patients (33.3%) (Fig. 3). In 3 of those cases (42.9%), the treatment was limited to the prolongation of the antibiotic therapy course (Grade II complications), and 4 cases

(57.1%) required the use of the puncture technique (Grade IIIa). Punctures were performed every 1-2 days for 10-14 days. In 1 of those cases (25.0%), the signs of infected seroma appeared on the 4th day. The US-guided drainage placement to the over-the--mesh space was undertaken that was followed by the cleansing and aspiration treatment that contributed to the patient's recovery. Infiltration was formed in 2 cases (8.7%) where the situation required no surgical correction (Grade II). Complications of the early postoperative period in the form of hematoma formation were observed in 4 patients (17.4%). In 1 case (25.0%), the hematoma was lysed and evacuated using the puncture technique. The signs of hematoma infection were identified in 3 patients (75.0%) on the 3rd-5th day. Those patients underwent a surgical treatment (mini-invasive cleansing-aspiration techniques), the de-escalation of antibiotic therapy with regard to the bacterial flora sensitivity, and a temporary reduction in the dose of immunosuppressive drugs (Grade IIIa).

So, the wound infection was seen in 4 patients (17.4%). The use of minimally invasive methods of surgical treatment appeared highly efficient in the treatment of Grade IIIa complications: no SI removal was required in any case.

We studied the incidence of surgical complications depending on the SI placement technique. A significantly higher incidence of Grade IIIa postoperative surgical complications was observed after using the inlay technique of prosthetic hernia repair, while there was no statistically significant difference in the incidence of Grade I and II complications. Thus, the sublay technique of SI positioning should be preferable when choosing the repair approach (Table).

Table. The incidence of wound complications after prosthetic hernia repair depending on the technique of synthetic implant positioning in the patients after solid organ transplantation

	SI placement technique		R
	Inlay (n = 14)	Sublay (n = 22)	
Uncomplicated course	3 (21.4%)	10 (45.5%)	0.14
Complications *	N = 18	N = 13	
Grade I	5 (27.8%)	8 (61.5%)	0.96
Grade II	3 (16.7%)	2 (15.4%)	0.29
Grade IIIa	10 (55.5%)	3 (23.1%)	> **0.01**

* According to Clavien-Dindo Classification, 2009.

The analysis of the long-term outcomes in patients whom we operated demonstrated 1 case (2.8%) of recurrent POVH after using a sublay technique of SI positioning in hernia repair. The relapse was detected during routine follow-up examination at 8 months after surgical intervention. The relapse, apparently, was caused by the incongruence between of the selected endoprosthesis area and hernia gate. The patient underwent a repeated surgery for the anterior abdominal wall reconstruction using SI, the surgery was a success. For the follow-up period (36 months), no data on the POVH recurrence were obtained.

In retrospect, the POVH incidence was 1.8% after renal transplantation, 6.4% after liver transplantation, and 2.0% after simultaneous pancreas and kidney transplantation. These figures seem very optimistic compared to the data of world literature.

Conclusion

The incidence of hernia formation after abdominal organ transplantation, as well as the incidence of surgical complications and recurrences after prosthetic hernia repair correspond to the data reported in the world literature. With regard to the higher incidence of postoperative complications after using inlay technique of hernia repair, we consider preferable to position the synthetic endoprosthesis into the deep layers of the musculo-aponeurotic structures of the anterior abdominal wall. Most complications observed in those cases were of mild to moderate severity and require no repeated operations under general anesthesia. If surgical treatment was necessary, the minimally invasive techniques were efficient for the treatment of early surgical complications after prosthetic hernia repair with SI. Thus, in patients on a continuous immunosuppressive therapy after solid organ transplantation, the use of synthetic materials makes the method of choice in the treatment of POVH, especially large and gigantic by size, and that allows a significant reduction in the incidence of relapses.

The authors state there is no conflict of interests to declare

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