EARLY AND LATE OUTCOME AFTER SUPRASONIC EXCISION OF INFECTED MESH IMPLANTS AFTER HERNIOPLASTY

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RANI I KASNI ISHODI SUPRAZVUČNE EKSCIZIJE INFICIRANIH MREŽNIH IMPANTATA NAKON NERNIOPLASTIKE

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ABSTRACT

The purpose of this research is to analyze early and postponed complications of the new method to eliminate mesh implants during full-grown infection process.

The Republican clinical hospital (Russia) was the location to carry out a post-hoc analysis of 149 cases on surgical removal of infected mesh implants for ventral hernias of different localization in the period 2000 to 2017. The control group were 78 patients who underwent meshes removal with traditional surgical instruments. The study group included 71 patients, who underwent our method of supra-sonic excision of the implants.

The duration of surgery in the group of patients subjected to supra-sonic excision of the implants was significantly lower (84.3 min vs. 141.5 min) than in the group of traditional surgical techniques. Complications of early postoperative period was most often registered in the control group: foreign bodies (92.8% vs. 7.2%), infection (81.8% vs. 18.2%) and bleeding (87.5% vs. 12.5%). In the long term the recurrence of hernias in the control group were detected 1.8 times more frequently for ventral hernias than in the group of supra-sonic excision of the implants.

Thus, supra-sonic excision of the implant prevents damage to viable tissues of the abdominal wall during the allocation of the implant and provides a good bactericidal effect, which promotes normal tissue regeneration and prevents possible recurrence of the herniation.

Keywords: *hernias, suprasonic excision of infected mesh, early and late outcome*

SAŽETAK

Cilj ovog istraživanja je analiza ranih i odloženih komplikacija novog metoda za eliminaciju mrežnih impantata tokom celokupnog procesa infekcije.

Republička klinička bolnica (Rusija) je predstavljala lokaciju sprovođenje post-hoc analize 149 slučajeva hirurškog uklanjanja inficiranih mrežnih impantata ventralnih kila različite lokalizacije u periodu od 2000. do 2017. Kontrolnu grupu je činilo 78 pacijenata kod kojih je mrežica uklonjena tradicionalnim hirurškim instrumenti. Eksperimentalna grupa se sastojala od 71 pacijenta koji su bili podvrgnuti našem metodu suprazvučne ekscizije impantata.

Trajanje hirurške intervencije u grupi pacijenata podvrgnutih suprazvučnoj eksciziji implantata značajno je bila niža (84,3 min naspram 141,5 min) nego u grupi u kojoj su korišćene tradicionalne hirurške tehnike. Komplikacije ranog postoperativnog perioda su najčešće registrovane u kontrolnoj grupi: strana tela (92,8% naspram 7,2%), infekcija (81,8% naspram 18,2%) i krvarenje (87,5% naspram 12,5%). U pogledu kasnih ishoda ponovna pojava kila u kontrolnoj grupi je zabeležena 1.8 puta češće nego u grupi sa suprazvučnom ekscizijom implantata.

Prema tome, suprazvučna ekscizija implantata prevenira oštećenja tkiva abdominalnog zida prilikom ugradnje implantata i pruža dobar baktericidni efekat, što stimuliše normalnu regeneraciju tkiva i sprečava mogućunost ponovne pojave kila.

Ključne reči: *kila, suprazvučna ekscizija inficirane mreže, rani i kasni ishodi*

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INTRODUCTION

Surgical infection that occurs after installing mesh implants in cases of ventral and inguinal hernia, is a serious problem that does not have a definite approach to its solution (1). The majority of authors believe that to eliminate this complication it is necessary to use all existing methods of conservative therapy (2). However, as practice shows, these methods are not always efficient, especially when performing radical hernioplasty method "on lay". Besides, when it becomes clear that conservative treatment of the wound infection is ineffective, the mesh implant gets firmly overgrown by the connective tissue and removing it is a major challenge (3). By using conventional surgical instruments, in separation of the foreign body (implant) from the soft tissue in the area of surgical intervention the surgeon always takes a risk to resect along with it an unreasonably large amount of tissue, which often results in the subsequent recurrence of the hernia. In addition, the operation to eliminate the implant comes with bleeding that requires hemostasis by suturing the blood vessels with introducing into the wound additional foreign bodies (suture), and most likely with leaving the undetected parts of the implant, "disguised" in the connective tissue and difficult to be discerned (4-6). This circumstance is unlikely to completely help get rid of wound infection, which later remind of itself by repeated inflammatory phenomena in the surgery location.

MATERIALS AND METHODS

The Republican clinical hospital (city of Ufa, Russia) was the location to carry out a post-hoc analysis of 149 cases on surgical removal of infected mesh implants for ventral hernias of different localization in the period 2000 to 2017. The study was approved by the permission of the Ethical Committee of the Bashkir State Medical University (city of Ufa, Russia). The necessary condition was to receive an informed voluntary consent of the patients to participate in the stated study.

To participate in the study one had to meet the following criteria: an infected mesh implant installed for ventral or inguinal hernia; no effect in relation to conservative therapy. The study excluded patients with complicated perioperational period, diagnosed intestinal fistulas and/or peritonitis, sepsis. The time, from placing the implant before admission of the patient to the surgical treatment to its removal, ranged from 3 weeks to 1.5 years, on average it was equal to 9 months.

Depending on the surgical technique the patients were divided into 2 groups. The control group (group I) were 78 patients who underwent meshes removal with traditional surgical instruments. The study group (group II) included 71 patients, which underwent our methodology of suprasonic excision of implants (table 1).

The developed method of surgical intervention with elimination of infected mesh implants is the following. After excision of the postoperative scar on the skin along with fatty tissue within healthy tissue a previously installed implant gets allocated. To do this, it is fixed on the edge with a mouse-tooth forcets and gets maximum pulled up, and then it gets separated from the aponeurosis and muscles of the abdominal wall by destroying the connective tissue adhesions using ultrasound, cavitated by "SONOCA-180" produced by the "Söring" company (Germany). The ultrasonic generator produces electrical oscillations at an ultrasonic frequency which is converted by a piezostrictive transducer located in the handpiece, into reciprocating motion of the titanium waveguide with the frequency of the system ultrasonic oscillations of 25 kHz. The energy of the ultrasonic vibrations is transferred to the liquid, supplied through the central channel into the wave-water, resulting in the abovementioned fluid cavitation processes (7).

The surgery technique provides for the devastating effect of ultrasonic waves on the connective tissue through a liquid antiseptic - 0.2% solution of aqueous chlorhexidine of bi-gluconate. For this purpose, 0.2% aqueous chlorhexidine of bigluconate solution is continuously fed between the installed implant and the abdominal wall during the entire ultrasonic treatment. The average speed of the ultrasonic processing is about 2 cm^2/min. The amount of the used antiseptic solution depends on the size of the wound surface. During the postoperative period the patients are provided with a rational antibacterial, analgesic therapy and prophylaxis of thromboembolic complications, individually to each patient (8, 9).

Table 1. The characteristics before surgery according to the procedure

Characteristic	Group I, n = 78	Group II, n = 71	p
Age, years	30.7 (8.8-84.1)	39.4 (6.1-87.7)	0.037*
Gender, M/F	23/55	20/51	0.653†
Time between operation, month	9.2 (6.5-11.3)	8.4 (7.1-10.2)	0.7*
WBC (10^3 /μL)	12.3 (4.3-26.5)	13.0 (4.4-36.4)	0.160*
Alb (g/dL)	4.4 (2.8-5.3)	4.4 (2.5-5.3)	0.154*
Neutro. (%)	80.9 (43.0-95.5)	83.6 (27.6-95.5)	0.674*
Lymph (%)	13.0 (3-46)	10.9 (3-57.8)	0.666*

Showing medians and interquartile ranges. *Tested by Mann-Whitney U-test. †Tested by Fisher's exact test. WBC: white cell count, Alb: Albumin, Neutro: neutrophil, Lymph: lymphocyte.

Table 2. The outcomes according to the procedure

Characteristic	Group I, n = 78	Group II, n = 71	p
Operation time, min	141.5 (101-153)	84.3 (54.2-93.7)	0.002*
Bleeding, n (%)	7 (8.9)	1 (1.4)	0.035†
Residual fragments of meshes, n (%)	13 (16.6)	1 (1.4)	0.003†
Eventration, n (%)	3 (3.8)	0 (0.0)	0.003†
LHS, days	14 (7-23)	7 (3-18)	0.001*
SOI, days	1 (0-6)	1 (5-14)	0.016*
SSI, n (%)	9 (11.5)	2 (2.8)	0.044†

Showing medians and interquartile ranges. *Tested by Mann-Whitney U-test. †Tested by Fisher's exact test. LHS: length of hospital stay, SOI: started an oral intake, SSI: surgical site infection, Clavien-Dindo classification IIIa.

Statistical analyses were performed with the SPSS statistical software package (version 13.0; SPSS Inc., Chicago, IL). Univariate and multivariate analyses were performed to clarify the laboratory parameter and clinical factors most significantly associated with supra-sonic excision and traditional surgical operation. Univariate analyses, Mann-Whitney U-test, and Fisher's exact test were utilized, and Odds ratios with 95% CI were calculated using logistic regression model analyses. P values of less than 0.05 were considered to be statistically significant.

RESULTS

The mediana operation time for both groups was 127 minutes. The duration of surgery in the group of patients subjected to supra-sonic excision of the implants was significantly lower (84.3 min vs 141.5 min) than in the group of traditional surgical techniques.

Among the complications (table 2) of the early postoperative period, the most frequently registered were foreign bodies (fragments of the mesh). The control group showed residual foreign bodies in 13 patients, which required a total of 17 repeated surgical operations. Herewith two patients had to undergo the mesh elimination in two stages. The study group registered only one patient with a residual mesh.

The second most common complication of early postoperative period was wound infection. In the group of traditional surgical technique the postoperative wound purulence was registered in 9 patients, in the study group - in 2 patients (81.8 % vs 18.2 %). It should be noted that at the stage of necrectomy remnants of the mesh were found in all 9 patients of group I. In group II, the wound infection was not associated with a foreign body.

Table 3. Recurrence of ventral hernias

Reherniation	Group 1 (n=78)	Group II (n=71)	p
Patients, n (%)	11 (14.1)	6 (8.5)	0.002

Showing medians and interquartile ranges. Tested by Fisher's exact test.

Bleeding and eventration characteristically exhibit less occurrence for both groups. However, in the group of traditional surgical technique the bleeding (87,5% for group I vs 12,5% for group II) happened more often which required a second surgery. Out of 7 patients of control group only two patients proved that conservative hemostatic therapy was effective. It should be noted that eventration was not registered in the group of patients subjected to supra-sonic excision of the implants.

In the late postoperative period (5 years), we were able to examine 137 out of 149 patients: Group I - 68 patients and group II - 69 patients. Dynamic observation primarily showed recurrent hernia formation, which was diagnosed in 46 patients under research (table 3).

Table 3 shows that the hernia recurrence was most frequent with conventional surgical techniques.

In multivariate analysis, bleeding, length of hospital stay and reherniation were significantly lower in Group II than in Group I (p=0.035, 0.001 and 0.02, Table 4).

DISCUSSION

According to the data (10) every year more than 20 million patients undergo hernia repair. Just like any invasive intervention hernia repair is associated with several complications, such as migration of the mesh into the ab-

Table 4. Multivariate analysis clinical and operative factors according to the procedure

Indicators	Group I (n=78)	Group II (n=71)	Odd ratio	95% CI	p
Bleeding, n (%)	7 (8.9)	1 (1.4)	2.29	1.04-4.97	0.035
LHS, days	14 (7-23)	7 (3-18)	2.03	1.12-3.71	0.001
Reherniation , n (%)	11 (14.1)	6 (8.5)	2.4	1.09-3.92	0.002

Showing medians and interquartile ranges. Tested by Fisher's exact test.

dominal cavity (11, 12), development of persistent seroma posterior (13-15), development of chronic pain (16, 17), and surgical infection. Although incisional hernia repair is classified as a clean surgery, it still has a high incidence of surgical site infection (SSI) (0.7%-26.6%). The presence of an SSI could increase early recurrence rates after hernia repair (18).

To reduce the frequency of complications different authors suggest applying different surgical techniques of hernia repair and using different materials (19-21).

The purpose of this research is to develop and assess advantages of the new method of mesh implants elimination in cases of full-grown infection process. Traditionally, the meshes installed for ventral hernias, are eliminated using the classic open method of elimination on the previous access. And our research used the open access to the mesh, when the initial absence of infection in the abdominal cavity allows avoiding the spread of this process. This technique was justified because, according to our data the group of the original method to eliminate the mesh registered the least number of early complications, including, in addition to wound infection, partial removal of the mesh and eventrations. Longer operative time and massive blood loss during operation are another issue in the comparison of operation techniques. Generally, those two factors are dependent on surgeon's experience. Though most surgical staffs in general has performed basic and advanced procedures, operating time is long when performed by inexperienced surgeons, and is shortened by accumulating experience. Also blood loss is dependent on surgeon's skill and on the situation of hernia. In our study, amount of blood loss and operation time were significantly lower in study group.

With regard to the postponed results and, namely, recurrence of the hernia after mesh is eliminated, Rehman *et al*. analyzed data from 40 patients, which showed that after the mesh is eliminated the recurrence rate of hernia amounted to an average of 5% (22). According to our data, the recurrence of hernias in the group, where the mesh is eliminated with ultrasound, was the smallest. Herewith the control group showed the recurrence rate which was consistent with Rehman's findings on the ventral hernias.

Thus, supra-sonic excision of the implant prevents damage to viable tissues of the abdominal wall during the allocation of the implant and provides a good bactericidal effect, which promotes normal tissue regeneration and prevents possible recurrence of the herniation.

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