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ADVANCES IN SURGICAL TECHNIQUES FOR THE TREATMENT OF GIANT HIATAL HERNIA

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Background. Laparoscopic surgery for large and giant hiatal hernias is associated with significant technical difficulties. This study compared outcomes of two surgical approaches: the use of mesh implants and relaxing incisions of the diaphragmatic crura.

Materials and Methods. Between 2015 and 2024, 78 patients (66.7% women; mean age 64.5 ± 1.1 years; BMI 29.4 ± 3.2 kg/m²) underwent laparoscopic surgery for giant hiatal hernia. Patients were randomized into two groups: Group I (n = 46) received mesh implants (Ultra Pro, PTFE-coated), while Group II (n = 32) underwent relaxing incisions of the diaphragmatic crura with defect coverage using a self-fixing ProGrip mesh. Follow-up lasted 12 months and included assessment of complications, recurrences, and quality of life (QoL) using the SF-36, GIQLI, and Visick scales.

Results. All procedures were performed laparoscopically. In Group I, there was one fatal case and 15 complications, compared with no deaths and three complications in Group II. Recurrence rates were 21.7% vs. 9.4%, respectively. Dysphagia (34.8% vs. 12.5%) and heartburn (37.0% vs. 15.6%) were significantly more common in Group I. Reoperations were required in 26.1% vs. 6.3% of cases ($p = 0.02$). Long-term QoL was higher in Group II, with significantly lower somatic discomfort and improved SF-36 scores ($p < 0.05$).

Conclusions. Laparoscopic surgery of giant hiatal hernias using relaxing incisions of the diaphragmatic crura is a safe and effective alternative to mesh implantation. This technique reduces recurrence rates (21.7% to 9.4%) and re-operations (26.1% to 6.3%; $\chi^2 = 5.04$, $p = 0.02$), while improving patient quality of life.

Keywords: hiatal hernia, mesh implant, fundoplication, minimally invasive surgery, quality of life.

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РОЗВИТОК ХІРУРГІЧНИХ ТЕХНОЛОГІЙ В ЛІКУВАННІ ГІГАНТСЬКИХ ГРИЖ СТРАВОХІДНОГО ОТВОРУ ДІАФРАГМИ
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Проведено порівняння результатів лапароскопічних операцій у пацієнтів із гігантськими хіатальними грижами, яким встановлювали сітчасті імплантати, з результатами лапароскопічних операцій, де додатково були виконані послаблюючі розрізи ніжок і купола діафрагми.

Встановлено, що застосування модифікованого способу пластики стравохідного отвору діафрагми дозволяє зменшити кількість ускладнень, відновити нормальну функцію стравоходу та значно покращити якість життя пацієнтів.

Зокрема, застосування послаблюючих розрізів під час хірургічного лікування гігантських гриж стравохідного отвору діафрагми виявилося виправданою тактикою – цей підхід дозволяє скоротити кількість рецидивів з 21,7% до 9,4%, а повторних операцій – з 26,1% до 6,3% ($\chi^2 = 5,04$ $p = 0,02$). Застосування послаблюючих розрізів дозволяє достовірно покращити якість життя пацієнтів впродовж 12 місяців довготривалого спостереження.

Ключові слова: грижа стравохідного отвору діафрагми, сітчастий імплантат, фундоплікація, мініінвазивна хірургія, якість життя.

Introduction

Laparoscopic surgery for large and giant hiatal hernias is associated with significant technical difficulties [1–3]. Successful closure of a large diaphragmatic defect often requires the use of mesh implants. However, direct contact between the mesh and the esophagus can lead to adverse effects, such as ingrowth of the mesh into the esophageal tissue, which can potentially lead to perforation, stenosis, dysphagia, or even complete obstruction of the esophagus [4; 5]. These complications may require additional complex surgical interventions.

Our clinic is engaged in the improvement of laparoscopic methods for the treatment of hiatal hernias. To date, we have performed operations on approximately 4.000 patients with this disease. Our extensive experience, combined with a thorough review of the relevant scientific literature,

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indicates that the most serious problems in surgical intervention arise in patients with large and giant hernias of the esophageal opening of the diaphragm, especially those where the distance between the crura of the diaphragm exceeds 5 cm [6–8]. Initially, like many surgeons, we used mesh implants fixed to the diaphragmatic crura in these cases [6]. However, reports in the medical literature and our clinical experience raised serious concerns about this approach [7; 8].

In order to reduce the risk of complications associated with mesh implants, we used a technique of creating relief incisions on the crura and dome of the diaphragm [9]. This modification allowed to suture the crura of the diaphragm without mesh. Although this technique was proposed by American surgeons quite some time ago [10], it has not gained widespread acceptance among practicing physicians due to concerns about its effectiveness and the risk of hernia recurrence and dysphagia [11; 12].

The aim of this scientific study was to compare the results of laparoscopic surgery in patients with giant hiatal hernias who had mesh implants with the results of laparoscopic surgery where we performed relaxing incisions of the crura and dome of the diaphragm.

Materials and methods

From 2019 to 2024, 78 patients with giant hiatal hernias were operated on at the clinic. The study was conducted in accordance with the principles of the World Medical Association's Declaration of Helsinki (1964, as amended). All study participants provided written informed consent to participate in the study.

To determine the size of the hernia, we used the proposed classification, according to which giant hernias are those in which the area of the hernial defect exceeds 20 cm² [6]. In these patients, the greatest distance between the crura of the diaphragm exceeded 5 cm and averaged (8.2 ± 0.3) cm.

The surgical intervention was performed through 4 ports: one 10 mm port for the laparoscope and three 5 mm ports for instruments. In very complex cases, an additional 5 mm port for instruments was used in 12 (15.4%) patients. Particular attention was paid to sufficient dissection of the esophagus, which allowed it to be lengthened by 7–8 cm. In two (2.6%) cases with a shortened esophagus, a Collis operation was performed. For this purpose, laparoscopic stapling devices were used to resect the fundus part of the stomach in order to create an elongated tubular part of the esophagus.

After dissecting the diaphragmatic and esophageal crura, excising the hernial sac, and removing the lipoma from the mediastinum, we proceeded to repair the hernial defect. In virtually all patients, it was impossible to close the defect with conventional sutures, as they did not allow the edges of the hernial opening to be pulled together.

Therefore, in Group I (46 patients), we closed the defect with a mesh implant. To do this, the edges of the hernial defect were fixed to the mesh implant using a lightweight Ultra Pro mesh, as well as coated PTFE meshes. An opening for the esophagus was formed in the center of the mesh implant.

In 12 patients, we used Parietex collagen-coated volumetric polyester meshes. To avoid direct contact between the mesh and the esophagus, we fixed the remnants of the hernial sac and a part of the omentum between the implant and the esophagus. The average size of the hernial defect in Group I was (29.6 ± 0.7) cm².

In Group II (32 patients), we used a technique involving incision of the right crus of the diaphragm and the dome of the diaphragm on the left. The defect was covered with a self-fixing ProGrip mesh.

The average size of the hernial defect in Group II was (28.5 ± 0.9) cm², i.e., the clinical groups did not differ in this parameter ($p > 0.05$).

All interventions were performed in compliance with modern bioethical requirements, and patients signed informed consent to participate in the study [13]. After obtaining the patient's consent to use data from medical records, all necessary measures were taken to comply with the rules of anonymity and confidentiality. The study implemented measures to ensure patient safety and rights, human dignity, and ethical standards in accordance with the principles of the Helsinki Declaration, the European Convention on Human Rights, and the current laws of Ukraine. The study was approved at a meeting of the Bioethics Commission of the Odesa National Medical University of the Ministry of Health of Ukraine (protocol No. 15 of 02.03.2020).

The observation period lasted from 6 to 60 months after surgery. Cases of complications, relapses, and quality of life (QoL) indicators were considered as control points. The SF36 and GIQLI questionnaires were used to assess QoL [14; 15]. Additionally, symptom regression was assessed according to Visick [16].

Statistical processing was performed using methods of variational statistics with the use of Excel software (MS Inc., USA) [17].

Results

In the cohort of operated patients, women constituted the majority – 52 cases (66.7%), compared with 26 men (33.3%). The average age of patients was (64.5 ± 1.1) years (ranging from 48 to 76 years). The average body mass index (BMI) was (29.4 ± 3.2) kg/m². Nine (11.5%) patients had severe thoracic kyphosis.

All patients had concomitant diseases. The most common were ischemic heart disease and atherosclerosis. Chronic hepatitis was diagnosed in 7 (9.0%) patients, gastric ulcer in 8 (10.3%), and a history of duodenal ulcer in 6 (7.7%). Erosive esophagitis was detected in 15 (19.2%) patients. Kidney and urinary tract diseases were noted in 19 (24.4%) patients.

A history of abdominal surgery was present in 29 (37.2%) patients.

The main clinical symptoms were: heartburn – in 48 (61.5%) patients, dysphagia – in 39 (50.0%) patients, pain behind the sternum and in the subcostal area – in 68 (87.2%) patients, partial obstruction of the esophagus – in 7 (9.0%) patients. Almost all patients experienced belching.

All 78 operations were performed laparoscopically. Complications included splenic bleeding in 3 patients (3.8%). It was stopped using bipolar coagulation, tamponade, and special hemostatic sponges. In 9 patients, left-sided pneumothorax developed after incision of the diaphragmatic dome, requiring drainage of the left pleural cavity.

One patient who had a coated PTFE mesh implant developed a perforation of the posterior wall of the stomach below the esophagogastric junction on the fifth day after surgery. The patient underwent several re-operations; however, unfortunately, four months after the reconstructive procedure, she died.

There were no fatal cases in the group of patients who underwent relaxing incisions.

In 3 (6.5%) patients who had mesh implants, suppuration developed in the mesh area with the formation of mediastinitis between 6 and 48 months after surgery. Two patients underwent laparoscopic surgery. During the operation, the mesh implants were removed and the mediastinum was drained. After 1.5–2 months, the patients recovered, but they had symptoms of hernia recurrence.

One patient underwent open surgery. He underwent left-sided thoracotomy, mesh removal, and diaphragmatic repair. The patient recovered, but 6 months after the operation, he began to complain of severe heartburn and partial dysphagia.

One patient from the Group I experienced mesh ingrowth into the esophageal lumen with the development of esophageal obstruction. Fourteen months later, she underwent repeated laparoscopic surgery. Removal of the mesh implant was accompanied by significant technical difficulties. This patient also underwent esophageal reconstruction. She recovered, but moderate dysphagia remained and continues to bother her.

Three (6.5%) patients developed severe dysphagia due to mesh ingrowth into the esophageal tissue without perforation of its wall. They complained of pain in the epigastrium and behind the sternum, as well as difficulty in swallowing. The patients underwent repeat laparoscopic surgery. It was possible to partially excise the mesh implants and perform additional plastic surgery on the esophageal opening of the diaphragm.

After multiple re-operations, patients continued to report dysphagia and heartburn.

During examination 6–60 months after surgery, 10 of 46 patients (21.7%) in the group of patients who had mesh implants developed hernia recurrence; 16 (34.8%) patients had dysphagia, and 17 (37.0%) patients complained of severe heartburn.

In Group II, hernia recurrence was observed in 3 (9.4%) of 32 patients. Heartburn was observed in 5 (15.6%) patients, partial dysphagia in 4 (12.5%).

Repeat surgeries were performed in 12 (26.1%) of 46 patients in Group I and in 2 (6.3%) patients in Group II ($\chi^2 = 5.04$, $p = 0.02$). After re-operations, good results were achieved in 6 out of 14 patients, i.e., in one-third of cases in Group I and in all re-operated patients in Group II ($\chi^2 = 3.11$, $p = 0.08$).

The results according to the Visick assessment system [16] are shown in Table 1. As can be seen from the above, in Group II, the effectiveness and safety of surgical treatment were better than in Group I ($\chi^2 = 21.1$, $df = 4$, $p = 0.0003$).

This is confirmed by the results of QoL assessment at distant stages of observation. Thus, in Group I, the GICLI scores were (106 ± 7) points, and in Group II, (92 ± 8) points ($p < 0.05$). Regarding quality of life assessed by the SF-36, patients in Group II demonstrated better scores across all subscales. (Fig. 1). In particular, a reduction in manifestations of somatic discomfort was observed, as evidenced by the normalization of scores on the subscales of bodily pain (up to 83.3 ± 1.8 points), role-emotional functioning (up to 82.6 ± 1.6 points), and role-physical functioning (up to 81.8 ± 2.3 points). The differences between the clinical groups were statistically significant ($p < 0.05$).

These findings indicate that the use of a modified surgical technique for giant hiatal hernias reduces the number of complications, restores normal esophageal function, and significantly improves patients' QoL. Contrary to the reports of other researchers [10; 11], our experience shows that relaxing incisions did not affect the risk of intraoperative complications but, on the contrary, minimized the number of repeat surgeries. We do not consider the tactic of artificially creating a left-sided pneumothorax to be an adequate alternative to relaxing incisions; in addition, we also avoid pleurotomy to minimize the risk of complications. Precision in manipulating the right crus of the diaphragm is particularly important.

In our opinion, important elements of surgical intervention that should be taken into account in the surgical treatment of hiatal hernias are ensuring sufficient distance between the right crus of the diaphragm and the inferior vena cava, avoiding injury to the pericardium when performing relaxing incisions, and ensuring sufficient distance between the left relaxing incision and the rib so that the mesh can be attached. In addition, it is advisable

Table 1

Regression of clinical manifestations after treatment (Visick score)

Visick score	Group I (n = 45*)		Group II (n = 32)	
	Abs.	%	Abs.	%
I (complete regression of symptoms)	17	37.8	20	62.5
II (incomplete regression of symptoms, significant clinical improvement)	19	42.2	10	31.3
III (incomplete regression of symptoms, moderate clinical improvement)	7	15.6	2	6.3
IV (incomplete regression of symptoms, significant clinical improvement)	1	2		
V (no improvement)	1	2		

Note: * – taking into account the fatal case.

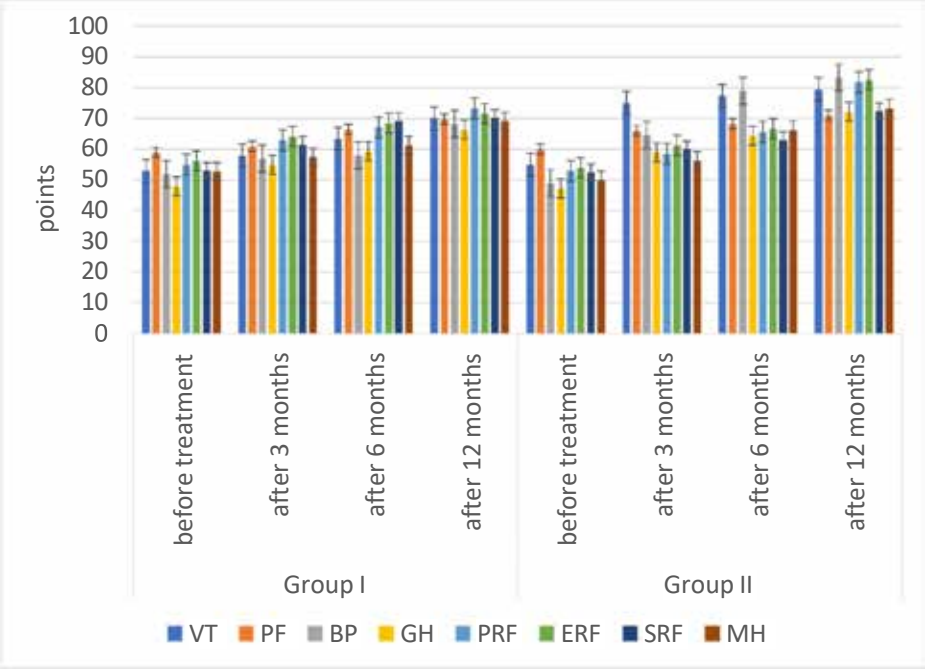

Fig. 1. Dynamics of quality of life indicators according to SF-36 subscales in patients undergoing surgery for giant hiatal hernias

to use intraoperative dynamometry to determine the degree of tension on the suture material and avoid cutting through the sutures [9].

Conclusions

The use of relaxing incisions in the surgical treatment of giant hiatal hernias is a justified and effective tactic.

This approach reduces the recurrence rate from 21.7% to 9.4% and the rate of re-operations from 26.1% to 6.3% ($\chi^2 = 5.04$, $p = 0.02$).

The application of relaxing incisions contributes to an improvement in patients' quality of life, with positive effects maintained over a 12-month follow-up period.

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