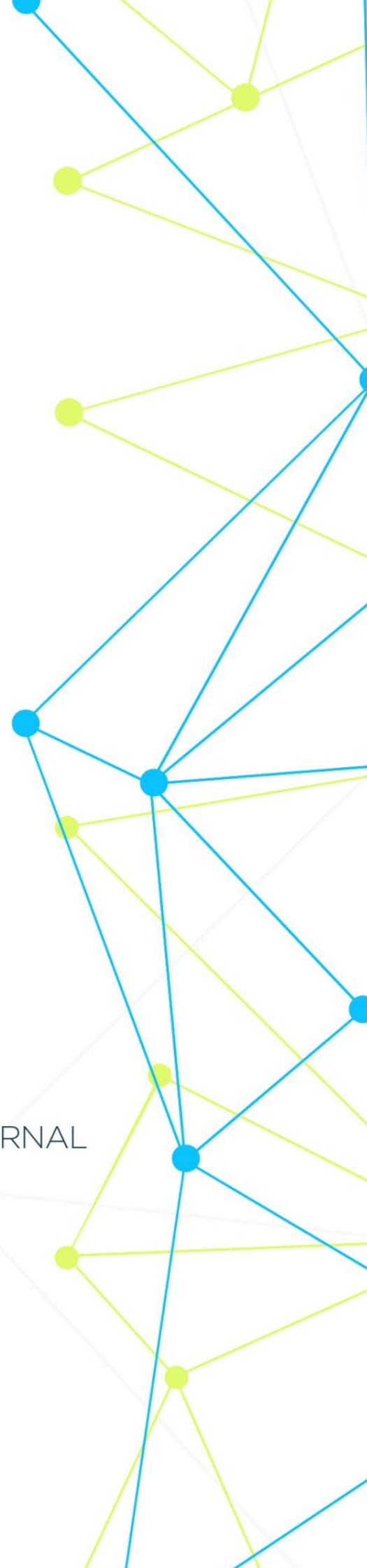


INTERNATIONAL MEDICAL SCIENTIFIC JOURNAL

ART OF MEDICINE



Art of Medicine International Medical Scientific journal

Founder and Publisher **Pascual Izquierdo-Egea**

Published science may 2021 year. Issued Quarterly.

Internet address: <http://artofmedicineimsj.us>

E-mail: info@artofmedicineimsj.us

11931 Barlow Pl Philadelphia, PA 19116, USA +1 (929) 266-0862

CHIEF EDITOR

Dr. Pascual Izquierdo-Egea

EDITORIAL BOARD

Prof. Dr. Francesco Albano

Prof. Dr. Tamam Bakchoul

Dr. Catherine J. Andersen

Prof. Dr. Pierre-Gregoire Guinot

Prof. Dr. Sandro Ardizzone

Prof. Dr. Rainer Haak

Dr. Dmitriy Atochin

Prof. Henner Hanssen

Prof. Dr. Antonio Aversa

Prosthetic hiatoplasty in surgical treatment of hiatal hernias

Khashimov Sh.Kh., Sadikov N.S., Ligai R.E., Tsoi A.O.,

Tashkenbaev F.R., Zaripov A.A.

**Republican specialized scientific and practical medical center of surgery named
after Academician V. Vakhidov. Tashkent, Uzbekistan**

Abstract. The article describes the experience of surgical treatment of hiatal hernias of types II and III. The authors proposed an original technique of prosthetic hiatoplasty aimed at the prevention of general and specific postoperative complications. The article presents an analysis of the immediate results of the proposed operation, as well as long-term results.

Key words: hiatal hernia, prosthetic hiatoplasty, laser therapy, postoperative complications.

Introduction

In recent years, interest in the problem of hiatal hernias and gastroesophageal reflux disease has increased, since today they occupy a leading position in gastroenterology in frequency after gastric ulcer and duodenal ulcer and cholecystitis [2,3,9]. Hernias of the esophageal opening of the diaphragm account for 98% of all hernias of the diaphragm. It is important to note that in 50% of patients, it does not cause any clinical manifestations and, therefore, is not diagnosed [1,5,6,10,12].

The urgency and need to address the issues of effective treatment of HH is primarily due to the frequency of the spread of this disease - in 44% of the population, at least once a month symptoms of heartburn appear; 7% experience it daily; 18% are forced to resort to self-medication to eliminate the symptom [1,7,11]. Thus, approximately 1% of the population suffers from GERD symptoms, and 40% of the diagnostic examination reveals a hiatal hernia [8,11].

The need for further study of various aspects of this problem does not raise doubts, since the issues of choosing the optimal method of treatment have not been fully determined [5,9,12]. This has become especially important in recent years in

connection with the widespread introduction of endovideosurgical technologies in the treatment of HH [2,7,10].

Purpose of the study

To study the results of a new method of surgical treatment of HH using prosthetic hiatoplasty.

Materials and methods

Department of Endovisual Surgery of the Republican specialized scientific and practical medical center of surgery named after Academician V. Vakhidov for the period from 2006 to 2019 has experience in the surgical treatment of 105 patients operated on for hernia of the esophageal opening of the diaphragm.

When distributing patients, the comparison group consisted of 61 patients, where the choice of surgery was carried out based on the preferences and experience of the operating surgeon, some of which are currently not used due to frequent relapses of the disease. When choosing the operation, such indicators as the hiatal surface area (HSA) and the degree of atrophy of the legs of the diaphragm were not taken into account, and it is these indicators that determine the long-term results.

The main group consisted of 44 patients, in whom a differentiated approach to the choice of surgical intervention depending on the HSA was used, as well as prosthetic hiatoplasty according to the original technique, both from the open and from the laparoscopic approach.

After a comprehensive examination, including endoscopy, X-ray contrast study, and computed tomography, the distribution of patients by the type of HH was carried out according to the classification recommended in 2013 by the American Association of Gastroenterological and Endoscopic Surgeons (SAGES) for the treatment of HH [6], which includes 3 types of HH (Fig. 1).

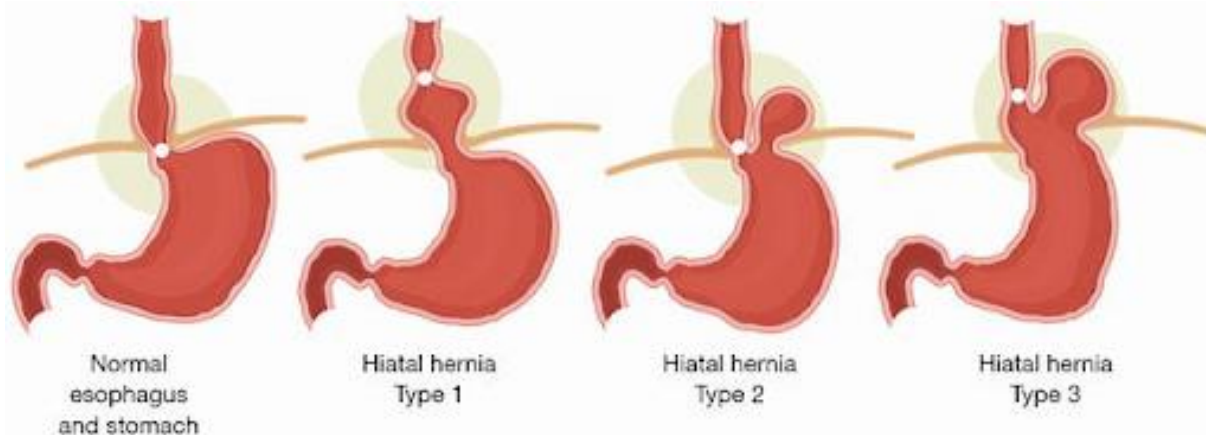


Fig. 1. Types of hiatal hernia (SAGES, 2013)

According to the classification, when examining patients, type II HH was diagnosed in 10 (9.5%), of which 7 (11.4%) patients in the comparison group and in 3 (6.8%) patients in the main group. HH type III were diagnosed in 95 (90.4%) patients, of which 54 (88.5%) patients in the comparison group and 41 (93.1%) patients in the main group. The distribution of patients depending on the type of HH is presented in Table 1.

Table 1

Distribution of patients by types of hiatal hernia

Size of hernia	Comparison group	Main group	Total
Type II	7(11,4%)	3(6,8%)	10(9,5%)
Type III	54(88,5%)	41(93,1%)	95(90,4%)
Total:	61(100%)	44(100%)	105(100%)
Reliability	$\chi^2=0.64, p=0.42$		

If with hernias of type II, the contents are the stomach, then with hernias of type III, in addition to the stomach, the hernial contents can be a loop of the small or large intestine, as well as a strand of the greater omentum. HH of type III was established in 95 (90.4%) patients, with subtotal gastric HH in 78 (74.2%) and total gastric HH in 17 (16.2%) patients. In this group, 15 (14.2%) of 105 patients had a

mixed nature of the HH content: small intestine - in 1 (1%), omental - in 6 (5.7%), colonic - in 5 (4.7%). %) and mixed (colonic + omental) - in 3 (2.8%) patients.

The distribution of patients depending on the type of surgery is presented in Table 2.

Table 2

Types of surgical interventions

Surgical intervention	Comparison group	Main group	Total
Allison's operation	4(6,5%)	-	4(3,8%)
Hill's operation	23(37,7%)	-	23(22%)
Collis's operation	1(1,6%)	-	1(1%)
Cruroraphy	33(54%)	18(41%)	51(48,5%)
Cruroraphy with prosthetic hiatoplasty	-	22(50%)	22(21%)
Laparoscopic cruroraphy with prosthetic hiatoplasty	-	4(9%)	4(3,8%)
Total	61(100%)	44(100%)	105(100%)

In the comparison group, the largest number was cruroraphy, performed in 33 patients and amounted to 54%. Hill's operation was performed in 23 (37.7%) patients, Allison's operation in 4 (6.5%) patients and Collis's operation in 1 (1.6%) patient. All of the above operations, the execution technique of which is widely known and described in detail in the available literature, therefore we do not consider it necessary to dwell on their description in detail.

As mentioned earlier, in the comparison group, the choice of surgical aid was based on the experience of the surgeon and his preferences. In the main group, the choice of surgical intervention was based on HSA and the presence of atrophy of the legs of the diaphragm.

The technique for measuring the size of a hernial defect is not standardized, and the measurement of such an indicator as diameter is incorrect, since in most cases the HH has the shape of a triangle or, more precisely, an inverted drop. Granderath F.A. et al. in 2007 [4] was published article based on the intraoperative measurement of the indicator they proposed - HSA (Fig. 2). It is calculated using the equation:

$$\text{HSA} = \arcsin (\text{TD} / 2 / \text{VD}) \times \text{VD}^2$$

VD - vertical dimension; TD - transverse dimension.

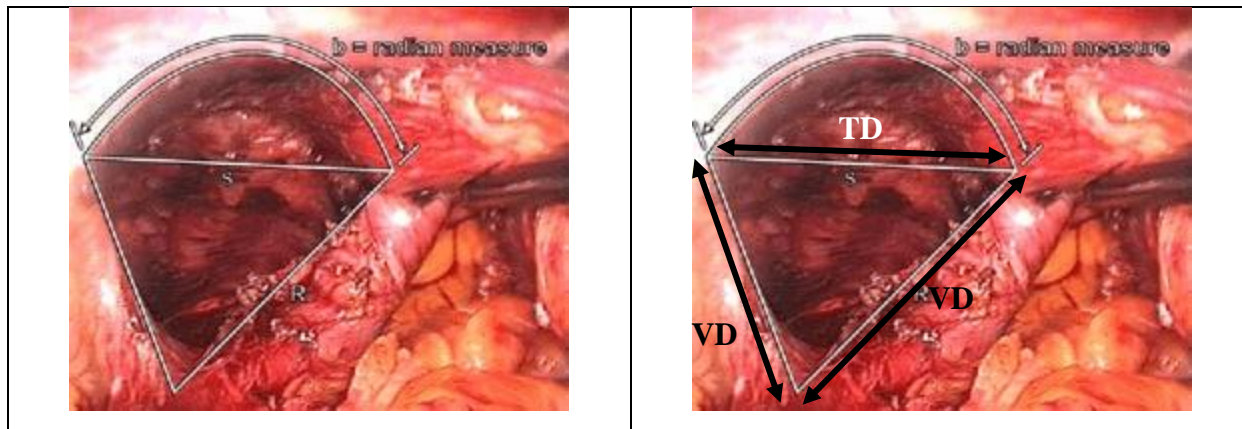


Fig. 2. Measurement of hiatal surface area (HSA).

Based on the method of measuring the indicator "hiatal surface area" Granderath F.A. et al. and the results of a retrospective analysis of 787 operations, created the classification of the HH:

Small – HH < 10 cm²;

Large – HH 10-20 cm²;

Giant – HH > 20 cm².

The applied value of this classification consists in a clear definition of the indications for the plastic technique (for small hernias, cruroraphy is indicated, for large and giant ones - alloplasty), which is evidence-based on the dependence of an increase in the frequency of relapses on the value of HH.

According to the proposed indicators and classification, in the main group, when choosing a surgical aid, we analyzed the following parameters: F.A. Granderath, as well as the degree of atrophy of the legs of the diaphragm in large and giant hiatal hernia.

HSA was measured intraoperatively according to the proposed equation. At the same time, in the main group, we obtained the following results: small HH was established in 18 (41%) patients, large in 17 (38.6%) patients and gigantic in 9 (20.4%) patients.

In addition to HSA, the degree of atrophy of the pedicles of the diaphragm was assessed, which was also important in determining the indications in favor of prosthetic hiatus. The severity of atrophy of one or both legs of the diaphragm depended on the size of the hernial sac and the location of the latter relative to the median axis. Atrophy of the legs of the diaphragm is the result of compression by the hernial sac and ischemization in the pressure zone, followed by atrophy of one or both legs. The degree of atrophy of the pedicles of the diaphragm, as well as the HH, was assessed intraoperatively. When assessing this indicator, we obtained the following results: no changes were found in both diaphragm legs in 18 (41%) patients with small HH, atrophy of the left leg was detected in 18 (41%) patients, while the hernial sac was located to the right of the median axis. The right leg was, on the contrary, pronounced in 8 (18.1%) patients.

After the analysis of the results obtained, in 18 (41%) patients, given the small size of the HH, the HSA is less than 10 cm^2 and the absence of changes in the side of the diaphragm legs, there were no indications for prosthetic hiatoplasty. In 26 (59%) patients, in addition to the large size of HH, HSA was from 10 cm^2 or more, and there was also atrophy of both one and both legs of the diaphragm. The totality of these indicators was an indication for performing prosthetic hiatoplasty.

The original technique of prosthetic hiatoplasty used in the main group included two stages: operational and postoperative. We named it "A method of surgical treatment of hiatal hernia" for which a patent was received for the invention of IPA RUz IAP23124.

Surgical stage: The method of surgical treatment of hiatal hernia includes, in addition to the conventional stages of surgery, selective proximal vagotomy, pyloroplasty according to Heinecke-Mikulich, the formation of a fundoplication cuff, behind the esophageal cruraphy, and the imposition of a U-shaped mesh implant on the suture area. At the same time, when the fundoplication cuff is formed, the anterior wall of the abdominal esophagus is captured, a U-shaped mesh prosthesis made of polytetrafluoroethylene (PTFE) is used, while the horizontal part of the prosthesis is

fixed to the diaphragm legs with interrupted (stapling) sutures, 3-4 mm away from the edges esophageal opening of the diaphragm, the free floors of the specified prosthesis are fixed to the diaphragm also with interrupted (stapling) sutures (Fig. 3).

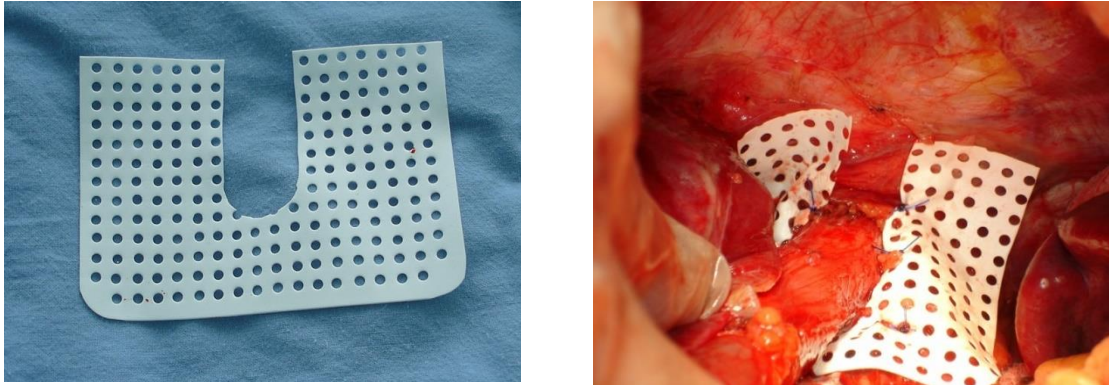


Fig.3. Cutting out the prosthesis and fixing it to the diaphragm.

Postoperative stage. Starting from the first day after the operation, 5 sessions of percutaneous laser therapy are performed using the Sogdiana apparatus (Fig. 4). With mild pain syndrome, the pulse frequency was 80 Hz, with intense pain syndrome, 1500 Hz, exposure time 256 s per 1 zone, daily during one session, 3 zones are affected - the lower third of the sternum, the epigastric region and the area of the pain point.

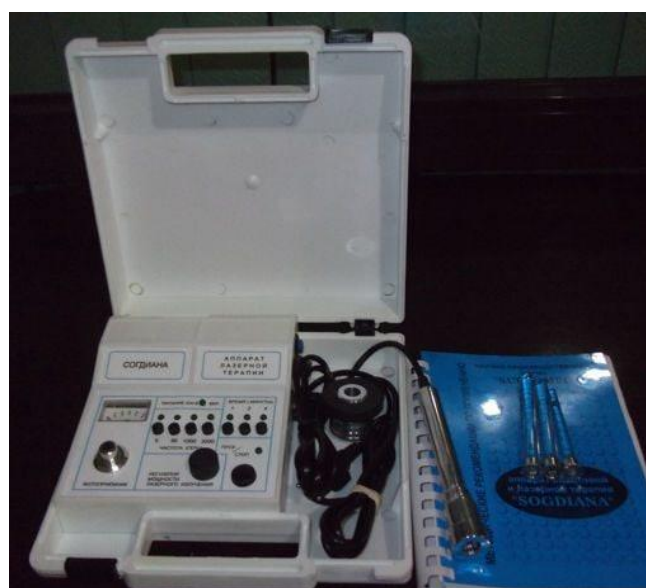


Fig. 4. Laser machine "Sogdiana"

Research results

When assessing the results, we assessed the frequency and nature of postoperative complications, the length of the patient's stay in the hospital, and also studied long-term results in terms of 1 month to 2 years.

Postoperative complications. Complications that developed in the postoperative period were conditionally divided into general and specific. General complications developed in 20 patients, which amounted to 19%, and specific complications in 17 patients, which amounted to 16.2%. All postoperative complications were eliminated by conservative measures and only in one case required relaparotomy. No lethal outcomes were observed.

When analyzing the postoperative period, it was found that in 85 patients, which amounted to 81%, the latter proceeded without any postoperative complications. In 20 patients, which amounted to 19%, general postoperative complications were observed in the postoperative period (Table 3.)

Table 3

General postoperative complications.

General complications.	Comparison group	Main group	Total
Without complications	43(70,5%)	42(95,4%)	85(81%)
Postoperative complications	18(29,5%)	2(4,5%)	20(19%)
Reliability	$\chi^2=10.33, p=0.0013$		
Postoperative complications			
Suppuration of the wound	5(8,2%)	-	5(4,7%)
Bleeding from a wound	3(5%)	-	3(2,8%)
Pneumonia	2(3,2%)	-	2(2%)
Pleurisy	3(5%)	1(2,2%)	4(3,8%)
Intra-abdominal bleeding	1(1,6%)	-	1(1%)
Cardiovascular complications	4(6,5%)	1(2,2%)	5(4,7%)
Total	61(100%)	44(100%)	105(100%)

In the main group, it was possible to reliably ($\chi^2 = 10.33, p = 0.0013$) reduce the number of postoperative complications from 29.5% to 4.5%.

The total number of specific complications observed in the immediate postoperative period was 83.8%. At the same time, thanks to a new method of surgical treatment of HH, in the main group it was possible to reduce the number of patients without specific complications from 73.7% in the comparison group to 97.7% in the main group. Specific complications developed in 17 patients, which amounted to 16.2%. Analysis of specific complications is presented in Table 4.

Table 4.

Specific complications

Specific complications	Comparison group	Main group	Total
Without specific complications	45(73,7%)	43(97,7%)	88(83,8%)
Specific complications	16(26%)	1(2,2%)	17(16,2%)
Reliability	$\chi^2=10.8, p=0.001$		
Specific complications			
Dysphagia	7(11,4%)	1(2,2%)	8(7,6%)
Reflux esophagitis	4(6,5%)	-	4(3,8%)
Gastrostasis	5(8,2%)	-	5(8,5%)
Total	61(100%)	44(100%)	105(100%)

In the main group, thanks to the proposed method, it was possible to reliably ($\chi^2 = 10.8, p = 0.001$) reduce the number of specific complications from 26% in the comparison group to 2.2% in the main group.

Among the specific complications in the immediate postoperative period, we noted the following: dysphagia was observed in 8 (7.6%) patients, of which in 7 (11.4%) patients in the comparison group and in 1 (2.2%) patients in the main group; reflux esophagitis was observed in 4 (6.5%) patients, only in the comparison group; gastrostasis was diagnosed in 5 (8.2%) patients also only in the comparison group.

The duration of the postoperative period. As the analysis of the duration of the postoperative period has shown, the number of patients with the shortest period of the postoperative period "up to 5 days" was observed in 4 (3.8%) patients. The largest number of patients were discharged within 5 to 7 days - 70 patients, which amounted to 66.6%. In terms of 7 to 10 days, 25 (23.8%) patients were discharged, and the

longest postoperative period of 10 or more days was observed in 6 (5.7%) patients (Table 5).

Table 5

Duration of the postoperative period

Bed days	Comparison group	Main group	Total
Up to 5	-	4(9%)	4(3,8%)
5-7	30(49,1%)	40(91%)	70(66,6%)
7-10	25(41%)	-	25(23,8%)
10 and more	6(9,8%)	-	6(5,7%)
Total	61(100%)	44(100%)	105(100%)
Reliability	$\chi^2=20,03, p=0.000008$		

As follows from the table, thanks to the introduction of a new method of surgical treatment of HH, the stages of which are aimed at the prevention of postoperative complications, as well as the possibility of laparoscopic execution, in the main group, 91% of patients were discharged on the 5th day after the operation, and patients after laparoscopic operations were discharged on the 3rd and 4 days after surgery, which amounted to 9%.

In the comparison group, there were no patients discharged within 5 days. With a favorable course, in the comparison group, patients were discharged within 5 to 7 days and amounted to 49.1%. In terms of 7 to 10 days, 41% of patients were discharged with general or specific complications. The longest postoperative period was also observed only in the comparison group in 6 patients and amounted to 9.8%.

Long-term results. After undergoing operations, out of 105 patients, in the long-term period from 1 month to 2 years, 93 patients were examined, which amounted to 88.5%, and 12 (11.4%) patients did not appear on time for the control examination. In the comparison group, out of 61 operated patients, 49 (80.3%) were examined, and 12 (19.6%) were not examined. In the main group, at various times after the operation, all 44 (100%) patients were examined (Table 6).

Table 6

Long-term observation

Terms of observation	CG N=61	MG N=44	Total N=105
Not observed	12(19,6%)	-	12(11,4%)
1 to 3 months	28(46%)	27(61,3%)	55(52,3%)
4 to 6 months	17(27,8%)	11(25%)	28(26,6%)
1 year	4(6,5%)	4(9%)	8(7,6%)
2 years	-	2(4,5%)	2(2%)
Total	49(80,3%)	44(100%)	93(88,5%)

In terms of 1 to 3 months, 55 (52.3%) patients underwent control examination, of which 28 (46%) were patients in the comparison group and 27 (61.3%) were patients in the main group. In the period from 4 to 6 months after the operation, 28 (26.6%) patients, 17 (27.8%) patients in the comparison group and 11 (25%) patients in the main group were examined. A year after the operation, 8 (7.6%) patients, 4 (6.5%) patients from the comparison group and 4 (9%) patients from the main group were examined. The longest follow-up period was 2 years after the surgery. During this period, 2 (4.5%) patients of the main group were examined.

After examining 93 patients, we found that 77 patients had no specific complications, which amounted to 82.8%. In 16 patients, which amounted to 17.2%, various specific complications were revealed. Analysis of specific complications in the long-term period is presented in Table 7.

Table 7

Long-term specific complications

Complications	Comparison group	Main group	Total
Without specific complications	37(75,5%)	40(91%)	77(82,8%)
Specific complications	12(24,4%)	4(9%)	16(17,2%)
Reliability	$\chi^2=3,86, p=0.049$		
Specific complications			
Dysphagia	4(8,1%)	2(4,5%)	6(6,4%)
Recurrent reflux esophagitis	3(6,1%)	1(2,2%)	4(4,3%)
Gastrostasis	2(4%)	1(2,2%)	3(3,2%)
Recurrent HH (clinically significant)	2(4%)	-	2(2,1%)
Recurrent HH (clinically insignificant)	1(2%)	-	1(1%)
Total:	49(100%)	44(100%)	93(100%)

In the main group in the long-term period, the number of specific complications was significantly ($\chi^2 = 3.86$, $p = 0.049$) lower than in the comparison group.

Discussion of research results

As follows from the table, dysphagia was established in 6 (6.4%) patients, while in 4 (8.1%) patients in the comparison group and in 2 (4.5%) patients in the main group. Recurrent reflux esophagitis was established in 4 (4.3%) patients, of which 3 (6.1%) patients in the comparison group and 1 (2.2%) patients in the main group. Gastrostasis was observed in 3 patients, which amounted to 3.2%. Of these, in the comparison group in 2 (4%) patients and in 1 (2.2%) in the main group. Relapse of HH was observed only in the comparison group in 3 (6.1%) patients. At the same time, a clinically significant relapse, accompanied by a relapse of preoperative complaints of heartburn, belching and feeling of a "lump" behind the breastbone after a meal, was observed in 2 patients, which amounted to 4%. Clinically insignificant recurrence of HH, not accompanied by any complaints, was observed in 1 patient, which was 2%.

Conclusions

Partial or total necrosis of the hernial contents, which occurs during infringement in type II and III HH, determines the absolute indications for surgical treatment in the diagnosis of the latter;

Measurement of the APF and assessment of the severity of atrophy of the legs of the diaphragm, with HH of the II and III types, is considered mandatory when choosing a surgical aid;

If the SFA is more than 10 cm², as well as in the presence of atrophy of one or both legs of the diaphragm, prosthetic hiatus is indicated;

The stages of the proposed method of surgical treatment of hiatal hernia are aimed at preventing the development of both general and specific complications in the immediate postoperative and long-term periods.

The use of prosthetic hiatoplasty made it possible to reliably ($\chi^2 = 10.33$, $p = 0.0013$) reduce the number of general postoperative complications from 29.5% to 4.5%. Thanks to the proposed method, it was also possible to reliably ($\chi^2 = 10.8$, $p = 0.001$) reduce the number of specific complications from 26% in the comparison group to 2.2% in the main group.

In the main group in the long-term period, the number of specific complications was significantly ($\chi^2 = 3.86$, $p = 0.049$) lower than in the comparison group.

References

1. Abu-Seida A. Diagnostic and Treatment Challenges for Diaphragmatic Hernia in Equids: A Concise Review of Literature. *J Equine Vet Sci.* 2021 Nov;106:103746.
2. Dallemagne B, Quero G, Lapergola A. Treatment of giant paraesophageal hernia: pro laparoscopic approach. *Hernia.* 2018 Dec;22(6):909-919.
3. Dreifuss NH, Schlottmann F, Molena D. Management of paraesophageal hernia review of clinical studies: timing to surgery, mesh use, fundoplication, gastropexy and other controversies. *Dis Esophagus.* 2020 Aug 3;33(8):doaa045.

4. Granderath FA, Schweiger UM, Pointner R. Laparoscopic antireflux surgery: tailoring the hiatal closure to the size of hiatal surface area. *Surg Endosc.* 2007 Apr;21(4):542-8.
5. Karatay E, Gok MA, Javadov M. Measurement of hiatal surface area and other hiatus oesophageal diameters at computed tomography imaging in patients with gastroesophageal reflux disease and its relationship with hiatal hernia. *J Minim Access Surg.* 2021 Oct-Dec;17(4):537-541.
6. Kohn GP, Price RR, DeMeester SR, Zehetner J, Muensterer OJ, Awad Z, Mittal SK, Richardson WS.; SAGES Guidelines Committee. Guidelines for the management of hiatal hernia. *Surg Endosc.* 2013 Dec;27(12):4409-28.
7. Lovece A, Sironi A, Asti E, Milito P, Boveri S, Bonavina L. Laparoscopic Surgery for Recurrent Hiatal Hernia: Clinical Outcomes and Quality of Life. *J Gastrointest Surg.* 2021 Oct 19. doi: 10.1007/s11605-021-05165-0.
8. Maret-Ouda J, Wahlin K. Association between laparoscopic antireflux surgery and recurrence of gastroesophageal reflux. *JAMA* 2017;318(10): 939-946.
9. Mazer L, Telem DA. Paraesophageal Hernia: Current Management. *Adv Surg.* 2021 Sep;55:109-122.
10. Pham M, Cohen-Hallaleh R. Laparoscopic Repair of Para-Esophageal Hernia Using Absorbable Biosynthetic Mesh. *J Vis Exp.* 2021 Sep 11;(175).
11. Rodríguez de Santiago E, Albéniz E, Estremera-Arevalo F. Endoscopic anti-reflux therapy for gastroesophageal reflux disease. *World J Gastroenterol.* 2021 Oct 21;27(39):6601-6614.
12. Suppiah A, Sirimanna P, Vivian SJ, O'Donnell H, Lee G, Falk GL. Temporal patterns of hiatus hernia recurrence and hiatal failure: quality of life and recurrence after revision surgery. *Dis Esophagus.* 2017;30(4):1–8.