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WAYS TO PREVENT RECURRENCE OF DYSPHAGIA AFTER CARDIODILATION IN PATIENTS WITH ACHALASIA OF CARDIA

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Abstract. The aim of the study is to improve the immediate results of pneumatic cardiodilation in patients with cardiospasm and achalasia of the cardia by introducing infrared pulsed laser radiation and an improved model of a cardiodilator. Materials and methods: The Department of Surgery of the esophagus and Stomach of the State Institution "Republican Specialized Scientific and Practical Medical Center for Surgery Named after Academician V.Vakhidov" has experience in treating 813 patients with neuromuscular diseases of the esophagus who were treated from 2010 to 2022. Results and discussion. After the dilation courses, 685 (84.2%) had no complications, and 128 patients, which was 15.7%, had various complications. Conclusions. The use of low-intensity laser radiation in combination with a new model of cardiodilator has significantly reduced the total number of complications from 20% to 10%.

Keywords: neuromuscular diseases of the esophagus, achalasia cardia, cardiospasm, laser therapy, pneumatic cardiodilation, complications of cardiodilation.

Relevance. For the first time, a pneumatic cardiodilator for the treatment of neuromuscular diseases of the esophagus was developed in the 50s of the last century, and in the Soviet Union it became widely used only since 1964, a modification developed in the same year by O.D.Fedorova and G.M. Melnik. Despite the fact that the pneumatic cardiodilator has more than half a century of history in the post-Soviet space, the technique remains relevant to this day. More than half a century later, the device of the pneumatic cardiodilator has not undergone much structural changes. The essence of pneumatic cardiodilation is the forcible expansion of the lower esophageal sphincter, which is associated with traumatization of the mucous membrane,

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muscle membrane, as well as feeding vessels. Given that the pressure injected into the esophageal-gastric cuff increases from session to session, the risk of complications such as bleeding, severe pain syndrome, reflux esophagitis and perforation of the esophagus increases accordingly with each subsequent session. The assessment of the effectiveness of cardiodilation is ambiguous. According to some authors, good immediate results of cardiodilation reach 85% - 90% [3, 5, 6, 7]. According to other researchers, a year after cardiodilation, its effectiveness decreases to 60%, and after 5 years, more than half of the patients have a relapse of the disease [1]. Many patients require repeated courses of cardiodilation [3, 4].

The development of laser medicine is one of the achievements of the late 20th century. The variety and wide possibilities of lasers have led to the fact that they have found their application in almost all fields of medicine [2, 12].

It is known that pulsed laser radiation can have a biological effect associated with the effect on the innervation of smooth muscles, changes in microcirculation, and absorb and prevent the development of connective tissue. These effects have been traced to a large number of studies conducted with pathology of the gastrointestinal tract [2, 8, 9, 10, 11].

When carrying out a cardiodilator, some effort is required to pass the end of the dilator through the spasmodic section of the cardia, as well as excessive force when pumping air, which leads to tears in the muscular wall of the esophagus. These complications contribute to an increase in the scarring of the cardia zone and a decrease in the effectiveness of the treatment sessions with a reduction in the duration of remission of the disease.

Considering that neuromuscular diseases of the esophagus are chronic and recurrent, new solutions are constantly being sought to improve both immediate and long-term results of minimally invasive treatments.

The aim of the study is to improve the immediate results of pneumatic cardiodilation in patients with cardiospasm and achalasia of the cardia by introducing infrared pulsed laser radiation and an improved model of a cardiodilator.

Materials and methods: The Department of Surgery of the esophagus and Stomach of the State Institution «Republican Specialized Scientific and Practical Medical Center for Surgery Named after Academician V.Vakhidov» has experience in treating 813 patients with neuromuscular diseases of the esophagus who were treated from 2010 to 2022. The standard distribution of patients by gender and age according to the WHO classification is shown in Table 1.

Table 1

Distribution of patients by gender and age

Gender	**<19 years old**	**19-44 years old**	**45-59 years old**	**60-75 years old**	**>75 years old**	**Total**
Men	31	200	84	40	4	**359(44,1%)**
Women	25	247	130	51	1	**454(55,8%)**
Total	**56 (6,8%)**	**447 (55%)**	**214 (26,3%)**	**91 (11,2%)**	**5 (0,6%)**	**813(100%)**

As follows from the table, there were 454 women, which was 55.8%, and 359 men, which was 44.1%. As is known, neuromuscular diseases of the esophagus, to a greater extent,

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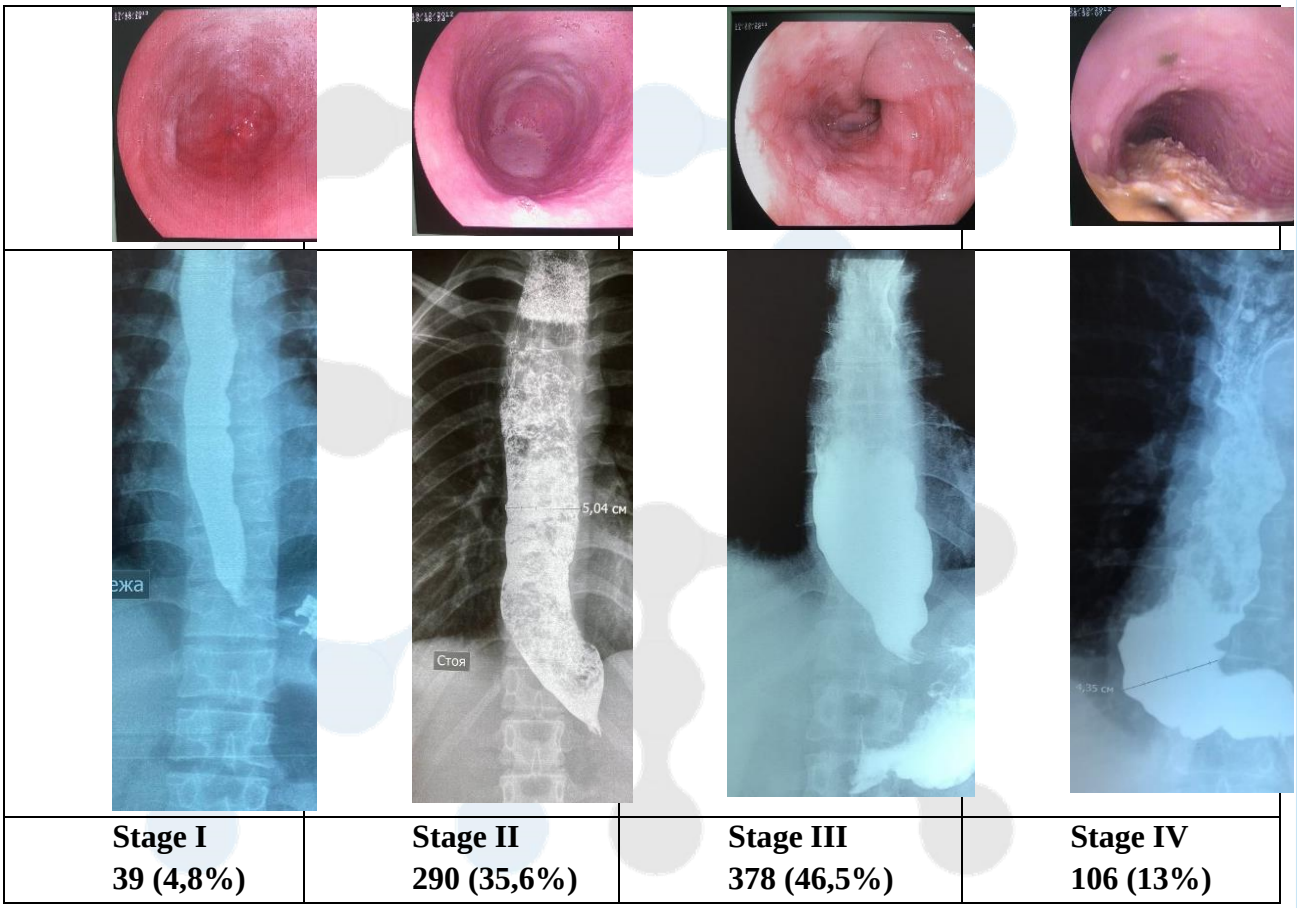
affect young and middle-aged people, i.e. the most able-bodied part of the population. Thus, the number of young and middle-aged patients amounted to 717 patients and amounted to 88.2%, which indicates the great social significance of the problem under study.

To establish a diagnosis, as well as to determine the stage of the disease according to the classification of Petrovsky B.V., an endoscopic and X-ray contrast examination was sufficient. The distribution of patients depending on the stage of the disease, as well as the endoscopic and X-ray picture are shown in Fig. 1.



Stage I	Stage II	Stage III	Stage IV
39 (4,8%)	290 (35,6%)	378 (46,5%)	106 (13%)

Fig. 1. Stages of the disease according to Petrovsky B.V.

In our opinion, regardless of the stage of the disease, treatment of neuromuscular diseases of the esophagus should begin with cardiodilation.

Since 2020, in the department of surgery of the esophagus and stomach, in the treatment of patients with cardiospasm and achalasia of the cardia, when performing cardio-dilation, the latter was supplemented with laser therapy using a semiconductor laser device "Impulse-100". For this method of treatment of neuromuscular diseases of the esophagus, the patent of AIS RUz was obtained, for the utility model FAP 82352 "Method for the treatment of cardiospasm".

In 2015, the Department of Surgery of the esophagus and stomach developed and introduced into clinical practice a useful model of a pneumatic cardiodilator (FAP 01357), as well as an original method of cardiodilation in patients with stages III and IV of the disease (IAP 06163), for which the patent of AIS RUz was obtained.

The clinical material was divided into two groups, taking into account the application of new developments in the minimally invasive treatment of neuromuscular diseases of the esophagus.

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The comparison group consisted of 457 patients who received treatment in the period from 2010 to 2016, who received only cardiodilation as treatment.

The main group consisted of 356 patients who received treatment in the period from 2017 to 2022, in whom cardiodilation was supplemented by the combined use of laser therapy, and at stages III and IV, cardiodilation was performed with an improved model of a pneumatic cardiodilator using a new original method of its management.

The distribution of patients depending on the stage of the disease, taking into account the division into groups, is shown in Table 2.

Table 2

Distribution by disease stage

	I	**II**	**III**	**IV**	
Comparison Group	24 (5,2%)	179 (39,1%)	204 (44,6%)	50 (10,9%)	**457 (100%)**
The main group	15 (4,2%)	111 (31,1%)	174 (48,8%)	56 (17,7%)	**356 (100%)**
TOTAL:	**39 (4,8%)**	**290 (35,6%)**	**378 (46,5%)**	**106 (13%)**	**813(100%)**

As follows from the table, in the comparison group of patients with stage I there were 24 (5.2%) patients, with stage II 179 (39.1%) patients, with stage III 204(44.6%) patients and with stage IV 50 (10.9%) patients. In the main group, there were 15 (4.2%) patients with stage I, 111 (31.1%) patients with stage II, 174 (48.8%) patients with stage III and 56 patients with stage IV, which was 17.7%.

The laser therapy technique was performed by us before, immediately before cardiodilation and after manipulation. Laser irradiation was carried out through the epigastric region immediately below the xiphoid process with the orientation of the radiator tube towards the anatomical localization of the gastric cardia (Fig.2). Irradiation is carried out with a pulse power of 100W and a frequency of 100 Hz. Through this point, irradiation is carried out for 2 minutes at the beginning of treatment, and subsequently the dose of laser radiation increases to 4 minutes. During the irradiation session, the patient is lying on his back in a relaxed state.

Pulse-100 laser device

Location of the radiator tube

Fig. 2. The laser device and the method of conducting.

The developed utility model of a pneumatic cardiodilator consists of a probe in the form of a silicone tube, the channel of which serves to supply air, and an expanding multilayer

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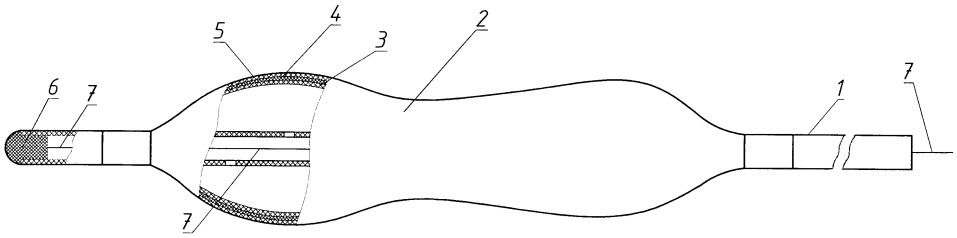
dumbbell-shaped balloon connected to it, the inner and outer layers of which are made of silicone, and the middle reinforcing layer is made of dense synthetic fabric, while the end of the probe is closed with a radiopaque mark in It is equipped with a metal string to be placed in the air supply channel, with one end of the string resting against the radiopaque mark, and the other extending beyond the probe (Fig. 3).



The pneumatic cardiodilator contains a probe 1 in the form of a silicone tube, the channel of which serves to supply air, and an expanding multilayer dumbbell-shaped balloon 2 connected to it, the inner 3 and outer 5 layers of which are made of silicone, and the middle

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reinforcing layer 4 is made of dense synthetic fabric (nylon). The end of the probe 1 is closed with a radiopaque label 6 in the form of a plug. The cardiodilator is equipped with a metal string 7 for placement in the air supply channel. One end of the string 7 rests against the radiopaque marker 6, and the other extends beyond the probe 1.

Fig. 3. The utility model is a "Pneumatic cardiodilator".

Pulling outwards and holding the metal string to the end of the cardiodilator is a variable stiffness of the working surface, makes it possible to conduct and correctly install a dumbbell–shaped balloon in the cardioesophageal transition, taking into account the pathological changes in food and water indicated earlier. The patent for the utility model of the Agency for Intellectual Property of the Republic of Uzbekistan FAP No. 01357 "Pneumatic cardiodilator" was received for the developed cardiodilator.

Results and discussion. After the dilation courses, 685 (84.2%) had no complications, and 128 patients, which was 15.7%, had various complications. The distribution of patients by the total number of complications is shown in Table 3.

Table 3

Distribution of patients by the total number of complications

	Comparison Group (n=457)	**The main group (n=356)**	**Total (n=813).**
Without complications	**365 (80%)**	**320(90%)**	**685(84,2%)**
Complications	**92 (20%)**	**36 (10%)**	**128 (15,7%)**
	P=0.257 and for no complications and <0.001 for complications		

As follows from the table, in the comparison group, the number of patients with no complications was 365 (80%) patients, and various complications were observed in 92 patients, which was 20%.

In the main group, thanks to the implemented technologies and own developments, the number of patients who had no complications increased to 90%, and the number of complications significantly decreased to 10%.

In the structural analysis of complications, we diagnosed the following types: the most common complication was reflux esophagitis, which was observed in 95 (37%) patients, the second in number was bleeding from the cardia zone, which was diagnosed in 66 (25.6%) patients, severe pain syndrome not relieved by non-narcotic analgesics was noted in 64 (25%) patients, non-penetrating esophageal damage was diagnosed in 29 (11.2%) patients and iatrogenic esophageal damage occurred in 3 (1.1%) patients. The discrepancy between the actual number of complications and the number of patients who developed them is due to the fact that several types of complications could occur in one patient. The structural analysis of the complications is presented in Table 4

Table 4

Distribution of patients according to the nature of complications

The nature of the complications	**Comparison Group (n=457)**	**The main group (n=356)**	**Reliability**	**%**

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Bleeding	54(11,8%)	12(3,3%)	**P<0,001**	**66(25,6%)**
Reflux	76(16,8%)	19(5,3%)	**P<0,001**	**95(37%)**
Non-penetrating damage	25(5,4%)	4(1,1%)	**P=0.002**	**29(11,2%)**
Iatrogenic damage	-	3(0,8%)	**P=0.051**	**3(1,1%)**
Severe pain syndrome, not relieved by non-narcotic analgesics	50(11%)	14(4%)	**P<0,001**	**64(25%)**
	205(44,8%)	**52(14,3%)**	**P<0,001**	**257(100%)**

As shown by the structural analysis of complications in the compared groups, in the main group, thanks to the implemented technologies and own developments, it was possible to significantly reduce the number of almost all complications by two or more times. Thus, in the main group, the number of bleeding was observed in 12 (3.3%) patients, while in the comparison group this Fig. was 54 (11.8%) patients. Reflux esophagitis in the comparison group was observed in 76 (16.8%) patients, and in the main group it decreased to 19 and amounted to 5.3%. Non-penetrating esophageal lesions in the comparison group were noted in 25 (5.4%) patients, while in the main group this indicator decreased to 4 patients and amounted to 1.1%. Iatrogenic damage to the esophagus was observed only in 3 patients of the main group and amounted to 0.8%. Pronounced pain syndrome that is not relieved by non-narcotic analgesics in the comparison group occurred in 50 (11%) patients, in the main group this indicator decreased to 14 patients and amounted to 4%.

After the treatment, the following parameters were evaluated: the dynamics of complaints and the objective status of the patient, data from X-ray contrast examination of the esophagus and endoscopic examination, on the basis of which the results were divided into good, satisfactory and unsatisfactory.

The results of cardiodilation were distributed as follows: Good results were obtained in 520 patients and amounted to 64%, satisfactory in 242 (29.7%) and unsatisfactory results were obtained in 51 patients and amounted to 6.2%. The analysis of the results of cardiodilation is presented in Table 5.

Table 5

Immediate results of dilatations

	Comparison Group	**The main group**	**Total:**	**Reliability**
Good	258(56,4%)	262(73,6%)	**520(64%)**	**P<0,001** 25.505
Satisfactory	162(35,4%)	80(22,4%)	**242(29,7%)**	**P<0,001** 16.119
Unsatisfactory	37(8%)	14(3,9%)	**51(6,2%)**	**P=0.016** 5.901
TOTAL:	**457(100%)**	**356(100%)**	**813(100%)**	

As follows from the analysis of the results of dilation, the implemented technologies and in-house developments have significantly increased the number of good and satisfactory results in the main group. The number of good results in the main group was achieved in 262 patients and amounted to 73.6%, and in the comparison group this indicator was achieved in 258 patients and amounted to 56.4%, which is significantly lower than in the main

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group. Satisfactory results in the main group were obtained in 80 (22.4%) patients, while in the comparison group this indicator was 35.4%. The number of unsatisfactory results decreased from 37 (8%) patients in the comparison group by half and amounted to 14 (3.9%) patients in the main group, although the difference was not significant.

Conclusions.

The use of low-intensity laser radiation in combination with a new model of cardiodilator has significantly reduced the total number of complications from 20% to 10%.

In the structural analysis of complications, thanks to new technologies and in-house developments, a significant reduction in almost all types of complications was also achieved from 44.8% to 14.3%.

Analysis of the results of cardiodilation showed that the combined use of two techniques significantly increased the number of good results from 56.4% to 73.6%, significantly reduced the number of satisfactory from 35.4% to 22.4%, as well as to reduce the number of unsatisfactory results from 8% to 3.9%.

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