



## CAUSES OF UNSUCCESSFUL SURGICAL TREATMENT OF HIATAL HERNIA

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*For citation:* Bechvaya GT, Ahmatov AM, Vasilevsky DI, Kovalik VV. Causes of unsuccessful surgical treatment of hiatal hernia. *Pediatrician (St. Petersburg)*. 2020;11(2):67-72. <https://doi.org/10.17816/PED11267-72>

Received: 18.02.2020

Revised: 19.03.2020

Accepted: 23.04.2020

Hiatal hernia is the most common type of visceral anatomy disorder, observed in people under 30 years of age in 10%, older than 50 years – in 60%. Four types of hiatal hernias (I–IV) are distinguished by the variant of the disturbances in the relationship between the esophagus, stomach, and diaphragm. Indications for surgical treatment of hiatal hernias are gastroesophageal reflux or anatomical disorders, which have a risk of developing life-threatening conditions (obstruction or necrosis of the stomach). An unresolved problem in this part of surgery is the high rate of disease recurrence, reaching 10–15 – 40–60%. The subjective reasons for the unsatisfactory results of surgical treatment of this pathology include technical errors in performing interventions (insufficient mobilization of the esophagus, stomach, legs of the diaphragm, incomplete excision of the hernial sac) and flaws in perioperative support (insufficient analgesia, vomiting, cough). The objective factors of the repeated displacement of the abdominal organs into the chest are the large size of the hiatal opening (more than 5 cm in maximum dimension), the insufficient mechanical strength of the legs of the diaphragm (hypotrophy, fibrosis) and the shortening of the esophagus (reduction of the abdominal part length less than 5 cm). Each of the noted factors plays a own role, together determining the success or failure of the surgical intervention. Understanding the basic principles and unresolved issues in this field of surgery is a prerequisite for its further development.

**Keywords:** hiatal hernias; surgical treatment; unsuccessful results.

## ПРИЧИНЫ НЕУДАЧ ХИРУРГИЧЕСКОГО ЛЕЧЕНИЯ ГРЫЖ ПИЩЕВОДНОГО ОТВЕРСТИЯ ДИАФРАГМЫ

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*Для цитирования:* Бечвая Г.Т., Ахматов А.М., Василевский Д.И., Ковалик В.В. Причины неудач хирургического лечения грыж пищевода и отверстия диафрагмы // Педиатр. – 2020. – Т. 11. – № 2. – С. 67–72. <https://doi.org/10.17816/PED11267-72>

Поступила: 18.02.2020

Одобрена: 19.03.2020

Принята к печати: 23.04.2020

Грыжи пищевода и отверстия диафрагмы являются наиболее распространенным видом нарушения висцеральной анатомии, отмечающимся у людей до 30 лет в 10%, старше 50 лет – в 60%. По характеру нарушений взаимоотношений между пищеводом, желудком и диафрагмой выделяют четыре типа хиатальных грыж (I–IV). Показанием к оперативному лечению хиатальных грыж являются гастроэзофагеальный рефлюкс или анатомические нарушения, несущие риск развития угрожающих жизни состояний (непроходимости или некроза желудка). Нерешенной проблемой данной области хирургии является высокая частота рецидива заболевания, достигающая от 10–15 до 40–60%. К субъективным причинам неудовлетворительных результатов хирургического лечения данной патологии относятся технические погрешности выполнения вмешательств (недостаточная мобилизация пищевода, желудка, ножек диафрагмы, неполное иссечение грыжевого мешка) и изъяны периоперационного сопровождения (недостаточное обезболивание, рвота, кашель). Объективными факторами повторного смещения органов брюшной полости в грудную клетку являются большие размеры хиатального отверстия (более 5 см в максимальном измерении), недостаточная механическая прочность ножек диафрагмы (гипотрофия, фиброз) и укорочение пищевода (уменьшение длины абдоминального отдела менее 5 см). Каждый из отмеченных факторов играет свою роль, в совокупности определяя успех или неудачный исход оперативного вмешательства. Понимание основных принципов и нерешенных вопросов данной области хирургии является необходимым условием ее дальнейшего развития.

**Ключевые слова:** хиатальные грыжи; хирургическое лечение; неудовлетворительные результаты.

Hiatal hernia (hiatus hernia) is condition where abdominal organs are displaced through the hiatal opening into the chest. In many cases, the stomach is dislocated, but in some cases, the small or large intestine, spleen, left lobe of the liver, or other organs are displaced into the mediastinum [1, 15, 16].

Hiatal hernias are considered the most common deviation of the anatomical relationships between internal organs. Accurate data on the prevalence of this condition are not available. Hiatal hernia was detected in 10% of the patients aged up to 30 years and in 60% of patients aged >50 years [1, 15, 16].

In many cases, hiatal hernia is an acquired condition; however, this pathology is also noted in early childhood, which suggests its congenital nature. The main cause of displacement of abdominal organs into the chest is the mechanical weakness of the esophagogastric membrane due to the congenital or involutive inferiority of the connective tissue (elastin deficiency). Stretching of the esophagogastric membrane leads to the displacement of one or more organs of the abdominal cavity into the mediastinum [1, 11, 15, 16].

Depending on type of anatomical disorders, it is customary to distinguish four types of hiatal hernia, taking into account all possible variants of occurring changes [1, 11, 15, 16].

In type I, axial hiatal hernias are characterized by axial displacement of the abdominal esophagus and gastroesophageal junction (often in more distal stomach segments) into the chest cavity. This type of displacement does not have a peritoneal sac and refers to sliding hernias. Axial hiatal hernia accounts for 90%–95% in the structure of this pathology [1, 11, 15, 16].

Type II implies paraesophageal hiatal hernias, which accounts for 1% of cases. This type of anatomical deviation indicates displacement of a part of the stomach (gastric fundus, less often, more distal parts) through the hiatal opening parallel to the esophagus into the mediastinum. The gastroesophageal junction is located in its natural abdominal position. This type of hernia always has a peritoneal sac [1, 11, 15, 16].

Type III is characterized with a combination of hiatal hernias. A similar variant combines the anatomical changes of the first two types of hernias: axial displacement of the gastroesophageal junction and paraesophageal displacement of other parts of the stomach into the chest cavity. Mixed as well as paraesophageal hernias always have a hernial sac. Mixed hernias are the second most common in this pathology and occur in 5%–8% of cases [1, 11, 15, 16].

Type IV hiatal hernia has a hernial sac and is characterized by displacement of any abdominal organs (small and large intestine, omentum, spleen, liver), except the stomach, through the hiatal opening into the mediastinum. This type also includes dislocation through the esophageal opening into the chest cavity and organs of the retroperitoneal space (left kidney, pancreas). Such anatomical disorder is noted in 1% of all cases [1, 11, 15, 16].

All recent clinical recommendations for the treatment of hiatal hernia enables application of therapeutic strategies in strict accordance with the type of anatomical disorders and the characteristics of accompanying (or likely to occur) associated diseases or complications [1, 7, 11, 15, 16].

The ineffectiveness of drug therapy for gastroesophageal reflux or the development of its complications (ulcers, strictures, Barrett syndrome, bronchial asthma, chronic laryngitis, recurrent otitis media, etc.) is considered an indication for surgical treatment for axial (type I) hiatal hernias [1, 11, 15–17].

Type II–IV hiatal hernias may be accompanied with life-threatening conditions, such as acute gastric or intestinal obstruction, ischemia, and necrosis located in the hernial sac of organs, and considered indications for surgical treatment, regardless of the presence or absence of clinical symptoms upon detection [9, 11, 13, 15, 16].

Surgical treatment of hiatal hernias involves the restoration of the normal anatomy between the esophagus, stomach, and diaphragm or other organs of the abdominal cavity and retroperitoneal space with type IV hernias. Obligatory conditions for the implementation of surgical intervention include pull-through of the stomach and abdominal part of the esophagus or other organs into the abdominal cavity, excision of the hernial sac types II–IV, and correction of the size of the hiatal opening [1, 11, 15, 16].

In case of axial and mixed hernias of the esophageal opening of the diaphragm (types I and III), in accordance with the concepts accepted to date, the surgical intervention should be supplemented with an antireflux component and fundoplication (or another option for enhancing the locking function of the gastroesophageal junction) [1, 3, 5, 15, 16]. The most commonly performed types of antireflux surgery are circular Nissen–Rossetti reconstructions as well as incomplete fundoplication such as Toupet (270°), Belsey (270°), Dor (180°), and some other types. The choice of reconstruction of the gastroesophageal junction should be based on esophagomanometry data. With the physiological

contractility of the esophagus, the most effective circular techniques are preferred to control gastroesophageal reflux. Esophageal motility disorders or reduced contractile potential requires incomplete fundoplication that does not lead to the development of mechanical dysphagia and other negative consequences (belching and vomiting mechanism disorder, flatulence) [1, 3, 11, 15, 16].

The frequency of complications directly related to the surgical treatment of hiatal hernia is low at approximately 1%, with mortality of 0%–0.1% [15, 16].

The most serious and unresolved problem in this surgical field is the high recurrence rate of hiatal hernias in the long term after surgery, which reaches 10%–15% to 30%–40%, and even 60% [3–5, 7, 8, 11, 14–16]. The causes of unsatisfactory outcomes of surgical treatment of hiatal hernia can be conditionally divided into several categories [7, 12, 15, 16]: group 1 consists of technical errors in performing surgical intervention, and group 2 comprises aspects of the anatomical structure and physiological activity of the diaphragm, esophagus, and stomach [7, 12, 15, 16].

Insufficient mobilization of the abdominal esophagus, stomach, and hernial sac during surgery is one of the common mistakes in practice and can cause a relapse of the hiatal hernia. After full dissection, all of the listed anatomical formations should be freely (without tension) located in the abdominal cavity [1, 11, 15, 16].

An important aspect for the surgical treatment of hiatal hernias is the circular separation of the lower thoracic, abdominal esophagus, gastroesophageal junction, and parts of the stomach displaced into the chest cavity (or other organs with type IV hernias). Neglect of this rule increases significantly the risk of disease recurrence [1, 11, 15, 16].

Excision of the hernial sac in type II–IV hernias is considered another prerequisite for technically correct surgical intervention. This stage is often challenging, as tight fusion of the hernial sac peritoneum with the esophagus and proximal sections of the stomach require great accuracy and attention during separation. As a possible option that reduces the risk of organ damage, some authors proposed an incomplete excision of the hernial sac, but only by its pull-through into the abdominal cavity with the release of the esophagus and the zone of the gastroesophageal junction [1, 11, 15, 16].

Errors during the reconstructive stage of surgery include the use of absorbable suture materials for the correction of the hiatal opening size and surface capture in the ligatures of the tissues

of the muscular crura of the diaphragm. Incomplete elimination of a hiatal hernia should also be considered given the excessively large size of the hiatal window, creating the prerequisite for repeated migration of the abdominal organs into the mediastinum [15, 16].

A separate category of conditions affecting surgical treatment outcomes of hiatal hernias is made up of subjective or objective factors directly associated with patients [7, 15, 16]. An important component of this category of surgical interventions is alleviation of intense pain, cough, and vomiting in the early postoperative period. All these can be an excessive load on the tissue, leading to eruption of sutures, formation of strong connective tissue adhesions, dislocation of the prosthesis, if it is installed, and early repeated displacement of the stomach into the mediastinum [1, 7, 15, 16].

An overweight status is also an unfavorable prognostic factor of long-term results. Premature physical load plays an important role in the development of disease relapse. These provisions have been confirmed by numerous clinical studies [7, 15, 16].

The anatomical causes for the recurrence of hiatal hernias after surgical treatment include large esophageal opening of the diaphragm, mechanical weakness of the muscular crura, and secondary or primary shortening of the esophagus. Physiological factors that predispose patients to repeated displacement of the abdominal organs into the mediastinum are respiratory contractions of the diaphragm, in which all its muscular structures are involved, including hiatal crura, as well as peristaltic contractions of the esophagus [1, 2, 4, 6, 11, 15–17].

Large esophageal opening in the diaphragm are considered the most important factor in the recurrence of hiatal hernias. A significant load on the joints with approximation of the muscle crura and significant diastasis leads to the gradual eruption of ligatures and repeated formation of hernial orifice [1, 10, 12, 15, 16].

To date, there are no generally accepted views on the size of the esophageal opening in the diaphragm (e. g., which dimensions and in what dimension), which should be considered prerequisites for grafting failure. Most researchers consider the 5-cm criterion in any dimension. However, clinical and experimental studies showed an increasing likelihood of relapse of this type of hernia with a hiatus size of >3.5 and even 2.5 cm [1, 7, 10, 12, 15].

The mechanical weakness of the diaphragm crura (e. g., hypotrophy, fibrosis) is also considered the most important factor in grafting failure. This provision is fully consistent with the general principles of herniology; however, to date, no criteria have been established for assessing the mechanical strength of the hiatal crura. The determination of the sufficient or insufficient strength of the muscle crura of the diaphragm largely remains the subject of intraoperative analysis, based on surgical experience [1, 11, 15, 16].

A decrease in the length of the esophagus (secondary or primary), along with the aforementioned conditions, is considered the most important factor but most difficult to overcome in the recurrence of hiatal hernias. The shortening of the esophagus was speculated as the main cause of the dislocation of the stomach into the chest cavity in axial (type I) and mixed (type III) hernias, and not the weakening of the ligamentous apparatus of the stomach and the gastroesophageal junction. With anatomical changes in type II and IV hernias, this factor, apparently, plays a minor role [2, 6, 7, 15, 16].

Primary shortening is a congenital condition with factual prevalence in the population, and its significance in the development of hiatal hernias is under-investigated. Secondary shortening of the esophagus is a consequence of the degenerative inflammatory changes in the muscle layer of the esophagus with the replacement of its fibers by connective tissue. This can be caused by severe manifestations of gastroesophageal reflux (with type I and III hernias), leading to damage to the deep layers of the esophagus, autoimmune, chemical, viral, or bacterial esophagitis, systemic diseases (systemic lupus erythematosus, scleroderma, ankylosing spondylitis), and other pathological conditions [2, 6, 7, 15, 16].

A clinical criterion for esophageal shortening is the reduction in the length of its abdominal section by less than 1.5–2.0 cm. The location of the gastroesophageal junction after full mobilization and excision of the hernial sac (if any) at a shorter distance from the hiatal window may revert the shortening of the esophagus. Such an anatomical option increases significantly the risk of hernia recurrence [2, 6, 7, 15, 16].

Contraction of the cruras of the diaphragm during respiratory excursions is an important physiological factor that increases significantly the load on the plastic zone of the esophageal hiatus. Notably, the features of the anatomical structure of the hiatal window, with a muscle loop shape during its constriction and relaxation, leads to a change

in the acting forces not only in one vector, but in at least three vectors. This aspect also reduces significantly the reliability of reconstruction (resizing) of the esophageal opening of the diaphragm [11, 15, 16].

Peristaltic contractions of the esophagus, which are an integral component of its physiological function, are also considered a factor that increases the risk of repeated displacement of the stomach into the mediastinum. The propulsive wave arising from the food transport leads to short-term and insignificant but often repeated changes in the length of the esophagus. In conjunction with other causes, this mechanism is likely to contribute to the destruction of the hiatal opening plasty [11, 15, 16].

Thus, surgical treatment outcomes of hiatal hernia are affected by diverse causes and factors. Some of them are amenable to elimination or correction, while others do not yet have a final solution and require further experimental and clinical studies. However, understanding of the basic principles and problems of this surgical field is a prerequisite for its further development.

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