

Current Issues of GERD Surgical Treatment in Children

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Abstract

Introduction: Gastroesophageal reflux disease is one of the most common diseases among a wide range of chronic inflammatory diseases of the gastrointestinal tract in children of all ages, significantly impairing the quality of life of the child and posing a serious threat to the health of the patient. **Materials and Methods:** From 2008 to 2019, 134 patients aging from 6 months to 12 years were hospitalized at the Scientific Center for Pediatrics and Pediatric Surgery, including 69 (51%) infants. Of them, 51 (38%) were the patients with persistent manifestations of regurgitation, despite an outpatient course of conservative therapy; 29 (22%) patients with recurrent reflux-associated pneumonia; also, 35 (26%) children with gastroesophageal reflux in the structure of the main pathology of the central nervous system, as well as 19 (14%) patients after surgery of the anastomosis of the esophagus with its atresia. One hundred and seven (79.8%) patients underwent surgery. Nissen esophagofundoplication was traditionally performed in 41 (38%) patients, in combination with Stamm gastrostomy in 14 (34%), with Mikulich pyloroplasty in 9 (22%), and in combination with gastrostomy and pyloroplasty in 12 (29%) children. Laparoscopic Nissen esophagofundoplication was used in 16 (15%). Thall esophagofundoplication was performed in 48 (45%) patients, whereas in two (2%) cases, Borema gastropexy was conducted. **Results:** The immediate results were studied in all 107 patients. Complications in the form of gastric distress syndrome were revealed in four (3.7%) patients who did not undergo pyloroplasty, which in two (1.9%) cases required additional surgery of the stomach draining, whereas in the other two (1.9%) patients, the distress syndrome was stopped conservatively. A dumping syndrome was identified in two (1.9%) patients. **Conclusion:** Timely recognition of the pathological process, its nature, and prevalence determines the indications for the use of various methods of operation, which are based on an individual approach to each patient.

Keywords: Children, esophagitis, esophagofundoplication, gastroesophageal reflux

INTRODUCTION

The relevance of gastroesophageal reflux disease in pediatrics is that it is a common disorder of the digestive system, and usually precedes or accompanies such serious diseases as peptic ulcer, peptic stricture, Barrett's esophagus with which it is pathogenically associated. Many authors consider it as a pathological condition with a potential for cell transformation from metaplasia to adenocarcinoma.^[1] Therefore, the treatment of reflux esophagitis should be assessed from the standpoint of esophageal adenocarcinoma prevention.

The current methods of drug treatment of GERD can prolong clinical remission and shorten the healing time of focal esophageal inflammatory injuries.^[2] However, despite the high level of modern medical therapy, it has only a short-term effect. The drug withdrawal is followed by the symptoms recurring in 50% of patients after 6 months and in 100% after

12 months.^[3] In this situation, surgery is an alternative solution to this problem.

The article presents our experience in the surgical treatment of children with gastroesophageal reflux disease.

MATERIALS AND METHODS

From 2008 to 2019, 134 patients aging from 6 months to 12 years were hospitalized at the Scientific Center for Pediatrics and Pediatric Surgery, including 69 (51%) infants. Of them 51 (38%) were the patients with persistent manifestations of regurgitation, despite an outpatient course of conservative therapy; 29 (22%) patients with recurrent reflux-associated

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pneumonia, repeatedly receiving inpatient treatment in the department of pulmonology; also, 35 (26%) children with gastroesophageal reflux in the structure of the main pathology of the central nervous system, as well as 19 (14%) patients with reflux after surgery of the anastomosis of the esophagus with its atresia. The diagnostic complex included a general clinical examination as well as endoscopic study with a pinch biopsy of the esophageal mucosa, ultrasonographic, X-ray studies, and 24-h pH monitoring.

A general clinical study was to identify the following symptoms: esophagus inflammation, malnutrition, and respiratory disorders.

At the outpatient and inpatient level, anamnestic data were studied according to a developed map-scheme, including identifying possible causes of the disease (pregnancy and childbirth, hereditary factor, concomitant pathology of the central nervous system, and factors of breast milk intolerance). A particular attention was paid to the patients' complaints: the nature of regurgitation and vomiting, their links to the start of feeding, anxiety during feeding, composition of regurgitate, and a monthly weight gain. Prescription of clinical manifestations, methods of previous treatment, and objective physical data (information about body type and body weight) were identified, and the results of the "pacifier test" were studied as well. This test is used as a method of early noninvasive diagnosis of GER, which aims to identify early clinical signs of the disease in infants on the primary outpatient level. Eighty-four (62.6%) children with GER were revealed thanks to the proposed method.

The method is used in the outpatient treatment conditions as follows: a child is fed (some milk or a mixture, half the volume of a singular feeding), then is held in the upright position for 20–30 min, and after that is given a pacifier. Thus, with GER, the food masses are released from the stomach into the esophagus and oral cavity. Without GER (when the cardiac sphincter is consistent) the test is negative – there is no reflux from the stomach into the oral cavity. With a positive pacifier test, a preliminary diagnosis of GERD can be made.

The children did not receive adequate nutrition due to their frequent regurgitation and vomiting, which led to a lag in the physical development and a lack of body weight. Thus, hypotrophy of the 1st degree was diagnosed in 42 (33%) of our patients and was observed mainly in young children. The 2nd degree hypotrophy was revealed in 54 (42%) children, whereas in 32 (25%) cases, the body mass deficit exceeded 20% (hypotrophy of 3rd degree). Sixty-eight (53.1%) children complained of constipation. The night regurgitation (a "wet pillow symptom") was observed in 54 (42.1%) children which posed a profound threat to a child's health due to the risk of aspiration. Twelve (9.3%) children, mostly older ones complained of chest pain. Pain sensations behind the breastbone correlate with the severity of reflux esophagitis. Dysphagia was observed in 16 (12.5%) patients with reflux esophagitis and peptic stenosis of the esophagus, mainly in the group of older children.

Anemic syndrome (predominantly iron deficiency anemia) was caused by chronic bleeding from the esophagus erosions or ulcers and by diapedesis bleeding during esophagitis. Anemia of the 1st degree was diagnosed in 26 (20.3%) patients and that of the 2nd degree in 14 (10.9%) cases.

Respiratory complications in the form of recurrent reflux-induced pneumonia were found in 37 (28.9%) children, and a night cough in 41 (32%) while in most cases, these symptoms were combined. In 21 (16.4%) cases, an apnea was observed.

RESULTS

An ultrasound study revealed the distal esophagus walls thickening in 54 (42%) children, and a pendulum-like turbulent movement of the contents from the stomach into the esophagus was found under dynamic observation.

According to the Savary-Miller classification of the esophagus severity, a fibroesofagoscopy revealed catarrhal esophagitis in 84 (66%) patients, traces of erosion in 12 (9%), and fibrinous erosive esophagitis in 18 (14%) children [Figure 1]. In 11 (9%) patients [Figure 2] who underwent a "medical calibration gauge," peptic narrowing of the lumen, ulceration, and increased contact bleeding was found.

The 24-h pH monitoring revealed an acid reflux in 26 (20.3%) patients and combined acid-alkaline reflux in 20 (15.6%) cases, of which 6 (30%) children were with fibrinous-erosive and ulcerative esophagitis, 11 (55%) with peptic stricture of the esophagus, and 3 (2%) children with esophageal metaplasia.

As a result of the X-ray examination, a distorsion in the ratio of the esophageal-gastric junction elements and the change in the angle of His were diagnosed in 124 (97%) cases [Figure 3]. In the Trendelenburg position, barium was thrown from the stomach into the lumen of the esophagus as "a roaring elephant" symptom in all children. Thus, reflux-throwing of the 1st degree was found in 52 (41%) children, of the 2nd degree in 44 (34%) patients, and reflux-throwing of the 3rd degree in 32 (25%) kids. The forming peptic stenosis of the esophagus with the preceding zone of suprastenotic expansion was observed in 11 (8.5%) patients [Figure 4].

With the pathology of the esophagus and stomach, the gastroduodenal junction is also comprehensively examined in the preoperative period. This allowed to identify a functional pylorospasm in 19 (14.8%) children, mainly in patients with neurological disorders, as well as single cases of its manifestation in early infancy in children with a previous history of esophageal atresia, in whom dysfunction of motility, in our opinion, was a consequence of functional immaturity.

After the diagnosis, all patients underwent a complex of conservative anti-reflux therapy for 3–6 months.

When choosing the method of esophagofunduplications, an algorithm was proposed, which in our opinion, optimally

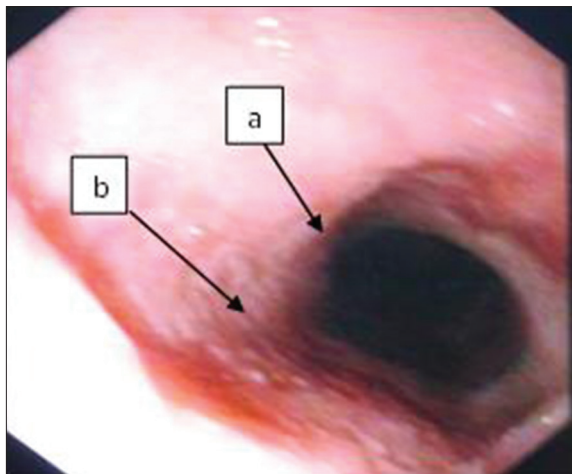


Figure 1: Erosive esophagitis Fibroesophagoscopy: (a) expansion of the cardiac outlet zone; (b) traces of erosion

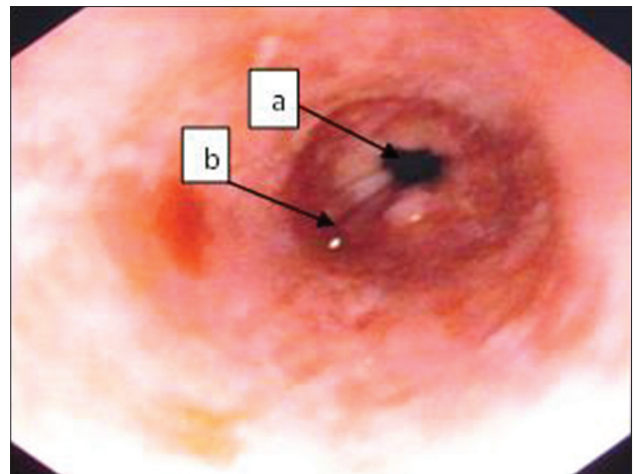


Figure 2: Peptic stricture of the esophagus Fibroesophagoscopy: (a) zone of peptic constriction at the level of the lower third of the esophagus; (b) erosive and ulcerative esophagitis

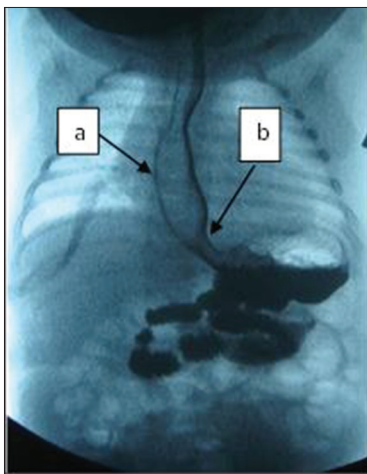


Figure 3: Esophagography: (a) expansion of the lumen of the lower third of the esophagus; (b) change of the His angle (110°)

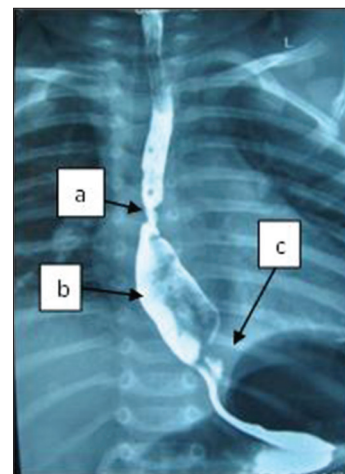


Figure 4: Esophagography: (a) Zone of peptic narrowing of the middle third of the esophagus; (b) expansion of the lumen of the lower third of the esophagus; (c) change of the His angle (110°)

reflects the choice of antireflux protection in children with GERD and with different somatic backgrounds [Figure 5].

Based on our research, we have proposed a diagnostic algorithm that consistently includes measures necessary for the verification of gastroesophageal reflux disease in children, which allows us to correct the actions of the doctor for timely diagnosis [Figure 6].

One hundred and seven (79.8%) patients underwent surgery following the results of treatment. Nissen esophagofundoplication was traditionally performed in 41 (38%) patients, of which in 14 (34%), it was combined with Stamm gastrotomy, mainly due to concomitant pseudobulbar disorders, as well as in children with peptic esophageal stricture for subsequent calibrating dilatation of the stricture zone; combined with Mikulich pyloroplasty in 9 (22%), mainly in children with neurological disorders; and in combination with gastrotomy and pyloroplasty in 12 (29%) children. Nissen esophagofundoplication was made laparoscopically (without gastrotomy and pyloroplasty) in 16 (15%) children,

Thall esophagofundoplication was performed in 48 (45%) patients, and Borema gastropexy was performed in 2 (2%) cases.

Immediate results were studied in all the 107 patients. Complications in the form of gastric distress syndrome were detected in four (3.7%) patients who did not undergo pyloroplasty, which in 2 (1.9%) cases required additional stomach draining surgery, while in the other 2 (1.9%), the distress syndrome was stopped conservatively. The dumping syndrome was observed in two (1.9%) patients.

Long-term results were studied in 96 children from 6 months to 2 years after surgery. In our opinion, this period is sufficient to assess the effectiveness of surgical treatment. A relapse of gastroesophageal reflux disease was diagnosed in three (2.8%) patients who were re-operated. Reflux esophagitis was preserved in 6 (5.6%) children with varying severity, of which 3 (2.8%) patients with recurrent gastroesophageal reflux

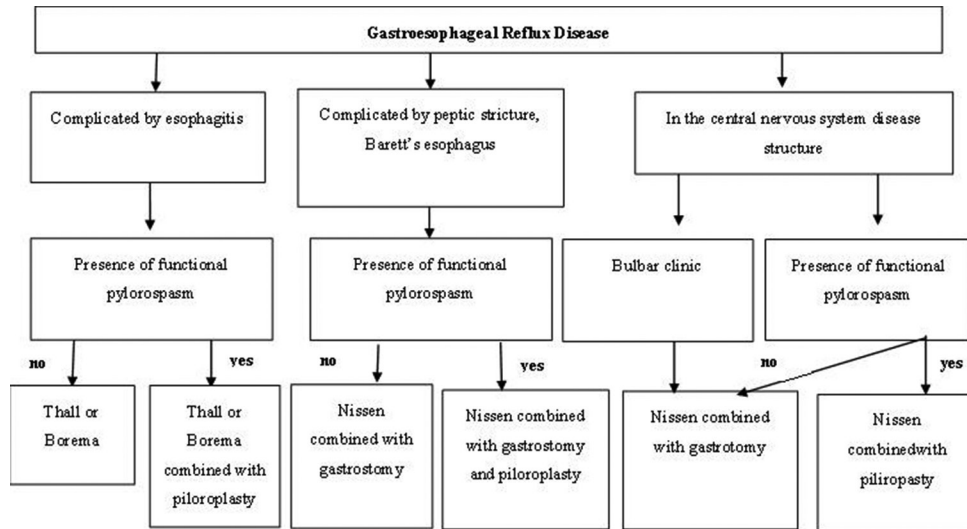


Figure 5: Algorithm for choosing the method of esophagofundoplication

disease were re-operated. The rest of the children have no particular complaints, they develop satisfactorily.

DISCUSSION

Interpretation of the literature on the surgical correction of gastroesophageal reflux has certain difficulties that arise when choosing the method of esophagofundoplasty as well.

To date, antireflux surgery is the most frequently performed surgical intervention on most children in all pediatric surgical services in Europe and the USA. Data from the United States national study show that 45% of anti-reflux procedures are performed on children under the age of 1 year.^[4] The profile of patients in this age group consists mainly of infants with impaired swallowing and aspiration with nervous system disorders background, as well as newborns with a previous history of esophageal atresia. The risk of gastroesophageal reflux in these infants is due to the pathological motility of the gastrointestinal tract, the increase in intra-abdominal pressure, and the immaturity of the gastroesophageal junction.

In the literary review Risto J. Rintala “Fundoplication in Patients with Esophageal Atresia: patient selection, indications, and outcomes” referring to literature sources summarizes the frequency of fundoplication in children with esophageal atresia in the range of 10%–45%. It should be noted that most patients need fundoplication before the age of 1 year. Among the symptomatic manifestations: anastomosis strictures requiring dilation occur in 30%–60% of patients. For patients suffering from recalcitrant structures, there is a significant GER that contributes to the formation of refractory stenosis. Up to 74% of patients suffer from chronic or recurrent respiratory symptoms. After fundoplication, most patients have excellent relief of their symptoms.^[5]

Despite its prevalence, information about the effectiveness of certain methods of anti-reflux protection of the esophagus is contradictory. R. Kubiak, J. Andrews, and H. W. Gran noted a

significantly higher percentage of relapses after Toupet (10% versus 5%) and Thal surgeries (15% versus 5%) compared with Nissen modification, especially in the group of children with neurological pathology.^[6]

Rare number of scientific works K. U. Ashcraft, T. M. Holder to a certain extent reflects the basic technical principles of the Nissen operation and its wider application; however, in some cases, it also completely eliminates the physiological reflux and consequently, the possibility of saving an opportunity of emptying by vomiting for the patient (if any is needed).

M. Fein, F. Seyfried compared laparoscopically performed Nissen esophagofundoplication and partial esophagofundoplication and agreed that the personal experience of the surgeon was the most important factor in choosing the antireflux protection method.^[7]

Technically, the Toupet partial “wrapping” requires a greater number of stitches, compared to a full “wrapping” by Nissen, which helps to prevent inconsistency, slipping, and divergence of the stitches. However, there is a theoretical risk of perforations with additional suturing by a less experienced surgeon.

Koch *et al.* in their randomized examinations of 125 patients assessed the effectiveness of the quality of life of patients after Nissen and Toupet esophagofundoplication and defined the gastro-esophageal quality of life index and esophageal symptom by 24-h pH monitoring before surgery and 1 year after surgery. In both groups, the DeMeester index was equally reduced, and the symptoms of GERD were stopped with equal efficiency.^[8]

Authors Moritz A. F., Rinsma N. F., and Ernest L. V. studied the effect of laparoscopic antireflux surgery on the initial impedance as a reflection of the integrity of the mucosa in 25 children with gastroesophageal reflux disease and concluded that surgical antireflux protection performed laparoscopically

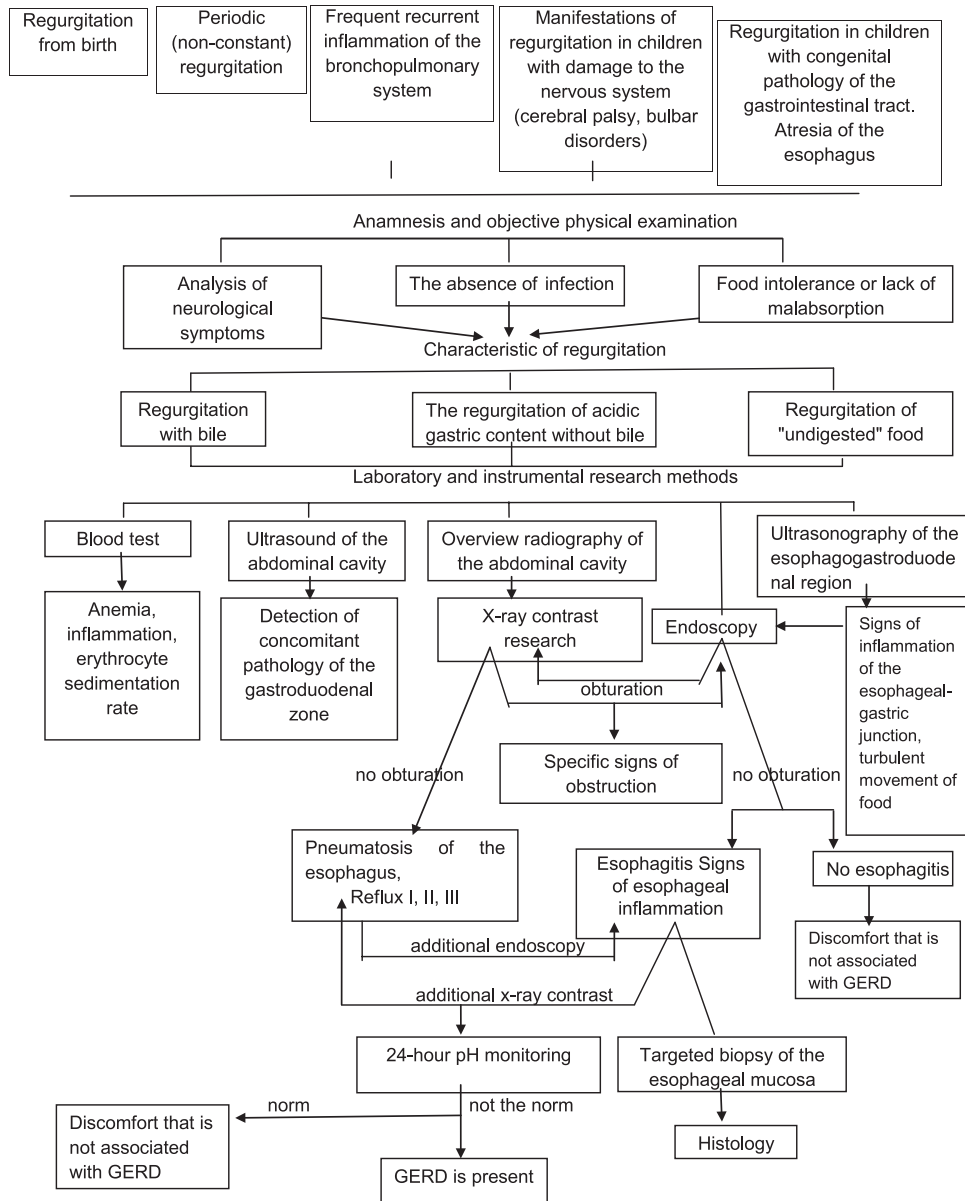


Figure 6: Algorithm for diagnostic research of children with regurgitations

reduces the time of acid exposure from 8.5% (6.0%–16.2%) to 0.8% (0.2%–2.8%), $P < 0.001$, respectively, increases the distal resistance, resulting in restoration of the base impedance, reduction of reflux symptoms, and restoration of the integrity of the esophageal mucosa.^[9]

The scientific retrospective review of Rosales A, Whitehouse J, Laituri analyzed the results of anti-reflux surgery in children under 2 years of age who underwent laparoscopic Nissen fundoplication. The present study included 106 patients, the average gestational age at birth was 32.50 weeks \pm 6.35; 64 (59.4%) children were premature. The average body weight during the operation was 4.81 \pm 2.10 kg. In the postoperative period, symptoms were resolved in 93 (87.7%) children. The authors believe that relieving GERD symptoms, no relapses, and a low incidence of complications is safe and

acceptable in the high-risk group of children under 2 years of age. The procedure has a low incidence and mortality in this population.^[10]

According to the result of our wholesale, it follows that timely recognition of the pathological process, its nature, and prevalence identifies the indications for the use of various methods of operation, which are based on an individual approach to each patient. The proposed algorithm for selecting the method of anti-reflux surgery, taking into account the background and neurological symptoms, will allow the surgeon to select the optimally reasonable anti-reflux surgery. The combination of fundoplication with pyloroplasty, especially in patients with concomitant neurological symptoms, will prevent gastric distress syndrome, helping to restore the motility of the gastrointestinal tract, and provide the best long-term result.

CONCLUSION

The study of long-term results suggests that the choice of a pathogenetically substantiated method of treatment of GERD helps to reduce the incidence of postoperative complications and improve the patient's quality of life.

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Conflicts of interest

There are no conflicts of interest.

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