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Research Article

Thoracoscopic Correction of Esophagal Atresia in Dagestan

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Abstract:

Introduction: The results of our experience in the treatment of children with esophageal atresia with thoracoscopic access are presented.

Materials and methods: From 2020 to 2022, 25 children with EA were operated on at the N.M. Kuraev Medical Center in Makhachkala. Thoracoscopy was performed on 17 children: 13 patients underwent primary anastomosis of the esophagus, 3 had a gastrostomy after TPS ligation, 1 child with a non-esophageal form of AP had internal traction sutures applied to the proximal and distal ends of the esophagus without a gastrostomy. 13 patients with primary anastomosis of the esophagus 3 underwent conversion. 1 child with a non-esophageal form of AP I stage internal traction sutures were applied to the proximal and distal ends of the esophagus without the imposition of gastrostomy. A thoracoscopic anastomosis of the esophagus was applied to 1 child with a non-esophageal form of EA on day 6 after internal traction sutures of stage II. Thus, the analysis was carried out in 10 patients with primary and 1 with delayed anastomosis of the esophagus by thoracoscopic access.

Results: The results of treatment of children with EA after thoracoscopic anastomosis of the esophagus were evaluated.

Discussion: Analyzing the results of thoracoscopic EA correction according to literary sources, a good cosmetic effect is noted in the early and especially in the long-term postoperative period with a low frequency of musculoskeletal deformity. A serious problem for most pediatric surgeons remains the impossibility of creating a primary anastomosis in the newborn period. In our case, the only obstacle was a large diastasis between the segments of the esophagus. Kozlov et al. a new therapeutic approach was reported for two newborns with EA, consisting in the fact that thoracoscopic traction elongation of the esophagus is possible without gastrostomy, followed by esophago-esophagoanastomosis for 5 and 6 days respectively. According to their work, only anastomosis stenosis was observed in both cases, which we also observed in 1 case.

Conclusion. The use of the thoracoscopic method of esophago-esophagoanastomosis provides low trauma, creates a good visualization of the surgical field, achieving a good cosmetic effect, does not form gross scarring and musculoskeletal deformities.

keywords: thoracoscopy; esophageal atresia; esophago-esophagoanastomosis

Introduction

Esophageal atresia (EA) with tracheoesophageal fistula (TEF) was first described by Thomas Gibson in 1696, after which there were attempts to treat EA. Only in 1939, Ladd and Leven independently obtained one good result in the treatment of EA with distal TEF. The stages of correction were the application of a gastrostomy, the elimination of TEF, the application of a cervical esophagostomy, followed by the formation of an artificial esophagus. This was the beginning of the development of staged treatment of EA P in children in the most severe condition [1--2]. In 1941, Cameron Haight successfully performed primary esophageal anastomosis for the first time [3--5]. In our country, the first successful primary anastomosis of the esophagus was performed in 1955 by Professor G.A. Bairov [6--7]. The development of endoscopic surgery in recent years has allowed pediatric surgeons to perform EA correction using a thoracoscopic approach. The first thoracoscopic operation was performed by Lobe T. on a child with a fistulaless form of EA in 1999 [8]. In 2000, Rothenberg S.S. reported successful thoracoscopic correction of EA with

distal TEF [0]. In Russia, for the first time, reconstruction of an artery through a thoracoscopic approach was performed by Yu.A. Kozlov in 2005 [9]. This method is an alternative to posterolateral thoracotomy and repeats the main steps of the operation developed by Cameron Haight.

The goal is to evaluate the results of thoracoscopic treatment of children with EA.

Material and methods

In the Children's Clinical Hospital named after. N.M. Kuraev, Makhachkala from 2020 to 2022. 25 children with EA were operated on. 17 children underwent thoracoscopy. Of these, there were 13 (76.5%) boys and 4 (23.5%) girls. Gestational age at birth ranged from 32 to 42 weeks, body weight from 1900 to 4400 g. According to the Gross classification, the fistulaless form of EP was observed in 1 (5.9%) child, AP with distal TEF - in 16 (94.1%) children.

33 developmental defects were identified in 12 (70.6%) children (Table 1). VACTER association was observed in 2 (11.8%) children, and heart disease - in 8 (47%).

One child with a fistulaless form of anal atresia underwent anterior anorectoplasty before correction of EA on the first day of life.

After preoperative preparation, on days 1–4, all patients were operated on.

In 13 patients with distal TEF, primary anastomosis of the esophagus was performed, in 3 patients a gastrostomy was placed after ligation of the TEF for subsequent delayed esophago-esophagoanastomosis, in 1 child with a fistulaless form of EA P, internal traction sutures were placed on the proximal and distal ends of the esophagus without applying a gastrostomy.

An obstacle to performing primary anastomosis of the esophagus in all cases was a large diastasis between the segments of the esophagus (more than 2 cm).

Of the 13 patients with primary esophageal anastomosis, 3 underwent conversion. The reasons for conversion in 2 cases were hemodynamic disturbances, in 1 case the wall of the azygos vein was damaged, the latter was ligated and crossed.

In 1 child with a fistulaless form of EA (the diastasis between the segments of the esophagus was 48 mm), stage I, internal traction sutures were placed on the proximal and distal ends of the esophagus without applying a gastrostomy. Stage II of the procedure - thoracoscopic anastomosis of the esophagus was performed on the 6th day after the first operation.

Thus, an analysis was carried out in 10 patients with primary and 1 with delayed anastomosis of the esophagus using thoracoscopic access.

Surgical technique

Endotracheal anesthesia was used for thoracoscopic correction of EA. The child was placed on his stomach with his right side elevated 30˚. 3 trocars (1x5 mm and 2x3 mm) were installed in the right pleural cavity. A 5 mm trocar was used to insert a telescope, a 3 mm trocar was used to insert endoinstruments. The 1st trocar (5 mm) was installed in the fifth intercostal space along the posterior axillary line, and the 2nd and 3rd trocars were placed under direct visual control within the boundaries of the triangle formed around the endoscope. CO2 insufflation into the pleural cavity was carried out at a pressure of 5 mm Hg. Art. In the absence of a decrease in the main parameters of ventilation and hemodynamics, surgical intervention was continued. After collapsing the right lung, the distal segment of the esophagus was mobilized to the tracheoesophageal fistula, sutured at the base, ligated and transected. Next, the oral end of the esophagus was mobilized from the trachea and circumferentially to the cervical esophagus. Then the lumen of both ends of the esophagus was opened and the formation of esophago-esophagoanastomosis began. The posterior lip of the anastomosis was formed with interrupted sutures (VICRYL 5/0). After its formation, a nasogastric tube was passed from the oral to the aboral end and then into the stomach. The anterior lip of the anastomosis was also formed with interrupted sutures on the probe. All sutures were placed extracorporeally with the nodes located outside the lumen of the esophagus. In all cases, a safety drain was left in the area of esophago-esophagoanastomosis. The operation was completed by removing CO2 and trocars from the pleural cavity. The wounds on the chest wall from the trocars were sealed using skin sutures.

Method of surgical intervention of the first stage of thoracoscopic treatment of EA with large diastasis without gastrostomy placement

After insertion of trocars and insufflation, both ends of the esophagus were mobilized. Then, between the ends of the esophagus, sutures were placed with sliding knots and clips, firmly fixing the threads at the site where the suture entered the tissue of the esophagus. Next, using sliding sutures, the proximal and distal ends of the esophagus were brought as close as possible. A gastrostomy tube was not placed. Total parenteral nutrition was provided throughout the traction period. At stage II, the technique of thoracoscopic esophago-esophagoanastomosis was carried out.

Postoperative management

In order to reduce the risk of failure of the esophago-esophagoanastomosis, myoplegia was performed for an average of 8 days. Enteral loading through a nasogastric tube began on the 8th postoperative day, through the mouth - on the 26th day. The safety drain was removed on the 6th postoperative day.

Results

The results were assessed according to the following criteria: the course of the postoperative period, postoperative complications and mortality.

The duration of thoracoscopic interventions was 128 minutes (range: 75-180 minutes).

The average duration of mechanical ventilation was 11 days (range: 5-29 days), the average time of stay in the intensive care unit was 30 days (range: 8-78 days), the average time of hospital stay in the postoperative period was 51 days (range: 7 --125 days). There were no intraoperative complications. Postoperative complications occurred in 9 children (81.8%): failure of the esophago-esophagoanastomosis - in 1 (9.1%), narrowing of the anastomosis - in 9 (81.8%), ZhPR - in 2 (18.2%) .

Failure of the esophagoesophagoanastomosis developed on the 4th postoperative day. As a result of copious discharge through the safety drainage and the presence of pneumothorax, rethoracoscopy and suturing of the anastomotic defect were performed.

In 8 children with anastomotic stenosis, the diameter of the esophageal lumen in the anastomosis zone was less than 4 mm during endoscopy. All patients underwent bougienage of the esophagus. In 1 case, the diameter of the lumen of the esophagus in the anastomosis zone was point-like and it was not possible to insert a string to bougienage the esophagus, and therefore laparoscopy and gastrostomy were performed, followed by bougienage of the esophagus using the thread.

All children with gastrointestinal tract received conservative therapy (drug therapy, diet, giving the child an upright position after eating to improve the passage of food masses through the stomach under the influence of gravity).

Mortality was observed in 1 (9.1%) case. Deceased child: a girl with a birth weight of 2340 g with VACTER association, agenesis of the right kidney, pelvic dystopia of the left kidney, ASD, ODA, perinatal hypoxic damage to the central nervous system, 2nd degree CI, acute kidney damage. The postoperative period was complicated by the development of pneumothorax on the right. The further course of the postoperative period was extremely difficult, due to cardiopulmonary and renal failure. She died from multiple organ failure.

After the operation of primary anastomosis of the esophagus, 2 (18.2%) children were re-operated on the 23rd and 41st days, respectively, after correction of EA with pyloric stenosis. All patients underwent pyloromyotomy.

We monitored the long-term (from 3 months to 2 years) results of treatment of patients with EA using thoracoscopic access. All children were repeatedly hospitalized for follow-up examinations in our department.

All parents surveyed indicate that their children accept any food.

All children with esophageal stenosis continued esophageal dilation on an outpatient basis. A good result was obtained in 5 children, and none required resection of the stenotic esophagus and repeated anastomosis. 3 children operated on in 2021 continue to undergo surgery. In 1 child, after staged thoracoscopic treatment of EA, during bougienage of the esophagus using a thread, perforation of the esophagus occurred with a large defect, and therefore extirpation of the esophagus was performed.

In the long-term period, post-intubation tracheal stenosis was detected in 2 cases, and bougienage of the trachea was performed using Hegar bougiens.

There were no cases of deaths in the long-term period.

Discussion

Treatment of children with EA is one of the most difficult tasks in neonatal surgery. To date, significant advances have been made in the treatment of EA thanks to the improvement of medical technologies, the development of endosurgery, advances in neonatology, pediatric surgery, intensive care and anesthesiology of newborns, intraoperative monitoring, parenteral nutrition, antibiotic therapy, and treatment of complications of concomitant pathology [10-14]. According to the literature, mortality in EA has recently decreased by 50 times, respectively, from 100 to 2% with thoracotomy treatment [15] and to 2.8% with thoracoscopic treatment [16]. In our case, mortality was observed in 1 child.

The development of endoscopic surgery has led to the fact that EA correction also began to be performed thoracoscopically. Analyzing the results of thoracoscopic correction of EA according to the literature, a good cosmetic effect is noted both in the early and especially in the late postoperative period with a low incidence of musculoskeletal deformity [17–18].

Despite advances in the treatment of EA, a serious problem for most pediatric surgeons is still the impossibility of creating a primary anastomosis in the neonatal period. According to many authors, large diastasis between segments of the esophagus, concomitant anomalies and very low birth weight were the reasons for refusal of primary anastomosis [6, 19–28]. In our case, the only obstacle to performing the primary anastomosis was a large diastasis between the segments of the esophagus (more than 2 cm), 1 of which was a fistulaless form of EA. If it is impossible to perform a primary anastomosis, delayed anastomosis or plastic surgery of the esophagus with intestines or stomach is indicated. Also in the literature, various approaches are described for bringing the ends of the esophagus together, allowing delayed esophago-esophageal anastomosis to be performed using lengthening plastic surgery on the esophagus or various elongation methods [13-14, 29-45]. There are no precise indications in the literature on the optimal timing for performing delayed esophageal anastomosis. Some authors note that delayed esophageal anastomosis can be performed at the age of 3 months [14, 28-29, 38, 46–48]. Yu.A. Kozlov et al reported a new treatment approach in two newborns with EA with a large diastasis between the segments, consisting in the fact that thoracoscopic tractional elongation of the esophagus is possible without gastrostomy, followed by esophagoesophageal anastomosis on the 5th and 6th days, respectively. According to their work, in both cases only anastomotic stenosis was observed [49], which we also observed in 1 case.

Comparing our data with the literature, we can focus on a meta-analysis of complications and long-term results of 44 articles, performed in 2012 by Friedmacher F. and Puri P. According to their work, the incidence of anastomotic leakage was 22.9-35.3%, narrowing of the anastomosis -- 50.9--62.9%, fatalities -- 41.8--53.9%, deaths -- 7.3--14.1% [50]. In our case, there was a high level of anastomotic narrowing (81.8%). The following factors were observed in the development of anastomotic stenosis: anastomosis with tension, leakage of anastomotic sutures and gastroesophageal reflux. All patients underwent bougienage of the esophagus. Simultaneously with bougienage, all children received antireflux therapy.

Conclusion

The use of the thoracoscopic method of esophago-esophagoanastomosis ensures minimal trauma, creates good visualization of the surgical field, helps to achieve a good cosmetic effect, and does not form gross scar changes and musculoskeletal deformities.

Conflict of interest: The authors declare no conflict of interest

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