

## Esophageal replacement for esophageal atresia in children -comparison between coloplasty and gastroplasty

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**Introduction:** When direct anastomosis by newborns with esophageal atresia fails, the method of choice for esophageal replacement is the transposition of colon or stomach. **The aim** of this study is to compare two surgical procedures for esophageal reconstruction – the coloplasty and gastroplasty. **Clinical material:** For a period of 15 years (1992 – 2006) 88 babies with esophageal atresia were treated at the Department of pediatric surgery - Sofia. By 15 of them a plastic reconstruction of the esophagus was necessary. There were 6 retrosternal transpositions of the left colon and 9 transpositions of the whole stomach using the retrosternal (3 children) or the posterior mediastinal route through the hiatus (6 children). The age at the operation ranged from 7.1 to 13 months. There was only one postoperative death (6.25 %). Early postoperative complications were observed in the group with coloplasty – cervical anastomotic leak in 3 children, one of them requiring reanastomosis. **Results:** In generally, our clinical results by the esophageal replacement in young children are satisfactory. The whole stomach transposition, especially through the hiatus in the posterior mediastinum has more advantages compare to the colon transposition and is a reliable alternative procedure for reconstruction of the esophagus in cases with failed primary anastomosis for esophageal atresia.

Main goal of the surgical treatment in newborns with esophageal atresia (EA) is the restoration of the esophageal continuity. However, when primary anastomosis fails or when anastomotic insufficiency occurs, a method of choice is esophageal replacement with colon, stomach, or stomach tube [6,7,9]. In the present study we analyze comparatively the results of two surgical procedures for esophageal reconstruction in early childhood – the coloplasty and gastroplasty.

### CLINICAL MATERIAL

For a period of 15 years (1992-2006) 88 newborns with EA were treated at the University department of pediatric surgery -

Sofia. Overall survival rate was 83 %. We analyze the clinical experience by 15 cases, of them 12 with distal fistula and three without TEF. Associate malformations were found in 6 cases - right aortic arch (n=2), congenital cardiac anomalies (n=2), anal atresia (n=1) and costovertebral defects (n=1). Nine children with long gap atresia underwent primary cervical esophagostomy and gastrostomy. In the other four the procedure was done due to insufficiency of the primary anastomosis. Two kids without TEF underwent unsuccessful elongation of the esophagus according to the method of Howard-Myers.

Average weight at birth was 2.1 kg (1.1 - 3.4). Mean age during the procedure was 9.95 mo (7.1 - 13), and weight - 8.3 kg (7.29 - 10.1).

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### METHODS

Throughout the period 1995 - 2000 we performed in 6 children a retrosternal transposition of the left colon supplied by the

left colic artery. In all cases a two-layered V-shaped cervical anastomosis and an antireflux cologastric anastomosis incorporating an invaginated mucosal valve at the gastric antrum were done (Fig.1,2). Gastrostomy was closed at the same stage.

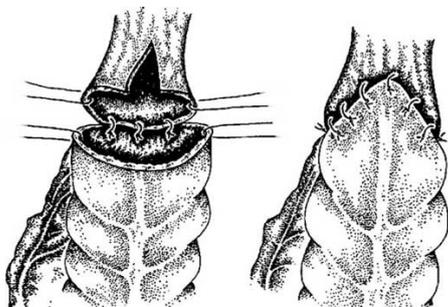


Fig.1. The cervical V-shaped esophagogastric anastomosis.

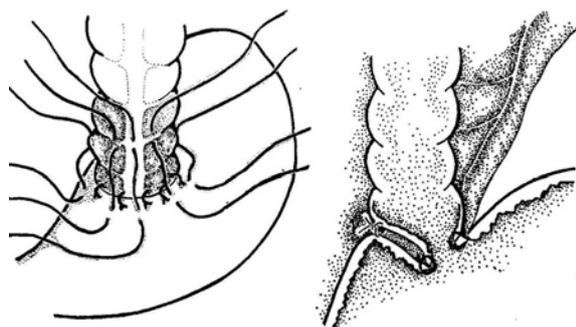


Fig. 2. Placing the second row of suture for achieving an invaginated antireflux cologastric anastomosis.

After the year 2001 we carry out by 9 children an esophagoplasty with the whole stomach. In 3 cases we completed anterior retrosternal transposition whereas in other 6 - a posterior mediastinal transposition through the hiatus after creating a suited tunnel by blunt mediastinal dissection. The cervical anastomosis between the apex of the fundus and the anteriorly incised cervical esophagus was done in two layers (Fig.3).

## RESULTS

**Coloesophagoplasty.** In the early postoperative period we observed in one patient a proximal graft necrosis, which

necessitated its removal and second replacement with right colon graft. Cervical anastomotic leakage occurred in two children that healed spontaneously; in another case reanastomosis was necessary to perform. Postoperatively we observed difficult adaptation for a short period of time in three kids; subsequently all children thrived practically well but some transitional disturbances in feeding and defecation were observed.

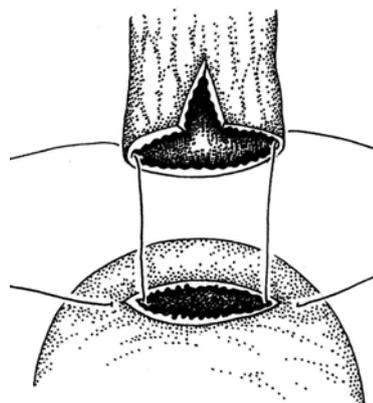


Fig. 3. The cervical V-shaped esophagogastric anastomosis

**Gastroplasty.** In all the children who underwent stomach transposition we did not ascertain early complications of the cervical anastomosis. One kid developed late esophageal stricture, and was treated successfully by balloon dilatation. There was one death on the 18 postoperative day in a child with retrosternal transposition and cardiac anomaly due to respiratory insufficiency as a result of chronic pulmonary infection. In two cases with retrosternal transposition we encountered temporary manifestation of chest compression - tachycardia and tachypnea by changing the position and during sleep. All kids passed through a short period of troubled adaptation presented with dysphagia, transitional unstable defecation and slow growth. That problem was overcome with designing an appropriate diet and eating small frequent

meals. Three kids had evidence of transitory spastic cough, which resolved spontaneously after improvement of swallowing act. In generally we found excellent results by long-term follow-up.

## DISCUSSION

Esophageal replacement in early childhood is very often burdened by various functional disturbances, which support the statement that preserving the native esophagus is the best alternative [4]. For this reason many authors recommend delayed primary anastomosis in long-gap EA [8] whereas other advocates primary repair by performing an anterior esophageal flap to bridge the residual gap [1].

Esophagoplasty is an alternative procedure in cases when direct anastomosis is not feasible. Other indication for esophageal reconstruction is the insufficiency of the direct anastomosis. Even though we try to use various techniques for elongating the proximal segment of the esophagus, the replacement with colon or stomach remains still a possible option.

According the choice of an appropriate term for reconstructive surgery in children with EA some authors preferred early surgery immediately after birth [2]. On the other site performing such complex operation on a newborn baby still carry significant operative and anesthetic risks. According to our experience we recommend this to be done after the age of 6 months and we perform the procedure after meticulous analysis of general condition and accompanying disturbances.

Diverse combined thoracoabdominal approaches with placing the conduit in the posterior mediastinum via the left or right chest has been reported [4,7]. Ure, BM a.al. published the first clinical experience on laparoscopically assisted gastric pull-up for long gap esophageal atresia [10]. We always use the middle abdominal and cervical

incisions as surgical approach by accomplish the retrosternal or transhiatal transposition.

Before switching to gastroplasty we used to complete an isoperistaltic transposition of the left and transverse colon supplied by the left colic vessels. We ascertain that the retrosternal route shortens the duration and extend of the surgical procedure thus avoiding difficult postoperative adaptation. The performed by us double-layer V-shape anastomosis decrease significantly the frequency of anastomotic leakage and late stricture, which by some authors could reach 40 %. We believe that our method for invaginated antireflux cologastric anastomosis avoid a secondary reflux to the new esophagus. The main advantage of this particularly method is that the colon graft serves as physiologic conduit of the food, so the stomach retains its reservoir function [9].

However this approach is not devoid of complications. A dangerous one is the graft necrosis due to folding or overstretching of the vascular pedicle. It is noteworthy that the coloplasty is a complicated and multistage procedure where three digestives anastomosis should be performed, which keeps the risk of potential contamination. In the later follow-up we observed in three children graft redundancy with food stasis, causing a bad smell taste to the mouth and digestive problems despite meticulously and correct tailoring of the conduit. (Fig.4,5).

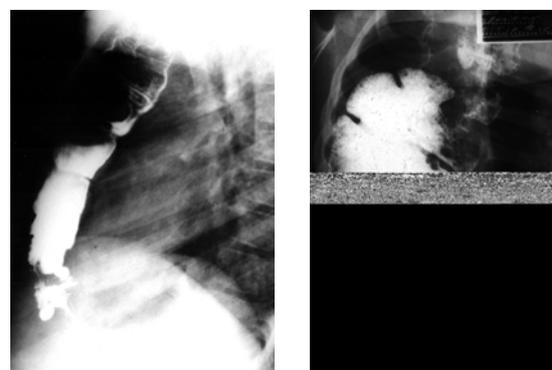


Fig. 4. Normal anterior position of the colon graft

Fig. 5. Redundancy of the colon graft

In cases with stomach transposition through the posterior mediastinum we found out satisfactory long-term results, which could be explained by the way of laying the stomach in the native esophageal bed; thereby the mediastinum contains the conduit, making it more tubular with less distention [4]. On contrarily with kids in whom the retrosternal route was used we observed a marked angulation of the stomach at the epigastric site in front of the liver edge. (Fig.6,7).

Tailoring the stomach is a crucial step in performing the procedure. In order to achieve enough length with relatively small diameter of the conduit and thus assuring minimal tension to the fundus apex we perform a tangential resection of the gastroesophageal junction. In cases with posterior mediastinal transposition we have not apply drainage procedure such as pyloroplasty because the stomach is placed in the physiologic groove and thus an angulation is avoided. For that purpose we try to liberate the pyloric-duodenal region from all fine adhesions. We did not subsequently observed duodenogastric reflux as reported by some authors [1]. However, two kids with retrosternal route, which experienced in the postoperative period delayed gastric emptying and stomach dilatation, necessitated additionally a pyloroplasty.

The mane advantages choosing a stomach as esophageal substitute are noticeable - easy mobilization, less traumatic procedure and shorter operative time [3,4,5]. And last but not least we need to perform only one anastomosis by preserving the continuity of the large intestinal tract. Main disadvantage is losing the stomach as reservoir, which leads to fast transit of the food. Other drawback is a loss of the valve mechanism that can cause acid reflux to the cervical portion. In rare cases the parents were recalling some dyspeptic symptoms, but the further investigations did not revealed any erosive changes to the cervical anastomosis.

Pulmonary function was routinely evaluated with satisfactory results.

Although some evidence of minor early complications after stomach transposition, those children express progressive psycho-physical improvement compare to the group with coloplasty. Regarding quality of life the children with whole stomach transposition manifest a better adaptation to the new condition.



Figure 6a

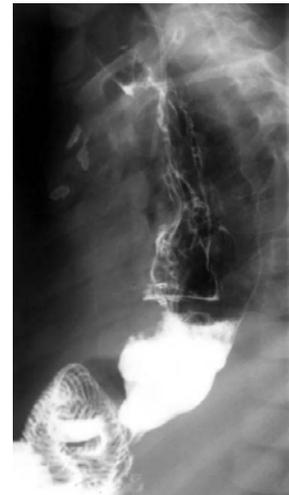


Figure 6b



Figure 7

Fig. 6 ab Normal position of the posteriorly placed stomach

Fig. 7. Angulation of the retrosternal placed stomach

## CONCLUSIONS

Reconstructive surgery of the esophagus represents a crucial moment in the multistage treatment of EA. Good therapeutic results depend on the timing of operation and the choice of most appropriate replacement method. We believe that the transhiatal stomach transposition through the posterior

mediastinum has better long-term results; therefore we prefer this technique for

esophageal reconstruction in the early childhood.

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