Results of Gastric Pull-up Procedure in Neonatal Long-gap Esophageal Atresia: A Single Center Prospective Study

Saeid Aslanabadi[1] Davoud Badebarin[1]* Emad Ghabeli[2]
Sina Zarrintan[2]

[1] Division of Pediatric Surgery, Children's Hospital, Tabriz University of Medical Sciences, Tabriz, Iran
[2] Department of General Surgery, Faculty of Medicine, Tabriz University of Medical Sciences, Tabriz, Iran

*Address for Corresponder: Dr. Davoud Badebarin, Department of Pediatric Surgery, Faculty of Medicine,Tabriz University of Medical Sciences,Tabriz, Iran
(email: dbadebarin@gmail.com)

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Abstract

Introduction: The management of long-gap esophageal atresia (LGEA) remains challenging and esophageal replacement is inevitable in some patients. The current study aimed at assessing the outcomes of gastric pull-up surgery for esophageal reconstruction in neonates with LGEA, and investigating the postoperative results, complications, and mortality.

Materials and Methods: In a prospective study 16 patients with LGEA were studied at Tabriz Children's Hospital, Tabriz, Iran. Gastric pull-up technique was used for esophageal replacement in all the patients. The study duration was 23 months from April 2014 to March 2016.

Results: The mean age of the neonates was 7.31 ± 3.91 days. Eleven patients (68.75%) were male and five (31.25%) female. Seven neonates (44%) had esophageal atresia type A and nine patients (56%) had type C. All of them (100%) were in need for postoperative mechanical ventilation. Mean period of postoperative mechanical ventilation was 0.87±5.69 days. Postoperative mortality was observed in three patients (18.75%). Patients were followed up for six months after the operation; poor feeding was observed in four patients (30.77%), mild respiratory distress in three patients (23.08%), and choking and aspiration in three patients (23.08%).

Conclusion: It was observed that gastric pull-up technique is a feasible and safe surgical method for neonates with long-gap esophageal atresia when primary anastomosis is not possible. Quality of life, feeding, and growth pattern were also acceptable. However, long-term outcomes were not assessed in the current study.

Keywords

- Esophageal Atresia
- Gastric Pull-up
- Neoesophagus
- Esophagogastrostomy

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Introduction

Esophageal replacement is necessary in a number of Long-Gap Esophageal Atresia (LGEA).[1] Outcomes depend on surgical skills and patient factors. [2,3] The most common type of EA is type C atresia which has a distal tracheoesophageal fistula and occurs in 85% of the cases followed by pure EA (type A), occurring in 8% - 10% of patients.[4] Surgical techniques to establish the continuity of anomalous esophagus in EA are discussed in detail in the literature. However, no optimal method for replacing the esophagus in cases of long-gap esophageal atresia (LGEA) or extensive corrosive strictures have been selected.[5]

The most common methods of esophageal replacement in the pediatric population are jejunal interposition, colon interposition, gastric tube interposition and gastric pull-up.[4-7] Surgeon's expertise and preference along with patient's anatomy are important aspects when selecting a suitable method for esophageal replacement in LGEA. Even though the patient's own esophagus is always the best option it is associated with high rates of complications.[8] Thus, appropriate operation should be considered regarding postoperative outcomes, complications and mortality.

The current study, aimed to assess the outcomes of gastric pull-up surgery for esophageal reconstruction in neonates with LGEA, and investigate the postoperative results, complications, and mortality.

Materials and Methods

In a single-center prospective study, results of gastric pull-up surgery in long-gap esophageal atresia were studied. The study was conducted at Tabriz Children's Hospital affiliated to, Tabriz University of Medical Sciences, Tabriz, Eastern Azerbaijan province, Iran. The study duration was 23 months from April 2014 to March 2016. A total of 16 neonates were studied. Tabriz Children's Hospital is the main and referral pediatric center in Tabriz that serves as the referral and tertiary level hospital for pediatric surgery in Northwest Iran. Thus, the studied neonates were the representatives of patients with LGEA in this region.

Inclusion criteria were long-gap type A or type C esophageal atresia with the distance between proximal and distal parts of the esophagus being more than six vertebrae. Exclusion criteria were multiple associated anomalies, major congenital heart disease, severe renal compromise duo to congenital kidney anomaly and VACTERL syndrome (vertebral defects, anal atresia, cardiac defects, tracheo-esophageal fistula, renal anomalies, and limb abnormalities).

Sixteen patients were studied. Proximal and distal esophageal pouches were too far for primary esophagoesophagostomy in all the subjects; thus, esophageal reconstruction was necessary. Gastric pull-up technique was used in all patients. All operations were conducted by the same pediatric surgeon. The stomach was pulled-up with blood supply of the right gastric artery. The left gastric artery was ligated. The neoesophagus traverse in all cases was carried out using the transhiatal rout except in one case which was done sub-sternally. The patients were followed-up six months after the operation. Results of surgery and complications were assessed and recorded. Figure 1 demonstrates flow diagram of the study patients.

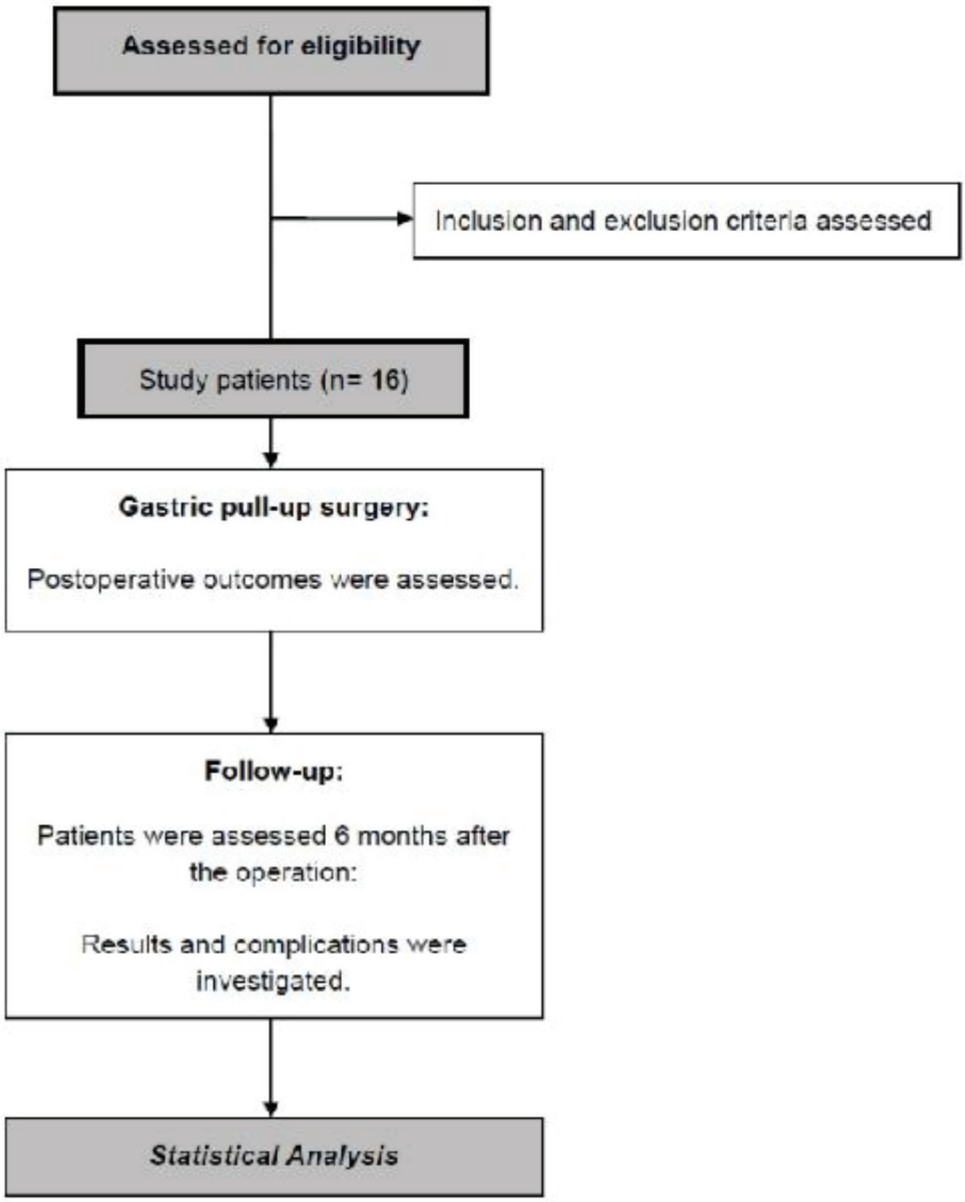

Figure 1: Follow diagram of study patients at Tabriz Children's Hospital, Tabriz, Iran.

Background variables were age, gender, need of mechanical ventilation preoperatively, type of atresia (type A or type C), and associated anomalies. The primary outcome was rate of mortality. Secondary outcomes consisted of anastomotic tension, conduction of jejunojejunostomy, conduction of pyloromyotomy, need of mechanical ventilation postoperatively, placement of chest tube and postoperative leakage. In addition, onsets of breast feeding and poor tolerance of oral feeding were considered secondary outcomes. Barium esophagography was conducted on the seventh

postoperative day. Findings were recorded. Also, postoperative follow-up was conducted six months after the operation. Poor feeding, respiratory distress, aspiration, choking and failure to thrive (FTT) were observed. A repeat esophagogram was conducted in all patients at the follow-up visit. The results were recorded and analyzed. Six-month mortality was also assessed. Background variables and outcomes were described by mean ± standard deviation (SD) and frequency (%). Statistical analyses were conducted with SPSS version 22.0.

The current study protocol was approved by Research Deputy of Faculty of Medicine, Tabriz University of Medical Sciences, and it was re-approved by Ethics Committee of Research Vice Chancellor at Tabriz University of Medical Sciences. Hospital ethics review was also conducted. Informed consent was obtained from the parents of our patients. It was explained that patients were allowed to withdraw from the study at any stage and their participation did not deprive them from routine medical and surgical care. Data used, published and analyzed in the current study were anonymous.

Results

Mean age of neonates was 7.31 ± 3.91 days; 11 patients (68.75%) were male and five (31.25%) female; three patients (18.75%) were in need for preoperative mechanical ventilation. The esophageal atresia was type A in seven neonates (43.75%) and type C in nine (56.25%). Associated anomalies were present in 12 cases (75.00%): eight neonates (50.00%) had congenital heart disease (CHD), one of them (6.25%) had anorectal malformation (ARM), and three patients (18.75%) had ARM and CHD.

All gastric pull-ups were through esophageal hiatus and esophagogastric anastomoses were conducted in a single layer by non-absorbable sutures. Esophagogastric anastomosis was under tension in three cases (18.75%); Jejunostomy tube was placed in three patients (18.75%), and pyloromyotomy was conducted in 15 patients (93.75%). All patients (100%) were in need for postoperative mechanical ventilation. Mean postoperative mechanical ventilation period was 5.69 ± 0.87 days. Chest tubes were inserted in 12 patients (75.00%): bilateral chest tubes were placed in two patients (12.50%), and right side chest tubes were placed in 10 patients (62.50%).

Postoperative mortality occurred in three patients (18.75%). Esophagography was conducted on the 7th postoperative day. One patient (7.69%) had anastomotic leakage. Stenosis of anastomotic site was observed in one patient (7.69%). Mean time of breast feeding initiation was 8.15 ± 1.00 days; two neonates (15.38%) could not tolerate oral feeding.

Follow-up of infants was conducted six months after their operation. Poor feeding was found in four patients (30.77%); mild respiratory distress in three patients (23.08%), and choking and aspiration was found in three patients (23.08%). FTT was not present in any of the infants. In addition, follow-up barium esophagography at six-month visit illustrated gastric reflux in six patients (46.15%) and anastomotic stenosis in two patients (15.38%). Size of neoesophagus was small in 11 patients (84.62%) and was large in two patients (15.38%). There was no mortality at six-month follow-up.

Discussion

The results of the current study shows that gastric pull-up technique is a feasible and safe operation for neonates with long-gap esophageal atresia, when primary anastomosis is not possible. The mortality rate was low (postoperative mortality was 18.8% and six-month mortality was 0%) and complication rate was acceptable. Quality of life, feeding, and growth pattern were also acceptable. However, long-term outcomes were not assessed in the current study. The six-month follow-up of infants after the operation revealed desired outcomes.

Hunter et al. [8] investigated 28 cases with LGEA. In their study, 10 patients underwent primary anastomosis, nine had colonic interpositions, three had gastric tube replacing their esophagus, and two patients underwent gastric interposition. They found that patients whom had reconstructions using the stomach had lower complication rates and suggested that gastric transposition may be a preferable and acceptable initial reconstructive technique. However, many studies suggested that the primary esophageal anastomosis was the procedure of choice when two pouches could reach each other. [7, 9, 10] We also found that gastric pull-up was a feasible and acceptable technique when primary esophagoesophagsotomy was not possible duo to LGEA. Bagolan et al,[6] recommended that esophageal substitution in LGEA should be carried out in patients for whom an earlier attempt of primary end to end esophageal reconstruction had failed.

In a retrospective study by Hirschl et al., [11] 41 patients who had undergone gastric transposition for esophageal replacement were evaluated. Among these patients, 26 had the diagnoses of esophageal atresia. They concluded that gastric transposition can potentially provide gastrointestinal continuity with few complications and proposed that gastric transposition was a suitable choice for esophageal reconstruction in the pediatric population. In a superiority study, Anderson et al., [12] compared the results of colon transposition for esophageal atresia with that of gastric tube. They found no difference between these two methods regarding early or late complications, growth and nutrition, and patient acceptability. In addition, in a study by Gallo et al., [13] results of gastric pull-up and jejunal interposition in children with LGEA were compare. Their results had no significant difference with those of the current study indicating gastric pull-up as a safe and feasible technique to restore gastrointestinal anatomy in children with LGEA.

Although there is no consensus regarding the most appropriate approach for esophageal reconstruction in LGEA, it is accepted that the most favorable option is preservation of the patient's own esophagus and it should be attempted before considering the use of an esophageal replacement. [14-18] The best choice for esophageal reconstruction in children with LGEA is a matter of controversy. A number of studies propose that colon interposition is the favorable technique; [18-20] however, other studies revealed favorable and acceptable outcomes for using the stomach.[21-23]

Pedersen et al., [21] conducted gastric tube placement for reconstruction of LGEA in three patients with redundant distal esophagus. They found this technique feasible with successful outcomes. Elin et al., [22] used gastric tube conduit

for reconstruction of gastrointestinal continuity in children with caustic injury. They found desired outcomes with acceptable complication rates. Lee et al., [23] studied 44 patients with LGEA; 30 patients underwent delayed primary anastomosis and 14 patients underwent esophageal replacement with gastric tube. They found that delayed primary anastomosis had better long-term outcomes compared with esophageal replacement with gastric tube. However, in the cases when primary anastomosis was not possible, reconstruction by gastric pull-up or gastric tube was a potential technique to provide gastrointestinal continuity. In a systematic review by Liu et al. [24] stated that current evidence on short- and long-term results of esophageal reconstruction in patients with LGEA is limited, and proper prospective comparative studies is needed. The review indicated that colon interposition and gastric pull-up were comparable and favorable approaches.

Conclusion

Although we have reached acceptable results with the gastric pull-up technique in this experience, but due to the low number of our cases and the type of our study which was a case-series we cannot state that this is the best option for esophageal reconstruction in LGEA and further multicentre randomized clinical trials are needed to reach such a conclusion.

Ethics Approval

This study was approved by Regional Ethics Committee on 1394.02.23.

Conflict of Interest

There is no conflict of interest.

ORCID ID:

Saeid Aslanabadi https://orcid.org/0000-0002-0613-8794
Davoud Badebarin https://orcid.org/0000-0001-8840-9502

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