



Long-term functional outcomes after replacement of the esophagus in pediatric patients: A systematic literature review



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ABSTRACT

Background: The indications of esophageal replacement (ER) in pediatric patients include long gap esophageal atresia (LGEA), intractable post-corrosive esophageal strictures (PCES), and some rare esophageal diseases. Various conduits and procedures are currently used worldwide with a lack of consensus regarding the ideal substitute to replace the esophagus replacement. The short-term outcomes of these advanced procedures are well known; there are few data available describing long-term functional outcomes of these patients with long life expectancy.

Objectives: The objective of this study is to investigate the long-term functional outcomes of the most widely used techniques for ER in pediatric patients based on a comprehensive literature search covering the last 10 years.

Methods: Eligible were all clinical studies reporting outcomes after esophagectomy in pediatric patients, which contained information on at least 3 years of follow-up after the operation. The review was conducted in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines. A systematic web-based search using MEDLINE, the Cochrane Library and EMBASE databases was performed, reviewing all medical literature published between January 2006 and December 2015.

Results: The scientific quality of the data was generally poor, converging toward only 14 full-text articles for the final analysis. The stomach was the preferred organ for esophageal replacement, where the tubulization of the stomach resulted in significant gastroesophageal reflux. Dysphagia symptoms were more seldom reported, but several authors presented growing figures with the length of follow-up. Dumping syndrome and delayed gastric emptying were only scarcely reported upon.

Following colonic graft, chronic gastrocolic reflux affects these patients, in the range of 35–70.8%, while 4 studies reported any dysphagia from 2.7% to 50% of the children. Only one study reported the outcome of the use of a long jejunal segment, where presence of symptoms of functional obstruction was mentioned in 46% of cases. Very few if any data were available on a structured assessment of postprandial dumping and disturbed bowel functions.

Conclusions: Available data in pediatric patients, on the long-term functional outcomes after esophageal replacement with a gastric tube, colonic graft or a long jejunal segment, are of poor scientific quality. Although symptoms are frequently reported currently no conclusions can be drawn regarding potential advantages of one graft over another.

Type of study: Treatment study, systematic review.

Level of evidence: IV.

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The common indications of esophageal replacement (ER) in pediatric patients include long gap esophageal atresia (LGEA), intractable post-corrosive esophageal strictures (PCES), and some rare esophageal disease [1–4]. In the relatively rare cases where the stomach is not available for use as a conduit for esophageal replacement, alternative strategies have to be pursued. In those situations the most commonly used conduit is the colon, prepared either from the right or the left colon and brought up to the proximal esophagus in an isoperistaltic position. During recent years some interest has emerged in the use of long jejunal segments sometimes combined with the supercharging of the proximal arcade fed from suitable vessels in the neck region [5,6]. In essence there seems to be a general agreement that the use of the colon is associated with an increased risk of immediate postoperative complications even in the hands of experienced surgeons [6,7]. Therefore many surgeons would argue that in cases with an intact stomach, the tubulisation and pull-up of the stomach shall always be preferred [8].

In benign lesions and diseases of the esophagus and GEJ, harboring a long predicted survival, it is basically unclear which conduit to be generally recommended. This controversy is mainly based on the opinion–assumption that the functional outcomes are superior over time when a bowel conduit is used. There are obvious disadvantages of the gastric conduit in the form of uncontrolled gastroesophageal reflux of gastric juice, stricture formation, dumping and delayed gastric emptying [8,9]. To what extent the use of alternative conduits, as replacement for the esophagus, is hampered by similar (except for those being gastric specific) problems is essentially unknown. As evidenced by previous studies the short-term outcomes of these challenging procedures are well defined; the mortality rate is estimated at about 2–4%, but overall morbidity such as anastomotic leak, anastomotic stricture, and graft failure reaches up to 2/3 of patients [10,11].

On the other hand, long-term follow-up after these procedures is less clear and only few reports investigate chronic long-term problems of these highly complex young patients with long life expectancy.

The objectives of the present study were therefore manifold. First to do a comprehensive literature search on the long-term outcomes of esophageal replacements in general and those residing after the selection of different conduit alternatives as stated above. In addition, we scrutinized the literature on the prevalence of symptoms alleged to be in favor, or alternatively against, the use of one conduit before the other. Since the development of surgical care and rehabilitation after esophagectomy in children has developed quite extensively during the last decades we have limited our literature search to the last 10 years.

1. Materials and methods

1.1. Eligibility criteria for clinical studies

We herein defined *long-term* as equal to or longer than three years. Thus, eligible studies included clinical studies that presented data on the outcome of esophagectomy, which was followed up at three years or more after the operation. In studies incorporating only information on patients' mean or median follow-up period, which was often the case in several retrospective cohort studies, only those with a follow-up period of > five years were considered eligible. If data were presented at various time points postoperatively, only those studies with a follow-up ≥ three years, after the respective procedure, were considered eligible. Along with this, studies were considered eligible if they reported on long-term functional results, addressing at least one of the following symptomatic outcomes: dysphagia, gastroesophageal reflux/regurgitation, dumping syndrome, delayed gastric emptying and diarrhea. Only patients who were younger than 18 years of age at the time of operation were included. Articles for which the full text was not available in English were excluded.

Table 1
Terms and formula for the comprehensive literature search.

Formula for the search (term 1 AND term 2) AND term 3 AND term 4 NOT term 5	
Term 1 (esophageal replacement and/or anastomosis)	("esophageal replacement" OR "esophageal reconstruction" OR "esophageal substitution" OR "esophageal resection" OR esophagectomy OR "oesophageal replacement" OR "oesophageal reconstruction" OR "oesophageal substitution" OR "oesophageal resection" OR oesophagectomy) OR ("whole stomach" OR "gastric tube" OR "gastric conduit" OR "gastric pull up" OR "gastric transposition" OR "stomach transposition" OR "jejunal interposition" OR "jejunal transposition" OR "jejunum interposition" OR "jejunum transposition" OR "colon interposition" OR "colonic interposition" OR "colon transposition" OR "colonic transposition") OR ("esophagogastrostomy" OR "esophago-gastrostomy" OR "esophagogastroplasty" OR "esophago-gastroplasty" OR "esophagogastric anastomosis" OR "esophago-gastric anastomosis" OR "esophagocolonic anastomosis" OR "esophagocolic anastomosis" OR "esophagocolonostomy" OR "esophagocolostomy" OR "esophago-colonostomy" OR "esophago-colostomy" OR "esophagocolonoplasty" OR "esophagocoloplasty" OR "esophago-colonoplasty" OR "esophago-coloplasty" OR "oesophagogastrostomy" OR "oesophago-gastrostomy" OR "oesophagogastroplasty" OR "oesophago-gastroplasty" OR "oesophagogastric anastomosis" OR "oesophago-gastric anastomosis" OR "oesophagocolonic anastomosis" OR "oesophagocolic anastomosis" OR "oesophago-colonic anastomosis" OR "oesophago-colic anastomosis" OR "oesophagocolonostomy" OR "oesophagocolostomy" OR "oesophago-colonostomy" OR "oesophago-colostomy" OR "oesophagocolonoplasty" OR "oesophagocoloplasty" OR "oesophago-colonoplasty" OR "oesophago-coloplasty")
Term 2 (functional outcomes)	("dysphagia" OR "odynophagia" OR "swallowing disorder" OR "deglutition disorder" OR "reflux" OR "regurgitation" OR "gastric emptying" OR "dumping" OR "functional outcomes" OR "functional results" OR "quality of life")
Term 3 (publication date)	"2006/01/01"[Date - Publication] - "2015/12/31"[Date - Publication]
Term 4 (language)	"english"[Language]
Term 5 (publication type)	"case reports"[Publication Type]

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