



## Outcomes of Esophageal Replacement in the Management of Corrosive Esophageal Injuries Via Colon Interposition, Gastric Pull-Up, Or Reverse Gastric Tube

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### Abstract

**Introduction:** Corrosive esophageal injuries result in mucosal damage related to the type, exposure time, and volume of the ingested substance, ranging from mild burns to severe necrosis. These injuries are usually seen in childhood; stricture and dysphagia are common. Swallowing problems are due to prolonged stricture and require surgery. However, postoperative problems should also be considered. The purpose of this study was to determine the results of esophageal replacement in the management of corrosive esophageal injury via three methods: colon interposition, gastric pull-up, and reverse gastric tube.

**Methods:** In this observational descriptive-comparative study, 50 consecutive patients admitted to Mofid Children's Hospital with corrosive esophageal injury from 2006 to 2016 were enrolled, and the results of esophageal replacement by colon interposition, gastric pull-up, or reverse gastric tube were determined and compared according to other variables.

**Results:** The results of this study demonstrated that 68% of the patients required surgery, with 82.3% undergoing repeated surgery. A total of 22 patients underwent surgery via the gastric pull-up method, which was the most successful procedure. Esophageal stricture (74%), vomiting (46%), and dysphagia (40%) were the most common preoperative complaints, whereas dysphagia (46%), stricture (36%), and vomiting (26%) were the most common postoperative problems. There were four cases of mortality.

**Conclusion:** According to the obtained results, it may be concluded that esophageal replacement in the management of corrosive esophageal injuries is effective, and that the gastric pull-up method is the best surgical option.

**Keywords:** Esophageal atresia, Interposition, Gastric surgery

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### Introduction

Corrosive esophageal injuries are seen in two-thirds of people who accidentally ingest acidic or

alkaline substances (1, 2). However, the severity of the injury is mild in 44%; this intensity differs according to the type and amount of ingested substance. The injury may be limited to the esophagus or may

extend inferiorly (1, 3). Such injuries besides early manifestations may result in chronic sequelae like dysphagia, stenosis, and malignancies (4-6).

Accordingly, prompt, effective treatment is essential. Different therapeutic modalities are available, including conservative versus surgical procedures; selection among them is dependent on primary severity, background diseases, and complications (7-10). Since portions with more severe esophageal burns are at higher risk of stenosis and malignancy, the employment of methods such as colon interposition / gastric pull-up / reverse gastric tube may entail good prognoses (11, 12). Hence, the purpose of this study was to determine the therapeutic outcomes of esophageal replacement in the management of corrosive esophageal injuries via three methods: colon interposition, gastric pull-up, and reverse gastric tube.

## Methods

In this observational descriptive-comparative study, 50 consecutive patients admitted to Mofid Children's Hospital with corrosive esophageal injury from 2006

to 2016 were enrolled in a census manner. Data were collected through observations, clinical examinations, interviews, phone calls, and existing medical documents. Patients lost to follow-up were excluded.

The outcomes of esophageal replacement surgery in the management of corrosive esophageal injury were compared across the three methods of colon interposition, gastric pull-up, and reverse gastric tube. These outcomes included stenosis, dysphagia, leak of anastomosis, hospital stay, length of intubation, need for repeated surgery, fistula, and mortality.

Data analysis was performed by SPSS (version 24.0) software [Statistical Procedures for Social Sciences; Chicago, Illinois, USA]. Analysis of variance (ANOVA) was used in addition to the chi-squared test, Fisher's exact test, and independent t-test for analysis, all being considered statistically significant at P values less than 0.05.

## Results

The mean age at injury was  $34.5 \pm 23.1$  months (range: 9 to 108 months), and 74% were younger than three

**Table 1:** Preoperative complications in patients

Complications Before Intervention	Number	Percent
Stricture	37	74.0
Vomiting	23	46.0
Dysphagia	20	40.0
Odynophagia	7	14.0
Esophageal perforation	5	10.0
Gastric outlet obstruction	4	8.0
Abdominal pain	4	8.0
Esophagitis	3	6.0
Heartburn	2	4.0
Gastric ulcer	1	2.0
Mediastinitis	1	2.0
Aspiration pneumonia	1	2.0
Esophagus ulcer	1	2.0
Drooling	1	2.0
Esophageal diverticulum	1	2.0
Esophageal fistula	1	2.0

**Table 2:** Postoperative complications in patients

Complications After Intervention	Number	Percent
No complication	12	24.0
Dysphagia	23	46.0
Stricture	18	36.0
Vomiting	13	26.0
Reflux	12	24.0
Infection	5	10.0
Tracheoesophageal fistula	2	4.0
Esophagitis	1	2.0
Esophageal perforation	1	2.0
Mediastinitis	1	2.0
Leak of gastrostomy	1	2.0
Regurgitation	1	2.0
Lung collapse	1	2.0
Gastrointestinal obstruction	1	2.0

**Table 3:** Type of complications across the groups

Complication	Dysphagia	Reflux	Stricture	Vomiting	Leak	Infection	Mortality
Gastric Pull up	9	5	8	5	3	1	1
Reverse gastric tube	2	1	5	-	6	-	3
Colon Interposition	1	-	1	-	-	-	-

**Table 4:** Hospital stay, ICU stay, and buji times across the groups

Stay	Total (Day)	ICU (Day)	Buji (Time)
Gastric pull-up	16	9	45
Reverse gastric tube	15	8	11
Colon interposition	15	10	13

years. Totally 33 patients (66%) were male. The mean age at intervention was  $34.4 \pm 24$  months, ranging from 9 to 96 months. The time from injury to hospital admission ranged from three hours to three months. The ingested substance included tube-openers, batteries, acids, gas washing fluid, whiteners, and thinners in 60, 8, 14, 8, 8, and 2%, respectively.

Data pertaining to burn severity were accessible in 27 cases, among which 1, 4, 18, and 3 cases had severity grades of 1, 2A, 2B, and 3, respectively. The mean frequency of dilatations was  $4.3 \pm 4.1$  times, ranging from 1 to 14 times. The preoperative complications, most notably stricture (74%), vomiting (46%), and dysphagia (40%), are shown in Table 1. The mean surgical procedure time was 2.2 hours, ranging from 1 to 5 hours. The postoperative complications (Table 2) included dysphagia (46%), stricture (36%), and vomiting (26%). The employed procedure included 22 cases of gastric pull-up, 26 of reverse gastric tube, and 2 of colon interposition.

The outcome of gastric pull-up was better ( $P=0.001$ ) with a dilatation rate of 36.4% versus 76.9 and 50% in the reverse gastric tube and colon interposition methods, respectively. Also, 45.5% had a complication in the gastric pull-up method versus 50% in each of the other two methods. The mean admission time was 1.2, 1.3, and 1.2 days in gastric pull-up, reverse gastric tube, and colon interposition, respectively. The type of complications, hospital stay, and ICU stay differed ( $P=0.001$ ) across the groups (Table 3 and Table 4).

## Discussion

In this study, the outcomes of esophageal replacement in the management of corrosive esophageal injury via three methods were compared, and it was found that gastric pull-up provided the best results. Stricture, vomiting, and dysphagia were the most common preoperative complications, and dysphagia, stricture, and vomiting were the most common postoperative complications. Also, four mortality cases were identified at follow up. Harlak et al. (13) assessed gastric pull-up outcomes and found one case with infection and 13 patients with stricture of the anastomosis. In our study, stricture was seen in 13 patients, while infection was observed in 5 cases. Kane et al. (14) reported two cases of esophageal

burns under gastric pull-up, and reported good efficacy and high safety in line with our study.

The study by Hamza et al. (15) among 850 patients revealed that in 75 cases for which gastric pull-up was performed, the cervical leak, stricture, and mortality rates were 10, 5, and 1%, respectively. We also had four cases with mortality in the present study. Arul et al. (16), in a review article, demonstrated that gastric pull-up is effective and safe for the treatment of esophageal burns, as elucidated by our study. Similar findings were provided in the review article of Lal et al. (17). Another review study by Soccorso et al. (18) showed that esophageal replacement with gastric transposition and colonic replacement has good short-term outcomes, but further studies about long-term outcomes are required. This matter shows the further importance of our results.

Gvalani et al. (19) retrospectively assessed 32 patients who underwent antesternal colonic interposition and reported it as a safe and effective method. Similarly, in our study, the outcomes of this method were relatively good. The study by Javed et al. (20) among 39 patients showed that five months after colon interposition, there were good outcomes and a low rate of complications, in line with our study. Burgos and colleagues (21) evaluated 96 patients with esophageal burns and found that the therapeutic outcomes for colonic interposition were good in 96 percent, which is a similar finding to that of our study. Also, Fürst et al. (22) assessed 12 cases with esophageal burns and found that 27% had complications after colon interposition. However, the complication rate was higher in our study. Our study had some limitations, including a small sample size due to incomplete data in some cases that were excluded. Also, the results have low generalizability due to sampling from a single center.

## Conclusion

Overall, according to the obtained results, it may be concluded that esophageal replacement in the management of corrosive esophageal injury is effective, and that the gastric pull-up method is the best surgical option. However, further studies with larger sample size and multi-center sampling are required to attain more definite results.

**Conflicts of interests:** None declared.

## References

- Bocharnikov ES, Orlov IuP, Ponomarev VI, Berezniak GN, Davydenko DV. Diagnosis and combined treatment of esophageal chemical burns in children. *Khirurgiia (Mosk)*. 1999; 7:30-2.
- Kamat R, Gupta P, Reddy YR, Kochhar S, Nagi B, Kochhar R. Corrosive injuries of the upper gastrointestinal tract: A pictorial review of the imaging features. *Indian J Radiol Imaging*. 2019;29(1):6-13.
- Isakov IF, Stepanov EA, Razumovskii AI, Timoshchenko OV. Treatment of chemical burns of the esophagus in children. *Khirurgiia (Mosk)*. 1996;(4):4-8.
- Lupa M, Magne J, Guarisco JL, Amedee R. Update on the diagnosis and treatment of caustic ingestion. *Ochsner J*. 2009 Summer;9(2):54-9.
- Glotov VA. Pathogenesis of dysphagia in chemical injuries of the esophagus. *Khirurgiia (Mosk)*. 1982;(9):64-7.
- Contini S, Scarpignato C. Caustic injury of the upper gastrointestinal tract: a comprehensive review. *World J Gastroenterol*. 2013;19(25):3918-30.
- Lamireau T, Rebouissoux L, Denis D, et al. Accidental caustic ingestion in children: is endoscopy always mandatory? *J Pediatr Gastroenterol Nutr* 2001; 33:81.
- de Jong AL, Macdonald R, Ein S, et al. Corrosive esophagitis in children: a 30-year review. *Int J Pediatr Otorhinolaryngol* 2001; 57:203.
- Arévalo-Silva C, Eliashar R, Wohlgelernter J, et al. Ingestion of caustic substances: a 15-year experience. *Laryngoscope* 2006; 116:1422.
- Moore WR. Caustic ingestions. Pathophysiology, diagnosis, and treatment. *Clin Pediatr (Phila)* 1986; 25:192.
- Uhlen S, Fayoux P, Vachin F, et al. Mitomycin C: an alternative conservative treatment for refractory esophageal stricture in children? *Endoscopy* 2006; 38:404.
- Han Y, Cheng QS, Li XF, Wang XP. Surgical management of esophageal strictures after caustic burns: a 30 years of experience. *World J Gastroenterol*. 2004;10(19):2846-2849.
- Harlak A, Yigit T, Coskun K, et al. Surgical treatment of caustic esophageal strictures in adults. *Int J Surg*. 2013;11(2):164-8.
- Kane TD, Nwomeh BC, Nadler EP. Thoracoscopic-assisted esophagectomy and laparoscopic gastric pull-up for lye injury. *JLS*. 2007;11(4):474-80.
- Hamza AF, Abdelhay S, Sherif H, et al. Caustic esophageal strictures in children: 30 years' experience. *J Pediatr Surg*. 2003 Jun;38(6):828-33.
- Arul GS, Parikh D. Oesophageal replacement in children. *Ann R Coll Surg Engl*. 2008;90(1):7-12.
- Lal R, Behari A, Reddy J, Poddar B. Esophageal exclusion and bypass for corrosive injury: The lessons learnt. *J Indian Assoc Pediatr Surg*. 2014;19(1):46-8.
- Soccorso G, Parikh DH. Esophageal replacement in children: Challenges and long-term outcomes. *J Indian Assoc Pediatr Surg*. 2016;21(3):98-105.
- Gvalani AK, Deolekar S, Gandhi J, Dalvi A. Antesternal colonic interposition for corrosive esophageal stricture. *Indian J Surg*. 2014 Feb;76(1):56-60.
- Javed A, Agarwal AK. Total laparoscopic esophageal bypass using a colonic conduit for corrosive-induced esophageal stricture. *Surg Endosc*. 2013; 27(10):3726-32.
- Burgos L, Barrena S, Andrés AM, Martínez L, Hernández F, Olivares P, et al. Colonic interposition for esophageal replacement in children remains a good choice: 33-year median follow-up of 65 patients. *J Pediatr Surg*. 2010; 45(2):341-5.
- Fürst H, Hartl WH, Löhe F, Schildberg FW. Colon interposition for esophageal replacement: an alternative technique based on the use of the right colon. *Ann Surg*. 2000;231(2):173-8.