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Total esophageal substitution for combined hypopharyngeal and esophageal strictures after corrosive injury in children

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ABSTRACT

Background/purpose: The treatment of children with esophageal strictures and involvement of the hypopharynx caused by caustic substance ingestion continues to be challenging. The aims of the present study are to describe the peculiarities of the technique of complete esophageal substitution for the treatment of children with severe caustic strictures (pharyngocoloplasties) and to compare the results to those of classical esophagocoloplasty with thoracic and abdominal esophageal substitution in another group of children.

Methods: A total of 258 children underwent colon interposition for esophageal replacement. Among these patients, 19 had complex esophageal caustic strictures involving the high level of the esophagus and hypopharynx without response to endoscopic dilatations. This group was compared with another group who required partial esophagocoloplasty with intact hypopharynx and high esophagus (239 patients). For the pharyngocoloplasty procedure, the transverse and great parts of the right colon were the segments selected for interposition and were maintained by a double vascular pedicle based on the left colic vessels and the marginal paracolic arcade via the sigmoid vessels.

Results: In the pharyngocoloplasty group, 9 patients (47.4%) presented with cervical anastomosis stenosis with episodes of aspiration pneumonia, although good responses to endoscopic dilatation treatments were observed. All patients survived. In the esophagocoloplasty group, the main complications were cervical leaking (18.0%) and stenosis (16.7%). Statistical comparisons revealed that the pharyngocoloplasty patients exhibited a lower incidence of cervical leakage and increased incidences of cervical stenosis and aspiration pneumonia, although all patients could swallow normally.

Conclusion: Pharyngocoloplasty with complete esophageal substitution is a safe and effective procedure for the treatment of esophageal caustic strictures with severe stenoses reaching the hypopharynx that are refractory to previous endoscopic treatment.

Level of evidence: II

Caustic substance ingestion (CSI) continues to be a life-threatening problem worldwide, especially in developing countries. CSI is usually accidental in children but intentional in adults [1,2]. In developing countries, such as Brazil, caustic soda (used as soap) is the principal agent of concern.

Recent clinical–epidemiological studies have demonstrated that CSI accidents occur more often in boys and in children with a mean age of 3 years [3]. Initial management includes ipecac, oral dilution of the ingested material, neutralizing agents, antibiotics, systemic corticosteroids, and antacids [4,5]. After the patient's recuperation from the acute phase, repeated endoscopic dilatations to maintain an adequate esophageal lumen diameter have been the treatment of choice for patients who develop chronic strictures. This treatment is effective in achieving complete resolution of the stenosis for the majority of patients [6,7].

Our institution is a university reference center for the treatment of children who need esophageal substitution procedures. In 1994, we published our first paper showing the main surgical details of the esophagocoloplasty procedure, giving emphasis to the optimization of the blood supply to the interposed colon [8]. Regarding children with caustic injuries to the upper digestive system and upper airway involvement, clinical practice indicates that some cases are refractory to endoscopic dilatations despite the large amount of sessions. In these cases, an esophageal replacement procedure is necessary. If the low cervical esophagus and/or the thoracic portion of the esophagus are involved, the classical technique of esophageal substitution is effective and achieves excellent results [9]. In more severe cases, multiple strictures may involve the hypopharynx and/or the upper segment of the cervical esophagus with associated upper airway involvement [10]. Such cases are treated with surgical procedures for the airway or even a

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tracheotomy, and pharyngocoloplasty is the indicated procedure for the resolution of esophageal obstructions.

Limited information is available in the literature about the technical details and postoperative course of this surgery. Therefore, the aim of the present study is to describe the peculiarities of the technique of pharyngocoloplasty with total esophageal substitution in the treatment of children with severe caustic strictures. The results were compared to those of another group of children who underwent classical esophagocoloplasty with partial esophageal substitution. Our ultimate objective was to verify if the surgery for complete substitution of the esophagus had different results and complications in comparison with the partial esophageal substitution.

1. Methods

From February 1982 to December 2015, 258 children underwent colon interposition for esophageal replacement. We retrospectively reviewed the records of these patients for data regarding demographics, initial esophageal diseases, and intraoperative and postoperative complications. The last author of this manuscript (UT) performed or oversaw all the operations.

Among the patients, 64 (24.8%) had caustic esophageal strictures with preservation of the cervical esophagus, although the majority of patients (191%–74.2%) had long gap esophageal atresia with or without distal tracheoesophageal fistula; in these patients, esophageal primary anastomosis was not possible or was attempted but failed. All these patients underwent a cervical esophagostomy and were fed via gastrostomy until the time of the surgery. We preferred to postpone the surgery until the child could assume an upright position. Children with caustic or peptic strictures underwent esophageal replacement if endoscopic dilatations failed.

The patients were divided into two groups. The first group included all the patients with a diagnosis of esophageal complex caustic strictures involving the upper segment of the esophagus and hypopharynx in whom a complete substitution of the esophagus was indicated after a long period of previously failed sessions of esophageal endoscopic dilatation. These patients were compared with another group who needed partial esophagocoloplasty and had an intact hypopharynx and the upper segment of cervical esophagus. The study protocol was approved by the ethics committee of our institution.

All these children were fed exclusively via gastrostomy before the definitive operation. The patients' age range was 11 months to 18 years (mean: 41.5 ± 39.0 months).

The following information was collected for all patients: gender, age at surgery, association with upper airway involvement, and the need for tracheostomy or Montgomery tube insertion.

The duration of surgery, early and late complications, necessity of mechanical ventilatory support, time to oral feeding, length of postoperative stay, and the results and length of follow-up were also analyzed.

1.1. Surgical technique

Until 2008, all patients underwent 48-h bowel cleansing and were placed on preoperative antibiotics (ampicillin, amikacin and metronidazole). After this period, no colon preparation was performed prior to surgery, and the antibiotic administration was initiated in the operating room according to a previous publication from our group [11]. After anesthesia, the entire abdomen, chest, and neck were prepared and draped.

In pharyngocoloplasty patients, the surgery began with the cervical approach. A thick oropharyngeal tube was initially placed for guidance and to localize the position at which the pharyngeal lumen was wide. A wide left cervicotomy was created from the manubrium to the mastoid, and the sternocleidomastoid muscle was retracted laterally in addition to the carotid artery and the internal jugular vein. The dissection was continued toward the pharynx above the stricture to achieve complete exposure of the pharynx just anterior to the cervical column. An important surgical detail is that the facial vein and artery were ligated and sectioned for better access to the pharynx in all cases. Subsequently, the distal extremity of the previously located oral tube could be palpated, and a series of coronal stitches were placed around the lumen. The posterior aspect of the pharynx was longitudinally opened toward the direction of the oral tube. The distal limit of this incision was the obstructed high esophageal or pharyngeal lumen, and the stricture was sufficiently high that the orotracheal tube could always be visualized in all cases. The cervical dissection was completed by sectioning the anterior cervical strap muscles (i.e., the sternohyoid, omohyoid and sternothyroid muscles) to avoid angulations of the ascending colon at the cervical level.

After completing the cervical dissections, the abdominal cavity was accessed via supraumbilical median laparotomy. For the pharyngocoloplasty procedure, the transverse and substantial parts of the right colon were the segments selected for interposition and were maintained by a double vascular pedicle based on the left colic vessels and the marginal paracolic arcade via the sigmoid. This double vascular pedicle was sufficiently long for adequate mobilization of the colonic segment up to the neck. The middle and right colonic vessels were ligated and sectioned close to the superior mesenteric vessels while maintaining all the branches that communicated with the left colic vessels. This surgical detail is very important to maintain the irrigation of the most proximal portion of the colon that will be left for the pharynx. Finally, we note that this portion is close to the cecum. In cases of partial esophagocoloplasty, the right colic vessels rarely need to be ligated.

At the distal end of the graft (descending colon), the small end vessels were divided just adjacent to the colon with an extension of 2.0 to 3.0 cm and without division of the distal marginal arcade in the mesentery. This process resulted in a small ischemic segment of the descending colon that was then resected. This maneuver allowed for greater mobilization of the colon graft. The final outcome of these maneuvers was the isolation of a long colonic segment maintained by a double vascular pedicle that was sufficiently long for the adequate mobilization of the colonic graft up to the neck (Fig. 1).

The remaining colon was reconstructed via end-to-end anastomosis. The isolated colon segment was then mobilized behind the stomach through the gastrohepatic ligament and placed retrosternally in most patients. The posterior mediastinum in the esophageal bed was chosen only in children in whom a concomitant esophagectomy was performed.

The long colon segment was passed through the thoracic pathway, which was obtained via a combined blunt finger dissection through the abdominal and cervical incisions without the need for a thoracotomy. The colon was always interposed as an isoperistaltic segment.

The pharyngocolic anastomosis was performed in the neck with interrupted sutures in a single layer using the previous coronal stitches that were passed (Fig. 2). The cologastric anastomosis was made at the lowest level of the anterior wall of the antrum close to the lesser curvature rather than at a higher position near the fundus as has been traditionally described. Pyloroplasty was performed only in patients with a concomitant esophagectomy. No drains were placed at the incisions.

In cases of the esophagocoloplasty procedure, the cervical esophagus was dissected around the esophagostomy medially to the sternocleidomastoid muscle, the carotid artery and the internal jugular vein. After dividing the anterior cervical strap muscles, the esophagocolic anastomosis was performed in the neck with one or two layers of sutures.

In the first three cases of the pharyngocoloplasty patient series, prior to transposing the colon to the neck, a concomitant transhiatal esophagectomy that worked from the neck and the abdomen was performed.

In all patients, the abdominal wall was closed with one layer of separate polyglactin sutures, including 1 cm of the aponeurosis and the parietal peritoneum. This important detail prevents abdominal evisceration. The gastrostomy was maintained during the postoperative period to

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