

PASSIVE LENGTHENING OF THE ESOPHAGEAL POUCHES IN LONG-GAP ESOPHAGEAL ATRESIA: A TECHNICAL INNOVATION

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There are many surgical procedures for the treatment of long-gap esophageal atresia, which are associated with different complications. In the passive lengthening of the esophageal pouch technique, one metallic or radio-opaque rubber ring is fixed to the blind end of each pouch, then a non-absorbable thread is fixed to the ring of the lower pouch, passed through the ring of the upper pouch, and finally fixed to the tip of a calibrated nasogastric tube (NGT) in the lower pouch. The NGT is anchored on the abdominal wall by a safety pin, and by gradual pulling of the NGT, lengthening of both pouches occurs. Determination of the degree of lengthening is easy and helps decide the time for the definitive repair. Saliva accumulation in the upper pouch can be managed at home by continuous Reblogle tube suction by keeping the patient in a prone head-down position, or by a combination of continuous Reblogle tube suction and oral suction dummy.

Method

Under general endotracheal anesthesia, with the patient in the left lateral position, right lateral extrapleural thoracotomy through the fourth intercostal space is performed. The azygos vein and posterior mediastinum should be exposed, so that both esophageal pouches and fistula are seen. The azygos vein is ligated and divided. The upper pouch is identified and dissected as much as possible to gain maximum length. The lower pouch is identified, and if a fistula is present, it has to be divided. Meticulous dissection of the lower pouch has to be done to gain the maximum length. Metallic or radiopaque rubber ring (stainless steel or titanium) is fixed, one to the end of each pouch with non-absorbable stitch. The ring is about 3 mm in diameter (Figures 1 and 2).

Gastrostomy is to be done, one for feeding gastrostomy tube and one for calibrating the NGT, which is passed up the lower pouch up to its opened end, in the presence of a fistula or up to its blind end, where there is no

fistula. In this case, it has to be opened to allow the NGT to come through its tip. The two pouches are anchored together by non-absorbable stitch with good tension. Using non-absorbable thread which is fixed to the ring attached to the lower pouch, it is passed through the ring fixed to the upper pouch and finally fixed to the tip of the NGT by the shortest length, which keeps the NGT pushing against the tip of the lower pouch. This will now be closed with a purse-string suture using non-absorbable thread. The gap between the ends of the two pouches can easily be measured intraoperatively.

The calibrated NGT is anchored on the abdominal wall with a safety pin and the point of exit, for example, at the 10 cm mark on the NGT. The thoracotomy incision is then closed in layers without intercostal tube drainage.

Passive stretching has to be done soon after surgery to avoid fibrous tissue formation around the pouches by pulling on the NGT, which will pull the lower pouch up and the upper pouch down, decreasing the gap. This maneuver has to be done twice weekly. After each setting, the NGT is anchored on the abdominal wall with good tension using a safety pin. The position of the safety pin will keep changing with repeated stretching, and finally the second exit point will be at about 8 cm on the NGT. So, the degree of lengthening will be the difference between 10 cm and 8 cm. Subtracting this difference from the previously known gap length will give the remaining gap between the two pouches. Depending on the length of the remaining gap, the time for the second definitive surgery will be decided. The patient can go home after the first thoracotomy. Home care includes continuous suction of the upper pouch, keeping the patient in a prone head down position without suction or intermittent aspiration of the upper pouch. Gastrostomy feeding can start on the fourth postoperative day. By this technique, the gap is determined without any x-ray exposure as with previous techniques, but it can also be determined by routine chest x-ray by measuring the distance between the fixed ends of the metallic or radio-opaque rubber rings.

Discussion

Long-gap esophageal atresia lacks a precise definition, but is generally defined as a gap greater than 2 cm or greater than two vertebral bodies.¹ Management of long-gap

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FIGURE 1. (A) Stay stitch between both esophageal pouches with good tension; (B&C) metallic or radio -opaque rubber rings fixed to both pouches; (H) stitch fixed to ring C, passing through ring B and fixed to the tip of NGT at D; (E) NGT; (F) purse string stitch; (G) gastrostomy tube; (I) safety pin.

FIGURE 2. (A) Stay stitch between both esophageal pouches with good tension; (B&C) metallic or radio -opaque rubber rings fixed to both pouches; (H) stitch fixed to ring C, passing through ring B and fixed to the tip of NGT at D; (E) NGT; (F) purse string stitch.

esophageal atresia in neonates is still a challenging problem and a topic of controversy among pediatric surgeons.²⁻⁶ The best esophagus is the patient's own and, therefore, every effort should be made towards esophageal preservation by delayed primary anastomosis.^{1,4,5,7,8}

It is generally agreed that the native esophagus is the best conduit for food and saliva, and numerous approaches have been described for the management of neonates with long-gap esophageal atresia. Replacement procedures using part of the gastrointestinal tract (GIT), such as the colon, small bowel or stomach, are associated with disadvantages, such as malignant degeneration, sacrifice of the distal esophagus and cardia, and absence of peristaltic swallowing function.^{2,6,8,9} Bouginage is associated with repeated aspiration and stricture of the final anastomosis and it requires anesthesia and fluoroscopic control.^{2,10} Proximal myotomies offer limited lengthening and are associated with diverticulum formation and peristaltic disturbances.²

Procedures for lengthening the lower esophageal pouch by division of the left gastric artery are associated with changes in the anatomy of the stomach, such as esophageal hiatus, and may necessitate additional procedures which may not be needed, for example, pyloroplasty and fundoplication, and complications associated with laparotomy, such as adhesive intestinal obstruction.^{2,6}

Spontaneous growth and hypertrophy of esophageal pouches occur in the absence of any mechanical stretching and reach their maximum by the end of the first eight weeks of life, therefore, delayed primary anastomosis occurs usually after eight weeks of life.^{2,7} However, the spontaneous growth sometimes of esophageal pouches is not enough to shorten the defect for primary repair,⁴ therefore, a variety of adjuvant methods have been described to promote interim esophageal growth.^{6,9}

This new technique is easy to perform, easy to manage at home while waiting for repair, and also easy to follow up during the waiting period. As well, it is easy to access the gap between the two pouches without the need for x-ray exposure, and thereby avoid the complications associated with other procedures.

When waiting for delayed primary repair, it is important to avoid aspiration of saliva accumulating in the upper pouch. The combination of upper pouch Reblogle tube decompression and suction dummy maintains a complication-free period and also allows the introduction of sham feeding, thereby maintaining swallowing reflexes.¹¹

Preoperative home care for patients with long-gap esophageal atresia has been safely used by some pediatric surgeons. It includes in the majority of cases, continuous upper pouch suction. Some patients have been treated in the prone Trendelenburg position without suction and others with only intermittent aspiration of the upper pouch.¹

Aspiration episodes can occur while patients are hospitalized awaiting delayed repair.¹ Lastly, each patient with esophageal atresia requires to be individualized, and there is absolutely no place for a completely rigid policy.¹²

In conclusion, this technique is easy to perform and follow up, and at the same time, it preserves the native esophagus, which is the aim of all the previous techniques.

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