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Reverse gastric tube oesophageal substitution for staged repair of oesophageal atresia and tracheo-oesophageal fistula

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ABSTRACT

The management of oesophageal atresia and tracheo-oesophageal atresia (OATOF) is very challenging. While in developed countries survival of patients with this condition has improved, the outcome in many developing countries has been poor. Primary repair through a thoracotomy (or video-assisted thoracoscopic surgery where available) is the gold standard treatment of OATOF. However, in our setting where patients typically present late and with minimum support resources such as Neonatal Intensive Care Unit and total parenteral nutrition; staged repair may be the only hope of survival of these patients and this communication highlights the essential steps of this mode of treatment.

Key words: Oesophageal atresia, oesophageal substitution, reverse gastric tube, tracheosophageal fistula

INTRODUCTION

The management of oesophageal atresia and tracheo-oesophageal atresia (OATOF) is very challenging. While in developed countries survival of patients with this condition has improved over the last five decades, the outcome in many developing countries including Nigeria has been poor.[1-4] Although prenatal diagnosis rapidly identifies these congenital anomalies early in developed countries, such services are primordial in many developing countries.[5] In addition, many of our patients present late with pneumonic complications. This is coupled with the challenges of lack of well-equipped Neonatal Intensive Care Unit (NICU) and total parenteral nutrition (TPN). These factors have been identified in previous studies from Nigeria as responsible for poor survival of neonatal surgical emergencies.[6,7]

The standard surgical treatment of OATOF is primary repair via a thoracotomy.[1,2] This can also be achieved using video-assisted thoracoscopic surgery (VATS) techniques.[1,2] However, in our setting with the aforementioned challenges, outcome using this approach is very poor.[4] As a result, the protocol in our unit is that when patients present to us unfed within 72 h of life without any chest signs — a primary thoracotomy is performed. For patients presenting after 72 h of life and those with florid chest signs, a staged repair is employed — an initial gastrostomy, lower oesophageal banding and cervical oesophagostomy followed within 6 months to a year of oesophageal substitution. In our centre, our preference has been for the reverse gastric tube oesophageal substitution technique. Despite some of the drawbacks of this technique, it is simple, effective, and physiological with good drainage. In addition, the learning curve is a gentle slope and skill transfer using the technique is attainable within a short time. This approach has also been found to be useful in some cases of patients we have managed with severe associated anomalies such as biliary atresia and complex anorectal malformations.

This communication is aimed at describing the essential steps in this technique with special emphasis on tips on how to avoid potential pitfalls in the technique.

FEEDING GASTROSTOMY, LOWER OESOPHAGEAL BANDING AND CERVICAL OESOPHAGOSTOMY

This is often done as an emergency and access to the abdomen is gained through a supra-umbilical midline incision. As a rule in the unit, the gloved

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hands are washed using sterile isotonic saline solution before any intra peritoneal exploration to reduce the risk of adhesions. After a brief exploration of the abdomen, the anterior and posterior vagal trunks are identified after a gentle pull is made on the stomach. With the help of O'Shaughnessy forceps, the vagal trunks are carefully separated from the lower oesophagus and a mersilene tape is wrapped around the abdominal oesophagus taking care to ensure the gastric fundus is not caught in the knot [Figure 1]. In our experience, this part of the surgery can be tricky as slippage of the knot has occurred with resultant gastric reflux into the lungs with attendant morbidity. Since unravelling is a frequent complication, we oversew the tape in place without catching the oesophagus.

We routinely place the gastrostomy on the right side of the abdomen on the anterior part of the abdomen leaving at least 3 cm from the greater curvature and the area of arborisation of the gastroepiploic artery. This is to ensure this strip of the stomach is free for the reverse gastric tube without the need to take-down and refashion the gastrostomy while creating the gastric tube [Figures 2a and b]. We also routinely anchor the anterior wall of the stomach to the anterior abdominal wall to prevent leakage around the gastrostomy tube during feeding.

The last step is to perform a cervical oesophagostomy. An essential step in this part of the procedure is to identify the oesophagus and ensure that the distal end of the pouch is what is brought out as a stoma i.e., to avoid making a side anastomosis. This is important for two reasons: first to avoid a residual pouch where saliva could be stored and second make the cervical anastomosis with the reverse gastric tube easier as an end to end anastomosis [Figures 3a and b].

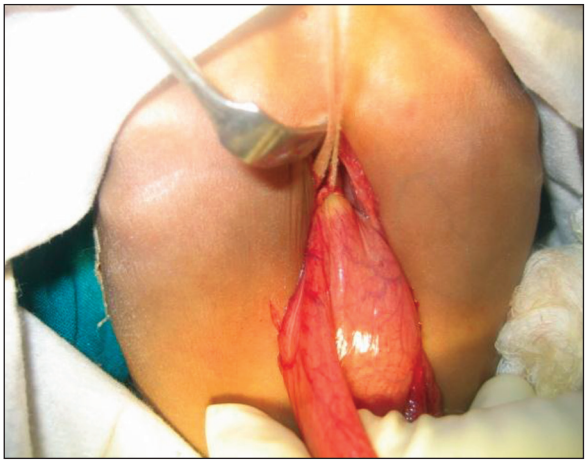

Figure 1: Lower oesophagus being wrapped with a mersilene tape just before the lower oesophageal banding

Figure 2a: Intra-operative photograph showing a previously sited right gastrostomy feeding tube. The old scar has been excised prior to oesophageal replacement procedure about to commence in the patient

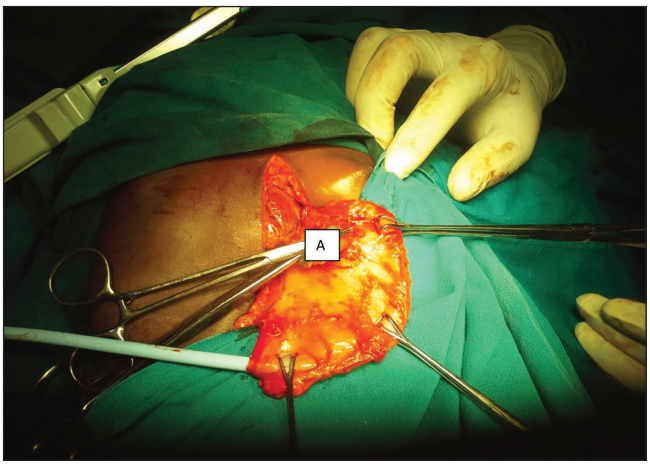

Figure 2b: Right-sided gastrostomy tube held with forceps (A) leaving the greater curvature of the stomach free for tubularisation held with Babcock tissue forceps

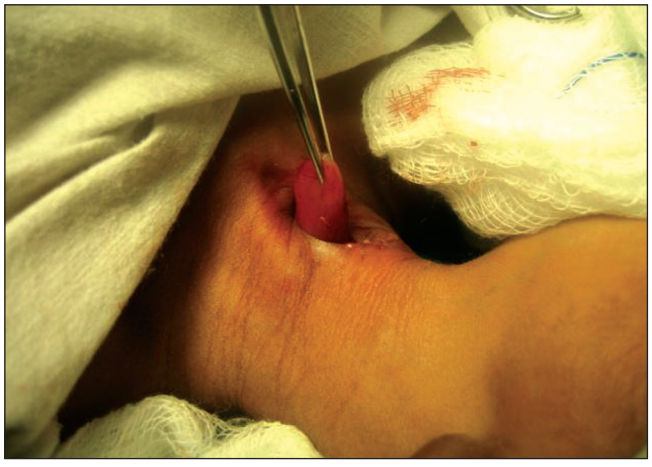

Figure 3a: Upper oesophageal pouch being held at the lower fundus before cutaneous anastomosis

REVERSE GASTRIC TUBE OESOPHAGEAL SUBSTITUTION PROCEDURE

The timing of the oesophageal substitution varies depending on how well the patient's nutritional rehabilitation programme progresses but we recommend a weight of at least 10 kg, often achieved within 6-10 months. Prior to surgery, it is important to ensure necessary surgical consumables are available. Size 16-18 F thoracostomy tube is the authors' preference for tubularisation of the gastric tube. Another important consumable is the gastrointestinal stapler. In the earlier days, the gastric tube was hand sewn using sutures but with the availability of staplers, this technique has been abandoned. Finally, a mersilene tape should be available for the rail-roading of the gastric tube in retrosternal space.

The surgery begins with the excision of the old midline scar up to the sternum and variable length distally. Depending on the amount of exploration necessary to adequately expose the stomach, the incision could skirt the umbilicus and extend distal to it. It is not unusual to encounter adhesion, and these should be separated carefully to be able to fully expose the stomach. No efforts should be spared in protecting the left gastroepiploic vessels which will nourish the whole pedicle. The whole length of the greater curvature should be freed and exposed. Great care must be taken not to injure the short gastric vessels and vascular pedicle of the splenic hilum while separating the fundus from adjacent structures.

An avascular plane around the area of the prepyloric vein of Mayo is incised in between clamps from the greater curvature about 2 cm deep, and the pyloric end is closed with sutures [Figure 4a]. With the thoracostomy tube introduced and held in place with serial Babcock's tissue forceps [Figure 2b], a GIA stapler is introduced to divide the stomach, leaving adequate space to form a gastric tube around the thoracostomy tube [Figure 4b]. The points of division are oversewn with sutures to prevent leakage [Figure 4c]. It is essential that the length

Figure 3b: Intraoperative photograph following completion of cervical oesophagostomy

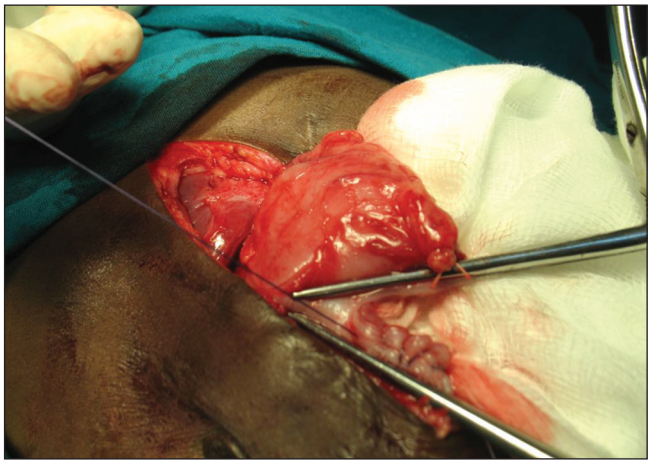

Figure 4a: Partial (about 2 cm deep) division of the pylorus in between clamps at an avascular plane around the prepyloric vein of Mayo

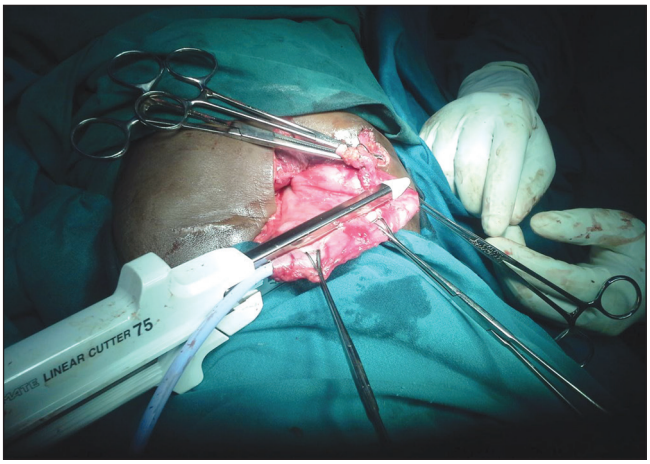

Figure 4b: Use of staplers to tabularise the greater curvature of the stomach into a gastric tube

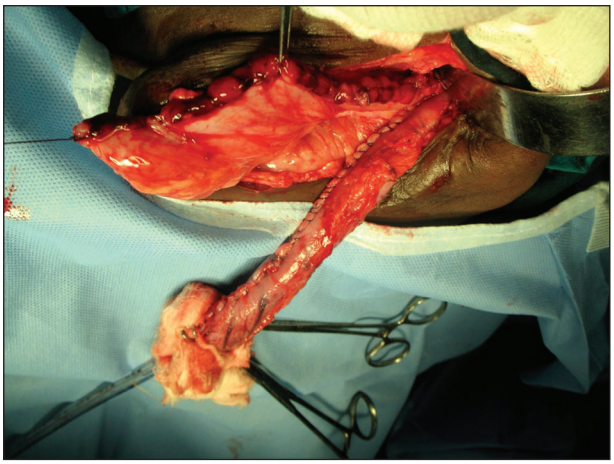

Figure 4c: Completion of gastric tubularisation using staplers

of the tube is long enough to traverse the thorax when pulled up into the thorax. It is equally important that the space left for drainage of the tube is adequate enough, and the pedicle must be kept moist and warm.

The next stage of the operation is to create a retrosternal channel for the gastric tube; this is achieved by teasing off the flimsy tissues just posterior to the perichondrium of the xiphisternum [Figure 5a]. This dissection is commenced using artery forceps and continued with the use of the forefinger. The *pulp of the finger* does all the dissection in apparent contact with the sternum, and the pumping action of the heart is felt by the back of the forefinger. The dissection can go as far as two-thirds the way up to the sternal notch. At this point, an incision is made a fingerbreadth above the sternal notch, and a similar dissection is done retrosternally using the left forefinger. The tunnelling is done until both forefingers meet. A long mersilene tape is introduced into the tunnel, and the distal end of the tape is sutured to the opening of the gastric tube and pulled up into the retrosternal space [Figure 5b]. Care must be taken to ensure that the tube is not twisted in the process, and it is equally important that there is adequate length in the neck to avoid anastomosis under tension.

The cervical oesophagostomy is "taken-down" by detaching the stoma, and an end-to-end anastomosis is done with the pulled up reverse gastric tube. Occasionally, the authors choose not to proceed with the cervical anastomosis at the same sitting with the pull up procedure, and the opening of the reverse gastric tube is brought out as a stoma in the neck [Figure 6]. This is to shorten the overall operative time, allow the reverse gastric tube to be in place for some time before commencing "deglutition" functions and more importantly to avoid turbulent post-operative period from possible anastomotic leakage. When this approach is adopted, the anastomosis is often performed between 2 and 3 weeks. The anastomosis is done as a single-layered anastomosis with careful attention to prevent any form of tension as this predisposes to its breakdown.

POST-OPERATIVE CARE

The immediate postoperative care is often routine with close monitoring of vital signs and fluid regimen. The gastrostomy feeding can be commenced as soon as bowel activity returns. This should be combined with sham feeding if delayed cervical anastomosis is the adopted approach. If primary cervical anastomosis was performed, a post-operative Barium swallow is ensured at 7-10 days, and if no leakage, oral feeding is commenced.

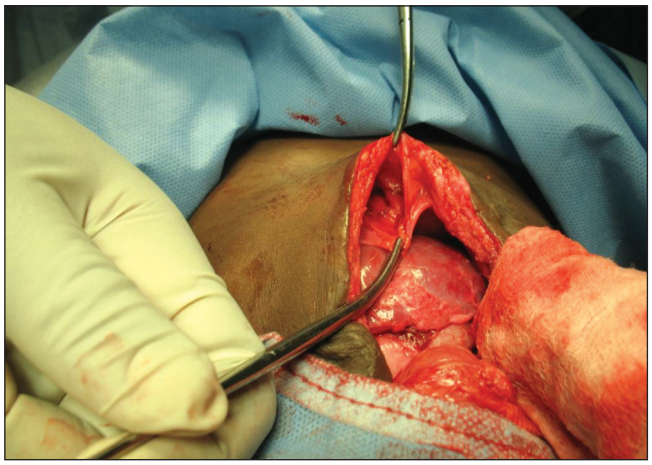

Figure 5a: Commencement of retrosternal space dissection. Dissection plane must begin from just beneath the perichondrium of the xiphisternum

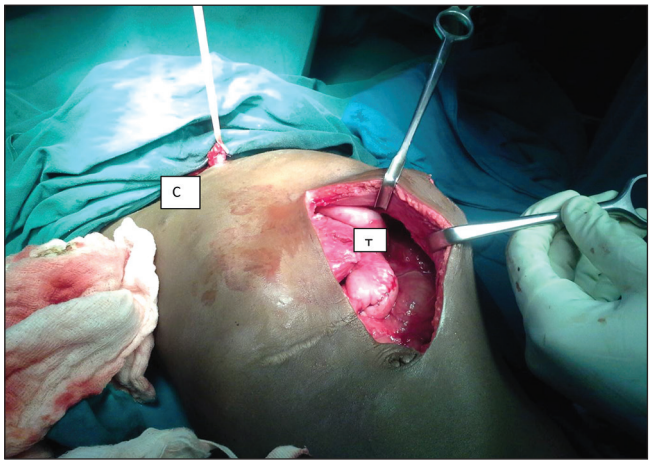

Figure 5b: The gastric tube (T) (now reversed) through the retrosternal space and emerging in the neck attached to a mersilene tape (C)

Figure 6: Cervical oesophagostomies in the neck prior to anastomosis

Another Barium swallow is undertaken within 3-6 months of the surgery to rule out a stricture. If any

is found, prophylactic dilation is instituted. At the moment, plastic oesophageal bougies are used but where available, balloon dilatation using oesophagoscopy is superior and should be performed.

CONCLUSION

Primary repair through a thoracotomy (or VATS where available) is the gold standard treatment of OATOF. However, in our setting where patients typically present late and with minimum support resources such as NICU and TPN, staged repair may be the only hope of survival of these patients, and this communication has highlighted the essential steps of this mode of treatment. While the first stage is relatively easy to perform, capacity still needs to be built in oesophageal substitution surgery.

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