Management of giant acquired tracheo-oesophageal fistula in a neonate using an oesophageal patch

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Abstract

A neonate who underwent arterial switch operation had his postoperative course complicated by the development of tracheo-oesophageal fistula. He underwent multiple reparative procedures, ultimately requiring the oesophagus as a patch to close the large defect in the trachea and subsequent interposition of descending colon to restore the continuity of the upper gastrointestinal tract.

Keywords: Trachea; Esophagus; Fistula

1. Introduction

Benign acquired tracheo-oesophageal fistula usually results from the erosion of the adjacent walls of the trachea and oesophagus. Ischaemia due to hyperinflated endotracheal or a tracheostomy tube used for mechanical ventilation is the commonest aetiology of these fistulae [1]. It usually results in the perpetuation of respiratory insufficiency and sepsis. It is heralded by a marked increase in tracheal secretions with characteristics of gastrointestinal contents. Operative closure is necessary because spontaneous closure is rare.

2. Case report

A 7-day-old neonate with transposition of the great arteries and persistence of desaturation, despite atrial septostomy, underwent an arterial switch procedure at the local children’s hospital. The patient was weaned off bypass on minimal inotropic support. He was extubated on the third postoperative day, but 5 days later was re-intubated following an episode of aspiration and respiratory insufficiency. After a few days tracheostomy was performed to assist in ventilatory weaning. A week later feeding-tube aspirate was found in the secretions from the airways. The patient developed pyrexia and raised inflammatory markers with evidence of widespread pulmonary collapse and consolidation on chest X-ray. Fibreoptic endoscopy revealed a fistulous communication between the oesophagus and posterior tracheal wall just distal to the tracheostomy site. A contrast swallow confirmed a fistulous connection between the oesophagus and trachea. The patient underwent right posterolateral thoracotomy, and diffuse pleural adhesions with infective debris in the mediastinum were found. The tracheo-oesophageal fistula was small, slit-like and involved the distal two-thirds of the trachea, and adjacent oesophagus was identified. It was possible to close the tracheal defect with interrupted 4-0 Vicryl sutures and the oesophageal defect was closed in two layers using interrupted 4-0 Vicryl sutures. A strip of pedicled intercostal muscle was interposed between the oesophagus and trachea to prevent the recurrence of fistula. The mediastinum was cleared of all debris and drained.

On the third day the child developed a major air leak through the intercostal drain with pneumothorax on the right side, suggestive of dehiscence of the repair. Re-exploration revealed that tracheal sutures had cut through the inflamed tissues resulting in a wide defect along the length of the trachea and extending into the right bronchus. The oesophageal repair was intact. The tracheal defect was closed using bovine pericardium held in place with interrupted 4-0 Vicryl suture.

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The patient continued to have persistent chest infection and increasing ventilatory dependence. On the fourth day following the second operation, gastric contents were aspirated from the tracheostomy tube. Contrast study confirmed the presence of a large tracheo-oesophageal connection at the level of the carina (Fig. 1). A retrograde oesophagogastric drainage tube and jejunal feeding tube were inserted with a view to divert the oesophageal contents from the fistulous site. After stabilization, the child underwent reoperation; a large defect was noted in the oesophagus and the pericardial patch applied to the trachea was leaking a large amount of air along most of the length of the suture line. The margins of the trachea and oesophagus were too friable and inflamed to hold the sutures. In view of the persistent infection, the large defect in the trachea and oesophagus, and friability of the tissues it was decided to use the residual healthy, vascular posterior wall of the oesophagus as a patch to close the defect in the tracheobronchial tree. The oesophagus was transected proximal and distal to the fistulous site. It was split open along its length and was sutured to the defect in the trachea using interrupted 4-0 Vicryl sutures, taking care to take the sutures away from the tracheal edges, where the tissue was relatively healthy. A cervical oesophagostomy was performed and the distal oesophageal opening was closed.

The child was started on jejunostomy feeding, had intensive physiotherapy and was gradually weaned from the ventilator. He recovered and began to thrive.

At 6 months the child had definitive surgery to restore the continuity of the oesophagus. An isoperistaltic segment of transverse colon was used routing it through the left thoracic cavity. The anastomosis consisted of proximal oesophago-colonic anastomosis in the neck and distal gastrocolonic anastomosis in the abdomen. The contrast study 10 days later confirmed the functioning colonic segment without any leak (Fig. 2). The child did well after the procedure, is on regular follow-up and is a healthy 11-year-old.

3. Discussion

The most frequent cause of tracheo-oesophageal fistula is a hyperinflated endotracheal or tracheostomy cuff.
compressing the membranous trachea against the nasogastric tube, resulting in full thickness wall necrosis and pathological communication [2]. Operative closure of tracheo-oesophageal fistula is essential because spontaneous closure is very rare [3]. The various surgical options available include direct closure of the oesophageal and tracheal defect with or without interposition of pedicled muscle flaps [4], segmental tracheal resection with anastomosis and oesophageal closure with diversion [5], use of skin graft [6] and isolated reports of making use of an oesophageal patch [7,8]. The described case is unique as it involved a neonate, who after major corrective cardiac surgery developed a tracheo-oesophageal fistula, probably as a result of tracheostomy or endotracheal and feeding tubes, requiring multiple reparative procedures. After failure of primary repair, re-exploration led to closure of the defect with bovine pericardium. There was further recurrence of tracheo-oesophageal fistula resulting in large defects with inflamed tracheal and oesophageal walls. As a last resort the posterior oesophageal wall was used as a patch sutured circumferentially around the trachea and right bronchus with oesophageal diversion. Oesophageal continuity was later restored using colon. The advantages of the oesophageal patch is that it is autologous tissue with rich blood supply, can withstand elevated inspiratory pressures, can create a solid posterior tracheal wall and it has been demonstrated to be a suitable material for the tracheal lumen [6,8].

In conclusion, although the use of a high-volume low-pressure cuff has reduced the incidence of tracheo-oesophageal fistula to 0.5%, long term intubation with overinflated cuffs and nasogastric tube in situ still results in the majority of acquired cases. The presence of very large defects, local infection and ventilator dependence precludes the primary repair. In a desperate situation such as the one described, the residual oesophageal wall can act as good substitute for patching the tracheal defect.

References