Pediatr Surg Int (1994) 9: 21–23

ORIGINAL ARTICLE

Delayed primary anastomosis for wide-defect esophageal atresia: a 17-year experience

M. N. de la Hunt, M. S. Fleet, and J. Wagget

Department of Paediatric Surgery, Royal Victoria Infirmary, Newcastle Upon Tyne, NEL 4LP, UK

Accepted 25 January 1993

Abstract. Fifteen infants with wide-defect esophageal atresia treated by delayed primary anastomosis since 1975 were reviewed. Nine had an associated tracheoesophageal fistula: 6 lower-pouch and 3 upper-pouch. All underwent initial gastrostomy and division of a lower-pouch fistula when present. Anastomosis was achieved in all cases at 18–252 days, but with circular myotomy in 4 and upper-pouch elongation in 4. Two had anastomotic leaks and 2 had chylothorax, which all healed with conservative management. Fourteen have needed esophageal dilatation and 2 have had anastomotic strictures resected. One developed an upper-pouch diverticulum, which has been resected. Five had symptomatic gastroesophageal reflux, 2 of whom have had fundoplication. One died from associated severe cyanotic congenital heart disease at the age of 12 months. The 14 survivors are well and making good progress. Delayed primary anastomosis remains our preferred approach for all infants with wide-defect esophageal atresia.

Key words: Esophageal atresia – Delayed primary anastomosis – Esophageal stricture

Introduction

We have been treating infants with wide-defect esophageal atresia (EA) by delayed primary anastomosis since 1975. For the majority of infants, a primary anastomosis can be achieved in the neonatal period. The surgical management of those with EA without lower-pouch fistulae and some of those with fistulae who have too long a gap for safe anastomosis is considerably more difficult. The traditional approach of primary cervical esophagostomy and gastrostomy followed by later esophageal replacement [16] has a high morbidity and mortality [4, 10, 15].

Reports of esophageal pouch elongation by bouginage appeared in the 1960s [6]. Puri et al. have since suggested that spontaneous growth occurs, narrowing the gap in the first weeks of life even without bouginage [11]. This has led to the concept of delayed primary anastomosis. We have reviewed our experience of the last 17 years to assess the efficacy, practicability, and safety of this approach.

Materials and methods

The records of all patients with wide-defect EA admitted to this hospital between January 1975 and May 1991 were reviewed. Of 171 patients with EA treated during this period, 19 had a wide defect and 15 had delayed primary anastomosis. In the early part of this study period, 4 other patients had a primary esophagostomy followed by esophageal replacement and have been excluded from further analysis.

The diagnosis of a wide defect was assumed if there was no lower-pouch tracheoesophageal fistula (TEF), indicated by absence of gas in the gastrointestinal tract on chest and abdominal radiographs. These infants had a gastrostomy as their primary procedure. For those with lower-pouch TEF the diagnosis was made at thoracotomy if it was considered that safe primary anastomosis could not be achieved, even with tension-relieving techniques [5, 8], after the fistula had been divided. The lower pouch was then repaired and sutured to the lateral chest wall and a gastrostomy fashioned. The upper pouch was usually repaired if it had been opened, but was exteriorized in 1 patient.

Gastrostomy feeds were introduced and all infants maintained on continuous upper-pouch suction using a Replogle sump drainage tube [13] with continuous saline irrigation of the outer channel to prevent blockage. The length of the gap was monitored radiographically by placing contrast into the stomach via the gastrostomy and filling the lower esophagus by reflux. Bouginage was not used routinely. Esophageal anastomosis was carried out when the gap was considered to have decreased significantly or after about 3 months. Circular myotomy [8, 14] or pouch elongation [5] was used when appropriate. If the anastomosis was still under tension, patients were ventilated electively and paralyzed postoperatively for 7 days. Postoperative contrast studies were not performed routinely. Oral feeds were offered from the 7th postoperative day depending on clinical progress.

Correspondence to: M. N. de la Hunt

Table 1. Patient details

Case no.	Sex	Gestation (weeks)	Birth weight (kg)	Tracheo-esophageal fistula (TEF)	Gap[a]	Associated abnormalities
Atresia without lower pouch TEF						
1	M	40	2.46		3	
2	F	38	2.34	upper	4	
3	M	39	2.55		3	skeletal
4	M	34	1.85		3	
5	M	31	1.35		5	
6	M	36	2.86		5	spasticity
7	M	39	2.78		4	cardiac
8	M	36	1.86	upper	8	anorectal, urethral
9	M	38	2.73	upper	5	trisomy 21
Atresia with lower pouch TEF						
10	M	36	1.95	lower	3	
11	M	38	2.57	lower	3	anorectal
12	M	40	3.23	lower	3	
13	F	34	1.82	lower	4	ptosis
14	M	35	2.09	lower	3	renal, thumb, eye
15	F	33	1.92	lower	3	

[a] Measured in vertebral bodies

Table 2. Operative details

Case no.	Age at anastomosis (days)	Other procedures	Complications	First feed (day)	Hospital stay (days)
Atresia without lower TEF					
1	71	myotomy		79	119
2	18	anterior flap		25	104
3	57	myotomy		64	85
4	89	myotomy		97	136
5	84	anterior flap		91	110
6	71			78	83
7	98	anterior flap	stricture (resected) died	152	335
8	112			27	144
9	87	anterior flap	chylothorax stricture	145	164
Atresia with TEF					
10	91		anastomotic leak	123	120
11	152		anastomotic leak stricture (resected)	172	244
12	88	myotomy	missed lower TEF	96	102
13	110		missed upper TEF	118	140
14	124		pneumothorax		
			GE reflux	28	46
15	57		chylothorax	57	69

TEF = Tracheoesophageal fistrela
GE = Gastroesophageeal

Results

Fifteen infants had delayed primary anastomosis. Median birth weight was 2.34 kg (range 1.35–3.23) and gestation 36 weeks (range 31–40). Eight of the mothers were reported to have had polyhydramnios in the later stages of pregnancy; 8 infants had other congenital anomalies (Table 1). Patients have been followed from 18 months to 17 years (median 9 years).

Nine patients had EA without a lower-pouch fistula and underwent gastrostomy as a primary procedure in the first few days of life. In 5 of the patients with lower-pouch TEF the diagnosis was made at initial thoracotomy. The other patient had a very narrow fistula with no gas below the diaphragm on presentation and was initially treated as a pure atresia. The upper pouch was exteriorized in 1 case as a cervical esophagostomy. Two patients with imperforate anus underwent colostomy at the same time.

Weight gain in all patients was satisfactory once gastrostomy feeds were established. No problems were encountered with continuous upper-pouch suction. Contrast studies were performed to assess the length of the lower pouch, and by pressing the Replogle tube with its radio-opaque marker into the upper pouch, the gap was assessed. Upper-pouch contrast studies demonstrated a previously unsuspected fistula in 1 case. A measurable narrowing of the gap was seen in only 1 patient. Before the esophageal anastomosis 2 patients had other operative procedures: 1 a rectal pull-through and subsequent colostomy closure and 1 pulmonary artery banding. The latter was complicated by phrenic nerve palsy.

Thoracotomy was performed at 18–152 days (median 88 days) (Table 2). Despite no radiologically demonstrable decrease in the gap in all but 1 patient, the esophageal pouches subjectively seemed wider, thicker, and stronger than in the newborn period. Anastomosis was achieved in all cases, with upper-pouch myotomy in 3, both upper and lower pouch myotomies in 1, and anterior flap upper-pouch elongation in 4. Eight of the 9 patients without lower-pouch TEF needed such procedures, compared with only 1 with a lower TEF. The patient with phrenic nerve palsy following earlier cardiac surgery underwent plication of his paralyzed left hemidiaphragm at the same time.

Three infants had upper-pouch TEF. In 2 this was diagnosed on early contrast studies and repaired electively at the same time as the delayed primary anastomosis. In 1 the diagnosis was not made until the age of 7 months. All were repaired using a right-sided cervical approach.

Four patients were ventilated electively postoperatively because of tension on the anastomosis. There was no early postoperative mortality. One patient died 1 year later from severe congenital heart disease. Two had anastomotic leaks and 2 others had postoperative chylothorax, all of which healed with conservative treatment. One patient had symptomatic tracheomalacia that responded well to aortopexy.

The patients were discharged home 12 to 237 days following restoration of esophageal continuity. Thirteen have since required esophageal dilatation on one or more occasions (maximum 30). Two patients had anastomotic strictures that did not improve with regular dilatation, and had resection with esophageal reanastomosis at 7 months and 3 years, respectively. Five had symptomatic gastroesophageal reflux, 2 of whom have since had fundoplication. The patient whose upper pouch was initially exteriorized and subsequently mobilized to enable delayed primary anastomosis developed a diverticulum above the anastomosis. This was resected at the age of 5 years. The latter procedure was technically difficult and complicated by a prolonged anastomotic leak, which healed with nonoperative management after 3 months.

Fourteen patients have now been followed for 2–17 years and are making good progress on full oral feeding. The most recent patient also has Down's syndrome and is only 18 months old. He had an upper-pouch fistula and virtually no distal esophagus and was reconstructed using an upper-pouch anterior flap. He takes some feeds by mouth, but has a persistent stricture that requires regular dilatation.

Discussion

Before 1975, most of our patients with long-gap EA were managed by neonatal cervical esophagostomy and gastrostomy following division of the TEF. This allowed the child to receive sham feeds and prevented aspiration from the proximal pouch, but usually necessitated later substitution of the esophagus with bowel interposition [10, 16] or a reversed gastric tube [2, 4]. While these techniques are successful in many cases, they are associated with high operative morbidity including graft ischemia, anastomotic leakage, and strictures. Later problems are common and include dysmotility, acid reflux, peptic ulceration, recurrent respiratory infections, malabsorption, and failure to thrive [9, 15].

In 1965, when Howard and Myers [6] first reported a case of long-gap EA managed by elongation of the upper pouch with mercury-loaded bougies and delayed primary anastomosis, they stated it was their "firm conviction that the best esophagus possible is one which is constructed entirely from the elements originally developed for its formation." We managed to achieve this goal without recourse to bouginage [7], but do recognize that reflux of gastric contents into the lower pouch and pressure of the Replogle tube on the upper pouch may have similar mechanical effects. The esophagus seemed wider and stronger, as has been reported by other authors [12], and although we were only able to document narrowing of the gap in 1 patient, we did not attempt measurement of the gap during bouginage with both ends under tension.

The exact timing of anastomosis did not appear to be critical to the eventual outcome, although a period of 8–10 weeks after initial gastrostomy appeared to be satisfactory. We did not find routine contrast studies helpful in this respect, although we would recommend an upper-pouch study if there is any suspicion of an upper TEF.

The anastomotic technique was decided upon at the time of surgery and depended on the tension required to approximate the pouches. The cases without a lower TEF were clearly more difficult in that 8 of the 9 patients required tension-relieving techniques. Although only 1 of the 6 with a lower TEF required a myotomy, it was not considered, even in retrospect, that anastomosis at the initial surgery could have been achieved safely using similar techniques.

The disadvantage of delayed primary anastomosis is the prolonged hospitalization while the infant is on continuous upper-pouch suction. Although complications due to suction catheters have been reported [1, 17], we found continuous suction to be safe and effective. The use of slow, continuous saline irrigation through the outer channel of the tube helped reduce the incidence of blockage. Initial upper-pouch exteriorization would avoid the need for suction, but after the complications encountered in our patient in whom this approach was used, we would hesitate to recommend this as a routine approach.

The overall results in terms of survival, long-term development, and growth have been excellent despite the expected high incidence of other congenital abnormalities [3]. Late anastomotic problems were common, but most were managed by dilatation and only 2 patients required open revision and esophago-esophageal reanastomosis. Symptomatic gastroesophageal reflux occurred in only 5 cases, less than expected, particularly when there had been considerable lower-pouch mobilization. It has not been our policy to pursue reflux aggressively, and as routine postoperative or later contrast studies were not done, more patients may have had asymptomatic reflux.

On the basis of our results, delayed primary anastomosis remains our treatment of choice for wide-defect EA.

References

1. Bar-Maor JA, Simon K (1981) Another complication of continuous upper pouch suction in esophageal atresia. J Pediatr Surg 16: 730
2. Burrington JD, Stephens CA (1968) Esophageal replacement with a gastric tube in infants and children. J Pediatr Surg 3: 246–252
3. Chittmittrapap S, Spitz L, Kiely EM, Brereton RL (1989) Oesophageal atresia and associated anomalies. Arch Dis Child 64: 364–368
4. Ein SH, Shandling B, Simpson JS, Stephens CA, Vizas D (1978) Fourteen years of gastric tubes. J Pediatr Surg 13: 638–642
5. Gough MH (1980) Esophageal atresia – use of an anterior flap in the difficult anastomosis. J Pediatr Surg 15: 310–311
6. Howard R, Myers NA (1965) Esophageal atresia: a technique for elongating the upper pouch. Surgery 58: 725–727
7. Howell CG, Davis JB Jr, Parrish RA (1987) Primary repair of esophageal atresia: how long a gap? J Pediatr Surg 22: 42–43
8. Livaditis A, Radberg L, Odensjo G (1972) Esophageal end-to-end anastomosis. Reduction of anastomotic tension by circular myotomy. Scand J Thorac Cardiovasc Surg 6: 206–214
9. Louhimo I, Pasila M, Visakorpi JK (1969) Late gastrointestinal complications in patients with colonic replacement of the esophagus. J Pediatr Surg 4: 663–673
10. Mitchell IM, Goh DW, Roberts KD, Abrams LD (1989) Colon interposition in children. Br J Surg 76: 681–686
11. Puri P, Blake N, O'Donnell B, Guiney E (1981) Delayed primary anastomosis following spontaneous growth of esophageal segments in esophageal atresia. J Pediatr Surg 16: 180–183
12. Puri P, Ninan GK, Blake NS, Fitzgerald RJ, Guiney EJ, O'Donnell B (1992) Delayed primary anastomosis for esophageal atresia: 18 months' to 11 years' followup. J Pediatr Surg 27: 1127–1130
13. Replogle RL (1963) Esophageal atresia: plastic sump catheter for drainage of the proximal pouch. Surgery 54: 296–297
14. Ricketts RR, Luck SR, Raffensperger JG (1981) Circular esophagomyotomy for primary repair of long-gap esophageal atresia. J Pediatr Surg 16: 365–369
15. Schiller M, Frye TR, Boles ET Jr (1971) Evaluation of colonic replacement of the esophagus in children. J Pediatr Surg 6: 753–760
16. Waterston D (1964) Colonic replacement of esophagus (intrathoracic). Surg Clin North Am 41: 1441–1447
17. Wright VM, Noblett HR (1978) A complication of continuous upper pouch suction in esophageal atresia. J Pediatr Surg 13: 369–370