Results and complications of surgery for gastro-oesophageal reflux

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SUMMARY One hundred and six children undergoing antireflux surgery were studied; 41 were severely mentally retarded and 29 had reflux strictures. Although the eventual rate of success was 92%, 20 patients developed complications that required a second operation. Prolapse of the fundoplication into the mediastinum was the commonest complication (in seven patients), followed by intestinal obstruction (in five), and intractable fibrous oesophageal strictures (in five). The incidence of postoperative complications was highest in patients with mental retardation or oesophageal strictures. Referral of these patients for operation was invariably delayed, and earlier referral may have avoided many of the complications.

Gastro-oesophageal reflux appears to be the fashionable disease of the 1980's. Large series of cases have been reported from several centres in the United States of America, where until recently the condition had apparently escaped recognition. Ashcraft *et al* accumulated a total of 605 children undergoing Thal fundoplication over a period of 10 years.¹ The most widely practiced antireflux procedure is Nissen fundoplication. The high rate of success for this operation in children is generally accepted.²⁻⁵ Little prominence has, however, been given to the complications of operation.

We report the complications encountered in a series of 106 children undergoing Nissen fundoplication. We have presented the clinical features, outcome of the various investigations, and indications for surgical intervention in order to emphasise the severity of the underlying conditions and the high proportion of associated malformations in our series compared with other reported series.

Patients and methods

A total of 106 children undergoing Nissen fundoplication over an eight year period, 1976-83, were analysed. The minimum follow up period was one year. The Figure gives the age of the patients at the time of operation. Of the 29 infants operated on within the first year of life, 15 had an associated congenital anomaly, eight had advanced oesophageal damage, and six were severely retarded. The Figure also shows the distribution of patients with mental retardation and those with reflux strictures.

Figure Age of patients and proportion with mental retardation and established reflux strictures.

Presenting features (Table 1). Persistent vomiting was the predominant symptom in all patients except in nine who presented primarily with respiratory symptoms (recurrent chest infections in five patients and apnoeic attacks in four). Gastrointestinal haemorrhage was noted in 40 patients (38%). Failure to thrive (weight below third centile for age) was present in 60% of patients and was even more common in children with mental retardation (80%). Thirty two children had a history of recurrent respiratory infections.

Table 1 *Presenting features*

Symptom	No (%) of patients
Persistent vomiting	97 (91)
Haematemesis	32 (30)
Hypochromic microcytic anaemia	8 (8)
Failure to thrive	63 (60)
Dysphagia	14 (13)
Recurrent chest infections	32 (30)
Apnoeic or cyanotic attacks, or both	4 (4)

Investigations.

Radiology

The presence of reflux was shown in all cases by upper gastrointestinal contrast studies with a standard technique without abdominal compression or other provocative manoeuvres to induce reflux. Particular attention was paid to the gastric outlet and configuration of the duodenum.

Endoscopy

Upper gastrointestinal fibre endoscopy was performed routinely before fundoplication. The findings were classified as follows: grade I, lax gastro-oesophageal junction only (48 cases); grade II, mild to moderate oesophagitis (12 cases); grade III, ulcerative oesophagitis (17 cases); and grade IV, stricture (29 cases).

Other investigations

Oesophageal manometry, pH monitoring, and Technetium-99 sulphur colloid milk scans were carried out in selected cases. Manometry was helpful in the diagnosis of achalasia, pH monitoring was useful to elucidate the cause of apnoeic attacks, and the milk scan occasionally noted aspiration.

Indications for antireflux surgery (Table 2). Indications for operation were as follows: (a) Oesophageal strictures secondary to reflux constituted an absolute indication for early surgical intervention. Dilatations were deferred until antireflux surgery

had been performed. (b) Anatomical anomaly. Four of the eight children, including one with trisomy 13, with oesophageal atresia had developed lower oesophageal reflux strictures. An antireflux procedure was used prophylactically in patients undergoing Heller's cardiomyotomy for achalasia. (c) Failure of conservative treatment. This constituted the largest group with 62 patients, 41 of whom were severely mentally retarded. The aetiology of the mental retardation consisted of asphyxia at birth (16 children), dysmorphism (11), microcephalus (four), Down's syndrome (three), hydrocephalus (two), cerebral tumour (two), familial dysautonomia (two), and tuberous sclerosis (one). Eleven of the remaining 21 patients had an associated malrotation, and five had ulcerative oesophagitis. (d) Apnoeic or cyanotic attacks were the primary indication for operation in only four patients; three had had an oesophageal atresia. (e) Recurrent respiratory infections constituted the primary indication for antireflux surgery in only five patients.

Operative procedure. The antireflux procedure was a standard Nissen fundoplication consisting of a loose but complete wrap over the distal 2–4 cm of oesophagus, the length varied according to the age of the patient. A short wrap was used in patients who had previously undergone repair of oesophageal atresia due to the disturbed motility of the oesophagus. Radio-opaque clips were attached to the proximal and distal extents of the wrap to help with the long term radiological localisation of the fundoplication. The oesophageal hiatus was narrowed as required with one or two deep crural sutures. Associated malrotation was corrected by Ladd's procedure. Postoperatively, the patients were nursed in an atmosphere of high humidity and received regular physiotherapy to avoid pulmonary atelectasis.

Results

An uneventful postoperative course with total resolution of all symptoms was achieved in 70 children (66%). Severely mentally retarded children generally responded promptly to antireflux surgery; their vomiting ceased completely and their overall management was greatly simplified. Their number of complications was, however, appreciably higher.

Mortality. Eight children in the series died. Three died from causes unrelated to the operation, two from cerebral tumours, and one from encephalitis. Two children, both severely mentally retarded, died from postoperative respiratory complications. The

Table 2 *Indications for antireflux surgery*

	No of patients
Oesophageal stricture	29 { 6 mental retardation 14 oesophageal atresia
Anatomical anomaly:	16
Diaphragmatic hernia	2
Achalasia	4
Laryngeal cleft	2
Oesophageal atresia	8
Failure of conservative treatment:	62
Mental retardation	41
Apnoeic attacks	4
Recurrent pulmonary infections	5

remaining three patients all had reflux strictures. A 1 month old infant was referred with a fibrous stricture after rupture of the oesophagus during fundoplication for recurrent apnoeic attacks. Empyema and septicaemia from an oesophageal leak developed after subsequent oesophagoplasty. Extensive necrotising enterocolitis was responsible for the death of a child with severe combined immune deficiency. The third death was a cot death in a previously asymptomatic 13 month old infant. At necropsy postoperative adhesions with a gangrenous volvulus of small intestine was found.

Morbidity. The following complications were recorded in our patients:

- (1) Prolapse of the fundoplication through the oesophageal hiatus into the mediastinum occurred in seven patients (7%). Difficulty in swallowing was experienced by all these children. The fundoplication remained intact and competent despite its abnormal position. Resiting of the fundoplication below the diaphragm in six of these children resulted in complete resolution of their dysphagia.
- (2) Paraoesophageal herniation developed in one patient consisting of gastric volvulus through a completely disrupted hiatal repair in a 14 year old boy with spastic diplegia.
- (3) Intestinal obstruction secondary to postoperative adhesion formation occurred in four patients while a fifth patient developed intestinal obstruction early in the postoperative period due to a jejunojejunal intussusception. All these children required an operation for relief of their obstruction.
- (4) Temporary gas bloat was commonly found in the immediate postoperative period but usually resolved spontaneously. In two extremely mentally retarded children it was severe enough to cause considerable discomfort. A tube gastrotomy in both these children effectively relieved their symptoms. One of these patients had previously undergone conversion of his complete fundoplication to a 75% wrap without any improvement in the gas bloat.
- (5) Abdominal wound dehiscence developed in one patient.
- (6) Dumping syndrome was identified in one infant, an 8 month old girl with a trisomy 13 chromosomal abnormality who had previously undergone repair of an oesophageal atresia. She responded to graded feeds with comminuted chicken and eventually tolerated a normal diet.
- (7) Intractable strictures, unresponsive to repeated bougienage, were encountered in five patients. Two severely retarded children required oeso-

ophageal replacement (colon and stomach), and the three remaining patients underwent limited resection of short residual strictures with primary oesophago-oesophageal anastomosis. Ectopic gastric mucosa (Barrett's oesophagus) was found at the site of stricture on histological examination.

- (8) Minor complications developed in 14 patients. These consisted of superficial wound sepsis (three cases), pulmonary atelectasis (eight), and temporary dysphagia due to incoordinated oesophageal peristalsis (three).

The incidence of complications was appreciably higher in the group of children with disorders of the central nervous system (five deaths and eight complications) and in children with reflux strictures (three deaths and seven complications).

Discussion

The final outcome of Nissen fundoplication was highly satisfactory with a complete amelioration of symptoms in 97 out of 106 cases. Twenty patients developed complications necessitating a second operation. These complications are discussed in detail below and reports on the subject are reviewed.

Prolapse of fundoplication. The commonest complication requiring another operation in our series was total prolapse of the fundoplication into the mediastinum. Bettex and Kuffer reported a 2.5% incidence of this complication⁶ and Tunnel an 8.5% incidence⁷ compared with the 6.6% incidence in our series. Other authors have encountered this complication less often.^{3 8 9} The plication retains its antireflux properties in the mediastinum and requires to be resited only if there is persistent dysphagia. A wide hiatus may predispose to prolapse of the plication into the chest. We experienced this complication even when the hiatus was narrowed at the time of plication. In view of the high incidence of prolapse we adopted an additional step in the operation in an attempt to prevent this complication. The most proximal suture of the second layer of the fundoplication is anchored to the undersurface of the diaphragm. No instances of prolapse have occurred since this precaution was adopted. We also found it useful to mark the upper and lower limits of the fundoplication with radio-opaque clips to facilitate its radiographic location as well as assess the integrity of the plication.

Paraoesophageal hernia. This was found in one patient who presented as an abdominal emergency. This potentially serious complication requires early

diagnosis and prompt operation as strangulation of the herniated bowel may occur. Festen recorded this problem in three of his 19 patients.¹⁰

Intestinal obstruction. Postoperative intestinal obstruction occurred in five of our patients, four were due to adhesion formation while the fifth developed a jejunojejunal intussusception early in the postoperative period. This complication has been encountered by others.^{3 7 11} The inability of the child to vomit after fundoplication may lead to a delay in diagnosis and referral of patients with adhesion obstruction.

We did not encounter a single case of wrap malalignment, slipping of the wrap, or disruption of the fundoplication, as described by Randolph,⁵ Tunnel,⁷ and Ashcraft.⁸ It is important that a sufficient length of the greater curvature of the stomach be freed to facilitate a comfortable wrap of the fundus around the oesophagus. It relieves any tension on the suture line and avoids disruption.

The group of mentally retarded children deserves special mention. These children are recognised for their poor response to conservative treatment.¹² They present with persistent vomiting, which is a major nursing and social problem. The relief they obtain from fundoplication is often quite dramatic and therefore these children may be given operations earlier than others. Nevertheless, in our series this group had a high morbidity (20%). Gas bloat occurred in three children, and in two it was severe enough to cause considerable discomfort from abdominal distension. Conversion of the complete fundoplication to a partial plication was carried out in one patient without any improvement. A tube gastrostomy for intermittent venting was effective in both cases in relieving the gas bloat. Five of the eight deaths occurred in this group of patients.

Interestingly, compared with other series we found a much higher incidence of strictures of the oesophagus (27%). The only other series with high incidences of strictures were reported by Schatzlein,¹³ Hicks,¹⁴ and O'Neill,¹⁵ who document incidences of 12%, 14%, and 15%, respectively. These cases present considerable difficulties in management and most require repeated dilatations after fundoplication. Those with established fibrotic strictures may ultimately need some form of resection. Two of our 29 patients with strictures required oesophageal replacement and three had residual strictures resected with primary reanastomosis of the oesophagus. In these patients gastric mucosa was found adjacent to an ulcer in the resected portion of the stricture. These Barrett's ulcers were proximal to the oesophagogastric junction and above an intact functioning fundoplication.¹⁶ There were four

deaths among patients with strictures, and seven patients developed postoperative complications.

Early operation before the development of an established stricture may reduce appreciably the number of complications. Evidence in support of this hypothesis is provided by an analysis of the number of complications in the 17 children with ulcerative oesophagitis, in whom only a single postoperative complication was encountered.

Interestingly, we found a low incidence of children presenting with apnoeic attacks or near miss sudden infant death syndrome and chronic respiratory infections compared with other reports. In most series from the United States of America 29–67% of patients undergoing operations presented primarily with respiratory symptoms.^{3 5 7 8 17} This difference is due to the less aggressive attitude of doctors in the United Kingdom towards these patients.

Nissen fundoplication is an excellent operation for patients with gastro-oesophageal reflux that fails to respond to conservative treatment or presents with strictures or ulcerative oesophagitis and with apnoeic attacks. Complications, however, are not uncommon and occur most commonly in patients with reflux strictures or in debilitated children with mental retardation. Referral of these patients for operation is invariably delayed and earlier referral may have avoided many of the complications.

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One hundred years ago

'Good news for pregnant women'

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MR. JOHN BLAND has been letting his mind dwell on the case of women who have the misfortune to have to bear children in cold or temperate climates, as compared with their luckier sisters who have to discharge the same duty in the South of Europe or in Africa. He assumes that much of the difference is due to the mere difference of climate, the warm climate relaxing the tissues, and *vice versa*. Upon this basis he has constructed a box with a heating apparatus, in which he proposes to place the lower part of the woman in labour. The heat of this box, he thinks, will bring the woman, at least in the lower part of the body, to the advantageous position of her more southern sisters. Again, it appears that a lady at the last Exhibition in Paris, in the seventh or eighth month of pregnancy, went up in a captive balloon, and before they could descend accomplished the whole of labour, including the expulsion of the placenta. He attributes this not to the fright of the lady, but to the diminution of atmospheric pressure. He has therefore included in his invention a provision for exhausting the box of air on the approach of a pain. The process of labour is to be watched through a window. Mr. Bland frankly tells us he is not a medical man. We might have guessed as much; otherwise he would not have troubled himself to spin such fine theories on a process which Providence has not made pleasant in any country, and which is not likely, we fear, to be much influenced one way or the other by his box. A much more effective way to test Mr. Bland's benevolent views would be to hire a Turkish bath, and use it for first labours for a few months, or to engage a few captive balloons and place them at the service of the maternity hospitals!