

## ORIGINAL ARTICLES

# Gastrointestinal morbidity and growth after repair of oesophageal atresia and tracheo-oesophageal fistula

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## Abstract

Upper gastrointestinal morbidity and anthropometric data in 334 patients aged 1 to 37 years with repaired oesophageal atresia and tracheo-oesophageal fistula are reported. Two thirds were subsequently hospitalised with oesophageal complications and half underwent one or more surgical procedures. Thirteen percent were hospitalised for more than 50 days. Anastomotic strictures were present in one third and just under half had gastro-oesophageal reflux. Dysphagia was present in about 65% in all age groups but symptom severity and surgical intervention decreased significantly after 5 years of age. Gastro-oesophageal reflux symptoms were commoner in the older patients increasing from 18% in the group under 5 years of age to 52% in those over 15 years. Height centile distribution was normal, but the median weight centile was the 25th. Weight for height values greater than 2 SD below the mean were present in 13%, and two thirds of these patients were under 5 years of age. The majority of adults enjoyed a normal lifestyle and were comparable with their peers.

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Successful surgical management of oesophageal atresia by alimentary continuity was first reported in the early 1940s.<sup>1</sup> Since then there has been a rapid decline in the perioperative mortality<sup>2-6</sup> and this is now usually related to the presence of associated congenital abnormalities.<sup>7</sup> Morbidity from oesophageal complications in survivors is well documented and is secondary to anastomotic strictures,<sup>3 5 8 9</sup> disordered motility<sup>10-13</sup> and gastro-oesophageal reflux.<sup>14-17</sup> The impact of these problems on the nutritional status of the patients<sup>18-21</sup> and parental feeding practices<sup>21 22</sup> has been studied in small and selected groups.

Knowledge of the prevalence and severity of upper gastrointestinal problems and anthropometric data in a large number of unselected patients of all ages after surgical repair of oesophageal atresia and tracheo-oesophageal fistula would be invaluable to paediatricians and paediatric surgeons, and would be helpful in assessing the level of medical and paramedical input required by the patients' families. This study reports the oesophageal morbidity and nutritional status of over 300 children and adults—over 90% of all the survivors born with

oesophageal atresia from a major centre. Respiratory problems and lung function data in these patients will be reported elsewhere.

## Patients and methods

Five hundred and thirty eight patients with oesophageal atresia and tracheo-oesophageal fistula were managed at the Royal Children's Hospital, Melbourne, from the first successful repair in 1948 until 1986. Three hundred and sixty six patients survived of whom 302 were interviewed and examined as part of a follow up study, and information was available from a telephone interview for a further 32 patients. The majority of adult patients were accompanied by their parents.

The following information was recorded from the case notes: type of oesophageal atresia, details of subsequent hospital admissions for oesophageal complications including surgical procedures, and radiological and endoscopic evidence of gastro-oesophageal reflux. Patients were defined as having anastomotic stricture if two or more oesophageal dilatations were performed. The types and management of other congenital anomalies were also recorded.

Details of medical history and health problems in the previous 12 months with emphasis on gastrointestinal symptoms were obtained from the patient and where possible the parents. The frequency of dysphagia, oesophageal food impaction, prolonged meal times, and gastro-oesophageal reflux symptoms were recorded. The latter was defined as effortless vomiting after feeds in the younger patients and regurgitation of food and heartburn in the older group.

Each patient was examined and height (cm) and weight (kg) measurements recorded. All values were expressed to the nearest centile based on standardised data.<sup>23</sup> Values above and below 2 SD from the mean were recorded separately. Weight for height SD scores were calculated.

The  $\chi^2$  test was used to analyse the relationship between current feeding difficulties and gastro-oesophageal reflux symptoms.

## Results

Data on 334 patients aged 1-37 years are

Table 1 Age and sex distribution

	Age (years)			
	0-5	5-10	10-15	>15
Male	39	30	31	92
Female	23	24	23	72

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presented. The age and sex distribution is shown in table 1. Two hundred and ninety patients (87%) had oesophageal atresia and distal tracheo-oesophageal fistula. Atresia and proximal fistula was present in six (2%), atresia alone in 16 (5%), and a fistula with intact oesophagus in 22 (6%). Other congenital abnormalities were present in 187 (56%) and are shown in table 2.

Two hundred and twenty one patients (67%)

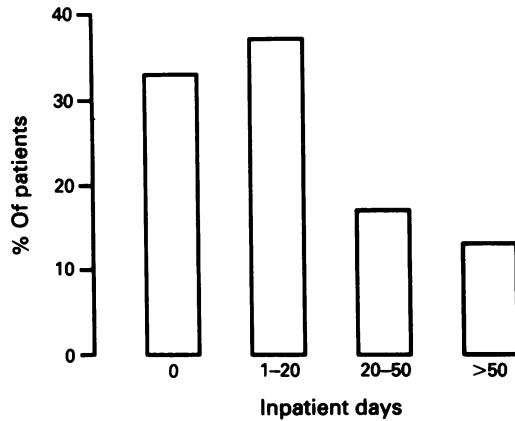


Figure 1 Total inpatient days for problems related to the oesophagus.

Table 3 Frequency of subsequent surgical procedures

	No (%)
Oesophageal dilatation ( $\geq 1$ )	158 (47)
Foreign body removal ( $\geq 1$ )	97 (29)
Oesophageal stricture resection	35 (11)
Fundoplication	42 (13)
Division of recurrent fistula	20 (6)

Table 4 Frequency of oesophageal dilatations

No of dilatations	No (%)
0	178 (53)
1	38 (12)
2-5	70 (21)
6-10	28 (8)
11-20	13 (4)
>20	7 (2)

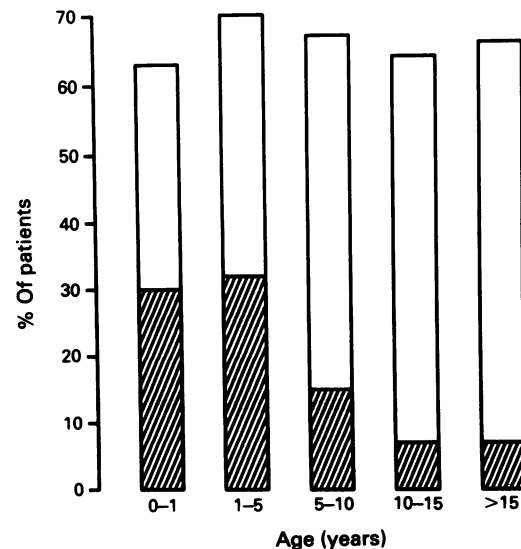


Figure 2 Prevalence of feeding difficulties in childhood (shaded area indicates surgical intervention) for all ages.

Table 2 Frequency of associated congenital abnormalities (n=187)

Abnormality	%
Vertebral	17
Anorectal	10
Cardiac	12
Renal	25
Radial	1
Limb	7
Digital	4
Chromosomal	2
Syndromes	3
Other	19

were hospitalised with oesophageal complications in the years after initial surgery, and the number of inpatient days is shown in fig 1. The surgical procedures undertaken and the frequency of oesophageal dilatations are shown in tables 3 and 4, respectively. Anastomotic strictures were present in 118 (35%) and gastro-oesophageal reflux was diagnosed in 142 (43%) in the five years after initial surgery. Sixteen patients had oesophageal replacement surgery and in 11 this was the primary procedure for achieving alimentary continuity. One hundred and seventy five patients (52%) had surgery as a result of other congenital abnormalities.

The prevalence of feeding difficulties (dysphagia, food impaction, prolonged meal-times) in different age groups for all ages and

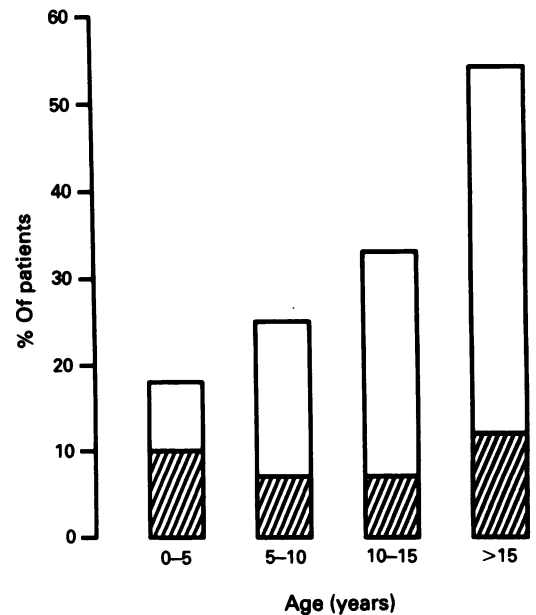


Figure 3 Prevalence of feeding difficulties in the 12 months before review (shaded area indicates daily symptoms).

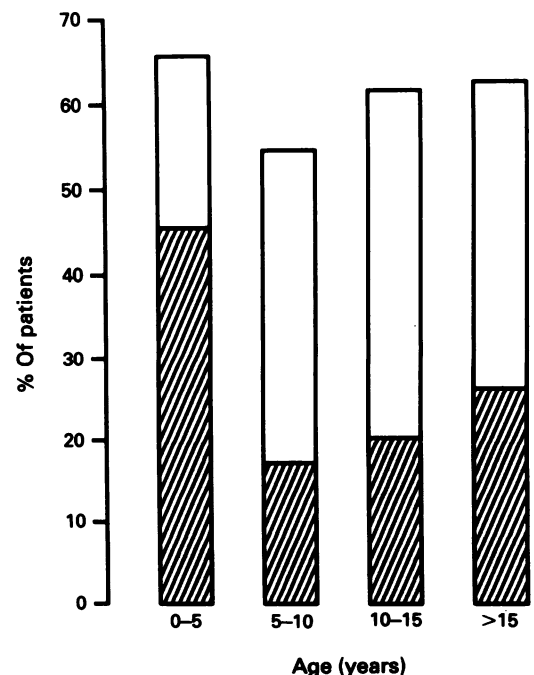


Figure 4 Prevalence of gastro-oesophageal reflux symptoms in the 12 months before review (shaded area indicates daily symptoms).

the age distribution of surgical interventions are shown in fig 2. Upper gastrointestinal symptoms in the 12 months before review for different ages are shown in figs 3 and 4. There was no significant relationship between current gastro-oesophageal reflux symptoms and current feeding difficulties ( $p>0.5$ ). While many older patients experienced symptoms, in the majority

these were not considered as being major. Poultry, meats, and bread were considered particularly difficult to swallow and many drank fluids with their meals. Eleven patients attended special schools and seven had invalid pensions none as a direct result of oesophageal complications.

Height and weight centiles for all patients and adult patients are shown in figs 5 and 6. Weight for height greater than 2 SD below the mean was present in 38 (13%): 20 were under 5 years of age, 10 were 5–10 years, seven were 10–15 years, and one over 15 years. These patients were more likely to have had more severe oesophageal complications.

**Discussion**

This study on a large number of patients after surgical repair of oesophageal atresia and tracheo-oesophageal fistula shows that oesophageal complications are common. Two thirds were rehospitalised and half underwent one or more further surgical procedures. Thirteen percent were admitted for more than 50 days. While dysphagia was present in two thirds of all age groups, the frequency and severity of symptoms and surgical intervention declined sharply after 5 years. Significant nutritional compromise was present in 13% and these were mainly younger patients. The majority of older patients did not feel that their upper gastrointestinal symptoms were major, enjoyed a normal lifestyle, and their growth parameters were comparable with their peers.

The results of our study will enable paediatricians and paediatric surgeons to be very encouraging to parents about the long term outcome of oesophageal atresia and/or tracheo-oesophageal fistula. The early postoperative years, however, may be difficult with major feeding difficulties and multiple hospital admissions. The psychological and social impact of these problems on the child and his family may be enormous.<sup>24</sup> A recent study has suggested that parents are not adequately prepared for these problems.<sup>21</sup> On the basis of our findings we would advocate that optimal advice and support is offered to parents as soon as possible after initial surgery.

In contrast to other studies<sup>18–21</sup> stunting of growth (height for age less than 2 SD below the mean) in our patients was uncommon, but the prevalence of wasting (weight for height less than 2 SD below the mean) was similar. Those studies were based on small numbers and in one anthropometric data was collected from parents by questionnaire.<sup>21</sup> This group may well have had more severe problems as they were members of an oesophageal atresia parent support group. In our population wasting was commoner in children under 5 years, and weight centile distribution for adult patients was normal. In one study of 43 patients with serial weight measurements over 12 years, the acute malnutrition present in the early years resolved completely,<sup>19</sup> supporting our view that the long term nutritional outcome is excellent.

Dysphagia was common in all age groups but less severe in older patients and is secondary to

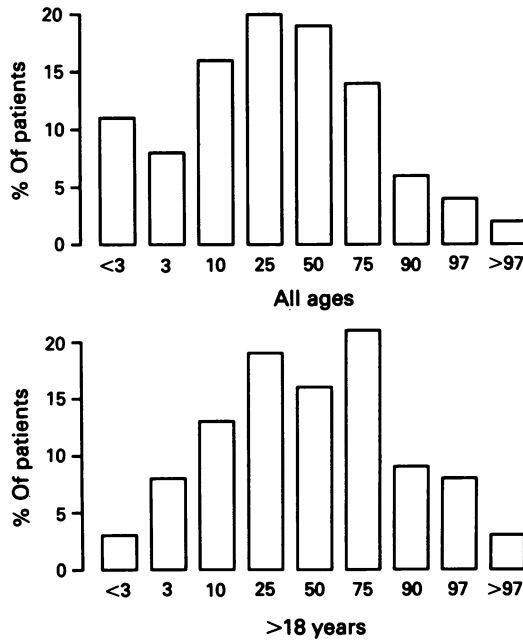


Figure 5 Percentage distribution of all patients and adult patients weight expressed to nearest centile.

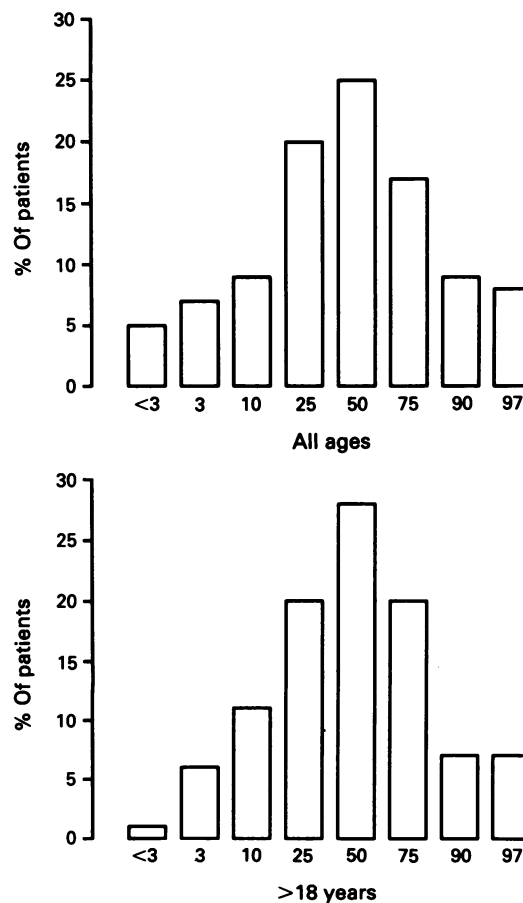


Figure 6 Percentage distribution of all patients and adult patients height expressed to nearest centile.

anastomotic stricture and disordered oesophageal motility. Stricture is uncommon after 5 years of age presumably as a result of oesophageal growth and many factors may contribute to its formation: rough handling of the oesophagus at the time of repair, tension on the anastomosis, the use of silk sutures,<sup>9</sup> gastro-oesophageal reflux, anastomotic dehiscence, and two layered anastomoses.<sup>25</sup> Motor dysfunction of the oesophagus is likely to be universal in these patients. Abnormal innervation of the oesophagus and stomach seen on postmortem specimens,<sup>26</sup> motor incoordination of the proximal and distal oesophageal body in preoperative studies<sup>27</sup> and in patients with H type tracheo-oesophageal fistulas,<sup>28 29</sup> and the finding of abnormal oesophageal motility in puppies<sup>30 31</sup> after oesophageal mobilisation, transection, and resuture would suggest a congenital aetiology.

Gastro-oesophageal reflux was documented in nearly half the group in the first 5 years after initial surgery, similar to the findings of published studies on small numbers,<sup>14-17</sup> but symptomatic evidence was present in only 18% under 5, suggesting that it is likely to be present at a subclinical level. Inherent oesophageal denervation,<sup>26</sup> vagal nerve damage, traction to the lower oesophagus, and gastrostomy<sup>9</sup> may all contribute to this. Symptomatic gastro-oesophageal reflux was much commoner in older patients and may in part be due to an increased willingness of older patients to admit to symptoms. Despite this in the majority these symptoms were mild and infrequent, and up to one third of adults in the general population may have occasional gastro-oesophageal reflux symptoms.<sup>32</sup>

The long term outcome of babies born with oesophageal atresia and/or tracheo-oesophageal fistula, despite a potentially difficult initial period as a result of oesophageal complications, respiratory morbidity, and associated congenital anomalies, is excellent. It is unlikely that surgical advances in the next decade will have a major impact on the prevalence of oesophageal complications in young children, but potentially treatable risk factors such as gastro-oesophageal reflux should be identified early. Maximum support should be offered to parents and children to minimise the traumatic effects of frequent surgical intervention and hospitalisation in these patients.

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