Role of hiatal hernia in delaying acid clearance

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Abstract

The aim of this study was to assess prospectively the relationship of a hiatal hernia to gastro-oesophageal reflux. Ninety five children with symptoms of gastro-oesophageal reflux in whom reflux was demonstrated radiologically were investigated. Oesophageal pH monitoring for 18 hours and endoscopy were performed in all patients. On the basis of radiology, patients were divided into those with hiatal hernia (n=37) and those without (n=58). Both groups had the same number of reflux episodes on pH monitoring. However, the median duration of the longest episode was significantly greater in the hiatal hernia group (30 min *v* 19 min), as was the number of reflux episodes longer than five minutes (5 *v* 4). The percentage with a pH<4 just failed to be significantly different (13% *v* 8%). Hiatal hernia was also found to correlate with the presence of oesophagitis. The presence of a hiatal hernia delays the clearance of acid from the oesophagus and is associated with an increased incidence of oesophagitis.

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Gastro-oesophageal reflux is a common condition in children.¹ Much attention has focused on the role of the lower oesophageal sphincter and its relaxation in the pathogenesis of gastro-oesophageal reflux.^{2,3} Despite this it is recognised

that many aetiological factors are involved, including the nature of the refluxate, oesophageal dysmotility, and clearance of the refluxate from the oesophagus.^{4,7} Recently the role of the hiatal hernia in the promotion of adult gastro-oesophageal reflux has been re-examined with interest focusing on its ability to delay oesophageal clearance.^{8,9} Simultaneous videofluoroscopy and manometry in patients with a hiatal hernia has demonstrated delayed clearance of barium with retrograde flow up the oesophagus.⁸ Radionuclide imaging along with pH monitoring showed the trapping of acid in the hernial sac with its subsequent regurgitation into the oesophagus.⁹ It has therefore been suggested that in adults the hiatal hernia does promote gastro-oesophageal reflux and oesophagitis by delaying acid clearance from the oesophagus.¹⁰ Impaired clearance of acid from the oesophagus has been demonstrated in children with oesophagitis.^{6,7} However, the relationship of the hiatal hernia to delayed acid clearance and oesophagitis in children has not been examined.

The purpose of this study was to compare the extent of oesophageal acid exposure and frequency of oesophagitis in children with and without a hiatal hernia.

Patients and methods

PATIENTS

Included in the study were 95 consecutive children (mean age (range) 28 (0-2-180) months) who presented with symptoms of gastro-oesophageal reflux and in whom it was demonstrated radiologically. Vomiting was present in all patients and in some this was associated with failure to thrive, haematemesis, or repeated respiratory tract infections. All patients in whom an alternative explanation for vomiting was demonstrated, for example urinary tract infection, were excluded.

RADIOLOGY

Infants were fed a dilute barium mixture (E-Z-HD, Henley's Medical Ltd) from a feeding bottle with a large holed teat that allowed the barium to flow freely. Older children drank the barium through a straw while recumbent. The oesophagus was observed during swallowing with the patient supine, paying particular attention to the oesophagogastric junction.

When the fundus of the stomach was filled, the patient was turned on to the right side and then rotated back into the supine position. This movement was generally repeated several times in an attempt to elicit gastro-oesophageal reflux. If it did not occur, older children were given a drink of water to facilitate reflux by the water syphon test.

Hiatal herniation was diagnosed by the identi-

The figure shows the presence of hiatal hernia.

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fication of gastric mucosal folds or a loculus of stomach above the diaphragm (figure).

All radiology was performed by one of two consultant radiologists experienced in barium radiology.

ENDOSCOPY

Upper gastrointestinal endoscopy was performed under general anaesthesia in all patients. The position of the oesophagogastric junction was noted and the presence of oesophagitis documented. Oesophagitis was defined by the demonstration of friability, erosions, or ulceration of the mucosa. All endoscopies were performed by one of two senior paediatric surgeons (RJS and VEB).

OESOPHAGEAL pH MONITORING

Oesophageal pH monitoring was performed in each patient using a monocrystalline antimony electrode (Synectics Medical Ltd). Beaker calibration, as recommended by Ask *et al.*, was carried out.¹¹ Both oesophageal and skin electrodes were placed in a beaker of buffer solution pH 7.01 for a period of 10 minutes, lifted out, wiped and placed in buffer solution pH 1.07 (Synectics Medical Ltd) for a similar period. During this time the electrodes were attached to the digitrapper which recorded the calibration. It was then switched off and the event marker pressed. Under direct endoscopic vision the electrode was placed in the lower oesophagus, 2–3 cm above the oesophagogastric junction.¹² The electrode was taped to the child's cheek at endoscopy and the distance to the nasal orifice of the nearest marking on the tubing noted. This electrode and a silver chloride skin electrode were connected to a digitrapper (Synectics Medical Ltd). The recording was commenced at least three hours after endoscopy and was concluded the next day after a minimum of 18 hours. To allow measurement under physiological conditions their feeding regimen and usual activities were not altered. During the study the child was observed by nursing staff and parents.

At the end of the study the position of the electrode with respect to the nose was checked. After removal the electrode was placed in pH 7.01 and pH 1.07 solutions to ensure that pH drift had not occurred.

Data were analysed using the Esophogram program (Gastrosoft Inc). The following parameters were measured: (i) percentage of total time at <pH 4, (ii) the total number of reflux episodes, (iii) the number of reflux episodes lasting longer than five minutes, and (iv) the duration of the longest reflux episode. A reflux

episode was defined as beginning when the oesophageal pH dropped below 4 and ending when the pH rose above this value. Upper limits of normal were taken as mean +3 SD using the normal data of Boix-Ochoa *et al.*¹³

STATISTICS AND ETHICAL APPROVAL

As the data do not follow a normal distribution, results are reported as medians and interquartile ranges and were analysed using the Mann-Whitney U test and the χ^2 test.

This study was performed with the approval of the ethical research committee, The Queen's University of Belfast, and with the informed consent of the parents.

Results

RADIOLOGY

Of the 95 children with gastro-oesophageal reflux, barium screening revealed that a hiatal hernia was present in 37 (39%) and absent in 58 (61%).

ENDOSCOPY

Twenty (21%) of the children had evidence of macroscopic oesophagitis. This finding was significantly more common in patients with a hiatal hernia (32% *v* 14%, $p < 0.05$).

OESOPHAGEAL pH MONITORING (TABLE)

Seventy seven (79%) patients had at least one of the four pH parameters exceeding the upper limit of normal. An abnormal test was significantly more common in patients with a hiatal hernia (92% *v* 75%, $p < 0.05$).

(i) *Percentage of total time at <pH 4* – This value only just failed to reach statistical significance on comparing those with and those without a hiatal hernia (13.1% *v* 8.4%; $p = 0.06$).

(ii) *Total number of reflux episodes* – The presence of a hiatal hernia did not alter the number of reflux episodes which occurred (67 *v* 67; this was not significant).

(iii) *Number of episodes longer than five minutes* – Patients with a hiatal hernia had significantly more episodes of reflux which lasted longer than five minutes (5 *v* 4; $p < 0.05$).

(iv) *Duration of longest reflux episode* – The median duration of the longest reflux episode was 58% greater in patients with a hiatal hernia compared with those who did not have a hiatal hernia (30 min *v* 19 min; $p < 0.05$).

Discussion

Before 1956, the presence of a hiatal hernia was virtually synonymous with the term gastro-oesophageal reflux.^{14–16} However, with the demonstration of a lower oesophageal sphincter and an increased understanding of its function, the significance of the hiatal hernia diminished.^{17–20} Recently there has been renewed interest in the role of the hiatal hernia in gastro-oesophageal reflux.^{8,9} In particular, Sloan and Kahrilas have demonstrated that the presence of a hiatal hernia delays clearance of acid from the

A comparison of pH parameters in patients with and without a hiatal hernia: median (interquartile range)

	Hiatal hernia (n=37)	No hiatal hernia (n=58)	p Value
(i) % Total time <pH 4	13.1 (6.7–26.4)	8.4 (3.4–19.6)	0.06
(ii) Total No of reflux episodes	67 (48–105)	67 (36–117)	0.80
(iii) No of reflux episodes >5 min	5 (3–12)	4 (1–7)	<0.05
(iv) Duration of longest episode (min)	30 (15–69)	19 (7–40)	<0.05

oesophagus, a process which increases mucosal acid exposure time and promotes oesophagitis.⁸

The investigation of childhood gastro-oesophageal reflux has taken a similar course. In his research in the 1950s, Carré demonstrated the importance of the hiatal hernia (then termed a partial thoracic stomach, PTS).²¹ He differentiated between reflux caused by a PTS and reflux in the absence of a PTS, with the former group having a significantly worse prognosis.²² However, the use of oesophageal pH monitoring has allowed investigation for a hiatal hernia to be neglected.^{7,13,23-26} Recently, Masliah *et al* have redressed the balance by demonstrating that the presence of a hiatal hernia predicted persistent symptoms.²⁷ No oesophageal pH parameter correlated with outcome in their study.

Our results have also demonstrated a role for the hiatal hernia in childhood gastro-oesophageal reflux. We have shown the presence of a hiatal hernia to be associated with longer reflux events measured as both the number of reflux events lasting longer than five minutes and as the duration of the longest event. This delay in acid clearance is similar to the finding in adults with hiatal hernias. Recent use of simultaneous video-fluoroscopy and manometry⁸ and combined radionuclide imaging and pH monitoring⁹ has demonstrated that the hernial sac traps acid which then regurgitates freely into the lower oesophagus. This prolongs the mucosal exposure to acid. The importance of this finding is confirmed by the work of Boix-Ochoa and colleagues who found a few long reflux events to be more significant than many brief ones in predicting oesophagitis.¹³

Evidence of oesophagitis at endoscopy has a relatively low sensitivity (25–54%) for histological oesophagitis. However, if present, it indicates gastro-oesophageal reflux with a high degree of specificity (83–100%).^{28,29} Macroscopic oesophagitis was present in 21% of our patients, a figure similar to that reported by others (18–38%).^{27,28} Patients with a hiatal hernia had a significantly increased incidence of oesophagitis. This is a finding which has been demonstrated previously in adults.³⁰

Masliah *et al* have confirmed the importance of the hiatal hernia, demonstrating that its presence predicted a poor outcome in children with gastro-oesophageal reflux.²⁷ Our results indicate a possible pathophysiological link between a hiatal hernia and the poor prognosis: the hernia delaying the clearance of acid from the oesophagus and thereby promoting oesophagitis.³¹ In infants without a hiatal hernia symptoms tend to disappear as the lower oesophageal sphincter matures.² By contrast, the anatomical abnormality of a hiatal hernia persists, impeding clinical improvement. In 1959, Carré first suggested that patients with a hiatal hernia had a more severe form of gastro-oesophageal reflux and that they should be treated more actively.²¹ Such patients require evaluation with upper gastrointestinal endoscopy and pH monitoring. The presence of oesophagitis should be actively managed with antacids, prokinetic agents and H₂ receptor antagonists. Repeat endoscopy and pH monitoring will assess the response to treatment. In the event of failure of medical management,

early consideration of surgical intervention is advised.

In conclusion, we have demonstrated that the finding of a hiatal hernia in children with gastro-oesophageal reflux is associated with delayed acid clearance from the oesophagus and oesophagitis. Gastro-oesophageal reflux in the presence of a hiatal hernia must be managed more aggressively.

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