ORIGINAL ARTICLE

Growth in children with *Helicobacter pylori* infection and dyspepsia

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Aims: To compare the height, weight, and body mass index (BMI) of children presenting with dyspeptic symptoms and *Helicobacter pylori* infection, to those with dyspepsia but without the infection.

Methods: A retrospective chart review of 257 children was performed. ^{13}C urea breath test was performed to detect *H pylori* infection; weight and height were recorded and BMI was calculated. Weight, height, and BMI SD scores were determined using the 1990 UK normative data. The Index of Multiple Deprivation 2004 (IMD 2004) scores, which measure deprivation at small area level, were calculated from the patients' postcodes.

Results: Ninety seven of the 257 children were *H pylori* positive. The mean age at diagnosis and presenting symptoms of *H pylori* positive and negative patients were similar. The mean IMD 2004 scores for children with *H pylori* infection were significantly higher compared to *H pylori* negative patients, suggesting that children with the infection came from relatively more deprived areas. The mean weight and height SD score were significantly lower for children with *H pylori* infection compared to those without. However, this difference was no longer significant after adjusting for socioeconomic deprivation and ethnic differences between the groups.

Conclusion: Children with dyspepsia and *H pylori* infection were shorter and lighter than patients with similar symptoms but no infection. The differences in anthropometry may be due to socioeconomic and ethnic factors rather than *H pylori* infection.

Infection by *Helicobacter pylori* plays a causal role in several diseases including chronic gastritis, peptic ulcer disease, gastric adenocarcinoma, and lymphoma in adults.¹ The infection is usually acquired in childhood, the consequences of infection in children are not well understood.^{2–3} The majority have no symptoms^{4–5} and peptic ulcer disease is relatively rare in childhood.⁶ Chronic gastritis associated with *H pylori* infection has been reported⁷ but the relation with dyspepsia is still controversial. Some authors have investigated the role of *H pylori* in extra gastroduodenal diseases; one such association is with short stature.^{8–11}

A Korean study suggested that *H pylori* infection in association with iron deficiency anaemia might suppress linear growth.¹² In a recent study, Bravo and colleagues followed 347 Colombian children who did not have *H pylori* at the time of entry into the study.¹³ One hundred and five children acquired *H pylori* infection during follow up and showed significant slowing of growth velocity. The effect of *H pylori* on growth velocity did not vary with socioeconomic status or over crowding. However, other investigators have suggested that growth suppression reported in children with *H pylori* infection could be due to socioeconomic, genetic, and environmental factors.¹⁴

Although the causal role of *H pylori* infection in children with recurrent abdominal pain is debatable, an increased incidence of infection in children with dyspepsia has been reported.⁷ It has also been hypothesised that *H pylori* associated dyspepsia may reduce nutrient intake and cause growth suppression. In this study, we have reviewed the growth parameters of children with dyspepsia referred to the Regional Paediatric Gastroenterology unit in Manchester, UK who were investigated for *H pylori* infection as part of their investigative work up.

METHODS

A retrospective review of hospital notes of all children presenting with dyspepsia between January 2001 and June

2004, who also had a ^{13}C urea breath test, was performed. Dyspepsia was defined as upper or central abdominal pain, with associated symptoms such as retrosternal pain, nausea, vomiting, and/or loss of appetite, of at least two months' duration. Three hundred and twenty five patients were identified. The hospital notes of 50 patients were not available or had inadequate information recorded and were therefore excluded. A paediatric gastroenterology team had evaluated these patients; 18 had associated conditions which can affect growth, such as inflammatory bowel disease, Alagilles syndrome, chronic asthma, and treatment with corticosteroids, and were also excluded. Following assessment by a gastroenterologist, and when clinically indicated, anti-endomysial antibodies were obtained, but coeliac disease was not excluded in every child. Two hundred and fifty seven patients were finally included in this retrospective study. Fifty one patients underwent endoscopic examination for abdominal pain; two patients had gastric ulcer, one duodenal ulcer, and 10 had endoscopic evidence of *H pylori* associated gastritis.

^{13}C urea breath test was performed using a standard protocol; after a six hour fast, two baseline breath samples were collected. The child was then given 200 ml of orange juice, followed by 30 ml of solution containing 75 mg of ^{13}C urea powder. Two breath samples were taken 30 minutes after drinking the test solution. These were analysed using an isotope mass spectrometer, which determines the $^{13}\text{C}:\text{C}^{12}$ ratio in the breath sample. The test was considered positive if the difference in the baseline value and 30 minute value of $^{13}\text{C}:\text{C}^{12}$ exceeded 4.0%. Antibiotic treatment was discontinued at least two weeks prior to and acid suppressant therapy at least a week prior to the test.

All patients had their weight and height recorded at the time of the ^{13}C urea breath test. Body mass index (BMI) was calculated ($\text{BMI} = \text{weight}/\text{height}^2$). Height, weight, and BMI standard deviation (SD) scores were calculated using the 1990 UK normative data supplied by the Child Growth

Table 1 Age, clinical characteristics, and IMD 2004 scores of children with and without *H pylori* infection

	<i>H pylori</i> negative n = 160	<i>H pylori</i> positive n = 97	p value	
Mean (SD) age in years	10.96 (3.1)	11.49 (3.3)	NS	
Gender: male/female	85/75	53/44		
Ethnic group*				
White Caucasian	133	64	}	0.004
South Asian	25	30		
Mean (SD) IMD 2004 score	30.66 (19.88)	38.90 (19.90)		0.003

*Five patients were of Afro-Caribbean or Chinese ethnicity.

Foundation, UK.¹⁵ Information regarding presenting symptoms, duration of symptoms, age at presentation, and change in symptoms following *H pylori* eradication was also collected.

The Index of Multiple Deprivation 2004 (IMD 2004), which is a measure of deprivation at the small area level, was calculated for 225 patients in whom information regarding postcode was available in the hospital notes.¹⁶ The IMD 2004 contains seven domains of deprivation: income deprivation; employment deprivation; health deprivation and disability; education, skills, and training deprivation; barriers to housing and services; living environment deprivation; and crime. The domains and the IMD 2004 are presented at the level of Super Output Area (SOA) Lower Level. These are relatively small areas of around 1500 people. There are 32 482 Lower Level SOAs in England. Each SOA has been assigned a score and a rank for the IMD 2004. Based on the patient postcodes the IMD 2004 scores for the area they lived in were calculated. The IMD 2004 deprivation scores range from 1 to 100; the higher the scores the more deprived is the area.

Statistics

We used SPSS for Windows, version 10.1 (SPSS Inc., Chicago, Illinois, USA) for statistical analysis. The clinical symptoms of subjects in *H pylori* positive and negative group, and the prevalence of *H pylori* infection in white Caucasian and subjects of South Asian descent were evaluated using χ^2 statistics. Independent samples Student's *t* test was used to compare height, weight, and BMI SD score in the *H pylori* positive and negative groups, and to compare the IMD 2004 score of the two groups of subjects. The weight, height, and BMI SD scores of *H pylori* positive and negative groups were also compared after correcting for socioeconomic deprivation and ethnicity using linear regression analysis.

RESULTS

Ninety seven patients were *H pylori* positive and 160 were negative. Table 1 summarises the age, gender, ethnic background, and deprivation scores (IMD 2004) of the *H pylori* negative and positive patients. The mean duration of symptoms for *H pylori* positive patients was 14.1 (range 2–84) months; it was 15.2 (range 2–72) months for the negative group. As expected from the study design the commonest symptom in *H pylori* positive and negative patients was

abdominal pain. The frequency of various symptoms in *H pylori* positive and negative group of patients is presented in table 2. The prevalence of *H pylori* infection was higher in patients of South Asian descent (55%) compared to white Caucasian patients (33%) (table 1).

The weight, height, and BMI SD score of the two groups of patients are summarised in table 3. The mean weight and height SD scores were significantly lower for patients with *H pylori* infection but BMI SD scores were not. However, after controlling for covariates of socioeconomic deprivation and ethnicity, the difference in height and weight SD scores were no longer significant (table 3).

All patients with *H pylori* infection were treated with a two week course of omeprazole, clarithromycin, and metronidazole. Seventy four patients had a repeat ¹³C urea breath test and the infection was successfully eradicated in 45 patients (57%) after the first course of triple therapy. Fourteen patients with *H pylori* infection in our study had a full blood count; as a group they did not have microcytic anaemia suggestive of iron deficiency.

DISCUSSION

The ¹³C urea breath test is a validated technique for diagnosing gastric *H pylori* infection; reported sensitivity and specificity of the test is over 90%.¹⁷ Thirty eight per cent of patients with dyspepsia seen at our hospital during the three and a half year study period had associated *H pylori* infection. Although the causal relation between *H pylori* and abdominal pain in the absence of peptic ulcer disease is debatable,^{4, 5} increased incidence of *H pylori* has been reported in children with abdominal pain.⁷ It can therefore be argued that this group of children may be especially vulnerable to growth suppression in association with *H pylori* infection. Our results suggest that children with dyspepsia and *H pylori* infection are shorter and lighter compared to children without the infection. However, this was not significant after adjusting for confounding factors such as socioeconomic status and ethnic differences between the two groups of patients. Our study may not have been sufficiently powered to study the effect of socioeconomic status and ethnic differences on height SD scores in patients with and without the infection, and we may have failed to detect this because of limited power of our study. This may become obvious in a

Table 2 Presenting symptoms of patients with and without *H pylori* infection

	<i>H pylori</i> negative n = 160	<i>H pylori</i> positive n = 97	Information not available
Abdominal pain	147/160 (91%)	81/95 (85%)	2
Retrosternal pain	29/84 (35%)	16/66 (24%)	107
Nausea	56/160 (35%)	55/90 (61%)	7
Vomiting	104/160 (65%)	46/89 (52%)	8
Loss of appetite	65/143 (46%)	23/72 (32%)	42

Table 3 The mean (SD) weight, height, and BMI, and SD scores of children with and without *H pylori* infection

	<i>H pylori</i> positive	<i>H pylori</i> negative	Estimated difference (95% CI)	p value
Weight (kg)	41.40 (15.93)	41.66 (16.85)	0.26 (−3.92 to 4.44)	0.90
Height (cm)	144.20 (18.19)	143.65 (19.43)	0.54 (−5.36 to 4.26)	0.82
BMI	19.10 (4.03)	19.37 (4.32)	0.27 (−0.80 to 1.34)	0.61
Weight SD score	0.10 (1.39)	0.50 (1.35)		
Unadjusted			0.39 (0.05 to 0.75)	0.026
Adjusted*			0.33 (−0.07 to 0.72)	0.11
Height SD score	−0.39 (1.32)	0.05 (1.17)		
Unadjusted			0.45 (0.13 to 0.76)	0.006
Adjusted*			0.33 (−0.03 to 0.69)	0.07
BMI SD score	0.46 (1.35)	0.71 (1.31)		
Unadjusted			0.25 (−0.09 to 0.59)	0.14
Adjusted*			0.27 (−0.11 to 0.66)	0.17

*Adjusted by multiple regression for socioeconomic deprivation (IMD 2004 scores) and ethnicity.

larger study. Although not statistically significant, the difference in height SD after adjustment for IMD 2004 scores and ethnicity was still large (0.33 SDs or half a channel width on the UK growth charts). The prevalence of *H pylori* infection was higher in patients of South Asian descent compared to white Caucasian subjects. However, no significant difference in anthropometric parameters was observed between the two ethnic groups (data not shown). It must be noted that number of patients of South Asian descent was relatively small in our study.

Patients with *H pylori* infection were living in more deprived areas compared to subjects without the infection. A recent epidemiological study has shown that despite overall improvement in growth, children living in deprived areas are still relatively shorter than their peers from less deprived areas.¹⁸ The authors of this study had concluded that this was mainly due to nutritional factors. However, they did not check the *H pylori* status of their subjects. Higher prevalence of *H pylori* infection in children living in overcrowded deprived areas is well documented.^{19–20} It is possible that *H pylori* infection may have some detrimental affect on growth, especially during the pubertal growth spurt. Since the mean age of our patients was about 11 years, it may be argued that the affect on *H pylori* infection on growth may have been more pronounced in an older cohort with a longer duration of infection. Since we did not have data regarding pubertal status of our patients, we were unable to determine if some patients had delayed puberty and whether this was related to *H pylori* infection.

What is already known on this topic

- Previous studies have reported growth suppression in children with *H pylori* infection living in developing countries, in pubertal girls, and in association with iron deficiency

What this study adds

- *H pylori* infection was more prevalent in children from lower socioeconomic status across all ethnicities and children with the infection were shorter compared to those without
- Socioeconomic status but not *H pylori* infection was the major contributory factor for difference in height between the two groups

A Korean study reported that *H pylori* infection on its own did not have a significant effect on growth, but in association with iron deficiency anaemia it may delay the pubertal growth spurt.¹² *H pylori* may cause iron deficiency anaemia by multiple and complex mechanisms, which include iron avidity of the organism, impaired gastric acid secretion caused by inflammation, and possibly abnormal mucosal ascorbic acid secretion.^{21–22} Information regarding iron deficiency anaemia was available in only a small number of patients in our study and we did not find a significant correlation with any of the anthropometric variables.

The available evidence regarding *H pylori* infection and its affect on growth in children is controversial. Some cross sectional studies have reported short stature in association with *H pylori*, but these studies did not account for socioeconomic and environmental factors, which may independently suppress growth. It is possible that *H pylori* infection may cause growth suppression in vulnerable groups of children, such as: children living in developing countries¹³ or socioeconomically deprived areas in the west, those who have iron deficiency anaemia, and in pubertal girls.¹² A larger prospective study evaluating growth velocity following *H pylori* eradication may help to clarify the relation between *H pylori* infection and growth further. One would expect growth velocity to improve following *H pylori* eradication, if the infection was the primary cause for growth suppression.

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