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Original Articles

The prevalence of Helicobacter pylori *carrier rates among the healthy blood donors in Hong Kong*

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Abstract

A serological assay was employed in this study to assess the *Helicobacter pylori* carrier rates among the healthy blood donors (all Chinese) in Hong Kong. The commercial kit for detecting anti-*H. pylori* antibody titres was found to have a sensitivity of 84% and a specificity of 85% by using the histochemistry results as the gold standard. Elevated anti-*H. pylori* antibody titres were observed in 42.4%, 53.2% and 72.2% of the healthy blood donors of age below 20, 21 to 30 and 31 to 40 years respectively. This indicates a steady rise of *H. pylori* carrier rates with age. The overall *H. pylori* prevalence rate was 54.9%. The positivity of *H. pylori* in teenagers appeared to be double that reported in Western countries. Whether this is related to the younger age of peptic ulcer presentation in Hong Kong compared with Western countries is not known. However, there was no significant difference of the *H. pylori* rates between males and females of each age group although a male predominance has been well established for peptic ulcer in Hong Kong.

Keywords: *Helicobacter pylori;* Blood donors

Introduction

Peptic ulcer disease is a common ailment among the Chinese in Hong Kong. Approximately one in 10 adults suffers from peptic ulcer disease during any period of time. It is one of the major reasons for taking sick leave in our society. Previous studies have demonstrated ulcer relapse rate could be higher than 50% if no maintenance therapy is given after successful treatment by using ulcer healing agents such as H_2-receptor antagonist or omeprazole.[1, 2] In our experience, the great majority (>95%) of duodenal ulcer patients in Hong Kong has *Helicobacter pylori* (*H. pylori*) infection.[3] *H. pylori* infection is now widely accepted as one of the major permissive factors in the development of peptic ulcer disease, particularly duodenal ulcer disease.[4-6] Furthermore, there is now a reported link between *H. pylori* and gastric cancer[7, 8] as well as B-cell lymphoma.[9] The enthusiasts would advocate eradication of the organism in all the infected people to prolong peptic ulcer remission rate and furthermore try and reduce the incidence of gastric cancer in the regions where gastric cancer and *H. pylori* infection are highly prevalent. Although we know peptic ulcer disease is common in Hong Kong, we have no confirmed report of the overall prevalence rate of *H. pylori* infection in our community. We have therefore carried out a retrospective study on the stored healthy blood donor sera to estimate the prevalence rate of *H. pylori* infection among the Chinese in Hong Kong.

Materials and methods

Patients and histopathology

Thirty patients with duodenal ulcer disease (DU) and

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68 patients with a final diagnosis of non-ulcer dyspepsia were subjected to antral biopsies (x 2) which were taken within 5 cm from the pylorus. These biopsies were fixed in formalin and subsequently sectioned and stained by both haematoxylin and eosin and warthin starry staining techniques to assess the presence of gastritis and/or *H. pylori*. The histology results were used as the gold standard for the determination of the sensitivity and the specificity of the commercial ELISA for *H. pylori* diagnosis. Ten millilitres of blood sample was obtained from each patient and the sera stored at $-20°C$ until required. Stored blood donor sera (282 males, mean age of 28 and range 16 to 65 years; 177 females, mean age of 25 and range 16 to 56 years) from the year 1991 were generous gifts of the Red Cross Hong Kong with the consent of the donors. Unfortunately, apart from the age and sex, the other demographic data were withheld due to confidentiality reason. Hence we were unable to demonstrate any correlation between *H. pylori* infection rates and other socio-economic factors.

Enzyme-linked immunosorbent assay (ELISA)

A commercially available anti-*H. pylori* (GAP-IgG, Biomerica, Newport Beach, CA) kit was used in this study. Crude *H. pylori* surface proteins are used as coating antigens in this assay kit. The assay was evaluated by the company to have a sensitivity of 99.4% and a specificity of 93.5%. Furthermore, the accuracy was claimed to be 97.4%. The intraplate and interplate variations were shown to be < 12% (7 to 11.2%) and < 14% (7.2 to 13.7%) respectively. Less than 1% cross reactivity rate was demonstrated against the bacteria *Campylobacter jejuni*, *Campylobacter coli*, *Campylobacter fetus* and *E. coli*. All the sera obtained for this study were tested for the presence of elevated anti-*H. pylori* IgG antibody by using this commercial ELISA kit. The procedure was carried out according to the manufacturer's recommendations. Internal standards were provided for calibration and used as the reference to determine the levels of anti-*H. pylori* IgG. A positive result at 1:200 dilution of the serum was regarded as a positive test. The ELISA was performed by a technician who was blinded to the clinical diagnosis.

Statistics

Chi square test was used to assess the difference in *H. pylori* infection between the male blood donors and the female blood donors. A p value of < 0.05 was accepted as significant difference.

Results

Histopathology

H. pylori organisms were observed in 29/30 (97%) duodenal ulcer patients by histochemistry. Gastritis was present in all these 29 cases. The remaining one patient was found to have neither gastritis nor *H. pylori* infection. Among the 68 patients with non-ulcer dyspepsia, 35 (51.5%) was found to have *H. pylori* infection. Similarly, gastritis was always present in the *H. pylori* infected gastric mucosa. In the remaining 33 *H. pylori* negative patients, only five were observed to have mild gastritis.

GAP-IgG ELISA

Elevated anti-*H. pylori* antibody titres (GAP-IgG levels) were observed in 25/29 and 29/35 *H. pylori* positive duodenal ulcer and non-ulcer dyspepsia patients respectively. The overall sensitivity of the GAP-IgG ELISA was therefore only 84%. There was a false positive rate of 15% giving the specificity of this assay of 85%. The positive and negative predictive value of this assay was 91.5% and 74% respectively.

H. pylori *carrier rates in healthy blood donors*

The distribution of the blood donors and their *H. pylori* status are shown in Table 1. The overall *H. pylori* prevalence in this random sample was 54.9%. When they were stratified according to age there was a gen-

Table 1. The *Helicobacter pylori* positive rates of different age group in the healthy blood donors of Hong Kong.

Age (yrs.)	Males (M)		Females (F)		M+ (%)	F+ (%)	Mean+ (%)
	+	−	+	−			
16–20	14	25	25	28	35.9	47.2	42.4
21–30	83	72	50	45	53.6	52.6	53.2
31–40	47	18	18	7	72.3	72	72.2
41–65	12	11	3	1	52.2	75	55.6

eral trend of increasing *H. pylori* positive rate with increasing age. The *H. pylori* positive rate was 42.4% in those aged 20 years or under, 53.2% in those aged 21 to 30 and 72.2% in those aged between 31 to 40 years. There was no statistical significance difference of the *H. pylori* positive rate detected between males and females in each age group (all p values were higher than 0.25).

Discussion

Histological evidence of *H. pylori* infection was found in 29/30 (97%) and 35/68 (51.5%) of patients with duodenal ulcer disease and non-ulcer dyspepsia respectively. These results are very similar to previous reports.[10-12] The GAP-IgG ELISA had an overall sensitivity of 84% and specificity of 85% for detecting *H. pylori* infection in this study. The results were disappointing and certainly inferior to those claimed by the manufacturer (sensitivity 99.4% and specificity 93.5%). It was not clear why there was such a marked discrepancy. However, we have had similar experience with another commercial ELISA (Helico-G ELISA, Porton Cambridge, U.K.).[13] We believe the variation of the sensitivity and the specificity results in different studies is almost inevitable because the study populations are different. It is believed that the variation in antibody recognition of the employed *H. pylori* antigens is predominantly host mediated rather than a reflection of antigenic differences between infecting strains.[14] However, there has been claims of the presence of antigenic variation within the species which could prevent the detection of antibody responses in those patients infected with the less-common variants.[14, 15] Although the diagnostic accuracy of ELISA is inferior to the urea breath test[16] (which is probably the most sensitive, and non-invasive but the most expensive test) for confirming *H. pylori* infection it is however the most convenient, economical and acceptable method for epidemiological studies. In a study such as this, it serves the purpose well enough because it gives us an overall idea of the *H. pylori* carrier rate in Hong Kong.

Hong Kong has always been regarded as a developed city. We have shown in this study that about 40% of the healthy blood donor had acquired *H. pylori* infection by the age of 20. Furthermore, about 50% and 70% of the blood donors had serological evidence of *H. pylori* infection by the age of 30 and 40 years respectively. The *H. pylori* prevalence rate in those over 40 years of age was about 55% which was lower than what one would have expected because in the majority of previous studies,[17, 19] there was usually a linear increase in the *H. pylori* infection rate with age. The apparently lower *H. pylori* positive rate in this group of people may represent sampling error. Similarly,

the difference of the *H. pylori* positive rate between the males (52%) and the females (75%) aged above 40 years was likely a result of the small sample size in this study. It probably represents the overall reluctance to donate blood above this age in our society.

This level of *H. pylori* infection in the healthy blood donors in Hong Kong far exceeds that of other developed countries but is still lower than the developing countries.[17-19] In the developed countries, the average prevalence of *H. pylori* infection rate in the population would be around 20% by the age of 20, < 35% by the age of 30 and < 50% by the age of 40.[7, 17-19] On the other hand, the *H. pylori* infection rates increased to > 50% by the age of 20 in the developing countries. More than 75% of the population would have been infected by the age of 30 in the third world.[7, 17-19] The overall *H. pylori* prevalence of 54.9% in Hong Kong is very similar to that in certain parts of China (45.5 to 60%).[20-22] However, areas with high gastric cancer rates in China has a much higher overall *H. pylori* prevalence rates.[8, 23] Furthermore, the *H. pylori* positivity rate reaches as high as near 70% in children under 12 years of age in these areas.[24, 25] Unfortunately, we had no other demographic data to correlate the results with the socio-economic status, which is one of the major determining factors[17, 19] of *H. pylori* positivity rate, of these blood donors. Blood donors in Hong Kong are likely to have come from the middle or upper social class. Hence, the results in this study may have underestimated the overall *H. pylori* prevalence rate in the general population of Hong Kong.

In this study, we did not detect any difference in the *H. pylori* infection rate between males and females at all age bands. However, there is an increased incidence of peptic ulceration in males when compared with the females in Hong Kong. According to our recent study, the male:female ratio for duodenal ulcer and gastric ulcer disease in Hong Kong is 2.6:1 and 2.1:1 respectively (manuscript in preparation). Clearly, there is more than one permissive factors, e.g., acid hypersecretion and ingestion of non-steroidal anti-inlammmatory drugs, in the development of peptic ulceration.[26] The fact that *H. pylori* infection is found in 97% of the duodenal ulceration patients when compared with only 51.5% in the non-ulcer dyspepsia patients supports its important role in the pathogenesis of duodenal ulcer disease. There are also recent evidence suggesting the relationships between *H. pylori* carrier and gastric cancer formation.[7, 8] *H. pylori* infection is believed to be transmitted by the oral-faecal route.[17] High incidence of familial clustering[17] supports the hypothesis of person-to-person spread. There has been an overall reduction in the *H. pylori* infection rate in recent years.[7, 17] It is believed to be attributed to the overall improvement of the people's living conditions. The latter has improved significantly in recent

years in Hong Kong. Therefore, we may expect a much lower *H. pylori* infection rate in the younger generation.

In conclusion, *H. pylori* infection is common among the Chinese in Hong Kong. The overall carrier rate falls between the developing countries and the developed countries. Furthermore, like other countries, there is a steady rise of *H. pylori* carrier rate from under 20 years to 40 years of age.

Acknowledgements

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