Duodenal ulcer and *Helicobacter pylori* infection at high altitude: Experience from southern Saudi Arabia

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MEBK Ahmed, BA Al-Knawy, AH Al-Wabel, AK Foli. Duodenal ulcer and *Helicobacter pylori* infection at high altitude: Experience from southern Saudi Arabia. Can J Gastroenterol 1997;11(4):313-316.

OBJECTIVE: To study the clinical presentation, endoscopic features and prevalence of *Helicobacter pylori* in duodenal ulcer (DU) patients in southern Saudi Arabia, located 3150 m above sea level, and to compare results with those from low altitude regions of the Kingdom.

METHODS: Prospective study of patients with proven DU referred for upper gastrointestinal endoscopy at Asir Central Hospital, Abha, southern Saudi Arabia over an 18-month period.

RESULTS: Of 126 patients with proven DU, 72% were men and mean age was 40.4 years (range 18 to 68). Twenty-eight per cent were smokers and only 5% used nonsteroidal anti-inflammatory drugs. Thirty-eight patients (30%) presented with hematemesis or melena, and the majority had a single ulcer. Nineteen per cent of patients with dyspepsia had DU and 96% had *H. pylori*. These results are comparable with those reported from the low altitude, warmer regions of Saudi Arabia.

CONCLUSIONS: Age of patients and the male:female ratio were similar to those in developing countries. The frequency of smoking is lower than in western countries and no patient in this report consumed alcohol. High altitude did not affect the prevalence of DU or the frequency of *H. pylori* because the results were comparable with those from the low altitude areas of the Kingdom of Saudi Arabia and other lowland developing countries. Although great socioeconomic changes have increased the incidence of heart disease, the patterns of DU and *H. pylori* infection assume those in developing nations.

Key Words: Duodenal ulcer, *Helicobacter pylori*, High altitude, Saudi Arabia

Ulcère duodénal et infection à *Helicobacter pylori* en haute altitude: expérience de l'Arabie Saoudite méridionale

OBJECTIF : Étudier le tableau clinique, les caractéristiques endoscopiques et la prévalence d'*Helicobacter pylori* dans l'ulcère duodénal chez les patients d'Arabie Saoudite méridionale vivant à 3 150 m au-dessus du niveau de la mer, en comparaison avec les résultats obtenus dans des régions de plus faible altitude du royaume.

MÉTHODES : Étude prospective sur des patients porteurs d'un ulcère duodénal confirmé, adressés pour endoscopie des voies digestives hautes au Centre Hospitalier Asir à Abba, en Arabie Saoudite méridionale au cours d'une période de 18 mois.

RÉSULTATS : Parmi les 126 patients porteurs d'un UD confirmé, 72 % étaient des hommes et l'âge moyen était de 40,4 ans (éventail 18 à 68). Vingt-huit pour cent étaient des fumeurs et 5 % seulement utilisaient des anti-inflammatoires non stéroïdiens. Trente-huit patients (30 %) ont présenté de l'hématémèse ou des mélénas et la majorité présentaient un seul ulcère. Dix-neuf pour cent des patients dyspeptiques présentaient un UD et 96 % étaient infectés à *H. pylori*. Ces résultats sont comparables à ceux que l'on obtient à plus faible altitude, dans les régions plus chaudes de l'Arabie Saoudite.

CONCLUSIONS : L'âge des patients et le ratio homme-femme étaient semblables à ceux des pays en voie de développement. La fréquence du tabagisme était plus faible que dans les pays occidentaux et aucun patient de cette étude ne consommait d'alcool. La haute altitude n'a pas affecté la prévalence de l'UD, ni la fréquence d'*H. pylori*, parce que les résultats étaient comparables à ceux obtenus dans les zones de plus faible altitude du royaume d'Arabie Saoudite et d'autres pays en voie de développement établis dans des terres basses. Bien que les changements socio-économiques considérables puissent contribuer à la hausse des cas de maladie cardiaque, le mode de présentation de l'UD et de l'infection à *H. pylori* suit celui des nations en voie de développement.

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Received for publication June 4, 1996. Accepted October 10, 1996

Although the prevalence of duodenal ulcer (DU) is declining in the western world, as judged by the fall of mortality from 40% in 1955 to 10% in 1985 in the United States (1-3), DU is still common in developing countries where the estimated prevalence of 15% to 42% (4-7) is subject to distinct geographical variations within the same country (8). A recent report from Japan suggested a significantly higher frequency of *Helicobacter pylori* in patients with gastric ulcer living in warmer areas compared with those in the colder region (93.3% versus 62.5%) (9). Moreover, the emergence of *H pylori* as an etiological cause of DU (10,11) and its high colonization rate in subjects from the Middle East (12,13) have increased the interest in exploring DU. The effect of climate and altitude on peptic ulcer and the prevalence of *H pylori* have not been well studied. Accordingly we prospectively studied the clinical features and the prevalence of *H pylori* in patients with DU in Asir Central Hospital, Abha, southern Saudi Arabia, which is located at 3150 m above sea level, and compared results with previously published data from the low altitude areas of the Kingdom of Saudi Arabia.

PATIENTS AND METHODS

All patients referred to the endoscopy unit at Asir Central Hospital who were endoscopically confirmed with DU were prospectively studied over an 18-month period from February 1992. The hospital is 3150 m above sea level with summer temperature of 16°C to 28°C and winter temperature from 5°C to 15°C. In contrast, central, eastern and western regions of Saudi Arabia, which were used for comparison, are warmer, with summer temperature between 38°C and 44°C. Asir Central Hospital serves a population of 900,000, 50% of whom were older than 15 years (450,000). The Saudi patients were either born there or lived for more than 10 years in the area, and have similar ethnic, social and dietary habits. Non-Saudi subjects were living in the area for a mean of five years. Patients were asked about their symptoms, smoking habits, family history and use of nonsteroidal anti-inflammatory drugs (NSAIDs). Upper gastrointestinal endoscopy was performed by one author according to a weekly endoscopy rotation. During the procedure a mean of four antral biopsies was obtained for rapid urease tests and histological identification of *H pylori* using hematoxylin and eosin and Giemsa stains. The rapid urease test was performed in the endoscopy unit as described previously (14,15). Data were analyzed using an SPSS for Windows statistical package (SPSS Inc; Illinois) for simple descriptive statistics and Student's *t* test to find differences between the means. $P > 0.05$ was considered significant.

RESULTS

According to the authors' endoscopy records over a five-period (1990 to 1994), an average of 107 new DU were diagnosed annually (range 96 to 119), giving an overall hospital incidence of 24/100,000 population. As non-Saudis constitute about 20% of the adult population, the annual hospital incidences for Saudis and non-Saudis were 21/100,000 and

TABLE 1
Characteristics of 126 duodenal ulcer patients

Variable	Years old (SD)
Age	
All (n=126)	40.4 (14.6)
Males (n=91)	40.0 (15.0)
Females (n=35)	38.6 (14.9)
Saudis (n=94)	39.8 (15.0)
Non-Saudis (n=32)	38.6 (11.0)

	Number (SD)	%
Positive family history	16	13
Regular smoking (at least five/day)	35	28
Mean duration of symptoms (years)	4 (1.6)	—
Use of nonsteroidal anti-inflammatory drugs	8	6

No *P* value was significant. *n* Number of patients

TABLE 2
Clinical presentation and endoscopic findings of duodenal ulcer patients

Variable	Number (%)
Epigastric pain	119 (94)
Nocturnal or hunger pain	93 (74)
Upper gastrointestinal bleeding	38 (30)

Endoscopic finding	Number (%)	
	Present	None
Gastritis	97 (77.0)	29 (23)
Duodenitis	60 (48.0)	66 (52)
Single ulcer	104 (82.5)	
1-1.5 cm diameter range		
Multiple ulcers	22 (17.5)	
Pyloric obstruction + duodenal ulcer	5 (4.0)	

TABLE 3
Prevalence of duodenal ulcer and *Helicobacter pylori* in patients with dyspepsia in different countries

Country (reference)	Duodenal ulcer	<i>H pylori</i>
Africa		
East Africa (5)	17	90
Sudan (4)	23	56
Burundi (7)	42	—
Middle and Far East		
Northern Saudi Arabia (17)	24.6	93
Eastern Saudi Arabia (12)	19	97
Western Saudi Arabia (15)	18	92
Southern Saudi Arabia*	19	93
United Arab Emirates (11)	27	70
Malaysia (6)	19	50
Western countries (18)	8-10	35-70

*Present study

27/100,000, respectively. On the other hand, 148 of 782 patients (19%) with dyspepsia endoscoped over this period were found to have DU. However, the analysis was confined to 126 of 148 DU patients because 22 were unwilling to give

details about their illness. There were 91 men (72%) (male:female ratio was 2.6:1) and 94 were Saudis (75%). Table 1 summarizes the characteristics of the patients. No patient admitted to consuming alcohol. There was no significant difference between the ages of males and females or Saudis and non-Saudis.

The clinical presentation of patients is shown in Table 2. Endoscopically, 77% and 47.7% of DU patients had gastritis and duodenitis, respectively. Histological gastritis was identified in all patients, and the overall prevalence of *H pylori* in DU patients, identified by either rapid urease test or histology, was 96% (121 patients). The prevalence of DU and *H pylori* in dyspeptic patients in different countries and in the low altitude areas of Saudi Arabia is shown in Table 3. No difference was found between Saudis and non-Saudis with regard to *H pylori* infection rate (96.3% versus 95.7%).

DISCUSSION

Effect of altitude and climate: The present study showed that the prevalence of DU, the age group of DU patients and the frequency of *H pylori* in the high altitude region of Saudi Arabia were comparable with those reported from the low altitude regions (12,16,17) and from neighbouring developing countries (4,5,11), but were higher than those in developed countries (18). We used the low altitude and warmer regions of Saudi Arabia as controls because natives share similar genetic, social and dietary factors. The male:female ratio in this study (2.6:1) was also higher than that in reports from western countries (1.1:1) (19), but the frequency of smoking in Saudi Arabia is lower (28% versus 49%); these differences could be due to the increasing number of female smokers in the west, while most Saudis refrain from smoking because of religious teaching. We also found a lower prevalence of DU in families of Saudi versus American patients (11) (13% versus 43%). Epigastric pain, particularly the typically described hunger pain, was the main presenting feature among our patients. However, when Kang et al (20) endoscopically perfused hydrochloric acid in patients with acute DU, typical ulcer pain was produced in only 40% of patients. The consumption of NSAIDs was strikingly low (6%) in this study compared with that in developed countries (34%) (21,22), likely because our patients were younger with less joint disor-

ders and, thus, less likely to use NSAIDs. It is striking to note that alcohol consumption was not reported by any patients; this is because Islamic teachings forbid alcohol consumption.

Geographic variations: Many published reports have demonstrated clear differences in the prevalence of *H pylori* between developing and developed countries (23,24). Furthermore, because the eradication of *H pylori* was proven to alter the natural history of DU favourably (25), these differences become significant. Moreover, marked geographical variations in prevalence of peptic ulcer were found even within genetically homogeneous populations in the same country (26). We found that both DU prevalence and *H pylori* colonization frequency in our patients living at a high altitude were similar to those found in the low altitude regions of Saudi Arabia (16,17,27). Thus, it seems that high altitude and the colder climate have no influence on the prevalence of DU and *H pylori* in Saudi nationals sharing similar genetic and cultural habits.

In contrast, Kubota et al (9) found a higher *H pylori* infection rate in gastric ulcer patients living in tropical areas of Japan, but no significant differences in *H pylori* infection rates in peptic ulcer and gastric cancer between warm and cold regions of Japan. Our results also contrast with the finding of a higher prevalence of peptic ulcer in the warmer tropical areas of Africa compared with the northern Savannah states (28). A similar observation was found in the Indian subcontinent: a higher prevalence of peptic ulcer was found in the southern warmer areas versus the colder high altitude northern areas of the Punjab and Himachal Pradesh (29). It seems that factors other than the genetic background, climate and altitude, such as socioeconomic state (30), influence the occurrence of peptic ulcer and *H pylori* infection. The need for further studies of this issue cannot be overemphasized.

CONCLUSIONS

The clinical presentation of DU and the *H pylori* infection rate in DU in different regions of Saudi Arabia are similar, and thus ethnic, social, cultural and dietary factors seem to be more important determinants of DU and *H pylori* infection than altitude and climate. However, these findings need further confirmation.

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