

Epidemiology of *Helicobacter pylori* Infection and Related Gastric Pathologies in Moroccan Population

Ghizlane Bounder^{1,2*}, Hasna Boura^{1*}, Saloua Nadifiyine¹, Mohamed Reda Jouimyi^{1,2}, Mariem Bensassi¹, Maria Kadi⁴, Meriem Eljihad⁴, Wafa Badre⁴, Hakima Benomar³, Anass Kettani², Halima Lebrazi² and Fatima Maachi¹

1. Laboratory of *Helicobacter Pylori* and Gastric Pathologies, Institut Pasteur du Maroc, Casablanca 20360, Morocco

2. Laboratory of Biology and Health, Faculty of Sciences Ben M'sik, University Hassan II, Casablanca 20800, Morocco

3. Laboratory of Histo-Cytopathology, Institut Pasteur du Maroc, Casablanca 20360, Morocco

4. Gastroenterology Department, Ibn Rochd University Hospital Center, Casablanca 20360, Morocco

*Both authors contributed equally to this work.

Abstract: *Helicobacter pylori* (*H. pylori*) colonize the gastric mucosa of 50% of the world's population. This infection is closely associated with the development of peptic ulcer disease and gastric cancer. The present study was conducted to assess the prevalence of *H. pylori* infection in Moroccan population and the risk to develop gastric precancerous lesions and gastric cancer. Totally, 298 patients were enrolled, 68 of asymptomatic subjects and 230 of patients with gastric diseases. Histological examination was effected to diagnostic gastric lesions and to detect *H. pylori*. ELISA was used to determine *H. pylori* status of patients. The prevalence of *H. pylori* within asymptomatic and symptomatic subjects was observed higher. A significant relationship was detected between *H. pylori* infection and the risk of gastric diseases (p -value < 0.0001). A meaningful association between chronic gastritis increasing and age was observed (p -value = 0.03). The risk to develop gastric cancer among infected patients was observed elevated with rate of 9%. Our results showed a high prevalence of *H. pylori* in both asymptomatic and gastric diseases patients. We noticed that chronic gastric infection increases with age. We remarked also that the risk to develop gastric cancer among infected patients was elevated in our population.

Key words: *Helicobacter pylori*, prevalence, Moroccan population, gastric diseases, gastric cancer.

1. Introduction

Helicobacter pylori (*H. pylori*) are the most common bacterial infections in the world [1]. Epidemiological studies have shown that nearly half of the world's population and the majority of people in developing countries are infected with this bacterium [2]. *H. pylori* interact with the host via several mechanisms and ways during its adhesion, colonization, invasion, and induction of inflammatory and immune responses [2].

The infection by this pathogen occurs during early childhood and can persist during the subject's life in the absence of treatment. The *H. pylori* infection

presents a geographical disparity throughout the world and depends on age, socioeconomic level, population density, sanitation and hygiene [3]. In developing countries, more than 80% of the populations are affected by this pathogen, even at young ages [4]. Unlike in developed countries, the prevalence of infection is generally less than 40% and is considerably lower in children and adolescents than in adults and elderly people [5].

H. pylori can cause several gastric diseases. It is now established that gastric colonization with *H. pylori* is strongly associated with various human gastric diseases, including superficial gastritis, peptic ulcer, MALT (mucosa-associated lymphoid tissue) lymphoma, and gastric adenocarcinoma [6-8]. This pathogen causes significant morbidity and mortality worldwide and the most significant in terms of

Corresponding author: Fatima Maachi, Ph.D., research fields: *Helicobacter pylori* and gastric pathologies. Ghizlane Bounder, Ph.D. student, research fields: *Helicobacter pylori* and gastric pathologies.

mortality is gastric adenocarcinoma. Various meta-analyses suggest that the relative risk of developing gastric cancer is 2 to 3 times higher for people infected with *H. pylori* than for those without infection [9, 10] and it is believed that roughly 65-80% of gastric cancers are associated with *H. pylori* infection [6, 11]. Also, several studies have reported that 61 to 94% of patients with peptic ulcer disease are infected by *H. pylori* [12]. The management of patients infected with *H. pylori* remains complex and still imperfect, the gastroenterologist having an essential role. Therefore the choice of the detection method [13] and treatment of *H. pylori* infection is a necessary condition for the eradication of this bacterium.

Regarding the importance of *H. pylori* infection on gastric diseases, we aim to assess the prevalence of *H. pylori* infection in our Moroccan population and the risk to develop gastric precancerous lesions and gastric cancer.

2. Material and Methods

2.1 Study Population and DATA Collection

In total, 298 subjects born and living in Morocco were enrolled in the present study, divided in two categories. The first category includes 68 asymptomatic healthy subjects that were recruited from the general population. Particular care was taken to ensure that all subjects were truly asymptomatic with any gastrointestinal symptoms, history of gastritis, peptic ulcer disease or other gastrointestinal illnesses, or regular use of antacids or other gastrointestinal medicines. The second category includes 230 patients with gastritis diseases (chronic gastritis, atrophic gastritis, intestinal metaplasia, gastric cancer and other gastric diseases). The samples were collected within departments of Gastroenterology and Oncology at the IBN ROCHD University Hospital Center. Clinical information about demographic characteristics of participants including

age, sex, place of birth, drugs consumption (antibiotics, proton pump inhibitors, non steroidal anti-inflammatory drugs, smoking and alcohol habits) was collected using a structured survey. Written informed consent was obtained from all participants.

Three biopsies (1 antrum, 1 fundus, 1 lesser curvature) were sampled from patients admitted for endoscopy and blood samples have been sampled from all the participants in this study. Biopsies were used for histopathological examination. Blood samples were centrifuged and the sera were used to detect IgG antibodies against *H. pylori*.

2.2 Histopathology Test

Biopsies of mucosa were made with disposable clamps, immediately placed in a receptacle containing the fixative (10% formalin), and taken to laboratory of Histo-Cytopathology of Pasteur Institute of Morocco, where they were embedded in paraffin blocks, sectioned and stained in haematoxylin and eosin for conventional histological examination and detection of *H. pylori*.

2.3 Serology Test

Serological detection of *H. pylori* infection was performed by the quantitative IgG ELISA, using a commercially available kit (EUROIMMUN, D-23560 Lubeck (Deutschland)). A cut-off value of antibody concentration ≥ 20 RU/mL was considered positive.

2.4 Statistical Analysis

Results were statistically analyzed, ORs (odds ratios) and 95% confidential ranges (95% CI) were calculated, and groups were compared using chi-square test. Statistical analyses were performed using Sergeant, ESG, 2017. Epitools are epidemiological calculators. Ausvet Pty Ltd. Available at: <http://epitools.ausvet.com.au>. The level of $p < 0.05$ was considered statistically significant.

3. Results

3.1 Asymptomatic Population

3.1.1 Description of Studied Asymptomatic Population

In this study, 68 asymptomatic healthy subjects were enrolled, with an average age of 46.2 ± 18 years (range of 6-90 years). Within this population, 66.2% (45 subjects) were female with mean age of 48.2 ± 18.8 years, and 33.8% (23 subjects) were male with mean age of 47.7 ± 17.4 . Our population was divided into four age groups, less than 20 years with 6 patients, 21-40 years with 22 patients, 41-60 years with 23 patients, and over than 61 years with 17 patients (Table 1).

3.1.2 Prevalence of *H. pylori* in Asymptomatic Population and Its Distribution According to Age and Gender

The overall prevalence of *H. pylori* infection was showed higher in our area. A total of 92.6% (63/68) of the populations were seropositive for *H. pylori* and only 7.4% (5/68) were found uninfected. There was no significant difference between female and male patients in terms of *H. pylori* sero-positivity (Table 2).

The distribution of *H. pylori* according to age has shown that the greater prevalence of infection was observed among subjects that belong to age group of 21-40 years with 95% (21/22) compared to subjects aged less than 20 years with 83% (5/6) and the subjects aged 41-60 years 91% (21/23). Though, we noticed that the distribution of *H. pylori* infection according to age was not significantly different between groups, and this prevalence was and still

always elevated in our area [OR = 0.8; 95% CI: 0.007-93.4; p -value = 0.9] (Fig. 1).

3.2 Population of Patients with Gastric Diseases

3.2.1 Description of Studied Gastritis Patient's Population

A total of 230 gastritis patients were enrolled in this study. The mean age of patients was 49.3 ± 13 years. Within this population, 46% were men with mean age of 51.2 ± 13.7 years and 54% were women with mean age of 47.7 ± 11.7 years (Table 3). The population comprises 148 patients (64.3%) with chronic gastritis, 27 patients (11.7%) with atrophic gastritis, 17 patients (7.4%) with intestinal metaplasia, 23 patients (10%) with gastric adenocarcinoma, and 15 patients (6.6%) with other gastric illnesses.

3.2.2 Prevalence of *H. pylori* in Patients with Gastric Diseases

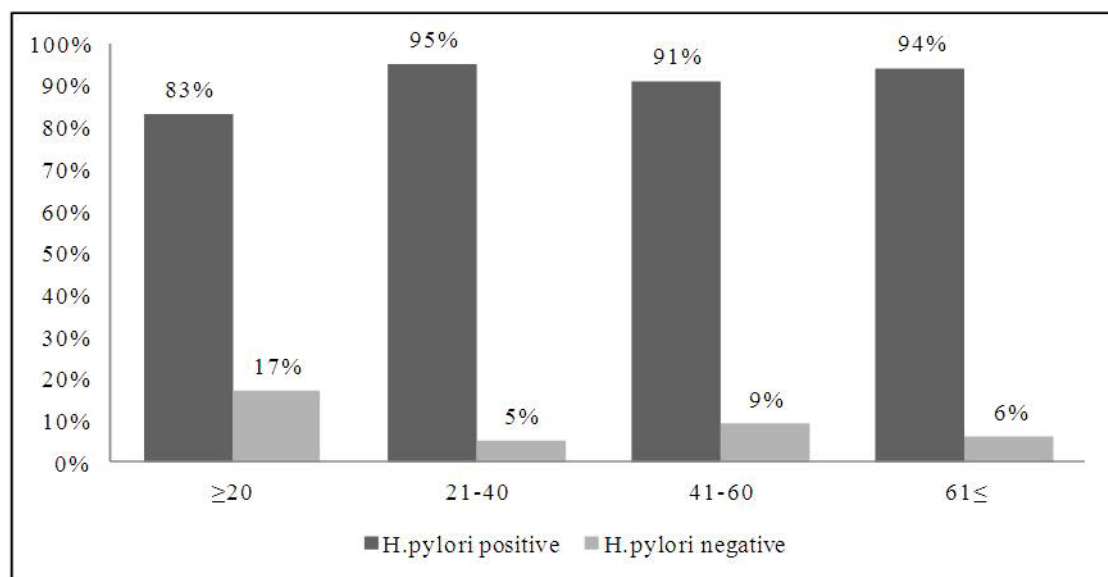
The overall prevalence of infection was observed elevated in patients with gastric diseases. Among 230 patients, 206 (89.6%) had *H. pylori* seropositive status and only 24 patients (10.4%) were negative. *H. pylori* were detected in 135/148 (91.2%) patients with chronic gastritis, 24/27 (89%) patients with atrophic gastritis, 16/17 (94%) patients with intestinal metaplasia, 19/23 (82.6%) patients with gastric cancer and 12/15 (80%) patients with other gastric diseases (Table 4). Men (92.4%) showed a higher *H. pylori* infection rate than the women (87.1%). However, this difference was not statistically significant (p -value = 0.2) (Table 4).

Table 1 Characteristics of studied Asymptomatic healthy subjects.

Subjects		Effective (%)
Gender	Man	23 (33.8)
	Woman	45 (66.2)
Age	≤ 20	6 (8.8)
	21-40	22 (32.4)
	41-60	23 (33.8)
	≥ 61	17 (25)
Total		68 (100)

Table 2 Distribution of *H. Pylori* by gender in Asymptomatic population.

		<i>H. pylori</i> positive n (%)	<i>H. pylori</i> negative n (%)	Odds ratio (95% CI), <i>p</i> -value
Total		63 (92.6)	5 (7.4)	
Gender	Man	21 (91.3)	2 (8.7)	1.33 (0.2-8.6), 1
	Woman	42 (93.3)	3 (6.7)	

**Fig. 1** Distribution of *H. Pylori* by age in Asymptomatic population.**Table 3** Characteristics of studied gastritis patient's population.

		Subjects	Effective (%)	Mean age
Gender	Man		106 (46)	51.2 ± 13.7
	Woman		124 (54)	47.7 ± 11.7
Gastric pathologies	Chronic gastritis		148 (64.3)	49 ± 13
	Atrophic gastritis		27 (11.7)	51.3 ± 10.3
	Intestinal metaplasia		17 (7.4)	53.6 ± 12.4
	Gastric cancer		23 (10)	53.6 ± 12
		Other diseases	15 (6.6)	45.5 ± 13
Total			230 (100)	49.3 ± 13

Table 4 Distribution of *H. Pylori* by gender in patients with gastric diseases.

		<i>H. pylori</i> positive n (%)	<i>H. pylori</i> negative n (%)	Odds ratio (95% CI), <i>p</i> -value
Total		206 (89.6)	24 (10.4)	<i>p</i> -value < 0.0001
Gender	Man	98 (92.4)	8 (7.5)	0.55 (0.22-1.34), 0.2
	Woman	108 (87.1)	16 (12.9)	
Gastric pathologies	Chronic gastritis	135 (91.2)	13 (8.8)	
	Atrophic gastritis	24 (89)	3 (11)	
	Intestinal metaplasia	16 (94)	1 (6)	
	Gastric cancer	19 (82.6)	4 (17.4)	
	Otherdiseases	12 (80)	3 (20)	

n: number of cases, CI: Confidence interval.

3.2.3 Distribution of Gastric Pathologies Associated to *H. pylori* Infection

Our study demonstrated that the commonest outcome of *H. pylori* infection was the chronic gastritis with rate of 65% (135/206). A total of 12% of patients (24/206) had atrophic gastritis, 9% (19/206) had gastric cancer, 8% (16/206) had intestinal metaplasia, and 6% (12/206) of those had other gastric diseases (Fig. 2).

3.2.4 Distribution of Gastric Pathologies Related to *H. pylori* Infection According to Age

The impact of age to the *H. pylori* infection severity was evaluated in this study, a meaningful association between increasing chronic gastritis and age (p -value = 0.03) was shown. In fact, chronic gastritis was

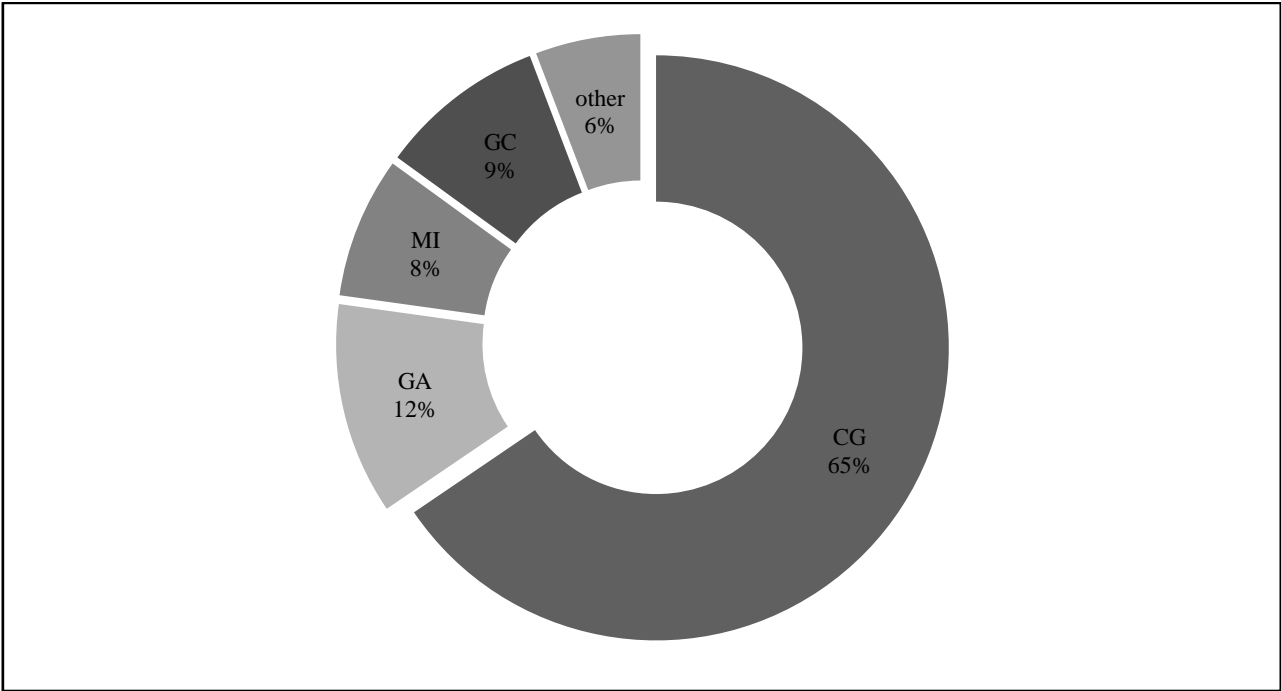


Fig. 2 Distribution of gastric pathologies associated with *H. pylori* infection.
CG: chronic gastritis, GA: atrophic gastritis, MI: intestinal metaplasia, GC: gastric cancer.

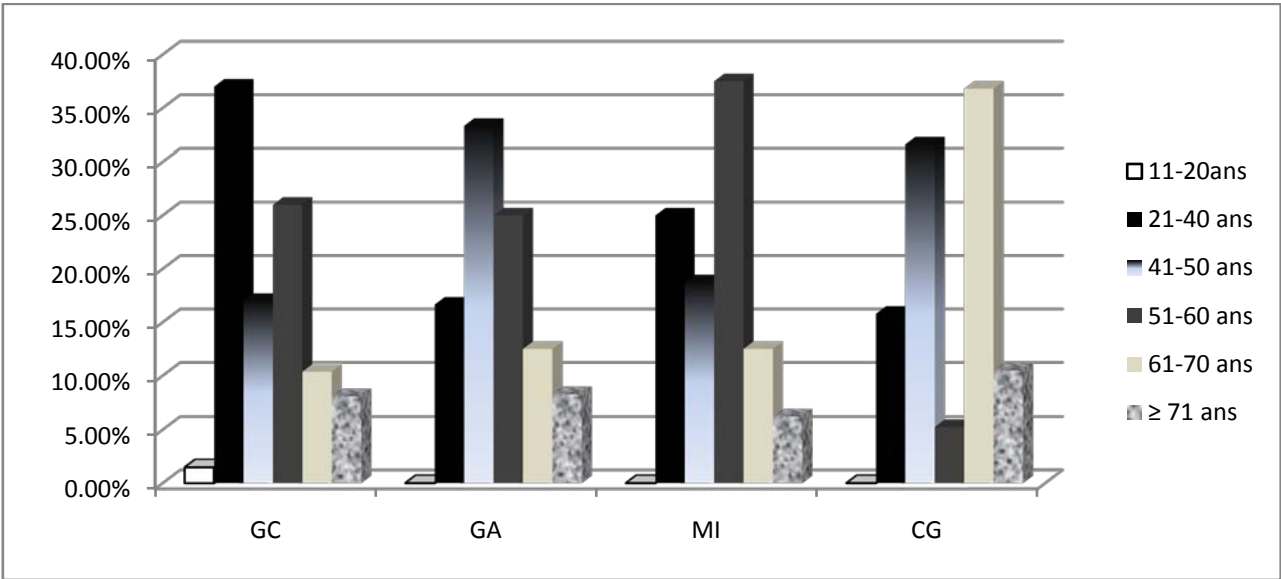


Fig. 3 Distribution of gastric pathologies related to *H. pylori* infection according to age.
CG: chronic gastritis, GA: gastritis atrophic, MI: intestinal metaplasia, GC: gastric cancer.

observed at early age ranging from 21 to 40 years, with a maximum rate of 37%, followed by atrophic

gastritis (33.3%) that appeared in an age range of 41 to 50 years, pursued by intestinal metaplasia that increased significantly in the age range of 51-60 years with a rate of 51.6%. Finally, gastric cancer occurred at a later age (61 to 70 years) with a rate of 36.8% (Fig. 3).

4. Discussions

Several epidemiological studies have shown that infection with *H. pylori* is one of the most common bacterial infections in the world. The infection rate of *H. pylori* varies according to geographical region, ranging from 30% in developed countries to 80% to 90% in developing countries [14, 15]. The present study showed that the prevalence of *H. pylori* infection in asymptomatic subjects was elevated in our population with a rate of 92%. Similar result was observed in some developing countries, in Africa (e.g. South Africa: 87% [16], Egypt: 72% [17]), in Latin America (e.g. Bolivia: 78% [18]) and in some Asian countries (e.g. Pakistani: 92% [19]). Contrary to developed countries, like Australia, Switzerland, and more generally North America and Western Europe where this incidence is low and varies between 7% and 33% [15].

The distribution of *H. pylori* infection according to age in our population was observed to be higher (95%) among subjects that belong to age group of 21-40 years. We noticed that the incidence of infection remains relatively constant and predominates in young subjects in our area, while it is rapidly declining in the developed nations, whereas an increasing prevalence of infection with age has been observed [20, 21], and the highest prevalence is recorded at age of 60 years [21].

The gender-specific prevalence has shown no difference statistically significant between male and female, and both are exposed similarly to be infected by this bacterium in agreement with Cosgun et al. [22] who reported the absence of relationship between the infection and gender. Unlike, in the United Kingdom,

a large cross-sectional survey of adults has shown that male gender was significantly associated with positive *H. pylori* serology [21]. Other studies, conducted in South Africa [16] and Albanian, demonstrated that female gender was correlated with the incidence of infection.

Epidemiological studies have shown that *H. pylori* are the major causative agent in the development of several gastric diseases, such as superficial gastritis, peptic ulcer, mucosal lymphoid lymphoma (MALT) and gastric adenocarcinoma. Our study showed a significant positive relationship between *H. pylori* infection and the risk of gastric diseases (p -value < 0.0001). Among 230 patients, 206 (89.6%) were infected by *H. pylori* compared to 10.4% (24/230) that were found uninfected. *H. pylori* were detected in 135/148 (91.2%) patients with chronic gastritis, 24/27 (89%) patients with atrophic gastritis, 16/17 (94%) patients with intestinal metaplasia, 19/23 (82.6%) patients with gastric cancer and 12/15 (80%) patients with other gastric diseases. Our results have shown an agreement with several studies that had confirmed that gastric diseases were strongly associated with *H. pylori* [23-26]. The study of Graham [27] reported that at least 80% of patients with gastric cancer were infected by *H. pylori*. The prevalence of atrophic gastritis in *H. pylori* infected patients was 82.9%, compared with 9.8% among those uninfected, and intestinal metaplasia was present in 43.1% of *H. pylori* positive persons compared with 6.2% among the uninfected patients [24].

All infected individuals develop a superficial gastritis within the first weeks of infection, followed by a chronic active gastritis which develops after months or years. After decades, patients can develop pangastritis. The latter can lead to atrophy and intestinal metaplasia, two prerequisites for the development of gastric cancer or gastric ulcer. The study of the impact of age on the development of gastric pathologies related to *H. pylori* infection has shown that the prevalence of the advanced gastritis

class, atrophic gastritis, intestinal metaplasia, ulcer and gastric cancer, increased with advanced age of patients infected with *H. pylori* ($p = 0.03$). Whereas, atrophic gastritis appeared highly at range of age 41-50 years, intestinal metaplasia at range of age 51-60 years, gastric cancer at range of age 61-70 years, compared to chronic which manifests at early age of 21-40 years. These results are reinforced by the study of Kenji et al. [28] which demonstrated the existence of a strong significant positive association between age, *H. pylori* infection and the risk of gastric atrophy and intestinal metaplasia [28]. Also, Salles et al. [29] have revealed that *H. pylori* infection is a chronic gastric infection increased with age. In contrary, of Aska et al. [24], they indicated that atrophic gastritis and intestinal metaplasia were strongly associated with *H. pylori* and not with aging.

In the majority of cases, *H. pylori* infection induces chronic gastritis with a rate of 80% to 90% and to 10% of infected individuals can develop peptic ulcers and 1-3% presents a risk of developing gastric cancer [7, 30-32]. Our study showed that the most common pathology resulting from *H. pylori* infection was chronic gastritis with a rate of 66%, followed by atrophic gastritis (12%), intestinal metaplasia (8%), and gastric cancer (9%). We also observed that the prevalence of gastric cancer (9%) in infected patients was higher compared to other studies that showed that the prevalence of risk to develop gastric cancer related to *H. pylori* was between 1 and 3% [7, 31].

5. Conclusions

Our results showed a high prevalence of *H. pylori* infection in both populations Asymptomatic and gastric diseases patients. We noticed that chronic gastric infection increases with age. We remarked also that the risk to develop gastric cancer among infected patients was elevated in our population. It is necessary to update the recommendations regarding diagnosis, treatment of *H. pylori* infection, and follow-up of the patients, to avoid the evolution of a simple chronic

gastritis to gastric cancer.

Acknowledgements

Acknowledgements contain the following elements from Laboratory of Histo-Cytopathology, Institut Pasteur du Maroc, Casablanca, Morocco:

Nadia El Gnaoui, Maria Serdani, Saida Moutahir, Oukkadi Amal.

Conflict of Interest

The authors declare that they have no competing interests.

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