

Helicobacter Pylori Infection is Associated with Portal Hypertensive Gastropathy in Patients with Liver Cirrhosis

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Background and study aims: Portal hypertensive gastropathy (PHG) is a complication of portal hypertension in patients with liver cirrhosis, and it is considered one of the causes of upper gastrointestinal bleeding. Helicobacter pylori (H. Pylori) is one of the most common pathogenic organism worldwide because it infects 50% of the population all over the world. The role of H. Pylori infection in the development of PHG and its severity is controversial. The aim of this study is to determine the frequency of H. pylori infection in cirrhotic patients with PHG, and to find out the possible association of H.pylori infection with PHG severity.

Method: This study was carried out on 90 patient with cirrhotic liver. Patients were divided into two groups according to the presence or absence of PHG diagnosed by upper endoscopy. Child's Pugh score,

MELD, uMELD and detection of H.Pylori by histopathological examination were done for all patients.

Results: The studied patients 47 were males and 43 were females their mean age was 51.96 ± 7.02 years (ranging between 38-66 years). H.Pylori infection was significantly more frequent in patients with PHG than patients without PHG ($P=0.001$). H.Pylori infection was significantly more frequent in patients with severe PHG than those with mild PHG ($P=0.012$). By multi-variant analysis, splenomegaly, presence of esophageal varices, gastric varices and H. Pylori infection were independent predictors for PHG presence.

Conclusion: H. Pylori infection could be an independent predictor for PHG development and associated with its severity.

INTRODUCTION

Portal hypertensive gastropathy (PHG) is a frequent finding diagnosed by upper endoscopy in cirrhotic patients in the form of mosaic pattern gastric mucosa and may be associated with red spots. PHG may cause upper gastrointestinal bleeding and anemia [1]. The prevalence of PHG in patients with cirrhosis ranges widely 20% - 98% which was reported by many studies as multiple various classifications and definitions were applied [2].

Helicobacter pylori (H. pylori) infection has a high prevalence especially in low socioeconomic class of developing countries, it is

considered as one of the causes of peptic erosions and ulcers [3].

In cirrhotic patients H. pylori infection is considered as a leading cause of non-variceal bleeding [4].

Moreover, Abdul Sattar et al. reported that there was a significant relation between H. pylori infection and PHG in cirrhotic patients and also, the severity of PHG [5]. Hence, the aim of this study to determine the frequency of H. pylori infection in cirrhotic patients with PHG and to detect the possible association of H. pylori infection with PHG severity.

PATIENTS AND METHODS

The current study was carried out on 90 patients with liver cirrhosis, divided into two groups according to presence or absence of PHG diagnosed by upper endoscopy, these patients attended or admitted to Hepatology and Gastroenterology Department at Nasser Institute Hospital and Department of Hepatology, Gastroenterology and Infectious diseases in Benha University Hospital, within the period between November 2018 and April 2019, after approval of the scientific committee of faculty of Medicine .

Patients with cirrhosis diagnosed by clinical manifestations, laboratory investigations and ultrasonography, which may reveal (surface nodularity, coarse echopattern of the liver, rarified hepatic central vein, enlarged caudate lobe, ascites, splenomegaly and collaterals) [5] Patients were classified according to presence or absence of portal hypertensive gastropathy which was diagnosed by upper gastrointestinal endoscopy.

Methods

Full history taking:

Age, sex, smoking, occupation and residence, abdominal pain, abdominal enlargement, Jaundice, hepatic encephalopathy, blood transfusion and history of previous attacks of bleeding.

Thorough clinical examination:

General examination: Blood pressure, pulse, temperature, Jaundice, ecchymosis, clubbing, palmar erythema, flapping tremors and lower limb edema and abdominal examination: Organomegaly (hepatomegaly and splenomegaly) and ascites.

Laboratory investigations including:

Fasting blood sugar (FBS), complete blood count (CBC), aspartate aminotransferase (AST), alanine aminotransferase (ALT), alkaline phosphatase (ALP), serum bilirubin (total, direct), serum albumin, prothrombin time (P.T), international normalized ratio (INR) and serum creatinine.

The severity of liver disease assessed by Modified Child's Pugh score[6]. MELD score (Model for End Stage Liver Disease) [7]. UMELD score (Updated Model for End Stage Liver Disease) [8].

Pelvi-abdominal Ultrasonography:

This was done using (LOGIC P6 PRO, GE Healthcare, Korea) with a convex probe (3.75 MHZ).

- Evaluation of liver (size, echo pattern , portal vein and presence of focal lesion).
- Evaluation of spleen (size and echo pattern).
- The presence of ascites .

Esophagogastroduodendoscopy (EGD):

This was done using disinfected upper gastrointestinal video scope (OLYMPUS Evis EXERAII CLV-180, Tokyo, Japan) after good preparation of the patient.

- Esophageal varices (E.V) were classified as :

- Small (E.V): defined as varices that flatten with insufflation or minimally protrude into the esophageal lumen.
- Large (E.V): defined as varices that protrude into the esophageal lumen and touch each other, or fill at least 50% of the esophageal lumen.

The grading (I-IV) classification:

- Grades I and II were reclassified as small.
- Grades III and IV were reclassified as large for this study.
- Portal hypertensive gastropathy (PHG): were reported according to Modified grading system proposed by the Baveno III meeting (Baveno, Italy(2000)on portal hypertension [9].
- PHG is mild when a pink mosaic-like mucosal pattern with no red signs or black brown spots.
- PHG is severe when the mosaic-like mucosal pattern is red and superimposed by any red sign (red point lesions and/or cherry red spots) or black brown spots.
- Presence or absence of gastric varices.
- Signs suggesting H. pylori infection e.g inflammation, erosions and ulcers.

Histopathological examination of H. pylori:

Routinely processed, Formalin-fixed, paraffin-embedded gastric antral tissues were used in this study and cut into three to four microns thick serial sections, then mounted on grease-free

slides and subjected to H&E (Haematoxylin-Eosin) stain:

Examined for the presence of *H. pylori* (Gram negative spiral to comma-shaped organisms, sometimes cocci).

Statistical Analysis

IBM SPSS statistics (V. 25.0, IBM Corp., USA, 2017-2018) was used for data analysis. Data were expressed as Mean \pm SD for quantitative parametric measures in addition to both number and percentage for categorized data.

The following tests were done:

Comparison between two independent mean groups for parametric data using Student t-test. Chi-square test to study the association between each 2 variables or comparison between 2 independent groups regarding the categorized data.

The probability of error at 0.05 was considered significant, while at 0.01 and 0.001 were highly significant. Logistic Multi-Regression analysis was used to search for a panel (independent parameters) that can predict the target parameter (dependent variable). By using logistic stepwise multi-regression analysis, we can get the most sensitive ones that predict the dependent variable. They can be sorted according to their sensitivity to discriminate according to their p-values.

RESULTS

Table (1) showed the demographic features of the studied patients, 47 were males (52.5%) and 43 were females (47.5%). Their mean age was 51.96 ± 7.02 years (ranging from 38 to 66 years). The patients were classified into two groups according to presence or absence of PHG.

Most of the patients with PHG were Child B and Child C, in contrast to most patients without PHG who were Child A as shown in table (2). MELD and UMELD scores were higher in patients with PHG with statistically significant difference in comparison to patients without PHG, as present in table (3) as well.

Table (4) showed that ascites, splenomegaly and dilated portal vein were significantly higher in patients with PHG than patients without PHG.

Helicobacter pylori (*H. pylori*) infection was significantly more frequent in cirrhotic patients with PHG than those without PHG and more frequent in patients with severe PHG than patients with mild PHG as shown in table (5&6).

By multi-variant analysis, splenomegaly, presence of esophageal varices, gastric varices and *H. Pylori* infection were independent predictors for PHG presence.

Table (1): Demographic features of the studied patients:

| | Without PHG (n = 45) | | With PHG (n = 45) | | Total (n = 90) | | P-value |
|--------------------|-------------------------|-------|----------------------|-------|-------------------|------|---------|
| | No. | % | No. | % | No. | % | |
| Gender | | | | | | | |
| Male | 19 | 42.2 | 28 | 62.2 | 47 | 52.2 | 0.058 |
| Female | 26 | 57.8 | 17 | 37.8 | 43 | 47.8 | |
| Age (years) | | | | | | | |
| Range | 38.0 – 66.0 | | 39.0 – 66.0 | | 38.0 – 66.0 | | 0.048 |
| Mean \pm SD. | 52.42 \pm 7.753 | | 55.51 \pm 6.814 | | 51.96 \pm 7.02 | | |
| Urban | 16 | 35.6% | 12 | 26.7% | 28 | 31% | 0.362 |
| Rural | 29 | 64.4% | 33 | 73% | 62 | 69% | |
| Farmer | 4 | 8.89% | 8 | 17.8% | 12 | 13% | 0.215 |
| Non farmer | 41 | 91% | 37 | 82.2% | 78 | 87% | |

PHG: portal hypertensive gastropathy, SD: standard deviation.

Table (2): The severity of liver disease assessed by Child–Pugh Classification among the studied patients.

| Child grade | Group I Without PHG | | Group II With PHG | | P-value |
|-------------|---------------------|------|-------------------|------|---------|
| | N | % | N | % | |
| Child A | 43 | 95.7 | 8 | 17.8 | 0.000 |
| Child B | 2 | 4.3 | 28 | 62.2 | |
| Child C | 0 | 0 | 9 | 20 | |

Table(3): The severity of liver disease in patients assessed by MELD and uMELD scores.

| Parameter | Group I Without PHG | | Group II With PHG | | P-value |
|-----------|---------------------|-------------|-------------------|-------------|---------|
| | Range | Mean±SD | Range | Mean±SD | |
| MELD | 8.0 – 16.0 | 12.64± 2.28 | 7.0 – 23.0 | 16.56± 4.36 | 0.000 |
| UMELD | 2.5 – 4.3 | 3.15 ± 0.27 | 2.7–4.5 | 3.66± 0.49 | 0.000 |

MELD: Model for end stage liver disease, UMELD: Updated Model for end stage liver disease.

Table(4): Abdominal ultrasonographic features of the studied patients.

| Parameter | Group I Non PHG n=45 | | Group II PHG n=45 | | P-value |
|---|-------------------------|------------|----------------------|-------------|---------|
| | Range | Mean± SD | Range | Mean ± SD | |
| Spleen size (normal: 12-14cm) | 11 - 14.06 | 12.56±0.92 | 12 – 21.5 | 15.77± 2.39 | 0.000 |
| P.V (cm) (normal: 1-1.3) | 1.06 – 1.5 | 1.37±0.108 | 1.2 – 1.8 | 1.46± 0.282 | 0.048 |
| | no | % | No | % | P-value |
| Ascites | 6 | 13.3 | 34 | 75.5 | 0.000 |
| Liver | | | | | |
| Enlarged | 2 | 4.4 | 0 | 0 | 0.153 |
| Shrunk | 43 | 95.5 | 45 | 100 | |

P.V: portal vein.

Table (5) : Endoscopic features of the studied patients.

| Parameter | Group I non PHG no=45 | | Group II PHG no=45 | | P-value |
|---------------------------|--------------------------|-------|-----------------------|------|---------|
| | No | % | No | % | |
| Esophageal varices | 6 | 13.33 | 43 | 95.5 | 0.000 |
| Small varices | 4 | 8.88 | 14 | 32.5 | 0.000 |
| Large varices | 2 | 4.4 | 29 | 67.4 | |
| Gastric varices | 1 | 2.22 | 9 | 16.1 | 0.007 |
| PHG grade | | | | | |
| Mild | 0 | 0 | 25 | 55.6 | 0.000 |
| Severe | 0 | 0 | 20 | 44.4 | |

Table (6) : Association between H. pylori and PHG.

| | Without PHG (n = 45) | | With PHG (n = 45) | | P-value |
|------------------|-------------------------|------|----------------------|------|---------|
| | No. | % | No. | % | |
| H. Pylori | | | | | |
| Negative | 31 | 68.9 | 15 | 33.3 | 0.001 |
| Positive | 14 | 31.1 | 30 | 66.7 | |

H.Plori: Helicobacter pylori.

Table (7): Association between the severity of PHG and H. Pylori.

| | With PHG | | | | P-value |
|------------------|------------------|----|--------------------|----|---------|
| | Mild (n = 25) | | Severe (n = 20) | | |
| | No. | % | No. | % | |
| H. pylori | | | | | |
| Negative | 12 | 48 | 3 | 15 | 0.012 |
| Positive | 13 | 52 | 17 | 85 | |

Table(8): Multi-variant analysis for prediction of PHG presence.

| Multi-Regression analysis: | | | | |
|----------------------------------|------------|--------|-------|------|
| Dependent Variable: PHG | | | | |
| Item | Reg. Coef. | T | P | Sig. |
| (Constant) | -0.602 | -0.809 | 0.422 | NS |
| Age | 0.004 | 0.928 | 0.357 | NS |
| Jaundice | -0.062 | -0.584 | 0.561 | NS |
| Abdominal enlargement | 0.018 | 0.128 | 0.898 | NS |
| Splenomegaly | 0.068 | 4.52 | 0.000 | HS |
| ascites Presence of | 0.104 | 0.78 | 0.439 | NS |
| Hemoglobin | -0.013 | -0.719 | 0.475 | NS |
| ALT | 3.626E-06 | 0.004 | 0.997 | NS |
| AST | 0.001 | 1.327 | 0.190 | NS |
| Creatinine | 0.097 | 0.387 | 0.701 | NS |
| Child classification | 0.109 | 0.822 | 0.415 | NS |
| MELD | -0.015 | -0.483 | 0.631 | NS |
| uMELD | 0.019 | 0.053 | 0.958 | NS |
| Portal vein diameter | -0.411 | -1.575 | 0.121 | NS |
| Esophageal varices | 0.218 | 4.413 | 0.000 | HS |
| Gastric Varices | -0.141 | -2.141 | 0.037 | S |
| Positivity of H.Pylori infection | -0.227 | -3.175 | 0.002 | HS |

RegCoef: regression coefficient, NS: non significant, S:significant, HS: highly significant.

DISCUSSION

Portal hypertensive gastropathy (PHG) is diagnosed by upper endoscopy characterized by a mosaic-like pattern or a diffuse, erythematous and reticular cobblestone pattern of gastric mucosa consisting of small polygonal areas with or without superimposed punctate red lesions and a depressed white border [10].

PHG develops as a consequence of portal hypertension which results in increasing gastric blood flow and congestion of mucosal and submucosal blood vessels leading to decrease of the mucous secretion and the local mucosal defense mechanism. Hence, the mucosa becomes susceptible to injurious agents such as non-steroidal antiinflammatory drugs (NSAID) and H. Pylori infection [11,12]. This study aimed to evaluate H. pylori infection in patients with liver cirrhosis and to detect the association of H.

pylori infection with PHG and the severity of PHG.

The present study was conducted on 90 patients with liver cirrhosis. Patients were divided into two groups according to the presence of PHG. In this study, PHG was more common in males than in females, and this came in agreement with Abdul Sattar et al. [5] who mentioned that PHG was more frequent in males, and Bang et al. [13] who mentioned that male predominance was observed in the collected data for 78.7 % of the PHG patients.

Regarding the age, the mean age was higher in patients with PHG with statistical significance, which came in agreement with Kiyono et al.[14] who mentioned that the PHG patients were significantly older than the non-PHG patients.

Ascites was more predominant in the PHG group than in the non-PHG group. These findings

agreed with the results of Kumar et al. [15] and Mandhwani et al. [16] who showed a significant relation between PHG and presence of ascites, where ascites was more in cirrhotic patients with PHG.

Regarding the severity of liver disease assessed by Child Pugh score, most patients with PHG were of Child class B and Child class C, in contrast with the patients without PHG, whose majority were of Child class A. This agreed with Delisi et al. [17] who reported a significantly higher prevalence of PHG in Child-Pugh class B and C patients when compared to patients with Child class A, and with Tiwari et al. [10] who reported that the presence of PHG was significantly associated with Child-Pugh classification.

Regarding the severity of liver disease evaluated by MELD and uMELD scores, there was a statistically higher MELD and uMELD scores in patients with PHG, which came in accordance with Kim et al. [18] who showed that there was a significant relation between PHG and MELD scores. On the contrary, Eid et al. [4] showed that there was no statistically significant association between PHG and MELD scores, with mean score for PHG patients being 17.4 ± 3.22 and for non-PHG patients being 16.7 ± 1.94 ($P=0.396$). It also disagreed with Tiwari et al. [10] who reported that there was no significant association between MELD score and PHG. This could be due to limitations of MELD scoring system.

Regarding abdominal ultrasonographic findings, ascites was significantly more in patients with PHG group than in non-PHG group, agreed with Mandhwani et al. [16] who found that there is significant association of PHG and presence of ascites. Regarding to examination of spleen, the present study showed that the splenic size was significantly enlarged in PHG group which agreed with Kim et al. [18] who reported that the mean of spleen size was higher in cirrhotic patients with PHG. However, it disagreed with Nashaat et al. [19] who documented that there was no statistically significant correlation between PHG and splenic diameter. The portal vein was significantly dilated in PHG patients compared to those with non-PHG which agreed with Zardi et al. [20] who stated that the Portal vein was more dilated in cirrhotic patients with PHG, reflecting the increase in the portal venous pressure with subsequent formation of the gastric mucosal spots (gastropathy).

Concerning endoscopic findings in the present study, esophageal varices and gastric varices were significantly more predominant in patients with PHG than in patients without PHG, in accordance with Abbasi et al. [21] who reported that the presence of oesophageal varices had significant relation with PHG, suggesting the presence of common pathophysiology for both of them. However, this disagreed with Tiwari et al. [10] who found that there was no association between the presence and esophageal varices and the presence of PHG. The variations in the results of the studies might be due to the fact that PHG is an objective diagnosis, consequently, there is interobserver variability. Moreover, many classifications for stratifying PHG severity. Most of the studies included unmatched groups of CLD, and others have included patients with portal hypertension caused by any causes other than cirrhosis.

This study showed that the large varices were more detected than small varices in patients with PHG, which agreed with Abbasi et al. [21] who reported that the PHG prevalence was higher in patients with large esophageal varices when compared to patients with small sized varices, and this might be due to sharing a common mechanism.

Concerning the relation of *H. pylori* to PHG, the present study showed that *H. Pylori* infection was more frequent in patients with PHG (66.7%) when compared to those without PHG (31.1%), and this came in agreement with Safwat et al. [22] who detected that the prevalence of *H. Pylori* infection was higher in patients with PHG in comparison to patients without PHG (69.2% vs. 42.9%; $p=0.022$). Moreover, Abdul satar et al. [5] detected that the presence of *H. pylori* infection was found in 31(44.3%) patients who had PHG when compared to 19 (27.1%) patients without PHG. Hence, they concluded that there was a significant association between *H. pylori* infection and PHG in patients with liver cirrhosis. Moreover, Eid et al. [4] reported that the prevalence of PHG was higher in PHG patients in comparison to those without (34 vs. 10%), this is due to the gastric mucosa in case of cirrhosis, which might provide a good media for *H. pylori* colonization, specifically when associated with swelling of the gastric mucosa and severe hemorrhagic congestion resulting in elevated inducible nitric oxid synthase (iNOS) expression, leading to increase reactive oxygen

species and impaired defence mechanism of gastric mucosa due to PHG.

Hu et al. [23] found that the association between H. Pylori and PHG is owing to the fact that gastric mucosa in PHG has thinner mucus and higher pH because of the decreased acid secretion and decreased prostaglandin, a protector of stomach, which eventually weakens the gastric barrier. Additionally, PHG has a lower resting gastric trans-mucosal potential difference that leads to decrease in intracellular pH among mucosal cells and the reduction of mucus and the weakness of the gastric mucosal barrier predisposing to mucosal lesions and resulting in suitable media for H. pylori infection.

Regarding the relation between PHG severity and H. pylori infection, H. Pylori infection was significantly more frequent in patients with severe PHG than in those with mild PHG. This was in agreement with Hammad [24] who showed a significant association between H. pylori infection and PHG severity, as H. pylori virulence factors induce the production of proinflammatory cytokines as tumor necrosis factor- α , inducing mucosal inflammation and predispose to severity of PHG.

By multi-variant analysis for prediction of PHG presence, splenomegaly, presence of esophageal varices, gastric varices and H. Pylori infection were significantly independent predictors for presence of PHG and this came in agreement with Eid et al. [4] who documented that there was a significant association between H. pylori infection and PHG. Moreover, the splenic size was correlated significantly with presence of PHG in cirrhotic patients which agreed with Elwakil et al.[25] who mentioned that a complex relationship between PHG and presence of oesophageal varices (EV) has been observed in various studies. On one hand, new onset of PHG has been found to be associated with new onset or higher grade of EV. On the other hand, endoscopic obliteration of large grade varices and thus reduction in their size has been studied as a risk factor to endoscopic and pathologic deterioration of PHG.

CONCLUSION

H. Pylori infection was significantly associated with the presence of PHG and its severity. Presence of splenomegaly, esophageal varices

(EV), gastric varices and H. pylori infection can independently predict the presence of PHG.

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Author contribution: All authors shared in conception of the idea, searching the literature, drafting the manuscript and all of them approved the final manuscript.

Ethical Approval: A written informed consent was taken from all included patients, and the study was approved by the Ethical Committee of our institution.

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