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Article

PREVALENCE OF HELICOBACTER PYLORI INFECTION IN HEMODIALYSIS PATIENTS AND ASSOCIATION WITH SERUM MAGNESIUM; SINGLE CENTER STUDY

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ABSTRACT: Patients with hemodialysis also experience gastrointestinal complications; however, it is uncertain whether infection with Helicobacter pylori is popular in these patients. OBJECTIVE: This research aims to determine the prevalence of infection with H. pylori in patients with stable chronic hemodialysis and its relation to serum magnesium level. Methods: The study was carried out at Theodor Bilharz Research Institute (TBRI) Hospital, as we have identified the prevalence of H. pylori infection in 80 Egyptian patients with hemodialysis by the anti-Helicobacter pylori IgG serum antibodies, and its relation to serum magnesium level. The results were compared to 40 subjects with normal renal function. RESULTS: 24 patients (30%) of the patients group and 18 subjects (45%) of the control group were positive for H. pylori infection, these differences were highly significant (P value < 0.001). There was no statistical difference in serum Mg level within the hemodialysis group between positive and negative H. pylori Ig G patients (P value 0.7).

Keywords: Helicobacter pylori; hemodialysis; Magnesium; end stage renal disease

INTRODUCTION

Chronic kidney disease (CKD) patients with different gastrointestinal symptoms including dyspepsia, lack of appetite, and heartburn, as well as gastrointestinal system histological and functional changes (1, 2). These symptoms can cause malnutrition in patients with CKD which is a strong predictor of morbidity and mortality. In addition, 25–75% of CKD patients with dialysis have multiple gastrointestinal lesions and complications (e.g., gastric erosions, peptic ulcers, angiodysplasia, and gastrointestinal bleeding) (3, 4).

Helicobacter pylori, a spiral-shaped Gram-negative flagellate bacterium (5), is present in about 50% of the general population, and in some developing countries infection levels exceed 70 % (6). Infection with H. pylori has not only been associated with gastrointestinal disease pathogenesis (gastritis, ulcerative diseases, low grade mucosa-associated lymphoid tissue lymphoma, and gastric malignancies) (7), but also to different extra gastrointestinal disorders (8). Patients undergoing long periods of hemodialysis or continuous ambulatory peritoneal dialysis (CAPD) have gastrointestinal manifestations from 25 to 75 % of end-stage renal disease (ESRD) (9). High concentration of urea has been postulated to make these patients' gastric mucosa more vulnerable to colonization by H. pylori (10). Yet a relation between H. Pylori, and asymptomatic or symptomatic dialysis patients, remain unknown. The prevalence of H. pylori infection can be as high as 64% in CKD patients and substantially higher in dialysis patients than in regular patients (11, 12). On the other hand, some researchers state that CKD patients have factors that may inhibit the growth of H. pylori in the stomach, such as proinflammatory cytokines, elevated pH, high levels of blood urea and antibiotic therapy (13, 14).

However, some research showed no difference in H. pylori prevalence infection among patients with hemodialysis and healthy individuals, leading to the belief that in this population, the urea level is not a risk factor that predisposes H. pylori infection (15, 16) Because of these inconsistent results, the significance of the problem in dialysis patients remains unclear.

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Magnesium (Mg) is a significant intracellular cation which is distributed among 3 main compartments: extracellular fluid (1%), intracellular space, (34%) mineral bone phase (65%)(17). Around one-third of the circulating Mg is attached to plasma proteins, whereas the remaining two-thirds are free, and theoretically accessible biologically (17, 18). Mg seems to be an important factor both for regulation of gastric acid secretion (together with Ca^{2+}) and for survival and virulence of H. pylori (19). Therefore, it is important to assess if H. pylori infection is accompanied by variations in the serum Mg levels in patients with CKD.

PATIENTS

This cross-sectional research was conducted in a total of 80 patients receiving hemodialysis (HD), 33(41.25%) females and 47(58.75%) males at TBRI. A total of 40 subjects who visited our hospital for an annual check-up on normal renal function, irrespective of the gastrointestinal symptoms, were used as control. Patients receiving proton pump inhibitors (PPIs) and who were unable to discontinue therapy at least two weeks prior the study were excluded, and patients who received antibiotics for 4 weeks and bismuth for 2 weeks prior the study started. The study was carried out at TBRI Hospital. All patients signed their consent form to take part in the research. Full History taking of all patients was done, particularly concerning the dyspepsia and the medications they were taking. Patients were also examined for blood pressure (BP).

Laboratory Methods

Samples of the blood were collected after fasting overnight. Within 15 min of collection the blood samples were centrifuged. Complete blood picture was performed using the automatic Hematology Analyzer Celtac-MEK 8118 (Nihon Kohden). Routine kidney function tests were assessed using automated analyzer Beckman coulter Synchron CX9 Pro. Serum electrolytes (Mg, Ca and PO4) were measured using fully automated instrument (AVL-9130) USA

At the beginning of this study, all patients were evaluated by serological testing using anti-H. pylori immunoglobulin G (IgG) for the H. pylori status. An enzyme-linked immunosorbent assay (ELISA) was used to measure H. pylori specific IgG antibody titer. A titre >1.1 U/ mL, according to the manufacturer's instructions, was construed as positive. A titre of serum Mg >2.5 mg/dl is considered high.

Statistical analysis:

Using Microsoft Excel 2010 and statistical package for social science (SPSS version 24.0) for windows (SPSS IBM., Chicago, IL), the data will be analyzed. Continuous variables normally distributed were defined as mean ± SD with 95 % confidence interval and use of frequency and percentage for categorical variables; p value < 0.05 is deemed to be statistically significant. We conducted The Student's t test to compare the means of the normally distributed variables among groups. $\chi 2$ test or the exact Fisher test would be used to determine the distribution of categorical variables among groups. The diagnostic performance of Mg and H. pylori (Ab. Titer) will be evaluated by receiver operating characteristic (ROC) curves. The area under the ROC (AUROC) is used as an index for comparing the accuracy of the test. The study group diagnosis cut-off will be taken from the point of sensitivity and specificity combined. It also showed the sensitivity and specificity for relevant cut-offs. In this study, to show the relationship between various parameters, Spearman's Rank-Order Correlation is used. Effect modifications were assessed by stratification, statistical interaction was evaluated by including in the logistic regression model main effect variables and the terms of their product.

RESULTS

A total of 80 patients receiving HD, 33 (41.25%) females and 47(58.75%) males at TBRI hospital were enrolled in the study. 40 subjects with normal renal function, 18 (45%) females and 22 (55%) males, who visited our hospital for annual health checkup, irrespective to the gastrointestinal symptoms, were used as control. 24 patients (30%) of the HD group and 18 subjects (45%) of the control group were positive for H. pylori infection, these variations have been highly significant (P value < 0.001). Table 1 shows demographic and biochemical data for the study groups. Different causes of renal failure in the patients' group are shown in table 2.

Table 1: Demographic and biochemical data

		Controln=40	HD Patientsn=80	P. value
Age		55.25±11.28	56.75±13.12	0.5
Gender	Female	18(45.0%)	33(41.25%)	0.4
	Male	22(55.0%)	47(58.75%)	
Hb.		11.80±1.10	10.91±1.62	0.001**

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Urea	29.90±5.84	136.86±38.97	0.001**
Creat.	0.81±0.19	7.58±1.39	0.001**
Ca.	8.71±0.50	8.04±0.92	0.001**
P	3.79±0.37	5.27±1.55	0.001**
Mg	1.98±0.22	2.42±0.40	0.001**
H. pylori Ig.G Negative	22(55.0%)	56(70.0%)	0.001**
H. pylori Ig.G Positive	18 (45.0%)	24 (30.0%)	
H. pylori (Ab. Titer)	0.92±0.29	0.85±0.35	0.2

Age, Hb, UREA, CREAT, Ca, P, Mg and H. pylori (Ab. Titer) are represented as Mean ± SD; the data were analyzed by student t test. While Gender, Cause and H. pylori Ig.G are represented as frequency and percent; the data were analyzed by X2 test. *P value ≤ 0.05 significant; **P value ≤ 0.01 highly significant.

Table 2: Different causes of renal failure in the patients' group

DM	9 (11.3%)
FMF	1 (1.3%)
HTN	39 (48.8%)
HTN+DM	4 (5.0%)
NSAIDs	5 (6.3%)
Obstructive Uropathy	7 (8.8%)
PCK	6 (7.5%)
Pyelonephritis	1 (1.3%)
Reflux	3 (3.8%)
SLE	1 (1.3%)
Unknown	4 (5%)

There was no statistical difference in serum Mg level between positive and negative H. pylori Ig G patients (P value 0.7). Table 3

Table 3: Comparison between positive and negative H. pylori IgG HD groups

		Negative n=56	**Positive n=24**	**P. value**
Age		58.46±13.18	52.75±12.32	0.07
Gender	Female	24(42.9%)	9(37.5%)	0.2
	Male	32(57.1%)	15(62.5%)	
Duration		6.65±4.47	7.27±4.62	0.5
Hb.		10.87±1.64	10.99±1.59	0.7
Urea		136.30±37.72	138.17±42.53	0.8
Creat.		7.42±1.47	7.93±1.14	0.1
Ca.		7.99±0.90	8.14±0.98	0.5
P		5.44±1.46	4.85±1.72	0.1
Mg		2.43±0.42	2.40±0.36	0.7

Age, Duration, Hb, UREA, CREAT, Ca, P, Mg and H. pylori (Ab. Titer) are represented as Mean ± SD; student test analyzed the data . While Gender and Cause are represented as frequency and percent; X2 test analyzed the data. *P value ≤ 0.05 significant; **P value ≤ 0.01 highly significant.

It has been found that there is no relation between the studied parameters and the positivity of H. pylori Ig.G (Table 4).

Table 4: Univariate analysis showing odd Ratio of the studied parameters for positivity of H. pylori Ig.G.

		O.R	**95% C.I**	**P. value**
Age		0.968	0.933 - 1.004	0.08
Sex		1.250	0.469 - 3.335	0.656
Cause		-	-	-
	DM	3.5	0.145 - 84.694	0.441
	FMF	-	-	-
	HTN	1.6	0.093 - 27.547	0.746
	HTN+DM	-	-	-

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	NSAIDs	1.5	0.055 - 40.633	0.810
	Obstructive Uropathy	-	-	-
	PCK	2.0	0.078 - 51.593	0.676
	Pyelonephritis	-	-	-
	Reflux	0.5	0.013 - 19.562	0.711
	SLE	-	-	-
	Unknown	-	-	-
Duration		1.030	0.929 - 1.143	0.572
Hb		1.048	0.780 - 1.409	0.756
Urea		1.001	0.989 - 1.014	0.844
Creat.		1.331	0.911 - 1.943	0.139
Ca		1.197	0.705 - 2.031	0.505
P		0.772	0.556 - 1.072	0.123
Mg		0.836	0.248 - 2.811	0.772

OR; Odd Ratio, 95% C.I; Confidence Interval, p-value calculated depend on simple linear regression analysis.

* p. value <0.05 is significant, ** p. value <0.01 is highly significant.

We found a negative correlation between the H. pylori IgG titre and between age of the patient (p value 0.029) and serum phosphorus level (p value 0.01), a positive correlation between serum Mg level and between duration of hemodialysis, serum urea, creatinine, and serum phosphorus level (p value 0.001) and we did not find any correlation between H. pylori IgG Titre and between serum Mg level. (Table 5)

Table 5. Correlation study

	Mg		H. pylori (**IgG titre)**	
	R	**P**	**r**	**P**
Age	-0.015	0.870	-0.199*	0.029
Sex	0.044	0.632	0.041	0.656
Duration	0.517**	0.001	-0.039	0.675
Hb	-0.143	0.120	0.064	0.489
Urea	0.584**	0.001	-0.028	0.760
Creat	0.487**	0.001	0.072	0.436
Ca	-0.060	0.517	-0.004	0.968
P	0.442**	0.001	-0.233*	0.01
Mg			0.033	0.720
IgG titre	0.033	0.720		

r = Correlation Coefficient, p= p. value *. Correlation is significant at the 0.05 level (2-tailed).

**. Correlation is significant at the 0.01 level (2-tailed).

DISCUSSION

Helicobacter pylori is a gram-negative bacterium and closely associated with gastritis type B, peptic ulcer disease, and correlated to mucosa-associated lymphoid tissue lymphoma (MALT), and gastric adenocarcinoma (20-22).

In our study we found that there is a decrease in H. pylori infection prevalence in patients with ESRD on HD (30%) compared with controls (45%). This is similar to other investigators who also reported reduced prevalence of H. pylori in patients with dialysis than those with normal renal function and suggesting that renal dysfunction patients tend to be partly safe against H. pylori (13-15). This could be explained by the fact that high urea levels in blood and gastric secretions of renal patients, proinflammatory cytokines from activated inflammatory cells (interleukin-1b, -6, -8, and tumor necrosis factor) and repeated courses of antibiotics usually prescribed for hemodialysis patients for different infections, all lead to inhibition of H. pylori growth in the gastric mucosa (12, 23). Some studies suggested that prevalence is close to that of the general population (24), indicating that higher levels of urea in stomach juice and blood in patients with ESRD does not pose a risk factor for H. pylori infection (12, 25). There are, however, few reports of H. pylori infection prevalence in HD patients indicating an increase in prevalence among patients undergoing hemodialysis (4, 26). The low gastric motility and hypochlorhydria may be synergic risk factors for H. pylori gastric colonization in uremic cases (27).

Haruma et, al**.** found that age is a closely related factor in the proportion of positive H. pylori patients (28). In our study, however, we did not find a relation between age and the prevalence of H. pylori infection.

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As regard blood urea and creatinine, we did not find a difference in their mean blood level between H. pylori positive and negative HD patients. This suggests that elevated urea levels in our population are not a risk factor for H. Pylori acquisition, as other investigators have already mentioned(29).

Most hemodialysis patients have upper gastrointestinal symptoms (30, 31). Similar findings have been found in our study, and nearly all HD patients with ESRD indicated gastrointestinal discomfort. These dyspeptic symptoms were found in our patients with and without H. pylori infection compared to controls (data not shown). This population may have factors other than H. pylori infection that cause dyspepsia. Possible causes include excessive use of steroids, non-steroidal anti-inflammatory medications, iron treatment and elevated urea levels, besides the increased serum gastrin levels, resulting in greater secretion of gastric acid (32, 33).

As regard duration of HD, we did not find that it affected the proportion of H. pylori- positive patients, although other studies showed that H. pylori- infection is significantly less in patients with prolonged dialysis (34).

In this study, we found that, there was a very substantial increase in serum magnesium level in HD patients relative to control group (p value 0.001), but the difference was not significant in serum Mg level between positive and negative H. pylori patients on HD, and no association existed between the H. pylori specific IgG titre and serum Mg level.

Similarly, Baradaran et, al. did not find in diabetic patients of type 2 with a mean creatinine clearance of 62 ± 23 mL / min, there is a significant association between serum H. pylori specific antibody titer and serum magnesium levels (35). Nasri H , however, observed a substantial positive association between H. pylori IgG titre with serum magnesium in HD patients (36). He explained that, the acquisition of magnesium ions is necessary for H. pylori infection and hypothesized that the high serum magnesium levels in patients with hemodialysis and its higher concentration in the stomach mucosa may boost the stomach colonization of H. pylori in patients with hemodialysis but not in patients with earlier CKD stages who did not initiate dialysis(36).

As regard renal transplant patients, Hafizi et, al. stated that H. pylori positive patients had a higher serum magnesium level than H. pylori negative patients (37), while another study , also conducted on renal transplant patients, by Baradaran et. al. did not show any association between serum magnesium and H. pylori Ab titre (38).

Gastric complications in patients who have hemodialysis are common (39), and H. pylori infection is thought to be one of the causes of gastrointestinal disease in these patients (40, 41). Another important factor to be considered in this context is the alteration in magnesium metabolism in renal patients (42, 43).

CONCLUSION

Our research revealed that H pylori infection prevalence in ESRD is low compared to control. However there is some indication that H. pylori infection may increase the risk of gastrointestinal lesion in patients with ESRD. Before a final conclusion is reached, more comprehensive as well as multicenter research is required to address the different implications of these findings. We did not find any relationship between serum Mg level and H. pylori IgG titre in hemodialysis patients.

RECOMMENDATION

Although H. pylori prevalence in our patients undergoing hemodialysis is low, long-term dialysis patients with H. pylori infection should receive eradication therapy, irrespective of gastric symptoms, to reduce the chance of developing severe gastroduodenal disease. In future studies regular check-ups and eradication treatment for patients with dialysis should be assessed. In order to demonstrate the correlation between serum magnesium level and H. pylori infection in hemodialysis and the clinical significance of our findings, more studies are needed.

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