A Comparative Study between Esophagogastroduodenoscopy and Non-Invasive Testing for Diagnosis of Helicobacter Pylori Infection in Hemodialysis Patients

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ABSTRACT

Background: Worldwide, data are conflicting on the prevalence of Helicobacter pylori (Hp) infection in Hemodialysis (HD) population. In Egypt, the data on this population are rather limited.

Objectives: The aim of this cross-sectional study was to screen HD patients with Gastrointestinal (GI) symptoms for the prevalence of Hp infection using non-invasive serological testing for Immunoglobulin G (IgG) antibody and then to compare the screening data with the confirmatory esophagogastroduodenoscopy (EGD) findings.

Patients and Methods: From January 2020 to June 2021, the sera of one hundred patients with GI complaints were screened for IgG antibody against Hp, among them fifty patients underwent EGD as per indication. Univariate and multivariate analysis were performed to compare serological versus invasive testing performance for Hp infection.

Results: In the present study, (60%) of the screened study population demonstrated a positive IgG against Hp, whereas the EGD findings confirmed Hp infection in (50%) of the fifty patients who underwent a confirmatory EGD. In comparison to EDG findings, IgG Antibody sensitivity and specificity for diagnosis of Hp infection was 65.5 % and 52.4 % respectively.

Conclusion: Among the one hundred HD patients screened for IgG against Hp, we found a seroprevalence of 60%; however, the performance characteristics of IgG antibody were limited. Further studies are warranted to explore these findings.

Keywords: End Stage Renal Disease, Esophagogastroduodenoscopy, Helicobacter pylori, Hemodialysis, IgG.

INTRODUCTION

Worldwide, Helicobacter pylori (Hp) is estimated to be the most prevalent chronic bacterial disease affecting almost 50% of the world's population. Hp infection accounts for a host of gastric disorders including malignancy and has been implicated in a growing list of extra-gastric disorders [1].

The increased recognition of the systemic effects of Hp [2] has revived the interest to study the epidemiology of Hp infection in patients with Chronic Kidney Disease (CKD) especially after studies implicating an increased risk of CKD in patients infected with Hp [3].

Unfortunately, data are still conflicting regarding the association between Hp infection and kidney diseases. Whilst some population-based studies have linked Hp to increased risk of renal disorders and CKD progression [3]. Contrarian meta-analysis studies have demonstrated a lower incidence of Hp infection in Hemodialysis (HD) population [4,5].

In Egypt, the prevalence of Hp in the general population varies according to the used test, serological screening reported a prevalence of 70 % to 90 % among adults tested for serum IgG for Hp [6]. Whilst another study using Enzyme-Linked Immunosorbent Assay (ELISA) to detect Hp Stool Antigen (HpSA) test among 1120 Egyptian patients reported a prevalence of 52% [7]. This high prevalence in previous studies was attributed to poor socioeconomic and sanitary conditions in addition to dietary, lifestyle, and age factors.

Epidemiological data are critical to guide the choice of the proper test (invasive versus non-invasive) for this prevalent problem in view of limited resources. Unfortunately, data about Hp infection in HD population in Egypt are rather limited despite the high prevalence of Hp in the general population in Egypt [6,7].

Gastrointestinal (GI) disorders are the most prevalent chronic problem in End Stage Renal Disease (ESRD) patients, ranking second in frequency only to renal failure itself. GI disorders affect 70 to 80% of patients on Hemodialysis (HD) [8]; yet, little is known about the impact of Hp infection on this multifactorial disorder [9].

Hence, the primary aim of the present cross-sectional study was to prospectively assess the prevalence of Hp infection among HD patients using both screening and confirmatory tests. Initially, ELISA-based screening for IgG antibodies in the sera of HD patients was performed. Then, the performance of serological non-invasive testing for Hp was compared to the confirmatory EGD findings.

PATIENTS AND METHODS

One hundred patients on maintenance Hemodialysis (HD) were enrolled in this prospective multicenter cross-sectional study. End Stage Renal Disease (ESRD) was defined as eGFR < 15 ml/min/1.73 m^2 and/or the need for renal replacement therapy for more than 3 months [10]. The patients were selected based on the presence of Gastrointestinal (GI) symptoms including: (nausea, vomiting, dyspepsia, dysphagia, abdominal pain, chest pain, and hiccough).

All the study population who reported GI symptoms (n=100) underwent an initial serological screening test using Enzyme-Linked Immunosorbent Assay (ELISA) technique to detect serum Immunoglobulin G (IgG) for Helicobacter Pylori (Hp), the test was labelled positive at a cutoff > 10 U/ml. This

cutoff was chosen in view of reports suggesting increased sensitivity and specificity for Hp detection at this threshold [11].

Among the study subjects, patients with significant GI symptoms were counselled and consented for Esophagogastroduodenoscopy (EGD), 50 patients (50%) underwent the EGD with rapid urease test (RUT) as the confirmatory test for Hp infection.

Demographic, clinical, laboratory, and endoscopic data for the study population were collected from January 2020 to end of June 2021. The study was conducted on patients selected from 4 military hospitals in Egypt namely: El-Maadi Military Hospital, Kobri El Koba Military Hospital, El Galaa Military Hospital, Ismailia Military Hospital.

Inclusion criteria included both sexes with age more than 18 years, ESRD patients on regular maintenance hemodialysis (more than 3 months). Whereas, exclusion criteria: included age less than 18 years, Patients with Acute Kidney Injury (AKI), Patients on incident hemodialysis (less than 3 months), frail patients with multiple comorbidities or malignant disease, and pregnant ladies.

Ethical approval:

The current study was carried out in accordance with the principles and regulations of the Helsinki's declaration. The study protocol was approved by the Ethical Committee of Benha University on 15/12/2019, with approval number 2454/217. All the participants gave an informed written consent in Arabic language fully detailing the study and highlighting the potential hazards and benefits of the Esophagogastroduodenoscopy (EGD) for the selected patients who had had an indication for the procedure.

Statistical analysis

Demographic, clinical, laboratory, and endoscopic data for the study population were collected, coded, processed, and analyzed using statistical package for the social sciences program (SPSS) (Chicago, Illinois, USA) in consultation with a medical statistician from the Epidemiology Department of Benha University. Parametric quantitative data were presented as mean and standard deviation (± SD), and were compared by independent t-test, while non-parametric data were presented as median and interquartile range (IQR), and were compared by Mann-Whitney test. Categorical variables were presented as counts (Frequency and percentage) and were compared by Chi-square (χ^2) and Fisher's Exact Test as appropriate. All tests were two sided. The level of significance was ($p \leq 0.05$) for all tests.

RESULTS

Both sexes were equally represented in the study. Their age ranged between 27-83 years and mean age was (60.03±13.19) year. Based on data suggesting higher incidence of HP in younger patients [3], the study cohort was divided into 3 age groups. The majority was of age between (46 -65) were 42 cases (Table 1).

Table (1): Baseline demographics of the study cohort (Age, sex and Body Mass Index)

		Total no. = 100
Age (years)	Mean ± SD	60.03 ± 13.19
	Range	27 – 83
Age (26 – 45) (years)		21 (21.0%)
Age (46- 65) (years)		42 (42.0%)
Age (66 – 85) (years)		37 (37.0%)
Sex	Females	50 (50.0%)
	Males	50 (50.0%)
BMI (kg/m^2)	Mean ± SD	25.41 ± 5.27
	Range	17 – 36
BMI (17 – 25) (kg/m^2)		52 (52.0%)
BMI (26 – 30) (kg/m^2)		30 (30.0%)
BMI >30 (kg/m^2)		18 (18.0%)

BMI: Body Mass Index

Twenty percent of the study population had positive serology for Hepatitis C Virus (HCV) antibody. 60 patient of the study group (60%) tested positive for serum IgG for Helicobacter Pylori. Dyspepsia and dysphagia were the most common complaints (Table 2).

Table (2): Hepatitis virus status, serological finding and frequency distribution of upper gastrointestinal symptoms in the studied group

Hepatitis Virus status		Total no. = 100
Hepatitis B surface antigen	Negative	100 (100.0%)
	Positive	0 (0.0%)
Hepatitis C Virus (HCV) antibody	Negative	80 (80.0%)
	Positive	20 (20.0%)
Serological finding		
Helicobacter pylori serum IgG	Negative	40 (40.0%)
	Positive	60 (60.0%)
Frequency distribution of upper gastrointestinal symptoms		
Dyspepsia or dysphagia	No	50 (50.0%)
	Yes	50 (50.0%)
Nausea or vomiting	No	55 (55.0%)
	Yes	45 (45.0%)
Abdominal pain	No	63 (63.0%)
	Yes	37 (37.0%)
Chest pain	No	88 (88.0%)
	Yes	12 (12.0%)
Hiccups	No	89 (89.0%)
	Yes	11 (11.0%)

Table 3 and figure 1 show that 50 cases underwent EGD which showed abnormality in 29 cases (58%). Gastritis was the commonest EGD finding.

Helicobacter pylori Rapid Ureases Test (RUT) was done to all the 29 cases with EGD abnormality and showed that 25 were tested positive whereas four patients were tested negatives. Out of the (50) patients who underwent EGD, 25 patients (50 %) had Hp infection.

Table (3): Esophagogastroduodenoscopy findings in the study population

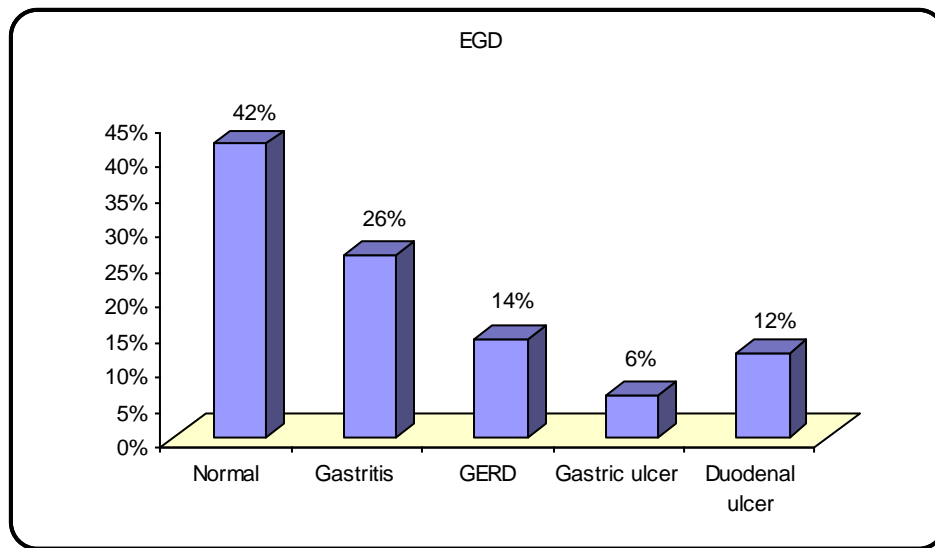| Finding	Total no. = 50
Normal	21 (42.0%)
Abnormal	29 (58.0%)
Gastritis	13 (26.0%)
GERD	7 (14.0%)
Gastric ulcer	3 (6.0%)
Duodenal ulcer	6 (12.0%)

Figure (1): EGD findings in the studied group (Total number = 50 patients).

Table (4) shows that there was no statistically significant relation found between Hp serum IgG antibody and age, sex, or BMI. The highest prevalence of Hp infection by IgG Ab was noted in the age group between (46 -65) year. Whereas, the highest prevalence of Hp infection by IgG Ab in BMI between 17 and 25, but all were statistically non-significant.

Table (4): Relation between age, gender, BMI and helicobacter pylori IgG antibody

		Helicobacter pylori serum IgG Ab		Test value	P-value
		Negative	**Positive**		
		No. = 40	**No. = 60**		
Age (years)	Mean ± SD	58.93 ± 13.64	60.77 ± 12.93	-0.682•	0.497
	Range	36 – 80	27 – 83		
Age (26 – 45) (years)		9 (22.5%)	12 (20.0%)		
Age (46- 65) (years)		17 (42.5%)	25 (41.7%)	0.147*	0.929
Age (66 – 85) (years)		14 (35.0%)	23 (38.3%)		
Sex	Females	21 (52.5%)	29 (48.3%)	0.167*	0.683
	Males	19 (47.5%)	31 (51.7%)		
BMI (kg/m^2)	Mean ± SD	25.28 ± 5.30	25.50 ± 5.29	-0.208•	0.835
BMI (17 – 25) (kg/m^2)		18 (45.0%)	34 (56.7%)		
BMI (26 – 30) (kg/m^2)		16 (40.0%)	14 (23.3%)	3.184*	0.204
BMI >30 (kg/m^2)		6 (15.0%)	12 (20.0%)		

BMI: Body Mass Index, *: Chi-square test; •: Independent t-test

Table (5) shows that there was no statistically significant difference between negative- and positive-Helicobacter pylori serum IgG antibody, as regard laboratory tests done for both groups.

Table (5): Relation between Helicobacter pylori IgG Antibody and laboratory findings

| | | Helicobacter pylori serum IgG Antibody | | Test value | P-value |
| | | Negative | Positive | | |
		No. = 40	No. = 60		
Hemoglobin(g/dl)	Mean ± SD	9.92 ± 1.65	9.94 ± 1.47	-0.069•	0.945
Platelet (/micro l)	Mean ± SD	188.9±23.4	194.3± 34.29	-0.556‡	0.578
TLC (/micro l)	Mean ± SD	5.64±1.31	5.31±1.98	-1.094‡	0.274
Pt (seconds)	Mean ± SD	11.95 ± 2.16	12.15 ± 2.09	-0.463•	0.645
INR	Mean ± SD	1.1±0.21	1.1 ±0.2	-0.835‡	0.404
ALT (u/l)	Mean ± SD	13.4 ±2.82	13.2 ±2.34	-0.754‡	0.451
AST (u/l)	Mean ± SD	15.3±3.35	16.4 ±3.48	-0.789‡	0.430
Albumin(g/dl)	Mean ± SD	4.04 ± 0.37	3.93 ± 0.48	1.238•	0.219

*: Chi-square test; •: Independent t-test; ≠: Mann-Whitney test

Table (6) shows that there was no statistically significant relation found between Helicobacter pylori serum IgG antibody regarding Cr, urea, Ca, PO₄, PTH, HBV and HCV.

Table (6): Relation between Helicobacter pylori serum IgG antibody and Cr, urea, Ca, PO₄, PTH, HBV and HCV

| | | Helicobacter pylori serum IgG Ab | | Test value | P-value |
| | | Negative | Positive | | |
		No. = 40	No. = 60		
Creatinine pre (mg/dl)	Mean ± SD	10.64 ± 2.54	10.07 ± 3.07	0.972•	0.334
Creatinine post (mg/dl)	Mean ± SD	4.80 ± 1.43	4.41 ± 1.57	1.278•	0.204
Urea pre (mg/dl)	Mean ± SD	122.3±3.65	153.6±43.65	-0.394‡	0.694
Urea post (mg/dl)	Mean ± SD	49.4±1.61	62.3 ±13.61	-1.777‡	0.076
Calcium (mg/dl)	Mean ± SD	8.52 ± 0.80	8.78 ± 0.18	-1.779•	0.078
Phosphorus (mg/dl)	Mean ± SD	4.79 ± 1.39	4.49 ± 1.1	1.061•	0.291
Parathyroid Hormone (pg/ml)	Mean ± SD	312.4±56.66	235.3± 45.62	-1.526‡	0.127
Hepatitis B Virus	Negative	40 (100.0%)	60 (100.0%)	0	1
	Positive	0 (0.0%)	0 (0.0%)		
Hepatitis C Virus	Negative	29 (72.5%)	51 (85.0%)	2.344	0.126
	Positive	11 (27.5%)	9 (15.0%)		

*: Chi-square test; •: Independent t-test; ≠: Mann-Whitney test

Table (7) shows that there was no statistically significant relation found between EGD and other laboratory variables including hemoglobin, platelet, TLC, PT, INR, ALT, albumin.

Table (7): Relation between Esophagogastroduodenoscopy (EGD) and laboratory variables

| | | Esophagogastroduodenoscopy (EGD) | | Test value | P-value |
| | | Normal | Abnormal | | |
		No. = 21	No. = 29		
Hemoglobin (g/dl)	Mean ± SD	9.56 ± 1.73	10.07 ± 1.42	-1.137•	0.261
Platelets (/micro l)	Mean ± SD	170.3±5.36	216.4 ±36.11	-1.425≠	0.154
WBC (/micro l)	Mean ± SD	4.6±1.23	5.4±1.67	-1.377≠	0.169
Pt (seconds)	Mean ± SD	12.10 ± 2.36	11.41 ± 1.70	1.187•	0.241
INR	Mean ± SD	1.1 ± 0.98	1.1 ±0.28	-1.034≠	0.301
ALT (u/l)	Mean ± SD	12.8 ±2.02	13.4 ±3.51	-0.256≠	0.798
AST (u/l)	Mean ± SD	14.3 ±3.51	22.4 ±4.39	-2.179≠	0.129
Alb. (g/dl)	Mean ± SD	4.07 ± 0.43	3.85 ± 0.54	1.546•	0.129

•: Independent t-test; ≠: Mann-Whitney test

Table (8) shows that there was no statistically significant relation found between Esophagogastroduodenoscopy (EGD) findings regarding Cr, urea, Ca, Po4, PTH, HBV, HCV.

Table (8): Relation between Esophagogastroduodenoscopy (EGD) and creatinine, urea, calcium, phosphorus, parathyroid hormone, HBV, HCV

		Esophagogastroduodenoscopy (EGD)		Test value	P-value
		Normal	**Abnormal**		
		No. = 21	**No. = 29**		
Cr pre (mg/dl)	Mean ± SD	10.07 ± 2.87	9.87 ± 2.30	0.281•	0.780
Cr post (mg/dl)	Mean ± SD	4.38 ± 1.76	4.24 ± 1.16	0.327•	0.745
Urea pre (mg/dl)	Mean ± SD	130.3±23.42	155.3 ±33.98	-0.875≠	0.382
Urea post (mg/dl)	Mean ± SD	42.5 ±3.41	63 .3±14.64	-1.593≠	0.111
Ca (mg/dl)	Mean ± SD	8.38 ± 0.81	8.68 ± 0.75	-1.350•	0.183
PO$_4$ (mg/dl)	Mean ± SD	4.51 ± 1.24	4.10 ± 1.30	1.114•	0.271
PTH (pg/ml)	Mean ± SD	290.6 ± 55.31	220.3±36.64	-1.276≠	0.202
HBV	Negative	21 (100.0%)	29 (100.0%)	–	–
	Positive	0 (0.0%)	0 (0.0%)		
HCV	Negative	17 (81.0%)	22 (75.9%)	0.184*	0.668
	Positive	4 (19.0%)	7 (24.1%)		

*: Chi-square test; •: Independent t-test; ≠: Mann-Whitney test

Table (9) shows that Esophagogastroduodenoscopy (EGD) findings were not statistically significantly associated with the Helicobacter pylori serum IgG status.

Table (9): Comparison between Esophagogastroduodenoscopy (EGD) and Helicobacter pylori IgG antibody in diagnosis of Helicobacter pylori infection

H. pylori serum IgG Antibody	Esophagogastroduodenoscopy (EGD)				Test value*	P-value
	Normal		**Abnormal**			
	No.	**%**	**No.**	**%**		
Negative	11	52.4%	10	34.5%	1.602	0.206
Positive	10	47.6%	19	65.5%		

*: Chi-square test

Table (10) shows H. pylori serum IgG Ab sensitivity 65.5 % and specificity 52.4 % in comparison to EGD for diagnosis of H. pylori infection.

Table (10): The performance characteristics of IgG compared to EGD findings

Parameter	TP	TN	FP	FN	Accuracy	Sensitivity	Specificity	PPV	NPV
IgG for H. pylori	**19**	**11**	**10**	**10**	**60.0**	**65.5**	**52.4**	**65.5**	**52.4**

DISCUSSION

The present study aimed to estimate the prevalence of Helicobacter pylori (Hp) infection among hemodialysis (HD) patients to assess the magnitude of the problem. Another consideration of the current study was to compare the performance characteristics of the non-invasive serological testing (serum IgG) versus the Esophagogastroduodenoscopy (EGD) as diagnostic tools for Hp infection.

The diagnosis of Hp infection serological testing offers an appealing option for screening purposes especially in resource-limited health care models due to its simplicity, low cost and accessibility. Nevertheless, serology still has significant limitations as the inability to discern active from remote infection and the lack of local validation against heterogenous antigen strains of Hp [11].

Furthermore, among different non-invasive testing strategies including Urea Breath Test (UBT), Helicobacter Stool Antigen (HpSA) and ELISA-Based IgG testing, an extensive Cochrane review suggested that UBT outperforms HpSA and IgG tests. In this review the ratios of diagnostic odds ratios (DORs) observed were 0.68 for urea breath test (UBT) versus IgG serology and 0.88 for urea breath test (UBT) versus stool antigen test (HpSA), respectively [11].

The present study found IgG antibody seroprevalence against Hp among 60% of the whole study population (n=100). This figure is higher than the average percentage previously reported worldwide on CKD patients which is (44 to 48.2%) [3-5], yet lower than the (70 to 90 %) seroprevalence reported in Egyptian population with normal renal functions [6-7].

Regarding the demographic data in our study, sexes were represented equally (50% each). Their age

ranged between 27-83 years and mean age was (60.03±13.19) year. Subgroup analysis on age as a variable did not show a statistically significant association with the prevalence of Hp with both the serology and EGD findings. Noteworthy, the studies that reported differences based on age are the meta-analysis studies which included pediatric patients [3-5]. The BMI ranged between 17-36 and mean BMI was (25.41±5.27) kg/m² and again, no difference was noted with regards to Hp infection in relation to BMI.

In contrast to our results, **Wijarnpreecha and colleagues** conducted a meta-analysis study to assess the prevalence and association of H. pylori with ESRD. In their analysis, which included thirty-five cross-sectional studies, the overall prevalence of Hp among HD patients was 44%. Subgroup analysis performed on thirty-two studies including adults only showed a 44% prevalence whilst in children the rate was 47% in the three remaining studies [4].

The higher prevalence in our study compared to the internationally reported rates is likely due to lower socioeconomic standards and sanitary conditions which contribute significantly to the high prevalence of Hp infection among developing countries.

Wijarnpreecha and colleagues also found a marginal but not significantly decreased risk of H. pylori infection in overall ESRD subjects compared with non-ESRD subjects. Subgroup analysis based on ageing as described above also demonstrated a significant decreased risk of H. pylori infection among adult ESRD patients compared with non-ESRD patients. Nevertheless, they did not find a significant association between H. pylori infection and ESRD among ESRD children [4].

Data on the prevalence of Hp in Chronic Kidney Disease (CKD) population are sparse and conflicted, whilst some nation-wide studies have linked Hp to a host of renal disorders suggesting a linear correlation between Hp infection and the stage of CKD, Nevertheless, causality cannot be inferred by association alone especially in view of larger scale studies that have demonstrated a lower incidence of Hp infection in ESRD patients on Hemodialysis (HD) when compared to the general population [3-5].

The explanation as to why HD patients have lower risk of Hp infection is far from clear, nevertheless, some postulated mechanisms include unintended antibiotic or antacid use or the enhanced inflammatory milieu that renders gastric environment in uremic patients more hostile to the growth of Hp due to the dominant inflammatory cytokines or atrophied mucosal barrier [12-15].

Among the 50 cases who underwent EGD as per indication, 29 patients had an abnormal EGD findings (58%), among them 25 cases were due to Hp and had a positive Rapid Urease Test (RUT) (50%). Our data reported a higher prevalence of Hp among HD patients who underwent EGD, in contrast to the study by **Pakfetrat et al.** [16], which reported a prevalence of Hp around 33% among 1200 patients on HD who underwent EGD as a part of pre-kidney transplant evaluation.

In agreement with our findings, **Asl and Nasri** found a significant difference of GI signs and symptoms between two included groups in his study: 40 ESRD patients on maintenance HD patients and 40 consecutive control subjects with normal renal function. In the microscopic examination of the tissue for H. pylori, no significant difference of H. pylori infection between two groups was seen. The microscopic examination of gastric fundus and gastric body showed no significant difference of H. pylori infection (p= 0.651 and p= 1, respectively). Tissue evaluation of gastric antrum however, showed significant difference 57.5% versus 32.5% (p= 0.025)[17].

In the current study, the correlation between serum IgG antibody and EGD findings showed a limited sensitivity of 65.5 % and specificity of 52.4 % for diagnosis of Hp infection. The performance of serological testing among other non-invasive testing compared the invasive testing (EGD with histopathology and Rapid Urea Test (RUT) is a heavily debated issue. Noteworthy, there is a significant uncertainty regarding the accuracy and performance of the non-invasive tests in the diagnosis and follow up of Hp infection, in addition, the thresholds used are highly variable among different studies.

The poor correlation between GI symptoms and EGD findings has implications in certain situations such as in pretransplant evaluation and alarming GI problems like unexplained anemia in HD patients where EGD better be offered as the test of choice [18-19].

In the present study, we found no correlation between baseline demographic or laboratory variables and both HP seroprevalence nor EGD findings. Other studies have not shown a consistent association between HP infection and other variables. The results of **Tsukada and colleagues** revealed that there was no significant difference in age, gender, endoscopic findings, or comorbid conditions (hypertension or diabetes mellitus) between these groups. Multivariate logistic regression analysis revealed that only the serum urea nitrogen level was significantly associated with Helicobacter pylori prevalence. In univariate analysis Hp positive patients received hemodialysis therapy significantly less often and had lower serum urea nitrogen and creatinine levels than Hp negative patients [20].

The present study has limitations including the small number of patients enrolled in the study, the cross-sectional design, which does not allow for establishing causality, in addition, the use of IgG serology only as a screening test rather than UBT or HpSA is a clear limitation, however the assessment of performance characteristics (sensitivity and specificity) of IgG as a screening test is an important consideration

in view of the limited resources. And finally, only half of the study population underwent EGD based on both consent and indication.

The present study findings have important diagnostic implications including: First; In view of the high prevalence of Hp in HD population, a lower clinical threshold for screening is warranted. Second; the limited performance of IgG serology in HD patients, in terms of specificity and sensitivity, further support the superiority of UBT and HpSA as non-invasive methods for screening for Hp infection. In addition, EGD despite the obvious limitation of being an invasive procedure still remains a valuable tool in managing the various GI disorders in HD patients especially in the setting of alarming or sinister presentation or for pre-kidney transplant assessment.

Further studies of a larger scale and a prospective long-term design are warranted to address the unmet needs in the management of Hp in patients with kidney disease as the validity of the used serological tests for screening and follow-up especially in the setting of the "test and treat" paradigm. The effectiveness of the antimicrobial therapy and its impact on the progression of CKD is another domain that needs future research.

CONCLUSION

Among the one hundred HD patients screened for IgG against Hp, we found a seroprevalence of 60%; however, the performance characteristics of IgG antibody were limited. Further studies are warranted to explore these findings.

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