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Original Article

The Role of Endoscopic Narrow Band Imaging [NBI] in Diagnosis of Helicobacter Pylori Gastritis

Khalid Abd El Meged Gamel [1]; Wael M. Abdel Razek[1]; Mahmod Helmy Allam[1]; Doha Maher Taie [1]; Dina Sweed [1]; Ibrahim Mahrous Ibrahim Amr[2]*

[1]Department of Hepatology and Gastroenterology, National Liver Institute, Menoufia University, Shebeen Elkom, Menoufia, Egypt.

[2]Department of Histology, Damietta Faculty of Medicine, Al-Azhar University, Damietta, Egypt..

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*Corresponding author

Email: ibrahimmahrousibrahimamr@gmail.com

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ABSTRACT

Background: Helicobacter pylori [*H. pylori*] is a predominant cause of chronic gastritis that can lead to gastric cancer if left untreated. Currently, endoscopy and histology are the gold standard tests for the diagnosis of H. pylori gastritis. Recently, studies have shown the utility of narrow-band imaging [NBI] in predicting *H. pylori* gastritis. Thus, this study aimed to determine the diagnostic accuracy of NBI in prediction of H. pylori gastritis.

Patients and Methods: This was a prospective cohort hospital based study. It was conducted on 50 consecutive adult patients attending the endoscopy unit of the Hepatology and gastroenterology department of the National Liver Institute, Menoufia University. Each patient underwent upper endoscopy, NBI studies followed by biopsies from the antrum and fundus of the stomach. Analysis was performed for the types of NBI pattern predicting H. pylori gastritis.

Results: The abnormal NBI pattern of the gastric mucosa on endoscopy was significantly linked to *H. pylori* infection [p 0.002]. In addition, NBI yielded an excellent diagnostic accuracy. The sensitivity was 86.36, and specificity was 66.67, PPV was 95.00, NPV was 40.00, and the accuracy was 84%..

Conclusion: NBI findings by endoscopy had an excellent diagnostic accuracy for identification of *H. pylori* gastritis. However, future multicenter large-scale studies are recommended to validate our results. In addition, future studies are required to study the site-specific biopsy guided by NBI of abnormal mucosa.

Keywords: Narrow-Band Image; Biopsy; Endoscopy; Helicobacter Pylori Gastritis..

INTRODUCTION

About 100 years ago, the Professor W. Jaworski described the presence of spiral-shaped microorganism inside the human stomach. However, the condition was not considered seriously until the late of 1970s. At this time, Warren described the spiral bacteria [*helicobacter pylori*] overlying the gastric mucosa, mainly the inflamed tissues [1].

After that, researches proved the significant association between H. Pylori infection and the development of cancer stomach, peptic ulcers and lymphoma of the gastric mucosa [2].

H. pylori infection is closely related to stomach ulcers [up to 80% of cases], duodenal ulcers [in approximately 90% of cases] [3], stomach carcinoma [2.7%] and mucosa-associated lymphoid tissue lymphoma [2%] [4].

Of interest, it is well-known that, H. Pylori colonization is widely spread worldwide [about 50% of populations]. However, this percentage is increased during outbreaks [up to 90% in poor nations and 40% in industrialized countries [5].

The diagnosis of H. pylori infection can be performed by invasive and non-invasive methods. The invasive techniques include endoscopy with biopsy, while non-invasive methods include serology, urea breath test, and stool antigen tests. The endoscopy is recommended in patients with dyspepsia and alarming manifestation or tumor history. It is mandatory to clarify the underlying cause [6].

Multiple gastric biopsies are necessary to assess the gastritis related to H. Pylori. However, magnifying endoscopic examination permits the detailed observation of the mucosal structure with visualization of the subepithelial capillary network around the gastric pits [7, 8].

Narrow band imaging [NBI] is a technique based on the depth of light penetration into the tissues, where the shorter the wavelength, the more superficial the light penetration as the light penetration is directly proportional to the wavelength [9].

The conventional NBI showed a good diagnostic power for the detection of H. Pylori infection and this was correlated to the histopathology of the gastric mucosa[10].

On examination, normal NBI findings showed small, round-shaped pits surrounded by honeycomb-like subepithelial capillary networks [SECNs]. The abnormal patterns were graded into three different types: the first showed slight enlarged, pits with irregular or unclear SECNs [9].

Type-2 however, showed obvious enlarged, oval shaped or prolonged pits with an increased density of irregular vessels. Furthermore, type 3 described a well-demarcated oval or tubulovillous pits with clear visible coiled or wavy vessels. This classification and types had a 95.2% sensitivity and 82.2% specificity for the detection of H. Pylori infection [9].

THE AIM OF THE WORK

This study aimed to determine the diagnostic accuracy of NBI in prediction of H. pylori gastritis.

PATIENTS AND METHODS

This was a prospective cohort hospital based study was conducted on 50 consecutive adult patients attending the endoscopy unit of the Hepatology and gastroenterology department of the National Liver Institute, Menoufia University.

The study was approved by ethical committee of National Liver Institute and written consents were taken from all patients. All individuals were subjected to thorough history taking, complete clinical examination and laboratory investigations to rule out exclusion criteria.

Upper endoscopy with NBI and biopsy were done. Our NBI results were investigated blindly by 3 endoscopic expert guided by **Tahara *et al.*** [9] [figure 1]. Gastric biopsies were taken from the antrum and fundus of the stomach. Biopsies were examined by a single histopathologist blinded to the endoscopic findings.

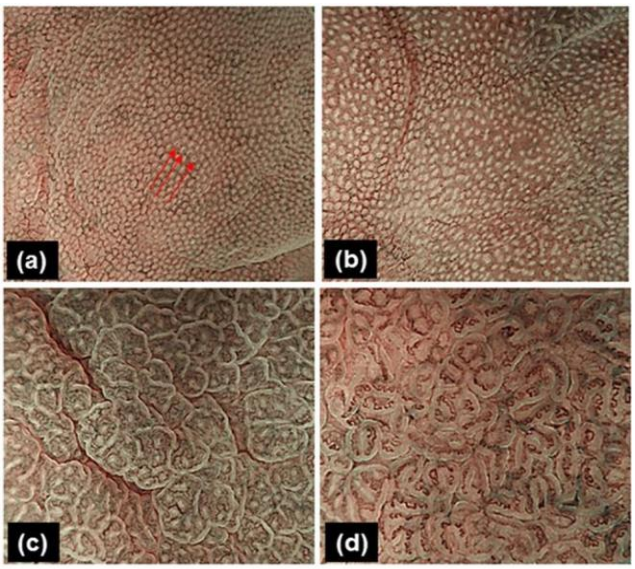

Figure [1]: Typical cases of one normal and three gastric mucosal patterns seen with magnifying NBI endoscopy. Normal [a]: small, round pits with surrounding subepithelial capillary networks [red arrows]. Type 1[b]: slightly enlarged, round-shaped pit with unclear or irregular subepithelial capillary networks. Type 2[c]: clearly enlarged, oval or prolonged pit with increased density of irregular vessels. Type 3 [d]: well-demarcated, tubulovillous pit with undoubtedly visible coiled or wavy vessels, subepithelial capillary networks.

Statistical analysis:

Data were collected, tabulated and statistically analyzed by an IBM compatible personal computer with SPSS statistical

package version 23 [Armonk, NY: IBM Corp, 2015]. Data were presented as mean and standard deviation for continuous variables.

Chi- square test was used to measure association between qualitative variables and p-value < 0.05 was considered significant.

ANOVA test was performed to test the significance of difference between means of all studied patients using one-way analysis of variance [ANOVA] test.

ROC [Receiver Operating Characteristic] curve was drawn to compare sensitivity and specificity between NBI and biopsy in the diagnosis of H. pylori. Sensitivity, specificity, positive and negative predictive values, and diagnostic accuracy were calculated.

RESULTS

The studied patients were 33 males [66%] and 17 females [34%]. On initial assessment of studied patients, patients 'demographics, their base-line laboratory data were shown at table [1].

In this study, chronic inflammation was absent in 4 patients [8%], mild chronic inflammation was present in 11 patients [22%], moderate chronic inflammation in 23 patients [46%] and severe chronic inflammation present in 12 patients [24%] [Figures 2-4].

The study revealed the activity of gastritis [neutrophil infiltration] was absent in 14 patients [28%], mild in 23patients [46%], moderate in 6 patients [12%], and extensive in 7 patients [14%]. The study revealed the Antral atrophy was absent in 31 patients [62%], mild in 14 patients [28%], moderate in 5 patients [10%] and sever in 0 patients [0%].

In this study the fundal atrophy was absent in 42 patients [84%], mild in 7 patients [14%], moderate in 1 patients [2%] and severe in 0 patients [0 %].Among patients in our study Antral metaplasia was absent in 47 patients [94%] and present in 3 patients [6%]. Among patients in our study fundal metaplasia was absent in 47 patients 94%, Present in 3patients 6% [Table 4].

The NBI findings of the studied patients were divided into: normal NBI findings [small, round pits surrounded by subepithelial capillary networks] in 6 patients [12%], type I NBI findings [slightly enlarged, round pit with unclear or irregular subepithelial capillary network] in 8 patients [16 %],type II NBI findings [obviously enlarged, oval or prolonged pit with increased density of irregular vessels] in 16 patients [32%] and type III NBI findings [well-demarcated, oval or tubulovillous pit with clearly visible coiled or wavy vessels] in 20 patients [40%] [figures 5 to 9].

There were statistical Significant differences between NBI findings and hemoglobin [P value 0.036], H. Pylori scoring [P value <0.002], Chronic Inflammation P value [<0.001], Activity [P value 0.013], [Tables 3 and 4].

While there were no statistical Significant differences between NBI findings and gender, age, clinical presentation, hemoglobin, Platelets , Albumin, Creatinine, D.M., Liver Cirrhosis , Predominant site, Antral atrophy, Fundal atrophy, Antral metaplasia, and Fundal metaplasia [Tables 2-4].

In correlation of types of NBI findings and H. Pylori scoring the sensitivity, specificity, PPV, NPV and accuracy of type I of NBI findings was 37.50, 66.67, 60.00, 44.44 and 50% respectively. While the sensitivity, specificity, PPV, NPV and accuracy of type II of NBI findings was 93.75, 66.67, 88.24, 80.00 and 86.36% respectively. The sensitivity, specificity, PPV, NPV and accuracy of type III of NBI findings was 100.00, 66.67, 90.91, 100.00 and 92.31 % respectively. This indicates that the best result was found with type III NBI findings figure [10] and [table 5].

Table [1]: distribution of studied patients according to age, Haemoglobin, Platelets count, Albumin, and Creatinine.

	Range			Mean±SD
	Minimum	-	Maximum	
Age	33	-	55	46.160±5.460
Hemoglobin	11	-	15.7	13.558±1.260
Platelets count	110	-	389	232.100±80.413
Albumin	2.8	-	4.6	3.822±0.432
Creatinine	0.5	-	1.2	0.828±0.188

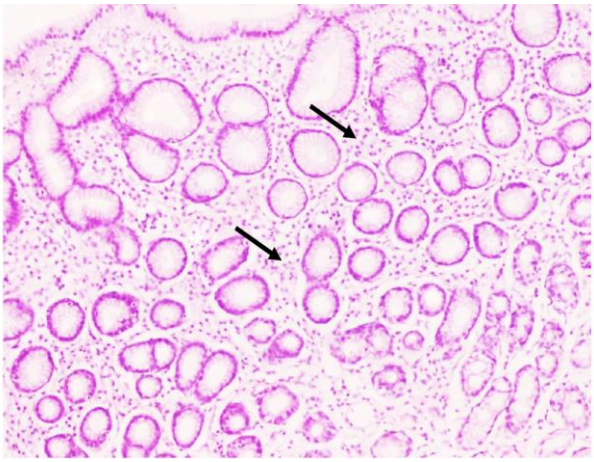

Figure [2]: A case of H. pylori gastritis of patient biopsy showed mild infiltration of lamina propria by chronic mononuclear inflammatory cellular infiltrate [H&E 100x].

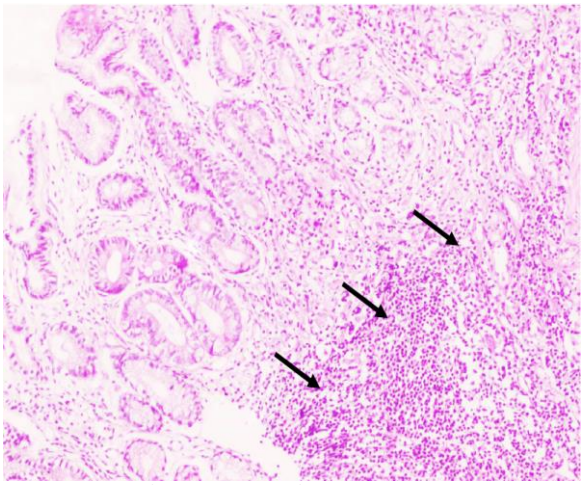

Figure [3] : A case of H. pylori gastritis of patient biopsy showed moderate infiltration of lamina propria by diffuse chronic mononuclear inflammatory cellular infiltrate [arrows] [H&E 100x].

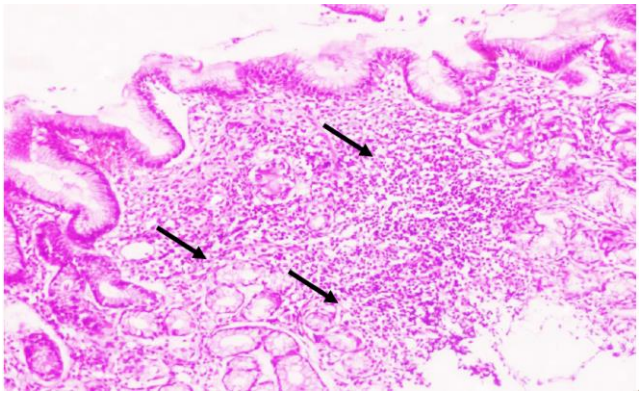

Figure [4]: A case of H. pylori gastritis of patient biopsy showed sever infiltration of lamina propria by diffuse chronic mononuclear inflammatory cellular infiltrate [[arrows] H&E 100x].

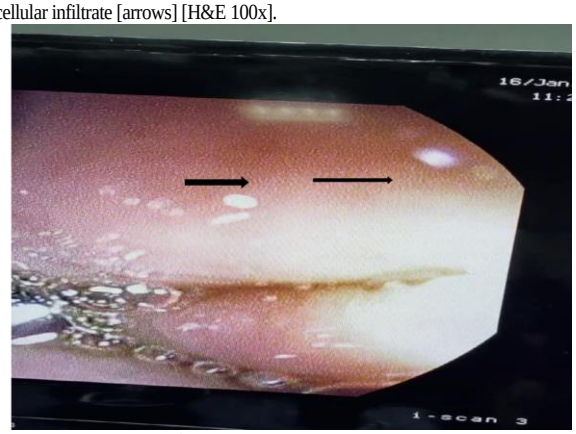

Figure [5]: Normal NBI findings: small, round pits surrounded by subepithelial capillary networks [arrows].

Figure [6]: Type 1 NBI: slightly enlarged, round pits with unclear or irregular subepithelial capillary networks arrows

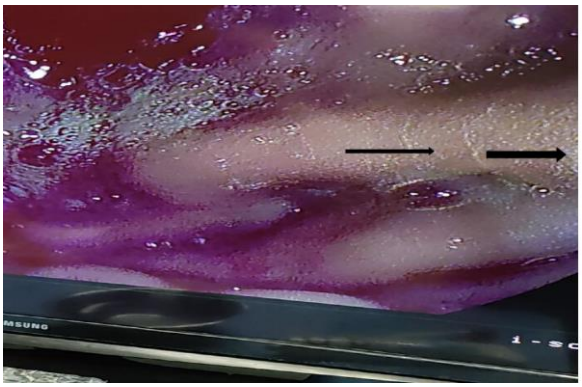

Figure [7]: Type 2: obviously enlarged, oval or prolonged pits with increased density of irregular vessels arrows

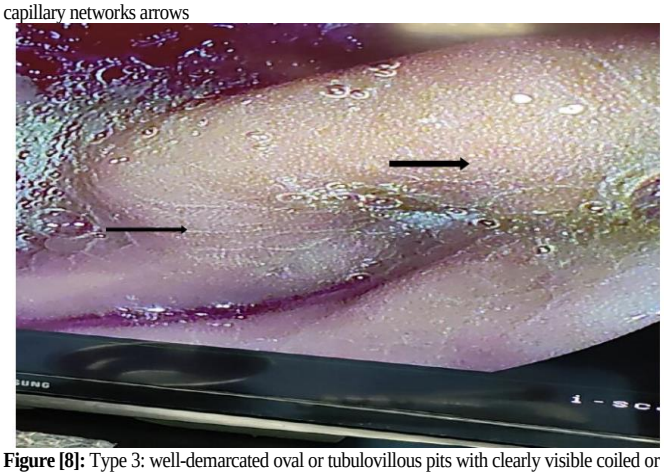

Figure [8]: Type 3: well-demarcated oval or tubulovillous pits with clearly visible coiled or wavy vessels arrows

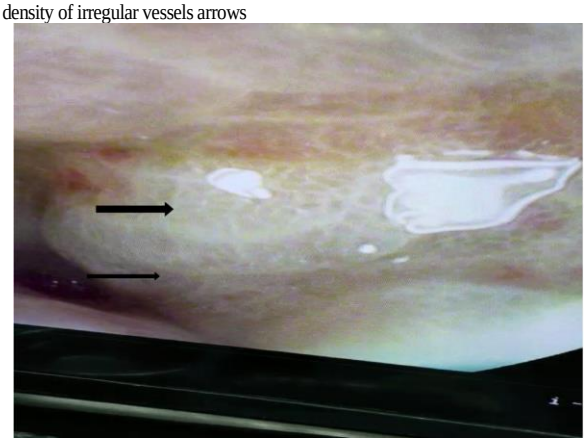

Figure [9]: Type 3: well-demarcated oval or tubulovillous pits with clearly visible coiled or wavy vessels arrow

Table [2]: Types of NBI findings in relation to studied variables

		Types of NBI findings										Chi-Square	
		Normal NBI findings[n=6]		Type I NBI findings [n=8]		Type IINBI findings [n=16]		Type III NBI findings [n=20]		**Total [n=50]**		**X2**	**P-value**
		n	%	n	%	n	%	n	%	n	%		
Gender	Female	3	50.00	3	37.50	4	25.00	7	35.00	17	34.00		
	Male	3	50.00	5	62.50	12	75.00	13	65.00	33	66.00	1.315	0.726
Clinical presentation	Chronic epigastric pain	1	16.67	2	25.00	4	25.00	3	15.00	10	20.00		
	Heart burn	1	16.67	1	12.50	3	18.75	3	15.00	8	16.00		
	Sense of fullness	0	0.00	2	25.00	3	18.75	5	25.00	10	20.00		
	History of vomiting of blood	4	66.67	3	37.50	6	37.50	9	45.00	22	44.00	3.232	0.954
Diabetes mellitus	Non-diabetics	4	66.67	7	87.50	5	31.25	11	55.00	27	54.00		
	Diabetics	2	33.33	1	12.50	11	68.75	9	45.00	23	46.00	7.344	0.062
Liver cirrhosis	Non-cirrhotic	3	50.00	2	25.00	7	43.75	7	35.00	19	38.00		
	cirrhotic	3	50.00	6	75.00	9	56.25	13	65.00	31	62.00	1.242	0.743

Table [3]: Types of NBI finding in association with other variables

Variables	Measures	Types of NBI findings				ANOVA	
		normal NBI findings	**Type I NBI findings**	**Type II NBI findings**	**Type III NBI findings**	**F**	**P-value**
Age [years]	Min. – ax.	39 -55	3 8 - 51	38 - 55	33 - 53	0.758	0.524
	Mean ±SD	47.67±5.50	43.62± 5.01	46.563± 4.647	46.40± 6.244		
Hemoglobin [g/dl]	Min.–Max.	12 -14	11 - 15	11 - 15.7	11.5 -15	**3.093**	**0.036***
	Mean ±SD	12.83±0.81	12.73±1.56	13.656 ± 1.360	14.025±0.933		
Platelets * 10^3/ml	Min.–Max.	150 - 322	149 - 322	110 - 389	121 - 351	0.902	0.447
	Mean ±SD	228.33±65.48	272.625±58.485	231.750 ±99.617	217.300±74.339		
Albumin [g/ml]	Min.–Max.	3 -4	3.6 -4.2	3 - 4.5	2.8 - 4.6	0.687	0.564
	Mean ±SD	3.717±0.360	4.013±0.203	3.819 ± 0.420	3.780± 0.522		
Creatinine [mg/ml]	Min.–Max.	0.5 - 0.9	0.6 - 1.2	0.5- 1.2	0.5 - 1.1	0.758	0.524
	Mean ±SD	0.733± 0.163	0.800± 0.207	0.863 ± 0.203	0.84± 0.179		

Table [4]: Association between types of NBI findings and gastric biopsies data

		Types of NBI findings										Chi-Square	
		normal		Type I		Type II		Type III		Total		X2	P-value
		N	%	N	%	N	%	N	%	N	%		
H. pylori scoring	Absent	4	66.67	5	62.50	1	6.25	0	0.00	10	20.00	**44.26**	**<0.002***
	Mild	2	33.33	3	37.50	8	50.00	0	0.00	13	26.00		
	Moderate	0	0.00	0	0.00	5	31.25	14	70.00	19	38.00		
	Severe	0	0.00	0	0.00	2	12.50	6	30.00	8	16.00		
Predominant site	Fundus	2	33.33	4	50.00	5	31.25	6	30.00	17	34.00	1.110	0.775
	Antrum	4	66.67	4	50.00	11	68.75	14	70.00	33	66.00		
Chronic Inflammation	Absent	4	66.67	0	0.00	0	0.00	0	0.00	4	8.00	**49.51**	**<0.001***
	Mild	1	16.67	6	75.00	3	18.75	1	5.00	11	22.00		
	Moderate	1	16.67	1	12.50	9	56.25	12	60.00	23	46.00		
	Severe	0	0.00	1	12.50	4	25.00	7	35.00	12	24.00		
Activity	Absent	4	66.67	6	75.00	1	6.25	3	15.00	14	28.00	**20.944**	**0.013***
	Mild	2	33.33	2	25.00	9	56.25	10	50.00	23	46.00		
	Moderate	0	0.00	0	0.00	2	12.50	4	20.00	6	12.00		
	Extensive	0	0.00	0	0.00	4	25.00	3	15.00	7	14.00		
Antral atrophy	Absent	5	83.33	7	87.50	9	56.25	10	50.00	31	62.00	11.773	0.067
	Mild	1	16.67	1	12.50	7	43.75	5	25.00	14	28.00		
	Moderate	0	0.00	0	0.00	0	0.00	5	25.00	5	10.00		
	Severe	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00		
Fundal atrophy	Absent	6	100.00	6	75.00	14	87.50	16	80.00	42	84.00	6.964	0.324
	Mild	0	0.00	1	12.50	2	12.50	4	20.00	7	14.00		
	Moderate	0	0.00	1	12.50	0	0.00	0	0.00	1	2.00		
	Severe	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00		
Antral metaplasia	Absent	6	100.00	8	100.00	14	87.50	19	95.00	47	94.00	2.128	0.546
	Present	0	0.00	0	0.00	2	12.50	1	5.00	3	6.00		
Fundal metaplasia	Absent	6	100.00	7	87.50	15	93.75	19	95.00	47	94.00	1.020	0.797
	Present	0	0.00	1	12.50	1	6.25	1	5.00	3	6.00		

Table [5]: Sensitivity, specificity, PPV, NPV and accuracy of all types of NBI findings and H. Pylori scoring.

H. Pylori scoring	Type I NBI findings						Chi-Square	
	Normal		Abnormal		Total			
	N	%	N	%	N	%	X2	P-value
Absent	4	66.67	5	62.50	9	64.29	0.026	0.872
Present	2	33.33	3	37.50	5	35.71		
Total	6	100.00	8	100.00	14	100.00		

ROC Curve				
Sensitivity	Specificity	PPV	NPV	Accuracy
37.50	66.67	60.00	44.44	50%

H. Pylori scoring	Type II NBI findings						Chi-Square	
	Normal		Abnormal		Total			
	N	%	N	%	N	%	X2	P-value
Absent	4	66.67	1	6.25	5	22.73	9.070	0.003*
Present	2	33.33	15	93.75	17	77.27		
Total	6	100.00	16	100.00	22	100.00		

ROC Curve				
Sensitivity	Specificity	PPV	NPV	Accuracy
93.75	66.67	88.24	80.00	86.36%

H. Pylori scoring	Type III NBI findings						Chi-Square	
	Normal		Abnormal		Total			
	N	%	N	%	N	%	X2	P-value
Absent	4	66.67	0	0.00	4	15.38	15.758	<0.001*
Present	2	33.33	20	100.00	22	84.62		
Total	6	100.00	20	100.00	26	100.00		

ROC Curve				
Sensitivity	Specificity	PPV	NPV	Accuracy
100.00	66.67	90.91	100.00	92.31%

H. Pylori scoring	Types of NBI findings						Chi-Square	
	Normal		Abnormal		Total			
	N	%	N	%	N	%	X2	P-value
Absent	4	66.67	6	13.64	10	20.00	9.280	0.002*
Present	2	33.33	38	86.36	40	80.00		
Total	6	100.00	44	100.00	50	100.00		

ROC Curve				
Sensitivity	Specificity	PPV	NPV	Accuracy
86.36	66.67	95.00	40.00	84%

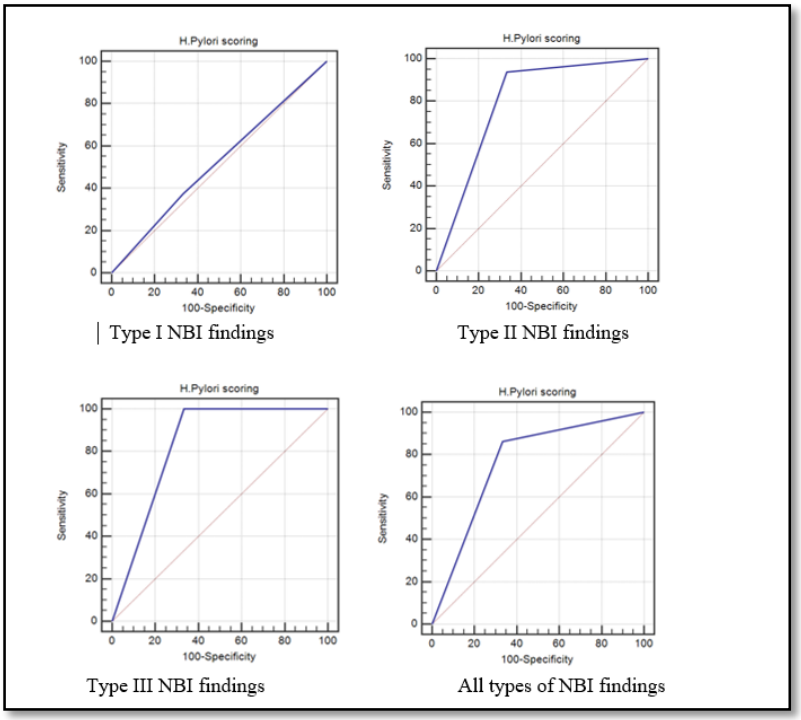

Figure [10]: The sensitivity and specificity of types of NBI findings versus H. pylori scoring by Receiver Operating Characteristic [ROC] Curve

DISCUSSION

H. pylori infection is a common infection all over the world. It is a crucial cause of different gastric conditions [e.g., peptic ulcers or cancer stomach]. A systematic review included studies from 73 countries, published in 2018 showed that, the overall prevalence of H. Pylori infection is up to 44.3% worldwide [50.8% in developing and 34.7% in developed countries] [11]. However, the endoscopic histo-pathology is an important diagnostic aid of gastro-intestinal diseases [12].

NBI facilitates the detailed examination of the gastrointestinal [GIT] mucosa. **Yagi *et al.*** [13] used NBI to demonstrate that regular arrangement of collecting venules [RAC] was a specific finding of normal mucosa of the stomach. **Anagnostopoulos *et al.*** [14] showed that NBI could recognize normal gastric mucosa, *H. pylori*–related gastritis, and gastric atrophy.

Our study was conducted to evaluate the role of NBI technique in endoscopic diagnosis of helicobacter pylori gastritis. Our study showed no statistical significance between NBI findings and gender [P value=0.726], age [P value = 0.524], clinical presentation [P value = 0.954], D.M., [P value = 0.062], liver cirrhosis [P value 0.743], platelets count [P value 0.447], serum albumin [P value 0.564], serum creatinine [P value = 0.524] and Predominant site [P value = 0.775]. Unfortunately, there were no studies focused on NBI findings and these parameters until now. Our study showed statistical significance between NBI findings and hemoglobin [P value 0.036].

Also in our study, there was a statistical significance between NBI findings and H. Pylori scoring [P value = 0.002]. The sensitivity was 86.36, and specificity was 66.67, the PPV was 95.00, the NPV was 40.00, and the accuracy was 84%. This in agreement with the study of **Tahara *et al.*** [15] found that NBI endoscopy has 97% sensitivity and 81% specificity in detection of H. pylori infection.

Our study showed that, the sensitivity, specificity, PPV, NPV and accuracy of type I of NBI findings versus H. pylori histopathology scoring was 37.50, 66.67, 60.00, 44.44 and 50% respectively. While the sensitivity, specificity, PPV, NPV and accuracy of type II of NBI findings versus H. pylori histo-pathology scoring was 93.75, 66.67, 88.24, 80.00 and 86.36% respectively. The sensitivity, specificity, PPV, NPV and accuracy of type III of NBI findings versus H. pylori histopathology scoring was 100.00, 66.67, 90.91, 100.00 and 92.31 % respectively. This indicates that the best result was found with type III NBI findings.

Cho *et al.* [16] found that the M-NBI endoscopy sensitivity for diagnosis of H. pylori was 96.3%. However, the specificity was 95.6%, the PPV was 97.5%, the NPV was 93.5%, and the accuracy was 96.1%. The sensitivity of M-NBI endoscopy was significantly better than the standard endoscopy [P = 0.016].

Also our study showed statistical significance between NBI findings and H. Pylori gastritis [Chronic inflammation, P value <0.001] and activity [P value 0.013].This in agreement with the study of **Ibrahim *et al.*** [17] they found that there was statistical significance between NBI findings and H. Pylori gastritis [P value <0.01]. Also, **Cho *et al.*** [16] found that the sensitivity of M-NBI endoscopy in diagnosis of H. Pylori gastritis was 96.3%, the specificity was 95.6%, PPV was 97.5%, NPV was 93.5%, and the accuracy was 96.1%.

In contrast to the study of **Memon *et al.*** [18], all three NBI finding lacked sensitivity and diagnostic accuracy for gastritis caused by H. Pylori infection on an individual basis. However, the detection of NBI types I and III together had a better diagnostic accuracy and specificity for H. pylori gastritis, with a sensitivity of 73%. Furthermore, the detection of all three abnormal NBI patterns together was significantly associated with H. pylori gastritis, [the sensitivity was 94.54%, specificity was 86.55%, and diagnostic accuracy was 90.32%].

Our study showed non statistical significance between NBI findings and antral atrophy [P value = 0.067]. This in contrast to the study of **Ibrahim *et al.*** [17]. They found that there was statistical significance between NBI findings and antral atrophy [P value <0.01]. In addition, **Pimentel-Nunes *et al.*** [19] said that the sensitivity and specificity of NBI endoscopy for the recognition of the atrophied gastric mucosa reached 95 and 98.5%, and for the diagnosis of early gastric cancer, the results were 83% and 96%, respectively.

Our study showed non significance correlation between NBI findings and fundal atrophy [P value 0.324].This in agreement with the study of **Sahu and Singh** [20]. They stated that, diagnostic accuracy of NBI was low for the recognition of precancerous lesions [72.6% and 61.1% for severe atrophied mucosa and IM in the corpus respectively].

In contrast to **Cho *et al.*** [16], they said that for the diagnosis of moderate to severe gastric atrophy, the NBI endoscopy sensitivity, specificity, PPV, NPV and overall accuracy were 100%, 59.0%, 54.7%, 100%, and 72.6% successively.

Our study showed no statistical significance between NBI findings, and metaplasia. [P value was 0.546, 0.797] in antral and fundal metaplasia respectively. In contrast to **Rokkasa and Ekmektzoglou [21].** They said that NBI is an accurate and useful tool to diagnose gastrointestinal metaplasia. NBI with magnification [sensitivity was 95% and specificity was 95%] performed better than NBI without magnification [sensitivity was 80% specificity was 93%]. However, **Pimentel-Nunes *et al.* [22]** said that the sensitivity of NBI for the diagnosis of intestinal metaplasia was [87 %] and the sensitivity for dysplasia was [92%].

In conclusion, NBI on endoscopy shows excellent diagnostic accuracy in identifying H. pylori gastritis. A further Large multicenter studies are required not only to validate our results but also to study the site-specific biopsy guided by NBI of abnormal mucosa. However, data of the current study must be explained with caution due to small sample size, one of the limiting steps of the current work.

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