

# CLINICAL, ENDOSCOPIC AND ESOPHAGEAL PH-IMPEDANCE STUDY IN PATIENTS WITH HEARTBURN REFERRED TO KURDISTAN CENTER FOR GASTROENTEROLOGY AND HEPATOLOGY



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## ABSTRACT

### *Background*

Heartburn is characterized by a discomfort or burning sensation behind the sternum that arises from the epigastrium and may radiate toward the neck. A subset of patients with heartburn are Non-erosive reflux disease (NERD) is characterized by reflux symptoms in the absence of esophageal mucosal breaks, with objective evidence of pathological levels of gastroesophageal reflux on pH or pH-impedance monitoring.

### *Objectives*

To evaluate patients with heartburn clinically, endoscopically and by combined pH-impedance study.

### *Methodology*

This is a cross-sectional descriptive study, a total of 60 cases of heartburn, referred to Kurdistan center for Gastroenterology and Hepatology in Sulaimani from February 2015 to December 2015 were enrolled. Cases interviewed and a questionnaire filled; body mass index measured. OGD and pH-impedance study were done for all participants.

### *Results*

Out of 60 cases of heartburn, erosive esophagitis (EE) found in 21.7% of cases and 78.7% had normal OGD. Regurgitation found in almost all cases of EE (100%) which was statistically significant ( $p=0.02$ ). Patients with hiatus hernia HH are at greater risk for EE than non-erosive cases ( $p=0.01$ ). By OGD and pH-study more than half of our cases (51.6%) were proved to have gastroesophageal reflux disease (GERD). There was significant difference ( $p < 0.001$ ) between those with erosive and non-erosive esophagitis in relation to number of reflux episodes and intensity of acid exposure.

### *Conclusion*

Only 21.3% of heartburn cases had EE. Having HH is a risk factor for EE. Almost half of cases with EE had abnormal pH-study; this means OGD has low sensitivity in the diagnosis of GERD with greater specificity. Adding combined pH-impedance test to OGD in the evaluation of heartburn increase the diagnostic utility of GERD.

**Keywords:** *Heartburn, GERD, NERD, Combined pH-impedance, KCGH.*

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## INTRODUCTION

Heartburn is characterized by a discomfort or burning sensation behind the sternum that arises from the epigastrium and may radiate toward the neck. Heartburn is an intermittent symptom, most commonly experienced after eating, during exercise, and while lying recumbent. It interferes significantly with the quality of life of many patients, and is a term that both medical and lay people easily recognize<sup>(1, 2)</sup>.

Regurgitation is the effortless return of food or fluid into the pharynx without nausea or retching. Patients report a sour or burning fluid in the throat or mouth that may also contain undigested food particles<sup>(1)</sup>.

Functional heartburn (FH) patients have normal esophageal acid exposure and no correlation between symptoms and reflux events and found in 25% of heartburn cases with normal OGD<sup>(2)</sup>.

Esophageal hypersensitivity (EH) demonstrates normal esophageal acid exposures but a positive correlation between reflux events and symptoms, as documented by a symptom index >50%, and/or a symptom association probability of >95%, which is found in 35% of cases of heartburn with OGD<sup>(2)</sup>.

Non-erosive reflux disease (NERD) is characterized by reflux symptoms in the absence of esophageal mucosal breaks, with objective evidence of pathological levels of gastroesophageal reflux on pH or pH-impedance monitoring.<sup>(2)</sup> Endoscopy-negative GERD patients are more likely to be female, younger, thin, and without hiatal hernia, and they have a higher prevalence of functional gastro-intestinal disorders<sup>(3)</sup>.

Gastroesophageal Reflux disease (GERD): defined by at least weekly symptoms of heartburn or acid regurgitation, is increasingly common. The prevalence in adult's ranges from 30% in some Western population to less than 10% in Eastern Asian populations, and the incidence is approximately 5 per 1000 person-year in western populations<sup>(4)</sup>. GERD is associated with reduced health-related quality of life, decreased work productivity<sup>(5, 6)</sup>.

Two commonly performed tests in evaluating heartburn are upper endoscopy and reflux testing<sup>(2)</sup>.

Current guidelines by the American College of Physicians suggest the major role of endoscopy is to diagnose and treat GERD complications, especially peptic strictures, and to define Barrett's esophagus. Other indications include typical GERD symptoms that persist despite a 4-8week trial of twice-daily PPI therapy, and patients with severe esophagitis after a 2-month PPI course, to assess healing and rule out Barrett's esophagus<sup>(7, 8)</sup>.

However, only 20% to 60% of patients with abnormal esophageal reflux by pH testing have esophagitis at endoscopy. Thus, the sensitivity of endoscopy for GERD is low, but it has high specificity at 90% to 95%.<sup>(9)</sup>

The majority of patients complaining of heartburn have normal endoscopic examinations.<sup>(10)</sup> One recent study reported 91% of patients with suspected GERD had a normal endoscopy and approximately one-third of these patients had a diagnosis of FH when pH testing was used.<sup>(11)</sup> The most thoroughly evaluated esophagitis classification is the Los Angeles (LA) system, which is now widely used throughout the world<sup>(12)</sup>. Figure 1<sup>(13)</sup>.

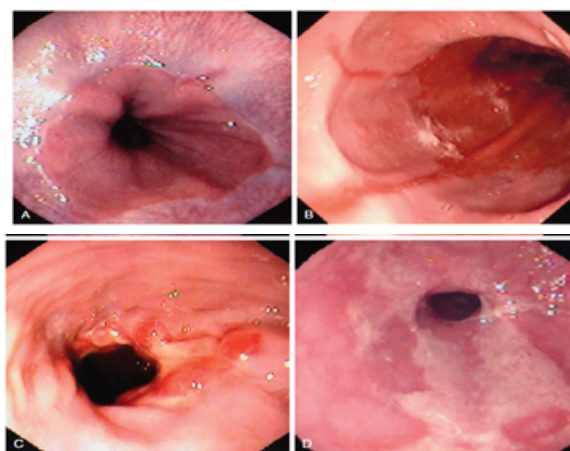


Figure 1. Endoscopic photographs of the 4 grades of esophagitis (A to D) using the Los Angeles classification system<sup>(13)</sup>.

### **Esophageal Reflux Testing**

Continuous esophageal pH monitoring has been available since the early 1960s<sup>(14)</sup>. The work of Johnson and DeMeester in the 1970s simplified the procedure and provided a method of interpreting the data obtained<sup>(15)</sup>.

### **Multichannel Intraluminal Impedance (MII)**

In 1991 Silny was the first investigator who described MII, a technique which detects intra esophageal bolus transport. This method is based on measuring the resistance to alternating current (i.e., impedance) of the content of the esophageal lumen. MII- pH monitoring was then developed by several clinical investigators<sup>(16)</sup>.

Combined impedance with pH testing, allows the measurement of acid and nonacid reflux, this is particularly important for patients on PPIs who continue to reflux, but now most episodes have pH higher than 4. Nonacid reflux is measured by the detection of a retrograde bolus of ion-rich fluid in the esophagus. Refluxes that are mixture of liquid and air are also readily detected<sup>(17,18)</sup>.

Ambulatory pH monitoring is useful for confirming GERD in those with persistent symptoms (whether typical or atypical) who do not have evidence for mucosal damage on endoscopy, particularly if a trial of twice daily PPI has failed<sup>(19)</sup>. The role of ambulatory monitoring in diagnosing GERD has evolved over the years. Impedance monitoring has provided the opportunity to detect esophageal exposure to both acid and non-acid reflux events and has increased sensitivity of reflux monitoring<sup>(20)</sup>.

Sensitivity and specificity of pH testing for the diagnosis of GERD have been reported to be 77 and 92%, respectively, with poor negative predictive values<sup>(21)</sup>.

### **Aims of the study**

To evaluate patients with heartburn clinically, endoscopically and by combined impedance-pH study, and to find the correlation between endoscopy and esophageal pH-study.

## **PATIENTS AND METHODS**

This is a cross-sectional descriptive case series study, was conducted in Kurdistan center for Gastroenterology and Hepatology in Sulaimani from February 2015 to December 2015.

The study started after approval of the ethical committee of Kurdistan board for medical specialization. Written consent has been taken from all patients.

A total number of 60 cases with heartburn for more than 4 weeks who have already referred to KCGH enrolled in this study. A validated questionnaire filled with face to face interview, including demographic data (gender, age, and smoking habit) symptoms of GERD regarding frequency and severity, duration with waist circumference and calculated BMI.

Frequency of heartburn in the questionnaire is clarified to those with infrequent (once a month), once a week and those with more than once a week of reflux symptoms. BMI (ratio of weight in kilogram to height in meter square) is calculated by using digital scale for weight and standard meter for height, WHO-recommendation used for cut-off ranges, as (18.5-24.9) kg/m<sup>2</sup> regarded as normal, 25-29.9kg/m<sup>2</sup> as overweight and  $\geq 30$ kg/m<sup>2</sup> considered obese<sup>(22)</sup>. While Asian-Pacific recommendation<sup>(23)</sup> depending on waist circumference as risk for comorbidities is used. Waist circumference is measured in centimeter ( $\geq 80$ cm for female  $\geq 90$  for male regarded risky) midway between the upper border of iliac crest and lower border of rib cage.

All cases underwent OGD by a certified gastroenterologist.

Hiatal hernia was considered when the gastroesophageal junction was positioned 2 cm or more above the diaphragm<sup>(24)</sup>.

Patients are scheduled on appointment list, explanation given regarding the pH-study procedure with advice regarding an over-night fasting (8hr) and withheld their anti-acid medications (H<sub>2</sub>-blocker and PPI) to a minimum of 7 days. Procedure performed using Impedance-pH monitoring for 24 hours (ZepHr, Sandhill scientific, Inc. Highlands Ranch, CO, USA), Figure 2.

A single used catheter (CamforTec<sup>R</sup> Z/pH- Highlands Ranch, CO, USA, single use impedance/ pH probe calibrated with buffer solution of pH-4 and pH-7 prior to use Then the catheter is lubricated with Lidocaine gel passed through the nostril, positioned 5 cm proximal to the LES fixed to the nose with tape left for almost 24 hrs. Data stored in the portable data logger. Instruction given to the patients regarding their daily activities and usual daily diets. The next morning, the stored data transferred to the computer, saved, analyzed and printed

to the patients after using DeMeester's composite score as the main variable for data analysis.

**Inclusion criteria**

Patient aged  $\geq 15$  years, History of heart burn for  $\geq 4$  weeks, not received PPI or H2 blocker for 7 days before pH study were included in the study. Patient less than 15 year of age and those whome are pregnants were excluded.

**Statistical analysis**

We used Statistical Package for Social Sciences (SPSS) version 23. A statistical significance threshold of  $P$ -value  $\leq 0.05$  was adopted and the results presented as tables and graphs.

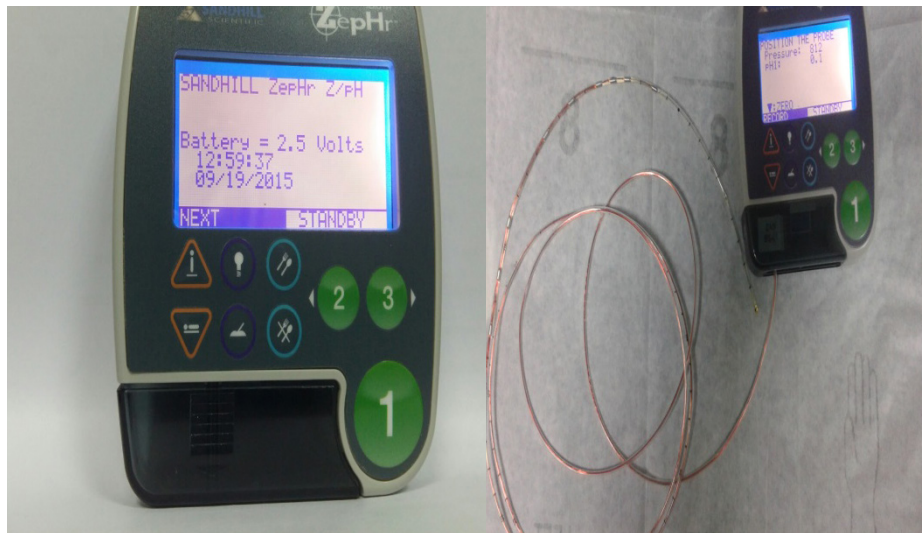


Figure 2. ZepHr SANDHILL a portable logger and the Impedance-pH probe.

**RESULTS**

Total of 60 cases with heartburn enrolled in this study, mean age was  $(36.8 \pm 10.6)$  year, ranges of (17-67) year. The greatest population seen in range of (36-45) year. Mean age of males was (40.4) year, mean age of females was (33.9) year, Table1.

Fifty-five percent were females, while males were 45% of the participants. Clinical and Demographic characteristics of patients are shown in Table 2.

Thirteen (21.7%) of cases had erosive esophagitis and forty-seven of cases (78.3%) had normal OGD (Non-erosive), Figure 5.

Greater percentages of HH and smoking observed among erosive esophagitis (EE) than non-erosive cases (30.8%, 23.1% vs 6.4%, 8.5%) respectively, Figure 6.

Table 1. Age distribution of studied population

| Age/year | No. | %    |
|----------|-----|------|
| 15-30    | 12  | 35   |
| 31-45    | 27  | 45   |
| 46-60    | 10  | 16.7 |
| >60      | 2   | 3.3  |

Table 2. Clinical characteristic of the patients.

| Variables                                   | No. | %    |
|---|-----|------|
| <b>Gender:</b>                              |     |      |
| Male  | 27  | 45   |
| Female                                      | 33  | 55   |
| <b>Smoking:</b>                             |     |      |
| Smoker                                      | 7   | 11.7 |
| Non-smoker                                  | 53  | 88.3 |
| <b>BMI kg/m2:</b>                           |     |      |
| Normal                                      | 27  | 45   |
| Overweight                                  | 26  | 43.3 |
| Obese                                       | 7   | 11.7 |
| <b>Male WCF (cm) Mean± SD (91.2±10)</b>     |     |      |
| >90   | 12  | 44.5 |
| <90   | 15  | 55.5 |
| <b>Female WCF (cm) Mean± SD (87.7±14.4)</b> |     |      |
| >80   | 20  | 60.6 |
| <80   | 13  | 39.4 |
| <b>Regurgitation:</b>                       |     |      |
| Yes   | 46  | 76.6 |
| No  | 14  | 23.4 |

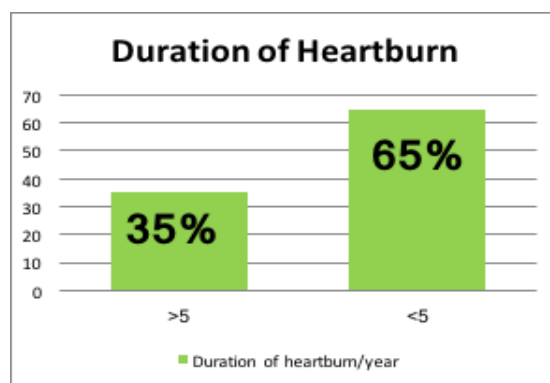


Figure 3. Duration of Heartburn

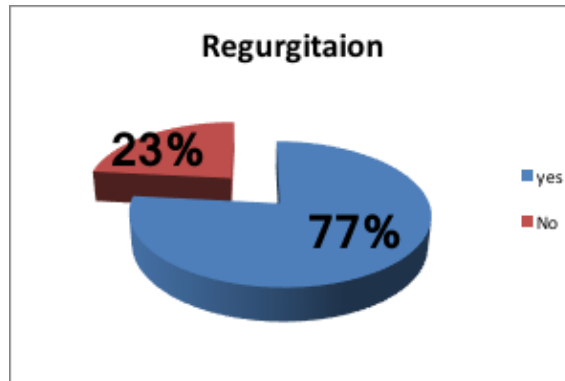


Figure 4. Distribution of regurgitation in studied population

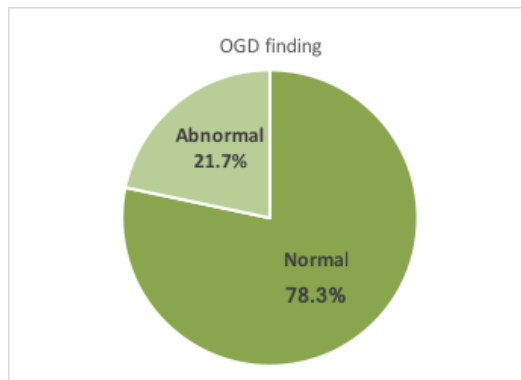


Figure 5. Distribution OGD findings in studied population

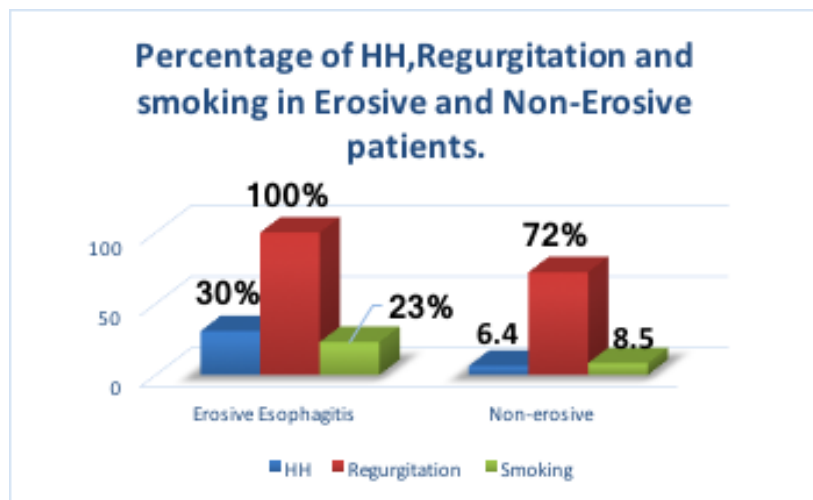


Figure 6. Distribution of HH, regurgitation and smoking in both erosive and non-erosive esophagitis cases according OGD finding.

*Clinical, Endoscopic and Esophageal pH-Impedance Study...*

There was a steadily increase in the percentage of HH with increasing BMI (10.3%, 12.5%,14.3%) for normal, overweight and obesity respectively, Figure 7.

Forty-six percent of those with erosive esophagitis (n=6/13) and 38.3 % Of those with non-erosive (n=18/43) had abnormal pH-impedance study, Figure 8.

Fifty-two percent of cases were GERD (EE and NERD), the remaining of 48% were FH and EH. Figure 9.

For those with GERD (52%), acid reflux episodes constitute greater percentage than non-acidic (58.1% vs 41.9%), Table 3.

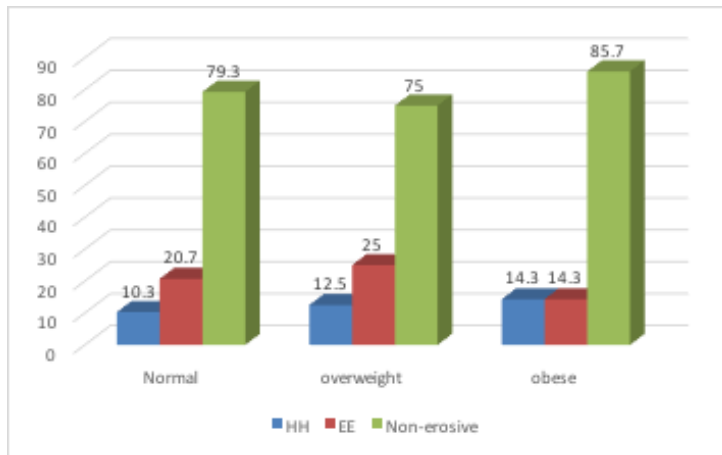


Figure 7. Distribution of HH, EE and Non-Erosive findings in relation to BMI

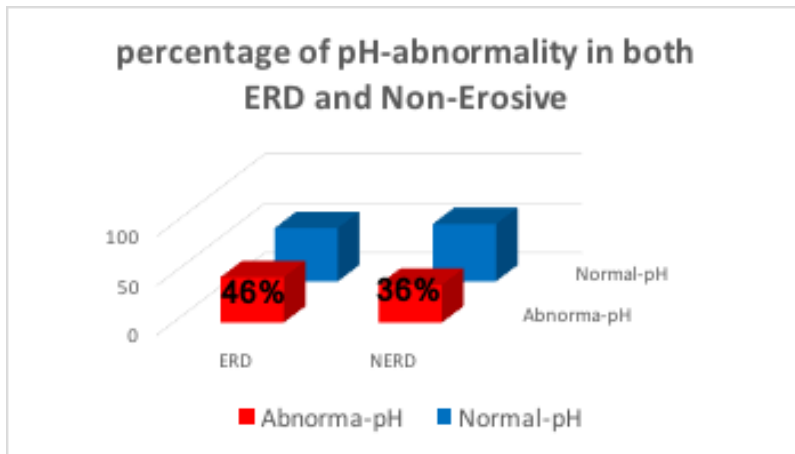


Figure 8. Distribution of abnormal pH-impedance study in both erosive and non-erosive cases.

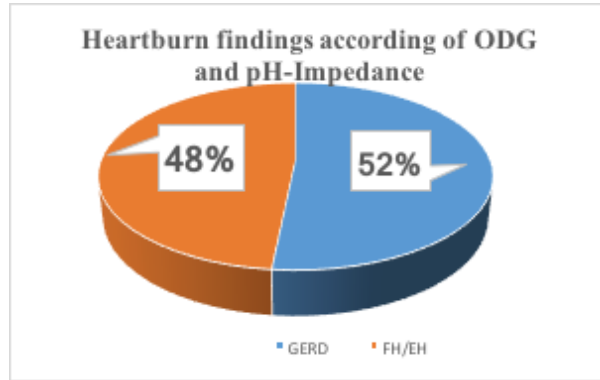


Figure 9. Findings of heartburn according of OGD and pH-impedance

Table 3. Distribution of reflux episodes in GERD cases in acidic vs non-acidic.

| GERD              | No.       | %           |
|-------------------|-----------|-------------|
| Mainly acidic     | 18        | 58.1        |
| Mainly non-acidic | 13        | 41.9        |
| <b>Total</b>      | <b>31</b> | <b>100%</b> |

In GERD cases, acid reflux episodes increased with increasing BMI, reaches (100%) in those who are obese, (57.1%) in overweight's, while (50%) in those with normal body weight, Figure 10.

OGD has greater specificity than sensitivity in the diagnosis of GERD (80.6% vs 25%) respectively, Table 4.

There was no statistically significant difference between patients with erosive and non-erosive esophagitis in relation to gender, age and smoking ( $p > 0.05$ ). Males slightly at higher risk of erosive esophagitis than females but was not significant statistically ( $p = 0.1$ ), Table 5.

Those with HH are at greater risk of erosive esophagitis with significant result statistically ( $p = 0.01$ ). Those with erosive esophagitis more likely to have regurgitation with statistically significant result ( $p = 0.02$ ), Table 6.

There was highly significant difference observed ( $p < 0.0001$ ) between those with erosive esophagitis and non-erosive cases in relation to means of percent time exposure of  $pH < 4$  in (total and upright position), longest acid episode, total reflux activity and number of dominant acid reflux activity. The mean relation is also significant ( $p = 0.03$ ) in % time acid exposure in relation to supine position as well. There is low ( $p = 0.06$ ) but statistically no significant relation seen in means of acid clearance time, Table 7.

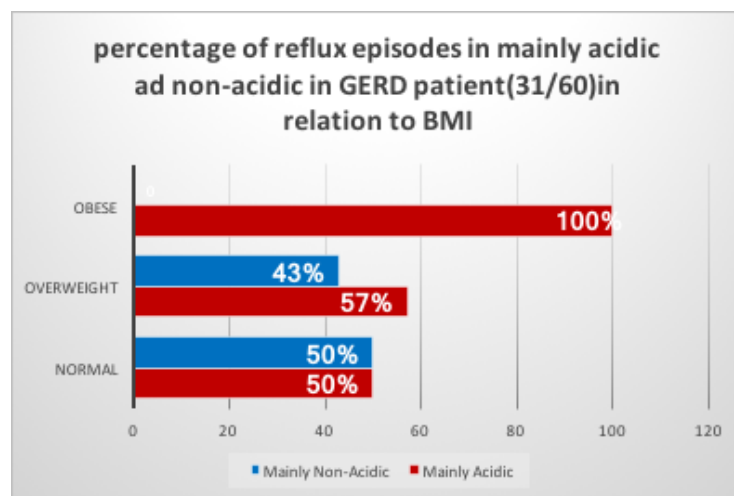


Figure 10. Distribution of reflux components in to (mainly acidic and non-acidic) in relation to BMI.

**Table 4. Distribution results of impedance in relation to OGD findings.**

| OGD            | Impedance-pH result                 |                                       | Total |
|----------------|-------------------------------------|---------------------------------------|-------|
|                | Abnormal                            | Normal                                |       |
| <b>Erosive</b> | 6 (80.6 % specificity)<br>PPV=46.1% | 7                                     | 13    |
| <b>Normal</b>  | 18                                  | 29<br>(25 % sensitivity)<br>NPV= 61.7 | 47    |
| <b>Total</b>   | 24                                  | 36                                    | 60    |

PPV= positive predictive value; NPV= negative predictive value

**Table 5. Demographic and social characteristic according OGD findings.**

| variables         | Erosive |      | Non -Erosive |      | X <sup>2</sup> | p.value |
|-------------------|---------|------|--------------|------|----------------|---------|
|                   | No.     | %    | No.          | %    |                |         |
| <b>Gender</b>     |         |      |              |      |                |         |
| male              | 8       | 61.5 | 19           | 40.4 | 1.8            | 0.1     |
| female            | 5       | 38.5 | 28           | 59.6 |                |         |
| <b>Age (year)</b> |         |      |              |      |                |         |
| 15-35             | 7       | 53.8 | 14           | 29.8 | 4.4            | 0.2     |
| 31-45             | 3       | 23.1 | 24           | 51.1 |                |         |
| 46-60             | 3       | 23.1 | 7            | 14.9 |                |         |
| >60               | 0       | 0    | 2            | 5.3  |                |         |
| <b>Smoking</b>    |         |      |              |      |                |         |
| Smoker            | 3       | 23.1 | 4            | 8.5  | 2              | 0.1     |
| Non-smoker        | 10      | 76.9 | 43           | 91.5 |                |         |

Table 6. Clinical characteristics of studied population according OGD findings.

| variables               | Erosive |      | Non -Erosive |      | X <sup>2</sup> | p.value |
|-------------------------|---------|------|--------------|------|----------------|---------|
|                         | No.     | %    | No.          | %    |                |         |
| <b>BMI (kg/m2):</b>     |         |      |              |      |                |         |
| Normal                  | 6       | 46.2 | 23           | 48.9 | 0.39           | 0.8     |
| Overweight              | 6       | 46.2 | 18           | 38.3 |                |         |
| Obese                   | 1       | 7.6  | 6            | 12.8 |                |         |
| <b>Male WCF (cm):</b>   |         |      |              |      |                |         |
| >90                     | 2       | 25   | 10           | 52.6 | 1.7            | 0.1     |
| <90                     | 6       | 75   | 9            | 47.4 |                |         |
| <b>Female WCF (cm):</b> |         |      |              |      |                |         |
| >80                     | 3       | 60   | 17           | 60.7 | 0.01           | 0.9     |
| <80                     | 2       | 40   | 11           | 39.3 |                |         |
| <b>HH:</b>              |         |      |              |      |                |         |
| Yes                     | 4       | 30.8 | 3            | 6.4  | 5.8            | 0.01    |
| No                      | 9       | 69.2 | 44           | 93.6 |                |         |
| <b>Regurgitation:</b>   |         |      |              |      |                |         |
| Yes                     | 13      | 100  | 33           | 70.2 | 5              | 0.02    |
| No                      | 0       | 0    | 14           | 29.8 |                |         |

Table 7. Mean acid exposure in both erosive and non-erosive groups according to OGD finding.

| variables                                | Erosive<br>(Mean± SD) | Non-erosive<br>(Mean± SD) | p.value |
|--|-----------------------|---------------------------|---------|
| <b>% time exposure (pH&lt;4) (total)</b> | 4.6±3.9               | 0.9±0.9                   | <0.001  |
| <b>% time-upright position</b>           | 4.7±3.6               | 1.5±2.2                   | <0.001  |
| <b>% time-supine position</b>            | 3.3±4.5               | 0.7±2.1                   | 0.03    |
| <b>Longest episode(min)</b>              | 17±22                 | 2.9±3.7                   | <0.001  |
| <b>Mean acid clearance(sec)</b>          | 101.9±93.6            | 61.1±71.3                 | 0.06    |
| <b>Total reflux activity</b>             | 86.5±31.4             | 42.1±14.5                 | <0.001  |
| <b>Number acid refluxes</b>              | 49.2±21.7             | 18.8±12.1                 | <0.001  |

There were no stastically significant differences (p >0.05) in gender, age, BMI, WCF, HH, smoking and regurgitation between ERD and NERD Table8.

There was no statistically significant difference between ERD and NERD (abnormal impedance) in relation to reflux episode and acid exposure intensity (p=>0.05), Table 9.

**Table 8. Clinical and Sociodemographic correlation of ERD and NERD**

| variables                     | ERD |      | NERD( +ve PH study) |      | X <sup>2</sup> | p.value |
|-------------------------------|-----|------|---------------------|------|----------------|---------|
|                               | No. | %    | No.                 | %    |                |         |
| <b>Gender:</b>                |     |      |                     |      |                |         |
| Male                          | 8   | 61.5 | 10                  | 55.5 | 0.1            | 0.7     |
| Female                        | 5   | 38.5 | 8                   | 44.5 |                |         |
| <b>Age/year:</b>              |     |      |                     |      |                |         |
| 15-30                         | 7   | 63.6 | 4                   | 36.4 | 4.9            | 0.1     |
| 31-45                         | 3   | 23.1 | 10                  | 76.9 |                |         |
| 46-60                         | 3   | 50   | 3                   | 50   |                |         |
| >60                           | 0   | 0    | 1                   | 100  |                |         |
| <b>BMI(kg/m<sup>2</sup>):</b> |     |      |                     |      |                |         |
| Normal                        | 6   | 46.1 | 8                   | 44.4 | 0.1            | 0.9     |
| Overweight                    | 6   | 46.1 | 8                   | 44.4 |                |         |
| Obese                         | 1   | 7.8  | 2                   | 11.2 |                |         |
| <b>Male WCF (cm):</b>         |     |      |                     |      |                |         |
| >90                           | 2   | 25   | 6                   | 60   | 2.2            | 0.1     |
| <90                           | 6   | 75   | 4                   | 40   |                |         |
| <b>Female WCF (cm):</b>       |     |      |                     |      |                |         |
| >80                           | 3   | 60   | 3                   | 37.5 | 0.6            | 0.4     |
| <80                           | 2   | 40   | 5                   | 62.5 |                |         |
| <b>Smoking:</b>               |     |      |                     |      |                |         |
| Smoker                        | 3   | 23   | 1                   | 5.6  | 2              | 0.1     |
| Non-smoker                    | 10  | 77   | 17                  | 94.4 |                |         |
| <b>HH:</b>                    |     |      |                     |      |                |         |
| Yes                           | 4   | 30.8 | 2                   | 11.2 | 1.8            | 0.1     |
| No                            | 9   | 69.2 | 16                  | 88.8 |                |         |
| <b>Regurgitation:</b>         |     |      |                     |      |                |         |
| Yes                           | 13  | 100  | 14                  | 77.7 | 3.3            | 0.06    |
| No                            | 0   | 0    | 4                   | 22.3 |                |         |

**Table 9. Mean of reflux episode activity and acid exposure in patients with both ERD and NERD (abnormal impedance).**

| Variables                     | ERD (Mean± SD) | NERD (Mean± SD) | p.value |
|-------------------------------|----------------|-----------------|---------|
| Number reflux episodes        | 64.2±35.3      | 84.1±34.4       | 0.1     |
| %time (total)exposure(pH<4)   | 2.6±3.6        | 4.8±3.6         | 0.1     |
| %time-upright                 | 3.4±4.2        | 4.2±3.1         | 0.5     |
| % time-supine                 | 1.4±2.8        | 3.5±4.8         | 0.1     |
| Longest episode(min)          | 4.6±12.3       | 18.7±23.5       | 0.09    |
| Mean acid clearance time(sec) | 56±40.6        | 111.1±105.7     | 0.06    |
| Number acid refluxes          | 35±28.7        | 46.4±20.2       | 0.2     |
| Number non-acid refluxes      | 29.2±17.6      | 37.7±21.7       | 0.2     |

## DISCUSSION

Heartburn is among the most common gastrointestinal symptoms presenting to both general physicians and gastroenterologists. (2). Non erosive reflux disease and erosive esophagitis are the most common phenotypic presentations of gastroesophageal reflux disease (25).

In our study, a total of 60 cases with heartburn evaluated, mean age was 36.8 year, while mean duration of heartburn was 4.6 year, meanwhile in Basim *et al* (26), the mean age was 47 and mean duration of heartburn was 6.1 year.

In current study, 77% of all cases had regurgitation and 100% of those with EE had regurgitation but it was 24% in Basim *et al* (26) and 66.3% in Lazebnik *et al* (27) studies.

In our study, OGD found EE in 21.7% of cases, the rest (78.7%) had normal OGD (non-erosive), Basim *et al* (26), who performed OGD for 50 cases with heartburn referred to Center of Gastrointestinal Disease in Baghdad, in their study 88% of cases had EE. This difference can be explained by the mean age which was older and with longer duration of heartburn in their studied population. However, they explained such a high percentage of EE on the basis that the study carried in a tertiary referral center (26). While comparing our study to neighbors, in Frootan *et al* (25) in Turkey 42.5% and Rezail ashkajani *et al* (28) in Iran, 50 % of their OGD finding were EE. The lower finding of EE in our study may be explained partly by earlier presentation in one hand, using PPI and life style differences in the

other hand, while almost similar to Morozova *et al* (29) in Russia, in which 60 cases of heartburn 18.3% turns out to be EE.

In this study, EE was more common in males than in females (61.5% vs 38.5%) respectively, in Basim *et al* (26) the results were (73% vs 27) respectively. This may be explained by fact that more males did smoke and HH found in greater percentage in males. Being male is a risk factor for EE in Wong *et al* (30).

We found that, prevalence of smoking greater among EE than those with normal OGD. (23.17%EE vs. 8.5 % non-erosive). Smoking increases LES relaxation (31).

In our study, OGD detected HH in 30.8 % of those with EE, while only 6.4% of those with normal OGD had HH. The result was statistically significant and close to the findings of Basim *et al* (26) which was 38.6%. HH is considered a risk factor for EE, because it reduces esophageal clearance and increases the risk of acid reflux (32).

In this study, EE found in 53.8% of those with abnormal BMI (BMI≥25). A study conducted by Savarino *et al* (33), stated that, being overweight is an independent risk factor for EE.

We observed with increasing BMI the number of acid reflux episodes increase as well this is comparative to the findings of Hajar *et al*. (34) Central obesity results in an increase in intragastric pressure, thus increasing the abdominal-thoracic pressure gradient, which overwhelms the reflux barrier (35). In addition, visceral

fat is metabolically active and produces a variety of cytokines including interleukin (IL)-6 and TNF- $\alpha$ , which may affect the function of the lower esophageal sphincter <sup>(36)</sup>.

In our study, the specificity of OGD in the diagnosis of GERD reaches 80.6% with low sensitivity (25%), which is comparative to Richter JE <sup>(9)</sup>, who found the endoscopic findings of distal esophageal erosions and ulcerations are a specific, but not very sensitive marker of GERD. This may be explained by the fact that longer duration of refluxes required to cause macroscopic changes.

In current study, 46% cases of EE and 38.3% of non-erosive cases revealed abnormal pH-study. The result was (47.1% in EE, 31.9% non-erosive) in Frootan *et al* <sup>(25)</sup> and was (53.9% in EE, 52.2% in non-erosive) cases in Grande *et al* <sup>(37)</sup>.

In our study, we found patients with EE had greater acid exposure time and total reflux activity than non-erosive cases and the differences were highly significant statistically, these differences even observed during both upright and supine positions. These results similar to Yi ZH *et al* <sup>(38)</sup>, they enrolled 94 cases with typical heartburn and regurgitation, participants were divided in two groups of EE and NERD on the basis of OGD. They found indicators of 24-hour pH monitoring were significantly higher in the EE group compared to those with NERD.

We found that, the number of reflux episodes and acid exposure activities were similar substantially between EE and NERD (NERD with abnormal pH-study) cases with no statistically significant difference. This is comparative to results observed in both Long *et al* <sup>(39)</sup> and Frootan *et al* <sup>(25)</sup>.

In Cheng *et al* <sup>(40)</sup>, GERD is determined by an abnormal OGD or 24-hour pH-impedance monitoring, in the light of above definition; we conclude that more than half (51.6%) of our cases with heartburn have a GERD which is lower than the results reported by both Grande *et al* <sup>(32)</sup> and Frootan *et al* <sup>(25)</sup> which were (83.3%, 74.4%) respectively. This may be explained by the differences in the samples, duration of heartburn and duration of the studies.

In conclusions, Twenty-one percent of cases with heartburn have EE. Hiatus hernia was found in 30.8% of cases with EE. OGD is highly specific in the diagnosis of GERD with low sensitivity. Fifty-

two percent of patients with heartburn have GERD by OGD and pH-study. Increasing BMI, associated with increasing acid reflux episodes. ERD and NERD (NERD with abnormal pH-study) cases were similar regarding total reflux episodes and acid exposure time. Patients with normal OGD have significant difference in acid exposure time and reflux activity comparing to those with EE.

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