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ABSTRACT

Background: In this study, the purpose was to determine the anatomical localizations of the cervical esophagus length, hiatal clamp, and esophagogastric junction depending on age and gender in patients who undergo Esophagogastroduodenoscopy (EGD).

Materials and methods: The images of the patients who underwent EGD between 2018 and 2020 were analyzed retrospectively in this study. The distance of the anatomical localizations of the cervical esophagus length, hiatal clamp, and esophagogastric junction to the anterior incisors, and the relations of this distance with the demographic

characteristics and clinical manifestations of the patients were investigated on the esophagogastroduodenoscopy data.

Results: A total of 298 patients (174 women/124 men) were included in the study. The cervical esophagus length and the distance of the esophagogastric junction and hiatal clamp localization of the patients were found to be 15.06±0.57 cm, 37.51±2.23 cm and 38.62±2.23 cm, respectively. It was also found that the mean values of all lengths in males were higher at a statistically significant level than in females ($p<0.001$; $p<0.01$).

Conclusions: Knowing these anatomical localizations may be important in predicting complications that may occur in this region in EGD and planning the precautions to be taken. We also believe that it will guide clinicians in determining hiatal hernia and related deficiencies.

Key words: esophagogastroduodenoscopy, cervical esophagus length, hiatal clamp, esophagogastric junction

INTRODUCTION

Endoscopic examination of the Gastrointestinal System (GIS) is accepted as the gold standard all over the world [1]. Esophagogastroduodenoscopy (EGD) includes the imaging of the oropharynx, esophagus, stomach, and proximal duodenum. The esophagus, after the oropharynx, is approximately 25 cm long and has the form of a collapsed tube unless inflated. It has three parts; the pars cervicalis extends from the lower edge of the cartilago cricoidea to the incisura jugularis at the level of the C6-T2 vertebra (5-8 cm). Pars thoracica is located at the level of T2-T10 vertebrae in mediastinum superius and posterius (15-18 cm). Pars abdominalis is the part (1-3 cm) passing through the hiatal clamp at the level of T10 vertebra and extending to the ostium cardiacum. Esophagogastric junction is usually 40 cm after the anterior incisors [1]. Although the esophagogastric junction is not an endoscopically visible part in patients without a hiatal hernia, it is considered to be the *Z* line where the lower esophageal sphincter is also located. The hiatus esophagus is the opening on the diaphragm where the esophagus passes from the thorax to the abdomen, and is one of the three openings of the diaphragm localized in the crus dextrum. This opening is at the T10 level, elliptical, and is located in the muscular part of the diaphragm with a diameter of approximately 2.5 cm and 2-3 cm in length in the left posterior upper

part of the hiatus aorticus slightly to the left at the middle part. This anatomical localization, which is clinically called the hiatal clamp, is detected below the esophagogastric junction on average 1 cm if viewed with EGD [2]. In the present study, hiatus esophagus was used as the distance of the hiatal clamp to the anterior incisors, which is in line with the literature.

The stomach fundus, which begins after it passes through the esophagogastric junction at the level of the thoracic eleventh vertebra, continues down and to the left with the corpus. The region that is called incisura angularis at the entrance of the antrum pyloricum in the stomach is an important point for EGD because it is the most common area of helicobacter pylori. Following the pars horizontalis (1st part), which is approximately 5 cm, of the duodenum that consists of four parts, the pars descendens (2nd part) begins as the part EGD process ends [1, 3].

Esophagogastric junction is an important anatomical area with its basic functions. Where the esophagus ends and the stomach begins is discussed among histologists, physiologists, gastroenterologists, radiologists, and surgeons for many years. It is important to understand that there are differences in the normality range which will be recognized and interpreted easily by an experienced gastroenterologist. Although monomeric evaluation is needed to evaluate functional disorders, biopsy and EGD are essential to diagnose structural and histological abnormalities [4]. This diagnostic and therapeutic method might lead to some life-threatening complications. The most common cause of esophageal perforations are particularly these iatrogenic damages. The incidence of this condition varies between 0.0009% and 0.01% [5]. Such iatrogenic injuries are most commonly detected in the part called “the cervical esophagus”. For this reason, preserving the tubular structure of the esophagus when the esophagus is entered is the most important aspect to be considered in this regard. However, since the esophagogastric junction shows continuous peristalsis, the normal change in the mucosa can usually be distinguished with a little excess air insufflation [1]. Determining the length of these areas, which were mentioned in the present study, will guide the endoscopy specialist who performs the procedure to be more careful in the detected lengths when s/he passes through these and similar risky areas.

In the present study, the purpose was to determine the anatomic localizations of cervical esophagus length, hiatal clamp, and esophagogastric junction in patients who undergo EGD, depending on age and gender.

MATERIALS AND METHODS

In this study, the data of 695 patients who underwent EGD between 2018 and 2020 were retrospectively analyzed. Among these patients, 56 patients who were under 18 years of age, 315 patients who had a history of upper gastrointestinal surgery, 9 patients who were diagnosed with upper gastrointestinal cancer, 1 with implanted PEG, and 16 patients with hiatal hernia were not included in the study. The present study was conducted with 298 patients.

After a full 6-hour oral intake restriction, verbal and written consent was obtained from the patient and necessary information was given. Before the procedure, pharyngeal anesthesia was applied with 10% lidocaine spray. Afterwards, the patient was positioned to the left of the endoscopist, with the head slightly flexed and the chin closer to the chest. The Olympus GIF-Q scope was advanced by providing direct vision. The structures in the mouth were roughly evaluated, and the esophagus was entered by observing the piriform sinuses. The distance from the anterior incisors to the first stricture after passing the epiglottis was considered as the cervical esophagus length (Fig.1). The esophagus was evaluated by providing adequate insufflation and the scope was pushed distally in a controlled manner. In the most distal part of the esophagus, the squamocolumnar epithelial region (transition zone), Z line, where the squamous epithelium of the esophagus ends and the columnar epithelium of the stomach begins, was observed. The distance between the anterior incisors and the Z line was measured as the distance to the anatomical localization of the esophagogastric junction (Fig 2). The place where the diaphragm crus are seen approximately 1 cm after the esophagogastric junction is considered as the hiatal clamp (hiatus esophagus). The distance from the anterior incisors to this point was measured as the distance to the anatomical localization of the hiatal clamp (Fig.3, Fig.4). The stomach was entered by passing the hiatal clamps. After careful evaluation of the stomach structures, the duodenum was evaluated by passing the pylorus. The distal end portion of the duodenum, which was evaluated, was the second continent and was advanced until the scope reached this point. Afterwards, a detailed controlled examination was performed at

the exit and the procedure was terminated by aspirating the air given during the procedure. All measurements were made by the same investigator. It was recommended that patients not take solid or liquid food for two hours after the procedure.

Previous studies have shown that these measurements can also be made with manometers and pH meters. If we look at the working principle of these methods, the pH meter is applied through the nose and the lower esophageal sphincter is directly reached without seeing the anatomical points we measured in the study. It is based on placing the catheter 5 cm above the sphincter and recording the pH changes on a digital recorder outside the catheter at 4-8 second intervals [6]. The manometer is suitable for use to detect esophageal motor patterns and extreme motor abnormalities (eg, achalasia and extreme hypomotility) [7]. In both methods, both the length cannot be determined objectively and the main indications differ. When these methods are considered and evaluated, the easiest, cheapest and most applicable method is endoscopy.

Statement of ethics

The approval of the Ethics Committee regarding the study was obtained from the Health Sciences University, Kartal Kosuyolu Training and Research Hospital, Non-Interventional Clinical Research Ethics Committee (IRB: 2019.4/26-203).

Statistical analysis

The population of the study consisted of approximately 1300 individuals who met the inclusion criteria in the evaluation between 2018 and 2019 based on esophagogastroduodenoscopy measurements. In this respect, in the calculation based on the following formula, the number of patients that would be included in the study was determined as a minimum of 297 patients, with n = 296.71 *[8]*.

$$n = \frac{Nt^2pq}{d^2(N-1)+t^2pq}$$

(N: Population; n: Frequency of application to be included in the sampling; p: Frequency of the occurrence of the investigated event; q: Frequency of absence of the investigated event; t: The theoretical value found from the **t** table at a certain degree of freedom and the detected error level; d: The ± deviation desired to be done according to the incidence of the event)

When the findings obtained in the study were evaluated, the IBM® SPSS® (Statistical Package for the Social Sciences) software version 22 (IBM Corp. Armonk, NY,

USA) was used for statistical analyses. The conformity of the variables to the normal distribution was evaluated with the Kolmogorov Smirnov Test, Q-Q Graphs, and Histograms. When the study data were evaluated, the Student-t Test was used for the evaluation of the quantitative data between two groups along with descriptive statistical methods (i.e. mean, standard deviation, frequency, percentage). The Student-t Test was used for the evaluation of the quantitative data between two groups. The One-Way Analysis of Variance (ANOVA) was used for the evaluation of quantitative data between more than two groups, and the Tukey Post-Hoc Test was used to determine the group which caused the difference. The Pearson Chi-Square Test, the Continuity (Yates) Corrected Chi-Square Test, and the Fisher's Full Chi-Square Test were used to evaluate qualitative data. Significance was taken as $p<0.05$ level.

RESULTS

The present study was conducted with 298 patients who underwent EGD, 41.6% (n=124) of whom were male, and 58.4% (n=174) female. The ages of the patients ranged between 21 and 91 with a mean of 53.77±13.47. A total of 6.7% (n=20) of the patients were under 35 years old, 19.5% (n=58) were between 35-44 years of age, 24.2% (n=72) were 45-54, 27.5% (n=82) were between 55-64, and 22.1% (n=66) were at and above the age of 65.

The cervical esophagus length of the patients varied between 14 and 16 cm with a mean of 15.06±0.57 cm, and the esophagogastric junction length varied between 30 and 44 cm with an average of 37.51±2.23 cm, and the distance of the hiatal clamp localization to the anterior incisors varied between 31 and 46 cm with a mean of 38.62±2.23 cm.

It was found that there were statistically significant differences between the average length of the anatomical location of the hiatal clamp, the distance from the anterior incisors, and the age groups ($p=0.031$; $p<0.05$). As a result of the Tukey Post-Hoc Test that was applied to determine which age group the difference originated from, the mean hiatal clamp length of the patients who were under 35 years of age was significantly higher than the patients who were between the ages of 35-44 ($p=0.030$; $p<0.05$).

When the cervical esophagus, esophagogastric junction, and hiatus clamp lengths were compared according to gender, the mean values of all lengths were found to be higher in males at a statistically significant level than in females ($p<0.001$; $p<0.01$).

When the indications for EGD applied to the patients were evaluated, 48.7% (n=145) had dyspepsia as the reason, 30.9% (n=92) cancer screening, 6% (n=18) follow-up, 5.4% (n=16) Gastroesophageal Reflux Disease (GERD), 5% (n=12) GIS bleeding, and 4% (n=15) other (dysphagia, intensive care patient nasogastric feeding).

No statistically significant differences were detected between the indications EGD in the patients and the mean lengths of cervical esophagus, hiatal clamp, and esophagogastric junction localizations ($p>0.05$) (Table 2).

No statistically significant differences were detected between the age groups and indications of performing EGD in patients ($p>0.05$). The relations between the indications for esophagogastroduodenoscopy and gender was also investigated. In this respect, the rate of EGD because of dyspepsia was found to be higher in women (55.2%) at a statistically significant level than in men (39.5%) ($p=0.008$; $p<0.01$) (Table 3). Also, the rate of EGD because of GIS bleeding was found to be higher at a statistically significant level in males (7.3%) than in females (1.7%) ($p=0.032$; $p<0.05$).

A total of 27.2% (n=81) of the patients who underwent esophagogastroduodenoscopy had antral gastritis diagnosis, 21.8% (n=65) loose Lower Esophageal Sphincter (LES), 11.1% (n=33) alkaline reflux, 10.4% (n=31) pangastritis, 8.1% (n=24) erosive gastritis, 3.4% (n=10), ulcer (antrum), 5% (n=15) other diagnoses (bulbitis, Barret's esophagus, esophagitis, pyloric strictures) and 4.7% (n=14) normal.

No statistically significant differences were detected between the diagnoses of the patients after EGD and the mean lengths of cervical esophagus, esophagogastric junction, and hiatal pincer localizations ($p>0.05$) (Table 4).

When the differences in the diagnosis were examined according to the age groups, no differences were detected except for the patients who were diagnosed with antral gastritis; however, statistically significant differences were detected in the incidence rates ($p<0.001$; $p<0.01$). It was also found that the rate of diagnosis of antral gastritis in those who were aged 65 and over was lower than in other age groups (Table 5).

When the diagnosis of the patients after EGD was evaluated according to gender, the rate of diagnosis of antral gastritis was found to be higher at a statistically significant level in women (77.6%) than in men (66.1%) ($p=0.028$; $p<0.05$) (Table 6).

The incidence of loose Lower Esophageal Sphincter was found to be higher at a statistically significant level in men (28.2%) than in women (17.2%) ($p=0.034$; $p<0.05$) (Table 6).

DISCUSSION

The esophagus is a muscular (smooth muscle) tube connecting the pharynx and the stomach, starting from the C6 vertebra level extending to the T11 level with an average length of 25-30 cm. In the literature, the esophageal length is accepted as the distance between the upper esophageal sphincter and the lower esophageal sphincter [1]. Although Lie et al. found the esophageal length as 22.9 cm on average in healthy individuals, Award et al. found it to be 28.3 cm on average, and Yau et al. as 23 cm, which is similar to the study of Lie et al. [9-11]. In their study, Marshall et al. found the esophageal length to be significantly higher with a mean of 21.12 cm in men than in women (mean 20.15 cm) [12]. The length of the esophagus is accepted as 25-30 cm on average in the literature, and was determined as 9-10 cm in newborns [13]. The cervical esophagus, which starts from the lower edge of the cartilago cricoidea and ends at the lower edge of the first thoracic vertebra, is approximately 18 cm after the anterior incisors [14]. Because of the anatomical localization of the cervical esophagus in esophagogastroduodenoscopy procedure, it is a difficult area to measure as it activates the gag reflex when passing with the endoscope. Studies conducted on cervical esophageal length are very limited in the literature. In the present study, in which the purpose was to investigate the cervical esophagus length and the relations between age and gender, the average cervical esophagus length was found to be 15.06±0.57 cm. We believe that the fact that it is shorter that the value reported in the literature was because of the difference between races. Although no significant differences were detected in cervical esophagus lengths between the age groups, cervical esophagus length was found to be significantly higher in men (mean 15.31 cm) than in women (mean 14.85 cm) between genders.

In the clinical practice, the hiatal clamp is formed by the right and left crus of the diaphragm at the 10 vertebra level after the anterior incisors at an average of 38 cm [15]. Csendes et al. investigated the localization of the lower esophageal sphincter in 778 patients comparing the results with 109 healthy control groups, and reported the lower esophageal sphincter of the healthy group to be 38 cm on average [16]. Similarly, in the

present study, the average length of the hiatal clamp distance from the anterior incisors was detected to be 38.6 cm. Also, the mean hiatal clamp length of patients under 35 years of age was found to be significantly higher than those of patients aged 35-44 in the study ($p=0.030$; $p<0.05$). It was also found that the mean hiatus esophagus distance was statistically longer in men (39.77 cm) than women (37.8 cm) in the comparison between the genders.

Previous studies showed that the average distance from the anterior incisors to the esophagogastric junction is 38-40 cm in men and 36-38 cm in women, which is 18 cm at birth, 22 cm at the age of 3, and 27 cm at the age of 10 [13, 17]. In the present study, the average length of the esophagogastric junction was found to be 37.5 cm, and no significant differences were detected between the age groups. This distance (mean 38.66 cm) was found to be longer in men than in women (mean 36.7 cm), which is consistent with the literature data.

Although the number of patients who were diagnosed with reflux esophagitis was 43% in the study of Csendes et al., it was reported that 15-25% of the patients who underwent EGB in western societies had esophagitis. This frequency was much less common (0.8-16.3%) in other studies that were conducted in Asia [16, 18]. In the present study, the incidence of esophagitis was found to be 6.5% under the heading of other diagnoses. We believe that the fact that this value was far below the literature data since it had a single-centered design, and therefore the number of cases was low.

There are many accepted indications for esophagogastroduodenoscopy the main ones including evaluation of dysphagia, GIS bleeding, peptic ulcer disease, medically resistant GERD, esophageal strictures, Celiac Disease, and unexplained diarrhea. The fact that the lower esophageal sphincter (LES) does not fully grasp the endoscope in endoscopic examinations performed with retroflexion from the fundus of the stomach despite deep inspiration and expiration and is considered as “LES Laxity” [1]. In the present study, the incidence of lower esophageal sphincter laxity after endoscopy was found to be statistically significantly higher in men (28.2%) than in women (17.2%) ($p=0.034$; $p<0.05$). In a study that was conducted by Aksoy et al. with geriatric patients, the rate of loose LES was reported as 34%. However, the rates were not given in this study for men and women.

Knowing the anatomical localization of the hiatal clamp is important to diagnose hiatal hernia and identify hiatal insufficiency. Hiatal hernia is a common disease defined as the protrusion of the abdominal organs -often the stomach- from the enlarged hiatus esophagus into the thoracic cavity [19]. Andujar JJ et al. [20] argued that laparoscopic repair of large paraesophageal hernia is associated with a low incidence of recurrence and reoperation. In their study conducted in 2006, Johnson et al. reported that the incidence of hiatal hernia increases with age [21]. The incidence of hiatal hernia in upper gastrointestinal system endoscopies was found to be higher in men (15.5%) than in women (14%) in our country [22]. The patients who were diagnosed with hiatal hernia were not included in the present study as it would disrupt the standardization of the normal anatomical structure. A total of 16 of 335 retrospectively screened patients were excluded from the study since they were diagnosed with hiatal hernia.

Esophagus strictures are among the most common problems in our present day. EGD must be performed to determine the underlying cause in esophageal strictures. The overall rate of esophageal strictures that require dilation among the patients who undergo upper gastrointestinal endoscopy was found to be 6%, and 3% of which were malignant, 2.7% benign, and 0.3% functional strictures [1]. In the study that was conducted by Chow et al., it was argued that the presence of hiatal hernia doubles the risk of esophageal carcinoma, and that the risk even increases cumulatively with the presence of reflux symptoms, dysphagia, and previously described symptoms of esophagitis [23].

The definition of the esophagogastric junction varies among specialty groups. One definition that was made by surgeons and endoscopy specialists where there is a sudden change of gastric mucosa in the mucosa passing through the esophagus, and this jagged line was designated as the “Z line” [13]. This line is used as a baseline in distinguishing anatomical concepts associated with the esophagus and measuring lengths. One of these is the measurement of the length of the Lower Esophageal Sphincter (LES). In the clinical practice, the LES length is used often for measuring the intraluminal pressure of the esophagus and for pH monitoring. Knowing the length of this area will ensure correct placement of the catheter, which will result in the better recognition and easier diagnosis of diseases in this area such as GERD and achalasia. For this reason, proper placement of the probes in these localizations is necessary [24]. Knowing the normal anatomy will also guide us in the diagnosis of diseases in this area. For example, measuring these parts in the

detection of hiatal hernias and detecting the short esophagus in the surgeries in the clinical practice can guide the surgeon in terms of the problems which might be faced after the surgery. Knowing that there is a short esophagus in patients who have hiatal hernia can guide the surgeon in dealing with related problems before the surgery about recurrences and complications which might occur in the postoperative period [25]. Another problem which might be faced in this area is the perforations as a result of endoscopic interventions. These iatrogenic perforations are most commonly detected in the hypopharynx and distal esophagus. The clinical manifestation of this varies depending on the level of the perforated area. For example, when patient present with symptoms such as neck pain, crepitation, etc. for perforation in the cervical parts, these symptoms cause other symptoms such as epigastric and shoulder pain as they progress towards the abdomen. The success in treatment also varies according to the localization. For example, it is already known that stent migration is more and is more difficult to place in proximal perforations, which complicates the treatment increasing stent-related treatment failure [26].

As understood with the examples, the determination of anatomical localizations not only guides the problems that might appear, it also helps to determine the treatment methods that will be chosen. The present study is an anatomy study in which it was found that the length of the anatomical localization of the hiatal clamp from the anterior incisors differed according to age and gender. It was also found that the hiatal clamp length is longer in young age than in older ages ($p=0.035$, Table 3), and the hiatal clamp length is longer in male gender than female gender at statistically significant levels ($p<0.001$, Table 4). In their study conducted on 50 cadavers, Shamiyeh et al. reported that this length is important in repairing the crus in hiatal hernias and in the treatment of GERD. They measured this length by measuring the area defined as the hiatal surface area [27]. As mentioned in this example, it was seen that the evaluation was made by measuring the hiatal surface area that can be measured during the operation. In another study that was conducted by Koch et al., it was reported that this length measurement could not be made accurately with radiological and endoscopy methods, and only the size of hiatal hernias could be determined with these methods [28]. It was reported in another study that the use of width measurement instead of length measurement would yield more accurate results because of the slippery nature of this area [29]. It was seen in the literature that the measurements of these lengths were made radiologically [30]. In the present study, the

measurement was made only endoscopically and was not verified radiologically. Despite these limitations, we believe that the fact that the measurement was made and recorded by a single expert endoscopy specialist to provide a certain standard, and the number of patients included in the study was 298 increases the importance of the study.

In the data obtained here, it was determined in the evaluations of the indication of the procedure and gender in the patients who underwent EGD that the EGD procedure was more common in women because of dyspepsia, and that gastritis, duodenitis, and peptic ulcer were more common in these patients than in men (Table 7). In the literature, in a study that included 12213 people conducted by Freha et al., it was reported that, unlike our study, gastritis was more common in male gender [31]. Similarly, in the same study as well as in our study, upper gastrointestinal system bleeding was found to be statistically higher in men than in women, which is consistent with the literature data ($p=0.032$; $p<0.05$). There are many factors, which can cause this situation such as smoking, drugs used, or accompanying comorbidities. This may be the subject of further studies.

Since no studies similar to our study were detected in the literature, it is not possible to verify and compare the relations of length measurements in these localizations with gender, age, and symptoms reported in other studies. At this point, we believe that the data found in this study will be important in terms of establishing a standardization in Turkish society, and will also guide clinicians. We also believe that the relations between the anatomical localizations that were examined in the present study and the Body mass index must be investigated in further studies.

CONCLUSIONS

Knowing the anatomical localizations of the cervical esophagus length, hiatal clamp, and esophagogastric junction may be important in planning the outcomes of the complications, which might occur in this region in EGD, and in planning the measures to be taken in this respect. It may also help clinicians to identify hiatal hernias and insufficiencies and to determine the treatment modalities to approach these diseases. In the future, if the present study is planned by including patients with certain symptoms and if the number of patients is increased, it will be more guiding for the interventions regarding treatment modalities. Also, these measurements should be supported with cadaver studies

for the purpose of providing a standard and achieving measurements with more objective values.

Conflict of interest: None declared

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Table 1. The evaluation of the EGD data according to the age groups

EGD Data (cm)	Age Group					F	p
	35 years ↓	35-44 years	45-54 years	55-64 years	65 years ↑		
	Mean±SD	Mean±SD	Mean±SD	Mean±SD	Mean±SD		
Cervical	15.15±0.	15.07±0.	15.07±0.	15.04±0.	15.06±0.	0.16	0.958

Esophagus length (cm)	67	56	54	6	58	1	
Esophagogastric junction length (cm)	38.35±2.30	37.22±2.24	37.86±2.11	37.28±2.41	37.42±2.08	1.641	0.164
Hiatal clamp length (cm)	39.80±2.71	38.14±2.37	38.96±2.04	38.51±2.26	38.44±2	**2.702**	**0.031***

F: One-Way Variance Analysis (ANOVA)
*p<0.05

Table 2. The evaluation of the patients' anatomical localizations according to the EGD indications

Indications	**Cervical Esophagus length (cm)**	**Esophagogastric junction length (cm)**	**Hiatal clamp length (cm)**
	Mean±SD	**Mean±SD**	**Mean±SD**
Dyspepsia	15.04±0.54	37.36±2.16	38.46±2.18
Cancer screening	15.17±0.72	38.75±2.09	39.50±2.39
Control	15.25±0.58	37.56±2.90	38.88±2.60
GERD	15.07±0.61	37.54±2.30	38.66±2.32
GIS bleeding	15.11±0.58	37.83±2.15	38.94±2.13
Other	14.93±0.59	37.40±2.03	38.47±1.92
F	0.634	0.959	0.653
P	0.674	0.443	0.660

F: One-Way Variance Analysis (ANOVA)

Table 3. The evaluation of the indications of EGD in patients according to the age groups

Indications	**Age Group**					χ^2	**P**
	35 years	**35-44 years**	**45-54 years**	**55-64 years**	**65 years and above↑**		
	n (%)	**n (%)**	**n (%)**	**n (%)**	**n (%)**		
Dyspepsia	10 (%50)	34 (%58.6)	34 (%47.2)	43 (%52.4)	24 (%36.4)	6.841	0.145
Cancer Screen	5 (%25)	17 (%29.3)	25 (%34.7)	21 (%25.6)	24 (%36.4)	2.886	0.577
Control	1 (%5)	1 (%1.7)	6 (%7.3)	6 (%7.3)	4 (%6.1)	2.845	0.584
GERD	3 (%15)	2 (%3.4)	3 (%4.2)	3 (%3.7)	5 (%7.6)	5.382	0.250
GIS bleeding	1 (%5)	-	2 (%2.8)	6 (%7.3)	3 (%4.5)	-	-

Other	-	4 (%6.9)	2 (%2.8)	3 (%3.7)	6 (%9.1)	-	-

χ^2: Pearson Chi-Square Test

Table 4. The evaluation of the anatomical localizations according to the diagnosis of patients after EGD

Diagnoses		**Cervical Esophagus length (cm)**	**Esophagogastric junction length (cm)**	**Hiatal clamp length (cm)**
		Mean±SD	**Mean±SD**	**Mean±SD**
Antral gastritis	Yes	15.09±0.57	37.59±2.33	38.64±2.30
	No	15.00±0.57	37.32±1.97	38.57±2.06
	T	0.248	0.908	0.234
	p	0.242	0.365	0.815
Loose lower esophagus sphincter	Yes	15.09±0.49	37.43±2.15	38.75±2.05
	No	15.06±0.60	37.54±2.26	38.58±2.28
	T	0.182	-0.337	0.556
	p	0.651	0.737	0.578
Alkalane reflux	Yes	14.97±0.53	37.33±2.07	38.82±2.35
	No	15.08±0.58	37.54±2.26	38.59±2.22
	T	-0.999	-0.490	0.547
	p	0.319	0.624	0.585
Pangastritis	Yes	15.00±0.63	37.10±2.48	38.39±2.36
	No	15.07±0.57	37.56±2.21	38.64±2.22
	t	-0.53	-1.097	-0.606
	p	0.514	0.274	0.545
Erosive gastritis	Yes	15.08±0.50	37.25±2.31	38.75±1.87
	No	15.06±0.58	37.54±2.23	38.61±2.26
	t	0.174	-0.601	0.303
	p	0.862	0.548	0.762
Ulcer	Yes	15.07±0.62	37.36±2.21	38.43±2.31
	No	15.06±0.57	37.52±2.24	38.63±2.23
	t	0.051	-0.268	-0.324
	p	0.959	0.789	0.746
Normal	Yes	15.20±0.63	38.30±2.75	39.20±2.53
	No	15.06±0.57	37.49±2.22	38.6±2.22
	t	0.419	0.378	0.839
	p	0.446	0.258	0.402
		15.07±0.59	37.2±2.27	38.27±2.15
		15.06±0.57	37.53±2.24	38.64±2.24
		0.981	0.903	0.677
		0.984	0.578	0.533

t: Student-t Test

Table 5. The evaluation of the diagnoses of the patients after EGD according to age groups

Diagnoses	Age Group					χ^2	p
	35 years↓	35-44 years	45-54 years	55-64 years	65 years and above↑		
	n (%)	n (%)	n (%)	n (%)	n (%)		
Antral gastritis	15 (%75)	50 (%86.2)	54 (%75)	63 (%76.8)	35 (%53)	**19.197**	**<0.001****
Loose lower esophagus sphincter	5 (%25)	13 (%22.4)	9 (%12.5)	21 (%25.6)	17 (%25.8)	5.088	0.278
Alkalane reflux	5 (%25)	5 (%8.6)	6 (%8.3)	9 (%11)	8 (%12.1)	4.917	0.296
Pangastritis	2 (%10)	4 (%6.9)	8 (%11.1)	7 (%8.5)	10 (%15.2)	2.710	0.607
Erosive gastritis	-	4 (%6.9)	4 (%5.6)	7 (%8.5)	9 (%13.9)	-	-
Ulcer (in the antrum)	-	2 (%3.4)	2 (%2.8)	1 (%1.2)	5 (%7.6)	5.548	0.236
Other	2 (%10)	2 (%3.4)	5 (%6.9)	2 (%2.4)	4 (%6.1)	3.187	0.527
Normal	1 (%5)	3 (%5.2)	1 (%1.4)	3 (%3.7)	6 (%9.1)	4.837	0.307

χ^2: Pearson Chi-Square Test
**p<0.01

Table 6. The evaluation of the diagnoses of the patients after EGD according to gender

Diagnoses	Gender		χ^2	p
	Male	Female		
	n (%)	n (%)		
Antral gastritis	82 (%66.1)	135 (%77.6)	[1]**4.802**	**0.028***
Loose lower esophagus sphincter	35 (%28.2)	30 (%17.2)	[1]**5.122**	**0.034***
Alkalane reflux	14 (%11.3)	19 (%10.9)	[2]0.010	0.920
Pangastritis	14 (%11.3)	17 (%9.8)	[2]0.053	0.817
Erosive gastritis	7 (%5.6)	17 (%9.8)	[2]1.153	0.283
Ulcer (in the antrum)	4 (%3.2)	6 (%3.4)	[3]0.011	1.000
Other	8 (%6.5)	7 (%4)	[2]0.458	0.499
Normal	6 (%4.8)	8 (%4.6)	[2]0.001	1.000

[1]χ^2: Pearson Chi-Square Test
[2]χ^2: Continuity (Yates) Corrected Chi-Square Test

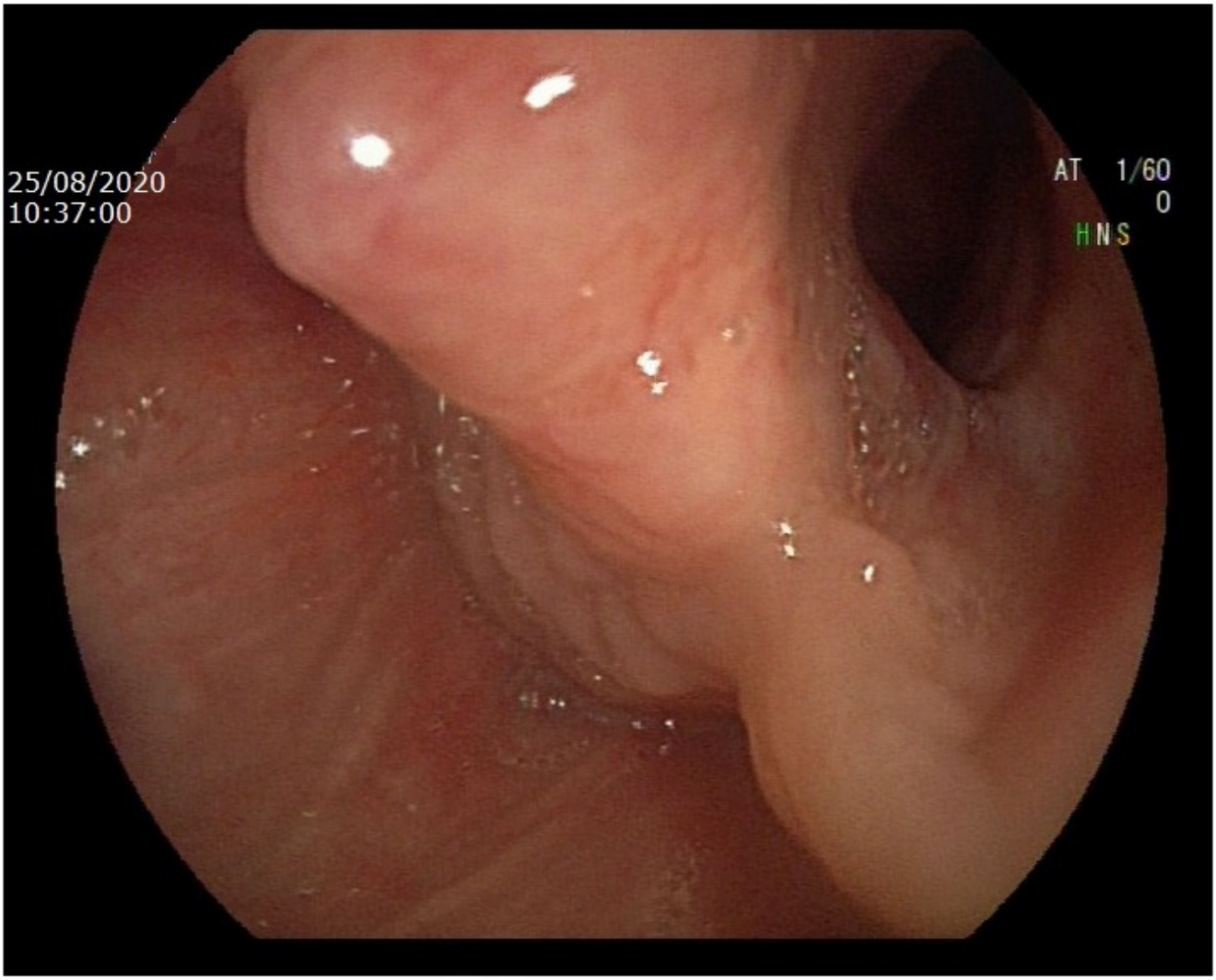
[3]χ^2: Fisher Exact Chi-Square Test
*p<0.05

Figure 1. Entry to cervical esophagus (EGD Image)

Figure 2. Esophagogastric junction, Z Line (EGD Image)

Figure 3. Hiatal Clamp (EGD Image)

Figure 4. Hiatal hernia (Loose hiatal clamp) (EGD Image)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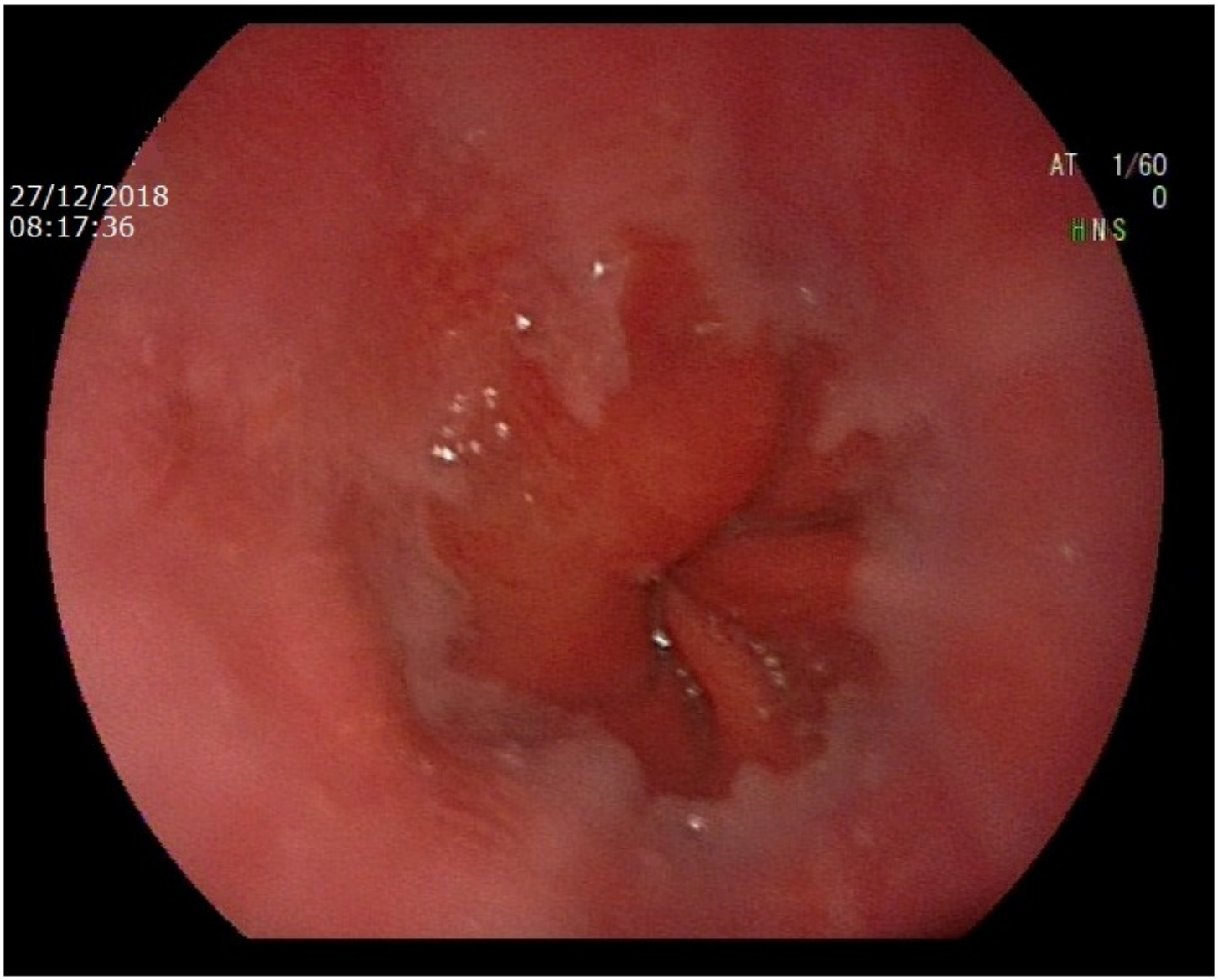
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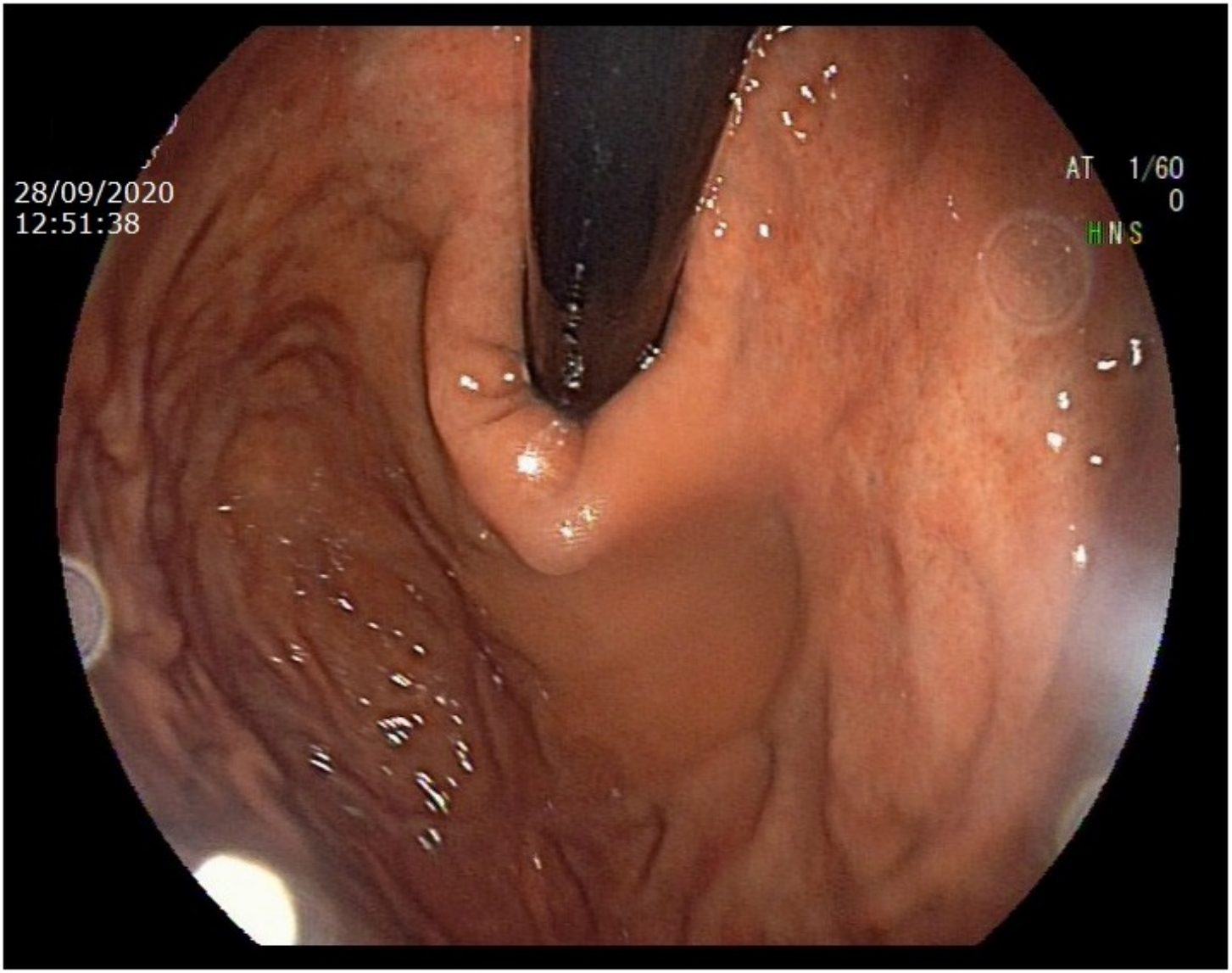
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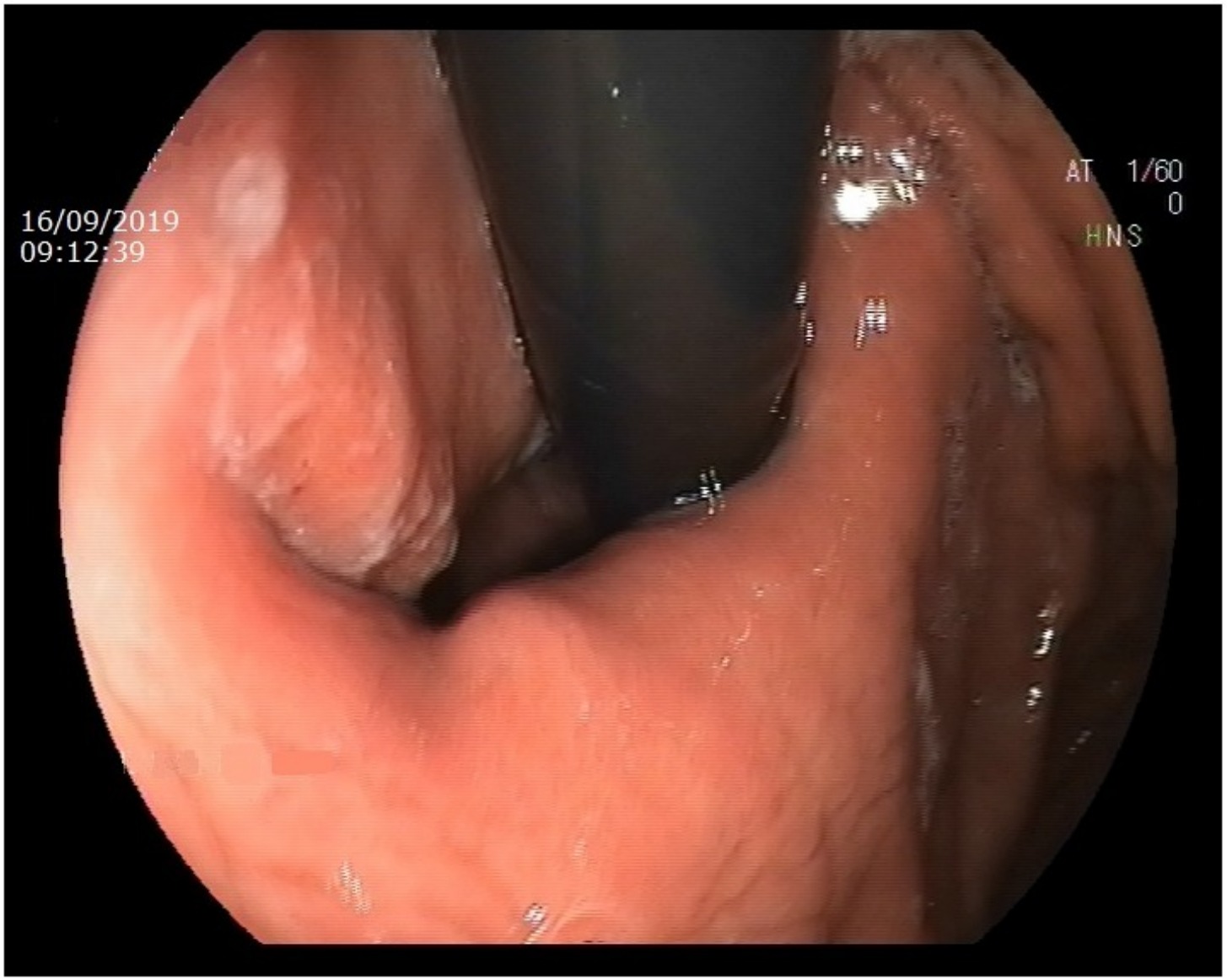
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