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## RESEARCH ARTICLE

### Hill's Classification of Gastro-Oesophageal Flap Valve weakness: A valuable Tool for Endoscopic Grading of Gastro-Oesophageal Reflux Disease

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#### ABSTRACT.

**Introduction:** Gastro-Oesophageal Reflux Disease is one of the most common conditions needing an endoscopy evaluation. The evaluation of this condition also needs 24-hour pH-monitoring and oesophageal manometry, but in reality, these investigations are not easily available and are cumbersome.

**Methodology:** We used the Hill's classification for the gastro-oesophageal flap valve and objectified the evaluation of the reflux present. We were able to objectively assess the findings during endoscopy mainly the Gastro-Oesophageal Flap Valve using the Hill's Classification and correlate its grade with the presentation of gastro-oesophageal reflux disease and its possible treatments with outcome. Inference and conclusion: We find this tool to be easy to perform and interpret as compared to the more cumbersome and complex 24-hour pH monitoring and Oesophageal Manometry. With our study we wish to encourage the use of Hill's Classification in all endoscopies done for reflux disease.

**Word of Caution:** Investigations like the 24-hour pH-monitoring and Oesophageal Manometry can be reserved for select cases that may either need further evaluation of this condition or have the need to rule out functional conditions of the oesophagus like the oesophageal motility disorders.

**Keywords:** Gastro-Oesophageal Reflux Disease (GERD); Gastro-Oesophageal Flap Valve (GEFV); Hill's classification; Laryngopharyngeal reflux disease (LPRD); H. pylori infection; Atrophic Gastritis; Erosive Esophagitis; Laparoscopic Sleeve Gastrectomy

**Introduction.**

Gastro-Oesophageal Reflux Disease (GERD) is one of the most common conditions in the patients visiting surgical clinics. The presentation is variable with patients suffering from dyspepsia, heartburn, dysphagia or odynophagia and rarely oropharyngo-laryngeal symptoms like recurrent sore throat, hoarseness of voice, recurrent sinusitis, etc.

Evaluation of Gastro – Oesophageal Reflux Disease (GERD) and related conditions include an upper gastrointestinal endoscopy, H. Pylori screening, and in select circumstances advanced investigations like the 24 – hour pH monitoring and oesophageal manometry. The latter investigations are accurate diagnostic tools for GERD, but are not easily available, are cumbersome and may also be sometimes complex for the physician to interpret the results accurately.

The Hill's classification of Gastro-Oesophageal Flap Valve (GEFV) evaluation is an effective tool to objectively identify the abnormality and confirm GERD. It has utility in evaluating GERD, LPRD, and outcomes of dyspeptic conditions like H. Pylori related Reflux Esophagitis and Atrophic Gastritis. It may also provide preoperative assessment of troublesome complications like erosive esophagitis associated with bariatric surgery procedures like laparoscopic sleeve gastrectomy.

**Materials and Methods.**

Over a period of 3 years, we performed a prospective observational study of a cohort of around 250 upper gastrointestinal endoscopies for patients with symptoms like dyspepsia, indigestion,

acidity, heartburn, upper abdominal pain, etc. Mandatorily, we used the Hill's Classification as a tool to grade the Gastro-Oesophageal Flap Valve (GEFV) in all the patients that underwent endoscopy. The classification divides patients with GERD into two groups – normal (grade 1-2) and abnormal (grade 3-4) GEFV.

The patients with grades 1-2 received a course of Proton Pump Inhibitors (PPI) and a Prokinetic. Those with grades 3-4 were also given the same medical treatment but were counselled for the need of an anti-reflux procedure, the Laparoscopic Nissen's Fundoplication. Those patients with grades 1-2 were informed to report relapse of symptoms after discontinuation of the medications after 3-6 months of use. Those with relapse in symptoms would be advised to undergo the surgery as a definitive procedure because the medical management did not bring sustained improvement in symptoms.

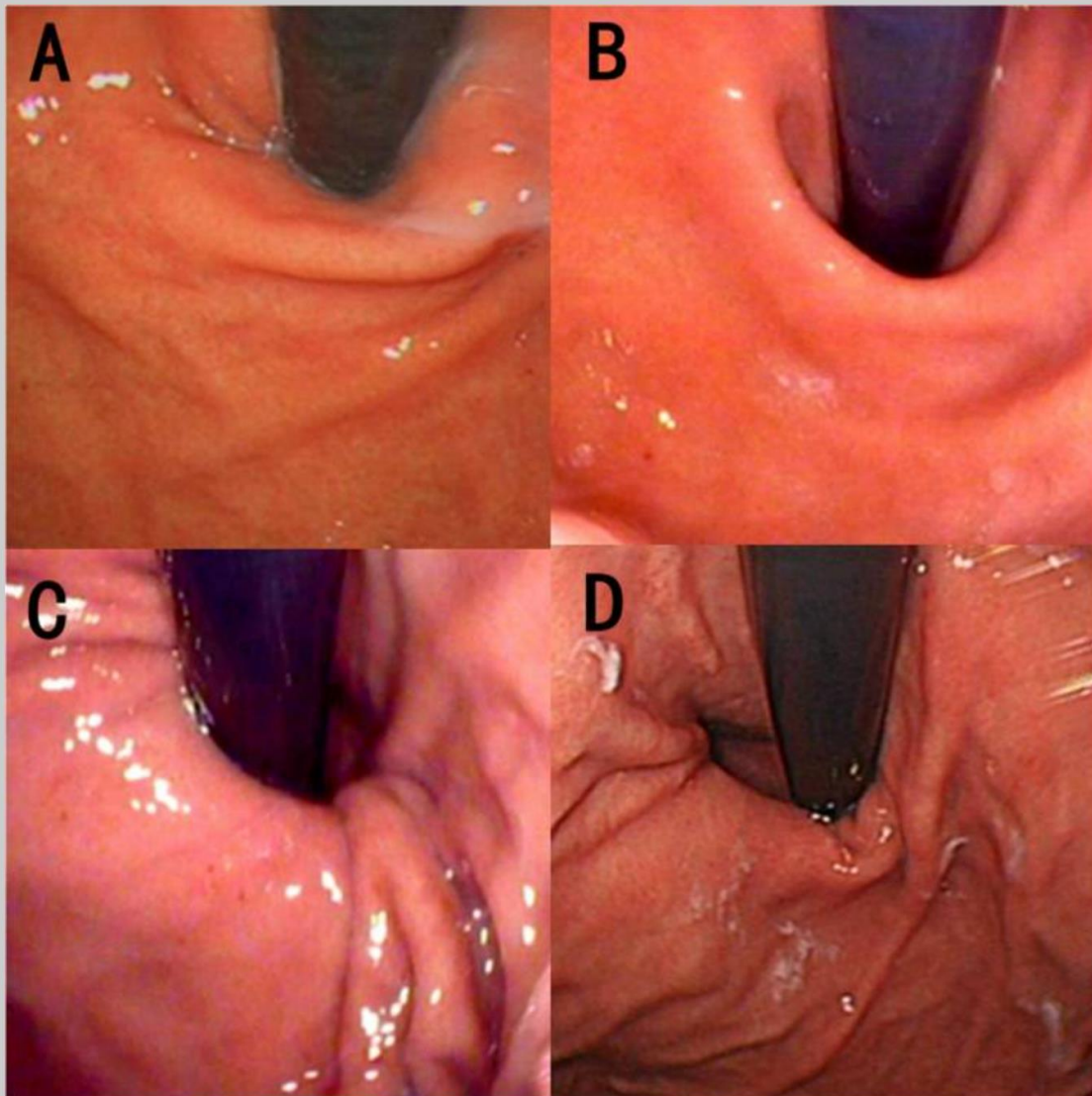
**Results.**

Majority of patients with grade 1-2 responded to 3-6 months use of PPI and prokinetics. Those with grades 3-4 who chose medical management instead of upfront surgery had varying levels of improvement. From this group a select few patients chose to undergo surgery. All the patients who underwent surgery had significant and sustained resolution of the symptoms. There were not given any PPI or prokinetic after the procedure nor did they need to use medications during immediate or long-term follow-up.

**Table 1.** PATIENT STATISTICS DURING STUDY.

TYPE OF PATIENT	NOS. OF PATIENTS
TOTAL PATIENTS UNDERGOING ENDOSCOPY	250
PATIENTS WITH GRADES 1-2	175
PATIENTS WITH GRADES 3-4	75
PATIENTS CHOOSING MEDICAL MANAGEMENT	225
PATIENTS CHOOSING SURGERY AS FIRST CHOICE OF TREATMENT	20
PATIENTS CHOOSING SURGERY AFTER FAILURE OF PPI AND PROKINETIC TREATMENT	5

**Figure 1.** Gastro-Oesophageal Flap Valve By Hill's Classification.



- A) GRADE 1: a prominent fold of tissue along the lesser curvature and closely apposed to the endoscope.  
 B) GRADE 2: the fold is present, but there are periods of opening and rapid closure around the scope.  
 C) GRADE 3: the ridge is barely present, and there is often failure to close around the scope.  
 D) GRADE 4: the muscular ridge is absent and the gastroesophageal area continuously remains open. A hiatal hernia is always present.

### **Discussion.**

The endoscopic grade of the gastroesophageal flap valve (GEFV) is suggested to be a good predictor of reflux status. GEFV is graded 1 through 4 using Hill's classification. GEFV is then classified into two groups: a normal GEFV group (grades 1 and 2) and an abnormal GEFV group (grades 3 and 4). Symptomatic GERD has more incidence of an abnormal Gastroesophageal Flap Valve (GEFV) noted on endoscopy.<sup>2</sup> Increased GEFV grade is significantly associated with an increased prevalence of both reflux esophagitis

and Barrett's epithelium. Lower oesophageal sphincter pressure is significantly lower in the abnormal GEFV group than in the normal GEFV group.<sup>1</sup> This close association highlights the recommendation to include Hill's classification in routine endoscopy reports and workup for GERD.<sup>2</sup> To establish the efficacy of the Hill's Classification; endoscopic grading of the GEFV is compared with the prevalence of a mechanically defective sphincter, abnormal oesophageal acid exposure, erosive esophagitis, and Barrett's oesophagus that increases with increasing alteration of the gastroesophageal valve. The presence of a grade

4 valve indicates increased oesophageal acid exposure in 75% of patients. As a predictor, this is similar to lower oesophageal sphincter pressure but not as good as the presence of oesophageal mucosal injury. Thus, endoscopic grading of the gastroesophageal valve though provides useful information about the reflux status but remains less useful as an indicator of gastroesophageal reflux disease (GERD) in respect to the presence of oesophageal mucosal injury.<sup>3</sup>

Efficacy of the Hill's classification is also aimed to investigate the potential correlation between grading of the GEFV and factors such as quality of life (QoL), gastroesophageal reflux disease (GERD) symptoms, oesophageal manometry, multichannel intraluminal impedance monitoring (MII) data, and size of the hiatal defect. Patients with documented chronic GERD undergo upper gastrointestinal endoscopy, oesophageal manometry, and ambulatory MII monitoring before laparoscopic fundoplication. The GEFV is graded 1-4 using Hill's classification. QoL is evaluated using the Gastrointestinal Quality-of-Life Index (GIQLI), and gastrointestinal symptoms documented using a standardized questionnaire. The size of the oesophageal hiatus is measured during surgery by calculating the hiatal surface area (HSA).<sup>4</sup>

A significant positive correlation is found between increased GEFV grade and DeMeester score, total number of acid reflux events, number of reflux events in the supine position, and number of reflux events in the upright position. Additionally, a significant positive correlation was found between HSA size and GEFV grading. No significant influence from intensity of GERD symptoms, QoL, and the GEFV grading was found. The mean LES pressures are found to be sometimes reduced with increased GEFV grade. This concludes that GEFV plays a major role in the pathophysiology of GERD. The results highlight the importance of reconstructing a valve in patients with GERD and an altered geometry of the gastroesophageal junction when they receive a laparoscopic or endoscopic intervention.<sup>4</sup>

GEFV may also be contributory for Laryngopharyngeal Reflux Disease (LPRD) along with GERD. Reflux symptom index (RSI) is used as a diagnostic tool for patients with LPRD and it is found that endoscopic grading of GEFV may provide an accurate diagnosis of GERD and LPRD. Patients with a Reflux Finding Score (RFS) of more than 7 were diagnosed with LPRD.<sup>5</sup> Two instruments,

the RSI and RFS, are commonly used as assessment tools in diagnosing and treating LPR. RFS based on the endo-laryngeal inflammatory findings is a scoring system that reduces the subjectivity of the evaluations of LPRD.<sup>6</sup>

Gastroesophageal reflux disease (GERD) is caused mainly by incompetence of the anti-reflux barriers at the esophago-gastric junction.<sup>6</sup> As GERD is a chronic symptom of mucosal damage caused by gastric acid reflux, the etiological factor behind this phenomenon remains abnormal GEFV. This establishes the relationship between GERD and LPRD using the grading of GEFV and additionally RSI to identify the potential candidates with symptomatic GERD. However, we do not find any correlation between RSI and degree of oesophageal mucosal injury.<sup>5</sup>

The gastroesophageal flap valve (GEFV) is a dynamic structure that influences gastroesophageal reflux disease (GERD). Endoscopic grading of the GEFV by the Hill's classification provides useful information about the status of gastroesophageal and gastro-pharyngeal reflux. Laryngopharyngeal reflux disease (LPRD) is regarded as different from GERD, because LPRD patients do not necessarily have specific symptoms of GERD such as regurgitation or heartburn.<sup>6</sup>

Even though the relationship between GERD and the otolaryngological manifestations is still controversial, the two main theories of laryngopharyngeal reflux (LPR) are characterized by acid reflux. The first theory suggests that the fragile mucosa of the larynx and pharynx, in contrast to the oesophagus, is far more susceptible to injury from acid and activated pepsin. The second theory suggests that acid stimulates vagally mediated reflexes in the oesophagus, leading to the symptoms of LPR, such as chronic cough and throat clearing sensation. LPRD patients have significantly longer acid reflux time in the upper oesophagus and patients who had LPRD with reflux oesophagitis (RE) experience more frequent acid exposure in the upper oesophagus than the LPRD without RE. Therefore, there is reason to believe that structural factors, such as GEFV, may affect the pathogenesis of LPRD.<sup>6</sup>

The lower oesophageal sphincter (LES) along with the flap valve works together and forms a powerful anti-reflux barrier. The flap valve is formed by the oblique angle at which the oesophagus enters and integrates with the stomach. A system like the Hill's

Classification of GEFV grading was created to describe and classify GEFV. Several studies have been performed assessing the relationship of endoscopic oesophagitis and gastroesophageal flap valve in patients with symptomatic gastroesophageal reflux. The finding that abnormal GEFV (grades 3 and 4) is more frequent in patients with oesophagitis and elderly patients are consistent with results of previous reports. LES pressure is significantly lower and gastroesophageal reflux in the probe are significantly higher in the abnormal GEFV group compared to the normal GEFV group.<sup>6</sup>

Abnormal GEFV plays an important role in GERD and LRP. Ultimately, our findings suggest that LRP may have a more complicated pathogenesis which involves oesophageal motility patterns, the function of pharynx and upper oesophageal sphincter, and mechanisms of airway protection. In conclusion, the frequency of both GERD and LPRD was significantly higher in the abnormal GEFV group than in the normal GEFV group. We suppose that gastroesophageal endoscopy can be performed to ensure the diagnosis of LPR by evaluating the GEFV.<sup>6</sup>

The association of GERD with *H. pylori* infection and Atrophic gastritis is often observed in conjunction with the evaluation for dyspeptic symptoms. It is often found that these presentations may overlap or co-exist in the same patient. Several studies have shown that reflux esophagitis (RE) occurs after eradication of *Helicobacter pylori*. However, endoscopic findings do not allow prediction of the development of RE after successful treatment. In patients who have had recent history of *H. Pylori* eradication, an endoscopic evaluation for the presence of a hiatal hernia (or an abnormal GEFV) reveals the presence of RE in patients with hiatus hernia or grade 2-4 GEFV on the Hill's classification. The pH level of gastric juice after eradication therapy is found to be lower in the group with successful eradication than in the group with failed therapy regardless of the incidence and degree of RE.<sup>7</sup>

There is a high incidence of RE after successful *H. pylori* eradication therapy. This incidence of RE is closely associated with the presence and degree of hiatal hernia and with the decrease in gastric juice pH. These findings suggest that the presence of hiatal hernia together with increase in gastric acidity are important determinant factors for the

development of RE after successful *H. pylori* eradication therapy.<sup>7</sup>

The endoscopic grading of the gastroesophageal flap valve (GEFV) is suggested to be a good predictor of reflux status. Atrophic gastritis is inversely associated with reflux esophagitis. Atrophic gastritis was classified into two groups by endoscopic atrophic border: closed-type (C-type) and open-type (O-type).<sup>8</sup>

When the association between GEFV, atrophic gastritis and gastroesophageal reflux is studied by endoscopy, oesophageal manometry and ambulatory 24-h pH monitoring; it is found that the incidence of reflux esophagitis and gastroesophageal reflux disease is associated with an abnormal GEFV grade and is inversely associated with open-type atrophic gastritis. The patients with a coexisting abnormal GEFV and closed-type atrophic gastritis show a significantly higher incidence of reflux esophagitis and gastroesophageal reflux disease than the patients with a coexisting normal GEFV and open-type atrophic gastritis.<sup>8</sup>

Evaluation of the GEFV is also important for the preoperative assessment of Laparoscopic Sleeve Gastrectomy (LSG) which remains one of the most commonly performed procedures in bariatric surgery. Gastro - Oesophageal Reflux Disease (GERD) and Oesophageal Erosions (OE) are two dreaded complications of this procedure. Hill's classification helps to identify the possibility of these complications in patients preoperatively. Patients with grade 2 have a possibility of GERD alone whereas grade 3 patients have increased incidence of GERD and EE. All patients with grade 4 seem to definitely have GERD and EE post sleeve gastrectomy. Since postoperative GERD and EE remain important limitation towards the choice of sleeve gastrectomy as a bariatric surgery, Hill's classification can provide adequate information about the probability of occurrence of the complications and also help in choosing other types of bariatric procedures if a high grade is found on endoscopy.<sup>9</sup>

### **Conclusion.**

GERD remains one of the most common conditions involving the upper gastrointestinal tract and its prevalence increases with changing lifestyle patterns, increased consumption of fast foods, and increasing incidence of obesity. There exists the

need for tools to assess this condition objectively to enable ease in understanding the treatment and its outcome. 24 – hour pH monitoring and Oesophageal Manometry are invaluable and the most accurate investigations for the diagnosis of GERD. However, they are not easily available, are cumbersome, and may even need experience for accurate interpretation by physicians. Hill's classification establishes the abnormality of the GEFV objectively. It also allows the physician to choose the best possible treatment based on the grade seen on endoscopy.

Our understanding of the relationship between GEFV and GERD based on the functional relationship of the lower oesophageal sphincter establishes the trust in this classification. We do caution the use of this classification in circumstances when motility disorders of the oesophagus are being considered as diagnosis. The classification should be considered as a mandatory finding in all endoscopy reports enabling physicians treating GERD to either consider the appropriate treatment and in select circumstances choose to evaluate further with accurate methods like the 24-hour pH monitoring and oesophageal manometry.

The objective of this manuscript lies to simplify the evaluation of an extremely prevalent condition – gastroesophageal reflux disease. Theoretically, several tools exist to evaluate this condition as mentioned but they are rarely performed, and the

patient is put on prolonged proton-pump inhibitors or prokinetics. We used the observational study to realise the importance of a simple but very objective tool – the Hill's classification of the Gastro-oesophageal flap valve, which has a proven role in the causation of reflux disease. The study only wishes to provide effective results of the patients who had undergone surgery based on the findings of the endoscopy using the Hill's classification. We found that all the patients had improvement in their symptoms and conclude that this tool would actually be an effective tool to select patients for anti-reflux surgery. However, we do understand that oesophageal motility disorders are also important to be ruled out in select circumstances where the 24-hour pH monitoring and Oesophageal manometry would prove to be invaluable.

#### **Conflicts of interest statement.**

The author has no conflict of interest to declare.

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