Proposal of a novel endoscopic classification for assessing laparoscopic fundoplication based on clinical and functional testing.

BACKGROUND AND AIM

Endoscopic follow-up is essential for evaluating patients after anti-reflux surgery (ARS). Even though endoscopy (EGD) is the most commonly performed diagnostic tool, so far there is no consensus on a standardized protocol to describe the anatomy and function of the reconstructed gastroesophageal valve [1-2]. Several studies highlighted the ineffectiveness and inconsistency of current reporting system after fundoplication [3-4].

This study aims to propose a novel endoscopic classification system based on clinical symptoms and objective pathophysiologic testing to improve the assessment of gastroesophageal valve function after ARS.

METHODS

We included adult patients (18-90 years) who underwent post-ARS EGD and high-resolution manometry (HRM) at our institution between April 2018 and April 2025. Patients with prior sphincter augmentation or bariatric surgery, or those without high-quality endoscopic images, were excluded. Endoscopic images in retroflexed view were collected, and data on demographic, clinical, HRM and, when available, pH-impedance testing were extracted from a prospectively maintained database. The endoscopic parameters evaluated included: (1) valve location relative to the crura diaphragm, (2) degree of valve disruption, assessed by the depth of anterior and posterior grooves, (3) hiatal opening, (4) presence of para-esophageal hernia, and (5) valve lip thickness. Patients were stratified into three groups based on the degree of valve impairment, and these groups were compared for correlations with clinical symptoms and functional tests results.

RESULTS

A total of 153 patients (males 47%, median age 59 years, median BMI 25.2 kg/m^2) were included. Patients with an intrathoracic valve, disrupted valve and visible hiatal opening presented significantly worse clinical symptoms and functional outcomes compared to those with an intra-abdominal valve. The presence of para-esophageal hernia and valve lip thickness did not show significant differences between the subgroups. When the population was stratified by the number of impaired endoscopic parameters, a progressive worsening symptom severity, HRM and pH-impedance metrics was observed, from patient with an intact valve to those with complete valve impairment ($p<0.001$) (Table 1).

CONCLUSION

We propose a novel endoscopic classification system based on three key parameters: valve location, degree of disruption and hiatal opening (Figure 1). These parameters effectively distinguish functionally intact valves from impaired ones, and allow to stratify the severity of impairment. This system has the potential to enhance the role of endoscopy in post-operative evaluation of ARS, providing a standardized and clinically meaningful approach.

BIBLIOGRAPHY

1. Jobe BA, Kahrilas PJ, Vernon AH, Sandone C, et al. Endoscopic appraisal of the gastroesophageal valve after antireflux surgery. *Am J Gastroenterol*. 2004 Feb;99(2):233-43. doi: 10.1111/j.1572-0241.2004.04042.x.

2. Nguyen NT, Bell R, Abu Dayyeh B, Kenneth C, et al. American Foregut Society White Paper on the Endoscopic Assessment of the Gastroesophageal Valve after Anti-Reflux Surgery. *Foregut*. 2024;0(0). doi:10.1177/26345161241300480

3. Fantasia JJ, Cock C, Watson DI, Bright T, et al. Assessment of laparoscopic fundoplication with endoscopy: room for improvement. *Surg Endosc*. 2024 Feb;38(2):713-719. doi: 10.1007/s00464-023-10570-4.

4. Latorre-Rodríguez AR, Kim P, Mittal SK. Endoscopic assessment of failed fundoplications differs between endoscopists. *Surg Endosc*. 2024 Nov;38(11):6839-6845. doi: 10.1007/s00464-024-11107-z.

Figure 1. Diagnostic algorithm to assess the gastroesophageal valve after ARS via endoscopy and distribution of the study population.

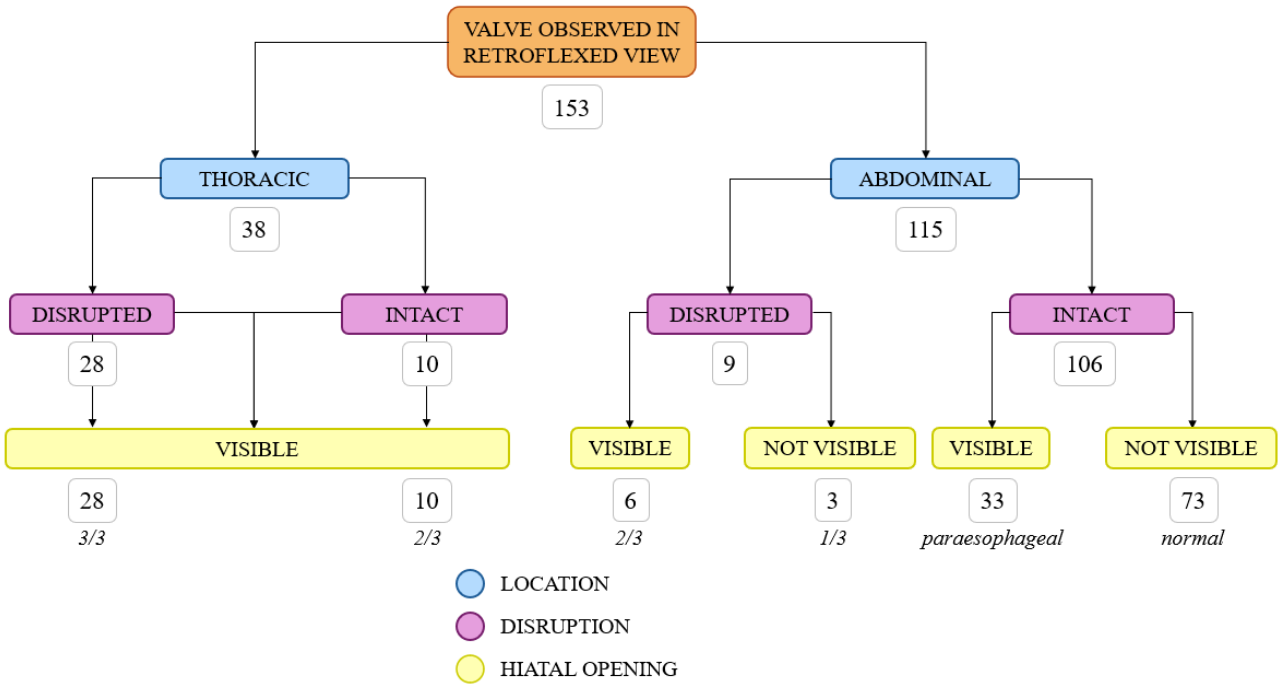

Table 1. Demographic, clinical and functional data of the study population according to the degree of impairment of the valve. Continuous values are presented as median [interquartile range]. HRM: High-Resolution Manometry; BMI: Body Mass Index; PPI: Proton-Pump Inhibitors; GERD-HRQL: GERD Health-Related Quality of Life; EGJ: Esophago-Gastric Junction; LES: Lower Esophageal Sphincter; EGJ-CI: Esophago-Gastric Junction Contractile Integral; IRP: Integrated Relaxation Pressure; DCI: Distal Contractility Integral; IEM: Impaired Esophageal Motility; SLR: Straight Leg Raise; GERD: Gastroesophageal Reflux Disease; AET: Acid Exposure Time.

	Total (n=153)	**Healthy (n=106)**	**1 + 2 mechanisms (n=19)**	**3 mechanisms (n=28)**	**p-value**
Male, n (%)	72 (47)	45 (42)	9 (47)	18 (64)	0.120
Age at HRM, years	59 [17]	60 [17]	60 [19]	56 [20]	0.738
BMI, kg/m^2	25.2 [4.4]	25.6 [4.6]	24.6 [3.9]	25.0 [3.7]	0.725
Reoperation, n (%)	36 (24)	28 (27)	2 (11)	6 (24)	0.424
Follow-up time, months	**15 [70]**	**13 [23]**	**84 [94]**	**83 [116]**	**<0.001**
SYMPTOMATOLOGY					
Heartburn, n (%)	**38 (25)**	**18 (17)^a**	**6 (32)^{ab}**	**14 (50)^b**	**0.001**
Regurgitation, n (%)	25 (16)	16 (15)	2 (11)	7 (25)	0.392
Dysphagia, n (%)	22 (14)	14 (13)	3 (16)	5 (18)	0.720
PPI, n (%)	**47 (33)**	**23 (23)^a**	**9 (50)^{ab}**	**15 (58)^b**	**0.001**
GERD-HRQL, points	**3 [11]**	**2 [8]^a**	**5 [19]^b**	**12 [17]^{ab}**	**0.006**
At least one positive questionnaire , n (%)	**46 (32)**	**24 (24)^a**	**9 (47)^{ab}**	**13 (52)^b**	**0.009**
HRM					
EGJ type, n (%)		**^{a}**	**^{a}**	**^{b}**	**<0.001**
1	113 (75)	91 (88)	14 (74)	8 (29)	
2	21 (14)	8 (7.7)	3 (16)	10 (36)	
3	17 (11)	5 (4.8)	2 (11)	10 (36)	
Hiatal hernia, n (%)	**35 (23)**	**12 (11)^a**	**4 (21)^a**	**19 (68)^b**	**<0.001**
LES total lenght, cm	**1.90 [0.70]**	**2.00 [0.78]^a**	**1.80 [0.80]^{ab}**	**1.60 [0.53]^b**	**0.011**
Intrabdominal LES, cm	**1.00 [1.80]**	**1.40 [1.20]^a**	**0.30 [1.70]$^{a/b}$**	**0.00 [0.15]^b**	**<0.001**
Phatological LES basal pressure, n (%)	**53 (35)**	**30 (28)^a**	**5 (26)$^{a/b}$**	**18 (64)^b**	**0.001**
EGJ-CI, mmHg-cm-s	29 [28]	30 [26]	37 [32]	23 [26]	0.062
IRP, mmHg	6.2 [6.2]	6.6 [6.2]	5.7 [5.8]	4.7 [5.5]	0.200
DCI, mmHg-cm-s	**737 [893]**	**814 [922]^a**	**551 [761]^{ab}**	**505 [509]^b**	**0.008**
IEM, n (%)	**46 (30)**	**25 (24)^a**	**6 (32)^{ab}**	**15 (54)^b**	**0.009**
SLR, mmHg	7 [14]	7 [13]	6 [14]	8 [16]	0.719
Milan Score, points	**81 [96]**	**65 [93]^a**	**92 [81]^{ab}**	**138 [74]^b**	**0.013**
GERD risk, %	**17 [52]**	**11 [50]^a**	**23 [40]^{ab}**	**51 [49]^b**	**0.013**
pH-METRY					
Total AET, %	**1 [5]**	**0 [1]^a**	**3 [4]^b**	**9 [18]^b**	**<0.001**
AET > 6%, n (%)	**14 (29)**	**4 (12)^a**	**2 (33)^{ab}**	**8 (80)^b**	**<0.001**
DeMeester, points	**5 [26]**	**1 [5]^a**	**11 [17]^b**	**36 [63]^b**	**<0.001**