J Neurogastroenterol Motil, Vol. 28 No. 4 October, 2022
pISSN: 2093-0879 eISSN: 2093-0887
https://doi.org/10.5056/jnm22135
Journal of Neurogastroenterology and Motility

Editorial

The Clinical Usefulness of Functional Luminal Imaging Probe in Esophageal Dysmotility Disorder

Kee Wook Jung

Department of Gastroenterology, Asan Medical Center, University of Ulsan College of Medicine, Seoul, Korea

Article: Estimating probability for esophageal obstruction: a diagnostic decision support tool applying machine learning to functional lumen imaging probe panometry
Schauer JM, Kou W, Prescott JE, Kahrilas PJ, Pandolfino JE, Carlson DA
(J Neurogastroenterol Motil 2022;28:572-579)

Functional luminal imaging probe (FLIP) is being increasingly used in the diagnosis of functional gastrointestinal (GI) disorders and has advantages of detection of distensibility in GI tract.[1,2] The previously used technique, manometry, could measure the inner active contractility of GI tract.[3] However, without active swallowing of bolus, manometry cannot generate a significant signal. To overcome this, the measurement of bolus transit from high-resolution impedance manometry has been attempted, especially in patients with functional dysphagia without major motor esophageal dysmotility.[4-8] However, FLIP can measure the passive outer distensibility of the GI tract, thus complementing the conventionally used manometry. FLIP assesses the "esophageal response to distension," with a degree of active distension from the FLIP filling protocol. Moreover, it can measure some degree of active esophageal muscle contraction and tone that occur as the esophagus's response to the distension. Moreover, FLIP measures the "distensibility of the esophageal wall" (from inside the lumen, assessing the contribution of the mucosa and inner and outer muscle layers) (Figure). As regards the pathophysiology of achalasia, the most representative disease of functional GI disorder, impaired "relaxation" of lower esophageal sphincter is the pathognomic finding.[9,10] Therefore, FLIP, which can measure the outer passive distensibility of the sphincter tone, may be a more appropriate diagnostic tool than manometry, which can measure the inner active contractility of the sphincter. Previously published papers suggested that the esophagogastric junction distensibility index (EGJ-DI) is more suitable in the discrimination of achalasia compared with previously used integrated relaxation pressure, which is affected by contraction of the esophageal body.[11-14] Therefore, the recently published Chicago 4.0 criteria recommended the use of FLIP in case of an inconclusive diagnosis of achalasia or esophagogastric junction (EGJ) outflow obstruction.[15-17]

Since FLIP can measure the outer passive distensibility of the GI tract, it can broaden our understanding of motility disorders. In case of epiphrenic diverticulum, the concurrent motility disorder may be hidden.[18,19] Manometry may miss abnormal findings in the patients with epiphrenic diverticulum.[18,19] Surgeons conventionally cut the EGJ muscle during diverticulectomy for epiphrenic diverticulum to prevent recurrence. With the development of endoscopic technology, diverticulum is treated with peroral endoscopic myotomy (POEM), In diverticulum POEM (D-POEM), the measurement of EGJ-DI using FLIP is necessary.[20] When FLIP detects impaired relaxation of EGJ, POEM of EGJ as well as D-

Received: August 22, 2022 Revised: None Accepted: October 7, 2022

*Correspondence: Kee Wook Jung, MD, PhD
Department of Gastroenterology, Asan Medical Center, University of Ulsan College of Medicine, 88, Olympic-ro 43-gil, Songpa-gu, Seoul 05505, Korea
Tel: +82-2-3010-3900, Fax: +82-2-3010-6517, E-mail: jung.keewook30@gmail.com

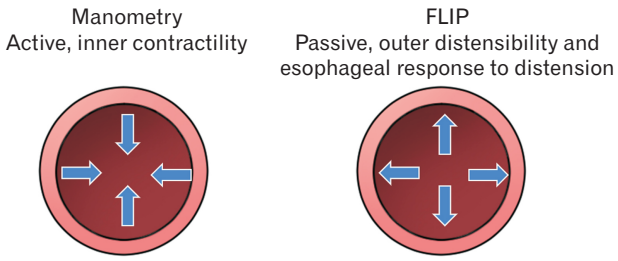

Figure. The illustration of measurement of manometry and functional luminal image probe (FLIP) in the gastrointestinal (GI) tract of humans. Conventionally used manometry can measure the active inner contractility of GI tract. Without active swallowing of bolus, manometry cannot produce a significant signal. However, FLIP can measure the passive outer distensibility of GI tract. FLIP assesses the "esophageal response to distension," with a degree of active distension from the FLIP filling protocol. Moreover, it can measure some degree of active esophageal muscle contraction and tone that occur as the esophagus's response to the distension. Moreover, FLIP measures the "distensibility of the esophageal wall" (from inside the lumen, assessing the contribution of the mucosa and inner and outer muscle layers). Therefore, these 2 tests are complementary to each other.

POEM of epiphrenic diverticulum should be considered. The abnormal thickening of the esophageal layer, which impairs the outer relaxation of the esophageal body due to a highly thickened esophageal muscle layer, may also be detected by FLIP.[1] Because manometry may miss abnormal esophageal motility findings in this case, FLIP may be beneficial for measuring the impaired distensibility of the thickened esophageal wall. However, more data is necessary to validate this hypothesis.

Additionally, FLIP can measure secondary peristalsis of the esophageal body.[21,22] When the balloon of FLIP is distended inside the esophageal body, it can show secondary peristalsis. Studies of FLIP panometry suggested its role in the prediction of outcome after treatment in patients with achalasia.[22,23] The Chicago group suggested a FLIP panometry pattern and categorized patients with dysphagia based on the value of EGJ-DI and patterns of secondary peristalsis.[1,24] From 2016 to 2022, the criteria of FLIP panometry has evolved from its prototype.[1,24,25] The most recently published criteria are based on a multicenter study with a large number of cases.[24] Prior research suggested the clinical usefulness of FLIP panometry in the diagnosis of EGJ obstruction.[26] The recently published manuscript in this issue of *Journal of Neurogastroenterology and Motility* used the machine learning technique in the identification of EGJ obstruction.[27] With the incorporation of this machine learning technique in the near future, we can effectively diagnose and expand our understanding of esophageal dysmotility disorders.

Financial support: This study was financially supported by a grant of the Korean Society of Neurogastroenterology and Motility (KSNM-20-02).

Conflicts of interest: None.

References

1. Carlson DA, Kahrilas PJ, Lin Z, et al. Evaluation of esophageal motility utilizing the functional lumen imaging probe. Am J Gastroenterol 2016;111:1726-1735.
2. Savarino E, di Pietro M, Bredenoord AJ, et al. Use of the functional lumen imaging probe in clinical esophagology. Am J Gastroenterol 2020;115:1786-1796.
3. Gyawali CP, Kahrilas PJ. A short history of high-resolution esophageal manometry. Dysphagia Published Online First: 5 Nov 2021. doi: 10.1007/s00455-021-10372-7.
4. Carlson DA, Lin Z, Kou W, Pandolfino JE. Inter-rater agreement of novel high-resolution impedance manometry metrics: bolus flow time and esophageal impedance integral ratio. Neurogastroenterol Motil 2018;30:e13289.
5. Gong EJ, Choi K, Jung KW, et al. New parameter for quantifying bolus transit with high-resolution impedance manometry: a comparison with simultaneous esophagogram. Neurogastroenterol Motil 2020;32:e13847.
6. Cha B, Choi K, Jung KW, et al. High-resolution impedance manometry for comparing bolus transit between patients with non-obstructive dysphagia and asymptomatic controls. Neurogastroenterol Motil Published Online First: 23 Aug 2022. doi: 10.1111/nmo.14452.
7. Zifan A, Gandu V, Ledgerwood M, Mittal R. Bolus flow and biomechanical properties of the esophageal wall during primary esophageal peristalsis: effects of bolus viscosity and posture. Neurogastroenterol Motil 2022;34:e14281.
8. Singendonk MJ, Lin Z, Scheerens C, et al. High-resolution impedance manometry parameters in the evaluation of esophageal function of non-obstructive dysphagia patients. Neurogastroenterol Motil 2019;31:e13505.
9. Savarino E, Bhatia S, Roman S, et al. Achalasia. Nat Rev Dis Primers 2022;8:28.
10. Jung KW. [Chicago classification ver. 4.0: diagnosis of achalasia and esophagogastric junction outflow obstruction]. Korean J Gastroenterol 2022;79:61-65.
11. Ponds FA, Bredenoord AJ, Kessing BF, Smout AJ. Esophagogastric junction distensibility identifies achalasia subgroup with manometrically normal esophagogastric junction relaxation. Neurogastroenterol Motil 2017;29:e12908.
12. Pandolfino JE, de Ruigh A, Nicodeme F, Xiao Y, Boris L, Kahrilas PJ. Distensibility of the esophagogastric junction assessed with the functional lumen imaging probe (FLIP) in achalasia patients. Neurogastroenterol Motil 2013;25:496-501.
13. Kim E, Yoo IK, Yon DK, Cho JY, Hong SP. Characteristics of a subset of achalasia with normal integrated relaxation pressure. J Neurogastroen-

terol Motil 2020;26:274-280.
14. Lin Z, Kahrilas PJ, Roman S, Boris L, Carlson D, Pandolfino JE. Refining the criterion for an abnormal integrated relaxation pressure in esophageal pressure topography based on the pattern of esophageal contractility using a classification and regression tree model. Neurogastroenterol Motil 2012;24:e356-e363.
15. Khan A, Yadlapati R, Gonlachanvit S, et al. Chicago classification update (version 4.0): technical review on diagnostic criteria for achalasia. Neurogastroenterol Motil 2021;33:e14182.
16. Bredenoord AJ, Babaei A, Carlson D, et al. Esophagogastric junction outflow obstruction. Neurogastroenterol Motil 2021;33:e14193.
17. Yadlapati R, Kahrilas PJ, Fox MR, et al. Esophageal motility disorders on high-resolution manometry: Chicago classification version 4.0©. Neurogastroenterol Motil 2021;33:e14058.
18. Tedesco P, Fisichella PM, Way LW, Patti MG. Cause and treatment of epiphrenic diverticula. Am J Surg 2005;190:891-894.
19. Carlson DA, Baumann AJ, Donnan EN, Krause A, Kou W, Pandolfino JE. Evaluating esophageal motility beyond primary peristalsis: assessing esophagogastric junction opening mechanics and secondary peristalsis in patients with normal manometry. Neurogastroenterol Motil 2021;33:e14116.
20. Noh JH, Kim DH, Jung KW, et al. Usefulness of EndoFLIP in diverticular peroral endoscopic myotomy for symptomatic epiphrenic diverticulum. J Neurogastroenterol Motil 2022 (in press).
21. Carlson DA, Lin Z, Rogers MC, Lin CY, Kahrilas PJ, Pandolfino JE. Utilizing functional lumen imaging probe topography to evaluate esophageal contractility during volumetric distention: a pilot study. Neurogastroenterol Motil 2015;27:981-989.
22. Carlson DA, Lin Z, Kahrilas PJ, et al. The functional lumen imaging probe detects esophageal contractility not observed with manometry in patients with achalasia. Gastroenterology 2015;149:1742-1751.
23. Hsing LC, Choi K, Jung KW, et al. The predictive value of intraoperative esophageal functional luminal imaging probe panometry in patients with achalasia undergoing peroral endoscopic myotomy: a single-center experience. J Neurogastroenterol Motil 2022;28:474-482.
24. Carlson DA, Gyawali CP, Khan A, et al. Classifying esophageal motility by FLIP panometry: a study of 722 subjects with manometry. Am J Gastroenterol 2021;116:2357-2366.
25. Carlson DA, Gyawali CP, Kahrilas PJ, et al. Esophageal motility classification can be established at the time of endoscopy: a study evaluating real-time functional luminal imaging probe panometry. Gastrointest Endosc 2019;90:915-923, e1.
26. Carlson DA, Prescott JE, Baumann AJ, et al. Validation of clinically relevant thresholds of esophagogastric junction obstruction using FLIP panometry. Clin Gastroenterol Hepatol 2022;20:e1250-e1262.
27. Schauer JM, Kou W, Prescott JE, Kahrilas PJ, Pandolfino JE, Carlson DA. Estimating probability for esophageal obstruction: a diagnostic decision support tool applying machine learning to functional lumen imaging probe panometry. J Neurogastroenterol Motil 2022;28:572-579.