Chicago classification of high-resolution esophageal manometry: Is old the gold or is new better?

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High-resolution manometry (HRM), a landmark concept in gastrointestinal motility study, was introduced in the early 1990s by Clouse and Staiano [1]. In this new technology, pressure profile is assessed during several liquid and viscous swallows using a catheter having a large number of ports at closely spaced positions in the esophagus [2]. Time, catheter position, and average pressure are then reconstructed into pseudo-3D “topographic plots” that demonstrated the functional anatomy of the esophagus and that of the gastroesophageal junction taking gastric pressure as the baseline [2].

There are several advantages of HRM over conventional manometry [2–7]. The advantages may be broadly classified into two groups, (a) those related to the recording of the data and (b) those related to the display of the data. The advantages of HRM over conventional manometry with respect to the data recording include (a) higher number of sensors that record lumen-occlusive contractions of the circular muscle of esophagus (typically six to eight ports in the earlier conventional manometry in contrast to 32 ports in current HRM), (b) use of solid-state catheter with higher fidelity in place of water-perfusion catheters, (c) use of circumferential in place of non-circumferential sensors, (d) facility to evaluate bolus transport by impedance monitoring that is available in most of the standard HRM devices, and (e) HRM is easier to perform than the conventional manometry. Display of the complex data using Clouse plot is a major advantage of HRM over conventional manometry. In the conventional manometry, the horizontal (*X*) axis depicts the time and the vertical (*Y*) axis represents the amplitude of contraction. In the Clouse plot of HRM, the horizontal (*X*) axis depicts the time, but the vertical

(*Y*) axis represents the length of the esophagus. How to depict the amplitude of contraction then? Ray E Clouse decided to use different colors to represent the amplitude of contraction, the deep blue being the most negative pressure, and black showing highest positive pressure. Conventional manometry may miss esophageal motility disorders causing dysphagia. In a study on 250 patients with motor dysphagia, the cause could not be identified by conventional manometry in 15 % patients [8]. This might be due to widely spaced sensors in the catheter. Due to large number of sensors, HRM is expected to have higher fidelity to diagnose esophageal motility disorders, which has been documented in the literature [9]. One of the many advantages of the Clouse plot in HRM is the ease with which different esophageal motility disorders can be grossly recognized by the experienced motility doctors, but in the era of super-speciality health care using evidenced-based medicine and various mathematical scoring systems, are the doctors and patients happy with gross recognition of disorders?

Chicago classification system has been developed by consensus among a group of motility experts based on the available evidence and general principles of esophageal physiology [4–6, 10, 11]. In this system, diagnosis of a motility disorder is not only based on the gross appearance of esophageal contractions on the Clouse plot but also on mathematical calculation of various parameters of contractions. These include resting lower esophageal sphincter (LES) pressure, integrated relaxation pressure (IRP), distal contractile integral (DCI), and contractile front velocity (CFV), etc. For example, achalasia is diagnosed in patients with simultaneous esophageal contractions as documented by a CFV of >8 cm/s and an IRP value of >10 mmHg in type I disease or 15 mmHg in types II or III disease [12]. The principle behind a higher IRP value in patients with type II or III achalasia is based on the fact that these subtypes of achalasia have a higher value of DCI and, hence, with a lower value of IRP, they may be able to push the food bolus through the LES. It is now well established that

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type II disease responds better to pneumatic dilation than other subtypes of achalasia [13]. Intra-rater and inter-rater agreement in subtyping achalasia on HRM using Chicago classification has been shown to be high [14]. Moreover, posttreatment LES pressure measurement helps in assessing adequacy of pneumatic dilation. A value of LES pressure less than 10 mmHg is associated with best response, and a value more than 22.5 mmHg suggests treatment failure [15]. Obviously, such utility of HRM may not be obtained if only “intuitive” visual inspection of motility tracing is performed and the Chicago classification system is not followed. Even though the current Chicago classification has limitations and with time [16], it is expected to improve and benefit the patients with esophageal motility disorders more.

In this issue of the *Journal*, Srinivas et al. compared interpretation of esophageal HRM tracings by intuitive visual inspection and Chicago classification in 77 patients undergoing evaluation for esophageal motor disorders [17]. They concluded that the Chicago classification was superior in identifying distinct clinical phenotypes than visual interpretation [17]. This result was quite expected and adds to the value of current Chicago classification in the diagnosis of esophageal motility disorders. In fact, the authors might have underestimated the value of Chicago classification in this study as they used a water perfusion rather than solid state system without impedance recording, and the manometry was done using a catheter with only 16 ports. The authors also rightly confessed that the sample size was quite small particularly for some subgroups of motility disorders such as ineffective esophageal motility, nutcracker esophagus, and achalasia cardia. The authors also rightly mentioned that whereas achalasia is subtyped in Chicago classification, it is not subtyped by intuitive visual inspection. Subtyping helps in predicting prognosis of patients with achalasia [13]. In this study, authors did not use viscous swallows. Viscous swallows may be superior to liquid swallows to evaluate some esophageal motility disorders [18].

Therefore, this study supports the utility of Chicago classification in diagnosis of esophageal motility disorders. Unfortunately, many motility personnel still use conventional manometry tracings rather than HRM plots and are not very familiar in using Chicago classification even though they use a HRM system to acquire the motility recording. This might be related to non-familiarity of HRM in general and Chicago classification in particular. This would remind us the saying by Maria Popova, “The future belongs to the curious. We are all lifelong learners, from day one to twenty-thousand-and-one, and that’s why we keep exploring, wondering and discovering, yearning and learning, reaching with more than just our hands...”

References

1. Clouse R, Staiano A. Topography of the esophageal peristaltic pressure wave. *Am J Physiol Gastrointest Liver Physiol*. 1991;261:G677–84.
2. Fox MR, Bredenoord AJ. Oesophageal high-resolution manometry: moving from research into clinical practice. *Gut*. 2008;57:405–23.
3. Conklin JL. Evaluation of esophageal motor function with high-resolution manometry. *J Neurogastroenterol Motil*. 2013;19:281–94.
4. Kahrilas PJ, Ghosh SK, Pandolfino JE. Esophageal motility disorders in terms of pressure topography: the Chicago Classification. *J Clin Gastroenterol*. 2008;42:627–35.
5. Pandolfino JE, Fox MR, Bredenoord AJ, Kahrilas PJ. High-resolution manometry in clinical practice: utilizing pressure topography to classify oesophageal motility abnormalities. *Neurogastroenterol Motil*. 2009;21:796–806.
6. Park MI. Recent concept in interpreting high-resolution manometry. *J Neurogastroenterol Motil*. 2010;16:90–3.
7. Carlson DA, Pandolfino JE. High-resolution manometry and esophageal pressure topography: filling the gaps of convention manometry. *Gastroenterol Clin North Am*. 2013;42:1–15.
8. Misra A, Chourasia D, Ghoshal UC. Manometric and symptomatic spectrum of motor dysphagia in a tertiary referral center in northern India. *Indian J Gastroenterol*. 2010;29:12–6.
9. Fox M, Hebbard G, Janiak P, et al. High-resolution manometry predicts the success of oesophageal bolus transport and identifies clinically important abnormalities not detected by conventional manometry. *Neurogastroenterol Motil*. 2004;16:533–42.
10. Bredenoord AJ, Fox M, Kahrilas PJ, Pandolfino JE, Schwizer W, Smout AJ. Chicago classification criteria of esophageal motility disorders defined in high resolution esophageal pressure topography. *Neurogastroenterol Motil*. 2012;24 Suppl 1:57–65.
11. Carlson DA, Pandolfino JE. The Chicago criteria for esophageal motility disorders: what has changed in the past 5 years? *Curr Opin Gastroenterol*. 2013;28:395–402.
12. 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:e356–63.
13. Pratap N, Kalapala R, Darisetty S, et al. Achalasia cardia subtyping by high-resolution manometry predicts the therapeutic outcome of pneumatic balloon dilatation. *J Neurogastroenterol Motil*. 2011;17:48–53.
14. Hernandez JC, Ratuapli SK, Burdick GE, Dibaise JK, Crowell MD. Interrater and intrarater agreement of the Chicago classification of achalasia subtypes using high-resolution esophageal manometry. *Am J Gastroenterol*. 2012;107:207–14.
15. Ghoshal UC, Rangan M, Misra A. Pneumatic dilation for achalasia cardia: reduction in lower esophageal sphincter pressure in assessing response and factors associated with recurrence during long-term follow up. *Dig Endosc*. 2011;24:7–15.
16. Wang YT, Yazaki E, Sifrim D. High-resolution manometry: Esophageal disorders not addressed by the “Chicago Classification”. *J Neurogastroenterol Motil*. 2012;18:365–72.
17. Srinivas M, Balakumaran TA, Palaniappan S, Srinivasan V, Batcha M, Venkataraman J. High resolution esophageal manometry-The switch from “intuitive” visual interpretation to Chicago classification. *Indian J Gastroenterol* 2014;33:doi 10.1007/s12664-013-0410-6.
18. Basseri B, Pimentel M, Shaye OA, Low K, Soffer EE, Conklin JL. Apple sauce improves detection of esophageal motor dysfunction during high-resolution manometry evaluation of dysphagia. *Dig Dis Sci*. 2011;56:1723–8.