

# A Unique Esophageal Motor Pattern That Involves Longitudinal Muscles Is Responsible for Emptying in Achalasia Esophagus

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## Summary

Hong et al<sup>1</sup> has reported a study entitled "A unique esophageal motor pattern that involves longitudinal muscles is responsible for emptying in achalasia esophagus" in the July 2010 issue of *Gastroenterology*. Achalasia esophagus is characterized by loss of peristalsis and incomplete esophagogastric junction (EGJ) relaxation. Recent studies showed that there is considerable heterogeneity in the disease entity of achalasia esophagus.<sup>2</sup> The symptoms such as dysphagia and chest pain in achalasia patients are related to poor esophageal emptying, and in turn related to impaired lower esophageal sphincter (LES) relaxation and lack of esophageal peristalsis. In achalasia, even though incomplete, esophageal emptying occurs intermittently, irrespective of the gravity. However, the precise mechanism of esophageal emptying has never been studied.

In this study, based on a recent high-resolution manometry (HRM) classification proposed by Pandolfino et al,<sup>3</sup> achalasia was categorized into 3 subtypes based on the esophageal response to wet swallows: type 1 was defined by simultaneous pressure

waves of < 30 mmHg, type 2 was defined by simultaneous pressure waves > 30 mmHg and type 3 was defined by spastic simultaneous contractions. The authors evaluated the mechanisms of esophageal emptying in 13 patients with achalasia using simultaneous HRM, multiple intraluminal impedance (MII) and high-frequency intraluminal ultrasonography (HFUIUS) images. In the results, based on HRM, the predominant achalasia pattern of type 2 was characterized by a unique motor pattern that consisted of upper esophageal sphincter contraction, simultaneous esophageal pressure (pan-esophageal pressurization [PEP]) and EGJ contraction following wet swallows. HFUIUS identified longitudinal muscle contraction of the distal esophagus as the cause of PEP in type 2 achalasia. MII revealed that esophageal emptying occurred intermittently (36% swallows) during the periods of PEP. On the other hand, type 1 achalasia had no emptying and type 3 achalasia had relatively normal emptying during most swallows. Therefore, they concluded that the esophageal emptying in achalasia results from swallow-induced longitudinal muscle contraction of the distal esophagus, which increases esophageal pressure and allows flow across the unrelaxed EGJ.

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## Comment

HFIUS imaging is a powerful tool to study esophageal sensory and motor function and dysfunction *in vivo* and in humans. It can be combined with HRM and MII to determine the relationships between different physiologic parameters.

Half of the esophageal muscle is comprised of longitudinal muscle layer, but its role in the gastrointestinal tract motility and bolus movement has not been well understood. One of the reasons for lack of understanding of longitudinal muscle function is the difficulty in recording its function. A number of investigators have studied muscle thickness at the LES and at the body of the esophagus using autopsy specimens, extracorporeal ultrasound transduction, endoscopy and then HFIUS. HFIUS is a relatively noninvasive method to measure longitudinal muscle contraction of the esophagus. On the basis of the ultrasound images and intraluminal pressure recordings, it seems that there is synchrony in the timing and the amplitude of contraction between the circular and longitudinal muscle layers.

HFIUS has provided a number of important insights regarding the longitudinal muscle function of the esophagus. According to the reports using HFIUS, achalasia, diffuse esophageal spasm and nutcracker esophagus (spastic motor disorders of the esophagus) are associated with hypertrophy of the circular as well as longitudinal muscle layers.<sup>4</sup> A sustained contraction of the longitudinal muscle of the esophagus is temporally related to chest pain and heartburn, and is suspected to be the cause of symptoms.<sup>5</sup> Also, the precise synchrony between contraction of the circular muscle and longitudinal muscle layers is altered in nutcracker esophagus.<sup>6</sup> We speculated that variations in esophageal circular and longitudinal muscle thickness measured by HFIUS may account in part for the heterogeneity of ineffective esophageal motility (IEM), and reported that all IEM cannot be attributable to gastroesophageal reflux disease and IEM may be a heterogeneous disease entity that has different features based on esophageal muscle thickness.<sup>7</sup> At present, esophageal HFIUS is the only technique proposed for clinical assessment of human esophageal longitudinal muscle function. Nevertheless, in fact, there has been a different viewpoint that further validation studies and appropriate analysis software are necessary in order to bring this technique into widespread clinical application, because this technique has only been performed in a few centers. Recently, Boesmans et al<sup>8</sup> validated the use of monitoring esophageal mus-

cle wall thickness with HFIUS to assess esophageal shortening and longitudinal muscle contraction with *in vivo* study. Therefore, the use of this technique is expected to be encouraged to other investigators to study the esophageal motility.

In this study, the authors speculated that the motor abnormalities of esophageal body in achalasia are secondary to dysfunctional LES and proposed that type 3 and 1 achalasia represent compensated and decompensated esophagus, respectively, in response to outflow obstruction caused by the dysfunctional LES. On the other hand, they underlined that PEP in type 2 achalasia represents a novel esophageal motor response where the normal peristaltic pattern of the esophagus is altered to a unique pattern that involves longitudinal muscle contraction of the distal esophagus. In conclusion, this report is the first study to establish the precise mechanism of esophageal emptying in achalasia esophagus using simultaneous HRM, MII and HFIUS images. These data provide strong evidence for achalasia classification as proposed by Pandolfino et al.<sup>3</sup> Besides distinct HRM motor patterns, achalasia subtypes have different patterns of longitudinal muscle contraction following swallows and different patterns of esophageal emptying.

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