



# High-resolution esophageal manometry as a tool for therapeutic decision changes

La manometría esofágica de alta resolución como herramienta para los cambios en la decisión terapéutica

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## Abstract

**Introduction.** High-resolution manometry is certainly an incredible technological advance when compared to conventional manometry. Esophageal high-resolution manometry presently guides esophageal motility disorders classification and nomenclature. Despite a growing enthusiasm, development of new parameters, improved technology and description of new diseases, it is elusive if high resolution manometry is only a superb tool to diagnose the same previous diseases perhaps with different names or a real therapy-changer instrument. This review aims to search current evidence for high resolution manometry as a tool for therapeutic decision changes regarding esophageal diseases.

**Methods.** A literature review was conducted on PubMed database restricting results to English language and studies in adults.

**Conclusions.** Despite based on low levels of evidence, high-resolution manometry seems to help in the therapeutic decisions in these situations: (a) treatment can be tailored based on achalasia manometric types; (b) cardiomyotomy may be tailored in length in spastic disorders based on the manometric extension of the spastic waves; (c) a partial fundoplication may be more adequate in patients with elevated lower esophageal sphincter integrated relaxation pressure; and (d) surgical therapy is more efficient in patients with higher distal contractility integral and abnormal relaxation of the lower esophageal sphincter.

**Keywords:** manometry; esophageal diseases; esophageal motility disorders; gastroesophageal reflux; esophageal achalasia; bariatric surgery.

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## Resumen

**Introducción.** La manometría de alta resolución es, sin duda, un avance tecnológico increíble en comparación con la manometría convencional. La manometría esofágica de alta resolución actualmente guía la clasificación y nomenclatura de los trastornos de la motilidad esofágica. A pesar del creciente entusiasmo, el desarrollo de nuevos parámetros, la mejora de la tecnología y la descripción de nuevas enfermedades, es difícil, esclarecer si la manometría de alta resolución es solo una excelente herramienta para diagnosticar las mismas enfermedades previas, tal vez con diferentes nombres, o es un verdadero instrumento que cambia la terapia. El objetivo de esta revisión fue resumir la evidencia actual de la manometría de alta resolución como herramienta para cambiar las decisiones terapéuticas en las enfermedades esofágicas.

**Métodos.** Se realizó una revisión de la literatura en la base de datos de PubMed de artículos en inglés y estudios realizados en adultos.

**Conclusiones.** A pesar de tener bajos niveles de evidencia, la manometría de alta resolución parece ayudar en las decisiones terapéuticas en estas situaciones: (a) el tratamiento puede adaptarse en función de los tipos manométricos de acalasia; b) La extensión de la miotomía se puede adaptar en los trastornos espásticos basándose en la extensión manométrica de las ondas espásticas; (c) una funduplicatura parcial puede ser más adecuada en pacientes con presión de relajación integrada elevada en el esfínter esofágico inferior; y (d) la terapia quirúrgica es más eficiente en pacientes con mayor integral de contractilidad distal y relajación anormal del esfínter esofágico inferior.

**Palabras clave:** manometría; enfermedades del esófago; trastornos de la motilidad esofágica; reflujo gastroesofágico; acalasia del esófago; cirugía bariátrica.

## Introduction

Esophageal dysmotility may be the direct cause for esophageal diseases, the primary esophageal motility disorders (PEMD). Achalasia is certainly the disease in this category with a reasonable consensus about pathophysiology, diagnosis, and treatment<sup>1</sup>. Esophageal motility may be secondarily affected by other esophageal diseases as well, especially gastroesophageal reflux disease (GERD)<sup>2</sup>.

Esophageal motility evaluation is currently delegated to high-resolution manometry (HRM). This tool is more precise and objective than radiologic evaluation<sup>3</sup>. HRM presently guides esophageal motility disorders classification and nomenclature. The most adopted classification is the Chicago Classification, periodically revised and now in its 4<sup>th</sup> edition<sup>4</sup>.

Despite a growing enthusiasm, development of new parameters, improved technology and even “discovery” of new diseases with HRM, it is elusive if HRM is only a superb tool to diagnose the same previous diseases perhaps with different names

or a real therapy-changer instrument. This review aims to search current evidence for HRM as a tool for therapeutic decision changes regarding esophageal diseases.

## Methods

A literature review was conducted on PubMed database restricting results to English language and studies in adults. Key terms used were “Manometry” AND “Bariatric Surgery” OR “Esophageal Motility Disorders” OR “Gastroesophageal Reflux”, with 4,843 results. References of the retrieved papers were manually reviewed. This review is not intended to be a systematic review of results but a narrative review supported by the personal experience of a panel of experts in esophageal surgery and physiology.

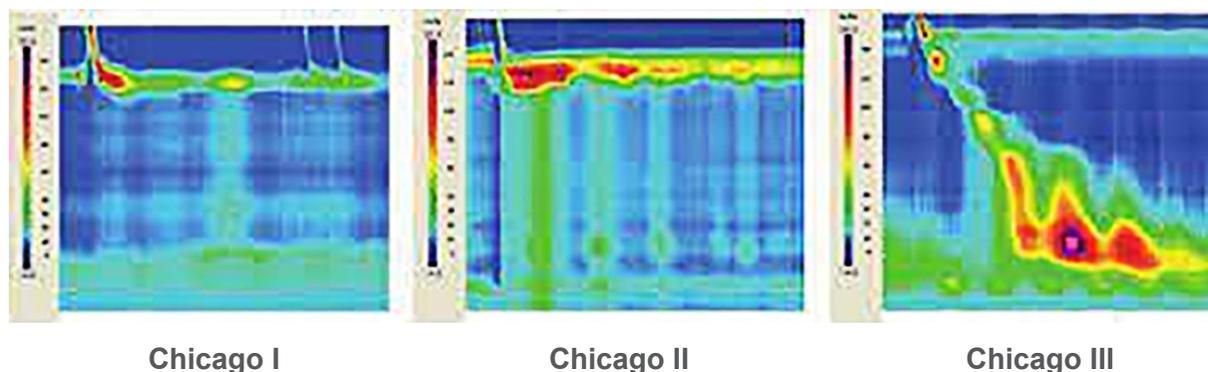
## Achalasia

Achalasia is defined by HRM similarly to conventional manometry: incomplete relaxation of the lower esophageal sphincter (LES) associated with

aperistalsis<sup>5</sup>. Some<sup>6</sup>, however, questioned the “all or nothing at all” concept for aperistalsis, defining achalasia variants with some sort of peristalsis. This was also contemplated by the Chicago Classification group as well<sup>7</sup>. We personally have never found these variants<sup>8</sup>. Latin American authors, similarly, and before these classifications, called attention to “undetermined” forms of achalasia in patients with Chagas’ disease and manometric alterations apart from aperistalsis<sup>9</sup>. We never agreed with this proposal since individuals with Chagas’ disease may not necessarily present with the achalasia-like esophagopathy and may simply have GERD<sup>10</sup>. In any case, literature is silent whether these cases deserve a different treatment or even have a distinct prognosis.

Chicago Classification classified achalasia in three types according to esophageal pressurization (Figure 1)<sup>11</sup>. Different prognoses in general

were initially attributed to these types<sup>12</sup>. Latter studies were able to show better outcomes for specific therapies according to the type. Andolfi and Fisichella<sup>13</sup> compiled the results in a meta-analysis for 1575 patients in 20 studies on a mean follow-up time ranging from 17 to 31 months depending on the type of treatment. Unfortunately, dysphagia relief was the only measured outcome. It must be remembered that GERD may be a drawback for many therapeutic alternatives and considered during clinical decision. A summary of their findings (Table 1) was that peroral endoscopic myotomy (POEM) is the modality with superior results for type I and III. POEM and Heller’s myotomy have similar outcomes for type II. Forceful endoscopic dilatation is the least efficacious treatment but similar to Heller’s myotomy for type III. A careful look at the results for Type III, however, shows that one study is an outlier for



**Figure 1.** Manometric achalasia types. Type 1 is characterized by absence of esophageal pressurization with swallows; Type II has panesophageal pressurization in 20% or more swallows; and Type III is characterized by spasm (20% or more swallows with premature contraction).

**Table 1.** Outcomes based on manometric achalasia types according to different treatments<sup>13</sup>.

<b>Type I</b>
POEM > Heller > dilatation
<b>Type II</b>
POEM = Heller > dilatation
<b>Type III</b>
POEM > Heller = dilatation

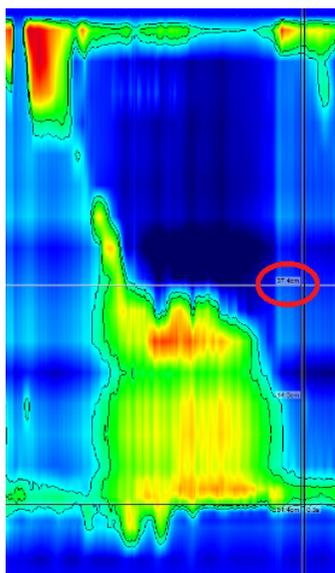
POEM: peroral endoscopic myotomy; Heller: laparoscopic Heller’s myotomy and fundoplication; Dilatation: endoscopic forceful pneumatic dilatation of the cardia.

Heller's myotomy worse results. This study<sup>14</sup> did not perform an extended myotomy that brings better results than the conventional length for types I and II<sup>15</sup>.

HRM may also be useful to guide myotomy length, especially in type III that an extended myotomy is necessary. Apparently, better outcomes can be achieved when the myotomy is tailored based on HRM measurement of the spastic segment<sup>16,17</sup> (Figure 2).

### Gastroesophageal reflux disease

HRM has clear advantage over conventional manometry in the evaluation of the sphincters due to the elimination of motion artifacts. The high density of sensors allows the sphincter to be always measurable despite its excursion with respiration or swallow that would place it outside the sensor range in conventional manometry. More than this, HRM allows the creation of more complex parameters to measure lower esophageal sphincter (LES) basal and relaxation pressures<sup>18</sup>. Even these complex parameters did not make the diagnosis of GERD by manometry only possible, even considering the interaction with the transdiaphragmatic pressure gradient<sup>19</sup>.



**Figure 2.** Manometric extension of the spastic segment in type III achalasia. This extension (circle) may be used to tailor myotomy length.

Lyon Consensus 2.0, however, states that abnormal esophagogastric junction morphology, a compromised barrier and esophageal hypomotility are supportive for GERD diagnosis<sup>20</sup>.

Some groups of gastroenterologists<sup>21,22</sup> tried to use HRM as predictor to medication refractoriness. These studies, however, mixes patients with positive and negative pH-monitoring. We do not believe these groups are comparable or even represent the same disease, preventing further discussion here.

There are no studies using HRM parameters as indication for antireflux surgery. A tailored approach –when patients with abnormal motility undergo a partial fundoplication and cases with normal motility a total fundoplication– has been recently revived. HRM parameter used to conceptualize abnormal motility is the distal contractility integral (DCI)<sup>23</sup>, a logic choice to match the wave amplitude from conventional manometry<sup>24</sup>. Other authors<sup>25</sup>, strangely, even include hypercontractile conditions in the group to undergo a partial fundoplication. Tailoring in these studies is based on surgeons' preference and there is no evidence that HRM can correctly guide therapy and bring better outcomes.

HRM has been studied as a predictor for postoperative dysphagia. Most studies, however, could not find a positive result<sup>26</sup>. Preoperative<sup>27,28</sup> and postoperative<sup>28,29</sup> elevated LES integrated relaxation pressure has been, however, associated with postoperative dysphagia. Curiously, impaired LES relaxation is also the main cause of post-Nissen dysphagia in patients with normal motility or endoscopy<sup>30,31</sup>. No study suggested or offered a different treatment in this situation though. The only study that correlated esophageal motility with dysphagia is the one by Siegal et al.<sup>32</sup> that did not find HRM as predictor for postoperative dysphagia, but those with preoperative dysphagia and a DCI  $\geq 1000$  mmHg-s-cm were more prone to be free of dysphagia after the operation. The authors suggested that a partial fundoplication could be more adequate in this setting. Interestingly, however, mean DCI is a not a parameter proposed by the current Chicago Classification<sup>4</sup>. The assessment of contractile reserve through multiple rapid swallows has also been studied.

Results are controversial with some showing a positive correlation between dysphagia and absent reserve<sup>33</sup> while others did not evidence significance for the test<sup>34</sup>.

Similar to the results for laparoscopic fundoplication, few studies are available regarding magnetic ring LES augmentation. Some fail to correlate HRM and outcomes<sup>35</sup>, while others did not correlate DCI to dysphagia<sup>36</sup>, but found more dysphagia in patients with ineffective esophageal motility<sup>36,37</sup>.

### Bariatric surgery

HRM has not been an explored tool to define therapy in bariatric surgery. It is even questionable if HRM should be part of the preoperative work-up<sup>38</sup>. As part of the unsolvable question if patients with GERD should undergo sleeve gastrectomy, some authors suggest that sleeve gastrectomy should be contraindicated in the setting of a hypotonic LES<sup>39</sup> although studies with objective evaluation (pH monitoring) do not show a correlation between postoperative GERD and preoperative LES pressure<sup>40</sup>. It must be noted that the LES may even be hypertonic in the obese with GERD due to a possible compensation for the increased transdiaphragmatic pressure gradient<sup>41</sup>. Bonaldi et al.<sup>42</sup> found GERD in half of the patients that underwent sleeve gastrectomy and had a mean DCI < 1600 mmHg-s-cm before the operation. It must be emphasized that no pH monitoring was performed.

### Other motility disorders

We previously discussed that HRM may guide myotomy length for achalasia type III. This is also true for other spastic and hypercontractile motility disorders. In fact, we were the first to propose this tailored extent<sup>43</sup>. Also, the presence of associate abnormal relaxation of the LES<sup>43</sup> and higher DCI (30000)<sup>44</sup> favors better outcomes for surgical therapy over clinical therapy in these patients.

### Conclusions

HRM certainly contributed to the diagnosis of motility disorders not much as a tool for therapeutic

decision changes. Despite based on low levels of evidence, HRM seems to help in the therapeutic decisions in these situations: (a) treatment can be tailored based on achalasia manometric types; (b) cardiomyotomy may be tailored in length in spastic disorders based on the manometric extension of the spastic waves; (c) a partial fundoplication may be more adequate in patients with elevated LES integrated relaxation pressure; and (d) surgical therapy is more efficient in patients with higher distal contractility integral and abnormal LES relaxation.

### Compliance with ethical standards

**Informed consent:** This was a review article. No informed consent was necessary.

**Conflict of interest:** the authors declare no conflict of interest.

**Use of artificial intelligence:** The authors declared that they did not use artificial intelligence (AI)-assisted technologies (such as large language models, chatbots, or image creators) in the production of this work.

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### Author's contribution

- Conception and design of the study: Fernando A. M. Herbella, Francisco Schlottmann, Marco G. Patti.
- Acquisition of data: Leonardo Y. K. Zanini, Fernando A. M. Herbella.
- Data analysis and interpretation: Leonardo Y. K. Zanini, Fernando A. M. Herbella.
- Drafting the manuscript: Leonardo Y. K. Zanini, Fernando A. M. Herbella.
- Critical review and final approval: Leonardo Y. K. Zanini, Fernando A. M. Herbella, Francisco Schlottmann, Marco G. Patti.

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