ALIMENTARY TRACT

A Comparison of Symptom Severity and Bolus Retention With Chicago Classification Esophageal Pressure Topography Metrics in Patients With Achalasia

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This article has an accompanying continuing medical education activity on page e15. Learning Objectives—At the end of this activity, the successful learner will review the assessment and management of a patient with achalasia using high-resolution manometry and the Chicago classification.

BACKGROUND & AIMS: We compared findings from timed barium esophagrams (TBEs) and esophageal pressure topography studies among achalasia subtypes and in relation to symptom severity. **METHODS:** We analyzed data from 50 patients with achalasia (31 men; age, 20–79 y) who underwent high-resolution manometry (HRM), had TBE after a 200-mL barium swallow, and completed questionnaires that determined Eckardt Scores. Twenty-five patients were not treated, and 25 patients were treated (11 by pneumatic dilation, 14 by myotomy). Nonparametric testing was used to assess differences among groups of treated patients (10 had type 1 achalasia and 15 had type 2 achalasia), and the Pearson correlation was used to assess their relationship. **RESULTS:** There were no significant differences in TBE measurements between patient groups. Of the 25 patients who received treatment, 10 had a manometric pattern consistent with persistent achalasia after treatment (6 patients with type 1 and 4 patients with type 2 achalasia), whereas 15 appeared to have resolved the achalasia pattern (peristalsis was absent in 8 patients and weak in 7 patients). The height of the barium column at 5 minutes and Eckardt Scores were reduced significantly in patients who had resolved their achalasia pattern, based on HRM. The integrated relaxation pressure and the TBE column height correlated at 5 minutes ($r = 0.422$; $P < .05$). **CONCLUSIONS: Patients who resolved their achalasia pattern, based on HRM, showed improved emptying based on TBE measurements and improved symptom scores. There was no significant difference between patients with type 1 or type 2 achalasia in TBEs. These findings indicate that normalization of the integrated relaxation pressure on HRM is a clinically relevant objective of treatment for achalasia.**

Keywords: Achalasia; Manometry; Esophagram; Symptom.

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Achalasia is diagnosed by showing dysfunction of lower esophageal sphincter relaxation and aperistalsis in the absence of obstructive pathology. The major modalities used to establish the diagnosis and manage the disease are endoscopy, timed barium esophagram (TBE), and esophageal manometry. A TBE quantifies delayed esophageal emptying as a surrogate marker of esophagogastric junction (EGJ) dysfunction, may identify the characteristic bird beak configuration at the lower esophageal sphincter, and details the degree of dilatation or sigmoid appearance. However, both TBE and endoscopy may be normal in achalasia patients[1,2] because they do not detect the early physiological dysfunction of the disease. Hence, manometry has become the gold standard for diagnosing achalasia.

High-resolution manometry (HRM) with esophageal pressure topography (EPT) has improved the accuracy of manometry in detecting achalasia and defined clinically relevant subtypes before treatment.[2–6] The achalasia subtypes are differentiated based on the patterns of esophageal pressurization and contraction during the 10-swallow protocol. However, no data exist to substantiate that HRM characteristics correlate with symptom severity or treatment efficacy. Hence, we hypothesized that the EPT features used to distinguish type 1 from type 2 achalasia would translate into differences on TBE before therapy and that improvement in EPT metrics of EGJ function after treatment would be associated with improved symptoms and reduced bolus retention.

The aim of this study was to assess the relationship between contractile and pressurization patterns defined on EPT, clinical end points of bolus retention on TBE, and symptom severity in type 1 and type 2 achalasia. In addition, we sought to compare EPT and TBE metrics as measures of treatment efficacy.

Abbreviations used in this paper: EGJ, esophagogastric junction; EPT, esophageal pressure topography; ES, Eckardt score; HRM, high-resolution manometry; IRP, integrated relaxation pressure; TBE, timed barium esophagram.

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Materials and Methods

Subjects

Fifty nonspastic achalasia patients (31 men; age, 20–79 y) prospectively were recruited into 2 separate cohorts. The first cohort of 25 patients was enrolled from the clinic at the Northwestern Esophageal Center based on a new diagnosis of type 1 or type 2 achalasia. All 25 patients underwent endoscopy, HRM, TBE, and symptom assessment before treatment. A second cohort of 25 treated patients were enrolled based on having had pretreatment type 1 or type 2 achalasia and were undergoing our post-treatment study protocol including HRM, TBE, endoscopy, and symptom assessment. Only types 1 and 2 were included in the study because the spastic contractions in type 3 achalasia have unique features on TBE and EPT that are independent of bolus retention and sphincter function. HRM and TBE studies were performed within 1 month of each other. All subjects gave written informed consent. The Northwestern University Institutional Review Board approved the study protocol.

Symptom Assessment

For all 50 patients, dysphagia, regurgitation, retrosternal pain, and weight loss were assessed to calculate the Eckardt Score (ES),[7–11] each graded from 0 to 3. Patients were classified as having a good outcome if ES was less than 3 or a poor outcome if ES was 3 or greater.

High-Resolution Manometry

Manometric studies were conducted in the supine position after a 6-hour fast. The HRM catheter was a 4.2-mm outer-diameter solid-state assembly with 36 circumferential sensors spaced 1 cm apart (Given Imaging, Duluth, GA). The HRM assembly was calibrated at 0 and 300 mm Hg and placed transnasally. The HRM assembly was positioned during endoscopy in instances of challenging anatomy, strong patient preference, or prior experience suggesting that would be necessary. In those instances, the manometry study was performed at least 2 hours after endoscopy. The manometric protocol included a 2-minute baseline recording and ten 5-mL swallows.

Manometry studies were analyzed using ManoView analysis software (Given Imaging). Key EPT metrics analyzed were integrated relaxation pressure (IRP),[12,13], nadir lower esophageal sphincter pressure, peristaltic integrity using the 20–mm Hg isobaric contour, distal contractile integral, contractile front velocity, and the distal latency.[1,14] The key metric in achalasia is the IRP, which quantifies EGJ relaxation both in completeness and persistence. The upper limit of normal of the mean IRP for this protocol and instrumentation is less than 15 mm Hg.[3] Additional measures of EGJ function analyzed were the mean resting EGJ pressure at end-expiration during the 2-minute baseline recording and mean nadir EGJ relaxation pressure measured using the isobaric contour tool on ManoView software.[7,9–11]

Pressure patterns within the esophagus were characterized as in Figure 1.[12] Peristaltic integrity was scored as intact (no break >2 cm in the 20–mm Hg isobaric contour), weak (breaks >2 cm in the 20–mm Hg isobaric contour), or failed (<3 cm integrity of the 20–mm Hg isobaric contour distal to the transition zone).[14]

The criteria used for defining type 1 achalasia in untreated patients were as follows: an IRP of 15 mm Hg or greater and 100% failed peristalsis. Pretreatment type 2 achalasia was defined as follows: an IRP of 15 mm Hg or greater and panesophageal pressurization in 20% or more of test swallows. The presence of premature contractions with 20% or more of test swallows or swallows showing preserved peristalsis excluded the diagnosis of type 1 or 2 achalasia because these would be categorized as type 3 achalasia and EGJ outflow obstruction, respectively.

With post-treatment patients, the same definitions were used with the caveat that patients were no longer categorized as having an achalasia subtype if the post-treatment IRP was less than 15 mm Hg. Hence, patients were categorized as having persistent achalasia (type 1 or 2) or a resolved achalasia pattern along with a description of the current manometric profile using the same Chicago Classification definitions as pretreatment. We emphasize that a resolved achalasia pattern does not equate to resolution of the achalasia disease process.

Timed Barium Esophagram

TBEs were performed in the upright position to obtain frontal spot films of the esophagus at baseline, and at 1, 2, and 5 minutes after ingestion of 200 mL (sometimes limited by patient tolerance) of low-density (45% weight to volume) barium sulfate. The height of the barium column was measured vertically from the EGJ using a lead scale placed directly on the patient. The maximal esophageal diameter was measured along the esophageal body perpendicular to the axial plane of the esophagus.

Statistical Analysis

Data from each patient cohort were analyzed independently. Continuous variables were expressed as the median (25th–75th percentile). We used the Mann–Whitney test to compare 2 samples, and the Kruskal–Wallis test to compare more than 2 samples using a significance level of P less than .05. Correlations were calculated using the Pearson correlation coefficient.

Results

The untreated cohort consisted of 17 men and 8 women, ages 31 to 67 years. The treated cohort had 14 men and 11 women, ages 20 to 79 years. Seven HRM studies (14%) were performed after using endoscopy to position the HRM assembly. The untreated group consisted of 10 type 1 and 15 type 2 achalasia patients, whereas the pretreatment distribution of the treated group was 15 type 1 and 10 type 2 achalasia patients. The treatments rendered were pneumatic dilation (n = 11), laparoscopic Heller myotomy (n = 9), and per-oral endoscopic myotomy (n = 5).

Untreated Patients

Type 2 untreated patients had a significantly greater IRP (24; interquartile range [IQR], 18–33 mm Hg vs mean, 16; IQR 12–21 mm Hg) and nadir-relaxation pressure (20; IQR, 14–29 mm Hg vs mean, 12; IQR, 9–18 mm Hg) compared with the type 1 patients. Resting EGJ pressure (type 1, 15; IQR, 12–21 mm Hg; type 2, 15; IQR, 18–33 mm Hg), barium column height (type 1, 8.9 cm; IQR, 7–14 cm; type 2, 7.0; IQR, 6.0–11.5 cm), and barium column width (type 1, 2.9; IQR, 2.2–4 cm; type 2, 3.4; IQR, 3.0–4.1 cm) were similar between achalasia subtypes (Figure 2). There were also no differences in ES for the type 1