High Cost and Low Yield: The Diagnostic Evaluation of Rumination Syndrome in Pediatrics

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Objective To document the use of diagnostic testing in adolescents who ultimately were diagnosed with rumination syndrome, a functional gastrointestinal disorder. We examined the diagnostic yield of each test as well as the associated costs, and we determined if any demographic or illness-related variables impacted the magnitude of the work-up.

Study design A retrospective chart review was conducted for 68 patients with rumination syndrome admitted to our inpatient treatment program. The cost and findings of patients' diagnostic investigations were gathered, as well as demographic and illness-related variables to determine factors that may be related to evaluation size.

Results The most commonly used tests in the evaluation of rumination syndrome included esophagogastroduodenoscopy, gastric emptying, antroduodenal manometry, upper gastrointestinal series, and abdominal ultrasound scan. Each patient underwent an average of 8.8 tests, with the average cost for each patient's diagnostic work-up being US $19,795. Few tests were found to be beneficial in the diagnosis of rumination syndrome, and few demographic or illness variables were found to be related to the overall extent of the investigation.

Conclusions Extensive testing for rumination syndrome in adolescents is common in clinical practice, and comes at a high financial cost with low yield, likely delaying diagnosis and treatment. Symptom-based criteria should be used to make the diagnosis of rumination syndrome. (J Pediatr 2017;).
not any demographic or illness-related variables impacted the extent of the work-up. We hypothesized that the amount of testing would be greater for patients with a longer duration of rumination symptoms, greater somatic complaints, reduced health-related quality of life, and those requiring special nutritional support because of the severity of their rumination.

### Methods

A chart review was conducted for the first consecutive 74 patients admitted to our inpatient treatment program from 2009 to 2015. Insufficient data were available for 6 patients, and these patients were removed from the sample, resulting in a total sample of 68 adolescents. Each patient met Rome III criteria for rumination syndrome. Patients were predominantly female (86.8%), similar to that seen in other samples of adolescents with rumination syndrome. Fifty percent of patients required special nutritional support (eg, gastric or jejunal tube feedings or total parenteral nutrition) at the time of their admission to our program. There was considerable variability in the duration of time patients had symptoms of rumination syndrome prior to receiving treatment at our center (range = 3-163 months, median = 21 months). Other patient characteristics are described in Table II. Many of the patients in the current chart review were described in a prior study by our group.

### Diagnostic Study Data

Because the majority of patients were referred from outside hospitals, diagnostic test data were extracted from electronically shared medical records and information forwarded by outside physicians as part of the initial referral. For internal referrals from our institution, data were obtained directly from the electronic medical record. We examined demographic information, medical history (eg, the current use of enteral or parental feeding), and past diagnostic testing (ie, radiologic, endoscopic, and motility). The only diagnostic tests considered for the current study were (1) those that explore UGI function and (2) those that took place between the dates of rumination symptom onset and admission to our program.

### Cost Data

Information regarding the cost of the diagnostic investigation was gathered from 2 sources. First, for each investigation, data regarding the “national pricing” of the test was obtained via the Pediatric Health Information System. The Pediatric Health Information System is a comparative pediatric database that contains pricing information for each test (as determined by the test’s current procedural terminology code) across 45 children’s hospitals. For the current study, the “national pricing” component of the cost was the average pricing for the investigation across comparison hospitals. Second, regarding the “professional charge” for each investigation (eg, test interpretation), national comparison data were not available. Therefore, the “professional charge” component of the total cost was obtained through our own hospital system for each investigation.

Taken together, the “total cost” data (Table III) was the sum of the national pricing for the diagnostic test and the professional charge associated with that individual test. The “grand sum” for each patient’s complete diagnostic work-up consisted of the total cost across all radiologic, endoscopic, and motility tests the individual patient received.

### Somatic Symptoms and Abdominal Pain

To index the presence and severity of somatic symptoms, parents and patients completed the Children’s Somatization Inventory-24 (CSI-24) and the Abdominal Pain Index-4 (API-4). The CSI-24 is a well-validated measure that asks patients (and parent by proxy report) about 24 nonspecific somatic complaints that may have occurred over the previous 2 weeks. Participants were asked to describe how much they were “bothered” by each symptom in the previous 2 weeks, with responses ranging from 0 (not at all) to 4 (a whole lot). Parents were asked to report on their impressions of their child’s somatic symptoms. The most common method of scoring the CSI-24 entails calculating a total score, which is the average of the scores across all 24 items (with a maximum score of 4.0). Higher scores represent greater symptom presence. This total score has been shown to have good internal consistency (α = 0.88). The CSI-24 was not used from our program’s inception, therefore, only 30 parent and 44 patient questionnaires were available for use in the current study (Table II).

The API-4 is a 4-item measure on which the individual (or parent) rates the frequency, duration, and intensity of the patient’s abdominal pain over the past 2 weeks. In line with the scoring procedure advocated by the authors, all items were converted to a 5-point scale, and a composite score created (with a maximum score of 4.0). The authors validated the measure...
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