Gastric emptying time in cyclic vomiting syndrome in children

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Abstract. – Pathogenesis of cyclic vomiting syndrome (CVS) is still uncertain. Aim of our study has been to verify the role of gastric emptying time in children affected by CVS. We studied 9 children with CVS who underwent measurement of gastric emptying time by real-time ultrasonography after administration of a mixed, solid-liquid meal. In all the children gastric emptying time resulted in normal range.

Our data suggest that mobility abnormalities of the stomach don’t play a key role in the pathogenesis of CVS.

Key words: Cyclic vomiting syndrome, Recurrent vomiting, Gastric emptying time, Real time ultrasonography.

Introduction

Cyclic vomiting syndrome (CVS) is characterized by recurrent, discrete, stereotypical episodes of intense vomiting, punctuating periods of completely normal health.

The prevalence of CVS is not entirely known and epidemiologic data indicate CVS currently occurs more commonly than in the past, affecting almost 2% of school-aged children. Pathogenesis of CVS is still uncertain but three pathophysiologic pathways may play a role: (1) mismatching with 5-gastrin related mechanism; (2) chronic CVS. In all patients, radiologic contrast study was performed to exclude anatomic malformations as well as 24-hour esophageal pH monitoring in order to exclude gastroesophageal reflux disease. Skin prick test, PRIST, RAST were carried out to evaluate the presence of food intolerance or allergy. Furthermore, IgA-antigliadin and IgA-antiendomysium antibodies tests were performed to exclude celiac disease. All of these tests were normal or negative in all children.

According to Consensus Diagnostic Criteria for CVS (Table I) cyclic vomiting diagnosis was given in all the patients.

After administration of a mixed solid-liquid meal measurement of gastric emptying time was taken in these patients by real-time ultrasonography.

The test meals were prepared by a team of dietitians, based on caloric intake at breakfast for children of different age groups (Table II).

Subjects were examined in the morning, after an overnight fast period, using a high-resolution real-time scanner (ALOKA SSD 250, Tokyo, Japan) with a 5 MHz linear array transducer, applied with minimal abdominal compression. The examination was always performed by the same operator; patients sat in 30° to the horizontal plane of the table.
In addition, the antral length (from the pylorus to the angle region), was measured by a transverse scan at the epigastrium.

So, the volume of the antropyloic portion of the stomach can be obtained from these measurements according to the formula:

\[0.065 \times h \times (2ab + 2ef + 4cd + cb + ad + ed + cf)\]

where \(h\) is the antral length;
\(a, c, e\) are the longitudinal diameters;
\(b, d, f\) are the anteroposterior diameters.

After the meal, changes of the gastric antrum were easily observed at ultrasound. The stomach was considered empty when the section area and the volume of the antrum returned to basal values and remained unchanged for at least 30 min, and also when a complete absence of food particles within the antrum was observed at real-time examination for 30 min.

Final emptying time was calculated in relation to the start of the meal.

Results

Table III shows changes in the cross sectional area (mean value in cm\(^3\)) of the gastric antrum before the meal test, immediately after, and at 30, 60, 90 min. Maximum cross sectional area was reached immediately after the meal (16.55 cm\(^3\)). Then, in the following 30 min, a significant decrease was observed. After that time the mean area gradually decreased and returned to basal values at 90 min (0.29 cm\(^3\)). Final emptying time, calculated according to the changes in the cross-sectional area of the gastric antrum was 120 min (normal range 150 ± 30 min).
Table III. Changes in the cross sectional area (mean value in cm³) of the gastric antrum before the meal test, immediately after, and at 30, 60, 90 min.

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<tbody>
<tr>
<td>Basal cross-sectional area</td>
<td>0.54</td>
</tr>
<tr>
<td>Cross-sectional area immediately after the meal</td>
<td>16.55</td>
</tr>
<tr>
<td>Cross-sectional area at 30'</td>
<td>3.63</td>
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<tr>
<td>Cross-sectional area at 60'</td>
<td>1.18</td>
</tr>
<tr>
<td>Cross-sectional area at 90'</td>
<td>0.29</td>
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In all cases, barium x-ray of the stomach confirmed the ultrasound findings regarding the presence or absence of contents within the stomach. None of the children complained of any problem during ultrasound measurement.

Discussion

Aim of our study has been to verify gastric emptying time in patients with cyclic vomiting, using real-time ultrasonography. The present study shows that this method can be used to obtain non-invasive and physiologic determinations of gastric emptying time by measuring morphologic changes of the gastric antrum after a meal.

The entire process of gastric emptying can be ultrasonographically monitored and a quantitative description of partial emptying at fixed times can be made directly by measuring the cross sectional area of the antpyloric region.

A comparison with x-ray contrast study of the stomach has validated this method: ultrasonogram proved to be reliable in establishing cross-sectional area during the exam. To obtain a similar x-ray evaluation it would be necessary to take a large number or radiograms, which means a great deal of time and a significant increase of radiation hazards.

The scintigraphic method is also rather time consuming and much more expensive than the ultrasound technique as it requires a sophisticated equipment. Furthermore, intestinal loops overlapping on the gastric area could sometimes prevent a correct measurement.

As opposed to what it happens by the ultrasound technique, degrees of duodenogastric reflux will not be appreciated by the radioisotope method. Another problem is the need to prepare the radiolabeled meal.

In children gastric emptying time has been used to study the pathogenesis of other diseases such as Helicobacter pylori gastritis, gastroparesis, abnormalities of gastrointestinal tract, gastroesophageal reflux disease, Sandifer's syndrome.

In all our patients we found a normal gastric emptying time. Our data suggest that motility abnormalities of the stomach don't play a key role in the pathogenesis of cyclic vomiting. However, further study are necessary to confirm our results in a greater number of patients.

CVS remains a mysterious disorder, a syndrome without known etiology, pathogenesis, laboratory markers and target organ, despite our increasing knowledge since its classic description by Samuel Gee in 1882.

We suspect it to be a disorder of the brain-gut axis, heightened by behavioral and physiological responses, and may represent an over-response of the natural defense mechanism developed teleologically to protect against a toxin or toxic ingestion and stress.


