Evaluation of Gastric Emptying Time in Patients with Subclinical Hypothyroidism and Euthyroid Goiter

Şule Ceylan

University of Health Sciences Türkiye, Gaziosmanpaşa Training and Research Hospital, Clinic of Nuclear Medicine, İstanbul, Türkiye

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ABSTRACT

Objective: Upper gastrointestinal complaints are common in patients with euthyroid goiter and subclinical hypothyroidism for whom follow-ups are performed without treatment. This study evaluated gastroparesis using radionuclide imaging in patients with dyspepsia.

Methods: A total of 56 adult patients were included in this retrospective study. The average age of the patients was calculated as 70.88±2.33 years. Euthyroid goiter was observed in 29 patients and subclinical hypothyroidism in 27 patients. A liquid gastric emptying scintigraphy test was performed on all patients, and thyroid function tests, thyroid ultrasonography, and body mass index evaluations were performed. Regions of interest, including the antrum and fundus, were drawn from anterior images. A time activity curve was obtained.

Results: The gastric emptying half-time was calculated using liquid gastric emptying scintigraphy. This value was found to be significantly higher in patients with subclinical hypothyroidism than in those with euthyroid goiter (p=0.033). Gastric emptying was prolonged in 17 subclinical hypothyroidism patients (63%) and 10 (34.5%) patients diagnosed with euthyroid goiter.

Conclusion: Liquid gastric emptying scintigraphy may be preferred in elderly patients with suspected gastroparesis because of its easy application and short duration. Detecting the prolongation of gastric emptying time due to the presence of gastroparesis in subclinical hypothyroidism and euthyroid goiter cases followed up without treatment may guide the prescription of treatment.

Keywords: Gastric emptying, goiter, dyspepsia, thyroid function tests, radionuclide imaging

INTRODUCTION

The presence of gastroparesis in patients with dyspepsia can be evaluated by gastric emptying scintigraphy. Gastric emptying scintigraphy can be applied to solid or liquid food (1). Solid gastric emptying scintigraphy (SGES) is considered to be the optimal test because it is a shorter study lasting for about 4 hours. There is a correlation between the results obtained by liquid gastric emptying scintigraphy (LGES) and those obtained by solid gastric scintigraphy (2). Upper gastrointestinal complaints are frequently encountered in patients with euthyroid goiter (EG) and subclinical hypothyroidism (SH) with whom follow-ups are held in thyroid outpatient clinics without treatment. Treatment is controversial in patients with EG if there is no suspicion of malignancy or signs of compression (3). Goiter is an enlargement of the thyroid gland and is common in the elderly (4). Ultrasonography (USG) and thyroid function tests (TFTs) are primarily used for diagnosis and follow-up. If necessary, scintigraphy and biopsy can be performed (5). SH describes conditions in which free T4 (fT4) and fT3 values are normal but the thyroid-stimulating hormone (TSH) value is above the upper limit. In these patients, treatment does not begin before TSH reaches a certain level or without obvious clinical symptoms, such as recurrent hypothyroidism symptoms (6,7). The present study evaluated gastric emptying time with LGES in elderly patients with a diagnosis of EG or SH with no use of thyroid hormone preparations and who suffered dyspeptic complaints. This study is expected to contribute to the literature to optimize treatment initiation in these patients.

METHODS

This retrospective study included 56 adult patients. The median age of the patients was 72 years (minimum 68, maximum 74). Of these, 49 (87.5%) were women. A total of 29 patients were diagnosed with EG and 27 with SH. LGES testing was performed on all patients. In addition, TFT, thyroid USG, and body mass index (BMI) evaluations were performed. Indigestion complaints were observed in all patients. Not included in the study were
very underweight or obese patients, those with a thyroid volume of more than 40 mL, those with the presence of chronic disease and thyroid preparation, prokinetic drug use, chronic drug use, diabetes mellitus, smoking, stomach or bowel operation anamnesis, hiatal hernia, gastroesophageal reflux, or a diagnosed esophageal motility disorder. Those with 20 to 30 mL of thyroid volume were accepted as mild goiter, and those with 30 to 40 mL were accepted as moderate goiter. According to their BMI, the patients were evaluated as normal or overweight. Four to six hours of fasting were required before scintigraphy. Imaging was performed early in the morning when gastric emptying was faster. The study did not include patients with blood glucose levels of <40 mg/dL or >275 mg/dL. When liquid food enters the stomach, the fundus relaxes. The fluid takes approximately 30 min to empty from the relaxed stomach. For the test, 18.5-37 MBq (0.5-1 mCi) Tc-99m nanocolloid was added to 300 mL of water, which the patient was asked to swallow immediately. A low-energy multi-purpose collimator was used in a 128x128 matrix. The patient was seated at a 30- to 45-degree angle. Imaging started immediately after the patient drank the liquid. Late images were acquired at 30 min and 1 h. The patient was kept in a sitting position to reduce physical activity between the images. Regions of interest containing the antrum and fundus were drawn from the anterior images (Figure 1), and a time activity curve was obtained. LGES half-time was accepted as 23±3 normal gastric emptying time (8). Our study was retrospective, and informed consent was obtained from all patients. Our study was approved by the University of Health Sciences Türkiye, Gaziosmanpaşa Training and Research Hospital Clinical Research Ethics Committee on 01.03.2023 with 28 decision numbers.

**Statistical Analysis**

SPSS version 21 software was used for statistical analysis. Normally distributed continuous variables were expressed as mean ± standard deviation, non-normally distributed continuous variables were expressed as median (minimum and maximum values), and categorical variables were expressed as number of cases and percentage. Whether continuous variables were normally distributed or not was determined by visual (histogram and probability graphs) and analytical (Kolmogorov-Smirnov test) methods. Patients with SH and patients with EG were tested for categorical variables (gender, excess goiter volume, obesity, and length of gastric emptying time) using the chi-square test and for normally distributed continuous variables (TSH and fT4) using Student’s t-test. It was compared with the Mann-Whitney U test for age and fT3, which is a non-normally distributed continuous variable. P<0.05 value was considered statistically significant. The tests were evaluated as two-sided.

**RESULTS**

A total of 29 patients were diagnosed with EG. Of these, 25 (86.2%) were female. The thyroid gland size was between 30 and 40 mL in 16 of these patients (55.2%) and between 20 and 30 mL in 13 patients (44.8%). TFT was within normal limits in these patients. In the 27 patients diagnosed with SH, TSH levels were higher than normal (7.47±0.20 mIU/L). fT4 (1.09±0.02 ng/dL) and fT3 [2.42 (2.17-2.73) pg/mL] values were within normal limits. These patients did not have any presence of goiter. The data for the patients are summarized in Table 1. The patients’ upper gastrointestinal complaints were examined (patient assessment of upper gastrointestinal disorders-symptom severity index) (9,10). All patients complained of fullness of the stomach, early satiety, postprandial bloating, and frequent belching. Gastric emptying half-time (GEHT) was calculated using LGES. GEHT in SH cases was found to be significantly longer than that in EG cases (p=0.033). GEHT was prolonged in 13 of the SH patients (63%). Of the 10 patients whose GEHT was calculated as normal, three were male. TSH levels in these 10 patients ranged from 3.47 to 3.69 mIU/L. GEHT was prolonged in only 10 (34.5%) patients with a diagnosis of EG; all 10 were female. Goiter volume was between 30 and 40 mL in eight patients. BMI was within normal limits for seven of the 10 patients. TSH values were between 3.47 and 3.69 mIU/L in these 10 patients (Table 1).

**DISCUSSION**

Hypothyroidism and gastroparesis commonly coexist. Thyroid hormones play an important role in the regulation of metabolism (11). Gastroparesis is a disease in which gastric emptying is delayed in the absence of mechanical obstruction. Patient quality of life decreases because of upper gastrointestinal complaints (12,13). Levothyroxine (LT4) tablets are preferred for treating hypothyroidism. However, in patients with EG and SH, LT4 is prescribed in selected patients only if necessary (14). Approximately 10% of patients receiving LT4 therapy are euthyroid. Treatment is initiated for these patients because of
Many studies do not recommend LT4 treatment for SH and EG disease until certain clinical findings occur. In elderly patients, this is due to TSH suppression, which can put the patients at risk of atrial fibrillation and metabolic bone disorder (3). If the aim is to reduce the euthyroid nodular goiter size, surgery or radioactive iodine treatment can be applied (3). Surgery is mandatory in the presence of cancer. A single measurement is not sufficient to diagnose TFT at follow-up. The present study’s patients were followed up from 6 months to one year, at least three months apart. Thyroid disease is generally more common in women (11). Female gender was also more common in the present study’s patients. Some male patients were excluded from the study because of smoking, which is more common among males in the country of study. Dyspeptic complaints in patients who received follow-ups without treatment may have resulted from gastroparesis. To evaluate gastroparesis, LGES and SGES results are correlated (2). SGES testing is lengthy and complex; therefore, it can be difficult to apply in the elderly population. LGES, in contrast, is very easy to apply and to obtain cooperation from elderly patients. Existing studies indicate that the correlation between GEHT and dyspeptic complaints lack statistical power (2). The present study, which evaluated GEHT by scintigraphy, found that more than one-third of the patients had normal gastric emptying (9). GEHT was within the normal limits for 29 patients with dyspeptic complaints. However, scintigraphic GEHT calculations may not fully represent the digestive process and gastrointestinal neuroendocrine events (9). A meta-analysis study that examined 25 studies in which GEHT was calculated for 29 patients with dyspeptic complaints. However, scintigraphic GEHT calculations may not fully represent the digestive process and gastrointestinal neuroendocrine events (9). A meta-analysis study that examined 25 studies in which GEHT was calculated using scintigraphy reported a relationship between delayed gastric emptying and dyspepsia complaints (24). In this study, prolonged GEHT was more common in patients with SH. Another study using wireless motility reported a relationship between gastroparesis and duodenal contractility severity (24), and a further study reported that gastroparesis symptoms are associated with small bowel dysmotility (25). In this study, LGES testing was completed within 1 h, and the standard method was used for all patients (9). As stated, there is no reliable method to evaluate mixed solid-liquid food and liquid gastric emptying (9). LGES may be preferred over SGES in the elderly population to evaluate gastroparesis apart from specific diseases. LGES, unlike

Table 1. Data on subclinical hypothyroidism and euthyroid goiter cases

<table>
<thead>
<tr>
<th></th>
<th>Subclinical hypothyroidism (n=27)</th>
<th>Euthyroid goiter (n=29)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age [med (min-max)]</td>
<td>72 (68-74)</td>
<td>72 (68-74)</td>
<td>0.584</td>
</tr>
<tr>
<td>Gender (female/male)</td>
<td>24 (88.9%)</td>
<td>25 (86.2%)</td>
<td>1</td>
</tr>
<tr>
<td>TSH (mIU/L) (mean ± standard deviation)</td>
<td>7.47±0.20</td>
<td>3.30±0.24</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>fT4 (ng/dL) (mean ± standard deviation)</td>
<td>1.09±0.02</td>
<td>1.28±0.08</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>fT3 (pg/mL) [med (min-max)]</td>
<td>2.42 (2.17-2.73)</td>
<td>3.15 (2.53-3.29)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Liquid gastric emptying T1/2 (prolonged/normal)</td>
<td>17 (63%)</td>
<td>10 (34.5%)</td>
<td>0.033</td>
</tr>
<tr>
<td>BMI (overweight/normal)</td>
<td>9 (33.3%)</td>
<td>10 (34.5%)</td>
<td>0.928</td>
</tr>
<tr>
<td>Goiter size (mild/moderate/normal)</td>
<td>0/0/0 (0/0/100%)</td>
<td>13/16/0 (44.8%/55.2%/0)</td>
<td>0.005</td>
</tr>
</tbody>
</table>

min-max: minimum-maximum, med: median, TSH: thyroid-stimulating hormone, fT4: free T4, BMI: body mass index
SGES, is an easy and short-term test. Solid foods are broken down into small pieces by enzymes and gastric juice. While solid food must be broken down to pass through the pyloric sphincter, liquids pass directly. No cause is found in 50% of patients with dyspeptic complaints (9). Patients with upper gastrointestinal symptoms may have antral duodenal contraction disorder (24). Scintigraphic GEHT calculation is superior to barium studies because LGES is a physiological test (24). Small intestinal dysmotility may be associated with gastroparesis symptoms. Normally, 12% of antral contractions cause duodenal spread (25). Gastroparesis is common in diabetic patients. The prevalence of gastroparesis in diabetic patients is 64% (25). Some studies involving diabetic patients have reported a correlation between dyspeptic complaints and prolonged GEHT. Furthermore, acute changes in blood sugar affect gastric emptying (24). Diabetic patients were not included in this study; the included patients did not have hypoglycemia or hyperglycemia. Rapid gastric emptying may also be a consequence of autonomic dysfunction (25). There was no evidence of rapid gastric emptying in the present study. Although SGES is the gold standard method for calculating GEHT, dynamic imaging for 90 min and imaging late at 4 h make it difficult to apply, especially in the elderly population. Dynamic imaging places significant strain on the SPECT system; therefore, static imaging is more advantageous. In this study, GEHT was calculated using LGES and static images. The radiation dose required for LGES imaging is very low and the test time is short; therefore, it fulfilled the requirement of a practical test. Dyspepsia complaints may accompany many chronic diseases, such as diabetes, neuromuscular disorders, and endocrine disorders. However, with appropriate precautions, dyspeptic complaints can be prevented. In cases of SH, minor changes in thyroid hormone levels may delay gastric emptying. In this study, patients with gastroparesis who were prolonged in GEHT were referred to the endocrinology outpatient clinic for treatment prescription.

**Study Limitations**

A retrospective approach is a weakness of our study.

**CONCLUSION**

LGES may be preferred in elderly patients with suspected gastroparesis because of its easy application and short duration. Detecting the prolongation of gastric emptying time due to the presence of gastroparesis in SH and EG cases followed up without treatment may guide the prescription of treatment.

**Ethics Committee Approval:** Our study was approved by University of Health Sciences Türkiye, Gaziosmanpaşa Training and Research Hospital Clinical Research Ethics Committee on 01.03.2023 with 28 decision numbers.

**Informed Consent:** Informed consent was obtained from all participants of this study.

**Financial Disclosure:** The author declared that this study has received no financial support.

**REFERENCES**


