 ISSN 0172–780X **www.nel.edu**

ORIGINAL ARTICLE

Gastric emptying in subclinical hyperthyroidism

Gurcan Kisakol [1], Ertugrul Kayacetin [2], Oktay Sari [3] & Ahmet Kaya [1]

1. Selcuk University Meram Medical Faculty, Internal Medicine, Division of Endocrinology and Metabolism;
2. Selcuk University Meram Medical Faculty, Internal Medicine, Division of Gastroenterology;
3. Selcuk University Meram Medical Faculty, Department of Nuclear Medicine;
KONYA/TURKEY

Correspondence to: Gurcan Kisakol, M.D.
Selcuk Universitesi,
Meram Tip Fakultesi
Ic Hastaliklari
Endokrinoloji ve Metabolizma Hast, KONYA/TURKEY
TEL: +90 332 3209208 FAX: +90 332 3236063
EMAIL: gurcank@hotmail.com

Submitted: *December 24, 2002*
Accepted: *December 27, 2002*

Key words: **subclinical hyperthyroidism; gastric emptying; ^{99m}Tc sulfur colloid**

Neuroendocrinol Lett 2003; ***24****(3/4):255–258 pii: NEL243403A17* *Copyright © Neuroendocrinology Letters* ***www.nel.edu***

Abstract

INTRODUCTION AND AIM: About 15% of hyperthyroid patients suffer from gastrointestinal symptoms such as diarrhea, constipation, nausea and early satiety the problem. Published reports on the topic of gastric emptying in hyperthyroidism are rare and discrepant in their results.

PATIENTS AND METHODS: Thirteen patients (8 women, 5 male; aged 41.92±1.491 SE yr) with a recently established diagnosis of subclinical hyperthyroidism due to Graves-Basedow disease and as control group 10 age-matched healthy subject (7 women, 3 male; 39.6±2.918 SE yrs) participated in this study. Scintigraphic method (food labeled with ^{99m}Tc sulfur colloid) was used for measurement of gastric emptying.

RESULTS: Gastric emptying time was similar in both subclinical hyperthyroid and control groups (p=0.413).

DISCUSSION: There are few studies on the subject of gastric emptying in hyperthyroidism with either delayed emptying or with emptying time similar to controls. In the only one study in subclinical hyperthyroidism, gastric emptying was found to be delayed. We also found that gastric emptying was delayed in subclinical hyperthyroidism. On the basis of this and other studies, we may suggest that in subclinical hyperthyroidism, gastric emptying of solids were similar to that in age-matched healthy control subjects and gastrointestinal dysfunction is dependent on severity of the hyperthyroid state and might be a result of impaired neuro-hormonal regulation. Yet the data must be supported on larger groups.

Introduction and aims

About 15% of hyperthyroid patients suffer from gastrointestinal symptoms such as diarrhea, constipation, nausea and early satiety the problem [1]. Notoriously, these symptoms are believed to be secondary to rapid gastric emptying. Published reports on the topic of gastric emptying in hyperthyroidism are rare and discrepant in their results. Normalization of the gastric emptying of a hypertonic glucose solution, in terms of prolongation of the gastric half-emptying time, has been observed in patients with hyperthyroidism when euthyroidism was restored after pharmacological treatment [2]. Remarkably, acute gastroparesis associated with thyrotoxicosis was rather recently described in a case report [3]. Laboratory work on rats after induction of hyperthyroidism revealed that gastric emptying was faster when compared to euthyroid state [4,5]. Results of these studies were compatible with increased gastric emptying in hyperthyroidism.

Consequently, we decided to survey, in our cross-sectional study, the changes in the kinetics of the gastric emptying of solids in subclinical hyperthyroidism. Age-matched healthy individuals were examined as a reference group.

Patients and methods

Thirteen patients (8 women, 5 male; aged 41.92 ± 1.491 SE yr) with a recently established diagnosis of subclinical hyperthyroidism due to Graves-Basedow disease participated in this study. The diagnosis of subclinical Graves-Basedow disease was established by the presence of a diffuse goiter, or normal FT_3 and FT_4 with decreased TSH concentrations in serum with increased thyroid uptake of radioactive ^{99m}Tc pertechnetate. Ten age-matched healthy subjects (7 women, 3 male; 39.6±2.918 SE yrs) served as the control group. Exclusion criteria for the study were cigarette smoking and alcohol abuse, as well as intake of drugs known to affect GI motility. Gastric emptying and the clinical and laboratory indices of thyroid function were examined in every patient.

Measurement of gastric emptying

Patients quit smoking and fasted overnight before the examination. As described previously [6,7] , a standard test meal consisting of scrambled eggs labeled with ^{99m}Tc sulfur colloid, white bread, and 250 ml of skim milk (390 kcal; 19.3 g protein, 14.8 g fat, 41.2 g carbohydrates) was given to the patients in the morning. The time needed to consume the meal did not exceed 5 min. With the 18.5 MBq of (500μCi) activity of ^{99m}Tc sulfur colloid used per examination. Data acquisition started immediately after the meal was completed. Ninety 1-minute frames were acquired with the patient lying in supine position in front of a gamma camera coupled on-line with a computer device. A parallel hole high resolution collimator was used. The analyzer was set on the 140-keV photopeak with 20% energy window width. Quantitative analysis of the stored data was performed as described previously [8]. A whole stomach region of interest was drawn manually. Time-activity curves from the gastric region of interest were corrected for the physical decay of the isotope and normalized for the fraction of activity remaining within the stomach (with a peak activity frame of 1.0). Taking into account previous investigations, correction for background was omitted as negligible. Correction for the spatial movement of the tracer within the stomach was assured by the experimental design, which considered a subject to be her own control. As described previously [9], the normalized gastric emptying curves were fitted with a power-exponential function to derive the gastric half-emptying time ($t_{1/2}$), the curve shape parameter (S), and the slope of the curve (K). A patient was considered to have abnormal gastric emptying if any of the gastric emptying parameters was outside the two-tailed 95% confidence limit established in healthy subjects, i.e., outside the mean ± 2 SD range.

Statistical methods

For comparisons between groups, Mann-Whitney U test was used. $p<0.05$ (two-tailed) was considered to be significant. Results presented here are expressed as the mean ± SEM.

Results

Patient and control subjects' profiles and clinical characteristics are shown in Table 1. Statistical analysis for age between groups revealed no difference. Serum levels of FT_3 and FT_4 were within normal ranges in both of the groups, statistical difference being non-significant. However, serum TSH was significantly lower in the subclinically hyperthyroid group than the control group. Gastric emptying time was similar in subclinical hyperthyroid group when compared to control group (p=0. 413) (figure 1).

Discussion

We found that gastric emptying was similar in subclinical hyperthyroid patients and control subjects (p=0.413). Unfortunately, we could not find in the literature any other publication, except one [10] on the topic of gastric emptying in subclinical thyroid disorders, with the results of which we could compare our results. For this reason, we mostly accepted the studies performed in overt hyperthyroidism as a reference point to our study.

Several research groups reported rapid orocecal transit times in hyperthyroidism [11,12]. As demonstrated previously [11,13,14], a rapid gastrocecal passage of chyme rather than an increased rate of gastric emptying would account for the phenomenon. On the other hand, some investigators observed that in thyrotoxicosis, small and large intestinal transit is accelerated, while gastric emptying was similar to that found in euthyroid control subjects [15]. Authors presumed that diarrhea in hyperthyroidism must be secondary to rapid intestinal transit. Previously Wiley *et al.*[16] reported that gastric emptying was unchanged in com-

Table 1: Patient and control subjects' profiles and laboratory characteristics

Groups	Control	Subclinical hyperthyroid group	P
Age (years)	39.6 ± 2.91	41.92 ± 1.4913	0.413
FT3 (pg/dL)	3.1010 ± 0.102	4. ± 0.1227	0.568
FT4 (ng/dL)	1.304 ± 0.07	1.46 ± 0.007	0.247
TSH (μIU/mL)	1.31 ± 0.3199	0.03 ± 0.009	0.001
Gastric emptying (t ½ min)	101.79 ± 25.55	92.14 ± 21.43	0.385

parison to the pretreatment situation in four patients with hyperthyroidism who returned to euthyroidism after pharmacological treatment. Nevertheless, Holdsworth *et al* observed a significant decrease in the rate of gastric half-emptying of a ^{51}Cr-labeled liquid meal in patients with hyperthyroidism with return to euthyroidism. However, in the latter study, a multicomponent liquid meal was applied [16] , as opposed to the hypertonic glucose solution applied in the former study [2]. Holdsworth *et al.*[2] found that rapid liquid phase gastric emptying in patients with hyperthyroidism was associated with elevated peak blood glucose and insulin levels. In contrast to human studies, Ikeda et al demonstrated in thyrotoxic rats that an altered glucose tolerance to intragastric glucose load was primarily due to rapid gastric emptying, whereas glucose absorption from the small intestine remained normal [5]. Miller *et al.* [4] did not observe any difference relative to healthy control subjects in the pattern of gastric emptying of a 458-kcal liquid meal in five untreated patients with hyperthyroidism or in the four who returned to euthyroidism after administration of ^{131}I. In one of the rare studies questioning autonomic nervous system (ANS) interaction with thyroid hormone status, it was demonstrated that ANS dysfunction in hyperthyroidism results in impaired neuro-hormonal regulation (decrease of vagal influence) of gastric myoelectrical activity followed by delay of gastric emptying [10]. Authors also found the degree of both gastric dysrhythmia and delay of gastric emptying to be proportional to the level of FT_3 in hyperthyroid groups. Additionally, they reported that among patients with moderate hyperthyroidism, the gastric emptying time was only slightly prolonged when compared to control group.

In summary, gastric emptying in hyperthyroidism was either found to be delayed or similar to controls. Several factors may account for these controversial results: different composition and consistency of the test meals, and the method chosen for measuring gastric emptying. On the basis of this and other studies [10], we may suggest that in subclinical hyperthyroidism, gastric emptying of solids were similar to that in age-matched healthy control subjects, gastrointestinal dysfunction is dependent on the severity of the hyperthyroid state and might be a result of impaired neurohormonal regulation. Yet the data must be supported on larger groups.

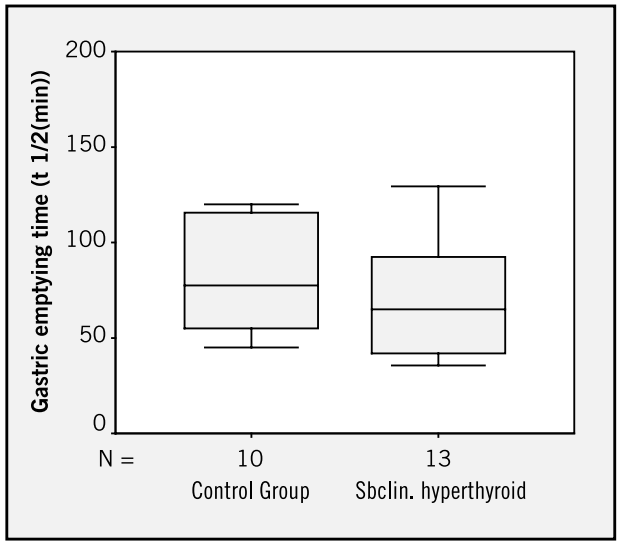

Figure 1. Gastric emptying times in Subclinical hyperthyroid and control groups

REFERENCES

1 Laurence JM, Colum AG, Vay Liang WG. Gut-thyroid interrelationships. *Gastroenterology* 1978; **75**:901-91.
2 Holdsworth CD, Besser GM. Influence of gastric emptying rate and of insulin response on oral glucose tolerance in thyroid disease. Lancet 1968; **2**:700-2.
3 Groskreutz JL, Kim CH, McConahey WM. Acute gastroparesis associated with thyrotoxicosis. Am J Gastroenterol 1990; **85**: 1206-7.
4 Derblom H, Johansson H, Nylander G. Thyroid hormone activity and gastrointestinal function. Acta Chir Scand 1963; **307**(suppl):1-47.
5 Ikeda T, Fujiyama K, Hoshino T, et al. Glucose tolerance and gastric emptying in thyrotoxic rats. Metabolism 1989; **38**: 874-7.
6 Jonderko K. Influence of oral cimetidine and ranitidine on gastric emptying in active duodenal ulcer. J Clin Gastroenterol 1988; **10**:143-9.
7 Jonderko K. Effect of calcitonin on gastric emptying in patients with an active duodenal ulcer. Gut 1989; **30**:430-5.
8 Jonderko K, Jonderko G, Marcisz C, Golab T. Gastric emptying in hyperthyroidism. Am J Gastroenterol 1997; **92**(5):835-8.
9 Jonderko K. Radionuclide studies on gastric evacuatory function in health and in duodenal ulcer disease, I: Type of solids meal distribution within the stomach and their relation to gastric emptying. Nucl Med Commun 1987; **8**:671-80.
10 Barczynski M, Thor P.Reversible autonomic dysfunction in hyperthyroid patients affects gastric myoelectrical activity and emptying. Clin Auton Res 2001 Aug; **11**(4):243-9.
11 Evans DF, Ballantyne KC, Pegg CA, et al. Abnormal motility patterns in thyrotoxicosis. Dig Dis Sci 1985; **30**:768 (abstract).

12 Thomas FB, Caldwell JH, Greenberger NJ. Steatorrhea in thyrotoxicosis: Relation to hypermotility and excessive dietary fat. Ann Intern Med 1973; **78**:669-75.
13 Shafer RB, Prentiss RA, Bond JH. Gastrointestinal transit in thyroid disease. Gastroenterology 1984; **86**:8552-5.
14 Tobin MV, Fisken RA, Diggory RT, et al. Orocaecal transit time in health and in thyroid disease. Gut 1989; **30**:26-9.
15 Wegener M, Wedmann B, Langhoff T, Schaffstein J, Adamek R Effect of hyperthyroidism on the transit of a caloric solid-liquid meal through the stomach, the small intestine, and the colon in man. J Clin Endocrinol Metab 1992; **75**(3):745-9.
16 Wiley ZD, Lavigne ME, Liu KM, et al. The effect of hyperthyroidism on gastric emptying rates and pancreatic exocrine and biliary secretion in man. Dig Dis 1978; **23**:1003-8.
17 Miller LJ, Owyang C, Malagelada JR, et al. Gastric pancreatic and biliary responses to meals in hyperthyroidism. Gut 1980; **21**:695-700.