Background: Atrophic body gastritis (ABG) has never been histologically characterized in patients with autoimmune thyroid disease (AITD), and its prevalence may be substantially different from that previously assessed based on only indirect evidence.

Objective: To detect and characterize the presence of ABG in patients with AITD.

Methods: Sixty-two patients with AITD (5 men and 57 women), aged between 21 and 74 years, have been screened for the presence of ABG by assaying serum gastrin levels. Patients with hypergastrinemia underwent gastroscopy followed by the histological examination of multiple biopsy specimens. The diagnosis of ABG was based on hypergastrinemia and pentagastrin-resistant achlorhydria, confirmed by histological examination.

Results: Twenty-two (35%) of 62 patients had hypergastrinemia (mean ± SEM gastrin level, 1070 ± 288 pmol/L). The diagnosis of ABG has been histologically confirmed in all 22 patients, and the score of atrophy was moderate to severe. In group A (patients aged 20-40 years; n = 21), 6 patients (29%) had ABG, compared with 11 patients (37%) in group B (patients aged 41-60 years; n = 30) and 5 patients (45%) in group C (patients aged 61-80 years; n = 11). Antiparietal cell antibodies were detected in only 68% (15/22) of patients with ABG. Anemia was observed in 82% (18/22) of patients with AITD and ABG but only in 22% (9/40) of patients without ABG (P < .0001).

Conclusions: In the patients with AITD studied, about one third had ABG, which was diagnosed also in young patients; the measurement of gastrin levels represented the most reliable tool in the diagnosis of ABG; and the presence of anemia, even microcytic, was suggestive of undiagnosed ABG.

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The association between autoimmune thyroid disease (AITD) and various other autoimmune diseases was first suggested in the early 1960s. Indeed, the term thyrogastric autoimmunity or disease has been used to define the prevalence of thyroid autoantibodies and/or overt AITD in patients with pernicious anemia (PA), which, in turn, was improperly used as synonymous with atrophic gastritis. More recently, the association between AITD and PA has been included in type IIIb polyglandular autoimmune disease. However, atrophic gastritis is represented by more than one distinct pathophysiological and clinical entity, which may precede the onset of PA by several years. In particular, atrophic body gastritis (ABG), formerly known as type A, represents a chronic, symptomless gastritis of the fundic mucosa, which often has an autoimmune pathogenesis, is involved in gastric carcinogenesis, and is closely related to the appearance of microcytic anemia and PA. To our knowledge, ABG has not yet been directly characterized in patients with AITD, and its prevalence may be substantially different from that previously assessed only by indirect evidence (ie, the presence of antiparietal cell antibodies [APCAb] and/or PA). Furthermore, the prevalence of AITD, namely, lymphocytic thyroiditis, in its subclinical form appears to have increased during the past 10 years, probably because of the availability of more sensitive diagnostic tools.

This study, therefore, aimed to detect and characterize the presence of histologically and functionally proved ABG in patients with AITD.
PATIENTS AND METHODS

For 13 months, 1035 outpatients were sequentially examined by the same physician (M.C.) in our tertiary outpatient Center for Thyroid Disease, University of Rome “La Sapienza,” Rome, Italy. Autoimmune thyroid disease was diagnosed in 62 patients (6.0%) (5 men and 57 women) aged 21 to 74 years (mean ± SD, 47.5 ± 14.0 years), who, besides other criteria, displayed pathological levels of antiperoxidase antibodies (>200 U/L; median, 1380 U/L; range, 269-6500 U/L) at the time of diagnosis and in at least 2 measurements during a 12-month period. This cohort represented the study population. At presentation, 26 patients were clinically euthyroid, 26 had overt or subclinical hypothyroidism, and 10 had hyperthyroidism. Patients were divided according to age as follows: group A, 20 to 40 years (n = 21); group B, 41 to 60 years (n = 30); and group C, 61 to 80 years (n = 11). Chronic autoimmune thyroiditis was diagnosed in 52 patients, 47 with goiter (Hashimoto thyroiditis) and 5 without goiter (atrophic thyroiditis). Graves disease was diagnosed in 10 patients. Serum gastrin levels and the presence of APCAb and Helicobacter pylori IgG antibodies, as well as that of anemia, were evaluated in all patients. Patients with increased fasting gastrin levels, which represent a regular feature of gastric atrophy,14-20 underwent further functional and morphologic characterization of the fundic mucosa of the stomach by gastric secretory tests, gastroscopy, and histological evaluation of multiple biopsy specimens, which were obtained during the gastrosopic examination. However, a higher gastrin level cutoff (>210 pmol/L; 2.5 times the cutoff of the method) was used in this study, as a small increase of the gastrin levels, due to H pylori infection and not related to gastric atrophy, has been reported.21 This clear-cut criterion has been used to avoid gastrosopic examinations, which, in patients without definite clinical and/or biochemical evidence of gastric atrophy, would not have been strictly necessary. However, patients without hypergastrinemia (gastrin level >210 pmol/L) but showing the presence of APCAb also underwent gastrosopy and histological evaluation of multiple biopsy specimens to compare the reliability of this diagnostic parameter as a marker of ABG.3,8,12

Informed consent was obtained from each patient before any invasive procedure, and the protocol was consistent with the Declaration of Helsinki.

DIAGNOSIS OF AITD

Diagnostic procedures included routine clinical examinations, serum free triiodothyronine and free thyroxine and basal thyrotropin measurements, antiperoxidase antibody detection, and ultrasonography. Where appropriate, patients underwent radiiodine uptake and scintigraphic mapping, ultrasonography-assisted fine needle aspiration biopsy, and a thyrotropin-releasing hormone test for serial thyrotropin measurements and detection of anti–thyrotropin receptor antibodies in serum. The antiperoxidase and anti–thyrotropin receptor antibodies were measured by a radioiodigand assay (intra-assay variation, 3.6%; interassay variation, 4.6%) (Radim Techland, Liege, Belgium) and a radioreceptor assay (AresSerono, Milan, Italy), respectively. Free triiodothyronine and free thyroxine levels were assayed by radioimmunoassay (AresSerono). Thyrotropin levels were assayed by immunoradiometric assay (Radim Techland).

DIAGNOSIS OF ABG

The diagnosis of ABG was based on hypergastrinemia and pentagastrin-resistant achlorhydria, confirmed by

Continued on next page
The reliability of the biological parameters used as diagnostic criteria of ABG in patients with AITD is shown in Figure 2. In the study population, the presence of APCAb was detected in 25 (40%) of the 62 patients (median, 500 U/mL; range, 130-1000 U/mL); however, APCAb were present only in 15 (68%) of 22 patients with the AITD plus ABG association. Gastroscopy was also performed in the remaining 10 APCAb-positive patients, as their presence was considered a marker of ABG, none of these patients showed histological evidence of this disease. Thus, 7 false-negative results and 10 false-positive results were due to that marker in the diagnosis of ABG. The presence of PA was diagnosed in 10 (16%) of 62 patients with AITD, all of whom had ABG. Specificity was thus 100%, but sensitivity as a marker of ABG was low (10 [45%] of 22 patients). Gastrin levels were, on the other hand, a reliable biological parameter in the screening of patients with ABG, the presence of which has been confirmed in all patients with hypergastrinemia, with no evidence of false positivity (100% specificity) (Figure 2). However, it was not possible to evaluate the sensitivity of gastrin levels as a marker, since, for the reasons previously described, not all the patients studied underwent gastroscopy. However, the gastrin levels were normal in the 10 APCAb-positive patients with no evidence of ABG. Overall, only 7 of 22 patients with ABG presented simultaneously with hypergastrinemia, APCAb, and PA.

Atrophic body gastritis is an asymptomatic disease, and its prevalence has never been assessed in an unselected population. Nevertheless, it is important to make an early diagnosis because patients with ABG have a 3 times greater risk for developing gastric cancer, and ABG is responsible for unexplained iron-deficient anemia. The results of the present study reveal a high prevalence (35%) of ABG in patients with AITD. Such a prevalence is substantially higher than that previously reported based on indirect evidence (ie, the presence of APCAb and/or PA). In a fact, a 12.3% prevalence of PA has been reported in patients with primary hypothyroidism; the same researchers, however, reported that, when achlorhydria was used as a marker, the prevalence rose to 32%, a finding comparable with that recorded in the present study. The results of the present study revealed the presence of ABG in 6 of 21 young patients (<40 years) with AITD. Two (9.5%) of these patients also had PA. These findings are in contrast with those in the historical ar-

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ticle by Irvine,4 who reported no ABG or PA in a large cohort of patients with AITD who were younger than 40. This discrepancy could be due to the use, at that time, of less reliable markers for an early diagnosis. In fact, the detection of APCAb and the presence of PA, used at that time as markers,3,4,6,8 showed, in the present study, an inadequate overall accuracy in the diagnosis of this disease. The reliability of measuring fasting gastrin levels to screen patients at risk for ABG is well established12,15; indeed, the most frequent cause of marked hypergastrinemia has been shown to be represented by ABG,24 although an appropriate cutoff level should be used to avoid the bias due to H pylori infection.21 The present study showed that the measurement of gastrin levels is also an important tool in the diagnostic work-up of ABG in patients with AITD, and represents a better diagnostic marker than those previously advocated.3,4,6,8,15

The presence of anemia has been described in patients with impaired thyroid homeostasis, 27 mainly referred to as PA.7,8,26 The results of this study confirm the higher prevalence of anemia in patients with AITD compared with that reported in referral patients.29 However, a marked difference has been found between patients with and those without ABG (82% vs 22%, P<.001), which was only partly due to the prevalence of PA. This fact indicates that, particularly in young patients with AITD, even the presence of unexplained microcytic anemia should be considered as highly suggestive of the presence of undiagnosed ABG. This assumption is in keeping with the finding that hypochlorhydria may lead to iron deficiency and anemia.28 In this respect, all patients with AITD should be routinely monitored at follow-up for the presence of anemia, which may represent the only clinical sign of undiagnosed ABG.14

The pathogenetic event responsible for the clinical relationship between AITD and ABG remains to be elucidated. The close association with various autoimmune diseases and the presence in familial clusters of AITD and

### Table 1. Functional and Morphologic Factors of Autoimmune Thyroid Disease in 22 Patients With Atrophic Body Gastritis

<table>
<thead>
<tr>
<th>Factors</th>
<th>Values*</th>
</tr>
</thead>
<tbody>
<tr>
<td>Functional</td>
<td></td>
</tr>
<tr>
<td>Fasting gastrin levels, pmol/L</td>
<td>1070 ± 288</td>
</tr>
<tr>
<td>Basal acid output, mEq/h</td>
<td>0.04 ± 0.03</td>
</tr>
<tr>
<td>Peak acid output, mEq/h</td>
<td>1.3 ± 0.7</td>
</tr>
<tr>
<td>Morphologic†</td>
<td></td>
</tr>
<tr>
<td>Chronic inflammation</td>
<td>1.37 ± 0.11</td>
</tr>
<tr>
<td>Atrophy</td>
<td>2.42 ± 0.18</td>
</tr>
<tr>
<td>Intestinal metaplasia</td>
<td>1.15 ± 0.23</td>
</tr>
</tbody>
</table>

*All values are given as mean ± SEM.
†Values are given as updated Sydney scores. 1 indicates mild; 2, moderate; and 3, severe.

### Table 2. Presence of Atrophic Body Gastritis (ABG) in Patients With Autoimmune Thyroid Disease (AITD) in Relation to Clinical Diagnosis

<table>
<thead>
<tr>
<th>Variable</th>
<th>No. (%) of Patients</th>
<th>P</th>
<th>1†</th>
<th>2‡</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total (N = 62)</td>
<td>27/62 (43)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Patients with AITD</td>
<td>9/40 (22)</td>
<td>.04</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Patients with AITD and ABG</td>
<td>18/22 (82)</td>
<td>.002</td>
<td>&lt;.0001</td>
<td></td>
</tr>
</tbody>
</table>

*Ellipses indicate data are not applicable.
†Values derived using the total sample as a reference group.
‡Values derived using patients with AITD, but without ABG, as a reference group.
ABG suggest an immunological cross-reaction.\textsuperscript{1,2,4,7} In this respect, Elisei et al.\textsuperscript{30} by comparing the sequence of the gastric parietal cell antigen with that of thyroid peroxidase, found a homologous 11-residue peptide in both proteins; on these grounds, these researchers suggested the existence of an epitope common to thyroid peroxidase and the gastric parietal cell antigen, which had previously been identified as the hydrogen-potassium adenosine triphosphatase, the acid-producing structure of the stomach.\textsuperscript{31} However, the role of antiperoxidase antibodies in the pathogenesis of AITD is, as yet, unclear.\textsuperscript{16} Moreover, the role of cross-reactive antibodies in the pathogenesis of coexisting thyroid and gastric autoimmune diseases has been excluded,\textsuperscript{32} and the pathogenesis of ABG is not exclusively of autoimmune origin.\textsuperscript{33} Thus, the correlation between AITD and ABG is clinically evident but as yet pathogenetically undefined.

In conclusion, data emerging from the present investigation indicate that about one third of patients with AITD have histologically and functionally proved ABG; ABG can be present even in young (<40 years) patients; the presence of ABG is not related to the clinical status of the AITD; the measurement of plasma gastrin levels represents the most reliable tool in the diagnosis of ABG in patients with AITD; and in patients with AITD, the presence of unexplained anemia, not necessarily PA, is highly suggestive of the presence of undiagnosed ABG.

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