Gastric pathology in patients with common variable immunodeficiency

A Zullo, A Romiti, V Rinaldi, A Vecchione, S Tomao, F Aiuti, L Frati, G Luzi

Abstract

Background/Aims—Common variable immunodeficiency (CVID) is an immunological disorder characterised by defective antibody production. Patients with CVID have a high risk of gastric cancer. It has been suggested that gastric cancer results from an interaction between environmental factors and a genetic predisposition. The role of Helicobacter pylori as an environmental factor in gastric carcinogenesis is of current interest. Moreover, p53 gene mutations have been reported in gastric cancer. This study focuses on the gastric pathology of patients with CVID and correlation with H pylori infection.

Methods—Thirty four consecutive dyspeptic patients with CVID (mean age 49.6 years, range 14–72; 17 men) were included in the study. An upper gastrointestinal endoscopy was performed and biopsy specimens were taken from the antrum, incisura angularis, and gastric body. Biopsies were used for histological assessment, to identify the presence of H pylori, and to evaluate p53 overexpression.

Results—H pylori infection was detected in 14/34 (41%) patients. Chronic active gastritis involving both antrum and body was observed more frequently in H pylori positive (79%) than H pylori negative (20%) patients (p = 0.001). Similarly, a histological feature of multifocal atrophic gastritis was found more frequently in infected (50%) than uninfected patients (10%) (p = 0.012). In addition, one case of gastric adenocarcinoma and another of notable dysplasia were observed in the H pylori positive group. Overexpression of p53 was found in six (18%) patients, including one with normal gastric mucosa.

Conclusions—It can be hypothesised that both H pylori and p53 alterations play a role in the gastric carcinogenesis of patients with CVID.

Keywords: common variable immunodeficiency; Helicobacter pylori; p53; pathology; carcinogenesis; gastritis

Methods

Thirty four dyspeptic patients (mean age 49.6 years, range 14–72; 17 men) out of 65 with CVID, regularly referred to our Day Hospital for Immunodeficiencies, were included in the

Abbreviations used in this paper: CVID, common variable immunodeficiency; MAG, multifocal atrophic gastritis.
Dyspepsia was considered present when the patient complained of at least one of the following symptoms: discomfort in the upper abdomen, epigastric pain, heartburn, nausea/vomiting, delayed digestion, belching. Diagnosis of CVID was made as described elsewhere. All patients were undergoing long term treatment (median eight years; range 1–15) with intravenous immunoglobulin (mean 150 mg/kg; range 100–250) at two weekly intervals, and antibiotics, if necessary. An upper gastrointestinal endoscopy was performed and biopsy specimens were taken from the antrum, incisura angularis, and the gastric body (three specimens for each site), as recommended in the updated Sydney System classification of gastritis. Further biopsies were performed on gastric lesions, when present. *H pylori* infection was detected by the rapid urease test (CP-test; Yamanouchi, Milan, Italy) and histology (Giemsa modified staining). Patients were considered to be *H pylori* positive if the CP-test was positive and/or bacteria were identified on histological examination. Haematoxylin and eosin staining was performed for histological assessment. Biopsy samples showing incomplete intestinal metaplasia were stained with Alcian blue, pH 2.5/periodic acid/Schiff reagent and high iron diamine Alcian blue, pH 2.5, in order to identify subtypes (II or III) of intestinal metaplasia.

Before intravenous immunoglobulin replacement, a blood sample was obtained from each patient for immunoglobulin level determination. All patients gave their informed consent to participate.

**IMMUNOHISTOCHEMICAL ANALYSIS**

Briefly, 5 µm serial sections from paraffin wax embedded tissue were used for the immunohistochemical analysis. Paraffin wax embedded tissue sections were dewaxed in xylene and rehydrated through graded ethanols to phosphate buffered saline, pH 7.4. Endogenous peroxidase activity was blocked by immersion in distilled water with 0.3% (v/v) hydrogen peroxide for 30 minutes. The specimens were then pretreated with an antigen retrieval in a microwave oven and immunostained with anti-*p53* monoclonal antibodies (Dako, Glostrup, Denmark) for 60 minutes at room temperature. Immunohistochemical analysis. Para wax embedded tissue were used for the immunohistochemical analysis. Immunostaining was evaluated by counting stained gastric cells out of a minimum of 500 cells in different microscopic fields at a magnification of × 400 and was expressed as a percentage. The results obtained were consistent with the overall reactivity of each monoclonal antibody in every particular tissue section, as examined at low magnification. All sections were examined independently by two investigators and complete agreement was found when they were determining *p53* positivity or negativity. When the positive values obtained were being observed, the inter-observer variation was found to be less than 10% in each case.

**STATISTICAL ANALYSIS**

Data analysis was performed using Student’s *t* test for unpaired data, Fisher’s exact test, and the Mann-Whitney test, as appropriate. Significance was assigned to values of p<0.05.

**Results**

*H pylori* infection was observed in 14/34 (41%) patients. The mean age differences between patients with and without infection were not significant, although *H pylori* negative patients tended to be younger than *H pylori* positive patients (48.7 (14.7) vs 51.6 (11.1) years). In addition, there was a trend, although not statistically significant, towards lower mean serum IgA concentrations in *H pylori* positive patients compared with those without infection (table 1). Use of antibiotics for unrelated infection (clarithromycin, amoxycillin, cefotaxime, ciprofloxacin) during the preceding two months was not different between infected and non-infected patients (4/14 vs 7/20 respectively).

**Table 1** Serum immunoglobulin levels (mg/dl) before a regular intravenous immunoglobulin replacement

<table>
<thead>
<tr>
<th>Immunoglobulin</th>
<th><em>H pylori</em> positive (n=14)</th>
<th><em>H pylori</em> negative (n=20)</th>
</tr>
</thead>
<tbody>
<tr>
<td>IgG</td>
<td>2.78 (0.05)</td>
<td>2.73 (0.13)</td>
</tr>
<tr>
<td>IgA</td>
<td>0.79 (0.48)</td>
<td>1.0 (0.56)</td>
</tr>
<tr>
<td>IgM</td>
<td>1.16 (0.83)</td>
<td>1.15 (0.61)</td>
</tr>
</tbody>
</table>

Results are mean (SD) expressed as a logarithm.

**Table 2** Endoscopic findings in *H pylori* positive and negative patients

<table>
<thead>
<tr>
<th>Endoscopy finding</th>
<th><em>H pylori</em> positive (n=14)</th>
<th><em>H pylori</em> negative (n=20)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Normal</td>
<td>2</td>
<td>12</td>
</tr>
<tr>
<td>Hiatal hernia and/or oesophagitis</td>
<td>6</td>
<td>7</td>
</tr>
<tr>
<td>Erosion</td>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>Duodenal ulcer</td>
<td>2</td>
<td>—</td>
</tr>
<tr>
<td>Gastric ulcer</td>
<td>2*</td>
<td>—</td>
</tr>
</tbody>
</table>

*In one case histological assessment disclosed adenocarcinoma.

**Table 3** Histological findings in *H pylori* positive and negative patients

<table>
<thead>
<tr>
<th>Histological feature</th>
<th><em>H pylori</em> positive (n=14)</th>
<th><em>H pylori</em> negative (n=20)</th>
<th>p Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chronic diffuse active gastritis*</td>
<td>11</td>
<td>4</td>
<td>0.001</td>
</tr>
<tr>
<td>Multifocal atrophic gastritis†</td>
<td>(7)</td>
<td>(2)</td>
<td>0.012</td>
</tr>
<tr>
<td>With metaplasia in the antrum</td>
<td>(2)</td>
<td>(2)</td>
<td></td>
</tr>
<tr>
<td>With metaplasia in the body</td>
<td>(2)</td>
<td>(2)</td>
<td></td>
</tr>
<tr>
<td>Without metaplasia</td>
<td>(2)</td>
<td>(2)</td>
<td></td>
</tr>
<tr>
<td>Chronic antral active gastritis</td>
<td>3</td>
<td>1</td>
<td></td>
</tr>
<tr>
<td>Chronic body gastritis</td>
<td>1</td>
<td>—</td>
<td></td>
</tr>
<tr>
<td>Normal mucosa</td>
<td>14</td>
<td>14</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

*Intestinal metaplasia was classified as the complete type in all but one patient, who had type III incomplete metaplasia.
†One of these patients had intestinal type adenocarcinoma and another had notable dysplasia.
Discussion

This study assesses histological and genetic alterations in the gastric mucosa of patients with CVID and correlates these with *H pylori* infection. The prevalence of *H pylori* infection was greater than that reported elsewhere. However, in these studies, the presence of the bacterium was only determined by histology (without Giemsa staining) on a single antral and a single gastric body biopsy specimen. It is possible that the prevalence of *H pylori* infection was therefore underestimated in these studies. In addition, the general prevalence of this infection in Italy is higher than that found in the United Kingdom and United States, increasing the likelihood of transmission to these patients. In addition, no patient was on prophylactic antibiotic therapy in our cohort.

Our results show that the prevalence of chronic active gastritis involving both antrum and body was significantly higher in *H pylori* positive (79%) than *H pylori* negative (20%) patients. Moreover, MAG was observed more frequently in patients with infection (50%) than in those without (10%). It should also be pointed out that both of the *H pylori* negative patients harbouring MAG had notable neutrophil and lymphocyte infiltration of the gastric mucosa, suggesting that *H pylori* infection cannot be excluded in these two patients.

Table 2 shows the endoscopic findings. In brief, among the *H pylori* positive patients, two cases of duodenal ulcer and two of gastric ulcer (one with a diameter >3 cm) were observed, while among the *H pylori* negative group endoscopy showed gastric erosions in a single patient.

Table 3 shows the histological features observed. Briefly, all *H pylori* positive patients had chronic gastritis and 11 of these (70%) had chronic active gastritis, involving both the antrum and body (diffuse). In seven (50%) *H pylori* positive patients, there was evidence of multifocal atrophic gastritis (MAG). A case of notable dysplasia on the incisura angularis (49 year old woman) and a case of intestinal type gastric carcinoma (65 year old man) were observed in patients with MAG. Intestinal metaplasia was classified as the complete type in all but one patient (54 year old woman), who had type III incomplete metaplasia. Among the *H pylori* negative patients, four out of 20 (20%) had chronic diffuse active gastritis, and two of these showed MAG. All patients had the complete type of intestinal metaplasia. Statistical analysis showed that the prevalence of chronic diffuse active gastritis was significantly higher in *H pylori* positive patients than in those without infection (p = 0.001). Moreover, MAG was observed more frequently in *H pylori* positive than negative patients (p = 0.012).

With regard to genetic alterations, p53 overexpression was found in six (18%) patients. The rate of p53 overexpression did not differ between *H pylori* positive and negative patients (2/14 vs 4/20; p = 0.5). The percentage of gastric cells displaying intense nuclear immunostaining, suggesting abnormal expression of p53, was as high as 50% in one case. No other cell types present in the tissue section were immunoreactive. Histological assessment showed normal mucosa in one case, mild chronic inactive gastritis in another, MAG in two other cases, and corpus restricted chronic atrophic gastritis in another; one patient had gastric adenocarcinoma. Figure 1 shows p53 expression in one patient.

Table 2 shows the endoscopic findings. In brief, among the *H pylori* positive patients, two cases of duodenal ulcer and two of gastric ulcer (one with a diameter >3 cm) were observed, while among the *H pylori* negative group endoscopy showed gastric erosions in a single patient.

Table 3 shows the histological features observed. Briefly, all *H pylori* positive patients had chronic gastritis and 11 of these (70%) had chronic active gastritis, involving both the antrum and body (diffuse). In seven (50%) *H pylori* positive patients, there was evidence of multifocal atrophic gastritis (MAG). A case of notable dysplasia on the incisura angularis (49 year old woman) and a case of intestinal type gastric carcinoma (65 year old man) were observed in patients with MAG. Intestinal metaplasia was classified as the complete type in all but one patient (54 year old woman), who had type III incomplete metaplasia. Among the *H pylori* negative patients, four out of 20 (20%) had chronic diffuse active gastritis, and two of these showed MAG. All patients had the complete type of intestinal metaplasia. Statistical analysis showed that the prevalence of chronic diffuse active gastritis was significantly higher in *H pylori* positive patients than in those without infection (p = 0.001). Moreover, MAG was observed more frequently in *H pylori* positive than negative patients (p = 0.012).

With regard to genetic alterations, p53 overexpression was found in six (18%) patients. The rate of p53 overexpression did not differ between *H pylori* positive and negative patients (2/14 vs 4/20; p = 0.5). The percentage of gastric cells displaying intense nuclear immunostaining, suggesting abnormal expression of p53, was as high as 50% in one case. No other cell types present in the tissue section were immunoreactive. Histological assessment showed normal mucosa in one case, mild chronic inactive gastritis in another, MAG in two other cases, and corpus restricted chronic atrophic gastritis in another; one patient had gastric adenocarcinoma. Figure 1 shows p53 expression in one patient.

Table 2 shows the endoscopic findings. In brief, among the *H pylori* positive patients, two cases of duodenal ulcer and two of gastric ulcer (one with a diameter >3 cm) were observed, while among the *H pylori* negative group endoscopy showed gastric erosions in a single patient.

Table 3 shows the histological features observed. Briefly, all *H pylori* positive patients had chronic gastritis and 11 of these (70%) had chronic active gastritis, involving both the antrum and body (diffuse). In seven (50%) *H pylori* positive patients, there was evidence of multifocal atrophic gastritis (MAG). A case of notable dysplasia on the incisura angularis (49 year old woman) and a case of intestinal type gastric carcinoma (65 year old man) were observed in patients with MAG. Intestinal metaplasia was classified as the complete type in all but one patient (54 year old woman), who had type III incomplete metaplasia. Among the *H pylori* negative patients, four out of 20 (20%) had chronic diffuse active gastritis, and two of these showed MAG. All patients had the complete type of intestinal metaplasia. Statistical analysis showed that the prevalence of chronic diffuse active gastritis was significantly higher in *H pylori* positive patients than in those without infection (p = 0.001). Moreover, MAG was observed more frequently in *H pylori* positive than negative patients (p = 0.012).

With regard to genetic alterations, p53 overexpression was found in six (18%) patients. The rate of p53 overexpression did not differ between *H pylori* positive and negative patients (2/14 vs 4/20; p = 0.5). The percentage of gastric cells displaying intense nuclear immunostaining, suggesting abnormal expression of p53, was as high as 50% in one case. No other cell types present in the tissue section were immunoreactive. Histological assessment showed normal mucosa in one case, mild chronic inactive gastritis in another, MAG in two other cases, and corpus restricted chronic atrophic gastritis in another; one patient had gastric adenocarcinoma. Figure 1 shows p53 expression in one patient.
Unexpectedly, intestinal metaplasia was classified as the complete type in all but one patient. However, an increasing loss of differ- entiation of intestinal metaplasia over time has been suggested.11, 35

Correa36 proposed a model of human gastric carcinogenesis in which a series of pathological events, beginning with active chronic gastritis and progressing to atrophy, metaplasia, and dysplasia, can lead to cancer. In particular, MAG is associated with an increased risk of gastric carcinoma,14 H pylori is frequently found along with MAG, and its prevalence is approximately 100% in populations with a high gastric cancer risk.15 Our study showed that in patients with CVID, in whom the incidence of gastric cancer is 50-fold higher than in the general population,1 MAG was significantly associated with H pylori infection. Moreover, gastric adenocarcinoma, notable dysplasia, and type III intestinal metaplasia were observed in three patients with H pylori infection. Thus H pylori may also play a role in gastric carcinogenesis in patients with CVID.

Inactivation of p53 anti-oncogene as the result of point mutations and/or gene deletions contributes to the onset of tumours in various organs.16 The mutated protein has a longer half-life than native p53, and as such can be detected by immunohistochemical techniques.17 Nearly 50% of gastric cancers show p53 overexpression,18 and some studies report p53 gene mutations in precancerous lesions, suggesting a role in the early stages of gastric carcinogenesis.17 Nevertheless, we18 20 and others21 26 failed to find p53 overexpression in gastric precancerous lesions, including mild to moderate dysplasia. In the present study, p53 overexpression was found in six patients, irrespective of H pylori status. Histological assessment showed that one of these patients had normal mucosa, and another had only mild chronic inactive gastritis. As p53 overexpression has not previously been reported in normal gastric mucosa or gastritis, some patients with CVID, similar to patients with ataxia telangiectasia, may have impaired DNA repair mechanisms which are unrelated to H pylori infection and which could predispose to cancer.22 In an experimental model it has recently been reported that p53 mutant mice have a higher proliferation index than the parent strain when infected with Helicobacter felis.23 In our study we found two patients with p53 alterations and H pylori infection, and one of these patients had gastric adenocarcinoma. Follow up of these patients will be important in order to establish a role for p53 alterations in gastric carcinogenesis in patients with CVID. Finally, there was no correlation between the frequency or dose of immunoglobulin replacement in those patients with and without H pylori infection. Furthermore, attempts to eradicate infection with immunoglobulin replacement failed in one previously reported case.20

In conclusion, H pylori infection appears to be a risk factor for the development of MAG in patients with CVID. Moreover, p53 alterations may be a cofactor in the development of cancer in these patients. Considering the low prevalence of CVID in the general population (1:50 000–200 000),23 and the high incidence of gastric cancer, it may be appropriate to screen for gastric abnormalities by endoscopy on a regular basis in patients with CVID.

The authors thank Professor Aldo Vecchione (Department of Experimental Medicine and Pathology, University of Rome) for kindly reviewing the manuscript and providing constructive criticism. Grateful thanks go to Simon Winn for editing the text and to Angelo Del Nero and Sandro Valia for invaluable technical assistance.


Gastric pathology in patients with common variable immunodeficiency

A Zullo, A Romiti, V Rinaldi, A Vecchione, S Tomao, F Aiuti, L Frati and G Luzi

Gut 1999 45: 77-81
doi: 10.1136/gut.45.1.77

Updated information and services can be found at:
http://gut.bmj.com/content/45/1/77

These include:

References
This article cites 41 articles, 8 of which you can access for free at:
http://gut.bmj.com/content/45/1/77#BIBL

Email alerting service
Receive free email alerts when new articles cite this article. Sign up in the box at the top right corner of the online article.

Topic Collections
Articles on similar topics can be found in the following collections
- Pancreatic cancer (660)
- Stomach and duodenum (1689)
- Endoscopy (1003)

Notes

To request permissions go to:
http://group.bmj.com/group/rights-licensing/permissions

To order reprints go to:
http://journals.bmj.com/cgi/reprintform

To subscribe to BMJ go to:
http://group.bmj.com/subscribe/