The histopathology of non-steroidal anti-inflammatory drug induced gastroduodenal damage: correlation with *Helicobacter pylori*, ulcers, and haemorrhagic events

M Frezza, N Gorji, M Melato

Abstract

Aims—The spectrum of microscopic lesions resulting from the chronic use of non-steroidal anti-inflammatory drugs (NSAIDs), known as chemical gastritis, remains unclear, and the variable prevalence reported in different studies makes this issue a matter of lively debate. The aim of this study was to evaluate the prevalence and importance of chemical gastritis in patients regularly taking NSAIDs. Owing to the high prevalence of *Helicobacter pylori* infection, particularly in subjects over 60 years of age, and in view of a possible association with damage, the presence of *H pylori* infection in the same tissue sample was also determined in all patients.

Methods—One hundred and ninety seven subjects were enrolled, 118 of whom were receiving chronic treatment with NSAIDs and 79 of whom were controls, pair matched for age, sex, and clinical symptoms (ulcer-like dyspepsia or upper digestive tract haemorrhage). Antral biopsies taken during upper gastroduodenal endoscopy were assessed for chemical gastritis according to a modified version of Dixon’s score, and for helicobacter correlated chronic active gastritis, according to the updated Sydney system.

Results—Chemical gastritis was identified in 11 patients taking NSAIDs (9%) and in four controls (5% (p < 0.05). *Helicobacter pylori* was detected in 53 patients taking NSAIDs (45%) and in 34 controls (43%). Patients taking NSAIDs had a significantly higher number of erosions and ulcers and worse endoscopes than controls. The presence of *H pylori* did not appear to increase histological damage, ulcer prevalence, or haemorrhagic events.

Conclusions—Chemical gastritis is present in a limited number of patients regularly taking NSAIDs, and is not strongly correlated with NSAID induced damage. In many cases of peptic ulcer or upper gastrointestinal bleeding in patients taking NSAIDs, the presence of chemical gastritis or *H pylori* infection cannot solely account for the development of mucosal damage.

Keywords: chemical gastritis; non-steroidal anti-inflammatory drugs; *Helicobacter pylori*
with haemorrhage presented melena or haematemesis of mild or medium severity; to be enrolled, however, they had to be able to undergo the endoscopic examination. The drugs, which had been used for at least one month at the dosage indicated, were: aspirin (100–200 mg), diclofenac (100–200 mg), naproxen (500–1000 mg), and ketoprofen (100–200 mg/day) in 68, 22, nine, and 19 patients, respectively. Seventy nine subjects not regularly taking NSAIDs, pair matched for age, sex, and symptoms, were used as controls. The exclusion criteria were: recent use of antibiotics, antisecretory (particularly proton pump inhibitors) or cytostatic drugs, and previous gastroduodenal surgery. All patients were asked for complete clinical notes and were questioned about habits such as smoking and alcohol intake. Informed consent was obtained before the upper gastroduodenal endoscopy, which was performed without medication.

The endoscopic lesions were graded according to the following score: 1, minor erythema; 2, antral or duodenal erosions (≤ 5); 3, antral and duodenal erosions (or > 5); 4, ulcerations measuring 5 mm in diameter or more.

A set of two to four mapped antrum biopsy specimens was obtained from patients and controls. Histology of all biopsies, processed routinely and stained by haematoxylin and eosin, according to the method of May-Grünwald-Giemsa, was assessed independently and blindly by two different pathologists trained in gastrointestinal pathology, and a third pathologist was consulted in the event of disagreement.

Chronic inflammation (CI), *H pylori* density (HpD), polymorphonuclear neutrophil activity (PNA), glandular atrophy (GA), and intestinal metaplasia (IM) were classified according to the updated Sydney system. To improve comparability of parameters, specimens were scored for HpD, IM, and GA as positive (1) or negative (0); CI and PNA were graded as negative (0), mild (1), moderate (2), or pronounced (3). Patients scoring 4 or more were considered to have chronic active gastritis. This form is characterised by a high infiltration of polymorphonuclear neutrophils (PMN) attracted to the tissue by the presence of *H pylori* (fig 1).

All biopsies were also graded according to a modified version of Dixon’s system for chemical gastritis. Foveolar hyperplasia, oedema, and prominent smooth muscle fibres were graded as absent (0) or present (1) because, in our experience, a more extensive score does not work; loss of PMN and plasma cells were scored inversely from many (0) to absent (3). Vasodilatation and congestion were not considered because, in our view, they are mostly the result of biotic trauma and are therefore also present in patients from the control group. Patients scoring more than 6 were considered to have chemical gastritis (fig 2).

The data were analysed using the χ² test for the per cent values and the Student’s paired t test for the comparison of mean values; p values < 0.05 were considered significant. Statistical analysis was performed with the SPSS for Windows Release 7.1 (Microsoft).

### Results

A total of 197 subjects were examined, 118 of whom were regular NSAID users, and 79 of whom were controls. Table 1 gives the demographic and clinical details of the patients and controls.

Table 2 details the histological pattern of the antral mucosa seen in the two groups. Chemical gastritis was only present in a minority of patients using NSAIDs, but its prevalence was significantly higher among controls (table 1).

### Table 1 Demographic and clinical details of patients and controls

<table>
<thead>
<tr>
<th></th>
<th>NSAID users (n = 118)</th>
<th>Controls (n = 79)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sex (M/F)</td>
<td>51/67</td>
<td>31/48</td>
</tr>
<tr>
<td>Mean age (range), years</td>
<td>66.5 (22–88)</td>
<td>67.3 (21–87)</td>
</tr>
<tr>
<td>Smokers</td>
<td>40</td>
<td>18</td>
</tr>
<tr>
<td>Alcoholics</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Ulcer-like dyspepsia</td>
<td>94</td>
<td>63</td>
</tr>
<tr>
<td>Haemorrhages</td>
<td>24</td>
<td>16</td>
</tr>
</tbody>
</table>

NSAID, non-steroidal anti-inflammatory drugs.

### Table 2 Histological pattern of antral mucosa in the two groups

<table>
<thead>
<tr>
<th></th>
<th>NSAID users (n = 118)</th>
<th>Controls (n = 79)</th>
<th>p Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Chemical gastritis</td>
<td>11 (9%)</td>
<td>4 (5%)</td>
<td>&lt;0.05</td>
</tr>
<tr>
<td>Acute gastritis</td>
<td>34 (29%)</td>
<td>NS</td>
<td>15 (19%)</td>
</tr>
<tr>
<td>Chronic gastritis</td>
<td>64 (54%)</td>
<td>NS</td>
<td>53 (67%)</td>
</tr>
<tr>
<td>No lesions</td>
<td>9 (8%)</td>
<td>NS</td>
<td>7 (9%)</td>
</tr>
<tr>
<td><em>Helicobacter pylori</em></td>
<td>53 (45%)</td>
<td>NS</td>
<td>32 (41%)</td>
</tr>
</tbody>
</table>

Significance was calculated by means of the χ² test. NS, not significant; NSAID, non-steroidal anti-inflammatory drugs.

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**Figure 1** A case of *helicobacter* correlated chronic active gastritis with evident infiltration of polymorphonuclear neutrophils (haematoxylin and eosin stained).

**Figure 2** A case of chemical gastritis showing absence of polymorphonuclear neutrophils and evident foveolar hyperplasia (haematoxylin and eosin stained).
NSAID induced gastro-duodenal damage

Table 3 Endoscopic and histological findings in NSAID users and controls complaining of ulcer-like dyspepsia

<table>
<thead>
<tr>
<th></th>
<th>NSAID users (n = 94)</th>
<th>Controls (n = 63)</th>
<th>p Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Erosions</td>
<td>33 (35%)</td>
<td>15 (24%)</td>
<td>&lt;0.05</td>
</tr>
<tr>
<td>Ulcers</td>
<td>22 (23%)</td>
<td>4 (6%)</td>
<td></td>
</tr>
<tr>
<td>Mean endoscore (SD)</td>
<td>1.20 (0.48)</td>
<td>0.46 (0.21)</td>
<td>&lt;0.05</td>
</tr>
<tr>
<td>Chemical gastritis</td>
<td>8 (8%)</td>
<td>3 (5%)</td>
<td></td>
</tr>
<tr>
<td>Active gastritis</td>
<td>20 (21%)</td>
<td>12 (19%)</td>
<td></td>
</tr>
<tr>
<td>Helicobacter pylori</td>
<td>45 (48%)</td>
<td>26 (41%)</td>
<td></td>
</tr>
</tbody>
</table>

Significance was calculated by means of the Student's t test for mean values and the χ² test for percentages.

NSAID, non-steroidal anti-inflammatory drug.

Table 4 Endoscopic and histological findings in NSAID users according to Helicobacter pylori infection

<table>
<thead>
<tr>
<th></th>
<th>Helicobacter present (n = 53)</th>
<th>Helicobacter absent (n = 62)</th>
<th>p Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (years)</td>
<td>67.3 (40–84)</td>
<td>66.1 (22–88)</td>
<td></td>
</tr>
<tr>
<td>Erosions</td>
<td>23 (43%)</td>
<td>24 (37%)</td>
<td></td>
</tr>
<tr>
<td>Ulcers</td>
<td>17 (32%)</td>
<td>21 (33%)</td>
<td></td>
</tr>
<tr>
<td>Mean endoscore (SD)</td>
<td>1.28 (0.31)</td>
<td>1.27 (0.21)</td>
<td></td>
</tr>
<tr>
<td>Chemical gastritis</td>
<td>0 (0%)</td>
<td>11 (17%)</td>
<td></td>
</tr>
<tr>
<td>Active gastritis</td>
<td>17 (32%)</td>
<td>7 (11%)</td>
<td>p &lt;0.03</td>
</tr>
</tbody>
</table>

Significance was calculated by means of the Student's t test for means and χ² test for percentages.

NSAID, non-steroidal anti-inflammatory drug.

Patients in the control group had a total of 12 ulcers—nine duodenal, two gastric, and one gastric and duodenal—and only six of these patients were positive for H pylori infection. NSAID users complaining of one or more haemorrhagic episodes had more ulcers and worse endoscopes than the others, although the prevalence of chemical and active gastritis did not reach significance. The prevalence of H pylori was considerably, although not significantly, lower (33% vs 48%) than in those patients without haemorrhage (table 5).

Finally, all the NSAIDs used in our series had a low damaging profile, which might account for the fact that we did not find a significant correlation between the severity of the endoscopic and/or histological finding and the type of drug used.

Discussion

In 1986, Dixon et al investigated several morphological parameters of the gastric mucosa (foveolar hyperplasia, occurrence of smooth muscle fibres and oedema in the lamina propria, vasodilatation, congestion of superficial capillaries, and paucity of both acute and chronic inflammatory cells) and found a strong association between severe grades of each of these histological variables and both hypochlorhydria and increased bile acid concentrations in the stomach, suggesting that reflux gastritis was a distinct histopathological entity. A few years later, Sobala et al stated that most cases of so-called ‘reflux gastritis’ in the intact stomach did not result from the reflux of bile, but were caused by NSAID use, and suggested calling this type of gastritis ‘C’ or ‘chemical’. In 1992, Laine et al considered a different set of morphological parameters and concluded that the development of ulcers (but not gastritis) in patients taking NSAIDs did not require H pylori.

Caselli et al reported that distinguishing features in patients treated with NSAIDs were erosions, macroerosions, and the presence of prominent capillaries in suberosive areas of the lamina propria. Finally, El-Zimaity et al concluded that none of these histological features could be used singularly to characterise the diagnosis of chemical gastropathy.

The variability of the data reported in the literature may have a variety of explanations, the most plausible being the fact that the parameters used to define chemical gastritis are not well defined. Foveolar hyperplasia, which appears to be a result of excessive cell exfoliation from the surface epithelium or of stimulation by cytokines or other inflammatory mediators, was first reported in patients with bile reflux and subsequently observed after gastric surgery in long term NSAID users. Currently, according to the updated Sydney system, it “may be seen in all forms of gastritis, but is most pronounced in chemical gastritis”. Oedema, vasodilatation, haemorrhage, and telangiectasia are unstable features that are possibly related to local factors and/or biopsy. The increased number of smooth muscle fibres in the lamina propria was originally demonstrated by Dixon and colleagues, but, although...
usually reported as characteristic of chemical gastritis, in later studies it was not seen in long term NSAID users with chemical gastritis or in chemical gastritis induced by naproxen. Erosion and macroerosion are not often present in biopsy specimens because they are dependent on the sectioning and localisation of the endoscopic biopsy.

Nonetheless, the prevalence of chemical gastritis in chronic NSAID users, described by the different authors, varies between 26% and 45%. In our study, we calculated a prevalence of about 10% in the whole population studied (table 2), with prevalence being only slightly lower among those patients with ulcers and not significantly higher in those reporting digestive haemorrhage (table 5). As can be seen in table 2, four patients in the control group had scores consistent with chemical gastritis. These patients had not taken NSAIDs in the three months preceding the study, and neither were they alcohol abusers. However, it cannot be excluded that these patients had taken other medications or ingested foods that were potentially harmful to the mucosa. In statistical terms they have to be considered false positives. These data confirm, in our view, that chemical gastritis is not a pathognomonic histotype of the chronic gastric damage caused by the use of NSAIDs. According to El-Zimaity and colleagues this may be accounted for by the use of NSAIDs. According to El-Zimaity and colleagues this may be accounted for by a lower prevalence of H pylori infection for their formation.

In our series of patients taking NSAIDs, H pylori infection was invariably close to 45%, both in those with ulcers and in those without (table 5). Of the 38 patients with ulcers, 17 were H pylori positive and three had chemical gastritis, but in 18 neither of these factors could explain the presence of the ulcer.

It must be concluded that, at least in our cases, the presence of H pylori does not seem to enhance the risk of the development of ulcers, so that in many cases NSAIDs might be responsible for producing the lesions via different pathways to those mentioned above. NSAIDs also act by means of other damage mechanisms, the most important being inhibition of the synthesis of prostaglandins and functional rupture of the mucosal barrier. These factors may underline erosion and/or ulcers in H pylori negative cases not presenting evidence of chemical gastritis.

Even in patients taking NSAIDs it is still unclear whether concomitant infection with H pylori plays a synergic role in causing bleeding. This hypothesis has been supported by some authors, but not confirmed by others. One paper has even shown that the prevalence of H pylori significantly prevents the depletion of tissue prostaglandins caused by NSAIDs, thus reducing their damage potential.

In our 24 chronic users of NSAIDs who reported one or more episode of upper intestinal tract haemorrhage, the bleeding originated from a gastric ulcer in 10 patients, a duodenal ulcer in four, a haemorrhagic gastropathy with erosions in eight, and a duodenal ulcer with gastric erosions in two. In this group, in agreement with the literature data that report a low prevalence of H pylori in patients with haemorrhage, we identified H pylori infection in only eight cases; three other cases had chemical gastritis. In 13 patients, none of whom were alcoholics, the mechanism underlying the mucosal damage was not easily identifiable on the basis of the histological findings (table 5).

These results seem to indicate that, as was noted for ulcers, the presence of H pylori does not increase the prevalence of haemorrhage.
In conclusion, our study has shown that neither chemical gastritis nor the presence of *H. pylori* strongly correlates with the gastroduodenal damage induced by NSAIDs. This damage eludes all attempts at histological characterisation: the histological parameters put forward to date lack sufficient sensitivity or specificity to be considered reliable.

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