"Maintenance therapy with pantoprazole 20 mg prevents relapse of reflux oesophagitis"

Escourrou, J ; Deprez, Pierre Henri ; Saggioro, A ; Geldof, H ; Fischer, R ; Maier, C

ABSTRACT

Background: Proton pump inhibitors can be effective as maintenance therapy in reducing the relapse rate of reflux oesophagitis at a dose lower than that used for acute healing. Patients and methods: Patients (n = 396, 18-88 years old) with healed reflux oesophagitis (grade II or III before healing) were included in this multinational, prospective, parallel-group, randomized double-blind study. They took oral pantoprazole 20 mg (n = 203) or 40 mg (n = 193), once daily for up to 12 months. Scheduled endoscopies were performed at entry, after 6 and 12 months, or when symptoms of at least moderate intensity were perceived on 3 consecutive days; symptoms were assessed every 3 months. The primary efficacy parameter was the time until endoscopically proven relapse of reflux oesophagitis occurred: the secondary parameters included tolerability, safety and time until symptomatic relapse occurred. Results: Analysis was performed using the 'all-patients-treated' approach. Endoscopic relapse rat...
Maintenance therapy with pantoprazole 20 mg prevents relapse of reflux oesophagitis

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Accepted for publication 26 July 1999

SUMMARY

Background: Proton pump inhibitors can be effective as maintenance therapy in reducing the relapse rate of reflux oesophagitis at a dose lower than that used for acute healing.

Patients and methods: Patients (n = 396, 18–88 years old) with healed reflux oesophagitis (grade II or III before healing) were included in this multinational, prospective, parallel-group, randomized double-blind study. They took oral pantoprazole 20 mg (n = 203) or 40 mg (n = 193), once daily for up to 12 months. Scheduled endoscopies were performed at entry, after 6 and 12 months, or when symptoms of at least moderate intensity were perceived on 3 consecutive days; symptoms were assessed every 3 months. The primary efficacy parameter was the time until endoscopically proven relapse of reflux oesophagitis occurred; the secondary parameters included tolerability, safety and time until symptomatic relapse occurred.

Results: Analysis was performed using the ‘all-patients-treated’ approach. Endoscopic relapse rates in the 20 mg group after 6 and 12 months were 16 and 29%, respectively; in the 40 mg group, they were 7 and 19%, respectively. Symptomatic relapse rates after 6 and 12 months were 14 and 21% in the 20 mg group and 10 and 17% in the 40 mg group, respectively. Pantoprazole 20 mg and 40 mg were well tolerated throughout the study; the type and frequency of adverse events reported were similar for both treatment groups.

Conclusion: The 20 mg dose was proven to be ‘at least equivalent’ to the 40 mg dose with respect to endoscopic and symptomatic relapse. The 20 mg once daily dose represents an effective and safe maintenance regimen for the majority of patients with healed reflux oesophagitis.

INTRODUCTION

Gastro-oesophageal reflux disease (GERD) affects up to 40% of adults in Great Britain and the USA.1, 2 GERD is multifactorial in aetiology and has several pathophysiological mechanisms that may be responsible for its development.3 Treatment of GERD involves therapies with drugs that have either prokinetic or antisecretory properties. The former approach converges on the primary motility disorder that leads to reflux.4 The latter, which is currently the option recommended for patients with more severe grades of GERD, is based on elevating gastric pH and decreasing the volume of gastric juice (hence of the refluxate).5

Gastric pH can be controlled to some extent with histamine-2 receptor antagonists (H2-RAs) and these drugs have been the mainstay of antisecretory therapy in the past. However, with the advent of proton pump inhibitors, the efficacy of H2-RAs has been overshadowed, particularly in the treatment of patients with GERD. Over 90% of patients with endoscopically
diagnosed moderate to severe GERD (grade II or III, Savary–Miller classification) can be healed during short-term treatment with a proton pump inhibitor: this compares to about 45% of patients healed following treatment with H₂-RAs. The higher rate of oesophageal healing is probably due to the proton pump inhibitors’ successful ability to elevate intragastric pH to higher levels and for a longer duration than the H₂-RAs. Moreover, proton pump inhibitors are not subject to the development of tolerance—a well-known disadvantage of H₂-RAs.

Acute reflux oesophagitis can clearly be healed by short-term regimens with antisecretory drugs. However, unless maintenance treatment is provided, patients tend to relapse with reflux oesophagitis at a rate of more than 80% in the first 6–12 months. Apart from the discomfort caused by the relapses, reflux oesophagitis could initiate morphological changes in the oesophagus resulting in complications that may include the development of oesophageal strictures, columnar cell replacement, or both. Therefore, for patients with recurrent reflux oesophagitis, long-term antisecretory therapy with proton pump inhibitors is recommended in order to minimize symptomatic and endoscopic relapses.

Recent studies indicate that patients with healed reflux oesophagitis can remain in remission even with a dose of proton pump inhibitor that is lower than that used for healing of the acute reflux oesophagitis. This approach was tested in the present study, using oral doses of 20 mg and 40 mg pantoprazole, administered as maintenance therapy for up to 12 months. Pantoprazole is a potent and safe proton pump inhibitor, which has been used clinically for the treatment of reflux oesophagitis and other gastric acid-related diseases.

PATIENTS AND METHODS

Study design

This was a prospective, randomized, double-blind study, involving 52 centres in Belgium, France, Italy and the Netherlands. It was conducted according to the Declaration of Helsinki and the guidelines for Good Clinical Practice. It was approved by the respective Ethics Committees and all patients gave their written informed consent prior to their participation in the study.

Inclusion criteria

Prior to the long-term maintenance study, patients with endoscopically diagnosed GERD grade II or III were enrolled into a short-term study to heal the acute reflux oesophagitis. Included in the short-term study were male and female patients (n = 460) presenting with reflux oesophagitis grade II (82%) or III (18%), according to the Savary–Miller classification. The short-term study lasted for 4 weeks and, if the healing was not complete (as assessed by endoscopy), the treatment continued for another 4 weeks. During the healing phase, patients received either pantoprazole 40 mg or omeprazole 20 mg (double-blind, parallel-group, multinational, multicentre study design); complete, endoscopically-confirmed healing rates were 95 and 96%, respectively (per protocol). Irrespective of the treatment during the short-term study, patients with an initial GERD grade II tended to heal faster than those with GERD grade III.

For the long-term maintenance study a total of 396 patients with completely healed oesophagitis (age range 18–88 years) were enrolled. Their demographic and anthropometric data are summarized in Table 1.

Table 1. Demographic and anthropometric data for the patient population enrolled into the long-term maintenance therapy study

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Pantoprazole</th>
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<tr>
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<td>20 mg</td>
<td>40 mg</td>
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<tr>
<td>Number of patients</td>
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<td>193</td>
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<tr>
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<td>Median weight (kg)</td>
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<td>Smokers (%)</td>
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<td>35 (18%)</td>
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<td>GERD at diagnosis</td>
<td></td>
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<tr>
<td>Grade II</td>
<td>162 (80%)</td>
<td>159 (82%)</td>
</tr>
<tr>
<td>Grade III</td>
<td>41 (20%)</td>
<td>34 (18%)</td>
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</table>

The long-term maintenance therapy consisted of pantoprazole 20 mg or 40 mg, administered once daily for up to 12 months. GERD at diagnosis refers to the grade of reflux oesophagitis diagnosed initially at the start of the short-term healing study.

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Exclusion criteria

Exclusion criteria were the presence of a peptic ulcer and ulcer complications, intake of supportive medication for the management of GERD during the study, regular and continued intake of glucocorticoids, ulcerogenic medications such as non-steroidal anti-inflammatory agents, or simultaneous intake of drugs whose absorption is pH-dependent, such as ketoconazole. Pregnant and nursing women, women of child-bearing age without reliable contraception, clinically relevant deviations from the normal range in laboratory parameters as assessed by the investigator, and patients who could not be expected to comply with the treatment were also excluded.

Treatment

Patients were allocated to one of two treatment groups according to a computer-generated randomization list; they took either 20 mg \( (n = 203) \) or 40 mg \( (n = 193) \) pantoprazole tablets, once daily before breakfast, for up to 12 months. The double-blind design of the study was ensured by using tablets that were identical in appearance.

Assessments

Follow-up visits were performed at 3, 6, 9 and 12 months after the first intake of the study medication. Scheduled endoscopies were performed at entry, and after 6 and 12 months. Patients who perceived symptoms of reflux oesophagitis of at least moderate intensity for at least 3 consecutive days between the scheduled study visits were asked to contact the investigator and an additional endoscopy was performed. Patients with endoscopically-verified relapse of oesophagitis, grade I–IV (Savary–Miller classification\(^6\)) or a peptic ulcer were excluded from further participation in the study; they were treated at the discretion of the attending physician.

The presence and severity of the principal symptoms of reflux oesophagitis included acid regurgitation, heartburn and pain on swallowing, and were defined as follows: *heartburn*, substernal pain or burning sensation in the epigastrium, possibly rising to the pharynx; *acid regurgitation*, backward flow of small amounts of the stomach contents, possibly rising to the pharynx and attributed to gastric acid which could sometimes occur together with coughing or choking; *pain on swallowing*, associated with retrosternal tightness.\(^{25, 26}\) Patients were asked at each visit to classify the severity of their symptoms as *mild*, barely noticeable, *moderate*, clearly noticeable symptoms, but tolerable without immediate relief, or *severe*, overwhelming discomfort, urgent desire for immediate relief.

The grading of endoscopically-proven reflux oesophagitis was defined according to Savary & Miller\(^6\) as follows: *Grade I*, presence of erythematous, oval or linear erosions above the mucosal transition; further multiple lesions may appear with time, however they must not become confluent; *Grade II*, lesions described for Grade I become confluent but do not cover the whole circumference; they are often covered by a fibrous layer; *Grade III*, exudative erosions can cover the whole circumference of the oesophagus; *Grade IV*, involves the complications associated with ulcer, stenosis, brachyoesophagus and columnar cell replacement.

Efficacy parameters

The primary efficacy parameter was defined as the time (up to 12 months) until the patient had an endoscopically-proven relapse. The secondary criterion of efficacy was the symptomatic relapse of reflux oesophagitis, defined as the time (up to 12 months) until a symptomatic relapse of leading or other gastrointestinal symptoms of GERD of at least moderate intensity occurred.

Supportive medication

With the exception of a defined amount of antacids, the intake of other supportive medications for the treatment of GERD was not permitted during the study. When a patient perceived symptoms of GERD for at least 3 consecutive days and when an endoscopic relapse of GERD was excluded, antacids could be ingested over a maximum of 7 days. Ingestion of antacids without prior endoscopy was disallowed. If symptoms persisted despite the intake of antacids for 7 days, the patient was withdrawn from the study and rated as a symptomatic relapse.

Compliance

Compliance with the study medication was required to be greater than 70% between two study visits; this was
checked by counting the returned tablets. Attendance at the follow-up visits had to occur within 7 days of the scheduled date. However, about one-third of the patients attended the study visit more than 10 days outside the scheduled date (earliest −28 days and latest +28 days). This was considered to be not clinically relevant and was dealt with as an accepted deviation from the protocol.

Safety
The safety of the study medication was assessed by monitoring adverse events, and analysis of biochemical and haematological laboratory parameters (listed below). Patients were asked to report any adverse events to the investigator. The causal relationship between the adverse event and the study medication was made by the investigator and assessed as ‘not related’, ‘possibly related’ or ‘definitely related’.

Haematological and biochemical parameters were determined at all study visits. Patients were fasted when specimens for the following parameters were obtained: blood, haemoglobin, erythrocytes, leucocytes, thrombocytes; serum, glucose, creatinine, total bilirubin, concentration of liver enzymes in serum (glutamic-oxaloacetic transaminase, serum glutamate pyruvate transaminase), alkaline phosphatase, total cholesterol, triglycerides, gastrin; urine, protein, glucose, blood cells. Except for gastrin, which was determined centrally in each country, all other parameters were analysed by the laboratories of the respective study centres.

Statistics

Determination of sample size. For the long-term study, about 150 patients per treatment group were expected to be enrolled. This calculation was based on the assumption that a 90% healing rate would be achieved during the short-term healing study, and that at least 80% of the healed patients would participate in the long-term study. Having 150 patients per treatment group and 90% as the average rate of patients in remission after 12 months would allow detection of a 10% difference at the $\alpha = 5\%$ level of significance with a power of more than 80% (Fisher’s exact test used as an approximation to the Kaplan–Meier, to estimate the difference in remission rates, 85%:95%, $\beta = 13\%$).

Endoscopic relapse. Remission rates and the corresponding standard errors for each treatment and time point were estimated using the life-table analysis according to Kaplan–Meier. Therapeutic ‘at least equivalence’ was concluded if the lower limit of this interval was above −20%. Additionally, the log-rank test was used to compare the time until relapse occurred (defined as ‘6 months’ and ‘12 months’ and representing the observation periods of 0–6 months and 6–12 months, respectively).

This analysis was performed using the ‘all patients treated’ approach which included all patients who provided at least one set of evaluable follow-up information. Patients terminating the study due to an adverse event that was considered to be ‘possibly’ or ‘definitely’ related to the study medication or due to lack of efficacy, presenting for example as intolerable symptoms, were evaluated as ‘endoscopic relapse’ from the respective time point (Table 2).

Symptomatic relapse
Symptomatic relapses were evaluated using the same methods as described above for the endoscopic relapses, but using the ‘per protocol’ approach; patients also included in this analysis were those...
terminating the study for reasons not related to symptoms, who were evaluated only until the date of the last valid symptom status. The time points included in the analyses were 0, 3, 6, 9 and 12 months, because these were the scheduled times for the assessment of symptoms.

Clinical laboratory parameters and adverse events. All patients who took the study medication at least once were included in the evaluation of safety parameters. These included adverse events and laboratory parameters, which were evaluated descriptively. Baseline comparisons for the variables smoking and alcohol consumption were compared between the treatment groups using the Cochran–Mantel/Haenszel method. The confidence intervals of the group medians were determined for the variables age, body mass index, and the number of preceding relapses.

RESULTS

Patient population

At the time of enrolment into the maintenance study there were no significant differences between the patients randomized for treatment with pantoprazole 20 mg (n = 203) and pantoprazole 40 mg (n = 193) with respect to the demographic and clinical parameters (Table 1). A flow chart, shown in Figure 1, summarizes the disposition of the patients.

Endoscopic relapse

In the 20 mg treatment group, 49 patients were classified as endoscopic relapse. Of these, 45 had endoscopically-verified relapse of reflux oesophagitis (grade I n = 35, grade II n = 7, grade III n = 2, and grade IV n = 1). An account of the patients with relapse, including the grade of GERD observed at diagnosis and upon relapse during the long-term treatment, is shown in Figure 2. In addition, endoscopic relapse status was assigned to another four patients because of either adverse events that were rated as ‘possibly’ or ‘definitely’ related to the study medication or intolerable symptoms (increased concentration of liver enzymes, taste perversion, insomnia) (Figure 1).

In the 40 mg treatment group, a total of 30 patients were classified as endoscopic relapse. Of these, 29 had endoscopically-verified relapse of reflux oesophagitis (grade I n = 21, grade II n = 8) (Figure 2); one other patient was also classified as an endoscopic relapse due to an adverse event (diarrhoea) that was rated as ‘definitely’ related to the study medication (Figure 1).

The number of patients with endoscopic relapse at 6 and 12 months, those in remission and completing the study interval, and the probability of endoscopic relapse...
together with its 95% confidence intervals, are summarized in Table 3. The estimated endoscopic relapse rates were 16 and 29% for the 20 mg group at 6 and 12 months, respectively. In the 40 mg group the estimated endoscopic relapse rates were 7% after 6 months and 19% after 12 months.

The 20 mg and 40 mg doses of pantoprazole were judged as therapeutically ‘at least equivalent’ in preventing endoscopic relapse of reflux oesophagitis at 6 and 12 months because the lower confidence limit of the 90% confidence interval for the difference was above the predefined −20% (Table 4). Hence by inference, an inferiority of more than 20% of one treatment over the other could be statistically excluded. These results are illustrated in Figure 3.

The time to relapse was compared between the two treatment groups by means of the log-rank test. It was shown that pantoprazole 40 mg was superior to 20 mg in preventing endoscopic relapse \( (P = 0.0368) \). Thus, there was a statistically significant difference between the two doses, but according to predefined criteria this difference was considered to be not clinically relevant.

Symptomatic relapse

The actual numbers of patients with symptomatic relapse after 3, 6, 9 and 12 months, the probability of symptomatic relapse and the number of patients completing the corresponding interval are listed in Table 3B. Time to symptomatic relapse, calculated according to the log-rank test, was not significantly different between the two treatment groups \( (P = 0.9955) \). Using the same analytical approach as for the endoscopic relapse, a therapeutic ‘at least equivalence’ of the 20 mg compared to the 40 mg dose of pantoprazole was concluded for the symptomatic relapse rates of reflux oesophagitis (Table 4, Figure 4).

Safety

Adverse events. As summarized in Table 5, a total of 135 adverse events was reported by 97 patients; 53/203 (26%) and 44/193 (23%) of patients were in the 20 mg and the 40 mg treatment group, respectively. The frequency and causality assessment, as well as the type of the most commonly reported adverse events, were similar in both treatment groups. They included elevated serum concentration of liver enzymes, diarrhoea, abdominal pain and bronchitis; they affected between 1 and 3% of the patients participating in the study (Table 5).

Among the adverse events, 14 were rated as serious. Although none of these adverse events were related to the study medication, the events were classified as serious because they involved hospitalization. A total of three patients discontinued the study for the following
reasons: cardiac draft surgery (n = 1, discontinued the
study after 10 months), myocardial infarction (n = 1,
discontinued after 4 months), and adenocarcinoma on
the right kidney (n = 1, discontinued after 3 months);
the other 11 patients who had accidental injury, ileus,
cholelithiasis, diarrhoea, psychosis, myocardial isch-
aemia, neoplasm, colitis, bronchitis and sepsis, contin-
ued with the treatment.

Four patients discontinued the study due to adverse
events assessed by the investigators as ‘possibly’ or
‘definitely’ related to the treatment medication. The
adverse events included hyperlipaemia, elevated con-
centration of liver enzymes in the serum, coughing and
taste perversion, insomnia, and substernal chest pain.

Laboratory parameters

Results of biochemical and haematological parameters
were analysed at each study visit and compared to
baseline values. Irrespective of the treatment group,
these parameters showed minimal changes in most
patients, who all continued with the treatment. For one
patient in the 20 mg pantoprazole group, an increase in
the serum concentration of liver enzymes was found at
the 3 month study visit. It was an adverse event rated
as possibly related to the study medication and this
patient discontinued the study.

Gastrin

During the 12 month treatment period the median
concentrations of serum gastrin increased slightly and
to a similar extent in both treatment groups. There were
no statistical differences in the gastrin values between
the treatment groups either at baseline or after
12 months of treatment. In the 20 mg pantoprazole
group, the values of the median gastrin values were:
10–56 ng/L at baseline and 22–129 ng/L after
12 months of treatment; in the 40 mg pantoprazole
group, the corresponding values were 15–58 ng/L and
10–100 ng/L, respectively.

DISCUSSION

Preventing a relapse of reflux oesophagitis in success-
fully healed patients is one of the common challenges
facing the attending physician. Studies with H2-RAs,
administered as maintenance therapy, have revealed
that between 67 and 87% of patients relapse within the
first 6–12 months. This represents a rate similar to
placebo or no treatment.4, 12, 27 In contrast, controlled
studies with proton pump inhibitors (omeprazole,
lansoprazole), administered as maintenance therapy,
have illustrated that within the first year of treatment
the relapse rate can be reduced to between 15 and
45%.20 Maintenance therapies with either omeprazole4, 16, 28–31
or lansoprazole17, 21, 32 prevent endoscopic relapse in a
dose-dependent manner. For both of these drugs, the
standard dose, as well as the low dose, are registered for
maintenance therapy in patients with healed oesophagus.
Results of controlled studies in such patients have
shown that after 12 months of regular maintenance
therapy, the relapse rates were 38–50% following
treatment with 10 mg omeprazole, compared with 12–32% when 20 mg was used.\(^4\), \(^6\), \(^8\), \(^26\), \(^29\), \(^31\) A similar trend was seen with lansoprazole 15 mg and 30 mg when relapse rates of 21–46% and 10–23%, respectively, were reported.\(^17\), \(^21\), \(^32\) In a 12 month open-label study with a maintenance dose of 40 mg oral pantoprazole, the endoscopically-proven relapse was shown in 6% of patients.\(^33\)

In the present study, maintenance therapy with 20 mg or 40 mg pantoprazole administered for up to 12 months led to an endoscopic relapse of reflux oesophagitis in 29 and 19% of patients, respectively; the corresponding values for the symptomatic relapse rates were 21% in the 20 mg and 17% in the 40 mg treatment group. Such values are in agreement with those found in a similar study performed in Germany and reported by Plein et al.\(^34\) In that study, the endoscopic relapse rates of reflux oesophagitis after 12 months of treatment were 25 and 22%, for patients treated with 20 mg or 40 mg pantoprazole, respectively.\(^34\)

The results described here also indicate that, as with other proton pump inhibitors used in this clinical indication, the relapse rate is dependent on the therapeutic dose of pantoprazole.\(^16\), \(^29\), \(^32\), \(^34\) The proportion of patients in the 20 mg pantoprazole treatment group who had an endoscopic relapse was lower than that shown for the group treated with a low dose (10 mg) of

### Table 3A. Evaluation of endoscopic remission and relapse

<table>
<thead>
<tr>
<th>Treatment and period</th>
<th>Number of patients at risk during the study interval (N)</th>
<th>Drop-outs and protocol violators (N)</th>
<th>Patients in remission completing the interval (N)</th>
<th>Patients with endoscopic relapse (N)</th>
<th>Probability of endoscopic relapse (%)</th>
<th>Confidence limits (95%)</th>
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<tr>
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<td>151</td>
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<td>6–12 months</td>
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<td>121</td>
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### Table 3B. Evaluation of symptomatic remission and relapse

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<th>Patients in remission completing the interval (N)</th>
<th>Patients with endoscopic relapse (N)</th>
<th>Probability of endoscopic relapse (%)</th>
<th>Confidence limits (95%)</th>
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</table>

Drop-outs and protocol violators represent the 'censored' patients indicated and defined in Table 2.
omeprazole,4 16, 28, 29, 31 and within the range reported for a low dose (15 mg) of lansoprazole.17, 20, 21, 32 It was noteworthy in our study that, of the patients who experienced endoscopic relapse, the proportion relapsing from the initial GERD grade II or III at diagnosis to grade I during the long-term maintenance treatment was similar in both treatment groups. Indeed, a worsening of the oesophagitis status was noticed for only one patient, for whom poor compliance with the 20 mg pantoprazole dose cannot be ruled out, and who had a relapse after 3 months from an initial grade II at diagnosis to grade (IV) (Figure 2).

The safety and tolerability of the treatment was monitored by the frequency and type of adverse events. According to the assessment made by the investigators, the number and the type of adverse events was similar between the two treatment groups (Table 5). The most common adverse events, affecting 1–3% of the total number of patients, included elevated serum concentration of liver enzymes, diarrhoea and abdominal pain; such results are in accord with other studies with pantoprazole10, 33, 34 or other proton pump inhibitors.15, 30

As with other proton pump inhibitors, patients receiving pantoprazole as maintenance therapy had slightly elevated concentrations of serum gastrin.12, 21, 33 Such elevation was regarded as not

Table 4. Differences between the treatment groups, together with the 90% confidence limits, according to a Kaplan–Meier life-table analysis

<table>
<thead>
<tr>
<th>Treatment interval</th>
<th>Endoscopic relapse (90% CI)</th>
<th>Symptomatic relapse (90% CI)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0–3 months</td>
<td>-8 (-14 to -3)</td>
<td>-3 (-7 to 1)</td>
</tr>
<tr>
<td>3–6 months</td>
<td>-4 (-10 to 1)</td>
<td>-4 (-10 to 2)</td>
</tr>
<tr>
<td>6–9 months</td>
<td>-4 (-10 to 2)</td>
<td>-4 (-11 to 3)</td>
</tr>
<tr>
<td>9–12 months</td>
<td>-10 (-17 to -2)</td>
<td>-4 (-11 to 3)</td>
</tr>
</tbody>
</table>

The test for equivalence is a procedure consisting of two one-sided tests. For a one-sided test, the lower 90% confidence interval’s limit provides the critical value. Hence, for the two one-sided tests the 90% confidence interval provides both critical values. Hypotheses being outside this interval can be rejected at the 5% level of significance. In the present study, only the lower limit was required, because only the ‘at least equivalence’ was tested for.

Figure 3. Endoscopic remission rates for patients enrolled in the long-term maintenance therapy and treated with either 20 mg or 40 mg pantoprazole for up to 12 months. The data are presented as the Kaplan–Meier plot with 95% confidence limits.

Figure 4. Symptomatic remission rates for patients enrolled in the long-term maintenance therapy and treated with either 20 mg or 40 mg pantoprazole for up to 12 months. The data are presented as the Kaplan–Meier plot with 95% confidence limits.

Table 5. Frequency and causality assessment of adverse events

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Treatment group</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pantoprazole 20 mg</td>
</tr>
<tr>
<td>Number of patients enrolled in the study</td>
<td>203</td>
</tr>
<tr>
<td>Number of patients with adverse events</td>
<td>53 (26%)</td>
</tr>
<tr>
<td>Number of adverse events</td>
<td>77</td>
</tr>
<tr>
<td>Not related</td>
<td>64 (83%)</td>
</tr>
<tr>
<td>Possibly related</td>
<td>13 (17%)</td>
</tr>
<tr>
<td>Definitely related</td>
<td>0</td>
</tr>
</tbody>
</table>

The numbers in brackets represent percentages of the respective parameter.

clinically relevant, as gastrin levels tend to return to normal after the discontinuation of treatment with proton pump inhibitors.\textsuperscript{35} Moreover, regular monitoring of serum gastrin concentration during therapy with proton pump inhibitors has been described as unnecessary by others.\textsuperscript{36}

In conclusion, the present long-term maintenance study demonstrates that a once daily dose of 20 mg or 40 mg pantoprazole is safe and well tolerated and that both doses are therapeutically ‘at least equivalent’ in preventing symptomatic and endoscopic relapse in patients with healed reflux oesophagitis. Because pantoprazole 20 mg can maintain the majority of patients free of relapse, this dose could be regarded as a good start for maintenance therapy.

For those patients who do relapse while receiving 20 mg pantoprazole, it may be necessary to regain healing with a short-term course (4–8 weeks) of 40 mg pantoprazole before recommencing with the maintenance dose of 20 mg. Such an approach would minimize the patients’ exposure to the drug and potentially lower the cost of the therapy.

ACKNOWLEDGEMENTS

The authors gratefully acknowledge the following investigators from The European Pantoprazole Study Group for their participation in the study. Belgium: Drs L. E. C. Lepoutre (Aalst), G. K. M. Robaeyens (Genk), A. Nakad (Tournai), V. Gillard (Liege), R. Fiasse (Bruxelles), P. A. R. Pelckmans (Edegem), J. P. F. Janssens (Leuven); France: Drs H. Baum (Strasbourg Cedex), J.-P. Descschailliers (Elbeuf), D. Cattan (Villeneuve), M. G. M. Doffoel (Strasbourg), E. Fort (Chateauroux), J. I. Gilson (Béziers Cedex), P. Guivarch (Castres), J. P. Ramain (Blois), H. Gouerou (Brest Cedex), J.-F. Rey (Saint Laurent Du Var), H. Michel (Montpellier Cedex 5), M. Mignon (Paris), G. Naquin (Paris Cedex 12). D. Sondag (Mulhouse), E. Vaucher (Narbonne Cedex); Italy: Drs E. Camarri (Grosseto), A. Cardelli (Rimini), R. Corinaldesi (Bologna), G. Dobrilla (Bolzano), A. Ferrari (Torino), S. Fiorucci (Perugia), R. Galeazzi (Ancona), G. Gatto (Palermo), G. Mazzacca (Napoli), F. Mazzeo (Piacenza), M. Miglioli (Bologna), G. Minoli (Como), A. Tittobello (Milano), M. Valenti (Aviano, Pordenone); the Netherlands: Drs J. A. Beker (Leidschendam), A. A. M. Geraedts (Amsterdam), W. W. Meyer (Den Helder), R. J. T. Ouwendijk (Rotterdam), H. Sikkens (Blaricum), B. D. Westerveld (Zwolle), A. M. H. Wetzels (Stadskanaal); and Dr Kathy B. Thomas (Byk Gulden, Konstanz, Germany), for helpful suggestions during the preparation and editing of this manuscript.

This study was supported by a grant from Nycomed Pharma, Roskilde, Denmark and Byk Gulden Pharmaceuticals, Konstanz, Germany.

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