

Tablets 20 mg and in 100% of subjects receiving Rabeprozole Sodium Delayed-Release Tablets 40 mg. With Rabeprozole Sodium Delayed-Release Tablets 20 mg and 40 mg per day, significant effects on gastric and esophageal pH were noted after one day of treatment, and more pronounced after seven days of treatment.

Effects on Serum Gastrin

In patients given daily doses of Rabeprozole Sodium Delayed-Release Tablets for up to eight weeks to treat ulcerative or erosive esophagitis and in patients treated for up to 52 weeks to prevent recurrence of disease the median fasting gastrin level increased in a dose-related manner. The group median values stayed within the normal range.

In a group of subjects treated with Rabeprozole Sodium Delayed-Release Tablets 20 mg for 4 weeks a doubling of mean serum gastrin concentrations were observed. Approximately 35% of these treated subjects developed serum gastrin concentrations above the upper limit of normal. In a study of CYP2C19 genotyped subjects in Japan, poor metabolizers developed statistically significantly higher serum gastrin concentrations than extensive metabolizers.

Effects on Enterochromaffin-like (ECL) Cells

Increased serum gastrin secondary to antisecretory agents stimulates proliferation of gastric ECL cells which, over time, may result in ECL cell hyperplasia in rats and mice and gastric carcinoids in rats, especially in females (see *Nonclinical Toxicology* (13.1)).

In over 400 patients treated with Rabeprozole Sodium Delayed-Release Tablets (10 or 20 mg/day) for up to one year, the incidence of ECL cell hyperplasia increased with time and dose, which is consistent with the pharmacological action of the proton-pump inhibitor. No patient developed the adenomatoid, dysplastic or neoplastic changes of ECL cells in the gastric mucosa. No patient developed the carcinoid tumors observed in rats.

Endocrine Effects

Studies in humans for up to one year have not revealed clinically significant effects on the endocrine system. In healthy male volunteers treated with Rabeprozole Sodium Delayed-Release Tablets for 13 days, no clinically relevant changes have been detected in the following endocrine parameters examined: 17 β -estradiol, thyroid stimulating hormone, tri-iodothyronine, thyroxine, thyroxine-binding protein, parathyroid hormone, insulin, glucagon, renin, aldosterone, follicle-stimulating hormone, luteotrophic hormone, prolactin, somatotrophic hormone, dehydroepiandrosterone, cortisol-binding globulin, and urinary 6 β -hydroxycortisol, serum testosterone and circadian cortisol profile.

Other Effects

In humans treated with Rabeprozole Sodium Delayed-Release Tablets for up to one year, no systemic effects have been observed on the central nervous, lymphoid, hematopoietic, renal, hepatic, cardiovascular, or respiratory systems. No data are available on long-term treatment with Rabeprozole Sodium Delayed-Release Tablets and ocular effects.

Microbiology

The following *in vitro* data are available but the clinical significance is unknown.

Rabeprozole sodium, amoxicillin and clarithromycin as a three drug regimen has been shown to be active against most strains of *Helicobacter pylori* *in vitro* and in clinical infections as described in the *Clinical Studies* (14) and *Indications and Usage* (1) sections.

Helicobacter pylori

Susceptibility testing of *H. pylori* isolates was performed for amoxicillin and clarithromycin using agar dilution methodology, and minimum inhibitory concentrations (MICs) were determined. Standardized susceptibility test procedures require the use of laboratory control microorganisms to control the technical aspects of the laboratory procedures.

Incidence of Antibiotic-Resistant Organisms Among Clinical Isolates

Pretreatment Resistance: Clarithromycin pretreatment resistance rate (MIC ≥ 1 μ g/mL) to *H. pylori* was 9% (51/560) at baseline in all treatment groups combined. A total of > 99% (558/560) of patients had *H. pylori* isolates which were considered to be susceptible (MIC ≤ 0.25 μ g/mL) to amoxicillin at baseline. Two patients had baseline *H. pylori* isolates with an amoxicillin MIC of 0.5 μ g/mL.

For susceptibility testing information about Helicobacter pylori, see *Microbiology section in prescribing information for clarithromycin and amoxicillin*.

CLARITHROMYCIN SUSCEPTIBILITY TEST RESULTS AND CLINICAL/BACTERIOLOGIC OUTCOMES FOR A THREE DRUG REGIMEN (RABEPROZOLE 20 MG TWICE DAILY, AMOXICILLIN 1000 MG TWICE DAILY, AND CLARITHROMYCIN 500 MG TWICE DAILY FOR 7 OR 10 DAYS)

Days of RAC Therapy	Clarithromycin Pretreatment Results	Total Number	<i>H. pylori</i> Negative (Eradicated)	<i>H. pylori</i> Positive (Persistent) Post-Treatment Susceptibility Results			
				S ^a	I ^b	R ^b	No MIC
7	Susceptible ^a	129	103	2	0	1	23
7	Intermediate ^a	0	0	0	0	0	0
7	Resistant ^a	16	5	2	1	4	4
10	Susceptible ^a	133	111	3	1	2	16
10	Intermediate ^a	0	0	0	0	0	0
10	Resistant ^a	9	1	0	0	5	3

^a Includes only patients with pretreatment and post-treatment clarithromycin susceptibility test results. ^b Susceptible (S) MIC ≤ 0.25 μ g/mL, Intermediate (I) MIC = 0.5 μ g/mL, Resistant (R) MIC ≥ 1 μ g/mL.

Patients with persistent *H. pylori* infection following rabeprozole, amoxicillin, and clarithromycin therapy will likely have clarithromycin resistant clinical isolates. Therefore, clarithromycin susceptibility testing should be done when possible. If resistance to clarithromycin is demonstrated or susceptibility testing is not possible, alternative antimicrobial therapy should be instituted.

Amoxicillin Susceptibility Test Results and Clinical/Bacteriological Outcomes: In the U.S. multicenter study, a total of >99% (558/560) of patients had *H. pylori* isolates which were considered to be susceptible (MIC ≤ 0.25 μ g/mL) to amoxicillin at baseline. The other 2 patients had baseline *H. pylori* isolates with an amoxicillin MIC of 0.5 μ g/mL, and both isolates were clarithromycin-resistant at baseline; in one case the *H. pylori* was eradicated. In the 7- and 10-day treatment groups 75% (107/145) and 79% (112/142), respectively, of the patients who had pretreatment amoxicillin susceptible MICs (≤ 0.25 μ g/mL) were eradicated of *H. pylori*. No patients developed amoxicillin-resistant *H. pylori* during therapy.

12.3 Pharmacokinetics

Rabeprozole Sodium Delayed-Release Tablets are enteric-coated to allow rabeprozole sodium, which is acid labile, to pass through the stomach relatively intact.

After oral administration of 20 mg Rabeprozole Sodium Delayed-Release Tablets, peak plasma concentrations (C_{max}) of rabeprozole occur over a range of 2 to 5 hours (T_{max}). The rabeprozole C_{max} and AUC are linear over an oral dose range of 10 mg to 40 mg. There is no appreciable accumulation when doses of 10 mg to 40 mg are administered every 24 hours; the pharmacokinetics of rabeprozole is not altered by multiple dosing.

Absorption: Absolute bioavailability for a 20 mg oral tablet of rabeprozole (compared to intravenous administration) is approximately 52%. When Rabeprozole Sodium Delayed-Release Tablets are administered with a high fat meal, T_{max} is variable, which concomitant food intake may delay the absorption up to 4 hours or longer. However, the C_{max} and the extent of rabeprozole absorption (AUC) are not significantly altered. Thus Rabeprozole Sodium Delayed-Release Tablets may be taken without regard to timing of meals.

Distribution: Rabeprozole is 96.3% bound to human plasma proteins.

Metabolism: Rabeprozole is extensively metabolized. A significant portion of rabeprozole is metabolized via systemic nonenzymatic reduction to a thioether compound. Rabeprozole is also metabolized to sulphone and desmethyl compounds via cytochrome P450 in the liver. The thioether and sulphone are the primary metabolites measured in human plasma. These metabolites were not observed to have significant antiserotory activity. *In vitro* studies have demonstrated that rabeprozole is metabolized in the liver primarily by cytochromes P450 3A (CYP3A) to a sulphone metabolite and cytochrome P450 C19 (CYP2C19) to desmethyl rabeprozole. CYP2C19 exhibits a known genetic polymorphism due to its deficiency in some sub-populations (e.g. 3 to 5% of Caucasians and 17 to 20% of Asians). Rabeprozole metabolism is slow in these sub-populations, therefore, they are referred to as poor metabolizers of the drug.

Elimination: Following a single 20 mg oral dose of ¹⁴C-labeled rabeprozole, approximately 90% of the drug was eliminated in the urine, primarily as thioether carboxylic acid; its glucuronide, and mercapturic acid metabolites. The remainder of the dose was recovered in the feces. Total recovery of radioactivity was 99.8%. No unchanged rabeprozole was recovered in the urine or feces.

Seratic: In 20 healthy elderly subjects administered 20 mg rabeprozole tablet once daily for seven days, AUC values approximately doubled and the C_{max} increased by 60% compared to values in a parallel younger control group. There was no evidence of drug accumulation after once daily administration [see *Use in Special Populations* (8.5)].

Pediatric: The pharmacokinetics of rabeprozole was studied in pediatric patients with GERD aged 12 to 16 years.

Patients 12 to 16 Years of Age

The pharmacokinetics of rabeprozole was studied in 12 adolescent patients with GERD 12 to 16 years of age, in a multicenter study. Patients received rabeprozole 20 mg tablets once daily for five or seven days. An approximate 40% increase in exposure was noted following 5 to 7 days of dosing compared with the exposure after 1 day dosing. Pharmacokinetic parameters in adolescent patients with GERD 12 to 16 years of age were within the range observed in healthy adult volunteers.

Gender and Race: In analyses adjusted for body mass and height, rabeprozole pharmacokinetics showed no clinically significant differences between male and female subjects. In studies that used different formulations of rabeprozole, AUC₀₋₂₄ values for healthy Japanese men were approximately 50-60% greater than values derived from pooled data from healthy men in the United States.

Renal Disease: In 10 patients with stable end-stage renal disease requiring maintenance hemodialysis (creatinine clearance ≤ 5 mL/min/1.73 m²), no clinically significant differences were observed in the pharmacokinetics of rabeprozole after a single 20 mg oral dose when compared to 10 healthy volunteers [see *Dosage and Administration* (2.9)].

Hepatic Disease: In a single dose study of 10 patients with chronic mild to moderate compensated cirrhosis of the liver who were administered a 20 mg dose of rabeprozole, AUC₀₋₂₄ was approximately doubled, the elimination half-life was 2- to 3-fold higher, and total body clearance was decreased to less than half compared to values in healthy men.

In a multiple dose study of 12 patients with mild to moderate hepatic impairment administered 20 mg rabeprozole once daily for eight days, AUC₀₋₂₄ and C_{max} values increased approximately 20% compared to values in healthy age- and gender-matched subjects. These increases were not statistically significant.

No information exists on rabeprozole disposition in patients with severe hepatic impairment. Please refer to the *Dosage and Administration* (2.9) for information on dosage adjustment in patients with hepatic impairment.

Combined Administration with Antimicrobials: Seven healthy volunteers genotyped as extensive metabolizers with respect to CYP2C19 were given 20 mg rabeprozole sodium, 1000 mg amoxicillin, 500 mg clarithromycin, or all 3 drugs in a four-way crossover study. Each of the four regimens was administered twice daily for 6 days. The AUC and C_{max} for clarithromycin and amoxicillin were not different following combined administration compared to values following single administration. However, the rabeprozole AUC and C_{max} increased by 11% and 34%, respectively, following combined administration. The AUC and C_{max} for 14-hydroxycloxythromycin (active metabolite of clarithromycin) also increased by 42% and 46%, respectively. This increase in exposure to rabeprozole and 14-hydroxycloxythromycin is not expected to produce safety concerns.

Concomitant Use with Clopidogrel: Clopidogrel is metabolized to its active metabolite in part by CYP2C19. A study of healthy subjects including CYP2C19 extensive and intermediate metabolizers receiving once daily administration of clopidogrel 75 mg concomitantly with placebo or with Rabeprozole Sodium Delayed-Release Tablets 20 mg (n=36), for 7 days was conducted. The mean AUC of the active metabolite of clopidogrel was reduced by approximately 12% (mean AUC ratio was 88%, with 90% CI of 81 to 95.5%) when Rabeprozole Sodium Delayed-Release Tablets was coadministered compared to administration of clopidogrel with placebo.

13 NONCLINICAL PHARMACOLOGY

13.1 Carcinogenesis, Mutagenesis, Impairment of Fertility
In a 88/104-week carcinogenicity study in CD-1 mice, rabeprozole at oral doses up to 100 mg/kg/day did not produce any increased tumor occurrence. The highest tested dose produced a systemic exposure to rabeprozole (AUC) of 1.40 μ g \cdot hr/mL, which is 1.6 times the human exposure (plasma AUC₀₋₂₄ = 0.88 μ g \cdot hr/mL) at the recommended dose for GERD (20 mg/day). In a 28-week carcinogenicity study in p53^{-/-} transgenic mice, rabeprozole at oral doses of 20, 60, and 200 mg/kg/day did not cause an increase in the incidence rates of tumors but produced gastric mucosal hyperplasia at all doses. The systemic exposure to rabeprozole at 200 mg/kg/day is about 17-24 times the human exposure at the recommended dose for GERD. In a 104-week carcinogenicity study in Sprague-Dawley rats, males were treated with oral doses of 5, 15, 30 and 60 mg/kg/day and females with 5, 15, 30, 60 and 120 mg/kg/day. Rabeprozole produced gastric enterochromaffin-like (ECL) cell hyperplasia in male and female rats and ECL cell carcinoid tumors in female

rats at all doses including the lowest tested dose. The lowest dose (5 mg/kg/day) produced a systemic exposure to rabeprozole (AUC) of about 0.1 μ g \cdot hr/mL which is about 0.1 times the human exposure at the recommended dose for GERD. In male rats, no treatment related tumors were observed at doses up to 60 mg/kg/day producing a rabeprozole plasma exposure (AUC) of about 0.2 μ g \cdot hr/mL (0.2 times the human exposure at the recommended dose for GERD).

Rabeprozole was positive in the Ames test, the Chinese hamster ovary cell (CHO/HGPRT) forward gene mutation test and the mouse lymphoma cell (L5178Y/TK⁺) forward gene mutation test. Its demethylated-metabolite was also positive in the Ames test. Rabeprozole was negative in the *in vitro* Chinese hamster lung cell chromosome aberration test, the *in vivo* mouse micronucleus test, and the *in vivo* and *ex vivo* rat hepatocyte unscheduled DNA synthesis (UDS) tests.

Rabeprozole at intravenous doses up to 30 mg/kg/day (plasma AUC of 8.8 μ g \cdot hr/mL, about 10 times the human exposure at the recommended dose for GERD) was found to have no effect on fertility and reproductive performance of male and female rats.

13.2 Animal Toxicology and/or Pharmacology
Studies in juvenile and young adult rats and dogs were performed. In juvenile animal studies rabeprozole sodium was administered orally to rats for up to 5 weeks and to dogs for up to 13 weeks, each commencing on Day 7 postpartum and followed by a 13-week recovery period. Rats were dosed at 5, 25 or 150 mg/kg/day and dogs were dosed at 3, 10 or 30 mg/kg/day. The data from these studies were comparable to those reported for young adult animals. Pharmacologically mediated changes, including increased serum gastrin levels and stomach changes, were observed at all dose levels in both rats and dogs. These observations were reversible over the 13-week recovery periods. Although body weights and/or crown-rump lengths were minimally decreased during dosing, no effects on the development parameters were noted in either juvenile rats or dogs.

14 CLINICAL STUDIES

14.1 Healing of Erosive or Ulcerative GERD in Adults
In a U.S., multicenter, randomized, double-blind, placebo-controlled study, 103 patients were treated for up to eight weeks with placebo, 10 mg, 20 mg or 40 mg Rabeprozole Sodium Delayed-Release Tablets OD. For this and all studies of GERD healing, only patients with GERD symptoms and at least grade 2 esophagitis (modified Hetsel-Dert grading scale), were eligible for entry. Endoscopic healing was defined as grade 0 or 1. Each rabeprozole dose was significantly superior to placebo in producing endoscopic healing after four and eight weeks of treatment. The percentage of patients demonstrating endoscopic healing was as follows:

Week	10 mg Rabeprozole Sodium Delayed-Release Tablets OD N=27	20 mg Rabeprozole Sodium Delayed-Release Tablets OD N=25	40 mg Rabeprozole Sodium Delayed-Release Tablets OD N=26	Placebo N=25
4	63%*	56%*	54%*	0%
8	93%*	84%*	85%*	12%

* (p<0.001 versus placebo)

In addition, there was a statistically significant difference in favor of the Rabeprozole Sodium Delayed-Release Tablets 10 mg, 20 mg, and 40 mg doses compared to placebo at Weeks 4 and 8 regarding complete resolution of GERD heartburn frequency (p<0.026). All Rabeprozole Sodium Delayed-Release Tablets groups reported significantly greater rates of complete resolution of GERD daytime heartburn severity compared to placebo at Weeks 4 and 8 (p<0.036). Mean reductions from baseline in daily antacid use were statistically significant for all Rabeprozole Sodium Delayed-Release Tablets groups when compared to placebo at both Weeks 4 and 8 (p<0.007).

In a North American multicenter, randomized, double-blind, active-controlled study of 336 patients, Rabeprozole Sodium Delayed-Release Tablets was statistically superior to ranitidine with respect to the percentage of patients healed at endoscopy after four and eight weeks of treatment (see table below):

Week	Rabeprozole Sodium Delayed-Release Tablets 20 mg OD N=167	Ranitidine 150 mg QID N=169
4	59%*	36%
8	87%*	66%

* (p<0.001 versus ranitidine)

Rabeprozole Sodium Delayed-Release Tablets 20 mg once daily was significantly more effective than ranitidine 150 mg QID in the percentage of patients with complete resolution of heartburn at Weeks 4 and 8 (p<0.001). Rabeprozole Sodium Delayed-Release Tablets 20 mg once daily was also more effective in complete resolution of daytime heartburn (p<0.025), and nighttime heartburn (p<0.012) at both Weeks 4 and 8, with significant differences by the end of the first week of the study.

14.2 Long-term Maintenance of Healing of Erosive or Ulcerative GERD in Adults
The long-term maintenance of healing in patients with erosive or ulcerative GERD previously healed with gastric antiserotory therapy was assessed in two U.S., multicenter, randomized, double-blind, placebo-controlled studies of identical design of 52 weeks duration. The two studies randomized 209 and 285 patients, respectively, to receive either 10 mg or 20 mg of Rabeprozole Sodium Delayed-Release Tablets OD or placebo. As demonstrated in the tables below, Rabeprozole Sodium Delayed-Release Tablets was significantly superior to placebo in both studies with respect to the maintenance of healing of GERD and the proportions of patients remaining free of heartburn symptoms at 52 weeks:

	Rabeprozole Sodium Delayed-Release Tablets 10 mg N=66	Rabeprozole Sodium Delayed-Release Tablets 20 mg N=67	Placebo N=70
Study 1	83%*	96%*	44%
Week 1	79%*	93%*	39%
Week 26	77%*	93%*	31%
Week 52	76%*	91%*	30%
Study 2	73%*	90%*	29%
Week 1	89%*	94%*	40%
Week 13	86%*	91%*	43%
Week 26	85%*	89%*	30%
Week 39	84%*	88%*	29%
Week 52	77%*	88%*	29%

COMBINED STUDIES N=159 N=160 N=169

Week 4 87%* 94%* 42%

Week 13 83%* 92%* 36%

Week 26 82%* 91%* 31%

Week 39 81%* 89%* 30%

Week 52 75% 87% 29%

* (p<0.001 versus placebo)

	Rabeprozole Sodium Delayed-Release Tablets 10 mg	Rabeprozole Sodium Delayed-Release Tablets 20 mg	Placebo
Heartburn Frequency			
Study 1	46/55 (84%)*	48/52 (92%)*	17/45 (38%)
Study 2	50/72 (69%)*	57/72 (79%)*	22/79 (28%)
Daytime Heartburn Severity			
Study 1	61/64 (95%)*	60/62 (97%)*	42/61 (69%)
Study 2	73/84 (87%)*	82/87 (94%)*	67/90 (74%)
Nighttime Heartburn Severity			
Study 1	57/61 (93%)*	60/61 (98%)*	37/56 (66%)
Study 2	67/80 (84%)*	79/87 (91%)*	64/87 (74%)

* p<0.001 versus placebo
† 0.001<p<0.05 versus placebo

14.3 Treatment of Symptomatic GERD in Adults
Two U.S., multicenter, double-blind, placebo-controlled studies were conducted in 316 adult patients with daytime and nighttime heartburn. Patients reported 5 or more periods of moderate to very severe heartburn during the placebo treatment phase the week prior to randomization. Patients were confirmed by endoscopy to have no esophageal erosions.

The percentage of heartburn free daytime and/or nighttime periods was greater with Rabeprozole Sodium Delayed-Release Tablets 20 mg compared to placebo over the 4 weeks of study in Study RAB-USA-2 (47% vs. 23%) and Study RAB-USA-3 (52% vs. 28%). The mean decreases from baseline in average daytime and nighttime heartburn scores were significantly greater for Rabeprozole Sodium Delayed-Release Tablets 20 mg as compared to placebo at week 4. Graphical displays depicting the daily mean daytime and nighttime scores are provided in Figures 2 to 5.

STUDY DAY	PLACEBO, n = 68	RAB 10mg, n = 64	RAB 20mg, n = 67
-14	~1.8	~1.8	~1.8
-7	~1.8	~1.8	~1.8
0	~1.8	~1.8	~1.8
7	~1.8	~1.8	~1.8
14	~1.8	~1.8	~1.8
21	~1.8	~1.8	~1.8
28	~1.8	~1.8	~1.8

STUDY DAY	PLACEBO, n = 68	RAB 10mg, n = 64	RAB 20mg, n = 67
-14	~1.8	~1.8	~1.8
-7	~1.8	~1.8	~1.8
0	~1.8	~1.8	~1.8
7	~1.8	~1.8	~1.8
14	~1.8	~1.8	~1.8
21	~1.8	~1.8	~1.8
28	~1.8	~1.8	~1.8

Heartburn Scores: 0 = None, 1 = Slight, 2 = Moderate, 3 = Severe, 4 = Very Severe.

FIGURE 3: MEAN NIGHTTIME HEARTBURN SCORES RAB-USA-2

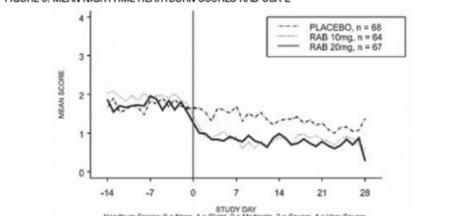


FIGURE 4: MEAN DAYTIME HEARTBURN SCORES RAB-USA-3

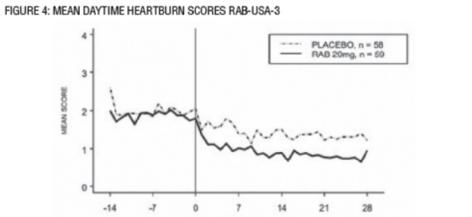
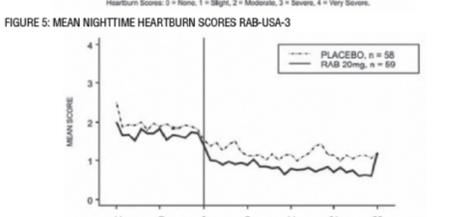


FIGURE 5: MEAN NIGHTTIME HEARTBURN SCORES RAB-USA-3



In addition, the combined analysis of these two studies showed Rabeprozole Sodium Delayed-Release Tablets 20 mg significantly improved other GERD-associated symptoms (regurgitation, belching and early satiety) by week 4 compared with placebo (all p values < 0.005).

Rabeprozole Sodium Delayed-Release Tablets 20 mg also significantly reduced daily antacid consumption versus placebo over 4 weeks (p<0.001).

14.4 Healing of Duodenal Ulcers in Adults
In a U.S., randomized, double-blind, multicenter study assessing the effectiveness of 20 mg and 40 mg of Rabeprozole Sodium Delayed-Release Tablets OD versus placebo for healing endoscopically defined duodenal ulcers, 100 patients were treated for up to four weeks. Rabeprozole Sodium Delayed-Release Tablets was significantly superior to placebo in producing healing of duodenal ulcers. The percentages of patients with endoscopic healing are presented below:

Week	Rabeprozole Sodium Delayed-Release Tablets 20 mg OD N=34	Rabeprozole Sodium Delayed-Release Tablets 40 mg OD N=33	Placebo N=33
2	44%	42%	21%
4			