

**HIGHLIGHTS OF PRESCRIBING INFORMATION**

These highlights do not include all the information needed to use RUFINAMIDE TABLETS, USP safely and effectively. See full prescribing information for RUFINAMIDE TABLETS, USP.

**RUFINAMIDE tablets, for oral use**  
Initial U.S. Approval: 2008

**INDICATIONS AND USAGE**

Rufinamide tablets USP are indicated for adjunctive treatment of seizures associated with Lennox-Gastaut Syndrome (LGS) in pediatric patients 1 year of age and older and in adults (1)

**DOSAGE AND ADMINISTRATION**

- Rufinamide tablets should be given with food. Tablets can be administered whole, as half tablets or crushed (2.2)

**Pediatric patients 1 year and older:**

- Starting daily dose: 10 mg/kg per day in two equally divided doses (2.1)
- Increase by 10 mg/kg increments every other day to maximum dose of 45 mg/kg per day, not to exceed 3,200 mg per day, in two divided doses (2.1)

**Adults:**

- Starting daily dose: 400 mg to 800 mg per day in two equally divided doses (2.1)
- Increase by 400 mg to 800 mg every other day until a maximum dose of 3,200 mg per day, in two divided doses, is reached (2.1)

**DOSAGE FORMS AND STRENGTHS****Functional scoring.**

Film-coated tablets: 100 mg (pink), 200 mg (pink), 400 mg (pink) (3)

**CONTRAINDICATIONS**

Rufinamide tablets are contraindicated in patients with Familial Short QT syndrome (4)

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**WARNINGS AND PRECAUTIONS**

- Monitor patients for new or worsening depression, suicidal thoughts/behavior and unusual changes in mood or behavior (5.1)
- Central nervous system reactions can occur (5.2)
- Use caution when administering rufinamide with other drugs that shorten the QT interval (5.3)
- Discontinue rufinamide if multi-organ hypersensitivity reaction occurs (5.4)
- Withdraw rufinamide gradually to minimize the risk of precipitating seizures, seizure exacerbation or status epilepticus (5.5)

**ADVERSE REACTIONS**

Most common adverse reactions ( $\geq 10\%$  and greater than placebo) were headache, dizziness, fatigue, somnolence and nausea (6.1)

To report SUSPECTED ADVERSE REACTIONS, contact Lupin Pharmaceuticals, Inc. at 1-800-399-2561 or FDA at 1-800-FDA-1088 or [www.fda.gov/medwatch](http://www.fda.gov/medwatch).

**DRUG INTERACTIONS**

- Patients on valproate should begin at a rufinamide dose lower than 10 mg/kg per day (pediatric patients) or 400 mg per day (adults) (7.2)
- Hormonal contraceptives may be less effective with rufinamide; use additional non-hormonal forms of contraception (7.3)

**USE IN SPECIFIC POPULATIONS**

- Pregnancy: Based on animal data, may cause fetal harm. (8.1)
- Renal impairment: Consider adjusting the rufinamide dose for the loss of drug upon dialysis (8.6)
- Not recommended in patients with severe hepatic impairment (8.7)

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Revised: 08/2024

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**FULL PRESCRIBING INFORMATION****1 INDICATIONS AND USAGE**

Rufinamide tablets USP are indicated for adjunctive treatment of seizures associated with Lennox-Gastaut Syndrome in pediatric patients 1 year of age and older and in adults.

**2 DOSAGE AND ADMINISTRATION****2.1 Dosage Information****Pediatric patients (1 year to less than 17 years)**

The recommended starting daily dose of rufinamide tablets in pediatric patients with Lennox-Gastaut Syndrome is approximately 10 mg/kg administered in two equally divided doses. The dose should be increased by approximately 10 mg/kg increments every other day until a maximum daily dose of 45 mg/kg, not to exceed 3,200 mg, administered in two equally divided doses, is reached. It is not known whether doses lower than the target doses are effective.

**Adults (17 years and older)**

The recommended starting daily dose of rufinamide tablets in adults with Lennox-Gastaut Syndrome is 400 mg to 800 mg per day administered in two equally divided doses. The dose should be increased by 400 mg to 800 mg every other day until a maximum daily dose of 3,200 mg, administered in two equally divided doses, is reached. It is not known whether doses lower than 3,200 mg are effective.

**2.2 Administration Information**

Administer rufinamide tablets with food. Rufinamide film-coated tablets can be administered whole, as half tablets or crushed.

**2.3 Dosing in Patients Undergoing Hemodialysis**

Hemodialysis may reduce exposure to a limited (about 30%) extent. Accordingly, adjusting the rufinamide tablets dose during the dialysis process should be considered [see CLINICAL PHARMACOLOGY (12.3)].

**2.4 Dosing in Patients with Hepatic Disease**

Use of rufinamide tablets in patients with hepatic impairment has not been studied. Therefore, use in patients with severe hepatic impairment is not recommended. Caution should be exercised in treating patients with mild to moderate hepatic impairment [see USE IN SPECIFIC POPULATION (8.7)].

**2.5 Dosing in Patients Taking Valproate**

Patients taking valproate should begin rufinamide tablets at a dose lower than 10 mg/kg per day in pediatric patients or 400 mg per day in adults [see DRUG INTERACTIONS (7.2)].

**3 DOSAGE FORMS AND STRENGTHS****Functional scoring.**

**100 mg Strength:** Pink, oblong shaped, film-coated, with a score on both sides, and debossed with 'L', 'U' on each side of the score on one side and 'P', '71' on each side of the score on the other side.

**200 mg Strength:** Pink, oblong shaped, film-coated, with a score on both sides, and debossed with 'L', 'U' on each side of the score on one side and 'P', '72' on each side of the score on the other side.

**400 mg Strength:** Pink, oblong shaped, film-coated, with a score on both sides, and debossed with 'L', 'U' on each side of the score on one side and 'P', '73' on each side of the score on the other side.

**4 CONTRAINDICATIONS**

Rufinamide tablets are contraindicated in patients with Familial Short QT syndrome [see WARNINGS AND PRECAUTIONS (5.3)].

**5 WARNINGS AND PRECAUTIONS****5.1 Suicidal Behavior and Ideation**

Antiepileptic drugs (AEDs), including rufinamide, increase the risk of suicidal thoughts or behavior in patients taking these drugs for any indication. Patients treated with any AED for any indication should be monitored for the emergence or worsening of depression, suicidal thoughts or behavior, and/or any unusual changes in mood or behavior.

Pooled analyses of 199 placebo-controlled clinical trials (mono- and adjunctive therapy) of 11 different AEDs showed that patients randomized to one of the AEDs had approximately twice the risk (adjusted Relative Risk 1.8, 95% CI:1.2, 2.7) of suicidal thinking or behavior compared to patients randomized to placebo. In these trials, which had a median treatment duration of 12 weeks, the estimated incidence rate of suicidal behavior or ideation among 27,863 AED-treated patients was 0.43%, compared to 0.24% among 16,029 placebo-treated patients, representing an increase of approximately one case of suicidal thinking or behavior for every 530 patients treated. There were four suicides in drug-treated patients in the trials and none in placebo-treated patients, but the number is too small to allow any conclusion about drug effect on suicide.

The increased risk of suicidal thoughts or behavior with AEDs was observed as early as 1 week after starting drug treatment with AEDs and persisted for the duration of treatment assessed. Because most trials included in the analysis did not extend beyond 24 weeks, the risk of suicidal thoughts or behavior beyond 24 weeks could not be assessed.

The risk of suicidal thoughts or behavior was generally consistent among drugs in the data analyzed. The finding of increased risk with AEDs of varying mechanisms of action and across a range of indications suggests that the risk applies to all AEDs used for any indication. The risk did not vary substantially by age (5 to 100 years) in the clinical trials analyzed. Table 1 shows absolute and relative risk by indication for all evaluated AEDs.

Table 1: Absolute and Relative Risk of Suicidal Behavior and Ideation

Indication	Placebo Patients with Events Per 1000 Patients	Drug Patients with Events Per 1000 Patients	Relative Risk: Incidence of Events in Drug Patients/ Incidence in Placebo Patients	Risk Difference: Additional Drug Patients with Events Per 1000 Patients
Epilepsy	1	3.4	3.5	2.4
Psychiatric	5.7	8.5	1.5	2.9
Other	1	1.8	1.9	0.9
Total	2.4	4.3	1.8	1.9

The relative risk for suicidal thoughts or behavior was higher in clinical trials for epilepsy than in clinical trials for psychiatric or other conditions, but the absolute risk differences were similar for the epilepsy and psychiatric indications.

Anyone considering prescribing rufinamide tablets or any other AED must balance the risk of suicidal thoughts or behavior with the risk of untreated illness. Epilepsy and many other illnesses for which AEDs are prescribed are themselves associated with morbidity and mortality and an increased risk of suicidal thoughts and behavior. Should suicidal thoughts and behavior emerge during treatment, consider whether the emergence of these symptoms in any given patient may be related to the illness being treated.

**5.2 Central Nervous System Reactions**

Use of rufinamide has been associated with central nervous system-related adverse reactions in the controlled clinical trial of patients 4 years or older with Lennox-Gastaut Syndrome. The most significant of these can be classified into two general categories: 1) somnolence or fatigue and 2) coordination abnormalities, dizziness, gait disturbances and ataxia.

Somnolence was reported in 24% of rufinamide-treated patients compared to 13% of patients on placebo and led to study discontinuation in 3% of rufinamide-treated patients compared to 0% of patients on placebo. Fatigue was reported in 10% of rufinamide-treated patients compared to 8% of patients on placebo patients. It led to study discontinuation in 1% of rufinamide-treated patients and 0% of patients on placebo patients.

Dizziness was reported in 2.7% of rufinamide-treated patients compared to 0% of patients on placebo and did not lead to study discontinuation.

Ataxia and gait disturbance were reported in 5.4% and 1.4% of rufinamide-treated patients, respectively, compared to no patient on placebo. None of these reactions led to study discontinuation.

Accordingly, patients should be advised not to drive or operate machinery until they have gained sufficient experience on rufinamide to gauge whether it adversely affects their ability to drive or operate machinery.

**5.3 QT Shortening**

Formal cardiac ECG studies demonstrated shortening of the QT interval (mean = 20 msec, for doses  $\geq 2400$  mg twice daily) with rufinamide. In a placebo-controlled study of the QT interval, a higher percentage of rufinamide-treated subjects (46% at 2400 mg, 46% at 3200 mg, and 65% at 4800 mg) had a QT shortening of greater than 20 msec at  $T_{max}$  compared to placebo (5 to 10%).

Reductions of the QT interval below 300 msec were not observed in the formal QT studies with doses up to 7200 mg per day. Moreover, there was no signal for drug-induced sudden death or ventricular arrhythmias.

The degree of QT shortening induced by rufinamide is without any known clinical risk. Familial Short QT syndrome is associated with an increased risk of sudden death and ventricular arrhythmias, particularly ventricular fibrillation. Such events in this syndrome are believed to occur primarily when the corrected QT

interval falls below 300 msec. Non-clinical data also indicate that QT shortening is associated with ventricular fibrillation.

Patients with Familial Short QT syndrome should not be treated with rufinamide. Caution should be used when administering rufinamide with other drugs that shorten the QT interval [see CONTRAINDICATIONS (4)].

**5.4 Multi-organ Hypersensitivity/Drug Reaction with Eosinophilia and Systemic Symptoms (DRESS)**

Drug Reaction with Eosinophilia and Systemic Symptoms (DRESS), also known as multi-organ hypersensitivity, has been reported in patients taking antiepileptic drugs, including rufinamide. DRESS may be fatal or life-threatening. DRESS typically, although not exclusively, presents with fever, rash, and/or lymphadenopathy, and/or facial swelling, in association with other organ system involvement, such as hepatitis, nephritis, hematological abnormalities, myocarditis, or myositis. Sometimes resembling an acute viral infection. Eosinophilia is often present. It is important to note that early manifestations of hypersensitivity, such as fever or lymphadenopathy, may be present even though rash is not evident. Because this disorder is variable in its expression, other organ systems not noted here may be involved.

All cases of DRESS identified in clinical trials with rufinamide occurred in pediatric patients less than 12 years of age, occurred within 4 weeks of treatment initiation, and resolved or improved with rufinamide discontinuation. DRESS has also been reported in adult and pediatric patients taking rufinamide in the postmarketing setting.

If DRESS is suspected, the patient should be evaluated immediately, rufinamide should be discontinued, and alternative treatment should be started.

**5.5 Withdrawal of AEDs**

As with all antiepileptic drugs, rufinamide should be withdrawn gradually to minimize the risk of precipitating seizures, seizure exacerbation or status epilepticus. If abrupt discontinuation of the drug is medically necessary, the transition to another AED should be made under close medical supervision. In clinical trials, rufinamide discontinuation was achieved by reducing the dose by approximately 25% every two days.

**5.6 Status Epilepticus**

Estimates of the incidence of treatment emergent status epilepticus among patients treated with rufinamide are difficult because standard definitions were not employed. In a controlled Lennox-Gastaut Syndrome trial, 3 of 74 (4.1%) rufinamide-treated patients had episodes that could be described as status epilepticus in the rufinamide-treated patients compared with none of the 64 patients in the placebo-treated patients. In all controlled trials that included patients with different epilepsies, 11 of 1240 (0.9%) rufinamide-treated patients had episodes that could be described as status epilepticus compared with none of 635 patients in the placebo-treated patients.

**5.7 Leukopenia**

Rufinamide has been shown to reduce white cell count. Leukopenia (white cell count  $< 3 \times 10^9/L$ ) was more commonly observed in rufinamide-treated patients 43 of 1171 (3.7%) than placebo-treated patients, 7 of 579 (1.2%) in all controlled trials.

**6 ADVERSE REACTIONS**

The following serious adverse reactions are described below and elsewhere in the labeling:

- Suicidal Behavior and Ideation [see WARNINGS AND PRECAUTIONS (5.1)]
- Central Nervous System Reactions [see WARNINGS AND PRECAUTIONS (5.2)]
- QT Shortening, see WARNINGS AND PRECAUTIONS (5.3)]
- Multi-Organ Hypersensitivity/ Drug Reaction with Eosinophilia and Systemic Symptoms (DRESS) [see WARNINGS AND PRECAUTIONS (5.4)]
- Leukopenia [see WARNINGS AND PRECAUTIONS (5.7)]

**6.1 Clinical Trials Experience**

Because clinical trials are conducted under widely varying conditions, adverse reaction rates observed in the clinical trials of a drug cannot be directly compared to rates in the clinical trials of another drug and may not reflect the rates observed in practice.

**Adverse Reactions in Adult and Pediatric Patients ages 3 to 17 years of age**

In the pooled, double-blind, adjunctive therapy studies in adult and pediatric patients ages 3 to 17 years of age, the most common ( $\geq 10\%$ ) adverse reactions in rufinamide-treated patients, in all doses studied (200 to 3200 mg per day) with a higher frequency than in patients on placebo were: headache, dizziness, fatigue, somnolence and nausea.

Table 2 lists adverse reactions that occurred in at least 3% of pediatric patients (ages 3 to less than 17 years) with epilepsy treated with rufinamide in controlled adjunctive studies and were numerically more common in patients treated with rufinamide than in patients on placebo.

At the target dose of 45 mg/kg per day for adjunctive therapy in pediatric patients (ages 3 to less than 17 years), the most common ( $\geq 3\%$ ) adverse reactions with an incidence greater than in placebo for rufinamide were somnolence, vomiting, and headache.

Table 2: Adverse Reactions in Pediatric Patients (Ages 3 to less than 17 years) in Pooled Double-Blind Adjunctive Trials

Adverse Reaction	Rufinamide Tablets (N=187) %	Placebo (N=182) %
Somnolence	17	9
Vomiting	17	7
Headache	16	8
Fatigue	9	8
Dizziness	8	6
Nausea	7	3
Influenza	5	4
Nasopharyngitis	5	3
Decreased Appetite	5	2
Rash	4	2
Ataxia	4	1
Diplopia	4	1
Bronchitis	3	2
Sinusitis	3	2
Psychomotor Hyperactivity	3	1
Upper Abdominal Pain	3	2
Aggression	3	2
Ear Infection	3	1
Disturbance in Attention	3	1
Pruritis	3	0

Table 3 lists adverse reactions that occurred in at least 3% of adult patients with epilepsy treated with rufinamide (up to 3200 mg per day) in adjunctive controlled studies and were numerically more common in patients treated with rufinamide than in patients on placebo. In these studies, either rufinamide or placebo was added to the current AED therapy.

All at doses studied of up to 3200 mg per day given as adjunctive therapy in adults, the most common ( $\geq 3\%$ ) adverse reactions, and with the greatest increase in incidence compared to placebo, for rufinamide were dizziness, fatigue, nausea, diplopia, vision blurred, and ataxia.

Table 3: Adverse Reactions in Adults in Pooled Double-Blind Adjunctive Trials

Adverse Reaction	Rufinamide Tablets (N=823) %	Placebo (N=376) %
Headache	27	26
Dizziness	19	12
Fatigue	16	10
Nausea	12	9
Somnolence	11	9
Diplopia	9	3
Tremor	6	5
Nystagmus	6	5
Blurred Vision	6	2

Adverse Reaction	Rufinamide Tablets (N=187) %	Placebo (N=182) %
Vomiting	5	4
Ataxia	4	0
Upper Abdominal Pain	3	2
Anxiety	3	2
Constipation	3	2
Dyspepsia	3	2
Back Pain	3	1
Gait Disturbance	3	1
Vertigo	3	1

**Discontinuation in Controlled Clinical Studies**

In controlled, double-blind, adjunctive clinical studies, 9% of pediatric and adult patients receiving rufinamide as adjunctive therapy and 4% receiving placebo discontinued as a result of an adverse reaction. The adverse reactions most commonly leading to discontinuation of rufinamide ( $>1\%$ ) used as adjunctive therapy were generally similar in adults and pediatric patients.

In pediatric patients (ages 4 to less than 17 years) double-blind adjunctive clinical studies, 8% of patients receiving rufinamide as adjunctive therapy (at the recommended dose of 45 mg/kg per day) and 2% receiving placebo discontinued as a result of an adverse reaction. The adverse reactions most commonly leading to discontinuation of rufinamide ( $>1\%$ ) used as adjunctive therapy are presented in Table 4.

Table 4: Most Common Adverse Reactions Leading to Discontinuation in Pediatric Patients (Ages 4 to less than 17 years) in Pooled Double-Blind Adjunctive Trials

Adverse Reaction	Rufinamide Tablets (N=823) %	Placebo (N=376) %
Convulsion	2	1
Rash	2	1
Fatigue	2	0
Vomiting	1	0

In adult double-blind adjunctive clinical studies, 10% of patients receiving rufinamide as adjunctive therapy (at doses up to 3200 mg per day) and 6% receiving placebo discontinued as a result of an adverse reaction. The adverse reactions most commonly leading to discontinuation of rufinamide ( $>1\%$ ) used as adjunctive therapy are presented in Table 5.

Table 5: Most Common Adverse Reactions Leading to Discontinuation in Adult Patients in Pooled Double-Blind Adjunctive Trials

Adverse Reaction	Rufinamide Tablets (N=823) %	Placebo (N=376) %
Dizziness	3	1
Fatigue	2	1
Headache	2	1
Nausea	1	0
Ataxia	1	0

**Pediatric Patients ages 1 to less than 4 years**

In a multicenter, parallel group, open-label study comparing rufinamide (45 mg/kg per day) adjunctive treatment (n=25) to the adjunctive treatment with an AED of the investigator's choice (n=11) in pediatric patients (1 year to less than 4 years of age) with inadequately controlled Lennox-Gastaut Syndrome, the adverse reaction profile was generally similar to that observed in adults and pediatric patients 4 years of age and older treated with rufinamide. Adverse reactions that occurred in at least 2 (8%) rufinamide-treated patients and with a higher frequency than in the AED comparator group were: vomiting (24%), somnolence (15%), bronchitis (12%), constipation (12%), cough (12%), decreased appetite (12%), rash (12%), otitis media (8%), pneumonia (8%), decreased weight (8%), gastroenteritis (8%), nasal congestion (8%) and pneumonia aspiration (8%).

**Other Adverse Reactions Observed During Clinical Trials**

Rufinamide has been administered to 1978 individuals during all epilepsy clinical trials (placebo-controlled and open-label). Adverse reactions occurring during these studies were recorded by the investigators using terminology of their own records. To provide a meaningful estimate of the proportion of patients having adverse reactions, these events were grouped into standardized categories using the MedDRA dictionary. Adverse events occurring at least three times and considered possibly related to treatment are included in the System Organ Class listings below. Terms not included in the listings are those already included in the tables above, those too general to be informative, those related to procedures and terms describing events common in the population. Some events occurring fewer than 3 times are also included based on their medical significance. Because the reports include events observed in open-label, uncontrolled observations, the role of rufinamide in their causation cannot be reliably determined.

Events are classified by body system and listed in order of decreasing frequency as follows: frequent adverse events—those occurring in at least 1/100 patients; infrequent adverse events—those occurring in 1/100 to 1/1000 patients; rare—those occurring in fewer than 1/1000 patients.

Blood and Lymphatic System Disorders: Frequent: anemia. Infrequent: lymphadenopathy, leukopenia, neut

<sup>a</sup> Phenobarbital, primidone and phenytoin were treated as a single covariate (phenobarbital-type inducers) to examine the effect of these agents on rufinamide clearance.

<sup>a</sup> All compounds of the benzodiazepine class were pooled to examine for 'class effect' on rufinamide clearance.

#### Phenytoin

The decrease in clearance of phenytoin estimated at typical levels of rufinamide ( $C_{10} = 15$  mcg/mL) is predicted to increase plasma levels of phenytoin by 7 to 21%. As phenytoin is known to have non-linear pharmacokinetics (clearance becomes saturated at higher doses), it is possible that exposure will be greater than the model prediction.

#### 7.2 Effects of Other AEDs on Rufinamide Tablets

Potent cytochrome P450 enzyme inducers, such as carbamazepine, phenytoin, primidone, and phenobarbital, appear to increase the clearance of rufinamide (see Table 6). Given that the majority of clearance of rufinamide is via a non-CYP-dependent route, the observed decreases in blood levels seen with carbamazepine, phenytoin, phenobarbital, and primidone are unlikely to be entirely attributable to induction of a P450 enzyme. Other factors explaining this interaction are not understood. Any effects, where they occurred, were likely to be more marked in the pediatric population.

#### Valproate

Patients stabilized on rufinamide before being prescribed valproate should begin valproate therapy at a low dose, and titrate to a clinically effective dose. Similarly, patients on valproate should begin at a rufinamide dose lower than 10 mg/kg per day (pediatric patients) or 400 mg per day (adults) [see *DOSE AND ADMINISTRATION (2.5), CLINICAL PHARMACOLOGY (12.3)*].

#### 7.3 Effects of Rufinamide Tablets on Hormonal Contraceptives

Female patients of childbearing age should be warned that the concurrent use of rufinamide with hormonal contraceptives may render this method of contraception less effective. Additional non-hormonal forms of contraception are recommended when using rufinamide [see *USE IN SPECIFIC POPULATIONS (8.3), CLINICAL PHARMACOLOGY (12.3)* and *PATIENT COUNSELING INFORMATION (1.7)*].

#### 8 USE IN SPECIFIC POPULATIONS

##### 8.1 Pregnancy

###### Pregnancy Exposure Registry

There is a pregnancy exposure registry that monitors pregnancy outcomes in women exposed to AEDs, such as rufinamide, during pregnancy. Encourage women who are taking rufinamide during pregnancy to enroll in the North American Antiepileptic Drug (NAAED) Pregnancy Registry by calling 1-888-233-2334 or visiting <http://www.aedpregnancyregistry.org>.

##### Risk Summary

There are no adequate data on the developmental risks associated with use of rufinamide in pregnant women. In animal reproduction studies, oral administration of rufinamide resulted in developmental toxicity in pregnant rats and rabbits at clinically relevant doses [see *Data*].

In the U.S. general population, the estimated background risk of major birth defects and miscarriage in clinically recognized pregnancies is 2 to 4% and 15 to 20%, respectively. The background risk of major birth defects and miscarriage for the indicated population is unknown.

##### Data

###### Animal Data:

Oral administration of rufinamide (0, 20, 100 or 300 mg/kg/day) to pregnant rats throughout organogenesis resulted in decreased fetal weight and increased incidence of fetal skeletal abnormalities at 100 and 300 mg/kg/day, which were associated with maternal toxicity. The maternal plasma exposure (AUC) at the no-adverse effect dose (20 mg/kg/day) for developmental toxicity was less than that in humans at the maximum recommended human dose (MRHD) of 3,200 mg/day.

Oral administration of rufinamide (0, 30, 200 or 1,000 mg/kg/day) to pregnant rabbits throughout organogenesis resulted in embryofetal death, decreased fetal body weight and increased incidence of fetal visceral and skeletal abnormalities at doses of 200 and 1,000 mg/kg/day. The high dose (1,000 mg/kg/day) was associated with abortion. Plasma exposure (AUC) at the no-adverse effect dose (30 mg/kg/day) was less than that in humans at the MRHD.

When rufinamide was orally administered (0, 5, 30 or 150 mg/kg/day) to pregnant rats throughout pregnancy and lactation, decreased offspring growth and survival were observed at all doses tested. A no-effect dose for adverse effects on pre- and postnatal development was not established. At the lowest dose tested (5 mg/kg/day), plasma exposure (AUC) was less than that in humans at the MRHD.

#### 8.2 Lactation

##### Risk Summary

There are no data on the presence of rufinamide in human milk, the effects on the breastfed infant or the effects of the drug on milk production.

The developmental and health benefits of breastfeeding should be considered along with the mother's clinical need for rufinamide and any potential adverse effects on the breastfed infant from rufinamide or from the underlying maternal condition.

#### 8.3 Females and Males of Reproductive Potential

##### Contraception

Use of rufinamide may reduce the effectiveness of hormonal contraceptives containing ethinyl estradiol or norethindrone. Advise women of reproductive potential taking rufinamide who are using a contraceptive containing ethinyl estradiol and norethindrone to use an additional non-hormonal form of contraception [see *DRUG INTERACTIONS (7.3)* and *CLINICAL PHARMACOLOGY (12.3)*].

##### Infertility

The effect of rufinamide on fertility in humans has not been established. Oral administration of rufinamide (20, 60, 200 and 600 mg/kg/day) to male and female rats prior to mating, during mating and during early gestation (females only) resulted in the impairment of fertility at all dose levels tested. The no-effect dose was not established. The plasma exposure level at 20 mg/kg was approximately 0.2 times the human plasma AUC at the MRHD [see *NONCLINICAL TOXICOLOGY (13.1)*].

#### 8.4 Pediatric Use

Safety and effectiveness have been established in pediatric patients 1 to 17 years of age. The effectiveness of rufinamide in pediatric patients 4 years of age and older was based upon an adequate and well-controlled trial of rufinamide that included both adults and pediatric patients, 4 years of age and older, with Lennox-Gastaut Syndrome. The effectiveness in patients 1 to less than 4 years was based upon a bridging pharmacokinetic and safety study [see *DOSE AND ADMINISTRATION (2.1), ADVERSE REACTIONS (6.1)* and *CLINICAL STUDIES (14)*]. The pharmacokinetics of rufinamide in the pediatric patients, ages 1 to less than 4 years of age is similar to children older than 4 years of age and adults [see *CLINICAL PHARMACOLOGY (12.3)*].

Safety and effectiveness in pediatric patients below the age of 1 year has not been established.

Oral administration of rufinamide (0, 15, 50 or 150 mg/kg) to young rats for 10 weeks starting on postnatal day 7 resulted in decreased brain weights at the mid and high doses and neurobehavioral impairment (learning and memory deficit, altered startle response, decreased locomotor activity) and decreased growth (decreased body weight) at the highest dose tested. The no-effect dose for adverse effects on postnatal development in rats (15 mg/kg) was associated with a plasma exposure (AUC) lower than that in humans at the maximum recommended human dose (MRHD) of 3200 mg/day.

#### 8.5 Geriatric Use

Clinical studies of rufinamide did not include sufficient numbers of subjects aged 65 and over to determine whether they respond differently from younger subjects. In general, dose selection for an elderly patient should be cautious, usually starting at the low end of the dosing range, reflecting the greater frequency of decreased hepatic, renal or cardiac function and/or concomitant disease or other drug therapy.

Pharmacokinetics of rufinamide in the elderly are similar to that in the young subjects [see *CLINICAL PHARMACOLOGY (12.3)*].

#### 8.6 Renal Impairment

Rufinamide pharmacokinetics in patients with severe renal impairment (creatinine clearance <30 mL/min) was similar to that of healthy subjects. Dose adjustment in patients undergoing dialysis should be considered [see *CLINICAL PHARMACOLOGY (12.3)*].

#### 8.7 Hepatic Impairment

Use of rufinamide in patients with severe hepatic impairment (Child-Pugh score 10 to 15) is not recommended. Caution should be exercised in treating patients with mild (Child-Pugh score 5 to 6) to moderate (Child-Pugh score 7 to 9) hepatic impairment.

#### 10 OVERDOSAGE

Because strategies for the management of overdose are continually evolving, it is advisable to contact a Certified Poison Control Center to determine the latest recommendations for the management of an overdose of any drug.

One overdose of 7200 mg per day rufinamide was reported in an adult during the clinical trials. The overdose was associated with no major signs or symptoms, no medical intervention was required and the patient continued in the study at the target dose.

#### Treatment or Management of Overdose

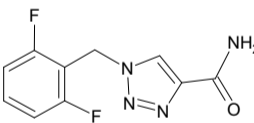
There is no specific antidote for overdose with rufinamide. If clinically indicated, elimination of unabsorbed drug should be attempted by induction of emesis or gastric lavage. Usual precautions should be observed to maintain the airway. General supportive care of the patient is indicated including monitoring of vital signs and observation of the clinical status of the patient.

#### Hemodialysis

Standard hemodialysis procedures may result in limited clearance of rufinamide. Although there is no experience to date in treating overdose with hemodialysis, the procedure may be considered when indicated by the patient's clinical state.

#### 11 DESCRIPTION

Rufinamide is a triazole derivative structurally unrelated to currently marketed antiepileptic drugs (AEDs). Rufinamide has the chemical name 1-[(2,6-difluorophenyl)methyl]-1H-1,2,3-triazole-4-carboxamide. It has an empirical formula of  $C_{12}H_8F_2N_4O$  and a molecular weight of 238.194. The drug substance is a white to off white color, crystalline, odorless and slightly bitter tasting neutral powder. Rufinamide is highly soluble in dimethylsulfoxide, tetrahydrofuran and in methanol, very slightly soluble in alcohol and in acetonitrile, practically insoluble in water.



Rufinamide tablet USP is available for oral administration in film-coated tablets, scored on both sides, containing 100 mg, 200 mg and 400 mg of rufinamide. Inactive ingredients are colloidal silicon dioxide, corn starch, croscarmellose sodium, hypromellose, iron oxide red, lactose monohydrate, magnesium stearate, polyethylene glycol, polyvinyl alcohol, sodium lauryl sulphate, talc, titanium dioxide.

USP Dissolution Test is Pending.

#### 12 CLINICAL PHARMACOLOGY

##### 12.1 Mechanism of Action

The precise mechanism(s) by which rufinamide exerts its antiepileptic effect is unknown.

The results of *in vitro* studies suggest that the principal mechanism of action of rufinamide is modulation of the activity of sodium channels and, in particular, prolongation of the inactive state of the channel. Rufinamide ( $\geq 1$  mM) significantly slowed sodium channel recovery from inactivation after a prolonged prepulse in cultured cortical neurons and limited sustained repetitive firing of sodium-dependent action potentials ( $EC_{50}$  of 3.6 mM).

##### 12.3 Pharmacokinetics

###### Overview

Rufinamide is well absorbed after oral administration. However, the rate of absorption is relatively slow and the extent of absorption is decreased as dose is increased. The pharmacokinetics does not change with multiple dosing. Most elimination of rufinamide is via metabolism, with the primary metabolite resulting from enzymatic hydrolysis of the carboxamide moiety to form the carboxylic acid. This metabolic route is not cytochrome P450 dependent. There are no known active metabolites. Plasma half-life of rufinamide is approximately 6 to 10 hours.

###### Absorption and Distribution

Following oral administration of rufinamide, peak plasma concentrations occur between 4 and 6 hours ( $T_{max}$ ) both under fed and fasted conditions. Rufinamide tablets display decreasing bioavailability with increasing dose after single and multiple dose administration. Based on urinary excretion, the extent of absorption was at least 85% following oral administration of a single dose of 600 mg rufinamide tablet under fed conditions.

Multiple dose pharmacokinetics can be predicted from single dose data for both rufinamide and its metabolite. Given the dosing frequency of every 12 hours and the half-life of 6 to 10 hours, the observed steady-state peak concentration of about two to three times the peak concentration after a single dose is expected.

Food increased the extent of absorption of rufinamide in healthy volunteers by 34% and increased peak exposure by 56% after a single dose of 400 mg tablet, although the  $T_{max}$  was not elevated [see *DOSE AND ADMINISTRATION (2.2)*].

Only a small fraction of rufinamide (34%) is bound to human serum proteins, predominantly to albumin (27%), giving little risk of displacement drug-drug interactions. Rufinamide was evenly distributed between erythrocytes and plasma. The apparent volume of distribution is dependent upon dose and varies with body surface area. The apparent volume of distribution was about 50L at 3200 mg per day.

#### Metabolism

Rufinamide is extensively metabolized but has no active metabolites. Following a radiolabeled dose of rufinamide, less than 2% of the dose was recovered unchanged in urine. The primary biotransformation pathway is carboxylesterase(s) mediated hydrolysis of the carboxamide group to the acid derivative CGP 47292. A few minor additional metabolites were detected in urine, which appeared to be acyl-glucuronides of CGP 47292. There is no involvement of oxidizing cytochrome P450 enzymes or glutathione in the biotransformation process.

Rufinamide is a weak inhibitor of CYP 2E1. It did not show significant inhibition of other CYP enzymes. Rufinamide is a weak inducer of CYP 3A4 enzymes.

Rufinamide did not show any significant inhibition of P-glycoprotein in an *in vitro* study.

#### Elimination/Excretion

Renal excretion is the predominant route of elimination for drug related material, accounting for 85% of the dose based on a radiolabeled study. Of the metabolites identified in urine, at least 66% of the rufinamide dose was excreted as the acid metabolite CGP 47292, with 2% of the dose excreted as rufinamide.

The plasma elimination half-life is approximately 6 to 10 hours in healthy subjects and patients with epilepsy.

#### Special Populations

##### Age:

- Pediatrics

Based on a population analysis which included a total of 115 patients, including 85 pediatric patients (24 patients ages 1 to 3 years, 40 patients ages 4 to 11 years and 21 patients ages 12 to 17 years), the pharmacokinetics of rufinamide was similar across all age groups.

- Elderly

The results of a study evaluating single-dose (400 mg) and multiple dose (800 mg per day for 6 days) pharmacokinetics of rufinamide in 8 healthy elderly subjects (65 to 80 years old) and 7 younger healthy subjects (18 to 45 years old) found no significant age-related differences in the pharmacokinetics of rufinamide.

##### Sex:

Population pharmacokinetic analyses of females show a 6 to 14% lower apparent clearance of rufinamide compared to males. This effect is not clinically important.

##### Race:

In a population pharmacokinetic analysis of clinical studies, no difference in clearance or volume of distribution of rufinamide was observed between the black and Caucasian subjects, after controlling for body size. Information on other races could not be obtained because of smaller numbers of these subjects.

##### Renal Impairment:

Rufinamide pharmacokinetics in 9 patients with severe renal impairment (creatinine clearance < 30 mL per min) was similar to that of healthy subjects. Patients undergoing dialysis 3 hours post rufinamide dosing showed a reduction in AUC and  $C_{10}$  by 29% and 16%, respectively.

##### Drug Interactions

Based on *in vitro* studies, rufinamide shows little or no inhibition of most cytochrome P450 enzymes at clinically relevant concentrations, with weak inhibition of CYP 2E1. Drugs that are substrates of CYP 2E1 (e.g., chlorzoxazone) may have increased plasma levels in the presence of rufinamide, but this has not been studied.

Based on a population pharmacokinetic analysis, rufinamide clearance was decreased by valproate. In pediatric patients, valproate administration may lead to elevated levels of rufinamide by up to 70% [see *DRUG INTERACTIONS (7.2)*].

Based on *in vivo* drug interaction studies with triazolam and oral contraceptives, rufinamide is a weak inducer of the CYP 3A4 enzyme and can decrease exposure of drugs that are substrates of CYP 3A4.

- Co-administration and pre-treatment of rufinamide (400 mg twice daily) and triazolam resulted in a 37% decrease in AUC and a 23% decrease in  $C_{10}$  of triazolam, a CYP 3A4 substrate
- Co-administration of rufinamide (800 mg twice daily for 14 days) and Ortho-Novum 1/35<sup>®</sup> resulted in a mean decrease in the ethinyl estradiol  $AUC_{0-24}$  of 22% and  $C_{10}$  by 31% and norethindrone  $AUC_{0-24}$  by 14% and  $C_{10}$  by 18%, respectively. The clinical significance of this decrease is unknown [see *DRUG INTERACTIONS (7.3)* and *USE IN SPECIFIC POPULATIONS (8.3)*].

Rufinamide is metabolized by carboxylesterases. Drugs that may induce the activity of carboxylesterases may increase the clearance of rufinamide. Broad-spectrum inducers such as carbamazepine and phenobarbital may have minor effects on rufinamide metabolism via this mechanism. Drugs that are inhibitors of carboxylesterases may decrease metabolism of rufinamide.

#### 13 NONCLINICAL TOXICOLOGY

##### 13.1 Carcinogenesis, Mutagenesis, Impairment of Fertility

###### Carcinogenesis

Rufinamide was given in the diet to mice at 40, 120 and 400 mg/kg per day and to rats at 20, 60 and 200 mg/kg per day for 2 years. The doses in mice were associated with plasma AUCs 0.1 to 1 times the human plasma AUC at the maximum recommended human dose (MRHD, 3200 mg/day). Increased incidences of tumors (benign bone tumors (osteomas) and/or hepatocellular adenomas and carcinomas) were observed in mice at all doses. Increased incidences of thyroid follicular adenomas were observed in rats at all but the low dose; the low dose is <0.1 times the MRHD on a mg/m<sup>2</sup> basis.

###### Mutagenesis

Rufinamide was not mutagenic in the *in vitro* bacterial reverse mutation (Ames) assay or the *in vitro* mammalian cell point mutation assay. Rufinamide was not clastogenic in the *in vitro* mammalian cell chromosomal aberration assay or the *in vivo* rat bone marrow micronucleus assay.

###### Impairment of Fertility

Oral administration of rufinamide (doses of 20, 60, 200, and 600 mg/kg per day) to male and female rats prior to mating, and throughout mating and continuing in females up to day 6 of gestation resulted in impairment of fertility (decreased conception rates and mating and fertility indices; decreased numbers of corpora lutea, implantations and live embryos; increased preimplantation loss; decreased sperm count and motility) at all doses tested. Therefore, a no-effect dose was not established. The lowest dose tested was associated with a plasma AUC  $\geq 0.2$  times the human plasma AUC at the MRHD.

#### 14 CLINICAL STUDIES

##### Adult and Pediatric Patients ages 4 years and older

The effectiveness of rufinamide as adjunctive treatment for the seizures associated with Lennox-Gastaut Syndrome (LGS) in adult and pediatric patients ages 4 years and older was established in a single multi-center, double-blind, placebo-controlled, randomized, parallel-group study (N=138). Male and female patients (between 4 and 30 years of age) were included if they had a diagnosis of inadequately controlled seizures associated with LGS (including both atypical absence seizures and drop attacks) and were being treated with 1 to 3 concomitant stable dose AEDs. Each patient must have had at least 90 seizures in the month prior to study entry. After completing a 4-week Baseline Phase on stable therapy, patients were randomized to have rufinamide or placebo added to their ongoing therapy during the 12-week Double-blind Phase. The Double-blind Phase consisted of 2 periods; the Titration Period (1 to 2 weeks) and the Maintenance Period (10 weeks). During the Titration Period, the dose was increased to a target dosage of approximately 45 mg/kg per day (3200 mg in adults of  $\geq 70$  kg), given on a twice daily schedule. Dosage reductions were permitted during titration if problems in tolerability were encountered. Final doses at titration were to remain stable during the maintenance period. Target dosage was achieved in 88% of the rufinamide-treated patients. The majority of these patients reached the target dose within 7 days, with the remaining patients achieving the target dose within 14 days.

The primary efficacy variables were:

- The percent change in total seizure frequency per 28 days;
- The percent change in tonic-clonic (drop attacks) seizure frequency per 28 days;
- Seizure severity from the Parent/Guardian Global Evaluation of the patient's condition. This was a 7-point assessment performed at the end of the Double-blind Phase. A score of +3 indicated that the patient's seizure severity was very much improved, a score of 0 that the seizure severity was unchanged, and a score of -3 that the seizure severity was very much worse.

The results of the three primary endpoints are shown in Table 7 below.

**Table 7: Lennox-Gastaut Syndrome Trial Seizure Frequency Primary Efficacy Variable Results**

Variable	Placebo	Rufinamide
Median percent change in total seizure frequency per 28 days	-11.7	-32.7 (p=0.0015)
Median percent change in tonic-clonic seizure frequency per 28 days	1.4	-42.5 (p<0.0001)
Improvement in Seizure Severity Rating from Global Evaluation	30.6	53.4 (p=0.0041)

##### Pediatric Patients ages 1 to less than 4 years

The effectiveness of rufinamide as adjunctive treatment for the seizures associated with Lennox-Gastaut Syndrome in pediatric patients ages 1 year to less than 4 years was established based on a single multi-center, open-label, active-controlled, randomized, pharmacokinetic bridging study. The pharmacokinetic profile of rufinamide is not significantly affected by age either as a continuous covariate (1 to 35 years) or as a categorical covariate (age categories: 1 to less than 4 years and 4 years of age and older), after body weight is taken into consideration.

#### 16 HOW SUPPLIED/STORAGE AND HANDLING

##### 16.1 How Supplied

###### Functional scoring

Rufinamide tablets USP, 100 mg (containing 100 mg rufinamide) are pink, oblong shaped, film-coated, with a score on both sides, and debossed with 'L', 'U' on each side of the score on one side and 'P', '71' on each side of the score on the other side. They are available in bottles of 30 tablets (NDC 68180-802-06) and 120 tablets (NDC 68180-802-16).

Rufinamide tablets USP, 200 mg (containing 200 mg rufinamide) are pink, oblong shaped, film-coated, with a score on both sides, and debossed with 'L', 'U' on each side of the score on one side and 'P', '72' on each side of the score on the other side. They are available in bottles of 30 tablets (NDC 68180-803-06) and 120 tablets (NDC 68180-803-16).

Rufinamide tablets USP, 400 mg (containing 400 mg rufinamide) are pink, oblong shaped, film-coated, with a score on both sides, and debossed with 'L', 'U' on each side of the score on one side and 'P', '73' on each side of the score on the other side. They are available in bottles of 120 tablets (NDC 68180-804-16).

##### 16.2 Storage and Handling

Store at 25°C (77°F); excursions permitted to 15 to 30°C (59 to 86°F) [see USP Controlled Room Temperature].

Protect from moisture.

Replace cap securely after opening.

#### 17 PATIENT COUNSELING INFORMATION

Advise the patient to read the FDA-approved patient labeling (Medication Guide and Instructions for Use).

##### Administration Information

- Advise patients to take rufinamide tablets with food [see *DOSE AND ADMINISTRATION (2.2)*].

##### Suicidal Thinking and Behavior

Inform patients, their caregivers, and families that antiepileptic drugs increase the risk of suicidal thoughts and behavior and should be advised of the need to be alert for the emergence or worsening of the signs and symptoms of depression, any unusual changes in mood or behavior, or the emergence of suicidal thoughts, behavior, or thoughts about self-harm. Behaviors of concern should be reported immediately to healthcare providers [see *WARNINGS AND PRECAUTIONS (5.1)*].

##### Central Nervous System Reactions

Inform patients about the potential for somnolence or dizziness and advise them not to drive or operate machinery until they have gained sufficient experience on rufinamide tablets to gauge whether it adversely affects their mental and/or motor performance [see *WARNINGS AND PRECAUTIONS (5.2)*].

##### Multi-Organ Hypersensitivity Reactions

Advise patients to notify their physician if they experience a rash associated with fever [see *WARNINGS AND PRECAUTIONS (5.4)*].

##### Drug Interactions

- Inform female patients of childbearing age that the concurrent use of rufinamide tablets with hormonal contraceptives may render this method of contraception less effective. Recommend patients use additional non-hormonal forms of contraception when using rufinamide tablets [see *DRUG INTERACTIONS (7.3)* and *USE IN SPECIFIC POPULATIONS (8.3)*].
- Inform patients that alcohol in combination with rufinamide tablets may cause additive central nervous system effects.

##### Pregnancy

Advise patients to notify their physician if they become pregnant or intend to become pregnant during therapy. Encourage patients to enroll in the North American Antiepileptic Drug Pregnancy Registry if they become pregnant. To enroll, patients can call the toll free number 1-888-233-2334 [see *USE IN SPECIFIC POPULATIONS (8.1)*].

##### Breast-feeding

Advise patients to notify their physician if they are breast-feeding or intend to breast-feed [see *USE IN SPECIFIC POPULATIONS (8.2)*].

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