

## HIGHLIGHTS OF PRESCRIBING INFORMATION

These highlights do not include all the information needed to use ALOXI safely and effectively. See full prescribing information for ALOXI.

**ALOXI® (palonosetron HCl) injection for Intravenous Use**  
**Initial U.S. Approval: 2003**

### RECENT MAJOR CHANGES

Indications and Usage, Postoperative Nausea and Vomiting (1.2)	02/2008
Dosage and Administration, Recommended Dosing (2.1)	02/2008
Warnings and Precautions, QTc Intervals (5.2) - Deletion	02/2008

### INDICATIONS AND USAGE

ALOXI is a serotonin subtype 3 (5-HT<sub>3</sub>) receptor antagonist indicated for:

- Moderately emetogenic cancer chemotherapy – prevention of acute and delayed nausea and vomiting associated with initial and repeat courses (1.1)
- Highly emetogenic cancer chemotherapy – prevention of acute nausea and vomiting associated with initial and repeat courses (1.1)
- Prevention of postoperative nausea and vomiting (PONV) for up to 24 hours following surgery. Efficacy beyond 24 hours has not been demonstrated (1.2)

### DOSAGE AND ADMINISTRATION

Chemotherapy-Induced Nausea and Vomiting (2.1)

- Adult Dosage: a single 0.25 mg I.V. dose administered over 30 seconds. Dosing should occur approximately 30 minutes before the start of chemotherapy.

Postoperative Nausea and Vomiting (2.1)

- Adult Dosage: a single 0.075 mg I.V. dose administered over 10 seconds immediately before the induction of anesthesia.

### DOSAGE FORMS AND STRENGTHS

0.25 mg/5 mL (free base) single-use vial (3)  
0.075 mg/1.5 mL (free base) single-use vial (3)

### CONTRAINDICATIONS

ALOXI is contraindicated in patients known to have hypersensitivity to the drug or any of its components (4)

### WARNINGS AND PRECAUTIONS

- Hypersensitivity reactions may occur in patients who have exhibited hypersensitivity to other selective 5-HT<sub>3</sub> receptor antagonists (5.1)

### ADVERSE REACTIONS

The most common adverse reactions in chemotherapy-induced nausea and vomiting (incidence ≥ 5%) are headache and constipation (6.1)

The most common adverse reactions in postoperative nausea and vomiting (incidence ≥ 2%) are QT prolongation, bradycardia, headache, and constipation.

**To report SUSPECTED ADVERSE REACTIONS, contact Eisai at 1-888-422-4743 or FDA at 1-800-FDA-1088 or [www.fda.gov/medwatch](http://www.fda.gov/medwatch).**

### DRUG INTERACTIONS

The potential for clinically significant drug interactions with palonosetron appears to be low (7)

### USE IN SPECIFIC POPULATIONS

Safety and effectiveness in patients below the age of 18 years have not been established (8.4)

**See 17 for PATIENT COUNSELING INFORMATION and FDA-Approved Patient Labeling**

Revised: 09/2008

## FULL PRESCRIBING INFORMATION: CONTENTS\*

<b>1</b>	<b>INDICATIONS AND USAGE</b>
1.1	Chemotherapy-Induced Nausea and Vomiting
1.2	Postoperative Nausea and Vomiting
<b>2</b>	<b>DOSAGE AND ADMINISTRATION</b>
2.1	Recommended Dosing
2.2	Instructions for I.V. Administration
<b>3</b>	<b>DOSAGE FORMS AND STRENGTHS</b>
<b>4</b>	<b>CONTRAINDICATIONS</b>
<b>5</b>	<b>WARNINGS AND PRECAUTIONS</b>
5.1	Hypersensitivity
<b>6</b>	<b>ADVERSE REACTIONS</b>
6.1	Chemotherapy-Induced Nausea and Vomiting
6.2	Postoperative Nausea and Vomiting
6.3	Postmarketing Experience
<b>7</b>	<b>DRUG INTERACTIONS</b>
<b>8</b>	<b>USE IN SPECIFIC POPULATIONS</b>
8.1	Pregnancy Teratogenic Effects
8.2	Labor and Delivery
8.3	Nursing Mothers
8.4	Pediatric Use
8.5	Geriatric Use
8.6	Renal Impairment
8.7	Hepatic Impairment
8.8	Race
<b>10</b>	<b>OVERDOSE</b>
<b>11</b>	<b>DESCRIPTION</b>
<b>12</b>	<b>CLINICAL PHARMACOLOGY</b>
12.1	Mechanism of Action
12.2	Pharmacodynamics
12.3	Pharmacokinetics
<b>13</b>	<b>NONCLINICAL TOXICOLOGY</b>
13.1	Carcinogenesis, Mutagenesis, Impairment of Fertility
<b>14</b>	<b>CLINICAL STUDIES</b>
14.1	Chemotherapy-Induced Nausea and Vomiting
14.2	Postoperative Nausea and Vomiting
<b>16</b>	<b>HOW SUPPLIED/STORAGE AND HANDLING</b>

## 17 PATIENT COUNSELING INFORMATION

- |      |                               |
|------|-------------------------------|
| 17.1 | Instructions for Patients     |
| 17.2 | FDA-Approved Patient Labeling |

\* Sections or subsections omitted from the full prescribing information are not listed.

# FULL PRESCRIBING INFORMATION

## 1 INDICATIONS AND USAGE

### 1.1 Chemotherapy-Induced Nausea and Vomiting

ALOXI is indicated for:

- Moderately emetogenic cancer chemotherapy – prevention of acute and delayed nausea and vomiting associated with initial and repeat courses
- Highly emetogenic cancer chemotherapy – prevention of acute nausea and vomiting associated with initial and repeat courses

### 1.2 Postoperative Nausea and Vomiting

ALOXI is indicated for:

- Prevention of postoperative nausea and vomiting (PONV) for up to 24 hours following surgery. Efficacy beyond 24 hours has not been demonstrated.

As with other antiemetics, routine prophylaxis is not recommended in patients in whom there is little expectation that nausea and/or vomiting will occur postoperatively. In patients where nausea and vomiting must be avoided during the postoperative period, ALOXI is recommended even where the incidence of postoperative nausea and/or vomiting is low.

## 2 DOSAGE AND ADMINISTRATION

### 2.1 Recommended Dosing

#### Chemotherapy-Induced Nausea and Vomiting

Dosage for Adults – a single 0.25 mg I.V. dose administered over 30 seconds. Dosing should occur approximately 30 minutes before the start of chemotherapy.

#### Postoperative Nausea and Vomiting

Dosage for Adults – a single 0.075 mg I.V. dose administered over 10 seconds immediately before the induction of anesthesia.

### 2.2 Instructions for I.V. Administration

ALOXI is supplied ready for intravenous injection. ALOXI should not be mixed with other drugs. Flush the infusion line with normal saline before and after administration of ALOXI.

Parenteral drug products should be inspected visually for particulate matter and discoloration before administration, whenever solution and container permit.

## 3 DOSAGE FORM AND STRENGTHS

ALOXI is supplied as a single-use sterile, clear, colorless solution in glass vials that provide:

- 0.25 mg (free base) per 5 mL
- 0.075 mg (free base) per 1.5 mL

## 4 CONTRAINDICATIONS

ALOXI is contraindicated in patients known to have hypersensitivity to the drug or any of its components. [see *Adverse Reactions* (6.2)]

## 5 WARNINGS AND PRECAUTIONS

### 5.1 Hypersensitivity

Hypersensitivity reactions may occur in patients who have exhibited hypersensitivity to other 5-HT<sub>3</sub> receptor antagonists.

## 6 ADVERSE REACTIONS

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 reported in practice.

### 6.1 Chemotherapy-Induced Nausea and Vomiting

In clinical trials for the prevention of nausea and vomiting induced by moderately or highly emetogenic chemotherapy, 1374 adult patients received palonosetron. Adverse reactions were similar in frequency and severity with ALOXI and ondansetron or dolasetron. Following is a listing of all adverse reactions reported by ≥ 2% of patients in these trials (Table 1).

Table 1: Adverse Reactions from Chemotherapy-Induced Nausea and Vomiting Studies ≥ 2% in any Treatment Group

Event	ALOXI 0.25 mg (N=633)	Ondansetron 32 mg I.V. (N=410)	Dolasetron 100 mg I.V. (N=194)
Headache	60 (9%)	34 (8%)	32 (16%)
Constipation	29 (5%)	8 (2%)	12 (6%)
Diarrhea	8 (1%)	7 (2%)	4 (2%)
Dizziness	8 (1%)	9 (2%)	4 (2%)
Fatigue	3 (< 1%)	4 (1%)	4 (2%)
Abdominal Pain	1 (< 1%)	2 (< 1%)	3 (2%)
Insomnia	1 (< 1%)	3 (1%)	3 (2%)

In other studies, 2 subjects experienced severe constipation following a single palonosetron dose of approximately 0.75 mg, three times the recommended dose. One patient received a 10 mcg/kg oral dose in a postoperative nausea and vomiting study and one healthy subject received a 0.75 mg I.V. dose in a pharmacokinetic study.

In clinical trials, the following infrequently reported adverse reactions, assessed by investigators as treatment-related or causality unknown, occurred following administration of ALOXI to adult patients receiving concomitant cancer chemotherapy:

Cardiovascular: 1%: non-sustained tachycardia, bradycardia, hypotension, < 1%: hypertension, myocardial ischemia, extrasystoles, sinus tachycardia, sinus arrhythmia, supraventricular extrasystoles and QT prolongation. In many cases, the relationship to ALOXI was unclear.

Dermatological: < 1%: allergic dermatitis, rash.

Hearing and Vision: < 1%: motion sickness, tinnitus, eye irritation and amblyopia.

Gastrointestinal System: 1%: diarrhea, < 1%: dyspepsia, abdominal pain, dry mouth, hiccups and flatulence.

General: 1%: weakness, < 1%: fatigue, fever, hot flash, flu-like syndrome.

Liver: < 1%: transient, asymptomatic increases in AST and/or ALT and bilirubin. These changes occurred predominantly in patients receiving highly emetogenic chemotherapy.

Metabolic: 1%: hyperkalemia, < 1%: electrolyte fluctuations, hyperglycemia, metabolic acidosis, glycosuria, appetite decrease, anorexia.

Musculoskeletal: < 1%: arthralgia.

Nervous System: 1%: dizziness, < 1%: somnolence, insomnia, hypersomnia, paresthesia.

Psychiatric: 1%: anxiety, < 1%: euphoric mood.

Urinary System: < 1%: urinary retention.

Vascular: < 1%: vein discoloration, vein distention.

### 6.2 Postoperative Nausea and Vomiting

The adverse reactions cited in Table 2 were reported in ≥ 2% of adults receiving I.V. ALOXI 0.075 mg immediately before induction of anesthesia in one phase 2 and two phase 3 randomized placebo-controlled trials. Rates of events between palonosetron and placebo groups were indistinguishable. Some events are known to be associated with, or may be exacerbated by concomitant perioperative and intraoperative medications administered in this surgical population. Please refer to Section 12.2, thorough QT/QTc study results, for definitive data demonstrating the lack of palonosetron effect on QT/QTc.

Table 2: Adverse Reactions from Postoperative Nausea and Vomiting Studies  $\geq 2\%$  in any Treatment Group

Event	ALOXI 0.075 mg (N=336)	Placebo (N=369)
Electrocardiogram QT prolongation	16 (5%)	11 (3%)
Bradycardia	13 (4%)	16 (4%)
Headache	11 (3%)	14 (4%)
Constipation	8 (2%)	11 (3%)

In these clinical trials, the following infrequently reported adverse reactions, assessed by investigators as treatment-related or causality unknown, occurred following administration of ALOXI to adult patients receiving concomitant perioperative and intraoperative medications including those associated with anesthesia:

Cardiovascular: 1%: electrocardiogram QTc prolongation, sinus bradycardia, tachycardia; < 1%: blood pressure decreased, hypotension, hypertension, arrhythmia, ventricular extrasystoles, generalized edema; ECG T wave amplitude decreased, platelet count decreased. The frequency of these adverse effects did not appear to be different from placebo.

Dermatological: 1%: pruritus.

Gastrointestinal System: 1%: flatulence, < 1%: dry mouth, upper abdominal pain, salivary hypersecretion, dyspepsia, diarrhea, intestinal hypomotility, anorexia.

General: < 1%: chills.

Liver: 1%: increases in AST and/or ALT < 1%: hepatic enzyme increased.

Metabolic: < 1%: hypokalemia, anorexia.

Nervous System: < 1%: dizziness.

Respiratory: < 1%: hypoventilation, laryngospasm.

Urinary System: 1%: urinary retention.

### 6.3 Postmarketing Experience

The following adverse reactions have been identified during postapproval use of ALOXI. Because these reactions are reported voluntarily from a population of uncertain size, it is not always possible to reliably estimate their frequency or establish a causal relationship to drug exposure.

Very rare cases (<1/10,000) of hypersensitivity reactions and injection site reactions (burning, induration, discomfort and pain) were reported from postmarketing experience of ALOXI 0.25 mg in the prevention of chemotherapy-induced nausea and vomiting.

## 7 DRUG INTERACTIONS

Palonosetron is eliminated from the body through both renal excretion and metabolic pathways with the latter mediated via multiple CYP enzymes. Further *in vitro* studies indicated that palonosetron is not an inhibitor of CYP1A2, CYP2A6, CYP2B6, CYP2C9, CYP2D6, CYP2E1 and CYP3A4/5 (CYP2C19 was not investigated) nor does it induce the activity of CYP1A2, CYP2D6, or CYP3A4/5. Therefore, the potential for clinically significant drug interactions with palonosetron appears to be low.

Coadministration of 0.25 mg I.V. palonosetron and 20 mg I.V. dexamethasone in healthy subjects revealed no pharmacokinetic drug-interactions between palonosetron and dexamethasone.

In an interaction study in healthy subjects where palonosetron 0.25 mg (I.V. bolus) was administered on day 1 and oral aprepitant for 3 days (125 mg/80 mg/80 mg), the pharmacokinetics of palonosetron were not significantly altered (AUC: no change, C<sub>max</sub>: 15% increase).

A study in healthy volunteers involving single-dose I.V. palonosetron (0.75 mg) and steady state oral metoclopramide (10 mg four times daily) demonstrated no significant pharmacokinetic interaction.

In controlled clinical trials, ALOXI injection has been safely administered with corticosteroids, analgesics, antiemetics/antinauseants, antispasmodics and anticholinergic agents.

Palonosetron did not inhibit the antitumor activity of the five chemotherapeutic agents tested (cisplatin, cyclophosphamide, cytarabine, doxorubicin and mitomycin C) in murine tumor models.

## 8 USE IN SPECIFIC POPULATIONS

### 8.1 Pregnancy

Teratogenic Effects: Category B

Teratology studies have been performed in rats at oral doses up to 60 mg/kg/day (1894 times the recommended human intravenous dose based on body surface area) and rabbits at oral doses up to 60 mg/kg/day (3789 times the recommended human intravenous dose based on body surface area) and have revealed no evidence of impaired fertility or harm to the fetus due to palonosetron. There are, however, no adequate and well-controlled studies in pregnant women. Because animal reproduction studies are not always predictive of human response, palonosetron should be used during pregnancy only if clearly needed.

### 8.2 Labor and Delivery

Palonosetron has not been administered to patients undergoing labor and delivery, so its effects on the mother or child are unknown.

### 8.3 Nursing Mothers

It is not known whether palonosetron is excreted in human milk. Because many drugs are excreted in human milk and because of the potential for serious adverse reactions in nursing infants and the potential for tumorigenicity shown for palonosetron in the rat carcinogenicity study, a decision should be made whether to discontinue nursing or to discontinue the drug, taking into account the importance of the drug to the mother.

### 8.4 Pediatric Use

Safety and effectiveness in patients below the age of 18 years have not been established.

### 8.5 Geriatric Use

Population pharmacokinetics analysis did not reveal any differences in palonosetron pharmacokinetics between cancer patients  $\geq 65$  years of age and younger patients (18 to 64 years). Of the 1374 adult cancer patients in clinical studies of palonosetron, 316 (23%) were  $\geq 65$  years old, while 71 (5%) were  $\geq 75$  years old. No overall differences in safety or effectiveness were observed between these subjects and the younger subjects, but greater sensitivity in some older individuals cannot be ruled out. No dose adjustment or special monitoring are required for geriatric patients.

Of the 1520 adult patients in ALOXI PONV clinical studies, 73 (5%) were  $\geq 65$  years old. No overall differences in safety were observed between older and younger subjects in these studies, though the possibility of heightened sensitivity in some older individuals cannot be excluded. No differences in efficacy were observed in geriatric patients for the CINV indication and none are expected for geriatric PONV patients. However, ALOXI efficacy in geriatric patients has not been adequately evaluated.

### 8.6 Renal Impairment

Mild to moderate renal impairment does not significantly affect palonosetron pharmacokinetic parameters. Total systemic

exposure increased by approximately 28% in severe renal impairment relative to healthy subjects. Dosage adjustment is not necessary in patients with any degree of renal impairment.

### 8.7 Hepatic Impairment

Hepatic impairment does not significantly affect total body clearance of palonosetron compared to the healthy subjects. Dosage adjustment is not necessary in patients with any degree of hepatic impairment.

### 8.8 Race

Intravenous palonosetron pharmacokinetics was characterized in twenty-four healthy Japanese subjects over the dose range of 3 – 90 mcg/kg. Total body clearance was 25% higher in Japanese subjects compared to Whites, however, no dose adjustment is required. The pharmacokinetics of palonosetron in Blacks has not been adequately characterized.

## 10 OVERDOSE

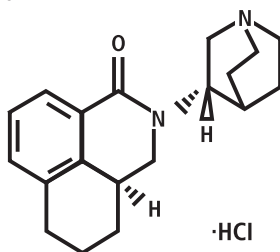
There is no known antidote to ALOXI. Overdose should be managed with supportive care.

Fifty adult cancer patients were administered palonosetron at a dose of 90 mcg/kg (equivalent to 6 mg fixed dose) as part of a dose ranging study. This is approximately 25 times the recommended dose of 0.25 mg. This dose group had a similar incidence of adverse events compared to the other dose groups and no dose response effects were observed.

Dialysis studies have not been performed, however, due to the large volume of distribution, dialysis is unlikely to be an effective treatment for palonosetron overdose. A single intravenous dose of palonosetron at 30 mg/kg (947 and 474 times the human dose for rats and mice, respectively, based on body surface area) was lethal to rats and mice. The major signs of toxicity were convulsions, gasping, pallor, cyanosis and collapse.

## 11 DESCRIPTION

ALOXI (palonosetron hydrochloride) is an antiemetic and antinauseant agent. It is a serotonin subtype 3 (5-HT<sub>3</sub>) receptor antagonist with a strong binding affinity for this receptor. Chemically, palonosetron hydrochloride is: (3aS)-2-[(S)-1-Azabicyclo [2.2.2]oct-3-yl]-2,3,3a,4,5,6-hexahydro-1-oxo-1H-benz[de]isoquinoline hydrochloride. The empirical formula is C<sub>19</sub>H<sub>24</sub>N<sub>2</sub>O.HCl, with a molecular weight of 332.87. Palonosetron hydrochloride exists as a single isomer and has the following structural formula:



Palonosetron hydrochloride is a white to off-white crystalline powder. It is freely soluble in water, soluble in propylene glycol, and slightly soluble in ethanol and 2-propanol.

ALOXI injection is a sterile, clear, colorless, non pyrogenic, isotonic, buffered solution for intravenous administration. ALOXI injection is available as 5 mL single use vial or 1.5 mL single use vial. Each 5 mL vial contains 0.25 mg palonosetron base as 0.28 mg palonosetron hydrochloride, 207.5 mg mannitol, disodium edetate and citrate buffer in water for intravenous administration.

Each 1.5 mL vial contains 0.075 mg palonosetron base as 0.084 mg palonosetron hydrochloride, 83 mg mannitol, disodium edetate and citrate buffer in water for intravenous administration.

The pH of the solution in the 5 mL and 1.5 mL vials is 4.5 to 5.5.

## 12 CLINICAL PHARMACOLOGY

### 12.1 Mechanism of Action

Palonosetron is a 5-HT<sub>3</sub> receptor antagonist with a strong binding affinity for this receptor and little or no affinity for other receptors.

Cancer chemotherapy may be associated with a high incidence of nausea and vomiting, particularly when certain agents, such as cisplatin, are used. 5-HT<sub>3</sub> receptors are located on the nerve terminals of the vagus in the periphery and centrally in the chemoreceptor trigger zone of the area postrema. It is thought that chemotherapeutic agents produce nausea and vomiting by releasing serotonin from the enterochromaffin cells of the small intestine and that the released serotonin then activates 5-HT<sub>3</sub> receptors located on vagal afferents to initiate the vomiting reflex.

Postoperative nausea and vomiting is influenced by multiple patient, surgical and anesthesia related factors and is triggered by release of 5-HT in a cascade of neuronal events involving both the central nervous system and the gastrointestinal tract. The 5-HT<sub>3</sub> receptor has been demonstrated to selectively participate in the emetic response.

### 12.2 Pharmacodynamics

The effect of palonosetron on blood pressure, heart rate, and ECG parameters including QTc were comparable to ondansetron and dolasetron in CINV clinical trials. In PONV clinical trials the effect of palonosetron on the QTc interval was no different from placebo. In non-clinical studies palonosetron possesses the ability to block ion channels involved in ventricular de- and re polarization and to prolong action potential duration.

The effect of palonosetron on QTc interval was evaluated in a double blind, randomized, parallel, placebo and positive (moxifloxacin) controlled trial in adult men and women. The objective was to evaluate the ECG effects of I.V. administered palonosetron at single doses of 0.25, 0.75 or 2.25 mg in 221 healthy subjects. The study demonstrated no significant effect on any ECG interval including QTc duration (cardiac repolarization) at doses up to 2.25 mg.

### 12.3 Pharmacokinetics

After intravenous dosing of palonosetron in healthy subjects and cancer patients, an initial decline in plasma concentrations is followed by a slow elimination from the body. Mean maximum plasma concentration (C<sub>max</sub>) and area under the concentration-time curve (AUC<sub>0-∞</sub>) are generally dose-proportional over the dose range of 0.3–90 mcg/kg in healthy subjects and in cancer patients. Following a single I.V. dose of palonosetron at 3 mcg/kg (or 0.21 mg/70 kg) to six cancer patients, mean (±SD) maximum plasma concentration was estimated to be 5.6 ± 5.5 ng/mL and mean AUC was 35.8 ± 20.9 ng•hr/mL.

Following I.V. administration of palonosetron 0.25 mg once every other day for 3 doses in 11 cancer patients, the mean increase in plasma palonosetron concentration from Day 1 to Day 5 was 42±34%. Following I.V. administration of palonosetron 0.25 mg once daily for 3 days in 12 healthy subjects, the mean (±SD) increase in plasma palonosetron concentration from Day 1 to Day 3 was 110±45%.

After intravenous dosing of palonosetron in patients undergoing surgery (abdominal surgery or vaginal hysterectomy), the pharmacokinetic characteristics of palonosetron were similar to those observed in cancer patients.

### Distribution

Palonosetron has a volume of distribution of approximately 8.3 ± 2.5 L/kg. Approximately 62% of palonosetron is bound to plasma proteins.

### Metabolism

Palonosetron is eliminated by multiple routes with approximately 50% metabolized to form two primary metabolites:

N-oxide-palonosetron and 6-S-hydroxy-palonosetron. These metabolites each have less than 1% of the 5-HT<sub>3</sub> receptor antagonist activity of palonosetron. *In vitro* metabolism studies have suggested that CYP2D6 and to a lesser extent, CYP3A4 and CYP1A2 are involved in the metabolism of palonosetron. However, clinical pharmacokinetic parameters are not significantly different between poor and extensive metabolizers of CYP2D6 substrates.

**Elimination**

After a single intravenous dose of 10 mcg/kg [<sup>14</sup>C]-palonosetron, approximately 80% of the dose was recovered within 144 hours in the urine with palonosetron representing approximately 40% of the administered dose. In healthy subjects, the total body clearance of palonosetron was 160 ± 35 mL/h/kg and renal clearance was 66.5 ± 18.2 mL/h/kg. Mean terminal elimination half-life was approximately 40 hours.

**Special Populations**

[See *USE IN SPECIFIC POPULATIONS* (8.5 – 8.8)]

**13 NONCLINICAL TOXICOLOGY**

**13.1 Carcinogenesis, Mutagenesis, Impairment of Fertility**

In a 104-week carcinogenicity study in CD-1 mice, animals were treated with oral doses of palonosetron at 10, 30 and 60 mg/kg/day. Treatment with palonosetron was not tumorigenic. The highest tested dose produced a systemic exposure to palonosetron (Plasma AUC) of about 150 to 289 times the human exposure (AUC= 29.8 ng•h/ mL) at the recommended intravenous dose of 0.25 mg. In a 104-week carcinogenicity study in Sprague-Dawley rats, male and female rats were treated with oral doses of 15, 30 and 60 mg/kg/day and 15, 45 and 90 mg/kg/day, respectively. The highest doses produced a systemic exposure to palonosetron (Plasma AUC) of 137 and 308 times the human exposure at the recommended dose. Treatment with palonosetron produced increased incidences of adrenal benign pheochromocytoma and combined benign and malignant pheochromocytoma, increased incidences of pancreatic Islet cell adenoma and combined adenoma and carcinoma and pituitary adenoma in male rats. In female rats, it produced hepatocellular adenoma and carcinoma and increased the incidences of thyroid C-cell adenoma and combined adenoma and carcinoma.

Palonosetron was not genotoxic in the Ames test, the Chinese hamster ovarian cell (CHO/HGPRT) forward mutation test, the *ex vivo* hepatocyte unscheduled DNA synthesis (UDS) test or the mouse micronucleus test. It was, however, positive for clastogenic effects in the Chinese hamster ovarian (CHO) cell chromosomal aberration test.

Palonosetron at oral doses up to 60 mg/kg/day (about 1894 times the recommended human intravenous dose based on body surface area) was found to have no effect on fertility and reproductive performance of male and female rats.

**14 CLINICAL STUDIES**

**14.1 Chemotherapy-Induced Nausea and Vomiting**

Efficacy of single-dose palonosetron injection in preventing acute and delayed nausea and vomiting induced by both moderately and highly emetogenic chemotherapy was studied in three Phase 3 trials and one Phase 2 trial. In these double-blind studies, complete response rates (no emetic episodes and no rescue medication) and other efficacy parameters were assessed through at least 120 hours after administration of chemotherapy. The safety and efficacy of palonosetron in repeated courses of chemotherapy was also assessed.

**Moderately Emetogenic Chemotherapy**

Two Phase 3, double-blind trials involving 1132 patients compared single-dose I.V. ALOXI with either single-dose I.V. ondansetron (study 1) or dolasetron (study 2) given 30 minutes prior to moderately emetogenic chemotherapy including carboplatin, cisplatin ≤ 50 mg/m<sup>2</sup>, cyclophosphamide < 1500 mg/m<sup>2</sup>, doxorubicin > 25 mg/m<sup>2</sup>, epirubicin, irinotecan, and

methotrexate > 250 mg/m<sup>2</sup>. Concomitant corticosteroids were not administered prophylactically in study 1 and were used by 4-6% of patients in study 2. The majority of patients in these studies were women (77%), White (65%) and naïve to previous chemotherapy (54%). The mean age was 55 years.

**Highly Emetogenic Chemotherapy**

A Phase 2, double-blind, dose-ranging study evaluated the efficacy of single-dose I.V. palonosetron from 0.3 to 90 mcg/kg (equivalent to < 0.1 mg to 6 mg fixed dose) in 161 chemotherapy-naïve adult cancer patients receiving highly-emetogenic chemotherapy (either cisplatin ≥ 70 mg/m<sup>2</sup> or cyclophosphamide > 1100 mg/m<sup>2</sup>). Concomitant corticosteroids were not administered prophylactically. Analysis of data from this trial indicates that 0.25 mg is the lowest effective dose in preventing acute nausea and vomiting induced by highly emetogenic chemotherapy.

A Phase 3, double-blind trial involving 667 patients compared single-dose I.V. ALOXI with single-dose I.V. ondansetron (study 3) given 30 minutes prior to highly emetogenic chemotherapy including cisplatin ≥ 60 mg/m<sup>2</sup>, cyclophosphamide > 1500 mg/m<sup>2</sup>, and dacarbazine. Corticosteroids were co-administered prophylactically before chemotherapy in 67% of patients. Of the 667 patients, 51% were women, 60% White, and 59% naïve to previous chemotherapy. The mean age was 52 years.

**Efficacy Results**

The antiemetic activity of ALOXI was evaluated during the acute phase (0-24 hours) [Table 3], delayed phase (24-120 hours) [Table 4], and overall phase (0-120 hours) [Table 5] post-chemotherapy in Phase 3 trials.

Table 3: Prevention of Acute Nausea and Vomiting (0-24 hours): Complete Response Rates

Chemotherapy	Study	Treatment Group	N *	% with Complete Response	p-value <sup>b</sup>
Moderately Emetogenic	1	ALOXI 0.25 mg	189	81	0.009
		Ondansetron 32 mg I.V.	185	69	
	2	ALOXI 0.25 mg	189	63	NS
		Dolasetron 100 mg I.V.	191	53	
Highly Emetogenic	3	ALOXI 0.25 mg	223	59	NS
		Ondansetron 32 mg I.V.	221	57	

- a Intent-to-treat cohort
- b 2-sided Fisher's exact test. Significance level α=0.025.
- c These studies were designed to show non-inferiority. A lower bound greater than -15% demonstrates non-inferiority between ALOXI and comparator.

These studies show that ALOXI was effective in the prevention of acute nausea and vomiting associated with initial and repeat courses of moderately and highly emetogenic cancer chemotherapy. In study 3, efficacy was greater when prophylactic corticosteroids were administered concomitantly. Clinical superiority over other 5-HT<sub>3</sub> receptor antagonists has not been adequately demonstrated in the acute phase.

Table 4: Prevention of Delayed Nausea and Vomiting (24-120 hours): Complete Response Rates

Chemotherapy	Study	Treatment Group	N <sup>a</sup>	% with Complete Response	p-value <sup>b</sup>
Moderately Emetogenic	1	ALOXI 0.25 mg	189	74	<0.001
		Ondansetron 32 mg I.V.	185	55	
	2	ALOXI 0.25 mg	189	54	0.004
		Dolasetron 100 mg I.V.	191	39	

- a Intent-to-treat cohort
- b 2-sided Fisher's exact test. Significance level at  $\alpha=0.025$ .
- c These studies were designed to show non-inferiority. A lower bound greater than -15% demonstrates non-inferiority between ALOXI and comparator.

These studies show that ALOXI was effective in the prevention of delayed nausea and vomiting associated with initial and repeat courses of moderately emetogenic chemotherapy.

Table 5: Prevention of Overall Nausea and Vomiting (0-120 hours): Complete Response Rates

Chemotherapy	Study	Treatment Group	N <sup>a</sup>	% with Complete Response	p-value <sup>b</sup>
Moderately Emetogenic	1	ALOXI 0.25 mg	189	69	<0.001
		Ondansetron 32 mg I.V.	185	50	
	2	ALOXI 0.25 mg	189	46	0.021
		Dolasetron 100 mg I.V.	191	34	

- a Intent-to-treat cohort
- b 2-sided Fisher's exact test. Significance level at  $\alpha=0.025$ .
- c These studies were designed to show non-inferiority. A lower bound greater than -15% demonstrates non-inferiority between ALOXI and comparator.

These studies show that ALOXI was effective in the prevention of nausea and vomiting throughout the 120 hours (5 days) following initial and repeat courses of moderately emetogenic cancer chemotherapy.

### 14.2 Postoperative Nausea and Vomiting

In one multicenter, randomized, stratified, double-blind, parallel-group, phase 3 clinical study (Study 1), palonosetron was compared with placebo for the prevention of PONV in 546 patients undergoing abdominal and gynecological surgery. All patients received general anesthesia. Study 1 was a pivotal study conducted predominantly in the US in the out-patient setting for patients undergoing elective gynecologic or abdominal laparoscopic surgery and stratified at randomization for the following risk factors: gender, non-smoking status, history of postoperative nausea and vomiting and/or motion sickness.

In Study 1 patients were randomized to receive palonosetron 0.025 mg, 0.050 mg or 0.075 mg or placebo, each given intravenously immediately prior to induction of anesthesia. The antiemetic activity of palonosetron was evaluated during the 0 to 72 hour time period after surgery.

Of the 138 patients treated with 0.075 mg palonosetron in Study 1 and evaluated for efficacy, 96% were women; 66% had a history of PONV or motion sickness; 85% were non-smokers. As for race, 63% were White, 20% were Black, 15% were Hispanic, and 1% were Asian. The age of patients ranged from 21 to 74 years, with a mean age of 37.9 years. Three patients were greater than 65 years of age.

Co-primary efficacy measures were Complete Response (CR) defined as no emetic episode and no use of rescue medication in the 0-24 and in the 24-72 hours postoperatively. Secondary efficacy endpoints included:

- Complete Response (CR) 0-48 and 0-72 hours
- Complete Control (CC) defined as CR and no more than mild nausea
- Severity of nausea (none, mild, moderate, severe)

The primary hypothesis in Study 1 was that at least one of the three palonosetron doses were superior to placebo.

Results for Complete Response in Study 1 for 0.075 mg palonosetron versus placebo are described in the following table.

Table 6: Prevention of Postoperative Nausea and Vomiting: Complete Response (CR), Study 1, Palonosetron 0.075 mg Vs Placebo

Treatment	n/N (%)	Palonosetron Vs Placebo	
		$\Delta$	p-value
<b>Co-primary Endpoints</b>			
<b>CR 0-24 hours</b>			
Palonosetron	59/138 (42.8%)	16.8%	0.004
Placebo	35/135 (25.9%)		
<b>CR 24-72 hours</b>			
Palonosetron	67/138 (48.6%)	7.8%	0.188
Placebo	55/135 (40.7%)		

\* To reach statistical significance for each co-primary endpoint, the required significance limit for the lowest p-value was  $p < 0.017$ .

$\Delta$  Difference (%): Palonosetron 0.075 mg minus placebo

Palonosetron 0.075 mg reduced the severity of nausea compared to placebo. Analyses of other secondary endpoints indicate that palonosetron 0.075 mg was numerically better than placebo, however, statistical significance was not formally demonstrated.

A phase 2 randomized, double-blind, multicenter, placebo-controlled, dose ranging study was performed to evaluate I.V. palonosetron for the prevention of post-operative nausea and vomiting following abdominal or vaginal hysterectomy. Five I.V. palonosetron doses (0.1, 0.3, 1.0, 3.0 and 30  $\mu\text{g}/\text{kg}$ ) were evaluated in a total of 381 intent-to-treat patients. The primary efficacy measure was the proportion of patients with CR in the first 24 hours after recovery from surgery. The lowest effective dose was palonosetron 1  $\mu\text{g}/\text{kg}$  (approximately 0.075 mg) which had a CR rate of 44% versus 19% for placebo,  $p=0.004$ . Palonosetron 1  $\mu\text{g}/\text{kg}$  also significantly reduced the severity of nausea versus placebo,  $p=0.009$ .

**16 HOW SUPPLIED/STORAGE AND HANDLING**

NDC # 62856-797-01, ALOXI Injection 0.25 mg/5 mL (free base) single-use vial individually packaged in a carton.

NDC # 62856-798-01, ALOXI Injection 0.075 mg/1.5 mL (free base) single-use vial packaged in a carton containing 5 vials.

**Storage**

- Store at controlled temperature of 20–25°C (68°F–77°F). Excursions permitted to 15–30 °C (59–86°F).
- Protect from freezing.
- Protect from light.

**17 PATIENT COUNSELING INFORMATION*****See FDA-Approved Patient Labeling (17.2)*****17.1 Instructions for Patients**

Patients should be advised to report to their physician all of their medical conditions, any pain, redness, or swelling in and around the infusion site [see *Adverse Reactions* 6.2].

Patients should be instructed to read the patient insert.

**17.2 FDA-Approved Patient Labeling**

---

## Patient Information

### **ALOXI® (Ah-lock-see)**

Palonosetron HCl injection

Read the Patient Information that comes with ALOXI before your treatment with ALOXI and each time you get ALOXI. There may be new information. This information does not take the place of talking with your doctor about your medical condition or your treatment. If you have questions about ALOXI, ask your doctor or pharmacist.

#### **What is ALOXI?**

ALOXI is a medicine called an “antiemetic.” ALOXI is used in adults to help prevent the nausea and vomiting that happens:

- right away *with certain anti-cancer medicines (chemotherapy)*
- or later with certain anti-cancer medicines
- right away after recovery from anesthesia after surgery

#### **What is ALOXI used for?**

ALOXI is used to prevent nausea and vomiting that may happen:

- soon after taking certain anti-cancer medicines
- later after taking certain anti-cancer medicines
- soon after recovery from anesthesia after surgery

#### **Who should not take ALOXI?**

**Do not take ALOXI if you are allergic to any of the ingredients in ALOXI.** The active ingredient is palonosetron hydrochloride. See the end of this leaflet for a complete list of ingredients in ALOXI.

ALOXI has not been studied in children under 18 years of age.

#### **What should I tell my doctor before using ALOXI?**

**Tell your doctor about all of your medical conditions, including if you:**

- **are pregnant.** It is not known if ALOXI may harm your unborn baby. You and your doctor should decide if ALOXI is right for you
- **are breastfeeding.** It is not known if ALOXI passes into your milk and if it can harm your baby. You should choose to either take ALOXI or breastfeed, but not both

**Tell your doctor about all of the medicines you take including prescription and nonprescription medicines, vitamins and herbal supplements.**

#### **How should I use ALOXI?**

ALOXI is given in your vein by I.V. (intravenous) injection. It is only given to you by a healthcare provider in a hospital or clinic. ALOXI is usually injected into your vein about 30 minutes before you get your anti-cancer medicine (chemotherapy) or immediately before anesthesia for surgery.

## **What are the possible side effects of ALOXI?**

**The most common side effects of ALOXI are** headache and constipation. Diarrhea and dizziness have also been observed.

These are not all the side effects from ALOXI. For more information ask your doctor or pharmacist.

## **General information about ALOXI**

Medicines are sometimes prescribed for conditions other than those listed in patient information leaflets. ALOXI was prescribed for your medical condition.

This leaflet summarizes the most important information about ALOXI. If you would like more information, talk with your doctor. You can ask your doctor or pharmacist for information about ALOXI that is written for health professionals. You can also visit the ALOXI web site at [www.ALOXI.com](http://www.ALOXI.com).

## **What are the ingredients in ALOXI?**

Active ingredient: palonosetron hydrochloride

Inactive ingredients: mannitol, disodium edetate, and citrate buffer in water

Rx Only

Mfd by OSO Biopharmaceuticals, LLC, Albuquerque, NM, USA or Pierre Fabre, Médicament Production, Idron, Aquitaine, France and Helsinn Birex Pharmaceuticals, Dublin, Ireland.

HELSINN, Mfd for Helsinn Healthcare SA, Switzerland

ALOXI® is a registered trademark of Helsinn Healthcare SA, Switzerland used under license.

Distributed and marketed by Eisai Inc.

©2009 Eisai Inc.

All rights reserved. Printed in USA. AL420 06/09

