

## **SUMMARY OF PRODUCT CHARACTERISTICS**

### **1 NAME OF THE MEDICINAL PRODUCT**

Granisetron 1mg/1ml concentrate for solution for infusion or injection

### **2 QUALITATIVE AND QUANTITATIVE COMPOSITION**

The active substance is granisetron.

Each 1 ml contains 1 mg of granisetron (as the hydrochloride)

For the full list of excipients, see section 6.1.

### **3 PHARMACEUTICAL FORM**

A glass ampoule containing a sterile, clear, colourless or slightly straw-coloured solution. The content allows withdrawal of 1ml.

Concentrate for solution for infusion or injection.

### **4 CLINICAL PARTICULARS**

#### **4.1 Therapeutic indications**

Granisetron is indicated in adults for the prevention and treatment of

- acute nausea and vomiting associated with chemotherapy and radiotherapy.
- post-operative nausea and vomiting.

Granisetron is indicated for the prevention of delayed nausea and vomiting associated with chemotherapy and radiotherapy.

Granisetron is indicated in children aged 2 years and above for the prevention and treatment of acute nausea and vomiting associated with chemotherapy.

## 4.2 Posology and method of administration

### Posology

#### *Chemo- and radiotherapy-induced nausea and vomiting (CINV and RINV)*

##### *Prevention (acute and delayed nausea)*

A dose of 1-3 mg (10-40 µg/kg) of granisetron should be administered either as a slow intravenous injection or as a diluted intravenous infusion 5 minutes prior to the start of chemotherapy. The solution should be diluted to 5ml per mg.

##### *Treatment (acute nausea)*

A dose of 1-3 mg (10-40 µg/kg) of granisetron should be administered either as a slow intravenous injection or as a diluted intravenous infusion and administered over 5 minutes. The solution should be diluted to 5ml per mg. Further maintenance doses of granisetron may be administered at least 10 minutes apart. The maximum dose to be administered over 24 hours should not exceed 9 mg.

##### *Combination with adrenocortical steroid*

The efficacy of parenteral granisetron may be enhanced by an additional intravenous dose of an adrenocortical steroid e.g. by 8-20 mg dexamethasone administered before the start of the cytostatic therapy or by 250 mg methyl-prednisolone administered prior to the start and shortly after the end of the chemotherapy.

##### *Paediatric population*

The safety and efficacy of granisetron in children aged 2 years and above has been well established for the prevention and treatment (control) of acute nausea and vomiting associated with chemotherapy and the prevention of delayed nausea and vomiting associated with chemotherapy. A dose of 10-40 µg/kg body weight (up to 3 mg) should be administered as an i.v. infusion, diluted in 10-30 ml infusion fluid and administered over 5 minutes prior to the start of chemotherapy. One additional dose may be administered within a 24 hour-period if required. This additional dose should not be administered until at least 10 minutes after the initial infusion.

##### *Post-operative nausea and vomiting (PONV)*

A dose of 1 mg (10 µg/kg) of granisetron should be administered by slow intravenous injection. The maximum dose of granisetron to be administered over 24 hours should not exceed 3 mg.

For the prevention of PONV, administration should be completed prior to induction of anaesthesia.

#### *Paediatric population*

Currently available data are described in section 5.1, but no recommendation on a posology can be made. There is insufficient clinical evidence to recommend administration of the solution for injection to children in prevention and treatment of Post-operative nausea and vomiting (PONV).

#### *Special populations*

##### *Elderly and renal impairment*

There are no special precautions required for its use in either elderly patients or those patients with renal or hepatic impairment.

##### *Hepatic impairment*

There is no evidence to date for an increased incidence of adverse events in patients with hepatic disorders. On the basis of its kinetics, whilst no dosage adjustment is necessary, granisetron should be used with a certain amount of caution in this patient group (see section 5.2).

#### Method of administration

Administration may be as either a slow intravenous injection (over 30 seconds) or as an intravenous infusion diluted in 20 to 50 ml of compatible infusion fluid and administered over 5 minutes.

### **4.3 Contraindications**

Hypersensitivity to the active substance or any of the excipients listed in section 6.1.

#### **4.4 Special warnings and precautions for use**

As granisetron may reduce lower bowel motility, patients with signs of sub-acute intestinal obstruction should be monitored following its administration.

As for other 5-HT<sub>3</sub> antagonists ECG changes including QT interval prolongation have been reported with granisetron. In patients with pre-existing arrhythmias or cardiac conduction disorders this might lead to clinical consequences. Therefore caution should be exercised in patients with cardiac co-morbidities, on cardiotoxic chemotherapy and/or with concomitant electrolyte abnormalities (see section 4.5).

Cross-sensitivity between 5-HT<sub>3</sub> antagonists (e.g. dolasetron, ondansetron) has been reported.

There have been reports of serotonin syndrome with the use of 5-HT<sub>3</sub> antagonists either alone, but mostly in combination with other serotonergic drugs (including selective serotonin reuptake inhibitors (SSRIs), and serotonin noradrenaline reuptake inhibitors (SNRIs)). Appropriate observation of patients for serotonin syndrome-like symptoms is advised.

##### **Information on sodium content**

This medicine contains less than 1 mmol sodium (23 mg) per dosage unit, that is to say essentially 'sodium-free'.

#### **4.5 Interaction with other medicinal products and other forms of interaction**

As for other 5-HT<sub>3</sub> antagonists, cases of ECG modifications including QT prolongation have been reported with granisetron. In patients concurrently treated with medicinal products known to prolong QT interval and/or which are arrhythmogenic, this may lead to clinical consequences (see section 4.4).

In humans, hepatic enzyme induction with phenobarbital resulted in an increase in total plasma clearance of granisetron of approximately 25%.

In studies in healthy subjects, no evidence of any interaction has been indicated between granisetron and benzodiazepines (lorazepam), neuroleptics (haloperidol) or anti-ulcer medicinal products (cimetidine). Additionally, granisetron has not shown any apparent medicinal product interaction with emetogenic cancer chemotherapies.

No specific interaction studies have been conducted in anaesthetised patients.

Serotonergic medicinal products (e.g. SSRIs and SNRIs)

There have been reports of serotonin syndrome following concomitant use of 5-HT<sub>3</sub> antagonists and other serotonergic medicinal products (including SSRIs and SNRIs) (see section 4.4).

## **4.6 Fertility, Pregnancy and lactation**

### Pregnancy

There is limited amount of data from the use of granisetron in pregnant women. Animal studies do not indicate direct or indirect harmful effects with respect to reproductive toxicity (see section 5.3). As a precautionary measure, it is preferable to avoid the use of granisetron during pregnancy.

### Breastfeeding

It is unknown whether granisetron or its metabolites are excreted in human milk. As a precautionary measure, breast-feeding should not be advised during treatment with granisetron.

### Fertility

In rats, granisetron had no harmful effects on reproductive performance or fertility.

## **4.7 Effects on ability to drive and use machines**

Granisetron is not expected to impair the ability to drive or to use machines.

## **4.8 Undesirable effects**

### Summary of the safety profile

The most frequently reported adverse reactions for granisetron are headache and constipation which may be transient. ECG changes including QT prolongation have been reported with granisetron (see sections 4.4 and 4.5).

### Tabulated summary of adverse reactions

The following table of listed adverse reactions is derived from clinical trials and post-marketing data associated with granisetron and other 5-HT<sub>3</sub> antagonists.

Frequency categories are as follows:

Very common:  $\geq 1/10$ ;

Common  $\geq 1/100$  to  $< 1/10$ ;

Uncommon  $\geq 1/1,000$  to  $< 1/100$

Rare ( $\geq 1/10,000$  to  $< 1/1,000$ )

Very rare ( $< 1/10,000$ )

<b><i>Immune system disorders</i></b>	
<i>Uncommon</i>	Hypersensitivity reactions e.g. anaphylaxis, urticaria
<b><i>Psychiatric disorders</i></b>	
<i>Common</i>	Insomnia
<b><i>Nervous system disorders</i></b>	
<i>Very common</i>	Headache
<i>Uncommon</i>	Extrapyramidal Reactions Serotonin Syndrome (see also sections 4.4 and 4.5)
<b><i>Cardiac disorders</i></b>	
<i>Uncommon</i>	QT prolongation
<b><i>Gastrointestinal disorders</i></b>	
<i>Very common</i>	Constipation
<i>Common</i>	Diarrhoea
<b><i>Hepatobiliary disorders</i></b>	
<i>Common</i>	Elevated hepatic transaminases*
<b><i>Skin and subcutaneous tissue disorders</i></b>	
<i>Uncommon</i>	Rash

\*Occurred at a similar frequency in patients receiving comparator therapy

#### Description of selected adverse reactions

As for other 5-HT<sub>3</sub> antagonists, ECG changes including QT prolongation have been reported with granisetron (see sections 4.4 and 4.5).

As with other 5-HT<sub>3</sub> antagonists, cases of serotonin syndrome (including altered mental status, autonomic dysfunction and neuromuscular abnormalities) have been reported following the concomitant use of granisetron and other serotonergic drugs (see sections 4.4 and 4.5)

#### Reporting of suspected adverse reactions

Reporting suspected adverse reactions after authorisation of the medicinal product is important. It allows continued monitoring of the benefit/risk balance of the medicinal product. Healthcare professionals are asked to report any suspected adverse reactions via the Yellow Card Scheme Website: [www.mhra.gov.uk/yellowcard](http://www.mhra.gov.uk/yellowcard) or search for MHRA Yellow Card in the Google Play or Apple App Store.

## 4.9 Overdose

There is no specific antidote for granisetron. In the case of overdose with the injection, symptomatic treatment should be given. Doses of up to 38.5 mg of

granisetron as a single injection have been reported, with symptoms of mild headache but no other reported sequelae.

## 5 PHARMACOLOGICAL PROPERTIES

### 5.1 Pharmacodynamic properties

Pharmacotherapeutic group: Antiemetics and antinauseants, Serotonin (5-HT<sub>3</sub>) antagonists.

ATC code: A04AA02

#### Neurological mechanisms, serotonin-mediated nausea and vomiting

Serotonin is the main neurotransmitter responsible for emesis after chemo- or radio-therapy. The 5-HT<sub>3</sub> receptors are located in three sites: vagal nerve terminals in the gastrointestinal tract and chemoreceptor trigger zones located in the *area postrema* and the *nucleus tractus solitarius* of the vomiting center in the brainstem. The chemoreceptor trigger zones are located at the caudal end of the fourth ventricle (*area postrema*). This structure lacks an effective blood-brain barrier, and will detect emetic agents in both the systemic circulation and the cerebrospinal fluid. The vomiting centre is located in the brainstem medullary structures. It receives major inputs from the chemoreceptor trigger zones, and a vagal and sympathetic input from the gut.

Following exposure to radiation or catotoxic substances, serotonin (5-HT) is released from enterochromaffine cells in the small intestinal mucosa, which are adjacent to the vagal afferent neurons on which 5-HT<sub>3</sub> receptors are located. The released serotonin activates vagal neurons via the 5-HT<sub>3</sub> receptors which lead ultimately to a severe emetic response mediated via the chemoreceptor trigger zone within the *area postrema*.

#### Mechanism of action

Granisetron is a potent anti-emetic and highly selective antagonist of 5-hydroxytryptamine (5-HT<sub>3</sub>) receptors. Radioligand binding studies have demonstrated that granisetron has negligible affinity for other receptor types including 5-HT and dopamine D<sub>2</sub> binding sites.

#### Chemotherapy- and radiotherapy-induced nausea and vomiting

Granisetron administered intravenously has been shown to prevent nausea and vomiting associated with cancer chemotherapy in adults and children 2 to 16 years of age.

#### Post-operative nausea and vomiting

Granisetron administered intravenously has been shown to be effective for prevention and treatment of post-operative nausea and vomiting in adults.

#### Pharmacological properties of granisetron

Interaction with neurotropic and other active substances through its activity on P 450-cytochrome has been reported (see section 4.5).

In vitro studies have shown that the cytochrome P450 sub-family 3A4 (involved in the metabolism of some of the main narcotic agents) is not modified by granisetron. Although ketaconazole was shown to inhibit the ring oxidation of granisetron in vitro, this action is not considered clinically relevant.

Although QT-prolongation has been observed with 5-HT<sub>3</sub> receptors antagonists (see section 4.4), this effect is of such occurrence and magnitude that it does not bear clinical significance in normal subjects. Nonetheless it is advisable to monitor both ECG and clinical abnormalities when treating patients concurrently with drugs known to prolong the QT (see section 4.5).

#### Paediatric population

Clinical application of granisetron was reported by Candiotti et al. A prospective, multicentre, randomized, double-blind, parallel-group study evaluated 157 children 2 to 16 years of age undergoing elective surgery. Total control of postoperative nausea and vomiting during the first 2 hours after surgery was observed in most patients.

## **5.2 Pharmacokinetic properties**

Pharmacokinetics of the oral administration is linear up to 2.5-fold of the recommended dose in adults. It is clear from the extensive dose-finding programme that the antiemetic efficacy is not unequivocally correlated with either administered doses or plasma concentrations of granisetron.

A fourfold increase in the initial prophylactic dose of granisetron made no difference in terms of either the proportion of patient responding to treatment or in the duration of symptoms control.

#### Distribution

Granisetron is extensively distributed, with a mean volume of distribution of approximately 3 l/kg. Plasma protein binding is approximately 65%.

#### Biotransformation

Granisetron is metabolized primarily in the liver by oxidation followed by conjugation. The major compounds are 7-OH-granisetron and its sulphate and

glycuronide conjugates. Although antiemetic properties have been observed for 7-OH-granisetron and indazoline N-desmethyl granisetron, it is unlikely that these contribute significantly to the pharmacological activity of granisetron in man.

*In vitro* liver microsomal studies show that granisetron's major route of metabolism is inhibited by ketoconazole, suggestive of metabolism mediated by the cytochrome P-450 3A subfamily (see section 4.5).

#### Elimination

Clearance is predominantly by hepatic metabolism. Urinary excretion of unchanged granisetron averages 12% of dose while that of metabolites amounts to about 47% of dose. The remainder is excreted in faeces as metabolites. Mean plasma half-life in patients by the oral and intravenous route is approximately 9 hours, with a wide inter-subject variability.

#### Pharmacokinetics in special populations

##### *Renal failure*

In patients with severe renal failure, data indicate that pharmacokinetic parameters after a single intravenous dose are generally similar to those in normal subjects.

##### *Hepatic impairment*

In patients with hepatic impairment due to neoplastic liver involvement, total plasma clearance of an intravenous dose was approximately halved compared to patients without hepatic involvement. Despite these changes, no dosage adjustment is necessary (see section 4.2).

##### *Elderly patients*

In elderly subjects after single intravenous doses, pharmacokinetic parameters were within the range found for non-elderly subjects.

##### *Paediatrics*

**In children, after single intravenous doses, pharmacokinetics are similar to those in adults when appropriate parameters (volume of distribution, total plasma clearance) are normalized for body weight.**

### **5.3 Preclinical safety data**

Non-clinical data reveal no special hazard for humans based on conventional studies of safety pharmacology, repeated dose toxicity, toxicity of reproduction and genotoxicity. Carcinogenicity studies revealed no special hazard for humans when used in the recommended human dose. However, when administered in higher doses and over a prolonged period of time the risk of carcinogenicity cannot be ruled out.

A study in cloned human cardiac ion channels has shown that granisetron has the potential to affect cardiac repolarisation via blockade of HERG potassium channels. granisetron has been shown to block both sodium and potassium channels, which potentially affects both depolarization and repolarisation through prolongation of PR, QRS, and QT intervals. This data helps to clarify the molecular mechanisms by which some of the ECG changes (particularly QT and QRS prolongation) associated with this class of agents occur. However, there is no modification of the cardiac frequency, blood pressure or the ECG trace. If changes do occur, they are generally without clinical significance.

## **6 PHARMACEUTICAL PARTICULARS**

### **6.1 List of excipients**

Sodium Chloride  
Hydrochloric Acid  
Sodium Hydroxide  
Water for Injections

### **6.2 Incompatibilities**

As a general precaution, Granisetron should not be mixed in solution with other drugs. Prophylactic administration of Granisetron should be completed prior to the start of cytostatic therapy.

### **6.3 Shelf life**

Granisetron ampoules have a shelf-life of 3 years.

Once opened, and after dilution with a recommended diluent, the ampoules have a shelf-life of 24 hours.

### **6.4 Special precautions for storage**

Keep the ampoules in the outer carton in order to protect from light.

Do not freeze.

## **6.5 Nature and contents of container**

Granisetron is supplied in clear glass ampoules in packs of five, with an outer carton.

## **6.6 Special precautions for disposal**

### ***Preparing the infusion***

*Children:* To prepare the dose of 40 µg/kg, the appropriate volume is withdrawn and diluted with infusion fluid to a total volume of 10 to 30ml. Any one of the following solutions may be used:

0.9% w/v Sodium Chloride Injection BP; 0.18% w/v Sodium Chloride and 4% w/v Glucose Injection BP; 5% w/v Glucose Injection BP; Hartmann's Solution for Injection BP; Sodium Lactate Injection BP; or 10% Mannitol Injection BP. No other diluents should be used.

Ideally, intravenous infusions of Granisetron should be prepared at the time of administration. After dilution (see above), or when the container is opened for the first time, the shelf-life is 24 hours when stored at ambient temperature in normal indoor illumination protected from direct sunlight. It must not be used after 24 hours. If to be stored after preparation, Granisetron infusions must be prepared under appropriate aseptic conditions.

*Adults:* to prepare a dose of 1mg, 1ml should be withdrawn from the ampoule and diluted to 5ml with 0.9% w/v Sodium Chloride Injection BP. No other diluent should be used.

## **7 MARKETING AUTHORISATION HOLDER**

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