

SUMMARY OF PRODUCT CHARACTERISTICS

1 NAME OF THE MEDICINAL PRODUCT

Granisetron, 1mg/ml, solution for injection

2 QUALITATIVE AND QUANTITATIVE COMPOSITION

The active substance is granisetron.

Each ml solution for injection contains 1 mg of granisetron (as the hydrochloride).

For the full list of excipients, see section 6.1.

3 PHARMACEUTICAL FORM

Solution for injection

The solution for injection is a clear, colourless liquid.

4 CLINICAL PARTICULARS

4.1 Therapeutic indications

Granisetron solution for injection is indicated in adults for the prevention or treatment of

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

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

Granisetron solution for injection 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 solution for injection 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 5 ml per mg.

Treatment (acute nausea)

A dose of 1-3 mg (10-40 µg/kg) of Granisetron solution for injection 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 5 ml per mg. Further maintenance doses of Granisetron solution for injection 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 solution for injection 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 to 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 (10µg/kg) of Granisetron solution for injection 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).

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

For instructions on dilution of the medicinal product before administration, see section 6.6.

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-HT₃ 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-HT₃ antagonists (e.g. dolasetron, ondansetron) has been reported

This medicinal product contains less than 1 mmol sodium (23 mg) per ampoule, that is to say essentially 'sodium free'

Serotonin syndrome

There have been reports of serotonin syndrome with the use of 5-HT₃ 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.

4.5 Interaction with other medicinal products and other forms of interaction

As for other 5-HT₃ 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 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-HT₃ 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.

Breast-feeding

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 has no or negligible influence on the ability to drive and 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 list 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-HT₃ antagonists.

The frequencies used in the table below are: 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 $< 1/1,000$) and very rare ($< 1/10,000$).

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

* Occurred at a similar frequency in patients receiving comparator therapy

Description of selected adverse reactions

As for other 5-HT₃ antagonists, ECG changes including QT prolongation have been reported with granisetron (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 at: www.mhra.gov.uk/yellowcard.

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-HT₃) 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-HT₃ 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 cytotoxic substances, serotonin (5-HT) is released from enterochromaffin cells in the small intestinal mucosa, which are adjacent to the vagal afferent neurons on which 5-HT₃ receptors are located. The released serotonin activates vagal neurons via the 5-HT₃ 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-HT₃) receptors. Radioligand binding studies have demonstrated that granisetron has negligible affinity for other receptor types including 5-HT and dopamine D₂ 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 neurotoxic 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 ketoconazole 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-HT₃ receptor 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 program 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 symptom 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 glucuronide 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.

Pharmacokinetic relationship(s)

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

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

Paediatric population

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 revealed no special hazard for humans based on conventional studies of safety pharmacology, repeated dose toxicity, reproductive toxicity 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 depolarisation 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

Citric acid, monohydrate
Hydrochloric acid (for pH adjustment)
Sodium chloride
Sodium hydroxide (for pH adjustment)
Water for injections

6.2 Incompatibilities

This medicinal product must not be mixed with other medicinal products except those mentioned in section 6.6.

6.3 Shelf life

Shelf life of the finished medicinal product:

3 years

After first opening:

Once opened the product should be used immediately.

After dilution:

Chemical and physical in-use stability has been demonstrated for 24 hours at 25 °C protected from direct sunlight.

From a microbiological point of view, the product should be used immediately. If not used immediately, in-use storage times and conditions prior to use are the responsibility of the user and would normally not be longer than 24 hours at 2 to 8°C, unless dilution has taken place in controlled and validated aseptic conditions

6.4 Special precautions for storage

Keep the ampoules in the outer carton in order to protect from light. Do not freeze.

For storage conditions after dilution of the medicinal product, see section 6.3.

6.5 Nature and contents of container

3 ml, type I clear glass ampoules

1 ml, type I clear glass ampoules

Pack sizes:

5 x 1 ml, 10 x 1 ml

5 x 3 ml, 10 x 3 ml

Not all pack sizes may be marketed.

6.6 Special precautions for disposal

For single use only. Any unused portion should be discarded.

The diluted injections and infusions are to be inspected visually for particulate matter prior to administration. They should only be used if the solution is clear and free from particles.

Preparing the infusion

Adults

The solution should be diluted to 5 ml per mg. i.e the contents of a 1 ml ampoule can be diluted to a volume of 5 ml; the contents of a 3 ml ampoule can be diluted to a volume of 15 ml.

Granisetron can also be diluted in 20 to 50 ml compatible infusion fluid and then given over five minutes as an intravenous infusion in any of the following solutions:

0.9 % w/v sodium chloride injection

5 % w/v glucose injection

Lactated Ringer's Solution;

No other diluents should be used.

Use in the paediatric population

Children 2 years of age and older: To prepare the dose of 10 - 40 µg/kg, the appropriate volume is withdrawn and diluted with infusion fluid (as for adults) to a total volume of 10 to 30 ml.

As a general precaution, Granisetron should not be mixed in solution with other drugs.

Granisetron 1 mg / ml is compatible with Dexamethasone dihydrogenphosphate dinatrium in a concentration of 10-60 µg/ml of Granisetron and 80-480 µg/ml Dexamethasonphosphate diluted in sodium chloride 0.9 % or Glucose 5 % solution over a period of 24 hours.

Any unused medicinal product or waste material should be disposed of in accordance with local requirements.

7 MARKETING AUTHORISATION HOLDER

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WA7 1NT
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8 MARKETING AUTHORISATION NUMBER(S)

PL 08828/0191

9 DATE OF FIRST AUTHORISATION/RENEWAL OF THE AUTHORISATION

Date of first authorisation: 22nd January 2009

Date of latest renewal: 14th March 2013

10 DATE OF REVISION OF THE TEXT

09/01/2021