SUMMARY OF PRODUCT CHARACTERISTICS

1 NAME OF THE MEDICINAL PRODUCT

Nitrofurantoin 100 mg Capsules

2 QUALITATIVE AND QUANTITATIVE COMPOSITION

Each hard capsule contains 100 mg nitrofurantoin in macrocrystalline form. Excipients with known effect

Lactose monohydrate – 207.0 mg per capsule

For the full list of excipients, see section 6.1.

3 PHARMACEUTICAL FORM

Size '2' (17-18 mm) ivory yellowish capsules with the content of yellow or yellow-white powder.

4 CLINICAL PARTICULARS

4.1 Therapeutic indications

For the treatment of and prophylaxis against acute or recurrent, uncomplicated lower urinary tract infections or pyelitis either spontaneous or following surgical procedures. It is indicated in adults, children and infants over 3 months old.

Nitrofurantoin is specifically indicated for the treatment of infections when due to susceptible strains of *Escherichia coli*, enterococci, staphylococci, *Citrobacter, Klebsiella* and *Enterobacter.*

4.2 Posology and method of administration

Posology

Adults

Acute Uncomplicated Urinary Tract Infections (UTIs): 50 mg four times daily for seven days.

Severe chronic recurrence (UTIs): 100 mg four times daily for seven days. Long term suppression: 50-100 mg once a day.

Prophylaxis: 50 mg four times daily for the duration of procedure and for three days thereafter.

Paediatric Population

Children and Infants over three months of age

Acute Urinary Tract Infections: 3mg/kg day in four divided doses for seven days.

Suppressive - 1mg/kg, once a day.

For children under 25 kg body weight consideration should be given to the use of nitrofurantoin suspension.

Elderly

Provided there is no significant renal impairment, in which Nitrofurantoin is contraindicated, the dosage should be that for any normal adult. See precaution and risks to elderly patients associated with long-term therapy (Section 4.8).

Renal impairment

Nitrofurantoin is contraindicated in patients with renal dysfunction and in patients with an eGFR of less than 45 ml/minute (see sections 4.3 & 4.4).

Method of Administration:

For oral use

This medicine should always be taken with food or milk. Taking Nitrofurantoin Capsules with a meal improves absorption and is important for optimal efficacy.

4.3 Contraindications

- Patients with known hypersensitivity to nitrofurantoin or other nitrofurans or to any of the excipients listed in section 6.1.
- Patients suffering from renal dysfunction with an eGFR of less than 45 ml/minute.
- G6PD deficiency (see also Section 4.6)
- Acute porphyria.
- In infants under three months of age as well as pregnant patients at term (during labour and delivery) because of the theoretical possibility of haemolytic anaemia in the foetus or in the newborn infant due to immature erythrocyte enzyme systems.

4.4 Special warnings and precautions for use

Hepatotoxicity:

Hepatic reactions, including hepatitis, autoimmune hepatitis, cholestatic jaundice, chronic active hepatitis, and hepatic necrosis, occur rarely. Fatalities have been reported. The onset of chronic active hepatitis may be insidious, and patients should be monitored periodically for changes in biochemical tests that would indicate liver injury. If hepatitis occurs, the drug should be withdrawn immediately and appropriate measures should be taken.

For long term treatment monitor the patient closely for appearance of hepatic or pulmonary symptoms and other evidence of toxicity.

Discontinue treatment with Nitrofurantoin if otherwise unexplained pulmonary, hepatic, haematological or neurological syndromes occur.

Pulmonary adverse reactions

Acute, subacute and chronic pulmonary reactions have been observed in patients treated with nitrofurantoin. If these reactions occur, nitrofurantoin should be discontinued immediately. Signs of pulmonary damage include difficulty and or pain when breathing, shortness of breath and coughing up blood or mucus.

Chronic pulmonary reactions

Chronic pulmonary reactions (including pulmonary fibrosis and diffuse interstitial pneumonitis) can develop insidiously and can often occur in elderly patients. Close monitoring of the lung disease of patients receiving long-term therapy is indicated (especially in the elderly).

Acute pulmonary reactions

Pulmonary reactions may be acute and usually occur within the first week of treatment. Increased vigilance for respiratory symptoms in patients who have just started therapy is warranted (especially in the elderly).

Urine may be coloured yellow or brown after taking Nitrofurantoin. Patients on Nitrofurantoin are susceptible to false positive urinary glucose (if tested for reducing substances).

Nitrofurantoin should be discontinued at any sign of haemolysis in those with suspected glucose-6-phosphate dehydrogenase deficiency.

Gastrointestinal reactions may be minimised by taking the drug with food or milk, or by adjustment of dosage.

Nitrofurantoin is not effective for the treatment of parenchymal infections of unilaterally nonfunctioning kidney. A surgical cause for infection should be excluded in recurrent or severe cases.

Nitrofurantoin may be used with caution as short-course therapy only for the treatment of uncomplicated lower urinary tract infection in individual cases with an eGFR between 30-44 ml/min to treat resistant pathogens, when the benefits are expected to outweigh the risks.

Since pre-existing conditions may mask adverse reactions, Nitrofurantoin should be used with caution in patients with pulmonary disease, hepatic dysfunction, neurological disorders, and allergic diathesis.

Peripheral neuropathy and susceptibility to peripheral neuropathy which may become severe or irreversible has occurred and may be life threatening. Therefore, treatment should be stopped at the first signs of neural involvement (paraesthesia).

Nitrofurantoin should be used in caution with patients with anaemia, diabetes mellitus, electrolyte imbalance, debilitating conditions and vitamin B (particularly folate) deficiency.

Capsule contains lactose

Patients with rare hereditary problems of galactose intolerance, total lactase deficiency or glucosegalactose malabsorption should not take this medicine.

4.5 Interaction with other medicinal products and other forms of interaction

1. Increased absorption with food or agents delaying gastric emptying.
2. Decreased absorption with magnesium trisilicate.
3. Decreased renal excretion of Nitrofurantoin by probenecid and sulphinpyrazone.
4. Decreased anti-bacterial activity by carbonic anhydrase inhibitors and urine alkalisation.
5. Anti-bacterial antagonism by quinolone anti-infectives.
6. Interference with some tests for glucose in urine.
7. As Nitrofurantoin belongs to the group of Antibacterials, it will have the following interactions:
    - Typhoid Vaccine (oral): Antibacterials inactivate oral typhoid vaccine.

4.6 Fertility, pregnancy and lactation

Pregnancy

Animal studies with Nitrofurantoin have shown no teratogenic effects. Nitrofurantoin has been in extensive clinical use since 1952, and its suitability in human pregnancy has been well documented. However, as with all other drugs, the maternal side effects may adversely affect course of pregnancy. The drug should be used at the lowest dose as appropriate for a specific indication, only after careful assessment.

Nitrofurantoin is however contraindicated in infants under three months of age and in pregnant women during labour and delivery, because of the possible risk of haemolysis of the infants' immature red cells.

Breast-feeding

Breast feeding an infant known or suspected to have an erythrocyte enzyme deficiency (including G6PD deficiency), must be temporarily avoided, since Nitrofurantoin is detected in trace amounts in breast milk.

4.7 Effects on ability to drive and use machines

Nitrofurantoin may cause dizziness and drowsiness and the patient should not drive or operate machinery if affected this way.

4.8 Undesirable effects

A tabulated list of undesirable effects is outlined below:
The undesirable effects are listed according to organ systems and following frequencies:

Rare (≥1/10,000 to <1/1,000)
Not known (cannot be estimated from the available data)

System organ class	Frequency	Adverse Reaction
Infections and infestations	Not known	Superinfections by fungi or resistant organisms such as Pseudomonas. However, these are limited to the genitourinary tract
Blood and lymphatic system disorders	Rare Not known	Aplastic anaemia Agranulocytosis, leucopenia, granulocytopenia, haemolytic anaemia, thrombocytopenia,glucose¬6-phosphatedehydrogenase deficiency anaemia, megaloblastic anaemia and eosinophilia
Immune system disorders	Not known	Allergic skin reactions, angioneurotic oedema, anaphylaxis and cutaneous vasculitis
Psychiatric disorders	Not known	Depression, euphoria, confusion, psychotic reactions
Nervous system disorders	Not known	Peripheral neuropathy including optic neuritis (sensory as well as motor involvement), nystagmus, vertigo, dizziness, headache and drowsiness. Benign intracranial hypertension
Cardiac	Rare	Collapse and cyanosis
Respiratory, thoracic and mediastinal disorders	Not known	Acute pulmonary reactions, Subacute pulmonary reactions* Chronic pulmonary reactions Cough, Dyspnoea, Pulmonary fibrosis; possible association with lupus-erythematous-like syndrome.
Gastrointestinal disorders	Not known	Sialadenitis, Pancreatitis, Nausea, Anorexia, Emesis, Abdominal pain and Diarrhoea.

Hepatobiliary disorders	Not known	Cholestatic jaundice, Chronic active hepatitis (fatalities have been reported), Hepatic necrosis, autoimmune hepatitis
Skin and subcutaneous tissue disorders	Not known	Transient alopecia Exfoliative dermatitis and erythema multiforme (including Stevens-Johnson Syndrome), maculopapular, erythematous or eczematous eruptions, urticaria, rash, and pruritus. Lupus-like syndrome associated with pulmonary reaction. Drug Rash With Eosinophilia And Systemic Symptoms (DRESS syndrome)
Renal and urinary disorders	Not known	Yellow or brown discolouration of urine, Interstitial nephritis
General disorders and administration site conditions	Not known	Asthenia, fever, chills, drug fever and arthralgia
Investigations	Not known	False positive urinary glucose

*Acute pulmonary reactions are commonly manifested by fever, chills, cough, chest pain, dyspnoea, pulmonary infiltration with consolidation or pleural effusion on chest x-ray, and eosinophilia. In subacute pulmonary reactions, fever and eosinophilia occur less often than in the acute form.

Chronic pulmonary reactions occur rarely in patients who have received continuous therapy for six months or longer and are more common in elderly patients. Changes in ECG have occurred, associated with pulmonary reactions.

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 or search for MHRA Yellow Card in the Google Play or Apple App Store.

4.9 Overdose

Symptoms

Symptoms and signs of overdose include gastric irritation, nausea and vomiting.

Management

There is no known specific antidote. However, Nitrofurantoin can be haemodialysed in cases of recent ingestion. Standard treatment is by induction of emesis or by gastric lavage. Monitoring of full blood count, liver function, and pulmonary function tests are recommended. A high fluid intake should be maintained to promote urinary excretion of the drug.

5 PHARMACOLOGICAL PROPERTIES

5.1 Pharmacodynamic properties

Pharmacotherapeutic group: Antibacterials for systemic use, nitrofuran derivatives

ATC Code: J01XE01

Mode of action

Nitrofurantoin is a broad spectrum antibacterial agent, active against the majority of urinary pathogens. The wide range of organisms sensitive to the bactericidal activity include:

Escherichia coli Enterococcus Faecalis Klebsiella Species Enterobacter Species

Staphylococcus Species, e.g. S. Aureus, S. Saprophyticus, S. Epidermidis Citrobacter Species

Resistance

Clinically most common urinary pathogens are sensitive to Nitrofurantoin.

Most strains of proteus and serratia are resistant. All pseudomonas strains are resistant.

5.2 Pharmacokinetic properties

The Nitrofurantoin macrocrystals are specially formulated. The controlled crystal size is designed to control the speed of absorption and thus reduce the incidence of nausea. Clinical and animal studies indicate that Nitrofurantoin therapy decreases the likelihood of nausea in patients who might experience these symptoms on Nitrofurantoin therapy. This special formulation of Nitrofurantoin had not caused any decrease in antibacterial efficacy.

Absorption

Orally administered Nitrofurantoin is readily absorbed in the upper gastrointestinal tract at a slower rate and to reduced extent when compared to microcrystalline Nitrofurantoin. Blood concentrations at therapeutic dosage are usually low.

Elimination

Maximum urinary excretion usually occurs 4-5 hours after administration of macrocrystalline Nitrofurantoin. Urinary drug dose recoveries of about 25- 30% are obtained. It has an elimination half-life of about 30 minutes or less.

5.3 Preclinical safety data

Carcinogenic effect of nitrofurantoin in animal studies was observed. However, human data and extensive use of nitrofurantoin over 50 years do not support such observations.

6 PHARMACEUTICAL PARTICULARS

6.1 List of excipients

Capsule fill

Lactose monohydrate

Maize starch

Talc

Capsule shell

Yellow iron oxide (E172)
Titanium dioxide (E171)
Gelatin

6.2 Incompatibilities

Not known.

6.3 Shelf life

36 months

6.4 Special precautions for storage

Do not store above 25°C.

6.5 Nature and contents of container

Nitrofurantoin 100 mg capsules are supplied in a PVC/aluminium foil blister.

Pack sizes: 14, 15, 28, 30, 56, 60, 84, 90, 100 and 112 capsules in blister pack. Not all pack sizes may be marketed.

6.6 Special precautions for disposal

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

7 MARKETING AUTHORISATION HOLDER

Activase Pharmaceuticals Limited

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P.C. 1060, Nicosia

Cyprus

8 MARKETING AUTHORISATION NUMBER(S)

PL 28444/0230

9 DATE OF FIRST AUTHORISATION/RENEWAL OF THE AUTHORISATION

20/04/2021

10 DATE OF REVISION OF THE TEXT

10/07/2023