

SUMMARY OF PRODUCT CHARACTERISTICS

1. NAME OF THE MEDICINAL PRODUCT

Alkindi 0.5 mg granules in capsules for opening
Alkindi 1 mg granules in capsules for opening
Alkindi 2 mg granules in capsules for opening
Alkindi 5 mg granules in capsules for opening

2. QUALITATIVE AND QUANTITATIVE COMPOSITION

Alkindi 0.5 mg granules in capsules for opening
Each capsule contains 0.5 mg hydrocortisone

Alkindi 1 mg granules in capsules for opening
Each capsule contains 1 mg hydrocortisone

Alkindi 2 mg granules in capsules for opening
Each capsule contains 2 mg hydrocortisone

Alkindi 5 mg granules in capsules for opening
Each capsule contains 5 mg hydrocortisone

For the full list of excipients, see section 6.1.

3. PHARMACEUTICAL FORM

Granules in capsules for opening.

The granules are white to off-white and contained in a transparent colourless (size 00e1) hard capsule.

Alkindi 0.5 mg granules in capsules for opening
The capsule is printed with "INF-0.5" in red ink.

Alkindi 1 mg granules in capsules for opening
The capsule is printed with "INF-1.0" in blue ink.

Alkindi 2 mg granules in capsules for opening
The capsule is printed with "INF-2.0" in green ink.

Alkindi 5 mg granules in capsules for opening
The capsule is printed with "INF-5.0" in grey ink.

4. CLINICAL PARTICULARS

4.1 Therapeutic indications

Replacement therapy of adrenal insufficiency in infants, children and adolescents (from birth to < 18 years old).

4.2 Posology and method of administration

Posology

Dosage must be individualised according to the response of the individual patient. The lowest possible dosage should be used.

Monitoring of the clinical response is necessary and patients should be observed closely for signs that might require dosage adjustment, including changes in clinical status resulting from remissions or exacerbations of the disease, individual responsiveness to the medicinal product, and the effect of stress (e.g. surgery, infection, trauma). During stress it may be necessary to increase the dose temporarily.

Replacement therapy in primary and secondary adrenal insufficiency

Alkindi is given as replacement therapy by oral administration of granules according to clinical practice, in a dose to be titrated against individual clinical response.

Recommended replacement doses of hydrocortisone are 8-10 mg/m²/day for patients with adrenal insufficiency alone and 10-15 mg/m²/day in patients with congenital adrenal hyperplasia (CAH), typically in three or four divided doses.

In patients with some remaining endogenous cortisol production a lower dose may be sufficient.

In situations when the body is exposed to excessive physical and/or mental stress, patients may need an increased dose, especially in the afternoon or evening.

Pre-operatively, during serious trauma or illness in patients with known adrenal insufficiency or doubtful adrenal reserve

Pre-operatively, anaesthetists must be informed if the patient is taking corticosteroids or has previously taken corticosteroids.

In less severe situations when parenteral administration of hydrocortisone is not required, for instance low grade infections, moderate fever of any aetiology and stressful situations such as minor surgical procedures, there should be high awareness of the risk of developing acute adrenal insufficiency, and the normal oral daily replacement dose should be increased temporarily; the Alkindi total daily dose should be increased by doubling or tripling the usual dose. Once the intercurrent illness episode is over, patients can return to the normal replacement dose of Alkindi.

In severe situations, an increase in dose is immediately required and oral administration of hydrocortisone must be replaced with parenteral treatment. Parenteral administration of hydrocortisone is warranted during transient illness episodes such as severe infections, in particular gastroenteritis associated with vomiting and/or diarrhoea, high fever of any aetiology or extensive physical stress, such as for instance serious accidents and surgery under general anaesthesia. Where parenteral hydrocortisone is required, the patient should be treated in a facility with resuscitation facilities in case of evolving adrenal crisis.

Changing from conventional oral glucocorticoid treatment to Alkindi

When changing patients from conventional oral hydrocortisone replacement therapy, crushed or compounded, to Alkindi, an identical total daily dose may be given. Alkindi is therapeutically equivalent to conventional oral hydrocortisone formulations. Where a patient is changed from other oral hydrocortisone formulations to Alkindi, inaccuracy in the dosing possible with other oral hydrocortisone formulations can lead to a relative fall in hydrocortisone exposure on the same nominal dose, leading to symptoms of adrenal insufficiency or crisis (see section 4.4).

Method of administration

The granules must be given orally and should not be chewed. The capsule shell must not be swallowed but carefully be opened as follows:

- The capsule is held so that the printed strength is at the top, and tapped to ensure all the granules are in the lower half of the capsule.
- The bottom of the capsule is gently squeezed.
- The top of the capsule is twisted off.
- The granules are either poured directly onto the child's tongue, or the granules are poured onto a spoon and placed in the child's mouth. For children who are able to take soft food, the granules may be sprinkled onto a spoonful of cold or room temperature soft food (such as yoghurt or fruit puree) and given immediately.
- Whichever method is used, the capsule is tapped to ensure all the granules are removed.

Immediately after administration a drink such as water, milk, breast-milk, or formula-milk should be given to help ensure all granules are swallowed.

If the granules are sprinkled onto a spoonful of soft food this should be given immediately (within 5 minutes) and not stored for future use.

The granules must not be added to liquid as this can result in less than the full dose being given, and may affect the taste masking which will allow the bitter taste of hydrocortisone to become apparent.

Do not administer via nasogastric tube as there is a risk of nasogastric tube blockage.

Detailed pictograms on how to administer the granules are provided in the package leaflet.

4.3 Contraindications

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

Patients with dysphagia or premature infants where oral feeding has not been established.

4.4 Special warnings and precautions for use

Adrenal crisis

Where a child is vomiting or acutely unwell parenteral hydrocortisone should be started without delay, carers should be trained in administering this in an emergency.

Sudden discontinuation of therapy with Alkindi risks triggering an adrenal crisis and death. Medicinal product-induced secondary adrenocortical insufficiency may result from too rapid a withdrawal of corticosteroids and may be minimised by gradual reduction of dosage. This type of relative insufficiency may persist for months after discontinuation of therapy; therefore, in any situation of stress occurring during that period, corticosteroid therapy should be reinstated.

Adrenal crisis can occur when switching from conventional oral hydrocortisone formulations, crushed or compounded, to Alkindi. Close monitoring of patients is recommended in the first week after switch. Healthcare professionals should inform carers and patients that extra doses of Alkindi should be given if symptoms of adrenal insufficiency are seen. If this is required, then an increase in the total daily dose of Alkindi should be considered and immediate medical advice should be sought.

Infections and immunisation

Replacement schedules of corticosteroids for people with adrenal insufficiency do not cause immunosuppression and are not, therefore, contraindications for administration of live vaccines.

Infection should not be more likely at a replacement dose of hydrocortisone, but all infections should be treated seriously and stress dosing of steroid initiated early (see section 4.2). Patients with adrenal

insufficiency are at risk of life-threatening adrenal crisis during infection so clinical suspicion of infection should be high and specialist advice should be sought early.

Undesirable effects of corticosteroid replacement therapy

Most undesirable effects of corticosteroids are dose and duration of exposure related. Undesirable effects are therefore less likely when using corticosteroids as replacement therapy.

Corticosteroids may cause growth retardation in infancy, childhood and adolescence; this may be irreversible. Treatment should be limited to the minimum dosage required to achieve desired clinical response and when reduction in dosage is possible, the reduction should be gradual. Excessive weight gain with decreased height velocity or other symptoms or signs of Cushing syndrome indicate excessive glucocorticoid replacement. Infants require frequent assessment and should be evaluated at a minimum every 3 to 4 months to assess growth, blood pressure, and general well-being.

Bone mineral density may be impacted in children when higher doses of replacement steroids are used. The lowest appropriate dose of steroid according to the response of the individual patient should be used.

Patients/and or carers should be warned that potentially severe psychiatric adverse reactions; euphoria, mania, psychosis with hallucinations and delirium have been seen in adult patients at replacement doses of hydrocortisone (see section 4.8). Symptoms typically emerge within a few days or weeks of starting the treatment. Risks may be higher with high doses/systemic exposure (see also section 4.5), although dose levels do not allow prediction of the onset, type, severity or duration of reactions. Most reactions recover after either dose reduction or withdrawal, although specific treatment may be necessary. Patients/carers should be encouraged to seek medical advice if worrying psychological symptoms develop, especially if depressed mood or suicidal ideation is suspected. Patients/carers should also be alert to possible psychiatric disturbances that may occur either during or immediately after dose tapering/withdrawal of systemic steroids, although such reactions have been reported infrequently.

Rare instances of anaphylactoid reactions have occurred in patients receiving corticosteroids, especially when a patient has a history of allergies to medicinal products.

Visual disturbance

Visual disturbance may be reported with systemic and topical corticosteroid use. If a patient presents with symptoms such as blurred vision or other visual disturbances, the patient should be considered for referral to an ophthalmologist for evaluation of possible causes which may include cataract, glaucoma or rare diseases such as central serous chorioretinopathy which have been reported after use of systemic and topical corticosteroids.

Excretion of granules

The granules may sometimes be seen in stools since the centre of the granule is not absorbed in the gut after it has released the active substance. This does not mean the medicinal product has been ineffective and the patient should not take another dose for this reason.

Nasogastric tube feeding

Alkindi granules are not suitable for nasogastric administration as they may cause tube blockage.

4.5 Interaction with other medicinal products and other forms of interaction

Hydrocortisone is metabolised by cytochrome P450 3A4 (CYP3A4). Concomitant administration of medicinal products that are inhibitors or inducers of CYP3A4 may therefore lead to unwanted alterations in serum concentrations of Alkindi with the risk of adverse effects, particularly adrenal crisis. The need for dose adjustment when such medicinal products are used can be anticipated and patients should be closely monitored.

Medicinal products inducing CYP3A4, requiring a potential increase in Alkindi dosing, include but are not limited to:

- Anticonvulsants: phenytoin, carbamazepine and oxcarbazepine
- Antibiotics: rifampicin and rifabutin
- Barbiturates including phenobarbital and primidone
- Antiretroviral medicinal products: efavirenz and nevirapine

Medicinal products/substances inhibiting CYP3A4, requiring a potential decrease in Alkindi dosing, include but are not limited to:

- Anti-fungals: itraconazole, posaconazole, voriconazole
- Antibiotics: erythromycin and clarithromycin
- Antiretroviral medicinal products: ritonavir
- Grapefruit juice
- Liquorice

4.6 Fertility, pregnancy and lactation

Pregnancy

Hydrocortisone for replacement therapy can be used during pregnancy. The ability of corticosteroids to cross the placenta varies between the different types of corticosteroids, however, hydrocortisone readily crosses the placenta.

Studies in animals have shown reproductive toxicity of corticosteroids (see section 5.3)

Breast-feeding

Hydrocortisone for replacement therapy can be used during breast-feeding.

Fertility

There are no data available for possible effects of Alkindi on fertility.

4.7 Effects on ability to drive and use machines

Alkindi has no or negligible influence on the ability to drive and use machines.

4.8 Undesirable effects

Summary of safety profile

A total of 30 healthy (but dexamethasone-suppressed) adult male subjects in two phase 1 studies and 24 paediatric patients with adrenal insufficiency in two phase 3 studies have been treated with Alkindi. There were no adverse reactions and no episodes of adrenal crisis seen in any of the studies.

Tabulated list of adverse reactions

The following adverse reactions have been reported in the scientific literature in adult patients for other hydrocortisone medicinal products when given as adrenal insufficiency replacement therapy with frequency not known (cannot be estimated from the available data).

MedDRA system organ class	Frequency: not known
Psychiatric disorders	Psychosis with hallucinations and delirium Mania Euphoria
Gastrointestinal disorders	Gastritis Nausea
Renal and urinary disorders	Hypokalaemic alkalosis

Historical cohorts of adults treated from childhood for CAH have been found to have reduced bone mineral density and increased fracture rates and growth retardation (see section 4.4) - it is unclear if these relate to hydrocortisone therapy using current replacement regimens.

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

4.9 Overdose

Reports of acute toxicity and/or deaths following hydrocortisone overdose are rare. No antidote is available. Treatment is probably not indicated for reactions due to chronic poisoning unless the patient has a condition that would render him/her unusually susceptible to ill effects from hydrocortisone. In which case, symptomatic treatment should be instituted as necessary.

The biological half-life of hydrocortisone is about 100 minutes.

5. PHARMACOLOGICAL PROPERTIES

5.1 Pharmacodynamic properties

Pharmacotherapeutic group: Corticosteroids for systemic use; Glucocorticoids. ATC code: H02AB09

Mechanism of action

Hydrocortisone is a glucocorticoid. Glucocorticoids are adrenocortical steroids, both naturally-occurring and synthetic, which are readily absorbed from the gastro-intestinal tract.

Pharmacodynamic effects

Hydrocortisone is believed to be the principal corticosteroid secreted by the adrenal cortex. Naturally-occurring glucocorticoids (hydrocortisone and cortisone), which also have salt-retaining properties, are used as replacement therapy in adrenocortical deficiency states. They are also used for their potent anti-inflammatory effects in disorders of many organ systems. Glucocorticoids cause profound and varied metabolic effects. In addition they modify the body's immune responses to diverse stimuli.

Clinical efficacy

Paediatric population

The pivotal study was an open-label single-dose single-centre trial in 24 paediatric patients aged less than 6 years requiring replacement therapy for adrenal insufficiency due to CAH, primary adrenal failure or hypopituitarism. The study consisted of three consecutive cohorts, the first including 12 patients aged 2 to less than 6 years, the second including 6 patients aged 28 days to less than 2 years, and the third including 6 neonates aged from birth to less than 28 days.

Of these 24 patients, 23 had a diagnosis of CAH and 1 had a diagnosis of hypopituitarism including hypothyroidism. 1 patient had renal hypoplasia, 1 patient atopic dermatitis and 1 patient had rhinitis. The study used a single dose of Alkindi granules equivalent to the previous morning's dose of each patient's usual glucocorticoid treatment. The Alkindi dose range administered was 1 mg - 4 mg. Parents/carers (and where possible children) assessed the palatability of Alkindi after administration using a 5-item Likert scale.

As this was a single-dose study, the primary efficacy assessment was serum cortisol at 60 minutes. In all 24 patients Alkindi was found to increase cortisol values from baseline as expected: median baseline cortisol 14.1 nmol/l (range 14.1 - 104.5), median C_{max} 535.2 nmol/l (range 346.2 - 1445.1).

Alkindi was positively assessed in terms of palatability. Among parents and carers asked about their child's experience of taking the medication (n=23), 82.6% agreed/strongly agreed that their child found swallowing Alkindi easy; 65.2% agreed/strongly agreed that their child showed a positive reaction after Alkindi administration; 95.5% would be happy to give their child Alkindi in the future; and 95.5% said that they would prefer Alkindi for their child's treatment over their usual hydrocortisone formulation. Six of the 12 children in Cohort 1 (age range 2.6 to 4.7 years) responded to an adjusted palatability questionnaire. $\geq 50\%$ subjects reported that the taste, feel in mouth and ease of swallowing were very good and that they were likely to take the medicinal product again. 68.8% of healthy adult volunteers have described the taste as neutral.

5.2 Pharmacokinetic properties

Absorption

Following oral administration, hydrocortisone is rapidly absorbed from the gastro-intestinal tract and the oral Alkindi 4x5 mg was approximately 87 % bioavailable when compared to intravenous hydrocortisone in dexamethasone-suppressed healthy adult male volunteers.

The coadministration of Alkindi with soft food (yoghurt and fruit puree) has been studied *in vitro* with no significant effect on dissolution seen.

Distribution

90% or more of circulating hydrocortisone is reversibly bound to protein.

The binding is accounted for by two protein fractions. One, corticosteroid-binding globulin is a glycoprotein; the other is albumin.

Biotransformation and elimination

Hydrocortisone is metabolised in the liver and most body tissues to hydrogenated and degraded forms such as tetrahydrocortisone and tetrahydrocortisol which are excreted in the urine, mainly conjugated as glucuronides, together with a very small proportion of unchanged hydrocortisone.

The terminal half-life of hydrocortisone is about 1.5 hours following intravenous and oral dosing of hydrocortisone tablets and Alkindi in dexamethasone-suppressed healthy adult male volunteers.

No studies have been conducted in patients with hepatic or renal impairment.

5.3 Preclinical safety data

Administration of corticosteroids to pregnant animals can cause abnormalities of fetal development including cleft palate, intrauterine growth retardation and effects on brain growth and development.

6. PHARMACEUTICAL PARTICULARS

6.1 List of excipients

Granules

Microcrystalline cellulose
Hypromellose
Magnesium stearate
Ethyl cellulose

Capsule
Hypromellose

Printing ink

All inks contain	Shellac, Propylene glycol, Concentrated ammonia solution
Strength (ink colour)	Also contains:
0.5 mg (red)	Red iron oxide (E172), Potassium hydroxide
1 mg (blue)	Indigotine (E132)
2 mg (green)	Indigotine (E132), Yellow iron oxide (E172), Titanium dioxide (E171)
5 mg (grey)	Titanium dioxide (E171), Black iron oxide (E172), Potassium hydroxide

6.2 Incompatibilities

Not applicable

6.3 Shelf life

3 years.

After first opening: 60 days.

6.4 Special precautions for storage

Do not store above 30°C. Store in the original bottle in order to protect from light.

6.5 Nature and contents of container

Hard capsule for opening, containing a single dose of granules. The capsules are provided in high-density polyethylene bottles with polypropylene closure with integrated desiccant.

Pack sizes:

1 bottle containing 50 capsules

6.6 Special precautions for disposal and other handling

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

7. MARKETING AUTHORISATION HOLDER

Diurnal Europe B.V.
Van Heuven Goedhartlaan 935 A
1181LD Amstelveen
The Netherlands
Tel. +31 (0)20 6615 072
info@diurnal.co.uk

8. MARKETING AUTHORISATION NUMBER(S)

Alkindi 0.5 mg granules in capsules for opening:	EU/1/17/1260/001
Alkindi 1 mg granules in capsules for opening:	EU/1/17/1260/002
Alkindi 2 mg granules in capsules for opening:	EU/1/17/1260/003
Alkindi 5 mg granules in capsules for opening:	EU/1/17/1260/004

9. DATE OF FIRST AUTHORISATION/RENEWAL OF THE AUTHORISATION

Date of first authorisation: 09 February 2018

10. DATE OF REVISION OF THE TEXT

8/05/2021

Detailed information on this medicine is available on the European Medicines Agency web site:
<http://www.ema.europa.eu>.