



PA002FSRI05

Somatropin for Injection I.P. (r-DNA origin)

HUMATROPE®

For Subcutaneous use only with the Humatrope®(Somatropin for injection) pen injection device

Lilly

NAME OF THE MEDICINAL PRODUCT

Humatrope®18IU (6 mg), powder and solvent for solution for injection
Humatrope®36IU (12 mg), powder and solvent for solution for injection

QUALITATIVE AND QUANTITATIVE COMPOSITION

Humatrope®18IU: The cartridge contains 6 mg of somatropin.
When reconstituted contains 1.9 mg/ml
Humatrope®36IU: The cartridge contains 12 mg of somatropin
When reconstituted contains 3.8 mg/ml

Somatropin is produced in Escherichia Coli cells by recombinant DNA technology.

Excipients with known effect

This medicinal product contains less than 1 mmol sodium per dose (23mg), i.e. essentially sodium free
For a full list of excipients, see section List of Excipients.

PHARMACEUTICAL FORM

Powder and solvent for solution for injection
The powder is a white or almost white powder.
The solvent is a clear solution.

CLINICAL PARTICULARS

Therapeutic Indications

Paediatric Patients

Humatrope® is indicated for the long-term treatment of children who have growth failure due to an inadequate secretion of normal endogenous growth hormone.

Humatrope® is also indicated for the treatment of short stature in children with Turner Syndrome, confirmed by chromosome analysis.

Humatrope® is also indicated for the long term treatment of idiopathic short stature also called non growth hormone deficient short stature.

Humatrope® is also indicated for the treatment of patients who have growth failure associated with SHOX (Short stature homeobox-containing gene) deficiency, as confirmed by DNA analysis.

Humatrope® is also indicated for the long term treatment of short stature in children born small for gestational age (SGA) who fail to manifest catch up growth by age 2.

Humatrope® is also indicated for the treatment of growth retardation in prepubertal children with chronic renal insufficiency.

Adult Patients

Humatrope® is indicated for replacement therapy in adults with pronounced growth hormone deficiency.

Patients must fulfill the following two criteria:

1. **Childhood Onset:** Patients who were diagnosed as growth hormone deficient during childhood must be retested and their growth hormone deficiency confirmed before replacement therapy with Humatrope® is started.
OR

Adult Onset: Patients who have somatotropin deficiency syndrome, either alone or with multiple hormone deficiencies (hypopituitarism), as a result of pituitary disease, hypothalamic disease, surgery, radiation therapy, or trauma.

AND

2. Biochemical diagnosis of growth hormone deficiency, as diagnosed by low abnormal response to dynamic tests for growth hormone secretion.

Posology and Method of Administration

Posology

The dosage and administration schedule should be personalised for each individual; however for:

Growth hormone deficient paediatric patients

The recommended dosage is 0.025-0.035 mg/kg of body weight per day by subcutaneous injection. This is the equivalent to approximately 0.7-1.0 mg/m² body surface area per day.

Patients with Turner Syndrome

The recommended dosage is 0.045-0.050 mg/kg of body weight per day given as a subcutaneous injection to be administered preferably in the evening. This is equivalent to approximately 1.4 mg/m² per day.

Paediatric patients with SHOX deficiency

The recommended dosage is 0.045-0.050 mg/kg of body weight per day given as subcutaneous injection.

Paediatric patients born Small for Gestational Age (SGA)

The recommended dose is 0.035 mg/kg of body weight per day (equivalent to 1 mg/m² body surface area per day) given as a subcutaneous injection, until final height is reached (see section *Pharmacodynamic properties*). Treatment should be discontinued after the first year of treatment, if the height velocity SDS is below +1.0 SDS. Treatment should be discontinued if height velocity is <2cm/year and, if confirmation is required, bone age is >14 years (girls) or >16 years (boys), corresponding to closure of epiphyseal growth plates.

Prepubertal paediatric patients with Chronic Renal Insufficiency

The recommended dosage is 0.045-0.050 mg/kg (approximately 0.14IU/kg) of body weight per day given as a subcutaneous injection.

Growth hormone deficient adult patients

The recommended starting dose is 0.15 – 0.30 mg/day. A lower starting dose may be necessary in older and obese patients.

This dose should be gradually increased according to individual patient requirements based on the clinical response and serum IGF-I concentrations.

Total daily dose usually does not exceed 1 mg.

IGF-I concentrations should be maintained below the upper limit of the age-specific normal range.

The minimum effective dose should be used and dose requirements may decline with increasing age.

The dosage of somatropin should be decreased in cases of persistent oedema or severe paresthesia, in order to avoid the development of carpal tunnel syndrome (see section *Undesirable Effects*).

Method of Administration

Humatrope is administered by subcutaneous injection after reconstitution

The subcutaneous injection sites should be varied in order to avoid lipatrophy.

For instructions on reconstitution of the medicinal product before administration, see section Special Precautions for disposal and other handling.

Contraindications

- Humatrope® should not be used when there is any evidence of activity of a tumour. Intracranial lesions must be inactive and antitumour therapy complete prior to the institution of growth hormone therapy. Humatrope® should be discontinued if there is evidence of tumour growth.
- Humatrope® should not be reconstituted with the supplied solvent for patients with a known sensitivity to either metacresol or glycerol.
- Humatrope® should not be used for growth promotion in children with closed epiphyses.
- Growth hormone should not be initiated to treat patients with acute critical illness due to complications following open heart or abdominal surgery, multiple accidental trauma, or to patients having acute respiratory failure (see section *Special Warnings and Special Precautions for Use*).

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

Special Warnings and Precautions for Use

The maximum recommended daily dose should not be exceeded (see section *Posology and Method of administration*)

- Previous paediatric subjects who had been treated with growth hormone during childhood until final height was attained, should be re-evaluated for growth hormone deficiency after epiphyseal closure, before replacement therapy is commenced at the doses recommended for adults.
- Diagnosis and therapy with Humatrope® should be initiated and monitored by physicians who are appropriately qualified and experienced in the diagnosis and management of patients with growth hormone deficiency.
- There is so far no evidence to suspect that growth hormone replacement influences the recurrence rate or regrowth of intracranial neoplasms, but standard clinical practice requires regular pituitary imaging in patients with a history of pituitary pathology. A baseline scan is recommended in these patients before instituting growth hormone replacement therapy.
- In childhood cancer survivors, a higher risk of a second neoplasm (benign or malignant) has been reported in patients treated with somatropin. Intracranial tumours, in particular, were the most common of these second neoplasms.

- In cases of severe or recurrent headache, visual problems, nausea and/or vomiting, a fundoscopy for papilloedema is recommended. If papilloedema is confirmed a diagnosis of benign intracranial hypertension should be considered and, if appropriate, the growth hormone treatment should be discontinued.
- At present there is insufficient evidence to guide clinical decision making in patients with resolved intracranial hypertension. If growth hormone treatment is restarted, careful monitoring for symptoms of intracranial hypertension is necessary.
- Patients with endocrine disorders, including growth hormone deficiency, may develop slipped capital epiphyses more frequently. Any child with the onset of a limp during growth hormone therapy should be evaluated.
- Growth hormone increases the extrathyroidal conversion of T4 to T3 and may as such unmask incipient hypothyroidism. Monitoring of thyroid function should therefore be conducted in all patients. In patients with hypopituitarism, standard replacement therapy must be closely monitored when somatropin therapy is administered.
- For paediatric patients, the treatment should be continued until the end of the growth has been reached. It is advisable not to exceed the recommended dosage in view of the potential risks of acromegaly, hyperglycemia and glucosuria.
- Before instituting treatment with somatropin for growth retardation secondary to chronic renal insufficiency, patients should have been followed for one year to verify growth disturbance. Conservative treatment for renal insufficiency (which include control of acidosis, hyperparathyroidism and nutritional status for one year prior to the treatment) should have been established and should be maintained during treatment. Treatment with somatropin should be discontinued at the time of renal transplantation.
- The effects of growth hormone on recovery were studied in two placebo-controlled clinical trials involving 522 adult patients who were critically ill due to complications following open heart or abdominal surgery, multiple accidental trauma, or who were having acute respiratory failure. Mortality was higher (41.9% vs. 19.3%) among growth hormone treated patients (doses 5.3-8 mg/day) compared to those receiving placebo. The safety of continuing growth hormone in patients receiving replacement doses for approved indications who concurrently develop these illnesses has not been established. Therefore, the potential benefit of treatment continuation in patients having acute critical illnesses should be weighed against the potential risks.
- Depending on dose and route of administration, oestrogen therapy may affect the response to growth hormone treatment. Higher doses of growth hormone may be required to achieve an equivalent increase in serum IGF-I in women, as compared to men, especially in women receiving oral oestrogen replacement. If a change of the route of oestrogen administration (oral to transdermal or vice-versa) is made, growth hormone should be newly titrated (see Section Interaction with other medical products and other forms of interaction). An increasing sensitivity to growth hormone (expressed as change in serum IGF-I per growth hormone dose) over time may be observed, particularly in men.
- Unless patients with Prader-Willi syndrome also have a diagnosis of growth hormone deficiency, Humatrope® is not indicated for the treatment of patients who have growth failure due to genetically confirmed Prader-Willi syndrome. There have been reports of sleep apnoea and sudden death after initiating therapy with growth hormone in patients with Prader-Willi syndrome who had one or more of the following risk factors: severe obesity, history of upper airway obstruction or sleep apnoea, or unidentified respiratory infection.
- Because somatropin may reduce insulin sensitivity, patients should be monitored for evidence of glucose intolerance. For patients with diabetes mellitus, the insulin dose may require adjustment after somatropin therapy is instituted. Patients with diabetes or glucose intolerance should be monitored closely during somatropin therapy.
- Elderly patients (age ≥ 65 years) are more sensitive to the action of Humatrope®, they may be more prone to develop (severe) adverse events.
- Experience with patients above 80 years is lacking.
- Experience with prolonged treatment in adults is lacking.
- In short children born SGA other medical reasons or treatments that could explain growth disturbance should be ruled out before starting treatment.
- In children born SGA it is recommended to measure fasting plasma insulin and blood glucose before start of treatment and annually thereafter. In patients with increased risk for diabetes mellitus (e.g. familial history of diabetes, obesity, severe insulin resistance, acanthosis nigricans) oral glucose tolerance testing (OGTT) should be performed. If overt diabetes occurs growth hormone should not be administered until the patient has been stabilized for diabetes care. Then growth hormone may be introduced with careful monitoring of the diabetic metabolic control. An increase in insulin dosage may be required.
- In children born SGA it is recommended to measure the plasma IGF-I concentration before the start of treatment and twice a year thereafter. If on repeated measurements IGF-I levels exceed +2 SD compared to references for sex, age and pubertal status, the IGF-I / IGFBP-3 ratio should be taken into account to consider dose adjustment.
- Initiating Humatrope® treatment in children born SGA and in children with SHOX deficiency near onset of puberty is not recommended because of limited experience.
- Some of the height gain obtained with treating short children born SGA with growth hormone may be lost if treatment is stopped before reaching final height.

Progression of scoliosis in paediatric patients

Scoliosis may progress in any child during rapid growth. Signs of scoliosis should be monitored during treatment.

Pancreatitis in children

Children treated with somatropin may have an increased risk of developing pancreatitis compared to adults treated with somatropin. Although rare, pancreatitis should be considered in somatropin-treated children who develop abdominal pain.

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Interaction with Other Medicinal Products and Other Forms of Interaction

- Patients with diabetes mellitus who receive concomitant somatotropin may require adjustment of their doses of insulin and/or other anti-hyperglycemic agents.
- If glucocorticoid replacement therapy is required, glucocorticoid dosage and compliance should be monitored carefully to avoid either adrenal insufficiency or inhibition of growth promoting effects. In patients treated with somatotropin, previously undiagnosed secondary hypoadrenalism may be unmasked, requiring glucocorticoid replacement therapy.
- In women on oral estrogen replacement, a higher dose of growth hormone may be required to achieve the treatment goal (see section Special Warnings and Special Precautions for Use)
- Somatotropin can increase cytochrome P450 (CYP) enzyme activity in Humans and may result in reduced plasma concentrations and decreased effectiveness of drugs metabolized by CYP3A such as sex steroids corticosteroids, cyclosporine and anticonvulsants.

Fertility, Pregnancy and Lactation

Animal reproduction studies have not been conducted with Humatrope®. It is not known whether Humatrope® can cause foetal harm when administered to a pregnant woman or can affect reproduction capacity. Humatrope® should be given to a pregnant woman only if clearly needed.

There have been no studies conducted with Humatrope® in nursing mothers. It is not known whether this drug is excreted in human milk. Because many drugs are excreted in human milk, caution should be exercised when Humatrope® is administered to a nursing woman.

Effects on the Ability to Drive and Use Machines

Humatrope® has no known effect on ability to drive or use machines.

Undesirable Effects

The following table of undesirable effects and frequencies is based on clinical trial and post-marketing spontaneous reports.

System Organ Class	Event
Immune system disorders	Hypersensitivity to solvent (metacresol/glycerol): 1%-10% Hypersensitivity to the active substance: Frequency not known (cannot be estimated from the available data)
Endocrine disorders	Hypothyroidism: 1%-10%
Reproductive system and breast disorders	Gynaecomastia: <0.01% paediatrics; 0.1%-1% adults
Metabolism and nutrition disorders	Mild hyperglycaemia: 1% paediatrics; 1%-10% adults. Type 2 diabetes mellitus: 0.1%-1% paediatrics; adults cases were reported spontaneously with unknown frequency Insulin resistance
Nervous system disorders	Benign intracranial hypertension: 0.01%-0.1% Headache: >10% adults Insomnia: <0.01% paediatrics; 1%-10% adults Paresthesia: 0.01%-0.1% paediatrics; 1% - 10 % adults Carpal Tunnel Syndrome: 1% - 10 % adults
Vascular disorders	Hypertension: <0.01% paediatrics; 1%-10% adults
Respiratory, thoracic and mediastinal disorders	Dyspnoea: 1%-10% adults Sleep Apnoea: 1%-10%
Musculoskeletal, connective tissue and bone disorders	Localised muscle pain (myalgia): 1%-10% adults, 0.01% - 0.1% paediatrics Joint pain and disorder (arthralgia): >10% adults Progression of scoliosis: 1% - 10% paediatrics
General disorders and administration site conditions	Weakness: 0.1% -1% Injection site pain (reaction): 1%-10% Oedema (local and generalised): 1%-10% paediatrics; 10% adults
Investigations	Glucosuria: <0.01% paediatrics; 0.01-0.1% adults

Paediatric patients

In clinical trials with growth hormone deficient patients approximately 2% of the patients develop antibodies to growth hormone. In trials in Turner Syndrome where higher doses were used, up to 8% of patients developed antibodies to growth hormone. The binding capacity of these antibodies was low and growth rate was not affected adversely. Testing for antibodies to growth hormone should be carried out in any patient who fails to respond to therapy.

A mild and transient oedema was observed early during the course of treatment.

Leukaemia has been reported in a small number of children who have been treated with growth hormone. However there is no evidence that leukaemia incidence is increased in growth hormone recipients without predisposing factors. Adult patients

In patients with adult onset growth hormone deficiency, oedema, muscle pain and joint pain and disorder, were reported early in therapy and tended to be transient.

Adult patients treated with growth hormone, following diagnosis of growth hormone deficiency in childhood, reported side effects less frequently than those with adult onset growth hormone deficiency.

Overdose

Acute overdose could lead initially to hypoglycaemia and subsequently to hyperglycaemia. Long-term overdosage could result in signs and symptoms of acromegaly consistent with the known effects of excess human growth hormone

PHARMACOLOGICAL PROPERTIES

Pharmacodynamic Properties

Pharmacotherapeutic group: anterior pituitary lobe hormones and analogues, ATC code: H01A C01

Somatotropin is a polypeptide hormone of recombinant DNA origin. It has 191 amino acid residues and a molecular weight of 22,215 daltons. The amino acid sequence of the product is identical to that of human growth hormone of pituitary origin. It is synthesised in a strain of *Escherichia coli* that has been modified by the addition of the gene for human growth hormone.

The biological effects of Humatrope® are equivalent to human growth hormone of pituitary origin.

The most prominent effect of Humatrope® is that it stimulates the growth plates of long bones. Additionally, it promotes cellular protein synthesis and nitrogen retention. Humatrope® stimulates lipid metabolism: it increases plasma fatty acids and HDL-cholesterols and decreases total plasma cholesterol. Humatrope® therapy has a beneficial effect on body composition in growth hormone deficient patients, in that body fat stores are reduced and lean body mass is increased. Long term therapy in growth hormone deficient patients increases bone mineral density.

Humatrope® may induce insulin resistance. Large doses of human growth hormone may impair glucose tolerance. The data available from clinical trials so far in patients with Turner Syndrome indicate that, while some patients may not respond to this therapy, an increase over predicted height has been observed, the average being 3.3 ± 3.9 cm.

In a clinical trial, patients (mean age 9.5 ± 0.9 yr) who were treated with a Humatrope® dose of 0.067mg/kg/day for two years showed a mean gain in height SDS of + 1.2 during treatment. The results obtained in this trial with Humatrope® are comparable with those described for other recombinant growth hormone preparations.

Paediatric Population

An open-label, multicentre, observational study GeNeSIS (Genetics and Neuroendocrinology of Short Stature International Study) was established as a post-authorisation safety surveillance programme. Paediatric data on the final height standard deviation score gain in the approved indications are: Growth hormone deficiency, 1.39 ± 1.14; Turner syndrome, 0.95 ± 0.82; short stature homeobox containing gene deficiency (SHOX-D), 0.86 ± 0.91; small for gestational age (SGA), 1.11 ± 0.96 and chronic renal insufficiency (CRI), 0.88 ± 0.81 after 6.0 ± 3.7, 6.4 ± 3.3, 4.7 ± 2.6, 5.4 ± 3.0, and 5.8 ± 2.8 years of somatotropin treatment, respectively.

Results from the long-term observational study (GeNeSIS) of paediatric somatotropin treatment included data from 22,311 somatotropin-treated patients (63.0% growth hormone deficiency, 12.7% idiopathic short stature, 8.4% Turner syndrome, 5.7% children born small for gestational age, 2.6% SHOX deficiency, 0.4% chronic renal insufficiency, 5.5% other, and 1.7% unknown) and were consistent with the known safety profile of somatotropin. Key safety objectives of incidence of type 2 diabetes, de novo cancers and mortality were assessed by comparison to contemporary general population registry data. Eighteen of the 21,448 somatotropin-treated patients eligible for analysis developed type 2 diabetes mellitus in the study; however, 13 out of the 18 patients had reported pre-existing diabetes risk factors. The standardised incidence ratio (95% CI) for type 2 diabetes in somatotropin-treated children was significantly elevated [3.77 (2.24 to 5.96)], but the incidence at 16.8 cases per 100,000 person-years of exposure is rare. The standardised incidence ratio (95% CI) for all-sites primary cancers in patients with no previous cancer history was 0.71 (0.39 to 1.20), based on 14 cases. There were 45 reported deaths in somatotropin-treated patients.

The standardised mortality ratio (95% CI), based on 42 deaths in patients who had follow-up during study, was 0.6 (0.4 to 0.8) for all-cause mortality for all short stature diagnoses combined; only the diagnostic subgroups of patients with a history of organic growth hormone deficiency, and in particular due to previous malignancy, had a significantly elevated standardised mortality ratio.

Pharmacokinetic Properties

A dose of 100 µg/kg to adult male volunteers will give a peak serum level (Cmax) of about 55 ng/mL, a half life (t_{1/2}) of nearly four hours and maximal absorption (AUC [0 to ∞]) of about 475 ng*hr/ml.

Preclinical Safety Data

Humatrope® is human growth hormone produced by recombinant technology. No serious events have been reported in subchronic toxicology studies. Long term animal studies for carcinogenicity and impairment of fertility with this human growth hormone (Humatrope®) have not been performed. There has been no evidence to date of Humatrope® induced mutagenicity.

PHARMACEUTICAL PARTICULARS

List of Excipients

Cartridges of powder: Mannitol I.P., Glycine I.P., Dibasic sodium phosphate I.P., Phosphoric acid I.P.
Solvent: Glycerol I.P., Metacresol Ph. Eur., Water for Injection I.P., Hydrochloric Acid I.P. and Sodium Hydroxide I.P.

Incompatibilities

In the absence of compatibility studies, this medicinal product must not be mixed with other medicinal products.

Shelf Life

Before reconstitution: 3 years.

After reconstitution: the product may be stored for a maximum of 28 days at 2°C-8°C. Daily room temperature exposure should not exceed 30 minutes.

Special Precautions for Storage

Store in a refrigerator (2°C – 8°C). Do not freeze.

Nature and Contents of Container

Humatrope® is available in the following pack sizes:

Humatrope® 6 mg: 1 cartridge (glass type I) with 6 mg of powder for solution for injection, and 3.17 ml of solvent solution in a pre-filled syringe (glass type I) with a plunger (rubber).

Humatrope® 12 mg: 1 cartridge (glass type I) with 12 mg of powder for solution for injection, and 3.15 ml of solvent solution in a pre-filled syringe (glass type I) with a plunger (rubber).

Special Precautions for Disposal and other Handling

Instructions for preparation and handling:

Reconstitution: Each cartridge of Humatrope® should be reconstituted using the accompanying solvent syringe. To reconstitute, attach the cartridge to the pre-filled solvent syringe and then inject the entire contents of the pre-filled solvent syringe into the cartridge. The solvent needle aims the stream of liquid against the glass wall of the cartridge.

Following reconstitution, gently invert the cartridge up and down 10 times until the contents are completely dissolved.

DO NOT SHAKE. The resulting solution should be clear, without particulate matter. If the solution is cloudy or contains particulate matter, the contents MUST NOT be injected.

The solvent syringe is for single use only. Discard it after use. A sterile needle should be used for each administration of Humatrope®. (See Information for the Patient for comprehensive directions on Humatrope® cartridge reconstitution.)

This cartridge has been designed for use only with the Humatrope® (Somatotropin for injection) pen injection device.

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

Manufactured by:

LILLY FRANCE S.A.S,

Centre de Production

2, Rue Du Colonel Lilly

Zone Industrielle

F-67640, Fegersheim, France.

Imported By: Eli Lilly and Company (India) Pvt. Ltd., Bldg. No. 14, Gala No. 1 to 4, 1st Fl, Arihant Comm. Complex, Purna Bhiwandi, Maharashtra-421302

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Eli Lilly and Company, USA

Date Modified: 11-Jul-2019

PA002FSRI05

Item Code PA002FSRI05		Previous Item Code (to be destroyed) PA002FSRI04	
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