

# GENOTROPIN

Recombinant human somatotropin (rhGH)

5 mg, 5.3 mg & 12 mg

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## Name of Medicine

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Somatropin (INN) recombinant

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## Presentation

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GENOTROPIN 5 mg powder for injection with solvent.

Two chamber cartridge, for use in an injection device. The cartridge contains 5 mg somatotropin, glycine, sodium dihydrogen phosphate anhydrous, disodium phosphate anhydrous, water for injection, m-cresol, mannitol.

GENOTROPIN 5.3 mg powder for injection with solvent.

Two-chamber cartridge, for use in an injection device. The cartridge contains 5.3 mg somatotropin glycine, sodium dihydrogen phosphate anhydrous, disodium phosphate anhydrous, water for injection, m-cresol, mannitol.

GENOTROPIN 12 mg powder for injection with solvent.

Two-chamber cartridge, for use in an injection device. The cartridge contains 12 mg somatotropin, glycine, sodium dihydrogen phosphate anhydrous, disodium phosphate anhydrous, water for injection, m-cresol, mannitol.

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## Uses

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### Actions

Somatropin is a potent metabolic hormone of importance for the metabolism of lipids, carbohydrates and proteins. In children with inadequate endogenous growth hormone and in children with Prader-Willi syndrome, somatotropin stimulates linear growth and increases growth rate. In adults, as well as in children, somatotropin maintains a normal body composition by increasing nitrogen retention and stimulation of skeletal muscle growth, and by mobilisation of body fat. Visceral adipose tissue is particularly responsive to somatotropin. In addition to enhanced lipolysis, somatotropin decreases the uptake of triglycerides into body fat stores. Serum concentrations of IGF-I (Insulin-like Growth Factor-I), and IGFBP3 (Insulin-like Growth Factor Binding Protein 3) are increased by somatotropin. In addition, the following actions have been demonstrated:

- Lipid metabolism: Somatropin induces hepatic LDL cholesterol receptors, and affects the profile of serum lipids and lipoproteins. In general, administration of somatropin to growth hormone deficient patients results in reductions in serum LDL and apolipoprotein B. A reduction in serum total cholesterol may also be observed.

- Carbohydrate metabolism: Somatropin increases insulin but fasting blood glucose is commonly unchanged. Children with hypopituitarism may experience fasting hypoglycaemia. This condition is reversed by somatropin.

- Water and mineral metabolism: Growth hormone deficiency is associated with decreased plasma and extracellular volumes. Both are rapidly increased after treatment with somatropin. Somatropin induces the retention of sodium, potassium and phosphorus.

- Bone metabolism: Somatropin stimulates the turnover of skeletal bone. Long-term administration of somatropin to growth hormone deficient patients with osteopenia results in an increase in bone mineral content and density at weight-bearing sites.

- Physical capacity: Muscle strength and physical exercise capacity are improved after long-term treatment with somatropin. Somatropin also increases cardiac output, but the mechanism has yet to be clarified. A decrease in peripheral vascular resistance may contribute to this effect.

- GENOTROPIN improves energy, vitality, memory functions and subjective well-being.

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## **Pharmacokinetics**

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### ***Absorption***

The bioavailability of subcutaneously administered GENOTROPIN is approximately 80% in both healthy subjects and growth hormone deficient patients. A subcutaneous dose of 0.035 mg/kg of GENOTROPIN results in plasma  $C_{max}$  and  $t_{max}$  values in the range of 13-35 ng/ml and 3-6 hours respectively.

### ***Elimination***

The mean terminal half-life of GENOTROPIN after intravenous administration in growth hormone deficient adults is about 0.4 hours. However, after subcutaneous administration, half-lives of 2-3 hours are achieved. The observed difference is likely due to slow absorption from the injection site following subcutaneous administration.

### ***Sub-populations***

The absolute bioavailability of GENOTROPIN seems to be similar in males and females following s.c. administration.

Information about the pharmacokinetics of GENOTROPIN in geriatric and paediatric populations, in different races and in patients with renal, hepatic or cardiac insufficiency is either lacking or incomplete.

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## Indications

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### Children

Growth disturbance due to insufficient secretion of growth hormone and growth disturbance associated with Turner syndrome or chronic renal insufficiency. Prader-Willi syndrome, for improvement of growth and body composition.

### Adults

Replacement therapy in adults with pronounced growth hormone (GH) deficiency as diagnosed in two different dynamic tests for GH deficiency. Patients must also fulfil the following criteria.

*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 GENOTROPIN is started.

*Adult onset:* Patients must have growth hormone deficiency as a result of hypothalamic or pituitary disease and at least one other hormone deficiency diagnosed (except for prolactin) and adequate replacement therapy instituted, before replacement therapy with GH may begin.

Prader-Willi syndrome, for improvement of body composition.

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## Dosage and Administration

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The dosage and administration schedule should be individualised.

The injection should be given subcutaneously and the site varied to prevent lipoatrophy.

*Growth disturbance due to insufficient secretion of growth hormone in children:*

Generally a dose of 0.025 - 0.035 mg/kg body weight per day or 0.7 - 1.0 mg/m<sup>2</sup> body surface area per day is recommended. Even higher doses have been used.

*Prader-Willi syndrome, for improvement of growth and body composition in children:*

Generally a dose of 0.035 mg/kg body weight per day or 1.0 mg/m<sup>2</sup> body surface area per day is recommended.

*Growth disturbance due to Turner syndrome:*

A dose of 0.045 - 0.05 mg/kg body weight per day or 1.4 mg/m<sup>2</sup> body surface area per day is recommended.

*Growth disturbance in chronic renal insufficiency:*

A dose of 1.4 mg/m<sup>2</sup> body surface area per day (approximately 0.045 - 0.05 mg/kg body weight per day) is recommended. Higher doses can be needed if growth velocity is too low. A dose correction can be needed after six months of treatment.

Dosage recommendations in children:

	<b>mg/kg</b> body weight	<b>mg/m<sup>2</sup></b> body surface area
	<b>dose per day</b>	<b>dose per day</b>
Growth hormone deficiency	0.025 - 0.035	0.7 - 1.0
Prader-Willi syndrome	0.035	1.0
Turner syndrome	0.045 - 0.05	1.4
Chronic renal insufficiency	0.045 - 0.05	1.4

*Adult patients with growth hormone deficiency or Prader-Willi syndrome:*

The recommended starting dose is 0.15 to 0.30 mg per day. The final dose should be individually titrated as needed with respect to age and gender. The daily maintenance dose seldom exceeds 1.3 mg per day. Women may require higher doses than men. As normal physiological growth hormone production decreases with age, dose requirements may be reduced. Clinical response, side effects, and determination of IGF-I in serum may be used as guidance for dose titration.

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## **Contraindications**

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GENOTROPIN should not be used when there is any evidence of tumour activity and anti-tumour therapy must be completed prior to starting therapy.

GENOTROPIN should not be used for growth promotion in children with closed epiphyses.

Patients with acute critical illness suffering complications following open heart surgery, abdominal surgery, multiple accidental trauma, acute respiratory failure or similar conditions should not be treated with GENOTROPIN. (Regarding patients undergoing substitution therapy, see “Warnings and Precautions”.)

GENOTROPIN is contraindicated in patients with Prader-Willi syndrome who are severely obese or have severe respiratory impairment (see Warnings and Precautions).

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## **Warnings and Precautions**

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Diagnosis and therapy with GENOTROPIN should be initiated and monitored by physicians who are appropriately qualified and experienced in the diagnosis and management of patients with growth disturbance.

There have been reports of fatalities associated with the use of growth hormone in paediatric patients with Prader-Willi syndrome who had one or more of the following risk factors: severe obesity, history of respiratory impairment or sleep apnoea, or unidentified respiratory infection. Another possible risk factor may be male gender. Patients with Prader-Willi syndrome should be evaluated for upper airway obstruction before initiation of treatment with somatropin. If during treatment with somatropin patients show signs of upper airway obstruction (including onset of or increased snoring), treatment should be interrupted. All patients with Prader-Willi syndrome should be evaluated for sleep apnoea and monitored if sleep apnoea is suspected. These patients should also have effective weight control and be monitored for signs of respiratory infections, which should be diagnosed as early as possible and treated aggressively (see Contraindications).

In patients with Prader-Willi syndrome, treatment should always be in combination with a calorie-restricted diet.

Myositis is a very rare adverse event that may be related to the preservative m-cresol. In the case of myalgia or disproportionate pain at injection site, myositis should be considered and if confirmed, a GENOTROPIN presentation without m-cresol should be used.

Somatropin reduces insulin sensitivity and therefore patients should be observed for evidence of glucose intolerance. In rare cases, therapy with somatropin may produce sufficient glucose intolerance to meet diagnostic criteria for Type 2 diabetes mellitus. The risk of developing diabetes during treatment with somatropin is greatest in those patients with other risk factors for Type 2 diabetes mellitus, such as obesity, family history of diabetes, treatment with steroids, or prior impaired glucose tolerance. In patients with pre-existing diabetes mellitus, the dose of anti-diabetic therapy might require adjustment when somatropin is instituted.

During treatment with somatropin an enhanced T4 to T3 conversion has been found which may result in a reduction in serum T4 and an increase in serum T3 concentrations. In general, the peripheral thyroid hormone levels have remained within the reference ranges for healthy subjects. The effects of somatropin on thyroid hormone levels may be of clinical relevance in patients with central subclinical hypothyroidism in whom hypothyroidism theoretically may develop. Conversely, in patients receiving replacement therapy with thyroxin mild hyperthyroidism may occur. It is therefore particularly advisable to test thyroid function after starting treatment with somatropin and after dose adjustments.

In growth hormone deficiency secondary to treatment of malignant disease, it is recommended to pay attention to signs of relapse of the malignancy.

In patients with endocrine disorders, including growth hormone deficiency, slipped epiphyses of the hip may occur more frequently than in the general population. Children limping during treatment with somatropin should be examined clinically.

In case of severe or recurrent headache, visual problems, nausea and/or vomiting, a funduscopy 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.

Progression of scoliosis can occur in patients who experience rapid growth. Because growth hormone increases growth rate, physicians should be alert to the abnormality, which may manifest during growth hormone therapy. Scoliosis is commonly seen in patients with Prader-Willi syndrome.

Experience in patients above 60 years is limited.

Experience with prolonged treatment in adults is limited.

In chronic renal insufficiency, renal function should be below 50 percent of normal before institution of therapy. To verify growth disturbance, growth should be followed for a year preceding institution of therapy. During this period, conservative treatment for renal insufficiency (which includes control of acidosis, hyperparathyroidism and nutritional status) should have been established and should be maintained during treatment.

The treatment should be discontinued at renal transplantation.

To date, no data on final height in patients with chronic renal insufficiency treated with GENOTROPIN are available.

The effects of GENOTROPIN on recovery were studied in two placebo controlled trials involving 522 critically ill adult patients suffering complications following open heart surgery, abdominal surgery, multiple accidental trauma or acute respiratory failure. Mortality was higher in patients treated with 5.3 or 8 mg GENOTROPIN daily compared to patients receiving placebo, 42% vs. 19%. Based on this information, these types of patients should not be treated with GENOTROPIN. As there is no information available on the safety of growth hormone substitution therapy in acutely critically ill patients, the benefits of continued treatment in this situation should be weighed against the potential risks involved. In all patients developing other or similar acute critical illness, the possible benefit of treatment with GENOTROPIN must be weighed against the potential risk involved (see Contraindications).

## **Pregnancy and lactation**

### **Category B2:**

No clinical experience of use in pregnant women is available. Animal reproduction studies have not shown evidence of harmful effects on the foetus. Treatment with GENOTROPIN should be interrupted if pregnancy occurs.

During normal pregnancy levels of pituitary growth hormone fall markedly after 20 gestation weeks, being replaced almost entirely by placental growth hormone by 30 weeks. In view of this, it is unlikely that continued replacement therapy with somatotropin would be necessary in growth hormone deficient women in the third trimester of pregnancy.

It is not known if somatotropin is excreted into breast milk, but absorption of intact protein from the gastrointestinal tract of the infant is extremely unlikely.

## Effects on ability to drive and use machines

Somatropin does not influence the ability to drive and use machines.

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## Interactions

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Data from an interaction study performed in GH deficient adults suggests that somatropin administration may increase the clearance of compounds known to be metabolised by cytochrome P450 isoenzymes. The clearance of compounds metabolised by cytochrome P 450 3A4 (e.g. sex steroids, corticosteroids, anticonvulsants and cyclosporin) may be especially increased resulting in lower plasma levels of these compounds. The clinical significance of this is unknown.

Also see “Warnings and Precautions” for statements regarding diabetes mellitus and thyroid disorder.

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## Adverse Effects

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### *System Organ Classes*

Neoplasms Benign, Malignant and Unspecified: Leukaemia.

Metabolism and Nutrition Disorders: Type 2 diabetes mellitus.

Nervous System Disorders: Paraesthesia, Benign intracranial hypertension.

Musculoskeletal and Connective Tissue Disorders: Arthralgia, Myalgia, Musculoskeletal stiffness.

General Disorders and Administration Site Conditions: Peripheral oedema, Injection site reaction.

Investigations: Serum cortisol decreased.

Patients with growth hormone deficiency are characterised by extracellular volume deficit. When treatment with somatropin is started this deficit is rapidly corrected. In adult patients adverse effects related to fluid retention, such as peripheral oedema, musculoskeletal stiffness, arthralgia, myalgia and paraesthesia are common (>1/100 and <1/10). In general these adverse effects are mild to moderate, arise within the first months of treatment and subside spontaneously or with dose-reduction.

The incidence of these adverse effects is related to the administered dose, the age of patients, and possibly inversely related to the age of patients at the onset of growth hormone deficiency. In children such adverse effects are uncommon ( $\geq 1/1000$  and  $< 1/100$ ).

Transient local skin reactions at the injection site in children are common ( $\geq 1/100$  and  $< 1/10$ ).

Rare cases ( $<1/1000$  and  $\geq 1/10\ 000$ ) of benign intracranial hypertension and Type 2 diabetes mellitus have been reported.

Somatropin has given rise to the formation of antibodies in approximately 1% of the patients. The binding capacity of these antibodies has been low and no clinical changes have been associated with their formation.

Somatropin has been reported to reduce serum cortisol levels, possibly by affecting carrier proteins or by increased hepatic clearance. The clinical relevance of these findings may be limited. Nevertheless, corticosteroid replacement therapy should be optimised before initiation of GENOTROPIN therapy.

Very rare cases ( $<1/10\ 000$ ) of leukaemia have been reported in growth hormone deficient children treated with somatropin, but the incidence appears to be similar to that in children without growth hormone deficiency.

In the post-marketing experience, rare cases of sudden death have been reported in patients affected by Prader-Willi syndrome treated with somatropin, although no causal relationship has been demonstrated.

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## **Overdosage**

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Acute overdosage could lead initially to hypoglycaemia and subsequently to hyperglycaemia.

Long-term overdosage could result in signs and symptoms consistent with the known effects of human growth hormone excess.

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## **Pharmaceutical Precautions**

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### **Instructions for use/handling**

*Two-chamber cartridge:* The solution is prepared by screwing the injection device together so that the solvent will be mixed with the powder in the two-chamber cartridge. Gently dissolve the drug with a slow, swirling motion. Do not shake vigorously, this might cause denaturation of the active ingredient.

When using an injection device the injection needle should be screwed on before reconstitution.

### **Incompatibilities**

Should be reconstituted only in the supplied solvent.

### **Shelf life**

The product should be stored and transported at 2°C - 8°C. The product should not be frozen and should be protected from light.

Shelf life (before reconstitution): 36 months at 2°C-8°C, protected from light.  
GENOTROPIN can be stored at room temperature (at or below 25°C) by the patient for 1 month.

Shelf life (after reconstitution): 4 weeks at 2°C-8°C protected from light.

### **Special precautions for storage**

Store cold at 2°C - 8°C. Before reconstitution keep container in the outer carton, after reconstitution protect from light. Do not freeze.

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## **Medicine Classification**

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Prescription Medicine.

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## **Package Quantities**

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GENOTROPIN 5 mg cartridge, 1's and 5's (non-marketed)  
GENOTROPIN 5.3 mg cartridge, 1's and 5's  
GENOTROPIN 12 mg cartridge, 1's and 5's

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## **Further Information**

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### **Pre-clinical data**

In studies regarding general toxicity, local tolerance and reproduction toxicity no clinically relevant effects have been observed.

In vitro and in vivo genotoxicity studies on gene mutations and induction of chromosome aberrations have been negative.

An increased chromosome fragility has been observed in one in-vitro study on lymphocytes taken from patients after long term treatment with somatropin and following the addition of the radiomimetic drug bleomycin. The clinical significance of this finding is unclear.

In another study, no increase in chromosomal abnormalities was found in the lymphocytes of patients who had received long term somatropin therapy.

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**Date of Preparation**

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