



Idiopathic Short Stature and Growth Hormone Treatment

GENOTROPIN is a prescription product for the treatment of children with idiopathic short stature (ISS), which means that they are shorter than 98.8% of other children of the same age and sex; they are growing at a rate that is not likely to allow them to reach normal adult height, and their growth plates have not closed. Other causes of short height should be ruled out. ISS has no known cause.

Please see Important Safety Information on pages 7, 8, 9, 16, and 17 and accompanying full Prescribing Information in pocket.

Deciding to go ahead with growth hormone treatment is a big decision. You and your family are sure to have questions about idiopathic short stature (ISS) and its treatment. This booklet will answer many of those questions. If you still need more information about GENOTROPIN, you can visit www.GENOTROPIN.com or call your child's health care provider.

Our patient support program is here to help.
Call the **Pfizer Bridge Program**[®] at **1-800-645-1280**
if you have questions about insurance or your child's device.

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Why does my child need growth hormone?

Your child's health care provider has prescribed growth hormone for your child because it may help him or her reach their growth potential. It works best if it is started at an early age. After your child completes puberty, no further growth in height is generally possible. That is why the earlier ISS is treated, the better the chance for success.

What is a growth hormone?

Hormones are substances made by glands in the body. They travel in the blood and help with important bodily functions. Natural growth hormone is a substance made by the body's pituitary (pit-TOO-it-tair-ee) gland. This pea-sized gland found at the base of the brain makes a group of hormones that control many of the body's functions. It helps children grow, and adults need it to stay healthy.

What is GENOTROPIN?

GENOTROPIN is the name of one growth hormone therapy your health care provider may prescribe for your child. It is just like the natural growth hormone that our bodies make. The main difference is that GENOTROPIN is man-made.

GENOTROPIN is a prescription product for the treatment of children with ISS, which means that they are shorter than 98.8% of other children of the same age and sex; they are growing at a rate that is not likely to allow them to reach normal adult height, and their growth plates have not closed. Other causes of short height should be ruled out. ISS has no known cause.

GENOTROPIN should not be used by patients who have had an allergy or bad reaction to somatropin or any of the other ingredients in GENOTROPIN. In the event of an allergic reaction, seek prompt medical attention.



**More than 83,000 children
all over the world have
taken GENOTROPIN over
the last 30 years.***

*Includes use in all approved indications.

**Please see Important Safety Information on pages 7, 8, 9, 16, and 17
and accompanying full Prescribing Information in pocket.**

Why is it important to start GENOTROPIN early?

Treatment with growth hormone may help children with ISS grow taller, but only while they're naturally growing in height. Once they've completed puberty, no further growth in height is generally possible.

Who should not take GENOTROPIN?

Growth hormone should not be used:

- To increase height in children after the growth plates have closed
- In patients with diabetes who have certain types of diabetic retinopathy (eye problems)
- In patients who have been recently diagnosed with cancer, with cancer, or who are being treated for cancer. Growth hormone deficiency can be caused by brain tumors. So, the presence of these brain tumors should be ruled out before treatment is started. Growth hormone should not be used if it is shown that a previous brain tumor has come back or is getting larger
- In patients who are critically ill because of surgery, trauma, or respiratory failure
- In children with Prader-Willi syndrome who are very overweight or have severe breathing problems
- By patients who have had an allergy or bad reaction to somatropin or any of the other ingredients in GENOTROPIN. In the event of an allergic reaction, seek prompt medical attention

What are the common side effects of GENOTROPIN?

Along with its benefits, any medical treatment may cause some unwanted effects. In studies of GENOTROPIN in children with ISS, side effects included respiratory illnesses, flu, throat infection, inflammation of the nose and throat, stomach pain, headaches, increased appetite, fever, fracture, mood changes, and joint pain.

This does not mean that your child will have any of these reactions. It's just that they are possible based on reactions some children have had. Tell your child's health care provider about these or any other side effects that you notice.

How long has GENOTROPIN been available in the United States?

GENOTROPIN has been available in the United States for more than 20 years. However, if your child experiences anything unusual, let your child's health care provider know right away.

**GENOTROPIN has
been available in the
United States for
more than 20 years.**



Please see Important Safety Information on pages 7, 8, 9, 16, and 17 and accompanying full Prescribing Information in pocket.

Taking GENOTROPIN

How will my child take GENOTROPIN?

GENOTROPIN is injected daily, just below the skin. It doesn't come in a pill because it can't do its work when taken by mouth. Injecting GENOTROPIN lets it stay active and help your child grow.

GENOTROPIN is given with a short, thin needle. Only a very small amount of GENOTROPIN is injected. A needle guard is available so the needle is not seen when injected.

Flexible device options are available to fit a range of individual needs. Your child's health care provider will decide which one is right for your child.

A health care provider may help you and your child with the first injection. He or she can also train you to inject GENOTROPIN on your own.

Will I hurt my child with a painful injection?

Many people say the injections feel like a pinch, and the needle is very thin. Naturally, you don't want to do anything that will cause your child discomfort, and it's normal to be a little nervous at first about giving an injection to your child.

When is the best time to give GENOTROPIN?

Your child's health care provider can tell you the best time to take GENOTROPIN. Many find the best time to inject GENOTROPIN is just before bedtime.

This works well for two reasons.

- First, the body releases the most growth hormone naturally at night. Taking GENOTROPIN at night imitates your body's pattern
- Second, nighttime is when most people brush their teeth and do other things to get ready for bed. Taking GENOTROPIN at this time makes it part of the normal bedtime routine and helps avoid missing a dose



**Try to inject GENOTROPIN
at the same time each day.**

Please see Important Safety Information on pages 7, 8, 9, 16, and 17 and accompanying full Prescribing Information in pocket.

Taking GENOTROPIN (continued)

Where on the body should the injections be given?

GENOTROPIN is injected just below the skin. The health care provider who teaches you how to inject GENOTROPIN can tell you where to inject it. Most often, he or she will tell you to use the thigh, the stomach, or the rear end.

He or she will also tell you it is important to change to a different injection area each day.

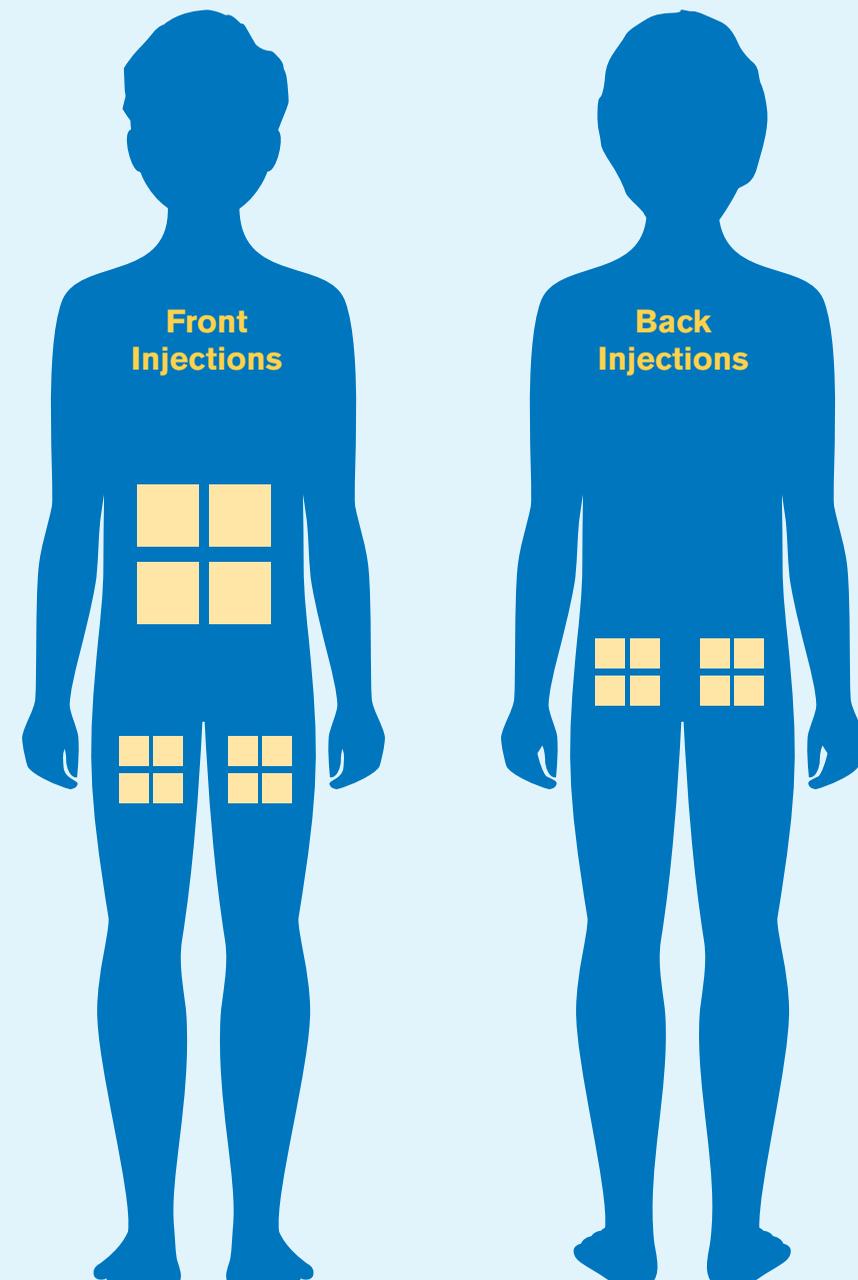
Change to a different injection area each day.

This helps keep injection sites from getting sore or lumpy.

To help you change the injection site each time, divide an area into smaller spots. Keep track of the places you have already used so you know to pick a different one.

Please see Important Safety Information on pages 7, 8, 9, 16, and 17 and accompanying full Prescribing Information in pocket.

The boxes mark places where the injection can be given.



How do I store GENOTROPIN?

- You should store the GENOTROPIN cartridges, GENOTROPIN Pen[®], and GENOTROPIN Mixer[®] in the refrigerator (36°F to 46°F) but not in the freezer. Protect it from light
- If the GENOTROPIN cartridges, Pen, or Mixer are left out of the refrigerator, contact your health care provider or pharmacy
- The GENOTROPIN MiniQuick[®] does not require refrigeration for up to 3 months before mixing

What if I have questions about my child's device?

If you have any other questions, you can call the Device Support Hotline at **1-800-645-1280**, available 24 hours a day, 7 days a week, including holidays. You can also get information and answers anytime at www.GENOTROPIN.com.

How long will my child have to take GENOTROPIN?

Your child's health care provider will determine the length of time for GENOTROPIN therapy. He or she will monitor progress regularly.

How will we know if GENOTROPIN is working?

Your child's health care provider will tell you if GENOTROPIN is working. Your child will have regular appointments with his child's health care provider to measure his or her growth, and monitor the child's growth and monitor progress. It's important to keep these appointments so your child's health care provider knows whether or not GENOTROPIN is working.

What if I have additional questions?

Through the Pfizer Bridge Program[®] your dedicated Patient Care Consultant will:

- Familiarize himself or herself with your child's case
- Offer help with the insurance reimbursement process
- Confirm if you are eligible for the GENOTROPIN Savings Program
- Serve as a coordinating liaison between you and your health care provider, your insurance provider, and your pharmacy
- Call your pharmacy to arrange the first shipment of GENOTROPIN and request shipment to you every month
- Set up training for you or a caregiver to learn how to give injections, when available and requested by your child's health care provider

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What other safety information should I know?

Some patients have developed diabetes mellitus while taking GENOTROPIN. Dosage of diabetes medicines may need to be adjusted during growth hormone treatment. Patients should be watched carefully if growth hormone is given along with glucocorticoid therapy and/or other drugs that are processed by the body in the same way.

In childhood cancer survivors, treatment with growth hormone may increase the risk of a new tumor, particularly certain benign brain tumors. This risk may be higher in patients who were treated with cranial radiation. Also, patients and their doctors should check regularly for skin changes.

A small number of patients treated with growth hormone have had increased pressure in the brain. This can cause headaches and problems with vision. Treatment should be stopped and reassessed in these patients. Patients with Turner Syndrome and Prader-Willi syndrome may be at higher risk of developing increased pressure in the brain.

Thyroid function should be checked regularly during growth hormone therapy. Thyroid hormone replacement therapy should be started or adjusted if needed.

Patients treated with growth hormone should be checked regularly for low serum cortisol levels and/or the need to increase the dose of the glucocorticoids they are taking.

In children experiencing rapid growth, curvature of the spine may develop or worsen. This is also called scoliosis. Patients with scoliosis should be checked regularly to make sure their scoliosis does not get worse during their growth hormone therapy.

In children experiencing rapid growth, limping or hip or knee pain may occur. If a child getting growth hormone therapy starts to limp or gets hip or knee pain, the child's doctor should be notified and the child should be examined.

Growth hormone should only be used during pregnancy if clearly needed. It should be used with caution in nursing mothers because it is not known whether growth hormone is passed into human milk.

Some cases of pancreatitis (inflamed pancreas) have been reported rarely in children and adults receiving growth hormone. There is some evidence that there is a greater risk of this in children than in adults. Literature suggests that girls who have Turner Syndrome may have a greater risk of pancreatitis than other children taking growth hormone. In any child who develops lasting, severe abdominal pain, pancreatitis should be considered.

GENOTROPIN cartridges contain m-Cresol and should not be used by patients allergic to it.

Use a different place on the body each day for growth hormone injections. This can help to prevent skin problems such as lumpiness or soreness.

A health care provider may help you with the first injection. He or she can also train you on how to inject GENOTROPIN.

Rx only

You are encouraged to report negative side effects of prescription drugs to the FDA. Visit www.fda.gov/medwatch or call 1-800-FDA-1088.

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Visit our website at www.GENOTROPIN.com
Contact the Pfizer Bridge Program[®] at **1-800-645-1280**

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side effects of prescription drugs to the FDA.
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HIGHLIGHTS OF PRESCRIBING INFORMATION

These highlights do not include all the information needed to use GENOTROPIN safely and effectively. See full prescribing information for GENOTROPIN

GENOTROPIN® (somatotropin) for injection, for subcutaneous use
Initial U.S. Approval: 1987

RECENT MAJOR CHANGES

Contraindications (4)	12/2016
Warnings and Precautions, Acute Critical Illness (5.1)	9/2016
Warnings and Precautions, Severe Hypersensitivity (5.6)	12/2016
Warnings and Precautions, Hypoadrenalism (5.8)	9/2016

INDICATIONS AND USAGE

GENOTROPIN is a recombinant human growth hormone indicated for:

- **Pediatric:** Treatment of children with growth failure due to growth hormone deficiency (GHD), Prader-Willi syndrome, Small for Gestational Age, Turner syndrome, and Idiopathic Short Stature (1.1)
- **Adult:** Treatment of adults with either adult onset or childhood onset GHD (1.2)

DOSAGE AND ADMINISTRATION

GENOTROPIN should be administered subcutaneously (2)

- **Pediatric GHD:** 0.16 to 0.24 mg/kg/week (2.1)
- **Prader-Willi Syndrome:** 0.24 mg/kg/week (2.1)
- **Small for Gestational Age:** Up to 0.48 mg/kg/week (2.1)
- **Turner Syndrome:** 0.33 mg/kg/week (2.1)
- **Idiopathic Short Stature:** up to 0.47 mg/kg/week (2.1)
- **Adult GHD:** Either a non-weight based or a weight based dosing regimen may be followed, with doses adjusted based on treatment response and IGF-I concentrations (2.2)
- **Non-weight based dosing:** A starting dose of approximately 0.2mg/day (range, 0.15-0.30 mg/day) may be used without consideration of body weight, and increased gradually every 1-2 months by increments of approximately 0.1-0.2 mg/day. (2.2)
- **Weight based dosing:** The recommended initial dose is not more than 0.04 mg/kg/week; the dose may be increased as tolerated to not more than 0.08 mg/kg/week at 4-8 week intervals. (2.2)
- GENOTROPIN cartridges are color-coded to correspond to a specific GENOTROPIN PEN delivery device (2.3)
- Injection sites should always be rotated to avoid lipoatrophy (2.3)

DOSAGE FORMS AND STRENGTHS

GENOTROPIN lyophilized powder in a two-chamber color-coded cartridge (3):

- 5 mg (green tip) and 12 mg (purple tip) (with preservative)
- GENOTROPIN MINIQUICK Growth Hormone Delivery Device containing a two-chamber cartridge (without preservative):
- 0.2 mg, 0.4 mg, 0.6 mg, 0.8 mg, 1.0 mg, 1.2 mg, 1.4 mg, 1.6 mg, 1.8 mg, and 2.0 mg

CONTRAINDICATIONS

- Acute Critical Illness (4)
- Children with Prader-Willi syndrome who are severely obese or have severe respiratory impairment – reports of sudden death (4)
- Active Malignancy (4)

- Hypersensitivity to somatotropin or excipients (4)
- Active Proliferative or Severe Non-Proliferative Diabetic Retinopathy (4)
- Children with closed epiphyses (4)

WARNINGS AND PRECAUTIONS

- **Acute Critical Illness:** Potential benefit of treatment continuation should be weighed against the potential risk (5.1)
- **Prader-Willi syndrome in Children:** Evaluate for signs of upper airway obstruction and sleep apnea before initiation of treatment
Discontinue treatment if these signs occur (5.2)
- **Neoplasm:** Monitor patients with preexisting tumors for progression or recurrence. Increased risk of a second neoplasm in childhood cancer survivors treated with somatotropin in particular meningiomas in patients treated with radiation to the head for their first neoplasm (5.3)
- **Impaired Glucose Tolerance and Diabetes Mellitus:** May be unmasked
Periodically monitor glucose levels in all patients. Doses of concurrent antihyperglycemic drugs in diabetics may require adjustment (5.4)
- **Intracranial Hypertension:** Exclude preexisting papilledema. May develop and is usually reversible after discontinuation or dose reduction (5.5)
- **Hypersensitivity:** Serious hypersensitivity reactions may occur. In the event of an allergic reaction, seek prompt medical attention (5.6)
- **Fluid Retention (i.e., edema, arthralgia, carpal tunnel syndrome – especially in adults):** May occur frequently. Reduce dose as necessary (5.7)
- **Hypoadrenalism:** Monitor patients for reduced serum cortisol levels and/or need for glucocorticoid dose increases in those with known hypoadrenalism (5.8)
- **Hypothyroidism:** May first become evident or worsen. Monitor thyroid function periodically (5.9)
- **Slipped Capital Femoral Epiphysis:** May develop. Evaluate children with the onset of a limp or hip/knee pain (5.10)
- **Progression of Preexisting Scoliosis:** Monitor any child with scoliosis for progression of the curve (5.11)
- **Pancreatitis:** Consider pancreatitis in patients with persistent severe abdominal pain (5.15)

ADVERSE REACTIONS

Other common somatotropin-related adverse reactions include injection site reactions/rashes and lipoatrophy (6.1) and headaches (6.3).

To report SUSPECTED ADVERSE REACTIONS, contact Pfizer Inc. at 1-800-438-1985 or FDA at 1-800-FDA-1088 or www.fda.gov/medwatch.

DRUG INTERACTIONS

- **Inhibition of 11 β -Hydroxysteroid Dehydrogenase Type 1:** May require the initiation of glucocorticoid replacement therapy. Patients treated with glucocorticoid replacement for previously diagnosed hypoadrenalism may require an increase in their maintenance doses (7.1, 7.2).
- **Glucocorticoid Replacement:** Should be carefully adjusted (7.2)
- **Cytochrome P450-Metabolized Drugs:** Monitor carefully if used with somatotropin (7.3)
- **Oral Estrogen:** Larger doses of somatotropin may be required in women (7.4)
- **Insulin and/or Oral/Injectable Hypoglycemic Agents:** May require adjustment (7.5)

See 17 for PATIENT COUNSELING INFORMATION

Revised: 12/2016

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FULL PRESCRIBING INFORMATION

1 INDICATIONS AND USAGE

1.1 Pediatric Patients

GENOTROPIN is indicated for the treatment of pediatric patients who have growth failure due to an inadequate secretion of endogenous growth hormone.

GENOTROPIN is indicated for the treatment of pediatric patients who have growth failure due to Prader-Willi syndrome (PWS). The diagnosis of PWS should be confirmed by appropriate genetic testing (see CONTRAINDICATIONS).

GENOTROPIN is indicated for the treatment of growth failure in children born small for gestational age (SGA) who fail to manifest catch-up growth by age 2 years.

GENOTROPIN is indicated for the treatment of growth failure associated with Turner syndrome.

GENOTROPIN is indicated for the treatment of idiopathic short stature (ISS), also called non-growth hormone-deficient short stature, defined by height standard deviation score (SDS) ≤ -2.25 , and associated with growth rates unlikely to permit attainment of adult height in the normal range, in pediatric patients whose epiphyses are not closed and for whom diagnostic evaluation excludes other causes associated with short stature that should be observed or treated by other means.

1.2 Adult Patients

GENOTROPIN is indicated for replacement of endogenous growth hormone in adults with growth hormone deficiency who meet either of the following two criteria:

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

Childhood Onset (CO): Patients who were growth hormone deficient during childhood as a result of congenital, genetic, acquired, or idiopathic causes.

Patients who were treated with somatropin for growth hormone deficiency in childhood and whose epiphyses are closed should be reevaluated before continuation of somatropin therapy at the reduced dose level recommended for growth hormone deficient adults. According to current standards, confirmation of the diagnosis of adult growth hormone deficiency in both groups involves an appropriate growth hormone provocative test with two exceptions: (1) patients with multiple other pituitary hormone deficiencies due to organic disease; and (2) patients with congenital/genetic growth hormone deficiency.

2 DOSAGE AND ADMINISTRATION

The weekly dose should be divided into 6 or 7 **subcutaneous** injections. **GENOTROPIN must not be injected intravenously.**

Therapy with GENOTROPIN should be supervised by a physician who is experienced in the diagnosis and management of pediatric patients with growth failure associated with growth hormone deficiency (GHD), Prader-Willi syndrome (PWS), Turner syndrome (TS), those who were born small for gestational age (SGA) or Idiopathic Short Stature (ISS), and adult patients with either childhood onset or adult onset GHD.

2.1 Dosing of Pediatric Patients

General Pediatric Dosing Information

The GENOTROPIN dosage and administration schedule should be individualized based on the growth response of each patient.

Response to somatropin therapy in pediatric patients tends to decrease with time. However, in pediatric patients, the **failure** to increase growth rate, particularly during the first year of therapy, indicates the need for close assessment of compliance and evaluation for other causes of growth failure, such as hypothyroidism, undernutrition, advanced bone age and antibodies to recombinant human GH (rhGH).

Treatment with GENOTROPIN for short stature should be discontinued when the epiphyses are fused.

Pediatric Growth Hormone Deficiency (GHD)

Generally, a dose of 0.16 to 0.24 mg/kg body weight/week is recommended.

Prader-Willi Syndrome

Generally, a dose of 0.24 mg/kg body weight/week is recommended.

Turner Syndrome

Generally, a dose of 0.33 mg/kg body weight/week is recommended.

Idiopathic Short Stature

Generally, a dose up to 0.47 mg/kg body weight/week is recommended.

Small for Gestational Age^a

Generally, a dose of up to 0.48 mg/kg body weight/week is recommended.

^aRecent literature has recommended initial treatment with larger doses of somatropin (e.g., 0.48 mg/kg/week), especially in very short children (i.e., height SDS < -3), and/or older/ pubertal children, and that a reduction in dosage (e.g., gradually towards 0.24 mg/kg/week) should be considered if substantial catch-up growth is observed during the first few years of therapy. On the other hand, in younger SGA children (e.g., approximately < 4 years) (who respond the best in general) with less severe short stature (i.e., baseline height SDS values between -2 and -3), consideration should be given to initiating treatment at a lower dose (e.g., 0.24 mg/kg/week), and titrating the dose as needed over time. In all children, clinicians should carefully monitor the growth response, and adjust the somatropin dose as necessary.

2.2 Dosing of Adult Patients

Adult Growth Hormone Deficiency (GHD)

Either of two approaches to GENOTROPIN dosing may be followed: a non-weight based regimen or a weight based regimen.

Non-weight based — based on published consensus guidelines, a starting dose of approximately 0.2 mg/day (range, 0.15-0.30 mg/day) may be used without consideration of body weight. This dose can be increased gradually every 1-2 months by increments of approximately 0.1-0.2 mg/day, according to individual patient requirements based on the clinical response and serum insulin-like growth factor I (IGF-I) concentrations. The dose should be decreased as necessary on the basis of adverse events and/or serum IGF-I concentrations above the age- and gender-specific normal range. Maintenance dosages vary considerably from person to person, and between male and female patients.

Weight based — based on the dosing regimen used in the original adult GHD registration trials, the recommended dosage at the start of treatment is not more than 0.04 mg/kg/week. The dose may be increased according to individual patient requirements to not more than 0.08 mg/kg/week at 4-8 week intervals. Clinical response, side effects, and determination of age- and gender-adjusted serum IGF-I concentrations should be used as guidance in dose titration.

A lower starting dose and smaller dose increments should be considered for older patients, who are more prone to the adverse effects of somatropin than younger individuals. In addition, obese individuals are more likely to manifest adverse effects when treated with a weight-based regimen. In order to reach the defined treatment goal, estrogen-replete women may need higher doses than men. Oral estrogen administration may increase the dose requirements in women.

2.3 Preparation and Administration

The GENOTROPIN 5 and 12 mg cartridges are color-coded to help ensure proper use with the GENOTROPIN Pen delivery device. The 5 mg cartridge has a green tip to match the green pen window on the Pen 5, while the 12 mg cartridge has a purple tip to match the purple pen window on the Pen 12.

Parenteral drug products should always be inspected visually for particulate matter and discoloration prior to administration, whenever solution and container permit. GENOTROPIN MUST NOT BE INJECTED if the solution is cloudy or contains particulate matter. Use it only if it is clear and colorless.

GENOTROPIN may be given in the thigh, buttocks, or abdomen; the site of SC injections should be rotated daily to help prevent lipatrophy.

3 DOSAGE FORMS AND STRENGTHS

GENOTROPIN lyophilized powder:

- **5 mg two-chamber cartridge (green tip, with preservative)** concentration of 5 mg/mL
- **12 mg two-chamber cartridge (purple tip, with preservative)** concentration of 12 mg/mL

GENOTROPIN MINIQUICK Growth Hormone Delivery Device containing a two-chamber cartridge of GENOTROPIN (without preservative)

- **0.2 mg, 0.4 mg, 0.6 mg, 0.8 mg, 1.0 mg, 1.2 mg, 1.4 mg, 1.6 mg, 1.8 mg, and 2.0 mg**

4 CONTRAINDICATIONS

• Acute Critical Illness

Treatment with pharmacologic amounts of somatropin is contraindicated in patients with acute critical illness due to complications following open heart surgery, abdominal surgery or multiple accidental trauma, or those with acute respiratory failure [see *Warnings and Precautions (5.1)*].

• Prader-Willi Syndrome in Children

Somatropin is contraindicated in patients with Prader-Willi syndrome who are severely obese, have a history of upper airway obstruction or sleep apnea, or have severe respiratory impairment. There have been reports of sudden death when somatropin was used in such patients [see *Warnings and Precautions (5.2)*].

• Active Malignancy

In general, somatropin is contraindicated in the presence of active malignancy. Any preexisting malignancy should be inactive and its treatment complete prior to instituting therapy with somatropin. Somatropin should be discontinued if there is evidence of recurrent activity. Since growth hormone deficiency may be an early sign of the presence of a pituitary tumor (or, rarely, other brain tumors), the presence of such tumors should be ruled out prior to initiation of treatment. Somatropin should not be used in patients with any evidence of progression or recurrence of an underlying intracranial tumor.

• Hypersensitivity

GENOTROPIN is contraindicated in patients with a known hypersensitivity to somatropin or any of its excipients. The 5 mg and 12 mg presentations of GENOTROPIN lyophilized powder contain m-cresol as a preservative. Systemic hypersensitivity reactions have been reported with post-marketing use of somatropin products [see *Warnings and Precautions (5.6)*].

• Diabetic Retinopathy

Somatropin is contraindicated in patients with active proliferative or severe non-proliferative diabetic retinopathy.

• Closed Epiphyses

Somatropin should not be used for growth promotion in pediatric patients with closed epiphyses.

5 WARNINGS AND PRECAUTIONS

5.1 Acute Critical Illness

Increased mortality in patients with acute critical illness due to complications following open heart surgery, abdominal surgery or multiple accidental trauma, or those with acute respiratory failure has been reported after treatment with **pharmacologic** amounts of somatropin [see *Contraindications (4)*]. Two placebo-controlled clinical trials in non-growth hormone deficient adult patients (n=522) with these conditions in intensive care units revealed a significant increase in mortality (42% vs. 19%) among somatropin-treated

patients (doses 5.3–8 mg/day) compared to those receiving placebo. The safety of continuing somatropin treatment in patients receiving replacement doses for approved indications who concurrently develop these illnesses has not been established. Therefore, the potential benefit of treatment continuation with somatropin in patients having acute critical illnesses should be weighed against the potential risk.

5.2 Prader-Willi Syndrome in Children

There have been reports of fatalities after initiating therapy with somatropin in pediatric patients with Prader-Willi syndrome who had one or more of the following risk factors: severe obesity, history of upper airway obstruction or sleep apnea, or unidentified respiratory infection. Male patients with one or more of these factors may be at greater risk than females. Patients with Prader-Willi syndrome should be evaluated for signs of upper airway obstruction and sleep apnea before initiation of treatment with somatropin. If during treatment with somatropin, patients show signs of upper airway obstruction (including onset of or increased snoring) and/or new onset sleep apnea, treatment should be interrupted. All patients with Prader-Willi syndrome treated with somatropin should also have effective weight control and be monitored for signs of respiratory infection, which should be diagnosed as early as possible and treated aggressively [see *Contraindications (4)*].

5.3 Neoplasms

In childhood cancer survivors who were treated with radiation to the brain/head for their first neoplasm and who developed subsequent GHD and were treated with somatropin, an increased risk of a second neoplasm has been reported. Intracranial tumors, in particular meningiomas, were the most common of these second neoplasms. In adults, it is unknown whether there is any relationship between somatropin replacement therapy and CNS tumor recurrence [see *Contraindications (4)*]. Monitor all patients with a history of GHD secondary to an intracranial neoplasm routinely while on somatropin therapy for progression or recurrence of the tumor.

Because children with certain rare genetic causes of short stature have an increased risk of developing malignancies, practitioners should thoroughly consider the risks and benefits of starting somatropin in these patients. If treatment with somatropin is initiated, these patients should be carefully monitored for development of neoplasms.

Monitor patients on somatropin therapy carefully for increased growth, or potential malignant changes, of preexisting nevi.

5.4 Impaired Glucose Tolerance and Diabetes Mellitus

Treatment with somatropin may decrease insulin sensitivity, particularly at higher doses in susceptible patients. As a result, previously undiagnosed impaired glucose tolerance and overt diabetes mellitus may be unmasked during somatropin treatment. New-onset Type 2 diabetes mellitus has been reported. Therefore, glucose levels should be monitored periodically in all patients treated with somatropin, especially in those with risk factors for diabetes mellitus, such as obesity, Turner syndrome, or a family history of diabetes mellitus. Patients with preexisting type 1 or type 2 diabetes mellitus or impaired glucose tolerance should be monitored closely during somatropin therapy. The doses of antihyperglycemic drugs (i.e., insulin or oral/injectable agents) may require adjustment when somatropin therapy is instituted in these patients.

5.5 Intracranial Hypertension

Intracranial hypertension (IH) with papilledema, visual changes, headache, nausea and/or vomiting has been reported in a small number of patients treated with somatropin products. Symptoms usually occurred within the first eight (8) weeks after the initiation of somatropin therapy. In all reported cases, IH-associated signs and symptoms rapidly resolved after cessation of therapy or a reduction of the somatropin dose. Funduscopic examination should be performed routinely before initiating treatment with somatropin to exclude preexisting papilledema, and periodically during the course of somatropin therapy. If papilledema is observed by funduscopy during somatropin treatment, treatment should be stopped. If somatropin-induced IH is diagnosed, treatment with somatropin can be restarted at a lower dose after IH-associated signs and symptoms have resolved. Patients with Turner syndrome and Prader-Willi syndrome may be at increased risk for the development of IH.

5.6 Severe Hypersensitivity

Serious systemic hypersensitivity reactions including anaphylactic reactions and angioedema have been reported with post-marketing use of somatropin products. Patients and caregivers should be informed that such reactions are possible and that prompt medical attention should be sought if an allergic reaction occurs [see *Contraindications (4)*].

5.7 Fluid Retention

Fluid retention during somatropin replacement therapy in adults may occur. Clinical manifestations of fluid retention (e.g., edema, arthralgia, myalgia, nerve compression syndromes including carpal tunnel syndrome/paraesthesias) are usually transient and dose dependent.

5.8 Hypoadrenalism

Patients receiving somatropin therapy who have or are at risk for pituitary hormone deficiency(s) may be at risk for reduced serum cortisol levels and/or unmasking of central (secondary) hypoadrenalism. In addition, patients treated with glucocorticoid replacement for previously diagnosed hypoadrenalism may require an increase in their maintenance or stress doses following initiation of somatropin treatment [see *Section 7.1, 11-β Hydroxysteroid Dehydrogenase Type 1*].

5.9 Hypothyroidism

Undiagnosed/untreated hypothyroidism may prevent an optimal response to somatropin, in particular, the growth response in children. Patients with Turner syndrome have an inherently increased risk of developing autoimmune thyroid disease and primary hypothyroidism. In patients with growth hormone deficiency, central (secondary) hypothyroidism may first become evident or worsen during somatropin treatment. Therefore, patients treated with somatropin should have periodic thyroid function tests and thyroid hormone replacement therapy should be initiated or appropriately adjusted when indicated.

5.10 Slipped Capital Femoral Epiphyses in Pediatric Patients

Slipped capital femoral epiphyses may occur more frequently in patients with endocrine disorders (including GHD and Turner syndrome) or in patients undergoing rapid growth. Any pediatric patient with the onset of a limp or complaints of hip or knee pain during somatropin therapy should be carefully evaluated.

5.11 Progression of Preexisting Scoliosis in Pediatric Patients

Progression of scoliosis can occur in patients who experience rapid growth. Because somatropin increases growth rate, patients with a history of scoliosis who are treated with somatropin should be monitored for progression of scoliosis. However, somatropin has not been shown to increase the occurrence of scoliosis. Skeletal abnormalities including scoliosis are commonly seen in untreated Turner syndrome patients. Scoliosis is also commonly seen in untreated patients with Prader-Willi syndrome. Physicians should be alert to these abnormalities, which may manifest during somatropin therapy.

5.12 Otitis Media and Cardiovascular Disorders in Turner Syndrome

Patients with Turner syndrome should be evaluated carefully for otitis media and other ear disorders since these patients have an increased risk of ear and hearing disorders. Somatropin treatment may increase the occurrence of otitis media in patients with Turner syndrome. In addition, patients with Turner syndrome should be monitored closely for cardiovascular disorders (e.g., stroke, aortic aneurysm/dissection, hypertension) as these patients are also at risk for these conditions.

5.13 Lipoatrophy

When somatropin is administered subcutaneously at the same site over a long period of time, tissue atrophy may result. This can be avoided by rotating the injection site [see *Dosage and Administration (2.3)*].

5.14 Laboratory Tests

Serum levels of inorganic phosphorus, alkaline phosphatase, parathyroid hormone (PTH) and IGF-I may increase during somatropin therapy.

5.15 Pancreatitis

Cases of pancreatitis have been reported rarely in children and adults receiving somatropin treatment, with some evidence supporting a greater risk in children compared with adults. Published literature indicates that girls who have Turner syndrome may be at greater risk than other somatropin-treated children. Pancreatitis should be considered in any somatropin-treated patient, especially a child, who develops persistent severe abdominal pain.

6 ADVERSE REACTIONS

The following important adverse reactions are also described elsewhere in the labeling:

- Increased mortality in patients with acute critical illness [see *Warnings and Precautions (5.1)*]
- Fatalities in children with Prader-Willi syndrome [see *Warnings and Precautions (5.2)*]
- Neoplasms [see *Warnings and Precautions (5.3)*]
- Glucose intolerance and diabetes mellitus [see *Warnings and Precautions (5.4)*]
- Intracranial hypertension [see *Warnings and Precautions (5.5)*]
- Severe hypersensitivity [see *Warnings and Precautions (5.6)*]
- Fluid retention [see *Warnings and Precautions (5.7)*]
- Hypoadrenalism [see *Warnings and Precautions (5.8)*]
- Hypothyroidism [see *Warnings and Precautions (5.9)*]
- Slipped capital femoral epiphysis in pediatric patients [see *Warnings and Precautions (5.10)*]
- Progression of preexisting scoliosis in pediatric patients [see *Warnings and Precautions (5.11)*]
- Otitis media and cardiovascular disorders in patients with Turner syndrome [see *Warnings and Precautions (5.12)*]
- Lipoatrophy [see *Warnings and Precautions (5.13)*]
- Pancreatitis [see *Warnings and Precautions (5.15)*]

6.1 Clinical Trials Experience

Because clinical trials are conducted under varying conditions, adverse reaction rates observed during the clinical trials performed with one somatropin formulation cannot always be directly compared to the rates observed during the clinical trials performed with a second somatropin formulation, and may not reflect the adverse reaction rates observed in practice.

Clinical Trials in children with GHD

In clinical studies with GENOTROPIN in pediatric GHD patients, the following events were reported infrequently: injection site reactions, including pain or burning associated with the injection, fibrosis, nodules, rash, inflammation, pigmentation, or bleeding; lipoatrophy; headache; hematuria; hypothyroidism; and mild hyperglycemia.

Clinical Trials in PWS

In two clinical studies with GENOTROPIN in pediatric patients with Prader-Willi syndrome, the following drug-related events were reported: edema, aggressiveness, arthralgia, benign intracranial hypertension, hair loss, headache, and myalgia.

Clinical Trials in children with SGA

In clinical studies of 273 pediatric patients born small for gestational age treated with GENOTROPIN, the following clinically significant events were reported: mild transient hyperglycemia, one patient with benign intracranial hypertension, two patients with central precocious puberty, two patients with jaw prominence, and several patients with aggravation of preexisting scoliosis, injection site reactions, and self-limited progression of pigmented nevi. Anti-hGH antibodies were not detected in any of the patients treated with GENOTROPIN.

Clinical Trials in children with Turner Syndrome

In two clinical studies with GENOTROPIN in pediatric patients with Turner syndrome, the most frequently reported adverse events were respiratory illnesses (influenza, tonsillitis, otitis, sinusitis), joint pain, and urinary tract infection. The only treatment-related adverse event that occurred in more than 1 patient was joint pain.

Clinical Trials in children with Idiopathic Short Stature

In two open-label clinical studies with GENOTROPIN in pediatric patients with ISS, the most commonly encountered adverse events include upper respiratory tract infections, influenza, tonsillitis, nasopharyngitis, gastroenteritis, headaches, increased appetite, pyrexia, fracture, altered mood, and arthralgia. In one of the two studies, during GENOTROPIN treatment, the mean IGF-1 standard deviation (SD) scores were maintained in the normal range. IGF-1 SD scores above +2 SD were observed as follows: 1 subject (3%), 10 subjects (30%) and 16 subjects (38%) in the untreated control, 0.23 and the 0.47 mg/kg/week groups, respectively, had at least one measurement; while 0 subjects (0%), 2 subjects (7%) and 6 subjects (14%) had two or more consecutive IGF-1 measurements above +2 SD.

Clinical Trials in adults with GHD

In clinical trials with GENOTROPIN in 1,145 GHD adults, the majority of the adverse events consisted of mild to moderate symptoms of fluid retention, including peripheral swelling, arthralgia, pain and stiffness of the extremities, peripheral edema, myalgia, paresthesia, and hypoesthesia. These events were reported early during therapy, and tended to be transient and/or responsive to dosage reduction.

Table 1 displays the adverse events reported by 5% or more of adult GHD patients in clinical trials after various durations of treatment with GENOTROPIN. Also presented are the corresponding incidence rates of these adverse events in placebo patients during the 6-month double-blind portion of the clinical trials.

Table 1
Adverse Events Reported by ≥ 5% of 1,145 Adult GHD Patients During Clinical Trials of GENOTROPIN and Placebo, Grouped by Duration of Treatment

Adverse Event	Double Blind Phase		Open Label Phase GENOTROPIN		
	Placebo 0–6 mo. n = 572 % Patients	GENOTROPIN 0–6 mo. n = 573 % Patients	6–12 mo. n = 504 % Patients	12–18 mo. n = 63 % Patients	18–24 mo. n = 60 % Patients
Swelling, peripheral	5.1	17.5*	5.6	0	1.7
Arthralgia	4.2	17.3*	6.9	6.3	3.3
Upper respiratory infection	14.5	15.5	13.1	15.9	13.3
Pain, extremities	5.9	14.7*	6.7	1.6	3.3
Edema, peripheral	2.6	10.8*	3.0	0	0
Paresthesia	1.9	9.6*	2.2	3.2	0
Headache	7.7	9.9	6.2	0	0
Stiffness of extremities	1.6	7.9*	2.4	1.6	0
Fatigue	3.8	5.8	4.6	6.3	1.7
Myalgia	1.6	4.9*	2.0	4.8	6.7
Back pain	4.4	2.8	3.4	4.8	5.0

* Increased significantly when compared to placebo, $P < 0.025$; Fisher's Exact Test (one-sided)
n = number of patients receiving treatment during the indicated period.
% = percentage of patients who reported the event during the indicated period.

Post-Trial Extension Studies in Adults

In expanded post-trial extension studies, diabetes mellitus developed in 12 of 3,031 patients (0.4%) during treatment with GENOTROPIN. All 12 patients had predisposing factors, e.g., elevated glycated hemoglobin levels and/or marked obesity, prior to receiving GENOTROPIN. Of the 3,031 patients receiving GENOTROPIN, 61 (2%) developed symptoms of carpal tunnel syndrome, which lessened after dosage reduction or treatment interruption (52) or surgery (9). Other adverse events that have been reported include generalized edema and hypoesthesia.

Anti-hGH Antibodies

As with all therapeutic proteins, there is potential for immunogenicity. The detection of antibody formation is highly dependent on the sensitivity and specificity of the assay. Additionally, the observed incidence of antibody (including neutralizing antibody) positivity in an assay may be influenced by several factors including assay methodology, sample handling, timing of sample collection, concomitant medications, and underlying disease. For these reasons, comparison of the incidence of antibodies to GENOTROPIN with the incidence of antibodies to other products may be misleading. In the case of growth hormone, antibodies with binding capacities lower than 2 mg/mL have not been associated with growth attenuation. In a very small number of patients treated with somatropin, when binding capacity was greater than 2 mg/mL, interference with the growth response was observed.

In 419 pediatric patients evaluated in clinical studies with GENOTROPIN lyophilized powder, 244 had been treated previously with GENOTROPIN or other growth hormone preparations and 175 had received no previous growth hormone therapy. Antibodies to growth hormone (anti-hGH antibodies) were present in six previously treated patients at baseline. Three of the six became negative for anti-hGH antibodies during 6 to 12 months of treatment with GENOTROPIN. Of the remaining 413 patients, eight (1.9%) developed detectable anti-hGH antibodies during treatment with GENOTROPIN; none had an antibody binding capacity > 2 mg/L. There was no evidence that the growth response to GENOTROPIN was affected in these antibody-positive patients.

Periplasmic Escherichia coli Peptides

Preparations of GENOTROPIN contain a small amount of periplasmic *Escherichia coli* peptides (PECP). Anti-PECP antibodies are found in a small number of patients treated with GENOTROPIN, but these appear to be of no clinical significance.

6.2 Post-Marketing Experience

Because these adverse events are reported voluntarily from a population of uncertain size, it is not always possible to reliably estimate their frequency or establish a causal relationship to drug exposure.

Serious systemic hypersensitivity reactions including anaphylactic reactions and angioedema have been reported with post-marketing use of somatropin products [see *Warnings and Precautions* (5.6)].

Leukemia has been reported in a small number of GHD children treated with somatropin, somatrem (methionylated rhGH) and GH of pituitary origin. It is uncertain whether these cases of leukemia are related to GH therapy, the pathology of GHD itself, or other associated treatments such as radiation therapy. On the basis of current evidence, experts have not been able to conclude that GH therapy *per se* was responsible for these cases of leukemia. The risk for children with GHD, if any, remains to be established [see *Contraindications* (4) and *Warnings and Precautions* (5.3)].

The following serious adverse reactions have been observed with use of somatropin (including events observed in patients who received brands of somatropin other than GENOTROPIN): acute critical illness [see *Warnings and Precautions* (5.1)], sudden death [see *Warnings and Precautions* (5.2)], intracranial tumors [see *Warnings and Precautions* (5.3)], central hypothyroidism [see *Warnings and Precautions* (5.9)], cardiovascular disorders, and pancreatitis [see *Warnings and Precautions* (5.15)].

Slipped capital femoral epiphysis and Legg-Calve-Perthes disease (osteonecrosis/ avascular necrosis; occasionally associated with slipped capital femoral epiphysis) have been reported in children treated with growth hormone [see *Warnings and Precautions* (5.10)]. Cases have been reported with GENOTROPIN.

The following additional adverse reactions have been observed during the appropriate use of somatropin: headaches (children and adults), gynecomastia (children), and significant diabetic retinopathy.

New-onset type 2 diabetes mellitus has been reported.

7 DRUG INTERACTIONS

7.1 11 β -Hydroxysteroid Dehydrogenase Type 1

The microsomal enzyme 11 β -hydroxysteroid dehydrogenase type 1 (11 β HSD-1) is required for conversion of cortisone to its active metabolite, cortisol, in hepatic and adipose tissue. GH and somatropin inhibit 11 β HSD-1. Consequently, individuals with untreated GH deficiency have relative increases in 11 β HSD-1 and serum cortisol. Introduction of somatropin treatment may result in inhibition of 11 β HSD-1 and reduced serum cortisol concentrations. As a consequence, previously undiagnosed central (secondary) hypoadrenalism may be unmasked and glucocorticoid replacement may be required in patients treated with somatropin. In addition, patients treated with glucocorticoid replacement for previously diagnosed hypoadrenalism may require an increase in their maintenance or stress doses following initiation of somatropin treatment; this may be especially true for patients treated with cortisone acetate and prednisone since conversion of these drugs to their biologically active metabolites is dependent on the activity of 11 β HSD-1 [see *Warnings and Precautions* (5.8)].

7.2 Pharmacologic Glucocorticoid Therapy and Supraphysiologic Glucocorticoid Treatment

Pharmacologic glucocorticoid therapy and supraphysiologic glucocorticoid treatment may attenuate the growth promoting effects of somatropin in children. Therefore, glucocorticoid replacement dosing should be carefully adjusted in children receiving concomitant somatropin and glucocorticoid treatments to avoid both hypoadrenalism and an inhibitory effect on growth.

7.3 Cytochrome P450-Metabolized Drugs

Limited published data indicate that somatropin treatment increases cytochrome P450 (CYP450)-mediated antipyrine clearance in man. These data suggest that somatropin administration may alter the clearance of compounds known to be metabolized by CYP450 liver enzymes (e.g., corticosteroids, sex steroids, anticonvulsants, cyclosporine). Careful monitoring is advisable when somatropin is administered in combination with other drugs known to be metabolized by CYP450 liver enzymes. However, formal drug interaction studies have not been conducted.

7.4 Oral Estrogen

In patients on oral estrogen replacement, a larger dose of somatropin may be required to achieve the defined treatment goal [see *Dosage and Administration* (2.2)].

7.5 Insulin and/or Oral/Injectable Hypoglycemic Agents

In patients with diabetes mellitus requiring drug therapy, the dose of insulin and/or oral/injectable agent may require adjustment when somatropin therapy is initiated [see *Warnings and Precautions* (5.4)].

8 USE IN SPECIFIC POPULATIONS

8.1 Pregnancy

Pregnancy Category B. Reproduction studies carried out with GENOTROPIN at doses of 0.3, 1, and 3.3 mg/kg/day administered SC in the rat and 0.08, 0.3, and 1.3 mg/kg/day administered intramuscularly in the rabbit (highest doses approximately 24 times and 19 times the recommended human therapeutic levels, respectively, based on body surface area) resulted in decreased maternal body weight gains but were not teratogenic. In rats receiving SC doses during gametogenesis and up to 7 days of pregnancy, 3.3 mg/kg/day (approximately 24 times human dose) produced anestrus or extended estrus cycles in females and fewer and less motile sperm in males. When given to pregnant female rats (days 1 to 7 of gestation) at 3.3 mg/kg/day a very slight increase in fetal deaths was observed. At 1 mg/kg/day (approximately seven times human dose) rats showed slightly extended estrus cycles, whereas at 0.3 mg/kg/day no effects were noted.

In perinatal and postnatal studies in rats, GENOTROPIN doses of 0.3, 1, and 3.3 mg/kg/day produced growth-promoting effects in the dams but not in the fetuses. Young rats at the highest dose showed increased weight gain during suckling but the effect was not apparent by 10 weeks of age. No adverse effects were observed on gestation, morphogenesis, parturition, lactation, postnatal development, or reproductive capacity of the offspring due to GENOTROPIN. There are, however, no adequate and well-controlled studies in pregnant women. Because animal reproduction studies are not always predictive of human response, this drug should be used during pregnancy only if clearly needed.

8.3 Nursing Mothers

There have been no studies conducted with GENOTROPIN 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 GENOTROPIN is administered to a nursing woman.

8.5 Geriatric Use

The safety and effectiveness of GENOTROPIN in patients aged 65 and over have not been evaluated in clinical studies. Elderly patients may be more sensitive to the action of GENOTROPIN, and therefore may be more prone to develop adverse reactions. A lower starting dose and smaller dose increments should be considered for older patients [see Dosage and Administration (2.2)].

10 OVERDOSAGE

Short-Term

Short-term overdosage could lead initially to hypoglycemia and subsequently to hyperglycemia. Furthermore, overdose with somatotropin is likely to cause fluid retention.

Long-Term

Long-term overdosage could result in signs and symptoms of gigantism and/or acromegaly consistent with the known effects of excess growth hormone [see Dosage and Administration (2)].

11 DESCRIPTION

GENOTROPIN lyophilized powder contains somatotropin, which is a polypeptide hormone of recombinant DNA origin. It has 191 amino acid residues and a molecular weight of 22,124 daltons. The amino acid sequence of the product is identical to that of human growth hormone of pituitary origin (somatotropin). GENOTROPIN is synthesized in a strain of *Escherichia coli* that has been modified by the addition of the gene for human growth hormone. GENOTROPIN is a sterile white lyophilized powder intended for subcutaneous injection.

GENOTROPIN 5 mg is dispensed in a two-chamber cartridge. The front chamber contains recombinant somatotropin 5.8 mg, glycine 2.2 mg, mannitol 1.8 mg, sodium dihydrogen phosphate anhydrous 0.32 mg, and disodium phosphate anhydrous 0.31 mg; the rear chamber contains 0.3% m-Cresol (as a preservative) and mannitol 45 mg in 1.14 mL water for injection. The GENOTROPIN 5 mg two-chambered cartridge contains 5.8 mg of somatotropin. The reconstituted concentration is 5 mg/ml. The cartridge contains overfill to allow for delivery of 1ml containing the stated amount of GENOTROPIN – 5 mg.

GENOTROPIN 12 mg is dispensed in a two-chamber cartridge. The front chamber contains recombinant somatotropin 13.8 mg, glycine 2.3 mg, mannitol 14.0 mg, sodium dihydrogen phosphate anhydrous 0.47 mg, and disodium phosphate anhydrous 0.46 mg; the rear chamber contains 0.3% m-Cresol (as a preservative) and mannitol 32 mg in 1.13 mL water for injection. The GENOTROPIN 12 mg two-chambered cartridge contains 13.8 mg of somatotropin. The reconstituted concentration is 12 mg/ml. The cartridge contains overfill to allow for delivery of 1ml containing the stated amount of GENOTROPIN – 12 mg.

GENOTROPIN MINIQUICK® is dispensed as a single-use syringe device containing a two-chamber cartridge. GENOTROPIN MINIQUICK is available as individual doses of 0.2 mg to 2.0 mg in 0.2 mg increments. The front chamber contains recombinant somatotropin 0.22 to 2.2 mg, glycine 0.23 mg, mannitol 1.14 mg, sodium dihydrogen phosphate 0.05 mg, and disodium phosphate anhydrous 0.027 mg; the rear chamber contains mannitol 12.6 mg in water for injection 0.275 mL. The reconstituted GENOTROPIN MINIQUICK two-chamber cartridge contains overfill to allow for delivery of 0.25 ml containing the stated amount of GENOTROPIN.

GENOTROPIN is a highly purified preparation. The reconstituted recombinant somatotropin solution has an osmolality of approximately 300 mOsm/kg, and a pH of approximately 6.7. The concentration of the reconstituted solution varies by strength and presentation (see HOW SUPPLIED).

12 CLINICAL PHARMACOLOGY

12.1 Mechanism of Action

In vitro, preclinical, and clinical tests have demonstrated that GENOTROPIN lyophilized powder is therapeutically equivalent to human growth hormone of pituitary origin and achieves similar pharmacokinetic profiles in normal adults. In pediatric patients who have growth hormone deficiency (GHD), have Prader-Willi syndrome (PWS), were born small for gestational age (SGA), have Turner syndrome (TS), or have Idiopathic short stature (ISS), treatment with GENOTROPIN stimulates linear growth. In patients with GHD or PWS, treatment with GENOTROPIN also normalizes concentrations of IGF-I (Insulin-like Growth Factor-I/Somatomedin C). In adults with GHD, treatment with GENOTROPIN results in reduced fat mass, increased lean body mass, metabolic alterations that include beneficial changes in lipid metabolism, and normalization of IGF-I concentrations.

In addition, the following actions have been demonstrated for GENOTROPIN and/or somatotropin.

12.2 Pharmacodynamics

Tissue Growth

A. Skeletal Growth: GENOTROPIN stimulates skeletal growth in pediatric patients with GHD, PWS, SGA, TS, or ISS. The measurable increase in body length after administration of GENOTROPIN results from an effect on the epiphyseal plates of long bones. Concentrations of IGF-I, which may play a role in skeletal growth, are generally low in the serum of pediatric patients with GHD, PWS, or SGA, but tend to increase during treatment with GENOTROPIN. Elevations in mean serum alkaline phosphatase concentration are also seen.

B. Cell Growth: It has been shown that there are fewer skeletal muscle cells in short-statured pediatric patients who lack endogenous growth hormone as compared with the normal pediatric population. Treatment with somatotropin results in an increase in both the number and size of muscle cells.

Protein Metabolism

Linear growth is facilitated in part by increased cellular protein synthesis. Nitrogen retention, as demonstrated by decreased urinary nitrogen excretion and serum urea nitrogen, follows the initiation of therapy with GENOTROPIN.

Carbohydrate Metabolism

Pediatric patients with hypopituitarism sometimes experience fasting hypoglycemia that is improved by treatment with GENOTROPIN. Large doses of growth hormone may impair glucose tolerance.

Lipid Metabolism

In GHD patients, administration of somatotropin has resulted in lipid mobilization, reduction in body fat stores, and increased plasma fatty acids.

Mineral Metabolism

Somatotropin induces retention of sodium, potassium, and phosphorus. Serum concentrations of inorganic phosphate are increased in patients with GHD after therapy with GENOTROPIN. Serum calcium is not significantly altered by GENOTROPIN. Growth hormone could increase calciuria.

Body Composition

Adult GHD patients treated with GENOTROPIN at the recommended adult dose (see DOSAGE AND ADMINISTRATION) demonstrate a decrease in fat mass and an increase in lean body mass. When these alterations are coupled with the increase in total body water, the overall effect of GENOTROPIN is to modify body composition, an effect that is maintained with continued treatment.

12.3 Pharmacokinetics

Absorption

Following a 0.03 mg/kg subcutaneous (SC) injection in the thigh of 1.3 mg/mL GENOTROPIN to adult GHD patients, approximately 80% of the dose was systemically available as compared with that available following intravenous dosing. Results were comparable in both male and female patients. Similar bioavailability has been observed in healthy adult male subjects.

In healthy adult males, following an SC injection in the thigh of 0.03 mg/kg, the extent of absorption (AUC) of a concentration of 5.3 mg/mL GENOTROPIN was 35% greater than that for 1.3 mg/mL GENOTROPIN. The mean (\pm standard deviation) peak (C_{max}) serum levels were 23.0 (\pm 9.4) ng/mL and 17.4 (\pm 9.2) ng/mL, respectively.

In a similar study involving pediatric GHD patients, 5.3 mg/mL GENOTROPIN yielded a mean AUC that was 17% greater than that for 1.3 mg/mL GENOTROPIN. The mean C_{max} levels were 21.0 ng/mL and 16.3 ng/mL, respectively.

Adult GHD patients received two single SC doses of 0.03 mg/kg of GENOTROPIN at a concentration of 1.3 mg/mL, with a one- to four-week washout period between injections. Mean C_{max} levels were 12.4 ng/mL (first injection) and 12.2 ng/mL (second injection), achieved at approximately six hours after dosing.

There are no data on the bioequivalence between the 12 mg/mL formulation and either the 1.3 mg/mL or the 5.3 mg/mL formulations.

Distribution

The mean volume of distribution of GENOTROPIN following administration to GHD adults was estimated to be 1.3 (\pm 0.8) L/kg.

Metabolism

The metabolic fate of GENOTROPIN involves classical protein catabolism in both the liver and kidneys. In renal cells, at least a portion of the breakdown products are returned to the systemic circulation. The mean terminal half-life of intravenous GENOTROPIN in normal adults is 0.4 hours, whereas subcutaneously administered GENOTROPIN has a half-life of 3.0 hours in GHD adults. The observed difference is due to slow absorption from the subcutaneous injection site.

Excretion

The mean clearance of subcutaneously administered GENOTROPIN in 16 GHD adult patients was 0.3 (\pm 0.11) L/hrs/kg.

Special Populations

Pediatric: The pharmacokinetics of GENOTROPIN are similar in GHD pediatric and adult patients.

Gender: No gender studies have been performed in pediatric patients; however, in GHD adults, the absolute bioavailability of GENOTROPIN was similar in males and females.

Race: No studies have been conducted with GENOTROPIN to assess pharmacokinetic differences among races.

Renal or hepatic insufficiency: No studies have been conducted with GENOTROPIN in these patient populations.

Table 2
Mean SC Pharmacokinetic Parameters in Adult GHD Patients

	Bioavailability (%) (N=15)	T_{max} (hours) (N=16)	CL/F (L/hr x kg) (N=16)	Vss/F (L/kg) (N=16)	$T_{1/2}$ (hours) (N=16)
Mean (\pm SD)	80.5 *	5.9 (\pm 1.65)	0.3 (\pm 0.11)	1.3 (\pm 0.80)	3.0 (\pm 1.44)
95% CI	70.5 – 92.1	5.0 – 6.7	0.2 – 0.4	0.9 – 1.8	2.2 – 3.7

T_{max} = time of maximum plasma concentration

CL/F = plasma clearance

Vss/F = volume of distribution

$T_{1/2}$ = terminal half-life

SD = standard deviation

CI = confidence interval

* The absolute bioavailability was estimated under the assumption that the log-transformed data follow a normal distribution. The mean and standard deviation of the log-transformed data were mean = 0.22 (\pm 0.241).

13 NONCLINICAL TOXICOLOGY

13.1 Carcinogenesis, Mutagenesis, Impairment of Fertility

Carcinogenicity studies have not been conducted with GENOTROPIN. No potential mutagenicity of GENOTROPIN was revealed in a battery of tests including induction of gene mutations in bacteria (the Ames test), gene mutations in mammalian cells grown in vitro (mouse L5178Y cells), and chromosomal damage in intact animals (bone marrow cells in rats). See PREGNANCY section for effect on fertility.

14 CLINICAL STUDIES

14.1 Adult Growth Hormone Deficiency (GHD)

GENOTROPIN lyophilized powder was compared with placebo in six randomized clinical trials involving a total of 172 adult GHD patients. These trials included a 6-month double-blind treatment period, during which 85 patients received GENOTROPIN and 87 patients received placebo, followed by an open-label treatment period in which participating patients received GENOTROPIN for up to a total of 24 months. GENOTROPIN was administered as a daily SC injection at a dose of 0.04 mg/kg/week for the first month of treatment and 0.08 mg/kg/week for subsequent months.

Beneficial changes in body composition were observed at the end of the 6-month treatment period for the patients receiving GENOTROPIN as compared with the placebo patients. Lean body mass, total body water, and lean/fat ratio increased while total body fat mass and waist circumference decreased. These effects on body composition were maintained when treatment was continued beyond 6 months. Bone mineral density declined after 6 months of treatment but returned to baseline values after 12 months of treatment.

14.2 Prader-Willi Syndrome (PWS)

The safety and efficacy of GENOTROPIN in the treatment of pediatric patients with Prader-Willi syndrome (PWS) were evaluated in two randomized, open-label, controlled clinical trials. Patients received either GENOTROPIN or no treatment for the first year of the studies, while all patients received GENOTROPIN during the second year. GENOTROPIN was administered as a daily SC injection, and the dose was calculated for each patient every 3 months. In Study 1, the treatment group received GENOTROPIN at a dose of 0.24 mg/kg/week during the entire study. During the second year, the control group received GENOTROPIN at a dose of 0.48 mg/kg/week. In Study 2, the treatment group received GENOTROPIN at a dose of 0.36 mg/kg/week during the entire study. During the second year, the control group received GENOTROPIN at a dose of 0.36 mg/kg/week.

Patients who received GENOTROPIN showed significant increases in linear growth during the first year of study, compared with patients who received no treatment (see Table 3). Linear growth continued to increase in the second year, when both groups received treatment with GENOTROPIN.

Table 3
Efficacy of GENOTROPIN in Pediatric Patients with Prader-Willi Syndrome (Mean ± SD)

	Study 1		Study 2	
	GENOTROPIN (0.24 mg/kg/week) n=15	Untreated Control n=12	GENOTROPIN (0.36 mg/kg/week) n=7	Untreated Control n=9
Linear growth (cm)				
Baseline height	112.7 ± 14.9	109.5 ± 12.0	120.3 ± 17.5	120.5 ± 11.2
Growth from months 0 to 12	11.6* ± 2.3	5.0 ± 1.2	10.7* ± 2.3	4.3 ± 1.5
Height Standard Deviation Score (SDS) for age				
Baseline SDS	-1.6 ± 1.3	-1.8 ± 1.5	-2.6 ± 1.7	-2.1 ± 1.4
SDS at 12 months	-0.5† ± 1.3	-1.9 ± 1.4	-1.4† ± 1.5	-2.2 ± 1.4

* $p \leq 0.001$

† $p \leq 0.002$ (when comparing SDS change at 12 months)

Changes in body composition were also observed in the patients receiving GENOTROPIN (see Table 4). These changes included a decrease in the amount of fat mass, and increases in the amount of lean body mass and the ratio of lean-to-fat tissue, while changes in body weight were similar to those seen in patients who received no treatment. Treatment with GENOTROPIN did not accelerate bone age, compared with patients who received no treatment.

Table 4
**Effect of GENOTROPIN on Body Composition
in Pediatric Patients with Prader-Willi Syndrome (Mean ± SD)**

	GENOTROPIN n=14	Untreated Control n=10
Fat mass (kg)		
Baseline	12.3 ± 6.8	9.4 ± 4.9
Change from months 0 to 12	-0.9* ± 2.2	2.3 ± 2.4
Lean body mass (kg)		
Baseline	15.6 ± 5.7	14.3 ± 4.0
Change from months 0 to 12	4.7* ± 1.9	0.7 ± 2.4
Lean body mass/ Fat mass		
Baseline	1.4 ± 0.4	1.8 ± 0.8
Change from months 0 to 12	1.0* ± 1.4	-0.1 ± 0.6
Body weight (kg)†		
Baseline	27.2 ± 12.0	23.2 ± 7.0
Change from months 0 to 12	3.7* ± 2.0	3.5 ± 1.9

* $p < 0.005$

† n=15 for the group receiving GENOTROPIN; n=12 for the Control group

‡ n.s.

14.3 SGA

Pediatric Patients Born Small for Gestational Age (SGA) Who Fail to Manifest Catch-up Growth by Age 2

The safety and efficacy of GENOTROPIN in the treatment of children born small for gestational age (SGA) were evaluated in 4 randomized, open-label, controlled clinical trials. Patients (age range of 2 to 8 years) were observed for 12 months before being randomized to receive either GENOTROPIN (two doses per study, most often 0.24 and 0.48 mg/kg/week) as a daily SC injection or no treatment for the first 24 months of the studies. After 24 months in the studies, all patients received GENOTROPIN.

Patients who received any dose of GENOTROPIN showed significant increases in growth during the first 24 months of study, compared with patients who received no treatment (see Table 5). Children receiving 0.48 mg/kg/week demonstrated a significant improvement in height standard deviation score (SDS) compared with children treated with 0.24 mg/kg/week. Both of these doses resulted in a slower but constant increase in growth between months 24 to 72 (data not shown).

Table 5
**Efficacy of GENOTROPIN in Children Born Small for Gestational Age
(Mean ± SD)**

	GENOTROPIN (0.24 mg/kg/week) n=76	GENOTROPIN (0.48 mg/kg/week) n=93	Untreated Control n=40
Height Standard Deviation Score (SDS)			
Baseline SDS	-3.2 ± 0.8	-3.4 ± 1.0	-3.1 ± 0.9
SDS at 24 months	-2.0 ± 0.8	-1.7 ± 1.0	-2.9 ± 0.9
Change in SDS from baseline to month 24	1.2* ± 0.5	1.7*† ± 0.6	0.1 ± 0.3

* $p = 0.0001$ vs Untreated Control group

† $p = 0.0001$ vs group treated with GENOTROPIN 0.24 mg/kg/week

14.4 Turner Syndrome

Two randomized, open-label, clinical trials were conducted that evaluated the efficacy and safety of GENOTROPIN in Turner syndrome patients with short stature. Turner syndrome patients were treated with GENOTROPIN alone or GENOTROPIN plus adjunctive hormonal therapy (ethinylestradiol or oxandrolone). A total of 38 patients were treated with GENOTROPIN alone in the two studies. In Study 055, 22 patients were treated for 12 months, and in Study 092, 16 patients were treated for 12 months. Patients received GENOTROPIN at a dose between 0.13 to 0.33 mg/kg/week.

SDS for height velocity and height are expressed using either the Tanner (Study 055) or Sempé (Study 092) standards for age-matched normal children as well as the Ranke standard (both studies) for age-matched, untreated Turner syndrome patients. As seen in Table 6, height velocity SDS and height SDS values were smaller at baseline and after treatment with GENOTROPIN when the normative standards were utilized as opposed to the Turner syndrome standard.

Both studies demonstrated statistically significant increases from baseline in all of the linear growth variables (i.e., mean height velocity, height velocity SDS, and height SDS) after treatment with GENOTROPIN (see Table 6). The linear growth response was greater in Study 055 wherein patients were treated with a larger dose of GENOTROPIN.

Table 6
Growth Parameters (mean ± SD) after 12 Months of Treatment with GENOTROPIN in Pediatric Patients with Turner Syndrome in Two Open Label Studies

	GENOTROPIN 0.33 mg/kg/week Study 055[^] n=22	GENOTROPIN 0.13–0.23 mg/kg/week Study 092[#] n=16
Height Velocity (cm/yr)		
Baseline	4.1 ± 1.5	3.9 ± 1.0
Month 12	7.8 ± 1.6	6.1 ± 0.9
Change from baseline (95% CI)	3.7 (3.0, 4.3)	2.2 (1.5, 2.9)
Height Velocity SDS (Tanner[^]/Sempé[#] Standards)	(n=20)	
Baseline	-2.3 ± 1.4	-1.6 ± 0.6
Month 12	2.2 ± 2.3	0.7 ± 1.3
Change from baseline (95% CI)	4.6 (3.5, 5.6)	2.2 (1.4, 3.0)
Height Velocity SDS (Ranke Standard)		
Baseline	-0.1 ± 1.2	-0.4 ± 0.6
Month 12	4.2 ± 1.2	2.3 ± 1.2
Change from baseline (95% CI)	4.3 (3.5, 5.0)	2.7 (1.8, 3.5)
Height SDS (Tanner[^]/Sempé[#] Standards)		
Baseline	-3.1 ± 1.0	-3.2 ± 1.0
Month 12	-2.7 ± 1.1	-2.9 ± 1.0
Change from baseline (95% CI)	0.4 (0.3, 0.6)	0.3 (0.1, 0.4)
Height SDS (Ranke Standard)		
Baseline	-0.2 ± 0.8	-0.3 ± 0.8
Month 12	0.6 ± 0.9	0.1 ± 0.8
Change from baseline (95% CI)	0.8 (0.7, 0.9)	0.5 (0.4, 0.5)

SDS = Standard Deviation Score
 Ranke standard based on age-matched, untreated Turner syndrome patients
 Tanner[^]/Sempé[#] standards based on age-matched normal children
p < 0.05, for all changes from baseline

14.5 Idiopathic Short Stature

The long-term efficacy and safety of GENOTROPIN in patients with idiopathic short stature (ISS) were evaluated in one randomized, open-label, clinical trial that enrolled 177 children. Patients were enrolled on the basis of short stature, stimulated GH secretion > 10 ng/mL, and prepubertal status (criteria for idiopathic short stature were retrospectively applied and included 126 patients). All patients were observed for height progression for 12 months and were subsequently randomized to GENOTROPIN or observation only and followed to final height. Two GENOTROPIN doses were evaluated in this trial: 0.23 mg/kg/week (0.033 mg/kg/day) and 0.47 mg/kg/week (0.067 mg/kg/day). Baseline patient characteristics for the ISS patients who remained prepubertal at randomization (n = 105) were: mean (± SD): chronological age 11.4 (1.3) years, height SDS -2.4 (0.4), height velocity SDS -1.1 (0.8), and height velocity 4.4 (0.9) cm/yr, IGF-1 SDS -0.8 (1.4). Patients were treated for a median duration of 5.7 years. Results for final height SDS are displayed by treatment arm in Table 7. GENOTROPIN therapy improved final height in ISS children relative to untreated controls. The observed mean gain in final height was 9.8 cm for females and 5.0 cm for males for both doses combined compared to untreated control subjects. A height gain of 1 SDS was observed in 10 % of untreated subjects, 50% of subjects receiving 0.23 mg/kg/week and 69% of subjects receiving 0.47 mg/kg/week.

Table 7. Final height SDS results for pre-pubertal patients with ISS*

	Untreated (n=30)	GEN 0.033 (n=30)	GEN 0.067 (n=42)	GEN 0.033 vs. Untreated (95% CI)	GEN 0.067 vs. Untreated (95% CI)
Baseline height SDS					
Final height SDS minus baseline	0.41 (0.58)	0.95 (0.75)	1.36 (0.64)	+0.53 (0.20, 0.87) <i>p</i> = 0.0022	+0.94 (0.63, 1.26) <i>p</i> < 0.0001
Baseline predicted ht					
Final height SDS minus baseline predicted final height SDS	0.23 (0.66)	0.73 (0.63)	1.05 (0.83)	+0.60 (0.09, 1.11) <i>p</i> = 0.0217	+0.90 (0.42, 1.39) <i>p</i> = 0.0004

*Mean (SD) are observed values.

**Least square means based on ANCOVA (final height SDS and final height SDS minus baseline predicted height SDS were adjusted for baseline height SDS)

16 HOW SUPPLIED/STORAGE AND HANDLING

GENOTROPIN lyophilized powder is available in the following packages:

5 mg two-chamber cartridge (with preservative)

Concentration of 5 mg/mL

For use with the GENOTROPIN PEN[®] 5 Growth Hormone Delivery Device and/or the GENOTROPIN MIXER™ Growth Hormone Reconstitution Device.

Package of 1 NDC 0013-2626-81

12 mg two-chamber cartridge (with preservative)

Concentration of 12 mg/mL

For use with the GENOTROPIN PEN 12 Growth Hormone Delivery Device and/or the GENOTROPIN MIXER Growth Hormone Reconstitution Device.

Package of 1 NDC 0013-2646-81

GENOTROPIN MINIQUICK Growth Hormone Delivery Device containing a two-chamber cartridge of GENOTROPIN (without preservative)

After reconstitution, each GENOTROPIN MINIQUICK delivers 0.25 mL, regardless of strength. Available in the following strengths, each in a package of 7:

0.2 mg	NDC 0013-2649-02
0.4 mg	NDC 0013-2650-02
0.6 mg	NDC 0013-2651-02
0.8 mg	NDC 0013-2652-02
1.0 mg	NDC 0013-2653-02
1.2 mg	NDC 0013-2654-02
1.4 mg	NDC 0013-2655-02
1.6 mg	NDC 0013-2656-02
1.8 mg	NDC 0013-2657-02
2.0 mg	NDC 0013-2658-02

Storage and Handling

Except as noted below, store GENOTROPIN lyophilized powder under refrigeration at 36°F to 46°F (2°C to 8°C). Do not freeze. Protect from light.

The 5 mg and 12 mg cartridges of GENOTROPIN contain a diluent with a preservative. Thus, after reconstitution, they may be stored under refrigeration for up to 28 days.

The GENOTROPIN MINIQUICK Growth Hormone Delivery Device should be refrigerated prior to dispensing, but may be stored at or below 77°F (25°C) for up to three months after dispensing. The diluent has no preservative. After reconstitution, the GENOTROPIN MINIQUICK may be stored under refrigeration for up to 24 hours before use. The GENOTROPIN MINIQUICK should be used only once and then discarded.

17 PATIENT COUNSELING INFORMATION

Patients being treated with GENOTROPIN (and/or their parents) should be informed about the potential benefits and risks associated with GENOTROPIN treatment. This information is intended to better educate patients (and caregivers); it is not a disclosure of all possible adverse or intended effects.

Patients and caregivers who will administer GENOTROPIN should receive appropriate training and instruction on the proper use of GENOTROPIN from the physician or other suitably qualified health care professional. A puncture-resistant container for the disposal of used syringes and needles should be strongly recommended. Patients and/or parents should be thoroughly instructed in the importance of proper disposal, and cautioned against any reuse of needles and syringes. This information is intended to aid in the safe and effective administration of the medication.

GENOTROPIN is supplied in a two-chamber cartridge, with the lyophilized powder in the front chamber and a diluent in the rear chamber. A reconstitution device is used to mix the diluent and powder. The two-chamber cartridge contains overfill in order to deliver the stated amount of GENOTROPIN.

The GENOTROPIN 5 mg and 12 mg cartridges are color-coded to help ensure proper use with the GENOTROPIN Pen delivery device. The 5 mg cartridge has a green tip to match the green pen window on the Pen 5, while the 12 mg cartridge has a purple tip to match the purple pen window on the Pen 12.

Follow the directions for reconstitution provided with each device. **Do not shake**; shaking may cause denaturation of the active ingredient.

Please see accompanying directions for use of the reconstitution and/or delivery device.

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