TABLE 402-3 HORMONE REPLACEMENT THERAPY FOR ADULT HYPOPITUITARISM[a]

Trophic Hormone Deficit	Hormone Replacement
ACTH	Hydrocortisone (10–20 mg A.M.; 5–10 mg P.M.)
	Cortisone acetate (25 mg A.M.; 12.5 mg P.M.)
	Prednisone (5 mg A.M.)
TSH	L-Thyroxine (0.075–0.15 mg daily)
FSH/LH	Males
	Testosterone gel (5–10 g/d)
	Testosterone skin patch (5 mg/d)
	Testosterone enanthate (200 mg IM every 2 weeks)
	Females
	Conjugated estrogen (0.65–1.25 mg qd for 25 days)
	Progesterone (5–10 mg qd) on days 16–25
	Estradiol skin patch (0.025–0.1 mg every week), adding progesterone on days 16–25 if uterus intact
	For fertility: menopausal gonadotropins, human chorionic gonadotropins
GH	Adults: Somatotropin (0.1–1.25 mg SC qd)
	Children: Somatotropin (0.02–0.05 mg/kg per day)
Vasopressin	Intranasal desmopressin (5–20 g twice daily)
	Oral 300–600 µg qd

[a]All doses shown should be individualized for specific patients and should be reassessed during stress, surgery, or pregnancy. Male and female fertility requirements should be managed as discussed in **Chaps. 411 and 412**.

Note: For abbreviations, see text.

TABLE 402-4 FEATURES OF ADULT GROWTH HORMONE DEFICIENCY

- **Clinical**
  - Impaired quality of life
    - Decreased energy and drive
    - Poor concentration
    - Low self-esteem
    - Social isolation
  - Body composition changes
    - Increased body fat mass
    - Central fat deposition
    - Increased waist-to-hip ratio
    - Decreased lean body mass
  - Reduced exercise capacity
    - Reduced maximum O_2 uptake
    - Impaired cardiac function
    - Reduced muscle mass
  - Cardiovascular risk factors
    - Impaired cardiac structure and function
    - Abnormal lipid profile
    - Decreased fibrinolytic activity
    - Atherosclerosis
    - Omental obesity
- **Imaging**
  - Pituitary: mass or structural damage
  - Bone: reduced bone mineral density
  - Abdomen: excess omental adiposity
- **Laboratory**
  - Evoked GH <3 ng/mL
  - IGF-I and IGFBP3 low or normal
  - Increased LDL cholesterol
  - Concomitant gonadotropin, TSH, and/or ACTH reserve deficits may be present

Abbreviation: LDL, low-density lipoprotein. For other abbreviations, see text.

estimated by adding 6.5 cm (boys) or subtracting 6.5 cm (girls) from the midparental height.

LABORATORY INVESTIGATION

Because GH secretion is pulsatile, GH deficiency is best assessed by examining the response to provocative stimuli, including exercise, insulin-induced hypoglycemia, and other pharmacologic tests that normally increase GH to >7 µg/L in children. Random GH measurements do not distinguish normal children from those with true GH deficiency. Adequate adrenal and thyroid hormone replacement should be assured before testing. Age- and sex-matched IGF-I levels are not sufficiently sensitive or specific to make the diagnosis but can be useful to confirm GH deficiency. Pituitary MRI may reveal pituitary mass lesions or structural defects. Molecular analyses for known mutations should be undertaken when the cause of short stature remains cryptic, or when additional clinical features suggest a genetic cause.

TREATMENT DISORDERS OF GROWTH AND DEVELOPMENT

Replacement therapy with recombinant GH (0.02–0.05 mg/kg per day SC) restores growth velocity in GH-deficient children to ~10 cm/year. If pituitary insufficiency is documented, other associated hormone deficits should be corrected, especially adrenal steroids. GH treatment is also moderately effective for accelerating growth rates in children with Turner's syndrome and chronic renal failure.

In patients with GH insensitivity and growth retardation due to mutations of the GH receptor, treatment with IGF-I bypasses the dysfunctional GH receptor.

ADULT GH DEFICIENCY (AGHD)

This disorder usually is caused by acquired hypothalamic or pituitary somatotrope damage. Acquired pituitary hormone deficiency follows a typical pattern in which loss of adequate GH reserve foreshadows subsequent hormone deficits. The sequential order of hormone loss is usually GH → FSH/LH → TSH → ACTH. Patients previously diagnosed with childhood-onset GH deficiency should be retested as adults to affirm the diagnosis.

PRESENTATION AND DIAGNOSIS

The clinical features of AGHD include changes in body composition, lipid metabolism, and quality of life and cardiovascular dysfunction **(Table 402-4)**. Body composition changes are common and include reduced lean body mass, increased fat mass with selective deposition of intraabdominal visceral fat, and increased waist-to-hip ratio. Hyperlipidemia, left ventricular dysfunction, hypertension, and increased plasma fibrinogen levels also may be present. Bone mineral content is reduced, with resultant increased fracture rates. Patients may experience social isolation, depression, and difficulty maintaining gainful employment. Adult hypopituitarism is associated with a threefold increase in cardiovascular mortality rates in comparison to age- and sex-matched controls, and this may be due to GH deficiency, as patients in these studies were replaced with other deficient pituitary hormones.

LABORATORY INVESTIGATION

AGHD is rare, and in light of the nonspecific nature of associated clinical symptoms, patients appropriate for testing should be selected carefully on the basis of well-defined criteria. With few exceptions, testing should be restricted to patients with the following predisposing factors: (1) pituitary surgery, (2) pituitary or hypothalamic tumor or granulomas, (3) history of cranial irradiation, (4) radiologic evidence of a pituitary lesion, (5) childhood requirement for GH replacement therapy, and rarely (6) unexplained low age- and sex-matched IGF-I levels. The transition of a GH-deficient adolescent to adulthood