

## APPROACH TO CHILDREN WITH SHORT STATURE

Short stature can be a sign of disease, disability and social stigma causing psychological stress. It is important to have early diagnosis and treatment.

### Definition

Height  $\leq$  -2 SD or height < 3rd percentile.

Serial heights should be measured to assess the growth pattern and height velocity.

Average height velocity at different phases:

- prenatal growth : 1.2 -1.5 cm / week
- infancy : 23 - 28 cm / year
- childhood : 5 - 6.5 cm / year
- puberty : 8.3 cm / year (girls), 9.5 cm / year (boys)

Definitions of growth failure:

- height below 3rd percentile (-2SD for age and gender)
- height significantly below genetic potentials (-2SD below mid-parental target)
- abnormally slow growth velocity
- downwardly crossing percentile channels on growth chart (> 18 months age)

**Table 1. Differential diagnosis of short stature and growth failure**

<i>Healthy but short children</i>	<i>Endocrinopathies</i>
familial short stature	hypothyroidism
constitutional growth delay	hypopituitarism
<i>Intrinsic short stature</i>	heredity, sporadic, idiopathic
small for gestational age	isolated GH deficiency
genetic syndromes	birth injury
Down syndrome, Turner syndrome	craniopharyngioma
Prader-Willi syndrome	cranial irradiation
skeletal dysplasia	brain tumours
achondroplasia, hypochondroplasia	midline defects
<i>Systemic diseases</i>	haemosiderosis
infectious	GH insensitivity (Laron syndrome)
HIV, tuberculosis	glucocorticoid excess
cardiac disease	Cushing syndrome, exogenous steroids
renal disease	poorly controlled diabetes mellitus
renal tubular acidosis	precocious puberty
chronic renal insufficiency	pseudohypoparathyroidism
gastrointestinal	pseudopseudohypoparathyroidism
cystic fibrosis	<i>Nonorganic aetiologies</i>
inflammatory bowel disease	psychosocial deprivation
central nervous system disease	nutritional dwarfing
chronic lung disease	
malignancy	

*Abbreviation. GH, Growth hormone*

**Table 1. Differential diagnosis of short stature and growth failure**

History	Physical Examination
<p><b>Antenatal</b>            complications of pregnancy, pre-eclampsia, hypertension            maternal history of smoking, alcohol, infections</p> <p><b>Birth</b>            gestational age            birth weight and length            mode of delivery (breech, forceps)            Apgar score            neonatal complications</p> <p><b>Nutrition</b>            general well being: appetite, energy, sleep, and bowel habits.            pattern of growth from birth</p> <p><b>Developmental milestones</b></p> <p><b>Maternal and child relationship</b></p> <p><b>Medical history</b>            underlying illness, drug intake, irradiation</p> <p><b>Family History</b>            short stature (3 generations).            age of onset of puberty in family members of the same sex.            diseases in the family.</p>	<p><b>Anthropometry</b>            height, weight, head circumference            height velocity            arm span            ratios of upper to lower segments            1.7 in neonates to slightly &lt;1.0 in adults</p> <p><b>General appearance and behaviour</b>            dysmorphism            pubertal staging</p> <p><b>Family Measurements</b>            measure height of parents for mid-parental height (MPH)</p> <p>Boys : <math>\frac{\text{Father's height} + (\text{mother's height} + 13)}{2}</math></p> <p>Girls : <math>\frac{\text{Mother's height} + (\text{father's height} - 13)}{2}</math></p>

**Initial screening evaluation of growth failure**

- general tests
  - FBC with differentials, renal profile, liver function test, ESR, Urinalysis
- chromosomal analysis in every short girl
- endocrine tests
  - thyroid function tests
  - growth factors: IGF-1, IGFBP-3
  - growth hormone stimulation tests if growth hormone deficiency is strongly suspected. (Refer to Paediatric Endocrine Centre)
- imaging studies
  - bone age : anteroposterior radiograph of left hand and wrist
  - CT / MRI brain ( if hypopituitarism is suspected)
- other investigations depends on clinical suspicion
  - blood gas analysis
  - radiograph of the spine

## Management

- treat underlying cause (hypothyroidism, uncontrolled diabetes mellitus, chronic illnesses)
- for children suspected to be GH deficient, refer to Paediatric Endocrinologist for initiation of GH.
- psychological support for non-treatable causes (genetic / familial short stature; constitutional delay of growth and puberty)

FDA approved indications for GH treatment in Children:

- paediatric GH deficiency
- Turner syndrome
- small for gestational age
- chronic renal insufficiency
- idiopathic short stature
- Prader–Willi syndrome (also improves linear growth)
- AIDS cachexia

## GH Treatment

- GH should be initiated by a Paediatric Endocrinologist.
- GH dose: 0.025 - 0.05 mg/kg/day (0.5 - 1.0 units/kg/wk) SC daily at night.
- GH treatment should start with low doses and be titrated according to clinical response, side effects, and growth factor levels.
- during GH treatment, patients should be monitored at 3-month intervals (may be more frequent at initiation and during dose titration) with a clinical assessment (growth parameters, compliance) and an evaluation for adverse effects (e.g. impaired glucose tolerance, carpal tunnel syndrome), IGF-1 level, and other parameters of GH response.
- other biochemical evaluations:
  - thyroid function
  - HbA1c
  - lipid profile
  - fasting blood glucose
- continue treatment till child reaches near final height, defined as a height velocity of < 2cm / year over at least 9 months (or bone age >13 years in girls and >14 years in boys).
- treat other pituitary hormone deficiencies such as hypothyroidism, hypogonadism, hypocortisolism and diabetes insipidus.