

EDITORIAL



Childhood Short Stature

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Abstract: Childhood short stature comprises Variety of endocrinal, systemic, Skeletal & genetic disorders of pediatrics and is not just confined for endocrinal disorder only. A systemic approach often reduces the need for test which is often expensive &unnecessary. Use growth chart & asses bone age during evaluation. Short & heavy child are generally due to Endocrine causes, Short & thin are due to systemic disease, Short with normal velocity are may be due to Constitutional delay in growth &puberty or Familial short stature, differentiation can be done by Bone Age. In Girls Turner syndrome has to be kept in mind. Purpose of evaluation to find out the child who does not need treatment, *who* cannot be treated & the child who can be benefited from treatment.

Keyword: Short stature, Growth chart, Bone age, Constitutional delay in growth &puberty, Familial short stature, Turner syndrome

Short stature is not a diagnosis by itself but a presenting symptom of a Variety of endocrinal, systemic &genetic disorders. Diagnosis of the child who is short and growing slowly comprises the whole of pediatrics and is not just confined for endocrinal disorder. So it is a very vast thing, here I am giving a few ideas and guidelines regarding the pediatrician's approach to a short-stature child. A systemic approach often reduces the need for test which is often expensive &unnecessary.

A child is considered short stature when his or her height is below 3rd percentile (less than 2 Standard Deviations (2SD) below the corresponding mean height for a given age, sex, and population group in a distance chart.. When growth (ht) velocity chart is used, short stature is considered if the child velocity of growth is less than 25th percentile below the mean $\{(< 5-6 \text{ cm/yr. from age of 3 years till onset of puberty})$ for that age. Mid-parental height [boys= $(\text{father} + \text{mother} + 13)/2$; girls= $(\text{father} - 13 + \text{mother})/2$] should be taken into consideration so that height of the child can be properly interpreted for the family's genetic potential for growth. The value of Mid-parental height is plotted as adult height at 18 years and spread 6 cm on other side of target height. If the child height is with within this percentile then it is consider as normal. Height (along with those of weight and head circumference) measurements must be made with an appropriate apparatus [1], and these measurements plotted accurately on the appropriate growth chart.

The common causes of short stature is express by mnemonics- **IS NICE**

Idiopathic : Constitutional delay in growth and velocity, Familial short stature.

- Intrauterine** : Growth retardation (SFD, TORCH & Fetal Alcohol Syndrome).
Skeletal : Skeletal dysplasia, Achondroplasia, Mucopolysaccharidosis, Osteogenesis imperfecta, Spinal defect (scoliosis, kyphosis), etc.
Nutritional : Nutritional nurturing (malnutrition)
Iatrogenic : Radiation, steroid
Chronic disease: Chronic anemia, chronic renal failure, chronic hepatitis, Congenital heart disease, Celiac disease,
Chromosomal : Turner's syndrome, Down's syndrome
Endocrine : Hypothyroidism, Growth hormone deficiency, Hypopituitarism, Pseudohypoparathyroidis, Cushing's syndrome

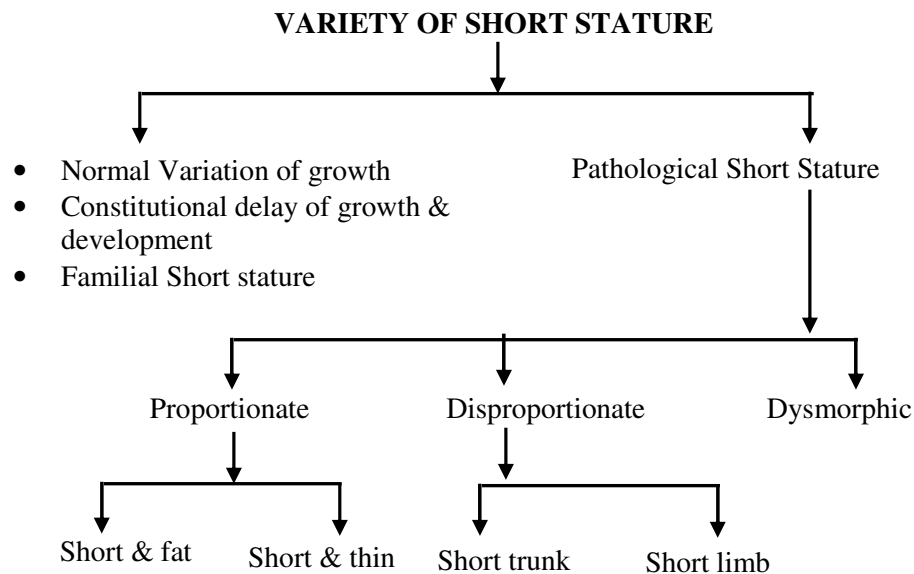
Among the entire short stature child approximately half will be physiological (familial or constitutional) & half will be pathological short stature. Short with normal growth velocity is taken as physiological short stature. It may be Familial short stature or constitutional delay of growth & development. The hallmarks of familial short stature (also referred to as genetic short stature) include bone age appropriate for chronologic age, normal growth velocity, and predicted adult height appropriate to the familial pattern (using the Bayley-Pinneau or Tanner-Goldstein-Whitehouse tables). By contrast, constitutional growth delay is characterized by delayed bone age, normal growth velocity, and predicted adult height appropriate to the familial pattern [2]. Bone age is a reliable, cheap & useful tool for a short child. Bone age [3-4] is an indicator of skeletal maturation. Bone age delay more than 2 SD i.e. more than 2 year is significant. Bone age speaks for remaining growth potential & helps in adult height prediction. A child with delayed bone age has a better prognosis for future height gain than those with appropriate or advanced bone age. Bone age correlates closely with Sexual maturity rating (SMR). In children who have chronic diseases & delayed puberty bone age is delayed but not as much as endocrinal disorder. Remember ICP model of growth [5] when you dealing with a case a case of short child. Based on this model if growth failure starts first time in infancy nutritional *deficiency* is the likely cause whereas if it is started in childhood, childhood hypothyroidism or growth hormone *deficiency* is likely cause. Growth failures if a start first time in puberty are usually due to puberty disorder & commonest is constitutional delay of growth & development [6].

Body proportion measurement is also important. If the short child is proportionate and heavy then you have to think of endocrine {congenital GH deficiency (? midline defects, perinatal asphyxia), Acquired GH def. (tumors, trauma, post-infectious), Hypothyroidism, Cushing syndrome} causes have to be kept in mind. In his cases endocrinal test -TSH, FT4, IGF-1 and IGFBP3, Bone Age, Cushing's evaluate-consider overnight Dexamethasone suppression test or 24 hour urinary Cortical etc has to be done. If the short child is proportionate and thin (the endless list...). cause may be GI losses- malabsorption, IBD, celiac, Renal- RTA, Nephrogenic DI, Chronic renal failure, CV- shunting, failure, Endo- Diabetes mellitus, Diabetes insipidus, Pulmonary- CF, Testing to be done according to cause. If the child is disproportionate short stature, commonly referred to as dwarfism, can manifest itself as short-limbed dwarfism or short-trunk dwarfism [7].

An abnormal upper/lower segment ratio or span/height ratio indicates disproportionate short stature; Radiological survey-Skeletal dysplasia is one of the important investigations in this group. Short trunk--- In short-trunk dwarfism (Mucopolysaccharidosis etc), span is greater than height, and US/LS ratio is decreased. Short limb--- In short-limbed dwarfism (Achondroplasia etc), the height is greater than arm-span, and US: LS ratio is high. (Rizomelic, Mesomelic, Acromelic).

Then by through look you have to find out where the child is dimorphic or not. If the child is Short and Dysmorphic Abnormal U/L body ratio indicate Skeletal dysplasias (Increased U/L= long bone defect, Decreased U/L=spine defect). Turner's (can be VERY subtle, is COMMON!) .Always think of Turner's in Girls. Other causes are Down's .Prader-Willi syndrome If we get multiple dysmorphic features, it can be diagnosed by taking assistance from a computer. In these cases Karyotype, Skeletal Radiographic studies &Genetics evaluation has to be done.

So short stature child can be evaluated in this way-



During the assessment of a short child the following thing has to be taken:

- Full medical and social history
- Accurate measurement of height of child and parents-(for accurate height, growth velocity and mid parental height).
- Good observation and thorough clinical examination and investigation
- Bone age, Chronological age, height age and body proportion assessments (upper / lower segment ratio & arm-span / height ratio)
- Karyotyping in specific cases
- Specific investigation according to the systemic disease.
- Biochemical investigation and
- Endocrinal tests accordingly

Outcome & treatment:

- The outcome and treatment of the short stature will depend upon the cause e.g.-
- Familial genetic short stature, Constitutional delay in growth (CDGP) and most causes of intrauterine growth retardation---no specific treatment--reassurance
- Skeletal dysplasias-Limb lengthening with limited benefit.
- Specific therapy for chronic systemic disorder, emotional deprivation is associated good catch up.
- Growth hormone is indicated in children with growth hormone *deficiency*.
- Hypothyroidism should be managed with replacement by sodium -l-thyroxin.

Bottom Line: Look at the growth chart!

- Short + heavy = Endocrine (GH/Thyroid/Cortisol)
- Short + thin = Systemic disease
- Short with normal velocity = Constitutional delay in growth or Familial short stature, sort out by Bone Age.
- Always think of Turner's in Girls

Purpose of Evaluation----so purpose of evaluation Identify and classify children:

- **Normal & short---** *Do not need treatment*
- **Short due to intrinsic causes--** *Cannot be treated*
- **Remediable cause of short stature/growth failure-** Can benefit from treatment

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