Growth Disorders

Supporting patients, TOGETHER

Definition, prevalence, and etiology

Selected growth disorders associated with short stature

Partnering with a pediatric endocrinologist

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Short stature associated with growth disorders

Suspect a growth disorder if you notice a slowdown in your patient's growth rate

Variation from normal growth pattern could indicate a pathological condition[1]

SHORT STATURE[1]

A height >2 SD below the mean for age, or less than the 3rd percentile.

Most common pathological causes

- Growth Hormone Deficiency (GHD)
- Hypothyroidism
- Celiac disease
- Turner syndrome (TS)

Other causes

- Renal, hepatic, and gastrointestinal diseases
- Other genetic syndromes

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Selected growth disorders associated with short stature

DESCRIPTION	ETIOLOGY	MAJOR CLINICAL SIGNS
Growth Hormone Deficiency (GHD)	Condition may be congenital or acquired. Acquired cause of GHD can be due to a history of head trauma, central nervous system infection, birth trauma, or cranial irradiation.[1]	Physical exam may reveal microphallus or midline craniofacial abnormalities. Growth may initially be normal but then fall progressively off the growth curve. Typically, children with this condition have[1]: • Short stature, which is often the only clinical manifestation of GHD[2] • A delayed bone age with a preserved or increased weight for age[1]
Noonan Syndrome (NS)	May affect between ≈1/1000 and 1/2500 live births.[3] • Most often the genetic defect is identified by PTPN11 gene sequencing[3] • KRAS, SHOC2, RAF1, and SOS1 gene sequencing also may help identify the genetic defect associated with a specific case of NS[3]	Usually birth weight and length are normal[3] • Short stature (<2 SD below mean) • Based on the underlying genetic defect, manifestations of NS may vary, but right sided cardiac findings are common[3] • In about 50% to 70% of NS cases, developmental delays, growth failure, and short stature are frequently observed[3] • In up to 10%–15% of children with NS, scoliosis and other spinal abnormalities are present[3]
Turner Syndrome (TS)	A chromosomal disorder that affects phenotypic females who have one intact X chromosome and complete or partial absence of the second sex chromosome with one or more clinical manifestations.[4]	Some common abnormalities associated with Turner Syndrome are[4]: • Short Stature • Pterygium colli (webbed neck) • Low hairline at the back of the neck • Lymphedema • Skeletal abnormalities • Heart defects

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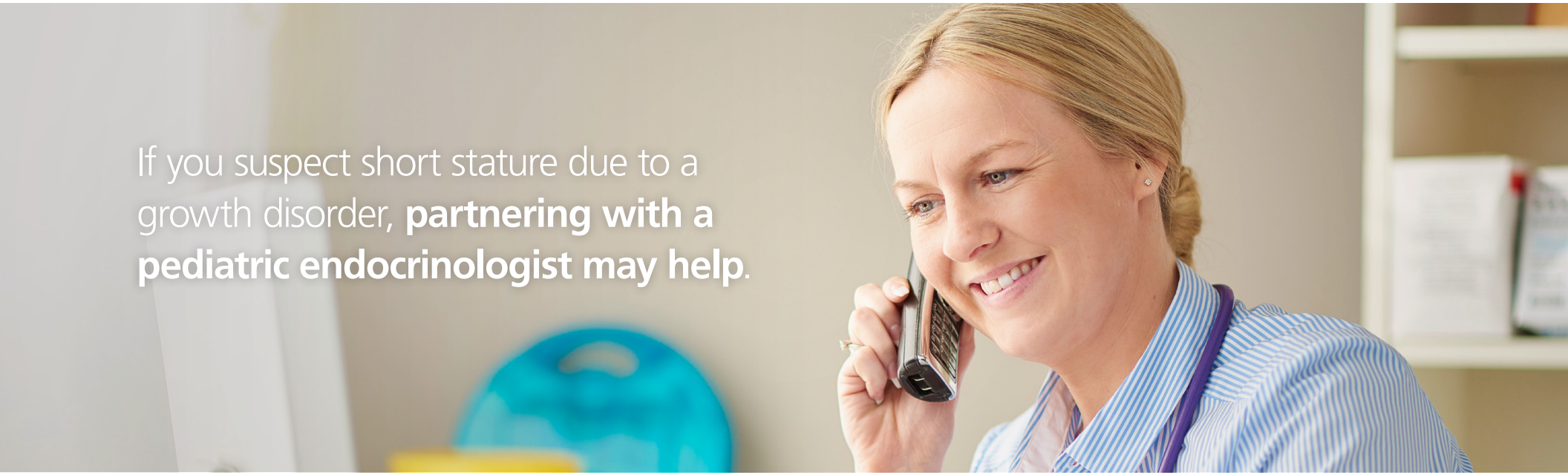
Selected growth disorders associated with short stature (cont'd)

DESCRIPTION	ETIOLOGY	MAJOR CLINICAL SIGNS
Small for Gestational Age (SGA)	Children with birth weight and/or length less than 2 SD below the mean for gestational age are classified as born SGA. There are several causes, including fetal, placental, maternal, and environmental factors, but the specific etiology is frequently unknown.[5] In SGA infants where an etiology is identified, about 50% involve maternal factors, 5% involve fetal abnormalities, and less than 5% are felt to be due to placental pathology.[5] SGA can occur alongside intrauterine growth restriction (IUGR) and/or premature birth or be diagnosed at term without any prenatal complications.[5]	Heterogeneous and characterized by broad spectrum of clinical characteristics, including[6]: • Endocrine and metabolic disturbances • Potential cognitive impairment • Low lean mass and potentially increased central adiposity • Some children born SGA have inadequate catch-up growth in first 2 years
Idiopathic Short Stature (ISS)	Unknown. However, children with ISS should be considered growth hormone sufficient. They have normal body proportions, no history of a low birth size, no chromosomal abnormalities, no dysmorphic syndromes, and no systemic, endocrine, or nutritional diseases.[7]	In absence of pathological causes, children with height >2 SD below the mean can be considered to have ISS.[3] • Often short stature is the only clinical feature[3]
Prader-Willi Syndrome (PWS)	Due to lack of expression of paternally inherited genes in the region of chromosome 15q11.2-q13.[8] 70% have a deletion of the paternally inherited region, while 25% have maternal uniparental disomy in which the individual has inherited 2 copies of the critical region on chromosome 15 from the mother.[8] 5% of cases have abnormal imprinting or methylation that silences paternal genes in the PWS region.[8]	The most distinctive characteristics[9]: In infancy • Poor muscle tone; lethargy; difficulty feeding; poor suck; poor reflexes In early childhood • Facial features such as a narrow forehead and almond-shaped eyes; puffy hands and fingers; delays in motor and language skills; learning disabilities; behavior problems; increased appetite; obesity; short stature In late childhood/adolescence • Abnormally increased appetite; lack of satiety after eating; food-seeking behavior; obesity-related complications such as diabetes and sleep apnea[10]

A **pediatric endocrinologist** can:

- Determine a differential diagnosis
- Tailor treatment if necessary
- Optimize outcomes



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