



Diagnostic Approach to Childhood Obesity

Setila dalili

Pediatric Endocrinology



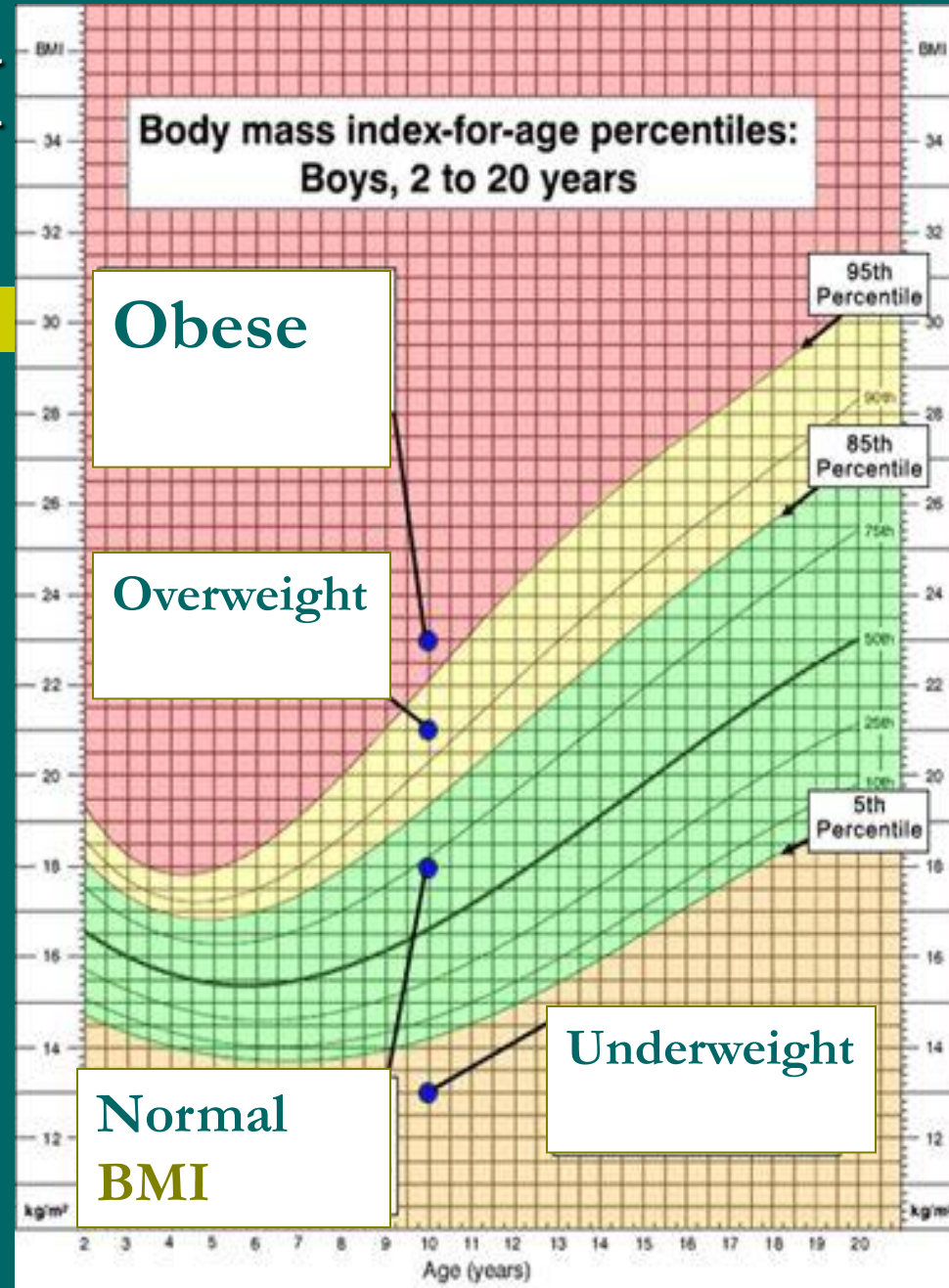


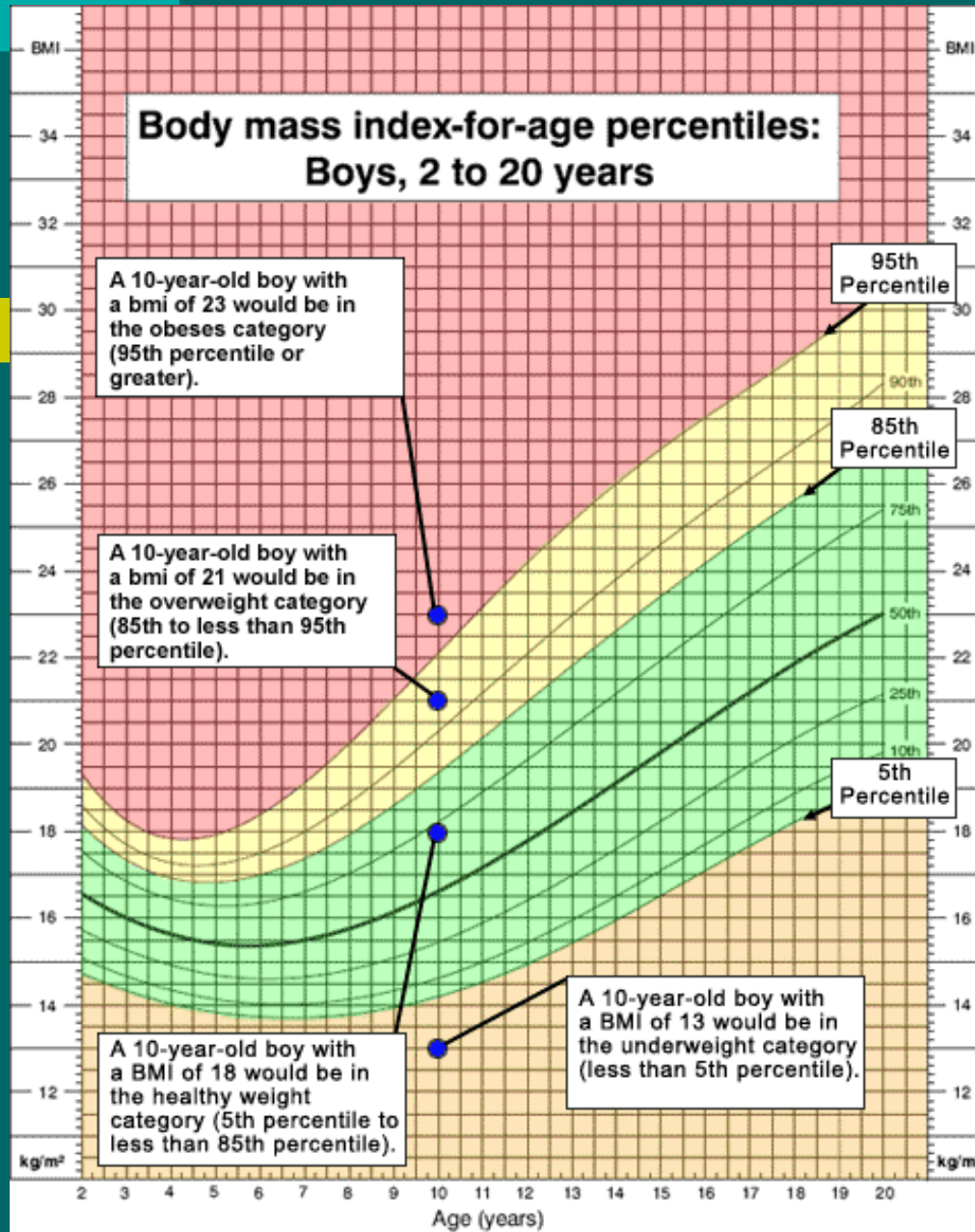
Obesity is chronic medical problem that requires management in a manner similar to that of other chronic disorders.

How is obesity defined in childhood:

BMI

BMI is a screening tool
Measure of adiposity





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BMI-for-age BOYS 5 to 19 years (z-scores)

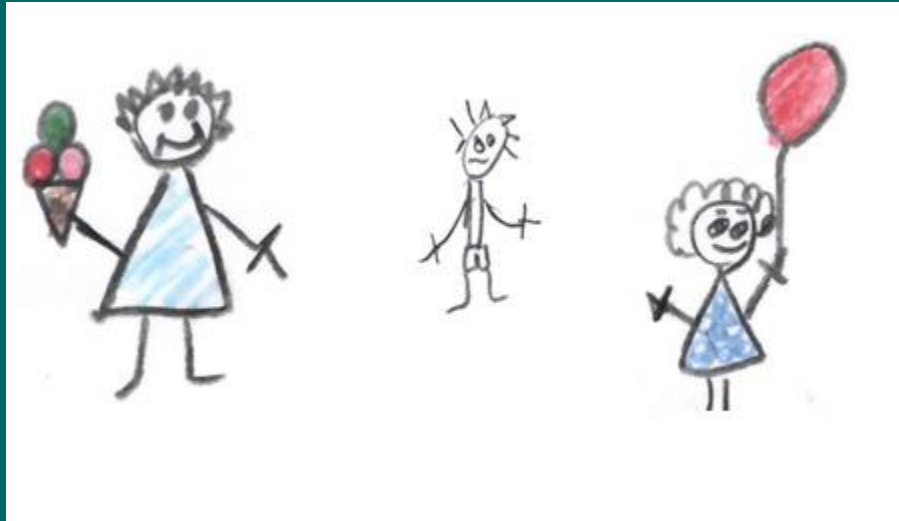


World Health
Organization

Year: Month	Months	-3 SD	-2 SD	-1 SD	Median	1 SD	2 SD	3 SD
5: 1	61	12.1	13.0	14.1	15.3	16.6	18.3	20.2
5: 2	62	12.1	13.0	14.1	15.3	16.6	18.3	20.2
5: 3	63	12.1	13.0	14.1	15.3	16.7	18.3	20.2
5: 4	64	12.1	13.0	14.1	15.3	16.7	18.3	20.3
5: 5	65	12.1	13.0	14.1	15.3	16.7	18.3	20.3
5: 6	66	12.1	13.0	14.1	15.3	16.7	18.4	20.4
5: 7	67	12.1	13.0	14.1	15.3	16.7	18.4	20.4
5: 8	68	12.1	13.0	14.1	15.3	16.7	18.4	20.5
5: 9	69	12.1	13.0	14.1	15.3	16.7	18.4	20.5
5: 10	70	12.1	13.0	14.1	15.3	16.7	18.5	20.6
5: 11	71	12.1	13.0	14.1	15.3	16.7	18.5	20.6
6: 0	72	12.1	13.0	14.1	15.3	16.8	18.5	20.7
6: 1	73	12.1	13.0	14.1	15.3	16.8	18.6	20.8
6: 2	74	12.2	13.1	14.1	15.3	16.8	18.6	20.8
6: 3	75	12.2	13.1	14.1	15.3	16.8	18.6	20.9
6: 4	76	12.2	13.1	14.1	15.4	16.8	18.7	21.0
6: 5	77	12.2	13.1	14.1	15.4	16.9	18.7	21.0
6: 6	78	12.2	13.1	14.1	15.4	16.9	18.7	21.1
6: 7	79	12.2	13.1	14.1	15.4	16.9	18.8	21.2
6: 8	80	12.2	13.1	14.2	15.4	16.9	18.8	21.3
6: 9	81	12.2	13.1	14.2	15.4	17.0	18.9	21.3
6: 10	82	12.2	13.1	14.2	15.4	17.0	18.9	21.4
6: 11	83	12.2	13.1	14.2	15.5	17.0	19.0	21.5
7: 0	84	12.3	13.1	14.2	15.5	17.0	19.0	21.6
7: 1	85	12.3	13.2	14.2	15.5	17.1	19.1	21.7
7: 2	86	12.3	13.2	14.2	15.5	17.1	19.1	21.8
7: 3	87	12.3	13.2	14.3	15.5	17.1	19.2	21.9
7: 4	88	12.3	13.2	14.3	15.6	17.2	19.2	22.0
7: 5	89	12.3	13.2	14.3	15.6	17.2	19.3	22.0
7: 6	90	12.3	13.2	14.3	15.6	17.2	19.3	22.1

دختر ۱۰ ساله ای با وزن ۶۰ کیلو گرم قد ۱۳۰ سانتی مترو دور
کمر ۸۵ سانتی متر به علت چاقی مراجعه کرده است
BMI را محاسبه و در نمودار مربوطه رسم کنید

$$60 \div (1/3)2 = 35.5$$



- وزن ایده ال وی چقدر است؟
- در شرح حال به چه نکاتی دقت می کنید
- چه آزمایشاتی آزمایشاتی ارسال



Ideal body weight

- BMI 50th * (height)²
- 16.5 * 1.3 * 1.3 = 27.885

● وزن مناسب قد ۵۰ پرسنتایل در ان سن

- Waist to Hight ratio =0.66

Waist-to-Height Ratio

- Waist-to-Height ratios of **0.5 or greater** are indicative of intra-abdominal fat for both males and females in childhood and adulthood



Evaluattion

● در شرح حال به چه نکاتی توجه می کنید



A thick, horizontal yellow bar with rounded ends, positioned in the upper third of the slide.

Take a complete history

- 
- Psychosocial problem
 - Developmental delays

Need attention before changes can be made..

Family history

- Family patterns of adiposity
- Family history (obesity, HTN, CV, DM, Stress)
- family history (high cholesterol, early onset heart disease)



Family history

- **Genetic factors also play a considerable role in the development of childhood obesity**



Exercise habits



History of CNS

- CNS damage
- Brain radiation
- Seizures
- Headache, dizziness, diplopia, papilledema
- vomiting, visual disturbances
- Developmental delays

History of endo

- Excessive urination and drinking
- intolerance to cold
- Fatigability
- Menstrual irregularity

A decorative graphic consisting of a teal background with a yellow horizontal bar and a teal vertical bar on the left side.

Physical examination

Physical examination ...

- Height & weight
- Growth velocity
- BMI
- Hypertension
- $BP > 95^{\text{th}}$ for age, sex, height

Gradual obesity & normal GV

- Exogenous obesity

Physical examination

Exogenous obesity

- Increased linear growth
- Advanced bone age
- Earlier onset of puberty

Physical examination

- Weight gain out of character for the family
- Obesity in a short child

➤ **Cushing**

➤ **Growth hormone**

➤ **Hypothyroidism**

➤ **pseudohypoparathyroidism**

Cushing Disease

- Accumulation of fat in the neck and trunk but not in the arms or legs(central obesity)
- Purple striae
- Hypertension
- Excess facial hair, acne
- Abrupt obesity
- Onset decrease GV

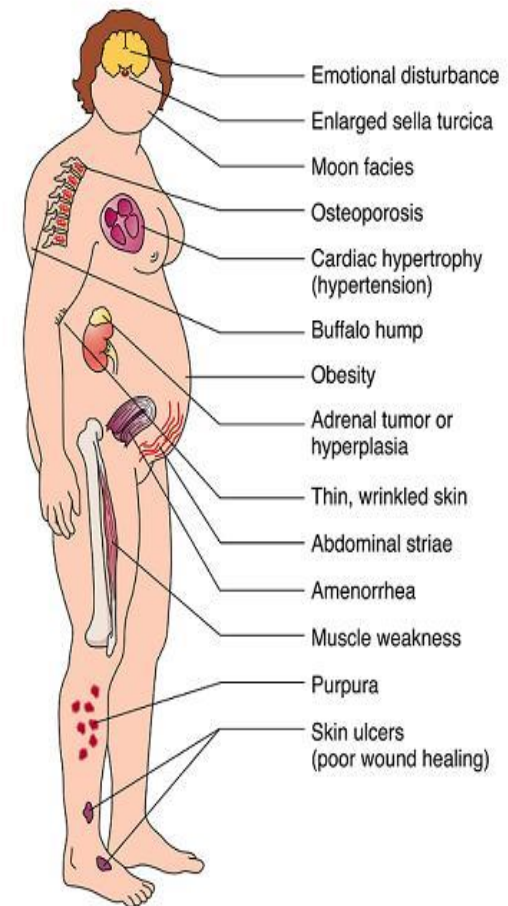
Normal linear growth alone generally precludes the diagnosis of endocrinologic disease

Laboratory Studies

- Cushing Disease

- The 24hr urinary free cortisol level

- DST



Suspicious patient For Cushing

24 h Urine cortisol/cr

Overnight dexamethasone test(1mg po 11 pm)
suppressed serum cortisol check 8 AM

Confirm Cushing

Low dose dexa test:30 μ gr/kg/po/q6h/for24 h
High dose dexa test:120 μ gr/kg/po/q6h/for24 h
And 8AM serum cortisol check

Suppressed cortisol

+
-90% central
-10% ectopic

-
ACTH

High ACTH:ectopic
Low ACTH : adrenal

Laboratory Studies

- Hypothyroidism



Decrease velocity & obesity

- GH deficiency
- Bone age
- MRI
- IGF1,IGFBP3

Physical examination

- Hirsutism
- Moon faces
- Irregular menses
- Acnea

➤ PCOD

➤ Cushing

PCOD

- **Hirsutism, acanthosis, amenorrhea, increased muscle mass**
- insulin resistance
- premature adrenarche
- Male pattern baldness, severe
- Acne
-

PCOD

- Testosterone, DHEAS, LH/FSH ratios, prolactin, Androstenedion,

Physical examination

Acanthosis nigricant

Dark, velvety skin seen mainly in skin folds

Axillae ,Under breasts,
Groin ,Antecubital/ popliteal areas
Neck

***Clinically indicative for hyperinsulinemia**



BMI > 85th

- Lipid profile
- FBS
- LFT
- Insulin
- HBA1c

Laboratory Studies

- Fasting glucose > 100mg/dl
- Hb A1c > %6
- insulin level > 15MU/MI

Should perform Oral Glucose tolerance test

- impaired fasting glucose tolerance 100-126
- impaired glucose tolerance test 140-200
- Diabetes mellitus Glucose >200mg/dl

Laboratory Studies

- HomA

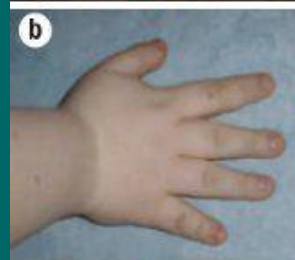
Glucose/mmol * insulin ÷ 22.5

>2.5-4

Pseudohypoparathyroidism

Moon face
Short metacarpal
Short stature

Serum calcium,
phosphorus, PTH



Physical examination

- Hepatomegally

Nonalcoholic fatty liver disease

Laboratory Studies

Nonalcoholic fatty liver disease

Cirrhosis

➤ AST,ALT

➤ Liver ultrasound,CT,MRI

AST

2-8yr

<58u/l

9-15yr

<46u/l

15-18yr

<35u/l

ALT

<35u/l

Physical examination

- Dry skin
- Hepatomegaly
- Dependent edema

- Liver disease
- Nephrotic syndrome
- Heart failure

Laboratory Studies

Focal glomerulosclerosis

- U/A
- Electrolyte
- BUN
- Creatinine
- Renal biopsy

Physical examination

Metabolic syndrome

- Abdominal obesity (Waist-to-Height ratios of 0.5 or greater)
- presence of two or more of following
 - Elevated triglycerides
 - low HDL-cholesterol
 - High blood pressure
 - increased plasma glucose

Dyslipidemia

- Fasting total cholesterol, HDL, LDL, TG

Laboratory Studies

- Serum leptin
- 25 OH D3

Vitamin D deficiency be defined as a:

Deficient \longrightarrow **$< 20\text{ng/ml}$**

insufficient \longrightarrow **$21\text{--}29\text{ ng/ml}$**

sufficient \longrightarrow **$\geq 30\text{ng/ml}$** .

Laboratory Studies

- Early onset obesity
- Dysmorphic features
- Delay puberty
- Delay development
- Retinitis pigmentosa

Genetic evaluation for

Dysmorphic features with childhood obesity

Alstrom
Bardet-biedl syndrome
Carpenter syndrome
Cohen syndrome
Cushing syndrome
Deletion 9q34
Froehlich syndrome
Hyperinsulinism
Melanocortin 4 receptor gen mutation
Muscular dystrophy
Myelodysplasia
Prader-willi syndrome
Pseudohypoparathyroidism
Turner syndrome

Excessive weight
Gain or BMI in
infant&toddler

Don't worry, be happy



<http://www.123cartoon.com>

TABLE 21-8 Suggested Workup of the Overweight Child**Clinical Parameter**

BMI > 85th percentile for age

Workup

- Careful history and physical exam looking for associated signs and symptoms
- Diet and activity logs
- Blood pressure
- Fasting lipid profile
- Fasting glucose, insulin
- Hemoglobin A1c
- AST, ALT

If fasting glucose > 100 mg/dL, insulin > 15 mU/mL or hemoglobin A1c > 6.0%, add

- Oral glucose tolerance test

If growth rate is decreased, add

- Free T₄, TSH
- 24-hour urine for free cortisol and creatinine
- IGF-1, IGFBP-3
- Bone age
- MRI of the pituitary if GH deficiency or more than one endocrine abnormality is present

If female with irregular menses, acanthosis nigricans and/or signs of hyperandrogenism, add

- FSH, LH, DHEA-S, free testosterone, androstenedione, pelvic US to evaluate for polystic ovarian disease

If early onset of obesity with or without syndromic features, retinitis pigmentosa, pubertal delay, add

- Genetic testing for the appropriate monogenic or syndromic causes of obesity

Generalized obesity

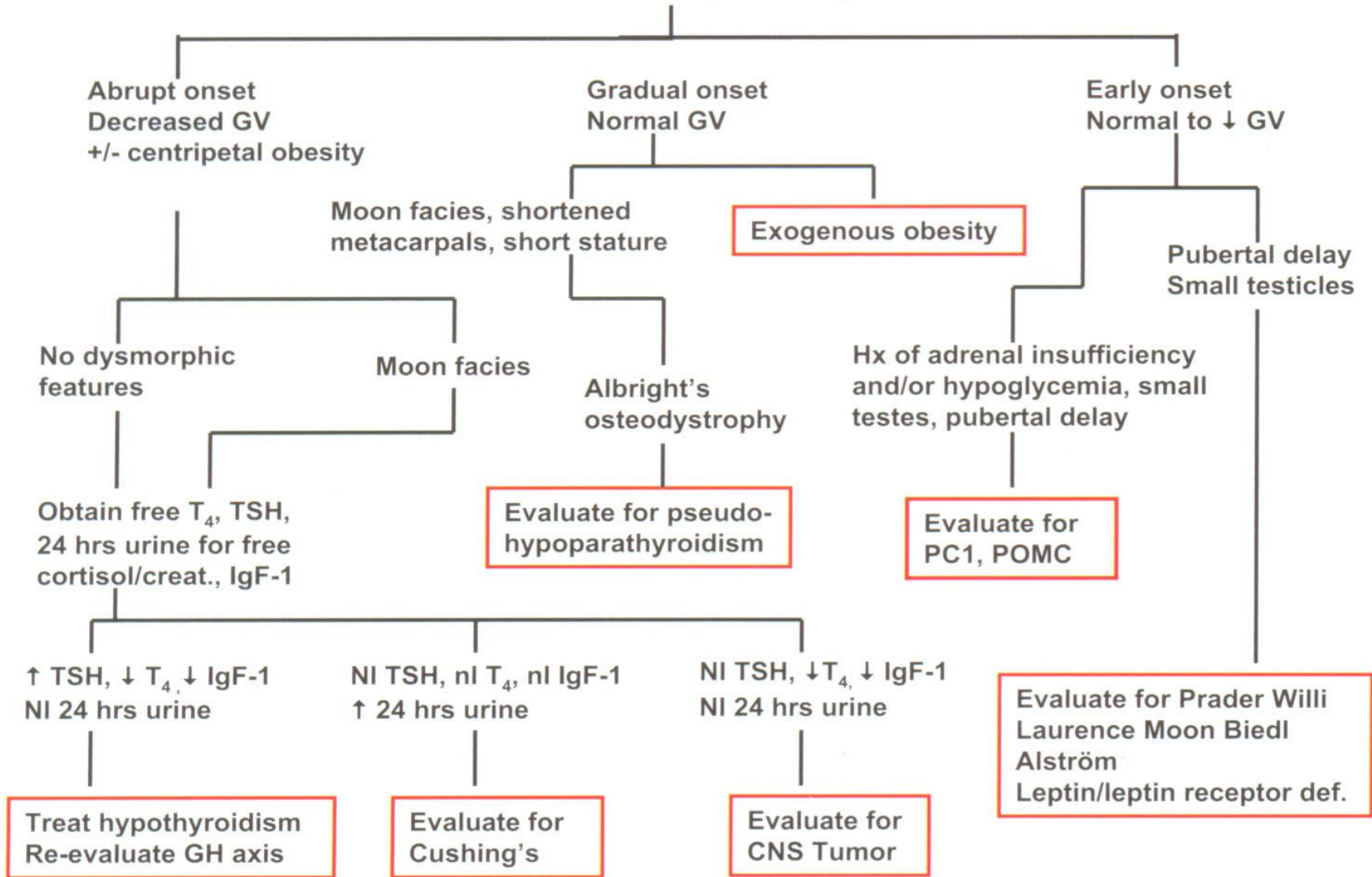


FIGURE 21-3. Diagnostic algorithm for child or adolescent presenting with obesity.

TABLE 21-3 Genetic Syndromes Associated with Obesity

Syndrome	Rate	Heredity	GENE	Locus	OR
Prader-Willi	1/10,000-15,000	Non-Mendelian (imprinting)	SNRPN, Necdin	15q12, 15q11-q13	#1
Bardet-Biedl	1/13,000- Middle East; 1/160,000- Europe	Autosomal recessive	Genetically heterogeneous	20p12, 16q21, 15q22.3-q23, 14q32.1, 12q21.2, 11q13, 9q31-q34.1, 7p14, 4q27, 4q27, 3p12-q13, 2q31	#2
Albright Hereditary OsteoDystrophy	3-7/1,000,000 (Japan); 2:1 female/male	Sex influenced autosomal dominant	GNAS1	20q13	#
Borjeson-Forsman-Lehmann	5 families reported	X-Linked	PHF6	Xq26.3	#
Cohen	~ 100 reported cases	Autosomal recessive	COH1	8q22-q23	#
Alstrom	~ 50 families	Autosomal recessive	ALMS1	2p13	#
Carpenter	~ 140 cases	Autosomal recessive	RAB23	6p11	#

Syndrome	Typical Features Other than Obesity	Level of Retardation
Prader-Willi	Neonatal hypotonia / failure to thrive; characteristic behavioral disorder (tantrums, obsessive-compulsive, discomfort with change in routine); narrow bifrontal diameter, almond shaped palpebral fissures, down-turned mouth, small, narrow hands and feet, hypogonadism	Usually mild
Bardet-Biedl	Hypogonadism, postaxial polydactyly; rod cone dystrophy; renal disease	Mild
Albright Hereditary Osteo-Dystrophy	Short, stocky build; round face; short neck, brachydactyly, hormonal disorders, ectopic calcifications; pseudohypoparathyroidism	Moderate to no
Borjeson-Forsman-Lehmann	Hypogonadism, large thick, ears, short stature, prominent supraorbital ridges, deep set eyes, ptosis, and narrow palpebral fissures	Severe
Cohen	Infantile hypotonia, narrow hands and feet with long tapering fingers, downslanting palpebral fissures, high nasal bridge, short philtrum, high narrow palate, prominent central incisors, open mouth, progressive retinochoroidal dystrophy, defective vision in bright light, optic atrophy	Mild to moderate
Alstrom	Obesity, insulin resistance, retinitis pigmentosa, with nystagmus and early loss of central vision, neurosensory deafness, ancanthosis nigricans, type II diabetes, dilated cardiomyopathy	May have delayed early milestones
Carpenter	Craniosynostosis, polysyndactyly, congenital heart disease, mental retardation, hypogonadism, cryptorchidism, obesity, umbilical hernia and bony abnormalities	Mild to moderate

Simplified laboratory norms for assessing overweight children

Glucose	<100mg/dl
Insulin	<15mu/l
Hemoglobin A1c	<6.0%
AST 2-8yr	<58u/l
9-15yr	<46u/l
15-18yr	<35u/l
ALT	<35u/l
Total cholestrol	<170mg/dl
LDL	<110mg/dl
HDL	<35mg/dl
Triglycerides	
2-15yr	<100mg/dl
15-19yr	<125mg/dl

- **Thank you for attention**