Medical Comorbidities of Obesity

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MAJOR HEALTH ISSUES FOR KIDS

NOW:
- Diabetes
- Sleep apnea
- Hypertension
- NAFLD
- Hyperlipidemia
- Pseudotumor cerebri
- Reduced Quality of Life

LATER:
- Heart disease
- Cancer
- Stroke
- Cirrhosis
- Renal failure
Expert Committee 2007

New diagnostic classifications
New evaluation recommendations
New treatment goals
New treatment algorithms

See *Pediatrics* vol 120: supplement 4, published December 2007 for these new Expert Committee recommendations
Old Pediatric Obesity Classification:

≥95th % ile BMI: overweight
85th - 94th % ile BMI: at risk for overweight

Adult Obesity Classification:

Overweight BMI 25-30
Class I BMI 30-35
Class II BMI 35-40
Class III BMI >40

www.cdc.gov/growthcharts
New Diagnostic Categories

Overweight (previously “at risk”)
   For 2 years and older, BMI at 85%-94%ile
   For under 2 years, Wt for Ht at 95%ile +

Obese (previously “overweight”)
   For 2 years and older, BMI at 95%ile +

Proposed New category
   For 2 years and older, BMI at 99%ile +
For BMI at 85%-94%ile
Laboratory Evaluation

With risk factors:

- Fasting lipids for age 2 years +
- Transaminase levels for age 10 years +
  - Repeat every two years if normal
  - If abnormal, check alpha-1 antitrypsin, ceruloplasmin, ANA, and hepatitis antibodies
  - Liver ultrasound detects NAFLD but does not predict fibrosis
  - Liver bx to rule out fibrosis

- Fasting glucose for age 10 + years
  - In presence of 2+ risk factors (FH, high risk ethnicity, signs of insulin resistance
For BMI at 95%ile

Laboratory Evaluation

With or without risk factors (Repeat every two years if normal):

- Fasting lipids for age 2 years +
- Transaminase levels for age 10 years +
  - If abnormal, check alpha-1 antitrypsin, ceruloplasmin, ANA, and hepatitis antibodies
  - Liver ultrasound detects NAFLD but does not predict fibrosis
  - Liver bx to rule out fibrosis
- Fasting glucose for age 10 + years
  - In presence of 2+ risk factors (FH, high risk ethnicity, signs of insulin resistance
  - Fasting insulin level may support dx of insulin resistance
- Urine microalbumin (first morning void) or microalbumin/creatinine ratio
For BMI at 95%ile
Laboratory Evaluation

Criteria for T2DM:
  Fasting glucose > 126 mg/dL
  Casual glucose > 200 mg/dL

Impaired glucose tolerance:
  Fasting glucose > 100 mg/dL
  Casual glucose > 140 mg/dL
Targeted Laboratory Evaluation

ECG, echocardiography
Liver ultrasound/liver biopsy
Thyroid studies
GTT (3 hour) with glucose and insulin levels
Urine microalbumin/creatinine ratio
Polysomnography
Skeletal radiographs (knee, hip, spine)
Plasma 17-OH progesterone, plasma DHEAS, androstenedione, testosterone (total and free), LH and FSH measurements
Genetic testing (FISH, fragile X, MCR4)
“Extreme Obesity”*

Proposed category for BMI $\geq 99$%ile

Strongly associated with abnormal cardiovascular risk factors in the Bogalusa Heart Study (59% had two or more risk factors):
- Hypertension
- Elevated LDL or triglycerides
- Low HDL
- Elevated fasting insulin

Strongly associated with adult obesity in the longitudinal component of the Bogalusa Heart Study (88% with adult BMI greater than 35)

Includes about 4% of the pediatric age group (using NHANES 1999-2004 data)

* Freedman et. al. J Pediatr 2007;150:12-7
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Obstructive Sleep Apnea

Increased behavior problems and decreased sleep duration (Owens et. al. 1998)
Adverse school performance (Gozal 1998)
Symptoms often improve with weight loss (Harris and Allen 1996)
Cardiac sequelae include decreased stroke volume, pulmonary hypertension, RV enlargement (cor pulmonale)
Occurs in over 50% of youth with BMI > 99 %ile (Verhulst 2007)
Sleep Apnea

Silvestri et. al. (Pediatr Pulm 1993):

- 32 3-14 yr olds with BMI > 90%
- Snoring 100%
- Difficulty breathing 59%
- Sweating 44%
- Arousals 41%
- Apnea 50%
- Mouth breathing 59%
- Hypersomnolence 59%
- Abnormal ECG 5%
- Symptoms worse in patients with adenotonsillar enlargement
Intermediary Mechanisms Associated with OSA That Potentially Contribute Risk of CVD

Adapted from Shamsuzzaman et al. JAMA 2003;290:1906-1914
NASH or NAFLD
(nonalcoholic steatohepatitis or nonalcoholic fatty liver disease)

Schwimmer JB et al (Pediatrics 2006;118:1388-93)
  Fatty liver found in more than 1/3 of obese youth

Strauss et. al. (J Peds 2000;136:727)
  NHANES survey of 12-18 yr olds (2450)
  NASH seen in 10 % of obese youth (>95%)
  Prevalence of 6 % with BMI 85-94%
  Prevalence of 50 % if consuming alcohol 4 times per month or more
Pseudotumor

Symptoms:
- Headache or retroocular pain
- Vision disturbance
- Irritability
- Sleep disturbance
- Nausea or vomiting

Signs:
- Papilledema (50-100%)
- Visual field defect (28%)
- Visual acuity defect (17%)
Pseudotumor

Evaluation

Ophthalmologic examination
Visual fields
Neuroimaging (MRI preferred)
Elevated opening pressure on lumbar puncture

MRI findings

Flattening of the posterior sclera (80%)
Empty sella (70%)
Enhancement of the optic nerve (50%)
Distension of the perioptic subarachnoid space (45%)
Polycystic Ovary Syndrome

- Syndrome of ovarian dysfunction and hyperandrogenism
- 50% of PCOS patients are overweight
- Many patients have hirsutism, acne vulgaris, and acanthosis nigricans
- Ovulatory dysfunction includes primary amenorrhea, oligomenorrhea, or dysfunctional uterine bleeding
Orthopedic Problems

Slipped Capital Femoral Epiphyses (SCFE)
- Discomfort in hip, groin, knee
- Limp, thigh atrophy (hard to see in obese)
- Gradual onset, progressive pain
- May lead to avascular necrosis of the fem head

Blount’s Disease (tibia vara)
- Asymmetric growth rates of medial and lateral sides of the tibial growth plate leading to bowleg deformity
- Pain aggravated by physical activity
Expected Outcomes for Surgical Intervention in Adolescents

Resolution of obstructive sleep apnea, dyslipidemia, diabetes mellitus, hypertension

Improvements in liver function, pseudotumor cerebri, gastroesophageal reflux

Improvements in psychosocial function, self esteem, social interaction, work status, and health related quality of life
Indications for Surgical Management of Adolescent Obesity *(Pediatrics 2004;114:217-223)*

**BMI > 40 with one or more of the following:**
- Obstructive sleep apnea
- Diabetes mellitus
- Pseudotumor cerebri

**BMI > 50 with one or more of the following:**
- Hypertension
- NASH
- GERD
- Dyslipidemia
- Venous stasis disease
- Weight related arthropathy or impairment of ADL’s
## Proposed Criteria for Adolescent Weight Loss Surgery*

<table>
<thead>
<tr>
<th>BMI</th>
<th>Co-morbidities</th>
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<tbody>
<tr>
<td>&gt;35 kg/m²</td>
<td>Serious: Type 2 diabetes mellitus, moderate or severe obstructive sleep apnea (AHI &gt;15 events/hr), pseudotumor cerebri, severe steatohepatitis.</td>
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<tr>
<td>&gt;40 kg/m²</td>
<td>Other: Mild obstructive sleep apnea (AHI ≥ 5 events/hr), hypertension, insulin resistance, glucose intolerance, dyslipidemia, impaired quality of life or activities of daily living, among others</td>
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*Inge et al, *Obesity*, in press
Medical Comorbidities

The End