Obesity Primer for the Pediatric Provider

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FUND-RAISER
HELP FIGHT
CHILDHOOD
OBESITY!
Obesity Overview

• How bad is the problem?
  – Are we recognizing it?

• Input > Output, right?
  – What else could it be?

• Evaluation and management strategies
  – Addressing barriers

• When should referral be considered?
Objectives

• Take many of the characteristics of a pediatric provider and refine them.
  – Convert from “fixers” to “motivators”.
  – No magic bullet.
Everything’s Bigger in Texas

- Childhood obesity prevalence has tripled in past 30 years.

- Prevalence
  - Children 6.5% in 1980 and 19.6% in 2008.
  - Teens 5% in 1980 and 18.1% in 2008.

Overweight/Obesity Defined

- **Overweight**
  - BMI percentile for age/gender $\geq 85\%$tile and $<95\%$tile

- **Obese**
  - BMI percentile for age/gender $\geq 95\%$tile
Silhouettes of 5- to 6-year-old children.
Weight for Length Charts

Birth to 36 months: Boys
Head circumference-for-age and Weight-for-length percentiles

Birth to 36 months: Girls
Head circumference-for-age and Weight-for-length percentiles

Published May 30, 2006 (modified 16/10/09).
Biocodex: developed by the National Center for Health Statistics in collaboration with
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http://www.cdc.gov/growthcharts

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BMI Charts

2 to 20 years: Girls
Body mass index-for-age percentiles

2 to 20 years: Boys
Body mass index-for-age percentiles

*To Calculate BMI: Weight (kg) = Height (cm) x 10,000
               or Weight (lb) = Height (in) x Height (in) x 700

Published May 30, 2000 (revised 10/18/03).
SOURCE: Developed by the National Center for Health Statistics in collaboration with the National Center for Chronic Disease Prevention and Health Promotion (2000).
http://www.cdc.gov/nccdphp/dnpa
Why do we care about height or length?
How does this influence interpretation of weight?
Contributors to excess weight gain

• More than a positive calorie balance.
• Many factors influence the balance,
  – Some can be controlled.
  – Others are difficult to control and/or not well understood.
  – Rarely, organic cause is clearly defined.
More than the golden arches

Early childhood predictors

- Higher birth weight is associated with higher adult BMI.
- Infant weight gain and later BMI.
  - 2-3X increase risk in overweight or obesity in those who crossed at least one %tile band.
- Infant weight gain and later body composition.
  - Weight gain associated with increases in relative fat mass.

Height/length growth

• Height/length growth is expected to be **normal or accelerated** with obesity.
  – Whereas, stature growth is expected to **slow**
    • Hypothyroidism, glucocorticoid excess, and growth hormone deficiency.
  – Consider chromosomal abnormalities
    • Overweight in relation to short stature.
  – What else could it be?
• Hypothyroidism may be associated with **modest** weight gain, but stalled height growth
  – 1-2 BMI unit increase.
  – Increased permeability of capillary walls lead to extravascular leakage and water retention.

Thyroid Controversy

• Elevation of TSH in obesity seems to be a consequence rather than a cause of obesity.
  – Moderate elevation of TSH has been described in 10-23% of obese youth.
    • Accompanied by normal or mildly elevated T4 and T3.
  – Ultrasound hypoechogenicity has been reported in youth without autoimmune thyroid disease.
  – Likely combination of pro-inflammatory state of obesity and leptin stimulation of the hypothalamic pituitary thyroid axis.

Glucocorticoid Excess

• Typically associated with excess weight gain (often over a short period of time) and stalled height/length growth.
  – Increased gluconeogenesis, insulin resistance, inhibition of lipolysis, and stimulation of lipogenesis.
  – Cushings, Prevalence ~1:1million.
  – Iatrogenic much more common.

Growth Hormone Deficiency

- Growth velocity **normal** and IGF-1 **normal or modestly diminished** in OBESE youth.
  - Hyperinsulinemia suppresses IGF-BP1, thereby leading to increased free IGF-1 and to suppression of GH axis.
- Whereas, both **Growth velocity and IGF-1 diminished** in true growth hormone deficiency.
  - Diminished growth velocity accompanied by continued increased body weight.
  - GH deficiency leads to increased fat mass and decreased lean mass 2\textsuperscript{nd} loss of GH typical lipolytic effect.
    - Adults with growth hormone deficiency are at risk for metabolic syndrome.
    - Effect on lean tissue can be seen soon after starting growth hormone therapy.

Hypothalamic

• Injury, congenital malformation, or post-op
  – Controls appetite and energy expenditure
    • Orexigenic and anorexigenic peptides
  – Very difficult to manage.
Syndromic Obesity

- Achondroplasia
- Alström syndrome
- Bannayan-Riley- Ruvalcaba syndrome
- Bardet-Biedl syndrome
- Beckwith-Wiedemann syndrome
- Borjeson-Forssman-Lehmann syndrome
- Carpenter syndrome
- CDG 1a
- Cohen syndrome
- Down Syndrome
- Fragile X
- Klinefelter Syndrome
- Mehmo syndrome
- Meningomyelocele
- Prader-Willi syndrome
- Pseudohypoparathyroidism 1a
- Simpson-Golabi-Behmel syndrome
- Smith-Magenis syndrome
- Sotos syndrome
- Turner syndrome
- Ulnar-Mammary Schinzel syndrome
- Weaver syndrome
- Wilson-Turner syndrome
Figure 1. Features suggestive of Albright hereditary osteodystrophy in the patient

Nwosu B U and Lee M M (2009) Pseudohypoparathyroidism type 1a and insulin resistance in a child

Nat Rev Endocrinol doi:10.1038/nrendo.2009.81
Leptin Signalling

• Leptin
  – Low leptin promotes appetite.
  – Produced by adipose tissue, rise with overweight (resistance).

• Pro-opiomelanocortin
  – Leptin stimulates POMC, precursor of ACTH and MSH among others.
  – Inactivating mutations lead to hyperphagia (lack of MC3R and MC4R), red hair (lack of peripheral alpha-MSH to bind to MCR1R), and adrenal insufficiency (insufficient ACTH to bind MCR2R).

• POMC processing
  – Prohormone convertase 1 cleaves POMC.
  – Mutations lead to obesity and ACTH deficiency as well as postprandial hypoglycemia (insufficient cleavage of pro-insulin), hypogonadotropic hypogonadism, and small bowel malabsorption.

• MCR
  – MSH binds MC3R and MC4R
    • MC4R mutations associated with obesity, hyperphagia, hyperinsulinism, and increased linear growth. Severe, early-onset obesity.

• Brain-derived neurotrophic factor
  – Downstream of MC4R.
  – May be to blame for obesity in WAGR syndrome.
Acquired Obesity

- Insulin or insulin secretagogues
- Glucocorticoids
- Antipsychotics such as olanzapine, risperidone, and clozapine
- Mood stabilizers such as lithium
- Antidepressants such as citalopram, escitalopram, and paroxetine
- Anticonvulsants such as carbamazepine and valproate
- Antihypertensives
- Chemotherapeutic agents
- Hormones such as OCP and leuprolide
Evaluation

• History
  – Pattern and timing of weight gain
    • Other associated symptoms
    • Perinatal factors and early growth
  – Dietary evaluation
    • Ask specific-pointed questions
  – Exercise evaluation
    • Ask specific-pointed questions, exclude PE
    • Screen time. (1) How much screen time is being spent per day?, (2) Is there a TV set or Internet connection in the child’s bedroom?
  – Family history? T2DM, overweight/obese, early CV disease, thyroid disease, menstrual.
  – Medications
  – Careful review of systems including sleep history, musculoskeletal, and mental health. Also menstrual, derm.

• **Exam**
  – Evaluate vitals, particularly BP in relation in age, gender, and height %tile
  – Look at growth pattern
    • Weight gain rate
    • Growth velocity (normal pre-pubertal rate 4-6cm/yr)
  – Careful exam
    • General
      – Weight dispersion
        » Central versus diffuse
      – Dysmorphic appearance?
    • Skin findings may include acanthosis nigricans, striae
      – Distinguish pale from purplish.
    • Neuro
      – Focus on strength, tone, and reflexes.
Developing a Plan

• Management Plan
  – Is the family and child ready?
  – Promote parenting
    • Limit-setting
    • For older children, empower the child.
  – Lifestyle counseling
    • Diet
    • Exercise
    • Time management
  – Laboratory evaluation
Diet Counseling

- Cut out ALL concentrated sugary beverages, drink more water.
- Reduce snacking and portion sizes.
- Family time with TV off.
- Eat more veggies and fruits (1/2 plate).
- At least ½ grains should be whole.
- Drink fat free or low fat (1%) milk.
- Limit fast-food intake.
- Pack lunch for school.
1500 kcal = 1 pound

- Bush’s sweet tea
  - 32 ounces = 130 cal
- Regular Gatorade
  - 12 ounces = 330 cal
  - G2 Natural
    - 16 ounces = 40 cal
- Prefer Zero or Diet products.
- Consider dietician evaluation (diary).
- Consider app use.
WHAT DO YOU MEAN I HAVE TO PEDAL?
Exercise Counseling

• Encourage at least 60 minutes of physical activity daily
  • Moderate to vigorous activity
    – Moderate physical activity is associated with increased heart rate and breathing, but still able to carry on a conversation. This may include walking briskly, bicycling, and less active competitive sports such as baseball/softball. Walking to and from school can help assure moderate exercise.
    – Vigorous physical activity involves rhythmic, repetitive physical activities with a much higher heart rate. This may include bicycling (more than 10 miles per hour), running/jogging, swimming laps, hiking/backpacking, tennis, racquetball, aerobic dancing, and more active competitive sports such as basketball.

Exercise

- Encourage parent to investigate available activities in local community.
  - Consider non-competitive organized activities at least 2-3 times weekly to start. Make sure it is something that the child will enjoy.
  - Consider formal weight management programs as available.
Time Management

• Limiting TV, computer, video games, texting, and other “screen time” is very important.
  – It is best to set firm rules.
  – Keep phones, computers, games and televisions out of bedrooms
    • To encourage good sleep patterns
    • Monitor inappropriate use or content
    • To reinforce the need for physical activity and family interaction.
Set Realistic Goals

- Prepare family.
- Prepare patient.
- Screen for depression and/or anxiety.
Laboratory Evaluation

Very controversial area!!!

– Fasting glucose, insulin, lipids, electrolytes, AST, ALT, BUN, creatinine, TSH, free T4 is a reasonable screening approach.

– Appropriate interpretation and referral of great importance.
Worrisome Findings

• Overweight/obese with poor height growth, either less than genetic potential (midparental height) or recent height deceleration.
  – Usually, overweight/obese are growing taller than their genetic potential.
  – Need prompt endocrine evaluation.
Diabetes or Not?

- A fasting glucose ≥ 126 mg/dl OR random glucose ≥ 200 mg/dl with symptoms defines diabetes mellitus. Warrants prompt endocrine referral.

- A hemoglobin A1c >6% indicates an average glucose >120mg/dl and may indicate insulin resistance and/or type 2 diabetes mellitus. Warrants endocrine referral.

- An elevated fasting insulin level (>20) alone, does not define diabetes mellitus. This indicates insulin resistance. *Lifestyle modification should be the primary focus.*
“It must be my thyroid”

• **TSH** is *commonly elevated in overweight/obese and appears to be a result of excess weight and not the culprit behind excess weight gain.*
  – If **TSH >10**, prompt pediatric endocrinology evaluation is recommended.
    • It can be helpful to repeat TSH and free T4 within 4-6 weeks if initial TSH elevated.
    • If TSH remains elevated (>7.5) or trends upward, endocrinology evaluation is warranted.
Puberty Concerns

• Sexual Precocity
  • Precious adrenarche (pubic hair, apocrine body odor) is common among overweight/obese youth.
    – This is often associated with advanced skeletal age.
    – Often, difficult to distinguish from precocious puberty.
    – Endocrine evaluation recommended.
  • Lifestyle modification should be the primary focus.
  • It is believed that overweight/obesity may contribute to true precocious puberty as well.
Puberty Concerns

• Irregular menses often in association with hirsutism (excess male-pattern hair) and excess acne is commonly seen in overweight/obese young woman.
  – *Gynecologic evaluation* should be considered initially, followed by *Pediatric Endocrinology*.
  – Avoid use of depot contraceptive or high-androgen containing contraceptive.

• *Gynecomastia* (excess breast tissue) is common in young men, especially when accompanied by excess weight gain. Most of the time this is actually adipose tissue and **not** true breast tissue.
  – *Lifestyle modification* should be the primary focus, followed by *Pediatric Endocrinology* evaluation and possibly *Pediatric Surgical or Plastic Surgery* consultation once weight loss has occurred.
Blood Pressure

• Associated with *hypertension* (defined as >95%tile for age, height %tile, and gender).
  – Important to assess on multiple checks, preferably manually using appropriate technique and with appropriately sized cuff.
  – If not associated with recent height deceleration, probably best to have initial evaluation from *Pediatric Nephrology*. 
Lipids

- Markedly elevated triglycerides and low HDL are commonly encountered in overweight/obese youth.
  - *Lifestyle modifications* and evaluating for secondary causes (such as hypothyroidism, liver or renal disease, and certain medications) should be the primary focus.
  - Fasting total cholesterol $\geq 200\text{mg/dl}$ and LDL $\geq 100\text{mg/dl}$ in overweight/obese youth warrant evaluation by the *Children’s Lipid Clinic*. 
Liver Function

- It is not uncommon to discover elevated transaminases (AST and ALT).
  - *Lifestyle modifications* often improve these parameters dramatically.
  - Persistently elevated or markedly elevated levels may necessitate *Pediatric Gastroenterology* evaluation. Pediatric endocrine evaluation may also be necessary.
Genetics

• Dysmorphic appearing youth, particularly with developmental delay warrants *Genetics* evaluation.
  – Feeding difficulty and hypotonia as a infant/toddler and foraging behaviors suggests the possibility of Prader-Willi syndrome.
iatrogenic

• Taking medications including lithium and atypical antipsychotics.
  – Consider medication change if possible.
    • Benefits versus risks
  – Preemptive counseling including dietician evaluation may be helpful.
  – Close monitoring is important.
Mental Health

• Quality of life studies show lower parent-proxy score than child scores.
  – Subsets show lower physical functioning and social scores.
• Often has low self-esteem, depression, and anxiety concerns.
  – Self-esteem better if weight accepted by parent.
• Awareness of obesity by 5 years of age.

Sleep-Disordered Breathing

• Abnormal breathing patterns including snoring, daytime hypoventilation, and obstructive sleep apnea.
• May affect as many as 50% of obese youth.
• Similar consequences as in adults including cardiovascular and neuropsych.
• Formal sleep study needed.

Orthopedic Concerns

- **SCFE**
  - More common in boys age 9-16 years.
  - Symptoms may include hip or referred knee pain.
- **Blount’s Disease**
  - Bowing of the tibias.
  - More common >8 years.
- **Common musculoskeletal complaints**, often limit activity.
- **Important to get orthopedics and PT involved early.**

Overview

• Overweight/obesity in youth is a major concern.
  – Important to **recognize early and distinguish factors consistent with organic cause.**

• Develop methods for addressing weight and promoting lifestyle modifications is essential. **No one method works best.**

• Develop **screening** methodologies.
  – Includes both signs and symptoms as well as proper interpretation of data.
  – Provide appropriate referral as indicated.
Resources

• CDC  http://www.cdc.gov/healthyyouth/obesity/
• Choose My Plate  http://www.choosemyplate.gov/
• Texas Department of State Health Services  http://www.dshs.state.tx.us/obesity/
• Texas Pediatrics Society  http://txpeds.org/childhood-obesity-treatment
• MEND Program  http://www.mendprogramme.org/
• American Heart Association  http://www.heart.org/HEARTORG/GettingHealthy/Physical-Activity-and-Children_UCM_304053_Article.jsp
• Let’s move  http://www.letsmove.gov/
Pediatric Endocrinology and Diabetes
Children’s Hospital at Scott & White
2401 S. 31st Street
Temple, Texas 76508
Medical Office 254-724-1492
Medical Fax 254-724-9909
Emergency Pager
888-404-4548
Email mstephen@swmail.sw.org
Referrals 800-792-3368 or 254-724-2218
swchildrens.org

Now Enrolling
Type 1 Diabetes Trial Net
• 1 to 45 years of age and have a brother, sister, child, or parent with type 1 diabetes, OR
• 1 to 20 years of age and have a cousin, aunt, uncle, niece, nephew, half-sibling, or grandparent with type 1 diabetes.

Contact
Nenita Torres RN, BSN, CCRP
at 254-724-6069
http://www.diabetestrialnet.org/