Advanced Pediatric Overweight and Obesity Management:
Evidence-Based Approaches to Clinical Care

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Disclosure Statement

- Upon disclosure, the speakers indicated that they did not have any relevant financial relationships to disclose.
Objectives

- Staged Treatment of Overweight/Obesity
  - Stage 1
    - Prevention Plus
  - Stage 2
    - Structured Weight Management
  - Stage 3
    - Comprehensive Multidisciplinary Intervention
  - Stage 4
    - Tertiary Care Intervention
Objectives

- Systems-based Clinical Management
  - Endocrine
    - Diabetes
    - Polycystic Ovary Syndrome
  - Sleep Disturbances
    - Obstructive Sleep Apnea
  - GI
    - NAFLD
  - Cardiovascular
    - Hyperlipidemia/Hypertriglyceridemia
    - Hypertension
Obesity Algorithm

Obesity Algorithm

Assess Behaviors & Attitudes:
- Eating
- Physical Activity
- Sedentary Time
- Motivation

Assess Medical Risk:
- Family History
- Review of Systems
- Physical Examination (BMI, BP)

Healthy Weight
BMI between 5th-84th Percentile

Over Weight
BMI between 85-94th Percentile

Obese
BMI between 95-99th Percentile

Severe Obese
BMI ≥ 100th Percentile

Assess Fasting Lipid Profile

Yes
- Assess
  - ALT, AST, Fasting Glucose
  - Ultrasound of Abdomen & Liver

No
- Other Tests as Indicated by Health Risks

Health Risk?
Medical or Behavioral Risk

Maintain Weight Velocity & Reassess Annually

Prevention Counseling
- Empathize
- Set Goals
- Facilitate Behavior Change

Stage 1 Prevention Plus
Progress to next stage if no improvement in BMI/Weight after 3 months and family willing
- Maintain Weight
- Gradual Weight Loss

Stage 2 Structured Weight Management
- Gradual to Moderate Weight Loss
- Restrict
- Every 3-6 Months

Stage 3 Comprehensive Multidisciplinary Intervention
- Gradual to Moderate Weight Loss
- Restrict
- Every 3-6 Months

Stage 4 Tertiary Care Intervention

Obesity Guidelines

1) Progress to the next stage if no improvement in BMI/Weight after 3 months and family is willing
2) Age 6-11 = 1 lb/week; Age 12-15 yrs = 2 lbs/week average
3) Age 2-5 yrs = 1 lb/month; Age 6-18 yrs = 2 lbs/week Average
Measure 9: Laboratory Testing: BMI ≥ 85%

- Fasting lipid panel testing

  - If risk factors, also obtain ALT, AST, fasting glucose every 2 years for children ≥ 10 years old
  - Other tests as indicated by health risks
Patient D.A.

- 12 year-old African-American female w/ h/o asthma and allergic rhinitis presents for WCC and concern for snoring
- BMI: 32.7; percentile: >95th
- Nutrition
  - Eats out (McDonald’s, Popeye’s, etc) 3 times per week
  - 24-32 oz of juice; “occasional” soda
- Physical activity
  - PE twice monthly; no activity at home due to concerns about asthma
  - 3-4 hours of video/TV time at home per day
- Strong family h/o morbid obesity
  - Mother (37 y.o.) w/ DM Type II and OSA
  - Father (39 y.o.) w/ DM, HTN, and OSA
  - Three morbidly obese older siblings, 2 w/ sleep apnea, 1 w/ DM II, dxed at 8 years old
  - Maternal first cousin died in her 20’s from an MI
Patient D.A.

- **Diagnoses**
  - WCC (V20.2)
  - Obesity

- **Plan**
  - Self management goals developed
  - Obesity related screening labs were ordered
  - Follow up visit scheduled for Stage 1 structured management in 1 month to begin obesity intervention plan and to address additional concerns
  - Labs ordered:
    - Lipid panel (non-fasting because family has h/o no-shows)
    - Comprehensive metabolic panel
Staged Treatment

- **Stage 1: Prevention Plus**
  - BMI ≥ 85-94% with risk factors
  - BMI ≥ 95% without co-morbidities
  - Frequent visits with health professionals trained in pediatric management
    - Evidence supports 3-6 month visits
  - Consider individual or group visit
# Staged Treatment

## Weight maintenance/management:

<table>
<thead>
<tr>
<th>Age</th>
<th>85-94th percentile</th>
<th>85-94th percentile w/ risk factors</th>
<th>&gt;95th percentile</th>
<th>&gt;99th percentile</th>
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<tbody>
<tr>
<td>2-5 year olds</td>
<td>Weight velocity maintenance</td>
<td>Weight maintenance or slow weight gain</td>
<td>Weight maintenance or weight loss of 1 pound/month</td>
<td>Weight loss up to 1 lb/mo acceptable if BMI 21 or 22 kg/m²</td>
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<tr>
<td>6-11 year olds</td>
<td>Same as above</td>
<td>Weight maintenance</td>
<td>Gradual weight loss (1 lb/mo)</td>
<td>Weight loss @ 2 lb/week</td>
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<tr>
<td>12-18 year olds</td>
<td>Same as above</td>
<td>Weight maintenance or gradual weight loss</td>
<td>Weight loss @ 2 lb/week</td>
<td>Same as above</td>
</tr>
</tbody>
</table>
Staged Treatment

- **Stage 2: Structured Weight Management**
  - For Patients at:
    - BMI $\geq 85$-$94\%$ with risk factors who have failed Stage 1
    - BMI $\geq 95\%$ with co-morbidities
  - Monthly office visits are recommended
  - Consider individual or group visits
  - Distinguished from Prevention Plus by:
    - Difference in the targeted behaviors by the support and structure provided to the child to achieve targeted behaviors
Staged Treatment

Stage 2: Structured Weight Management

- Specific eating and activity goals include:
  - Structured daily meals and planned snacks
  - Additional reduction of television and other screen time to 1 hour per day
  - Planned, supervised, physical activity or active play for 60 minutes per day

- For implementation of Stage 2, additional resources may be needed
Staged Treatment

- **Stage 3: Comprehensive Multidisciplinary Intervention**
  - For patients at:
    - BMI $\geq 85$ who have failed stage 1 and 2
    - BMI $\geq 95\%$ with significant co-morbidities
  - Frequent office visits should be scheduled; weekly visits for a minimum of 8-12 weeks
  - Subsequent monthly visits to maintain behaviors
  - Structured program consists of:
    - Food Monitoring, short-term diet and physical activity goal setting, and contingency management
    - Negative energy balance resulting from structured dietary and physical activity change
    - Team should include a behavioral counselor, registered dietitian, exercise specialist, and a provider to monitor medical issues
Staged Treatment

Stage 4: Tertiary Care Intervention

- Offered to severely obese youth
- Moves beyond the goal of balanced healthy eating and activity habits that are the core of the other stages
- Lack of success with the comprehensive multidisciplinary intervention is not by itself an indication to move to this level of treatment.
- Candidates for consideration should
  - Have attempted weight control in the comprehensive multidisciplinary intervention stage
  - Have the maturity to understand possible risk and should be willing to maintain physical activity and consistent with the additional intervention, a healthy diet with appropriate behavior monitoring
Staged Treatment

- **Stage 4: Tertiary Care Intervention**
  - Interventions listed below have been used for adolescents
  - Consideration of each intervention depends on the patient and resources available
  - Interventions should occur in pediatric weight management centers with comprehensive services
  - Intervention include:
    - Very low-calorie diet
    - Medications
    - Weight control Surgery
Systems-based Clinical Management

- Endocrine
  - Diabetes
  - Polycystic Ovary Syndrome
- Sleep disturbances
  - Obstructive Sleep Apnea
- GI
  - Nonalcoholic Fatty Liver Disease
- Cardiovascular
  - Hyperlipidemia/Hypertriglyceridemia
  - Hypertension
Endocrine

- Diabetes Type 2
  - Risk Factors
    - BMI >85\textsuperscript{th} percentile
    - Strong family history of diabetes
    - Other related conditions, such as polycystic ovarian syndrome, acanthosis nigricans, or CV risk factors
    - Prevalence of childhood diabetes higher among North American Indian, African-American, Latino population

1. JAMA 2003 October 8;290(14):1884-1890
**Endocrine**

- **Diabetes Type 2**
  - **Diagnosis**
    - Fasting glucose test when a child is overweight and has 2 additional risk factors
    - Screening should begin at puberty or 10 years of age
    - Should be performed every 2 years
    - A fasting glucose level of 126 mg/dL or a casual glucose level of 200 mg/dL indicates diabetes and requires oral glucose tolerance test and referral to a pediatric endocrinologist
    - Fasting glucose levels of 100 mg/dL are considered prediabetes, indicating future risk of diabetes
Endocrine

Diabetes Type 2

Management

- Therapy usually initiated and managed by pediatric endocrinologist
- Metformin/Insulin therapy

Patient D.A.

- Initial non-fasting blood sugar: 150
- Repeat fasting done 3 months later: 125
- OGTT wnl
- Continued w/ Stage 1 management
Endocrine

- Polycystic Ovary Syndrome (PCOS)
  - Occurs in 8% of young women 18 to 25 years of age
  - Earlier age of onset in obese adolescent females
  - Clinical presentation
    - Infrequent menses (less than/≤ 9 cycles per year) is the most important finding
  - Common exam findings
    - Hirsutism
    - Excessive acne
    - Acanthosis nigricans
Endocrine

- **PCOS**
  - **Diagnosis**
    - Other medical conditions causing irregular menstrual cycles and androgen excess have been excluded and when 2 of the following are present:
      - Oligo-ovulation or anovulation (usually manifested as oligomenorrhea or amenorrhea)
      - Elevated levels of circulating androgens or clinical manifestations of androgen excess
      - Ultrasonography showing polycystic ovaries
  - **Management**
    - Subspecialist may be required to interpret labs, initiate and monitor treatment to protect fertility
    - **Sequellae**
      - Females w/ PCOS often have insulin resistance or type 2 diabetes
      - PCOS is difficult to manage without weight management
      - May have metabolic syndrome
Sleep Disturbances

- Obstructive Sleep Apnea (OSA)
  - Clinical presentation
    - Snoring
    - Daytime sleepiness
    - Nocturnal enuresis
    - Restless sleep
    - Pauses in breathing
    - Tonsillar hypertrophy
      - OSA can occur in the absence of enlarged tonsils
Sleep Disturbances

- **OSA**
  - **Sequellae**
    - Higher prevalence of OSA among severely obese children (about 50%)
    - Poor attention
    - Poor academic performance
    - Right ventricular hypertrophy and pulmonary hypertension
Sleep Disturbances

- OSA
  - Management
    - Referral for sleep study to assess for OSA
    - Referral to ENT for T&A if indicated
    - Referral to Pulmonologist to evaluate for CPAP if T&A not indicated or ineffective
    - Link to referral for sleep study available on QI team space
  - Patient D.A.
    - Exam consistent w/ poorly controlled allergic rhinitis
    - Appropriate allergy treatment provided
    - Snoring sx continued after 1 month; sleep study ordered
    - No evidence of significant sleep apnea; continued allergy treatment continued w/ improvement of sx
Sleep Disturbances

- Obesity hypoventilation syndrome
  - Impairment of ventilation due to weight of fat on chest and abdomen
  - Diagnosis
    - Elevated carbon dioxide on sleep study
    - +/- elevated hemoglobin/hematocrit
  - Management
    - CPAP until substantial weight loss relieves symptoms
15 year old male of Asian ancestry with a BMI at 90%ile for age and no abdominal complaints or hepatomegaly.
Nonalcoholic Fatty Liver Disease

- 38% of NAFLD among obese children
- Higher incidence
  - Males
  - Asian ethnicity
  - Mexican ethnicity
  - Metabolic syndrome: insulin resistance, increased blood pressure, elevated waist circumference, obesity
- Usually asymptomatic
NAFLD

- **Screening Labs**
  - ALT and AST
  - Biannual screening suggested for children 10 years of age and older with BMI ≥ 95%
  - Biannual screening for 10 years and older with BMI ≥ 85% with risk factors

- **Referral**
  - ALT/AST twice normal level indicates need for referral

- **Diagnosis**
  - Ultrasound can be helpful
  - Liver biopsy is gold standard
NAFLD Treatment

- Weight loss (≥ 5%) leads to decrease in LFT’s
- Increased physical activity helps decrease hepatic enzymes
- Increased mono/polyunsaturated fats in diet can also help improve liver health
- Evidence that Vitamin E useful, often prescribed by gastroenterologists
Cardiovascular

- Hypertension
- Dyslipidemia
Hypertension

11 yo male with BMI at 98%ile, blood pressure of 119/76
Hypertension

- Use NHLBI blood pressure tables which are categorized according to height, age, and gender
- High prevalence of hypertension among obese children (≈30%)
## Blood Pressure Levels for Boys by Age and Height Percentile (Continued)

<table>
<thead>
<tr>
<th>Age (Year)</th>
<th>BP Percentile</th>
<th>Systolic BP (mmHg)</th>
<th>Diastolic BP (mmHg)</th>
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<td></td>
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<td>Percentile of Height</td>
<td>Percentile of Height</td>
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<tr>
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</tr>
</tbody>
</table>
Prehypertension

- **Measurement:** Blood pressure > 90% and < 95% for age, sex, and height or > 120/80, repeat twice at the same office visit (auscultation) and average

- **Action:** improve BMI, lower dietary sodium, increase physical activity

- **Recheck BP in 6 months**
Stage 1: Hypertension

- Measurement: systolic or diastolic BP > 95% plus 5 mm and < 99%

- Confirmed on 2 separate occasions (repeat 1-2 weeks and average)

- Treatment: improve BMI, increase physical activity, lower dietary sodium, basic work up
Stage 2: Hypertension

- **Measurement:** systolic or diastolic BP >99% + 5 mm Hg
- **Confirmed** three times on the same occasion by auscultation and averaged
- **Treatment:** refer for treatment within a week
Ordering Lipid Profiles

3 year old presents for a well child visit, BMI at 88%ile

Is this child overweight?
Does this child need to have a lipid panel?
What constitutes high risk?

- Parental cholesterol ≥ 240 mg/dL (total cholesterol)

- Positive family history: parents or grandparents have evidence of coronary artery disease < 55 years (males), < 65 years (females)

- Family history of dyslipidemia
What constitutes individual risk?

- Personal history of the following conditions:
  - Diabetes mellitus
  - Renal failure
  - Hypothyroidism
  - Liver failure
  - Obesity/overweight
  - PCOS
Serum Lipids

- Data indicates an increase in lipid in the first 2 years of life
- Lipid levels reach levels of young adults by 2 years of age
Relationship between lipid profile and CVD

- Bogalusa Heart Study
  - Increased incidence of fatty deposits and fibrous plaques in individuals with elevated TC, LDL, TG and low HDL, obesity

- Pathological Determinants of Atherosclerosis in Youth
  - Increased incidence of fatty deposits and fibrous plaques associated with elevated TC, BP, and obesity
Obesity

- Obesity is considered an independent risk factor for dyslipidemia in children
  - Increased TG, low HDL, mildly elevated LDL
  - Increased prevalence of insulin resistance and hypertension which contribute to CVD risk
Relationship between pediatric obesity and CVD

- Measure of carotid intima-media thickness as measure of development of atherosclerosis

- Children 6-14 years old who are obese have statistically significant greater thickness
Prevalence of Abnormal Lipid Levels among Adolescents

- 14.2% among normal weight
- 22.3% among overweight
- 42.9% among obese
Abnormal Lipid Levels in Children and Adolescents

- High LDL: ≥ 130 mg/dL
- Low HDL: ≤ 40 mg/dL
- High Triglycerides:
  - ≥ 100 mg/dL (0-9 yo)
  - ≥ 130 mg/dL (10-19 yo)
- Total cholesterol ≥ 200 mg/dL
- Non-HDL cholesterol ≥ 145 mg/dL
Treatment

- Diet Therapy
  - Trans fat limited to 1% of calories
  - Saturated fat < 7% of total calories, daily cholesterol < 200 mg daily
  - Fiber intake should be child’s age plus 5 up to 20 g/day
  - Total fat intake < 30% of calories
  - Reduction of weight and simple carbohydrate intake helps decrease triglyceride level
Treatment

- Physical Activity
  - Increased HDL
  - Decreased TG, LDL, and total cholesterol
Elevated LDL

- Medication to treat 10 years and older after diet therapy for 6 months has failed:
  - LDL $\geq 190$ mg/dL
  - LDL $\geq 160$ mg/dL with family history of premature cardiovascular disease, 1 high risk factor or 2 moderate cardiovascular risk factors in child
  - LDL $\geq 130$ mg/dL and personal history of diabetes, 2 high level risk factors, or 1 high level and 2 moderate level risk factors
Medical Therapy for Obesity

- Orlistat
- Metformin
- Sibutramine
Orlistat

- Binds lipase in the stomach and small intestine so that dietary fat can not be hydrolyzed for absorption
- Side effects: abdominal cramping, flatus with discharge, oily spotting of underwear
- Must take daily MVI as can inhibit absorption of fat soluble vitamins
- Recent update to safety profile includes possible liver injury or hepatic failure
Metformin

- Adolescents with severe obesity and evidence of insulin resistance
- FDA approved for children 10 years and older with diabetes, **not FDA approved for weight loss**
- Side Effects: abdominal pain, diarrhea, vomiting, nausea
Metformin

- Can be helpful in weight loss in obese children and adolescents
- Long term data of safety or weight gain off metformin not known
Sibutramine

- FDA recall in October 2010 due to increase in cardiovascular events
Bariatric Surgery

- Surgical modifications of the gastrointestinal tract to decrease caloric intake with resultant weight loss
  - Resolution of comorbidities of obesity such as diabetes, metabolic syndrome, obstructive sleep apnea
Bariatric Surgery

Inclusion criteria

- Minimum age: 14 years
- Stage in Puberty: Tanner 4 or greater
- BMI ≥ 35 with comorbidity
- BMI > 40 without comorbidity
- Documented failed outpatient attempts
- Emotional maturity as assessed by psychologist
Laparoscopic adjustable gastric band
Laparoscopic Gastric Bypass
Laparoscopic sleeve gastrectomy
ICD-9 Codes for Weight Associated Conditions

- **Digestive System**
  - 571.8 Other chronic nonalcoholic liver disease
  - 790.4 Nonspecific elevation of transaminase

- **Endocrine, Nutritional, Metabolic**
  - 250.00 Diabetes mellitus without mention of complication, type II or unspecified type
  - 272.0 Pure hypercholesterolemia
  - 272.1 Pure hyperglyceridemia
  - 272.2 Mixed hyperlipidemia
  - 256.4 Polycystic ovaries
ICD-9 Codes for Weight Associated Conditions

- Nervous System and Sense Organs
  - 780.50 Sleep disturbance, unspecified
  - 327.23 Obstructive sleep apnea

- Skin and Subcutaneous Tissue
  - 701.2 Acquired Acanthosis Nigricans
Additional Resources

- CNMC referral list provided on QI Team space
- Sleep study referral form available on QI Team space
- Please share any additional referral sources with TJ so that they can be made available to the group
Questions