

# OBESITY SCREENING, REFERRAL AND TREATMENT TO REDUCE CARDIOVASCULAR RISK FACTORS

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# Objectives

- ① Understand that the obesity epidemic is also affecting children and adolescents with resultant metabolic abnormalities.
- ① Be able to identify the factors used to define metabolic syndrome in children.
- ① Understand the mechanisms thought to increase an individual's risk for metabolic syndrome.

# Objectives

- Be able to identify the lipid patterns frequently seen in young children and adolescents with insulin resistance.
- Understand that Type 2 diabetes in children has been shown to have a more aggressive course towards diabetic complications than Type 1 diabetes.
- Be able to identify treatment recommendations for obese children and adolescents.

# Obesity

- **Monogenetic**

Mutations in leptin and melanocortin pathways

- **Syndromic**

Prader-Willi Syndrome, Albright Hereditary Osteodystrophy, Alstrom Syndrome

- **Polygenic**

Genetic polymorphisms increasing susceptibility to environmental changes

# Obesity

- ◎ United States (NHANES 2011-2012):
  - 1/3 children overweight
  - 17% obese
  - Rates decreased in ages 2-5 years from 13.9% to 8.4% compared to 2003-2004
- ◎ African American and Hispanic children have increased risk of being overweight or obese

# Obesity

Overweight at age 5 years = 4 x  
likelihood of obesity at age 14  
years

Cunningham, SA et al, New England Journal of Medicine, 2014; 370: 403-411.

# Metabolic (Insulin Resistance) Syndrome

- Cluster of risk factors believed to predict future cardiovascular disease and Type 2 diabetes
- More than 46 different pediatric definitions for metabolic syndrome
- Factors: Abdominal adiposity, dyslipidemia, hypertension, glucose intolerance

# Metabolic (Insulin Resistance) Syndrome

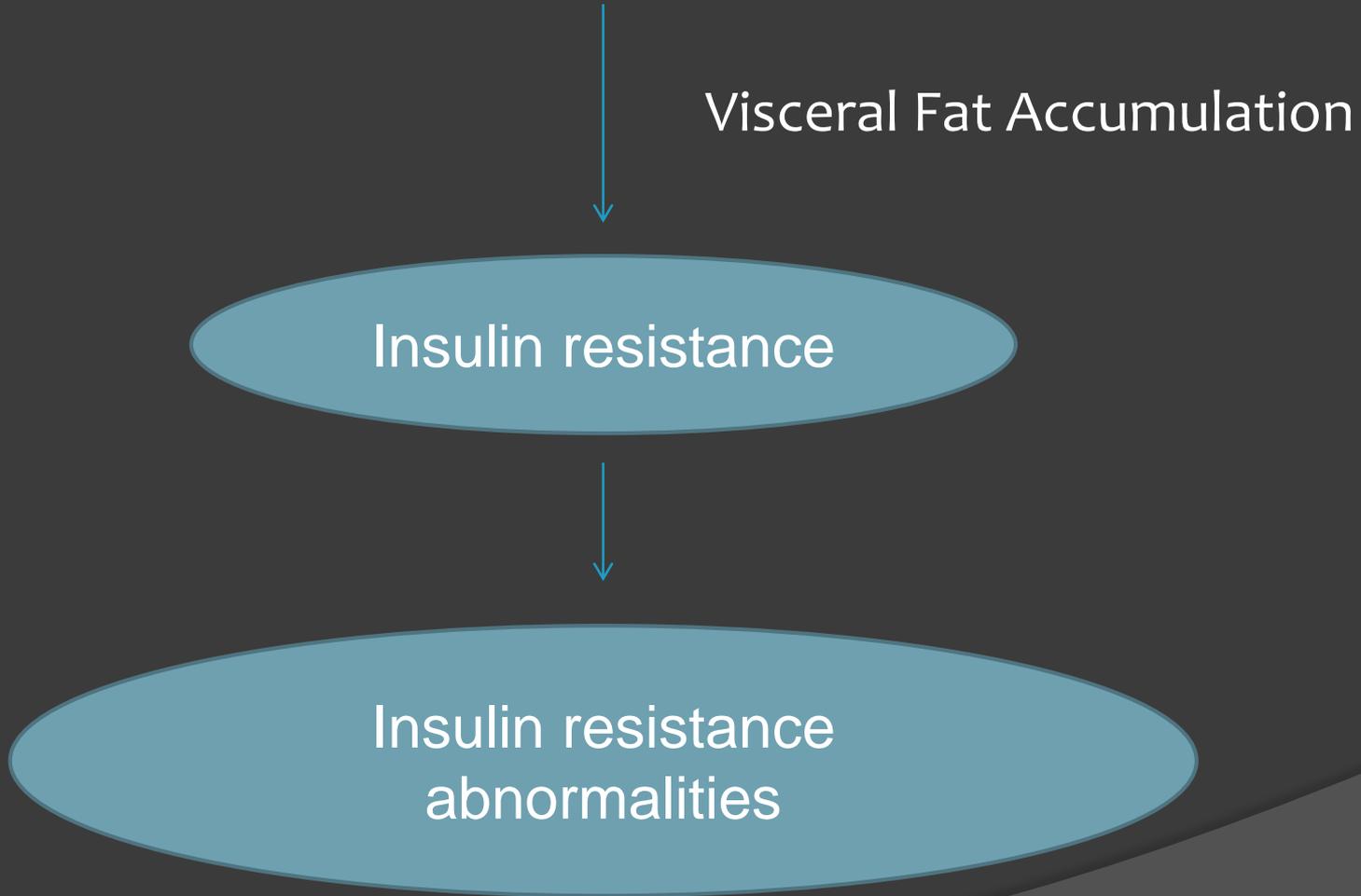
- ① International Diabetes Foundation (10 to < 16 years): Waist circumference  $\geq 90\%$  plus any two:
  - 1) TG  $> 150$  mg/dL or treatment for elevated triglycerides
  - 2) HDL  $< 40$  mg/dL men or  $< 50$  mg/dL women or treatment for low HDL
  - 3) Systolic blood pressure  $> 130$ , diastolic blood pressure  $> 85$ , or treatment for hypertension
  - 4) Fasting plasma glucose  $> 100$  mg/dL or previously diagnosed with Type 2 diabetes

Excess weight gain  
(genetic risk and environment)

Visceral Fat Accumulation

Insulin resistance

Insulin resistance  
abnormalities



# Insulin Resistance Abnormalities

## ● Glucose Abnormalities

- Impaired glucose tolerance to Type 2 DM
- Impaired fasting glycemia

## ● Lipid Abnormalities

- Increased triglycerides/low HDL
- Small dense LDL-C

## ● Increased Coagulation Factors

- Plasminogen activator inhibitor-1
- Fibrinogen

# Insulin Resistance Abnormalities

- Hemodynamic Changes
  - Increased renal Na absorption
  - Increased sympathetic activity
- Inflammation
- Increased Hepatic Fat Deposition
- PCOS

# Metabolic Syndrome in Children and Adolescents

## ● NHANES III (12-19 years of age):

### Prevalence 4.2%

- BMI < 85%- 0.1%
- BMI 85-95%- 6.8%
- BMI  $\geq$  95%- 28.7%

Metabolic syndrome prevalence increases and each metabolic component worsens with degree of obesity.

Weiss R et al, New England Journal of Medicine, 2004; 350: 2362-2374.

Metabolic syndrome and its components track into adulthood. Childhood BMI is a strong indicator adult metabolic syndrome.

Burns TL et al, The Journal of Pediatrics, September 2009; 155: S5.e17-26

# Obesity Screening

US Preventative Service Task Force (2005) recommends that clinicians screen (using BMI) children 6-18 years for obesity and provide or refer to intensive counseling and behavioral interventions to improve weight.

# Obesity Screening

## ● History

- Signs or symptoms of diabetes
- Family History
- Medications

## ● Physical Examination

- Signs of insulin resistance  
(acanthosis nigricans)
- Weight, Height, BMI, Vitals

# Obesity Screening

- ⦿ Laboratory Evaluation
  - Comprehensive metabolic panel
  - Lipid panel
  - HbA1C
  - Vitamin D25OH
  - Thyroid function tests
  - Urine microalbumin

# Dyslipidemia in Metabolic Syndrome

## Triad:

- 1) Elevated triglycerides
- 2) Decreased HDL
- 3) Elevated small density LDL particles

# Dyslipidemia in Metabolic Syndrome

## ◎ Copenhagen Male Study

Ischemic heart disease occurred in:

- 6.6% controls with normal TG, HDL, LDL
- 8.2% individuals with elevated TG
- 11.4% individuals with high TG, low HDL
- 17.5% individuals with high TG, low HDL, high LDL.

# Dyslipidemia in Metabolic Syndrome

In adolescents and young adults, non-HDL and HDL levels were best predictors of pathologic atherosclerotic lesions.

Rainwater DL et al, Atherosclerosis Thrombosis Vascular Biology, 1999: 19(3): 753-761.

# Glucose Abnormalities

## ● Fasting Blood Glucose

### Normal

< 100 mg/dL

### Impaired Fasting Glucose (Pre-diabetes)

100-125 mg/dL

### Diabetes

≥ 126 mg/dL

# Glucose Abnormalities

## ● Non-Fasting Blood Glucose

### Normal

< 140 mg/dL

### Impaired Glucose Tolerance (Pre-diabetes)

140-199 mg/dL

### Diabetes

≥ 200 mg/dL

# Glucose Abnormalities- HbA1C

	HBA1C
Normal	$\leq 5.7\%$
Pre-diabetes	5.8-6.4%
Diabetes	$\geq 6.5\%$

# Type 2 Diabetes

## ◎ Insulin Resistance:

- Decreased muscle glucose uptake
- Increased hepatic glucose production
- Increased adipose tissue breakdown

# Type 2 Diabetes

Type 2 diabetes develops when insulin secretion is not sufficient to meet the needs of the body that are increased by insulin resistance.

# TODAY Study

- Complications and comorbidities in Type 2 DM in adults and Type 2 DM in children and adolescents are the same.
- It appears that they occur more rapidly in children and adolescents.

Tryggestad JB et al, Journal of diabetes and its complications 2015; 29: 307-312

# TODAY Study

- Over an average follow-up of 3.86 years
  - Hypertension 11.6% → 33.8%
  - High-risk LDL 4.5% → 10.7%
  - Microalbuminuria 6.3% → 16.6%
  - Retinopathy present in 13.9% at end of study.

# Type 1 DM vs Type 2 DM

Type 2 diabetic youth compared to Type 1 diabetic youth have increased mortality after a shorter disease duration and had more cardiovascular deaths.

Constantino MI et al, Diabetes Care 2013; 36: 3863-3869.

# Management

- Lifestyle Modification
  - Diet
  - Exercise
- Pharmacotherapy

# Dietary Management

- Elimination of sugared beverages
- Increasing fruits and vegetables
- Reducing foods with refined, simple sugars
- Limit distractions while eating
- Reducing processed, packaged foods
- Reducing meals not eaten at home
- Portion control
- Carbohydrate limits at meals
- Limit high calorie foods

# Exercise Management

- Moderate-to-vigorous exercise at least 60 minutes daily
- Limit daily screen time to < 2 hours
- Encourage physical activity as a family event

# Pharmacotherapy

- **Glucose Abnormalities:**

Pre-diabetes: Metformin

Diabetes: Metformin, Insulin therapy

# Pharmacotherapy

- Lipid Abnormalities:

Elevation in LDL: Statins

Elevation in TG: Fibrates, Niacin

# Risk Factors for Dyslipidemia

## Algorithms

(+) Family history: myocardial infarction, angina, coronary artery bypass graft/stent/angioplasty, sudden cardiac death in parent, grandparent, aunt or uncle (male < 55 years, female < 65 years)

Hypertension, Cigarette smoker, Obesity, High risk conditions (diabetes, chronic renal disease)

NHLB Institute, 2012, Expert Panel on Integrated Guidelines for Cardiovascular Health and Risk Reduction in Children and Adolescents

Referral?

# Question

There is consensus on an appropriate definition of metabolic syndrome in children?

- A) True
- B) False

# Question

There is consensus on an appropriate definition of metabolic syndrome in children?

- A) True
- B) **False**

# Question

Current studies indicate that the risk of complications and morbidities is less in Type 2 diabetic youth than Type 1 diabetic youth?

- A) True
- B) False

# Question

Current studies indicate that the risk of complications and morbidities is less in Type 2 diabetic youth than Type 1 diabetic youth?

- A) True
- B) **False**

# Question

What is the classic lipid pattern triad that is described in metabolic syndrome?

- a) Elevated TG, elevated HDL, low sdLDL.
- b) Elevated TG, low HDL, elevated sdLDL.
- c) Low TG, low HDL, elevated sdLDL.
- d) Low TG, elevated HD, low sdLDL.
- e) None of the above.

# Question

What is the classic lipid pattern triad that is described in metabolic syndrome?

- a) Elevated TG, elevated HDL, low sdLDL.
- b) **Elevated TG, low HDL, elevated sdLDL.**
- c) Low TG, low HDL, elevated sdLDL.
- d) Low TG, elevated HD, low sdLDL.
- e) None of the above.