Diabetes, lipids and obesity: Not just for adults

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Disclosure Statement

- No conflicts of interest to disclose

Objectives

- Clinical cases
- General approach to:
  - Diabetes
  - Obesity
  - Dyslipidemia

IN KIDS!

Case

- 15 year-old boy comes in with a 3-week history of polyuria, polydipsia, noctiuria
- Weight loss of 10 lbs
- Past medical history unremarkable
- Family history unremarkable
- Physical examination reveals a thin yet well-looking young man, unremarkable

Case

- What is the first and easiest thing to do in the office setting?
- Urinalysis
- Glucosuria and ketonuria
- ER to document blood glucose (and blood gas) and start treatment

Question

- How many of you are certain this is type 1 diabetes?
- How many of you are certain this is type 2 diabetes?

Diagnosis

- CDA guidelines:
  - Symptoms
  - Random BG $\geq$ 11.1 mmol/L
  - This does not distinguish type 1 versus 2

- Clinical diagnosis

Case

- 15 year-old boy with a 3-week history of polyuria and polydipsia
- Weight loss of 30 lbs. over the past 4 months
- Starting weight of 250 lbs.
- Past medical history unremarkable
- Family history positive for obesity and type 2 diabetes in his father
- Physical exam reveals obesity, nil else significant

Case

- In such a scenario, which investigations would you want to do:
  - Urinalysis?
  - Blood glucose?
  - Oral glucose tolerance test?
  - Blood gas?

Case

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  - Blood glucose?
  - Oral glucose tolerance test?
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OGTT

- Valuable test used in the diagnosis of diabetes
- More sensitive than a fasting blood glucose
- Will give you the answer
- But not necessary in this scenario

- Diagnostic criteria: remember in the face of symptoms, random BG $\geq$ 11.1 mmol/L is enough

Case

- How many of you are certain this is type 1 diabetes?
- How many of you are certain this is type 2 diabetes?

Case

- CLINICAL PICTURE!
- Baseline weight/BMI
- Family history
- Acanthosis nigricans

Type 1 versus Type 2

- What tests can we do to distinguish between the two?
- Islet autoantibodies
- Insulin levels not useful, may be low due to glucose toxicity
- DNA diagnostic testing if you are considering MODY, in scenario of dominant inheritance pattern without signs of insulin resistance

Case

- Blood glucose is 24.9 mmol/L, blood gas is normal
- Clinical suspicion is type 2
- At this point in time, does it really matter?
- Breaking the news
- Management

Management

- Interdisciplinary healthcare team
- Lifestyle
- Psychological issues
- Insulin: required in severe metabolic decompensation at diagnosis, including an A1C ≥ 9.0% or symptoms of hyperglycemia

Case

- Blood gas reveals a pH of 7.25 and a bicarbonate of 9
- How many of you are certain this is type 1 diabetes?
- How many of you are certain this is type 2 diabetes?

DKA in type 2 DM

- The presence of DKA does not rule out the possibility of type 2 diabetes
- As in adults, children with type 2 diabetes can also have HHS
- High morbidity and mortality in youth with combined DKA and HHS at time of diagnosis of type 2 diabetes
- Judicious use of fluids and insulin

Management

- In type 2 diabetes, insulin may be successfully weaned once glycemic targets are achieved
- Limited data on safety and efficacy of oral antihyperglycemic agents in peds
- Metformin- safe in adolescents up to 16 weeks

Could this have been prevented?

- Higher index of suspicion
- Earlier screening for type 2
- Fasting plasma glucose is the recommended screening test
- OGTT

Consensus

- Pubertal children should be screened q2yrs using a FPG if they have ≥ 2 of the following (nonpubertal ≥ 3)
  - Obesity
  - High-risk ethnic group and/or family history and/or exposure to diabetes in utero
  - Signs or symptoms of insulin resistance
  - IGT
  - Use of antipsychotic meds
- Very obese children should be screened annually with an OGTT (BMI ≥ 99th percentile)

Case

- 12 year-old girl
- Past medical history unremarkable
- Obese
- Hispanic origin
- Mother has type 2 diabetes
- OGTT

Diagnosis

- Glucose intolerance
  - Fasting BG 6.1-6.9 mmol/L
  - 2-hr BG 7.8-11.0 mmol/L
- Diabetes
  - Fasting BG $\geq$ 7.0 mmol/L
  - 2-hr BG $\geq$ 11.1 mmol/L
- Insulin resistance when insulin > 500 pmol/L

Case

- Fasting BG 6.2 mmol/L
- 2-hr BG 11.4 mmol/L

Management

- Blood glucose monitoring at home
- ac and 2-hr pc blood glucose values
- Lifestyle changes
- Consider initiating metformin if A1C > 7.0%

Complications & Comorbidities

- Dyslipidemia
- Hypertension
- NAFLD
- Nephropathy
- Neuropathy
- Retinopathy
- PCOS

Obesity

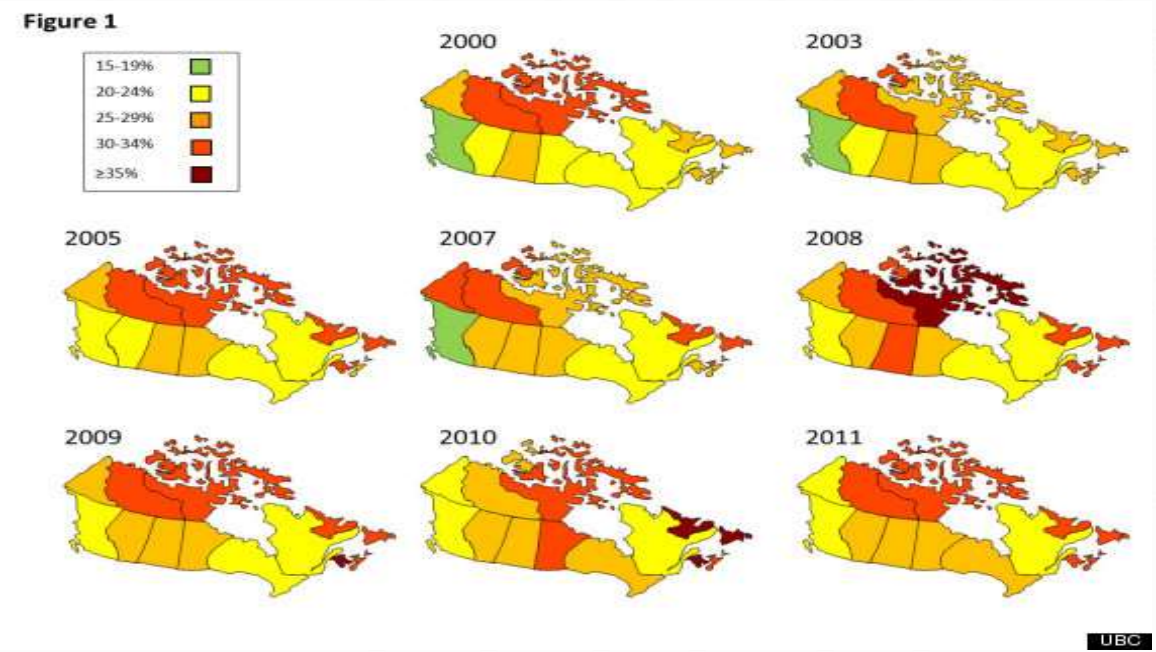
Figure 1
15-19%
20-24%
25-29%
30-34%
≥35%
2000
2003
2005
2007
2008
2009
2010
2011
UBC

Causes

- Exogenous
- Exogenous
- Exogenous
- Exogenous
- Exogenous
- Exogenous
- Exogenous
- Exogenous
- Endocrine

Endocrine causes of obesity

- Hypothyroidism
- Cortisol excess
- Growth hormone deficiency
- Unifying feature is poor growth

Cushing's syndrome

- "Moon" facies
- Striae
- "Buffalo" hump
- Hyperglycemia/hypertension
- Exceedingly rare
- Most common cause in pediatrics is iatrogenic
- Dexamethasone suppression test

Exogenous obesity

- Intake > output
- Baby steps
- 3 goals
- Close follow-up
- Think of all associated morbidities

Take-Home Points

- Type 1 and type 2 diabetes may present with identical symptoms
- Look at the whole clinical picture
- Distinguishing between the two may not impact your management
- Metabolic decompensation: INSULIN
- OGTT is a screening tool for asymptomatic children at risk, not needed to diagnose a patient with symptoms

Case

- 14 year old girl has a lipid profile done because of recent weight gain and parental concern
- Cholesterol total 5.4 mmol/L
- LDL 3.86 mmol/L
- HDL 0.91 mmol/L
- TG 2.3 mmol/L

When do we screen?

- Should this girl have even been screened?

- Universal screening
- Targeted screening

Universal Screening

- Screening everyone at a given point in time
- 9-11 years old, then q5 years
- National Lipid Association
- Complete case ascertainment
- Very little evidence
- Cost-effectiveness?
- NOT advocated in the Canadian Cardiovascular Society Position Statement

Targeted Screening

- > 2 years old with any of the following:
  - One or both parents with high cholesterol or are on lipid-lowering agents
  - Family history of premature ASCVD (men < 55 years old, women < 65 years old)
  - Family history is unknown
  - Moderate to high risk for premature ASCVD

High ASCVD risk

- Smokers
- BMI > 97th percentile
- HTN requiring Rx
- DM type 1 or 2
- Kawasaki with persistent aneurysm
- Post heart transplant
- Chronic renal disease

Moderate ASCVD risk

- BMI 95-96th percentile
- HTN no Rx
- Kawasaki disease with regressed aneurysm
- SLE
- JIA
- HIV
- Nephrotic syndrome

Back to our patient…

- Was it reasonable to screen her?
- Do you refer her now?

Reasonable referral criteria

- LDL $\geq$ 3.4 mmol/L
- HDL $\leq$ 0.9 mmol/L
- TG $\geq$ 2.3 mmol/L

Case

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What do you want to know?

- Family history
- Diet
- Activity
- Reason for weight gain?

Diet History

- What do you eat and drink in a typical day?
- Be as specific as possible…
- Examples
  - What kind of milk?
  - Do you put mayo on your sandwich?
  - What kind of bread?
  - How do you prepare food at home (baked, pan-fried, deep-fired…?)
- Restaurants
- Fried food

Physical Examination

- Weight, height and BMI

$$\frac{\text{Weight}}{(\text{Height})^2}$$

- BP
- Stigmata of hyperlipidemia
- Signs of insulin resistance

Management?

- Cholesterol total 5.4 mmol/L
- LDL 3.86 mmol/L
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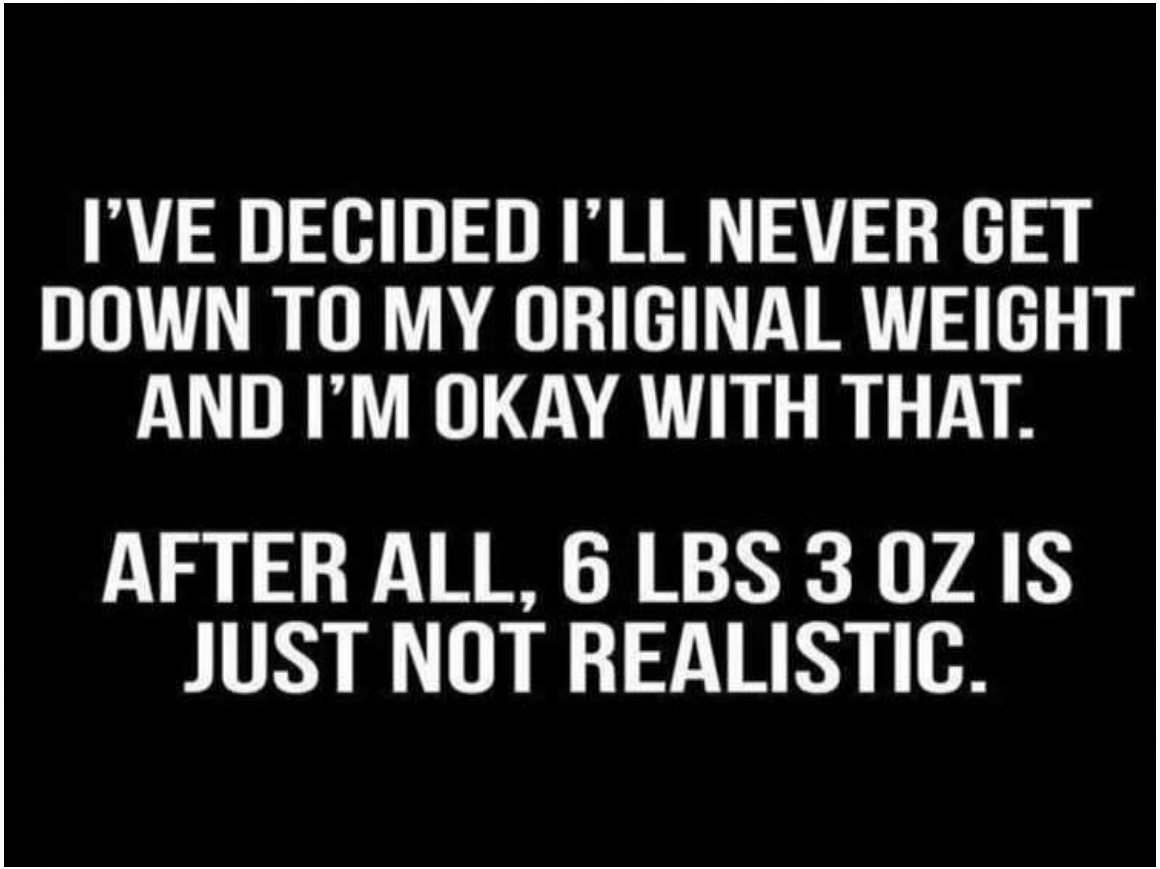
- TG 2.3 mmol/L

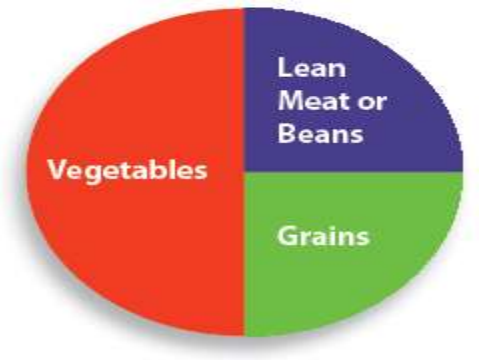

I'VE DECIDED I'LL NEVER GET DOWN TO MY ORIGINAL WEIGHT AND I'M OKAY WITH THAT.
AFTER ALL, 6 LBS 3 OZ IS JUST NOT REALISTIC.

Management

- Focus on diet
- Fats and simple concentrated sugars
- Quantities
- Exercise to increase the HDL
- Motivational strategies

Diet

- Keep it simple
- Cut back, don’t cut out
- The rule of the plate



Setup for Success

- 3 goals
  - Food-related
  - Activity-related
  - Screen time related
- Family affair
- Calendar
- Follow-up

Anything else to consider?

- Hypothyroidism
- Screen with a TSH
- Borderline TSH is not the cause of obesity nor abnormal lipid profile

Case

- 11 year old boy referred for the following:
- Total cholesterol 5.98 mmol/L
- LDL 3.01 mmol/L
- HDL 2.42 mmol/L
- TG 1.27 mmol/L
- Does this patient need to be seen?

Don’t forget…

- Total cholesterol alone is not a reason to refer
- High HDL is a good thing!

Case

- 7 year old boy
- Pediatrician was worried that patient's weight is 97th percentile
- Ordered routine bloodwork
- Cholesterol 9.3 mmol/L
- What else do you want to know?
- Is this obesity related?

Causes of Hypercholesterolemia

- Cholestasis
- Hypothyroidism
- Anorexia nervosa
- Nephrosis

Cholestasis

- Extra- or intrahepatic obstruction of biliary flow
- Abnormal lipoproteins in plasma
- Planar and palmar xanthomas
- Neuropathy

Hypothyroidism

- Decreased biliary excretion of cholesterol and bile acids
- Cholesterol biosynthesis decreased
- Number of LDL receptors decreased

Anorexia Nervosa

- 40% of patients have elevated LDL
- Decreased fecal excretion of bile acids and cholesterol
- Normal levels restored with proper nutrition

Nephrosis

- Biphasic hyperlipoproteinemia
- First, elevation in LDL
- Increased VLDL production by liver
- Catabolism of LDL may be impaired
- Low metabolic rate?

Primary Hypercholesterolemias

- Familial hypercholesterolemia
- Familial combined hyperlipidemia
- LP(a) hyperlipoproteinemia
- Familial ligand-defective apo-B

Familial Hypercholesterolemia

- AD
- Heterozygotes 1/500
- Selective increase in LDL
- Defect in LDL receptors on cell membranes
- Combined heterozygotes
- Homozygous

Causes of Hypercholesterolemia

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What do you want to know?

- Family history
- If unknown, screen the others!
- Detailed PMHx
- Symptoms and signs of hypothyrodism
- Definite urgent referral

Tendinous xanthomas

Corneal arcus

Familial Hypercholesterolemia

- Step One diet
- AHA
- Less than 30% of calories from fat
- Less than 10% of calories from saturated fat
- Less than 300 mg of cholesterol daily

Making it practical

2% REDUCED-FAT MILK
Nutrition Facts

Serving Size 1 cup (240 ml)
Servings Per Container 8

Amount Per Serving	
Calories 120	Calories from Fat 45
	% Daily Value
Total Fat 5g	8%
Saturated Fat 3 g	15%
Cholesterol 50 mg	17%
Sodium 125mg	5%
Total Carbohydrate 12 g	4%
Dietary Fiber0g	0%
Sugars 11g	
Protein 8g	

Making it practical

- How many calories in a gram of fat?
- 9 calories per gram of fat

- Fat grams x 9 = Fat calories

Making it practical

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Protein 8g	

Medications?

- After 6 months of lifestyle changes
- LDL $\geq$ 4.2 mmol/L with risk factors
- LDL $\geq$ 4.9 mmol/L without risk factors

Bile acid sequestrants

- Cholestyramine
- Colestid
- GI effects
- Compliance

Ezetimibe (Ezetrol)

- FDA-approved as monotherapy in kids ≥ 10 years old
- Studied in age 6-10 year olds

Statins

- Most approved ≥ 10 years old
- Pravastatin approved ≥ 8 years old
- Practice is variable
- Post-puberty
- Follow liver enzymes and CK
  - 1-2 months after Rx initiation
  - 1-2 months after dose change
  - q 6 months

What am I thinking...?

Homozygous FH

- 1 in 1 million
- Consider statins earlier
- Referral for plasmapheresis

Take-Home Points

- Targeted screening – controversial
- Is it primary or secondary?
- Even when the cause is obvious, look closely at anything else that may contribute
- In pediatrics, diet is key and is the first step
- Meds are an option

Reasonable referral criteria

- LDL $\geq$ 3.4 mmol/L
- HDL $\leq$ 0.9 mmol/L
- TG $\geq$ 2.3 mmol/L

Common Causes

- Elevated LDL
  - CHAN
- Elevated TG
  - Anything that causes insulin deficiency or resistance

- Obesity-related dyslipidemia
- Familial combined dyslipidemia
- Familial hypercholesterolemia

Rx

- High LDL – decrease the fats
- High TG – decrease the sugars
- Low HDL – increase exercise

- Meds if
  - LDL $\geq$ 4.2 mmol/L with other risk factors
  - LDL $\geq$ 4.9 mmol/L without other risk factors

THANK YOU!