Pediatric Hyperlipidemia

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Objectives

1. Describe pediatric hyperlipidemia
2. Recognize abnormal pediatric lipid levels
3. Outline the treatment for pediatric hyperlipidemia

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1. Describe Pediatric Hyperlipidemia

- Lipid is a non soluble material in liquid
  - Includes:
    - Cholesterol
    - Triglyceride
    - Phospholipids

- Lipids form cell membranes, produce bile acids, and are used in hormone synthesis
- Exogenous – taken in with food
- Endogenous – synthesized within the body

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1. Describe Pediatric Hyperlipidemia

- Exogenous – Intestinal absorption of dietary cholesterol and fatty acids
  - Saturated fats (Meats, dairy especially whole milk products, coconut oil, palm oil, cocoa butter)
  - Trans fats (Historically crackers, baked goods, french fries, donuts)
  - Cholesterol (Egg yolks, organ meats)
- Endogenous – Synthesis in the liver

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1. Describe Pediatric Hyperlipidemia

- Lipids are carried in the blood stream by complexes called lipoproteins
- Lipoproteins Classes:
  - Chylomicrons – from the intestines
  - Very low density lipoprotein
  - Intermediate density lipoprotein
  - Low density lipoprotein – serum
  - High density lipoprotein – reverse transport

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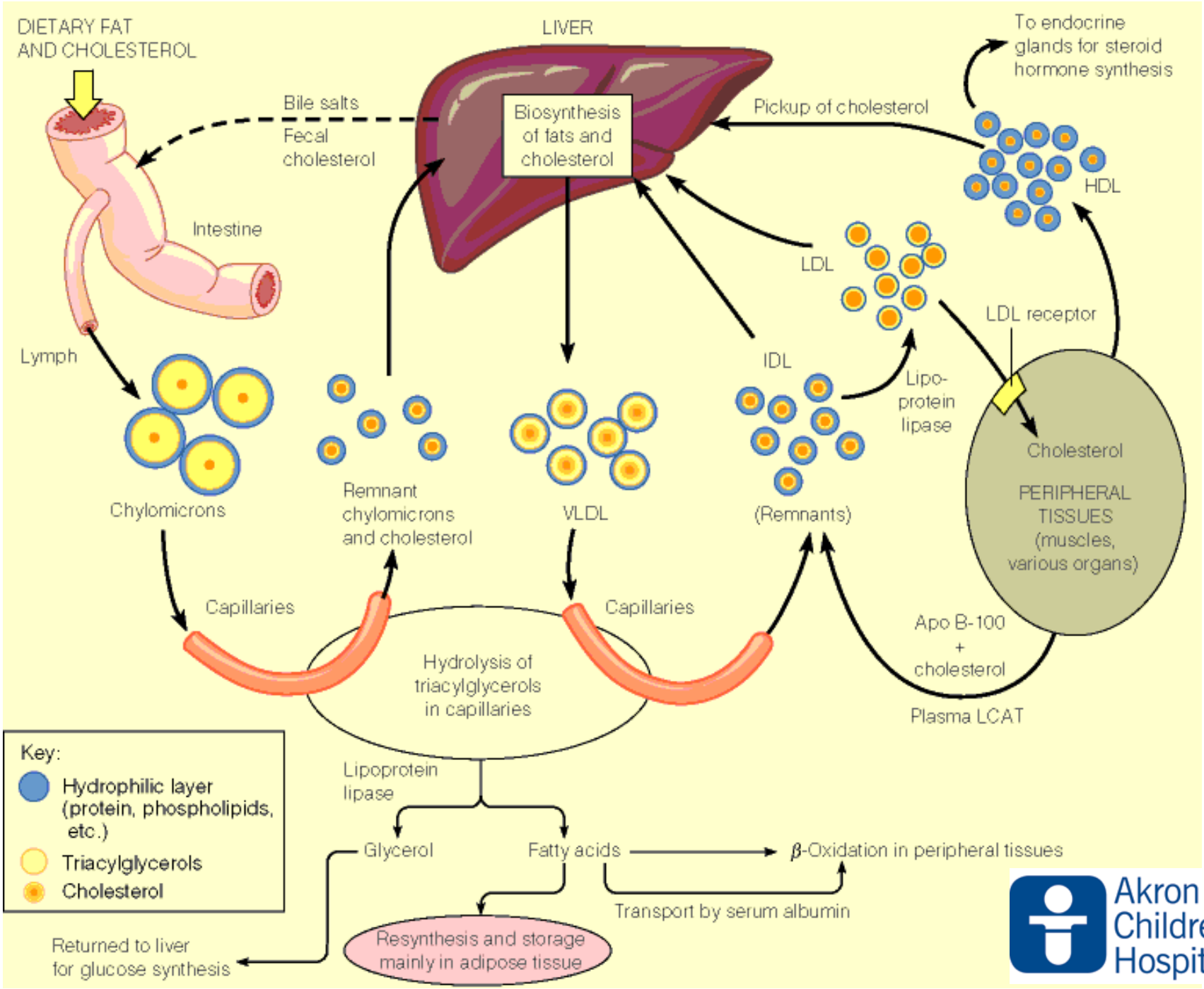

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1. Describe Pediatric Hyperlipidemia

- Normal pediatric lipid levels
  - Total cholesterol <170
  - LDL cholesterol <110
  - HDL cholesterol >45
  - Triglycerides <90
  - Non-HDL cholesterol: <145
- Pediatric hyperlipidemia is an increase in triglycerides and/or LDL cholesterol

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1. Describe Pediatric Hyperlipidemia

- Abnormal pediatric lipid levels
  - Total cholesterol >200
  - LDL cholesterol >130
  - HDL cholesterol <40
  - Triglycerides >130

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1. Describe Pediatric Hyperlipidemia

- Primary dyslipidemia
  - Familial hypercholesterolemia
  - American diet
- Secondary dyslipidemia
  - Diabetes mellitus/Metabolic syndrome
  - Biliary atresia/cholestasis/Hepatitis
  - Nephrotic syndrome/renal failure
  - Hypothyroidism
  - Kawasaki disease/rheumatoid arthritis/SLE
  - Medications (Steroids, OCP's)

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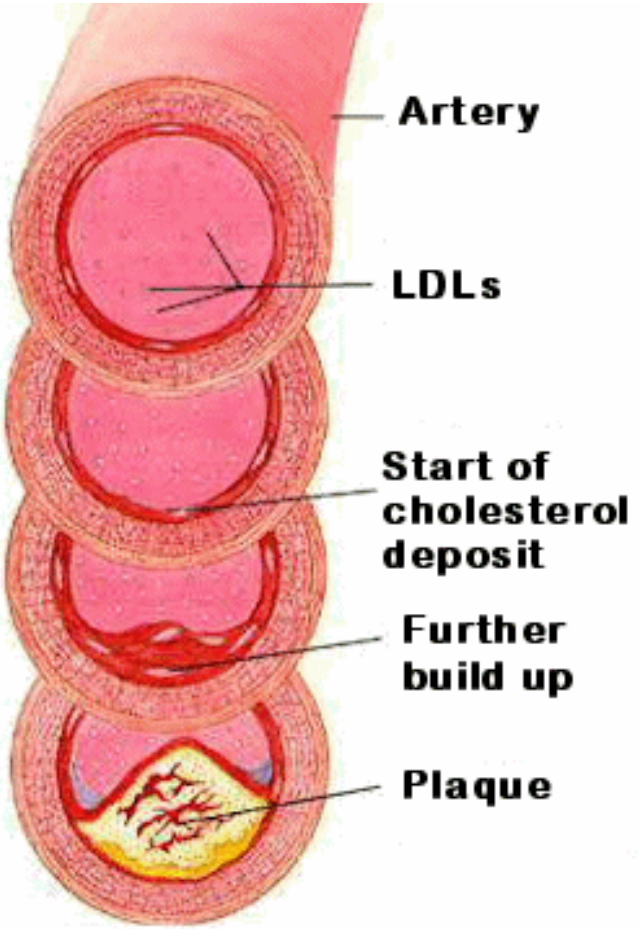
1. Describe Pediatric Hyperlipidemia

- Heterozygous familial hypercholesterolemia
  - 1 in 250 are affected
- Homozygous familial hypercholesterolemia
  - 1 in 1 million are affected



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1. Describe Pediatric Hyperlipidemia

- As weight increases, so does the likelihood of an abnormal cholesterol panel
  - Normal weight: 14% with lipid panel abnormality
  - Overweight: 22% lipid panel abnormality
  - Obese patients: 42% lipid panel abnormality

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2. Recognize Pediatric Hyperlipidemia

- Serum lipid panel
  - Total Cholesterol= LDL + VLDL +HDL
    - LDL is calculated (Valid only if TG<400)
    - Often underestimates IDL component
  - VLDL = TG/5
    - Triglycerides
  - LDL
  - HDL
  - Non HDL cholesterol= TC – HDL

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2. Recognize Pediatric Hyperlipidemia

- Previous recommendations
  - Check Total cholesterol or fasting lipid profile on any patient after the age of 2 if:
    - Parental total cholesterol >240
    - Family history of PCAD in parents or grandparents(<55 in males or <65 in females)
    - Unknown family history
    - Patient with obesity, hypertension, or diabetes

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2. Recognize Pediatric Hyperlipidemia

- CARDIAC program trialed universal screening of 20,266 fifth grade students in West Virginia
  - 71.4% of patients that would have met the AAP screening criteria:
    - 8.3% had LDL >130mg/dL
    - 1.2% had LDL >160
  - 28.6% of pts wouldn't have been screened
    - 9.5% had LDL >130mg/dL
    - 1.7% had LDL >160

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2. Recognize Pediatric Hyperlipidemia

- In 2011, the National Lipid Association recommended universal screening for all children between the ages of 9-11 years
  - Fasting lipid panel
  - Or non-fasting non-HDL cholesterol
- Earlier lipid screening can still be performed starting after age 2 for high risk patients

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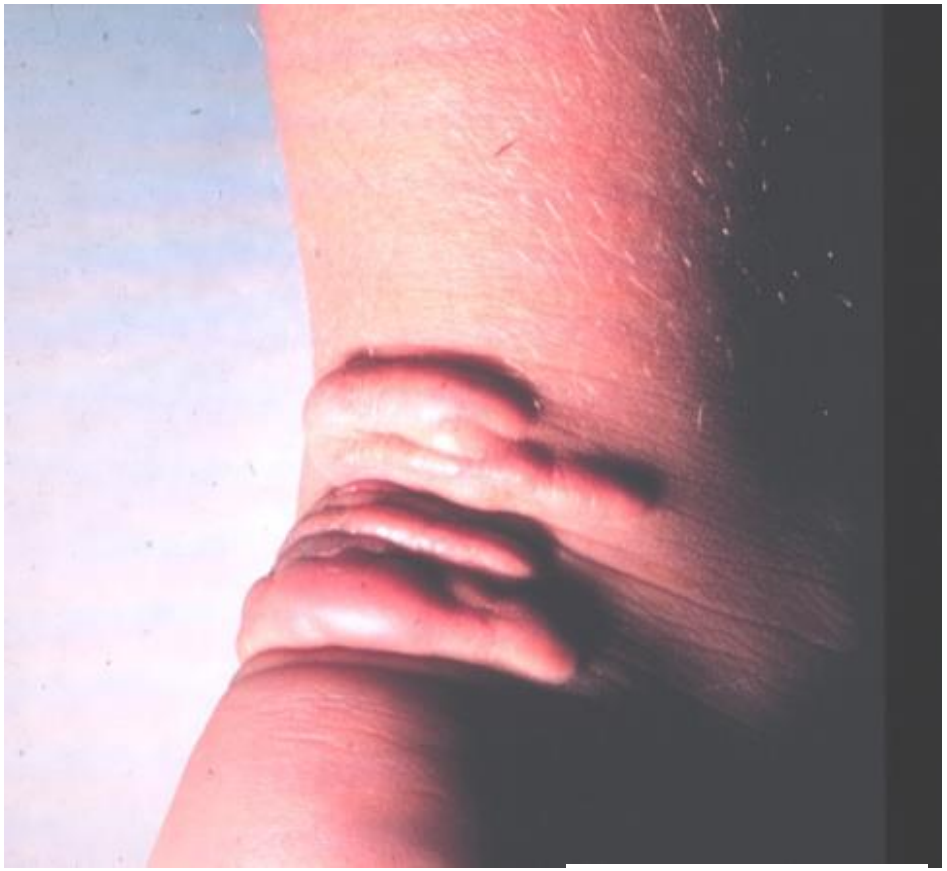
2. Recognize Pediatric Hyperlipidemia

- Physical examination
  - Tendon Xanthoma
    - Accumulation of lipids in cutaneous foam cells
    - Associated with marked elevation of cholesterol



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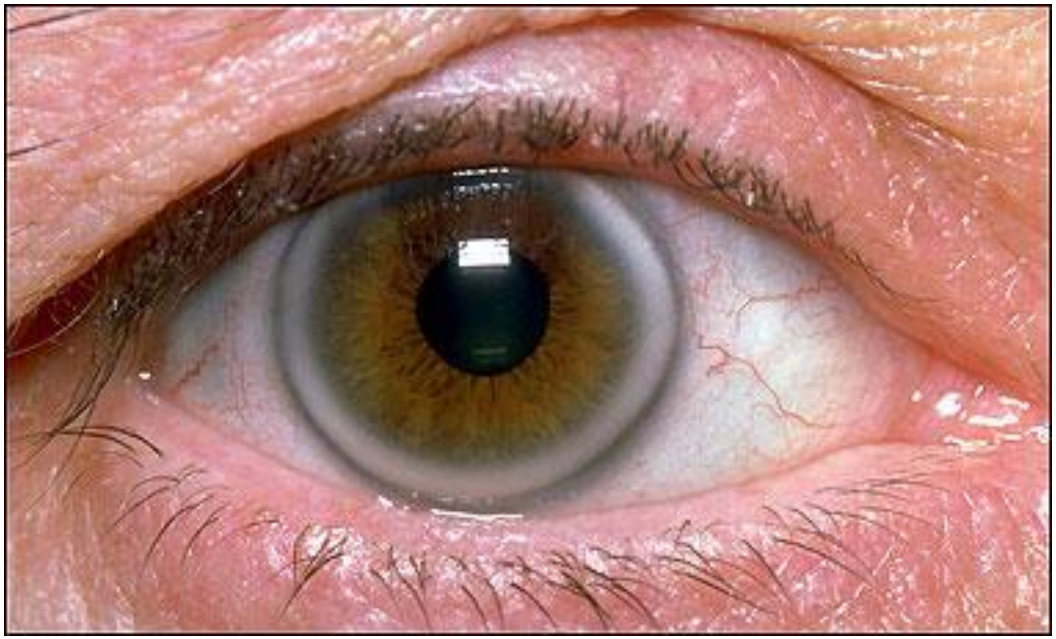
2. Recognize Pediatric Hyperlipidemia

- Corneal Arcus - a lipid-rich corneal deposit that does not affect the patient's vision. It begins at the top and bottom of the cornea and spreads to form a complete ring



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3. Treatment of Pediatric Hyperlipidemia

- First line therapy
  - Diet
    - Can decrease triglycerides and LDL cholesterol
  - Exercise
    - Daily exercise is the best way to increase low HDL levels

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3. Treatment of Pediatric Hyperlipidemia

- Diet
  - Reduce saturated fats (red meat, dairy products) and trans fats (baked goods, desserts, crackers)
  - Goal saturated fat <10% of daily caloric intake
  - Limit daily cholesterol intake <200mg
  - Use only nonfat dairy products
  - Increase daily grams of fiber to (age + 5), up to 25 grams maximum

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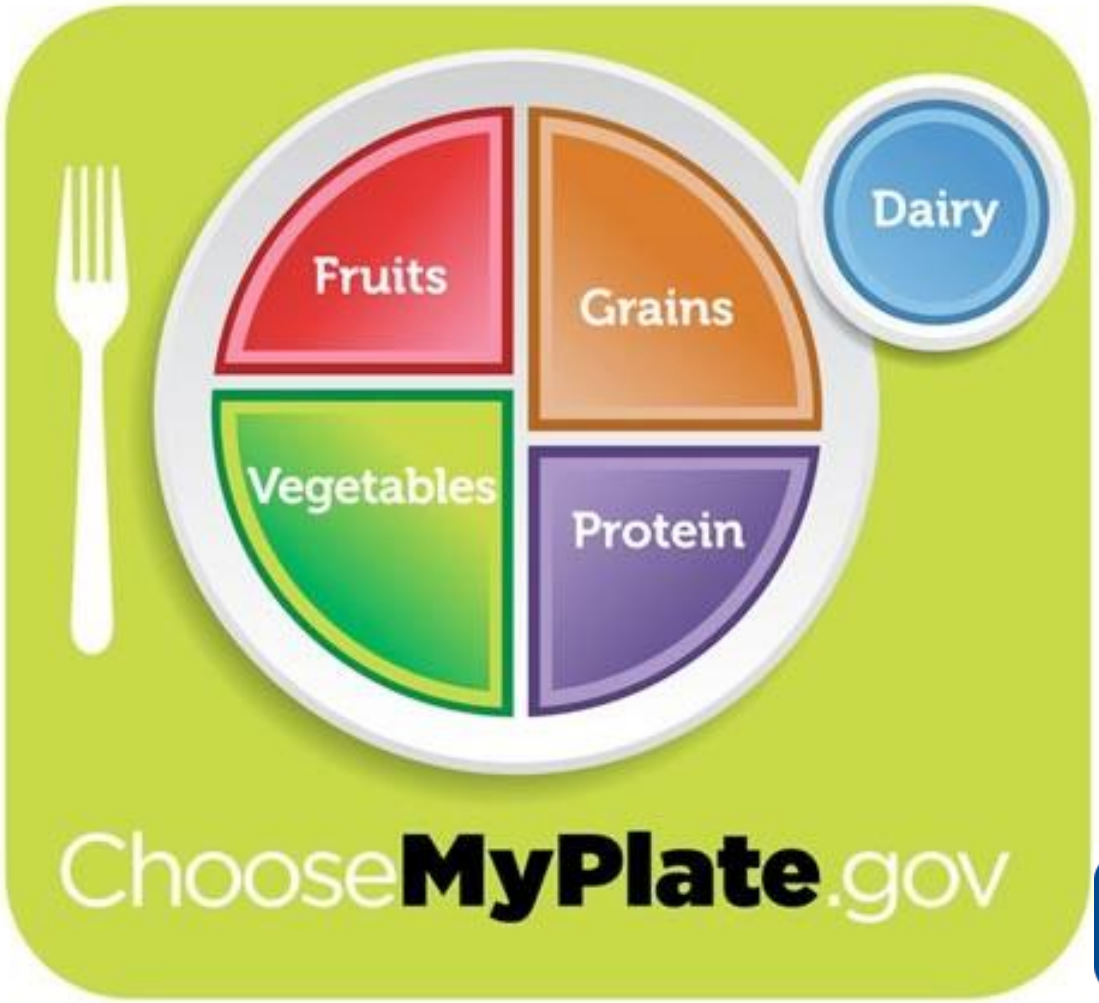
3. Treatment of Pediatric Hyperlipidemia



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3. Treatment of Pediatric Hyperlipidemia

- 5-2-1-0 Obesity prevention plan
  - 5 Fruits/Vegetables daily
  - 2 Or less hours of screen time daily
  - 1 Hour of moderate physical activity daily
  - 0 Soda, juice, sport drinks daily

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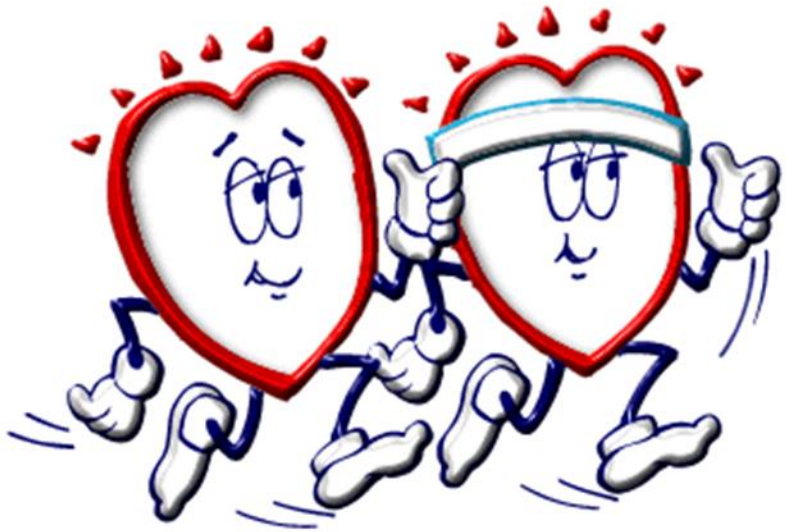
3. Treatment of Pediatric Hyperlipidemia

- Exercise
  - AAP recommendations are for all pediatric patients to get a minimum of 60 minutes of sweat producing exercise every single day!



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3. Treatment of Pediatric Hyperlipidemia

- Second Line Therapy
  - Plant Stanols/Sterols
  - Omega 3 fatty acids
  - Prescription pharmacotherapy

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3. Treatment of Pediatric Hyperlipidemia

- Plant Stanols/Sterols
  - Decrease absorption of cholesterol in GI tract
  - Often recommended as 2 - 4 grams per day
  - Shown to lower LDL cholesterol by 5-10%
  - Can be found in certain grocery store products:
    - Added to margarine
    - Added to orange juice

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3. Treatment of Pediatric Hyperlipidemia

- Omega 3 fatty acids
  - Essential unsaturated fatty acids
  - Found in fish oils as well as flaxseed oil
  - Usual dose 2-4 grams daily
  - Works best to reduce elevated triglycerides

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3. Treatment of Pediatric Hyperlipidemia

- Prescription pharmacotherapy (statins, bile acid resins, fibrates)
  - If LDL cholesterol >190 with no other risk factors
  - If LDL >160 with FHx PCAD, or 1 high risk factor or two moderate risk factors
  - If LDL >130 with 2 high risk factors or 1 high risk and two moderate risk factors

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3. Treatment of Pediatric Hyperlipidemia

High-level risk factors:

Hypertension that requires drug therapy (BP ≥99th percentile + 5 mmHg)

Current cigarette smoker

Obesity with BMI ≥97th percentile

•Presence of a high risk condition: Diabetes (type 1 or type 2)
•Chronic kidney disease/end-stage renal disease/post-renal transplant
•Post-orthotopic heart transplant
•Kawasaki disease with current aneurysms

Moderate-level risk factors:

Hypertension (defined as systolic and/or diastolic BP ≥95th percentile measured on three or more separate occasions) that does not require drug therapy

•Obesity: For children age 2 to 11 years: BMI ≥95th to <97th percentile
•For adolescents ≥12 years: BMI ≥85th to <97th percentile

HDL cholesterol <40 mg/dL

•Presence of a moderate risk condition: Kawasaki disease with regressed coronary aneurysms
•Chronic inflammatory disease (eg, systemic lupus erythematosus, juvenile idiopathic arthritis)
•HIV infection
•Nephrotic syndrome
•Adolescent depressive and bipolar disorders¶

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3. Treatment of Pediatric Hyperlipidemia

- Statins (Atorvastatin)
  - 3-Hydroxy-3-methyl-glutaryl Coenzyme A reductase inhibitors
  - Upregulate LDL receptors which clear LDL from the circulation
  - 20-50% reduction in LDL cholesterol
  - SE: Can elevate liver enzymes, cause rhabdomyolysis
    Possibly teratogenic to fetus

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3. Treatment of Pediatric Hyperlipidemia

- Bile acid binding resins (Cholestyramine)
  - Bind the cholesterol containing bile acids in the GI tract and prevent reuptake in the enterohepatic circulation
  - Can lower cholesterol 10-20%
  - SE: GI symptoms

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3. Treatment of Pediatric Hyperlipidemia

- Ezetemibe
  - Inhibits cholesterol absorption from intestine
  - Blocks the cholesterol transporting NPC1L1 protein
  - The liver subsequently increases absorption of cholesterol from the blood stream and reduces LDL cholesterol 15%
  - Often used in combination with statin or in statin intolerant patients
  - Potential side effects can be diarrhea, fatigue, jaundice, rhabdomyolysis

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3. Treatment of Pediatric Hyperlipidemia

- Fibrates (Gemfibrozil)
  - Inhibit synthesis of VLDL apolipoprotein B
  - Decreased hepatic extraction of free fatty acids, thus decreasing hepatic triglyceride production
  - SE: rhabdomyolysis, especially when used in combination with a statin

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3. Treatment of Pediatric Hyperlipidemia

- PCSK9 Inhibitor (Evolocumab)
  - Proprotein convertase subtilisin/kexin type 9 inhibitor blocks the breakdown of LDL receptors
  - More LDL receptors allows for more removal of LDL from the bloodstream
  - Reduced LDL by 44% in one study of pediatric patients age 10-17 years old
  - Subcutaneous injection monthly
  - SE: Fatigue, muscle pain

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3. Treatment of Pediatric Hyperlipidemia

- Monoclonal antibody inhibitor of ANGPTL3
  - IV monthly injectable (Evinacumab)
  - Doesn't require LDL receptors to function
  - Use in children ages 5 and older for homozygous familial hypercholesterolemia
  - Had significant reduction of 40% LDL by 2 weeks and sustained reduction in LDL to approximately 48% over 24 week period

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3. Treatment of Pediatric Hyperlipidemia

- Children ages 8-18 started on statin therapy had less carotid intimal media thickness than those not treated at reevaluation at 4.5 years
- Teenagers started on statins had no cardiovascular events by age 30, when their affected parent had 7% CHD event rate by age 30
- Adults taking lipid lowering drugs for 13 years had protection against progression of carotid intima media thickness

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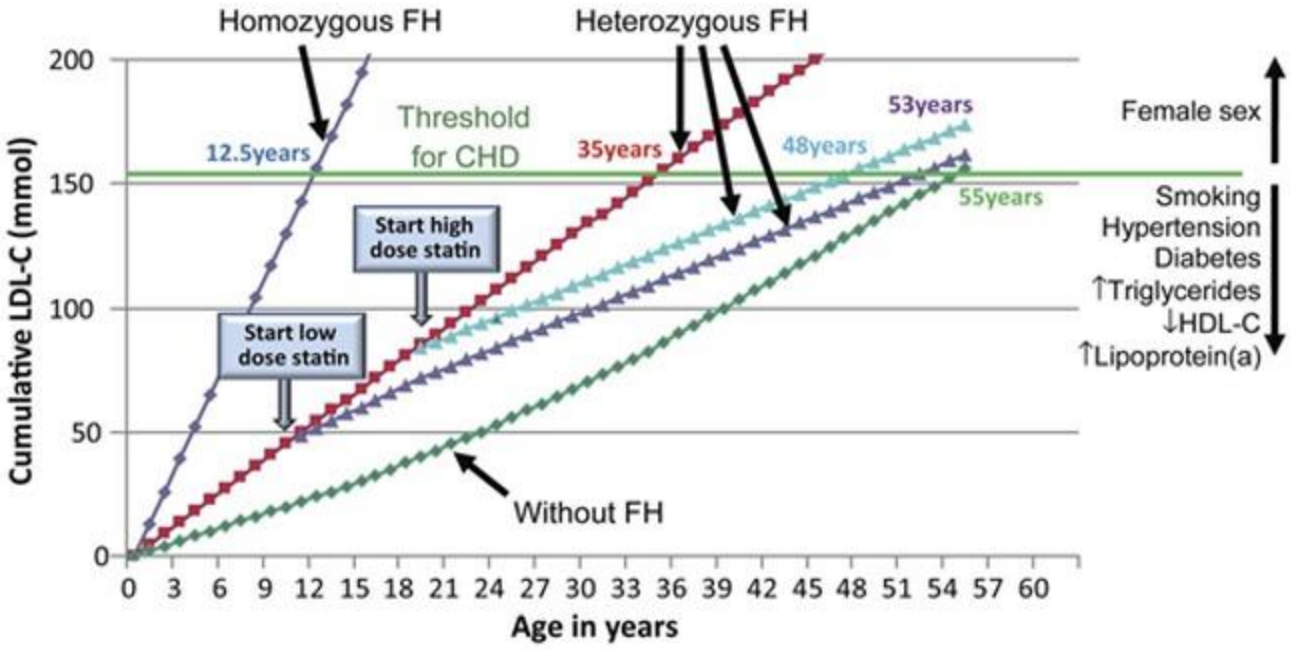
3. Treatment of Pediatric Hyperlipidemia



LDL = low-density lipoprotein
LDL-C = LDL cholesterol
HDL-C = high-density lipoprotein cholesterol
CHD = coronary heart disease
FH = familial hypercholesterolæmia

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Summary

- Pediatric hyperlipidemia is a common disorder
- Patients are asymptomatic and the only way to diagnose is with lipid screening
- Recommendations are to screen every child
  - Typically best age is 9-11 years old
  - Can screen after age 2 for high risk patients
- Pharmacotherapy can be effective and safe in pediatric patients

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Thank You!

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