



Cardiovascular Unit Hyperlipidemia



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Hyperlipidemia

- There had been extensive evidence showing direct link between cholesterol and CAD.
- High cholesterol can block the coronary arteries of the heart causing coronary artery disease (CAD) causing chest pain (angina) and may lead to heart attack (Myocardial Infarction-MI).
- Cholesterol can also block the carotid arteries (arteries going to brain) leading to Stroke.
- Cholesterol can also block the peripheral arteries of the legs causing leg pain via Peripheral Artery Disease (PAD).

What is Cholesterol?



Total cholesterol is a mixture of LDL, HDL and other fats. Total cholesterol should be **< 200mg/dl**. They include:

LDL Cholesterol – Lousy, Lethal, Keep it Low, clogs the arteries. In healthy individual, LDL should be **< 130**.

Diabetics, should be **< 100**.

CAD, CABG, PAD, Stroke, should be **< 70**.

HDL Cholesterol – “Healthy” “Keep it High”, HDL acts like a garbage truck, taking cholesterol from the blood and dumping it in the liver (it cleans the arteries).

HDL Cholesterol should be **> 40**.

Triglycerides (TG)

- A type of fat in your body that increases when you consume more food than you can not burn, especially when you eat carbohydrates.
- TGs have been implicated in CAD.
- If it is greater than 1000, it can cause **acute pancreatitis** (3rd most common cause after EtOH and GS).
- Triglyceride level should be less than 150.

Familial Hypercholesterolemia (FH)

- **LDL is greater than 190**, there is a genetic defect which makes the body unable to remove LDL cholesterol from the blood due to defective LDL receptors. This results in a very high level of LDL cholesterol.
- **Autosomal dominant**
- **Sx:** Cholesterol skin deposits called **xanthomas** anywhere on the body and eyelid.
- Patients develop signs of CAD and stroke at a young age.

Treatment of Hyperlipidemia

LIFESTYLE MODIFICATIONS

- Exercise: walking for at least 1 hr/day for at least 5 days/wk.
- Weight loss: 10-15 lbs. or 10% of your weight if you are obese.
- Quit from smoking.
- Oatmeal, Fruits and vegetables, nuts.
- Grilled chicken, salmon, catfish, tilapia and tuna to increase fish oil.
- Vegetable or, olive oil, no butter. Use low fat food, skim or low fat milk.

LDL Cholesterol

LDL \geq 70
CAD, PAD, CVA

LDL 160-190 no RFs
LDL 130-160 with \geq 2 RFs

LDL $>$ 160
 \geq 2 RFs

LDL \geq 100 DM

Start Statins
Moderate-high dose
(Intensity)

Diet & Exercise for 3 mths

Start Statins

If still high aft 3 mths,
another round of
Diet & ex OR start statins

**Risk Factors: Smoking, HTN,
DM, $>$ 50 y/o, HDL \leq 35, Family hx**

HOW TO CHOOSE TREATMENT: see flow chart

- **With Diabetes, the LDL goal <100.**

If LDL > 100, start Statin.

- **With CAD, CABG, PAD, Stroke the LDL goal <70.**

If LDL \geq 70, start Statin.

- **The ATP (Adult Treatment Panel) III guidelines** state that LDL level and presence of risk factors determine whether to start patient on Lifestyle Modification or Drug therapy.
- **The ATP IV**, moves away from specific LDL values instead focuses on risk factors. For example all patients with diabetes (DM) and CAD must be treated with high dose (high intensity) statin therapy regardless of LDL levels.

CHOLESTEROL-LOWERING MEDICATIONS

Meds	Dosages	MOA	Effect on Lipid Panel	Side effect
Atorvastatin (Lipitor) Simvastatin (Zocor) Pravastatin (Pravachol) Lovastatin (Mevacor) Rosuvastatin (Crestor)	10,20,40,80mg For Crestor its 5,10,20,40mg	Inhibits Synthesis of Cholesterol (HMG-CoA Reductase Inhibitor)	↓LDL↓Triglycerides to a lesser degree, ↓CAD and mortality (have antioxidants effect on endothelial linings)	↑LFTs,√ ALT, AST, Muscle Pain can lead to Rhabdomyolysis if it occurs can stop, ↓dose, change brand also check CPK
Ezetimide (Zetia)	10 mg	Decreases absorption of cholesterol at the intestine	↓ LDL: Use in those who have high LFT or Statin not enough to lower LDL	GI problem Diarrhea
Gemfibrozil (Lopid) Fenofibrate (Tricor)	Triglycerides are > 400 otherwise use fish oil	Activate lipoprotein lipase:↑ breakdown of Triglyceride	↓Triglycerides do not take with statins it increases chance of Rhabdomyolysis	GI upset, muscle pain ↑LFTs Cholelithiasis
PCSK9 Inhibitors (injection): Evolocumab (Repatha), Alirocumab (Praluen)	Injectable Monthly or Bi-monthly	Monoclonal ab increasing receptors available to capture LDL	Lowers LDL (Can be used with statins) Used for Familial Hyperlipidemia	Injection site reactions Does NOT affect LFTs.
Niacin (Niaspan)	500, 1000, 1500, 2000mg	lowers hepatic synthesis of LDL	Increases HDL Lowers LDL	flushing(prevented with 81mg ASA) Itching (pruritus), ↑ LFT ↑ uric acid

Fish oil (Omega-3-FA): It is OTC give if triglyceride greater than 200, (1000-4000mg), Lovaza, Vascepa
Herbal products: Oatmeal, any form of soluble fiber, and soy can lower cholesterol

Patient Education

- Total Cholesterol is a mixture of LDL, HDL and other fats.
- LDL Cholesterol (Lousy or Lethal Cholesterol) is bad cholesterol that can block your heart arteries (coronary arteries) and cause heart attack. It can also block your arteries going to the brain causing stroke and block arteries of the legs causing leg pain (Peripheral Artery Disease).
- HDL cholesterol (Healthy Cholesterol) is good cholesterol. It removes cholesterol from the blood & helps to clean arteries.

	CHOOSE	Avoid	AVOID
Meat, Poultry, Fish	Grilled chicken (no skin), Turkey, fish (choose salmon, catfish, tilapia & tuna).	Avoid Red meats such as beef and steak (lean not fatty); eat once a week.	Avoid Sausages, Bacon, Hot Dog, Pork, Canned Meat, liver and Lunch Meats.
Fats & Oils	Olive oil & Canola oil , other vegetable oils like corn oil.	Avoid saturated fats , coconut oil, palm oil and butter.	Avoid Butter and Salad Dressing (use lemon and olive oil). Avoid Trans-fats & Saturated fats (they are filled with cholesterol).
Dairy	Skim milk , low-fat & 1% milk and yogurt, low-fat cheeses.	Avoid 2% milk, yogurt , light cream cheese.	Avoid Whole milk , heavy creams, whipped cream, cream cheese
Breads, Cereals, Pasta, Rice And Beans	Oatmeal , any soluble fiber, any corn flake cereal, oat bran cereal, wheat bread, whole grain or multi-grain products; barley, and brown rice.	Avoid white breads, instead choose wheat bread. Try low-fat baked foods with light toppings. Pancakes, waffles, biscuits & muffins.	Avoid Doughnuts, Sweets, croissants, Danish, crackers made w/ saturated oils, sugary cereals, creamy pasta and rice.
Fruits and Vegetables	Fresh fruits and vegetables; Spinach, broccoli, apples, oranges, pears & lemons.	Avoid canned and dried fruits/vegetables.	Avoid Vegetables prepared in butter/creamy sauces/sugar.
Snacks / Sugar	Walnuts , almonds, peanuts, pistachio, fat-free frozen yogurt.	Avoid Cakes and cookies , pies,	Avoid Ice cream, sodas, juices, chocolates , potato chips, fries, buttered popcorn, milkshakes, store pies and cakes.

Questions

1. Which of the following is the worst risk factor for CAD?

- a) Essential Hypertension
- b) Age > 55 years
- c) Hyperlipidemia
- d) Smoking
- e) Diabetes Mellitus

2. Which of the following risk factors for CAD will result in the most immediate benefit for the patient?

- a) Diabetes Mellitus Type 2
- b) Tobacco smoking
- c) Essential Hypertension
- d) Hyperlipidemia
- e) Weight loss

3. Which of the following is the most common adverse effect of statin therapy?

- a) Rhabdomyolysis
- b) Liver Dysfunction
- c) Renal Failure
- d) Encephalopathy
- e) Hyperkalemia

4. A 7 year old boy is referred to a specialty clinic because of digestive problem, abdominal cramps after eating a high fat meal. He is worked up with genetic defect of lipoprotein lipase. What will be elevated in his blood after meal?

- a) Free fatty acid
- b) LDL
- c) HDL
- d) Chylomicrons
- e) Unesterified fatty acid

5. A 38-year-old man in a rural area presents to a physician for an employment physical. Ocular examination reveals small opaque rings on the lower edge of the iris in the anterior chamber of the eye. Nodular lesions are found on his Achilles tendon. Successful therapy should be aimed at increasing which of the following gene products in hepatocyte cell membranes?

- a) Apo B-100
- b) Apo E
- c) Apo B-100 Receptor
- d) Apo E receptor
- e) Lecithin cholesterol acyltransferase

6. A 50-year-old man was recently diagnosed with diabetes mellitus type 2 after targeted screening revealed persistently elevated fasting blood glucose levels. Since being diagnosed, he has started metformin and an ACE inhibitor, and has his statin therapy adjusted to reach a goal of an LDL-cholesterol of 100 mg/dL. Despite counseling, he continues to smoke, but is following a diabetic diet and exercising regularly. He is currently healthy, and is up to date with his vaccinations, having received a pneumococcal vaccination five years prior, and an influenza vaccine earlier this year. Which of the following is an appropriate strategy for health care maintenance in this patient?

- a) Annual monitoring of hemoglobin A1C
- b) Dilated eye exams on a six-month basis
- c) Empiric use of daily aspirin therapy
- d) Nerve conduction screen for neuropathy
- e) Repeat pneumococcal vaccination yearly

7. A 56-year-old woman with a long history of hypothyroidism comes for a routine clinic appointment. She is concerned that her hypothyroidism is getting worse. Although her symptoms had been well controlled previously with supplemental levothyroxine, over the last 6 months she has noticed increasing malaise, weight gain, and temperature intolerance, all symptoms that she suffered from before starting treatment. She reports taking her medications as prescribed and has had no major illness over the past year. Her only recent medical problems have involved getting her LDL-cholesterol under control. This goal has been met, however, though it required the addition of cholestyramine in addition to the statin she was taking already. Which of the following is the most likely

- a) Coexisting major depressive disorder mimicking hypothyroid state underlying cause of this patient's symptoms?
- b) Dietary indiscretion resulting in reduced drug absorption and utilization
- c) Drug interaction with cholestyramine resulting in reduced bioavailable levothyroxine
- d) Occult malignancy or illness resulting in increased utilization of thyroid hormone
- e) Natural progression of thyroid disease; patients require more medication over time

A 55-year-old woman with a history of type II diabetes mellitus (DM), hypertension, and obesity is seen in the clinic for general followup. Her current medications include metformin, lisinopril, aspirin, and citalopram. She reports well controlled fasting blood glucose values with AM fingersticks of approximately 100 mg/dL. Her blood pressure is controlled at 120/70 mm Hg. You order fasting lipids. Her laboratory studies show:

Which of the following is the most appropriate medication at this time?

- a) Garlic
- b) Gemfibrozil
- c) Niacin
- d) Not medication is necessary
- e) Statins

9. A 72-year-old woman is seen for follow-up of therapy for hyperlipidemia. She recently was started on pravastatin (40 mg/day) for this problem, and she does not receive any other medications besides over-the-counter vitamin preparations. She is otherwise healthy, but has been complaining of fatigue. General physical examination is normal. Laboratory testing yields the following results that are confirmed on repeat testing:

Which of the following is the most appropriate management at this time?

- a) Add a second anti-lipid agent
- b) Measure anti-thyroperoxidase antibody levels
- c) Order a radioactive iodine uptake scan
- d) Stop pravastatin because of fatigue
- e) Treat the patient with thyroid hormone

10. A 49-year-old woman comes to the clinic for a routine healthcare checkup. She has a past medical history that includes diabetes and hypertension. Her diabetes and hypertension have been well controlled, requiring metformin, lisinopril, and hydrochlorothiazide, in addition to the baby aspirin and potassium supplementation she takes daily. She was discovered to have dyslipidemia 1 year earlier, however. Despite following a strict diabetic diet, exercising regularly, and taking a high-dose statin, her LDL-cholesterol remains at greater than goal. Additionally, her HDL-cholesterol is mildly less than normal. Which of the following is an appropriate medication to start at this time?

- a) Additional statin
- b) Bile acid sequestrant
- c) Fish oil
- d) Probucol
- e) Short-acting nicotinic acid

11. A 30-year-old man has chest pain and shortness of breath for the past 4 hours. He denies prior episodes. He has no medical issues, takes no medications and has no allergies. He reports a strong family history of coronary artery disease. Evaluation reveals positive cardiac enzymes, consistent with a non-Q wave myocardial infarction. He is admitted for management. Examination shows nodular swellings on his Achilles tendon. His serum cholesterol level is 400 mg/dL. Which of the following protein defects is the most likely cause of this patient's condition

- a) Apoprotein CII
- b) Apoprotein E
- c) LDL receptor
- d) Lipoprotein (a)
- e) Lipoprotein lipase