

Lipids and Vascular Risk

**(an educational program for pharmaceutical representatives,
written in 1993; has not been updated)**

Learning Objectives

After completing this section, you should be able to:

1. Select correct definitions of fatty acid, free fatty acid, and chylomicron.
2. State the function of lipoproteins.
3. Name and briefly describe the three types of lipoproteins.
4. Given a list of lipid-screening recommendations, select those from the National Institutes of Health (NIH) consensus panel and those from the National Cholesterol Education Program (NCEP).
5. Name and briefly describe the two general causes of hyperlipidemia.
6. Describe the two initial steps in managing hyperlipidemia.
7. Describe two major dietary measures for reducing cholesterol levels, starting with the most important.
8. State the appropriate basis for selecting a lipid-lowering drug for a given patient.
9. Name the two types of antihypertensive agents that have little effect on lipid levels.

Lipids and Vascular Risk

The concept of lipids and vascular risk was introduced in Section 2 of the Level 1 Diabetes program. You may wish to review that section briefly before proceeding.

Lipids and risk are discussed in detail below. In your role as a consultant in the health care field, you'll need to understand this important and timely subject.

Transport and Characteristics of Lipids

Fats do not circulate freely in the blood. Instead, they are carried in the bloodstream in the form of lipid-protein complexes. For example, after fats in food are digested and absorbed, they are carried in small particles called chylomicrons. An hour or so after a fatty meal, the chylomicron concentration in plasma may increase to about 2%. If a blood specimen is obtained at this time, the plasma may appear turbid.

Within a few hours after a meal, chylomicrons are broken down by an enzyme, mostly into fatty acids. The fatty acids are either used for energy or stored in fat cells and in the liver for future use.

When stored fat is to be used for energy, it is transported in the blood to various tissues, mostly in the form of free fatty acids. Normally the plasma contains only small amounts of free fatty acids, but the amount increases when the body uses greater amounts of fat for energy, as in

chylomicron: a small particle that carries dietary fats from the intestine to the liver after a meal

fatty acid: the form in which fat from dietary sources is stored in fat cells and in the liver

free fatty acid: the form in which fat that has been stored in fat cells is transported elsewhere in the body

uncontrolled diabetes.

The Role and Significance of Lipoproteins

Several hours after a meal, when blood levels of chylomicrons are very low, almost all of the plasma fats are carried in molecules called lipoproteins. Lipoproteins are formed mostly in the liver. Their function is to carry lipids throughout the body.

Specifically, lipoproteins contain a mixture of:

- protein
- cholesterol
- triglycerides
- phospholipids

***phospholipid:** a fatty substance containing mostly phosphorus and fatty acids*

(Because chylomicrons also contain a mixture of lipids and protein, they are sometimes classified as lipoproteins.)

When their density is measured in an ultracentrifuge, lipoproteins are classified as:

INSERT VISUAL: CHARACTERISTICS OF LIPOPROTEINS

- very low density lipoproteins (VLDLs)
- low density lipoproteins (LDLs)
- high density lipoproteins (HDLs)

VLDLs contain mostly triglyceride, which they carry to fat tissue and other tissues.

LDLs are the residuals of VLDLs after the triglyceride has been delivered. Consequently, they contain mostly cholesterol, which they carry to the body cells. The ways in which LDLs are removed from the blood are not clearly understood, but apparently some of their cholesterol is incorporated into the plaque of

atherosclerotic vessels.

HDLs contain smaller amounts of cholesterol, which they carry from the body cells to the liver. It's believed that HDLs may even draw cholesterol out of atherosclerotic plaque. In the liver, most of the cholesterol enters the bile and is eliminated in the intestine.

Recent studies reveal that:

- high LDL levels are directly related to cardiovascular risk

- low HDL levels are an independent risk factor for CHD

Framingham data suggest that increases in the concentration of HDL-cholesterol (HDL-C), the amount of cholesterol carried on the HDL molecule, are accompanied by a proportional decrease in the risk of CHD.

Elevated HDL-C ("good cholesterol") levels are associated with hereditary factors, exercise, and high estrogen levels. Low HDL-C levels are linked with hereditary factors, obesity, diabetes mellitus or glucose intolerance, cigarette smoking, and male sex. HDL-C levels are lower in those with CHD and other diseases than they are in healthy persons.

The exact relationship between triglyceride levels and cardiovascular risk is unclear. Hypertriglyceridemia has not been proven to be an independent risk factor. Risk may be increased, however, in those who have all of the following characteristics: high triglyceride levels, high levels of either LDL-C ("bad cholesterol") or total cholesterol, and low HDL levels.

As this program is being written, the NCEP recommends routine initial screening of total cholesterol levels only, along with evaluation of CHD risk factors. The rationale is that total cholesterol screening does not require subjects to fast, and is more available and less expensive than other screening methods. If total cholesterol levels are borderline (200 to 239 mg/dL), the panel recommends providing dietary information and rechecking annually, unless patients have CHD or two or more other risk factors. The risk factors identified by the NCEP panel are listed on the right.

NCEP Risk Factors for CHD

- male sex
- hypertension
- cigarette smoking (> 10 cigarettes per day)
- diabetes mellitus
- evidence of cerebrovascular or peripheral vascular disease
- family history of premature CHD (myocardial infarction or sudden death before age 55 in parent or sibling)
- obesity (\geq 30% overweight)
- low HDL cholesterol (< 35 mg/dL)

