(1-1) Introduction :

In the early 1960 s researchers identified high blood cholesterol, or hypercholesterolemia, along with smoking and high blood pressure as principal risk factors for cardiovascular disease. They understood that a high fat, high cholesterol diet tends to raise blood cholesterol, and that high blood cholesterol levels promote atherosclerosis. Atherosclerosis leads to artery disease and often causes heart attacks.

Recently, the cholesterol-heart disease picture has become more complicated. Total cholesterol levels do not tell the entire story. The levels of LDL and HDL cholesterol predict health risks more accurately than total cholesterol levels do. High LDL cholesterol levels are a greater risk than high total cholesterol, with some kinds of LDL being more dangerous than others. Low HDL cholesterol levels increase the risk of heart disease, as do high levels of triglycerides and other newly discovered blood lipid.

(1-2) Myocardial Infarction :

The World Health Report, (2004) defined acute myocardial infarction (**AMI** or **MI**), commonly known as a heart attack, is a disease state that occurs when the blood supply to a part of the heart is interrupted. The resulting ischemia or oxygen shortage causes damage and potential death of heart tissue (1).

Acute myocardial infarction is a type of acute coronary syndrome, which is most frequently (but not always) a manifestation of coronary artery disease. The most common triggering event is the disruption of an atherosclerotic plaque in an epicardial coronary artery, which leads to a

clotting cascade, sometimes resulting in total occlusion of the artery as in (Fig. 1-1).

Atherosclerosis is the gradual buildup of cholesterol and fibrous tissue in plaques in the wall of arteries (in this case, the coronary arteries), typically over decades. Blood stream column irregularities visible on angiographies reflect artery lumen narrowing as a result of decades of advancing atherosclerosis. Plaques can become unstable, rupture, and additionally promote a thrombus (blood clot) that occludes the artery; this can occur in minutes. When a severe enough plaque rupture occurs in the coronary vasculature, it leads to myocardial infarction (necrosis of downstream myocardium) (2) as in (Fig. 1-2).

If impaired blood flow to the heart lasts long enough, it triggers a process called the ischemic cascade; the heart cells die (chiefly through necrosis) and do not grow back. A collagen scar forms in its place. Recent studies indicate that another form of cell death called apoptosis also plays a role in the process of tissue damage subsequent to myocardial infarction (3).

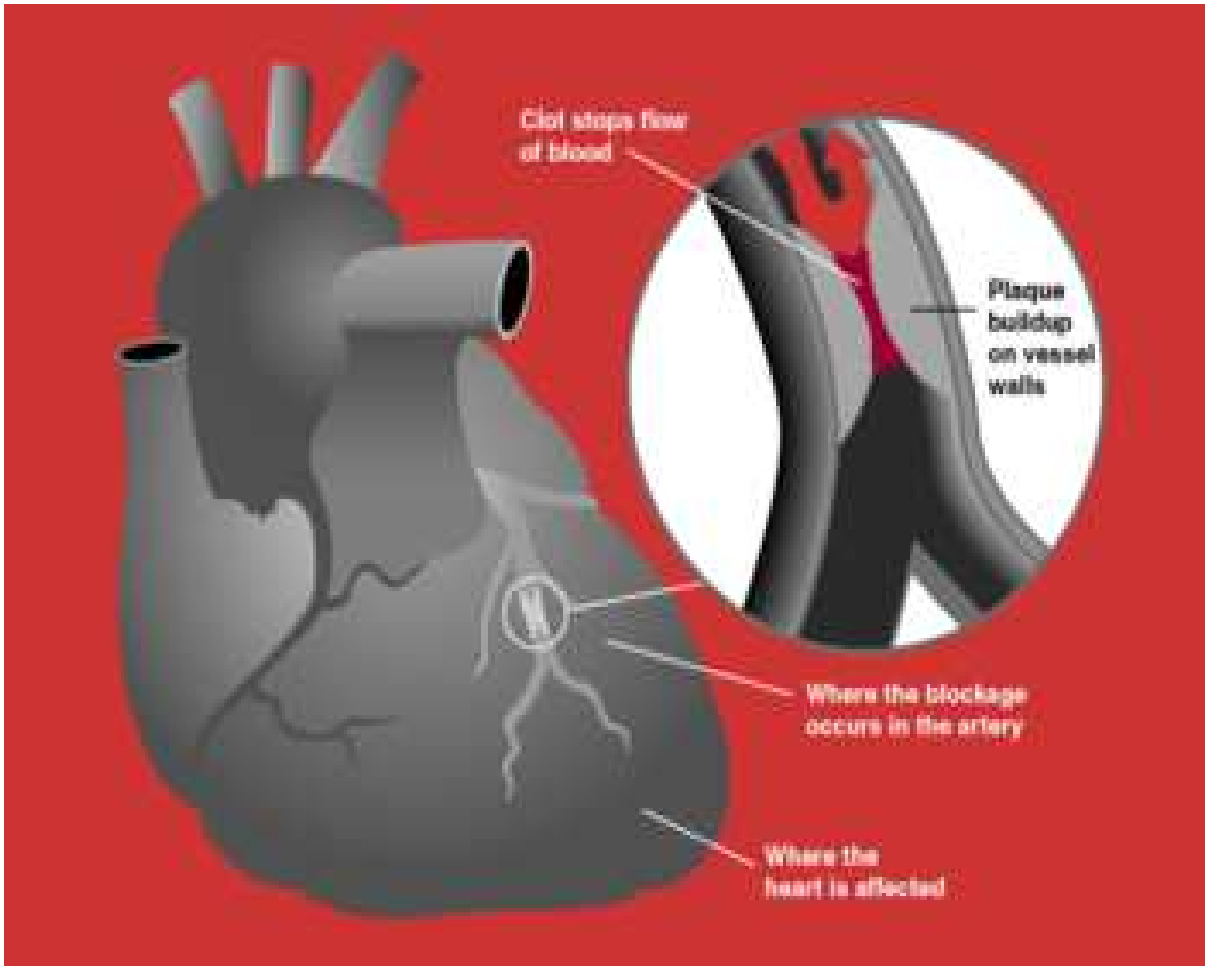

Figure (1-1): A myocardial infarction occurs when an atherosclerotic plaque slowly builds up in the inner lining of a coronary artery and then suddenly ruptures, totally occluding the artery and preventing blood flow downstream (2).

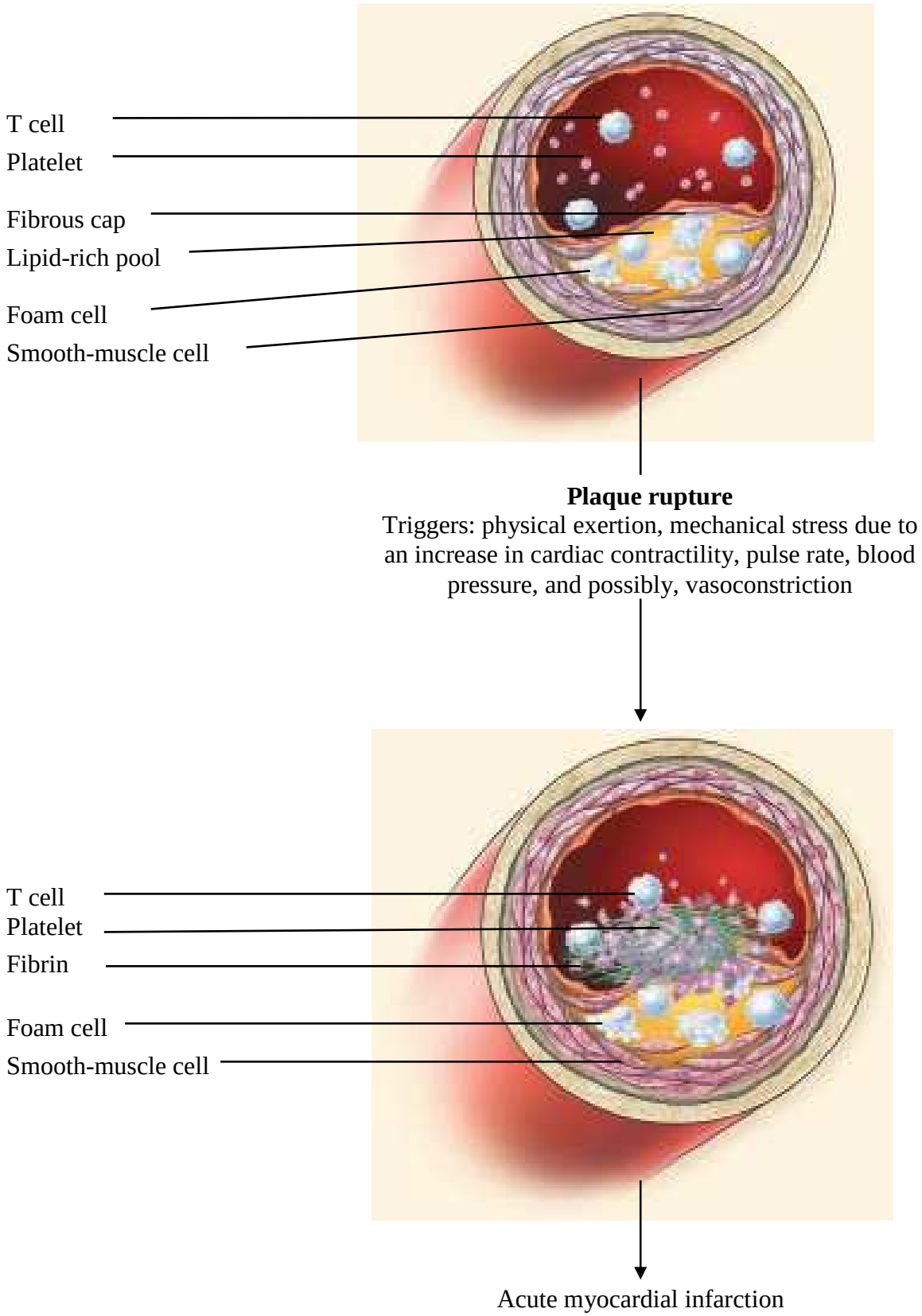

Figure (1-2): Pathophysiologic Events Culminating in the Clinical Syndrome of myocardial infarction (53).

(1-3) Classification :

Depending on the location of the obstruction in the coronary circulation, different zones of the heart can become injured. Using the anatomical terms of location, one can describe anterior, inferior, lateral, apical and septal infarctions (and combinations, such as anteroinferior, anterolateral, and so on) (4). For example, an occlusion of the left anterior descending coronary artery will result in an anterior wall myocardial infarct (5).

(1-4) Risk Factors :

Many people have multiple risk factors and that these factors exponentially increase the risk for CAD. An assessment of the Framingham and Multiple Risk Factor Intervention Trial data showed that approximately 85% of excess risk for premature CAD is due to one or more of the following major risk factors (6):

(1-4-1)Older Age :

The plaques in the arterial walls of patients with atherosclerosis contain large amounts of cholesterol. The higher the level of LDL cholesterol, the greater the risk of atherosclerotic heart disease; conversely, the higher the HDL cholesterol, the lower the risk of coronary heart disease (CHD).

This is true in men and women, in different racial and ethnic groups, and at all ages up to age 75 years. Because most cholesterol in serum is LDL, high total cholesterol levels are also associated with an increased risk of CHD.

Middle-aged men whose serum cholesterol levels are in the highest quintile for age (above about 230 mg/dL) have a risk of coronary death

before age 65 years of about 10%; men in the lowest quintile (below about 170 mg/dL) have a 3% risk. Death from CHD before age 65 years is less common in women, with equivalent risks one-third those of men. In men, each 10-mg/dL increase in cholesterol (or LDL cholesterol) increases the risk of CHD by about 10%; each 5-mg/dL increase in HDL reduces the risk by about 10%. The effect of HDL cholesterol is greater in women, whereas the effects of total and LDL cholesterol are smaller. All of these relationships diminish with age (7).

Risk increases with age in both men and women. The natural distribution of risk factors, particularly in women, changes dramatically after age 50 years (30).

(1-4-2) Smoking :

Cigarette smoking is a powerful risk factor, especially for myocardial infarction. It accelerates development of coronary plaques and may lead to rupture of plaques, and it is especially dangerous in patients with advanced coronary atherosclerosis.

(1-4-3) Hypertension :

Hypertension is an independent risk factor for CVD in both women and men, and risk increases continuously as blood pressure rises from levels which are within normal range. For every 20 mmHg systolic or 10 mmHg diastolic increase in BP there is a doubling of CVD mortality (28). Systolic blood pressure >130 mm Hg or diastolic blood pressure >85 mm Hg independently accelerates atherogenesis, and the risk of CAD increases as blood pressure increases (6).

(1-4-4) Diabetes Mellitus :

Although diabetes mellitus is usually recognized as a major risk factor for coronary heart disease (CHD) morbidity and mortality, in several studies it has not been found responsible as a single factor (8).

(1-4-5) Obesity :

(Defined by a body mass index of more than 30 kg/m^2, or alternatively by waist circumference or waist-hip ratio) Mortality from cardiovascular disease is almost 50% higher in obese patients than in those of average weight and is 90% higher in those with severe obesity.

BMI is calculated by dividing weight (in kilograms) by square height (in meters)

(1-4-6) Family History of Premature CVD(MI) :

Family history of an early heart attack (before 50 years in men and 55 years in women), which is thought of as reflecting a genetic predisposition. Atherosclerosis and CAD are often the result of a complex interaction between genes and the environment (9).

There is a suggestion that a positive family history of CVD is a stronger risk factor for women than it is for men (28). Parental history of MI < 60 years is a particularly strong risk factor for women (29).

(1-4-7) hypercholesterolemia (high blood cholesterol):

Hypercholesterolemia is the presence of high levels of cholesterol in the blood. It is not a disease but a metabolic derangement that can be secondary to many diseases and can contribute to many forms of disease, most notably cardiovascular disease. It is closely related to the terms "hyperlipidemia" (elevated levels of lipids) and "hyperlipoproteinemia" (elevated levels of lipoproteins) (12).

Conditions with elevated concentrations of oxidized LDL particles, especially small LDL particles, are associated with atheroma formation in the walls of arteries, a condition known as atherosclerosis, which is the principal cause of coronary heart disease and other forms of cardiovascular disease. In contrast, HDL particles (especially large HDL) have been identified as a mechanism by which cholesterol and inflammatory mediators can be removed from atheroma. Increased concentrations of HDL correlate with lower rates of atheroma progressions and even regression (17).

Reducing cholesterol levels in healthy middle-aged men without CHD (primary prevention) reduces their risk in proportion to the reduction in LDL cholesterol and the increase in HDL cholesterol. Treated patients have statistically significant and clinically important reductions in the rates of myocardial infarctions (7).

Cholesterol concentration in the blood of males is generally higher than that in premenopasal females. After menopause, however, the cholesterol concentration is higher in females than in males. Serum cholesterol levels in males seem to reach a plateau by 50 to 60 years of age (19).

The mean biochemical markers in this study are lipid profile because the elevated level of lipid profile leads to hypercholesterolemia. Longstanding elevated hypercholesterolemia leads to accelerated atherosclerosis; this can express itself in a number of cardiovascular diseases especially myocardial infarction.

(1-5) Lipid Profile :

A lipid profile is a group of blood tests that tells how your body uses, changes, or stores lipids and often ordered together to determine risk of coronary heart disease.

Lipids are cannot dissolve in blood. Lipids stick on proteins in the blood and are called lipoproteins. The amount of lipoproteins in the blood can change with what you eat. The amount can also change because of some illnesses and because of heredity (10).

The digestive tract is not the only place where lipids special handling to more in a water-based environment. To travel in the bloodstream, lipid must be specially packaged into lipoprotein carriers.

Lipoproteins have a lipid core of triglycerides and cholesterol esters (cholesterol linked to fatty acids) surrounded by a sell of phospholipids with embedded proteins and cholesterol. They can carry water-insoluble lipids through the watery environment of the bloodstream. There are several main classes of lipoprotein and many subclasses. These differ mainly by size, density and the composition of their lipid cores. In general, as the percentage of triglyceride drops, the density increases. A lipoprotein will a small core that contains little triglyceride is much more dense than a lipoprotein with a large core composed mostly of triglycerides.

The lipid profile includes total cholesterol, HDL-cholesterol (often called good cholesterol), LDL-cholesterol (often called bad cholesterol), and triglycerides. Sometimes the report will include additional calculated values such as the Cholesterol/HDL ratio or a risk score based on lipid profile results, age, sex, and other risk factors.

The lipid profile is used to guide providers in deciding how a person at risk should be treated. The results of the lipid profile are considered along with other known risk factors of heart disease to develop a plan of treatment and follow-up (13).

A lipid profile measures total cholesterol, HDL cholesterol, LDL cholesterol, and triglycerides. A physician may order a lipid profile as part of an annual exam or if there is specific concern about CVD, especially coronary artery disease.

The National Cholesterol Education Program recommends that individuals age twenty and over have a fasting lipoprotein profile every five years. A lipid profile should be done after a nine- to twelve-hour fast without food, liquids, or medication. If fasting is not possible, the values for total cholesterol and HDL-C may still be useful. If total cholesterol is 200 milligrams per deciliter (mg/dl) or higher or HDL-C is less than 40 mg/dl, the individual will need to have a follow-up lipoprotein profile done to determine LDL-C and triglyceride levels (11).

(1-5-1) Cholesterol :

Cholesterol is a sterol (a combination steroid and alcohol), a lipid found in the cell membranes of all body tissues, and is transported in the blood plasma of all animals. Trace amounts of cholesterol are also found in plant membranes.

Cholesterol is minimally soluble in water; it cannot dissolve and travel in the water-based bloodstream. Instead, it is transported in the bloodstream by lipoproteins - protein "molecular-suitcases" that are water-soluble and carry cholesterol and triglycerides internally. The apolipoproteins forming the surface of the given lipoprotein particle determine from what cells cholesterol will be removed and to where it will be supplied.

Most of the cholesterol is synthesized by the body and some has dietary origin. Cholesterol is more abundant in tissues which either synthesize more or have more abundant densely-packed membranes, for example, the liver, spinal cord, brain, and atheromata (arterial plaques). Cholesterol plays a central role in many biochemical processes, but is best known for the association of cardiovascular disease with various lipoprotein cholesterol transport patterns and high levels of cholesterol in the blood. Cholesterol is insoluble in blood, but is transported in the circulatory system bound to one of the varieties of lipoprotein, spherical particles which have an exterior composed mainly of water-soluble proteins.

In recent years, the term "bad cholesterol" has been used to refer to cholesterol contained in LDL (low-density lipoprotein) which, according to the lipid hypothesis, is thought to have harmful actions, and "good

cholesterol" to refer to cholesterol contained in HDL (high-density lipoprotein), thought to have beneficial actions (14).

(1-5-1-1) Food Sources :

Cholesterol is found in animal fats: all food containing animal fats contains cholesterol; food not containing animal fats either contains no cholesterol or negligible amounts. Major dietary sources of cholesterol include eggs, beef and poultry (31).

Plants have trace amounts of cholesterol, so even a vegan diet, which includes no animal foods, has traces of cholesterol. However, the amounts are very small. For example, to ingest the amount of cholesterol in one egg, one would need to drink about 9.6 liters (19.57 pounds) of pure peanut oil (32).

Plant products (e.g. flax seed, peanut), also contain cholesterol-like compounds, phytosterols, which are suggested to help lower serum cholesterol (33).

(1-5-1-2) Function :

Cholesterol is required to build and maintain cell membranes; it regulates membrane fluidity over a wider range of temperatures. The hydroxyl group on cholesterol interacts with the phosphate head of the membrane, while the bulky steroid and the hydrocarbon chain is embedded in the membrane. Some research indicates that cholesterol may act as an antioxidant.

Cholesterol also aids in the manufacture of bile (which is stored in the gallbladder and helps digest fats), and is also important for the

metabolism of fat soluble vitamins, including vitamins A, D, E and K. It is the major precursor for the synthesis of vitamin D and of the various steroid hormones (which include cortisol and aldosterone in the adrenal glands, and the sex hormones progesterone, the various estrogens, testosterone, and derivatives) (15).

Recently, cholesterol has also been implicated in cell signalling processes, where it has been suggested that it forms lipid rafts in the plasma membrane. It also reduces the permeability of the plasma membrane to hydrogen ions (protons) and sodium ions.

Cholesterol is required in the membrane of mammalian cells for normal cellular function, and is either synthesized in the endoplasmic reticulum, or derived from the diet, in which case it is delivered by the bloodstream in low-density lipoproteins. These are taken into the cell by receptor-mediated endocytosis in clathrin-coated pits, and then hydrolysed in lysosomes (16).

(1-5-2)Triglycerides :

Triglycerides are the major form of fat found in nature and their primary function is to provide energy for the cell. The human body stores large amount of fatty acids in ester linkages with glycerol in the adipose tissue. This form of reserve energy storage is high efficient because of the magnitude of the energy released when fatty acids undergo catabolism. Most of the fatty acids come from our diets, can be synthesized endogenously, and are called nonessential fatty acids. There are three fatty acids (linoleic, linolenic and arachidonic acids) that cannot be made by the human body. These fatty acids are called essential fatty acid and

are important for proper growth and development of cells, cell membrane integrity and myelinization of the central nervous system.

(1-5-2-1) Triglyceride structure :

Most fatty acids in food and in the body exist as part of a triglyceride molecule. A triglyceride consists of three fatty acids attached to a glycerol back bone. Alone, glycerol is a thick, smooth liquid often used by the food industry.

Two fatty acid attached to a glycerol form a diglyceride. A monoglyceride has one fatty acid attached to glycerol. Our foods contain relatively small amount of monoglycerides and diglycerides, mostly as food additives used for their emulsifying or blending qualities.

(1-5-2-2) Function :

Triglycerides are by far the most abundant subclass of neutral glycerides in nuture. Mammalian tissues also contain some diglycerides and monoglyceridees, but these occur in trace level when compared with triglycerides. Most triglyceride molecules in mammalian tissues are mixed glycerides.

Because of their water insolubility, triglycerides are transported in the plasma in combination with other more polar lipids (phospholipids) and proteins, as well as with cholesterol and cholesteryl ester, in the complex lipoprotein macromolecules. It appears that the essentially nonpolar triglycerides (and cholesteryl ester) are largely in the center of the lipoprotein, whereas the more polar protein and phospholipid components are at the surface, with their polar groups directed outward to stabilize the whole structure in the aqueous plasma environment (19).

(1-5-2-3) Role in disease :

In the human body, high levels of triglycerides in the bloodstream have been linked to atherosclerosis, and, by extension, the risk of heart disease and stroke. However, the negative impact of raised levels of triglycerides is lower than that of LDL: HDL ratios. The risk can be partly accounted for by a strong inverse relationship between triglyceride level and HDL-cholesterol level (37).

(1-5-3) High Density Lipoprotein :

High-density lipoproteins (HDL) form a class of lipoproteins, varying somewhat in their size (8–11 nm in diameter), that carry cholesterol from the body's tissues to the liver. About thirty percent of blood cholesterol is carried by HDL.

It is hypothesised that HDL can remove cholesterol from atheroma within arteries and transport it back to the liver for excretion or re-utilization which is the main reason why HDL-bound cholesterol is sometimes called "good cholesterol", or HDL-C.

A high level of HDL-C seems to protect against cardiovascular diseases, and low HDL cholesterol levels (less than 40 mg/dL) increase the risk for heart disease. When measuring cholesterol, any contained in HDL particles is considered as protection to the body's cardiovascular health, in contrast to "bad" LDL cholesterol (18).

(1-5-3-1) Function :

The HDL macromolecular complex contains approximately 50% protein and 50% lipid (19). HDL are the smallest of the lipoproteins. They are the densest because they contain the highest proportion of protein. They contain the A class of apolipoproteins (20).

The liver synthesizes these lipoproteins as complexes of apolipoproteins and phospholipid, which resemble cholesterol-free flattened spherical lipoprotein particles. They are capable of picking up cholesterol, carried internally, from cells they interact with. A plasma enzyme called lecithin-cholesterol acyltransferase (LCAT) converts the free cholesterol into cholesteryl ester (a more hydrophobic form of cholesterol) which is then sequestered into the core of the lipoprotein particle eventually making the newly synthesized HDL spherical. They increase in size as they circulate through the bloodstream and incorporate more cholesterol molecules into their structure. Thus it is the concentration of large HDL particles which more accurately reflects protective action, as opposed to the concentration of total HDL particles (21).

Men tend to have noticeably lower HDL levels, with smaller size and lower cholesterol content, than women. Men also have an increased incidence of atherosclerotic heart disease (22).

Epidemiological studies have shown that high concentrations of HDL (over 60 mg/dL) have protective value against cardiovascular diseases such as ischemic stroke and myocardial infarction. Low concentrations of HDL (below 40 mg/dL for men, below 50 mg/dL for women) are a positive risk factor for these atherosclerotic diseases.

Data from the landmark Framingham Heart Study showed that for a given level of LDL, the risk of heart disease increases 10-fold as the HDL varies from high to low. Conversely, for a fixed level of HDL, the risk increases 3-fold as LDL varies from low to high (23).

(1-5-4) Low Density Lipoprotein :

Low-density lipoprotein (LDL) belongs to the lipoprotein particle family. Its size is approx. 22 nm but since LDL particles contain a changing number of fatty acids they actually have a mass and size distribution. Each native LDL particle contains a single apolipoprotein B-100 molecule (Apo B-100, a protein with 4536 amino acid residues) that circles the fatty acids keeping them soluble in the aquous environment. LDL is commonly referred to as bad cholesterol as high LDL levels can lead to cardiovascular disease (24).

LDL particles actually vary in size and density, and studies have shown that a pattern that has more small dense LDL particles called "Pattern B" equates to a higher risk factor for coronary heart disease (CHD) than does a pattern with more of the larger and less dense LDL particles ("Pattern A"). This is because the smaller particles are more easily able to penetrate the endothelium. "Pattern I", meaning "intermediate", indicates that most LDL particles are very close in size to the normal gaps in the endothelium (26 nm) (25).

When a cell requires cholesterol, it synthesises the necessary LDL receptors, and inserts them into the plasma membrane. The LDL receptors diffuse freely until they associate with clathrin coated pits. LDL particles in the blood stream bind to these extracellular LDL receptors.

The clathrin coated pits then form vesicles which are endocytosed into the cell.

After the clathrin coat is shed the vesicles deliver the LDL and their receptors to early endosomes, onto late endosomes to lysosomes. Here the cholesterol esters in the LDL are hydrolysed. The LDL receptors are recycled back to the plasma membrane.

(1-5-4-1) Function :

Generally, LDL transports cholesterol and triglycerides from the liver and small intestine to cells and tissues which are taking up cholesterol and triglycerides (26).

(1-5-4-2) Role in Disease :

Because LDLs transport cholesterol to the arteries and can be retained there by arterial proteoglycans starting the formation of plaques, increased levels are associated with atherosclerosis, and thus heart attack, stroke and peripheral vascular disease. This is why cholesterol inside LDL lipoproteins is called bad cholesterol. Still, it is not the cholesterol that is bad; it is instead how and where it is being transported, and in what amounts over time.

Increasing evidence has revealed that the concentration and size of the LDL particles more powerfully relates to the degree of atherosclerosis progression than the concentration of cholesterol contained within all the LDL particles. The healthiest pattern, though relatively rare, is to have small numbers of large LDL particles and no small particles. Having small LDL particles, though common, is an unhealthy pattern; high concentrations of small LDL particles (even though potentially carrying

the same total cholesterol content as a low concentration of large particles) correlates with much faster growth of atheroma, progression of atherosclerosis and earlier and more severe cardiovascular disease events and death.

LDL poses a risk for cardiovascular disease when it invades the endothelium and becomes oxidized since the oxidized form is more easily retained by the proteoglycans. A complex set of biochemical reactions regulates the oxidation of LDL, chiefly stimulated by presence of free radicals in the endothelium (27).

(1-6) Lipid Profile Metabolism :

Lipid metabolism is divided into two pathways exogenous and endogenous:

(1-6-1) Exogenous Pathway:

Dietary triglyceride and cholesterol are absorbed in the intestinal mucosa and incorporated to form the core of nascent chylomicrons, which are then transported to plasma (Fig. 1-3). In peripheral tissues, chylomicrons interact with lipoprotein lipase, which removes most of the coretriglyceride from the lipoprotein particle. The resulting glycerol and fatty acids are taken up by adipose and other tissues, re-formed into triglyceride, and stored. Redundant surface material (apolipoprotein C, phospholipids, and cholesteryl ester) joins the HDL particle. The remnant chylomicron particles, which are now smaller and enriched in their core with cholesteryl ester and some remaining triglyceride, are taken up by the liver. This dietary cholesterol can then be used for bile acid formation,

incorporated into membranes, resecreted back into the circulation as lipoprotein cholesterol, or excreted into bile as cholesterol.

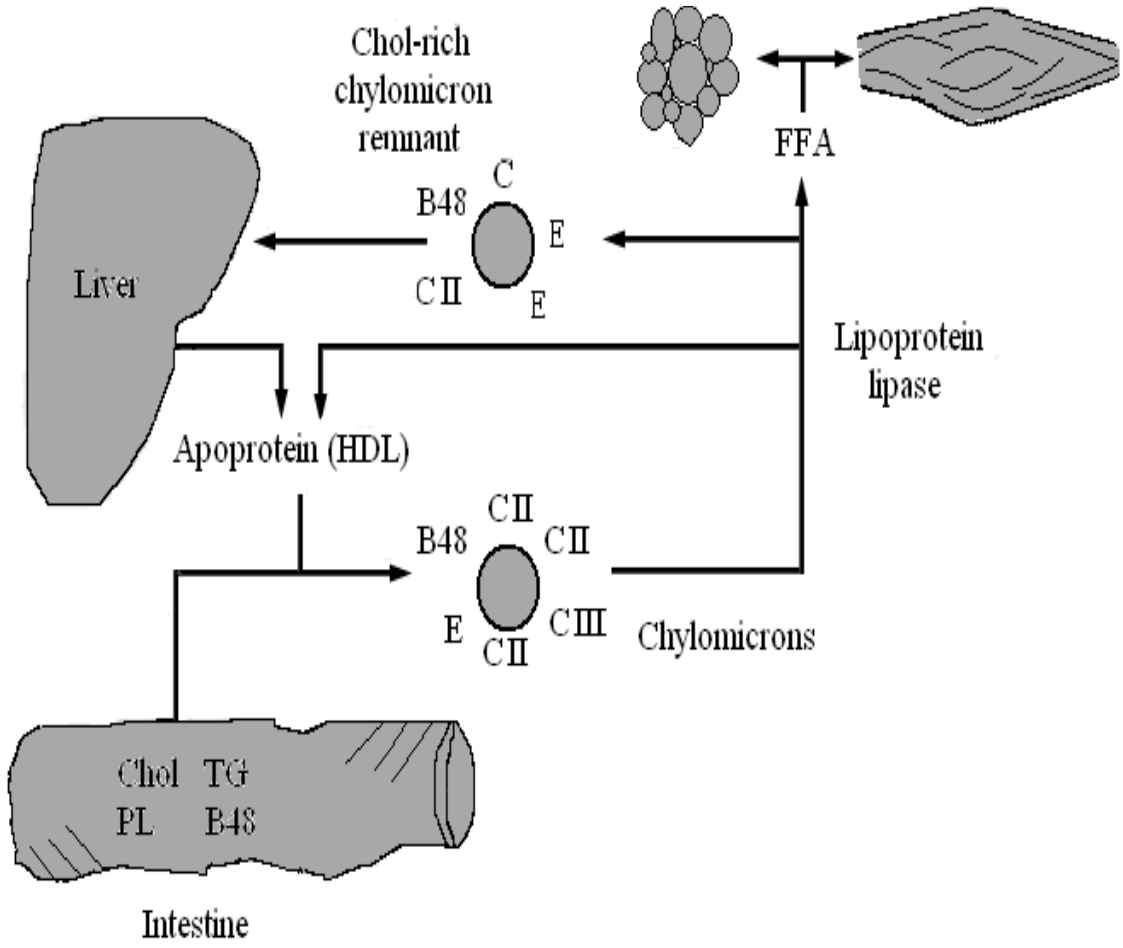

Figure (1-3): Transport of exogenously derived lipids from the intestine to the peripheral tissues and liver. FFA = free fatty acids; HDL = high-density Lipoproteins; PL = phospholipase; TG = triglycerides (6).

(1-6-2) Endogenous Pathway :

Triglycerides and cholesterol are also synthesized in the liver. This endogenous system, which conveys these lipids from the liver to peripheral tissues and back to the liver, is divided into two subsystems: the apo B-100 lipoprotein system (VLDL-C, IDL-C, and LDL-C) and the apo A-I lipoprotein system (HDL-C).

(1-6-2-1) Apo B-100 Lipoprotein System:

In the liver, triglycerides and cholesterol are packaged with apo B-100 and phospholipids to form VLDL (Fig. 1-4). Once released into plasma, VLDL undergoes triglyceride removal by means of lipoprotein lipase; the resulting cholesteryl ester-rich remnants are the IDL. Unlike the chylomicron remnants, IDL can be converted by further triglyceride removal to even smaller and denser LDL. During this process, the lipoprotein loses all its surface apolipoproteins except apo B-100.

(1-6-2-2) Apo A-I Lipoprotein System:

HDL, rich in apo A-I, transports cholesterol from peripheral tissues to the liver (Fig. 1-5). Cholesterol-poor HDL3 particles first form in plasma from coalescence of phospholipid-apolipoprotein complexes. Free cholesterol then transfers from cell membranes to HDL3, where it converts into cholesteryl ester and enters the HDL core. The HDL3 can then accept more free cholesterol and become the larger, more cholesterol-rich HDL2 particle. HDL2 is then metabolized by one of two main pathways:

Transfer to apo B lipoproteins (which are subsequently removed by the liver) by means of cholesteryl ester transfer protein or direct hepatic metabolism with removal of the HDL2 apoproteins from plasma.

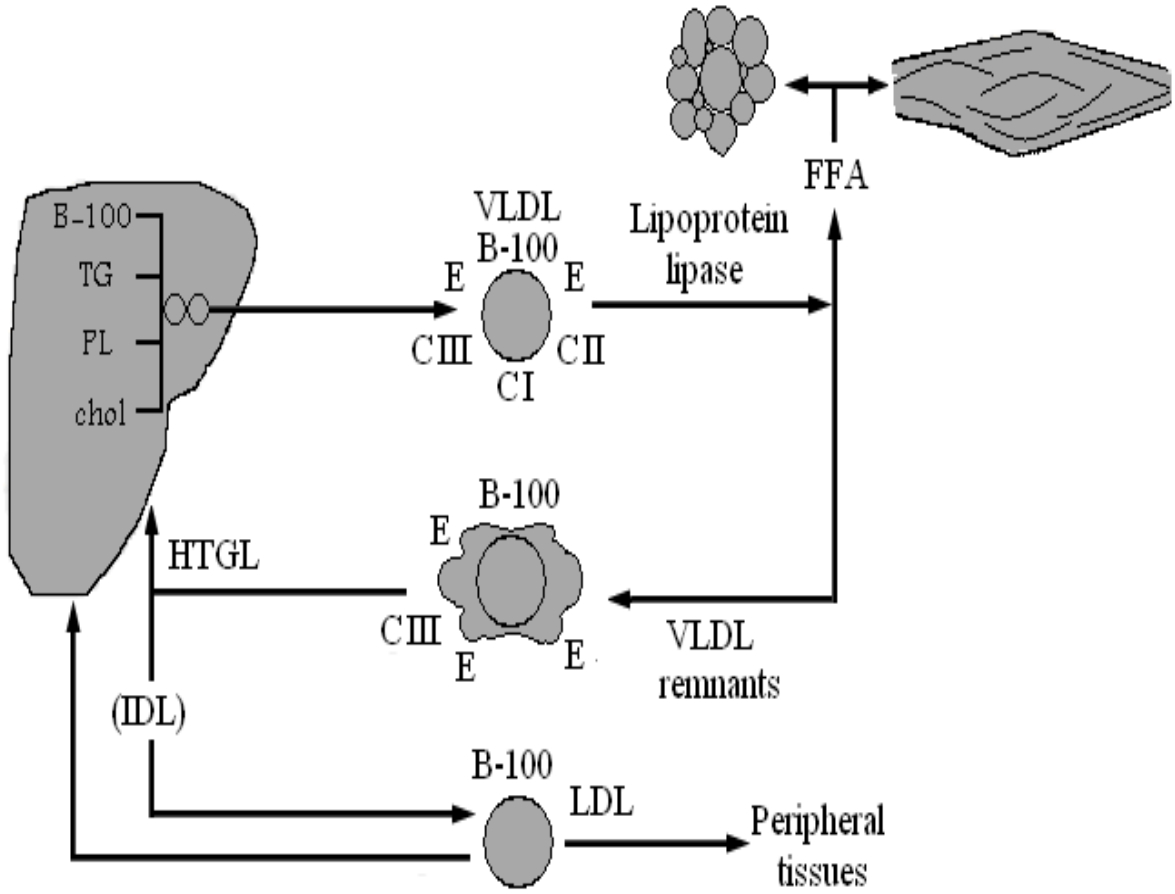

Figure (1-4): Transport of endogenous hepatic lipids by means of very low- density lipoproteins (VLDL), intermediate-density lipoproteins (IDL), and low-density lipoproteins (LDL). HTGL = hepatic triglyceride lipase. For explanations of other abbreviations, see Figure (1-3) legend (6).

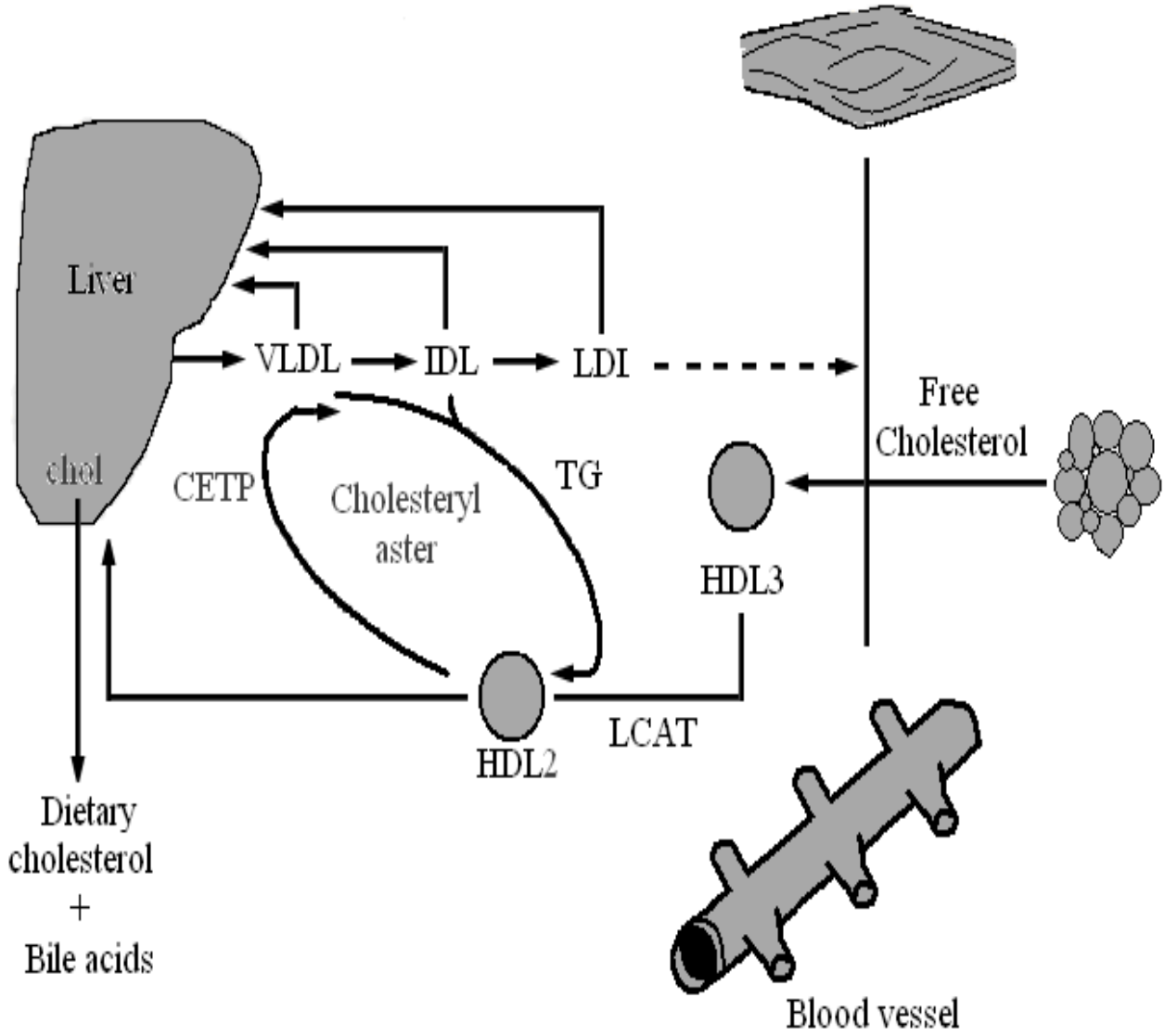

Figure (1-5): High-density lipoprotein metabolism and the role of high density lipoproteins in reverse cholesterol transport. CETP = cholesterol ester transfer protein*;* LCAT = lecithin: cholesterol acyltransferase. For explanations of other abbreviations, see Figure (1-3) and (1-2) legends (6).

(1-7) Physical Activity and Nutrition Therapy :

In May 2001, the NCEP released new guidelines for reducing heart disease risk. Changes from earlier guidelines include :

1. Treating high cholesterol more aggressively in people with diabetes.
2. Testing all adults over age 20 for cholesterol levels every five years.
3. Defining low HDL as being less than 40 mg/dl, rather than the earlier value of 35 mg/dl.
4. Intensifying the use of nutrition, physically activity and weight control in the treatment of elevated blood cholesterol.
5. Identifying a metabolic syndrome of risk factors linked to insulin resistance that often occur together and dramatically increase risk of heart attack.
6. Treating people with elevated triglycerides more aggressively.

Dietary cholesterol elevates serum cholesterol. Dietary therapy, weight reduction and increased physical activity should be initiated when these limits are exceeded in order to minimize the development of CHD (35).

Most studies of the effect of cholesterol lowering have distinguished between primary and secondary prevention. The important distinction is that primary prevention trials enroll healthy subjects who have relatively low rates of coronary disease but in whom other causes of morbidity and mortality are proportionately more common. Secondary prevention trials, on the other hand, follow patients who have a high rate of subsequent coronary disease; other causes of mortality are relatively less important (7).

Physical activity tends to lower serum total cholesterol, LDL cholesterol and triglycerides. Much of this effect depends on the type, intensity duration and frequency of physical activity. Physical activity also can lower blood pressure, reduce insulin resistance and reduce stress. In addition, physical inactivity further enhances the risk for CHD by impairing cardiovascular fitness and coronary blood flow (35).

American Heart Association recommend diet and lifestyle modification as the first line of defense against abnormal blood lipids. These recommendations include a diet low in total fat, saturated fat, and cholesterol; a diet high in fiber; increased intake of plant sterols (e.g., margarines and salad dressings made with soybean sterols). Both plant sterols and viscous fiber found in fruits and vegetables (36).

Diets containing 2 to 4 g of fish oils (omega-3 fatty acids) per day primarily for hypertriglyceridemia. Fish oils seem to lower triglycerides more than cholesterol (6).

Evidence is accumulating that eating more carbohydrates - especially simpler, more refined carbohydrates - increases levels of triglycerides in the blood, lowers HDL, and may shift the LDL particle distribution pattern into unhealthy atherogenic patterns. Thus a low fat diet, which often means a higher carbohydrate intake, may actually be an unhealthy change (34).

Although obesity is commonly regarded as an important contributor to the development of hypertriglyceridemia, it is well established that as the percentage of individuals with obesity increases with age, so do blood cholesterol concentrations. Approximately 30% of American adults can be considered obese. It is estimated that over 65 million American adults are obese, and the problem is acute for American children.

Weight reduction therapy for overweight or obese patients will enhance lowering of LDL cholesterol levels and will provide other health benefits, including modifying other lipid and non lipid risk factors. The current ATP III guidelines recommend that diet be focused on a balanced energy intake and expenditure to maintain desirable body weight and to prevent weight gain. Additional risk reduction can be achieved by simultaneously increasing physical activity (35).

(1-8) Lipid-Lowering Drug Therapy :

Experts who developed the ATP III guidelines recommend targeting high LDL levels. The optimal LDL level is <100 mg/dl; >190 mg/dl is considered very high. Oxidized LDLs impair endothelial-dependent vasodilation, induce apoptosis of endothelial cells, generate an inflammatory response, inhibit nitric oxide activity on platelets, and modify the functional response of vascular smooth muscle.

ATP III guidelines are congruent with the American Diabetes Association guidelines that advocate decreasing LDL levels and, secondly, increasing HDL levels. The target for HDL levels has not yet been identified. Low HDL levels are associated with increasing obesity, metabolic syndrome, and diabetes mellitus(Susan B. Fowler, Marty Kelly, Donna Ruh and Deborah Johnson-Wells, 2006) (38).

Multiple human trials utilizing HMG-CoA reductase inhibitors, known as statins, have repeatedly confirmed that changing lipoprotein transport patterns from unhealthy to healthier patterns significantly lowers cardiovascular disease event rates, even for people with cholesterol

values currently considered low for adults; however, no statistically significant mortality benefit has been derived to date by lowering cholesterol using medications in asymptomatic people, i.e., no heart disease, no history of heart attack, etc.

Cholesterol-lowering drugs works to lower LDL by reducing cholesterol synthesis and by binding bile acids in the small intestines. However, there are possible side effects to these drugs that patients should be aware of.

Current lipid-lowering drugs include nicotinic acid(niacin), bile acid sequestrants (resins), hydroxymethylglutaryl- coenzyme A reductase inhibitors (statins), and fibric acid derivatives (fibrates). When drug therapy is prescribed, the physician and patient should establish each patient's lipid goal together, and treatment should be tailored to achieve that goal.

(1-8-1) Statins :

Five general categories of medications are available for the treatment of lipid disorders [Atorvastatin (Lipitor), Fluvastatin (Lescol), Lovastatin (Mevacor), Pravastatin (Pravachol), Rosuvastatin (Crestor), Simvastatin (Zocor)]. Statins are cholesterol-lowering drugs that work by stimulating hepatic lipoprotein A-1 expression and weakly inhibiting the cholesterylester transfer protein (CETP), which changes HDLs to LDLs (Toth, 2004) (39). People with low HDL levels benefit most from statins. Statins may also decrease stroke risk by lowering systolic and diastolic blood pressures (Amarenco, Labreuche, Lavallee and Touboul, 2004) (40).

The first statin developed was lovastatin (Mevacor); six statins are presently marketed in the United States. There are two types of statins: fermentation-derived natural statins, (e.g., lovastatin) or synthetic statins (e.g., atorvastatin and fluvastatin). The naturally derived statins have shown the greatest benefit in decreasing stroke and CAD incidence.

Numerous studies and meta-analyses have concluded that cholesterol-lowering medications reduce stroke risk for patients with known CAD and normal or elevated cholesterol levels but not for patients with a history of stroke or transient ischemic attack (TIA, Futterman and Lemberg, 2004, Lockman, Tribaston, Kinght and Franko 2005) (41). The American Stroke Association Stroke Council (2004, p. 1023) has stated that, "given early benefits in trials of acute coronary syndromes, statin initiation during hospitalization for first ischemic stroke of atherosclerotic origin is probably justified and may increase rates of long-term use".

Individuals who take statins for long periods of time are most at risk for complications. All statins have the potential to cause muscle problems, but based on clinical trials, muscle symptoms attributed to statins are rare (Moran, 2004) (42). The mechanism by which statins cause muscle problems remains unknown, although a number of theories have been proposed (Thompson, Clarkson and karas, 2003) (43). A lower cholesterol level within the muscles may lead to muscle instability. Statins may block small proteins that help maintain the stability of the muscle cell membrane. It also is postulated that there may be a decrease in a compound involved in mitochondrial transport. Use of more than one statin at a time is not recommended because of the increased risk of muscle problems (Moran, 2004) (42).

The spectrum of muscle complaints ranges from myalgia to rhabdomyolysis, with or without elevations in creatine kinase (CK; Moran, 2004) (42). This panel should be repeated 6–12 weeks after initiation of statin therapy, 6 months later, and periodically afterwards. Most statins pass through the liver, and a rise in liver enzymes may suggest the need to lower the dosage or discontinue use of the medication. Statin-induced rhabdomyolysis occurred in 0.1%– 0.5% of patients treated with statins during randomized clinical trials (Graham et al., 2004) (44). Byproducts of muscle tissue are excreted in the urine and can lead to renal failure. Rhabdomyolysis usually occurs with concomitant use of such drugs as erythromycin and azithromycin (45). Combination therapy of statins and fibrates increases patient risk for rhabdomyolysis, especially in elderly patients and patients with diabetes (Gramham et al., 2004) (44).

(1-8-2) Nicotinic Acid :

Niacin (vitamin B3) has been shown to decrease triglyceride levels while increasing HDLs by blocking its hepatic uptake and catabolism (Wittert, 2004) (45). Side effects include flushing, which decreases with duration of use and is often treated with unbuffered aspirin. Niacin initially decreases free fatty acids, but after its effect subsides, the level of free fatty acids rises and impairs the ability of glucose to stimulate uptake and suppress glucose production. As a result, blood sugar levels can rise transiently (Miller, 2003) (46). If niacin is taken at bedtime with food, the likelihood of gastrointestinal disturbances is reduced. Extended-release niacin can be easier to tolerate and is available by prescription. Advicor is

a combination of extended-release niacin and lovastatin; it is available with incrementally increasing doses of niacin (Bryan, 2004) (47).

(1-8-3)Fibrates :

Fibrate therapy benefits those with high triglyceride and low HDL levels and is the first line of defense for patients with these abnormalities (Moon and Kashyap, 2004; Toth 2004) (48) (39). Commonly used fibrates include gemfibrozil and fenofibrate. Fibrates stimulate hepatic apolipoprotein A-1 expression and lipoprotein lipase activity. If LDL levels increase with use of fibrates, adding a statin may be beneficial. No clinical trial to date has investigated the combined use of fibrates and statins, although it is an option for high-risk patients. However, combined use requires regular monitoring of liver function and CK due to the increased risk of adverse effects (Wierzbicki et al., 2003; Wittert, 2004) (49) (45). Fibrates should be taken in the morning and statins at night to minimize peak-dose interactions.

(1-8-4) Resins or Bile-Acid Sequestrants :

Resins, or bile-acid sequestrants, decrease reabsorption of bile in the intestine, leading to increased secretion in stool. The liver responds by increasing the clearance of LDLs from plasma so new bile acids can be formed. Resins do not have an impact on triglycerides but can lower LDL levels with a possible effect of increasing HDLs. The best-tolerated resin is colesevelam, because it works in the gut rather than systemically (Wittert, 2004) (45).

(1-8-5) Cholesterol-Absorption Inhibitors :

The newest class of cholesterol-lowering agents is cholesterol-absorption inhibitors, which are used primarily as an add-on medication to statins (Wittert, 2004) (45). Ezetimibe (Zetia) was released in 2002; it was demonstrated to affect LDL, triglyceride, and HDL levels alone or in combination with a statin McDonald, 2003) (50). Ezetimibe enhances the beneficial pleiotropic effects of statins and is also available in a combination drug (Futterman and Lemberg, 2004) (38).

Aim of the Study :

1. Study the effect of acute myocardial infarction on levels of total cholesterol, triglyceride, high density cholesterol, low density cholesterol, ratios total cholesterol/HDLC and LDLC/HDLC at acute phase.

2. Comparing the levels of total cholesterol, triglyceride, high density cholesterol, low density cholesterol, ratios total cholesterol/HDLC and LDLC/HDLC at 24 hours on acute myocardial infarction with day 3 after acute myocardial infarction.

3. Comparing the levels of total cholesterol, triglyceride, high density cholesterol, low density cholesterol, ratios total cholesterol/HDLC and LDLC/HDLC at 24 hours on acute myocardial infarction with day 3 after acute myocardial infarction according to pathologic levels (lower, borderline and higher) levels of risk factors for heart diseases.

4. Study the effect of acute myocardial infarction on levels total cholesterol, triglyceride, high density cholesterol, low density cholesterol, ratios total cholesterol/HDLC and LDLC/HDLC day 1 (within 24 hours) on acute myocardial infarction as comparing with day 3 after acute myocardial infarction for males and females.

Figure (1-2): Pathophysiologic Events Culminating in the Clinical Syndrome of

5. Comparing the levels of total cholesterol, triglyceride, high density cholesterol, low density cholesterol, ratios total cholesterol/HDLC and LDLC/HDLC at 24 hours on acute myocardial infarction with day 3 after acute myocardial infarction for the patients with diabetes mellitus and hypertension that consider risk factors for heart diseases and secondary cause of lipid abnormalities.

Information:

No:

Date:

Time:

.....

Name:

Age:

Sex:

Weight:

Height:

Ethnic:

Occupation:

.....

+ve / -ve	
DM:	B.Sugger:
HT:	B.Pr:
FH of CHD:	
Histories of CHD:	
Smoking:	
Type MI:	ECG finding:

Lipid Profiles:

Serum Lipids	Within 24 h of MI	Day 3 of MI	N-Value
TC (mg/dl)			<200
TG (mg/dl)			60 – 165 male 40 – 140 female
HDLC (mg/dl)			35
LDLC (mg/dl)			130
TC/HDLC			5
LDLC/HDLC			1 male 1.47 female

Notes:

Conclusions:

1. In this study we found that acute myocardial infarction effect on lipid profiles levels only HDLC has not been affected on acute myocardial infarction but HDLC still could be useful for risk assessment in the patients with acute myocardial infarction.

2. In this study it was found that acute myocardial infarction affect on lipid profiles with higher pathologic values (higher risk levels for heart diseases) but has not been affected on the lower and borderline risk levels for heart diseases. Only HDLC has not been affected by acute myocardial infarction at higher pathologic values (higher risk levels for heart diseases) but affect at borderline risk levels.

3. This study proved that higher levels risk of lipid profiles increase risk for heart diseases. Only HDLC at higher levels was considered as protective against heart diseases.

4. In this study it was found that levels lipid profiles for females higher than lipid profiles levels for males.

5. Acute myocardial infarction incidence on males was higher than incidence of acute myocardial infarction than in females.

6. This study was found that acute myocardial infarction has been affected on lipid profiles levels on the patients with diabetes mellitus but has not been affected on lipid profiles in the patients with hypertension.

7. This study proved that the patients with diabetes mellitus and hypertension increase levels of total cholesterol, triglyceride, LDLC, ratios TC/HDLC and LDLC/HDLC but decrease HDLC levels.

Recommendations :

1. Study effect of acute myocardial infarction on levels of apoproteins.

2. Study effect of acute on myocardial infarction levels of lipid profiles in patients with abnormal thyroid function.

3. Study of change in blood levels of lipid profiles during active rheumatoid arthritis.

Discussion :

Iraq is in a phase of transition in which infectious and nutritional diseases are the major causes of morbidity and mortality. One disease of major impact is CAD. The large population of the country, the problem of CAD will be a major source of death and disability, as well as a major drain on national resources.

The prevalence of conventional risk factors such as smoking, hypertension and diabetes mellitus is not different in our country as compared with other ethnic groups. Lipid patterns however, are known to vary with dietary habits, which could be different in diverse ethnic groups and geographical locations (56).

In developing countries, CAD is thought to be predominantly a disease of the upper income groups. As development progresses this relation may reverse. Low education level may change the life style like diet rich in saturated fats which contribute to increase lipid and lipoprotein levels which may lead to coronary artery disease. Hardarson and Kevin have stated that low education level can be considered as one of the independent risk factor for causing coronary heart disease (57) (58).

Hyperlipidemia is an elevated concentration of lipids in the blood. The major plasma lipids of interest are total cholesterol and the triglycerides. When one or more of these major classes of plasma lipids is elevated, a condition referred to as hyperlipidemia exists. The major exceptions are individuals with excessive amounts of LDLC whose plasma cholesterol is kept within normal limits by a concomitant decrease in HDLC (19).

Hyperlipidemia is usually a symptom less biochemical state that, if present for a sufficiently long time, may be associated with the development of atherosclerosis and its complications, including myocardial infarctions. Opinion is divided on the changes that occur in serum lipids and lipoproteins following myocardial infarction. Most workers have reported a reduction in total cholesterol, HDL cholesterol and LDL cholesterol after acute MI. Others have, however, reported no change in serum total cholesterol and HDLC.

Similar variations have also been noted in serum triglycerides levels. From these reports it is clear that phasic changes do occur in patients following MI and therefore there is a recommendation for detection of hyperlipidemia in patients with acute MI that the serum lipids should be assessed either within 24 hours after infarction or after 3 day of acute MI. Several epidemiologic studies have shown that the ratio of total cholesterol to HDLC and of LDLC to HDLC also can be used as predictors of acute coronary events (59).

Prevalence of hypertension (54%), diabetes mellitus (30%), family history (24%) and history of coronary heart diseases (30%) was high in our study population and was similar to the incidence reported in previous studies. Smoking (54%) was the most prevalent risk factor in the patients with MI as shown in table (3-1).

Prevalence of inferior MI (58%) was very high in our study .the prevalence of anterior MI (16%), anterioseptal MI (20%) and anteriolateral MI (6%) also reported in our study as shown in table (3-2).

BMI has reported in our study as a criterion for assessing obesity for several reasons as shown in table (3-3). Assessment begins with classification by body mass index (BMI), with overweight and obesity defined as a BMI of 25 and 30 kg/m2, respectively. The prevalence of appropriate weight (<25) was very low in our study (6%) but the patient overweight (56%) and obese (38%) was very high in our study and to the incidence similar reported in previous studies.

BMI correlates significantly with body fat, morbidity, and mortality and it can be calculated quickly and easily in a busy clinical setting. BMI can overstate medical risk by overestimating body fat. Because muscle mass declines with age, BMI can understate risk in the elderly. The relationship between BMI and body fat can vary with ethnicity and gender, although including waist circumference as a parameter in risk assessment may help compensate for associated differences in fat distribution.

Age of onset of obesity should be determined in part because the age potentially can be correlated with lifestyle changes contributing to obesity (67). Patients with a sedentary lifestyle should be identified, because this lifestyle contributes to obesity and because the sedentary lifestyle itself is an independent risk factor for all-cause and cardiovascular mortality. Conversely, in some obese patients with underlying coronary disease, a sudden increase in physical activity could be dangerous, but more importantly, a baseline level of activity needs to be established to make exercise recommendations (68).

A BMI of 25 kg/m2 is the generally accepted threshold for identifying a patient at higher risk for obesity-related diseases, most notably type 2

diabetes, hypertension, and cardiovascular disease (69). Medical risk rises progressively with increasing degrees of obesity beginning with overweight; defined by BMI between 25.0 and 29.9 kg/m2 more than 80% of deaths estimated to be caused by comorbidities associated with obesity occur in patients with a BMI of at least 30 kg/m2 (70).

A high-risk waist circumference is accepted to be 35 inches or greater for women and 40 inches or greater for men. Waist circumference is a practical indicator of visceral abdominal fat. Evidence suggests that abdominal fat carries a higher health risk than peripheral fat, and that the visceral fat component correlates the most strongly with increased risk. Whereas computed tomography and magnetic resonance imaging allow more precise measurement of abdominal fat, they are impractical for routine clinical use. Some epidemiological studies have found the waist-to-hip ratio to correlate with increased risk for diabetes, coronary heart disease (CHD), and hypertension; however, this measure is not established as an independent risk factor. Waist circumference also has been found to be a superior indicator of abdominal fat distribution (71).

(4-1) Lipid profiles:

The results of the present study have been shown in table (3-4). After acute myocardial infarction we found significant decrease in the serum total cholesterol between day 1 during acute MI and day 3 after acute MI. Serum triglycerides recorded decrease significantly in day 3 as compared to day 1 after acute MI. However, a significant increased in triglyceride after acute MI has been reported by others.

With respect serum HDLC our study shown none significant increased on day 3 as compared to day 1 after acute MI.

The serum LDLC levels show significant decrease in day 3 as compared with day 1 after acute MI.

Several studies have advocated the value of ratio of TC/HDLC and LDLC/HDLC as a correlate of severity and extent of coronary artery disease because these ratios sum up the importance of both the TC or LDLC and HDLC collectively. In our study the ratio of TC/HDLC and LDLC/HDLC recorded a significant decrease day 3 as compared to day 1 during acute MI.

The acceptable time for the measurement of plasma lipids after an acute MI is within 24 hours after the onset of symptoms, and the plasma lipid levels measured beyond 24 hours are mostly considered to be invalid. The post MI decline in serum cholesterol occurs because of the acute phase response and is of greatest extending by day 3 after MI (61).

Fasting state can possible influence the lipoprotein pattern in the acute phase after tissue damage. The risk for coronary heart disease increases from low to very high as fasting lipid values rise from optimal to very high. If the patient is nonfasting, the values for total cholesterol and HDLC will be usable (19).

Only few studies have dealt with serum lipid profile changes in acute phase of MI. The first report by Aull *et al*. (1996) reported on 37 patients between (36-85) years during acute MI decrease significant ($p<0.01$) for serum TC, LDLC and HDLC with complete stroke and increased none significant ($p>0.05$) for triglycerides day 1 to day 3 after acute MI (60).

Norrapol Wattanosuwan *et al.* (2001) reported on 45 patients (mean age 70±14 years) with acute MI found significant decrease on serum TC

(0.011), HDLC (p=0.001) and LDLC (p=0.009) day 3 after MI as compared to day 1 during acute MI but triglycerides increased significantly (p=0.006). The ratio TC/HDLC (p=0.348) and LDLC/HDLC (p=0.759) remained unchanged between day 1 during acute MI and day 3 after acute MI (change not significant) (61).

Recently, P.K. Nigam *et al*. (2004) reported on 29 patients (40-70) years with acute MI showed no significant change during acute phase day 1 to day 3 on serum TC and LDLC (P>0.05). HDLC increased none significantly between day 1 and day 3 of acute MI (p>0.05). The ratio of TC/HDLC (p=0.01) and LDLC/HDLC (p=0.05) showed significant increased on day 3 as compared to day 1. serum triglycerides also showed an increasing trend after MI with a significant increased on day 3 as compared to day 1 (p=0.001) (59).

With respect to TC and LDLC values, our results in patients with acute MI are consistent with the studies mentioned above (60, 61) only P.K. Nigam *et al.* (2004) (59) found none significant decrease in TC and LDLC with acute phase.

With respect to HDLC values our results in patient with acute MI are not consistent with the three studies mentioned above (59, 60, and 61) because in our study HDLC increased none significantly day 1 on acute MI to day 3 after acute MI.

The TG value of patient disagree with the studies mentioned above because in our study significant decreased day 3 after acute MI as compared with day 1 on acute MI.

According to the ratios TC/HDLC and LDLC/HDLC values, our study are consistent with P.K. Nigam *et al.* (2004) (59) of the studies mentioned

above that shown significant decreased day 1 on acute MI to day 3 after acute MI and disagree with Norrapol Wattanosuwan *et al.* (2001) (61) found change not significant day 3 after acute MI as compared to day 1 of acute MI.

An inverse relationship between TG and HDLC has been reported by the above mentioned studies (59, 60 and 61) and in this study also found this correlation, however, the low levels of HDLC at day 3 in our study indicated an irreversible change and since there were no per infarction values of HDLC known, the effect of infarction can only be assumed and by no means proven.

The mechanistic aspect of these changes deserves further investigations with large number of patients. Many hypothesis and theories have been presented and discussed the changes in lipid profiles after acute myocardial infarction. First, one recent study has shown that acute myocardial infarction causes a profound up regulation of cholesterol synthesis as acute phase response and the observed decrease of plasma cholesterol levels after acute MI must, therefore, be explained by the parallel increased of LDL receptor activity and thus increased cholesterol catabolism (62).

Second, the local response includes vasodilatation, leukocyte infiltration chemotaxis, monocyte and macrophage activation and cytokine release. The cytokines act on the systemic targets, including the liver, to generate changes in the concentration of various heterogeneous plasma proteins that are known collectively as acute phase reactants, including lipoproteins and C-reactive protein. By day 4 to 5 post MI, there is a significant decrease in the serum concentrations of apoprotein A-I and apoprotein B (61) (lipoprotein B-100 which binds to LDL

receptors and acts as an atherogenic protein and apoprotein A which resembles plasminogen and competes with the latter for binding to fibrinogen and monomer, thus acting as a prothrombtic agent) (63), reflecting the maximum decrease in the serum cholesterol level by this time (61).

Third, reduced lipoprotein synthesis in the liver, a key organ in the lipoprotein metabolism, may play a role. The inflammatory process in response to tissue injury alters the hepatic production of several plasma proteins involved in the acute phase response. Massive shifts in the synthesis and secretion of proteins in the liver lead to an increased protection of acute phase proteins at the cost of the synthesis of other proteins, probably including lipoproteins, resulting in a decreased rate of VLDL production and subsequently of LDLC. Reduced dietary intake and malnutrition may also be of importance for circulating lipoprotein levels.

Fourth, inflammatory mediators might increase the removal of lipoproteins from the circulation. C-reactive protein increase in response to most forms of tissue injury, inflammation, or infection. In vitro, aggregated C-reactive protein binds selectively with LDL particles.

Fifth, the distribution of lipoprotein particles between the intravascular and extravascular space may change. Inflammatory processes or tissue damage lead to an increased permeability of the capillary membranes and consecutively to an extravasation of albumin and smaller plasma protein. Small lipoproteins Small lipoproteins, namely HDLC, could follow a pathway parallel to that of albumin and get lost to the extravascular space (60).

sixth, several large-scale epidemiologic studies have shown that the total cholesterol/HDL cholesterol ratio and the LDL cholesterol/HDL cholesterol ratio are also strong predictors of coronary artery disease events because these ratios sum up the importance of both the total cholesterol or the LDL cholesterol and HDL cholesterol collectively. The ratios of total cholesterol to HDL cholesterol and LDL cholesterol to HDL cholesterol that have been reported to correlate with the development of acute coronary events are > 4.5 and > 2.5, respectively. On the current recommendation by National Cholesterol Education Program, Adult Treatment Panel II. These findings suggest that the cholesterol ratios could be used to determine cholesterol risk in patients who experienced acute MIs and may have an advantage in situations in which the absolute total and fractionated cholesterol levels are no longer applicable because of the effect of the acute MI (beyond 24 h after the onset of acute MI) (61).

HDLC levels was found to be strongly and independently associated with coronary artery diseases. The Framingham data suggested an optimal HDLC level >52 mg/dl in men and > 66mg/dl in women, which probably may not apply to patients that have much lower levels even in the absence of disease. It is possible that in the face of low HDLC, even modest elevation of LDL with consequent elevation of the LDLC/HDLC and total cholesterol/HDLC ratio could contribute to atherogenesis in this population (59).

Seventh, judged by number of recently published studies dedicated to HDLC, it appears that lipid research has discovered HDLC, due to the remarkable progress in unraveling the HDLC metabolism. Major break through include the discovery of the HDLC receptor, the scavenger

receptor B-1 (SR-B 1), which is expressed at high levels at the main sites of selective uptake of HDLC. In addition, along with epidemiologic evidence, recent major clinical intervention trials have shown the importance of HDLC on coronary artery diseases, in particular in patients without elevated LDLC levels. The recently published veterans Affairs Cooperative Studies Program High Density Lipoprotein Cholesterol Intervention Trial proved that a modest increase in HDLC levels in coronary artery diseases patients with normal LDLC levels (≤3.6 mmole/L) resulted in a significant reduction of risk on major cardiovascular events (64).

In addition, HDL participates in the regulation of triglyceride catabolism and cholesteryl ester formation by providing the respective cofactors, Apo C II for activation and Apo CIII for inhibition of lipoprotein lipase activity. Also, normal HDL may balance LDL transport by mediating cholesterol removal from peripheral sites to derogative and excretory sites.

Recent research has shown that plasma LDLC can incite many early features of the atherosclerotic inflammatory response though oxidative modification. Oxidized LDL particles contribute to formation of unstable plaques by stimulating recruitment of monocytes from the circulation into the sub endothelial space to form activated macrophages. Investigators have observed that the smaller, dense LDL is particularly susceptible to oxidation and may have easier access to the sub endothelial space than the large, buoyant LDL particle.

LDL-C may contribute to atherogenesis through other mechanisms, including stimulation of macrophage production of metalloproteinases, which can degrade the collagenous matrix and fibrous cap; production of cytokines capable of inducing apoptosis of smooth muscle cells, which produce collagen; and uninhibited engorgement of modified LDL by the macrophage, transforming it into a foam cell that, on cell death, adds to the cholesteryl ester liquid plaque core. Approximately 75% of human plasma cholesterol is contained in LDL particles, and both the LDL particles and their more triglyceride-rich precursors (IDL) can produce these cholesteryl ester-laden macrophages in vitro. A threshold plasma cholesterol concentration is believed to exist, above which abnormal amounts of lipid accumulate in the arteries and transform macrophages into foam cells, although the precise threshold is unknown.

Triglycerides may also contribute to atherogenesis through a direct effect or through their effect on other lipoproteins. Triglycerides are statistically and clinically correlated with low HDL-C levels and clotting factor changes that produce a procoagulant state. Furthermore, increased triglyceride levels in the core of LDL can promote aggressive lipolysis (triglyceride removal) and the formation of the small, dense LDL particles. High triglyceride levels may also adversely affect endothelial function, as demonstrated after consumption of a fatty meal when the level of triglyceride increase is directly proportionate to the level of arterial dysfunction.

Univariate analysis showed that mean TG levels were significantly higher in patients with CAD than controls and in multivariate analysis TG is not found to be an independent risk factor of CAD (59).

(4-2) Lipid profiles levels in the patients with pathologic values:

In our study tables (3-5), (3-6), (3-7), (3-8), (3-8), (3-9) and (3-10) showed that decrease significantly day 1 as compared to day 3 after acute MI for TC, TG and LDLC only in high risk levels for heart diseases but none significant decrease day 1 as compared to day 3 after acute MI in low and borderline risk levels for heart diseases. For HDLC showed significant increase day 1 as compared to day 3 after acute MI in borderline risk levels for heart diseases and none significant increase day 1 as compared to day 3 after acute MI in high and low risk levels for heart diseases. The ratio TC/HDLC showed none significant decrease day 1 as compared to day 3 after acute MI in low risk levels for heart diseases and significant increase day 1 as compared to day 3 after acute MI in borderline and high risk levels for heart diseases. The ratio LDLC/HDLC showed significant decrease day 1 as compared to day 3 after acute MI in low and borderline risk levels for heart diseases but none significant decrease day 1 as compared to day 3 after acute MI in high risk levels for heart diseases.

Our study disagree with the study done by Aull *et al*. (1996), that showed elevated serum TC and TG greater than 200 mg/dl, elevated serum LDLC greater than 130 mg/dl and reduced serum HDLC less than 35 mg/dl did not remarkably between day 1 as compared to day 3 after acute MI (60).

Because of the positive correlation between blood cholesterol concentration and the increased risk for CHD, many investigators believe

that the average cholesterol concentration for the entire population should be as low possible. According to clinical data, individuals with plasma cholesterol values 180 mg/dl experience minimum CHD. In addition, clinical trials have documented that reversal of the coronary stenosis of the blood vessels is possible when total cholesterol is reduced to less than 180 mg/dl or when LDLC is lowered to less than 100 mg/dl. On the other hand, the relative risk is increased by 25% for those with values between 180 mg/dl and 200 mg/dl. For values between 200 mg/dl and 240 mg/dl, the relative risk is increased about 80%; for values above 240 mg/dl, the relative risk rises almost two and one-half times. In simplistic terms, concentrations below 200 mg/dl can be considered more ideal than concentrations above 200 mg/dl for the adult population. Recent reports suggest that the mean cholesterol value of the U.S. population declined from 220 mg/dl to less than 215 mg/dl, and the CHD morbidity and mortality have decreased. Again, it should be remembered that the relationship between blood cholesterol concentration and CHD shows no threshold for the disease (19).

Recent evidence indicates that LDL particle size and number may predict CHD risk independently of lipid levels, and that small, dense LDL particles are associated with the metabolic syndrome and with preclinical atherosclerosis the carotid and femoral arteries. In spite of the face that LDLC is a weak predictor of the risk for myocardial infarction in the elderly (55).

Epidemiological surveys have shown that serum total cholesterol levels are continuously correlated with CHD risk over a broad range of cholesterol values. This relationship has been observed in many populations throughout the world. Because serum LDLC levels correlate

highly with total cholesterol in populations, the same relation must exist between LDLC concentrations and CHD risk. At any level of LDLC, for a given milligram-per-deciliter change in the LDLC level, the change in relative risk is the same as at any other LDLC level. This relationship has 2 important implications. First, when person with low LDLC have the same absolute risk (because of other risk factors) as those with high LDLC, the same absolute benefit is attained for a given milligram-per-deciliter lowering of LDLC. Second, when persons with low LDLC have a lower absolute risk than those with higher LDLC, less absolute benefit is attained for a given LDLC lowering in the low LDLC group (65).

The adult upper limit of normal triglyceride was once defined as 200 mg/dl for both sexes, regardless of age. The new NIH ATP III guidelines define the upper limits of normal for serum triglyceride as less than 150 mg/dl. Borderline-high triglycerides level is now defined as 150 mg/dl to 199 mg/d, and high triglyceride level is 200 mg/dl. According to the NCEP III guidelines, the treatment strategy for elevated triglyceride depends on the causes and severity of the elevation. For all persons with borderline-high or high triglyceride levels, the primary aim of therapy is to achieve the target goal for LDLC. Emphasis should be placed on weight reduction and increased physical activity. In many instances, the lowering of the triglycerides will normalize the below-normal HDLC levels <40 mg/dl because of the existence of the reverse relationship between triglyceride and HDLC concentration (19).

(4-3) Lipid profiles in males and females:

Table (3-11) showed that serum TG, TG, LDLC and ratio TC/HDLC levels decreased significantly day 1 on acute MI as compared to day 3 after MI and none significant increased HDLC with none significant decreased for ratio LDLC/HDLC day 1 on acute MI compared to day 3 after MI in male patients.

But in females the serum TG levels decreased significantly and HDLC increased significantly in day 1 on acute MI as compared to day 3 after acute MI in female patients. But serum TC, LDLC, ratio TC/HDLC and ratio LDLC/HDLC showed decreased none significantly in day 1 as compared to day 3 after acute MI in female patients as shown in table (3-12).

In this study we found that levels of serum lipid profiles for females higher than levels for males. The serum of HDLC for females inversely correlated and higher significant with risk for recurrent events but in males serum HDLC lower than in females and none significant. This agreed with Jeanine E. Roeters van Lennep *et al.* (2000) study that found the impact of HDLC on coronary risk was greater in females than in males and significant only in females.

ApoA-I, the major apolipoprotein of HDLC, showed a predictive value for CHD events similar to HDLC in females. The level of apoA-I, but not the level of HDLC, was an indicator of future CAD for males ApoA-I than HDLC. Biologically, this finding can be explained because not all HDLC particles an equally protective. Two predominant classes of HDLC can be recognized; HDLC particles that only contain apoA-I (lipoprotein A-I) and particles that contain both apoA-I and apoA-II

(lipoprotein A-I: A-II). In general, lipoprotein A-I is considered to be more protective against CHD than lipoprotein A-I: A-II. Therefore, apoA-I levels may be a better marker for functional reverse cholesterol transport than HDLC (64).

Cholesterol concentration in blood of males is generally higher than that in premenopausal females. After menopause, however, the cholesterol concentration is higher in females than in males. Serum cholesterol levels in males seem to reach a plateau by 50 to 60 years of age.

Studies in free-living populations in the United States have documented increases in triglyceride levels with age and have indicated that as many as one fourth of middle-aged men have triglyceride levels that exceeded previous published cutoff values. Thus, although statistically valid, the critical limits for triglyceride concentrations may not represent physiological limits. Therefore investigators might expect a greater prevalence of combined hyperlipoproteinemia in older age groups.

The possible effects of dietary carbohydrates should not be overlooked when assessing this lipoprotein disorder. It has been shown that fasting hypertriglyceridemia in patients with this metabolic lipoprotein profile could be attributable to an acute increase in dietary carbohydrates. It appears that triglyceride values greater than 4000 mg/L are rare in patients with this lipoprotein pattern. The few reported cases in the medical literature occurred in postmenopausal women (19).

(4-4) Lipid profiles levels in the patients with diabetes mellitus and hypertension :

Table (3-13) in our study showed that patients with D.M had significant decrease for TC, TG, LDLC and ratio TC/HDLC but none significant decrease for ratio LDLC/HDLC and none significant increase for HDLC levels between day 1 on acute MI and day 3 after acute MI.

But the patients with H.T showed that none significant change for lipid profiles day 1 on acute MI as compared with day 3 after acute MI as in table (3-14).

Our study disagrees with the study done by Aull *et al*., which showed the prevalence of generally acknowledged risk factor for stroke which may influence lipid values. During the observation period, the prevalence of patients with diabetes mellitus remained unchanged in patients with acute MI (59).

The intracellular adipose triglyceride enzyme is distinct from the plasma enzyme and is called hormone-sensitive lipase because it is converted from an inactive to an active form. Insulin inhibits the activity of this lipase. Unlike the lipoprotein lipase of adipose tissue, hormone-sensitive lipase of other tissue exhibits increased activity during fasting, possibly because of falling insulin levels. It is believed that hormone-sensitive lipase plays an important role in fat mobilization from adipose tissue (19).

The hydrolysis of triglycerides is inhabited in the fed state by high concentrations of insulin. The pathway for the inhibition of fatty acid

release by insulin is poorly understood. When carbohydrate stores are depleted and insulin concentrations are low, increased concentrations of epinephrine stimulate triglyceride hydrolysis. Epinephrine binds to the β-adrenergic receptors of adipocytes, which leads to activation of the cAMP-dependent protein kinase A. In adipocytes, protein kinase A catalyzes the phosphorylation and activation of hormone-sensitive lipase.

Glycerol and free fatty acids diffuse through the adipocyte plasma membrane and enter the bloodstream. Glycerol is metabolized by the liver, where most of it is converted to glucose. Fatty acids are poorly soluble in aqueous solution and travel through blood bound to serum albumin, a protein that accounts for half of the total protein of serum. Fatty acids are carried to tissues such as heart, skeletal muscle and liver where they are oxidized in mitochondria to release energy. Fatty acids are a major source of energy during the fasting state (54).

The prevalence of hypertension and diabetes mellitus were significantly higher in older patients (>45years). Study by Vivek P. Singh *et al.* demonstrated diabetic patient with CAD had significantly higher levels of total cholesterol and triglycerides than non-diabetics patients with CAD.

Study by Ramachandran *et al.*, had shown that the lipid profile of diabetic CAD patients had a higher concentration of TC, TG, LDLC, LDLC / HDLC ratio, and a lower concentration of HDLC, which is almost similar to our results. Test of proportion showed that the diabetic subgroup had a significantly higher prevalence of hypertension which could be one of the associated risk factor for CAD (66).

The patients were at increased risk before the development of their diabetes because of insulin resistance, which manifests with

hyperinsulinemia, increased triglyceride levels, and low high-density lipoprotein cholesterol (HDL-C) levels. Individuals with a defect in insulin secretion who subsequently develop diabetes have a tripling of cardiovascular disease (CVD) risk. Comparing individuals with similar blood glucose levels who have insulin resistance or insulin deficiency alone, the former have higher blood pressure, higher triglyceride levels, and lower HDL-C levels. Dr. Haffner suggested, insulin-resistant individuals who subsequently develop diabetes are at increased risk for macrovascular disease years or even decades before the onset of illness (51).

There is a positive relationship between hyperinsulinemia and CVD risk in nondiabetic individuals as well. Results of the Quebec Heart study demonstrated the additive effect of hyperinsulinemia on increasing levels of apolipoprotein B in conferring CVD risk, suggesting the need for treatment of both the lipid and insulin components. Among individuals without diabetes, the degree of insulin resistance was related to HDL-C levels, blood pressure, and fasting insulin levels. Comparing patients with the highest quintiles of fasting insulin levels to those with the lowest quintiles, HDL-C was 12 mg/dL lower, blood pressure was 9 mm Hg higher, and triglyceride levels were doubled. After controlling for these factors, low-density lipoprotein cholesterol (LDL-C), and glucose levels, the most insulin-resistant group demonstrated a 2.5-fold increase in their risk of vascular events. Dr. Haffner noted, however, that these observational studies have yet to be verified by clinical trials.

An important additional aspect of risk in diabetes is the emerging relation between insulin resistance and inflammation. C-reactive protein levels are strongly related to insulin levels and obesity, although one cannot yet be certain as to the direction of causality (52).

Other factors that possibly influence on lipid profiles in acute myocardial infarction are physical inactivity due to hospitalization, fasting state, inadequate dietary intake or intravenous nutrition (60). Only patients able consume the usual diet without any restriction have been consider.

Also the patients that taken drugs like Beta-blockers and diuretics effect on levels of lipid profiles that cause increase levels of total cholesterol and triglyceride and decrease levels of HDLC (7). Beta-blockers effect on serum of lipid profiles if the patients take them about two weeks (59).

The clinical characteristics of the study patients summarized in (table 3-1). Forty male (80%) age range was between 35 to 83 years (mean age 60±11.3 years) and ten female (20%) age range was between 45 to 82 years (mean age 60±11.5 years).

Diabetes mellitus was present in 15 patients (30%); hypertension was present in 27 patients (54%). Twelve patients (24%) had positive family histories, fifteen patients (30%) had positive histories of coronary heart diseases and 27 patients (54%) were smokers.

Table (3-1): Clinical characteristics of the patients (n=50) with acute myocardial infarction.

Clinical Characteristics	No	%
Diabetes mellitus (n=50)	15	30
Hypertension (n=50)	27	54
Family history of CHD (n=50)	12	24
History of CHD (n=50)	15	30
Smoking (n=50)	27	54

CHD = coronary heart diseases.

Change in ST-elevation of myocardial infarction summarized in (table 3-2) was diagnosed in 29 patients (58%) were had inferior myocardial infarction, eight patients (16%) had anterior myocardial infarction, ten patients (20%) had anterioseptal myocardial infarction and three patients (6%) had anteriolateral myocardial infarction.

Table (3-2): Types of myocardial infarction in the patients (n=50) with acute myocardial infarction.

Types of MI	No	%
Inferior	29	58
Anterior	8	16
Anterioseptal	10	20
Anteriolateral	3	6

The result of this study include three patients (6%) with appropriate (BMI <25), twenty eight patients (56%) was overweight (25-30) and nineteen (38%) patients were obese (BMI>30) as in table (3-3).

Table (3-3): Classification of body weight by BMI in the patients (n=50) with acute myocardial infarction.

Parameters	No	%
BMI <25 weight appropriate	3	6
BMI (25-30) over weight	28	56
BMI >30 obese	19	38

BMI = body mass index (Kg/ m^2)

(3-1) Biochemical markers in acute myocardial infarction :

(3-1-1) Lipid Profiles :

All serum lipid levels were compared between day 1 (within 24 hours) during the acute phase and day 3 after myocardial infarction using t-test as in table (3-4).

From day 1 (within 24 hours) in acute phase of MI to day 3 after MI, serum total cholesterol levels (222.3±57.4 mg/dl vs. 207.65±63.1 mg/dl, respectively; p=0.011), triglycerides levels were (141.5±89.7 mg/dl vs. 133.7±83 mg/dl, respectively; p=0.01), LDLC levels were (134.5±57.1 mg/dl vs. 115.85±61.3 mg/dl, respectively; p=0.033), the ratio of TC/HDLC were (4.65±2.2 vs. 3.9±2.2, respectively; p=0.0047) and the ratio LDLC/HDLC were (2.95±1.8 vs. 2.3±1.86, respectively; p=0.034) decreased significantly. On the contrary, HDLC levels increased none significantly from 44.9±20 mg/dl on day 1 (within24 hours) of MI to 47.6±23.2 mg/dl on day 3 after MI (p=0.052).

Table (3-4): Comparison of serum lipid profiles between day 1 (within 24 hours) and day 3 in the patients with acute myocardial infarction.

Serum Lipids	Within 24 h of MI	Day 3 of MI	P-Value
TC (mg/dl)	222.3 ± 57.4	207.65 ± 63.1	0.011
TG (mg/dl)	141.5 ± 89.7	133.7 ± 83	0.01
HDLC (mg/dl)	44.9 ± 20	47.6 ± 23.2	0.052
LDLC (mg/dl)	134.5 ± 57.1	155.85 ± 61.3	0.033
TC/HDLC	4.65 ± 2.2	3.9 ± 2.2	0.0047
LDLC/HDLC	2.95 ± 1.8	2.3 ± 1.86	0.034

TC = total cholesterol

TG = triglyceride

HDLC = high density lipoprotein cholesterol

LDLC = low density lipoprotein cholesterol

(3-1-2) Lipid profiles levels in the patients with pathologic values :

This study compared serum of lipid levels between day 1 (within 24 hours) during myocardial infarction and day 3 after myocardial infarction according to lipid levels (lower, borderline and higher) risk levels for heart diseases using t-test as in tables (3-5), (3-6), (3-7), (3-8), (3-9) and (3-10).

At lower risk levels for heart diseases we found decreased none significantly between day 1 during MI and day 3 after MI for total cholesterol (160.15±25.56 mg/dl vs. 141.97±28.35 mg/dl, respectively; p=0.074), triglycerides (101.22±30.25 mg/dl vs. 100.3±45.21 mg/dl, respectively; p=0.352), LDLC (69±19.28 mg/dl vs. 56.38±27.59 mg/dl, respectively; p=0.344) and ratio TC/HDLC (2.6±0.7 vs. 2.6±0.9, respectively; p=0.477) and HDLC increased none significantly between day 1on MI and day 3 after MI (34.5±2.98 mg/dl vs. 32.84±6.4 mg/dl, respectively; p=0.129) but ratio LDLC/HDLC decreased significantly between day 1 on MI and day 3 after MI (1.05±0.35 vs. 1±0.92, respectively; p=0.047).

At borderline risk levels for heart diseases we found decreased none significantly between day 1 during acute MI and day 3 after acute MI for total cholesterol (222±10.6 mg/dl vs. 204±47.65 mg/dl, respectively; p=0.203), triglycerides (158.2±16.59 mg/dl vs. 133.7±50.1 mg/dl, respectively; p=0.071) and LDLC (133.69±18.24 mg/dl vs. 114.1±48.8 mg/dl, respectively; p=0.179) but HDLC increased significantly between

day 1 on MI to day 3 after MI in borderline levels (45.495±3.96 mg/dl vs. 48.355±18.659 mg/dl, respectively; p=0.03).The decreased was significant between day 1 on MI and day 3 after MI for ratio TC/HDLC (4.75±0.57 vs. 3.95±1.6, respectively; p=0.039) and ratio LDLC/HDLC (3.5±1.38 vs. 2.7±1.65, respectively; p=0.012).

At higher risk levels for heart diseases we found decreased significantly between day 1 (within 24 hours) during MI to day 3 after MI for total cholesterol (265.17±34.38 mg/dl vs. 265±37.06 mg/dl, respectively; p=0.039), triglycerides (266.66±55.15 mg/dl vs. 233±56.5 mg/dl, respectively; p=0.01), LDLC (191.38±26.87 mg/dl vs. 184.4±33.7 mg/dl, respectively; p=0.02) and ratio TC/HDLC (7.7±1 vs. 7.3±1.54, respectively; p=0.008). The HDLC increased none significantly between day 1 on MI to day 3 after MI (70.66±18.75 mg/dl vs. 71.2±23.1 mg/dl, respectively; p=0.341). The ratio LDLC/HDLC decreased none significantly (6.7±0.17 vs. 6.4±0.5, respectively; p=0.219) between day 1 on MI to day 3 after MI.

Table (3-5): Comparison of serum total cholesterol between day 1 (within 24 hours) and day 3 in the patients with acute myocardial infarction according to risk levels for heart diseases.

Parameters	Within 24 h of MI	Day 3 of MI	P-Value
TC<200 mg/dl (lower risk level for heart disease)	160.15 ± 25.56	141.97 ± 28.35	0.074
TC(200-239) mg/dl (Borderline risk level for heart disease)	222 ± 10.6	204 ± 47.65	0.203
TC>240 mg/dl (Higher risk level for heart disease)	265.17 ± 34.38	265 ± 37.06	0.039

TC = total cholesterol

Table (3-6): Comparison of serum triglyceride between day 1 (within 24 hours) and day 3 in the patients with acute myocardial infarction according to risk levels for heart diseases.

Parameters	Within 24 h of MI	Day 3 of MI	P-Value
TG<150 mg/dl (lower risk level for heart disease)	101.22 ± 30.25	100.3 ± 45.21	0.352
TG(150-199) mg/dl (Borderline risk level for heart disease)	158.2 ± 16.59	133.7 ± 50.1	0.071
TG>200 mg/dl (Higher risk level for heart disease)	266.66 ± 55.15	233 ± 56.5	0.01

TG = triglyceride

Table (3-7): Comparison of serum high density lipoprotein cholesterol between day 1 (within 24 hours) and day 3 in the patients with acute myocardial infarction according to risk levels for heart diseases.

Parameters	Within 24 h of MI	Day 3 of MI	P-Value
HDLC<40 mg/dl (Lower level, heightened risk for heart disease)	34.5 ± 2.98	32.84 ± 6.4	0.129
HDLC (40-60) mg/dl Medium level	45.495 ± 3.96	48.355 ± 18.659	0.03
HDLC >60 mg/dl (High level, optimal condition considered protective against heart disease)	70.66 ± 18.75	71.2 ± 23.1	0.341

HDLC = high density lipoprotein cholesterol

Table (3-8): Comparison of serum low density lipoprotein cholesterol between day 1 (within 24 hours) and day 3 in the patients with acute myocardial infarction according to risk levels for heart diseases.

Parameters	Within 24 h of MI	Day 3 of MI	P-Value
LDLC<100 mg/dl (lower risk level for heart disease)	69 ± 19.28	56.38 ± 27.59	0.344
LDLC (100-150)mg/dl (Borderline risk level for heart disease)	133.69 ± 18.24	114.1 ± 48.8	0.179
LDLC >150 mg/dl (Higher risk level for heart disease)	191.38 ± 26.87	184.4 ± 33.7	0.02

LDLC = low density lipoprotein cholesterol

Table (3-9): Comparison of the ratio total cholesterol/high density cholesterol between day 1 (within 24 hours) and day 3 in the patients with acute myocardial infarction according to risk levels for heart diseases.

Parameters	Within 24 h of MI	Day 3 of MI	P-Value
TC/HDLC<4 (lower risk level for heart disease)	2.6 ± 0.7	2.6 ± 0.9	0.477
TC/HDLC (4-6) (Borderline risk level for heart disease)	4.75 ± 0.57	3.95 ± 1.6	0.039
TC/HDLC >6 (Higher risk level for heart disease)	7.7 ± 1	7.3 ± 1.54	0.008

Table (3-10): Comparison of the ratio low density lipoprotein cholesterol/high density lipoprotein cholesterol between day 1 (within 24 hours) and day 3 in the patients with acute myocardial infarction according to risk levels for heart diseases.

Parameters	**Within 24 h of MI**	**Day 3 of MI**	**P-Value**
LDLC/HDLC<1.5 (lower risk level for heart disease)	1.05 ± 0.35	1 ± 0.92	0.047
LDLC/HDLC (1.5-6) (Borderline risk level for heart disease)	3.5 ±1.38	2.7 ± 1.65	0.012
LDLC/HDLC >6 (Higher risk level for heart disease)	6.7 ± 0.17	6.4 ± 0.5	0.219

(3-1-3) Lipid profiles in males and females:

Forty males with acute myocardial infarction were compared for their changes in lipid profile levels between day 1(within 24 hours) on MI and day 3 after MI using t-test as in table (3-11).

From day 1 (within 24) to day 3 on acute MI for males we found, serum total cholesterol (212±56.68 mg/dl vs. 187.5±63.86 mg/dl, respectively; p=0.012), triglycerides (132.2±92.7 mg/dl vs. 122.68±87.5 mg/dl, respectively; p=0.044), LDLC (129.3±56.6 mg/dl vs. 110.1±61.5 mg/dl, respectively; p=0.035) and The ratio of TC/HDLC (4.65±2.09 vs. 3.9±2.15, respectively; p=0.01) decreased significantly. HDLC levels increased none significantly (44.57±20.75 mg/dl vs. 46.05±24.3 mg/dl, respectively; p=0.086) between day 1 (within 24 hours) and day 3.

But the ratio of LDLC/HDLC was decreased none significantly as compared day 1 on MI to day 3 of MI (2.9±1.75 vs. 2.3±1.85, respectively; p=0.055).

Table (3-11): Comparison of serum lipid profiles between day 1 (within 24 hours) and day 3 in males with acute myocardial infarction.

Parameters	Within 24 h of MI	Day 3 of MI	P-Value
TC (mg/dl)	212 ± 56.68	187.5 ± 63.86	0.012
TG (mg/dl)	132.2 ± 92.7	122.68 ± 87.5	0.044
HDLC (mg/dl)	44.57 ± 20.75	46.05 ± 24.3	0.086
LDLC (mg/dl)	129.3 ± 56.6	110.1 ± 61.5	0.035
TC/HDLC	4.65 ± 2.09	3.9 ± 2.15	0.01
LDLC/HDLC	2.9 ± 1.75	2.3 ± 1.85	0.055
BMI (Kg/m^2)	27 ± 3.9	------	------
Age (years)	60 ± 11.3	------	------

TC = total cholesterol

TG = triglyceride

HDLC = high density lipoprotein cholesterol

LDLC = low density lipoprotein cholesterol

BMI = body mass index (Kg/ m^2)

This study also including ten females with acute myocardial infarction compared the change lipid profiles levels between day 1(within 24 hours) on MI and day 3 after MI using t-test as table (3-12).

From day 1 (within 24) to day 3 on acute MI for females we found, serum total cholesterol (250.2±54.4 mg/dl vs. 247.75±48.85 mg/dl, respectively; p=0.319), LDLC (174.75±56.3 mg/dl vs. 167.3±53 mg/dl, respectively; p=0.395), the ratio TC/HDLC (5.15±2.45 vs. 4.95±2.35, respectively; p=0.06) and the ratio LDLC/HDLC (3.5±2 vs. 3.5±1.9, respectively; p=0.011) decreased none significantly but triglyceride levels decreased significantly day 1 on MI to day 3 after MI (175.8±74.6 mg/dl vs. 157.6±61.4 mg/dl, respectively; p=0.03) and. HDLC increased significantly day 3 after MI as compared with day 1 on MI (49.8±17.8 mg/dl vs. 54.4±18.9 mg/dl, respectively; p=0.01).

Table (3-12): Comparison of serum lipid profiles between day 1 (within 24 hours) and day 3 in females with acute myocardial infarction.

Parameters	Within 24 h of MI	Day 3 of MI	P-Value
TC (mg/dl)	250.2 ± 45.4	247.75 ± 48.85	0.319
TG (mg/dl)	175.8 ± 74.59	157.6 ± 61.4	0.033
HDLC (mg/dl)	49.77 ± 17.8	54.39 ± 18.9	0.015
LDLC (mg/dl)	174.75 ± 56.3	167.3 ± 53	0.395
TC/HDLC	5.15 ± 2.45	4.95 ± 2.35	0.06
LDLC/HDLC	3.5 ± 2	3.5 ± 1.9	0.11
BMI (Kg/m^2)	34 ± 4.1	-------	------
Age (years)	60 ± 11.5	------	------

TC = total cholesterol

TG = triglyceride

HDLC = high density lipoprotein cholesterol

LDLC = low density lipoprotein cholesterol

BMI = body mass index (Kg/ m^2)

(3-1-4) Lipid profiles levels in the patients with diabetes mellitus and hypertension :

Also this study compared between lipid profile levels in day 1 (within 24 hours) during acute myocardial infarction and day 3 after acute myocardial infarction with regarded to the prevalence of diabetes mellitus and hypertension (risk factors for heart diseases) using t-test as in table (3-13) and (3-14).

Fifteen patient with diabetes mellitus we found that serum total cholesterol (209.1±52.5 mg/dl vs. 185.5±57.7 mg/dl, respectively; p=0.001), triglycerides (192.69±98.06 mg/dl vs. 122.99±100 mg/dl, respectively; p=0.011), LDLC (124.95±45.88 mg/dl vs. 102.7±46.8, respectively; p=0.013) and the ratio TC/HDLC (3.6±1.86 vs. 3±2, respectively; p=0.021) decreased significantly in day 1 in MI as compared day 3 after MI. HDLC increased none significantly (49.03±26.8 mg/dl vs. 55.16±29.9 mg/dl, respectively; p=0.097) day1 in MI as compared with day 3 after MI. The ratio LDLC/HDLC decreased none significantly (1.9±1.39 vs. 1.5±1.4 l, respectively; p=0.058) day1 in MI as compared with day 3 after MI.

Table (3-13): Comparison of serum lipid profiles between day 1 (within 24 hours) in acute myocardial infarction and day 3 after acute myocardial infarction in the patients with diabetes mellitus.

Serum Lipids	Within 24 h of MI	Day 3 of MI	P-Value
TC (mg/dl)	209.1 ± 52.5	185.5 ± 57.7	0.001
TG (mg/dl)	192.69 ± 98.06	122.99 ± 100	0.011
HDLC (mg/dl)	49.03 ± 26.8	55.16 ± 29.9	0.097
LDLC (mg/dl)	124.95 ± 45.88	102.7 ± 46.8	0.013
TC/HDLC	3.6 ± 1.86	3 ± 2	0.021
LDLC/HDLC	1.9 ± 1.39	1.5 ± 1.4	0.058

TC = total cholesterol

TG = triglyceride

HDLC = high density lipoprotein cholesterol

LDLC = low density lipoprotein cholesterol

Twenty seven patients with hypertension we found that serum for total cholesterol (222±59.4 mg/dl vs. 217.8±60.25 mg/dl, respectively; p=0.087), triglycerides (137.3±87.49 mg/dl vs. 134.3±86.25, respectively; p=0.195), LDLC (142.7±59.46 mg/dl vs. 116.6±59.99 mg/dl, respectively; p=0.052), ratio TC/HDLC (4.8±2.5 vs. 4±2.3, respectively; p=0.125) and ratio LDLC/HDLC (3.2±2 vs. 2.3±1.8, respectively; p=0.0726) decreased none significantly between day 1 in MI and day 3 after MI but increased serum HDLC none significantly (45.87±23.16 mg/dl vs. 46.43±24.06 mg/dl, respectively; p=0.4) day 1 on MI compared with day 3 after MI.

Table (3-14): Comparison of serum lipid profiles between day 1 (within 24 hours) in acute myocardial infarction and day 3 after acute myocardial infarction in the patients with hypertension.

Serum Lipids	Within 24 h of MI	Day 3 of MI	P-Value
TC (mg/dl)	222 ± 59.4	217.8 ± 60.25	0.087
TG (mg/dl)	137.3 ± 87.49	134.3 ± 86.25	0.195
HDLC (mg/dl)	45.87 ± 23.16	46.43 ± 24.06	0.4
LDLC (mg/dl)	142.7 ± 59.46	116.6 ± 56.99	0.052
TC/HDLC	4.8 ± 2.5	4 ± 2.3	0.125
LDLC/HDLC	3.2 ± 2	2.3 ± 1.8	0.0726

(3-2) Correlation between Lipid Profile Levels, BMI and Age in all study groups :

The correlation test done by using Excel 2003, according to the program ± (0.1-0.35) consider as weak correlation, ± (0.35-0.5) consider as correlation and ± (0.5-1) consider as strong correlation. The possible correlation between different lipid profile levels, BMI and age were investigated by the value of correlation coefficient. Results of lipid profiles shown that high positive correlation with highly significant was regarded between total cholesterol with triglycerides (0.509039), LDLC (0.89523), ratio TC/HDLC (0.745431) and ratio LDLC/HDLC (0.746936), also, high positive correlation between LDLC with ratio TC/HDLC (0.825769) and ratio LDLC/HDLC (0.894074), also, high correlation between ratios TC/HDLC with ratio LDLC/HDLC (0.969905). Strong negative correlation between HDLC with ratio TC/HDLC (-0.73348) and with ratio LDLC/HDLC (-0.69703). Positive correlation between triglycerides with ratio TC/HDLC (0.499854) and with ratio LDLC/HDLC (0.353201). Negative correlation between HDLC with LDLC (-0.458717). A weak correlate was regarded between triglycerides and LDLC (0.286098), also, negative weak correlation between total cholesterol with HDLC (-0.203186) and between triglycerides with HDLC (-0.201981).

The results of lipid profile with BMI were regarded high positive correlation BMI with total cholesterol (0.679929), triglycerides (0.535177), LDLC (0.567636), ratio TC/HDLC (0.571906) and ratio (0.533004). But negative weak correlation between BMI with HDLC (-0.173119).

The results of lipid levels with age were regarded weak correlation between age and HDLC (0.135864). Also negative weak correlation between age with BMI (-0.196166), total cholesterol (-0.224269), triglycerides (-0.234775), LDLC (-0.252085), ratio TC/HDLC (-0.27828) and ratio (-0.275804).

Table (3-15): Correlation coefficient of lipid profiles in the patients with acute myocardial infarction.

	TC	**TG**	**HDLC**	**LDLC**	**TC/HDLC**	**LDLC/HDLC**	**BMI**
TG	0.509						
HDLC	-0.203	-0.201					
LDLC	0.896	0.286	-0.458				
TC/HDLC	0.745	0.499	-0.733	0.825			
LDLC/HDLC	0.746	0.353	-0.697	0.894	0.969		
BMI	0.679	0.535	-0.173	0.567	0.571	0.533	
Age	-0.224	-0.234	0.135	-0.252	-0.278	-0.275	-0.196

TC = total cholesterol

TG = triglyceride

HDLC = high density lipoprotein cholesterol

LDLC = low density lipoprotein cholesterol

BMI = body mass index

(2-1) Chemicals :

(2-1-1) *Cholesterol (TC) :*

Cholesterol was measured by (Cholesterol enzymatic colorimetric kit CHOD-POD 200), Spinreact, S.T. ctra. Santa Coloma, Spain.

(2-1-2) *Triglycerides (TG) :*

Triglycerides were measured by (Triglycerides enzymatic colarimetric test kit GPO-PAP 120), Biomaghreb, Tunisia.

(2-1-3) *High Density Lipoprotein Cholesterol (HDL-C) :*

High density cholesterol was measured by:-

1. HDL cholesterol precipitant kit PAP 100, BioMerieux, France.
2. Cholesterol enzymatic colorimetric kit CHOD-POD 200, Spinreact, S.T. ctra. Santa Coloma, Spain.

(2-2) Instruments:

The instrument used in this study to measured cholesterol, triglycerides and high density cholesterol is done by Spectrophotometer (Cecil) No. 142-309 Spectrophotometer Company from France.

(2-3) Subject Selection :

This study conducted at the Central Laboratories Department of Biochemistry and Coronary Care Unit in Al-Yarmook Teaching Hospital. All measurements were during the period (1/3/2007 to 15/1/2008).

The present study comprised 50 patients (40 males and 10 females), admitted to coronary care unit with a confirmed diagnosis of acute myocardial infarction were enrolled in this study. The patients are diagnosed with myocardial infarction if two or three of the criteria are satisfied:

1. Clinical history of ischemic type chest pain lasting for more than 30 minutes.
2. Change in serial ECG tracings: development of abnormal Q waves, ST segment elevation more than 1 mm above baseline in at least two leads of a standard 12-lead electrocardiogram.
3. Raise and fall of serum cardiac biochemical markers (blood tests for heart muscle cell damage) such as troponin test which is very specific for the heart muscle and are though to raise before permanent injury develops.

All the information consent was obtained from all patients by direct interview according to our questionnaire in this study. Detailed clinical examination with a special questionnaire form filled for each patient includes:

Date and time of the chest pain, sex, age, ethnic, occupation, body weight and height. Type of myocardial infarction was be known according to the ECG diagnostic.

And the concomitant risk factors: smoking, diabetes mellitus, hypertension, history of artery heart diseases, family history of artery heart diseases, hypercholesterolemia.

This study excluded criteria were the following:

1. Patient had symptoms suggestive of acute myocardial infarction for more than 24 hours.
2. Hospital stays of less than 3 days.
3. The patients were receiving lipid-lowering drugs.
4. The patients who have liver or renal disorder and abnormal thyroid function.

(2-4) Serum Collection :

Blood samples of patients were taken within 24 hours (1 day) of the onset of symptoms of MI to measured level of lipid profile at acute phase and again after 48 hours later (3 day) to measured level of lipid profile at non acute phase. All samples were taken at fasting period between 9 and 11 AM from a forearm vein after venous occlusion over few second in a sitting position.

Blood was drawn into sterile, disposable plastic syringes. Then the blood allowing to clotting in test tubes. After that the serum was separated from blood cells by centrifugation at 2000 rpm for 10 minute at room temperature. Then freezing serum at -20°C will keep samples stable until assayed.

(2-5) Methods :

Lipid profiles were measured by using the following techniques:

(2-5-1) Cholesterol Enzymatic Colorimetric Test (CHOD-POD) :

(2-5-1-1) *Principle :*

The principle of the method is the cholesterol present in the sample originates a coloured complex, according to the following reaction:

$$\text{Cholesterol esters} + H_2O \xrightarrow{\text{CHE}} \text{Cholesterol} + \text{fatty acids}$$

$$\text{Cholesterol} + O_2 \xrightarrow{\text{CHOD}} \text{4-Cholestenona} + H_2O_2$$

$$2\ H_2O_2 + \text{Phenol} + \text{4-Aminophenazone} \xrightarrow{\text{POD}} \text{Quinonimine} + 4H_2O$$

The intensity of proportional to the cholesterol concentration in the sample.

(2-5-1-2) Working procedure of cholesterol :

Cholesterol was measured by (Cholesterol enzymatic colorimetric kit CHOD-POD 200), Spinreact, S.T. ctra. Santa Coloma, Spain.

(2-5-2) Triglycerides Enzymatic Colorimetric test (GPO-PAP) :

(2-5-2-1) *Principle :*

The triglycerides are enzymatically hydrolyzed to glycerol according to the following reactions:

$$\text{Triglycerides} \xrightarrow{\text{Lipoprotein Lipase}} \text{Glycerol + Fatty acids}$$

$$\text{Glycerol + ATP} \xrightarrow{\text{Glycerolkinase, } Mg^{++}} \text{Glycerol-3-phosphate + ADP}$$

$$\text{Glycerol 3-p + } O_2 \xrightarrow[\text{Oxidase}]{\text{Glycerol Phosphate}} \text{Dihydroxyacetone-p + } H_2O_2$$

$$\text{H2O2 + 4-aminophenazone + p-chloropheno} \xrightarrow{\text{Peroxydase}} \text{H2O + Quinonimine}$$

(2-5-2-2) Working procedure of triglycerides :

Triglycerides was measured by (Triglycerides enzymatic colarimetric test kit GPO-PAP 120), Biomaghreb, Tunisia.

(2-5-3) High Density Lipoprotein Cholesterol Precipitant (HDLC Pre) :

(2-5-3-1) *Principle :*

Chylomicrons, very low density lipoproteins (VLDL) and low density lipoproteins (LDL) contained in the specimen are precipitated by the addition of phosphotungstic acid in the presence of magnesium ions.

The supernatant obtained after centrifugation contains high density lipoproteins (HDL). The cholesterol bound to the HDL is determined using the cholesterol enzymatic colorimetric (CHOD-POD).

(2-5-3-2) Working procedure of HDLC :

High density cholesterol was measured by (HDL cholesterol precipitant kit PAP 100), BioMerieux, France and Cholesterol enzymatic colorimetric kit CHOD-POD 200), Spinreact, S.T. ctra. Santa Coloma, Spain.

(2-5-4) Working Procedure of LDLC :

Low density lipoprotein cholesterol was estimated by Friedewald formula (19):

LDL cholesterol = total cholesterol – (triglyceride/5 + HDL cholesterol)

(2-6) Determination of cholesterol and triglycerides in Enzymatic Colorimeteric :

This method was used to measured (cholesterol and triglycerides). Numbering sufficient coated tubes (blank, standards and serum samples).

1. Preparation of working reagent : The contents of one vial R_2 enzymes (cholesterol esterase (CHE), cholesterol oxides (CHOD), peroxidase (POD) and 4-Aminophenazone (4-AP)) was dissolved in one bottle of R_1 buffer (pipes PH 6.9 and phenol).
2. Assay conditions :
   Wave length (505 nm)
   Cuvatte (1 cm) light path
3. (10 µl) from standards and serum samples were pipette into tubes.

4. (1ml) from working reagent was added into blank, standards and serum samples.
5. The mixture was mixed for 10 minutes at room temperature.
6. The absorbance (A) of the standards and serum samples were read against blank.

   The reading will be completed within approximately 60 minutes.

(2-7) General Procedure of High Density Lipoprotein Cholesterol :

This procedure includes two steps. The first one include the separation of high density lipoprotein cholesterol by precipitation and the second step include measured the absorbance.

(2-7-1) Step (1) :

In HDL Cholesterol Precipitant (C-HDL pre) :

This method was used to separation of high density lipoprotein for determination of cholesterol bound to this fraction:

1. (50µl) of precipitating reagent was added to (500µl) of serum samples.
2. Wait 10 minutes at 20-25˚C.
3. Then the mixture was separated by centrifuge for 10 minutes.
4. After centrifugation the separation obtained contains high density lipoprotein cholesterol.

(2-7-2) Step (2) :

Enzymatic Calorimeteric (CHOD-POD) :

This method was used to determine the cholesterol bound to the high density cholesterol in clear supernatant result from step (1):

Numbering sufficient coated tubes (blank, standards and supernatant).

1. Preparation of working reagent: The contents of one vial R_2 enzymes (cholesterol esterase (CHE), cholesterol oxidase (CHOD), peroxidase (POD) and 4-Aminophenazone (4-AP) was dissolved in one bottle of R_1 buffer (pipes PH 6.9 and phenol).
2. Assay condition :
   Wave length (500 nm)
   Cuvette (1 cm) light path
3. (50 µl) of standards and supernatant were Pipette in tubes.
4. (1ml) working reagent was added into blank, standards and supernatant.
5. The mixture was mixed for 10 minutes at room temperature.
6. The absorbance (A) of the standards and supernatant were read against blank.

The reading will be completed within approximately 60 minutes.

(2-8) Calculation :

The concentration of cholesterol, triglycerides and high density lipoprotein cholesterol were calculated by use the following equation:

$$\text{Cholesterol conc. (mg/dl)} = \frac{\text{(A) sample}}{\text{(A) standard}} \times 200 \text{ (standard conc.)}$$

$$\text{Triglycerides conc. (mg/dl)} = \frac{\text{(A) sample}}{\text{(A)standard}} \times 200 \text{ (standard conc.)}$$

$$\text{HDL cholesterol conc. (mg/dl)} = \frac{\text{(A) sample}}{\text{(A)standard}} \times 55.341 \text{(standard conc.)}$$

(2-9) Statistical Analysis :

Continuous variables were expressed as the mean ± SD, and the category variables were expressed as a percentage. The student's t-test was used to compare lipid values and ratios between day 1 (within 24 hour) of myocardial infarction and day 4 (within 48 hour) of myocardial infarction. ANOVA-test to compare the different between groups and correlation regression, taking p value < 0.05 was considered to be significant.

P value < 0.05 was regarded as statistically significant.

All the statistical analysis was performed using computer software the SPSS 12.01 statistical package for social sciences and also Excel 2003. Data analysis was done using chi-square test for tables with frequencies.

(1-1) Introduction :

In the early 1960 s researchers identified high blood cholesterol, or hypercholesterolemia, along with smoking and high blood pressure as principal risk factors for cardiovascular disease. They understood that a high fat, high cholesterol diet tends to raise blood cholesterol, and that high blood cholesterol levels promote atherosclerosis. Atherosclerosis leads to artery disease and often causes heart attacks.

Recently, the cholesterol-heart disease picture has become more complicated. Total cholesterol levels do not tell the entire story. The levels of LDL and HDL cholesterol predict health risks more accurately than total cholesterol levels do. High LDL cholesterol levels are a greater risk than high total cholesterol, with some kinds of LDL being more dangerous than others. Low HDL cholesterol levels increase the risk of heart disease, as do high levels of triglycerides and other newly discovered blood lipid.

(1-2) Myocardial Infarction :

The World Health Report, (2004) defined acute myocardial infarction (**AMI** or **MI**), commonly known as a heart attack, is a disease state that occurs when the blood supply to a part of the heart is interrupted. The resulting ischemia or oxygen shortage causes damage and potential death of heart tissue (1).

Acute myocardial infarction is a type of acute coronary syndrome, which is most frequently (but not always) a manifestation of coronary artery disease. The most common triggering event is the disruption of an atherosclerotic plaque in an epicardial coronary artery, which leads to a

clotting cascade, sometimes resulting in total occlusion of the artery as in (Fig. 1-1).

Atherosclerosis is the gradual buildup of cholesterol and fibrous tissue in plaques in the wall of arteries (in this case, the coronary arteries), typically over decades. Blood stream column irregularities visible on angiographies reflect artery lumen narrowing as a result of decades of advancing atherosclerosis. Plaques can become unstable, rupture, and additionally promote a thrombus (blood clot) that occludes the artery; this can occur in minutes. When a severe enough plaque rupture occurs in the coronary vasculature, it leads to myocardial infarction (necrosis of downstream myocardium) (2) as in (Fig. 1-2).

If impaired blood flow to the heart lasts long enough, it triggers a process called the ischemic cascade; the heart cells die (chiefly through necrosis) and do not grow back. A collagen scar forms in its place. Recent studies indicate that another form of cell death called apoptosis also plays a role in the process of tissue damage subsequent to myocardial infarction (3).

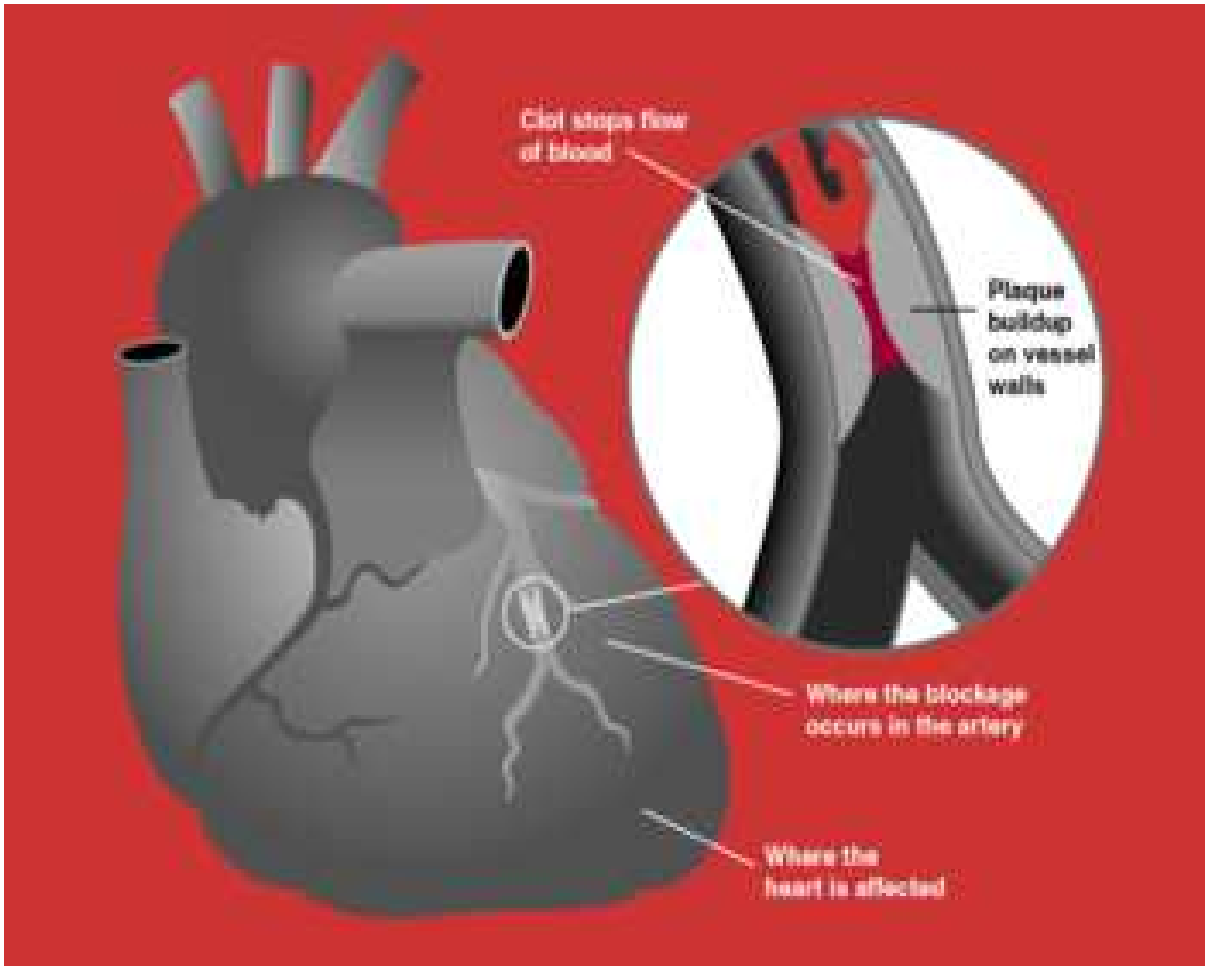

Figure (1-1): A myocardial infarction occurs when an atherosclerotic plaque slowly builds up in the inner lining of a coronary artery and then suddenly ruptures, totally occluding the artery and preventing blood flow downstream (2).

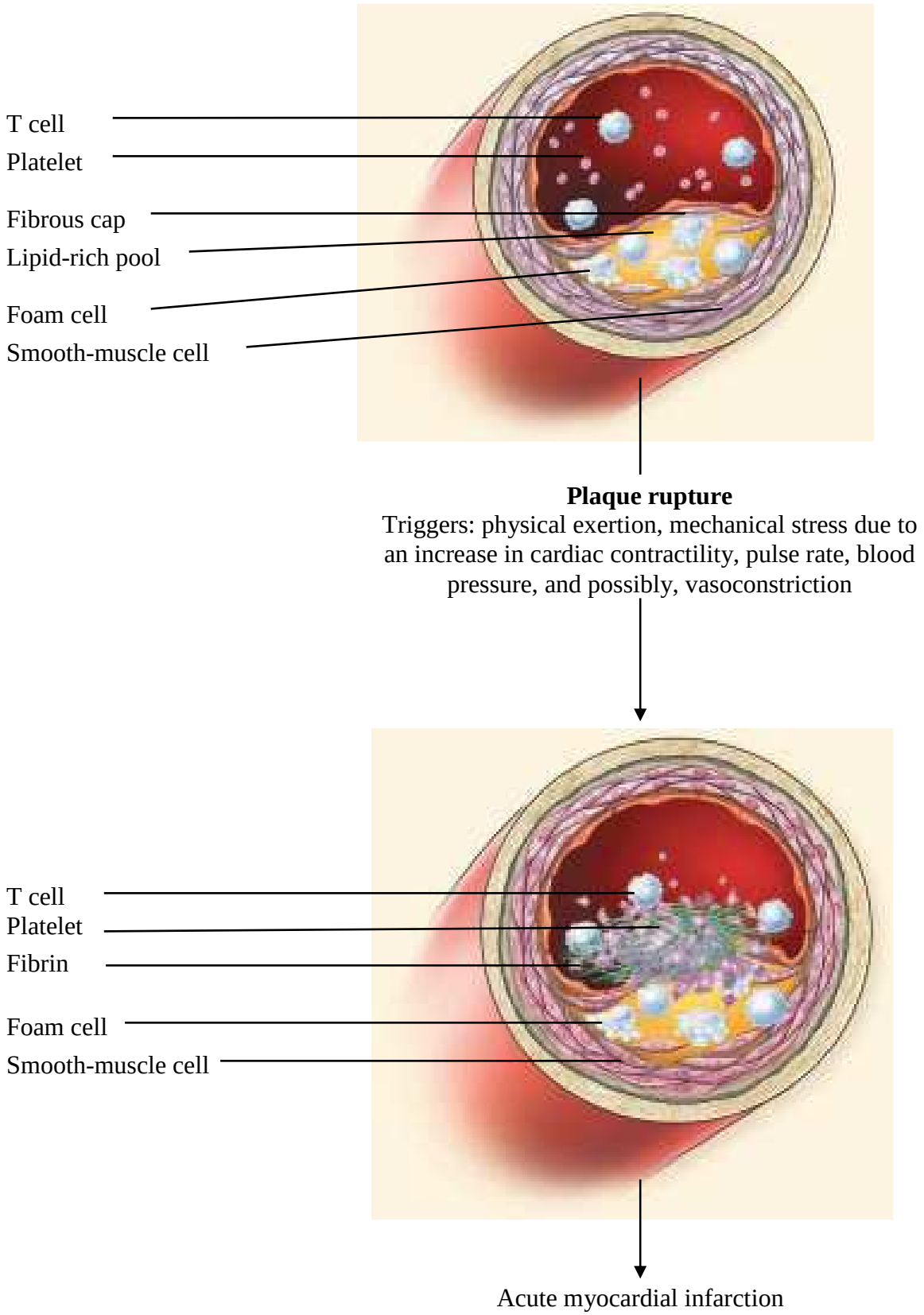

Figure (1-2): Pathophysiologic Events Culminating in the Clinical Syndrome of myocardial infarction (53).

(1-3) Classification :

Depending on the location of the obstruction in the coronary circulation, different zones of the heart can become injured. Using the anatomical terms of location, one can describe anterior, inferior, lateral, apical and septal infarctions (and combinations, such as anteroinferior, anterolateral, and so on) (4). For example, an occlusion of the left anterior descending coronary artery will result in an anterior wall myocardial infarct (5).

(1-4) Risk Factors :

Many people have multiple risk factors and that these factors exponentially increase the risk for CAD. An assessment of the Framingham and Multiple Risk Factor Intervention Trial data showed that approximately 85% of excess risk for premature CAD is due to one or more of the following major risk factors (6):

(1-4-1)Older Age :

The plaques in the arterial walls of patients with atherosclerosis contain large amounts of cholesterol. The higher level of LDL cholesterol, the greater risk of atherosclerotic heart disease; conversely, the higher HDL cholesterol, the lower the risk of coronary heart disease (CHD).

This is true in men and women, in different racial and ethnic groups, and at all ages up to age 75 years. Because most cholesterol in serum is LDL, high total cholesterol levels are also associated with an increased risk of CHD.

Middle-aged men whose serum cholesterol levels are in the highest quintile for age (above about 230 mg/dL) have a risk of coronary death

before age 65 years of about 10%; men in the lowest quintile (below about 170 mg/dL) have a 3% risk. Death from CHD before age 65 years is less common in women, with equivalent risks one-third those of men. In men, each 10-mg/dL increase in cholesterol (or LDL cholesterol) increases the risk of CHD by about 10%; each 5-mg/dL increase in HDL reduces the risk by about 10%. The effect of HDL cholesterol is greater in women, whereas the effects of total and LDL cholesterol are smaller. All of these relationships diminish with age (7).

Risk increases with age in both men and women. The natural distribution of risk factors, particularly in women, changes dramatically after age 50 years (30).

(1-4-2) Smoking :

Cigarette smoking is a powerful risk factor, especially for myocardial infarction. It accelerates development of coronary plaques and may lead to rupture of plaques, and it is especially dangerous in patients with advanced coronary atherosclerosis.

(1-4-3) Hypertension :

Hypertension is an independent risk factor for CVD in both women and men, and risk increases continuously as blood pressure rises from levels which are within normal range. For every 20 mmHg systolic or 10 mmHg diastolic increase in BP there is a doubling of CVD mortality (28). Systolic blood pressure >130 mm Hg or diastolic blood pressure >85 mm Hg independently accelerates atherogenesis, and the risk of CAD increases as blood pressure increases (6).

(1-4-4) Diabetes Mellitus :

Although diabetes mellitus is usually recognized as a major risk factor for coronary heart disease (CHD) morbidity and mortality, in several studies it has not been found responsible as a single factor (8).

(1-4-5) Obesity :

(Defined by a body mass index of more than 30 kg/m^2, or alternatively by waist circumference or waist-hip ratio) Mortality from cardiovascular disease is almost 50% higher in obese patients than in those of average weight and is 90% higher in those with severe obesity.

BMI is calculated by dividing weight (in kilograms) by square height (in meters)

(1-4-6) Family History of Premature CVD(MI) :

Family history of an early heart attack (before 50 years in men and 55 years in women), which is thought of as reflecting a genetic predisposition. Atherosclerosis and CAD are often the result of a complex interaction between genes and the environment (9).

There is a suggestion that a positive family history of CVD is a stronger risk factor for women than it is for men (28). Parental history of MI < 60 years is a particularly strong risk factor for women (29).

(1-4-7) hypercholesterolemia (high blood cholesterol):

Hypercholesterolemia is the presence of high levels of cholesterol in the blood. It is not a disease but a metabolic derangement that can be secondary to many diseases and can contribute to many forms of disease, most notably cardiovascular disease. It is closely related to the terms "hyperlipidemia" (elevated levels of lipids) and "hyperlipoproteinemia" (elevated levels of lipoproteins) (12).

Conditions with elevated concentrations of oxidized LDL particles, especially small LDL particles, are associated with atheroma formation in the walls of arteries, a condition known as atherosclerosis, which is the principal cause of coronary heart disease and other forms of cardiovascular disease. In contrast, HDL particles (especially large HDL) have been identified as a mechanism by which cholesterol and inflammatory mediators can be removed from atheroma. Increased concentrations of HDL correlate with lower rates of atheroma progressions and even regression (17).

Reducing cholesterol levels in healthy middle-aged men without CHD (primary prevention) reduces their risk in proportion to the reduction in LDL cholesterol and the increase in HDL cholesterol. Treated patients have statistically significant and clinically important reductions in the rates of myocardial infarctions (7).

Cholesterol concentration in the blood of males is generally higher than that in premenopasal females. After menopause, however, the cholesterol concentration is higher in females than in males. Serum cholesterol levels in males seem to reach a plateau by 50 to 60 years of age (19).

The mean biochemical markers in this study are lipid profile because the elevated level of lipid profile leads to hypercholesterolemia. Longstanding elevated hypercholesterolemia leads to accelerated atherosclerosis; this can express itself in a number of cardiovascular diseases especially myocardial infarction.

(1-5) Lipid Profile :

A lipid profile is a group of blood tests that tells how your body uses, changes, or stores lipids and often ordered together to determine risk of coronary heart disease.

Lipids are cannot dissolve in blood. Lipids stick on proteins in the blood and are called lipoproteins. The amount of lipoproteins in the blood can change with what you eat. The amount can also change because of some illnesses and because of heredity (10).

The digestive tract is not the only place where lipids special handling to more in a water-based environment. To travel in the bloodstream, lipid must be specially packaged into lipoprotein carriers.

Lipoproteins have a lipid core of triglycerides and cholesterol esters (cholesterol linked to fatty acids) surrounded by a sell of phospholipids with embedded proteins and cholesterol. They can carry water-insoluble lipids through the watery environment of the bloodstream. There are several main classes of lipoprotein and many subclasses. These differ mainly by size, density and the composition of their lipid cores. In general, as the percentage of triglyceride drops, the density increases. A lipoprotein will a small core that contains little triglyceride is much more dense than a lipoprotein with a large core composed mostly of triglycerides.

The lipid profile includes total cholesterol, HDL-cholesterol (often called good cholesterol), LDL-cholesterol (often called bad cholesterol), and triglycerides. Sometimes the report will include additional calculated values such as the Cholesterol/HDL ratio or a risk score based on lipid profile results, age, sex, and other risk factors.

The lipid profile is used to guide providers in deciding how a person at risk should be treated. The results of the lipid profile are considered along with other known risk factors of heart disease to develop a plan of treatment and follow-up (13).

A lipid profile measures total cholesterol, HDL cholesterol, LDL cholesterol, and triglycerides. A physician may order a lipid profile as part of an annual exam or if there is specific concern about CVD, especially coronary artery disease.

The National Cholesterol Education Program recommends that individuals age twenty and over have a fasting lipoprotein profile every five years. A lipid profile should be done after a nine- to twelve-hour fast without food, liquids, or medication. If fasting is not possible, the values for total cholesterol and HDL-C may still be useful. If total cholesterol is 200 milligrams per deciliter (mg/dl) or higher or HDL-C is less than 40 mg/dl, the individual will need to have a follow-up lipoprotein profile done to determine LDL-C and triglyceride levels (11).

(1-5-1) Cholesterol :

Cholesterol as shown in figure (1-3) is a sterol (a combination steroid and alcohol), a lipid found in the cell membranes of all body tissues, and is transported in the blood plasma of all animals. Trace amounts of cholesterol are also found in plant membranes.

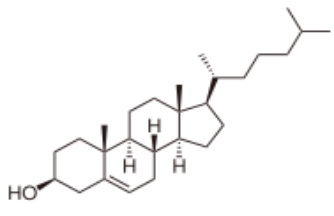

Figure (1-3): cholesterol Structure (14).

Cholesterol is minimally soluble in water; it cannot dissolve and travel in the water-based bloodstream. Instead, it is transported in the bloodstream by lipoproteins - protein "molecular-suitcases" that are water-soluble and carry cholesterol and triglycerides internally. The apolipoproteins forming the surface of the given lipoprotein particle determine from what cells cholesterol will be removed and to where it will be supplied.

Most of the cholesterol is synthesized by the body and some has dietary origin. Cholesterol is more abundant in tissues which either synthesize more or have more abundant densely-packed membranes, for example, the liver, spinal cord, brain, and atheromata (arterial plaques). Cholesterol plays a central role in many biochemical processes, but is best known for the association of cardiovascular disease with various lipoprotein cholesterol transport patterns and high levels of cholesterol in the blood.

In recent years, the term "bad cholesterol" has been used to refer to cholesterol contained in LDL (low-density lipoprotein) which, according to the lipid hypothesis, is thought to have harmful actions, and "good

cholesterol" to refer to cholesterol contained in HDL (high-density lipoprotein), thought to have beneficial actions (14).

(1-5-1-1) Food Sources :

Cholesterol is found in animal fats: all food containing animal fats contains cholesterol; food not containing animal fats either contains no cholesterol or negligible amounts. Major dietary sources of cholesterol include eggs, beef and poultry (31).

Plants have trace amounts of cholesterol, so even a vegan diet, which includes no animal foods, has traces of cholesterol. However, the amounts are very small. For example, to ingest the amount of cholesterol in one egg, one would need to drink about 9.6 liters (19.57 pounds) of pure peanut oil (32).

Plant products (e.g. flax seed, peanut), also contain cholesterol-like compounds, phytosterols, which are suggested to help lower serum cholesterol (33).

(1-5-1-2) Function :

Cholesterol is required to build and maintain cell membranes; it regulates membrane fluidity over a wider range of temperatures. The hydroxyl group on cholesterol interacts with the phosphate head of the membrane, while the bulky steroid and the hydrocarbon chain is embedded in the membrane. Some research indicates that cholesterol may act as an antioxidant.

Cholesterol also aids in the manufacture of bile (which is stored in the gallbladder and helps digest fats), and is also important for the

metabolism of fat soluble vitamins, including vitamins A, D, E and K. It is the major precursor for the synthesis of vitamin D and of the various steroid hormones (which include cortisol and aldosterone in the adrenal glands, and the sex hormones progesterone, the various estrogens, testosterone, and derivatives) (15).

Recently, cholesterol has also been implicated in cell signalling processes, where it has been suggested that it forms lipid rafts in the plasma membrane. It also reduces the permeability of the plasma membrane to hydrogen ions (protons) and sodium ions.

Cholesterol is required in the membrane of mammalian cells for normal cellular function, and is either synthesized in the endoplasmic reticulum, or derived from the diet, in which case it is delivered by the bloodstream in low-density lipoproteins. These are taken into the cell by receptor-mediated endocytosis in clathrin-coated pits, and then hydrolysed in lysosomes (16).

(1-5-2)Triglycerides :

Triglycerides are the major form of fat found in nature and their primary function is to provide energy for the cell. The human body stores large amount of fatty acids in ester linkages with glycerol in the adipose tissue. This form of reserve energy storage is high efficient because of the magnitude of the energy released when fatty acids undergo catabolism. Most of the fatty acids come from our diets, can be synthesized endogenously, and are called nonessential fatty acids. There are three fatty acids (linoleic, linolenic and arachidonic acids) that cannot be made by the human body. These fatty acids are called essential fatty acid and

are important for proper growth and development of cells, cell membrane integrity and myelinization of the central nervous system.

(1-5-2-1) Triglyceride structure :

Most fatty acids in food and in the body exist as part of a triglyceride molecule. A triglyceride consists of three fatty acids attached to a glycerol back bone. Alone, glycerol is a thick, smooth liquid often used by the food industry.

Two fatty acid attached to a glycerol form a diglyceride. A monoglyceride has one fatty acid attached to glycerol. Our foods contain relatively small amount of monoglycerides and diglycerides, mostly as food additives used for their emulsifying or blending qualities.

(1-5-2-2) Function :

Triglycerides are by far the most abundant subclass of neutral glycerides in nuture. Mammalian tissues also contain some diglycerides and monoglyceridees, but these occur in trace level when compared with triglycerides. Most triglyceride molecules in mammalian tissues are mixed glycerides.

Because of their water insolubility, triglycerides are transported in the plasma in combination with other more polar lipids (phospholipids) and proteins, as well as with cholesterol and cholesteryl ester, in the complex lipoprotein macromolecules. It appears that the essentially nonpolar triglycerides (and cholesteryl ester) are largely in the center of the lipoprotein, whereas the more polar protein and phospholipid components are at the surface, with their polar groups directed outward to stabilize the whole structure in the aqueous plasma environment (19).

(1-5-2-3) Role in disease :

In the human body, high levels of triglycerides in the bloodstream have been linked to atherosclerosis, and, by extension, the risk of heart disease and stroke. However, the negative impact of raised levels of triglycerides is lower than that of LDL: HDL ratios. The risk can be partly accounted for by a strong inverse relationship between triglyceride level and HDL-cholesterol level (37).

(1-5-3) High Density Lipoprotein :

High-density lipoproteins (HDL) form a class of lipoproteins, varying somewhat in their size (8–11 nm in diameter), that carry cholesterol from the body's tissues to the liver. About thirty percent of blood cholesterol is carried by HDL.

It is hypothesised that HDL can remove cholesterol from atheroma within arteries and transport it back to the liver for excretion or re-utilization which is the main reason why HDL-bound cholesterol is sometimes called "good cholesterol", or HDL-C.

A high level of HDL-C seems to protect against cardiovascular diseases, and low HDL cholesterol levels (less than 40 mg/dL) increase the risk for heart disease. When measuring cholesterol, any contained in HDL particles is considered as protection to the body's cardiovascular health, in contrast to "bad" LDL cholesterol (18).

(1-5-3-1) Function :

The HDL macromolecular complex contains approximately 50% protein and 50% lipid (19). HDL are the smallest of the lipoproteins. They are the densest because they contain the highest proportion of protein. They contain the A class of apolipoproteins (20).

The liver synthesizes these lipoproteins as complexes of apolipoproteins and phospholipid, which resemble cholesterol-free flattened spherical lipoprotein particles. They are capable of picking up cholesterol, carried internally, from cells they interact with. A plasma enzyme called lecithin-cholesterol acyltransferase (LCAT) converts the free cholesterol into cholesteryl ester (a more hydrophobic form of cholesterol) which is then sequestered into the core of the lipoprotein particle eventually making the newly synthesized HDL spherical. They increase in size as they circulate through the bloodstream and incorporate more cholesterol molecules into their structure. Thus it is the concentration of large HDL particles which more accurately reflects protective action, as opposed to the concentration of total HDL particles (21).

Men tend to have noticeably lower HDL levels, with smaller size and lower cholesterol content, than women. Men also have an increased incidence of atherosclerotic heart disease (22).

Epidemiological studies have shown that high concentrations of HDL (over 60 mg/dL) have protective value against cardiovascular diseases such as ischemic stroke and myocardial infarction. Low concentrations of HDL (below 40 mg/dL for men, below 50 mg/dL for women) are a positive risk factor for these atherosclerotic diseases.

Data from the landmark Framingham Heart Study showed that for a given level of LDL, the risk of heart disease increases 10-fold as the HDL varies from high to low. Conversely, for a fixed level of HDL, the risk increases 3-fold as LDL varies from low to high (23).

(1-5-4) Low Density Lipoprotein :

Low-density lipoprotein (LDL) belongs to the lipoprotein particle family. Its size is approx. 22 nm but since LDL particles contain a changing number of fatty acids they actually have a mass and size distribution. Each native LDL particle contains a single apolipoprotein B-100 molecule (Apo B-100, a protein with 4536 amino acid residues) that circles the fatty acids keeping them soluble in the aquous environment. LDL is commonly referred to as bad cholesterol as high LDL levels can lead to cardiovascular disease (24).

LDL particles actually vary in size and density, and studies have shown that a pattern that has more small dense LDL particles called "Pattern B" equates to a higher risk factor for coronary heart disease (CHD) than does a pattern with more of the larger and less dense LDL particles ("Pattern A"). This is because the smaller particles are more easily able to penetrate the endothelium. "Pattern I", meaning "intermediate", indicates that most LDL particles are very close in size to the normal gaps in the endothelium (26 nm) (25).

When a cell requires cholesterol, it synthesises the necessary LDL receptors, and inserts them into the plasma membrane. The LDL receptors diffuse freely until they associate with clathrin coated pits. LDL particles in the blood stream bind to these extracellular LDL receptors.

The clathrin coated pits then form vesicles which are endocytosed into the cell.

After the clathrin coat is shed the vesicles deliver the LDL and their receptors to early endosomes, onto late endosomes to lysosomes. Here the cholesterol esters in the LDL are hydrolysed. The LDL receptors are recycled back to the plasma membrane.

(1-5-4-1) Function :

Generally, LDL transports cholesterol and triglycerides from the liver and small intestine to cells and tissues which are taking up cholesterol and triglycerides (26).

(1-5-4-2) Role in Disease :

Because LDLs transport cholesterol to the arteries and can be retained there by arterial proteoglycans starting the formation of plaques, increased levels are associated with atherosclerosis, and thus heart attack, stroke and peripheral vascular disease. This is why cholesterol inside LDL lipoproteins is called bad cholesterol. Still, it is not the cholesterol that is bad; it is instead how and where it is being transported, and in what amounts over time.

Increasing evidence has revealed that the concentration and size of the LDL particles more powerfully relates to the degree of atherosclerosis progression than the concentration of cholesterol contained within all the LDL particles. The healthiest pattern, though relatively rare, is to have small numbers of large LDL particles and no small particles. Having small LDL particles, though common, is an unhealthy pattern; high concentrations of small LDL particles (even though potentially carrying

the same total cholesterol content as a low concentration of large particles) correlates with much faster growth of atheroma, progression of atherosclerosis and earlier and more severe cardiovascular disease events and death.

LDL poses a risk for cardiovascular disease when it invades the endothelium and becomes oxidized since the oxidized form is more easily retained by the proteoglycans. A complex set of biochemical reactions regulates the oxidation of LDL, chiefly stimulated by presence of free radicals in the endothelium (27).

(1-6) Lipid Profile Metabolism :

Lipid metabolism is divided into two pathways exogenous and endogenous:

(1-6-1) Exogenous Pathway:

Dietary triglyceride and cholesterol are absorbed in the intestinal mucosa and incorporated to form the core of nascent chylomicrons, which are then transported to plasma (Fig. 1-3). In peripheral tissues, chylomicrons interact with lipoprotein lipase, which removes most of the coretriglyceride from the lipoprotein particle. The resulting glycerol and fatty acids are taken up by adipose and other tissues, re-formed into triglyceride, and stored. Redundant surface material (apolipoprotein C, phospholipids, and cholesteryl ester) joins the HDL particle. The remnant chylomicron particles, which are now smaller and enriched in their core with cholesteryl ester and some remaining triglyceride, are taken up by the liver. This dietary cholesterol can then be used for bile acid formation,

incorporated into membranes, resecreted back into the circulation as lipoprotein cholesterol, or excreted into bile as cholesterol.

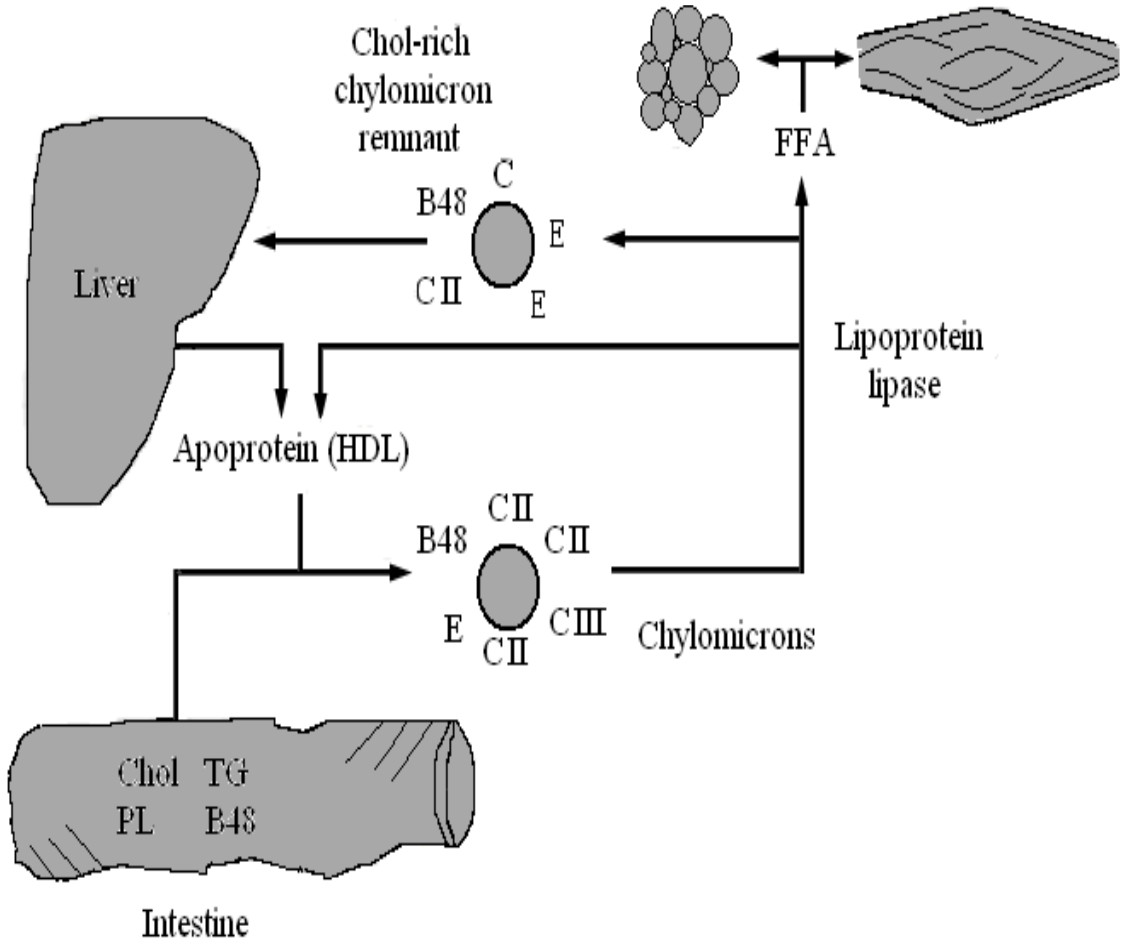

Figure (1-4): Transport of exogenously derived lipids from the intestine to the peripheral tissues and liver. FFA = free fatty acids; HDL = high-density Lipoproteins; PL = phospholipase; TG = triglycerides (6).

(1-6-2) Endogenous Pathway :

Triglycerides and cholesterol are also synthesized in the liver. This endogenous system, which conveys these lipids from the liver to peripheral tissues and back to the liver, is divided into two subsystems: the apo B-100 lipoprotein system (VLDL-C, IDL-C, and LDL-C) and the apo A-I lipoprotein system (HDL-C).

(1-6-2-1) Apo B-100 Lipoprotein System:

In the liver, triglycerides and cholesterol are packaged with apo B-100 and phospholipids to form VLDL (Fig. 1-4). Once released into plasma, VLDL undergoes triglyceride removal by means of lipoprotein lipase; the resulting cholesteryl ester-rich remnants are the IDL. Unlike the chylomicron remnants, IDL can be converted by further triglyceride removal to even smaller and denser LDL. During this process, the lipoprotein loses all its surface apolipoproteins except apo B-100.

(1-6-2-2) Apo A-I Lipoprotein System:

HDL, rich in apo A-I, transports cholesterol from peripheral tissues to the liver (Fig. 1-5). Cholesterol-poor HDL3 particles first form in plasma from coalescence of phospholipid-apolipoprotein complexes. Free cholesterol then transfers from cell membranes to HDL3, where it converts into cholesteryl ester and enters the HDL core. The HDL3 can then accept more free cholesterol and become the larger, more cholesterol-rich HDL2 particle. HDL2 is then metabolized by one of two main pathways:

Transfer to apo B lipoproteins (which are subsequently removed by the liver) by means of cholesteryl ester transfer protein or direct hepatic metabolism with removal of the HDL2 apoproteins from plasma.

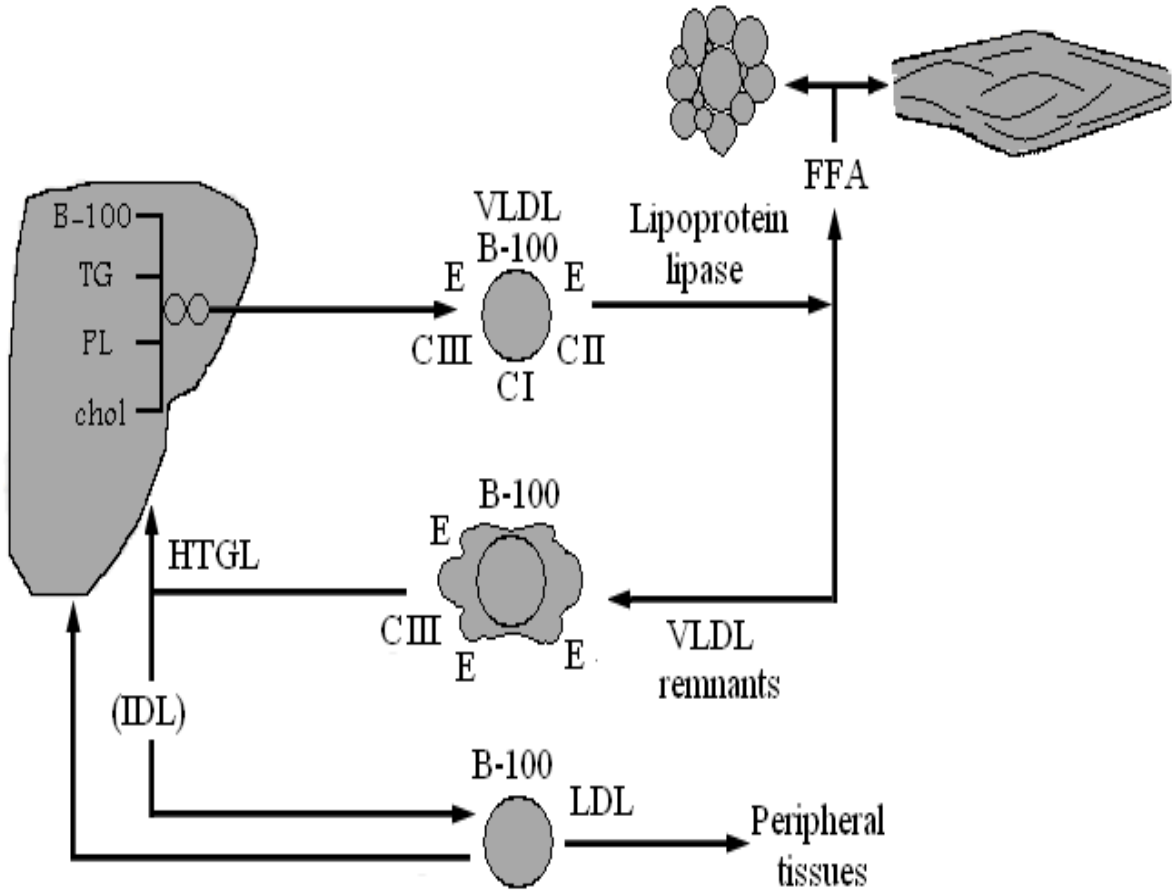

Figure (1-5): Transport of endogenous hepatic lipids by means of very low- density lipoproteins (VLDL), intermediate-density lipoproteins (IDL), and low-density lipoproteins (LDL). HTGL = hepatic triglyceride lipase. For explanations of other abbreviations, see Figure (1-4) legend (6).

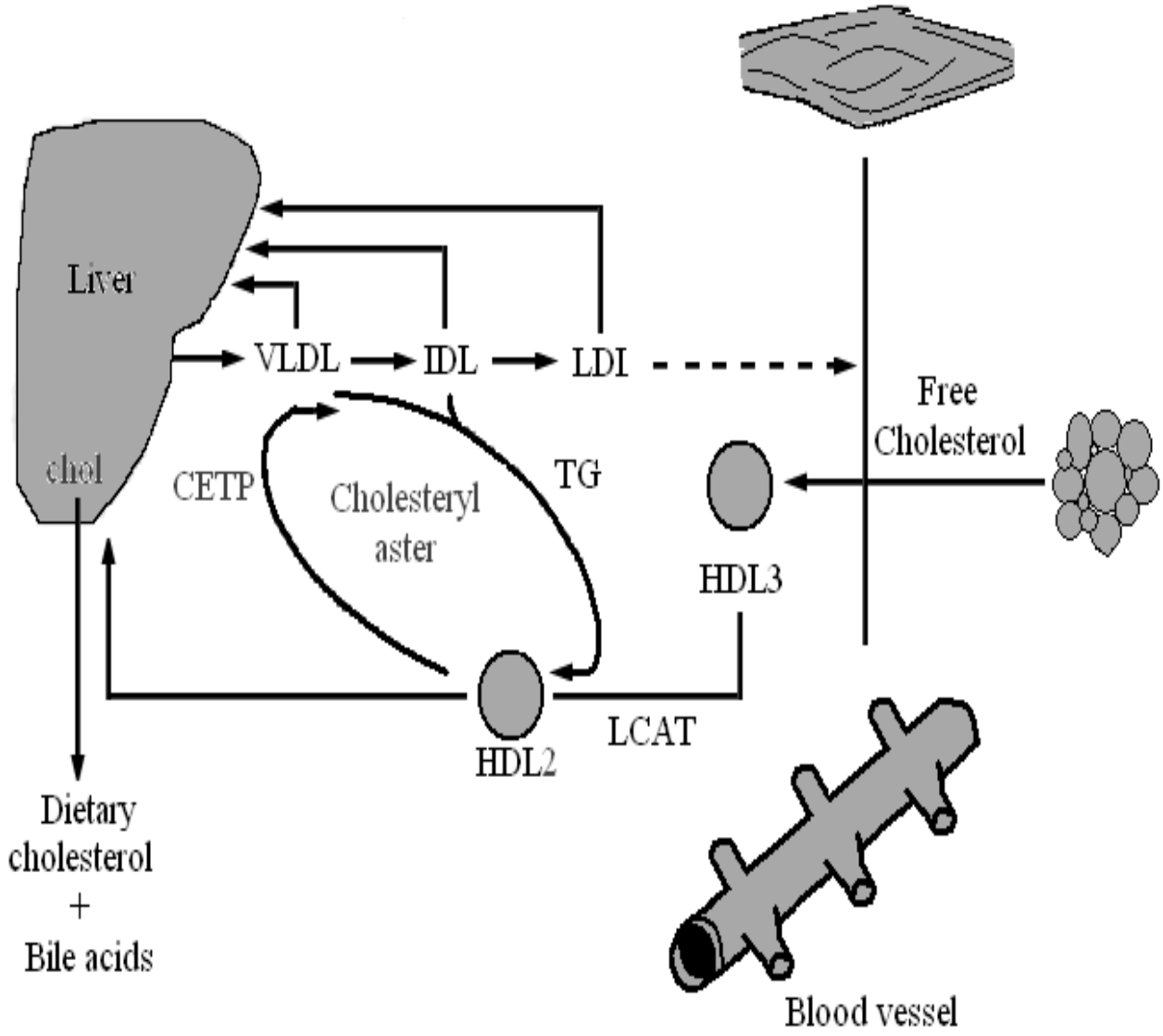

Figure (1-6): High-density lipoprotein metabolism and the role of high density lipoproteins in reverse cholesterol transport. CETP = cholesterol ester transfer protein; LCAT = lecithin: cholesterol acyltransferase. For explanations of other abbreviations, see Figure (1-4) and (1-5) legends (6).

(1-7) Physical Activity and Nutrition Therapy :

In May 2001, the NCEP released new guidelines for reducing heart disease risk. Changes from earlier guidelines include :

1. Treating high cholesterol more aggressively in people with diabetes.
2. Testing all adults over age 20 for cholesterol levels every five years.
3. Defining low HDL as being less than 40 mg/dl, rather than the earlier value of 35 mg/dl.
4. Intensifying the use of nutrition, physically activity and weight control in the treatment of elevated blood cholesterol.
5. Identifying a metabolic syndrome of risk factors linked to insulin resistance that often occur together and dramatically increase risk of heart attack.
6. Treating people with elevated triglycerides more aggressively.

Dietary cholesterol elevates serum cholesterol. Dietary therapy, weight reduction and increased physical activity should be initiated when these limits are exceeded in order to minimize the development of CHD (35).

Most studies of the effect of cholesterol lowering have distinguished between primary and secondary prevention. The important distinction is that primary prevention trials enroll healthy subjects who have relatively low rates of coronary disease but in whom other causes of morbidity and mortality are proportionately more common. Secondary prevention trials, on the other hand, follow patients who have a high rate of subsequent coronary disease; other causes of mortality are relatively less important (7).

Physical activity tends to lower serum total cholesterol, LDL cholesterol and triglycerides. Much of this effect depends on the type, intensity duration and frequency of physical activity. Physical activity also can lower blood pressure, reduce insulin resistance and reduce stress. In addition, physical inactivity further enhances the risk for CHD by impairing cardiovascular fitness and coronary blood flow (35).

American Heart Association recommend diet and lifestyle modification as the first line of defense against abnormal blood lipids. These recommendations include a diet low in total fat, saturated fat, and cholesterol; a diet high in fiber; increased intake of plant sterols (e.g., margarines and salad dressings made with soybean sterols). Both plant sterols and viscous fiber found in fruits and vegetables (36).

Diets containing 2 to 4 g of fish oils (omega-3 fatty acids) per day primarily for hypertriglyceridemia. Fish oils seem to lower triglycerides more than cholesterol (6).

Evidence is accumulating that eating more carbohydrates - especially simpler, more refined carbohydrates - increases levels of triglycerides in the blood, lowers HDL, and may shift the LDL particle distribution pattern into unhealthy atherogenic patterns. Thus a low fat diet, which often means a higher carbohydrate intake, may actually be an unhealthy change (34).

Although obesity is commonly regarded as an important contributor to the development of hypertriglyceridemia, it is well established that as the percentage of individuals with obesity increases with age, so do blood cholesterol concentrations. Approximately 30% of American adults can be considered obese. It is estimated that over 65 million American adults are obese, and the problem is acute for American children.

Weight reduction therapy for overweight or obese patients will enhance lowering of LDL cholesterol levels and will provide other health benefits, including modifying other lipid and non lipid risk factors. The current ATP III guidelines recommend that diet be focused on a balanced energy intake and expenditure to maintain desirable body weight and to prevent weight gain. Additional risk reduction can be achieved by simultaneously increasing physical activity (35).

(1-8) Lipid-Lowering Drug Therapy :

Experts who developed the ATP III guidelines recommend targeting high LDL levels. The optimal LDL level is <100 mg/dl; >190 mg/dl is considered very high. Oxidized LDLs impair endothelial-dependent vasodilation, induce apoptosis of endothelial cells, generate an inflammatory response, inhibit nitric oxide activity on platelets, and modify the functional response of vascular smooth muscle.

ATP III guidelines are congruent with the American Diabetes Association guidelines that advocate decreasing LDL levels and, secondly, increasing HDL levels. The target for HDL levels has not yet been identified. Low HDL levels are associated with increasing obesity, metabolic syndrome, and diabetes mellitus(Susan B. Fowler, Marty Kelly, Donna Ruh and Deborah Johnson-Wells, 2006) (38).

Multiple human trials utilizing HMG-CoA reductase inhibitors, known as statins, have repeatedly confirmed that changing lipoprotein transport patterns from unhealthy to healthier patterns significantly lowers cardiovascular disease event rates, even for people with cholesterol

values currently considered low for adults; however, no statistically significant mortality benefit has been derived to date by lowering cholesterol using medications in asymptomatic people, i.e., no heart disease, no history of heart attack, etc.

Cholesterol-lowering drugs works to lower LDL by reducing cholesterol synthesis and by binding bile acids in the small intestines. However, there are possible side effects to these drugs that patients should be aware of.

Current lipid-lowering drugs include nicotinic acid(niacin), bile acid sequestrants (resins), hydroxymethylglutaryl- coenzyme A reductase inhibitors (statins), and fibric acid derivatives (fibrates). When drug therapy is prescribed, the physician and patient should establish each patient's lipid goal together, and treatment should be tailored to achieve that goal.

(1-8-1) Statins :

Five general categories of medications are available for the treatment of lipid disorders [Atorvastatin (Lipitor), Fluvastatin (Lescol), Lovastatin (Mevacor), Pravastatin (Pravachol), Rosuvastatin (Crestor), Simvastatin (Zocor)]. Statins are cholesterol-lowering drugs that work by stimulating hepatic lipoprotein A-1 expression and weakly inhibiting the cholesterylester transfer protein (CETP), which changes HDLs to LDLs (Toth, 2004) (39). People with low HDL levels benefit most from statins. Statins may also decrease stroke risk by lowering systolic and diastolic blood pressures (Amarenco, Labreuche, Lavallee and Touboul, 2004) (40).

The first statin developed was lovastatin (Mevacor); six statins are presently marketed in the United States. There are two types of statins: fermentation-derived natural statins, (e.g., lovastatin) or synthetic statins (e.g., atorvastatin and fluvastatin). The naturally derived statins have shown the greatest benefit in decreasing stroke and CAD incidence.

Numerous studies and meta-analyses have concluded that cholesterol-lowering medications reduce stroke risk for patients with known CAD and normal or elevated cholesterol levels but not for patients with a history of stroke or transient ischemic attack (TIA, Futterman and Lemberg, 2004, Lockman, Tribaston, Kinght and Franko 2005) (41). The American Stroke Association Stroke Council (2004, p. 1023) has stated that, "given early benefits in trials of acute coronary syndromes, statin initiation during hospitalization for first ischemic stroke of atherosclerotic origin is probably justified and may increase rates of long-term use".

Individuals who take statins for long periods of time are most at risk for complications. All statins have the potential to cause muscle problems, but based on clinical trials, muscle symptoms attributed to statins are rare (Moran, 2004) (42). The mechanism by which statins cause muscle problems remains unknown, although a number of theories have been proposed (Thompson, Clarkson and karas, 2003) (43). A lower cholesterol level within the muscles may lead to muscle instability. Statins may block small proteins that help maintain the stability of the muscle cell membrane. It also is postulated that there may be a decrease in a compound involved in mitochondrial transport. Use of more than one statin at a time is not recommended because of the increased risk of muscle problems (Moran, 2004) (42).

The spectrum of muscle complaints ranges from myalgia to rhabdomyolysis, with or without elevations in creatine kinase (CK; Moran, 2004) (42). This panel should be repeated 6–12 weeks after initiation of statin therapy, 6 months later, and periodically afterwards. Most statins pass through the liver, and a rise in liver enzymes may suggest the need to lower the dosage or discontinue use of the medication. Statin-induced rhabdomyolysis occurred in 0.1%– 0.5% of patients treated with statins during randomized clinical trials (Graham et al., 2004) (44). Byproducts of muscle tissue are excreted in the urine and can lead to renal failure. Rhabdomyolysis usually occurs with concomitant use of such drugs as erythromycin and azithromycin (45). Combination therapy of statins and fibrates increases patient risk for rhabdomyolysis, especially in elderly patients and patients with diabetes (Gramham et al., 2004) (44).

(1-8-2) Nicotinic Acid :

Niacin (vitamin B3) has been shown to decrease triglyceride levels while increasing HDLs by blocking its hepatic uptake and catabolism (Wittert, 2004) (45). Side effects include flushing, which decreases with duration of use and is often treated with unbuffered aspirin. Niacin initially decreases free fatty acids, but after its effect subsides, the level of free fatty acids rises and impairs the ability of glucose to stimulate uptake and suppress glucose production. As a result, blood sugar levels can rise transiently (Miller, 2003) (46). If niacin is taken at bedtime with food, the likelihood of gastrointestinal disturbances is reduced. Extended-release niacin can be easier to tolerate and is available by prescription. Advicor is

a combination of extended-release niacin and lovastatin; it is available with incrementally increasing doses of niacin (Bryan, 2004) (47).

(1-8-3)Fibrates :

Fibrate therapy benefits those with high triglyceride and low HDL levels and is the first line of defense for patients with these abnormalities (Moon and Kashyap, 2004; Toth 2004) (48) (39). Commonly used fibrates include gemfibrozil and fenofibrate. Fibrates stimulate hepatic apolipoprotein A-1 expression and lipoprotein lipase activity. If LDL levels increase with use of fibrates, adding a statin may be beneficial. No clinical trial to date has investigated the combined use of fibrates and statins, although it is an option for high-risk patients. However, combined use requires regular monitoring of liver function and CK due to the increased risk of adverse effects (Wierzbicki et al., 2003; Wittert, 2004) (49) (45). Fibrates should be taken in the morning and statins at night to minimize peak-dose interactions.

(1-8-4) Resins or Bile-Acid Sequestrants :

Resins, or bile-acid sequestrants, decrease reabsorption of bile in the intestine, leading to increased secretion in stool. The liver responds by increasing the clearance of LDLs from plasma so new bile acids can be formed. Resins do not have an impact on triglycerides but can lower LDL levels with a possible effect of increasing HDLs. The best-tolerated resin is colesevelam, because it works in the gut rather than systemically (Wittert, 2004) (45).

(1-8-5) Cholesterol-Absorption Inhibitors :

The newest class of cholesterol-lowering agents is cholesterol-absorption inhibitors, which are used primarily as an add-on medication to statins (Wittert, 2004) (45). Ezetimibe (Zetia) was released in 2002; it was demonstrated to affect LDL, triglyceride, and HDL levels alone or in combination with a statin McDonald, 2003) (50). Ezetimibe enhances the beneficial pleiotropic effects of statins and is also available in a combination drug (Futterman and Lemberg, 2004) (38).

Aim of the Study :

1. Study the effect of acute myocardial infarction on levels of total cholesterol, triglyceride, high density cholesterol, low density cholesterol, ratios total cholesterol/HDLC and LDLC/HDLC at acute phase.

2. Comparing the levels of total cholesterol, triglyceride, high density cholesterol, low density cholesterol, ratios total cholesterol/HDLC and LDLC/HDLC at 24 hours on acute myocardial infarction with day 3 after acute myocardial infarction.

3. Comparing the levels of total cholesterol, triglyceride, high density cholesterol, low density cholesterol, ratios total cholesterol/HDLC and LDLC/HDLC at 24 hours on acute myocardial infarction with day 3 after acute myocardial infarction according to pathologic levels (lower, borderline and higher) levels of risk factors for heart diseases.

4. Study the effect of acute myocardial infarction on levels total cholesterol, triglyceride, high density cholesterol, low density cholesterol, ratios total cholesterol/HDLC and LDLC/HDLC day 1 (within 24 hours) on acute myocardial infarction as comparing with day 3 after acute myocardial infarction for males and females.

Figure (1-2): Pathophysiologic Events Culminating in the Clinical Syndrome of

5. Comparing the levels of total cholesterol, triglyceride, high density cholesterol, low density cholesterol, ratios total cholesterol/HDLC and LDLC/HDLC at 24 hours on acute myocardial infarction with day 3 after acute myocardial infarction for the patients with diabetes mellitus and hypertension that consider risk factors for heart diseases and secondary cause of lipid abnormalities.

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الإهداء

إلى مصباح الهدى و سفينة النجاة

نبي الرحمة محمد (صلى الله عليه و سلم).

إلى من أرضعتني محبة الله و الناس

إلى من وضعت تحت أقدامها الجنة ..... أمي

إلى قدوتي و رافد منهل علمي ..... أبي

الى من وضعوا الابتسامة على وجهي

إلى شركائي في أفراحي وأحزاني ..... أختي و أخوتي

اهدي هذا المشروع

الخلاصة

المقدمة :

إن زيادة نسبة الدهون في الدم تشخص بواسطة ارتفاع تركيز الدهون في الدم. الدهون الأساسية الموجودة في مصل الدم و التي تعد الأكثر أهمية هي الكوليستيرول و الترايجليسيرايد. زيادة نسبة الدهون في الدم ترتبط إلى حد بعيد مع زيادة نسبة البروتينات الناقلة للدهون في الدم التي تشخص بواسطة ارتفاع تركيز البروتينات الناقلة للدهون في الدم.

إن زيادة نسبة الدهون في الدم لا تعد مرض وإنما هو خلل في النظام الايضي للدهون داخل الجسم و الذي يعتبر سبب ثانوي للعديد من الأمراض و قد يسهم أيضا في تكوين العيد من الأمراض، و بالأخص أمراض الشرايين القلبية من ضمنها مرض احتشاء العضلة القلبية (الجلطة القلبية، و هي حالة مرضية تحدث عند عدم وصول الدم إلى جزء من عضلة القلب. ينتج عن ذلك نقص في كمية الأوكسجين في ذلك الجزء يتسبب في حدوث ضرر في ذلك الجزء و ممكن موت خلايا القلب في الجزء المتضرر).

تهدف الدراسة إلى :

١. دراسة تأثير احتشاء العضلة القلبية الحاد على مستوى الكوليستيرول ، الترايجليسيرايد ، البروتين الناقل عالي الكثافة ، البروتين الناقل قليل الكثافة ، النسبة بين الكوليستيرول/ البروتين الناقل عالي الكثافة و النسبة بين البروتين الناقل قليل الكثافة/ البروتين الناقل عالي الكثافة.

٢. مقارنة مستوى الكوليستيرول, الترايجليسيرايد , البروتين الناقل عالي الكثافة, البروتين الناقل قليل الكثافة, النسبة بين الكوليستيرول/ البروتين الناقل عالي الكثافة و النسبة بين البروتين الناقل قليل الكثافة/ البروتين الناقل عالي الكثافة خلال ٢٤ ساعة من حدوث الجلطة القلبية الحادة مع اليوم الثالث بعد حدوث الجلطة القلبية الحادة.

٣. مقارنة مستوى الكوليستيرول , الترايجليسيرايد ، البروتين الناقل عالي الكثافة , البروتين الناقل قليل الكثافة, النسبة بين الكوليستيرول/ البروتين الناقل عالي الكثافة و النسبة بين البروتين الناقل قليل الكثافة/ البروتين الناقل عالي الكثافة خلال ٢٤ ساعة من حدوث الجلطة القلبية الحادة مع اليوم الثالث بعد حدوث الجلطة القلبية الحادة حسب مستوى الخطر للدهون (قليل، متوسط و عالي) بالنسبة إلى مستوى الخطر لإمراض القلب.

٤. دراسة تأثير احتشاء العضلة القلبية الحاد على مستوى الكوليستيرول, الترايجليسيرايد , البروتين الناقل عالي الكثافة, البروتين الناقل قليل الكثافة, النسبة بين الكوليستيرول/ البروتين الناقل عالي الكثافة و النسبة بين البروتين الناقل قليل الكثافة/ البروتين الناقل عالي الكثافة خلال ٢٤ ساعة من حدوث الجلطة القلبية الحادة مع اليوم الثالث بعد حدوث الجلطة القلبية الحادة لكل من الرجال و النساء على حدة.

٥. مقارنة مستوى الكوليستيرول , الترايجليسيرايد, البروتين الناقل عالي الكثافة, البروتين الناقل قليل الكثافة, النسبة بين الكوليستيرول/ البروتين الناقل عالي الكثافة و النسبة بين البروتين الناقل قليل الكثافة/ البروتين الناقل عالي الكثافة خلال ٢٤ ساعة من حدوث الجلطة القلبية الحادة مع اليوم الثالث بعد حدوث الجلطة القلبية الحادة للمرضى الذين يعانون من الأمراض المزمنة الضغط و السكر لمعرفة تأثير هذه الأمراض على مستوى الدهون.

الطرق والمرضى :

الدراسة صممت لتحري التغيرات التي تحدث في مستويات الدهون عند مجموعة من المرضى الذين يعانون من احتشاء عضلة القلب الحاد و تشمل الدراسة مجموعة من الرجال و الذين تتراوح أعمارهم بين ٣٥- ٨٣ سنة و مجموعة من النساء واللاتي تتراوح أعمارهن بين ٥٤-٨٢ سنة.

ضمت الدراسة ٥٠ مريض من الذين يدخلون إلى المستشفى يعانون من احتشاء عضلة القلب الحاد. وتمت دراسة التغيرات في مستوى الكوليستيرول, الترايجليسيرايد, البروتين الناقل عالي الكثافة, البروتين الناقل قليل الكثافة , النسبة بين الكوليستيرول/ البروتين الناقل عالي الكثافة و النسبة بين البروتين الناقل قليل الكثافة/ البروتين الناقل عالي الكثافة خلال ٢٤ ساعة من حدوث الجلطة القلبية الحادة مع اليوم الثالث بعد حدوث الجلطة القلبية الحادة. تم مقارنة مستوى مصل الدهون بين ٢٤ ساعة الأولى من حدوث الجلطة القلبية الحادة مع اليوم الثالث بعد حدوث الجلطة القلبية الحادة. القياسات تمت في المختبرات المركزي في مستشفى اليرموك التعليمي. حيث تم قياس كل من الكوليستيرول و الترايجليسيرايد بواسطة التفاعل الأنزيمي

(enzymatic colorimetric) باستخدام Spectrophotometer بينما البروتين الناقل عالي الكثافة تم قياسه بطريقة الترسيب, هذه القياسات تمت خلال الفترة من ٢٠٠٧/٣/١ إلى ٢٠٠٨/١/٥١ .

هذه الدراسة شملت المرضى الذين يعانون من احتشاء عضلة القلب الحاد واستثنت المرضى الذين يعانون من أمراض الكبد , الكلى, خلل في مستوى هرمونات الغدة الدرقية والمرضى الذين يعانون من أعراض احتشاء عضلة القلب الحاد لأكثر من ٢٤ ساعة والمرضى الذين تكون فترة بقائهم في المستشفى اقل من ٣ أيام بالإضافة إلى المرضى الذين يتناولون أدوية لعلاج نسبة الدهون في الجسم.

النتائج :

مصول الكوليستيرول, الترايجليسيرايد, البروتين الناقل قليل الكثافة , النسبة بين الكوليستيرول/ البروتين الناقل عالي الكثافة و النسبة بين البروتين الناقل قليل الكثافة/ البروتين الناقل عالي أظهرت قيمة الاحتمالية اقل من (P<٠،٠٥) خلال ٢٤ ساعة من حدوث الجلطة القلبية الحادة مقارنة مع اليوم الثالث بعد حدوث الجلطة القلبية الحادة. البروتين الناقل عالي الكثافة اظهر الاحتمالية P=٠،٠٥٢ .

النتائج عند حسب مستوى الخطر للدهون أظهرت الكوليستيرول, الترايجليسيرايد, البروتين الناقل قليل الكثافة و النسبة بين الكوليستيرول/ البروتين الناقل عالي الكثافة نقصان في الاحتمالية من (P<٠،٠٥) خلال ٢٤ ساعة من حدوث الجلطة القلبية الحادة مقارنة مع اليوم الثالث بعد حدوث الجلطة القلبية فقط عند المستوى الأعلى للخطر بالنسبة إلى أمراض القلب.

ولكن أظهرت قيمة الاحتمالية عالية(P>٠،٠٥) خلال ٢٤ ساعة من حدوث الجلطة القلبية الحادة مقارنة مع اليوم الثالث بعد حدوث الجلطة القلبية عند مستوى الخطر الأقل و المتوسط بالنسبة لإمراض القلب. البروتين الناقل عالي الكثافة اظهر زيادة بالاحتمالية (P=٠،٠٣) فقط عند مستوى الخطر المتوسط بالنسبة لإمراض القلب. النسبة بين الكوليستيرول/ البروتين الناقل عالي الكثافة اظهر نقصان في الاحتمالية خلال ٢٤ ساعة من حدوث الجلطة القلبية الحادة مقارنة مع اليوم الثالث بعد حدوث الجلطة القلبية عند مستوى الخطر المتوسط بالنسبة لإمراض القلب (P٠،٠٣٩) و عند مستوى الخطر العالي بالنسبة لإمراض القلب(P=٠،٠٠٨).

النتائج لمجموعة من الرجال أظهرت قيمة الاحتمالية اقل من (P<٠،٠٥)بالنسبة إلى الكوليستيرول, الترايجليسيرايد, البروتين الناقل قليل الكثافة و النسبة بين الكوليستيرول/ البروتين الناقل عالي الكثافة خلال ٢٤ ساعة من حدوث الجلطة القلبية الحادة مقارنة مع اليوم الثالث بعد حدوث الجلطة القلبية. البروتين الناقل عالي الكثافة و النسبة بين البروتين الناقل قليل الكثافة/ البروتين الناقل عالي أظهرت الاحتمالية عالية(P>٠،٠٥).

النتائج لمجموعة من النساء أظهرت أن الكوليستيرول, البروتين الناقل قليل الكثافة , النسبة بين الكوليستيرول/ البروتين الناقل عالي الكثافة و النسبة بين البروتين الناقل قليل الكثافة/ البروتين الناقل عالي الاحتمالية أعلى من(P>٠،٠٥) خلال ٢٤ ساعة من حدوث الجلطة القلبية الحادة مقارنة مع اليوم الثالث بعد حدوث الجلطة القلبية. الترايجليسيرايد اظهر زيادة بالاحتمالية أعلى من (P=٠،٠٣٣) خلال ٢٤ ساعة من حدوث الجلطة القلبية الحادة مقارنة مع اليوم الثالث بعد حدوث الجلطة القلبية و لكن البروتين الناقل عالي الكثافة اظهر نقصان بالاحتمالية

اقل من (P=٠،٠١٥) خلال ٢٤ ساعة من حدوث الجلطة القلبية الحادة مقارنة مع اليوم الثالث بعد حدوث الجلطة القلبية. أظهرت الدراسة إن مستوى الدهون للنساء أعلى من الرجال.

النتائج لمجموعة من المرضى الذين يعانون من مرض السكر بالإضافة إلى الجلطة القلبية الحادة إن تقل اقل من (P<٠،٠٥) بالنسبة إلى الكوليستيرول, الترايجليسيرايد, البروتين الناقل قليل الكثافة و النسبة بين الكوليستيرول/ البروتين الناقل عالي خلال ٢٤ ساعة من حدوث الجلطة القلبية الحادة مقارنة مع اليوم الثالث بعد حدوث الجلطة القلبية. البروتين الناقل عالي اظهر زيادة بالاحتمالية اعلي من(P>٠،٠٥). النسبة بين البروتين الناقل قليل الكثافة/ البروتين الناقل اظهر الاحتمالية أعلى من(P=٠،٠٥٨).

النتائج لمجموعة من المرضى الذين يعانون من مرض الضغط بالإضافة إلى الجلطة القلبية الحادة أظهرت أن الاحتمالية أعلى من(P>٠،٠٥) لكل من الكوليستيرول, الترايجليسيرايد, البروتين الناقل عالي الكثافة, البروتين الناقل قليل الكثافة , النسبة بين الكوليستيرول/ البروتين الناقل عالي الكثافة و النسبة بين البروتين الناقل قليل الكثافة/ البروتين الناقل عالي الكثافة خلال ٢٤ ساعة من حدوث الجلطة القلبية الحادة مقارنة مع اليوم الثالث بعد حدوث الجلطة القلبية الحادة.

وجد إن هناك علاقة موجبة قوية بين الكوليستيرول و الترايجليسيرايد , البروتين الناقل قليل الكثافة , النسبة بين الكوليستيرول/ البروتين الناقل عالي الكثافة و النسبة بين البروتين الناقل قليل الكثافة/ البروتين الناقل عالي الكثافة أيضا علاقة موجبة قوية بين البروتين الناقل قليل

الكثافة و النسبة بين الكوليستيرول/ البروتين الناقل عالي الكثافة و النسبة بين البروتين الناقل قليل الكثافة/ البروتين الناقل عالي الكثافة . كما وجد بان هنالك علاقة سلبية قوية بين البروتين الناقل عالي الكثافة و النسبة بين الكوليستيرول/ البروتين الناقل عالي الكثافة و النسبة بين البروتين الناقل قليل الكثافة/ البروتين الناقل عالي الكثافة. و كذلك علاقة موجبة بين الترايجليسيرايد و النسبة بين الكوليستيرول/ البروتين الناقل عالي الكثافة و النسبة بين البروتين الناقل قليل الكثافة/ البروتين الناقل عالي الكثافة. كما وجد علاقة سلبية بين البروتين الناقل عالي الكثافة و البروتين الناقل قليل الكثافة.

كما أظهرت الدراسة إن هنالك علاقة موجبة قوية بين معامل كتلة الجسم و الكوليستيرول , الترايجليسيرايد, البروتين الناقل قليل الكثافة و الكوليستيرول/ البروتين الناقل عالي الكثافة ولكن علاقة سلبية ضعيفة بين معامل كتلة الجسم و البروتين الناقل عالي الكثافة.

كما أظهرت إن هنالك علاقة ضعيفة بين العمر و البروتين الناقل عالي الكثافة. كذلك هنالك علاقة سلبية ضعيفة بين العمر و معامل كتلة الجسم, الكوليستيرول , الترايجليسيرايد, البروتين الناقل قليل الكثافة, النسبة بين الكوليستيرول/ البروتين الناقل عالي الكثافة و النسبة بين البروتين الناقل قليل الكثافة/ البروتين الناقل عالي الكثافة.

الاستنتاجات:

١. في هذه الدراسة وجد إن احتشاء عضلة القلب الحاد يؤثر على مستوى الكوليستيرول , الترايجليسيرايد, البروتين الناقل قليل الكثافة, النسبة بين الكوليستيرول/ البروتين الناقل عالي الكثافة و النسبة بين البروتين الناقل قليل الكثافة/ البروتين الناقل عالي الكثافة فقط البروتين

الناقل عالي الكثافة لا يتأثر ولاكته يبقى في معرفة نسبة الخطر للمرضى الذين يعانون من احتشاء عضلة القلب الحاد.

٢. في هذه الدراسة وجد إن احتشاء عضلة القلب الحاد يؤثر على مستوى الدهون فقط عند أعلى قيمة خطر بالنسبة لأمراض القلب فقط البروتين الناقل عالي الكثافة لا يتأثر عند أعلى قيمة خطر بالنسبة لأمراض القلب ولكنه يتأثر عند القيمة الخطر الوسطى بالنسبة لأمراض القلب.

٣. هذه الدراسة برهنت إن ارتفاع مستوى الدهون يزيد من خطر أمراض القلب فقط البروتين الناقل عالي الكثافة عند أعلى مستوى يعتبر وقاية للجسم ضد أمراض القلب.

٤. في هذه الدراسة وجد إن مستوى الدهون للنساء أعلى من مستوى الدهون عند الرجال.

٥. هذه الدراسة برهنت إن احتشاء عضلة القلب الحاد يحدث عند الرجال أكثر من حدوثها عند النساء.

٦. في هذه الدراسة وجد إن احتشاء عضلة القلب الحاد يؤثر على مستوى الدهون بالنسبة للمرضى الذين يعانون من مرض السكر و عدم تأثيرها على المرضى الذين يعانون من مرض الضغط.

٧. هذه الدراسة لوحظ إن المرضى الذين يعانون من مرض السكر ومرض الضغط يزداد مستوى الكوليستيرول , الترايجليسيرايد, البروتين الناقل قليل الكثافة, النسبة بين الكوليستيرول/ البروتين الناقل عالي الكثافة و النسبة بين البروتين الناقل قليل الكثافة/ البروتين الناقل عالي الكثافة بينما يقل مستوى البروتين الناقل عالي الكثافة.

Republic Of Iraq
The Ministry Of Higher Education
And Scientific Research
Al-Nahrain University
College Of Science
Department Of Chemistry

A Study of Serum Lipid Profile in Iraqi patients with Acute Myocardial Infarction

A Thesis

Submitted to the College of Science

Of Al-Nahrain University

In Partial Fulfillment of the Requirements

for the degree of Master of Science

in

Biochemistry

By

Media Noori Ibraheem

B.Sc. in Chemistry (Al-Nahrain University 2005)

May 2008 **Rabeea Al - Thani 1429**

جمهورية العراق
وزارة التعليم العالـــي والبحث العلمـــي
جامعة النهرين \ كلية العلـوم
قسم الكيمياء

دراسة التغيرات الكيميائية للدهون لمرضى الاحتشاء الحاد لعضلة القلب

رسالة مقدمة إلى
كلية العلوم جامعة النهرين
كاستكمال جزئي لمتطلبات نيل درجة ماجستير
علوم في الكيمياء الحياتية

من قبل

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ربيع الثاني ١٤٢٩ أيار ٢٠٠٨

بسم الله الرحمن الرحيم

قالوا سبحانك لا علم لنا
الا ما علمتنا انك انت
العزيز الحكيم

صدق الله العظيم

سورة البقرة
الاية ٣٢

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في الكيمياء الحياتية

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Committee certification

We, the examining committee, certify that we have read this thesis and have examined the student ***Media Noori Ibraheem*** in its content, and that in our opinion it is adequate with ( ) standing as a thesis for the degree of ***Master of Science in Biochemistry.***

Chairman

Signature:

Name:

Date: / / 2008

Member

Signature:

Name:

Date: / / 2008

Member

Signature:

Name:

Date: / / 2008

Member (supervisor)

Signature:

Name: **Assist. Prof. Dr. Salman A. Ahmad**

Date: / / 2008

Approved for the council of the College of Science.

Signature:

Name: **Assist. Prof. Dr. Laith Abdul Aziz Al-Ani**

Dean of the College of Science

Date: / / 2008

Supervision Certification

I certify that this thesis was prepared under my supervision at the College of science in a partial fulfillment of the requirements for the degree of ***Master of Science in Biochemistry***.

Signature:
Name: ***Assist. Prof. Dr. Salman A. Ahmad***
Date: / / 2008

In view of the available recommendation, it forwards this thesis for debate by the examining committee.

Signature:
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List of Abbreviations:

4-AP	:	4-Aminophenazone
BMI	:	Body mass index
CAD	:	Coronary artery disease
CETP	:	cholesterol ester transfer protein
CHE	:	Cholesterol esterase
CHOD	:	Cholesterol oxidase
CHD	:	Coronary heart disease
CK	:	Creatine Kinase
CVD	:	cardiovascular disease
dl	:	deciliter
D.M	:	diabetes mellitus
FFA	:	Free fatty acids
HDLC	:	High density lipoprotein cholesterol
HMG-CoA	:	3-hydroxy-3-methylglutary-CoA
H.T	:	hypertension
IDLC	:	Intermediate density lipoprotein cholesterol
LCAT	:	lecithin cholesterol acyltransferase
LDLC	:	Low density lipoprotein cholesterol
mg	:	milligram
MI	:	myocardial infarction
PL	:	phospholipase
POD	:	Peroxidase
TC	:	Total cholesterol
TG	:	Triglyceride
VLDLC	:	Very low density lipoprotein cholesterol

شكر و تقدير

الحمد لله الأول بلا أول كان قبله ، والأخر بلا أخر يكون بعده ، الذي قصرت عن رؤيته أبصار الناظرين ، و عجزت عن نعمه أوهام الواصفين و الحمد لله الذي لا يبلغ مدحه القائلون ولا يحسب نعمه العادون ولا يؤدي حقه المجتهدون حمدا يكون لحقه قضاء و لشكره رداء .

أتقدم أنا طالبة المشروع بالشكر و التقدير إلى الأستاذ الفاضل المشرف على المشروع دكتور سلمان علي احمد لما أبداه من تشجيع وتوجيه و أرشاد طوال هذه فترة.

كما أتقدم بجزيل الشكر و الامتنان إلى رئيس و كادر قسم الكيمياء , كلية العلوم , جامعة النهرين على كل ما قدم إلى من مساعدة طوال سنوات الدراسة.

كما أدين بجزيل الشكر إلى كادر المختبرات المركزية في مستشفى اليرموك التعليمي لما قدمه لي من مساعدة .