Chapter 2: Stage A Heart Failure: Dyslipidemia

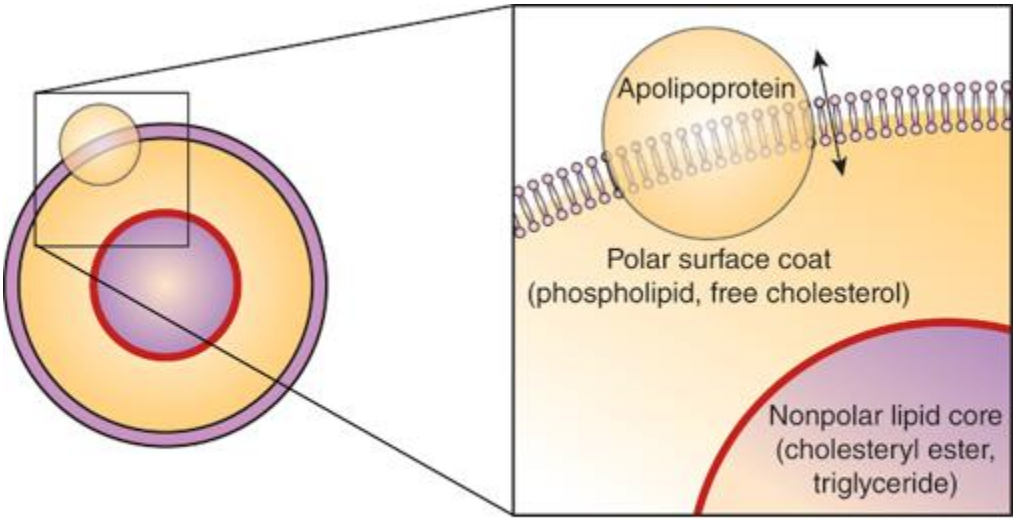
PATHOPHYSIOLOGY

Along with proteins and carbohydrates, lipids play an integral role in maintaining cell function and sustaining life. Lipids are a family of water-insoluble organic compounds that includes fats, oils, sterols, and triglycerides. Cholesterols and phospholipids are the building blocks for the cell wall and the plasma membrane, respectively. Triglycerides are made of fatty acids, which can be utilized for energy production.

Given that the human body is primarily aqueous and lipids are water-insoluble, lipids are transported via a unique lipoprotein family. This consists of a water-soluble outer coat with nonpolar lipid coat. Apolipoproteins are proteins that help in this transport system (Figure 2-1).

Figure 2-1

Apolipoprotein on lipid surface membrane.



Source: R. R. Baliga, William T. Abraham:
Color Atlas and Synopsis of Heart Failure

Briefly, there are two major sources for lipids in the body: diet and hepatic production. The chylomicrons deliver lipids from dietary fat to the plasma, and the very low-density lipoproteins (VLDLs) transport lipids from the hepatic production of lipids to the body (Figure 2-2). Lipoprotein lipase breaks down the VLDL to low-density lipoprotein (LDL), which is internalized by the cells to provide fatty acid for cell function and energy (Figure 2-3). Cholesteryl ester transfer protein (CETP) permits exchange of triglycerides and cholesteryl esters from VLDL to high-density lipoprotein (HDL), allowing for reverse cholesterol transport via the HDL system (Figure 2-4).

Figure 2-2

Lipid subtypes. The circles indicate the relative size of these lipid particles. Abbreviations: CM: chylomicrons; FA, fatty acids; HDL: high-density lipoprotein; LDL: low-density lipoprotein; LPL: lipoprotein lipase; TG: triglycerides; VLDL; very low-density lipoprotein.

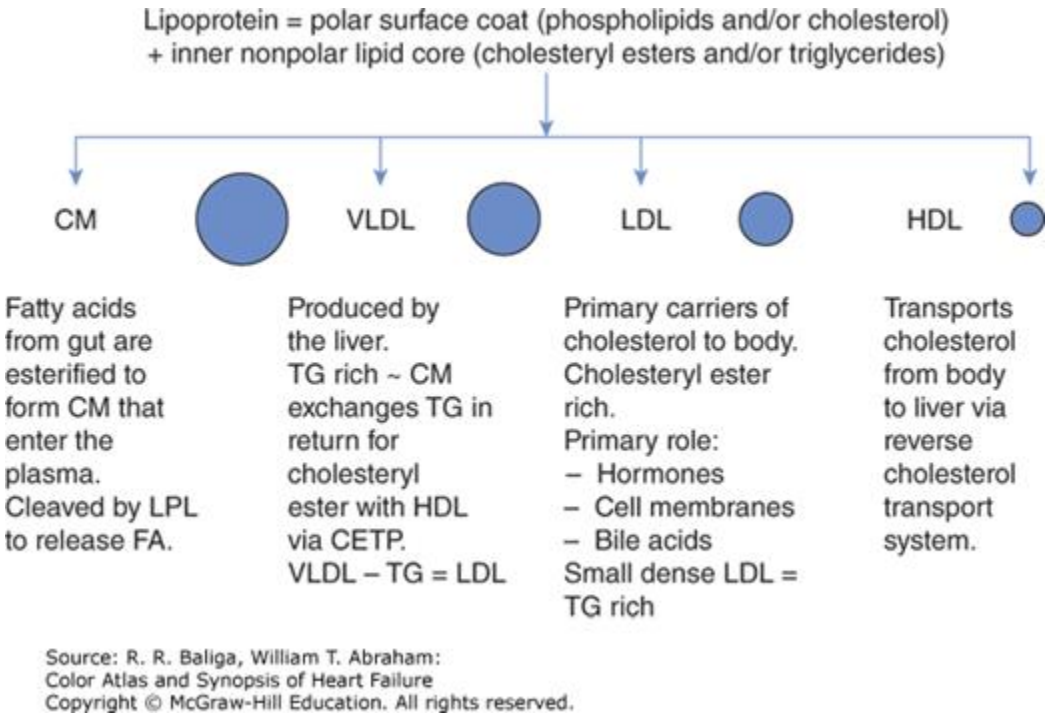


Figure 2-3

Internalization of LDL.

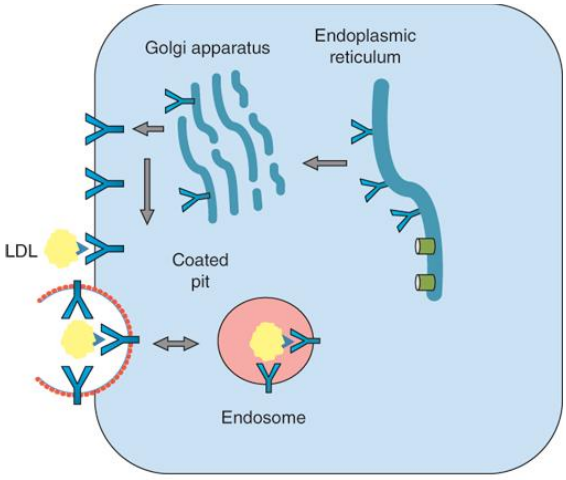
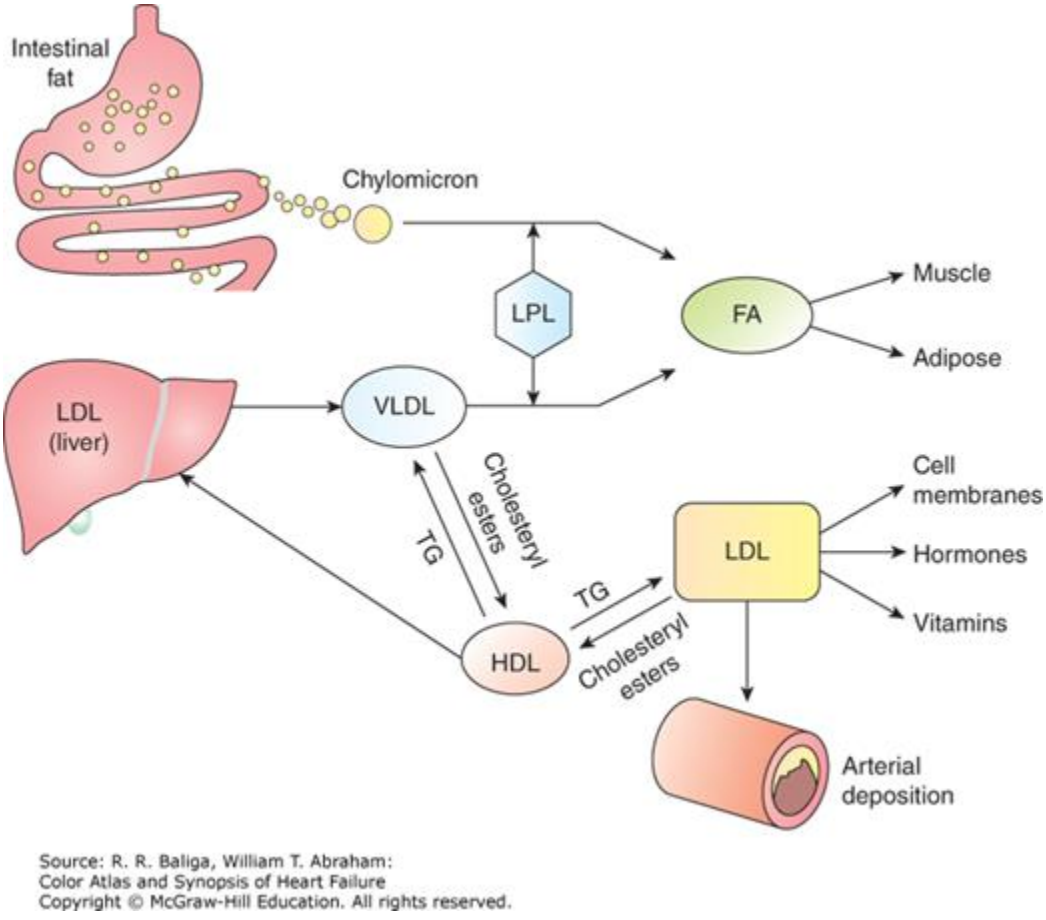


Figure 2-4

Lipids and their interactions. Abbreviations: FA: fatty acids; HDL: high-density lipoprotein; LDL: low-density lipoprotein; LPL: lipoprotein lipase; TG: triglycerides; VLDL: very low-density lipoprotein.



LIPID DISORDERS

Hyperlipidemia is a condition in which there are abnormally elevated levels of lipids or lipoproteins in the blood. They can be divided into primary or secondary causes. Primary hyperlipidemia is typically due to a genetic cause, whereas secondary hyperlipidemia usually occurs as a result of a systemic disorder, such as diabetes mellitus. The types of familial hyperlipidemia are categorized by the Fredrickson classification (Table 2-1).

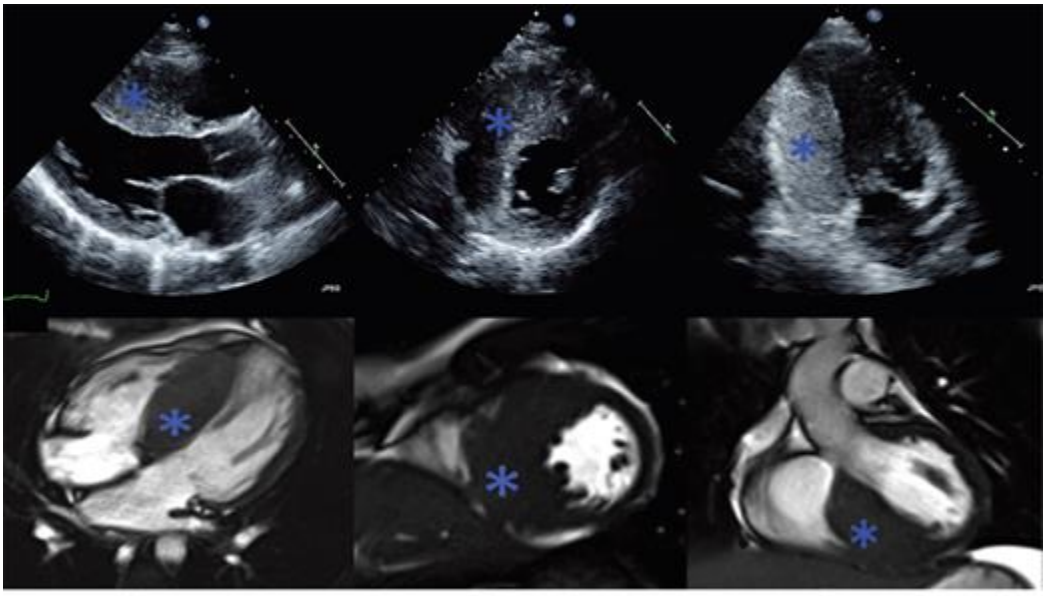
Chapter 10: Hypertrophic Cardiomyopathy

PATIENT CASE

A 17-year-old adolescent boy presented to the general cardiology clinic for family screening after a maternal aunt had been diagnosed with hypertrophic cardiomyopathy (HCM). He had no history of chest pain, breathlessness, or syncope. He reported mild symptoms of postural hypotension. Examination revealed normal first and second heart sounds with an audible and palpable fourth heart sound, but no murmurs. His electrocardiogram (ECG) demonstrated left ventricular hypertrophy (LVH) with repolarization abnormalities, and echocardiographic and cardiac magnetic resonance imaging (MRI) features of severe asymmetric LVH are noted in this patient (Figure 10-1). He had no evidence of arrhythmia on ambulatory Holter monitoring, but exercise testing demonstrated an abnormal blood pressure response on exercise. Familial genetic testing was performed and identified a pathogenic mutation in the sarcomere gene *MYL3*. Given his risk factor profile for sudden cardiac death (SCD), an automatic implantable cardioverter defibrillator (AICD) was implanted for primary prevention.

Figure 10-1

Classic asymmetric left ventricular hypertrophy (LVH) in hypertrophic cardiomyopathy (HCM). Marked hypertrophy (*) of the interventricular septum is noted on both echocardiography (upper panel) and cardiac magnetic resonance imaging (MRI) (lower panel).



EPIDEMIOLOGY

- HCM represents the most common inherited cardiac disorder and is a global disease with no racial or ethnic preponderance.[1] A reported prevalence of approximately 0.2% (1:500) has been reported consistently in epidemiological studies.[1]
- Age-related penetrance is a key feature of the disease, with onset and progression of hypertrophy occurring at virtually any age.
- Importantly, it is the most common cause of SCD in young people (<35 years of age) and athletes.[2]

CLINICAL DEFINITION

- HCM represents a primary disease of the myocardium. The hallmark of the disease is the presence of increased left ventricular (LV) wall thickness in the absence of another cardiac or systemic disease that could result in a similar degree of myocardial hypertrophy.
- On a microscopic level there is extensive disarray of myocytes and myofibrils, as well as thickening of the intramural microvessels and interstitial fibrosis.

ETIOLOGY

- In adults and adolescents, the disease typically exhibits an autosomal dominant pattern of inheritance. In around 40% to 60% of cases, a mutation in 1 of the genes encoding sarcomeric proteins is identified.
- In up to 10% of cases in adults another underlying genetic disorder may be the cause of the HCM phenotype. In addition, nongenetic causes also account for some cases of unexplained LVH.[3,4]

DIFFERENTIAL DIAGNOSIS

- LVH can represent either a physiologic (athlete's heart) or pathologic cardiac response that can occur in a variety of cardiac, genetic, and systemic diseases (Figure 10-2), or in response to hemodynamic loading of the ventricle (arterial hypertension and aortic stenosis).
- Accurate identification of the underlying etiology is critical given that HCM is a ...

Chapter 15: Valvular Heart Disease

PATIENT CASE: AORTIC STENOSIS

Mrs. R is a 92-year-old woman with history of severe aortic stenosis (AS), hypertension (HTN), atrial flutter, and nonobstructive coronary artery disease (CAD). She first developed symptoms around 2 years ago that were characterized by mild dyspnea on exertion and fatigue, and was appropriately referred for further therapy with either a surgical or transcatheter aortic valve replacement (TAVR). However, the patient at the time refused any further intervention for fear of complications given her advanced age.

She returned to the clinic 2 years later with now severe dyspnea even on minimal exertion, significant fatigue, dizziness, lower extremity edema, and weight loss. Physical examination revealed a frail elderly woman. The carotid pulse was slow and decreased in amplitude. On cardiac auscultation a soft S_2 was heard along with a late-peaking systolic murmur that was best heard at the right upper sternal border and radiated to the carotids.

Repeat echocardiography revealed a heavily calcified aortic valve with limited mobility (Figure 15-1). Doppler assessment of the aortic valve yielded a peak velocity of 5.4 m/sec, a mean gradient of 62 mm Hg, and a calculated aortic area of 0.6 cm^2, making the diagnosis of critical AS (Figure 15-2). The left ventricle (LV) showed moderate concentric hypertrophy with preserved ejection fraction (EF), but with evidence of diastolic dysfunction. Because of her significant, activity-limiting symptoms, the patient agreed to undergo further therapy. She was deemed high surgical risk because of high frailty score. She was therefore, referred for transcatheter aortic implantation with an Edwards SAPIEN 3 prosthesis. The procedure was successfully completed. However, the patient experienced a prolonged hospital course because of her advanced disease, significantly delayed intervention since symptom onset, and frailty. She has since recovered with markedly improved symptoms, and the latest echocardiogram shows a normally functioning prosthetic valve with a peak velocity to 2.8 m/sec, and mean gradient of 16 mm Hg (Figure 15-3).

Figure 15-1

Parasternal long-axis echocardiographic view of a patient with severe aortic stenosis due to calcific degenerative disease. Note the heavily calcified aortic valve and the concentric hypertrophy of the left ventricle. Abbreviations: AV, aortic valve; LA, left atrium; LV, left ventricle.

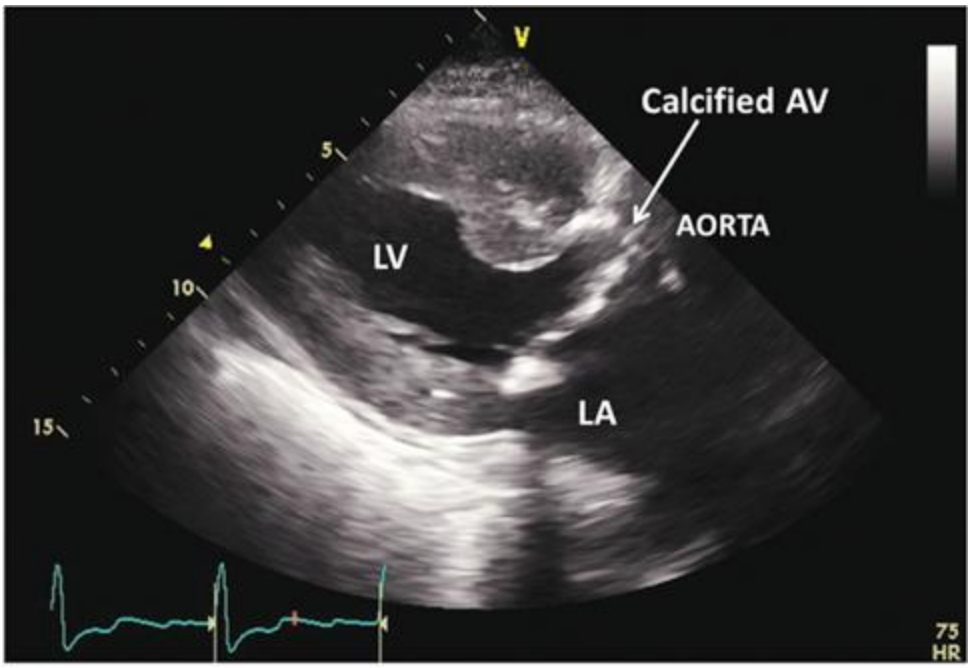


Figure 15-2

Transthoracic echocardiographic assessment of a stenotic aortic valve. Panels A and B (parasternal long-axis view and parasternal short-axis view) show the heavily calcified aortic valve with restricted opening in systole. Doppler hemodynamic assessment of the aortic valve (panels C and D) show significantly elevated velocity at 5.4 m/sec, mean pressure gradient of 62 mm Hg, and a calculated aortic valve of 0.6 cm^2. A diagnosis of critical aortic stenosis is made. Abbreviations: AV, aortic valve; LA, left atrium; LV, left ventricle.