



Figure 11-6 Vascular pathology in hypertension. **A**, Hyaline arteriosclerosis. The arteriolar wall is thickened with increased protein deposition (hyalinized), and the lumen is markedly narrowed. **B**, Hyperplastic arteriosclerosis (onion-skinning) causing luminal obliteration (periodic acid–Schiff [PAS] stain). (Courtesy Helmut Rennke, MD, Brigham and Women’s Hospital, Boston, Mass.)

KEY CONCEPTS

Hypertension

- Hypertension is a common disorder, affecting roughly 30% of adults in the U.S.; it is a major risk factor for atherosclerosis, congestive heart failure, and renal failure.
- Essential hypertension represents 90% to 95% of cases and is a complex, multifactorial disorder, involving both environmental influences and genetic polymorphisms that influence sodium resorption and the renin-angiotensin-aldosterone system.
- Hypertension is occasionally caused by single gene disorders or is secondary to diseases of the kidney, adrenal, or other endocrine organs.
- Sustained hypertension requires participation of the kidney, which normally responds to hypertension by eliminating salt and water. In established hypertension, both increased blood volume and increased peripheral resistance contribute to the increased blood pressure.
- Histologically, hypertension is associated with thickening of arterial walls caused by hyaline deposits and, in severe cases, by proliferation of smooth muscle cells and reduplication of basement membranes.

Arteriosclerosis

Arteriosclerosis literally means “hardening of the arteries”; it is a generic term for arterial wall thickening and loss of elasticity. There are three general patterns, with different clinical and pathologic consequences:

- *Arteriosclerosis* affects small arteries and arterioles, and may cause downstream ischemic injury. The two anatomic variants, hyaline and hyperplastic, are discussed earlier in relation to hypertension.
- *Mönckeberg medial sclerosis* is characterized by calcification of the walls of muscular arteries, typically involving the internal elastic membrane. Persons older than age 50 are most commonly affected. The calcifications

do not encroach on the vessel lumen and are usually not clinically significant.

- *Atherosclerosis*, from Greek root words for “gruel” and “hardening,” is the most frequent and clinically important pattern and is discussed here.

Atherosclerosis

Atherosclerosis underlies the pathogenesis of coronary, cerebral and peripheral vascular disease, and causes more morbidity and mortality (roughly half of all deaths) in the Western world than any other disorder. Because coronary artery disease is an important manifestation of the disease, epidemiologic data related to atherosclerosis mortality typically reflect deaths caused by ischemic heart disease (Chapter 12); indeed, myocardial infarction is responsible for almost a quarter of all deaths in the United States. Significant morbidity and mortality are also caused by aortic and carotid atherosclerotic disease and stroke.

The likelihood of atherosclerosis is determined by the combination of acquired (e.g., cholesterol levels, smoking, hypertension) and inherited (e.g., LDL receptor gene mutations) risk factors. Acting in concert they cause initial lesions called *atheromas* (also called *atheromatous* or *atherosclerotic plaques*) that protrude into vessel lumens. An atheromatous plaque consists of a raised lesion with a soft grumous core of lipid (mainly cholesterol and cholesterol esters) covered by a fibrous cap (Fig. 11-7). Besides mechanically obstructing blood flow, atherosclerotic plaques can rupture leading to catastrophic obstructive vascular thrombosis. Atherosclerotic plaque can also increase the diffusion distance from the lumen to the media, leading to ischemic injury and weakening of the vessel wall, changes that may result in aneurysm formation.

Epidemiology. Although atherosclerosis-associated ischemic heart disease is ubiquitous among most developed nations, risk reduction and improved therapies have combined to moderate the associated mortality. At the same time, reduced mortality from infectious diseases and the adoption of Western lifestyles has led to increased