Thrombosis. As mentioned earlier, partial or total thrombosis superimposed on a disrupted plaque is a central factor in acute coronary syndromes. In its most serious form, thrombosis leads to total occlusion of the affected vessel. In contrast, in other coronary syndromes (Chapter 12), luminal obstruction by the thrombus is incomplete, and may even wax and wane with time.

Mural thrombi in a coronary artery can also embolize. Indeed, small embolic fragments of thrombus can often be found in the distal intramyocardial circulation or in association with microinfarcts in patients with atherosclerosis who die suddenly. Finally, thrombin and other factors associated with thrombosis are potent activators of smooth muscle cells and can thereby contribute to the growth of atherosclerotic lesions.

Vasoconstriction. Vasoconstriction compromises lumen size, and, by increasing the local mechanical forces, can potentiate plaque disruption. Vasoconstriction at sites of atheroma may be stimulated by (1) circulating adrenergic agonists, (2) locally released platelet contents, (3) endothelial cell dysfunction with impaired secretion of endothelial-derived relaxing factors (nitric oxide) relative to contracting factors (endothelin), and (4) mediators released from perivascular inflammatory cells.

KEY CONCEPTS

Atherosclerosis

- Atherosclerosis is an intimal-based lesion composed of a fibrous cap and an atheromatous core; the constituents of the plaque include smooth muscle cells, extracellular matrices, inflammatory cells, lipids, and necrotic debris.
- Atherogenesis is driven by an interplay of vessel wall injury and inflammation. The multiple risk factors for atherosclerosis all cause endothelial cell dysfunction and influence inflammatory cell and smooth muscle cell recruitment and stimulation.
- Atherosclerotic plaques develop and grow slowly over decades. Stable plaques can produce symptoms related to chronic ischemia by narrowing vessel lumens, whereas unstable plaques can cause dramatic and potentially fatal ischemic complications related to acute plaque rupture, thrombosis, or embolization.
- Stable plaques tend to have a dense fibrous cap, minimal lipid accumulation and little inflammation, whereas "vulnerable" unstable plaques have thin caps, large lipid cores, and relatively dense inflammatory infiltrates.

Aneurysms and Dissection

An aneurysm is a localized abnormal dilation of a blood vessel or the heart that may be congenital or acquired (Fig. 11-18). When an aneurysm involves an attenuated but intact arterial wall or thinned ventricular wall of the heart, it is called a "true" aneurysm. Atherosclerotic, syphilitic, and congenital vascular aneurysms, as well as ventricular aneurysms that follow transmural myocardial infarctions are of this type. In contrast, a *false aneurysm* (also called *pseudo-aneurysm*) is a defect in the vascular wall leading to an extravascular hematoma that freely communicates with the intravascular space ("pulsating hematoma"). Examples include a ventricular rupture after myocardial infarction that is contained by a pericardial adhesion, or a leak at the sutured junction of a vascular graft with a natural artery. An arterial *dissection* arises when blood enters a defect in the arterial wall and tunnels between its layers. Dissections are often but not always aneurysmal (see later). Both true and false aneurysms as well as dissections can rupture, often with catastrophic consequences.

Descriptively, aneurysms are classified by macroscopic shape and size (Fig. 11-18). *Saccular aneurysms* are spherical outpouchings involving only a portion of the vessel wall; they vary from 5 to 20 cm in diameter and often contain thrombus. *Fusiform aneurysms* are diffuse, circumferential dilations of a long vascular segment; they vary in diameter (up to 20 cm) and in length and can involve extensive portions of the aortic arch, abdominal aorta, or even the iliacs. These types are not specific for any disease or clinical manifestations.

Pathogenesis of Aneurysms. To maintain their structural and functional integrity, arterial walls constantly remodel

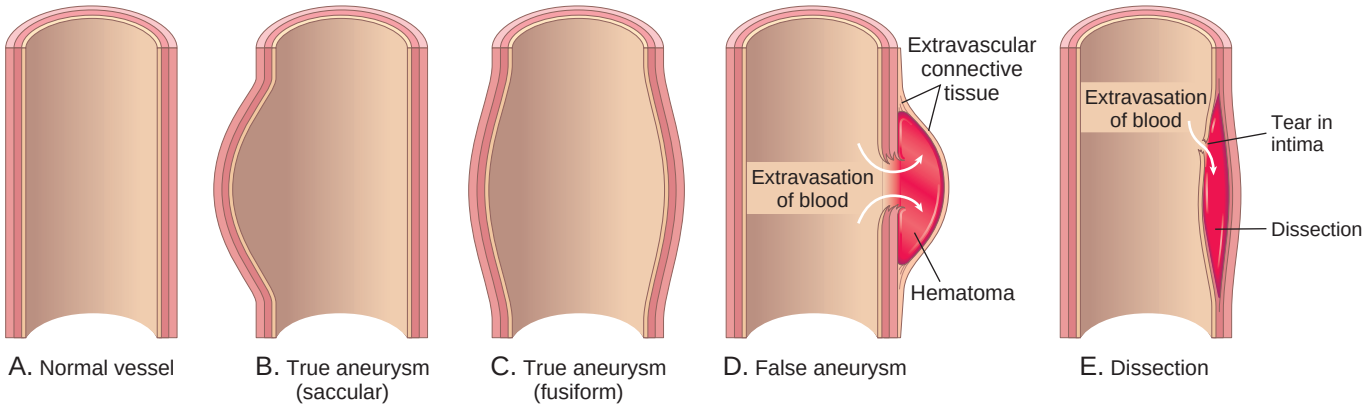

Figure 11-18 Aneurysms. **A,** Normal vessel. **B,** True aneurysm, saccular type. The wall focally bulges outward and may be attenuated but is otherwise intact. **C,** True aneurysm, fusiform type. There is circumferential dilation of the vessel, without rupture. **D,** False aneurysm. The wall is ruptured, and there is a collection of blood (hematoma) that is bounded externally by adherent extravascular tissues. **E,** Dissection. Blood has entered (dissected) the wall of the vessel and separated the layers. Although this is shown as occurring through a tear in the lumen, dissections can also occur by rupture of the vessels of the vasa vasorum within the media.