



Hemodynamic Disorders, Thromboembolic Disease, and Shock

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Cardiovascular disease is the most important cause of morbidity and mortality in Western society. In 2008, it was estimated that 83 million people in the United States had one or more forms of cardiovascular disease, accounting for 35% to 40% of deaths. These diseases primarily affect one of the three major components of the cardiovascular system: the heart, the blood vessels, and the blood itself, which is composed of water, salts, a wide variety of proteins, elements that regulate clotting (the coagulation factors and platelets), and other formed elements (red cells and white cells). For simplicity, disorders that affect each component of the cardiovascular system are considered separately, recognizing that disturbances affecting one component often lead to adaptations and abnormalities involving others. Herein, we focus on disorders of hemodynamics (edema, effusions, congestion, and shock), provide an overview of disorders of abnormal bleeding and clotting (thrombosis), and discuss the various forms of embolism. Diseases that primarily affect the blood vessels and the heart are discussed in Chapters 11 and 12, respectively, while specific bleeding disorders are covered in greater detail in Chapter 14.

Edema and Effusions

Disorders that perturb cardiovascular, renal, or hepatic function are often marked by the accumulation of fluid in

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tissues (edema) or body cavities (effusions). Under normal circumstances, the tendency of vascular hydrostatic pressure to push water and salts out of capillaries into the interstitial space is nearly balanced by the tendency of plasma colloid osmotic pressure to pull water and salts back into vessels. There is usually a small net movement of fluid into the interstitium, but this drains into lymphatic vessels and ultimately returns to the bloodstream via the thoracic duct, keeping the tissues “dry” (Fig. 4-1). **Elevated hydrostatic pressure or diminished colloid osmotic pressure disrupts this balance and results in increased movement of fluid out of vessels.** If the net rate of fluid movement exceeds the rate of lymphatic drainage, fluid accumulates. Within tissues the result is *edema*, and if a serosal surface is involved, fluid may accumulate within the adjacent body cavity as an *effusion*.

Edema fluids and effusions may be *inflammatory* or *noninflammatory* (Table 4-1). Inflammation-related edema and effusions are discussed in detail in Chapter 3. These protein-rich *exudates* accumulate due to increases in vascular permeability caused by inflammatory mediators. Usually, inflammation-associated edema is localized to one or a few tissues, but in systemic inflammatory states, such as sepsis, that produce widespread endothelial injury and dysfunction, generalized edema may appear, often with severe consequences (discussed later). In contrast, noninflammatory edema and effusions are protein-poor fluids called *transudates*. Noninflammatory edema and effusions are common in many diseases, including heart failure, liver failure, renal disease, and severe nutritional disorders (Fig. 4-2). We will now discuss the various causes of edema.