

diabetes, cystinuria, renal tubular acidosis) or acquired (e.g., lead nephropathy).

- *Urinary tract obstruction* and *renal tumors* have varied clinical manifestations based on the specific anatomic location and nature of the lesion. *Urinary tract infection* is characterized by bacteriuria and pyuria (bacteria and leukocytes in the urine). The infection may be symptomatic or asymptomatic, and it may affect the kidney (*pyelonephritis*) or the bladder (*cystitis*).
- *Nephrolithiasis (renal stones)* is manifested by spasms of severe pain (renal colic) and hematuria, often with recurrent stone formation.

Chronic kidney disease is estimated to affect 11% of all adults in the United States, with a particular predominance amongst older adults. It is the end result of a variety of renal diseases, but most commonly diabetes and hypertension, and the major cause of death from renal disease. The evolution from normal renal function to symptomatic chronic kidney injury progresses through a series of stages that are defined by measures of serum creatinine from which estimates of reduction in GFR are derived. Chronic kidney disease causes significant systemic abnormalities, which are listed in [Table 20-1](#).

KEY CONCEPTS

Clinical Manifestations of Renal Diseases

- Azotemia is the biochemical manifestation of acute or chronic kidney injury and is characterized by elevated blood urea nitrogen (BUN) or alternately by an elevated serum creatinine. It reflects a reduction in the glomerular filtration rate.
- Kidney injury that results in azotemia can be either acute or chronic. Acute kidney injury can be reversible or progress to chronic kidney disease; chronic kidney disease is generally irreversible.
- One major manifestation of kidney injury is the nephrotic syndrome, in which injury to the glomerulus results in abnormal filtration, leading to heavy proteinuria, edema and metabolic disturbances.
- Nephritic syndromes are those in which hematuria, azotemia, hypertension, and sub-nephrotic proteinuria are the major manifestations.
- Diseases involving the tubules and interstitium may have clinical manifestations of the nephritic syndrome, or of specific defects in tubular function, or of acute or chronic kidney disease without more specific defining features.

Glomerular Diseases

Glomerular diseases constitute some of the major problems in nephrology; indeed, chronic glomerulonephritis is one of the most common causes of chronic kidney disease in humans. Glomeruli may be injured by a variety of factors and in the course of several systemic diseases. Systemic immunologic diseases such as systemic lupus

Table 20-1 Principal Systemic Manifestations of Chronic Kidney Disease and Uremia

Fluid and Electrolytes
Dehydration
Edema
Hyperkalemia
Metabolic acidosis
Calcium Phosphate and Bone
Hyperphosphatemia
Hypocalcemia
Secondary hyperparathyroidism
Renal osteodystrophy
Hematologic
Anemia
Bleeding diathesis
Cardiopulmonary
Hypertension
Congestive heart failure
Cardiomyopathy
Pulmonary edema
Uremic pericarditis
Gastrointestinal
Nausea and vomiting
Bleeding
Esophagitis, gastritis, colitis
Neuromuscular
Myopathy
Peripheral neuropathy
Encephalopathy
Dermatologic
Sallow color
Pruritus
Dermatitis

erythematosus (SLE), vascular disorders such as hypertension, metabolic diseases such as diabetes mellitus, and some hereditary conditions such as Fabry disease often affect the glomerulus. These are termed *secondary glomerular diseases*. Disorders in which the kidney is the only or predominant organ involved constitute the various types of *primary glomerulonephritis* or, because some do not have a cellular inflammatory component, *glomerulopathy*. However, both the clinical manifestations and glomerular histologic changes in primary and secondary forms can be similar.

In the following sections we discuss the various types of primary glomerulopathies and briefly review the secondary forms covered in other parts of this book. [Table 20-2](#) lists the most common forms of glomerulonephritis that have reasonably well defined morphologic and clinical characteristics. The clinical manifestations of glomerular disease are clustered into the five major glomerular syndromes summarized in [Table 20-3](#). Both the primary glomerulopathies and the systemic diseases affecting the glomerulus can result in these syndromes. Because glomerular diseases are often associated with systemic disorders, mainly *diabetes mellitus*, *SLE*, *vasculitis*, and *amyloidosis*, in any patient with manifestations of glomerular disease it is essential to consider these systemic conditions.