- Dysfunction of the primary cilium of tubular epithelial cells results in alterations in ion flux and changes in cell proliferation and function, culminating in renal cyst formation.

Urinary Tract Obstruction (Obstructive Uropathy)

Obstructive lesions of the urinary tract increase susceptibility to infection and to stone formation, and unrelieved obstruction almost always leads to permanent renal atrophy, termed *hydronephrosis* or *obstructive uropathy*. Fortunately, many causes of obstruction are surgically correctable or medically treatable.

Obstruction may be sudden or insidious, partial or complete, unilateral or bilateral; it may occur at any level of the urinary tract from the urethra to the renal pelvis. It can be caused by *intrinsic* lesions of the urinary tract or *extrinsic* lesions that compress the ureter. The common causes are as follows (Fig. 20-47):

- *Congenital anomalies:* posterior urethral valves and urethral strictures, meatal stenosis, bladder neck obstruction; ureteropelvic junction narrowing or obstruction; severe vesicoureteral reflux
- *Urinary calculi*
- *Benign prostatic hypertrophy*
- *Tumors:* carcinoma of the prostate, bladder tumors, contiguous malignant disease (retroperitoneal lymphoma), carcinoma of the cervix or uterus
- *Inflammation:* prostatitis, ureteritis, urethritis, retroperitoneal fibrosis
- *Sloughed papillae or blood clots*
- *Pregnancy*
- *Uterine prolapse and cystocele*
- *Functional disorders:* neurogenic (spinal cord damage or diabetic nephropathy) and other functional abnormalities of the ureter or bladder (often termed *dysfunctional obstruction*)

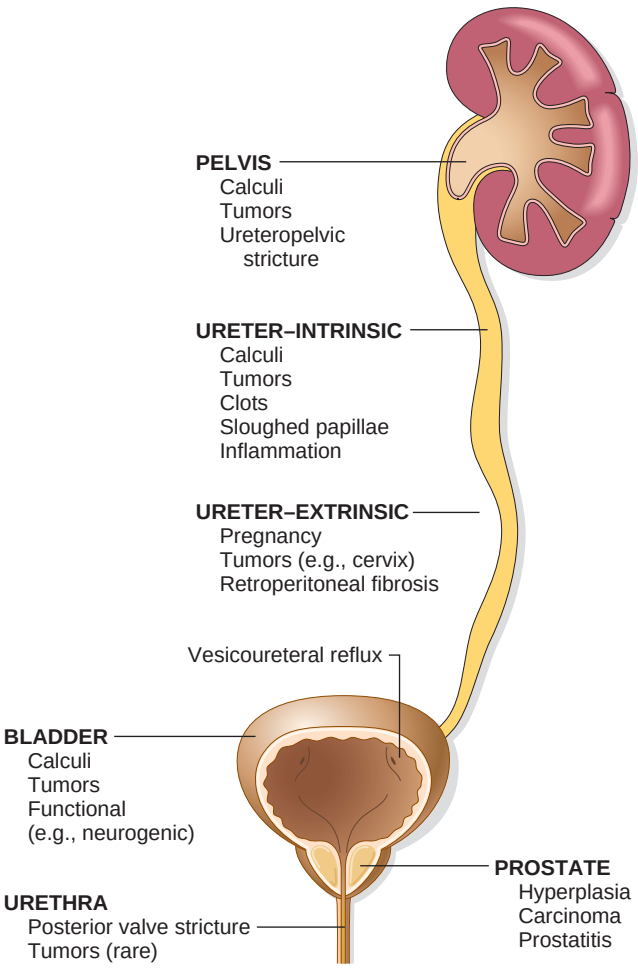

Figure 20-47 Obstructive lesions of the urinary tract.

***Hydronephrosis* is the term used to describe dilation of the renal pelvis and calyces associated with progressive atrophy of the kidney due to obstruction to the outflow of urine.** Even with complete obstruction, glomerular filtration persists for some time because the filtrate subsequently diffuses back into the renal interstitium and perirenal spaces, from where it ultimately returns to the lymphatic and venous systems. Because of this continued filtration, the affected calyces and pelvis become dilated, often markedly so. The high pressure in the pelvis is transmitted back through the collecting ducts into the cortex, causing renal atrophy, but it also compresses the renal vasculature of the medulla, causing a diminution in inner medullary blood flow. The medullary vascular defects are initially reversible, but lead to medullary functional disturbances. Accordingly, the initial functional alterations caused by obstruction are largely tubular, manifested primarily by impaired concentrating ability. Only later does the GFR begin to fall. Obstruction also triggers an interstitial inflammatory reaction, leading eventually to interstitial fibrosis, by mechanisms similar to those discussed earlier (Fig. 20-9).

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When the obstruction is sudden and complete, it leads to mild dilation of the pelvis and calyces and sometimes to atrophy of the renal parenchyma. When the obstruction is subtotal or intermittent, progressive dilation ensues, giving rise to hydronephrosis (Fig. 20-48). Depending on the level of urinary block, the dilation may affect the bladder first, or the ureter and then the kidney.

The kidney may be slightly to massively enlarged, depending on the degree and the duration of the obstruction. The earlier features are those of simple dilation of the pelvis and calyces, but in addition there is often significant interstitial inflammation, even in the absence of infection. In chronic cases the picture is one of cortical tubular atrophy with marked diffuse interstitial fibrosis. Progressive blunting of the apices of the pyramids occurs, and these eventually become cupped. In far-advanced cases the kidney may become transformed into a thin-walled cystic structure having a diameter of up to 15 to 20 cm (Fig. 20-48) with striking parenchymal atrophy, total obliteration of the pyramids, and thinning of the cortex.

Clinical Features. *Acute obstruction* may provoke pain attributed to distention of the collecting system or renal