The language of radiology is rich with descriptions of imaging findings, often metaphorical, which have found common usage in the day-to-day practice of genitourinary radiology. These “classic signs” give us confidence in our diagnosis. Some of the signs have become so familiar to us that they are referred to as “Aunt Minnie.” When the sign is invoked, or an Aunt Minnie is recognized, it often brings an impression of the image to mind, and it may have specific diagnostic and pathologic implications. The article uses classic signs accumulated from the literature to review a variety of pathologic conditions in the urinary tract.

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Introduction
Descriptions of observations made from images are the radiologist’s stock in trade. Because we “see what we know,” any device that aids in the recognition and interpretation of imaging findings is useful. The article reviews “classic signs,” often referred to as an “Aunt Minnie,” encountered in the urinary tract.

Staghorn and Related Signs
A renal stone described as a staghorn implies a branched renal calculus that resembles the antlers of a stag (Fig 1). It is usually composed of struvite; but less commonly, it is formed from cystine...
or uric acid. In its most common form, a staghorn renal stone is associated with recurrent urinary tract infections from bacterial pathogens that produce alkaline urine. As such, it is the only type of renal stone that is more commonly seen in women (1).

The staghorn configuration can be disrupted when infection complicates obstruction related to the stone. Renal enlargement from pyonephrosis or xanthogranulomatous pyelonephritis may produce a fragmented staghorn (2). In addition to the obstructing stone, which may be fragmented, renal enlargement and nonexcretion of contrast material from the involved kidney constitute the classic excretory urographic triad of xanthogranulomatous pyelonephritis (Fig 2). A stone associated with a nonfunctioning kidney may also be seen with pyonephrosis or long-standing hydronephrosis. CT of xanthogranulomatous pyelonephritis will also illustrate this classic triad. The replacement of the renal parenchyma by the indolent infectious process in the diffuse form of xanthogranulomatous pyelonephritis produces hypodense masses arranged in a “hydronephrotic” pattern, which replaces the renal parenchyma. There may be enhancement in the margins of these masses after contrast material administration. This appearance on CT scans has been described as the bear paw sign (Fig 3) (3).

**Jack Stone and Other Stone Configurations**

Urinary tract stones composed of calcium oxalate dihydrate can assume a spiked configuration, resembling a child’s toy jack. Although most commonly seen in the bladder, jack stones may
occasionally form in the kidney (Fig 4). A stone with less well-developed spikes, giving rise to a mamillated appearance, is sometimes referred to as a 

mulberry stone (Fig 5). The loose crystalline lattice of calcium oxalate dihydrate allows these stones to be easily fragmented with various forms of lithotripsy, despite their formidable appearance (1).

Renal Parenchymal Calcification

Thin rims of dystrophic calcification may be deposited at the inner and outer margins of the renal cortex as a result of a major vascular insult that produces cortical necrosis, or rarely, as a consequence of glomerulonephritis, hyperoxaluria, and Alport syndrome, with the development of cortical nephrocalcinosis. The pattern of parenchymal calcification is said to resemble a tramline or railroad tracks (4).

Medullary nephrocalcinosis is most commonly caused by medullary sponge kidney, renal tubular acidosis, and hyperparathyroidism (1). Medullary 
sponge kidney is the term applied to the development of ectatic tubules occurring in the medullary pyramids (Fig 6) (5,6). As a result of stasis and the occasionally associated condition of hypercal-
ciuria, stones may form in the cavities, producing medullary nephrocalcinosis. The growing calculus sign refers to the apparent enlargement of stones between the preliminary image and images obtained after contrast material administration, as contrast material fills the ectatic tubules harboring the stones (6).

**Perirenal Cobwebs**

Perirenal cobwebs were initially attributed to collateral vessels seen in the perinephric space in patients with renal vein thrombosis (7). As our ability to image the perinephric space with CT improved, it became clear that a number of disease processes were manifest by development of prominent perinephric structures (8). Kunin (9) formalized our understanding by describing several types of septa that compartmentalize the perirenal space and that may confine, or act as a conduit for, extension of a disease process (Fig 7).

Currently, perirenal cobwebs (visualization of perirenal septa) are most frequently encountered during the CT evaluation of urinary tract obstruction from stone disease. Perirenal stranding, occurring in the setting of flank pain from ureteral colic, is an exaggeration of the visibility of these septations due to edema and fluid extravasation, and is an important secondary sign of acute ureteral obstruction from stones (10). Perirenal stranding in the asymptomatic patient is often a nonspecific finding and may be seen in benign and malignant conditions.

**Soft-Tissue Rim Sign**

The CT evaluation of stone disease has given rise to new signs. The soft-tissue rim sign is caused by edema of the ureteral wall surrounding a stone at
its site of impaction (Fig 8) (11). The importance of the sign lies in the fact that it may help to distinguish a stone in the ureter from a phlebolith in an adjacent vein, because the occurrence of a soft-tissue rim around a phlebolith is uncommon. It should be noted, however, that the soft-tissue rim sign may be absent with stones larger than 4 mm or when a stone is impacted at the ureterovesical junction.

**Comet Sign**

The *comet sign* (Fig 9) has also been used at CT to aid in the differentiation of a phlebolith from a stone in the ureter, especially in the anatomic pelvis (12). The calcified phlebolith represents the comet nucleus and the adjacent, tapering, noncal-

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**Figure 8.** (a) One kind of rim (with thanks to Christopher R. Dyer for his assistance with this photograph.) (b) CT scan shows a thin soft-tissue rim (arrow) surrounding a stone impacted in the middle of the left ureter. The rim represents edema of the ureteral wall. The presence of a tissue rim sign allows a confident diagnosis of a stone within the ureter.

**Figure 9.** (a) Comet. (Photograph entitled “Comet Hyakutake” reprinted with permission from Bill and Sally Fletcher.) (b) CT scan shows a calcification (the comet nucleus) (arrow) with a soft-tissue tail that represents a pelvic vein (arrowhead). Together, this appearance constitutes the comet sign. Note the stone at the left ureterovesical junction.
The reliability of the comet sign is not as great as that for the soft-tissue rim sign, however.

**Other Rims**

A very important rim sign with an entirely different cause is that associated with major vascular compromise in the kidney. This sign is most commonly seen with renal artery obstruction from thrombosis, embolus or dissection. At contrast-enhanced CT or MR imaging, a 1- to 3-mm rim of subcapsular enhancement, paralleling the renal margin, can be seen as a result of preserved perfusion of the outer renal cortex by capsular perforating vessels. The finding may be partial or total depending on the level of vascular occlusion, and there may be an abrupt termination of contrast material in the renal artery referred to as the arterial cut-off sign (Fig 10) (13,14). The rim sign of vascular compromise has also been described with renal vein thrombosis and acute tubular necrosis (13).

The reverse rim sign refers to a hypoattenuating renal cortex visualized at CT, seen against a background of intact medullary perfusion after contrast material is given. This sign also implies severe derangement of cortical blood flow with development of cortical necrosis (Fig 11) (15). Cortical necrosis may develop as a consequence of obstetric complications, shock from numerous causes, transfusion reaction or other causes of intravascular hemolysis, toxins, and rejection in the transplanted kidney (16).

A different type of rim sign can be seen in association with chronic hydronephrosis. After contrast material is administered, enhancement occurs in the residual, but markedly atrophic, renal parenchyma, surrounding the dilated calices and renal pelvis. The inner margin of this hydrenephrotic rim is concave toward the renal hilum, and enhancement of the cortical columns between the dilated collecting system elements may be seen. This type of rim has been observed in all forms of
Figure 12. Hydronephrotic rim. CT scan, obtained in a patient with hematuria after minimal trauma, reveals a rim of enhancement surrounding a markedly dilated right renal pelvis and collecting system, findings consistent with congenital ureteropelvic junction obstruction. Note the variable thickness of the enhancing tissue rim (in contrast to the rim sign of vascular compromise [cf Fig 10]), as well as enhancement within cortical columns (arrow).

Figures 13, 14. Spotted nephrogram. (13a) Spotted cat. (Courtesy of Russell I. Poole, Mishawaka, Ind.) (13b) Late image from midstream aortography demonstrates patchy perfusion in both kidneys, giving the parenchyma a spotted appearance: the spotted nephrogram. (13c) Late image from selective right renal arteriography in the same patient demonstrates small vessel occlusion and multiple areas of parenchymal infarction (arrow) with islands of preserved perfusion. The patient proved to have periarteritis nodosa. (14) CT scan of another patient with periarteritis nodosa demonstrates the CT correlate of the angiographic findings, with patchy perfusion of the kidneys caused by multiple areas of infarction. (Case courtesy of N. Reed Dunnick, MD, University of Michigan Health System, Ann Arbor, Mich.)
contrast-enhanced imaging of the obstructed kidney (Fig 12). Unopacified urine in the dilated collecting system may produce a negative pyelogram. Depending on the degree of residual excretory function, delayed imaging may show pools of contrast material or a urine–contrast material level within the distended collecting system (17).

**Spotted Nephrogram**

Irregular, patchy enhancement in the renal parenchyma, referred to as the spotted nephrogram, may occur as a result of small vessel occlusion, which can be seen with necrotizing vasculitis (periarteritis nodosa), scleroderma, and hypertensive nephrosclerosis (18). Although first observed on angiograms (Fig 13), the abnormal perfusion pattern can be identified on CT (Fig 14) and MR images after contrast material administration (19).

**Figure 15.**  (a) Crescent. (Photograph entitled “Moon with Earthshine” reprinted with permission from Bill and Sally Fletcher.)  (b) Crescent sign. CT image obtained during the corticomedullary phase of enhancement shows decreased thickness of the parenchyma surrounding the dilated collecting system in the left kidney.  (c) Concentrated contrast material crescents surround the dilated collecting system elements (arrows) on this delayed image, which also shows a urine–contrast agent level in the dependent aspect.

**Crescent Sign**

This sign is fundamentally different in its pathophysiology from the rim sign of hydronephrosis. The crescent sign refers to the appearance of concentrated contrast material in collecting tubules, arranged parallel to the margin of a dilated calix, which produces a thin line of contrast material at the edge of the calices, resembling a crescent (Fig 15). This change in tubule orientation from vertical to near horizontal, at the margin of the calix, is related to prolonged, but often incomplete, obstruction that produces gradual dilatation of the collecting system (20,21). The sign is important because it indicates that renal function within the kidney is recoverable, despite the severity of collecting system dilatation.
Balloon on a String Sign

The balloon on a string sign may be seen with the rim sign of hydronephrosis, with the crescent sign, or as an isolated finding. This sign refers to the appearance of a high and somewhat eccentric exit point of the ureter from a dilated renal pelvis and is a typical finding of ureteropelvic junction obstruction (Fig 16) (22). The possibility of an associated crossing vessel should always be evaluated before therapeutic intervention.

Concentric Ring Sign (Target Sign) and Kidney Sweat

MR imaging may reveal a concentric ring or target pattern of hyper- and hypointensity within hematomas that have been present for more than 3 weeks (23). The ring pattern is best seen on T1-weighted images (Fig 17). The peripheral dark rim is likely related to pseudocapsule development. An inner bright ring is thought to be caused by hemoglobin degradation, whereas a central core of intermediate, but variable, intensity is related to the age of the hematoma (23).

An extracapsular, hypoechoic rim of simple-appearing fluid surrounding the kidneys, first described at ultrasonography (US) in some patients with renal failure, was called kidney sweat (Fig 18) (24). These collections can also be identified at CT and MR imaging (Fig 19). The rim is thought to represent perirenal edema, and recognition of this sign should prevent confusion with more significant perirenal fluid collections, such as hematoma or abscess.
Figure 17. (a) Target sign (registered trademark of Target, Inc.). (b) T1-weighted MR image of the right kidney shows a subcapsular collection with a target appearance, a finding indicative of hemoglobin degradation in a subacute hematoma. (c) Gadolinium-enhanced, fat-suppressed T1-weighted MR image reveals that the source of the hemorrhage was a papillary renal cell carcinoma (arrow).

Figures 18, 19. Kidney sweat. (18) Longitudinal US image of the left kidney in a patient with acute renal failure reveals a sliver of fluid in a subcapsular location (arrow). This appearance has been called kidney sweat. Similar findings were seen on the right. (19) In another patient with acute renal failure, the T2-weighted MR image shows kidney sweat on the left (arrow). A balloon on a string appearance is seen in the right kidney, which had no excretory function because of severe parenchymal atrophy.
Horseshoe describes the shape of the most common congenital renal fusion anomaly, occurring in approximately one in 400 live births (25). Fusion of the lower renal poles, which produces an isthmus of tissue crossing the midline anterior to the aorta, has a number of consequences. The isthmus is an impediment to normal rotation and upward ascent as it encounters the inferior mesenteric artery (Fig 20). Routinely, the vascular supply to these horseshoe kidneys will be anomalous (Fig 21). The rotational anomalies and transit of the isthmus by the ureters can result in varying degrees of obstruction of the renal moieties, with an increased prevalence of stone formation and infection (25). The horseshoe kidney can be associated with a variety of other congenital anomalies including vertebral, anorectal, tracheal, and esophageal malformations. Other fusion anomalies may be encountered including a wide variety of crossed-fused ectopic kidneys, the disc (pancake) kidney, and pelvic lump (cake) kidney. Patients with these types of kidneys suffer similar complications (25).

**Figures 20, 21.** Horseshoe kidney. (20a) Horseshoe. (20b) Enhanced CT image shows the functional isthmus of a horseshoe kidney anterior to the aorta, immediately beneath the inferior mesenteric artery (arrow). (21a) Midstream aortogram demonstrates multiple renal arteries supplying a horseshoe kidney (black arrows and arrowheads). Note the position of the inferior mesenteric artery (white arrow). (21b) Late phase image from aortography demonstrates the horseshoe kidney configuration (arrow), with the superior aspect of the isthmus immediately below the origin of the inferior mesenteric artery.
Loop-to-Loop Colon and the Lying Down (Pancake) Adrenal Gland

A normal kidney in a normal position is the foundation for image interpretation of many of the anticipated anatomic relationships. The loop-to-loop colon describes an abnormal colonic course associated with the absence of the left kidney from the renal fossa. The transverse colon extends to the lateral margin of the abdominal wall, and the descending colon courses medially to fill the renal fossa, resulting in the looped colonic configuration (Fig 22) (26). The presence of large intestine in the renal fossa at imaging should lead to a consideration of renal agenesis or ectopia.

Similarly, the typical radiologic appearance of an inverted Y-shaped, V-shaped, or wishbone-shaped adrenal gland depends, in part, on the presence of a kidney in the renal fossa. With renal agenesis, the ipsilateral adrenal gland will be present in the majority of cases, but the configuration of the gland, especially if it is on the left side, may assume a long slender pancake or disc shape that has been described as lying down (Fig 23) (27).

Lumps, Bumps, and Dromedary Humps

Normal tissue can appear as a variety of pseudomasses in the kidney. Renal tissue molded by adjacent organs, most commonly the spleen affecting the left kidney, may create a prominent mass...
referred to as a dromedary hump (Fig 24) (28). The appearance of this tissue should have the signature of normal renal parenchyma, regardless of the type of imaging study performed. Most important, the area should be subtended by a normal collecting system element, and a normal interpapillary line should be present. Prominent cortical columns, suprahilar lips, and persistent fetal lobation may also produce confusing appearances at imaging studies with the potential for misdiagnosis for those who are unaware (Fig 25) (25,28–30).

**Putty Kidney and Other Signs Associated with Urinary Tract Tuberculosis**

As an end stage of infection with tuberculosis in the genitourinary tract, calcification may entirely outline a nonfunctional kidney. The radiologic appearance of this condition, which is associated with autonephrectomy, has been described as the putty kidney (Figs 26, 27) (31,32). Calcification
Figure 25. Drawings illustrate a variety of pseudomasses that can be created by normal renal tissue: fetal lobation (A), dromedary hump (B), cortical column (arrow) (C), and prominent hilar lips (arrowheads) (D). Familiarity with the typical locations and appearances of pseudomasses aids in the correct diagnosis.

Figures 26, 27. Putty kidney. (26a) Putty kidney. (26b) Plain radiograph of the abdomen demonstrates extensive calcification in the left kidney, which was nonfunctional (the putty kidney), consistent with autonephrectomy from tuberculosis. (27) CT images through the upper (a) and lower (b) regions in another patient with autonephrectomy of a left-sided, putty kidney demonstrate the extensive parenchymal and collecting system calcification as a result of tuberculosis infection.
may also be seen in other portions of the urinary tract as a consequence of tuberculosis infection. Following reactivation of hematogenously disseminated disease, irregularity of the caliceal margin, which is sometimes referred to as a moth-eaten appearance, may be the first recognizable excretory urographic finding of urinary tract tuberculosis. As these areas coalesce, frank papillary cavitation can be identified, with an appearance similar to that of papillary necrosis. As the infection gains access to the collecting system and ureter, a variety of metaphorical terms have been used to describe the imaging findings. Infundibula may be strictured or amputated. An involved calix may not be opacified at excretory urography, producing a phantom calix (described later). Distortion of the renal pelvis because of stricturing and retraction has been described as a hiked-up or purse-string appearance. Tuberculosis involvement of the ureter is initially heralded by dilatation and ragged irregularity of the lumen, referred to as a sawtooth appearance. Later, the ureter may become a straight rigid tube, referred to as a pipistem ureter. Healing with associated fibrosis may also produce a beaded or corkscrew ureter. Tuberculosis involvement of the bladder may cause calcification in the wall, which may become thick and reduce the capacity of the bladder; the resultant, very small bladder has been referred to as a thimble bladder (31,32).

**Ball-on-Tee, Lobster Claw, and Signet Ring Appearances**

The descriptive terms ball-on-tee, lobster claw, and signet ring refer to the radiographic patterns of papillary excavation seen with papillary necrosis (Fig 28) (33,34). The necrotic papillary tip may remain within the excavated calix, producing the signet ring sign when the calix is filled with contrast material. The devitalized papilla may act as a nidus for calcification, thus creating a true “stone” for the signet ring. The patterns of papillary excavation are best seen with standard excretory urography or retrograde urography (Figs 29–31). Papillary necrosis is usually the result of an ischemic injury to the medullary portion of the kidney and is most often associated with use of Nonsteroidal anti-inflammatory drugs; Sickle cell anemia; Analgesic nephropathy; Infection, especially tuberculosis; and Diabetes mellitus (the capitalized, italicized letters create the memory aid NSAID) (33).
Figures 29–31. Papillary necrosis. (29) On an excretory urogram, contrast material fills central excavations (arrows) in the papilla of the interpolar region, giving the ball-on-tee appearance. Note the abnormal calices in the upper and lower poles as well. (30) Excavation extending from the caliceal fornices (arrows) produces the lobster claw deformity in another patient. (31a) Tomogram demonstrates triangular, peripherally calcified structures (arrows)—the sloughed papilla—in the region of the left ureter. (31b) Retrograde ureteropyelogram demonstrates contrast material surrounding sloughed papilla retained in some of the calices, producing the signet ring appearance (arrows).
Phantom Calix

The *phantom calix sign* refers to images of the kidney in which no collecting system element can be identified where one should be found. This finding usually reflects an intrarenal process that has infiltrated and obliterated the collecting system element. The differential diagnosis for this finding includes inflammation (especially tuberculosis and occasionally acute pyelonephritis), neoplasm (especially transitional cell carcinoma), a stricture from trauma or stone passage, ischemia, a congenital anomaly of the calix, renal contusion, or technical underfilling (Fig 32) (35).

Faceless Kidney

The term *faceless kidney* was originally reported as a CT sign of renal duplication (36). In this setting, *faceless* refers to the appearance of the kidney on a CT section obtained at a level between duplicated collecting system elements; at this level, the kidney is entirely filled by normal renal parenchymal tissue, thus lacking the typical familiar signature of central renal sinus structures and sinus fat (Fig 33). Use of the term has been broadened to include any process that obliterates the anticipated sinus appearance of the kidney. Thus, edema from inflammatory conditions or a more “sinister” infiltrative process such as lymphoma or transitional cell carcinoma may render the kidney *faceless* (Fig 34). The familiar “face” should
Figure 33. Faceless kidney sign. (a, b) Kidney with (a) and without (b) a face. (c) Unenhanced CT image through the kidneys shows absence of the typical sinus signature in the left kidney. (d) Contrast-enhanced image, obtained at the same level as seen in c, shows normal parenchymal enhancement. (e) Delayed image obtained at the lower aspect of the left kidney shows the presence of two ureters (arrowheads). (f) Excretory urogram demonstrates duplication of the left collecting system, with the two separate collecting system elements and two ureters exiting the kidney. It is easy to see how the images in c and d were generated from a position between the collecting system elements.
always be present, regardless of the imaging technique used. Its absence or distortion requires explanation (Fig 35).

**Drooping Lily Sign**

At urography, a dilated, obstructed upper moiety ureter, in a completely duplicated system, may produce downward and lateral displacement of the functional lower moiety collecting system, appearing radiographically as the well-known *drooping lily sign* (Fig 36) (37,38). The sign is often accompanied by a bladder filling defect, representing a ureterocele, which is associated with the ectopic insertion of the upper moiety ureter. As the frequency of excretory urography wanes, the “classic” drooping lily is less frequently encountered. Diagnostic consideration should be given to the presence of a duplication anomaly whenever a process is discovered in only one portion of a kidney (37).
Maiden Waist Deformity (of Ureteral Deviation)

Retroperitoneal fibrosis is defined as the deposition of unencapsulated fibrous tissue, usually centered at the lumbosacral junction. The fibrotic plaque may encompass the ureters and may draw them medially, which results in alteration of the normal ureteral course and tapered narrowing of the opacified ureteral lumen. When the disease process involves both ureters, the ureteral course from the kidneys to the bladder is said to resemble a narrow-waisted maiden (Figs 37, 38) (39,40). Although idiopathic in up to 50% of cases (and called Ormond disease), retroperitoneal fibrosis can be associated with a variety of inflammatory insults including autoimmune disease or vasculitis, use of drugs such as methysergide and ergotamine, or traumatic retroperitoneal hemorrhage or urine leak; the condition may also develop as a response to tumor or in association with other fibrotic processes (40). Incongruity between the severe clinical degree of renal failure and the relatively mild degree of hydronephrosis seen at imaging may provide a diagnostic clue. Intraperitonealization (ie, surgical rerouting of ureters into the peritoneal cavity) of the ureters is

Figures 37, 38. (37) Maiden waist deformity. (a) Radiograph of Barbie (registered trademark of Mattel) clearly depicts a narrow-waisted maiden. (b) Composite image of bilateral retrograde examinations performed in a patient with renal failure and minimal hydronephrosis shows narrowed areas in both ureters at the lumbosacral junction with medial deviation. This appearance has been described as the maiden waist deformity of the ureters. (38) Retroperitoneal fibrosis. (a) CT image of another patient demonstrates moderate hydronephrosis with delay in development of the tubular nephrogram on the right. (b) On CT scan obtained at a lower level, the right ureter can be seen entering a fibrotic plaque surrounding the aorta and inferior vena cava at the lumbosacral junction.
sometimes used as a therapeutic intervention to free the ureters from the fibrotic plaque and relieve associated obstruction. This intervention converts the ectomorphic position of the ureters into that of an endomorph (Fig 39).

**Bullet and Bodkin Sign**

Encasement of the ureter may produce an abrupt transition in ureteral caliber. The dilated ureter (the bullet) may appear to be precariously perched on the nondilated, encased ureter (the bodkin, which is defined as a sharp, slender instrument) (41). The bullet and bodkin appearance can be caused by metastatic disease, extension from an adjacent tumor (Fig 40), lymphoma, and rarely by benign inflammatory conditions such as retroperitoneal fibrosis.

**Goblet Sign and Stipple Sign**

The goblet sign describes the appearance of ureteral dilatation below the site of an intraluminal ureteral filling defect, best seen at retrograde ureteropyelography. The sign implies that the filling defect has been created by a chronic process, which has allowed the ureter below the site of the filling defect to accommodate to the lesion. The appearance is likely the result of mechanical dilatation of the ureter below the filling defect due to ureteral peristalsis (Fig 41) (42,43). Although originally described with transitional cell carcinoma of the ureter, the goblet sign may be seen
with any process, including metastatic disease or endometriosis, that slowly grows into the ureteral lumen. The dilated ureteral segment below the filling defect provides a potential space that may allow coiling of a catheter within it, if retrograde catheterization is attempted. The appearance of the catheter in this setting has been referred to as the coiled catheter sign (Fig 42) (42). At CT, the site of ureteral caliber transition should be closely

**Figure 41.** (a) Goblet. (b) Retrograde ureteropyelogram, obtained to further evaluate a nonfunctional left kidney discovered at excretory urography, shows a filling defect due to transitional cell carcinoma, with dilatation of the ureter below the defect, producing the goblet sign.

**Figure 42.** Coiled catheter sign. (a) On a retrograde ureteropyelogram, persistent coiling of a guide wire was seen in the distal ureter during an attempt at retrograde stent placement. (b) Retrograde ureteropyelogram demonstrates dilatation of the ureter (arrow) below a site of complete ureteral obstruction caused by transitional cell carcinoma.
inspected for the presence of an intraluminal soft-tissue mass, as a reflection of the goblet appearance (Fig 43) (43).

The artist Georges Seurat is known for his detailed pictures created with tiny dots of color, a style of painting called pointillism. Contrast material entrapped between the papillary projections of a transitional cell carcinoma can produce a pointillistic effect referred to as the *stipple sign* (44). This appearance is best seen in large papillary bladder tumors (Fig 44), but stippling may occur anywhere the papillary form of a urothelial tumor is fully expressed. Thus, it can be seen in other areas of the urinary tract and on any contrast-enhanced image.

**Cobra Head Sign**

Also known as the *spring onion* appearance, the *cobra head sign* refers to dilatation of the distal ureter, surrounded by a thin lucent line, which is seen in patients with adult-type (orthotopic) ureteroceles (Fig 45) (45,46). The distal ureter dilates in response to restriction of flow at the ureteral orifice in the bladder. The lucent hood represents the combined thickness of the ureteral wall and prolapsed bladder mucosa, outlined by contrast material within the bladder lumen. This lucent line should be thin and well defined. Any thickening, irregularity, or loss of definition of the
cobra’s hood should raise concern for the presence of a pseudoureterocele. A pseudoureterocele can result from edema related to stone impaction or recent stone passage, or more important, tumor overgrowth of the ureteral orifice (Figs 46, 47). If the appearance is not “classic,” cystoscopic evaluation should be performed (45,46).

Figure 44. Stipple sign. (a) Image from excretory urography shows a lesion with irregular margins that produces a filling defect in the upper aspect of the right side of the bladder. Note the dots of contrast material within the filling defect, the stipple sign. (b) Post-void image accentuates the findings. The appearance is typical of entrapment of contrast material between the projections of a papillary-type transitional cell carcinoma.

Figure 45. (a) Cobra’s head. (b) Late excretory urogram demonstrates bilateral ureteral obstruction from large, adult-type ureteroceles. Despite their size, the lucent rims surrounding the ureteroceles are thin and well defined.
Figure 46. Pseudoureterocele. Excretory urogram shows a thickened, irregular halo (arrow) surrounding the distal ureter, caused by transitional cell carcinoma, resulting in a pseudoureterocele.

Figure 47. Pseudoureterocele. (a) Excretory urogram obtained after lithotripsy shows stone fragments (arrow) that have impacted at the right ureterovesical junction. (b) Excretory urogram demonstrates dilatation of the distal ureter and a thickened, edematous halo surrounding the dilated segment. Prelithotripsy excretory urography had shown no such findings. Note the ureterocele on the left.
Spaghetti Sign

In a patient with gross hematuria, a linear filling defect within the bladder may result from extrusion of a blood clot from the ureter, which has acted as a mold. This *spaghetti sign* implies that the bleeding source is above the bladder, aiding the investigation of hematuria (Fig 48) (47). Although originally described at urography, the finding may occasionally be seen with other imaging modalities (Fig 49).

Pear-shaped and Pie-in-the-Sky Bladder

The normal round or oval shape of the opacified bladder may assume a *pear* or *tear drop* shape when it is symmetrically compressed in the

**Figures 48, 49.** Spaghetti sign. (48a) Spaghetti. (48b) Excretory urogram shows an unusual filling defect in the right side of the bladder in a patient with gross hematuria. This defect resulted from a long clot being extruded into the bladder from the ureter. (48c) Retrograde ureteropyelogram demonstrates the linear clot in the left ureter (arrows), which was the result of an upper urinary tract transitional cell carcinoma. (49) CT scan demonstrates a linear filling defect (arrow), representing a clot extruded from the ureter, in the dependent portion of the bladder. Note the dilated left ureter, which was the source of the bleeding.
Figures 50, 51. (50a) Pear. (50b) Excretory urogram of a trauma victim. Pelvic trauma has resulted in extraperitoneal bladder rupture with urinary extravasation and pelvic hematoma, which produces symmetric compression of the bladder, resulting in the pear shape. (51) Pear-shaped bladder. (51a) Scout image shows perivesical lucency in a patient with pelvic lipomatosis. (51b) Excretory urogram demonstrates medial deviation of the distal ureters, which is an associated finding in pelvic lipomatosis. Note the compression of the bladder, giving it a pear shape.
anatomic pelvis by an extrinsic process (Fig 50). The differential diagnosis of the imaging appearance includes the presence of pelvic fluid (hematoma, lymphocele, urinoma, or abscess), pelvic lipomatosis (Fig 51), vascular dilatation (aneurysm or collateral vessel development), symmetric lymph node enlargement, or psoas muscle hypertrophy. CT is the most helpful examination for determining the specific cause of the finding (Fig 52) (47–49).

A pie-in-the-sky bladder may also be seen with pelvic trauma. The sign refers to a high position of the opacified bladder within the pelvis at imaging and implies the presence of a large pelvic hematoma, associated with disruption of the bladder moorings. Observation of this sign should raise concern for an associated urethral injury (Fig 53) (50).
Keyhole Sign
Sonographic identification of hydronephrosis in a male fetus or infant should prompt investigation for the presence of posterior urethral valves. The thick-walled bladder and dilated posterior urethra related to obstruction by the valves, as seen at US, may resemble a keyhole (51). The more familiar appearance of posterior urethral valves seen at voiding cystourethrography reinforces the sonographic findings (Fig 54).

Threads and Streaks Sign
The threads and streaks sign was originally a description of the angiographic appearance of vascularized tumor thrombus extending into the renal vein or inferior vena cava from a renal cell carcinoma. Recognition of the sign is important, because it may mean that the surgical approach to the renal tumor must be altered. At angiography, opacified vessels supplying the intravascular tumor may produce a linear, threadlike, or string-like appearance (Fig 55) (52). Cross-sectional images and multiplanar reconstructions from CT or MR imaging studies may also reveal the sign (Fig 56).

Spoked Wheel Pattern
The spoked wheel description was applied to the angiographic appearance of the vascular pattern seen in some oncocytomas. Centripetal “spoke” vessels arising from a peripheral “rim” vessel were initially thought to be characteristic of this tumor (Fig 57). However, the pattern is now known to be nonspecific, and a similar vascular arrangement has been described with renal cell carcinoma (53). The angiographic appearance may relate to the presence of a pseudocapsule and a stellate, central scar, which can be seen in some oncocytomas larger than 3 cm in diameter (54). The scar has been described at US, CT (Fig 58), and MR imaging.
**Figure 55.** (a) Threads and streaks. (b) Late phase image from selective right renal arteriography demonstrates distortion of the normal vascular arborization pattern in the upper portion of the right kidney (upper arrow) with linear vessels (lower arrow) extending into vascularized tumor thrombus in the right renal vein and inferior vena cava.

**Figure 56.** Threads and streaks. Gadolinium-enhanced, coronal T1-weighted MR image of the left kidney in another patient with a left upper pole renal mass shows linear vascularity supplying a tumor thrombus extending along the left renal vein and into the inferior vena cava (arrows).
The descriptive term string of pearls has been applied to the angiographic appearance of arteries involved with the medial form of fibromuscular dysplasia (55). Thickened fibromuscular ridges, alternating with areas of wall thinning and aneurysm formation, create the typical appearance, most often seen in the renal arteries (Fig 59) (55,56). The presence of fibromuscular dysplasia as a cause of renovascular hypertension is always a consideration in children and middle-aged women. Distinction of fibromuscular dysplasia from atherosclerotic disease is important for proper therapeutic intervention. Improving resolution of CT angiography and MR angiography should allow identification of the sign with these techniques as well (Fig 60).

Figures 57, 58. Spoked wheel pattern. (57a) Spoked wheels. (57b) Collimated view from selective left renal arteriography shows a mass in the interpolar region of the kidney with a peripheral rimming vessel (arrow) and centripetal vessels projecting into the mass (arrowhead), resembling the rim and spokes of a wagon wheel. (57c) Late phase image shows decreased vascularity in the central portion of the mass consistent with a scar. The mass was a surgically proved oncocytoma. (58) Renal oncocytoma. Enhanced CT image shows a left renal mass with a relatively homogeneous enhancement pattern, except for a stellate central scar. Although the pattern may be seen with an oncocytoma, as in this case, it has also been described with renal cell carcinoma.
Conclusions
The familiarity afforded by recognition of a classic sign or Aunt Minnie allows for a more confident diagnosis. Newer imaging modalities may render some signs obsolete, but they do not change the basic pathophysiology on which the signs are based; rather, we must reinterpret these “old stand-bys.” Newer imaging modalities beget new signs each day. At the end of the day, perhaps a familiar face will make the interpretive process a bit easier and a bit more fun.

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