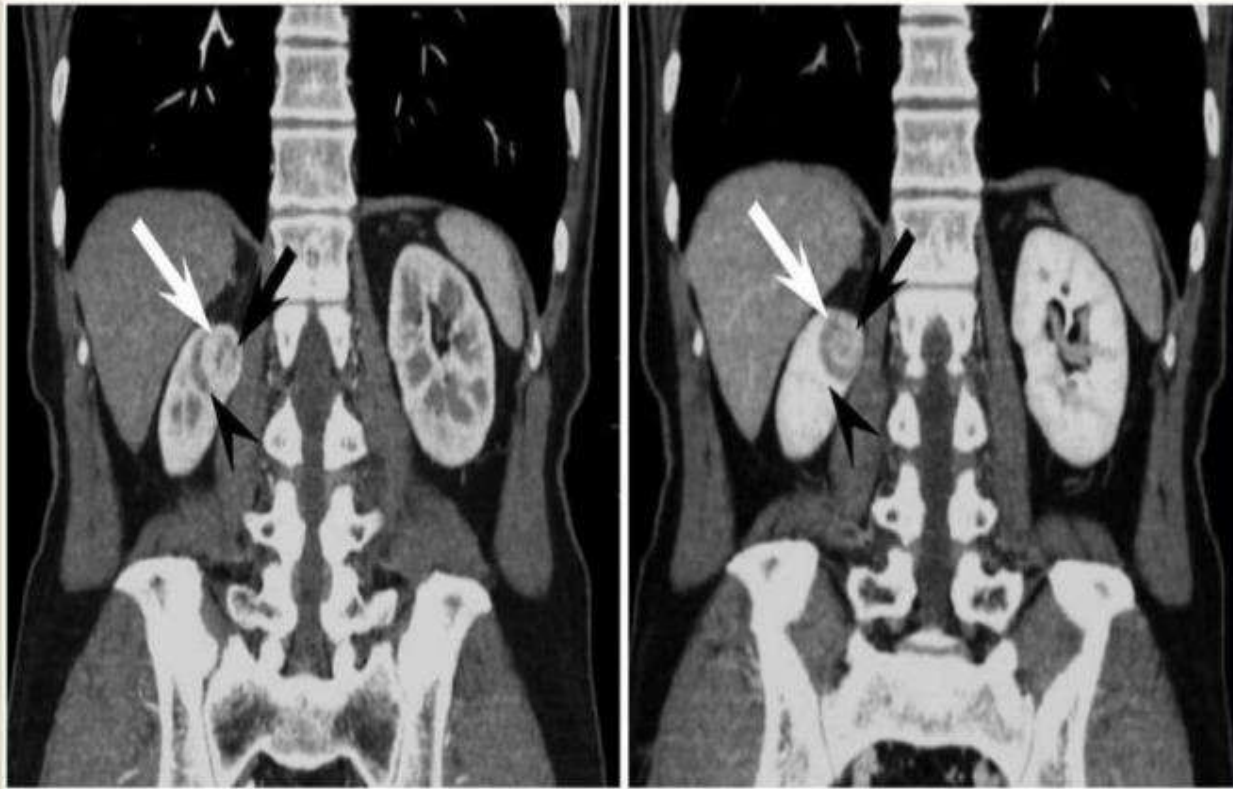


# COMMON PATHOLOGIES IN URINARY SYSTEM AND SIGNS ASSOCIATED WITH THEM

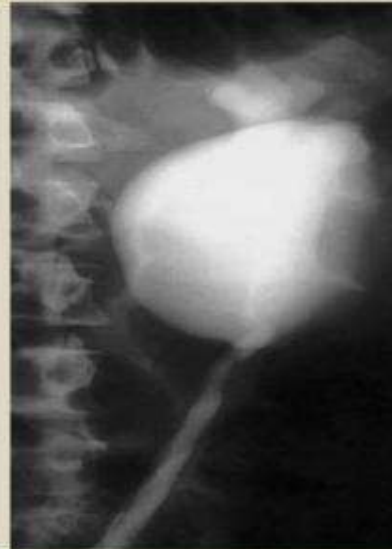


A

B

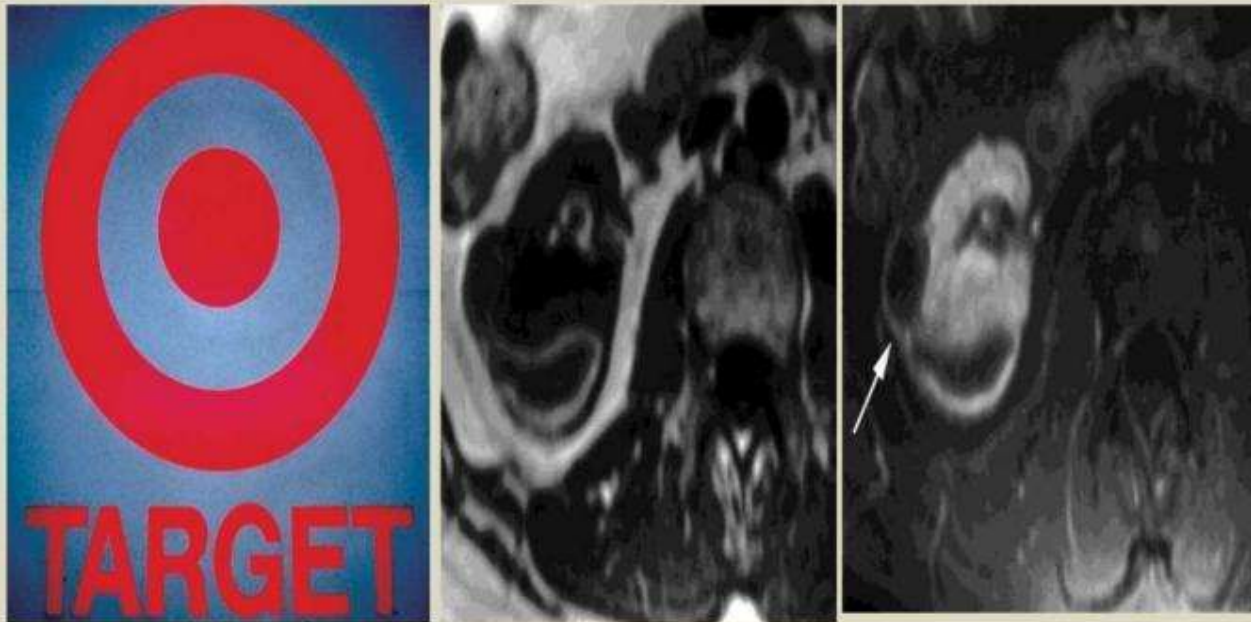
***Crescent sign of the right kidney with oncocytoma.***

**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



(a) Balloon on a string (with thanks to Richard T. Dyer for his help with this photograph). (b) Balloon on a string sign. Delayed tomographic image from excretory urography shows calyceal crescents (arrowheads) surrounding the dilated collecting system. Contrast material pools dependently. (c) Image from retrograde ureteropyelography, performed after several weeks of ureteral stent placement, shows an eccentric exit of the ureter from the dilated renal pelvis. This appearance resembles a balloon on a string and is typical of ureteropelvic junction obstruction.

**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. The ring pattern is best seen on T1- weighted images.



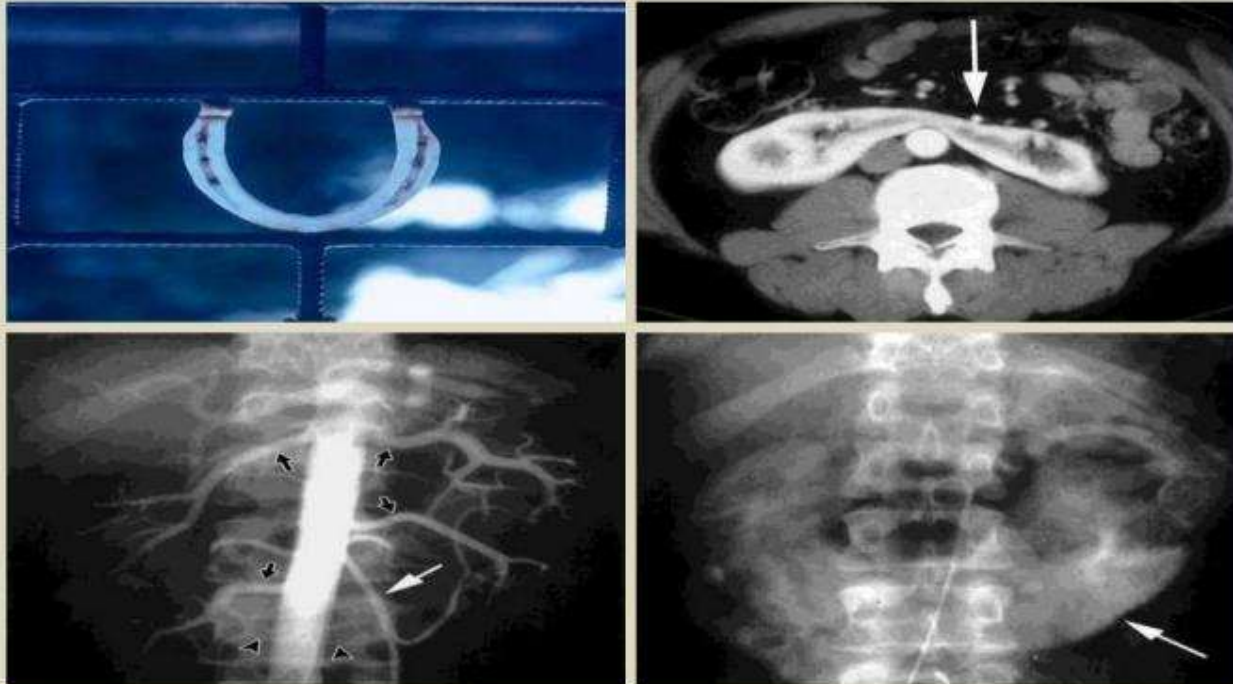
(a) Target sign (registered trademark of Target, Inc.). (b) T1-weighted MR image of the right kidney shows a subcapsular collection with a target appearance, a finding indicative of hemoglobin degradation in a subacute hematoma. (c) Gadolinium-enhanced, fat suppressed T1-weighted MR image reveals that the source of the hemorrhage was a papillary renal cell carcinoma (arrow).



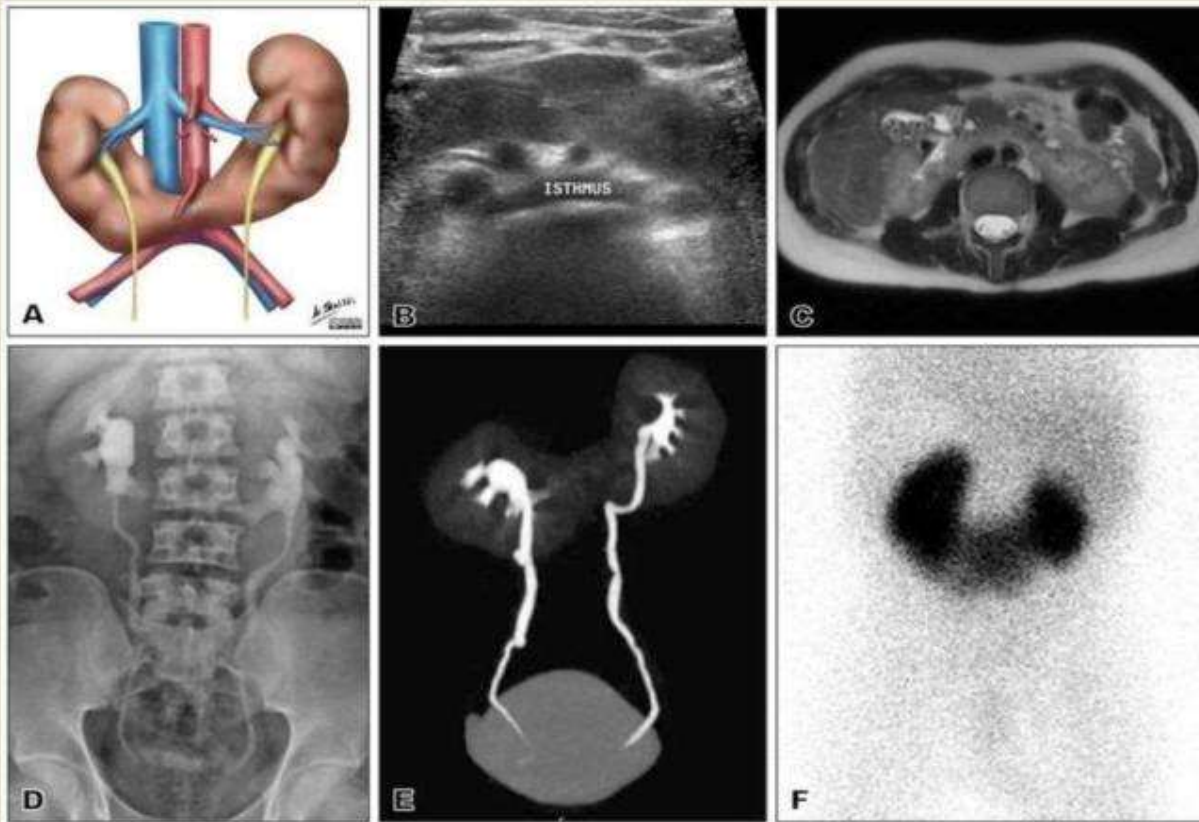


**Kidney sweat.** (18) Longitudinal US image of the left kidney in a patient with acute renal failure reveals a sliver of fluid in a subcapsular location (arrow). This appearance has been called kidney sweat. Similar findings were seen on the right. (19) In another patient with acute renal failure, the 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 Kidney and Other Fusion Anomalies** Horseshoe describes the shape of the most common congenital renal fusion anomaly, occurring in approximately one in 400 live births . Fusion of the lower renal poles, which produces an isthmus of tissue crossing the midline anterior to the aorta, has a number of consequences



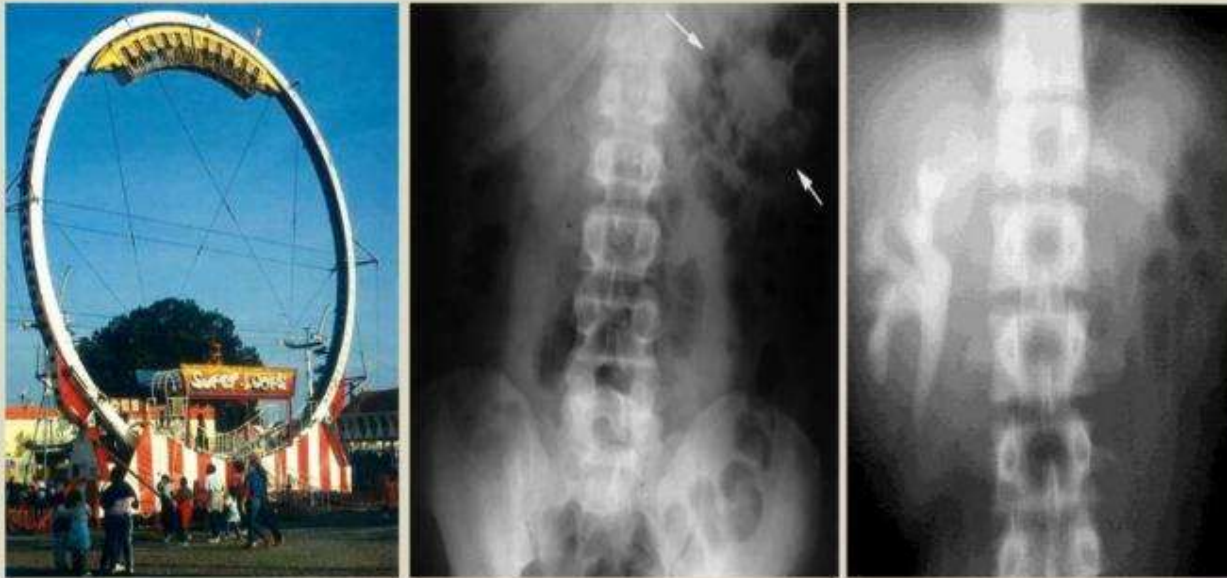
Horseshoe kidney. (20a) Horseshoe. (20b) Enhanced CT image shows the functional isthmus of a horseshoe kidney anterior to the aorta, immediately beneath the inferior mesenteric artery (arrow). (21a) Midstream aortogram demonstrates multiple renal arteries supplying a horseshoe kidney (black arrows and 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.



***Multi-modality imaging of a horseshoe kidney.***

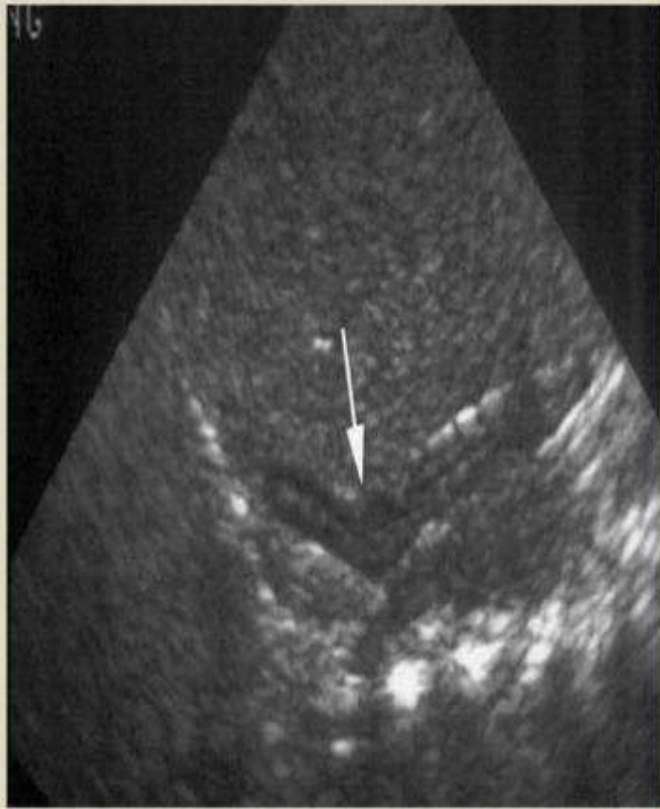


**Loop-to-Loop Colon and the Lying Down (Pancake)** A normal kidney in a normal position is the foundation for image interpretation of many of the anticipated anatomic relationships. The loop-to-loop colon describes an abnormal colonic course associated with the absence of the left kidney from the renal fossa



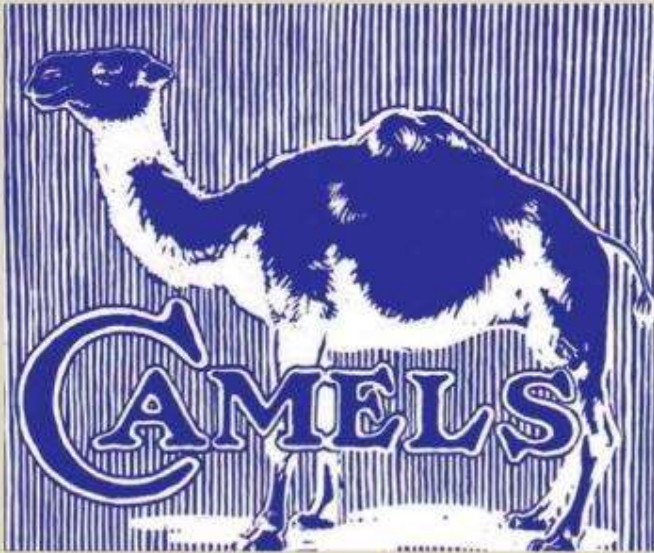
(a) One kind of loop-to-loop. (b) Preliminary image from excretory urography demonstrates a looped configuration of the distal transverse colon and splenic flexure (arrows). (c) Tomogram from excretory urography demonstrates absence of the left kidney and deviation of the descending colon into the renal fossa.



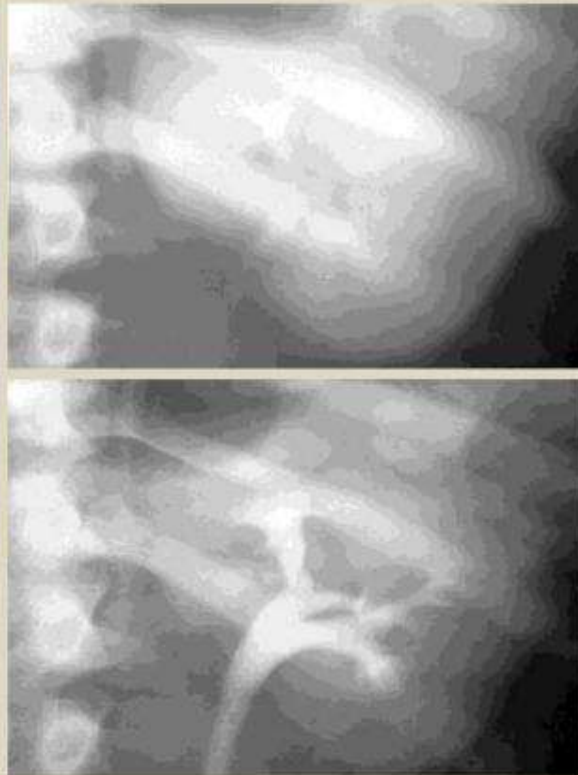


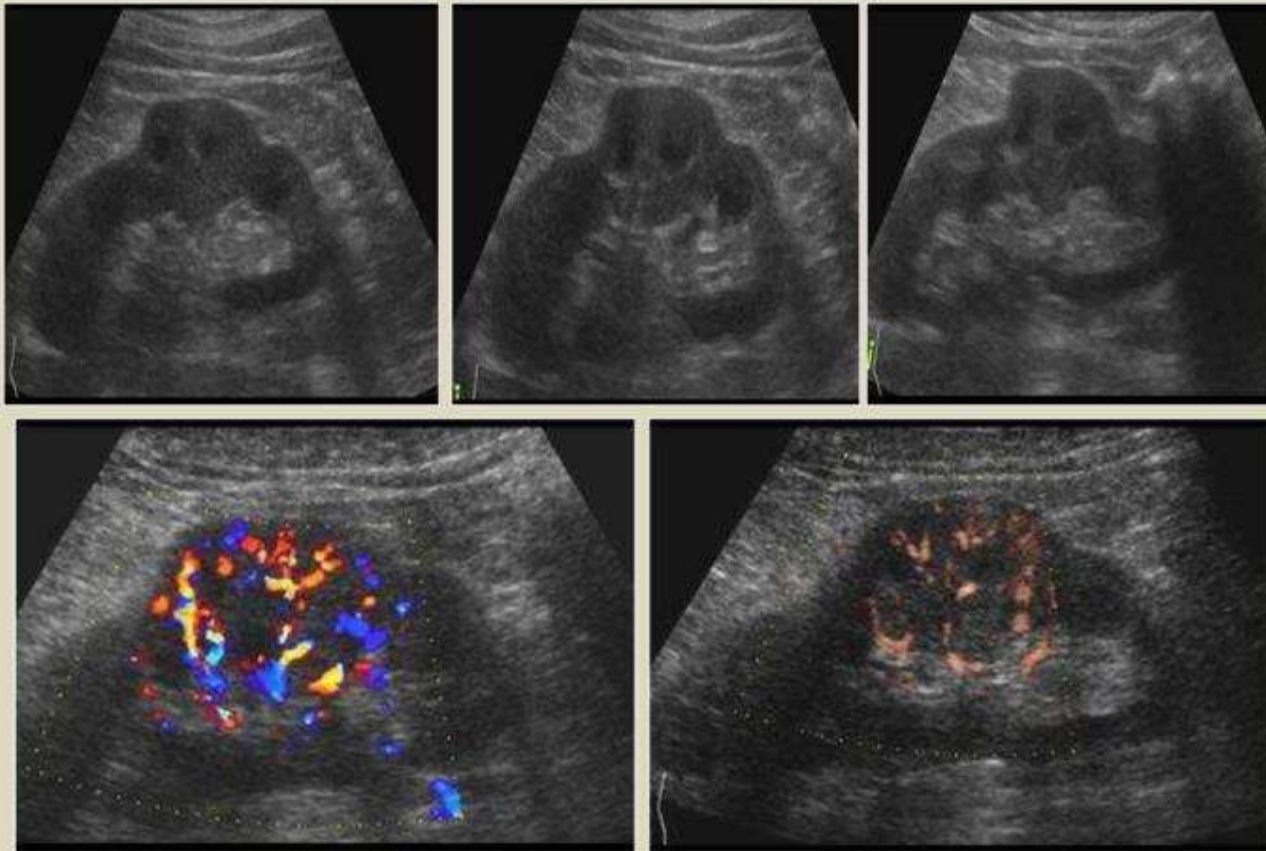
*Lying down adrenal glands. US images of the right (a) and left (b) renal fossae demonstrate absence of the kidneys, and long, slender adrenal glands (arrows) in an infant with bilateral renal agenesis.*

**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.



(a) Dromedary camel (registered trademark of R. J. Reynolds Tobacco Co.). (b) Dromedary hump. Tomogram from excretory urography demonstrates a prominent cortical hump in the interpolar region of the left kidney. (c) On a compression image obtained in a later phase of the sequence, the hump is subtended by a normal collecting system element, indicating that it represents normal functioning tissue.





*Dromedary hump of the left kidney that should not be mistaken for a tumor.*

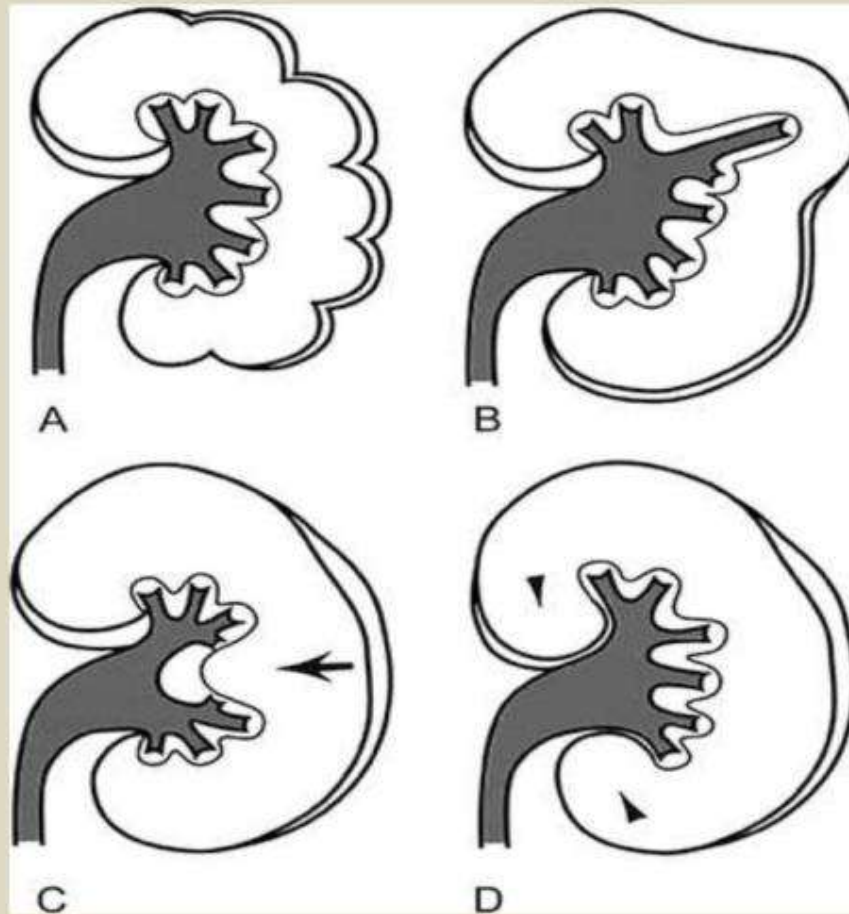




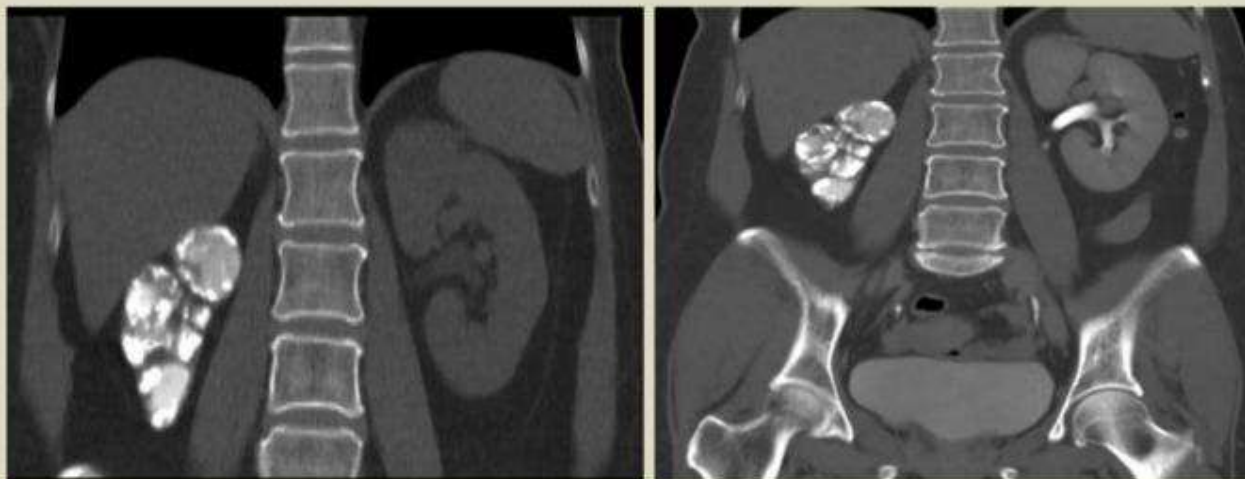
*Dromedary hump of the left kidney.*

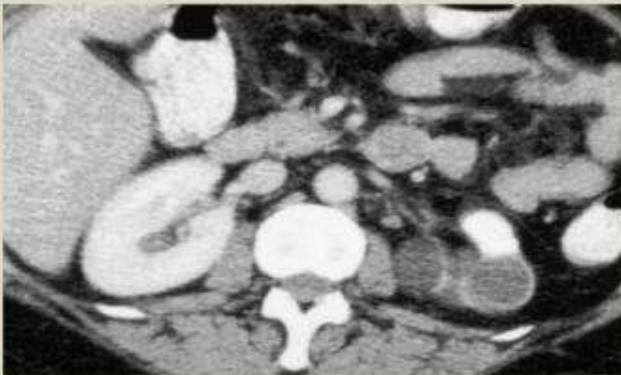
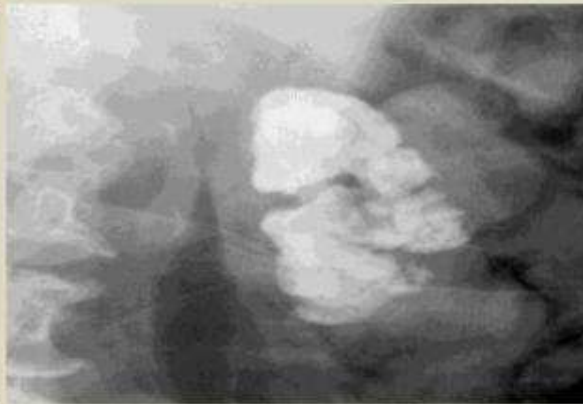


*Drawings illustrate a variety of pseudo masses that can be created by normal renal tissue: fetal lobation (A), dromedary hump (B), cortical column (arrow) (C), and prominent hilar lips (arrowheads) (D). Familiarity with the typical locations and appearances of pseudo masses aids in the correct diagnosis.*



**A putty kidney** refers to a pattern of renal calcification associated with renal tuberculosis conventionally described on plain radiography. Calcification characteristically is very homogeneous and ground glass like, representing calcified caseous tissue. Premkumar et al labelled calcification 'putty like' if any faint area of uniform calcification was more than 1 cm in diameter. Putty calcification needs to be differentiated from lobar pattern of calcification, wherein dense calcific rims outline the periphery of distorted renal lobes. Lobar calcification represents an end-stage appearance, associated with autonephrectomy.





*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.*

## Putty kidney

- Diffuse or scattered renal calcifications (25%)
- Often small kidney

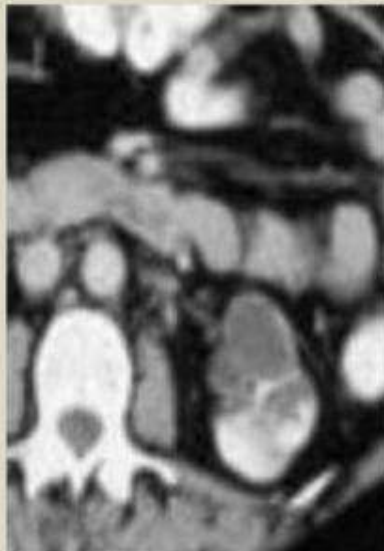


Radiographics 2008; 28(255):1

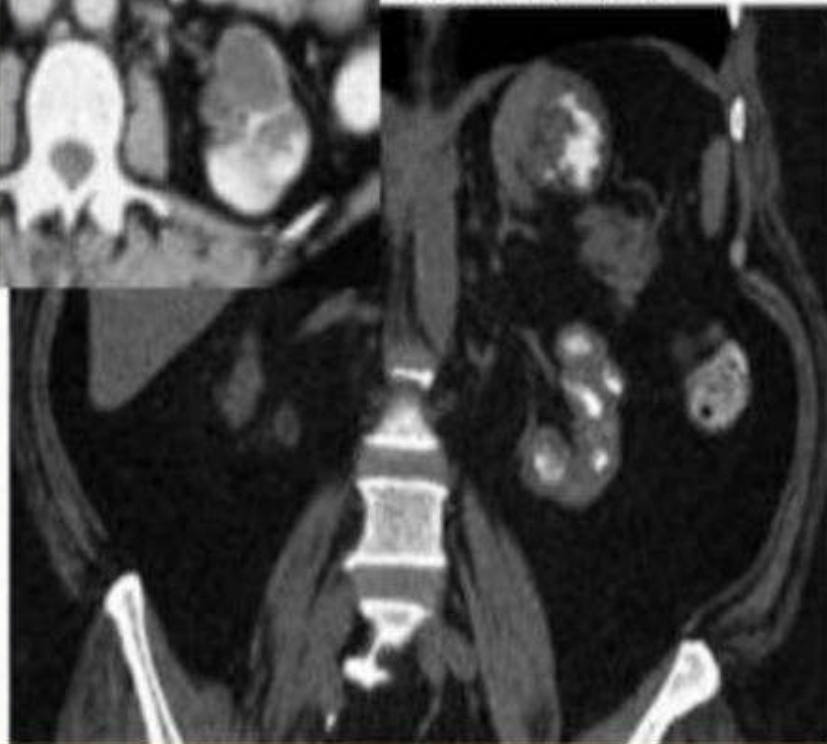


Radiographics 2004;  
24:issue suppl\_1



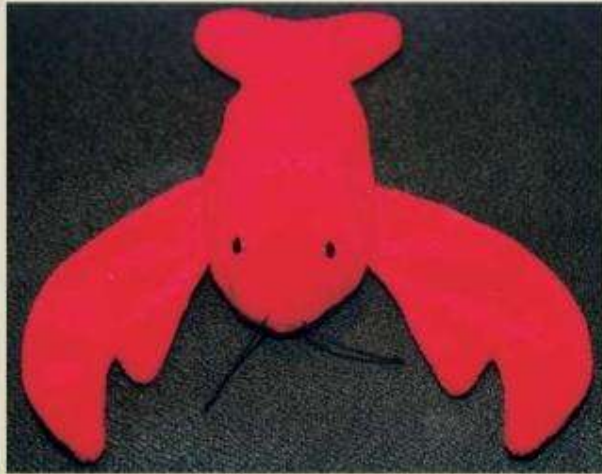


Radiol Clin N Am 50 (2012) 259–270

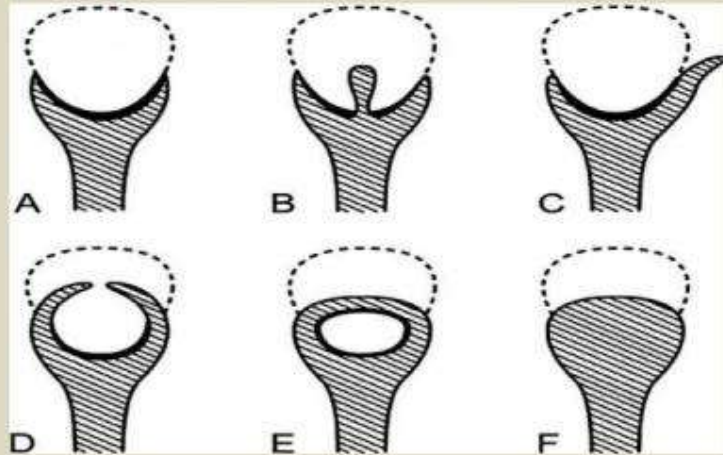


### ***Ball-on-Tee, Lobster Claw, and Signet Ring Appearances***

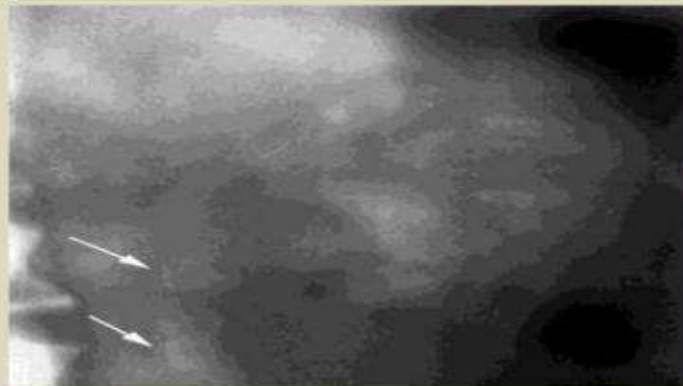
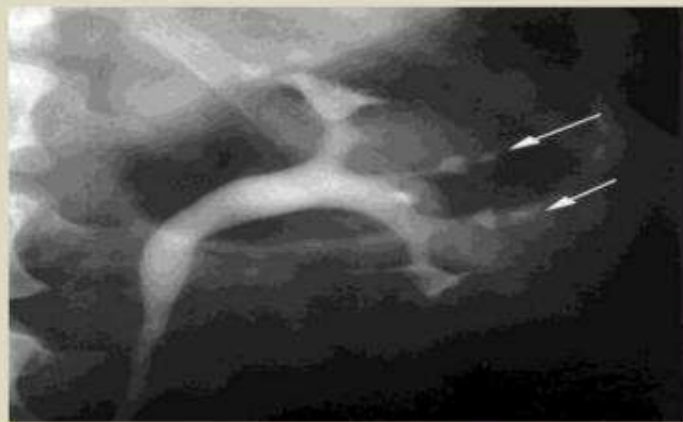
***The descriptive terms ball-on-tee, lobster claw, and signet ring refer to the radiographic patterns of papillary excavation seen with papillary necrosis. The necrotic papillary tip may remain within the excavated calyx, producing the signet ring sign when the calyx is filled with contrast material. 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. 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 Non steroidal anti-inflammatory drugs; Sick cell anemia; Analgesic nephropathy; Infection, especially tuberculosis; and Diabetes mellitus***



(a) Ball-on-tee. (b) Lobster claws with lobster. (c) Drawing illustrates the different patterns of excavation that can be seen with papillary necrosis: normal (A), central excavation with ball-on-tee appearance (B), forniceal excavation (C), lobster claw appearance (D), signet ring appearance (E), and sloughed papilla with clubbed calix (F).







**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 calyceal 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).





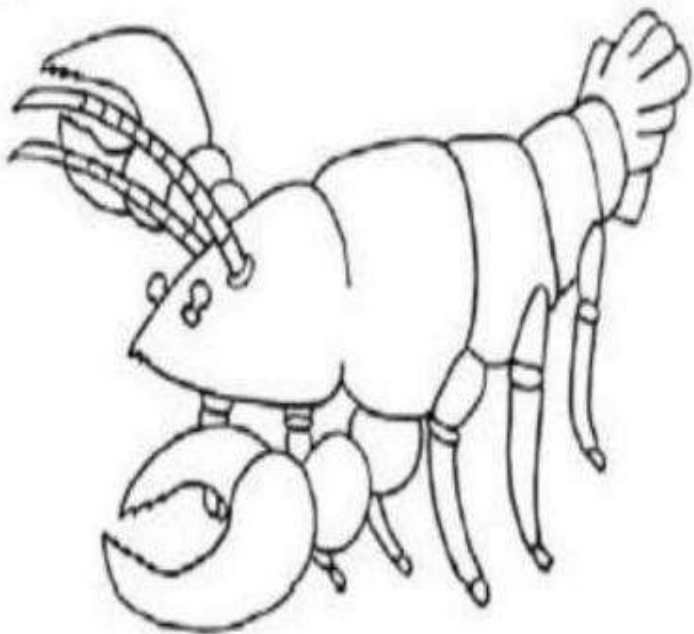
***Phantom calyx. (a) On an excretory urogram, stricturing of the superior infundibulum caused by tuberculosis has obliterated the upper calyx (arrow), producing a phantom calyx. (b) On image of another patient, a mass in the upper pole of the right kidney has destroyed the calyceal elements normally seen in this region. In this case, the phantom calices are secondary to renal cell carcinoma.***



Radiographics 2004;  
24;issue suppl\_1

***Papillary necrosis with signet ring sign.***

3a



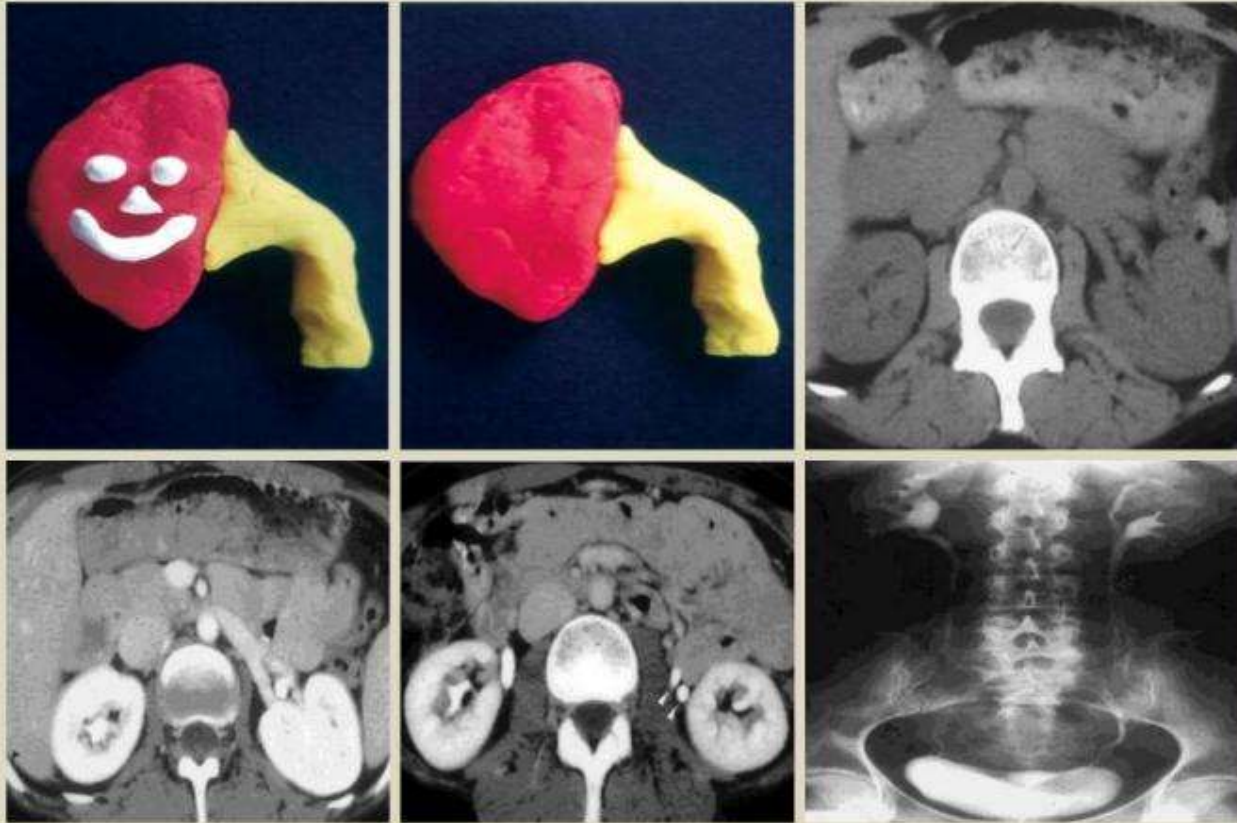
Rev Chil Radiol 2010; 16(3): 128-133

3b



**Faceless Kidney** The term faceless kidney was originally reported as a CT sign of renal duplication. 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. 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. The familiar “face” should always be present, regardless of the imaging technique used. Its absence or distortion requires explanation.

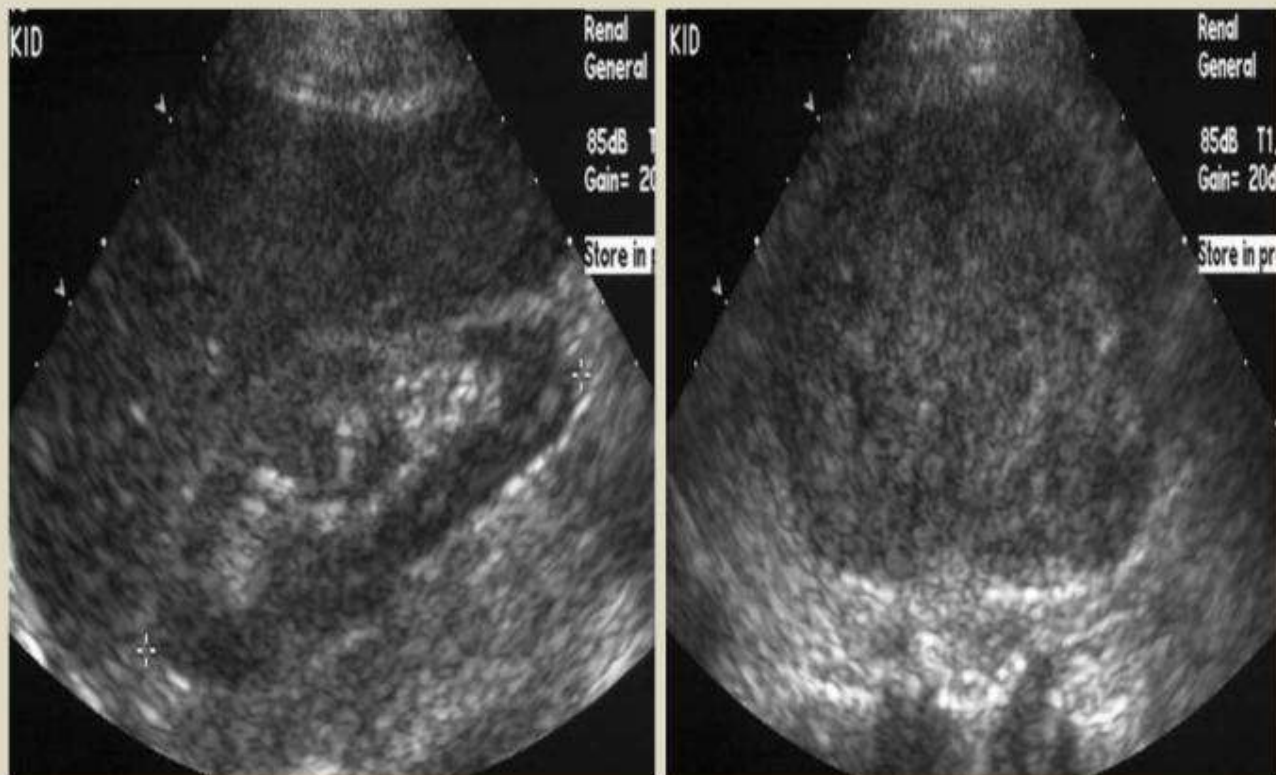




*Faceless kidney sign. (a, b) Kidney with (a) and without (b) a face. (c) Unenhanced CT image through the kidneys shows absence of the typical sinus signature in the left kidney. (d) Contrast-enhanced image, obtained at the same level as seen in c, shows normal parenchymal enhancement. (e) Delayed image 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.*



***Faceless kidney. (a) Unenhanced CT image shows absence of the central sinus signature in the left kidney. Note perinephric stranding and abnormalities in the hilar region. (b) Enhanced image obtained at the same level as a shows abnormal parenchymal enhancement, in this case from a diffusely infiltrating transitional cell carcinoma.***



**Faceless kidney.** (a) US image of the right kidney (same patient as in Fig 34) shows the normal sonographic signature of the renal sinus. (b) Sonographic sinus signature in the left kidney is grossly distorted due to infiltration by transitional cell carcinoma.



**The drooping lily sign** is a urographic sign in some patients with a duplicate collecting system. It refers to the inferolateral displacement of the opacified lower pole moiety due to an obstructed (and unopacified) upper pole moiety.



***Drooping lily sign with duplicated kidney.***



*(a) Drooping lily. (b) Excretory urogram of an infant with a urinary tract infection demonstrates downward and lateral displacement of the opacified lower pole moiety of a duplicated system (the drooping lily appearance) caused by the dilated, obstructed collecting system and ureter of the nonfunctional upper pole moiety.*



***Drooping lilly sign.***



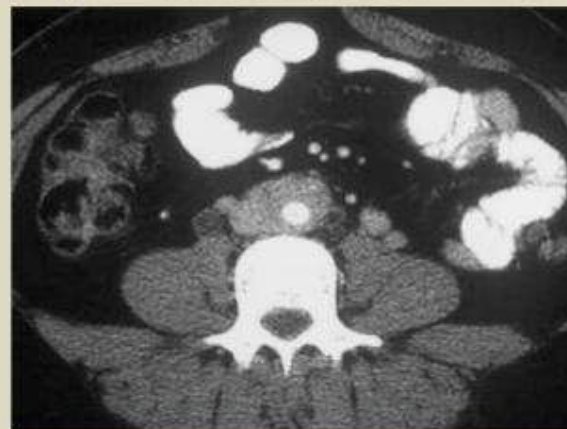


***Duplex collecting system: drooping lily sign.***

***Maiden waist deformity*** is the appearance of the deviation of bilateral ureters. This typically occurs in retroperitoneal fibrosis. In this condition, there is medial drawing of the ureter due to deposition of fibrous tissue in the lumbosacral junction. Due to involvement of both ureters, the course of the medially-drawn ureters is said to have an appearance of a narrow waist maiden, thus giving the name.



***Maiden waist deformity.***



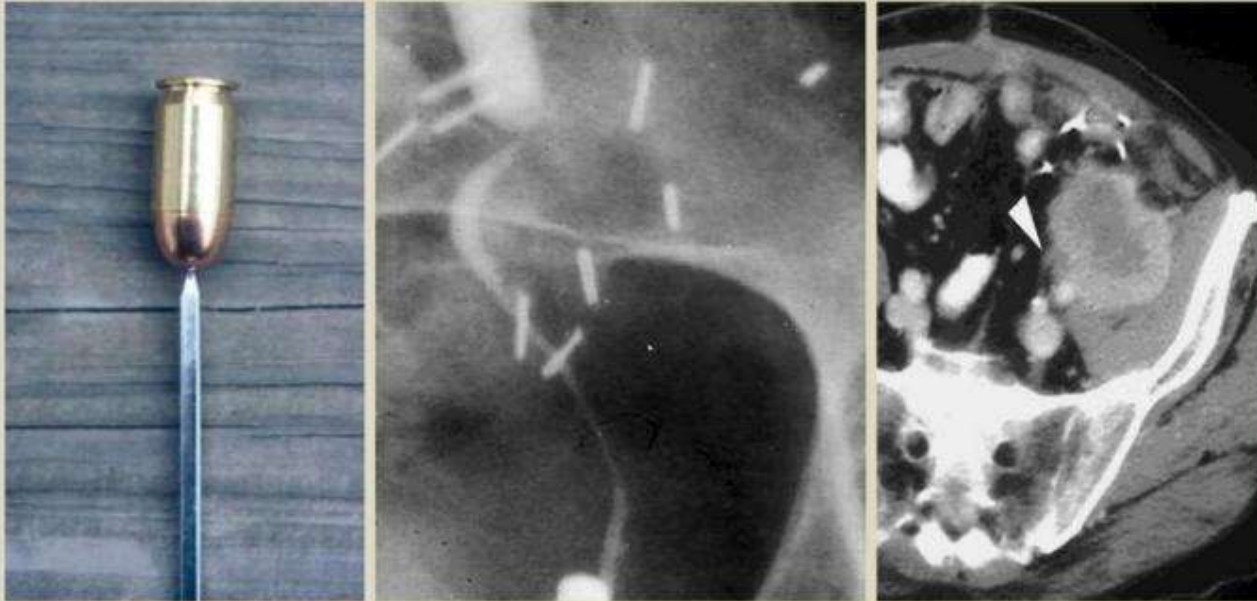
**(37) Maiden waist deformity.** (a) Radiograph of Barbie (registered trademark of Mattel) clearly depicts a narrow-waisted maiden. (b) Composite image of bilateral retrograde examinations performed in a patient with renal failure and minimal hydronephrosis shows narrowed areas in both ureters at the 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.



***Retroperitoneal fibrosis. Scout image of the abdomen shows bilateral stents in place in a patient who underwent intraperitonealization of the ureters as therapy for retroperitoneal fibrosis. Note the lateral position of the ureters associated with this intervention.***

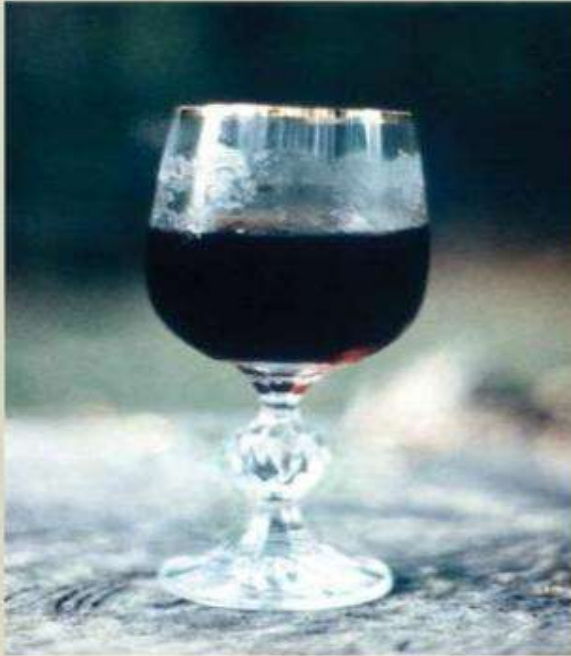


**Bullet and Bodkin Sign** Encasement of the ureter may produce an abrupt transition in ureteral caliber. The dilated ureter (the bullet) may appear to be precariously perched on the nondilated, encased ureter (the bodkin, which is defined as a sharp, slender instrument)

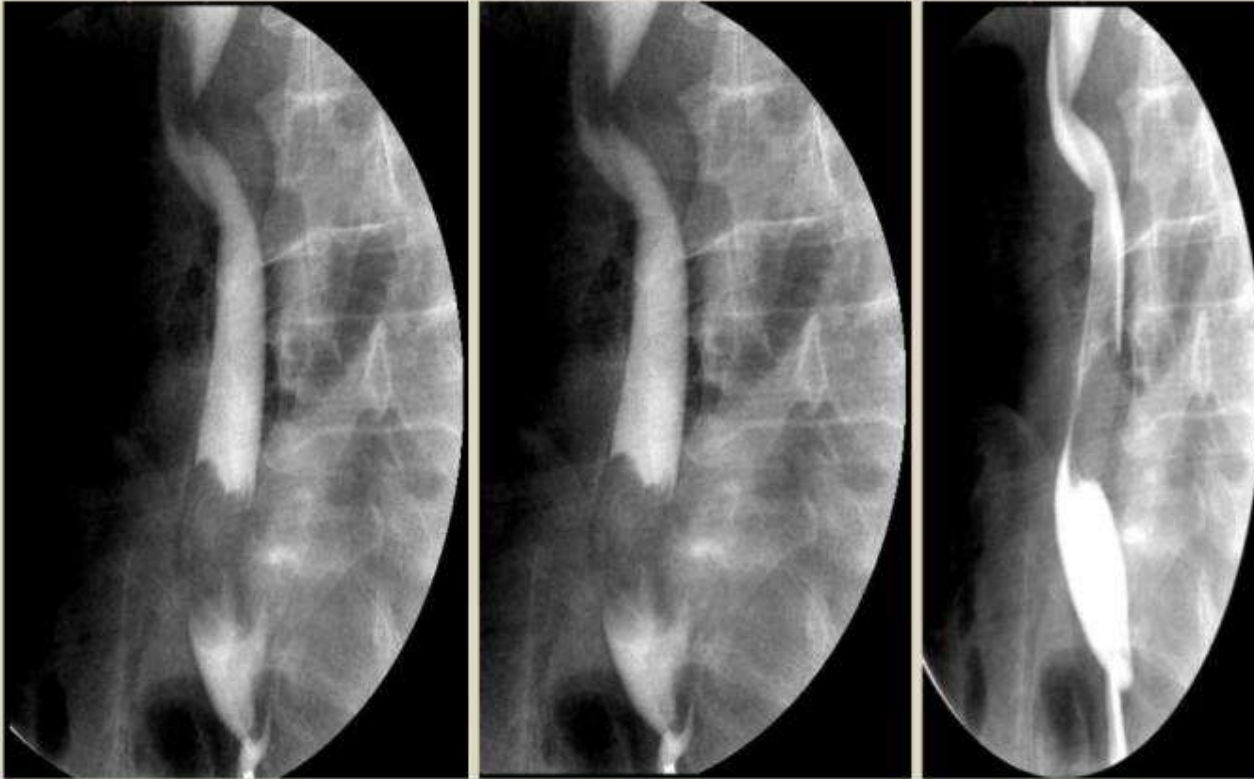


*(a) Bullet on a bodkin. (b) Retrograde ureteropyelogram demonstrates an abrupt transition between the dilated upper ureter and normal-appearing lower ureter. (c) Enhanced CT scan demonstrates encasement of the ureter (arrowhead) in the left anatomic pelvis by a mass, secondary to recurrent carcinoma of the colon.*

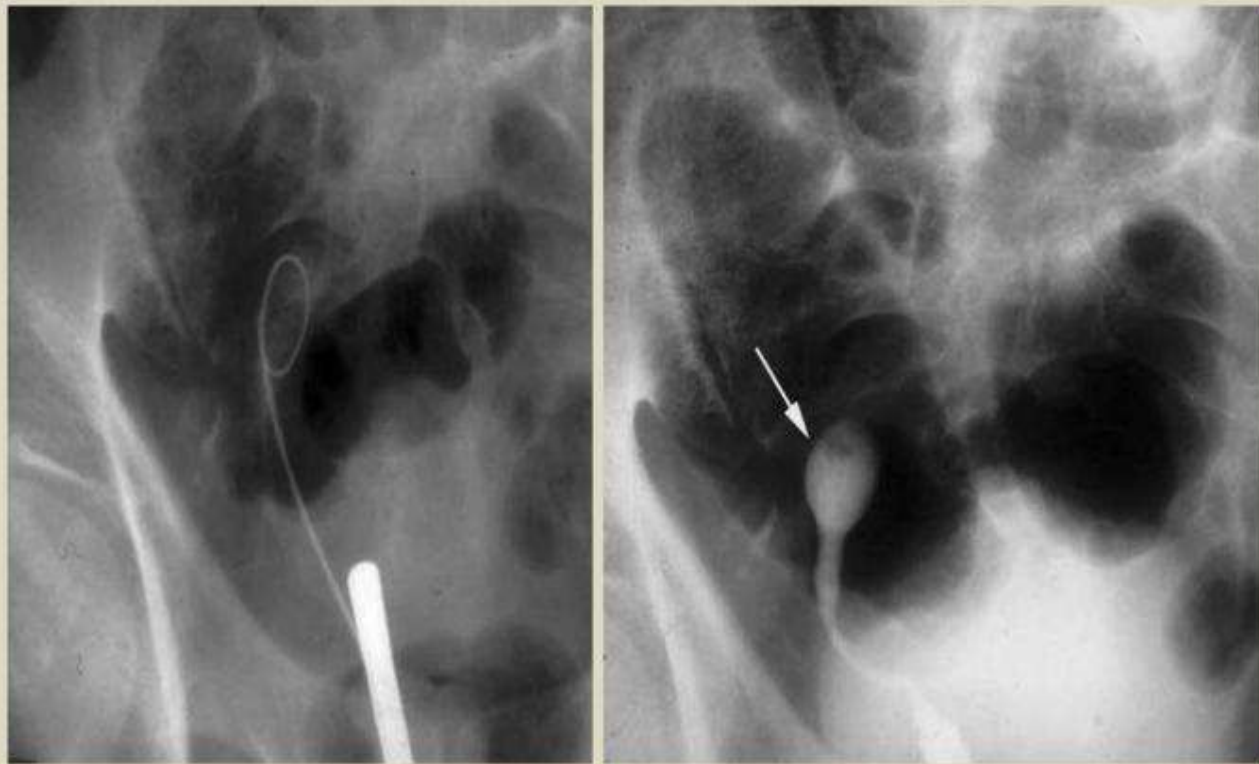
The goblet sign (or champagne glass sign) refers to the appearance of the ureter when it is focally dilated by an intraluminal mass. It is best seen when the ureter is opacified from below, by a retrograde ureterogram. Presence of this sign indicates the pathology to be chronic, permitting the lesion to be accommodated in the ureter.



(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.

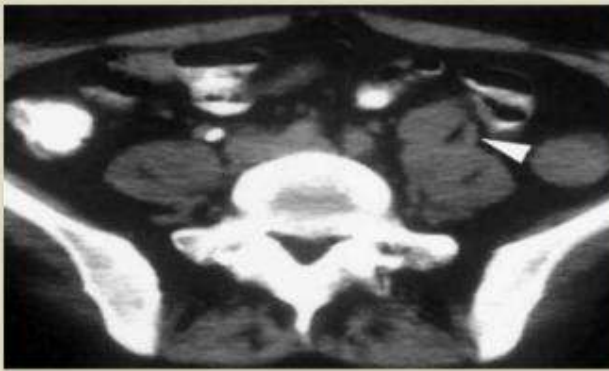
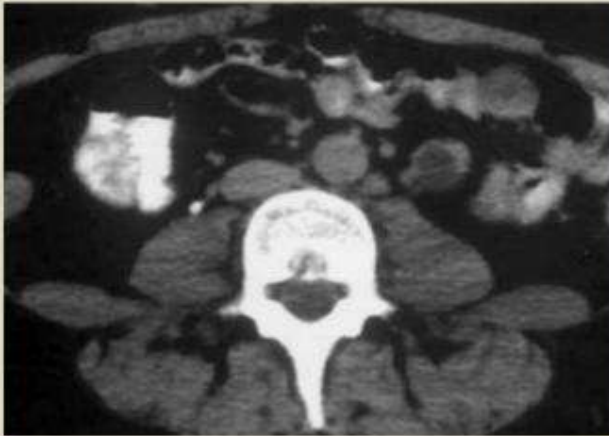


***The goblet sign (or champagne glass sign).***



**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.



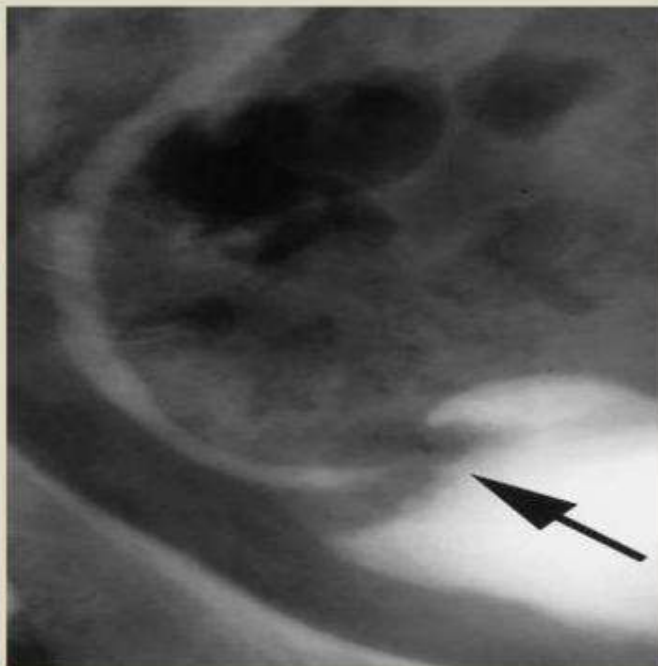


*Ureteral transitional cell carcinoma. Sequence of enhanced CT scans, obtained after discovery of a nonfunctional left kidney, demonstrate hydronephrosis, hydroureter, and a soft-tissue mass in the distal left ureter (arrow in c). Note the transition to a normal ureter in d (arrowhead). These images provide an axial demonstration of the goblet sign.*



*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.*

**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) ureterocele.

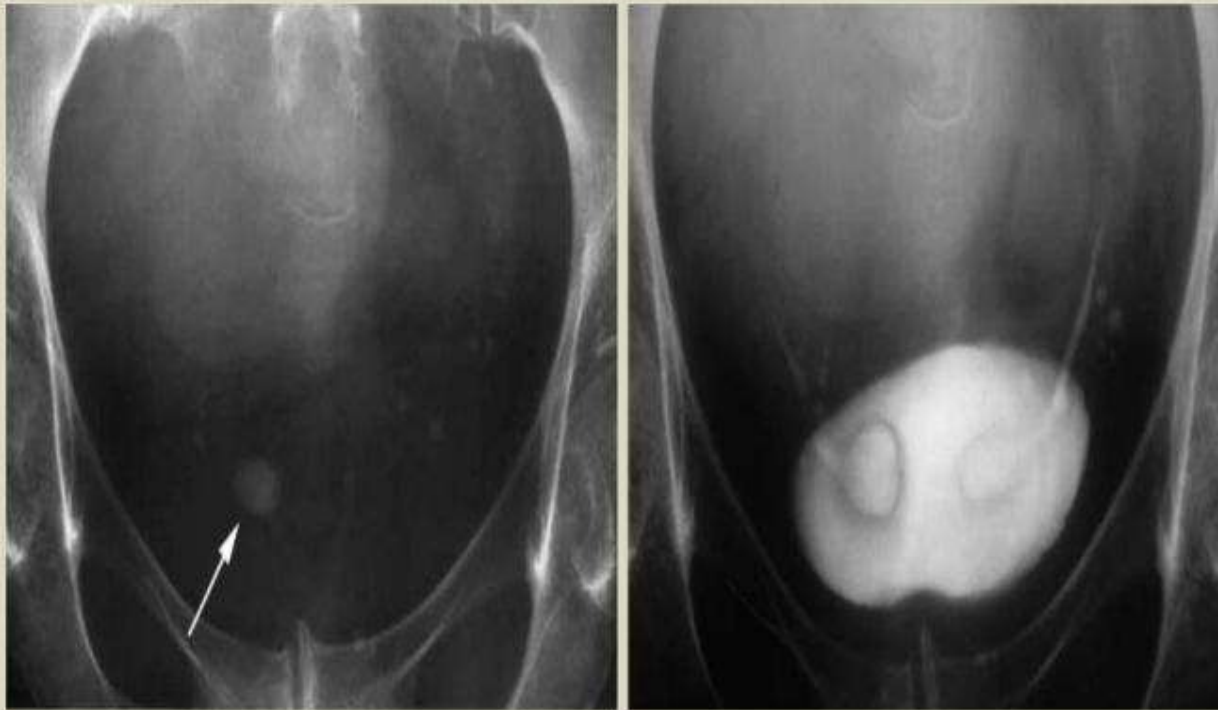


(a) Cobra's head. (b) Late excretory urogram demonstrates bilateral ureteral obstruction from large, adult-type ureteroceles. Despite their size, the lucent rims surrounding the ureteroceles are thin and well defined.



***Cobra head sign.***

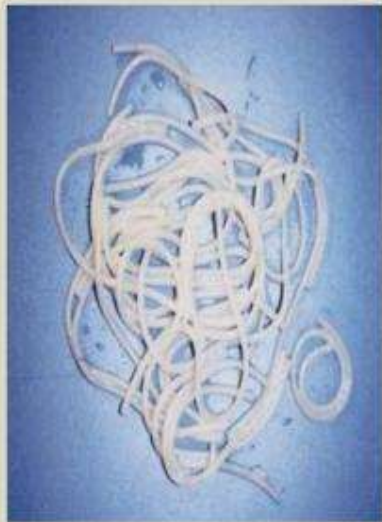




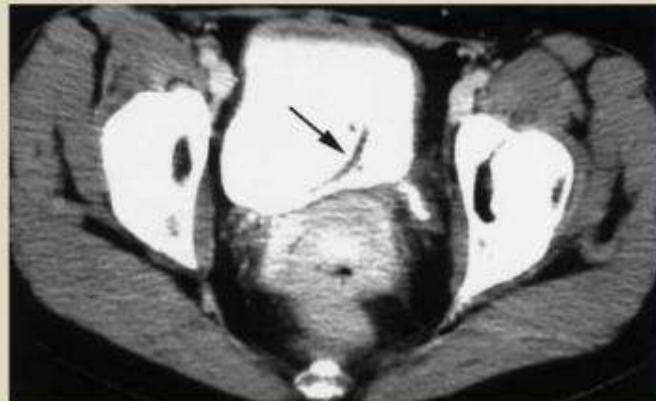
*Pseudoureterocele. (a) Excretory urogram obtained after lithotripsy shows stone fragments (arrow) that have impacted at the right ureterovesical junction. (b) Excretory urogram demonstrates dilatation of the distal ureter and a thickened, edematous halo surrounding the dilated segment. Prelithotripsy 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. Although originally described at urography, the finding may occasionally be seen with other imaging modalities.*

**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 anatomic pelvis by an extrinsic process. The differential diagnosis of the imaging appearance includes the presence of pelvic fluid (hematoma, lymphocele, urinoma, or abscess), pelvic lipomatosis, 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.*



*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.*



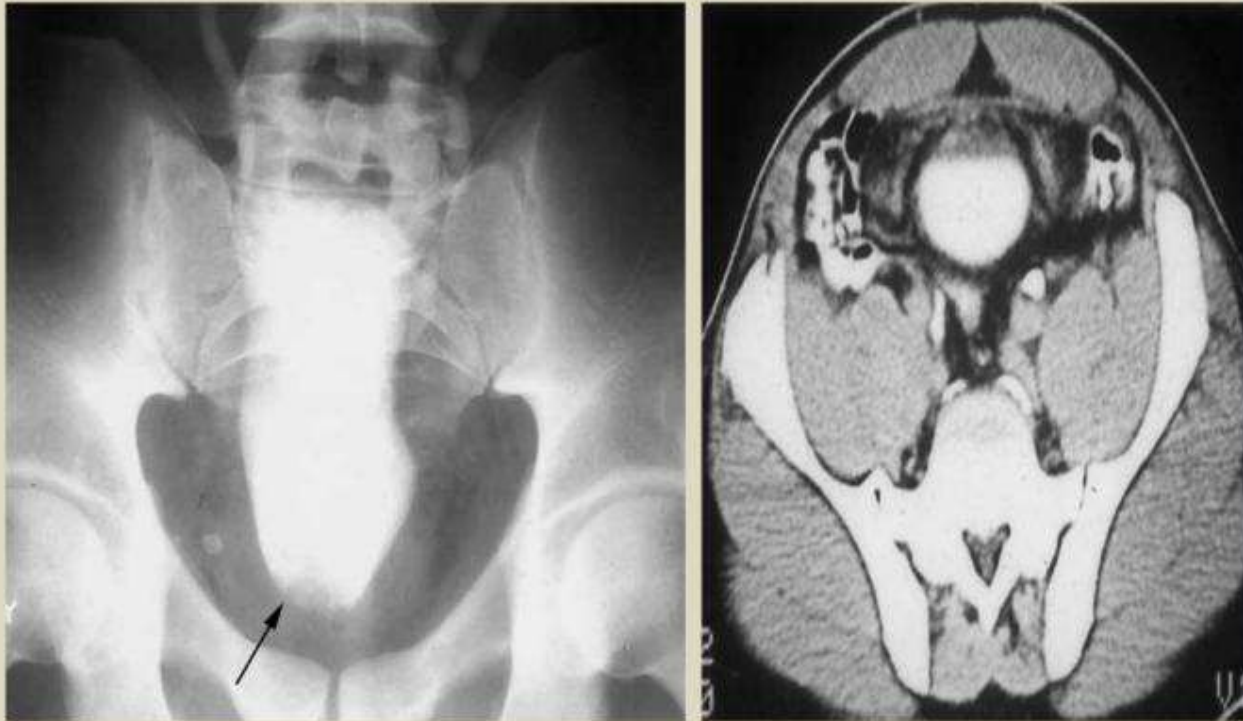




*(50a) Pear. (50b) Excretory urogram of a trauma victim. Pelvic trauma has resulted in extraperitoneal bladder rupture with urinary extravasation and pelvic hematoma, which produces symmetric compression of the bladder, resulting in the pear shape. (51) Pear-shaped bladder. (51a) Scout image shows perivesical 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.*





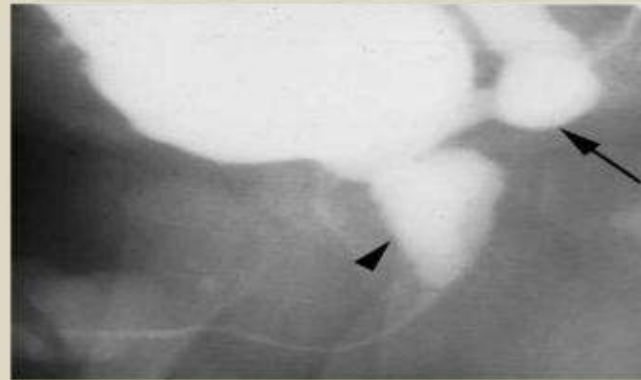
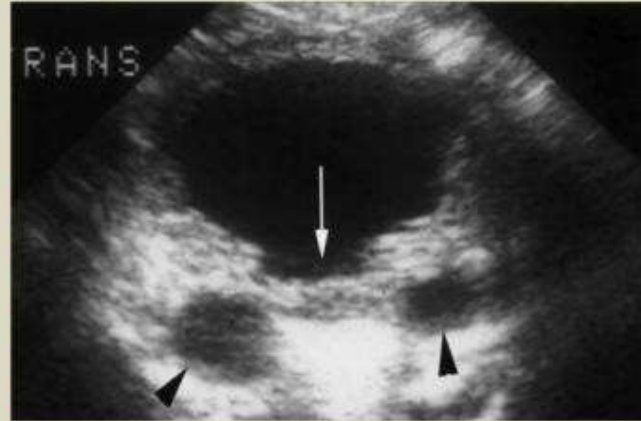


***Pear-shaped bladder. (a) Excretory urogram demonstrates filling defects (arrow) in the bladder base, which proved to be cystitis glandularis, associated with symmetric bladder compression. (b) Although cystitis glandularis has been associated with pelvic lipomatosis, in this case, the CT scan reveals the compression is caused by psoas muscle hypertrophy.***



*Pie-in-the-sky bladder. Scout image of the pelvis, obtained after administration of contrast material for CT, demonstrates bilateral pubic rami fractures. The associated pelvic hematoma elevates the bladder, giving it the pie-in-the-sky appearance. There was an associated posterior urethral injury*

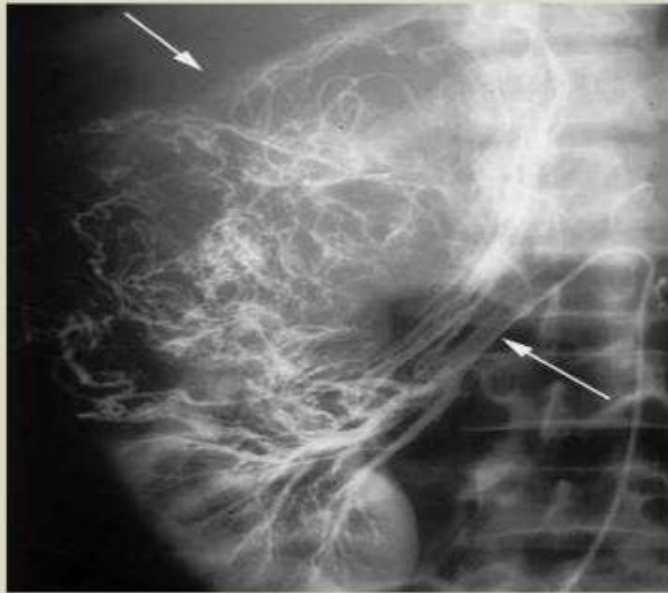
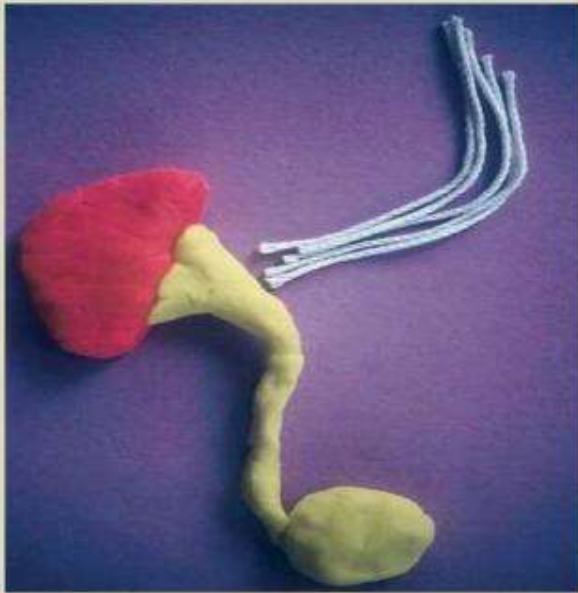
**Keyhole Sign** Sonographic identification of hydronephrosis in a male fetus or infant should prompt investigation for the presence of posterior urethral valves. The thick-walled bladder and dilated posterior urethra related to obstruction by the valves, as seen at US, may resemble a keyhole



(a) Keyhole. (b) Transverse US image of the bladder in a male infant demonstrates bladder wall thickening and dilatation of the posterior urethra, resulting in a keyhole appearance (arrow). Note the dilated ureters posterior to the bladder (arrowheads). (c) Image from voiding cystourethrography in the same patient demonstrates dilatation of the urethra proximal to posterior urethral valves (arrowhead), with reflux into the dilated distal ureter (arrow).

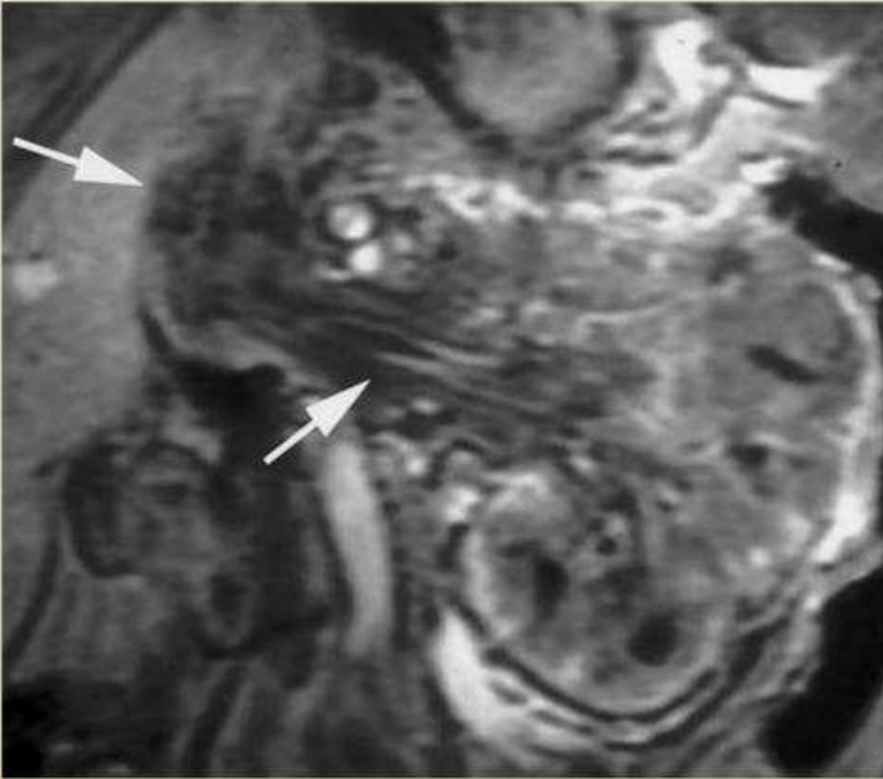


**Threads and Streaks Sign** The threads and streaks sign was originally a description of the angiographic appearance of vascularized tumor thrombus extending into the renal vein or inferior vena cava from a renal cell carcinoma.



(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.

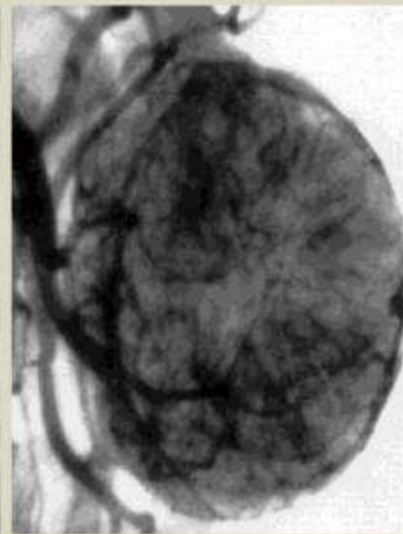
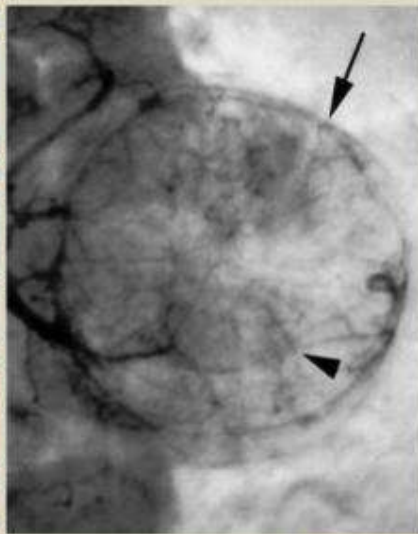




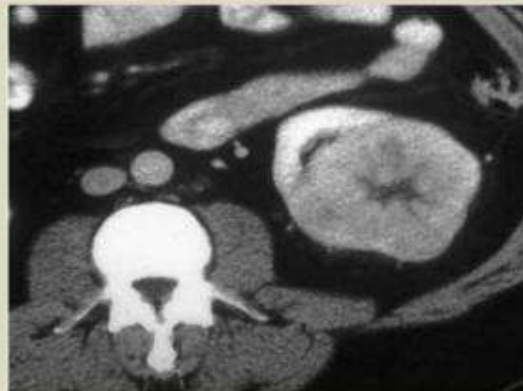
*Threads and streaks. Gadolinium-enhanced, coronal T1-weighted MR image of the left kidney in another patient with a left upper pole renal mass shows linear vascularity supplying a tumor thrombus extending along the left renal vein and into the inferior vena cava (arrows).*

**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. However, the pattern is now known to be nonspecific, and a similar vascular arrangement has been described with renal cell carcinoma. 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. The scar has been described at US, CT, and MR imaging.

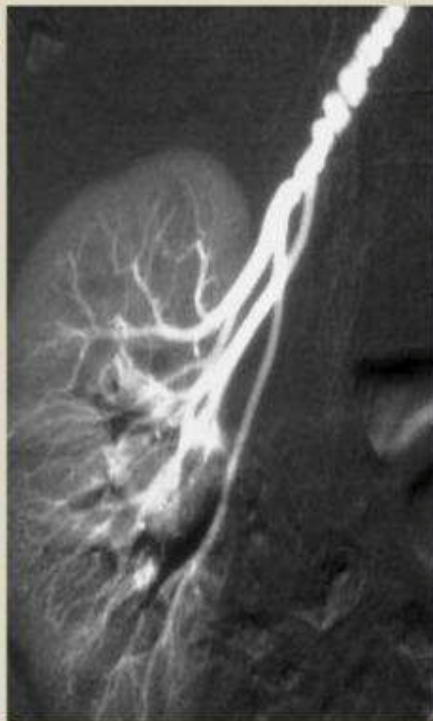
**String of Pearls Appearance** The descriptive term string of pearls has been applied to the angiographic appearance of arteries involved with the medial form of fibromuscular dysplasia. Thickened fibromuscular ridges, alternating with areas of wall thinning and aneurysm formation, create the typical appearance, most often seen in the renal arteries. 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.



*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.*







*String of pearls appearance. (59a) String of pearls. (59b) Selective right renal arteriogram shows areas of aneurysmal dilatation alternating with areas of stenosis in the distal main renal artery, giving the typical string of pearls appearance associated with the medial form of fibromuscular dysplasia. (60) Gadolinium-enhanced MR angiographic image of another patient with fibromuscular dysplasia also demonstrates the string of pearls appearance in the right renal artery*



A **pine cone bladder** or Christmas tree bladder is a **cystogram** appearance in which the **bladder** is elongated and pointed with thickened trabeculated wall. It is typically seen in severe **neurogenic bladder** with increased sphincter tone (detrusor sphincter dysynergia) due to suprasacral lesions



**Christmas tree bladder.**



***Christmas tree bladder.***



***Christmas tree bladder.***