به نام خدا

تصویربرداری در جراحی کلیه و مجاری ادراری

کتاب جامع اورولوژی ایران

دکتر دانش دوست

متخصص اورولوژی

INTRAVENOUS UROGRAPHY (IVU)

IVU

KUB first

Contrast is injected as a bolus of 50 to 100 mL of contrast

nephrogenic phase → immediately after injection

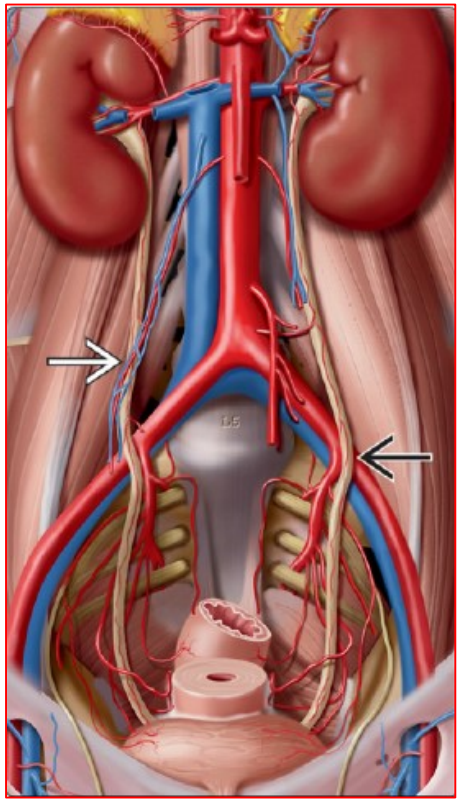
A film is taken at 5 minutes

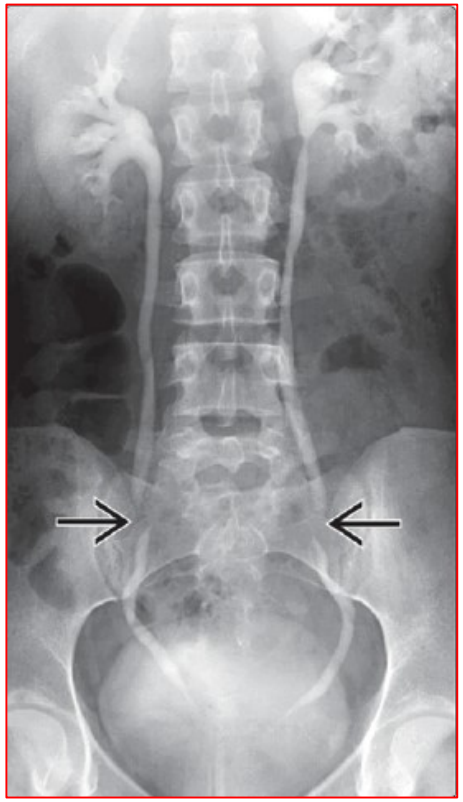
Additional films at 5-minute intervals until the question that prompted the IVU is answered

IVU

Indications

1. Demonstration of renal collecting systems and ureters
2. Investigation of level of ureteral obstruction
3. Demonstration of intraoperative opacification of collecting system during extracorporeal shock wave lithotripsy or percutaneous access to the collecting system
4. Demonstration of renal function during emergent evaluation of unstable patients
5. Demonstrate renal and ureteral anatomy in special circumstances (e.g., ptosis, after transureteroureterostomy, and after urinary diversion)



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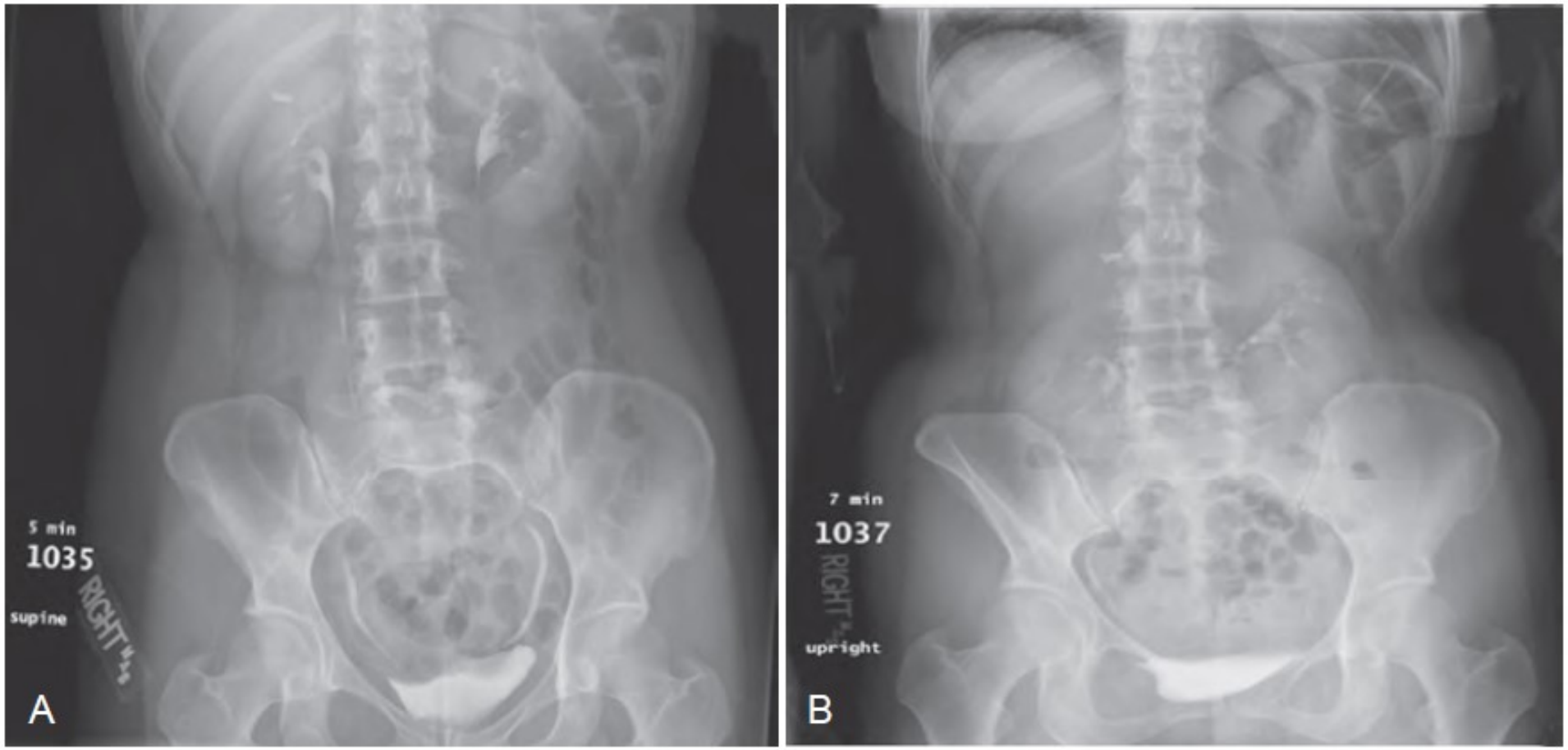


Figure 2-2. Intravenous excretory urogram (IVU) in a 40-year-old woman with the complaint of a mobile mass in the right lower quadrant with standing associated with bilateral flank and back pain that resolved in the supine position. A, Supine IVU shows kidneys in the normal position with normal ureters and proximal collecting systems. B, Standing film shows significant displacement of both kidneys, with the right kidney moving onto the pelvis as described by the patient.

PLAIN ABDOMINAL RADIOGRAPHY

دکتر رزگار دانش دوست (دانشگاه علوم پزشکی کردستان)

PLAIN ABDOMINAL RADIOGRAPHY

Supine position

Anterior to posterior exposure

Indications

1. Used as a preliminary film in anticipation of contrast administration
2. Assessment of presence of residual contrast from a previous imaging procedure
3. Assessment of renal calculus disease before and after treatment
4. Assessment of the position of drains and stents
5. Used as an adjunct to the investigation of blunt or penetrating trauma to the urinary tract

PLAIN ABDOMINAL RADIOGRAPHY

Limitations in evaluation of calculus disease

۱. overlying stool and bowel gas

۲. obscured by other structures such as bones or ribs

۳. calcifications in pelvic veins or vascular structures

۴. stones that are poorly calcified or composed of uric acid

Figure 2-3. A, Right ureteral calculus *(arrow)* overlying the sacrum is difficult to visualize on the plain film. B, The right posterior oblique study fails to confirm the location of the ureteral calculus. C, Computed tomography confirms this 6-mm calculus in the right ureter at the level of the third sacral segment *(arrow)*.

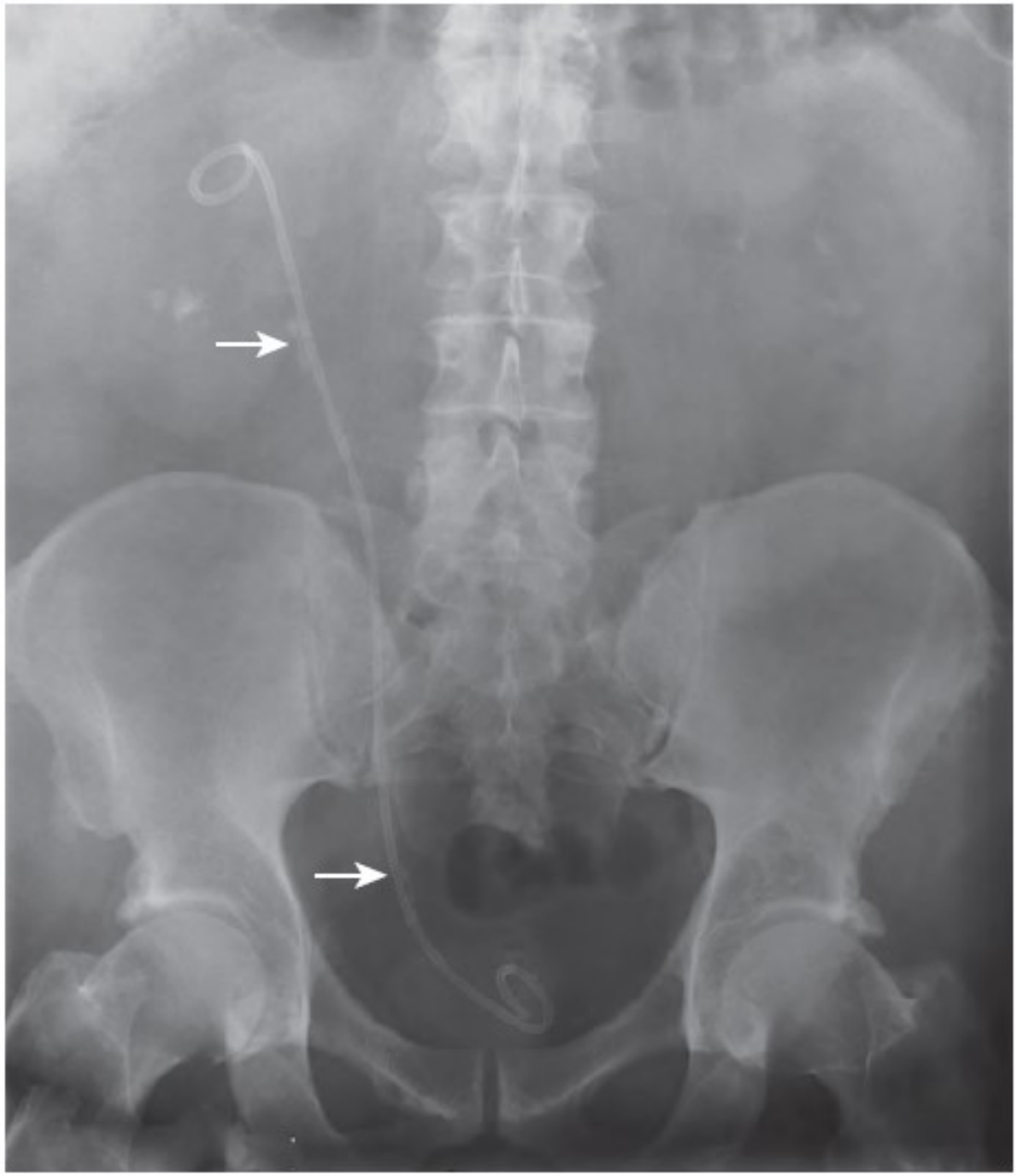
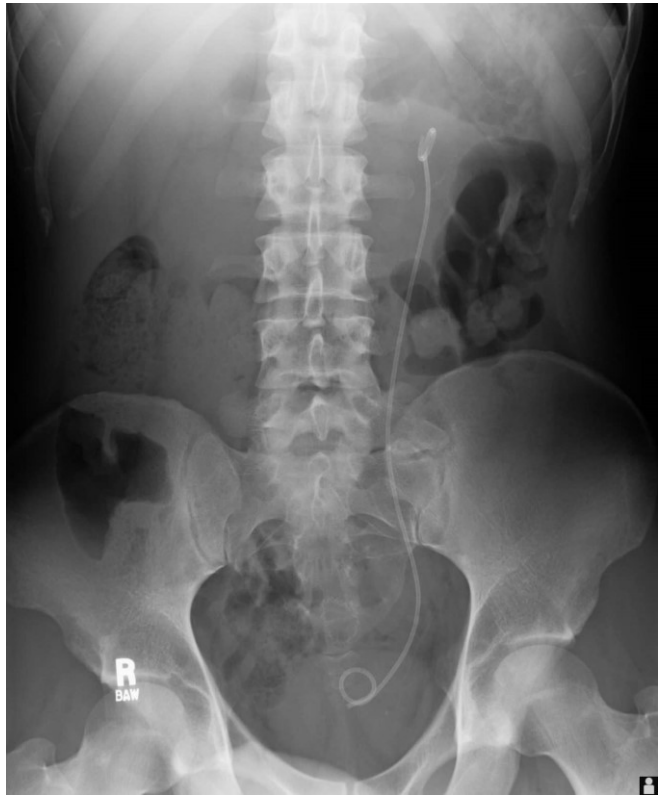


Figure 2-4. KUB (kidney-ureter-bladder) film demonstrating residual stone fragments *(arrows)* adjacent to a right ureteral stent 1 week following right extracorporeal shock wave lithotripsy.


R
BAW


Plain
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RETROGRADE PYELOGRAPHY

RETROGRADE PYELOGRAPHY

Unique ability to document the normalcy of the ureter distal to the level of obstruction

Better define the extent of the ureteral abnormality

Contrast injection through

Nonobstructing catheters

whistle tip, spiral tip, or open-ended catheters

allows passage of the catheter into the ureter

Obstructing catheter

bulb-tip, cone-tip, or wedge-tip catheter

RETROGRADE PYELOGRAPHY

Usually requiring 5 to 8 mL of contrast

Real-time interpretation

Indications

1. Evaluation of congenital ureteral obstruction
2. Evaluation of acquired ureteral obstruction
3. Elucidation of filling defects and deformities of the ureters or intrarenal collecting systems
4. Opacification or distention of collecting system to facilitate percutaneous access
5. In conjunction with ureteroscopy or stent placement
6. Evaluation of hematuria
7. Surveillance of transitional cell carcinoma
8. Evaluation of traumatic or iatrogenic injury to the ureter or collecting system

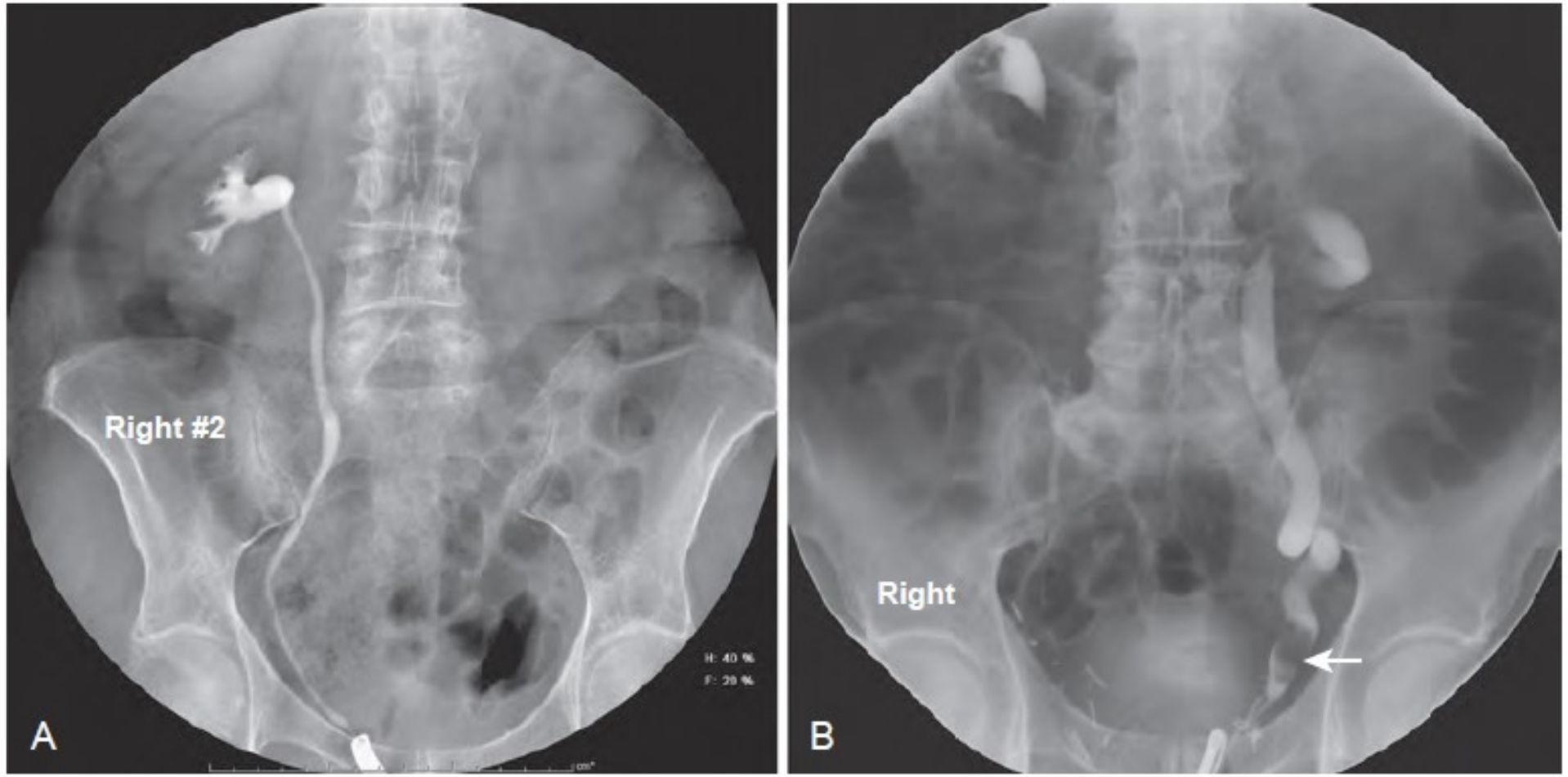


Figure 2-5. A, Right retrograde pyelogram performed using an 8-Fr cone-tipped ureteral catheter and dilute contrast material. The ureter and intrarenal collecting system are normal. B, Left retrograde pyelogram using an 8-Fr cone-tipped ureteral catheter. A filling defect in the left distal ureter *(arrow)* is a low-grade transitional cell carcinoma. The ureter demonstrates dilation, elongation, and tortuosity, the hallmarks of chronic obstruction.

RETROGRADE PYELOGRAPHY

Contrast backflow → risk of UTI & contrast reactions

Pyelotubular backflow

Pyelosinus backflow

Peylolymphatic backflow

Pyelovenous backflow

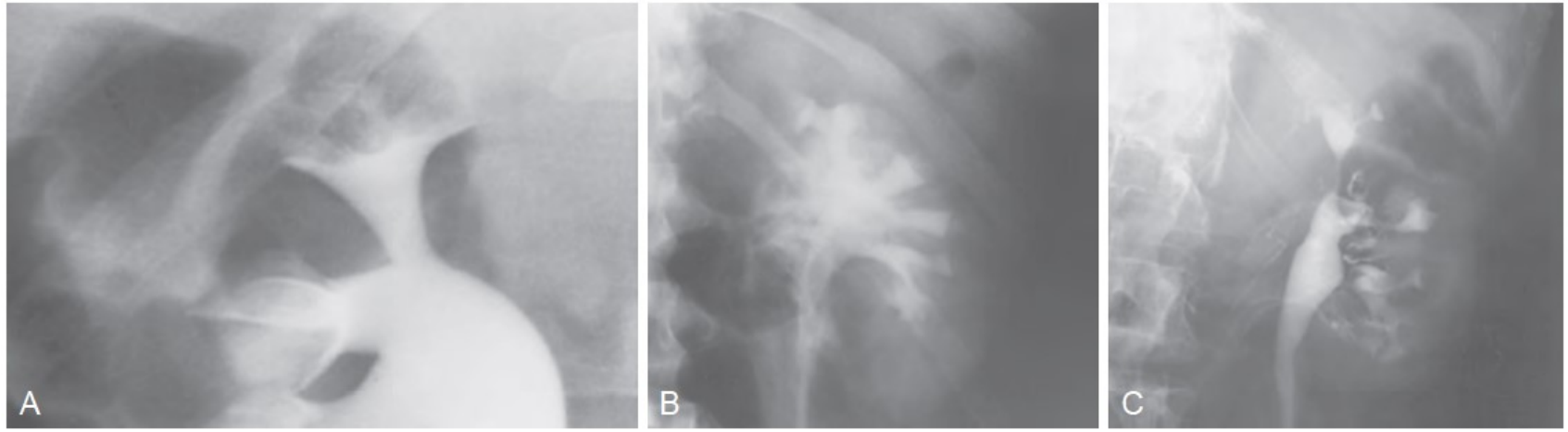


Figure 2-6. Patterns of backflow during retrograde pyelography. A, Pyelotubular backflow. B, Pyelosinus backflow. C, Pyelolymphatic backflow.

RETROGRADE URETHROGRAPHY

RETROGRADE URETHROGRAPHY

Patient is usually positioned slightly obliquely

Penis is placed on slight tension

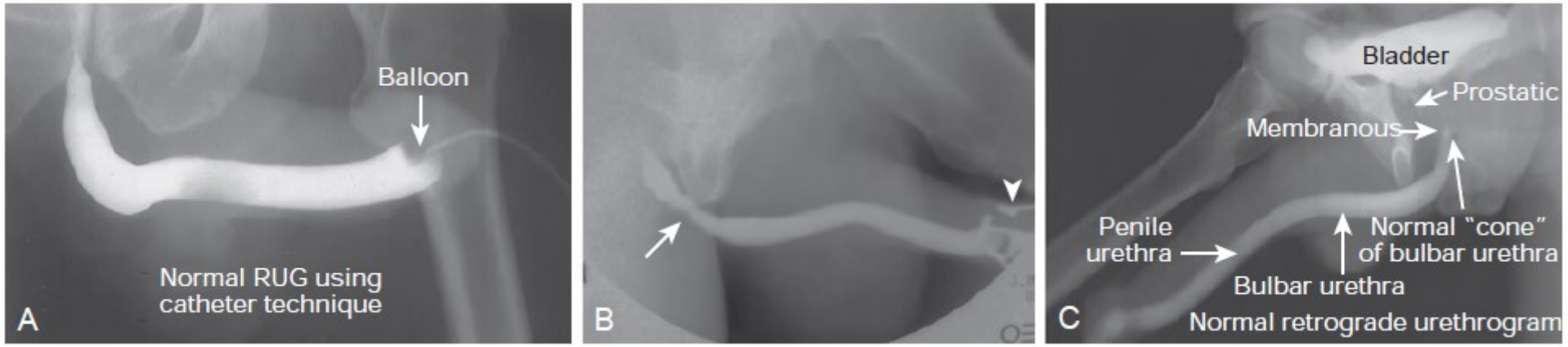
Balloon inflated to 2 mL

Alternatively, a penile clamp (e.g., Brodney clamp)

Indications

1. Evaluation of urethral stricture disease
   a. Location of stricture
   b. Length of stricture
2. Assessment for foreign bodies
3. Evaluation of penile or urethral penetrating trauma
4. Evaluation of traumatic gross hematuria

RETROGRADE URETHROGRAPHY



VOIDING CYSTOURETHROGRAM

VOIDING CYSTOURETHROGRAM

Position:

supine or in a semiupright position using a table capable of bringing the patient into the full upright position

Bladder filling:

Adult: 200-400 mL

Bilateral oblique views

may demonstrate low-grade reflux

bladder or urethral diverticula

VOIDING CYSTOURETHROGRAM

Limitation

Need for catheterization

Filling of the bladder may stimulate bladder spasms at low volumes

Some are unable to hold adequate volumes

Bladder filling in patients with spinal cord injuries higher than T6 may precipitate autonomic dysreflexia

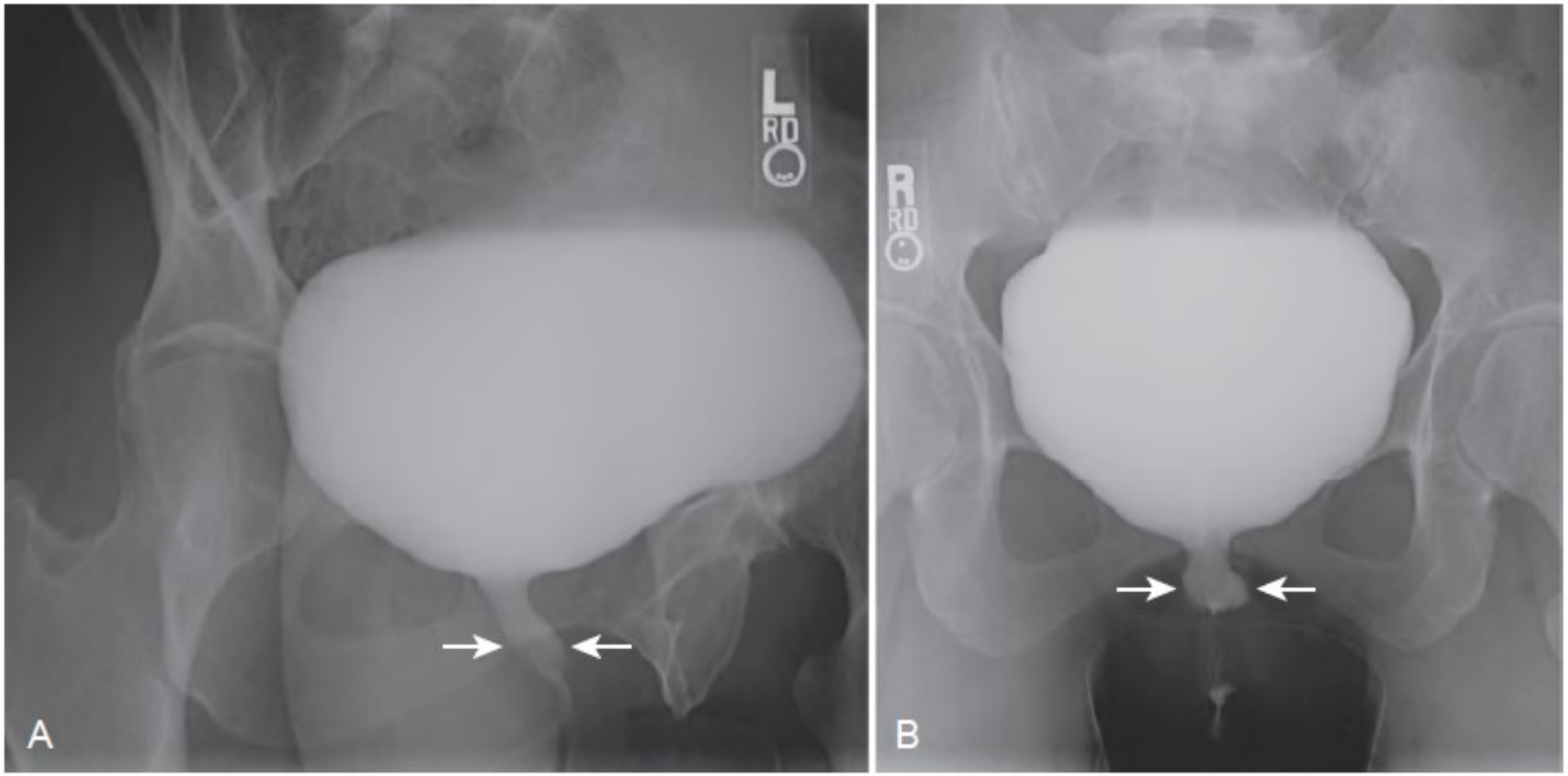
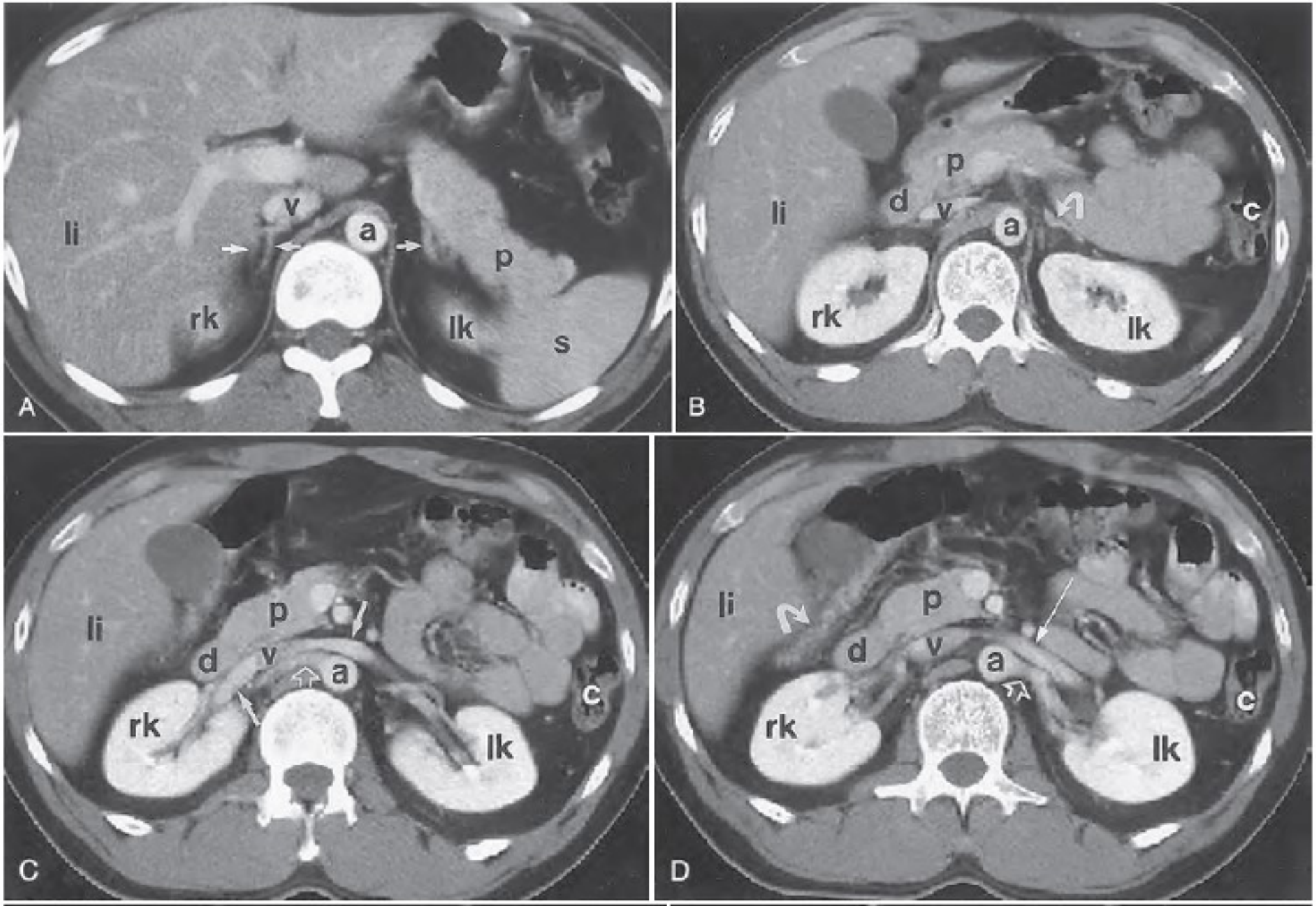


Figure 2-10. A voiding cystourethrography performed for the evaluation of recurrent urinary tract infection in this female patient. A, An oblique film during voiding demonstrates thickening of the midureteral profile *(arrows)*. B, After interruption of voiding, a ureteral diverticulum is clearly visible extending posteriorly and to the left of the midline *(arrows)*.

COMPUTED TOMOGRAPHY



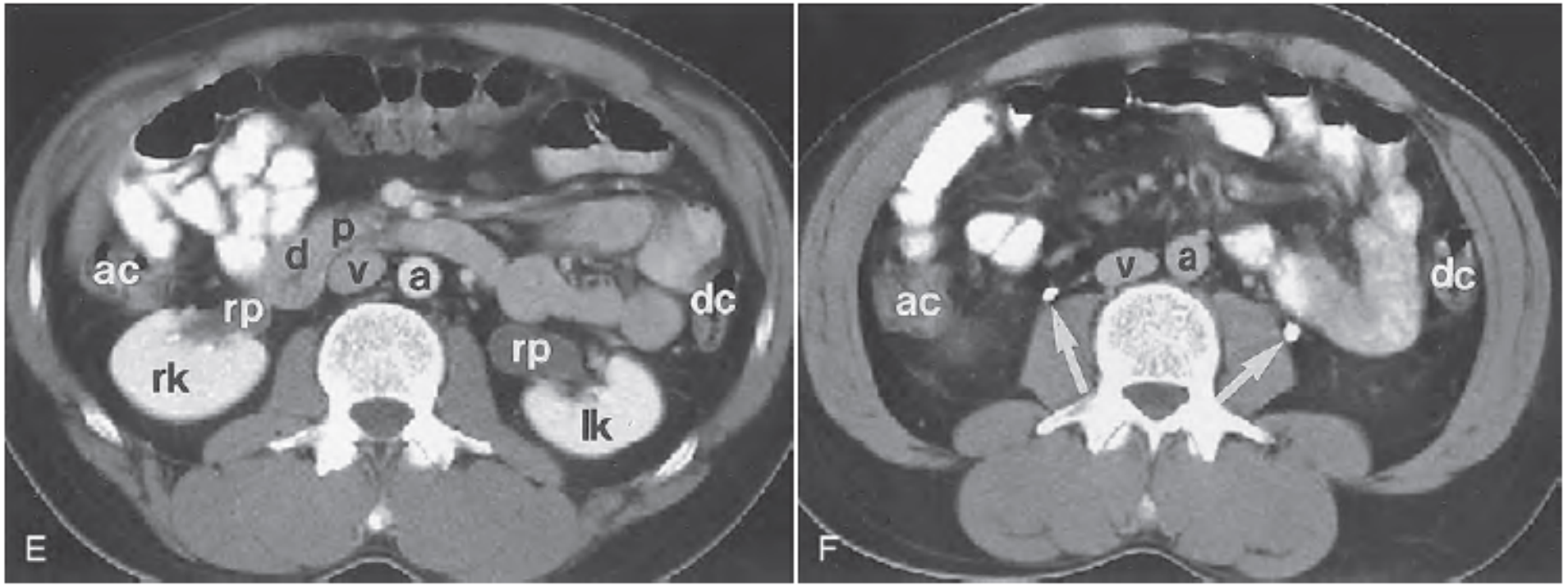


Figure 2-15. Computed tomography of the abdomen and pelvis demonstrating normal genitourinary anatomy. A, The adrenal glands are indicated with *arrows.* The upper poles of the right and left kidneys are indicated with rk and lk, respectively. a, aorta; li, liver; p, pancreas; s, spleen; v, inferior vena cava. B, Scan through the upper pole of the kidneys. The left adrenal gland is indicated with an *arrow.* a, aorta; c, colon; d, duodenum; li, liver; lk, left kidney; p, pancreas; rk, right kidney; v, inferior vena cava. C, Scan through the hilum of the kidneys. The main renal veins are indicated with *solid arrows*, and the right main renal artery is indicated with an *open arrow.* a, aorta; c, colon; d, duodenum; li, liver; lk, left kidney; p, pancreas; rk, right kidney; v, inferior vena cava. D, Scan through the hilum of the kidneys slightly caudal to C. The left main renal vein is indicated with a *solid straight arrow*, and the left main renal artery is indicated with an *open arrow.* The hepatic flexure of the colon is indicated with a *curved arrow.* a, aorta; c, colon; d, duodenum; li, liver; lk, left kidney; p, pancreas; rk, right kidney; v, inferior vena cava. E, Scan through the mid to lower polar region of the kidneys. a, aorta; ac, ascending colon; d, duodenum; dc, descending colon; lk, left kidney; p, pancreas; rk, right kidney; rp, renal pelvis; v, inferior vena cava. F, CT scan obtained below the kidneys reveals filling of the upper ureters *(arrows).* The wall of the normal ureter is usually paper thin or not visible on CT. a, aorta; ac, ascending colon; dc, descending colon; v, inferior vena cava.

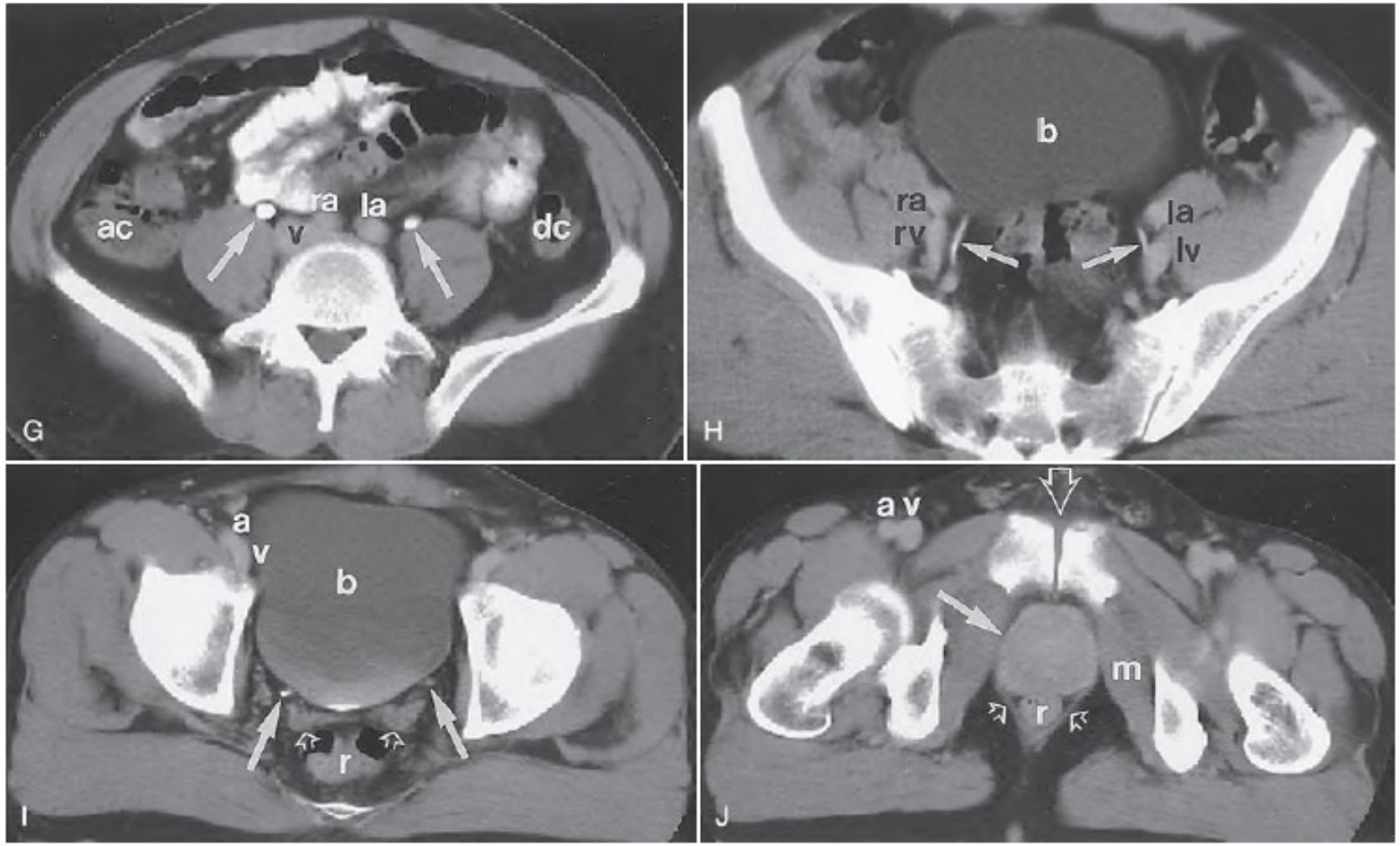


Figure 2-15, cont'd G, Contrast filling of the midureters *(arrows)* on a scan obtained at the level of the iliac crest and below the aortic bifurcation. ac, ascending colon; dc, descending colon; la, left common iliac artery; ra, right common iliac artery; v, inferior vena cava. H, The distal ureters *(arrows)* course medial to the iliac vessels on a scan obtained below the promontory of the sacrum. b, urinary bladder; la, left external iliac artery; lv, left external iliac vein; ra, right external iliac artery; rv, right external iliac vein. I, Scan through the roof of the acetabulum reveals distal ureters *(solid arrows)* near the ureterovesical junction. The bladder (b) is filled with urine and partially opacified with contrast material. The normal seminal vesicle *(open arrows)* usually has a paired bow-tie structure with slightly lobulated contour. a, right external iliac artery; r, rectum; v, right external iliac vein. J, Scan at the level of the pubic symphysis *(large open arrow)* reveals the prostate gland *(solid arrow).* a, right external iliac artery; m, obturator internus muscle; r, rectum; v, right external iliac vein; *small open arrows*, seminal

COMPUTED TOMOGRAPHY

Real-time CT fluoroscopy

Most common use in urology is for biopsy of the kidney

Used for fluid aspiration, drain placement, catheter placement, percutaneous cryoablation, and radiofrequency (RF) ablation of renal tumors

Significant disadvantage → increased radiation exposure to the patient and radiologist or surgeon

COMPUTED TOMOGRAPHY

CTU

Excretory urography

MDCT is used

Indicated in the workup of hematuria, kidney stones, renal masses, renal colic, and urothelial tumors.

Approximately 90% of malignant upper tract lesions can be detected with CT urography (retrograde pyelogram → ~80%)

COMPUTED TOMOGRAPHY

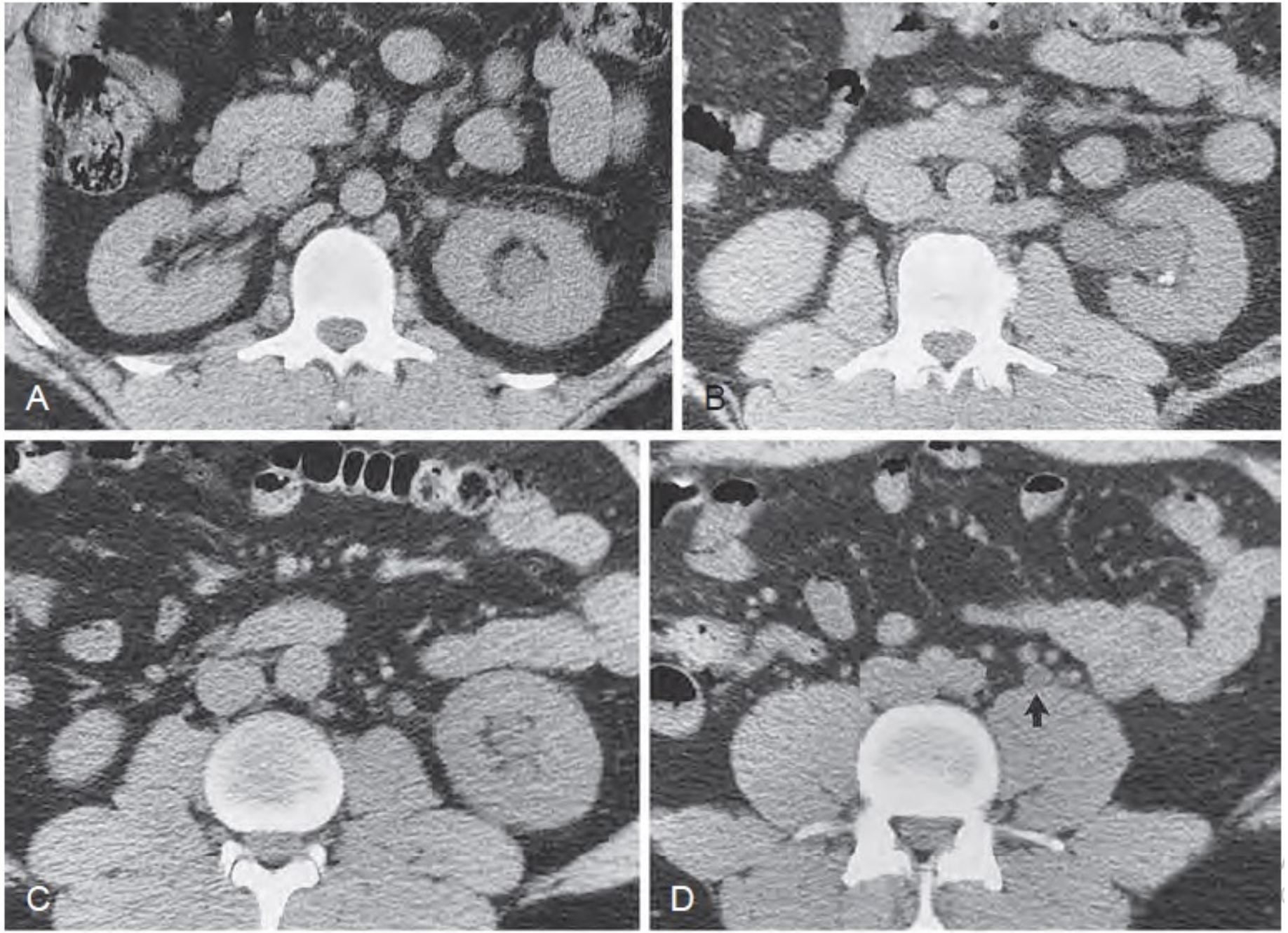
Stones in the distal ureter can be difficult to differentiate from pelvic calcifications → look for other signs of obstruction

Ureteral dilation

Inflammatory changes in the perinephric fat

Hydronephrosis

Soft tissue rim surrounding the calcification within the ureter (represents irritation and edema in the ureteral wall)


A
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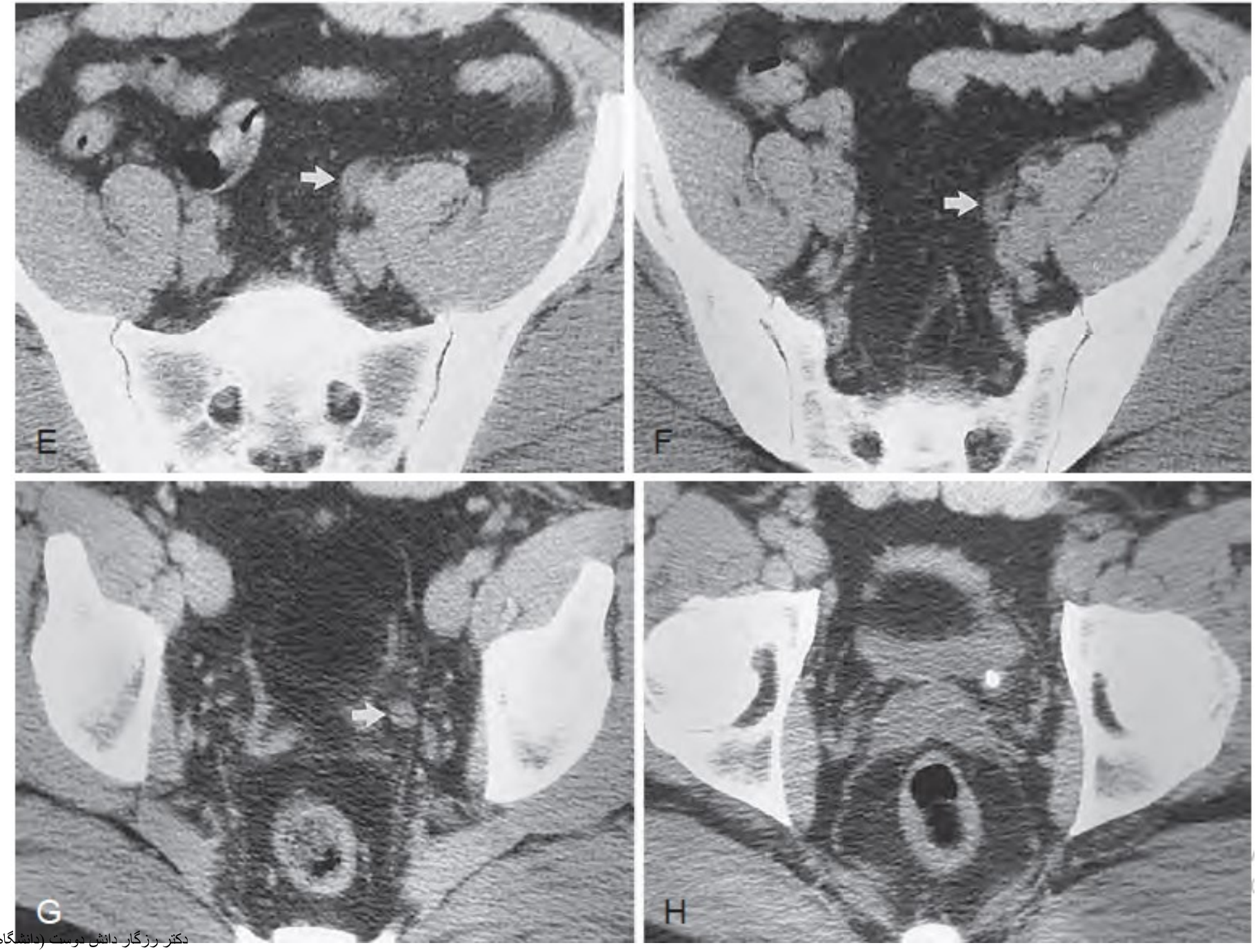


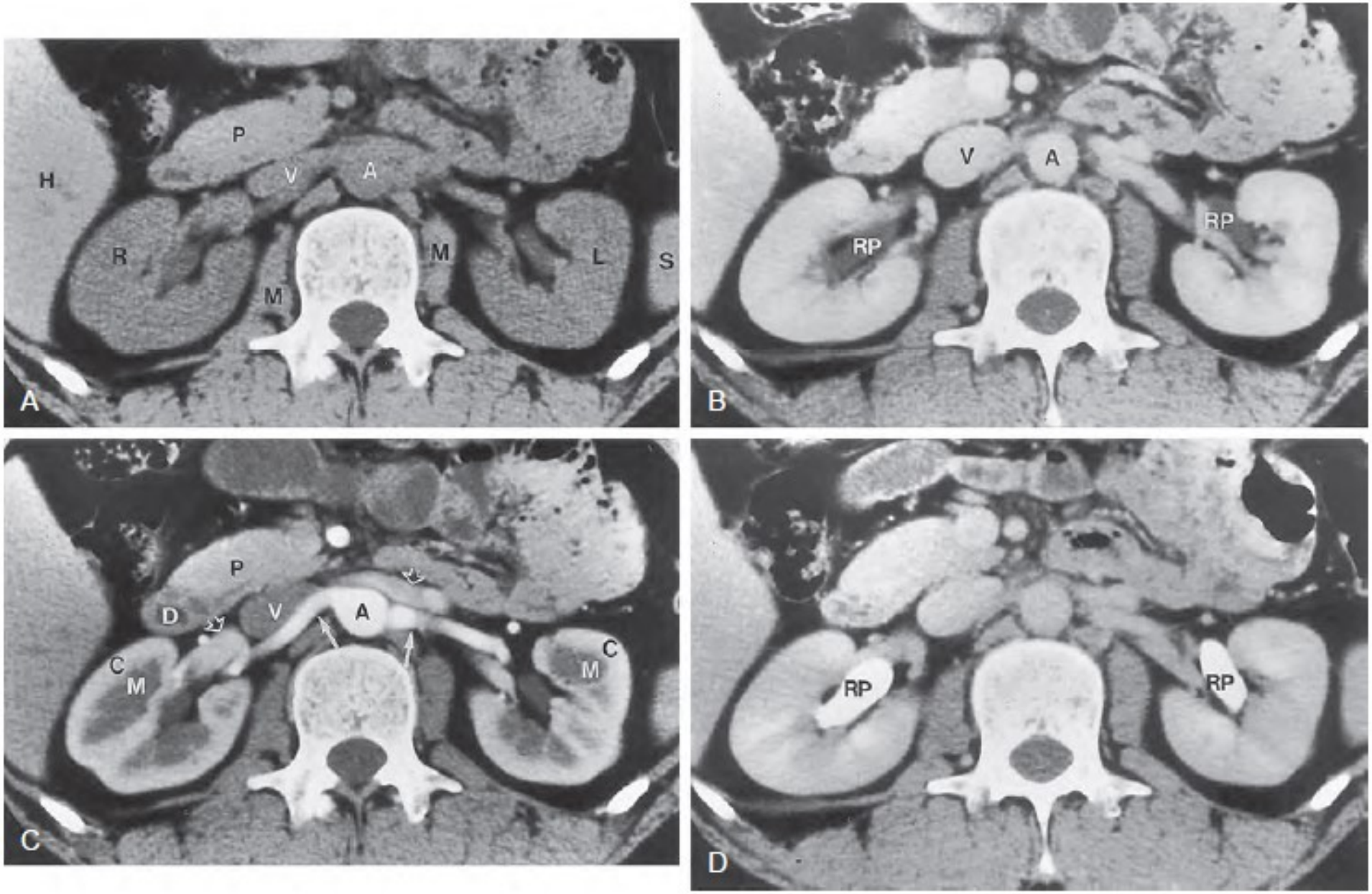
COMPUTED TOMOGRAPHY

Cystic and Solid Renal Masses

Increase in HU (measured in the area of the renal mass) by 15 to 20 HU confirms the presence of a solid enhancing mass, which is usually renal cancer.

The presence of fat, which should enhance less than 10 HU, is diagnostic for angiomyolipoma.

A hyperdense cyst shows no change in density between the postcontrast and delayed phase images



A: unenhanced, C: cortical nephrogenic phase (25-80s),
B: homogenous enhancement (80-120s), D: excretory phase

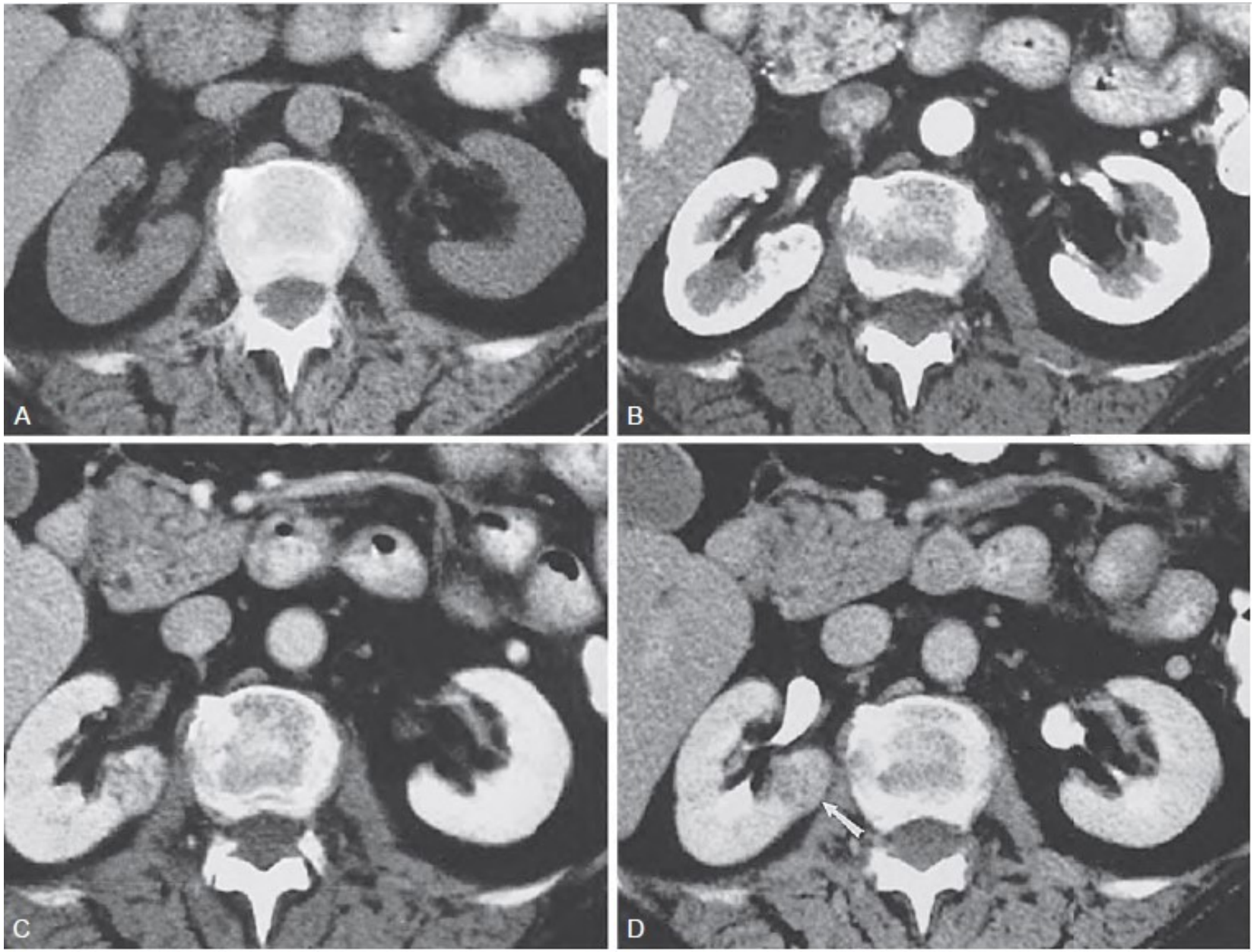


Figure 2-18. Small renal cell carcinoma in the infrahilar lip of the right kidney is not easily seen on unenhanced image (A). On corticomedullary phase image (B), the lesion is subtly visible as a hyperenhancing focus within the renal medulla. On nephrographic (C) and pyelographic phase (D) images, the full extent of the lesion *(arrow)* within the medulla and cortex is depicted. (From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