

DILATED RENAL COLLECTING SYSTEMS: DIFFERENTIATING OBSTRUCTIVE FROM NONOBSTRUCTIVE DILATION USING DUPLEX DOPPLER ULTRASOUND

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ABSTRACT—Two patients with ileal loop urinary diversions, studied with real-time and Doppler sonography ("duplex sonography") of the kidneys, were shown to have dilated intrarenal collecting systems. Resistive index measurements calculated from the Doppler signal correctly identified obstructive dilatation in 1 case and nonobstructive dilatation in the other.

The role of duplex sonography in the evaluation of renal transplants has been documented.^{1,2} The difficulty in using gray-scale sonography to differentiate obstructive from nonobstructive collecting system dilatation in patients predisposed to reflux (often diverted kidneys) is well known.³ The recent literature⁴ suggests that duplex sonography can differentiate obstructive

from nonobstructive dilatation in kidneys, using a measurement known as the resistive (or Pourcelot) index⁵ (Fig. 1). We describe the duplex sonographic evaluation of 2 patients with diverted kidneys, one with obstructive and the other with nonobstructive collecting system dilatation.

Case Reports

Case 1

A thirty-seven-year-old woman presented to the emergency room. She had a past history of left nephroureterectomy (sixteen years previously) for transitional cell carcinoma, radical cystectomy with ileal loop diversion (five years previously) for invasive transitional cell carcinoma of the bladder, and biopsy-proved sarcoidosis in mediastinal nodes (one year previously). There was a history of right flank pain

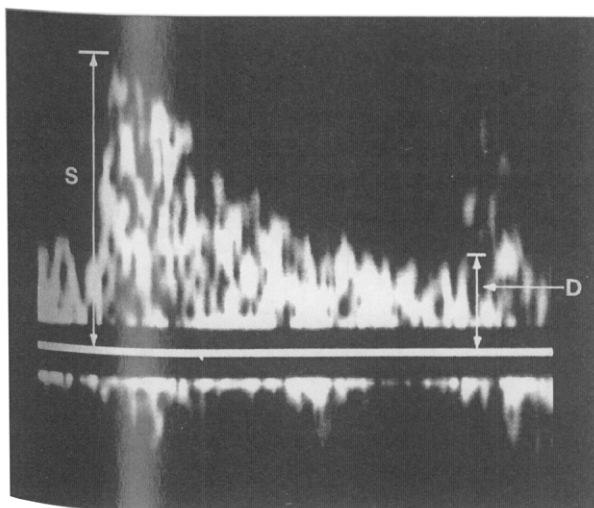


FIGURE 1. Method of obtaining resistive (Pourcelot) index from arcuate artery Doppler profile. $RI = (S-D)/S$, where S = height of systolic peak (to baseline), D = height of diastolic trough (to baseline), and RI = resistive index.

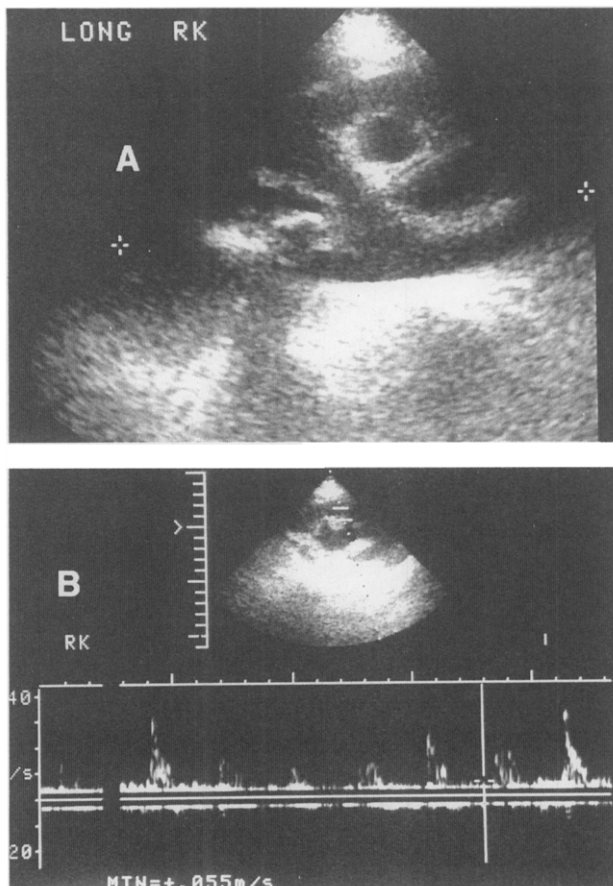


FIGURE 2. Case 1. (A) Isolated image from right renal ultrasound showing moderate dilatation of collecting systems. Incidental note is made of upper pole calculus (poorly visualized). (B) Doppler profile shows resistive index calculated from this image was 0.88, compatible with obstruction rather than passive dilatation.

and essentially no urine output from the ileostomy stoma for five hours preceding presentation. At presentation, the creatinine was elevated to 1.4, from a baseline of 0.6. Right renal duplex ultrasound examination at the time of admission showed moderate dilatation of intrarenal collecting systems (Fig. 2A) with an elevated resistive index of approximately 0.88 (Fig. 2B). The findings were thought to represent obstructive rather than passive dilatation. Subsequent loopogram on the same day (Fig. 3) disclosed obstruction by a calculus at the ureteropelvic junction (UPJ)/proximal right ureteral region. Percutaneous nephrostomy placed the same day relieved the obstruction.

Repeat renal ultrasound examination three days after percutaneous nephrostomy showed a nonobstructed right kidney with the resistive index having returned to a normal level of 0.68 (Fig. 4). The patient underwent uneventful ex-

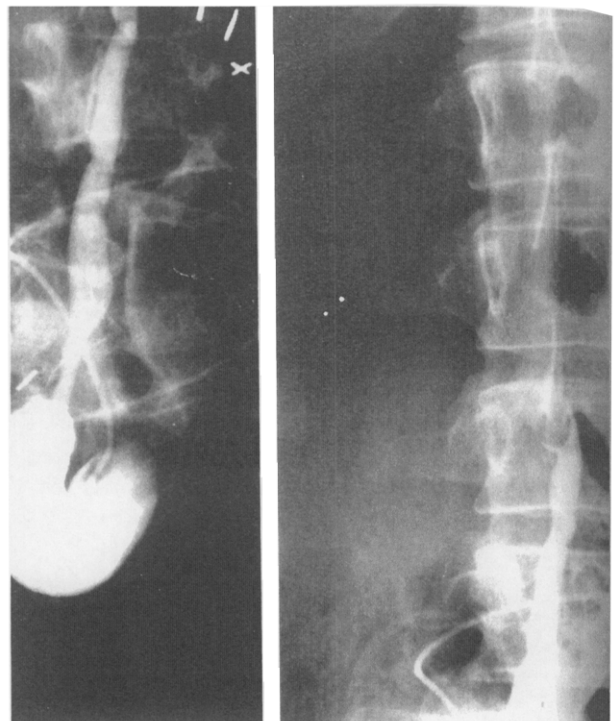


FIGURE 3. Case 1. Ileal loopogram. On right radiograph note obstruction of proximal ureter by filling defect (consistent with calculus).

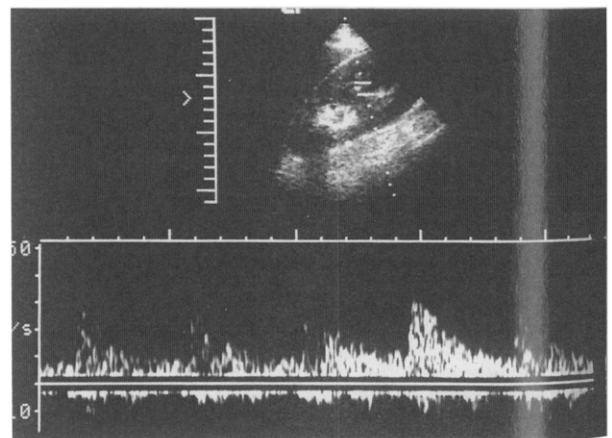


FIGURE 4. Case 1. After relief of obstruction with percutaneous nephrostomy, resistive index (calculated from this image) now normal, measuring 0.68.

tracorporeal shock-wave lithotripsy and was discharged with an indwelling right percutaneous nephrostomy. The stone fragments later cleared, and the nephrostomy tube was removed.

Case 2

The patient is a fifty-six-year-old woman post pelvic exenteration for bladder cancer, with ileal loop urinary diversion in 1973. There was a

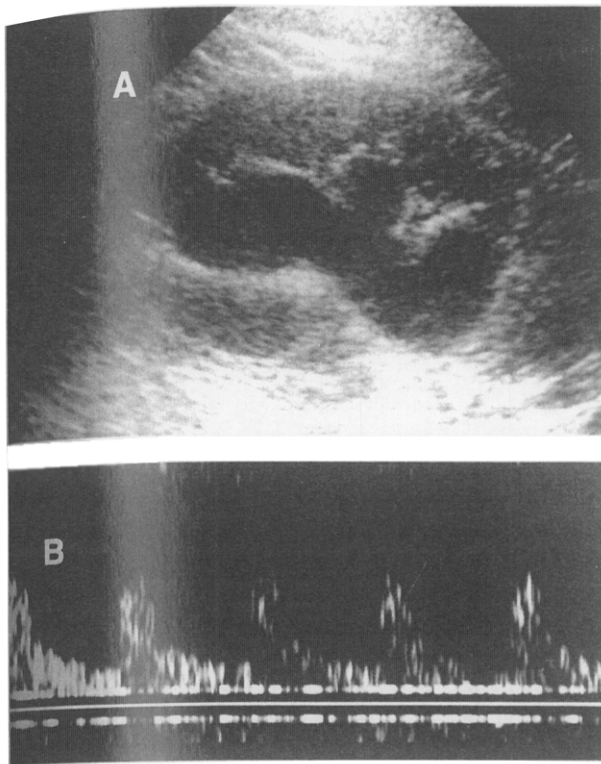


FIGURE 5. Case 2. (A) Left renal ultrasound showing moderate dilatation of collecting systems, and (B) normal Doppler US of left kidney, with normal resistive index of 0.66.

history of struvite stone disease in the past. Three weeks before admission for elective left renal stone removal, renal duplex ultrasound examination (Fig. 5A) showed moderate dilatation of left intrarenal collecting systems, a normal Doppler profile, and a normal resistive index of 0.66 (Fig. 5B). The findings were compatible with passive dilatation, without evidence of obstruction. Ileal loopograms both at that time and at the time of percutaneous stone removal showed no evidence of obstruction.

Comment

The difficulty in differentiating obstructive from nonobstructive intrarenal collecting system dilatation in general⁴ and in the ileal loop

diverted kidney in particular³ is well known. Early animal research has shown that the intrarenal vascular resistance increases secondary to obstruction.⁶⁻⁸ The recent literature⁴ suggests that measuring this increased resistance with duplex Doppler sonography, using the resistive (or Pourcelot) index⁵ can distinguish between obstructed and passively dilated collecting systems (Fig. 1). A resistive index of 0.7 appears to be optimal for this distinction, with values less than 0.7 being normal and values greater than 0.7 being abnormal and consistent with obstruction.⁴

In the 2 patients presented here, both with dilated collecting systems in ileal loop diverted kidneys, the resistive index correctly identified obstructed and nonobstructed kidneys. Given these results, as well as those of Platt *et al.*,⁴ it is reasonable to assume that duplex sonography has the potential of becoming a primary method (and in some cases the only method) for differentiating obstructive from nonobstructive dilatation in diverted kidneys.

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