

Wax-and-Wane Hydronephrosis: Sonographic Finding in Vesicoureteral Reflux

Because vesicoureteral reflux (VUR) predisposes patients to urinary tract infection and renal damage, early detection is essential. The diagnosis is usually based on voiding cystourethrography (VCG), which is unpleasant to patients and exposes them to ionizing radiation. Sonography has been studied as a substitute for VCG in screening for VUR, although many investigators have found sonography too inaccurate to enable diagnosis without bladder filling or voiding during the examination.¹⁻⁴ During sonographic examination of the kidneys, we observed cyclic dilatation of the pelvicaliceal system over several minutes in a child with VUR, and subsequent VCG proved the presence of VUR in 3 other children who had displayed this cyclic dilatation and who were thus strongly suspected of having VUR. This cyclic phenomenon would thus appear to be a useful sonographic sign of VUR.

Sonography showed marked dilatation of the pelvicaliceal system of the right kidney of a 3-year-old boy who had been referred to our institution because of a recurrent urinary tract infection. Reexamination of the right kidney after other organs had been screened showed no dilatation (Figure 1A). Dilatation reappeared several minutes later, however, even though the patient had remained calm and still throughout the examination (Figure 1B). The length of the right kidney was 5.8 cm; that of the left kidney was 8.3 cm. VCG showed grade IV reflux in the right kidney, and excretory urography showed the right kidney to be small and to have relatively well-preserved function.

We also observed this phenomenon in a 9-month-old boy with a history of sepsis at the age of 1 month and a 7-year-old boy with a history of recurrent urinary tract infection. Little or no dilatation of the pelvicaliceal system was observed at first, but marked dilatation was noticed several minutes later. VCG showed grades V and IV VUR, respectively. Pelvicaliceal dilatation observed in an asymptomatic newborn who had received sonographic kidney screening similarly disappeared and reappeared over several minutes. Grade III VUR with intrarenal reflux was identified on VCG.

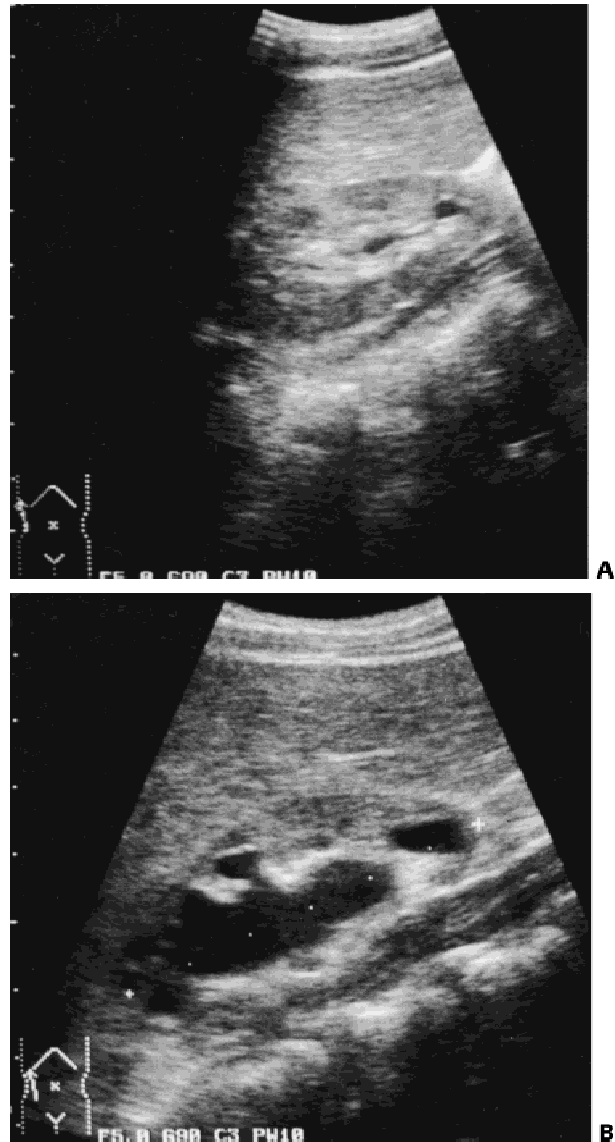


FIGURE 1. Wax-and-wane hydronephrosis. (A) Sonogram of the right kidney 8 minutes after marked dilatation of the pelvicaliceal system was observed shows no dilatation, only minimal residual splaying of the collecting system. (B) Several minutes later, dilatation has reappeared.

Pelvicaliceal dilatation and a dilated ureter may indicate VUR, although these signs are neither specific nor sensitive enough to serve as a basis for diagnosis.¹ Ballooning of the renal pelvis during forced voiding has been reported to be a useful finding in neonates³ and children with VUR. Ballooning also may be produced by pressing the lower abdomen when the bladder is full.⁴ We observed a phenomenon that has not been previously reported, one that occurs spontane-

ously and appears to be specific to VUR: cyclic appearance and disappearance of pelvicaliceal dilatation in a relatively short period of time. We call this "wax-and-wane hydronephrosis." Mild dilatation of the renal pelvis may occur in normal individuals, when the bladder is full and during diuresis; this dilatation disappears after urination. Intermittent pelvicaliceal dilatation can occur in patients with occult ureteropelvic obstruction (intermittent hydronephrosis); in these cases, however, dilatation is accompanied by pain and hematuria. We used clinical features to distinguish intermittent hydronephrosis from wax-and-wane hydronephrosis, which cycles without symptoms in a relatively short period and which may represent reflux. This marked dilatation cannot be explained by diuresis. We thus believe that this phenomenon is specific to VUR. Accordingly, we recommend that sonographic examination of the kidneys include multiple scans taken several minutes apart, especially when the subjects are children who have a history of or who are suspected of having urinary tract infection. When the wax-and-wane phenomenon is observed, VCG should be used to establish whether VUR is present, even in a symptomless child.

Michiru Nakamura, MD

Kouichi Itoh, PhD

Jichi Medical School

Tochigi Prefecture 329-04, Japan

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Nephrocalcinosis Induced by Long-term Therapy with Furosemide

Nephrocalcinosis, the abnormal deposition of calcium salts in the renal parenchyma, is a rare disease. It can assume 2 different patterns. In the more common pattern, central or medullary nephrocalcinosis, only the pyramids are involved. In

diffuse or cortical nephrocalcinosis, which is rare, the entire parenchyma is affected; this pattern is associated with severe metabolic disorders, such as hyperoxaluria, or end-stage nephropathy.¹

In nephrocalcinosis, sonography shows an increase in medullary echogenicity; this can be massive or appear only as an echogenic ring at the periphery of the renal pyramids. This pattern is an early manifestation of nephrocalcinosis. The calcification may also be detected by computed tomography (CT) but not by plain radiography.²

The association of renal calcifications with furosemide therapy in newborns has been previously reported.³ However, we have not found any report in the medical literature about nephrocalcinosis induced by furosemide in adults. In 2 years (1994–1995), we observed 4 cases in which nephrocalcinosis appeared to be related to long-term furosemide treatment. These 4 adults had an increase in echogenicity of the renal pyramids on sonography (Figure 1). The sonographic findings were perfectly correlated with CT findings in all cases, while conventional radiology was always negative. This emphasizes the ability of sonography to diagnose early-stage nephrocalcinosis.

The 4 cases have some interesting details in common. In particular, the possibility of nephrocalcinosis being due to type I renal tubular acidosis was excluded by a complete nephrologic examination. The only likely explanation for the nephrocalcinosis, apart from idiopathy, was the prolonged treatment with furosemide. In all 4 cases, damage to the renal pyramids was limited at the periphery and more extensive at the bases, next to the cortex; these findings are consistent with an early stage of disease.² Another common finding was normal Doppler indices; this finding is in disagreement with a previous report on furosemide-induced nephrocalcinosis in children.⁴



FIGURE 1. Sonogram showing echogenic renal pyramids without evidence of frank calcifications.

CORRESPONDENCE

In the first 2 cases, we did not make a connection between the sonographic findings and the furosemide therapy, so we did not perform follow-up sonography after cessation of the treatment.

Based on our findings, we suspect that long-term treatment with furosemide in adults may cause mild medullary nephrocalcinosis, characterized by peripheral deposition of calcium salts in the pyramids without apparent modifications of renal function and without changes in the Doppler indices. We believe that this information may be helpful to sonographers involved in the diagnosis of nephropathies. We would be interested in learning about the experiences at other institutions.

Francesco Maria Solivetti, MD
Hospital "S. Pertini"

Carla Paganelli, MD
Marco Zoffoli, MD
Demetrio Bacaro, MD

Domenico Quintigliano, MD
Naim Nasrollah, MD
University of Rome, Tor Vergata
Rome, Italy

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