The role of ultrasound in initial evaluation of renal colic

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ABSTRACT

Objective: The objective of this study is to support the use of ultrasound examination in the initial evaluation of renal colic.

Methods: From January 1998 through April 1998, 21 patients referred for radiographic evaluation of possible renal colic were studied prospectively. All referrals came from either emergency clinic of Prince Hashim Ben-Al-Hussein Hospital or outpatient clinic of the same hospital. All sonographic studies were performed with real-time sector scanner (Kretz, Compeson 410 3.5-MHz Probe). Our sonographic criterion for a positive examination consisted of visualization of urinary tract calculi and unilateral hydronephrosis with or without ureterectomy or both.

Results: Of the 21 patients studied the presence of urinary calculi was proved in 18 cases. The absence of calculi was established in 3 cases either by negative intravenous urography (2 cases) or the by clinical and sonographic demonstration of epididymitis as the cause in one patient. In the 18 patients with proved urinary calculi, ultrasound correctly visualized the calculus in 15 cases (83%). Of the 15, 11 calculi were located at the ureterovesicular junction, 2 in the renal pelvis, one in the proximal third of the ureter, and one in the distal third. Using our sonographic criterion for positive examination mentioned in materials and methods, sensitivity was 95% (18/19). Specificity 95% (18/19). The one false positive examination with unilateral hydronephrosis proved to be due to a retroperitoneal liposarcoma. There were two cases in which the urinary tract ultrasound examination was negative. In one patient the symptoms were found to be due to epididymitis, in the other case the symptoms remained unexplained following entirely normal intravenous urography. There were no false negatives in our series.

Conclusion: The results of this study support the use of ultrasound as an alternative to intravenous urography for the initial evaluation of renal colic, in third world countries.

Keywords: Calculi, kidney, ultrasound studies ureter.


Renal colic is a common urologic problem. Renal colic is defined as an acute flank pain radiating to the groin or testicle, with or without nausea, vomiting, dysuria and hematuria. Intravenous urography (IVU) has long been accepted as the primary radiologic study for the diagnosis of renal colic. We describe a prospective sonographic study of patients in whom renal colic was clinically suspected. This study was conducted to determine the potential role of diagnostic ultrasound in the evaluation of renal colic.

Methods. From January 1998 through April 1998, 21 patients referred for radiographic evaluation of possible renal colic were studied prospectively. Inclusion of the study required a history of recent onset of pain suggesting renal colic, most often described as a sharp, spasmodic pain beginning in the flank, radiating to the lower abdomen, groin, or inner...
thigh. All referrals came from either emergency clinic of Prince Hashim Ben Al-Hussein Hospital or outpatient clinics of the same hospital, Zarqa, Jordan.

Urinalysis and an abdominal radiograph (KUB) for each patient were obtained prior to the sonographic evaluation.

Each patient was well hydrated with oral or intravenous fluid in attempt to assure a distended urinary bladder. All sonographic studies were performed with real-time sector scanner (Kretz, Compasson 410 3.5-MHz probe). The results were reviewed by both authors.

Sonographic evaluation consisted of: visualization of both kidneys for the presence of calculus, hydronephrosis, and peritoneal Urinomas; examination of the expected course of the ureters for calculi and dilatation and examination of the bladder for the presence of calculi. Particular attention was directed to the distal pelvic ureters and ureterovesicular junction (UVJ) to identify calculi and edema or both at these locations. In those patients in whom the screening KUB study demonstrated calcification suggestive of a calculus, additional care was directed to the area of suspicion.

Our sonographic criteria for a positive examination consisted of visualization of urinary tract calculus and unilateral hydronephrosis or both with or without ureterectasis. Hydronephrosis was defined as asymmetrical dilatation of the renal pelvocalyceal system.

Ureteral dilatation was defined as a persistent visualization of a tubular structure greater than 6mm in diameter and following the course of the ureter, calculi were characterized as echogenic shadowing foci within the kidney, ureter, or bladder.

Results. Of the 21 patients studied, the presence of urinary calculi was proved in 18 cases by surgery, spontaneous passage and recovery of a stone, and documentation of calculi by IVU or both. The absence of calculi was established in 3 cases, either by negative IVU (2 cases) or by the clinical and sonographic demonstration of epididymitis as the cause of pain and hematuria in one patient.

In the 18 patients with proved urinary calculus, ultrasound correctly visualized the calculus, presumed to be cause of colic, (Figure 1a, 1b), in 15 cases (83%) of the 15, 11 calculi were located at the UVJ, two in the renal pelvis, one in the proximal third of the ureter, and are in the distal third. In 3 patients where the calculus could not be imaged, its presence was suggested by unilateral hydronephrosis. In one the proximal third of the ureter on the screening KUB, and was spontaneously passed 4 days later. In another case the suspected calculus was identified on the screening KUB over the middle third of the ureter, a level of obstruction identified by sonography. One day later a calculus was removed from this site during ureterolithotomy. In the 3rd case, possible stone was noted on KUB in the region of the UVJ. Ultrasound reveal ureteral dilatation to this level, but the UVJ could not be adequately imaged due to insufficient bladder distention. A stone was spontaneously passed the next day.

Unilateral hydropnephrosis was depicted in 16 of the 18 patients with proved urinary calculi (89%). In the two cases hydronephrosis was not present, sonography demonstrated UVJ calculi.

Perirenal urinomas were identified in three of the 18 patients with proved calculus. Our sonographic criteria for positive examination consisted of visualization of a urinary tract calculus or unilateral hydronephrosis, with or without ureterectasis. Using the two criteria, sensitivity was 100% (18/18) specificity 95% (18/19). The one false positive examination demonstrated unilateral hydronephrosis that was subsequently found to be secondary to a retroperitoneal liposarcoma rather than a calculus. There were no false positive examinations in those cases in which echogenic calculus was sonographically demonstrated.

There were two cases in which the urinary tract ultrasound examination was negative. In one case the patient's symptoms were found to be due to epididymitis. In the other case the symptoms remained unexplained following entirely normal IVU and subsequent straining of the urine for calculi. There were no false negatives in our series.

Discussion. The emergency intravenous urogram (IVU) has long been the recommended examination to confirm the presence of renal colic and to elucidate its cause. The IVU does pose risks, although small, of contrast material reactions and exposure to ionizing radiation, it may also precipitate severe renal colic in a patient with an obstruction or exacerbate renal failure in patients with compromised renal function. The ultrasonographic evaluation of the urinary tract is attractive in that it poses none of these risks. Such an examination without ionizing radiation, with high sensitivity, rapidity, ease with which it can be performed may make it an attractive screening modality as well a most beneficial for the pediatric or pregnant women.

Our study demonstrates that a complete sonographic evaluation offers a viable alternative to the IVU in the initial evaluation of renal colic. Using as the sonographic criterion for positive examination either a visualized urinary tract calculus or unilateral hydronephrosis and a unilateral hydroureret or both, we correctly identified all of the patients in whom a stone was subsequently demonstrated. A calculus presumed to be the cause of renal colic, was imaged in 83% of these patients.

It is of interest that in two patients, stones that were imaged ultrasonographically were not visible, even retrospectively, on the screening KUB. One was a 10-mm urate stone and the other a 2-mm Calcium Oxalate stone.
Sonography is a sensitive examination for the detection of urinary tract obstruction. As part of our study examination technique, patient hydration was attempted prior to and during the sonographic examination, as a method of emphasizing early mild caliectasis and ureterectasis. It was necessary that asymmetrical (unilateral) pellocalceal dilatation be present on the side of the patient's complaint for an examination to considered positive for hydronephrosis. In contradistinction to physiologic calyceal dilatation, which is transient and may be observed with diuresis, hydronephrosis was constant and unchanging during the course of the sonography examination. In our series, 89% of patients with proved calculi had unilateral hydronephrosis with or without ureterectasis. In two patients with UVJ calculi, neither hydronephrosis nor a hydrourereter was present. Although, the presence of non-obstructing ureteric calculi associated with colic has also been observed during IVU examination.

The association of urinomas with renal colic is interesting. Perirenal urinomas were sonographically identified in three patients with urinary calculi (17%). Although each of these patients also had hydronephrosis, it is conceivable that extravasation of urine into the perirenal space might decompress the kidney and mask obstruction as manifested by hydronephrosis. The presence of a urinoma may be a useful sign indicative of acute obstruction. The major limitation to the use of ultrasound in evaluating colic is the difficulty in visualizing the middle third of the ureter, particularly if ureteral dilatation is not present. In some cases it may be impossible to visualize a calculus lodged in the middle of the ureters, particularly if ureteral dilatation is not present. In some cases it may be impossible to visualize a calculus lodged in the middle of the ureter. Fortunately, the most frequent site for stones to lodge is in the distal ureter, and in our experience predominantly at the UVJ. UVJ calculi were generally easy to visualize through a distended bladder; a few UVJ calculi were visible only when the bladder was fully distended.

We included a KUB as part of our protocol, and found the initial KUB to be complementary to the ultrasonographic evaluation. Just as an initial KUB is useful part of the IVU examination for calculi, the KUB helped to focus the sonographic search on areas suggestive of urinary calculi.

The result of this study supports the use of ultrasound as an alternative to intravenous urography for the initial evaluation of renal colic. In all patients with proved urinary tract calculi, either the actual calculus or unilateral urinary obstruction was identified by sonography. No false negatives were encountered in our study. Emergency IVU examinations may be reserved for those cases in which the clinical situation strongly suggests renal colic and the ultrasound examination is negative.

References