Ureteral Stone Location at Emergency Room Presentation With Colic

Brian H. Eisner,*,† Adam Reese, Sonali Sheth and Marshall L. Stoller

From the Department of Urology, School of Medicine, University of California-San Francisco, San Francisco, California

Purpose: It is thought that the 3 narrowest points of the ureter are the ureteropelvic junction, the point where the ureter crosses anterior to the iliac vessels and the ureterovesical junction. Textbooks describe these 3 sites as the most likely places for ureteral stones to lodge. We defined the stone position in the ureter when patients first present to the emergency department with colic.

Materials and Methods: We retrospectively reviewed the records of 94 consecutive patients who presented to the emergency department with a chief complaint of colic and computerized tomography showing a single unilateral ureteral calculus. Axial, coronal and 3-dimensional reformatted computerized tomography scans were evaluated, and stone position and size (maximal axial and coronal diameters) were recorded, as were the position of the ureteropelvic junction, the iliac vessels (where the ureter crosses anterior to the iliac vessels) and the ureterovesical junction. Patients with a history of nephrolithiasis, shock wave lithotripsy, ureteroscopy or percutaneous nephrolithotripsy were excluded from study. Statistical analysis was performed using Student's t test and Pearson's correlation coefficient.

Results: At the time of emergency department presentation for colic ureteral stone position was the ureteropelvic junction in 10.6% cases, between the ureteropelvic junction and the iliac vessels in 23.4%, where the ureter crosses anterior to the iliac vessels in 1.1%, between the iliac vessels and the ureterovesical junction in 4.3% and at the ureterovesical junction in 60.6%. Proximal calculi had a greater axial diameter than distal calculi (mean 6.1 vs 4.0 mm) and a greater coronal diameter than distal calculi (6.8 vs 4.1 mm, each $p < 0.001$). Axial and coronal diameters moderately correlated with stone position ($r = -0.47$ and -0.55, respectively, each $p < 0.001$).

Conclusions: Proximal ureteral stones were larger in axial and coronal diameter than distal ureteral stones. At emergency department presentation for colic most stones were at the ureterovesical junction and in the proximal ureter between the ureteropelvic junction and the iliac vessels. A few stones were at the ureteropelvic junction and only 1 lodged at the level where the ureter crosses anterior to the iliac vessels, despite the literature stating that these locations are 2 of the 3 most likely places for stones to become lodged.

Key Words: ureter, ureteral calculi, colic, emergencies

Abbreviations and Acronyms

CT = computerized tomography

PCNL = percutaneous nephrolithotripsy

SWL = shock wave lithotripsy

UPJ = ureteropelvic junction

UVJ = ureterovesical junction

Submitted for publication November 20, 2008.

Study received institutional review board approval.

* Correspondence: Department of Urology, University of California-San Francisco, 400 Parnassus Ave., San Francisco, California 94143 (telephone: 415-353-2200; FAX: 415-353-2641; e-mail: eisnerbh@urology.ucsf.edu).

† Financial interest and/or other relationship with Boston Scientific.

For another article on a related topic see page 343.

It has long been urological dogma that the 3 narrowest points in the ureter are the UPJ, the point where the ureter crosses anterior to the external iliac vessels, and the UVJ, and these are the 3 most likely locations for ureteral stones to lodge.[1–5] With the advent of medical expulsive therapy as first line treatment for the index patient with ureteral calculi[6] it is impor-

0022-5347/09/1821-0165/0
THE JOURNAL OF UROLOGY®

Vol. 182, 165-168, July 2009
Printed in U.S.A.
DOI:10.1016/j.juro.2009.02.131

tant to understand the natural history of ureteral stone passage and the points in the ureter where stones are likely to become lodged or impacted. Recent evidence suggests that historical teachings regarding the UPJ, the level where the ureter crosses anterior to the iliac vessels and the UVJ as the most likely places to find an obstructing ureteral stone may be inaccurate.[7] We determined the exact location of ureteral stones when patients first presented to the emergency department with colic.

MATERIALS AND METHODS

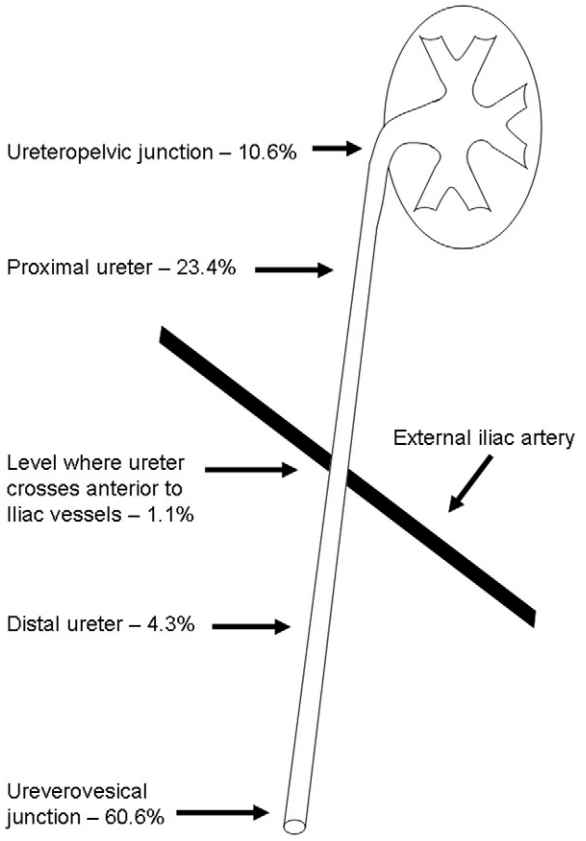
We retrospectively reviewed the records of 94 consecutive patients who presented to the emergency department with a chief complaint of colic and unenhanced CT that showed a single unilateral ureteral calculus. Axial, coronal and 3-dimensional reformatted CT images were evaluated by 2 observers. Stone position and size (axial and coronal diameters) were recorded, as were the position of the UPJ, the site where the ureter crosses anterior to the iliac vessels and the UVJ. The UPJ was defined as the convergence of the renal pelvis and the ureter. The UVJ was defined as the segment of ureter that traverses the bladder wall. Ureteral distances were calculated by subtracting CT slice numbers and multiplying by CT cut thickness. Patients with a history of nephrolithiasis, SWL, ureteroscopy or PCNL were excluded from study. Statistical analysis was performed using Student's t test and Pearson's correlation coefficient.

RESULTS

The records of 94 patients were analyzed. Mean age was 43.6 years (range 23 to 74). The female-to-male ratio was 17:77. CT cut thickness was 0.625 mm in 2 patients (2.1%), 1.25 mm in 81 (86.2%), 2.5 mm in 3 (3.2%) and 5 mm in 8 (8.5%). Calculi were located in the left ureter in 42 patients (45%) and in the right ureter in 52 (55%). There was no difference in mean ureteral length between females and males (21.7 vs 20.9 cm, $p = 0.25$).

At emergency department presentation for colic ureteral stones were at the UPJ in 10 cases (10.6%), between the UPJ and the iliac vessels in 22 (23.4%), where the ureter crosses anterior to the iliac vessels in 1 (1.1%), between the iliac vessels and the UVJ in 4 (4.3%) and at the UVJ in 57 (60.6%) (see figure).

The 22 stones in the proximal ureter (between the UPJ and the iliac vessels) were significantly closer to the UPJ than to the iliac vessels. Mean distance below the UPJ was 4.3 cm (range 0.75 to 7.5) and mean distance above the iliac vessels was 8.9 cm (range 5.0 to 12.5) ($p < 0.001$). The 4 stones in the distal ureter (between the iliac vessels and the UVJ) were significantly closer to the UVJ than to the iliac vessels. Mean distance below the iliac vessels was 4.9 cm (range 3.5 to 6) and mean distance above the UVJ was 1.75 cm (range 1.25 to 2.25) ($p = 0.001$).



Ureteral stone location at emergency department presentation with colic.

Proximal calculi in 28 patients had a greater mean axial diameter than distal calculi in 65 (6.1 mm, range 2.0 to 16.3 vs 4.0, range 1.8 to 7.2, $p < 0.001$) as well as a greater coronal diameter than distal calculi (6.8 mm, range 1.8 to 15 vs 4.1, range 1.9 to 10.2, $p < 0.001$). Axial diameter and coronal length moderately correlated with stone position ($r = -0.47$ and -0.55, respectively, each $p < 0.001$).

DISCUSSION

We examined the veracity of what has long been taught in urology, that the UPJ, the site where the ureter crosses anterior to the iliac vessels and the UVJ are the 3 narrowest points in the ureter and the likeliest places for stones to lodge.[1–5] Despite historical teachings there is a paucity of corroborating evidence. Older data relied on traditional excretory urography and plain abdominal x-ray to determine stone location. These studies cannot definitively identify the site of the iliac vessels and may not be able to identify the site of the UPJ and UVJ as accurately as CT.[8–10] Recent data suggest that the most common places where stones become impacted in the ureter may not be at those 3 sites.[7]