# Is Intravenous Urography Required When Ultrasonography and KUB Evidence a Ureteroscopy Plan?

Seyed Mohammad Kazem Aghamir,[1] Seyed Saeed Modaresi,[1] Alborz Salavati,[1] Mehdi Aloosh,[2,3] Ali Pasha Meysami[4]

[1]Department of Urology, Sina Hospital, Tehran University of Medical Sciences, Tehran, Iran
[2]Urology Research Center, Sina Hospital, Tehran University of Medical Sciences, Tehran, Iran
[3]Research Development Center, Sina Hospital, Tehran University of Medical Sciences, Tehran, Iran
[4]Department of Epidemiology and Bioinformatics, Sina Hospital, Tehran University of Medical Sciences, Tehran, Iran

Corresponding Author:

Seyed Saeed Modaresi, MD
Sina Hospital, Hassan Abad Sq., Imam khomeyni Ave., Tehran, Iran

Tel: +98 912 404 6303
E-mail: modaresis@razi.tums.ac.ir

Received May 2011
Accepted May 2011

**Purpose:** To determine whether pre-ureteroscopic stone extraction (USE) evaluation by intravenous urography (IVU) can change the clinical decision made on the basis of a plain X-ray of the kidneys, ureters, and bladder (KUB) plus an ultrasonography in the case of ureteral calculi.

**Materials and Methods:** From October 2005 to November 2007, 139 USE candidates were selected based on ultrasonography and KUB, and were randomly divided into two groups. Each group was assessed by an expert urologist to decide about the treatment plans. Thereafter, all the patients underwent an IVU pre-operatively and were evaluated for the second time by the other urologist considering IVU. Presence of a hydronephrotic kidney on the ultrasonography, existence of a density in the probable tract of the ureter on KUB, and previous episodes of renal colic were considered as inclusion criteria. Exclusion criteria were non-opaque stones on KUB, hypersensitivity to contrast media, and serum creatinine > 1.5 mg/dL.

**Results:** On the basis of ultrasonography and KUB assessment, all of the patients were identified candidate for USE. According to secondary IVU-based planning, of 139 patients, 127 (91.3%) required USE, 10 (7.1%) ureteroscopy, and 2 (1.4%) non-operative treatment. About 8.7% of treatment plans was changed by IVU, which was not statistically significant ($P = .35$). Positive predictive value of ultrasonography plus KUB to diagnose a ureteral stone which needed USE was 92.8% while IVU is the gold standard (95% confidence interval: 92.38 to 93.22).

**Conclusion:** Intravenous urography is not useful enough to be performed routinely before entire USEs.

**Keywords:** ultrasonography, ureteroscopy, hydronephrosis, ureteral obstruction, patient safety

## INTRODUCTION

Ureteroscopic stone extraction (USE) is a commonly used endourological procedure in the treatment of ureteral calculi. Furthermore, it has been revealed that open surgery is necessary in a considerable portion of ureteral stones.[1-3] Despite the high sensitivity of spiral computed tomography (CT) scan for detecting renal calculi, intravenous urography (IVU) is still considered as the gold standard imaging modality for evaluation of the ureteral calculi, but it carries the risk of X-ray exposure and has financial burden. Nowadays, the combination approach comprising of ultrasonography plus a plain abdominal X-ray, kidneys, ureters, and bladder (KUB) X-ray, is the first-line evaluating method for patients with renal colic in many countries.[1,4]

This prospective study was designed to determine whether performing IVU as the routine pre-USE evaluation can significantly change the clinical decision made on the basis of KUB and ultrasonography or not.

## MATERIALS AND METHODS

After receiving the approval from Tehran University of Medical Sciences' medical ethics committee, the current study was conducted on a consecutive group of patients with renal colic who presented to the department of emergency of Sina Hospital from October 2005 to November 2007.

All the patients underwent ultrasonography, KUB, and urinalysis. Due to our limited accessibility to CT scan, we did not perform spiral CT scan for all the patients. Computed tomography was only done for diagnosing non-opaque stones. Existence of a hydronephrotic kidney on the ultrasonography, a density in the probable tract of the ureter on KUB, and previous episodes of renal colic were considered as inclusion criteria. Exclusion criteria were non-opaque stones on KUB, hypersensitivity to contrast media, and serum creatinine > 1.5 mg/dL.

Most of the patients were managed conservatively with excessive fluid intake, analgesics, and physical activity. Patients who did not respond to this conservative treatment or those who had other definite indications for intervention were planned to undergo USE. One hundred and thirty-nine patients were identified definite candidate for USE, based on ultrasonography and KUB results. All of these patients were admitted to the department of urology and underwent IVU on the same day.

Patients were randomly divided into two groups. Group A consisted of 70 patients and group B composed of the rest 69 participants. The two groups were visited by two expert endourologists. While ultrasonography and KUB of patients in group A were reviewed by the first endourologist, the other group was assessed by the second endourologist. They made their decisions about patients' treatments. Thereafter, the patients in each group underwent an IVU pre-operatively and were evaluated for the second time by the other urologist considering IVU. At last, we compared treatment plans of these patients that were once provided by ultrasonography plus KUB and another time by IVU.

Data were analyzed by SPSS software (the Statistical Package for the Social Sciences, Version 13.0, SPSS Inc, Chicago, Illinois, USA), and *P* values less than .05 were considered statistically significant.

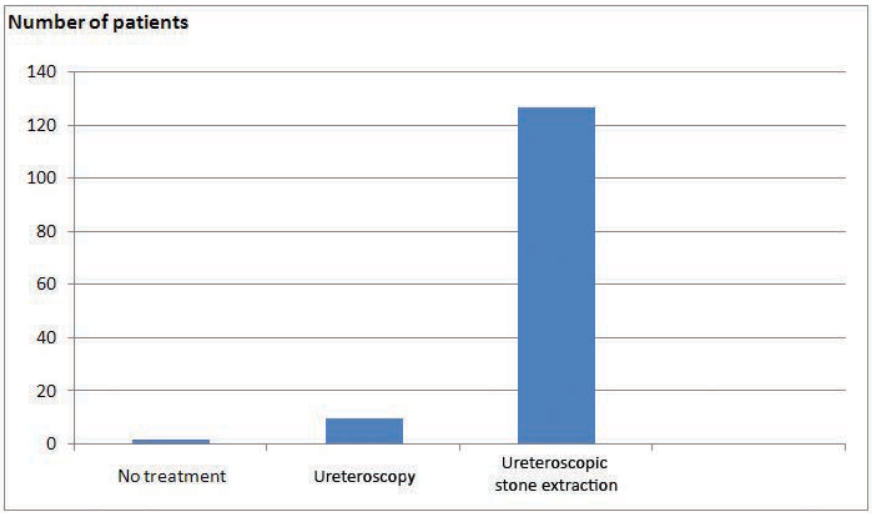
## RESULTS

Patients consisted of 84 (60.4%) men and 55 (39.6%) women, with the mean age of 43 years (range, 19 to 75 years). Mean serum level of creatinine was 1.3 mg/dL (range, 0.7 to 1.5 mg/dL). One hundred and thirty-two (94.9%) patients had hematuria.

Ultrasonography revealed mild hydronephrosis in 20 (14.3%), moderate hydronephrosis in 67 (48.2%), and severe hydronephrosis in 52 (37.4%) patients. All of these patients had one or more densities with a mean size of 10 mm (range, 4 to 20 mm) in the probable tract of the ureter on the KUB.

Intravenous urography revealed mild, moderate, and severe hydronephrosis in 18 (12.9%), 67 (48.2%), and 52 (37.4%) patients, respectively. Intravenous urography was normal in 2 (1.4%) patients, while these patients had mild hydronephrosis on ultrasonography and a 5-mm density in the distal ureter on KUB, which resembled a stone. On the other hand, intravenous urography evidenced hydronephrosis in 10 (7.1%) patients, while those densities were not inside the ureter, but extraurinary. Due to IVU, these cases were selected for ureteroscopy and not for USE (Figure).

According to IVU, 127 (91.3%) patients were candidate for



Treatment plans based on intravenous urography.

USE. The indications for USE in these patients are shown in Table.

If we postulate that the acceptable limit of plan change with IVU is 10%, only 8.7% of plans was changed by IVU in our study, which was not statistically significant ($P = .35$). Positive predictive value of ultrasonography plus KUB to diagnose a ureteral stone which needed USE was 92.8% while IVU is the gold standard (95% confidence interval: 92.38 to 93.22).

## DISCUSSION

Intravenous or excretory urography, firstly introduced in 1923,[5] is a diagnostic test of choice for many indications. Intravenous urography has been a mainstay of urologic imaging for several years.[1] Current literature suggests that performing IVU is mandatory prior to endourological procedures and it should be done routinely before USE.[2] Intravenous urography is still indicated when a urologist requests a map of the urinary tract for percutaneous, endoureteral, or surgical procedures. Intravenous urography is indicated when: 1) Ultrasonography evidences hydronephrosis in the absence of a stone on the KUB; 2) A stone is suspected on the KUB in the absence of any evidence of stones or hydronephrosis on ultrasonography; and 3) The colic recurs with negative KUB and ultrasonography.[6,7]

However, IVU should not be performed routinely because it is an expensive and time-consuming diagnostic procedure with a mean imaging time of 75 minutes.[8] Furthermore, bowel preparation is needed and a pregnancy test may be required. Intravenous urography requires an intravenous cannulation and injection of the contrast media, which is bothersome for the patient. Intravenous urography utilizes ionizing radiation and contrast media, which carry health risks, morbidity, and mortality.[9] The risk of contrast reaction during IVU is between 5% and 10%, with a mortality rate of approximately 1 in 40 000.[10] Another negative point of IVU is radiation exposure. The New Zealand national radiation

Indications for ureteroscopic stone extraction in 127 patients.

| Indication for ureteroscopic stone extraction | Definition | Number of patients |
|---|---|---|
| Unresponsiveness to expectant management | No spontaneous stone passage after 2 weeks of medical therapy | 59 |
| Prolonged symptoms | Colic pain > 1 month prior to the first visit | 29 |
| Large ureteral stone | Not probably passing spontaneously (> 9 mm) | 19 |
| Impacted stones | No change in stone position within 2 months | 11 |
| Severe acute symptoms refractory to medical treatment | | 6 |
| Single kidney | | 2 |
| Special considerations | Like hazardous occupations, such as pilot | 1 |

laboratory quotes a maximum allowable reference dose of 6 MSV for an IVU.[11]

In the current study, all the patients who had hydronephrosis on ultrasonography and a density in favor of calculi in the course of the ureter on KUB were planned for USE. Thereafter, IVU was performed and based on its findings, only 2 (1.4%) patients did not need any endourologic procedure. This means, only the plan of two patients was changed significantly and they were not transferred to the operating room, but other 137 patients finally underwent an endourologic procedure (USE for 127 and ureteroscopy for 10 patients).

Costs and complications of IVU make it more reasonable to conclude that performing IVU is a redundant test in these conditions. Consequently, IVU did not change the treatment plan of patients significantly and was an unnecessary procedure.

## CONCLUSION

We concluded that IVU should not be performed routinely before the entire USEs.

## CONFLICT OF INTEREST

None declared.

## REFERENCES


1. Chew BH, Denstedt JD. Ureteroscopy and Retrograde Ureteral Access. In: Wein AJ, Kavoussi LR, Novick AC, Partin AW, Peters CA, eds. *Campbell-Walsh Urology*. Vol 2. 9 ed. Philadelphia: Saunders; 2007:1508-25.
2. Bichler KH, Lahme S, Strohmaier WL. Indications for Open Stone Removal of Urinary Calculi. Urol Int. 1997;59:102–8.
3. Aghamir SK, Mohseni MG, Ardestani A. Treatment of ureteral calculi with ballistic lithotripsy. J Endourol. 2003;17:887-90.
4. Türk C, Knoll T, Petrik A, Sarica K, Seitz C, Straub M. Guidelines on Urolithiasis. European Association of Urology 2010; 2011.
5. Worster A, Haines T. Does replacing intravenous pyelography with noncontrast helical computed tomography benefit patients with suspected acute urolithiasis? Can Assoc Radiol J. 2002;53:144-8.
6. Dalla Palma L. What is left of i.v. urography? Eur Radiol. 2001;11:931-9.
7. Pollack HM, Banner MP. Current status of excretory urography. A premature epitaph? Urol Clin North Am. 1985;12:585-601.
8. Thomson JM, Glocer J, Abbott C, Maling TM, Mark S. Computed tomography versus intravenous urography in diagnosis of acute flank pain from urolithiasis: a randomized study comparing imaging costs and radiation dose. Australas Radiol. 2001;45:291-7.
9. Andrews SJ, Brooks PT, Hanbury DC, et al. Ultrasonography and abdominal radiography versus intravenous urography in investigation of urinary tract infection in men: prospective incident cohort study. BMJ. 2002;324:454-6.
10. Lindbloom EJ, Chang SI. Clinical inquiries. What is the best test to diagnose urinary tract stones? J Fam Pract. 2001;50:657-8.
11. Homer JA, Davies-Payne DL, Peddinti BS. Randomized prospective comparison of non-contrast enhanced helical computed tomography and in-travenous urography in the diagnosis of acute ureteric colic. Australas Radiol. 2001;45:285–90