

URETEROSCOPY – AS EMERGENCY TREATMENT PERFORMED FOR URETERAL STONES IN SOLITARY KIDNEY

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ORIGINAL PAPER

Doi: 10.33695/rojes.v1i1.1
Accepted: 05.12.2019

Abstract

Acute renal failure caused by ureteral stones represents one of the most important urologic emergencies. Patients with solitary kidney need periodic evaluation and increased attentions. The aim of this study is to evaluate the effectiveness of first choice ureteroscopy as definitive treatment for ureteral calculi in patients with solitary kidney. A series of 43 patients with solitary kidney for specific reasons who underwent primarily ureteroscopy were analyzed from 1 January 2018 to 31 October 2019 at “Prof. Dr. Th. Burghele” Clinical Hospital in Bucharest. All patients were imagistic evaluated with abdominal ultrasound, KUB and intravenous urography when possible. Blood tests and urine tests were analyzed for each case. There were excluded patients with fever or altered clinical status. We enrolled 25 men and 18 females with a mean age of 45.67 years old. The major symptoms at presentation were flank pain and oligo-anuria. Based on the imagistics we estimated a mean stone size about 6.74 mm. Frequently stones were located at pelvic level in 79.06% flowed by lumbar 16.27% and ureteropelvic junction 4.65% The stone free rate was 97.67% without major complications. All cases were standard ureteral stented for 3 weeks and were extracted after reevaluation. More and more studies consider that ureteroscopy as first line management can be a valid option instead of placing a nephrostomy tube or double J stent.

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Keywords: solitary kidney, ureteroscopy, ureteral stone, acute renal failure, emergency

Introduction

Renal colic represents one of the most frequent urologic emergencies and it needs proper investigations and personalized careful

management in accordance with patient's condition. Approximately 95% are caused by migrated stones. It represents an important healthcare problem according to the patient's

estimated risk of recurrence at about 50% at 5 years from the first episode [1], [2].

Usually, the primary goal in treatment of renal colic is to minimize patient's symptoms with a correct medication and to facilitate stone passage when possible in absence of indications for surgical intervention. If renal drainage is considered according to patient's status, the most common endourological approach is placing a ureteral catheter or a nephrostomy tube. Stone extraction is performed after patient's complete recovery.

One of the most challenging situations in urological emergencies which need immediate surgical treatment is acute renal failure secondary to stone obstruction. Acute renal failure is a condition with rapid alteration of the glomerular filtration rate that associates with high levels of blood urea nitrogen and creatinine [3]. A very fragile segment of the population in front of this situation is represented by patients with single surgical or functional kidney to whom emergency hospital admission is required. Usually, minimal invasive treatment to assure renal drainage like minimal percutaneous nephrostomy or ureteral stent is preferred by most surgeons but the advancing technology offers new possibilities for definitive management of ureteral stones at first presentation. The absence of patient septic condition evaluated with complete blood tests and imagistic exams offers the possibility to attempt ureteroscopy and stone removal from the first presentation.

Ureteroscopic lithotripsy is the most used procedure when dealing with ureteral stones and it is appreciated to be a safe and effective method by most surgeons. The advance techniques gave the chance to use improved endoscopic instruments which significantly reduces the complication rates and offers a high success rate. More and more studies evaluated, described and debated, the use of ureteroscopy as first line

endourological approach for ureteral stones [4] - [6].

Patients with solitary kidney may benefit of nowadays advantages and reach the stone free status more rapidly and maintain a normal kidney function without any loss of viable nephrons. Ureteroscopy solve the symptomatic issue by definitive pain relief, provides stone fragmentation and assures a proper renal drainage with minimal complications and it can be used even in patients with solitary kidney in selected cases.

The aim of this study is to evaluate the efficacy and safety of ureteroscopy used as first line management of different ureteral stone locations in patients with solitary kidney.

Materials and methods

This is a retrospective study on 43 cases of patients diagnosed with solitary kidney that underwent ureteroscopy as first line treatment for ureteral stones during 1 January 2018 and 31 October 2019 at "Prof. Dr. Theodor Burghele" Clinical Hospital in Bucharest.

All the medical records were carefully analyzed to obtain the complete medical history and patient's condition at the hospital admission of the selected cases. Data as gender, age, symptomatology at presentation, causes for single kidney were registered. Patients with an altered condition were primarily excluded for safety reasons. In these cases, placement of a ureteral stent or nephrostomy tube was preferred

Patients were primarily assessed with complete blood tests and urine samples. The imagistic examination at presentation included first intention Abdominal Ultrasound Evaluation (figure1) and was completed with Kidney – Ureter – Bladder (KUB) X-ray or Intravenous Urography (IVU) (figure 2) when the levels of urea and serum creatinine were normal or closed to normal range.

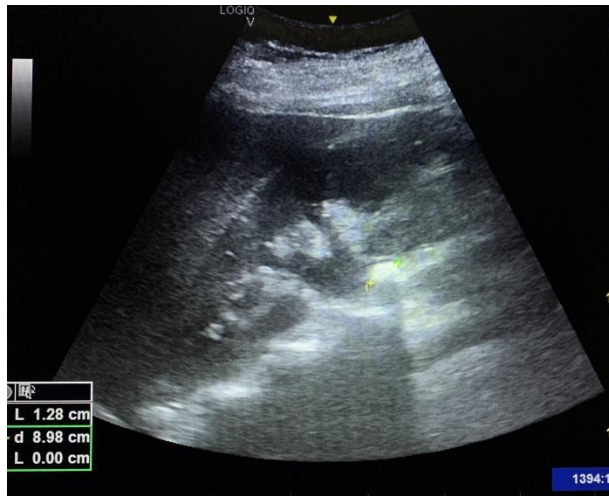


Figure 1 - Kidney Ultrasound – uretero-hydronephrosis grade I secondary to a lumbar ureteral stone

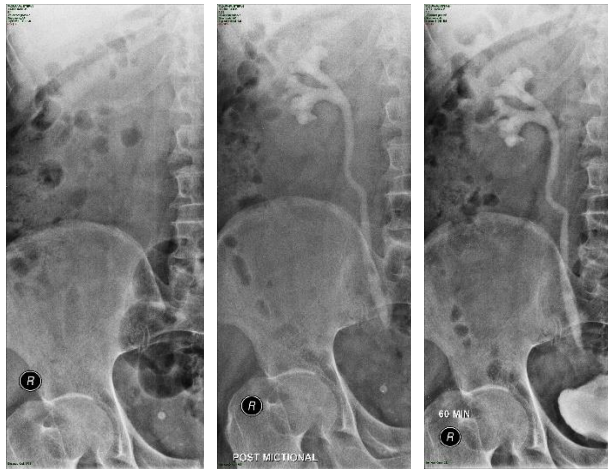


Figure 2 - Intravenous Urography at a patient with solitary kidney – right uretero-hydronephrosis secondary to pelvic stone

All selected cases underwent primarily ureteroscopy under spinal anesthesia, as first line treatment according to the clinical and bio humoral status. Semirigid ureteroscope (8 Fr and 10 Fr) were used. For stone fragmentation were available ultrasonic and pneumatic lithotrippers.

Double J ureteral stents placement was used after intervention in all cases and it was maintained 3 weeks after until the clinical, imagistic and bio humoral evaluation

permitted extraction in safe condition. No severe complications were registered.

Results

From 1 January 2018 to 31 October 2019, more than 1500 patients diagnosed with ureteral stone were surgical treated at “Prof. Dr. Th. Burghele” Clinical Hospital, Bucharest, one of the most important urological centers in Romania, with a high experience on endourological procedures.

Forty tree cases with solitary kidney that primarily underwent ureteroscopy as definitive treatment for ureteral stones were selected. According to Table 1, we enrolled 25(58.13%) males and 18(41.86%) females with almost the same clinical condition. The mean age was 45.67 years old.

All patients were hospitalized based on anamnestic interview and ultrasound evaluation at the emergency room. The clinical symptoms at presentation were defined by flank pain and oligo-anuria installed for less than 24 hours – table 1. Nausea and vomiting were also registered in a high rate about 58.13%.

The most common cause responsible for solitary kidney status was lithiasis 74.41% followed by single functional kidney 16.27% and nephrectomy for renal tumor 9.30%. No nephrectomies for renal tumor were encoured in adults younger than 40 years. All patients received medical treatment until investigations were completed and they were prepared for emergency intervention. Large spectrum antibiotics were administered before and after the procedure.

		Nr.	%
Sex	Male	25	58.13
	Female	18	41.86
Mean Age		45.67	
Solitary kidney-cause	Lithiasis	32	74.41
	Renal tumor	4	9.30

	Unfunctional kidney	7	16.27
Symptoms	Flank pain	42	97.67
	Oligo-anuria	36	83.72
	Nausea and vomiting	25	58.13
Uretero-hydronephrosis (UHN)	UHN gr. I	26	60,64
	UHN gr.II	11	25,58
	UHN gr. III	6	13,95
Stone location	Pelvic	34	79.06
	Lumbar	7	16.27
	Ureteropelvic junction	2	4.65

Table 1 - Patient characteristics

The complete blood count at presentation revealed normal levels of hemoglobin and leukocytes, without septic blood evidences – table 2.

	<i>Mean</i>
Haemoglobin (g/dl)	13.12
Leukocytes	8.700
Serum Creatinine (mg/dl)	2.24

Table 2 - Blood tests in study group

As a first step imagistic procedure we performed abdominal ultrasound evaluation and KUB for all patients in the shortest time from the hospital admission and when possible Intravenous Urography. Different grades of uretero-hydronephrosis (UHN) from 1 to 3 were registered without correlation with clinical symptomatology. The mean stone length was evaluated at 6.74 mm.

As referring to stone location, the most frequent was determined at the pelvic level in 79.06 % of cases followed by lumbar 16.27% and ureteropelvic junction in 4.65%. In all the procedures performed for the pelvic location the stones were completely removed using pneumatic lithotripters. For the lumbar and ureteropelvic stones, the ultrasonic lithotripters were preferred to avoid retropulsion. In 1 case the stone migrated into

the middle calyx and the procedure was abandoned and completed with extracorporeal shockwave lithotripsy after the patient's complete recovery.

All patients were double JJ stented for a 3 weeks period after procedure.

Complications were grouped into intraoperative and postoperative as we can observe in table 3. According to Clavien Dindo modified classification system, no severe complication was registered. In 1 case after stone removal the fluoroscopic control with contrast revealed a small extravasation at the intervention site. The check control with contrast medium after 3 weeks showed complete recovery. Mild intraoperative bleeding after mucosal injury caused by impacted stones was registered in 4 cases without affecting the procedure course. Extracorporeal shock wave lithotripsy was performed in 1 case for migrated calculus, 1 week after ureteroscopy.

	<i>No.</i>	<i>%</i>
Intraoperative		
Perforation	1	2.32
Bleeding	4	9.30
Migrated calculi	1	2.32
Postoperative		
Bleeding	8	18.60
Fever	2	4.65
LUTS	15	34.88
Flank pain and pelvic pain	11	25.58

Table 3. Complications after ureteroscopy

The most frequent postoperative complication after procedure was lower urinary tract symptoms caused by ureteral stent placement especially in man. The symptomatology reduced or almost disappeared after 3 or 4 days. Another important aspect was flank pain associated with retrograde urine reflux on double J stent. The patients were trained to urinate more often to avoid complete filling of the urinary

bladder. Mild bleeding observed on the urethral catheter had a complete resolution in less than 24 hours.

Fever in the first hours after the intervention was registered in 2 cases. There was no need to change the antibiotic therapy scheme.

No severe complications as avulsion, sepsis, lung embolism, deep venous thrombosis or acute abdomen were noted after the intervention.

Discussions

Acute renal failure is one of the most important emergency situation that need rapid diagnose to identify the cause and to apply the proper management by the healthcare providers. The capacity to almost complete recovery of the kidney is remarkable among the human organs. The urologists often confront with the postrenal causes of acute renal failure. The management of migrated ureteral stones is a very challenging situation because the kidney function recovery depends on the duration of obstruction. Some older studies revealed that the human kidney has the ability to recover function after more than 69 days of obstruction [7], [8].

Nowadays the advancing technologies offer the possibility for prompt intervention and rapidly establish of a normal function for obstructed kidneys. The usual approach is placing a percutaneous nephrostomy or a ureteral stent for renal drainage [9].

The improvements made on the ureteroscope design, the lithotripters and the calculus extraction devices increased the success rate of obtaining the stone free status and decreased the number of associated complications. In most patients, a renal colic it firstly treated conservatory with correct medication and hydration until the stone expulsion [10].

In complicated renal colic associated with fever or installed oligo-anuria surgical

treatment with minimal invasive approach need to be considered as soon as possible. The American and European Urological Association report in their guidelines a stone free rate of 97% after ureteroscopy [11]. Compared, in this retrospective study the success rate was 97.67% implying a high percentage of complete removal without serious complications. It can be concluded that ureteroscopy as first line treatment even in patients with solitary kidney can be a feasible alternative to double J stent insertion or nephrostomy tube in selected cases.

Isen K and Utku V presented in a similar study their results on 21 patients with a stone length less than 10 mm and a stone free rate of 95.4 % [12]. Compared to that, the mean stone size registered in this study was 6.74 mm. They used only pneumatic lithotripters for distal ureteral calculi. The advantage may be the lower costs associated with good results [13]. Producing larger fragments and retropulsion may be considerable disadvantages of using only compressed air based lithotripters [14]. In this study ultrasonic sonotrodes were preferred for proximal ureteral stones. Even that, the serum pressure determined migration in one case of junctional stone. In this case JJ stent was placed and combined with extracorporeal shock wave lithotripsy.

As some other authors suggest in their papers graspers and baskets can be used to remove the fragment resulted after lithotripsy [15], [16]. The use of stone forceps may associate with mucosal injury. No significant differences depending on the stone removal instrument used were noticed in this study.

Some authors suggest that YAG laser lithotripsy can be successfully used with a high rate of success for both proximal and distal impacted stones. Emergency situations efficacy do not seem to be affected by ureteroscopy with laser fragmentation [17], [18]. However, the costs limitation makes difficult this procedure for daily usage.

For safety reasons all patients in this study were ureteral stented for 3 weeks until reevaluation. Serum creatinine, blood urea nitrogen and intravenous urography, when possible, were used in the evaluation scheme. After normal renal function was regained the stents were extracted under cystoscopic guidance. Mild complications related to double J stent like: lower urinary tract symptoms, bleeding and flank pain were registered. The associated symptoms reduced with normal hydration and patients training to avoid the complete filling of the urinary bladder. Some studies specify that in uncomplicated ureteroscopy for ureteral stones, the routine stenting can be avoided [19].

One of the most dangerous situation in acute renal failure evolution is hyperkalemia. The presence of severe hyperkalemia may be an indication for hemodialysis. The indications for emergency dialysis before surgery include volume overload, pericarditis, metabolic acidosis, severe hyperkalemia and uremic symptoms [20].

The increased advances achieved in technology and surgical skills extremely limited complications after performing ureteroscopy in recent years and more and more studies present ureteroscopy as first line treatment for ureteral stones. The risk for ureteral perforation in patients with both kidneys was estimated between 0-4% in a contemporary series [21]. In this study one minor perforation (2.32%) was noticed at the fluoroscopic control after the procedure. Fever was noticed in 2 cases (4.65%) with a complete resolution at 24 hours without changing the antibiotic treatment.

The usual hospital stay for patients who underwent an uncomplicated ureteroscopy is generally 1 day. According to patients condition included in this study we preferred a longer period. The mean hospital stay for cases with solitary kidney included in this

study was 3.56 day until patient's condition permitted ambulatory follow-up.

The new technological achievements by improving the ureteroscopes design, new types of lithotripters, forceps, graspers and baskets makes more and more feasible the idea of using ureteroscopy as first intension definitive treatment for stone removal even in acute renal failure.

It seems that ureteroscopy for ureteral stones provides an important alternative with minimal morbidity and good results in selected cases. Stone position may have an influence on the procedure results. Better results on stone free rate and less postoperative complications were observed on pelvic positioned calculi. According to our analysis the procedure success depends also on the surgeon's experience and it is recommended to be performed in high experienced centers.

Double J stent necessity, hospital stay and stent removal in patients with solitary kidney and acute renal failure may differ from same procedure practiced on normal persons because of safety reasons.

Ultrasonic sonotrode and pneumatic lithotripters combined with ureteral forceps usage for larger fragments showed good results. Holmium laser may be more effective but the costs don't recommend this as a standard technique for daily usage.

One of the study limitations is the number of cases included. Larger series of patients should be presented in further studies to validate the procedure benefits and to determine the social-economic impact in terms of: less costs of drug administration, less clinical surveillance and earlier return to work.

Conclusions

Postrenal acute renal failure is one of the most important urological emergencies and needs immediate intervention for stone

removal and regaining the normal kidney function. The standard treatment according to actual guidelines is to assure a proper drainage by placing a ureteral stent or nephrostomy tube.

Ureteroscopy as first line treatment even in patients with solitary kidney and acute renal failure, in selected cases, should be considered as routine practice in experienced centers.

Acknowledgements

The results have been partially presented as a poster at the EAU 19th Central European Meeting (CEM19), Vienna, Austria, 9 – 10 May 2019.

Conflict of interest

The authors declare that they have no potential conflicts of interest to disclose.

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