ORIGINAL PAPER

The efficacy and safety of ureteroscopy for ureteral calculi in pregnancy: our experience in 32 patients

**Yasar Bozkurt · Necmettin Penbegul · Haluk Soylemez ·
Murat Atar · Ahmet Ali Sancaktutar · Kadir Yıldırım ·
Muhammet Erdal Sak**

Abstract The aim of this study was to investigate the efficacy and safety of ureteroscopy (URS) in pregnant women. A retrospective analysis was performed on 32 pregnant patients referred to our center between April 2005 and November 2010 with hydronephrosis requiring surgical intervention. A semirigid URS of 9.5 F was used in all patients. The mean age of patients was 27.8 years (range 20–39), and the mean gestation duration was 24 weeks (15–34). The ultrasound findings were diagnostic of obstructive ureteral calculi in 16 (50%) patients and the mean stone diameter was 8 mm. Spinal anaesthesia was performed in 22 (68.8%) patients, while general anaesthesia was performed in 7 (21.8%) patients. Ureteric stones were found in 27 (84.3%) patients during endoscopy, 10 being distal, 9 middle and 8 proximal. There were no stones in five patients. The stones were fragmented with pneumatic lithotripsy in 8 patients and with holmium laser in 17 patients and the fragments were retracted with forceps. Of the 32 patients, 19 (59.4%) required JJ stent insertion peroperatively. There was no serious complication intraoperatively, while urinary tract infection developed in four and renal colic in two patients postoperatively. In one patient, sepsis developed postoperatively, and improved with appropriate treatment. All babies were born normally. Semirigid ureteroscopy for diagnosing and treating ureteral calculi by intra- corporeal pneumatic or holmium laser lithotripsy is a safe and reasonable treatment option for pregnant patients.

Keywords Pregnancy · Ureteroscopy · Urolithiasis · Hydronephrosis

Introduction

The incidence of urolithiasis has been reported as 1/1,500 in pregnancy [1]. Renal colic is the most common cause of non-obstetrical abdominal pain and requires hospitalization among pregnant women [2]. 80–90% of urinary calculi in pregnant women are diagnosed after the first trimester [3, 4].

Treatment of stones in pregnancy ranges from conservative management (bed rest, hydration, analgesia) to more invasive measures (ureteral double-J stent or percutaneous nephrostomy). Although pregnant women requiring intervention for urolithiasis in the past, underwent treatment modalities such as placement of ureteral stent or percutaneous nephrostomy tube, these interventions also are not completely harmless [5]. These treatment modalities are invasive and provide a temporary relief to patients. In order to delay definitive treatment until termination of pregnancy, the catheters have to be changed periodically over the all course of pregnancy. Recently, ureteroscopy (URS) is becoming a more popular treatment option due to the improvements in technology and surgical technics [6]. The main advantages of ureteroscopy are complete visualization of ureter and renal pelvis that enable accurate diagnosis and definitive treatment for ureteral stones. Efficacy and safety of URS have been reported for treatment of urolithiasis in all trimesters of pregnancy [7, 8].

In this retrospective study, we evaluated the efficacy and safety of URS in 32 pregnant women, and to the best of our

Y. Bozkurt (✉) · N. Penbegul · H. Soylemez · M. Atar ·
A. A. Sancaktutar · K. Yıldırım
Department of Urology, University of Dicle, Diyarbakir, Turkey
e-mail: dryasarbozkurt@hotmail.com

M. E. Sak
Department of Obstetrics and Gynecology,
University of Dicle, Diyarbakir, Turkey

knowledge, this is the largest study on URS using for urolithiasis in pregnant women.

Materials and methods

In this retrospective study, we reviewed 32 cases of pregnant women who had been treated by URS due to ureteral stones or symptomatic persistent hydronephrosis in our center between April 2005 and November 2010. Hospital charts of the patients were retrospectively reviewed and patients, data including patient's age, presenting symptoms, diagnostic methods, previous urological interventions, localization and size of stone and stage of pregnancy were recorded.

An obstetric physical examination and ultrasonography (USG) were performed to all patients for determining gestational stage and excluding obstetric complications. The diagnosis of ureteral obstruction in pregnancy was made on the basis of the clinical presentation, presence of microscopic haematuria in urinalysis, and transabdominal USG. Complete blood count, creatinine, urea and urine culture were also performed to all patients and blood culture when needed. Conservative treatments such as intravenous fluids and analgesics were given to all patients following admission to hospital. Second (cefaclor, cefuroxime) or third (ceftriaxone) generation cephalosporines were given in cases with infection. In the presence of an active genitourinary infection in patients, the URS procedure was delayed until appropriate treatment and in all patients urine was sterile before intervention.

The USG findings were diagnostic for obstructive ureteral calculi in 16 (50%) patients. In the remaining 16 patients, the clinical findings and observation of progressive hydronephrosis on ultrasound examination were used for diagnosis. The stones below the lower limit of the sacroiliac joint were classified as lower ureteral stones, the ones above the upper limit of this joint were accepted as upper ureteral stones and the ones at the level of this joint as middle ureteral stones. Spinal anaesthesia was performed in 22 (68.8%) patients, while general anaesthesia without halothane and nitrous oxide [9] was performed in seven (21.8%) patients and local anaesthesia in three patients. All patients undergoing URS had antibiotic prophylaxis. Each of them took one dose of second (cefaclor) generation cephalosporine intravenously, 1 h before the URS and if necessary, medication was continued for 7 days after operation.URS could not pass the ureters of five patients with narrow ureters; therefore the ureter was dilated by a balloon dilator. The calculi were fragmented with pneumatic lithotripsy or a holmium laser, and then extracted with forceps. A double J (JJ) stent was applied to patients had apparent

oedema of ureter or stone fragments and was traumatized during URS procedure.

Pre/postoperative fetal viability was assessed by USG because of avoiding medicolegal issues and probable maternal anxiety. If patients' symptoms were back and/or groin pain which were present in patients whom were ≥24 gestational week, non-stress test was performed to exclude preterm labor (uterin contraction). Also, in early postoperative period the patients are followed up carefully to make sure of maternal well-being, and the outpatient follow-up included clinical assessment, USG examination, and urine samples for culture and antibiogram. Fifteen days after operation and/or postpartum, USG was repeated and the JJ stent was removed endoscopically if not required to remain.

Results

The mean age of patients was 27.8 years (range 20–39), and the gestational period was 24 weeks (range 15–34). The patients' characteristics are listed in Table 1. There was a history of urolithiasis in 10 (31.3%) patients. The symptoms were renal colic in 25 (78%) patients, fever-chills in 6 (18.75%) patients and haematuria-microscopic pyuria in 20 (62.5%) patients. Eight patients had positive urine cultures. Twenty-six (81.2%) patients had right and six had left side hydronephrosis. Ultrasonography detected grade I hydronephrosis in 1, grade II in 22 (68.75%) and grade III in 9 (28%) patients. The mean diameter of stones was 8 mm (results of 16 pregnant patients whose stone was seen on USG preoperatively). Endoscopically ureteric stones were found in 27 (84.3%) patients, which were distal in 10, middle in 9 and proximal in 8. There were no stones in five patients whom had grade II hydronephrosis on the right and only a JJ stent was inserted to these patients.

The stones were fragmented by pneumatic lithotriptor in 8 and by holmium laser in 17 patients, and the stone fragments were retracted with forceps. Two lower ureteric stones, which were smaller than 7 mm, were extracted with forceps. After lithotripsy the ureteral JJ stent (4.7 F in diameter and 28 cm in length) was performed in 19 patients (59.4%), 10 of them were removed by cystoscopy under local anaesthesia after 2 weeks from the initial procedure. The JJ stents were extracted after 2 weeks of birth in seven patients. In two patients, upper ureteric stones were retropulsed to the kidney by ureteroscope and a JJ stent placement was performed. In these two patients, the stents were changed every 8 weeks. After delivery, urolithiasis was successfully treated by performing shock wave lithotripsy after removing of ureteral stents. In these 19 patients, none reported complaint according to JJ stents except two pregnants. These patients had dysuria and pelvic pain. External

Table 1 Baseline characteristics of the 32 pregnant women

Characteristic	Value
Age (years)	27.8 (20–39)
Gestation (weeks)	24 (15–34)
Stone size on USG (mm)	8 (5–19)
Number of pregnancies	2.5 (1–6)

Characteristic	N (%)
Laterality	
Right	26 (81.2)
Left	6 (18.7)
Multiple stones in kidney and ureter	5 (15.6)
History of urolithiasis	10 (31.3)
Positive urine culture	8 (25)
Stone diagnosed by USG	16 (50)
Symptoms	
Pain and renal colic	25 (78.1)
Fever, chills, sweat	6 (18.8)
Haematuria and microscopic pyuria	20 (62.5)

USG ultrasonography

Table 2 Details of procedure and outcome

	N (%)
Site of the stone	
Lower third	10 (31.3)
Middle third	9 (28.1)
Upper third	8 (25)
No stones	5 (15.6)
Methods of Stone manipulation	
Stone forceps	2 (6.3)
Laser lithotripsy	17 (53.1)
Pneumatic lithotripsy	8 (25)
Double-J stent insertion	19 (59.4)
Peroperative complication (Laceration)	2 (6.2)
Postoperative complication	
Urinary Infection	4 (12.5)
Dysuria-pain	2 (6.3)
Sepsis	1 (3.1)

ureteral catheters were performed in eight patients while the ureteral catheter was not used for five patients. The external ureteral catheters were extracted on the first day postoperatively. The intraoperative details and procedure outcomes are listed in Table 2.

Intraoperatively, there was no ureteral perforation or obstetric complication, while in two patients, ureteral laceration was observed. Postoperatively, four patients had a urinary tract infection that was successfully treated with appropriate antibiotics. Dysuria and pain were observed in two patients. Postoperatively, sepsis developed in one patient; this healed with the appropriate treatment, and the child was born healthy at term. All babies were born normally.

Discussion

Urolithiasis and renal colic in the course of pregnancy may lead to urinary stasis and hydronephrosis that causes urinary tract infection and pyelonephritis. These complications may be associated with obstetric complications such as low birth weight, premature delivery and spontaneous abortion [10].

The first step for management of urinary lithiasis or renal colic during pregnancy should be conservative treatment. These conservative treatment modalities included intravenous hydration and analgesia resulted in spontaneous stone passage in 4–84% of pregnant patients [11, 12]. However, some of the patients still need more invasive treatment modalities. Surgical approach is necessary for the treatment of 20–30% of pregnant women with urolithiasis [3]. The aim of the treatment is to decrease maternal discomfort, to prevent deterioration of renal function and urosepsis secondary to obstruct urinary stone, and to minimize obstetric complications.

The conventional treatment of ureteral obstruction during pregnancy may be ureteral stenting or insertion of a percutaneous nephrostomy (PCN) tube. However, some risks such as urinary tract infection, discomfort to patient and encrustation related to PCN tube and ureteral stents have been reported if inserted in early stage of pregnancy [9, 13, 14]. Placement of ureteral stents often causes irritative voiding symptoms and patients discomfort [15]. The kidneys and ureters have physiologic hydrourerteronephrosis during pregnancy therefore ureteral stents are migrated more frequently in pregnant patients [16]. Parulkar et al. [11] reported a group of 70 pregnant women with urinary stones; 19 of 70 patients required invasive treatment, 15 of them undergone ureteral JJ stents placement. In this study, 1/3 of patients needed subsequent interventions because of encrustation, severe irritative symptoms or migration. Denstedt et al. [17] reported that ureteral stent installing is not recommended before 22 weeks of gestation, instead of ureteral stent percutaneous nehprostomy tube is recommended. After the URS procedure, JJ stent was placed in 19 (59.4%) of our patients, 10 of whom had it removed by cystoscopy under local anaesthesia 2 weeks after the initial procedure. In seven patients, the JJ stents were removed 2 weeks after the post-natal period, and we did not see any complications related to the JJ stents.

If a ureteral stent is indicated but cannot be placed with ultrasound guidance, or if urosepsis is present, a percutaneous nephrostomy tube should be placed instead. Placement of a nephrostomy tube provides a fast and complete decompression of the upper urinary tract, relieves the pain and resolves the infected hyronephrosis. Futhermore placing of a percutaneous nephrostomy tube may be advantageous, due to antegrad irrigation with an antibiotic solution for minimizing the risk of infection and encrustation [13]. Percutaneous nephrostomy had some disadvantages including bacteriuria, frequent urinary tract obstruction requiring tube change, bleeding risk and discomfort. Although ureteral stents or percutaneous nephrostomy procedures accepted as minor invasive procedures, they may carry comparable risks with definitive ureteroscopy because of repeated insertions or changes [18].

Ureteroscopy allows for complete visualization of the entire ureter and renal pelvis, providing complete diagnosis and definitive treatment for urolithiasis. It has been thought that ureteroscopy may be impossible because of anatomic distorsion of pregnancy especially close to delivery. However, it has been reported that ureteroscopy can be safely and effectively performed in all trimesters of pregnancy [7, 8, 18–20]. Rigid ureteroscopy can be performed, even in third trimester of pregnancy [7]. Lemos et al. [21] reported a group of patients consisting of 68 pregnant women who underwent ureteroscopy for diagnosis and/or treatment. In that study no obstetrical complications was not reported. Only one ureteral perforation was observed, and perforation was successfully treated by placement of a ureteral stent and a healthy baby was born at term. In our study, we did not see any ureteral perforation or obstetric complications. During intervention in two patients, ureteral laceration was observed and JJ stents were inserted under direct vision of a 9.5 F ureteroscope. Because of physiologic dilatation of ureter and collecting system during pregnancy, ureteroscopy was performed without dilating the ureter's orifis and allows the ureteroscope under direct vision [1, 7, 18]. In our study, we performed ureteral dilatation in 5 (15.6%) patients.

General anaesthesia is rarely used in pregnant patients. The most of the URS procedures have been carried out with spinal or epidural anaesthesia [20, 22]. Scarpa et al. [7] reported a series of 15 patient who underwent URS they used no anaesthesia to 5 patients while neuroleptic anaesthesia (propofol or fentanyl and atropine) was used in 10 patients. In another series the authors reported that the use of sedation analgesia can be preferred to general or spinal anaesthesia for both rigid and flexible ureteroscopy [18]. In this study, we only used semirigid URS, and spinal anaesthesia was performed on 22 (68.8%) patients. In the remaining patients, general anaesthesia was performed on seven (21.8%) patients, and local anaesthesia on three patients. We did not use mask or sedation anaesthesia.

Stone fragmentation and retrieval have been successfully made by many kinds of lithotriptors and forceps during ureteroscopy [7, 18, 19, 23]. All of the previous techniques are used safely without known complications. In most of the recent studies, holmium YAG laser is used for treatment [19, 20, 23, 24]. Akpinar et al. reported a series of seven patients who underwent ureterorenoscopy and the stones are fragmented by holmium YAG laser; six of seven patients were stone free. In this study the authors recommended that routine ureteral stent placement for 72 h postoperatively due to reduce pain and analgesic requirements [23]. In this study, we used holmium laser with success in 17 (53.1%) patients and pneumotic lithotriptor in 8 (25%) patients. We found that the pneumatic lithoclast and holmium YAG laser to be safe and effective for both the patients and foetuses. No complications among the newborns were recorded. No ureteric calculi were seen in five patients; in two patients, there was oedema and haemorrhage of the ureteric wall, and the patients may have passed calculi spontaneously, shortly before ureteroscopy. In the remaining patients, ureteroscopy was normal.

Multiple calculi, stones bigger than 1 cm, transplanted kidneys, presence of sepsis and absence of general obstetrical services or high-risk obstetrical services are contraindications of ureteroscopy in pregnancy [3]. In our study, the mean stone size on ultrasonography was 8 mm, and in seven patients, stones were bigger than 1 cm, and URS was also effective and successful in these patients. The sepsis, which is an unwanted complication, was seen in one of our patients. This patient was followed in intensive care, and healed with the appropriate treatment after 7 days. The patient gave birth to her child the normal way, and the child was healthy.

Conclusion

A conservative management is advised for the initial treatment of ureteral stones and renal colic in pregnant patients. However, if the symptoms persist or complications develop, URS is a safe and reasonable treatment option with acceptable complications in pregnant women. Semirigid ureteroscopy should be used to diagnose ureteral calculi and treatment should be with intracorporeal pneumatic lithotripsy and holmium laser lithotripsy, which is the most efficient and definitive treatment modality during pregnancy. However, a prospective, randomized, controlled trial with a higher number of patients will help to establish clearer conclusions.

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