



ORIGINAL ARTICLE

Definitive ureteroscopy and intracorporeal lithotripsy in treatment of ureteral calculi during pregnancy



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KEYWORDS

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Pregnancy;
Lithotripsy

ABBREVIATIONS

US, ultrasonography

Abstract Objective: To evaluate the outcome of using semi-rigid ureteroscopy with or without intracorporeal pneumatic lithotripsy vs. temporary ureteric JJ stenting in the management of obstructing ureteric calculi in pregnant women.

Patients and methods: This prospective comparative study comprised 43 pregnant women with obstructing ureteric calculi. The diagnosis was based on the acute flank pain as the main symptom, microscopic haematuria, and unilateral hydronephrosis on abdominal ultrasonography (US). The patients were randomly divided into two groups; those in group 1 (22 patients) were treated by temporary ureteric JJ stenting until after delivery, and those in group 2 (21) were treated definitively by ureteroscopic stone extraction with intracorporeal pneumatic lithotripsy. Postoperative complications and the degree of patient satisfaction were reported.

Results: An obstructing ureteric stone was identified by US in 68% and 76% of groups 1 and 2, respectively. In group 1, nine patients had mid-ureteric stones and 13 had stones in the lower ureter. In group 2, seven patients had mid-ureteric stones,

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whilst the stones were in the distal ureter in 14. No perioperative foetal complications were detected in any group and all patients completed the full term of pregnancy. In group 1, four patients had a postoperative urinary tract infection (UTI), and the JJ stent was exchanged in seven. Two patients in group 2 had a postoperative UTI.

Conclusions: Definitive ureteroscopy, even with intracorporeal pneumatic lithotripsy, is an effective and safe treatment for pregnant women with obstructing ureteric calculi. It has a better outcome and is more satisfactory for the patients than a temporary JJ stent.

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Introduction

The incidence of urinary stones during pregnancy is reported to be 1/1500 and this is similar to that in non-pregnant women [1,2]. Pregnancy-related stones are most commonly composed of calcium phosphate [3]. Diagnosing calculi obstruction of the urinary tract in a pregnant woman is not easy, as most traditional radiological tools are avoided because of the hazards of radiation exposure, especially in the first trimester [4]. Ultrasonography (US) with an experienced operator is considered to be the diagnostic tool of choice for calculi ureteric obstruction during pregnancy, because it is safe, and has reasonable sensitivity and specificity for detecting hydronephrosis and ureteric stones [5]. If there is infection or persistent pain, pregnant women with ureteric stones can be managed by placing a ureteric JJ stent or percutaneous nephrostomy tube to relieve the obstruction until the end of pregnancy [6]. However, the risk of a UTI, or ureteric stent or nephrostomy tube blockage, rather than loin and/or bladder discomfort, is not uncommon, especially if the procedure was performed at an early stage of pregnancy [7]. Because reports on ureteroscopy and stone retrieval during pregnancy remain infrequent, more studies are required to assess the safety and effectiveness of such a procedure [8,9]. Thus we evaluated the outcome of using semi-rigid ureteroscopy with or without intracorporeal pneumatic lithotripsy, vs. temporary ureteric JJ stenting in the management of obstructing ureteric calculi in pregnant women.

Patients and methods

This prospective comparative study included pregnant women with unilateral calculi ureteric obstruction during the period from October 2006 to December 2013. Patients with no stones and those having bilateral ureteric obstruction or a single kidney were excluded. After failure of medical expulsive therapy, 43 patients were randomly divided according to the planned procedure into two groups. Group 1 included 22 patients who were

assigned to be treated by temporary ureteric JJ stenting until the end of their pregnancy, whilst in group 2, 21 patients were assigned to be treated definitively by ureteroscopic stone extraction.

The study was conducted in accordance with the code of ethics of the World Medical Association (Declaration of Helsinki), and an informed consent was obtained from all patients.

Preoperative data for patient age, period of pregnancy, previous stone passage or urological interventions, and presenting symptoms and signs were reported. All patients had a detailed physical examination supported by transabdominal US and urine analysis to identify the presence of hydronephrosis, ureteric stone, microscopic haematuria and UTI, as well as the foetal condition. An intravenous injection with an antibiotic (1 g ceftriaxone) was given to all patients 1 h before surgery and then daily for 5 days after endoscopy. Under strict maternal and foetal care, spinal anaesthesia was administered in 18 patients in group 1 and 19 in group 2, whilst topical lidocaine anaesthesia with sedo-analgesia was used in four and two patients of groups 1 and 2, respectively. Anaesthetic drugs that are a risk during pregnancy, e.g., halothane and nitrous oxide, were avoided. US (not fluoroscopy) was used for obstetric and renal monitoring throughout all procedures. Endoscopy was carried out using a semi-rigid 9.5 F ureteroscope for all patients. Ureteric stones were diagnosed on US in 31 of the 43 patients, 15 of whom were treated with a JJ catheter using a cystoscope only, and the other 16 had definitive ureteroscopy. During the study 12 of the 43 patients with unilateral hydronephrosis only and no stones on US were included in the study, when the ureteroscope was needed to negotiate the guidewire up to the kidney. A JJ stent was placed in seven of these patients until delivery, whilst the other five had definitive ureteroscopy. In group 2, dilatation of the ureteric orifice was required in only four patients. The stone was extracted by ureteroscopy without fragmentation in seven patients, whilst the stones were removed after fragmentation using a Swiss pneumatic lithoclast in the other 14. In each patient in this group

a thread-ended JJ stent was left in place for 2 weeks only, and hence could be removed without endoscopy. All patients were followed up during pregnancy using US, with urine analysis every 4 weeks, until delivery. The results of the procedures were reported as primary and secondary outcomes. The primary outcomes included the resolution of hydronephrosis, achievement of a stone-free state, and a safely completed pregnancy. The secondary outcomes comprised postoperative complications like UTI, any irritative LUTS, and the patient's overall satisfaction, assessed from a verbal report by the patient.

The chi-squared test was used to compare categorical variables, and an independent-samples *t*-test was used for quantitative variables, with $P < 0.05$ considered to indicate significance. The study had a statistical power of 80% and 95% level of confidence.

Results

In groups 1 and 2, the mean (SD, range) age and gestation period were 26.6 (4.65, 19–35) years and 24.1 (5.44, 15–33) weeks, and 25.5 (4.26, 18–32) years and 25.7 (4.95, 17–33) weeks, respectively. The results in Table 1 show that there were no statistically significant differences between the groups in preoperative patient criteria. In group 2 (22 patients), nine had mid-ureteric stones and 13 had stones in the lower ureter, whereas in group 1 (21 patients), seven had mid-ureteric stones and the remaining 14 had stones in the distal ureter. In group 1 the JJ stent was exchanged in seven patients because of persistent infection in two and JJ stent blockage in five. The operative data of each group are also shown in Table 1. The hydronephrosis was relieved and the patient rendered stone-free in all, with no perioperative foetal complications in both groups, and all patients completed the full term of their pregnancy. There was a postoperative UTI in four patients in group 1 and in two in group 2. Persistent irritative LUTS, e.g., increased frequency, urgency and dysuria, were reported by 13 and four patients in groups 1 and 2, respectively. Seven patients in group 1 reported that they were greatly satisfied with the procedure and its outcome, compared to 15 in group 2. The procedure outcomes and patient satisfaction are also reported in Table 1.

Discussion

Renal pain due to urinary calculi is the most common non-obstetric abdominal pain among pregnant women requiring hospitalisation [10]. Stone disease during pregnancy can be dangerous for both the mother and the foetus, as renal colic can precipitate pre-term labour or other peripartum complications [11]. It was reported that 80–90% of urinary calculi during pregnancy are diagnosed during the second or third trimesters [12].

None of the present patients reported their complaint during the first trimester of pregnancy.

Many investigators have abandoned the use of fluoroscopy for either the diagnosis or the treatment of ureteric stones in pregnant women, because of possible teratogenic effects. With a precisely adjusted radiation dose in well-equipped radiology centres, low-dose CT has been suggested for the diagnosis of urolithiasis during pregnancy. Recent advances in the technology of US have increased its capability in the diagnosis of ureteric stones as a cause of hydronephrosis during pregnancy [4,13]. US, as the safest diagnostic tool, was used both in the diagnosis of calculi ureteric obstruction and during endoscopic intervention to ensure the correct placement of a JJ stent proximal coil in the pelvicalyceal system. With colour Doppler US and other facilities, US was used to detect ureteric stones in $\approx 76\%$ of the present patients, but as noted by Shokeir and Mutabagani [8], it had lower sensitivity in cases of middle ureteric stones.

Conservative management by fluids, anti-inflammatory agents and other drugs should be tried first, as 50–70% of patients can pass the stone spontaneously [1]. However, when conservative treatment fails, intervention with either temporary drainage by a ureteric catheter, or definitive ureteroscopy, is required [6,7]. Spinal or epidural regional anaesthesia is considered the standard for such procedures in pregnant women, whilst topical anaesthesia with sedo-analgesia can be considered in some situations with reasonable patient tolerability [8,14–16].

Ureteroscopy can be easier in pregnant women, as dilatation of the ureteric orifices is often unnecessary [12,14] due to the muscle-relaxing effect of progesterone and other hormones which are elevated during pregnancy [17]. In the present study the ureteric orifice was dilated up to 12 F in four patients only in group 2. The ideal stone-fragmentation device should deliver the energy to a localised area with minimal collateral damage, via a flexible or semi-rigid endoscope. The holmium laser is used via rigid and flexible ureteroscopes [15], whilst the pneumatic lithoclast, used in the present study, can be applied only via a semi-rigid ureteroscope. Other stone-fragmentation energy sources have different risks during pregnancy. Shock-wave lithotripsy has been shown to be associated with growth retardation in animal models, and therefore contraindicated in pregnant women [12]. Electrohydraulic generators have a very high peak pressure and the narrowest margin of safety of all devices [18]. Ultrasonic lithotripsy is quite safe except for the risk of hearing defects in the foetus due to the high-frequency sound produced during stone disintegration by the sonotrode [19].

It was reported that ureteroscopy can be safe and effective in all trimesters of pregnancy [5,14,15]. This idea contradicts the previous concept that only distal

Table 1 Preoperative patient criteria, operative data, and outcomes.

Mean (SD) or n (%) variable	Group 1 (22)	Group 2 (21)	P
<i>Preoperative</i>			
Age, years	26.6 (4.65)	25.5 (4.26)	0.399
Gestation, weeks	24.1 (5.44)	25.7 (4.95)	0.326
History of urolithiasis	9 (41)	8 (38)	0.902
Side of complaint:			0.902
Right	14 (64)	12 (57)	
Left	8 (36)	9 (43)	
Symptom:			
Renal pain or colic	22 (100)	21 (100)	1.000
Fever or chills	6 (27)	4 (19)	0.782
Signs:			
Hydronephrosis	22 (100)	21 (100)	1.000
Ureteric stone	15 (68)	16 (76)	0.806
Microscopic	13 (59)	11 (52)	0.892
Haematuria			
<i>Operative</i>			
Type of anaesthesia:			
Spinal	18 (82)	19 (90)	0.705
Topical + sedo-analgesia	4 (18)	2 (10)	
Stone location:			
Middle ureter	9 (41)	7 (33)	0.843
Lower ureter	13 (59)	14 (67)	
Need for JJ exchange	7 (32)	0	0.016
<i>Outcomes and satisfaction</i>			
Stone-free	22 (100)	21 (100)	1.000
Safely completed pregnancy	22 (100)	21 (100)	1.000
Postoperative UTI	4 (18)	2 (10)	0.705
Irritative LUTS	13 (59)	4 (19)	0.018
Degree of satisfaction:			
Satisfied	15 (68)	5 (24)	0.009
Greatly satisfied	7 (32)	16 (76)	

ureteroscopy is safe in late pregnancy [1,10,20]. Many trials were reported on the safety and efficacy of ureteroscopy in pregnant women [8,9,15,16], but we could not identify any previous report comparing definitive ureteroscopy with ureteric catheterisation in the treatment of ureteric stones during pregnancy. In the present study, all patients in both groups completed their pregnancy safely and became stone-free at the end of the planned treatment.

However, there was a statistically significant difference favouring patients who had definitive ureteroscopy with stone removal in the degree of satisfaction about the procedure and its outcome, most commonly because it involved fewer treatment sessions and less postoperative LUTS. As stated by many authors [5,7–9,12,14,15], we consider that definitive ureteroscopy and stone removal, even with lithotripsy, is an ideal intervention for managing pregnant women with obstructing lower ureteric calculi that did not respond to conservative treatment. Ureteroscopy during pregnancy is reported to be as effective and safe as in non-pregnant females [16].

The limitations in this study include relatively few patients in each group, which could be explained by the low incidence rate of unilateral ureteric stones during pregnancy. Also, the degree of satisfaction was assessed subjectively from the patient's verbal report,

as no validated questionnaire is yet available to determine the satisfaction status in such cases.

In conclusion, definitive ureteroscopy, even with pneumatic lithotripsy, is as safe and effective as ureteric JJ stenting to treat accessible ureteric stones in pregnant women. In such cases it can replace the previous concept of temporary ureteric catheterisation that can cause persistent LUTS and requires a further endoscopy after labour to remove the stone and the stent.

Conflict of interest

None declared.

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None.

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