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ORIGINAL PAPER

Treatment outcomes of semirigid ureterorenoscopy and intracorporeal lithotripsy in pregnant women with obstructive ureteral calculi

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Abstract The purpose of the study is to evaluate the outcomes of semirigid ureterorenoscopy and intracorporeal lithotripsy as a definitive treatment in pregnant women with obstructive ureteral calculi. A retrospective analysis was performed of 16 pregnant patients referred to gynecology department with ureteral obstruction from 2007 to 2009. The mean age was 25 years, and mean gestation period was 30 weeks. Of the 16 patients; 50% had fever, 100% flank pain, 56% dysuria, 25% gross hematuria, 50% positive urine culture, and 75% pyuria and microscopic hematuria. Abdominal ultrasonography was the principle diagnostic test used. The mean stone size was 9.45 mm. Eleven of the 16 patients, 54% had stones located in the distal ureter and 46% proximal ureter. The stones were fragmented using a swiss pneumatic lithoclast through 9.5 F semirigid ureteroscope by 0.035 mm safety guidewire with the patient under general anesthesia. Eleven patients had obstruction due to the ureteral calculi. Eight of 11 patients had complete fragmentation of the calculi by ureteroscopy as a primary treatment. Push-back was performed in the other three patients. By applying Dj catheter, and performing eswl after giving birth, the patient became stone-free. Dj catheter was applied peroperative to all 16 patients. No complications were recorded, and all patients completed the full term of pregnancy. The results of our study have shown that semirigid ureteroscopy to diagnose ureteral calculi and treat them with intracorporeal pneumatic lithotripsy and ureteral stent insertion, as indicated, is the most efficient and definitive treatment modality in pregnant women.

Keywords Semirigid ureterorenoscopy · Intracorporeal lithotripsy · Treatment · Pregnant women · Obstructive ureteral calculi

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Introduction

Urolithiasis during pregnancy is uncommon, and only one in 500 pregnancies is complicated by urinary calculi [1, 2]. Urinary stones during pregnancy are composed mainly of calcium phosphate (hydroxyapatite) in 74% of cases and calcium oxalate in remaining 26% [3]. Most pregnant women with nephrolithiasis may be treated conservatively and do not require a surgical procedure to treat the stone while pregnant [4]. The established initial management of the stone disease in pregnancy has been conservative and includes hydration, analgesics, and antibiotics in the presence of infection, and is likely to result in spontaneous passage of 70–80% of the stones [5, 6]. However, fever, infection, uncontrolled pain, and progressive hydronephrosis, occurring in 20–30% of patients are indications for surgical intervention.

Materials and methods

From 2007 to 2009, 16 patients who had ureteral obstruction and indications for surgical intervention such as persistent pain, fever, positive urine culture, and progressive hydronephrosis were analysed retrospectively. The mean

Table 1 Patient characteristics

Patient (*n*)	
Total	16
First trimester	0
Second trimaster	8
Third trimester	8
Symptoms	
Pain and renal colic	16
Fever	8
Leukococytosis	16
Microscopic pyuria and hematuria	12
Positive urine culture	8
Stone diagnosed by ultrasonography	11
History of urolithiasis	6
Stone size on ultrasonography (mm)	
Mean	9.45
Range	5–12
Stone location	
Proximal	5
Distal	6
Double J stent insertion	16

age of patients was 25 years (range 19–34), and the mean gestational period was 30 weeks (range 23–35). The patient characteristics are listed in Table 1.

The diagnosis of ureteral obstruction was determined from clinical presentation, and the patients were evaluated with complete blood analysis, urea and creatinine measurement, urinalysis, urine culture, blood culture if indicated, and ultrasonography. Microscopic hematuria–pyuria was present 12 patients (75%). The ultrasound findings were diagnostic of obstructive ureteral calculi in 11 patients.

All patients underwent treatment as inpatients. Within anesthesiology assessment ureteroscopy was performed under general anesthesia with antibiotic coverage. Ureteroscopy was performed using a 9.5 F (KARL STORZ GmbH & Co KG, Tuttlingen, Germany) semirigid ureteroscope by 0.035 mm safety guidewire. Of the 11 stones, six were in the distal ureter and five were in the proximal ureter. They were fragmented with a Swiss lithoclast used as the sole device for stone fragmentation using 2.4 F long probe (0.8 mm thick). The postoperative follow-up included obstetric care to ensure maternal and fetal well being, and the outpatient follow-up included clinical assessment, ultrasound examination, and urine culture.

Results

Of the 11 patients, eight had complete fragmentation of the calculi through the ureteroscopy as primary treatment. In three patients, stone push-back was performed, and eswl was applied after giving birth. Complete fragmentation was defined as the stone being fragmented into pieces $\leq$4 mm and declared as clinically insignificant residual fragments [7]. The decision to leave the double J stent in place after procedure completion was dependent on the presence of local edema at the site of the stone impaction, pre-existing renal calculi, and migration of the stone fragment back into the kidney. The ureteral double J stent was 4.7 F in diameter and 26 cm in length (EliteSoft Ureteral Stent Set, EVA Tech, Lyon, France). No patient experienced any procedure-related or general anesthesia-related complication.

Comment

Urolithiasis occurs more frequently in multiparous women during the second and third trimester and is equally present on both the sides [8, 9]. Physiologic hydronephrosis occurs in 90% of pregnant women and can manifest as early as 6–10 weeks of gestation. This results from the smooth muscle relaxing effect of progesterone initially and the direct compression of the ureters by the ever-increasing size of the uterus later in the pregnancy [10]. This compression effect is more pronounced on the right side, possibly because of the dextrorotation of the uterus, and is less noticeable on the left side owing to the cushioning effect of the intraperitoneal sigmoid colon. Hydronephrosis of pregnancy causes urinary stasis, which predisposes to urinary tract infection and urolithiasis. These complications have been associated with spontaneous abortion, premature labor, and a low birth rate. In pregnancy, a decrease in systemic vascular resistance leads to a 30–50% increase in the glomerular filtration rate, which elevates the urinary sodium, uric acid, and calcium levels. Hypercalciuria is further increased by suppression of parathyroid hormone production and elevation of 1–25 dihydroxycholecalciferol from the placenta, which, in turn, increases the absorption of gastrointestinal calcium, thus promoting stone formation [11, 12].

The customary treatment of the obstructed ureter during pregnancy has been either insertion of a percutaneous nephrostomy tube or ureteral stenting [13, 14]. The recent technological advances in ureteroscope design, stone fragmentation devices, and the administration of safe anesthesia have forced clinicians to embark on more definitive stone management techniques, with the result that contraindications to ureteroscopy such as stone size bigger than 1 cm, multiple calculi, transplanted kidney, and solitary kidney have been made redundant and irrelevant [15]. The clinical presentation of urinary tract obstruction during pregnancy presents not only a diagnostic challenge, but also a management dilemma. Renal colic and ascending urinary tract

infections can turn into life-threatening sepsis, with associated complications to the mother and fetus both. The avoidance of pregnant women to radiation exposure is of outmost importance when rapidly dividing fetal cells are the most vulnerable to teratogenic effects of radiation, especially in the first trimester. At present, renal ultrasound scan is considered the imaging method of choice for routine evaluation of suspected urinary stones in pregnant women because of absence of radiation exposure and reasonable sensitivity and specificity for stone detection of 34 and 86%, respectively [16–18]. The insertion of percutaneous nephrostomy tubes and internal ureteral catheters alone for the complications of obstructed ureters during pregnancy still works. But these are fast becoming obsolete as a result of being associated with infection, blockage, breakage, fragmentation, leakage, and dislodgement and because of the greater success rates reported with ureteroscopy offering definite treatment. We used double J stents in 16 patients (100%). The stents were inserted under direct vision. Ureteroscopy is a safe procedure during pregnancy and can be performed with a rigid, semi-rigid, or flexible instrument with good results [19]. Ureteroscopy is easier during pregnancy because preliminary dilatation of the ureteric orifices is not needed as a result of the muscle relaxing effects of progesterone and other pregnancy hormones. In a recent meta-analysis of 14 reports about the use of ureteroscopy in 108 pregnant women with urolithiasis, there was no significant difference in the complication rate compared to nonpregnant women indicating that ureteroscopy should be considered a first-line treatment of stone disease during pregnancy [20].

The vast armamentarium of stone fragmentation energy sources such as shock wave lithotripsy, electrohydraulic lithotripsy, ultrasound lithotripsy, laser lithotripsy, and pneumatic lithoclasts have their own benefits and risks. Shock wave lithotripsy has been associated with the growth retardation in animal models and is, therefore, contraindicated in pregnancy [21]. Electrohydraulic lithotripsy generates a very high peak pressure and has the narrowest margin of safety of all the devices [22]. Although ultrasound lithotripsy is quite safe to the surrounding tissue, the production of a greater frequency of vibration energy might be a risk factor for the development of hearing in the fetus [23].

Therefore, the stone fragment device must have the ability to deliver the energy to a very localized area with minimal or no collateral damage and must be able to be delivered through a flexible or semirigid ureteroscope. Holmium lasers and pneumatic lithotripsy both fulfill these criteria. A holmium laser can be used through a rigid or flexible ureteroscope with comparable ease. The pneumatic lithoclast can only be applied through semirigid ureteroscopes with an end channel owing to the semirigid probe. As we did not have access to holmium laser treatment, we found the pneumatic lithoclast to be safe and effective for the patient and fetus both. No complications among the newborns, in general, or in terms of deafness, in particular, were recorded.

Conclusion

Management of the pregnant stone patient can be challenging as there is a significant risk associated with acute renal colic in this patient population. As always, conservative management with medical therapy and observation should be the first-line treatment approach. However, should conservative management fail either intervention with temporary drainage or definitive treatment of the stone is the most appropriate next step. The surgical option of ureteroscopy and the use of intracorporeal lithotripsy can safely be offered to these patients as definitive treatment of obstructive ureteral calculi during all trimesters of pregnancy.

References

1. Meria P, Anidjar M, Hermieu JF et al (1993) Urinary lithiasis and pregnancy. Prog Urol 3:937–943
2. Rodriguez PN, Klein AS (1988) Management of urolithiasis during pregnancy. Surg Gynecol Obstet 166:103–106
3. Ross AE, Handa S, Lingeman JE, Matlaga BR (2008) Kidney stones during pregnancy: an investigation into stone composition. Urol Res 36:99–102
4. McAleer SJ, Loughlin KR (2004) Nephrolithiasis and pregnancy. Curr Opin Urol 14:123
5. Drago JR, Rohner TJ Jr, Chez RA (1982) Management of urinary calculi in pregnancy. Urology 20:578–581
6. Harris RE, Dunnihoo DR (1967) The incidence of urinary calculi in pregnancy. Am J Obstet Gynecol 99:237–241
7. Delvecchio FC, Perminger G (2000) Management of residual stones. Urol Clin North Am 24:347–357
8. Maikranz P, Coe FL, Parks J (1987) Nephrolithiasis in pregnancy. Am J Kidney Dis 9:354–358
9. Maikranz P, Lindheimer M, Coe FL (1994) Nephrolithiasis in pregnancy. Bailliere's Clin Obstet Gynaecol 8:375–386
10. Gorton E, Whitfield H (1997) Renal calculi in pregnancy. Br J Urol 80:4–9
11. Smith C, Kristensen C, Davis M et al (2001) An evaluation of the physicochemical risk for renal stone disease during pregnancy. Clin Nephrol 55:205–211
12. Maikranz P, Holley J, Parks J et al (1989) Gestational hypercalciuria causes pathological urine calcium oxalate super saturations. Kidney Int 36:108–113
13. Kavoussi LR, Albala DM, Basler JW et al (1992) Percutaneous management of urolithiasis during pregnancy. J Urol 148:1069–1071
14. Jarrard DJ, Gerber GS, Lyon ES (1993) Management of acute ureteral obstruction in pregnancy utilizing ultrasound guided placement of ureteral stents. Urology 42:263–267
15. Biyani C, Joyce A (2002) Urolithiasis in pregnancy. I: pathophysiology, fetal considerations and diagnosis. BJU Int 89:811–818
16. Wayment R, Schwartz BF (2009) Pregnancy and urolithiasis. Emedicine, http://emedicine.medscape.com/article/455830-overview

17. Swanson SK, Heilman RL, Eversman WG (1995) Urinary tract stones in pregnancy. Surg Clin North Am 75:123–142
18. Patel SJ, Reede DL, Katz DS, Subramaniam R, Amorosa JK (2007) Imaging the pregnant patient for nonobstetric conditions: algorithms and radiation dose considerations. Radiographics 27:1705–1722
19. Scarpa RM, De Lisa A, Usai E (1996) Diagnosis and treatment of ureteral calculi during pregnancy with rigid ureteroscopes. J Urol 155:875–877
20. Semins MJ, Trock BJ, Matlaga BR (2009) The safety of ureteroscopy during pregnancy: a systematic review and metaanalysis. J Urol 181:139–143
21. Biyani CS, Joyce AD (2002) Urolithiasis in pregnancy. II: Management. BJU Int 89:819–823
22. Zheng W, Denstedt JD (2000) Intracorporeal lithotripsy: update on technology. Urol Clin North Am 27:301–313
23. Smith D, Graham J, Prystowsky JB et al (1992) The effects of ultrasoundguided shock waves early in pregnancy in Sprague-Dawley rats. J Urol 147:1197–1203