Percutaneous Nephrolithotomy During Early Pregnancy in Urgent Situations: Is It Feasible and Safe?

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Purpose: Urolithiasis during pregnancy poses risks for mother and the fetus with specific challenges in diagnosis and management. We report our experience with urgent percutaneous nephrolithotomy (PCNL) in seven pregnant patients with symptomatic renal stone in early pregnancy.

Materials and methods: Seven pregnant patients with symptomatic renal stones were reviewed. The technique comprised PCNL with complete access under guide of ultrasonography in prone position under general anesthesia using pneumatic lithoclast for stone fragmentation.

Results: There was no significant residual fragment of stone in the operated kidneys. The patients discharged without complications and delivered their babies healthy.

Conclusion: PCNL should not be considered as the first therapeutic method in the first trimester of pregnancy, unless in urgent situations such as symptomatic renal pelvic stone with moderate to severe hydronephrosis in patients who do not tolerate or are complicated by nephrostomy or internal stent. However, this procedure could be technically demanding and should be done in centers with enough experience and equipment in percutaneous nephrolithotomy.

Key words: pregnancy; percutaneous nephrolithotomy; urolithiasis; ultrasonography.

INTRODUCTION

Nephrolithiasis affects 10% of the whole population and the incidence seems to be increasing especially in women[1]. The incidence of urinary calculi in pregnancy and women in childbearing age are similar and about 1 in 1240 pregnancies[2], but urolithiasis during pregnancy poses risks for both the mother and the fetus [3] including: preterm delivery, miscarriage, premature rupture of membrane, and preeclampsia[4] with specific challenges in diagnosis and dilemmas in management[1]. The treatment is challenging because of our limitation in using x-rays and extra corporeal shock wave lithotripsy (ESWL)[5]. The recommended procedures in symptomatic renal stones during pregnancy are nephrostomy insertion or ureteral stent insertion but sometimes a definite management seems necessary[6,7].
In this paper, we report 7 pregnant women with refractory pain and symptomatic obstructive renal stone in which totally ultrasound guided percutaneous nephrolithotomy (PCNL) was performed.

MATERIALS AND METHODS

All of our patients were referred by their perinatalogist because of recurrent renal colic. They were admitted in emergency department and received analgesic and antiemetic. Three patients underwent cystoscopy and jj insertion at first but they later complained of severe LUTS which was unresponsive to medical therapy and they did not accept nephrostomy insertion. The other four patients were educated medical staff and refused any temporary diversion such as nephrostomy or jj stent despite of discussion about possible hazards of anesthesia and operation, and accepted and signed the informed consent. Then, they were transferred to our department as urgent cases. After checking urine analysis and urine culture, intravenous cefriaxone 1 gram every 12 hours was started. Moreover, we used ultrasonography for making the diagnosis and evaluating the extent of hydronephrosis.
Under general anesthesia, a 6F ureteral catheter was inserted in lithotomy position by cystoscopy. The catheter was advanced as far as it passed into renal pelvic stone and gush of urine was observed from the catheter. Then, it was fixed to foley catheter and then patient's position was turned to prone position. With the help of ultrasonography we located the stone inside the kidney and the existing hydronephrosis was also evaluated (**Figure 1**) .We chose lower pole for access in all cases. (**Figure 2**) After passing the chiba needle and confirming its correct position by instilling normal saline from the ureteral catheter for better visualization of system, guide wire (0.038) was advanced in a secure place .We removed needle sheath with accurate measurement of the inside depth of the sheath that was an estimate of the skin to renal access point distance. According to the measured scale and ultrasonography guidance tract dilation was done by elastic semirigid dilators to 12F and advanced to 27 F by metallic dilators. During dilation we injected normal saline retrogradely in each step to observe the outflow of urine from dilator lumen to make sure that they are in correct place. After insertion-

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Table 1. Demographic and clinical data in 7 cases of percutaneous nephrolithotomy in pregnancy.

Characteristics	Case 1	Case 2	Case 3	Case 4	Case 5	Case 6	Case 7
Age (year)	32	30	23	28	31	26	28
Gestational Age (week + day)	10+3	10 + 4	8 + 0	9 + 0	8 + 5	12 + 3	10 + 5
Stone Size(mm)	40+8	19	20	22 + 9	18	20 + 11	15 + 11 + 8
Stone Location	Renal pelvis and Lower Pole	Renal pelvis	Renal pelvis	Renal pelvis and lower pole	Renal pelvis	Renal pelvis and lower pole	Renal pelvis
Side of involvement	Right	Right	Right	Left	Left	Right	Left
Preoperative creatinine(mg/dL)	0.7	0.8	0.8	0.9	0.7	0.9	1.1
Preoperative hemoglobin (g/dL)	15.3	13	12.7	11	12	12.6	13.3

of 2bF amplatz sheath, we performed nephroscopy to locate the stone. Pneumatic lithoclast was used to fragment the stone into small particles which were extracted by forceps. When meticulous nephroscopy showed no residual stones we inserted an 18F nephrostomy tube in order to maintain the patency and good drainage of the kidney. Patients' ureteral and foley catheters were removed on the first postoperative day and the nephrostomy tube was removed after 48 hours. All patients were discharged from hospital with good condition and very close outpatient follow up was scheduled.
Patients were followed by ultrasonography 1 week after the operation.

RESULTS

The demographic and clinical data of patients are summarized in **Table 1**. The mean age of the patients was 28.8 years old and all the patients were in their first trimester of pregnancy between 8 to 13 weeks of gestation. The stones in all patients were located in the renal pelvic and also lower pole in three cases; causing moderate to severe hydronephrosis with a mean stone size of 22.2 mm (range, 14-40mm). We did not identify any abnormal creatinine during preoperative evaluation with a mean level of 0.78mg/dl. The mean estimated hemoglobin loss was 1.12gr/dl (range, 0.9-1.5) and none of the patients required blood transfusion.
The preoperative data are summarized in **Table 2**. Mean operation time was 85 minutes (range, 65-115 minutes). As we evaluated our patients after the operation with follow up ultrasonography, there was no significant residual fragment of stone (> 4mm) in the operated kidneys. The patients passed their hospital course uneventful with a mean hospital stay of 57.6 hours (range, 48-72 hours).
We did lower pole access in all cases with no intraoperative or postoperative complications. All patients were discharged from hospital in a good condition with clear urine and asymptomatic condition. We followed up the patients till their delivery time. All babies were born full-term, completely healthy and without any complications.

DISCUSSION

Physiological alteration creates an optimal environment for stone formation during pregnancy. Although the incidence of stone formation does not increase during pregnancy but due to its unique imposed risks, it merits a special attention for diagnosis and management[1].
Nowadays the modality of choice for evaluation of stone is non-contrast computed tomography (CT) in general population but CT emits radiation that is potentially teratogenic that limits its usage during pregnancy notably in the first trimester. Ultrasonography is the safest method and is our mostly used diagnostic tool in pregnancy[1]. About 70-80% of stones presenting during pregnancy will pass spontaneously therefore a trial of conservative management could be given to most of the patients[8].
Renal colic is a urological emergency because of associated complications for both the mother and the fetus and could also be life threatening by creating sepsis[9]. Maternal kidney stones can induce several complications, including recurrent abortions, hypertensive disorders, gestational diabetes, and cesarean deliveries[9]. Due to conservative management failure, sometimes an intervention seems necessary[10]. Retrograde ureteral double j stent insertion or percutaneous nephrostomy are two less invasive techniques for relieving the obstruction or better urinary drainage when kidney obstruction occurs[11]. However, stent encrustation because of hypercalciuria are often observed in cases of long standing ureteral catheter usage and lower urinary tract symptoms are also attributable to indwelling stents [12].
As an alternative method for urinary drainage, placement of the percutaneous nephrostomy was performed in 6 pregnant patients in first series by Kavoussi et al. [13], however, nehphrostomy tubes harbor some disadvantages such as bacterial colonization and infection with risk of accidental dislodgment and the inconvenience of dealing with an external collection device[10]. Moreover, strict contraindication exists against using extracorporeal shockwave lithotripsy in pregnancy because of its deleterious effects on the fetus[10,11].
PCNL is a safe treatment option with low complication

Table 2. Results of 7 percutaneous nephrolithotomies in pregnancy.

Characteristics	Case 1	Case 2	Case 3	Case 4	Case 5	Case 6	Case 7
Operating time(minutes)	115	80	95	100	65	60	75
Hydronephrosis	Moderate	Severe	Moderate	Moderate	Moderate	Severe	Moderate
Percutaneous access	Lower pole	Lower pole	Lower pole	Lower pole	Lower pole	Lower pole	Lower pole
Complications	None	None	None	None	None	None	None
Hospital stay(hours)	48	60	48	60	72	60	72
Postoperative hemoglobin (g/dL)	14	12.1	11.8	10	10.5	12.1	12.7
Hemoglobin drop (mmol/l)	1.3	0.9	0.9	1.0	1.5	0.5	0.6

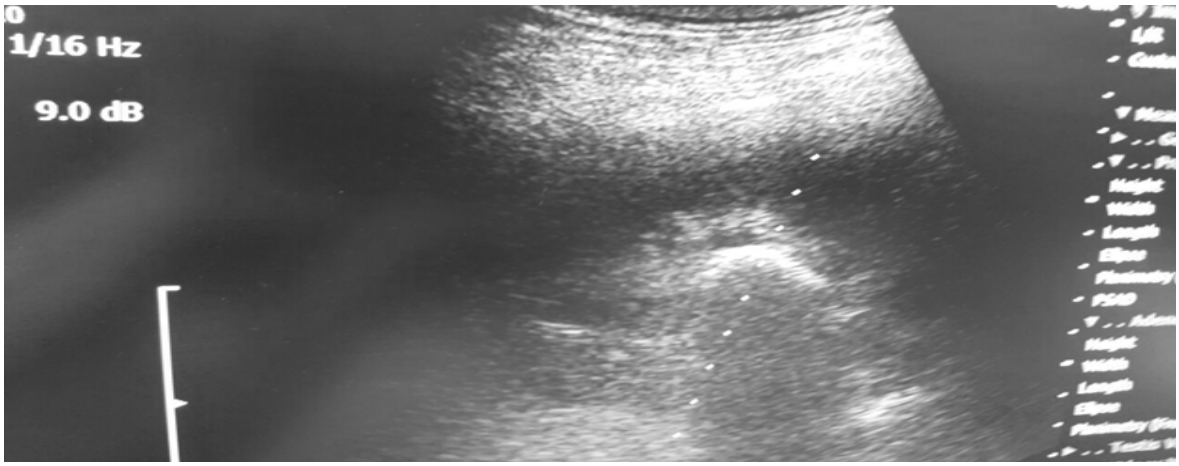

Figure 1. Ultrasonography shows large right renal pelvic stone

rates in renal calculi but its use has been limited in pregnancy because of radiation exposure of the fetus [10] and also the risk of general anesthesia and prone position of patient during operation[14]. In spite of these threats there has been reports of performing PCNL under fluoroscopy with limited radiation exposure in first trimester of pregnancy by Shah et al.[15].

The feasibility and safety of complete ultrasonography guided PCNL has been previously described in 357 cases by Hosseini and colleagues[16]. There are also many reports of performing totally ultrasound guided PCNL in lateral flank[6,17] and supine positions[7].

Access under guide of ultrasonography can be safe because it allows to identify the kidney and calyceal system clearly and to obtain an optimum access by an expert surgical team[12].

There are a few reports of PCNL under guide of ultrasonography in pregnancy period; Toth et al. reported their experience in doing PCNL on a 31 year old pregnant woman at 11 weeks of gestation under guide of ultrasonography in prone position with a good result[18]. There is also a successful report of ultrasonography guided supine PCNL in a 24 year old female in her 22 weeks of gestation by Fregonesi et al.[10]. Basiri and colleagues recently published their expertise in supine and lateral flank position PCNL in pregnant patients in their second and third trimester with good results[19].

Some of the inhalational anaesthetic agents such as nitrous oxide and hallothane can be transfered to the fetus. In animal studies teratogenic effects of these agents were reported. Therefore general anesthesia with these agent is not recommended in first trimester, and may be replaced with regional techniques.[20]

In this study we report our experience with promising results in accomplishing PCNL under guide of ultrasonography in prone position in 7 pregnant patients with urinary stones. All the patients passed their pregnancy without any further complication and gave birth to healthy babies. However, this operation is not without risk during pregnancy so it is noteworthy to say that it should be done only in selected cases with caution.

CONCLUSIONS

PCNL is not recommended as the first option in pregnancy, however it can help the patients with symptomatic obstructive renal stones who are complicated with longstanding indwelling ureteral catheters or nephrostomy tubes. In these urgent situations, we recommend that this procedure can be done in centers with enough experience and equipment in PCNL and special

Figure 2. Pecutaneous nephrolithotomy under guide of ultrasonography

care by perinatalogist. .

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CONFLICT OF INTEREST

The authors declare that they have no conflict of interest.

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