

# Management of Urinary Calculi in Pregnant Women

The incidence and predisposing factors of urinary calculi are generally the same in both pregnant and non pregnant women, but anatomic changes during pregnancy make diagnosis and treatment a more challenging issue. We reviewed 16 patients(22 stones) of urinary stone during pregnancy between 1986 and 1996 at Kyung Hee Medical Center. The most common symptom was flank pain, seen in 81.3 % of patients, while 68.8 % of patients were displayed microscopic hematuria. In all cases, diagnosis was made by abdominal ultrasound, there was no need for other harmful investigative procedures. Forty point nine percent of the total stones(9/22) were passed spontaneously, double J stenting was carried out in three cases because of persistent pain or urinary tract infection(UTI), ureteroscopic stone removal was performed in one case. Based on our experience and a review of the literature, abdominal ultrasound should be performed first and in all cases appears sufficient for the diagnosis of a stone. In case of persistent pain or urinary tract infection, a double J stent is more effective than percutaneous nephrostomy. (*JKMS 1997; 12: 40~3*)

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## INTRODUCTION

The incidence of urinary stones in pregnant women is similar to that in non-pregnant women, but anatomic and physiologic changes during pregnancy make diagnosis a more challenging issue(1). In diagnosis, limited urography was not harmful to the fetus after the first trimester but abdominal ultrasound at this time was not useful for detecting a ureter stone because of the enlarged fetus (2). Hendricks et al.(3) and Loughlin and Bailey (4) have reported that ultrasound alone confirmed the diagnosis of a urinary stone.

A principle of treatment of pregnant women with a renal stone is that management should be conservative, except where there is also severe urinary tract infection. In more than 50% of cases the ureter stone was passed spontaneously and this minimized harmful effects on both the fetus and the mother. In cases where there is retractable pain and UTI, however, selection of the most appropriate treatment remains controversial ; whether the best choice is double J stent or percutaneous nephrostomy was not determined.

By assessing clinical data and literature, we plan to set up a diagnostic modality and management scheme for patients with a urinary stone during pregnancy.

## MATERIALS AND METHODS

We reviewed the records of 16 patients with a urinary stone during pregnancy between January, 1986 and June, 1996 at the Department of Urology, Kyung Hee University Hospital. These records were retrospectively reviewed for clinical presentation, duration of pregnancy, calcium, phosphate and uric acid in serum and 24 hours urine, serum parathyroid hormone, urinalysis, urine culture, the results of stone analysis, site and size of stone and whether the stone was recurrent. The site of the stone was classified according to whether renal, upper, mid or lower ureter. Stone analysis was carried out using a Beckman 4350 infrared spectrophotometer. Calcium, phosphate and uric acid in serum was checked three times consecutively. Hypercalciuria was defined as a calcium level of more than 200mg/day in 24 hour urine ; hypercalcemia was defined as a serum calcium level of more than 10.3mg/dl ; hyperuricosuria was defined as a uric acid level more than 750mg/day in 24 hour urine. The level of serum parathyroid hormone was determined by the radioimmunoassay method(antibody to C-terminal before 1988, then antibody to mid-molecule). The double J catheter was polyurethane, 24cm, 6 F (Cook®).

## RESULTS

During the ten-year study period, 16 pregnant women had a total of 22 urinary stones; with 18,203 deliveries, the incidence of stones was thus 0.09%. Age ranged from 24 to 36 years (mean 28.6). A stone was diagnosed during the first trimester in three patients (18.8%), in the second trimester in ten (62.5%) and in the third trimester in three (18.8%). Flank pain was the most common clinical presentation in 13 cases (81.3%), fever in two and routine abdominal ultrasound in one. Microscopic hematuria was found in 12 cases (75%), pyuria was present in four and *Proteus mirabilis* and *Escherichia coli* were isolated in one case each (Table 1).

Serum calcium, phosphate, uric acid and parathyroid hormone were measured in 16 patients, and these values were all within normal limits. In a 24 hour urine study, hypercalciuria and hyperuricosuria were found in one case each. In the former patient whose serum parathyroid hormone level was within the normal range, the stone was recurrent and was present in the kidney and ureter. The latter patient had two stones, but levels were within the normal range. In both cases, stone analysis was carried out; in the former case calcium oxalate was present and in the latter, a mixture of calcium oxalate and calcium phosphate.

There were five renal, three upper ureter, three mid ureter and eleven lower ureter stones. Multiple stones were found in six patients. Of the stones, 56% were on

the right side and 44% were on the left. The size of stone was in ten cases below 0.5cm, in ten cases was 0.6-1.0 cm and in two cases was 1.1-1.5cm.

In all 16 patients, the stone-including three cases of midureter stone - was diagnosed by abdominal ultrasound.

Management was initially conservative in all patients, except for the women at 14 weeks of gestation with urinary tract infection due to 1.5cm sized Rt. upper ureter stone. Eight patients spontaneously expelled the stones and require no more treatment. The average size of the stone was 5.2mm (range: 3-8mm) that passed spontaneously. Of the patients who conservatively treated, five underwent ESWL (extracorporeal shock wave lithotripsy), one performed ureteroscopic stone removal in postpartum period. In three patients, a double J stent was placed, because of persistent pain in two, urinary tract infection in one women at 14 weeks of gestation with 1.5cm sized Rt. upper ureter stone (Table 2). The average gestation week at stenting was 19 weeks, and the mean indwelling time for stent was 24 weeks. Stent incrustation as a complication of double J catheter insertion was found in one case. Urinary tract infection, hypercalciuria and hyperuricosuria were not found, but there had been no follow-up after catheter insertion in this patient. The double J catheter had been removed after traction of the catheter and ESWL around the stent incrustation had been performed because severe incrustation prevented catheter removal after delivery. All patients who placed a stent performed the ESWL after delivery. The woman at 23 weeks of gestation with a 0.8cm left lower ureter stone was treated by ureteroscopic stone removal, safely. There was no preterm birth complication in our patients.

**Table 1.** General characteristics of patients

Patient age	28.6 years
Symptom	flank pain - 13
	fever - 2
	incidental - 1
Urinalysis	hematuria - 12
	pyuria - 4

## DISCUSSION

Dilatation of the upper urinary tract, decreased ureteral motility and subsequent stasis of urine in pregnancy increase the incidence of urinary tract infection. Hyper-

**Table 2.** Management of pregnant women with stone

Method	No. patients (No. stones)		Site of stone	No. stones
Conservative management	5	( 9 )	renal	4
			mid ureter	2
			lower ureter	3
Spontaneous expulsion	8	( 9 )	renal	1
			upper ureter	1
			lower ureter	7
Double J stent	3	( 3 )	mid ureter	1
			upper ureter	2
Ureteroscopic stone removal	1	( 1 )	lower ureter	1

calciuria and hyperuricosuria have also been found as metabolic change (5). Such mechanical and metabolic change in pregnant women seems to increase the incidence of stone formation, but the actual incidence of urinary stones in pregnant women was 0.03-0.6%. This incidence is similar to that in non-pregnant women (1, 3). So called, urinary calculi occur in one of every 1,500 pregnancies (6). In our series from 1986 to 1996, 16 women with urinary stone (0.09%) were found in 18,203 deliveries; the total number of patients with urinary stone during this period was 4,619.

Most stones are diagnosed during the second and third trimester of pregnancy (2, 7). Dilatation of the upper urinary tract starts at 6 to 10 weeks of gestation and is present in about 90% of women by the third trimester. Hendricks et al. (1991) advocated that proximal ureteral dilatation may allow the passage of previously formed calculi to the level of the distal, non-dilated ureter when the stone causes symptomatic obstruction. However, Coe et al. (8) reviewed the records of 78 women with a history of urolithiasis and found no increased rate of stone passage associated with subsequent pregnancy. We agree with their opinion since there was no difference between right and left side involvement even though in our series 81.3% of patients were diagnosed after the second trimester and in 93.8% of cases there were obstructive symptoms.

Flank pain is the most commonly presented symptom as 84-100% in patient with urinary stone (9, 10). Hendricks et al. (3) reported, however, that in their series urinary tract infection was the most common presentation (60%). In our series, flank pain was 81.3% and urinary tract infection was 12.5%. In patients with renal colic, flank pain frequently accompanied by abdominal pain, nausea and vomiting. Incorrect diagnoses of appendicitis, diverticulitis and placental abruption were made in 28% of patients in whom a stone had been confirmed (11). This fact emphasizes that differential diagnosis of acute abdomen in pregnant women is difficult. Hematuria is the most important diagnostic clue in patients with a stone; Jones et al. (9) reported microscopic hematuria in 75% of such cases. Interestingly, microscopic hematuria was not noted in 25% of stone confirmed patients until urinalysis was repeated two or three times. The absence of hematuria in either gross or microscopic form suggests a diagnosis other than renal colic. It is well known that the prevalence of bacteriuria among pregnant women is 4-7%, in 20-40% of women with untreated bacteriuria pyelonephritis will subsequently develop (12). Zinner and Kass (13) reported that one in every 3,000 pregnant women with pyelonephritis will eventually suffer end stage renal disease. We think that where small, asymptomatic renal

calculi are present in women of childbearing age, extracorporeal shock wave lithotripsy (ESWL) should be performed prophylactically.

Because of the low sensitivity of abdominal ultrasound, Stothers and Lee (11) recommended limited IVP or RGP (retrograde pyelography), if needed in the diagnosis of a stone in pregnant women. In the case that stone was not found, even when the ureter was dilated, it was difficult to know whether this dilatation was caused by a stone or pregnancy. Generally speaking, ultrasonography is not effective for the diagnosis of urolithiasis in advanced pregnancy due to the enlarged fetus. However, Hendricks et al. (3) reported that in 66.7% of pregnant women with stone, diagnosis was possible using only ultrasonography and that 80% of those patients were in the third trimester of pregnancy. They advocated that non invasive testing should always be attempted initially. Loughlin (5) stated that although radiographic studies may continue to be required in some cases of urolithiasis during pregnancy, technological advances are making reliance on radiography less compelling. In our series, ultrasonography alone accurately diagnosed urinary calculi in all cases, even during advanced pregnancy and where the stones were in mid ureter.

The use of radiation for diagnostic studies during pregnancy has been and remains controversial. Of course, there is no argument against not exposing the fetus to radiation during first trimester. Although a safe level of radiation amount for the fetus is not known, Swartz and Reichling (14) estimated that 25 to 80 rad may expose the fetus to enough radiation to double the current incidence of congenital malformation. Burgess (15) demonstrated that a single film from an IVP exposes the fetus to 20 mrad while 1 minute of fluoroscopy exposes the fetus to 200 mrad. Stothers and Lee (11) advocated that limited IVP was not harmful to the fetus, except during the first trimester of pregnancy since between 74 and 95% of all patients were diagnosed in either the second or third trimester and exposure to ionizing radiation was minimal in limited IVP. Harvey et al. (16) reported, however, that a fetus exposed to 1 rad, which is an amount similar to that from a limited IVP, had an overall risk of 2.4 for all childhood malignancies. It is recommended that abdominal ultrasound is first used in the diagnosis of urolithiasis in pregnancy, since ultrasound at this time is inconclusive and the presence of urolithiasis may complicate the pregnancy, in that invasive intervention may be required. Pregnancy should not, however, deter appropriate uro-radiographic evaluation; in such cases, exposure should be limited to the necessary portion, and shielding should be provided.

It is well known that conservative management is the most appropriate for pregnant women with a stone, since

the rate of spontaneous passage of stones during pregnancy has been previously documented as being between 74 and 86% (3, 17). However, urinary diversion by means of a double J stent or percutaneous nephrostomy should be considered when colicky pain is sustained or urinary tract infection is combined. Although some investigators have advocated ureteroscopic stone removal during pregnancy (18), we think this is an unnecessary procedure for mother and fetus. ESWL, as a well-known method for treating stone, appears to be an absolute contraindication during pregnancy (19). In some cases, ureterolithotomy is performed during the last trimester of pregnancy, but this is not general. In cases where invasive treatment is required, there is controversy as to whether the double J stent or percutaneous nephrostomy is the preferred course of treatment. Placement of the nephrostomy tube can be achieved with local anesthesia under ultrasound guidance; because there is no bladder irritation, the patient may be more comfortable than with the double J stent, which may be difficult to insert due to an enlarged fetus (5, 20, 21). Kroovand (22), however, cautions that with nephrostomy tubes there may be a higher risk of infection and more patient discomfort than with use of an internal stent; Denstedt and Razvi (20) advocated the replacement of a percutaneous nephrostomy tube at less than 22 weeks of pregnancy, with later conversion to internal stent. They also recommended that the double J stent should be used after the twenty-second week of pregnancy and changed every six weeks and that in pregnant women with urosepsis, a percutaneous nephrostomy is needed, in order to ensure drainage. Even though percutaneous nephrostomy is safe, it is more invasive for both mother and fetus than the double J stent and thus should be employed in cases of urinary tract infection or failure of internal stenting. In the case of the double J stent, the puzzling issues are change of indwelling catheter at 4 to 8 weeks and stone incrustation. Guidelines for the optimal frequency of catheter change do not exist, but it would be reasonable to change every eight weeks, as is the case with other patients. Incrustation may be exacerbated by hyperuricosuria and hypercalciuria that may occur during pregnancy (17, 23) and by urea splitting bacteria (24). Sufficient hydration, restriction of calcium and control of urinary tract infection may prevent incrustation. Periodic follow-up is required in women with a stent.

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