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# Problematic renal calculi presenting during pregnancy

**L J Fligelstone** FRCS*
*Registrar in Urology*

**C Evans** FRCR
*Consultant Radiologist*

**S N Datta** FRCS
*Research Registrar in Urology*

**P N Matthews** FRCS
*Consultant Urologist*

Departments of Urology and Radiology, University Hospital of Wales, Cardiff

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**Urinary tract calculi presenting during pregnancy are rare, with less than 0.1% of pregnancies being associated with stones, the vast majority being asymptomatic and a chance finding.**

**We outline six cases treated over an 8-year period. They presented with combinations of pain, sepsis and obstruction. Intervention was required in four cases: insertion of antegrade nephrostomy, double-J stent, Dormia basket stone extraction, open pyelolithotomy and induction of labour. In each case the pregnancy had a successful outcome.**

**Renal colic can precipitate premature labour. Delayed diagnosis and intervention can result in permanent renal impairment. Ionising radiation and anaesthetic agents may be harmful during pregnancy. The problem is rarely encountered and we therefore present information on the relative risks in each trimester of exposure to the mother and fetus and present a clinical algorithm for the management of these patients.**

The prevalence of renal calculi in women is 0.03% to 0.5% and is no different in pregnancy *(1,2)*. Calculus disease presenting during pregnancy is a cause of concern as the surgeon has a dual responsibility to the mother and the unborn child. This problem is encountered so infrequently that it is important to highlight the controversies and review the literature to obtain an overview of the topic and provide some basic guidelines for optimal management of these patients. We describe six cases that presented to the urology service at the University Hospital of Wales over an 8-year period and discuss the investigation and intervention with special reference to the relative risks to mother and baby.

* Present appointment: Registrar, Royal Gwent Hospital, Newport, Gwent

Correspondence to: Mr P N Matthews, Department of Urology, University Hospital of Wales, Heath Park, Cardiff CF4 4XW

## Case reports

*Case 1*

GL, aged 27 years, presented at 7 weeks' gestation with recurrent urinary tract infections and subsequently developed pyelonephritis. Culture of the urine disclosed mixed pathogens, which included coliforms and *Staphylococcus aureus* sensitive to amoxycillin. At this time the patient was thought to have recently menstruated and pregnancy was not suspected. Investigation of the cause of the recurrent infection therefore included an intravenous urogram of four films, with a total radiation exposure of 0.8 rads, which demonstrated left-sided renal calculi. Pregnancy was subsequently diagnosed and the patient elected to continue to term. At 37 weeks' gestation, she progressively developed more severe symptoms and was febrile. A further plain film (0.2 rads) was therefore requested and this showed that one of the stones had moved to the level of the pyeloureteric junction (PUJ). The patient thus underwent insertion of a nephrostomy drain under local anaesthesia and ultrasound guidance. An elective caesarian section was performed successfully 2 days later, with delivery of a healthy baby. She returned for open pyelolithotomy 1 month later and made a full recovery.

*Case 2*

BM, aged 25 years, presented at 19 weeks' gestation with a 3-week history of right-sided loin pain. Investigation showed sterile urine and an ultrasound scan of the renal tract demonstrated a right-sided hydronephrosis, but was

unable to display the ureter or the cause of the obstruction. An intravenous urogram was therefore carried out, requiring six films with an exposure of 0.8 rads. Examination of the left kidney and pelvicalyceal system was normal, but at 3 h only a dense nephrogram was demonstrated on the right. A nephrostomy tube was inserted under ultrasound guidance using local anaesthesia. Antegrade pyelography showed the cause of the obstruction to be due to a calculus overlying the sacroiliac joint (0.2 rads). The nephrostomy drainage tube was left *in situ* to relieve the obstruction. However, this blocked on several occasions and an unsuccessful attempt was made to perform antegrade insertion of a double-J stent. Cystoscopic stent insertion was carried out successfully, but this was subsequently removed within 2 weeks owing to severe symptoms of bladder irritation and a Dormia basket extraction of the stone was performed during the same anaesthetic. This procedure required a further 0.4 rads of screening X-radiation. Recovery was complete and the pregnancy was otherwise uneventful.

*Case 3*

EM, 29 years, presented at 20 weeks' gestation with left loin pain and a coliform urinary tract infection. She was treated with intravenous cefuroxime but had persistent loin pain. After 3 days the patient underwent ultrasound examination of the renal tract and this showed a dilated left pelvicalyceal system and a probable calculus causing obstruction just distal to the PUJ. Plain abdominal radiographic examination (0.2 rads) confirmed the presence of a 2 cm stone. A percutaneous nephrostomy was carried out under local anaesthesia, but this blocked on multiple occasions. The patient therefore underwent open pyelolithotomy. This was performed successfully, without any ill effects to mother or baby.

*Case 4*

BT, 22 years, presented at 37 weeks' gestation with left renal colic. Ultrasound examination of the urinary tract revealed partial obstruction. Plain abdominal radiographs, with a radiation dose of 0.2 rads, confirmed the presence of a 4 mm urinary calculus at the distal left ureter. The patient continued to suffer pain and it was decided to induce labour. The delivery was uneventful and the stone passed spontaneously in the puerperium.

*Case 5*

SM, 22 years, presented at 18 weeks' gestation with right-sided loin pain associated with recurrent urinary tract infections. A staghorn calculus was diagnosed on ultrasound and confirmed on plain abdominal radiograph (0.2 rads). She required admission three times and was managed successfully with parenteral fluids and antibiotic therapy with cephradine. She underwent elective percutaneous nephrolithotomy 3 months post-partum.

*Case 6*

VN, 33 years, became pregnant while awaiting extracorporeal shock wave lithotripsy and presented with an exacerbation of her renal pain. Ultrasound examination showed no dilated upper renal tracts and she was managed conservatively throughout her pregnancy. Post-partum, she was briefly lost to follow-up and presented several months later with renal colic and ureteric obstruction. The calculus had enlarged markedly and the obstruction was relieved temporarily by insertion of a double-J stent. The calculus was subsequently removed by percutaneous nephrolithotomy.

## Discussion

Pregnancy is associated with hypercalciuria and increased uric acid excretion. However, changes in the composition of the urine, for example, alkalisation, increased magnesuria, citraturia and increased levels of nephrocalcin compensate for the extra solute load and may explain why there is not an increased incidence of symptomatic stones during pregnancy *(3)*.

In a pregnant woman with symptoms suggestive of urinary calculi, it is imperative to confirm the diagnosis as quickly as possible with the minimum of risk to the developing fetus. Unnecessary delay may result in irreversible damage to the maternal kidney owing to septic obstruction, or result in premature labour secondary to renal colic *(4)*.

The major cause of concern in investigating this group of patients is the use of ionising radiation to verify the presence of calculi and confirm or exclude urinary tract obstruction. The risk of exposure of the fetus to X-irradiation varies according to the trimester, and pregnancy remains a relative contraindication to ionising radiation. The total level of X-irradiation associated with a plain kidney–ureter–bladder (KUB) film is in the order of 0.2 rads (1.4 mSv). A limited intravenous urogram, with four or five films, requires an exposure of 0.4 to 1.0 rads (2.8 to 7.0 mSv) *(5)*. Screening exposes the patient to varying degrees of X-irradiation and a modern C-arm device will give approximately 0.4 rads of radiation over 1 min. The risk of X-irradiation is greatest during the first trimester, especially between the 4th and 8th week of gestation. This is the period of most rapid organogenesis and exposure during this time may result in birth defects, chromosomal mutation and spontaneous abortion. A level of exposure of 5 rads is the threshold in the USA at which the patient would be offered a therapeutic termination of pregnancy. After an exposure of 10 rads in the first trimester, the patient is advised to terminate her pregnancy *(6)*. During the second and third trimsters, intravenous urography and fluoroscopic screening (of short duration) are considered to be relatively safe procedures with minimal risk of harm to mother or fetus.

The use of ultrasound avoids X-irradiation and may confirm the diagnosis in the majority of non-gravid patients, but diagnostic accuracy is reduced during pregnancy. Ultrasound diagnosis is further complicated by the physiological dilatation of the upper urinary tract *(1)*. In a recent review, ultrasound assessment of pregnant patients with symptomatic renal calculi demonstrated a sensitivity of 34% and a specificity of 86%, compared

with a sensitivity of 98% and a specificity of 74% for the non-gravid patient *(7)*. A KUB and limited intravenous urogram has a sensitivity of 94% and a specificity of 100% *(6)*. It is fortunate that nearly all cases of renal calculus disease present in the second or third trimesters when the risks associated with X-irradiation are significantly reduced *(4)*. Urinary stone disease is the most common non-obstetric cause of abdominal pain in pregnancy and most patients present with flank pain *(8–11)*. Examination may reveal flank tenderness in a small proportion of cases *(1)*. However, the differential diagnosis of appendicitis, pyelonephritis and premature labour should be considered, with the latter two often associated with stones *(2)*. The clinical diagnosis may also be complicated by an enlarging gravid uterus increasing the symptoms of the calculus, as gestation progresses *(12)*.

Over three-quarters of renal calculi presenting during pregnancy will pass spontaneously with conservative management comprising bed rest, hydration, analgesia and antibiotics where indicated *(1,2,4,8–15)*. Some commonly used urinary tract antibiotics must, however, be used with extreme caution during pregnancy and, in some cases, not at all. Sulphonamides may cross the placenta late in pregnancy and compete with bilirubin for albumin binding sites, thus elevating the levels of free bilirubin in the neonate and so increasing the risk of kernicterus. Phase I studies of ciprofloxacin showed alterations in the joint cartilages of new-born puppies, and so this antibiotic is not recommended during pregnancy. Gentamicin has a theoretical risk of inducing fetal ototoxicity, but in practice should not be withheld in cases of severe, potentially life-threatening infections. Trimethoprim is an antifolate that produces teratogenicity in animals, although no documented cases have been reported in humans. Cephalosporins and penicillins are generally safe to use *(16)*.

In cases where there is calculus causing obstruction of the urinary tract, relief of the obstruction has previously required stone removal at open surgery. The use of open surgery has been superseded in most cases by minimally invasive techniques of cystoscopic stent placement, percutaneous stent insertion, ureteroscopy and Dormia basket stone extraction. These techniques combined with antibiotic therapy result in the majority of pregnancies coming to term without complication.

There have been reports of percutaneous nephrolithotomy performed during pregnancy for obstructing calculi unrelieved by stent insertion, two cases having a successful outcome, but a third case resulting in premature labour at 28 weeks' gestation *(9,10)*. The difficulties of placing the pregnant patient in the prone position and the increased radiation exposure from prolonged fluoroscopy, combined with the risks of premature labour suggest that this is not a satisfactory procedure. The use of extracorporeal shock wave lithotripsy (ESWL) in non-gravid patients is well established, but its use in the pregnant patient is at present contraindicated as the effect of the energy dispersion on developing fetal tissue is not known *(17)*.

Patients presenting with obstruction should have this

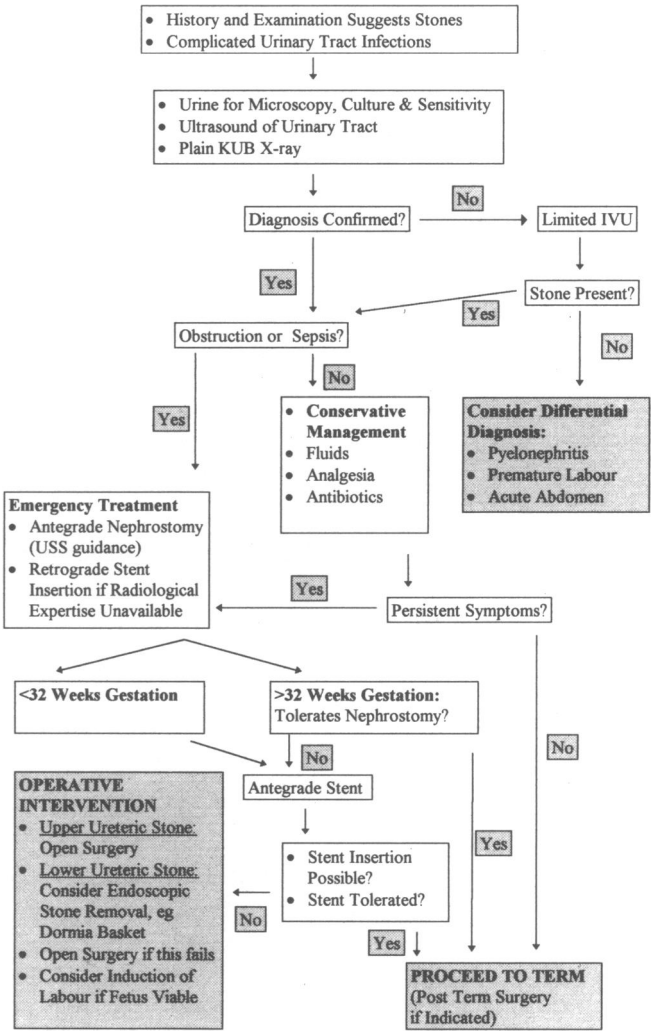


*Figure 1.* Algorithm for the management of renal calculi in pregnancy.

relieved, initially with a percutaneous nephrostomy or stent. In the patients nearing delivery, this short-term measure may suffice, and removal of the stent after delivery often results in spontaneous passage of the stone *(7,10,11)*. Temporary diversions such as these tend to be less satisfactory in women earlier in pregnancy because the stents tend to block. In these cases, further intervention, such as open surgery or Dormia basket extraction may be necessary. Ureteroscopy is probably unwise in the presence of a large gravid uterus. We have found a progressively interventional approach satisfactory and present an algorithm based on our experience and a review of the literature (Fig. 1).

## References

1 Maikranz P, Coe FL, Parks J, Lindheimer MD. Nephrolithiasis in pregnancy. *Am J Kidney Dis* 1987; **9:** 354–8.
2 Marlow RA. Nephrolithiasis in pregnancy. *Am Fam Physician* 1989; **40:** 185–9.
3 Maikranz P, Coe FL, Parks J, Lindheimer MD. Nephrolithiasis and gestation. *Baillieres Clin Obstet Gynaecol* 1987; **1:** 909–19.

4 Drago JR, Rohner TJ, Chez RA. Management of urinary calculi in pregnancy. *Urology* 1982; **20:** 578–81.
5 Horowitz E, Schmidt JD. Renal calculi in pregnancy. *Clin Obstet Gynecol* 1985; **28:** 324–38.
6 Swartz HM, Reichling BA. Hazards of radiation exposure for pregnant women. *JAMA* 1978; **18:** 1907.
7 Ellenbogen PH, Scheible FW, Talner LB *et al.* Sensitivity of grey scale ultrasound in detecting urinary tract obstruction. *AJR* 1978; **130:** 731–3.
8 Strothers L, Lee LM. Renal colic in pregnancy. *J Urol* 1992; **148:** 1383–7.
9 Lattanzi DR, Cook WA. Urinary calculi in pregnancy. *Obstet Gynecology* 1980; **56:** 462–6.
10 Denstedt JD, Razvi H. Management of urinary calculi in pregnancy. *J Urol* 1992; **148:** 1072–5.
11 Kavoussi LR, Albala DM, Basler JW, Apte S, Clayman RV. Percutaneous management of urolithiasis in pregnancy. *J Urol* 1992; **148:** 1069–71.
12 Hendricks SK, Ross SO, Krieger JN. An algorithm for diagnosis and therapy of management and complications of urolithiasis during pregnancy. *Surg Gynecol Obstet* 1991; **172:** 49–54.
13 Strong SW, Murchison RJ, Lynch DF. The management of urinary calculi during pregnancy. *Surg Gynecol Obstet* 1978; **146:** 604.
14 Cass AS, Smith CS, Gleich P. Management of urinary calculi during pregnancy. *Urology* 1986; **38:** 370–2.
15 Rodriguez PN, Klein AS. Management of urolithiasis during pregnancy. *Surg Gynecol Obstet* 1988; **166:** 103.
16 Maclean AB, McAllister T. Antimicrobial therapy in obstetrics and gynaecology. In: MacLean AB, ed. *Clinical Infection in Obstetrics and Gynaecology*. Oxford: Blackwell, 1990.
17 Kroovand RL. Stones in pregnancy and children. *J Urol* 1992; **148:** 1076–8.

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