ORIGINAL RESEARCH PAPER
Volume - 9 | Issue - 6 | June - 2020 | PRINT ISSN No. 2277 - 8179 | DOI : 10.36106/ijsr
INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH

UROLITHIASIS IN PREGNANCY-INVETIGATIONS ,DIAGNOSIS AND MANAGEMENT -A REVIEW

General Surgery

Dr. Chandra mauli Upadhyay Associate professor, Dept. of Surgery, JLNMCH, Bhagalpur, Bihar

Dr. Himanshu Verma* 2nd Year PG Resident, Dept. of Surgery, JLNMCH, Bhagalpur, Bihar *Corresponding Author

Dr. P. Dubey H.O.D (Dept. Of Zoology),T.N.B College, Bhagalpur, Bihar

ABSTRACT

Urinary stones are polycrystalline concretions occurring in the urinary tract of humans and animals. Like bones and teeth, they are biominerals. While the non-pathological products of biomineralization, formed in genetically determined processes, display a high degree of biological organization, uroliths are a special case. Their formation is governed by pathoanatomical and physicochemical factors . Around 97% of urinary stones are found in the kidneys and ureters (kidney stones), the remaining 3% in the urinary bladder and urethra .Between 1to15% people globally are affected at some point by urolithiasis in their life time.

Urolithiasis is the most common cause of urological-related abdominal pain in pregnant women after urinary tract infection. It occurrs in 1/200 to 1/2,000 women during pregnancy, which is more or less equal to the incidence reported in the nonpregnant female population of reproductive age.Urolithiasis presenting during pregnancy is a cause of major concern, considering the potential adverse effects of radiation exposure, any invasive surgical procedures and anaesthesia on the mother and fetus.During pregnancy, the frequency of stone localization is twice as higher in the ureter than in the renal pelvis or calyx, but there is no difference between the left and right kidney or ureter. Urinary stones during pregnancy are composed mainly of calcium phosphate (hydroxyapatite) in 74% of cases and calcium oxalate in the remaining 26% (Ross et al., Urol Res 36:99–102, 2008). **A significant proportion of patients with asymptomatic renal calculi are detected incidentally in the nonpregnant population compared with pregnant women. Factors that contribute to the diagnostic challenges include anatomic and physiologic changes to the female urinary tract during pregnancy and the limitations on the use of ionizing radiation. The treatment of such patients requires a multidisciplinary team approach involving the urologist, obstetrician, and radiologist. The potential hazards of intervention (either surgical or medical) and anesthesia need to be considered carefully.**In conclusion, urolithiasis during pregnancy can be serious, causing preterm labor in up to 40% of affected women.

Aim and objectiveof study: The analysis of pathogenesis, diagnosis, investigations, and management ofurolithesis in pregnancy.

KEYWORDS

INTRODUCTION

The incidence of urolithiasis during pregnancy is 0.026–0.531% , complicates 1 : 200 to 1 : 2000 pregnancies and may be a contributing factor in up to 40% of premature births [3] The incidence of symptomatic stones has been calculated to be the same during pregnancy as in nonpregnant women of childbearing age . Multiparous women seem to be affected more often than primiparae by a ratio of 3:1. . However, the incidence in multiparous women is no greater when adjusted for age .Folgerreported that pain resulting from urinary stones is the most common cause of abdominal pain requiring hospitalization during pregnancy. Left- and right-side calculi occur with equal frequency and ureteric stones seem to occur about twice as often as renal calculi. Interestingly, 80–90% of patients present in the second or third trimester of pregnancy, but rarely in the first trimester . The management of urolithiasis during pregnancy is often challenging, requiring close co-operation between urologist, radiologist and obstetrician. Fortunately, with conservative management, 70–80% of symptomatic calculi pass spontaneously with no sequelae.

The management of stone disease in pregnancy is initially conservative. Surgical measures are reserved for patients with sepsis, intractable pain, acute renal failure or for patients who fail to respond to conservative management. Herein we provide a comprehensive review of the management of stone disease in pregnancy and outline a treatment algorithm.

Effects of pregnancy on the urinary tract

Normal anatomical and physiological changes that occur during pregnancy may predispose to kidney stone formation. Physiological hydronephrosis occurs in 90%of pregnancies, starting at 6–10 weeks of gestation, and generally resolves within 4–6 weeks of parturition .Hydronephrosis is caused by a combination of hormonal and mechanical effects. Progesterone affects the urinary smooth muscle during early pregnancy, causing decreased peristalsis and dilatation of the ureter, above the pelvic brim, with the right side more affected than the left because of compression from the right ovarian vein (engorged) and uterine dextro-rotation. Recent articles suggest that mechanical compression is the main, if not the only, cause for the dilatation. Studies have shown that dilatation is not seen when the ureter does not cross the pelvic brim, as in patients with pelvic kidneys or an ilealconduit. Several physiological adaptations occur during pregnancy which may affect renal stone formation. The renal plasma flow increases in pregnancy, leading to a 30–50% increase in GFR, resulting in an increased clearance of creatinine, uric acid and urea. During normal pregnancy there is a physiological state of absorptive hypercalciuria, presumably caused by placental formation of 1,25-dihydroxycholecalciferol and suppressed production of parathyroid hormone. However, the filtered loads of citrate, magnesium and urinary glycosaminoglycans, which inhibit urinary lithogenesis, are increased . Pathological calcium oxalate supersaturation has been reported during pregnancy, but crystalluria is no more common than in nonpregnantwoman. Thus, the relative percentage, type and frequency of urinary stones occurring during pregnancyare similar to those in nonpregnant stone-formers.

Fetal considerations of urolithiasis in pregnancy

Risk of radiation exposure The most important factor complicating the radiological evaluation of stone disease in pregnancy is the risk of radiation exposure to the fetus. The principal effects of irradiation on the mammalian fetus include teratogenesis, carcinogenesis and mutagenesis. These are divided into two categories: (a) those effects thatbecome more severe with increasing dose and for which a threshold is believed to exist, termed 'nonstochastic' (threshold), e.g. malformation, growth retardation and cataracts; and (b) those effects where the probability of the effect increases with increasing dose and which have no threshold, termed 'stochastic', e.g. cancer and genetic effects .

Much of the information about the effects of radiation in humans originates from the study of survivors of the atomic bomb, who were irradiated with high doses in utero in Nagasaki and Hiroshima . The risk associated with radiation depends critically on the gestational age and the amount of radiation delivered. During early organogenesis, the embryo is very sensitive to the growth-retarding, teratogenic and lethal effects of radiation. During the early fetal period, the fetus has diminished sensitivity to multiple organ teratogenesis but retains CNS

sensitivity. During later stages the fetus is not grossly deformed by radiation but can sustain permanent cell depletion of various organs and tissues if the radiation exposure is high enough .

Radiation-induced fetal malformation. The classical effects of radiation on the developing embryo are gross congenital malformation, intrauterine growth retardation (IUGR) and embryonic death. There is a linear, dose-related association between severe mental retardation and radiation, with the important caveat that most cases followed exposures during weeks 10–17 of gestation . Irradiation of the human fetus from diagnostic exposures of<50mGy has not been reported to cause congenital malformations or IUGR . Although the animal and human data support the 'safe limit' of 50 mGy, there is the theoretical possibility that functional or biochemical changes may be produced at low levels with a low incidence .Schull and Otake estimated that there is an=0.03point IQ loss per mGy arising from in utero exposure to ionizing radiation during the most sensitive period of human brain development.

Radiation-induced malignancy. Stewart suggested that the human embryo was more sensitive to the leukaemogenic effects of radiation and noted that exposure to as little as 10–20 mGy was associated witha slight increase in childhood cancers, by a factor of 1.5–2.0. Lilienfeld reviewed nine studies, of which six reported a 1.3–1.8-fold increase in the risk of leukaemia after diagnostic radiation exposure in utero. In contrast, Court-Brown et al. examined the relationship between diagnostic X-rays in pregnant patients and childhood cancers, and surprisingly neither study showed a statistically significant increase. At present, some believe that in utero exposure to small amounts of radiation increases the risk of leukaemia and other cancers, whereas others question the contention that the embryo is markedly more sensitive to the leukaemogenic effects of radiation than the child or adult. There is little disagreement with the concept that low doses of radiation present a carcinogenic risk to the embryo and adult, and that there may be different risks with dose at different stages of development .

Radiation-induced mutagenesis. Genetic effects primarily involve haploid germinal cells. In the general population genetic diseases occur in about 11% of birthand spontaneous mutations account for< 2-3%of genetic disease . The dosage required to double the baseline mutation rate is 500–1000 mGy, far greater than the radiation doses occurring in common radiographic studies . It appears that radiation is weakly mutagenic and that inherited mutations are rare, especially at low radiation levels .

Fetal doses after common diagnostic uro-radiological procedures

	Fetal dose (mGy)	
Examination	*Mean*	*Maximum*
Abdominal X-ray	1.4	4.2
IVU	1.7	10
CT abdomen	8.0	49
CT pelvis	25	79
^{99m}Tc kidney scan (DTPA)	1.5	4.0
^{99m}Tc MAG 3		0.7

Anaesthetic agents

Morphine sulphate and meperidine in small doses for episodic pain have had no adverse effect on the fetus, but chronic use of these agents can lead to fetal narcotic addiction, IUGR and premature labour. Compounds containing codeine have been shown to have teratogenic effects when used in the first trimester, but may be used in the second and third trimester for short intervals with little fetal risk . NSAIDs block prostaglandin synthesis and therefore may lead to premature closure of the ductusarteriosus in utero, and should thus be avoided in pregnancy. Patients taking aspirin for analgesia have delayed and prolonged labour as it decreases uterine contractility. Because aspirin decreases platelet aggregation there is an increased risk of bleeding before and after birth. In a neonate exposed to aspirin in utero, platelet dysfunction has been reported 5 days after delivery. No evidence of teratogenicity has been reported for other drugs (e.g. ibuprofen and naproxen), and short courses would be appropriate for up to 48 h, if indicated. Chronic use may lead to oligohydramnios and constriction of the fetal ductusarteriosus. When mild analgesia is needed, acetaminophen should be preferred over aspirin, because it does not prolong the bleeding time in pregnant patients and it has not been shown to be toxic to new-borns. Propoxyphen is an acceptable alternative. Patients undergoing other than obstetric surgery may require antibiotic treatment and the antibiotics of choice are penicillins and cephalosporin, which have not been associated with any adverse effects; and erythromycin, which is also well tolerated without fetal morbidity, although erythromycin estolate salt compounds should not be used in pregnancy because they can cause cholestatic jaundice in pregnant females . Aminoglycosides, tetracycline, chloramphenicol, fluoroquinolones and sulpha drugs are contraindicated in pregnancy because they have adverse effects on the fetus.

Clinical presentation

The most common presenting symptoms and signs of urolithiasis are flank pain, gross or microscopic haematuria and urinary infection . The aetiology of loin pain in pregnancy includes both general abdominal conditions and the possible obstetric major complications of pregnancy. Stothers and Lee reported an incorrect diagnosis of appendicitis, diverticulitis and placental abruption in 28% of patients in whom a stone was subsequently confirmed; this emphasizes the diagnostic difficulties of patients presenting with urinary stone disease in pregnancy. Alder's sign (palpation eliciting pain disappears with a change in position) may be helpful in differentiating between pain and tenderness of gynaecological and non-gynaecological origin. Microscopic and gross haematuria occur in 75% and 15% of cases, respectively . Patients may present with UTI, irritative LUTS and rarely with pre-eclampsia. Bladder stones are reportedly rare during pregnancy. Cope reviewed published reports and identified 30 cases of bladder calculi in pregnancy, of which 24 were diagnosed during labour. A bladder stone has even been reported to cause a vesicovaginal fistula during pregnancy .

Diagnostic evaluation

The most germane questions when presented with a pregnant patient with suspected urolithiasis are how to evaluate the problem, choose the appropriate management and when to intervene surgically. Before the advent of ultrasonography (US) the diagnosis centred on plain radiography of the abdomen, and IVU, but because of the concerns about the radiation risks during pregnancy, US has now become the standard first-line investigation. Real-time US has revolutionized obstetrics and become the most commonly used imaging method in pregnancy; it has also become the cornerstone of the diagnostic evaluation of suspected renal colic in pregnancy. However, with US it can be difficult to differentiate the physiological dilatation of pregnancy from ureteric obstruction, and it is therefore of limited value in cases of acute obstruction. Stothers and Lee reported a 34% sensitivity and 86% specificity for US in detecting abnormal findings in the presence of stones. Several measures have been recommended to enhance the performance of US. Pelvic diameter. Muller-Suur and Tydenmeasured the renal pelvic diameter and recommended renography in symptomatic patients with a renal pelvic diameter of >17 mm. In contrast, Erickson et al. found a maximum pelvic diameter of 27 mm on the right side and 18 mm on the left side during last two trimesters of pregnancy in asymptomatic patients Colour Doppler imaging. MacNeily et al. suggested that the presence of a dilated ureter below the crossing point of the iliac artery is strong evidence of pathological distal ureteric obstruction.

Resistive index (RI). Doppler US, and more specifically the RI, have been proposed to increase the ability of US to identify urinary tract obstruction.RI can be calculated by --Peak systolic velocity-End diastolic velocity/Peak systolic velocity.An RRI value 0.60±0.01(mean±SD) is usually taken as normal with a value of 0.70 being considered the upper normal threshold.Many authors have proposed that acute or chronic urinary tract obstruction would change the RI in the affected kidney by increasing renal vascular resistance . However, other studies have reported RI to be of little use in identifying acute renal colic. Tublinetal. reported a 44% sensitivity and 82% specificity for RI in identifying ureteric obstruction. During acute ureteric obstruction defined changes occur in renal haemodynamics and an important question is whether these changes affect the renal RI. Opdenakker et al. calculatedrenal RI in 72 patients, referred to the emergency department with acute renal colic, with no known associated renal disease. There was no statistically significant difference within the first 6 h but at 6–48 h the RI in the affected kidney was significantly different from that in the normal kidney. They also reported that after 48 h the sensitivity of RI decreased substantially.

Furthermore, Shokeir et al. showed that NSAIDs significantly decreased the RI of the acutely obstructed kidney. Therefore, if precise anatomical and physiological information is needed, the RI cannot be used as a single method for assessing a symptomatic patient with hydronephrosis. Interestingly, in a recent clinical study, Shokier et al. measured the RI and change (DRI) in pregnant women with acute unilateral ureteric obstruction caused by a stone, reporting a sensitivity of 45%, a specificity of 91% and an accuracy of 87% for RI. The corresponding values for DRI were 95%, 100% and 99%.

Ureteric jets The characterization of ureteric jets may be useful as an ancillary technique. These jets can be visualized by real-time US or colour Doppler US. Deyoe et al. reported that a complete obstruction can be diagnosed with a sensitivity of 100% and a specificity of 91% if there are no ureteric jets detectable on the suspected side of obstruction. In contrast, Burke and Washowichreported complete unilateral absence of jets in four asymptomatic pregnant patients, and recommended a cautious interpretation of this approach.

Transvaginal/endoluminal US. Another technological advance that may enhance the diagnosis is the use of transvaginal US. Laing et al. detected 13 distal stones using transvaginal US but only two using the transabdominal approach.

IVU As stated in a regulatory guide , exposure to any level of radiation is assumed to carry some risk. In the absence of scientific certainty about the relationship between low-dose exposure and health effects, any exposure to ionizing radiation may cause undesirable biological effects. The use of radiation for diagnostic studies during pregnancy has been and remains controversial. With proper planning of exposure, the use of tight collimation, low voltages (60–70 kV), a brief exposure, high-speed screen and prone positioning may decrease the radiation dose delivered to the fetus . Various investigators have suggested that modified or limited IVU can be used to decrease the radiation dose to the fetus, and even be considered safe during the first trimester . However, there are data that cause concern with even low doses of radiation exposure to the fetus. Modified IVU has been varyingly defined (Table 2) . Another limitation of IVU in pregnancy is the difficulty in differentiating delayed excretion of the contrast material associated with physiological dilatation from that associated with obstruction caused by calculus. Furthermore, an enlarged uterus and fetal skeleton may obscure small stones.

The reported modified IVU protocols

Reference	*Protocol*
[2]	Two-exposure limited IVU, second film at 30–60 min
[52]	Plain film + 20 min, ± delayed films
[53]	Plain film + 15 min, if obstruction then 60 min film
[54]	Plain film + 1 min + 15 min; faint nephrogram on the 1-min film and no excretion on the 15-min film, delayed films at 120–180 min; dense nephrogram – further film at 45–60 min

IVU should be discouraged, as X-rays present inherent risks of ionizing radiation, as does injection with contrast medium to the fetus.
Radionuclide renography The administration of a radioisotope to a pregnant woman will result in exposure of the fetus to radiation emitted from adjacent maternal organs and from any radioactivity transferred across the placenta. Renography delivers equivalent to 10% of the radiation dose of IVU. The USA Nuclear Regulatory Commission developed a guide to calculate the radiation dose to the embryo/ fetus . For 99mTc-labelled radiopharmaceuticals, the absorbed doses is 0.2–1.8 mGy. Importantly, the radioisotope is excreted in urine and the bladder reservoir component will act as a significant source of exposure to the fetus. Therefore, to minimize the radiation risk to the fetus, the patient should be encouraged to maintain a high fluid intake and void as frequently as possible. Renography provides a physiological approach to diagnostic evaluation and its safety has been confirmed . The present authors' protocol is to assess patients with suspected ureteric obstruction in pregnancy with US followed by isotope renography.

MR urography (MRU)
MRU can be used to evaluate the urinary tract without using ionizing radiation and with no administration of contrast medium; this has important considerations for patients in pregnancy. MRI is confirmed as a safe imaging method, with no known teratogeniceffects . Roy et al. reported excellent accuracy (sensitivity 100%) using 'rapid acquisition with relaxation enhancement' MRU. Using MRU it is possible to differentiate a physiological from pathological ureteric dilatation during pregnancy, but it is an expensive technique and is of limited availability. Thus it should be reserved for special cases when US fails to provide the diagnosis. Recently, Spencer et al. reported the use of gadolinium-enhanced breath-hold gradient-echo MR excretory urography to assess symptomatic hydronephrosis in pregnancy. They compared MR excretory urography with 'gold standard' isotope diuretic renography in 11 symptomatic pregnant women, and reported a good correlation between the assessment of excretion from symptomatic kidneys for isotope and MR studies. MRU should be considered the procedure of choice when US fails to establish a diagnosis, and we expect this technique to gain more widespread use.

Other imaging methods
Retrograde pyelography is of limited value because of the risk of sepsis. Several recent studies showed that unenhanced helical CT is a safe, rapid and highly accurate technique for evaluating acute flank pain. However, the radiation dose of CT, and particularly pelvic CT, can be high, thus precluding its routine use during pregnancy.

CONCLUSION
Urolithiasis during pregnancy, although rare, is a difficult clinical problem, requiring co-operation between obstetrician, urologist and radiologist. Flank pain and haematuria are the common presenting symptoms. The differential diagnosis of flank pain during pregnancy is vast. The major differential diagnosis is between nonurological and urological pathology, for which a thorough medical history and physical examination is helpful. An extremely important part of the evaluation is urine analysis. In addition, US is useful in resolving the diagnostic dilemma at the time of initial assessment. US combined with measurements of renal vascular resistance and ureteric jets appears to be helpful, but the clinical significance of such new approaches remains to be determined. If US fails to detect a calculus in a symptomatic patient with hydronephrosis, isotope renography or MRU is useful in delineating the level and grade of obstruction. If these are not available then insertion of a stent or nephrostomy tube is justified, as it relieves symptoms immediately. Both limited IVU and CT are excellent tools in evaluating ureterohydronephrosis, but there is a potential hazard which demands avoiding radiation if possible. The recommendations from key organizations that may help clinicians better understand the overall risks from X-rays and other diagnostic imaging methods are: ' X-ray imaging: NRPB, Royal College of Radiologists, UK: 'Radiation doses resulting from most diagnostic procedures in an individual pregnancy present no substantial risk of causing fetal death or malformation or impairment of mental development' .

National Council on Radiation Protection: 'Fetal risk is considered to be negligible at f50 mGy when compared to the other risks of pregnancy, and the risk of malformations is significantly increased above control levels at doses >150 mGy' . ' American College of Obstetricians and Gynecologists (ACOG): 'Women should be counselled that X-ray exposure from a single diagnostic procedures does not result in harmful effects. Specifically, exposure to ' X-ray imaging: NRPB, Royal College of Radiologists, UK: 'Radiation doses resulting from most diagnostic procedures in an individual pregnancy present no substantial risk of causing fetal death or malformation or impairment of mental development' .

'National Council on Radiation Protection: 'Fetal risk is considered to be negligible at f50 mGy when compared to the other risks of pregnancy, and the risk of malformations is significantly increased above control levels at doses >150 mGy' .

American College of Obstetricians and Gynecologists (ACOG): 'Women should be counselled that X-ray exposure from a single diagnostic procedures does not result in harmful effects. Specifically, exposure to<50 mGy has not been associated with an increase in fetal anomalies or pregnancy loss' .

US: American Institute of Ultrasound in Medicine: 'Mammalian bioeffects are not seen below a SPTA intensity of 100 mW/cm2 '. ACOG: 'There have been no reports of documented adverse fetal effects for diagnostic ultrasound procedures, including duplex Doppler imaging' .

MRI: ACOG and NRPB: 'Although there is no evidence to suggest that the embryo is sensitive to magnetic and radiofrequency at the intensities encountered in MRI, it might be prudent to exclude pregnant women during the first trimester' . Safety Committee of the Society for MRI: 'MRI is indicated for use in pregnant women if other non-ionizing forms of diagnostic imaging are inadequate, or if the examination provides important information that would otherwise require exposure to ionizing radiation' .

'Radionuclide scintigraphy: Administration of Radioactive Substances Advisory Committee: 'Special attention should be given to the optimization of the exposure, taking into account the exposure of the expectant mother and the unborn child' . US Department of Health and Human Services: 'Consideration should be given to technical modification of the procedure that will minimize fetal radiation exposure' .

The effects of low doses of ionizing radiation, such as those typically involved in diagnostic radiology procedures, are uncertain . A discriminatory approach on the part of the physician with careful weighing of the risk : benefit ratio is warranted.

Management

Natural history

Contemporary publications reflect that 70–80% of pregnant patients with symptomatic calculi will pass them spontaneously, if treated conservatively with hydration, analgesia and antibiotics (if infected) . Horowitz and Schmidt described it as 'expectant therapy for the expectant mother'. However intervention may be necessary in 20–30% of patients. Indications for a more aggressive approach in pregnant patients include:

- Colic refractory to drug therapy;
- Sepsis;
- Obstruction of a solitary kidney;
- Social and psychological reasons.

Premature labour from renal colic is the most common obstetric complication of urolithiasis. Standard tocolytic therapy with β adrenergic agents halts premature labour and a single subcutaneous or intravenous dose of terbutalinesulphate (0.25 mg) is often sufficient to arrest contractions. The risk of premature labour should cease completely with the passage or removal of the stone.

Medical management

The initial management should be conservative, consisting primarily of rest, adequate hydration, analgesia and antiemetics. The use of continuous segmental epidural block (T11 and L2) has been recommended and may even influence spontaneous passage of the calculi .Tschada *et al.* reported a significantly higher concentration of βreceptors during pregnancy than after birth. Consequently, β1adrenoreceptor blocking agents may also be used in the management of hydronephrosis during pregnancy . These drugs may stimulate contractile activity of the renal pelvis and ureter, and this in turn may increase the flow of urine in the upper urinary tract. These observations are important, as there is only limited experience confirming the efficacy of this approach.

Active management

Historically, pregnant patients with urolithiasis underwent open surgery or 'blind' basketry of the stone. Recent radiological advances, and technological advances in new ureteric catheters, instrument design and energy sources, make the management of these patients potentially less invasive. The management should be based on the type, timing of presentation and available local expertise. Temporizing manoeuvres in the third trimester may be appropriate because of the high risk of spontaneous abortion.

Temporary urinary diversion

In 1978, Meares suggested a percutaneous nephrostomy (PCN) tube or internal ureteric stent(s) for complications of urolithiasis in pregnancy. Proponents of percutaneous drainage cite several advantages over retrograde ureteric stent placement.

- The procedure can be undertaken safely in acutely ill or septic patients with local anaesthesia, guided by ultrasonography (US).
- It provides immediate drainage and culture of urine, allowing organism specific antibiotic therapy.
- A variety of tube sizes can be placed (8–12 F).
- It provides access for future percutaneous stone manipulation.
- It avoids manipulation of the obstructed ureter with its potential for perforation and exacerbation of the infection.
- Advocates of PCN maintain that if necessary the nephrostomy tube can be irrigated to dissolve uric acid, cystine or struvite stones.

In addition, PCN is more cost effective than retrograde uretericcatheterization and is successful in > 90% of patients . Nevertheless, the disadvantages of nephrostomy tube insertion are well recognized:

- Possibility of encrustation and tube obstruction;
- Infection;
- Possibility of bleeding from the track;
- Discomfort and the need to continue with external drainage, which may result in tube displacement.
- The procedure may be technically difficult in the third trimester.
- Dislodgement of nephrostomy tube.
- Internal ureteric stents can be inserted with general/local anaesthesia under transabdominal US guidance or with limited fluoroscopy. The most common complication of ureteric stents is encrustation. Pregnancy related hyperuricosuria and absorptive hypercalciuria coupled with infection can cause encrustation, therefore hydration, dietary calcium restriction and antibiotics, and frequent stent replacement have been recommended . Infection and migration are other complications of internal stent placement. As a consequence of these difficulties, Denstedt and Razvi suggested that a ureteric stent should be reserved for the later stage (> 22 weeks) of pregnancy.

Ureteroscopy

Advances in instrument design, flexibility and reduced size have broadened both ureteroscopic diagnostic and therapeutic capabilities. Ureteroscopy has also been used during pregnancy, although this procedure may require general anaesthesia. Whilst recent reports enthusiastically support the use of ureteroscopy during pregnancy, there is always the potential for ureteric perforation and sepsis, and therefore ureteroscopy should be undertaken by a experienced urologist. Rittenberg and Bagley reported the safe and effective use of rigid and flexible ureteroscopes during all trimesters of pregnancy, with no fluoroscopy andanaesthesia. Vest and Warden suggested that the anatomical distortion of the bladder and distal ureter, particularly during the third trimester, may make semirigidureteroscopy more difficult, and therefore ureteroscopic stone manipulation at or near term should be discouraged. However, others reported successful examination up to the renal pelvis even during the third trimester.

Ureteroscopy in pregnant women can usually be undertaken with no dilatation of the ureteric orifice, probably because of the muscle relaxing effects of progesterone like hormones. Most distal ureteric stones can be retrieved with a stone basket, but some may require fragmentation, which can be accomplished

safely with pulse dye laser, holmium:YAGlaser or pneumatic lithotripsy.Contraindications to the use of ureteroscopy during pregnancy are:

- inexperience and inadequate endoscopic instruments;
- stone >1 cm;
- multiple calculi;
- transplanted kidney;
- sepsis caused by the increased risk of complications.

- A solitary kidney is a relative contraindication for ureteroscopic manipulations. Caution must be used when undertaking ureteroscopy in a patient with a solitary kidney and not attempted by those who are inexperienced. Temporizing procedures should be considered in these situations. In a recent review, Shokeir and Mutabagani also suggested that ureteroscopy must be undertaken by an experienced surgeon because complications during the procedure may jeopardise fetal health. The European Association of Urology proposed guidelines for managing urolithiasis in pregnancy, stating that 'ESWL, PCNL and ureteroscopy are contraindicated in pregnancy, although ureteroscopy has been used by experts to remove ureteric stones during pregnancy'.

Other methods of Open surgery

Open surgery remains a viable alternative for the management of selected patients with urolithiasis. The risk of surgery has been

examined by Shnider and Webster , who reported premature delivery in 6.5%, 8.6% and 11.9% of patients during the first, second and third trimester, respectively. However, open surgery may be indicated in the symptomatic septic patient where endourological techniques have failed or are unavailable.

Postnatally, a complete diagnostic evaluation (metabolic and radiological) should be undertaken in the newly diagnosed stone former, to assess the current stone status.

DISCUSSION

The discussion covers two main groups, those who are stone formers but are contemplating a future pregnancy, and those who present acutely with stones during pregnancy.

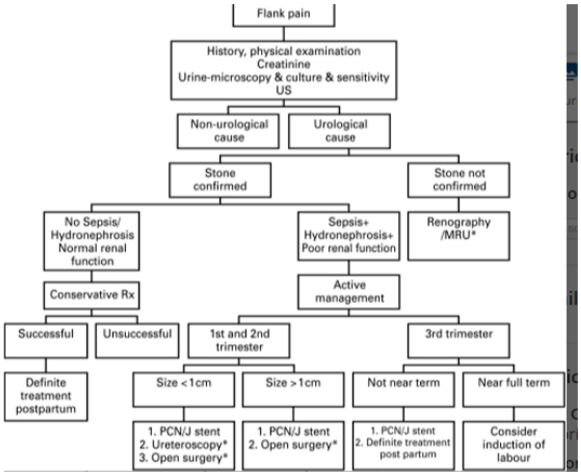
The management of asymptomatic calculi in women of childbearing age must be considered. Glowacki *et al.* reviewed 107 asymptomatic patients with renal calculi who received no treatment at the time of diagnosis, with a mean follow up of 31.6 months; 31.8% became symptomatic during this period, 15% passed their stones spontaneously, whilst 8.4%, 5.6% and 2.8% required SWL, ureteroscopic extraction and percutaneous nephrolithotomy, respectively. These results support the prophylactic treatment of asymptomatic stones, to prevent later disabling episodes of pain and obstruction. If possible a careful metabolic evaluation should be carried out before pregnancy.

Common questions asked by women with cystinuria and contemplating pregnancy are whether pregnancy is advisable and whether they will have a healthy baby. Therefore the management and genetic counselling of women with cystinuria should begin before conception. In patients with cystinuria, assiduous maintenance of a high fluid intake must be the mainstay of management .

When the diagnosis is confirmed, a conservative approach is recommended if there is no hydronephrosis, sepsis or abnormal renal function. Conservative management with bedrest, hydration and analgesia results in spontaneous passage of the stone in two-thirds of patients. Surgical intervention is reserved for patients with urosepsis or renal failure, or failure of expectant treatment. The availability of urological and radiological expertise is important in decision making, and stone size and pregnancy status will also influence further management. If conservative treatment fails, temporary urinary diversion with PCN or an internal stent may be appropriate. In the last 5 years there has been a revolution in diagnostic technology and endoscopic instrumentation, resulting in high quality imaging and small caliberureteroscopes, making ureteric access feasible and safe. Nevertheless, the need for the greatest possible care during ureteroscopy cannot be overemphasised and it should be undertaken centres with sufficient experience. ESWL remains experimental and pregnancy is an absolute contraindication for its use.

There is no universal consensus on a clinical algorithm for managing a patient presenting with loin pain in pregnancy. The diagnostic and therapeutic dilemma presented by these patients is well recognized. We propose a logical clinical management plan based on evidence and the best investigations to reach the diagnosis, with the least possible risk to the patient and the fetus. During the first and second trimesters, US guided PCN or internal ureteric stents are usually the first line of treatment. Specifically, ureteroscopic extraction is reserved for stones of <1cm; ureteroscopy should be avoided in the presence of sepsis and for stones of >1cm. Ureteroscopy a useful option, as it combines the diagnostic procedure with definitive treatment. Patients with complicated stone disease should be delivered near full term and definitive measures planned for after birth. Finally, for patients who are not near full term, temporizing procedures appear to be valid alternatives. The management of stones in pregnancy must therefore be tailored to fit the individual.

Percutaneous stone extraction should be deferred until after birth because the need for prolonged anaesthesia and radiation may pose a major hazard to the outcome of pregnancy. ESWL is contraindicated in pregnancy because of the potential disruptive effects of the shock wave energy on the fetus .Vieweg *et al.* reported a spontaneous miscarriage 24h after ESWL of a distal ureteric stone in the first trimester. Interestingly, Asgari *et al.* inadvertently treated six patients with renal stones during the first month of pregnancy, using the modified Dornier HM3 lithotripter, and found no detectable malformations or chromosomal anomalies in children.



The management algorithm proposed for treating stones in pregnant women; *in selected cases

REFERENCES

1. Semmens JP. Major urologic complications in pregnancy. ObstetGynecol 1964; 23: 561– 5
2. Drago JR, Rohner TJ Jr, Chez RA. Management of urinary calculi in pregnancy. Urology 1982; 20: 578– 81
3. Harris RE, Dunnihoo DR. The incidence and significance of urinary calculi in pregnancy. Am J ObstetGynecol 1967; 99: 237– 41
4. Horowitz E, Schmidt JD. Renal calculi in pregnancy. ClinObstetGynecol 1985; 28: 324– 38
5. Maikranz P, Coe FL, Parks J, Lindheimer MD. Nephrolithiasis in pregnancy. Am J Kidney Dis 1987; 9: 354– 8
6. Tschada R, Hettenbach A, Melchert F, Alken P. Pregnancy induced changes in adrenergic receptors. Z Fur GeburtshilfePerinatologie 1991; 195: 182– 6
7. Hettenbach A, Tschada R, Hiltmann WD, Zimmermann T. UntersuchungenzumEinfluss von β Stimulation and β 1 Blockade auf die Motilitatt des oberenHarntraktes. Z GeburtshilfePerinatol 1988; 192: 273– 7
8. Meares EM Jr. Urologic surgery during pregnancy. ClinObstGynec 1978; 21: 907– 20
9. Pearle MS, Lyle Pierce H, Miller GL et al. Optimal method of urgent decompression of the collecting system for obstruction and infection due to ureteral calculi. J Urol 1998; 160: 1260– 4
10. Stables DP. Percutaneous nephrostomy. Technique, indications and results. UrolClin North Am 1982; 9: 15– 29
11. Rodriguez PN, Klein AS. Management of urolithiasis during pregnancy. SurgGynecolObstet 1988; 166: 103– 6
12. Denstedt JD, Razvi H. Management of urinary calculi during pregnancy. J Urol 1992; 148: 1072– 5
13. Rittenberg MH, Bagley DH. Ureteroscopic diagnosis and treatment of urinary calculi during pregnancy. Urology 1988; 32: 427– 8
14. Vest JM, Warden SS. Ureteroscopic stone manipulation during pregnancy. Urology 1990; 35: 250– 2
15. Bakke A, Ulvik NM. Ureteroscopy (URS) in pregnancy. Scand J UrolNephrol 1988; 110: 243– 4
16. Ulvik NM, Bakke A, Hoisaeter PA. Ureteroscopy in pregnancy. J Urol 1995; 154: 1660– 3
17. Carringer M, Swartz R, Johansson JE. Management of ureteric calculi during pregnancy by ureteroscopy and laser lithotripsy. Br J Urol 1996; 77: 17– 20
18. Scarpa RM, De Lisa A, Usai E. Diagnosis and treatment of ureteral calculi during pregnancy with rigid ureteroscopes. J Urol 1996; 155: 875– 7
19. Shokeir AA, Mutabagani H. Rigid ureteroscopy in pregnant women. Br J Urol 1998; 81: 678– 81DOI: 10.1046/j.1464-410x.1998.00626.x
20. European Association of Urology. Guidelines on Urolithiasis (ISDN 90–806179–3–8), March 2001: 10
21. Chaussy CG, Fuchs GJ. Current state and future developments of noninvasive treatment of human urinary stones with extracorporeal shock wave lithotripsy. J Urol 1989; 141: 782– 9
22. Vieweg J, Weber HM, Miller K, Hautmann R. Female fertility following extracorporeal shock wave lithotripsy of distal ureteral calculi. J Urol 1992; 148: 1007– 10
23. Asgari MA, Safarinejad MR, Hosseini SY, Dadkhah F. Extracorporeal shock wave lithotripsy of renal calculi during early pregnancy. BJU Int 1999; 84: 615– 7
24. Shnider SM, Webster GM. Maternal and fetal hazards of surgery during pregnancy. Am J ObstetGynecol 1965; 92: 891– 900
25. Glowacki LS, Beecroft ML, Cook RJ, Pahl D, Churchill DN. The natural history of asymptomatic urolithiasis. J Urol 1992; 147: 319– 21