Original Research Article

A study on diagnosis and management of urinary calculi in pregnancy

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Abstract

Background: Acute renal colic during pregnancy is associated with significant potential risks to both mother and fetus. Diagnosis is often challenging because good imaging options without radiation use are limited. Management of diagnosed nephrolithiasis is unique in the pregnant population and requires multi-disciplinary care.

Aim: To study the metabolic alterations during pregnancy that may promote kidney stone formation, the complications associated with acute renal colic in the pregnant state, and our proposed diagnostic and management algorithms when dealing with this clinical scenario.

Materials and methods: This observational study was done in 2017-2018 at, Department Of Urogynecology, Institute of Social Obstetrics, Government Kasturba Gandhi Hospital, Chennai. Totally 22 pregnant women were included in the study. Charts of the patients were retrospectively reviewed and observations included age, presenting symptoms, diagnostic methods, urologic intervention, calculi location, stone size, trimester of diagnosis, and postpartum treatment.

Results: The diagnosis of urolithiasis was two (11.1%) in the first trimester, six (33.3%) in the second trimester, and 10 women (55.5%) in the third trimester. Of the 20 stones, nine were on the right side and 11 were on the left; two patients had bilateral urinary stones detected. Flank pain was the most common clinical presentation in 17 women, gross hematuria in five, fever in four, and urinary frequency in one patient. In laboratory tests, microscopic hematuria was found in 10 cases, pyuria in six, and leukocytosis (leukocyte cell count > 10,000/mm^3) in five. Diagnostic imaging was based on the transabdominal US. In 14 cases, renal or ureteral stones were detected by the US. The other four patients had hydronephrosis on the US without definite detection of the ureteral stones.

Conclusion: Women, in general, appear to be developing urolithiasis with increasing frequency. Consequently, it is expected that the incidence of pregnant women with stones may also increase. A

diagnostic and therapeutic approach that takes into account the individual patient's symptoms, stage of pregnancy and stone characteristics should be the intent in each case.

Key words

Pregnancy, Urolithiasis, Urologic intervention, Calculi location, Stone size.

Introduction

Kidney stones afflict 10% of the population during their lifetime and over the past two decades this statistics has risen, thought to be caused by diet, climate changes, and a concurrent rise in comorbidities like diabetes and obesity [1]. This increase in stone events has been quite dramatic for women and incidence is now close to equal between sexes, while previously it was far more common in men. While this rise has not necessarily been observed in pregnant females, this population is still affected by kidney stones, which occur in 1 in 200–1,500 pregnancies [2]. The incidence of physiologic hydronephrosis is as high as 90% on the right side and 67% on the left side during pregnancy [3]. Though this typically resolves within 4–6 weeks postpartum, its laterality throughout pregnancy has shown no association with factors such as urinary tract problems or prior pregnancies. Given this unpredictable nature, it may be difficult for a clinician to distinguish between physiologic and pathologic hydronephrosis [4]. The underlying pathophysiology of hydronephrosis in pregnancy is secondary to both mechanical and hormonal factors. The primary cause is ureteral obstruction secondary to compression from the gravid uterus at the pelvic brim. The anatomic relations of the ureters at the pelvic brim explain the susceptibility for development of right hydronephrosis; specifically, the right ureter crosses the iliac artery at the pelvic brim, whereas the left ureter does so more proximally and laterally, resulting in lower probability of compressing of the left ureter [5]. Other contributory mechanical factors such as the dextrorotation of the uterus and the cushioning of the left ureter by the sigmoid colon also help explain the predisposition of hydronephrosis for the right kidney. Hormonally, increased levels of progesterone during pregnancy decrease ureteral peristalsis, causing ureteral dilation above the pelvic brim. This physiologic hydronephrosis may result in stagnation of urine, potentially predisposing to stone formation and complicating diagnosis, as will be subsequently discussed [6]. Diagnosis of urolithiasis in the gravid patient with suspected renal colic is complex. Maternal physiologic changes, such as hydronephrosis, make it difficult for the urologist to rely on traditional clinical signs and symptoms of urolithiasis for diagnosis [7]. Furthermore, utilization of diagnostic imaging can only be done after careful consideration of risks and benefits; the ideal technique maximizes diagnostic yield while minimizing harm to the fetus and the mother by contrast methods and ionizing radiation. Accurate diagnosis is paramount as it guides appropriate management [8].

Materials and methods

This observational study was done in 2017-2018 at, Department of Urogynecology, Institute of Social Obstetrics, Government Kasturba Gandhi Hospital, Chennai. Totally 22 pregnant women were included in the study. Charts of the patients were retrospectively reviewed and observations included age, presenting symptoms, diagnostic methods, urologic intervention, calculi location, stone size, trimester of diagnosis, and postpartum treatment. The diagnosis of urolithiasis in pregnancy was made on the basis of the clinical presentation, the presence of microscopic hematuria in urinalysis, and transabdominal ultrasonography (US), including renal and bladder the US. We carefully examined the kidney and ureter for the presence of urinary stones. If the stone could not be visualized by the US, only those cases where the postpartum X-ray confirmed urolithiasis were enrolled in this retrospective study. Fetal status was evaluated by

obstetric examinations. Pregnancy complications including preterm labor, preterm premature rupture of membrane, and pre-eclampsia were reviewed and the types of delivery were recorded. Follow-up information included the outcome of the infant and the further procedures required after the temporary procedures.

Results

Among common associated symptoms flank pain was more common among 12 women (92,5%) fever was ruled out in 3 women (2.5%) abdominal pain 2(2%) hematuria in 3(2.5%) pyuria in 1(1%) leucocytosis was in 1(1%) of pregnant women (**Table – 1**).

Management was initially conservative in all patients. In four patients, a double-J stent was inserted for persistent pain or urinary tract infection. In three of these fever patients, the failure of double-J stent placement was then treated with ureteroscopic lithotripsy under epidural anesthesia. We used a semirigid (6F) ureteroscope without ureteral dilatation. One patient received percutaneous nephrostomy for persistent renal colic and obstruction. This patient underwent extracorporeal shock wave lithotripsy (ESWL) in the postpartum period. Of the 10 conservatively treated patients, seven expelled the stone spontaneously, two underwent ESWL and one received percutaneous nephrolithotomy after successful delivery (**Table – 2**).

Table – 1: Correlation with symptoms and laboratory values.

Symptoms	**N(%)**
1. Flank pain	12 (92.5)
2. Fever	3(2.5)
3. Abdominal pain	2(2.0)
4. Hematuria	3(2.5)
5. Pyuria	1(1)
6. Leucocytosis (white blood cell count > 10,000/mm^3)	1 (1)

Table – 2: Management of pregnant women with renal stones.

Initial management	**Patients (N=22)**	**Postpartum management**	**Patients (N=22)**
Conservative treatment	11	Spontaneous expulsion	5
Double-J stent insertion	8	ESWL	10
Percutaneous nephrostomy	2	PCNL	5
Ureteroscopic stone removal	2	Spontaneous expulsion	2

Discussion

The incidence and prevalence of kidney stones are increasing globally. According to the National Health and Nutrition Examination Survey (NHANES) data, the self-reported prevalence of kidney stones has increased from 5.2 to 8.8% from 1994 to 2010. The prevalence has increased in both men (6.3–10.6%) and women (4.1–7.1%), with recent evidence suggesting a more marked increase among women [9]. During pregnancy, many factors contribute to increases in lithogenic urinary constituents. Hypercalciuria of pregnancy is primarily driven by increases in GFR. Additionally, placental production of 1,25-dihydroxycholecalciferol (1,25-Vit D) triggers a cascade of events that augment urinary calcium levels. 1,25-Vit D increases gastrointestinal absorption and bone resorption of calcium, which suppress parathyroid hormone levels. This results in further increases in the filtered load of calcium, decreasing the renal resorption of calcium, and thus augmenting hypercalciuria [10]. Similarly, elevated GFR results in increased

natriuresis during pregnancy, although the overall effect of pregnancy is an increase in total body sodium and fluid retention as a result of a lower threshold for thirst and antidiuretic hormone release. The balance of these factors results in slightly lower plasma sodium and osmolarity during pregnancy Serum uric acid levels decrease by 25–35%, which corresponds to increased glomerular filtration and reduced proximal tubular reabsorption during pregnancy [11]. Renal colic is the most common nonobstetric source of abdominal pain in pregnant patients requiring hospital admission Flank or abdominal pain is present in >85% of pregnant women presenting with stone disease Due to the prevalence of nonspecific abdominal or back pain, nausea, and vomiting, and lower urinary tract symptomatology in pregnancy the diagnosis of urolithiasis may be delayed, missed, or mistaken for pregnancy itself in up to 30% of cases. Lower urinary tract voiding symptoms are very common in pregnant women and may be exacerbated by a distal ureteral stone [12]. Uncommonly patients may present with complications of urolithiasis such as urosepsis, premature labor or pre-eclampsia. Patients who present with symptoms suggestive of urolithiasis should undergo a thorough history and physical exam. Up to 30% of patients have had a previous stone and 3.7% have had a stone during a previous pregnancy [13]. The diagnostic tools of choice in pregnancy are the US and magnetic resonance urography (MRU). Most of the stones in our cases were detected by conventional renal and bladder of the US. Renal grayscale US was usually the initial study performed when examining a pregnant woman with abdominal pain. However, the false negative rate is high and the sensitivity of US in detecting stones in pregnant women varies from 34% to 47% [14]. To improve the value of the US, the evaluation of the dilated collecting system must include the entire ureter. Romero V et al reported that the lumbar ureters could be visualized in 77% of hydronephrotic kidneys in asymptomatic pregnant women. The gravid fetus, with the placenta and amniotic fluid, provide a perfect acoustic window and the ureters can be easily detected. Stones located in the pelvic ureter or terminal portion of the ureter may require anterior transabdominal or endovaginal approaches [15]. Rosenberg E, et al. have shown that the endovaginal approach may improve the sensitivity of detection of small calculi in the terminal portion of the ureter. If the pregnant patient fails conservative management, then intervention is needed. Other reasons for intervention include symptoms of infection such as fever, uncontrolled pain, solitary kidney, bilateral obstructing stones, renal dysfunction, preterm labour, preeclampsia, other obstetric complications, persistent nausea and vomiting, worsening obstruction, stone size of >1cm, or inability to diagnose the clinical condition [16]. Surgical intervention has only recently become a widely accepted option for pregnant women within the past 1–2 decades, as this approach was previously thought to involve too much risk to the fetus [17]. Prior to this shift in management approach, drainage with a nephrostomy tube or stent placement was the mainstay of temporary management, with definitive surgical management deferred until after delivery [18]. However, definitive surgical management with ureteroscopy is now an acceptable option and might even be preferable in some situations, including patients who require multiple tube changes before delivery and those who cannot tolerate a stent or nephrostomy tube owing to discomfort [19, 20].

Conclusion

Diagnosis and management of pregnant women with urolithiasis remain a clinical challenge. Ultrasonographic evaluation of a pregnant woman with suspected renal colic is a reasonable diagnostic procedure with high sensitivity. Conservative treatment is still the first choice because most patients with symptomatic calculi will spontaneously pass the stone. If conservative treatment fails, a double-J stent insertion will relieve the majority of symptoms until definite treatment can take place after delivery. Ureteroscopy is another choice when definite intervention is required and the patient is refractory to conservative treatment.

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