Our ultrasonographic experience in the management of symptomatic hydronephrosis during pregnancy

Lucio Dell'Atti

Received: 23 January 2014 / Accepted: 29 May 2014 / Published online: 21 June 2014
© Società Italiana di Ultrasonologia in Medicina e Biologia (SIUMB) 2014

Abstract

Introduction The aim of the present study was to document the role of ultrasound in the diagnosis and management of symptomatic hydronephrosis during pregnancy.

Methods In this study, we reviewed 36 consecutive cases of pregnant women whose pregnancy was complicated by symptomatic hydronephrosis. In all patients, management was initially conservative (analgesics and fluids) after hospitalization. The following criteria were used to indicate double-J stent placement under US guidance rather than a conservative treatment: persistent pain with no improvement after conservative treatment, progressive hydronephrosis (>2 cm dilatation of the renal pelvis) or presence of uterine contractions.

Results The mean patient's age was 25 years (17–35) and gestational age at clinical presentation was 24 weeks (13–37). 81 % of cases had a renal pelvis dilatation >2 cm, while in only 19 % of cases there was a hydronephrosis between 1 and 2 cm in diameter; however, calculi were confirmed only in 25 patients. 28 patients required an invasive management with double-J stent insertion under US guidance. The sensitivity and specificity of US in the etiological diagnosis of hydronephrosis during pregnancy was 83 and 91 %, respectively.

Conclusion Conservative management with medical therapy and observation should be the first-line treatment approach. In our opinion a rapid ureteral decompression with the insertion of a ureteral double-J stent, under US visualization, is the safest method in the treatment of pregnant women with obstructed renal systems.

Keywords Pregnancy · Hydronephrosis · Stones · Ultrasound · Stent · Ureteroscopy

Riassunto

Introduzione Lo scopo del presente studio è stato quello di analizzare il ruolo dell'ecografia nella diagnosi e gestione durante la gravidanza di pazienti affette da idronefrosi sintomatica.

Metodi In questo studio abbiamo preso in esame 36 casi di donne in gravidanza complicata dall'insorgenza di un'idronefrosi sintomatica. In tutti i pazienti fu adottato dopo il ricovero in un primo momento un trattamento conservativo (con idratazione e analgesici). I criteri utilizzati per porre indicazione nel posizionamento di uno stent doppio J sotto guida ecografica al posto di un trattamento conservativo sono stati: dolore al fianco persistente senza alcun miglioramento dopo terapia medica, progressivo incremento del quadro idronefrotico (diametro della pelvi renale >2 cm) o comparsa di contrazioni uterine.

Risultati L'età media delle pazienti è stata di 25 anni (range 17–35), mentre l'età gestazionale al momento della presentazione del quadro clinico è stata di circa 24 settimane (range 13–37). L'81 % delle pazienti aveva una dilatazione della pelvi renale >2 cm, mentre solo nel 19 % c'è stata un'idronefrosi compresa tra 1 e 2 cm di diametro; tuttavia la presenza di calcolosi è stata confermata in sole 25 pazienti. In ventotto pazienti è stata necessaria una gestione invasiva con posizionamento di stent doppio J sotto guida ecografica. La sensibilità e la specificità dell'ecografia nella diagnosi eziologica d'idronefrosi è stata dell'83 % e del 91 % rispettivamente.

Conclusioni Secondo il nostro parere un trattamento conservativo con terapia medica ed osservazionale dovrebbe essere l'approccio di prima linea; una rapida

L. Dell'Atti (✉)
Department of Urology, Arcispedale "S. Anna", University of Ferrara, 8 A. Moro Street, 44124 Cona, Ferrara, Italy
e-mail: dellatti@hotmail.com

decompressione ureterale con l'inserimento di un stent ureterale doppio J sotto guida ecografica è il metodo più sicuro nel trattamento di donne in stato di gravidanza che presentano ostruzione delle vie escrettrici superiori.

Introduction

Approximately 1 out of 500 pregnancies are complicated by the presence of urinary calculi and the incidence of ureteral colic is the same as in non-pregnant women in reproductive age [1, 2]. Ureteral stones in pregnant women become clinically manifested during the second and third trimesters of pregnancy in 80–90 % of patients [3]. Clinical presentation for urolithiasis during pregnancy is renal colic, dull aching pain, tenderness, fever and hematuria. These conditions have been associated with increased risk of spontaneous abortion, premature labor and low-birth weight infants [3].

At present, abdominal ultrasonography (US) is suggested as a first-line imaging test to make a diagnosis of symptomatic hydronephrosis during pregnancy [4].

US is excellent for detection of hydronephrosis. However, it can be problematic recognize physiologic hydronephrosis during pregnancy from the one due to an obstructing stone. In literature, conventional gray-scale US is successful in detecting the obstructing ureteral calculus in 77–80 % of patients. The missed stones are located in the middle third of the ureter [5].

Most pregnant women with symptomatic kidney stones can be managed conservatively during pregnancy. In fact, between 40 and 80 % of patients spontaneously pass their stones without complication [6]. However, there are pregnant women with kidney stones, who may suffer from infection, persistent pain, progressive renal obstruction or obstetric complication. Such clinical scenario needs a more definitive approach than expectant management [7].

The use of double-J stent in order to bypass urinary obstruction in pregnant women has been documented in several series [8, 9].

The majority of the diagnosis and procedures can be performed without ionizing radiation under US guidance, with fluoroscopy used just in case of guidewire advancing failure [9].

The most important limiting factor is the risk for the fetus deriving from the radiation exposure, depending also on fetal gestational age and radiation dosage [10, 11].

The aim of the present study was to document retrospectively more than 5 years of ultrasonographic experience in diagnosis and drainage of symptomatic hydronephrosis with double-J stent.

Materials and methods

In this retrospective study, we reviewed 36 consecutive cases of pregnant women whose pregnancy was complicated by symptomatic hydronephrosis with or without obstructive ureteric stones and managed between January 2008 and January 2013 at our urology department.

Women with demonstrable hydronephrosis and a history of severe loin pain believed of renal origin were referred by their obstetricians to our urology department for advice.

In our study, US was the only imaging method used in the diagnosis and management of patients with hydronephrosis or obstructing ureteric stones. A standard obstetric ultrasonography was first taken to determine gestational age and to exclude obstetric complications as a symptom's cause.

Renal size, echogenicity and the presence of perinephric fluid or renal calculi were documented. Collecting systems and renal pelvis (Rp) presence and dilatation were determined and subjectively graded as absent dilatation of Rp (with or without dilatation of collecting systems), mild (dilatation of Rp < 1 cm in diameter), moderate (dilatation of Rp between 1 and 2 cm in diameter) or marked (dilatation of Rp > 2 cm in diameter). The dilated ureter, if present, was followed as distally as possible and its relationship to the iliac vessels analysed, aided color imaging. The presence and position of an intra-ureteric calculus were documented when observed. All patients were evaluated with complete blood analysis, urea and creatinine measurement, urinalysis, urine culture, C-reactive protein measurement.

In all patients, management was initially conservative after hospitalization. This included analgesics, antispasmodics and fluids. Antibiotics (usually amoxicillin) were administered just in case of fever with positive urine culture. The following criteria were used to indicate double-J stent placement under US guidance: persistent pain with no improvement after conservative treatment, uncontrolled pain and progressive hydronephrosis (>2 cm dilatation of Rp) or presence of uterine contractions. Double-J stent was performed under spinal anesthesia. The safety guidewire was placed under US visualization. (Fig. 1)

The postoperative follow-up included obstetric care to ensure maternal and fetal well-being, and the outpatient follow-up included clinical assessment, ultrasound examination and urine culture. One month after partum all patients were subjected to follow-up with Computed Tomography (CT) without the use of intravenous contrast for a future therapeutic treatment plan.

Fig. 1 Symptomatic hydronephrosis in a 25-year-old pregnant woman; sagittal ultrasonography image of the right kidney during double-J stent placement under US guidance

Results

The mean patient's age was 25 years (17–35) and gestational age at clinical presentation was 24 weeks (range 13–37). Six (16 %, 6/36) patients had a positive history of urological disease: five of them suffered from renal calculi and one from ureter reimplantation. Most ureterolithiasis cases during pregnancy (61 %, 22/36) occurred in the third trimester. Flank pain was the common presenting symptom (94 %, 34/36), 63 % (23/36) had associated fever and 33 % (12/36) had irritative voiding symptoms. Only one patient run high fever (40 °C). A great quantity of red blood cells was found in 17 patients in urine (47 %), and more than half of the patients (58 %, 21/36) showed 10–20 white blood cells (WBC) per high power field in urine. Urine culture was positive in 16 patients who also had fever (Table 1).

Eighteen patients (50 %, 18/36) had an elevated count of WBC in routine blood test, while thirteen patients presented elevated serum creatinine.

In 29 patients (80 %) US marked hydronephrosis, in 6 cases (17 %) there was a moderate hydronephrosis, while only in one cases (3 %) there was a mild hydronephrosis. US detected ureteral stones in 25 patients (70 %). In regard to localization, 11 stones were in the distal ureter, 2 were in the middle ureter and 12 were in the proximal ureter.

However, concomitant renal stones were also present in 4 of 25 patients with ureteral stones documented. The mean diameter of stones was 7.2 mm (range 3–12).

In six patients who had fever and also positive urine culture test, symptoms are relieved by antibiotic administration without additional treatment needed. Performing a

Table 1 Clinical presentation of the 36 pregnant women

Variables	Number (%)
Mean age (years)	25
Gestational age (weeks)	24
Pregnancy stage	
First trimester	5 (14)
Second trimester	9 (25)
Third trimester	22 (61)
Concomitant disease: (diabetes, hepatitis, hypertension, anemia)	4 (11)
History of urolithiasis	6 (16)
Clinical presentation	
Hematuria (gross/microscopic)	17 (47)
Pain	34 (94)
Fever	23 (63)
Leucocytosis	18 (50)
Irritative voiding symptoms	12 (33)
Urine culture positive	16 (44)
Laterality	
Left	14 (39)
Right	22 (61)
Hydronephrosis, cm	
<1 cm	1 (3)
1–2 cm	6 (17)
>2 cm	29 (80)

conservative management with analgesics and hydration, spontaneous passing of stones was noted in two cases (6 %). Invasive management with double-J stent insertion was required during pregnancy in 28 patients to relieve persistent pain and/or ureteral obstruction. None of the patients received percutaneous renal puncture.

Intraoperatively, there was no ureteral perforation or obstetric complication. Postoperatively, two patients had a urinary tract infection that was successfully treated with appropriate antibiotics, while dysuria and pain were observed in three patients (Table 2).

However, in all other patients, the pain was relieved and hydronephrosis vanished. All babies were born normally.

One month after partum all 36 patients were subjected to CT and were documented ureteral stones in 78 % (28/36) of patients.

Definitive treatment was performed after birth in 28 cases. These underwent the insertion of double-J stent; calculi were treated properly and then the double-J stent was removed. Based on the post-partum diagnosis the sensitivity and specificity of US in the etiological diagnosis of hydronephrosis during pregnancy was 83 and 91 %, respectively.

Table 2 Details of procedure and outcome of double-J stent insertion under ultrasonography guidance

Variables	Number (%)
Site of stone diagnosed by US	25 (70)
Upper third	11 (44)
Middle third	2 (8)
Lower third	12 (48)
Mean diameter of stone with US (mm)	7.2 (3–12)
Multiple stones in kidney and ureter	4 (16)
Double-J stent insertion	28 (78)
Intraoperative complication	0
Postoperative complication	
Urinary infection	2 (7)
Dysuria-pain	3 (11)

US Ultrasonography

Discussion

Management of pregnant women with symptomatic hydronephrosis is controversial considering that literature is inharmonious in defining the proper treatment regimen. The first step in the management of urinary lithiasis or renal colic during pregnancy should be a conservative treatment. Conservative treatment modalities (intravenous hydration and analgesia) favor a spontaneous stone passage in 4–84 % of pregnant patients [12–14].

At present, US is preferred as first-line imaging modality in pregnancy, because it is non-invasive and free from ionizing radiation. Stothers and Lee [15] reported 34 % sensitivity and 86 % specificity for US in detecting abnormal findings in presence of stones, percentages much lower than those we found in our study.

US may be limited by the patient's body habitus and overlying bowel gas and it depends on the skill of the sonographer. Interpretation of US exams is confounded by physiologic hydronephrosis as well as frequent inability to visualize the mid ureter. In fact, these factors have created in our study 1 false positive and 3 false negative. Computed Tomography (CT) has a detection rate approaching 100 % for urinary tract calculi, but it involves ionizing radiation. In recent years, low-dose CT is recommended by some authors to make the diagnosis when US is found to be inconclusive. White et al. [16] in a retrospective study on 20 pregnant women, who underwent renal US followed by low-dose CT scan (1.372 rad), found that CT is more sensitive in locating urinary calculi than renal US. Magnetic Resonance (MR) urography provides high-quality images of the kidneys and urinary tract with obstruction and is used by some as second-line to US. MR urography does not use ionizing radiation or ionated contrast. Limitations of MR urography include its limited visualization of small calculi [17].

Abdominal US was the initial and principal diagnostic tool in our study. The lumbar ureters can be visualized in 77 % of the hydronephrotic kidneys, thanks to the fact that the fetus with placenta and amniotic fluid provides a perfect acoustic window [18]. Definitive diagnosis of ureteral stone was done by US in 70 % of the patients. Our results demonstrated that US may not be enough to resolve the diagnostic of ureteral stone approximately in 14 % of the patients. Transvaginal ultrasonography with use of probe convex “end-fire” was useful in diagnosis of distal ureteric stones in five women in the present study. Some authors reported that three-dimensional transvaginal sonography confirmed the presence of distal ureteral calculi in all 62 patients of their study (sensitivity and specificity: 100 %) [19]. Furthermore, the transvaginal ultrasonography was well tolerated by all pregnant women.

We performed insertion of double-J stent under US guidance in 78 % of the patients to relieve persistent pain and/or ureteral obstruction. In the present study, US was used for diagnosis and guidance of double-J stent insertion in all the patients because it does not involve ionizing radiation or contrast material, is non-invasive, and is relatively cost-effective. We did not observe any significant complications associated with the stent's insertion, and we did not use fluoroscopy during the procedures.

Some authors recommended percutaneous nephrostomy (PCN) for drainage of infected hydronephrosis. Such approach was not used in our study. Disadvantages of PCN include tubal obstruction by debris, change, use of external bag, urine leakage, erosion and bleeding [20].

Therefore, in our opinion, effective and rapid ureteral decompression with insertion of an indwelling ureteral double-J stent, under US visualization, is the safest method to treat pregnant women with obstructed renal systems [21].

Although this technique reduces very often the quality of life because of the occurrence of irritative lower urinary-tract symptoms and hematuria, we believe it is the safest to avoid possible manipulation or ureteral trauma.

Conclusion

In conclusion, we can say that in order to establish the management of pregnant women with symptomatic hydronephrosis and ureteric stones treatment an algorithmic approach is important.

A multidisciplinary approach is the key to a successful management of this complex patient population.

Conservative management with medical therapy and observation should be the first-line treatment approach. However, conservative management should fail, either intervention with temporary drainage is the most

appropriate next step. The health of the patient and the developing fetus is paramount when considering investigations and therapeutic options. In absence of prospective studies, this remains an area of much debate.

In our opinion a rapid ureteral decompression with the insertion of a ureteral double-J stent, under US visualization, is the safest method to treat pregnant women with obstructed renal systems.

Conflict of interest Lucio Dell’Atti declares that I have no conflict of interest.

Informed consent All procedures followed were in accordance with the ethical standards of the responsible committee on human experimentation (institutional and national) and with the Helsinki Declaration of 1975, as revised in 2000 (5). All patients provided written informed consent to enrollment in the study and to the inclusion in this article of information that could potentially lead to their identification.

Human and animal studies The study was conducted in accordance with all institutional and national guidelines for the care and use of laboratory animals

References

1. Biyani CS, Joyce AD (2002) Urolithiasis in pregnancy: pathophysiology, fetal consideration and diagnosis. *BJU Int* 89:811–818
2. Hoscan MB, Ekin M, Tunckiran A, Oksay T, Ozorak A, Ozkardes H (2012) Management of Symptomatic ureteral calculi complicating pregnancy. *Urology* 80(5):1011–1014
3. Kilpatrick CC, Monga M (2007) Approach to the acute abdomen in pregnancy. *Obstet Gynecol Clin North Am* 34(3):389–402
4. Oto A, Ernst RD et al (2009) MR imaging in the triage of pregnant patients with acute abdominal and pelvic pain. *Abdom Imaging* 34(2):243–250
5. Elgamasy A, Elsherif A (2009) Use of Doppler ultrasonography and rigid ureteroscopy for managing symptomatic ureteric stones during pregnancy. *BJU International* 106:262–266
6. Evans HJ, Wollin TA (2001) The management of urinary calculi in pregnancy. *Curr Opin Urol* 11:379–384
7. Stothers L, Lee LM (1992) Renal colic in pregnancy. *J Urol* 148:1383–1387
8. McAleer SJ, Loughlin KR (2004) Nephrolithiasis and pregnancy. *Curr Opin Urol* 14:123–127
9. Fabrizio MD, Gray DS, Feld RI, Bagley DH (1996) Placement of ureteral stents in pregnancy using ultrasound guidance. *Tech Urol* 2:121–125
10. Brent RL (1989) The effect of embryonic and fetal exposure to X-ray, microwaves and ultrasound: counselling the pregnant and non pregnant patient about these risks. *Semin Oncol* 16:347–368
11. Watterson JD, Girvan AR, Beiko DT et al (2002) Ureteroscopy and holmium: YAG laser lithotripsy: an emerging definitive management strategy for symptomatic ureteral calculi in pregnancy. *Urology* 60:383–387
12. Turk C, Knoll T, Petrik A et al: Guidelines on Urolithiasis. *European Association of Urology* 2013: 55
13. Denstedt JD, Razvi H (1992) Management of urinary calculi during pregnancy. *J Urol* 148:1072–1074
14. Charalambous S, Fotas A, Rizk DE (2009) Urolithiasis in pregnancy. *Int Urogynecol J Pelvic Floor Dysfunct* 9:1133–1136
15. White WM, Zite NB, Gash J et al (2007) Low-dose computed tomography for evaluation of flank pain in the pregnant population. *J Endourol* 21:1255–1260
16. Patel SJ, Reede DL, Katz DS et al (2007) Imaging the pregnant patient for nonobstetric conditions: algorithms and radiation dose considerations. *Radiographics* 27:1705–1722
17. McNeily AE, Goldenberg SL, Allen GJ, Cooperberg PL (1991) Sonographic visualization of the ureter in pregnancy. *J Urol* 146:289–301
18. Mitterberger M, Pinggera GM, Maier E et al (2007) Value of 3-dimensional transrectal/transvaginalsonography in diagnosis of distal ureteral calculi. *J Ultrasound Med* 26:19–27
19. Rana AM, Aquil S, Khawaja AM (2009) Semirigidureteroscopy and pneumatic lithotripsy as definitive management of obstructive ureteral calculi during pregnancy. *Urology* 73:964–967
20. Akpinar H, Tufek I, Alici B, Kural AR (2006) Ureteroscopy and holmium laser lithotripsy in pregnancy: stents must be used postoperatively. *J Endourol* 20:107–110
21. Delakas D, Karyotis I, Loumbakis P et al (2000) Ureteral drainage by double-J-catheters during pregnancy. *Clin Exp Obstet Gynecol* 27:200–202