

## CASE REPORT

## Renal calculi in pregnancy? The role of ultralow-dose CT

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**SUMMARY**

Presented is a case of an acute, right flank, loin to groin pain in the third trimester of an otherwise uncomplicated pregnancy. Renal calculi was suspected clinically and supported by radiological evidence. Temporising treatment was undertaken successfully by retrograde ureteric stenting, which became blocked, secondarily resulting in a percutaneous nephrostomy. Good symptomatic control was achieved before the delivery at 38 weeks and 1 day gestation. Postpartum intravenous urogram and ureteroscopy did not reveal evidence of calculi. The patient does not recall passing a stone. With existing diagnostic modalities having poor sensitivity and specificity, the clinical role of ultralow-dose CT is explored, in light of recent new evidence.

**BACKGROUND**

Renal calculi are relatively common affecting 1:200–1:2500 pregnancies, the same incidence as seen in the non-pregnant population despite significant physiological changes to the renal system.<sup>1</sup> As many as 80% of calculi resolve with conservative treatment: intravenous fluids and analgesia. Twenty per cent of patients remain symptomatic and require further treatment, with either temporary treatment (nephrostomy or stenting) or definitive ureteroscopy.<sup>1</sup>

In the non-pregnant patient diagnosis is made by intravenous urogram (IVU) or CT of the kidneys, ureter and bladder. The desire to avoid radiation during pregnancy has resulted in the first-line use of ultrasound and then MRI.<sup>1</sup> These modalities are not without limitations and this case is important as it highlights the diagnostic challenges presented by imaging suspected renal calculi in pregnancy. It is of interest to obstetricians, urologists and radiologists.

**CASE PRESENTATION**

A woman in her mid-30s, gravidity 2, parity 0+1, self-presented to the hospital, at 31 weeks and 4 days of gestation, with a sudden onset of right flank pain from loin to groin. The pain was severe and radiated to the back, with no other associated symptoms. There were no urinary or bowel symptoms. The uterus was soft and no vaginal bleeding was seen.

The patient had no significant medical history and no past episode of abdominal pain or renal disease. The pregnancy had been uncomplicated thus far except for several episodes of sciatica.

**INVESTIGATIONS**

Temperature 36.3°C, blood pressure 119/87, heart rate 94.

Cardiotocography (CTG) monitoring showed a normal reactive trace and no contractions.

Bloods on admission: white cell count (WBC)  $10.6 \times 10^9$ , neutrophils  $7.8 \times 10^9$ , C reactive protein (CRP) 7.

Initial midstream urine: WBCs, red blood cells and bacteria not detected.

Midstream urine on evening of admission: WBCs and bacteria not detected. Red blood cells seen.

Bloods 1 day after admission: WBC  $13.3 \times 10^9$ , Neutrophils  $10.9 \times 10^9$ , CRP 11.

Ultrasound revealed both kidneys to be of a normal size, outline and corticomedullary differentiation. No cysts, calculi, focal lesions or dilations were seen. Perinephric fluid measuring  $21 \times 20 \times 21$  mm surrounded the right kidney.

MRI subsequently revealed a mildly hydronephrotic right kidney with likely small calculus (5 mm) at the pelviureteric junction. Extensive fluid was seen around the kidney, suggestive of urinoma. All other abdominal viscera were visualised and reported as normal.

**DIFFERENTIAL DIAGNOSIS**

The differential of abdominal pain in pregnancy is extensive.

Obstetric causes were first considered; premature labour was discounted as no contractions were seen on CTG. Placental abruption was ruled out with a soft uterus on examination and normal fetal heart rate.

Pyelonephritis was unlikely as the patient was not feverish and urine culture showed no microorganisms, a normal white cell count and only slightly raised CRP.

Appendicitis, diverticulitis, pancreatitis and ovarian torsion were ruled out by normal appearance on MRI.

Renal calculi were considered most likely, given renal colic and haematuria.

**TREATMENT**

Analgesia of paracetamol and subsequently 10 mg of intramuscular morphine provided some relief; however, the patient was still symptomatic.

Retrograde ureteric stenting under spinal anaesthetic provided full symptomatic relief and subsequent good urine output.

**To cite:** Nash Z, Mascarenhas L. *BMJ Case Rep* Published online: [please include Day Month Year] doi:10.1136/bcr-2013-009021

## OUTCOME AND FOLLOW-UP

Retrograde ureteric stenting succeeded for 41 days, before readmission with a second episode of right-sided flank pain.

On readmission: WBC  $10.6 \times 10^9$ , neutrophils  $7.5 \times 10^9$ , CRP 7.

Midstream urine showed no WBC or bacteria; red blood cells were seen.

The stent had become blocked. Nephrostomy relieved the pain and a good urine output was seen.

Delivery of a healthy neonate (APGAR 9 at 1 min and 10 at 5 min with grade 2 meconium) was achieved at 38 weeks and 1 day gestation by caesarean section for maternal request.

In the postpartum period, IVU demonstrated normal renal pelvices and ureters with a complete resolution of the hydronephrosis. Ureteroscopy was undertaken with good visualisation of the ureter and renal calyces. No calculus was seen and the patient did not report passing a stone. In subsequent weeks she has been well and reports no urinary or abdominal symptoms.

## DISCUSSION

Ultrasound is the first-line radiological investigation as it is cheap, accessible and free of ionising radiation. It is of limited usefulness with a sensitivity of 34–94% and specificity of 72–87%<sup>2–4</sup> in the detection of renal calculi, with significant interoperator variability.<sup>5</sup> In the case presented, initial ultrasound did not correlate with the clinical picture prompting MRI.

MRI has a specificity of 80%.<sup>4</sup> In this case, MRI provided a tentative radiological diagnosis, demonstrating not only hydronephrosis but also evidence of an obstruction. This highlights the diagnostic value of MRI in comparison with ultrasound despite the cost, equipment and skills required. A further strength of MRI is in the visualisation of other abdominal viscera, ruling out important differentials such as ovarian torsion, appendicitis and pancreatitis.

Interpretation of imaging of the renal tract in pregnancy is complicated by the frequency of physiological hydronephrosis.<sup>4</sup> Significantly, physiological hydronephrosis complicates the interpretation of ultrasound and MRI as these modalities rely upon changes to the renal tract and not direct visualisation of the calculi.<sup>5</sup>

Hydronephrosis is particularly problematic on the right side, the side on which our patient was affected, because of dextro-rotation of the uterus.<sup>5</sup> In itself, hydronephrosis can cause loin to groin pain; however, this was considered an unlikely differential as the onset of pain was sudden and would not account for red blood cells being seen in urine.

The gold standard imaging modality in non-pregnant patients, with the highest sensitivity and specificity, is CT. This is avoided in pregnancy because of the risk of radiation-induced teratogenicity in all trimesters, and the anxiety about such from clinician and patient.<sup>6</sup>

Ultralow-dose CT has recently been investigated<sup>6</sup> and it significantly reduces the radiation dose to below that said to induce teratogenicity in the fetus, making it, theoretically, safe in pregnancy.<sup>7</sup>

Evidence shows sensitivity and specificity in detecting non-pregnant patients with calculi of 97% and 95% respectively.<sup>8</sup> More recently, 23 cases in pregnancy underwent diagnosis with ultra low-dose CT. Only 4.5% of patients had a negative ureteroscopy after ultra low-dose CT diagnosis, showing 95.5% specificity.<sup>4</sup>

Despite these promising results, the investigation was not deemed suitable for our patient, even in the face of a radiological question. Anxiety on the part of the clinician and patient towards exposure to radiation is justified. The existing studies were conducted on relatively small populations and without long-term

follow-up. Further, there is a lack of mechanical and human expertise in ultra low-dose protocols outside few centres, necessitating patient transfer away from friends and family.

First-line treatment with ureteroscopy is gaining some popularity,<sup>4</sup> particularly in the USA. Ureteroscopy though carries the risk of inducing premature labour. The largest case series published to date, of 45 women, across all trimesters, showed a 4% obstetric complication rate. One preterm delivery at 33 weeks and one preterm labour was managed successfully, conservatively and carried to term. While this was lower than previous reports, of a 12.8% preterm delivery risk,<sup>4</sup> it is still a possible source of significant morbidity and mortality.

Ureteroscopy was not undertaken in this patient because of the known risk and uncertain benefit. Improved radiological evidence with ultra low-dose CT would have contributed to discussion of the risks and benefits of ureteroscopy, with certainty about the presence and location of a calculus potentially justifying the risk of intervention.

This case is interesting as although renal calculi were suggested clinically, radiological evidence was never conclusive. That said, there was no clinical significance to these limitations, with diagnostic confidence being taken from MRI, not alone, but in light of history, clinical examination and laboratory tests. Ultra low-dose CT may have altered the patient's management if ureteroscopy was being considered. The role of ultra low-dose CT is therefore likely to be in informing management decisions, when the benefit of the images obtained outweighs the radiation risk, however, small.

## Learning points

- ▶ Ultrasound is a valid first-line investigation, although the low, and variable, sensitivity and specificity is a significant limitation.
- ▶ MRI provides the best diagnostic tool when taken along side the clinical picture.
- ▶ The use of ultra low-dose CT cannot be justified routinely, as there is a lack of evidence regarding long-term safety.
- ▶ Ultra low-dose CT could play a limited role, on a case by case basis, if management dilemmas cannot be answered by ultrasound and MRI.

**Competing interests** None.

**Patient consent** Obtained.

**Provenance and peer review** Not commissioned; externally peer reviewed.

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