

Case Series

Surgical Management Of Renal Calculi In Pregnancy

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Abstract

Purpose: Recurrent renal calculi, or kidney stones, during pregnancy present a unique set of challenges for both the mother and the developing fetus. While kidney stones are relatively common in the general population, its occurrence in pregnancy can lead to significant complications. Surgical management of kidney stones during pregnancy is complex and requires a multidisciplinary approach. The primary goal is to avoid harm to the fetus while effectively treating the stone and alleviating maternal symptoms. This paper showcases a few cases in which kidney stones in pregnancy are surgically managed.

Method: A retrospective observational analysis was conducted at a major tertiary level maternity hospital in Southeast Queensland, Australia between 1st February 2024 and 31st October 2024. Pregnant patients who presented with urolithiasis were identified. Key data elements, including patient demographics, gestation, infection status, and surgical interventions were systematically extracted through independent review of the medical record. Three cases were identified and analysed. These women had obstructing stones which required surgical management with retrograde ureteric stenting. Further treatment was done either in the second trimester or post-partum.

Conclusion: Large kidney stones that are unlikely to pass spontaneously necessitate medical intervention. Indications for treatment include persistent symptoms, acute kidney injury, and the presence of infection. Acute management options involve ureteric stenting or percutaneous nephrostomy insertion to ensure adequate drainage. Subsequent treatments primarily consist of ureteroscopy and laser lithotripsy. The timing of these subsequent treatments is crucial and should ideally be performed either in the second trimester or postpartum.

Keywords: Pregnancy, Renal Calculi

Introduction

Recurrent renal calculi, or kidney stones, during pregnancy present a unique set of challenges for both the mother and the developing fetus. While kidney stones are relatively common in the general population, its occurrence in pregnancy can lead to significant complications. Besides anatomical changes due to the gravid

uterus, physiological changes during pregnancy, such as increased urinary stasis and changes in calcium metabolism, can predispose women to stone formation [1]. Symptoms often include severe flank pain, fever, haematuria, and urinary frequency, which can be particularly concerning for both the patient and treating clinician during pregnancy. Prompt diagnosis and management is crucial to reduce important adverse maternal and fetal outcomes such as premature rupture of membranes, preterm birth and neonatal mor-

bidity [2]. Understanding the risk factors and implementing preventative measures can help mitigate the impact of recurrent renal calculi in pregnant women. Surgical management of kidney stones during pregnancy is complex and requires a multidisciplinary approach [3]. The primary goal is to avoid harm to the fetus while effectively treating the stone and alleviating maternal symptoms. Most cases of kidney stones can be managed conservatively, but when intervention is necessary, ureteral stenting or percutaneous nephrostomy is preferred [4]. Invasive procedures, including ureteroscopy and lithotripsy, are generally reserved for specific cases, particularly in the second trimester when they pose the least risk

to the fetus. Close monitoring, especially for signs of infection and obstruction, is critical throughout the pregnancy.

Method

A retrospective observational analysis was conducted at a major tertiary maternity hospital in Southeast Queensland, Australia between 1st February 2024 and 31st October 2024. Pregnant patients who presented with urolithiasis were identified. Key data elements, including patient demographics, gestation, infection status, and surgical interventions were systematically extracted through independent review of the medical record.

Case series

Patient number	Demographics	Gestation	Stone location	Infection present	Intervention	Stone composition
	Age, sex					
1	NT, 29F	31+5	R) 8mm mid ureter	Yes	Acute: Stent	Not sent
				E.coli	Delayed: Ureteroscopy postpartum	
2	CH, 25F	23	R) 8mm distal ureteric	Yes	Acute: Stent x2	CaPhos
				E.coli	Delayed: Ureteroscopy in 2nd trimester	
3	CM, 36F	4	L) 7mm PUJ	Enterococcus	Acute: Stent L) and R)	Cysteine
			R) 10mm distal		Delayed: Ureteroscopy in 2nd trimester	

Case 1: NT

This 29-year-old woman who is G2P0 with a history of gastric sleeve surgery and concurrent antenatal issues of intrauterine fetal growth restriction and pre-eclampsia presented to the emergency department at 31+5/40 weeks pregnant with right sided loin to groin pain. Blood tests showed an acute kidney injury with peak serum creatinine of 100umol/L. Ultrasound renal tract revealed a 8mm right mid proximal ureteric stone with associated hydroureter and hydronephrosis. Initial urine test showed infection which later grew a pan-sensitive E.Coli. Given the risk of potential urosepsis with a large stone, she underwent ureteric stenting with the aid of ultrasound imaging and remained on cephalexin for the duration of her entire pregnancy. Subsequently, three weeks postpartum, she underwent ureteroscopy and laser lithotripsy to the stone. A replacement stent was placed due to localized inflammation secondary to impaction. This stent was subsequently removed after a few weeks.

Case 2: CH

This 25-year-old woman presented 23/40 weeks pregnant with in-

termittent right flank pain, cloudy urine and subjective fevers. She has had a previous history of pyelonephritis with renal abscesses. She had an ultrasound in the emergency department which showed right sided moderate hydronephrosis. She subsequently underwent Magnetic Resonance Imaging (MRI) of her abdomen and pelvis which revealed a right sided 8mm distal ureteric calculus. Due to instability, she was admitted to the intensive care unit for ionotropic support and broad-spectrum antibiotics. She underwent ureteric stenting without the aid of ultrasound. Unfortunately, due to limited clinical response another MRI was performed which showed that the stent had migrated into the urinary bladder. A second procedure was required, and the stent was replaced with the aid of ultrasound guidance. Subsequently, she underwent ureteroscopy and laser lithotripsy during her second trimester to clear this stone. The stone was cleared successfully, and analysis revealed a calcium phosphate stone. She also remained on prophylactic cephalexin for the duration of her pregnancy.

Case 3 CM

This 36-year-old woman presented 4/40 weeks pregnant with left

flank pain with associated nausea. She had a history of previous cysteine renal stones, requiring lithotripsy. Before knowing she was pregnant, she had a CT which revealed a 9mm left pelvico-ureteric junction calculus which was causing this pain. She had further ipsilateral and contralateral renal stones. A stent was placed on the left side with the aid of ultrasound guidance with the plan to clear her stones when she reaches the second trimester. At 13/40 weeks pregnant, she returned and had left sided ureteropyeloscopy and laser. The case was complicated by significant stent encrustation and difficulties with removing the initial stent. The ureteric stone was successfully cleared, and a stent was replaced to allow easier access to renal stones. 4 weeks later, she returned for another pyeloscopy and her 1cm intra-renal stone was mostly cleared. Due to the long laser time, the case was terminated with the plan to return for another relook and to remove what was remaining. Unfortunately, a week later, she returned with right sided pain. An ultrasound showed that one of the right sided intra-renal stones had migrated and was in her distal ureter. This stone measured about 1cm. She had a ureteric stent placed on that side given the size and ongoing pain. Her urine was also suspicious for infection, and this eventually grew enterococcus. At the 20/40 week mark, she returned for bilateral ureteropyeloscopy and laser. Bilateral stones that were in the kidney and ureters were systematically cleared. She was re-stented bilaterally after the procedure and finally had these stents removed after a week. As expected, calculus analysis revealed cysteine stones.

Discussion

Incidence of Kidney Stones in Pregnancy

The incidence of kidney stones in pregnancy is relatively low, but the condition is becoming more recognized due to improved diagnostic techniques and increased awareness. The exact prevalence can vary based on the population studied, but general estimates suggest the incidence of kidney stones in pregnancy is estimated to be approximately 1 in 204 [5] to 1 in 3300 [6] pregnancies. The overall prevalence suggests that about 0.3% to 2% [5,6] of pregnant women will develop symptomatic kidney stones during pregnancy.

Pathophysiology and Risk Factors

During pregnancy, several physiological changes can increase the risk of renal calculi, or kidney stones. One major factor is increased urinary stasis, as the growing uterus exerts pressure on the urinary tract, slowing down the flow of urine and providing an ideal environment for stone formation [7]. Additionally, changes in calcium metabolism during pregnancy can contribute to stone formation [8]. During pregnancy, both renal plasma flow and glomerular filtration rate increase by as much as 80% and 50%, respectively. This leads to an elevated filtered load of calcium and uric acid

[9]. These elevated levels of urinary calcium and uric acid which is excreted in the urine leads to high risk of formation of stones. Common risk factors for developing renal calculi during pregnancy include dietary factors such as a high intake of oxalates found in certain foods, genetic predisposition to stone formation, and dehydration, which concentrates the urine and promotes stone crystallization. Understanding and addressing these factors is crucial for preventing kidney stones and ensuring a healthy pregnancy.

Clinical Presentation and Diagnosis

Renal calculi in pregnancy can present with a multitude of symptoms. These often include severe flank pain, which can be sudden and intense, haematuria, and urinary tract infections that manifest as fever, chills, or painful urination. Diagnosing kidney stones during pregnancy poses unique challenges due to overlapping symptoms with other pregnancy-related conditions, such as Braxton Hicks contractions or preterm labour. Additionally, the anatomical changes that occur during pregnancy can make it more difficult to accurately identify the source of pain and discomfort. Safe diagnostic methods for pregnant women are crucial to avoid harm to the fetus. Ultrasound is typically the first-line imaging modality due to its safety profile and effectiveness in detecting kidney stones without exposure to ionizing radiation. In certain cases where ultrasound is inconclusive, low-dose CT scans may be utilized, balancing the need for accurate diagnosis with minimizing radiation exposure to the developing fetus. Accurate and timely diagnosis is essential to manage symptoms and prevent complications in both the mother and the baby.

Complications

Renal calculi during pregnancy can lead to a host of complications for both the mother and the fetus. For the mother, severe pain is one of the most immediate and distressing symptoms, which can significantly impact her quality of life and ability to carry out daily activities. This pain, if untreated, can also cause an increase in stress and anxiety. Moreover, kidney stones can lead to infections such as pyelonephritis, which, if severe, may necessitate hospitalization and aggressive treatment to prevent sepsis. These complications not only pose direct risks to maternal health but also indirectly affect the fetus. Additionally, treatment interventions, while necessary, can pose risks to the fetus, due to the medications used or the physiological stress of surgical procedures. Therefore, managing renal calculi in pregnancy requires a delicate balance to minimize risks and ensure the safety and well-being of both the mother and the baby.

Management and Treatment

Managing renal calculi during pregnancy requires a careful approach to ensure the safety of both the mother and the fetus. Conservative management strategies are often the first line of treat-

ment and include maintaining adequate hydration to help flush the urinary tract and prevent further stone formation [10]. Pain management is also crucial and typically involves the use of safe analgesics that pose minimal risk to the fetus. The use of non-steroidal anti-inflammatory medications should be generally avoided after 20 weeks of gestation due to risks pertaining to oligohydramnios. In cases where conservative measures are insufficient, medical and surgical interventions may be necessary. Urological procedures like ureteric stenting followed by ureteroscopy, allow for the treatment of ureteric stones. These procedures can be performed safely during pregnancy. The involvement of a multidisciplinary care team is critical in these scenarios. Obstetricians, urologists, obstetric physicians, midwifery team and other healthcare professionals work collaboratively to monitor the health of the mother and the fetus, tailor treatment plans, and ensure that both receive the best possible care [11]. This coordinated approach helps to balance the needs of managing kidney stones while prioritizing the well-being of the pregnant patient and her unborn child.

Indications for Interventional Management

Intervention is generally considered necessary for certain indications. For instance, if the stone is too large to pass naturally (typically larger than 7 mm), intervention should be considered. Persistent or worsening pain that cannot be controlled by medication is another indicator for intervention. Infection with obstruction also necessitates prompt medical intervention. Furthermore, urinary obstruction causing severe acute kidney injury and the potential risk of kidney damage are factors that warrant intervention. Other uncommon factors such as renal transplant, solitary functioning kidney or bilateral obstructing ureteric stones are also indications for prompt treatment. There are several possible interventions to address these conditions. Ureteral stenting is often the first-line procedure when intervention is required. This procedure involves placing a stent from the bladder to the kidney to relieve obstruction and facilitate drainage, all while minimizing harm to the fetus. In cases where ureteral stenting is not feasible or appropriate, particularly in severe obstruction or infection scenarios, percutaneous nephrostomy can be performed. This procedure involves interventional radiology input to place nephrostomies to drain the renal pelvis to relieve obstruction and manage the infection effectively.

Following the acute phase, the renal or ureteric calculi can be dealt with follow-up endoscopic surgery. Minimally invasive techniques such as ureteroscopy and flexible pyeloscopy can be considered if necessary, especially in the second trimester when the uterus is less likely to interfere with the procedure. Stone fragmentation with laser (e.g., holmium laser) and extraction with baskets are preferentially used to clear obstructing stones. Extracorporeal Shock Wave Lithotripsy is generally avoided during pregnancy due to concerns about fetal exposure to shock waves, particularly in the

early stages of pregnancy. It may be considered in certain cases where the risks are outweighed by the benefits and no other options are viable. A retrospective study [12] shows Percutaneous Nephrolithotripsy might potentially be safe in pregnancy during the 2nd trimester. This technique involves puncturing the kidney using image guidance, followed by dilatation and the use of a nephroscope to assess the collecting system directly. Laser or an ultrasonic, pneumatic device is used directly on the stone. These are generally used for larger stones in the renal pelvis or pelvic ureteric junction, which would otherwise require multiple endoscopic procedures to clear the larger stone burden. In this review which included seven studies with sixteen patients, there were no complications in the mother or fetus, suggesting that this technique could potentially be safe.

Timing and Trimester Considerations

Timing and trimester considerations play a crucial role in the management of kidney stones during pregnancy. In the first trimester, stone management can be particularly challenging due to the potential concerning effects of various medications as well as radiation from imaging and procedures. As a result, conservative management is typically preferred. However, intervention may become necessary in cases of infection, obstruction, or unmanageable pain to ensure the safety of both the mother and the fetus. It is important to note that while it is crucial to be mindful of fetal radiation exposure, it is essential that diagnostic studies should not be avoided for optimal patient management and outcomes. Generally, the fetus radiation dose of below 50 mGy is considered safe, and doses above 150 mGy would be considered the minimum amount of dosage at which negative fetal outcomes would occur [13]. Majority of diagnostic studies performed to investigate renal calculi during pregnancy would generally fall below this level. The second trimester is often considered the safest period for invasive procedures such as ureteroscopy and stenting. During this time, the uterus is less likely to interfere with access to the renal system, and the risks to the fetus are lower compared to the first and third trimesters. This makes it an optimal window for addressing kidney stones that require more direct intervention. In the third trimester, management becomes more challenging due to the enlarged uterus, which can hinder access and visualization of the urinary tract. Procedures at this stage may carry higher risks, making conservative management the preferred approach. However, if intervention is necessary, more invasive options such as nephrostomy may be considered to effectively manage the condition while minimizing risks to both the mother and the fetus.

Perioperative care and monitoring

Perioperative care of renal stones in pregnancy requires a multidisciplinary approach to ensure the safety of both the mother and the fetus. This care involves careful preoperative assessment to

identify any underlying conditions that may complicate surgery. During the procedure, minimizing the use of radiation and opting for ultrasound guidance is crucial to avoid fetal exposure. Anaesthesia management is tailored to reduce risks, and meticulous surgical techniques are employed to minimize complications such as bleeding and infection. Postoperatively, close monitoring is essential to detect any early signs of complications, and effective pain management strategies are implemented to ensure patient comfort. Regular follow-ups are necessary to monitor the health of both the mother and the fetus, ensuring a smooth recovery process.

Postpartum Management

After delivery, the management of kidney stones can typically follow standard protocols used for non-pregnant individuals. Stones that required acute interventions, such as stenting or nephrostomies during the third trimester, can be addressed post-delivery. Postpartum evaluation, including stone analysis and metabolic workup would be beneficial, especially in cases of recurrent stone disease. This evaluation helps identify underlying metabolic abnormalities and provides guidance on preventative measures to reduce the risk of future stone formation in subsequent pregnancies.

Prevention

Preventative measures are essential in reducing the risk of renal calculi during pregnancy. One of the primary strategies is dietary modification. Pregnant women should aim to consume a balanced diet that is low in oxalate-rich foods, such as spinach and nuts, and ensure an adequate intake of calcium and magnesium to help bind oxalate in the gut and reduce stone formation. Maintaining proper hydration is equally crucial, as it helps to dilute the urine and prevent the concentration of minerals that lead to stone formation. Drinking large quantities of water aiming for 2.5-3 litres throughout the day can significantly lower the risk of developing kidney stones. Additionally, regular antenatal care and monitoring play a vital role in the early detection and management of renal calculi. Routine check-ups allow healthcare providers to identify and address potential issues before they become severe. Prenatal care also includes educating pregnant women about recognizing early symptoms of kidney stones and seeking timely medical advice. By combining preventative measures with consistent prenatal monitoring, the risk of renal calculi can be significantly reduced.

Conclusion

Large kidney stones that are unlikely to pass spontaneously necessitate medical intervention. Indications for treatment include

persistent symptoms, acute kidney injury, and the presence of infection. Acute management options involve ureteric stenting or percutaneous nephrostomy insertion to ensure adequate drainage. Subsequent treatments primarily consist of ureteroscopy and laser lithotripsy. The timing of these subsequent treatments is crucial and should ideally be performed either in the second trimester of pregnancy or postpartum.

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