Unveiling the Uncommon: Gas-Containing Renal Stones - A Unique Case Study

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Running Title: GAS-CONTAINING RENAL STONES

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Authors Contributions:

Maryam Movahedi: contributed in data acquisition, writing the draft of the manuscript, writing and editing of the final draft of the manuscript, and supervision of the project.

Fahimeh Zeinalkhani: contributed in clinical evaluation and management of the patient, and supervision.

Peyman Kamali Hakim: contributed in Conceptualization and Resources

Fatemeh Zare Bozorgabadi: contributed in management of the patient, Data curation.

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Key clinical statement: Gas-containing renal stones is a rare condition. There is an association between renal stones containing gas, urinary tract infection and renal fusion anomalies so that, it is essential to know the radiographic features for prompt diagnosis and treatment.

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Introduction:

Gas-containing renal stones, documented in only twelve cases before this\(^1\), remain a medical rarity, often associated with recurrent Urinary Tract Infections (UTIs)\(^2\). This contribution sheds light on the thirteenth reported case, exploring clinical nuances, imaging nuances, and tailored management approaches.

Case Presentation:

A 31-year-old female with history of three times urinary tract infection (UTI), who has undergone two times Percutaneous Nephrolithotomy (PCNL) and one Transurethral Lithotomy (TUL) due to previous renal stones, and without history of diabetes mellitus, vesicourethral reflux or hypertension, came at the emergency department with right flank pain and macroscopic hematuria. Plain Computed Tomography (CT) revealed numerous stones containing gas in all calyces and pelvis with maximum dimensions of 22x14mm in the right kidney accompanied by horse shoe kidneys (Figure 1a&b&c & Figure 2). Urine analysis also showed a significant white blood cell count, and moderate bacteria.

Management: The patient initially received conservative management with antibiotics and hydration. Imaging studies, including enhanced CT, validated the stone’s location. Given the unusual nature of the Case, a multidisciplinary approach involving urologists, nephrologists, and infectious disease specialists is needed to determine the most appropriate course of action. The absence of fat stranding and free fluid in perinephric space further supported the gas-containing stones diagnosis. Ultimately, patient went under Percutaneous Nephrolithotomy (PCNL) and close monitoring for signs of infection were scheduled to assess progression.

Conclusion: Gas-containing renal stones present an uncommon diagnostic and management challenge. This case report contributes to the sparse literature on this subject, emphasizing the need to consider this rare condition in the differential diagnosis of renal stones. Future investigations should delve into the underlying renal fusion anomalies, metabolic and infectious factors contributing to gas-containing stone formation, guiding optimal therapeutic strategies.\(^3\)

Discussion: Gas-containing renal stones present a diagnostic conundrum, necessitating differentiation from emphysematous pyelonephritis\(^3\). UTIs play a pivotal role in the development of these stones, evident in most of the reported cases, including this one\(^2\). Bacteria within stones metabolize generating gas and in most cases E.coli was responsible\(^4\). Presence of gas inside the stones indicates a combination of two pathologies, called
tissue metabolism and metabolic activity. Imaging features, showing distinct gas pockets within the stone, underscore the uniqueness of gas-containing stones compared to other renal pathologies.

**Figure legends:**

Figure 1a: Axial view of non contrast abdominopelvic CT scan demonstrated gas within renal stone in the right kidney, Plain computed tomography (CT)

Figure 1b: Coronal view of non contrast abdominopelvic CT scan demonstrated gas within renal stone in the right kidney, Plain computed tomography (CT)

Figure 1c: Coronal view of non contrast abdominopelvic CT scan demonstrated gas within renal stone in the right kidney, Plain computed tomography (CT)

Figure 2: Axial view of non contrast abdominal CT-scan showed horse shoe kidneys, Plain computed tomography (CT)

**References:**


