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Zinner Syndrome: A Radiological Case Report with Multimodal Imaging Insights

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Abstract:

- ***Background:***
  Zinner Syndrome is a rare congenital condition of the male urogenital tract, defined by unilateral renal agenesis, ipsilateral seminal vesicle cyst, and ejaculatory duct obstruction, resulting from mesonephric duct maldevelopment.

- ***Case Presentation:***
  A 27-year-old male presented with urinary frequency, dysuria, painful ejaculation, and secondary infertility. His history included recurrent urinary tract infections and a solitary kidney. Physical examination revealed a retrovesical mass.

- ***Imaging Findings:***
  Transabdominal ultrasound identified a 5.5-cm left seminal vesicle cyst and absent left kidney. CT urogram confirmed renal agenesis and a non-enhancing retrovesical cyst. Pelvic MRI demonstrated a T1-hyperintense, T2-intermediate cyst with hemorrhagic contents, ejaculatory duct obstruction, and associated prostatitis.

- ***Conclusion:***
  Multimodal imaging, particularly MRI, is essential for diagnosing Zinner Syndrome in young males with urogenital symptoms or infertility. Accurate radiological assessment guides management, ranging from conservative surveillance to surgical intervention.

Keywords: *Zinner Syndrome, Renal Agenesis, Seminal Vesicle Cyst, Ejaculatory Duct Obstruction, Magnetic Resonance Imaging, Ultrasound, Computed Tomography*.

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I. INTRODUCTION

Zinner Syndrome, first reported in 1914, is a rare congenital anomaly characterized by unilateral renal agenesis, ipsilateral seminal vesicle cyst, and ejaculatory duct obstruction due to aberrant mesonephric (Wolffian) duct development during the 4th to 13th gestational weeks [1,2]. This embryological defect affects the formation of the kidney, ureter, seminal vesicle, and vas deferens, resulting in an ipsilateral triad [3]. Historically underdiagnosed, Zinner Syndrome is increasingly detected due to advancements in imaging modalities like ultrasound, CT, and MRI [4].

Patients typically present in their 20s or 30s with non-specific symptoms such as dysuria, painful ejaculation, or infertility, often leading to delayed diagnosis [5]. This case report describes a 27-year-old male with Zinner Syndrome, highlighting the critical role of multimodal imaging in achieving a definitive diagnosis and informing clinical management.

II. CASE PRESENTATION

A 27-year-old male presented to the urology clinic at NRI Institute of Medical Sciences with a two-month history

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of progressive urinary frequency, hesitancy, dysuria, and painful ejaculation, accompanied by secondary infertility. He reported recurrent urinary tract infections treated with antibiotics and a childhood diagnosis of a solitary kidney, not further investigated.

Physical examination showed stable vital signs, mild hypogastric tenderness, and a palpable, tender retrovesical mass on digital rectal examination, distinct from a normal-sized prostate. Laboratory tests, including complete blood count, serum electrolytes, urea, and creatinine, were within normal limits. Urinalysis revealed no hematuria or pyuria, ruling out active infection. Semen analysis confirmed oligospermia, consistent with infertility. Imaging was initiated to evaluate the retrovesical mass and renal anomaly.

➢ *Imaging Findings*

Multimodal imaging was performed using standardized protocols to confirm Zinner Syndrome.

➢ *Ultrasound*

Transabdominal ultrasound revealed a well-defined anechoic cystic lesion measuring approximately 29 x 22 mm in the left periprostatic region, abutting and raising the bladder base, and absence of the left kidney with compensatory right kidney hypertrophy [Fig.3(a) and (b)]. The left seminal vesicle was edematous, and the left vas deferens was dilated, indicating ejaculatory duct obstruction. Mild prostatic heterogeneity suggested chronic prostatitis.

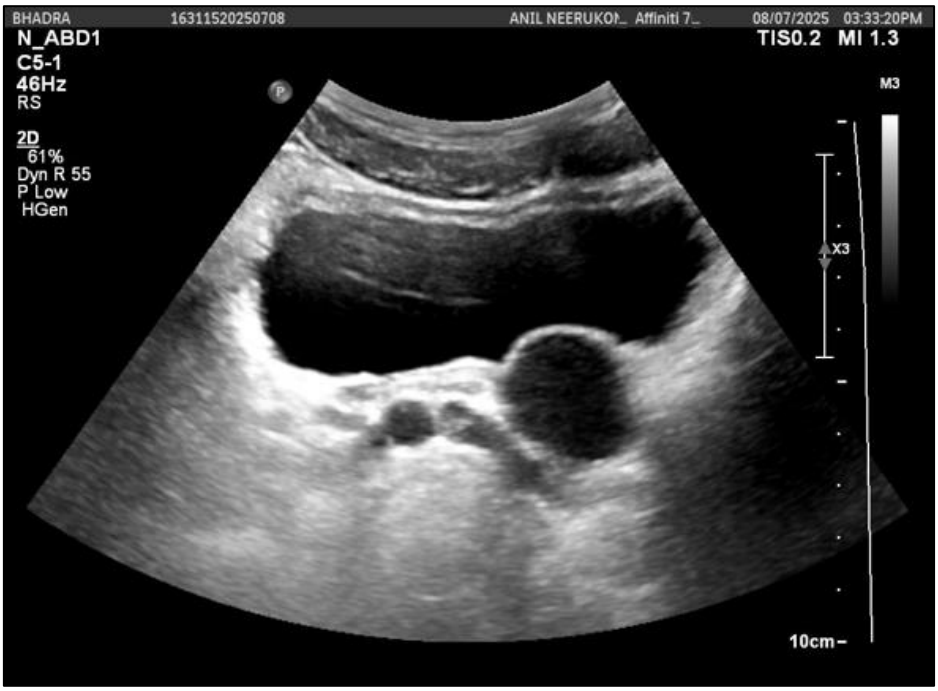

Fig 1 An Anechoic Cystic Lesion Noted in Peri-Prostatic Region.

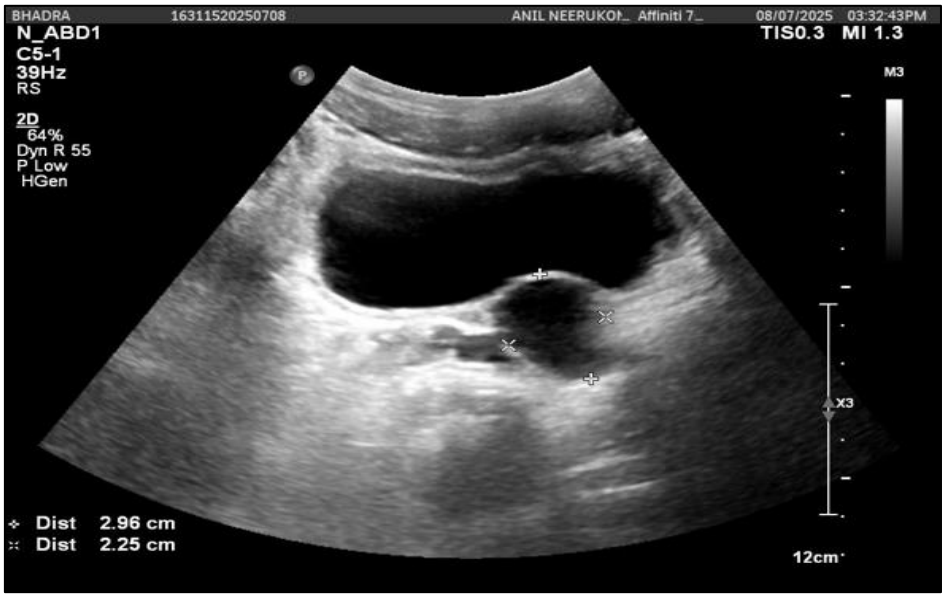

Fig 2 Anechoic Cystic Lesion Measuring Approximately 29 x 22 mm, Abutting and Raising the Lower Border of Urinary Bladder.

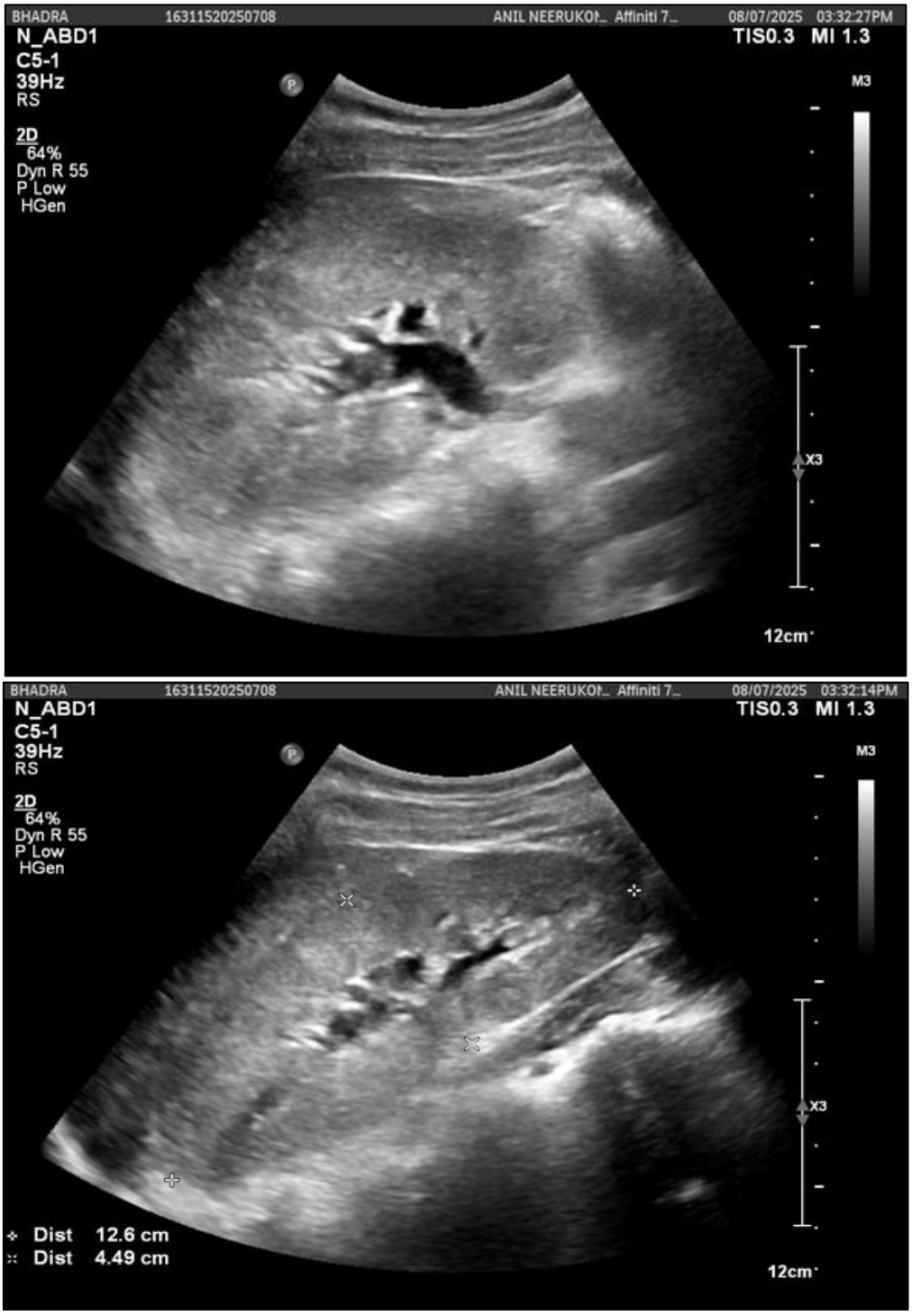

Fig 3 (A) and (B) Compensatory Increase in Size of Right Kidney.

➢ *Computed Tomography (CT)*

A CT urogram (120 kVp, 200 mAs, 3-mm slice thickness, 100 mL iohexol at 3 mL/s, 70-s delay) confirmed left renal agenesis, with bowel loops occupying the renal fossa and right kidney hypertrophy. A 29 x 22 mm retrovesical cyst, hyperdense on pre-contrast images and non-enhancing post-contrast, exerted mild mass effect on the bladder.

➢ *Magnetic Resonance Imaging (MRI)*

Pelvic MRI (3T, T1-weighted: TR 500 ms, TE 10 ms; T2-weighted: TR 4000 ms, TE 100 ms) established the diagnosis (Figs. 4–5). The left seminal vesicle cyst was hyperintense on T1-weighted and intermediate on T2-weighted images, with fluid levels indicating hemorrhagic contents. The left ejaculatory duct was dilated, hyperintense on T1-weighted and hypointense on T2-weighted images, communicating with the cyst. Coronal MRI confirmed left renal agenesis. Additional findings included T2-hyperintense prostate with periprostatic edema, consistent with chronic prostatitis, and a dilated left vas deferens.

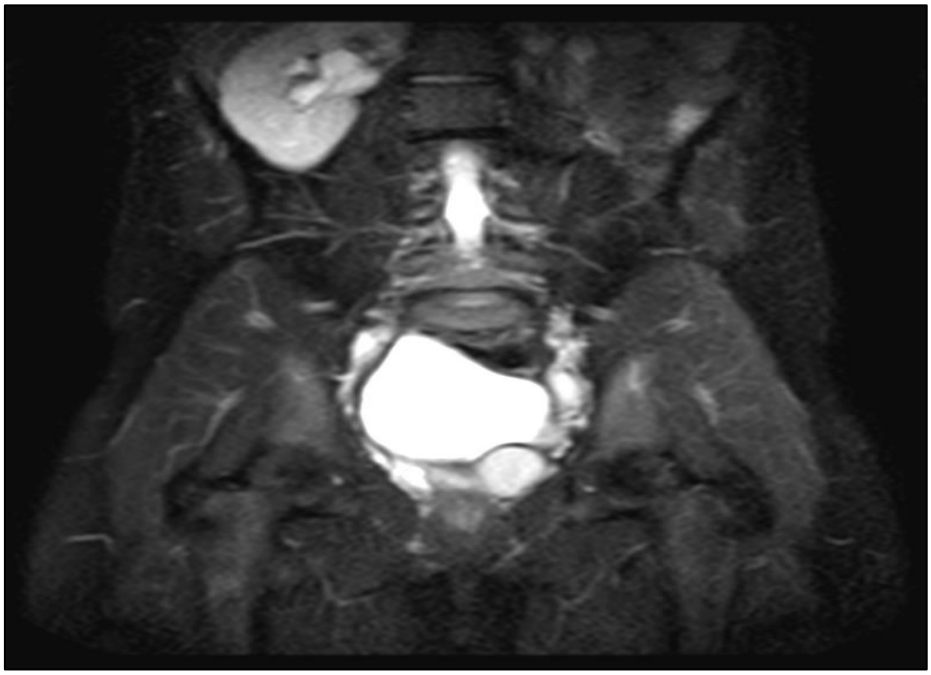

Fig 4 Coronal MRI Showing T2 Hyperintense Left Seminal Vesicle Cyst Abutting the Base of the Bladder

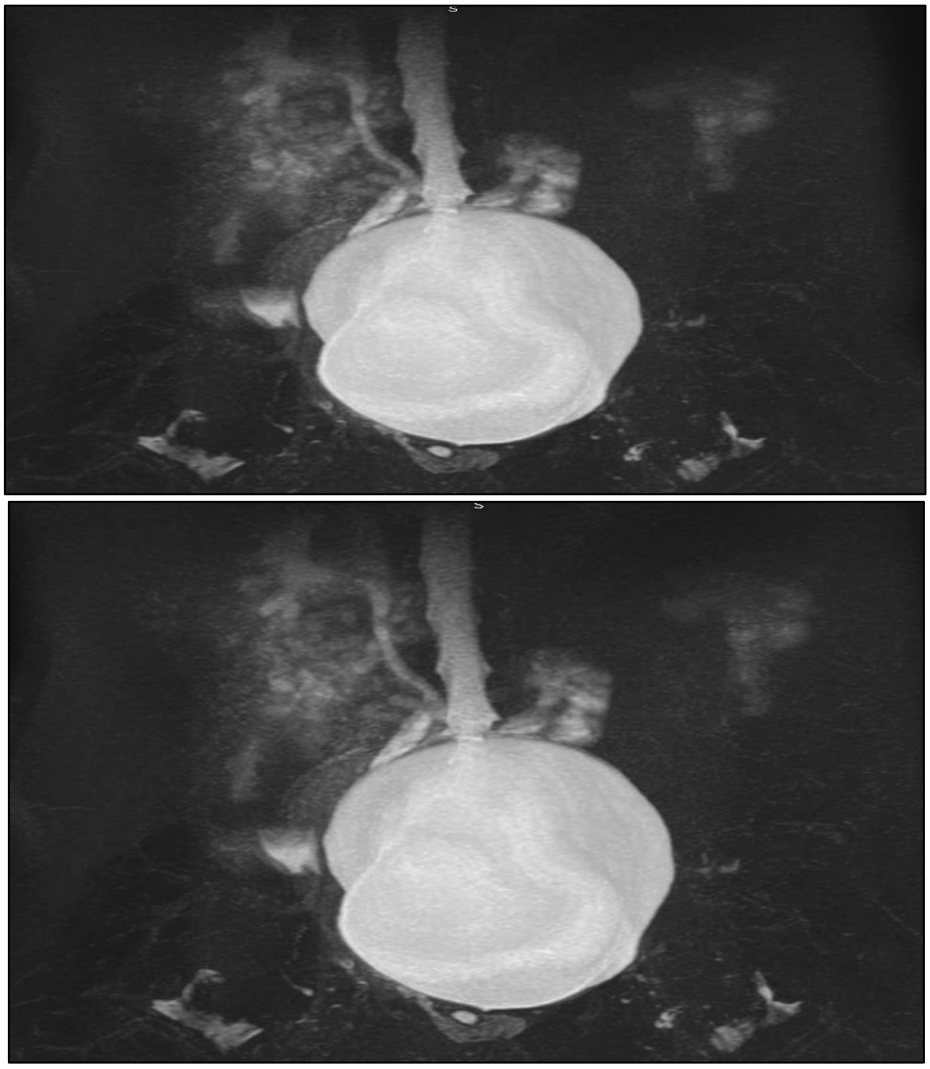

Fig 5 Coronal MRI Showing Renal Agenesis on Left Side with Compensatory Hypertrophy of Right Kidney.

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III. DISCUSSION

Zinner Syndrome arises from mesonephric duct maldevelopment, causing distal duct atresia, ejaculatory duct obstruction, seminal vesicle cystic dilatation, and ureteral bud failure, resulting in renal agenesis [2,3]. Diagnosed primarily in males aged 20–40, it presents with dysuria, painful ejaculation, or infertility, often mimicking chronic prostatitis [5]. Improved imaging has increased detection, suggesting historical underdiagnosis [4].

➢ *Imaging Role*

Ultrasound is an accessible initial tool, identifying cystic lesions and renal agenesis [7]. TRUS provides detailed seminal vesicle and ejaculatory duct visualization. CT confirms renal anatomy but lacks soft tissue contrast [4]. MRI, the gold standard, offers superior characterization of cyst contents (e.g., T1-hyperintense hemorrhage vs. T2-hyperintense fluid) and delineates the Zinner triad [8]. Associated anomalies, such as ectopic ureter or vas deferens absence, warrant comprehensive evaluation [6].

➢ *Differential Diagnosis*

Pelvic cystic lesions require careful differentiation (Table 1). Zinner Syndrome is distinguished by its ipsilateral triad, unlike midline Mullerian or prostatic utricle cysts [9]. MRI's multiplanar imaging ensures accurate diagnosis.

Table 1 Differential Diagnosis of Pelvic Cystic Lesions in Males

Condition	Location	Imaging Features	Associated Findings
Zinner Syndrome	Ipsilateral seminal vesicle	Cyst with renal agenesis, ejaculatory duct obstruction	Unilateral renal agenesis
Mullerian Duct Cyst	Midline	No renal agenesis, no urethral communication	Normal kidneys
Prostatic Utricle Cyst	Midline	Communicates with urethra	Normal kidneys
Ejaculatory Duct Cyst	Ejaculatory duct	Small cyst, no renal agenesis	Normal kidneys

➢ *Management*

Management varies by symptom severity [5]. Asymptomatic cases require surveillance with annual ultrasound. Mild symptoms may respond to alpha-blockers (e.g., tamsulosin) [11]. Severe cases benefit from transurethral resection of the ejaculatory duct (TURED, 70% success rate) or laparoscopic vesiculectomy for large cysts [12]. This patient received tamsulosin and surveillance, with symptom improvement at six months and referral for fertility counselling.

➢ *Clinical Considerations*

Zinner Syndrome's non-specific symptoms necessitate a high index of suspicion. Rare associations with malignancies (e.g., renal cell carcinoma, <1% of cases) do not justify routine screening without additional risk factors [10]. Comprehensive imaging ensures detection of associated anomalies, guiding long-term care.

IV. CONCLUSION

Zinner Syndrome, characterized by unilateral renal agenesis, seminal vesicle cyst, and ejaculatory duct obstruction, is increasingly recognized due to advanced imaging. MRI, the definitive diagnostic tool, confirms the triad and distinguishes Zinner Syndrome from other pelvic cystic lesions. This case of a 27-year-old male with urinary symptoms and infertility underscores the importance of multimodal imaging and tailored management, from surveillance to surgery, to optimize outcomes.

➢ *Teaching Point*

Zinner Syndrome should be suspected in young males with lower urinary tract symptoms or infertility, with pelvic MRI confirming the triad of unilateral renal agenesis, ipsilateral seminal vesicle cyst, and ejaculatory duct obstruction.

➢ *Declarations*

- Patient Consent: Written informed consent was obtained for publication.
- Conflict of Interest: The authors declare no conflict of interest.
- Funding: None.
- Ethical Approval: Not required for this anonymized case report, per institutional guidelines.
- Author Contributions:

✓ Dr. VVT Sai Lekha drafted the manuscript and analyzed imaging.

✓ Dr. Akanksh Chokkapu MD assisted with the draft and supervised.

✓ Dr. Sasidhar MD reviewed the final draft.

✓ Disclosures: The authors declare no conflict of interest. No funding was received.

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