Complete ureteral duplication with distal ureteral fusion: a rare case report

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ABSTRACT

Background: Ureteral duplications are among the most common anomalies of the urinary tract. However, complete ureteral duplication, in which two ureters originating from the same kidney merge distally and then open separately into the bladder, is a rarer variation. This case report presents a female patient with a distal ureteral stone who underwent successful surgical management, highlighting the clinical significance and surgical approach to this rare anatomical variation.

Case Presentation: This case report discusses in detail the successful surgical management of a patient with a stone in the right distal ureteral segment and right complete ureteral duplication, a rarer variation where two ureters arising separately from the same kidney form a confluence point in the distal segment and subsequently open independently into the bladder.

Conclusion: Complete ureteral duplication can often be overlooked during preoperative imaging. This case highlights the importance of detailed radiological assessment and surgical planning in managing such anomalies.

Keywords: Case report, complete ureteral duplication, obstruction, ureteral calculi, ureterorenoscopy.

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Background

Ureteral duplications are among the most common anomalies of the urinary tract [1]. They are more frequently observed in females compared to males and have a higher prevalence among Caucasian women [2]. The incidence of unilateral ureteral duplication is approximately six times higher than that of bilateral cases [3]. Complete duplication refers to a system in which two ureters originating from the same kidney open separately into the bladder, whereas partial duplication involves two proximal branches that empty into the same renal pelvis but merge distally to enter the bladder as a single ureter [1] (Figure 5). The Meyer-Weigert rule predicts the drainage pattern of duplex ureters in bipolar renal duplication. The upper pole is typically ectopic and, therefore, dysplastic due to obstruction, while the lower pole is associated with vesicoureteral reflux [4]. Complete ureteral duplication is typically unilateral, although bilateral cases have also been reported. Duplex renal systems are often asymptomatic and incidentally detected; however, they may be associated with clinically significant conditions such as obstruction, reflux disease, and urinary system stones [5].

Urinary system stones may develop due to urinary stasis associated with ureteral duplication or as a result of other independent factors [6]. Although the radiological diagnosis of ureteral duplication is typically established through computed tomography (CT), some cases may be overlooked due to imaging pitfalls [7]. In standard CT scans, complex anatomical variations of the ureters can be missed. In recent years, advanced imaging techniques such as high-resolution CT and magnetic resonance (MR) urography have improved the detection of ureteral anomalies [8].

This case report details the successful surgical management of a 53-year-old female patient with right complete ureteral duplication, which was not detected preoperatively by the radiologist on CT imaging, and who had a stone located in the distal ureter and at the junction of the duplicated ureters. This case is significant as it highlights both diagnostic challenges and the surgical decision-making process. The possibility of missing ureteral duplication on standard CT imaging presents a critical diagnostic pitfall for radiologists and clinicians. This study contributes to the literature by discussing the imaging challenges in diagnosing ureteral duplication and the role of advanced techniques in enhancing diagnostic accuracy.

Case Presentation

Timeline of presentation and symptoms

A 53-year-old female patient presented with right flank pain, dysuria, nausea, and vomiting. She had no known comorbidities or history of previous surgeries. Due to persistent symptoms lasting for 3 months, she had visited the emergency department multiple times and had been treated with antibiotics for a presumed urinary tract infection. On physical examination, right costovertebral angle tenderness was noted.

Diagnostic evaluation and imaging findings

Laboratory investigations revealed microscopic hematuria and leukocyturia. Renal function tests showed a mild elevation, while the complete blood count was within normal limits. Preoperative CT reported a 7 mm stone in the distal right ureter and grade 2 hydronephrosis in the right kidney (Figure 1). In the initial CT evaluation, the radiologist did not identify ureteral duplication, and the stone was reported as being located in a single distal ureter. However, during surgery, it was discovered that two separate ureters opened into the bladder.

Surgical intervention

The patient underwent semi-rigid ureteroscopy and laser lithotripsy under general anesthesia and antibiotic prophylaxis. In the lithotomy position, a 6.5 F Karl Storz ureteroscope was introduced through the urethra into the bladder. One left and two right ureteral orifices were identified. Under fluoroscopic guidance, 0.038-inch guidewires were placed into both right ureters (Figure 2). A stone was observed in the distal portion of the lateral right ureter. At the stone's location, a connection point approximately 1 cm medial to the right ureter was visualized (Figure 3). Edema was noted in the mucosa of both ureters at the stone's site. The stone was fragmented using a holmium laser, and the stone fragments were extracted. The lateral right ureter was explored up to the proximal segment, and no additional stones were detected. The medial right ureter was then accessed, revealing an edematous mucosal connection at the stone's location with the lateral right ureter. The medial right ureter was also examined up to the proximal segment, and no stones were identified. To prevent potential obstruction following lithotripsy and to mitigate postoperative obstruction due to the anatomical

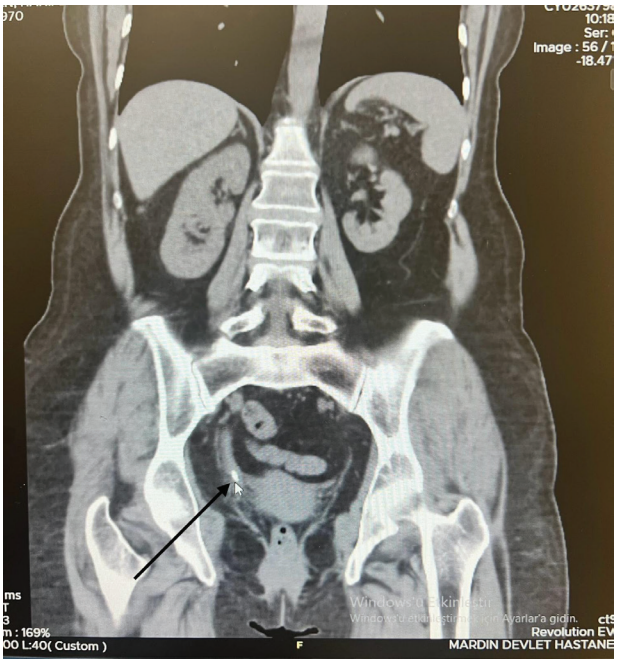

Figure 1. *Preoperative coronal abdominal CT scan showing a 7-mm ureteral stone in the distal right ureter (black long arrow).*

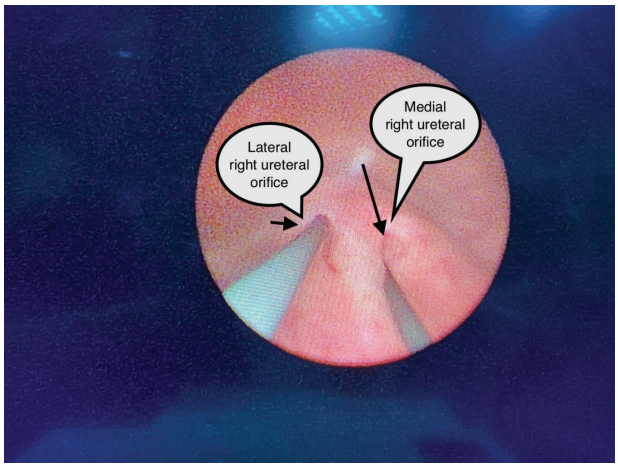

Figure 2. *During cystoscopy, the orifices of the right complete ureteral duplication are catheterized using guidewires. (Short arrow: lateral right ureteral orifice, long arrow: medial right ureteral orifice.)*

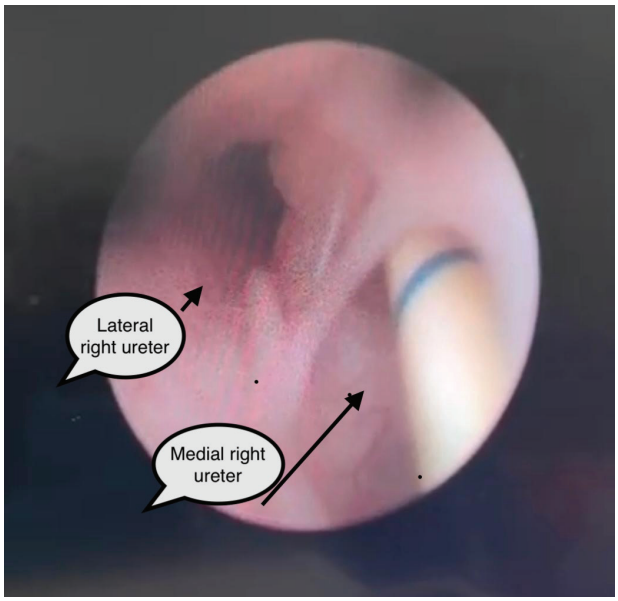

Figure 3. *In the case of right complete ureteral duplication, the junction of both ureters at the site of the distal stone is visualized. (Short arrow: Lateral right ureter, long arrow: Medial right ureter with the double J stent passing through it.)*

anomaly, 4.8 F, 26 cm double J stents were placed in both right ureters under fluoroscopic guidance.

Postoperative follow-up and outcomes

The patient recovered without complications. A plain radiograph of the urinary system obtained on postoperative day 1 confirmed complete stone clearance and appropriate positioning of the stents (Figure 4). The double J stents were removed under local anesthesia after 2 weeks. The patient was provided with follow-up recommendations for the prevention of potential urinary system stones and the monitoring of renal function. She remained asymptomatic, and no stone recurrence was observed during follow-up.

Discussion

With the increasing prevalence of interventional radiological procedures, vascular surgeries, urological interventions, and kidney transplants, findings related to renal tract variations are being encountered more frequently [9]. In this case, the missed diagnosis of the right complete ureteral duplication on preoperative CT highlights the diagnostic challenges associated with such anomalies. Due to the anatomical variability of ureteral orifices, standard imaging modalities may not always provide sufficient diagnostic accuracy. It is well known that ureteral stones can complicate retrograde ureterorenoscopic (URS) access. Therefore, particularly in patients with complex anatomy, careful evaluation of each orifice during surgery is essential. There is no established standard for the treatment of urinary stones in the presence of ureteral duplication. In recent years, with advancements in flexible instrument technology and holmium lasers, flexible ureterorenoscopy (F-URS) has become more widely available for many patients. Due to its minimally invasive nature, repeatable applicability, and acceptable complication rates, holmium laser lithotripsy with F-URS has been proven to be an effective treatment for most stones in anomalous kidneys [10]. A study reported a case in which an undiagnosed complete ureteral duplication was overlooked on preoperative CT, leading to the missed detection of a ureteral stone. The duplication was identified only after discovering the stone in the ureter where a double J stent had not been placed. This study underscores the importance of meticulous preoperative imaging assessment and highlights the diagnostic challenges associated with ureteral duplication [7].

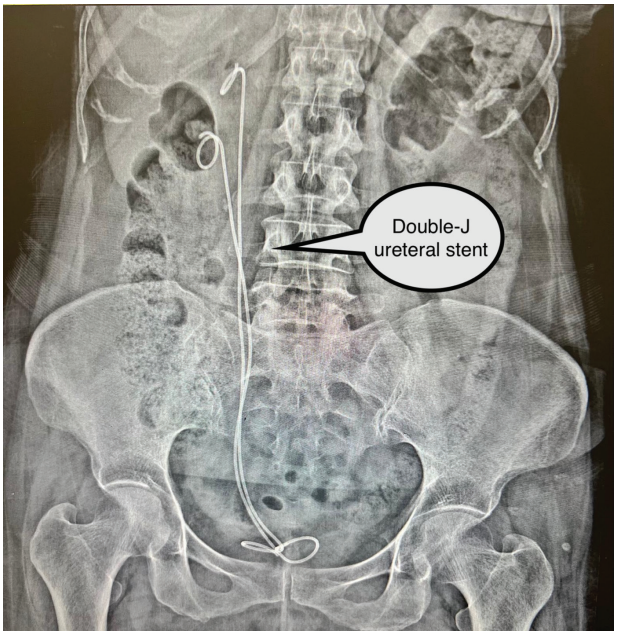

Figure 4. *Postoperative day 1 follow-up plain urinary system radiograph showing double-J stents placed in both right ureters.*

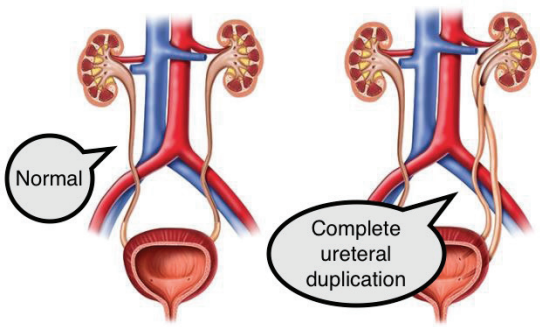

Figure 5. *An anatomical illustration comparing normal ureteral anatomy with complete ureteral duplication.*

Cases in the literature have reported delays in the diagnosis of complete ureteral duplication, with the anomaly often being identified intraoperatively. Aiken et al. [6] described a patient with bilateral complete ureteral duplication and obstructing stones in both limbs, for whom ureteroscopy was not feasible due to the narrow ureters. To facilitate passive dilation and ensure the safe passage of the ureteroscope, they recommended the placement of a double J stent before surgery [6]. Huang et al. [11] evaluated a patient presenting with acute periumbilical colicky pain, in whom the initial ureteroscopy failed to detect a stone. Following the patient's clinical deterioration in the postoperative period, a follow-up radiograph revealed a stone adjacent to the double J stent, raising suspicion of complete ureteral duplication. The diagnosis was subsequently confirmed through a second ureteroscopy [11]. Similarly, Abdi et al. [12] reported a case of left complete ureteral duplication with stones in both left ureters. They successfully cleared the stones in a single session and placed a double J stent [12]. These cases highlight the potential for delays in diagnosing complete ureteral duplication and emphasize the need for vigilance regarding anatomical variations that may become apparent during surgery.

Less invasive procedures can be considered in such cases. Although F-URS is technically feasible, the location of the stone at the distal junction required a more controlled approach using rigid ureteroscopy. Alternatively, percutaneous nephrolithotomy may be a suitable alternative for patients with a high stone burden. In our case,

successful surgical management was achieved by identifying the right complete ureteral duplication and the stone, followed by the placement of double J stents in both ureters.

Conclusion

Complete ureteral duplication, particularly with distal fusion, presents unique diagnostic and surgical challenges. Awareness of such anomalies is essential for urologists to avoid misdiagnosis and optimize treatment outcomes. Additionally, stronger communication and a multidisciplinary approach between radiologists and urologists can contribute to improving the preoperative diagnosis of rare anomalies such as ureteral duplication.

What's new?

Complete ureteral duplication, particularly when associated with distal fusion, presents unique diagnostic and surgical challenges. Awareness of such anomalies is crucial for urologists to avoid misdiagnosis and optimize treatment outcomes.

List of Abbreviations

CT	Computed tomography
F-URS	Flexible ureterorenoscopy
URS	Ureterorenoscopy

Conflicts of interest

The authors declare that they have no conflict of interest regarding the publication of this case report.

Funding

None.

Consent for publication

The patient and his parents gave informed consent for the publication.

Ethical approval

Ethical approval is not required at our institution to publish an anonymous case report.

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Summary of case

1	Patient (gender, age)	53 years, female
2	Final diagnosis	Complete ureteral duplication with distal ureteral fusion and distal ureteral stone.
3	Symptoms	Dysuria and right flank pain.
4	Medications	Treatment of ureteral stones.
5	Clinical procedure	Surgical treatment and follow-up
6	Specialty	Urology