

CASE REPORT

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# Bilateral duplex kidney and ureter with multiple stones: a case report

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## Abstract

**Background** Bilateral duplicated kidney and ureter is a rare condition in urology, and it is even rarer for patients to have multiple stones simultaneously. We delineate the diagnostic and therapeutic trajectory of a patient presenting with bilateral duplex kidneys and ureters, characterized by the presence of multiple stones. Notably, the left kidney is a complete duplication, whereas the right kidney exhibits an incomplete duplication.

**Case presentation** A 47-year-old male patient was diagnosed with bilateral duplex kidney and ureter combined with multiple stones. Ureteral flexible lithotripsy and percutaneous nephrolithotomy were performed successively in our hospital. On the postoperative five day, he was discharged from the hospital without apparent discomfort. The double J tube was pulled out one month later, and no stone recurrence was found after 3 months of follow-up.

**Conclusions** Bilateral duplicated renal ureteral malformations combined with multiple stones are very rare. Stones can be removed by ureteroscopic lithotripsy or percutaneous nephrolithotripsy and sometimes multiple procedures are required, which should be chosen according to the patient's relevant condition.

**Keywords** Duplex kidney, Duplex ureter, Multiple renal calculi

## Background

Duplex kidney and ureter is a relatively common congenital anomaly of the urinary tract, primarily occurring unilaterally, while bilateral cases are exceedingly rare. The occurrence of bilateral duplex kidney and ureter accompanied by multiple stones is virtually unprecedented [1]. We reported a case of bilateral duplex kidney and ureter with multiple stones. The patient had congenital bilateral duplex kidney malformation, in which the left side was complete and the right side was incomplete. We reviewed the existing literature and shared our experience in the diagnosis and treatment of this patient.

## Case presentation

The patient, a 47-year-old male, was admitted to the hospital with 'kidney and ureteral stones detected by physical examination for 2 years'. One year ago, he was admitted to the hospital because of lower back pain and was treated with extracorporeal shock wave lithotripsy at another hospital without any other treatment. After the recurrence of low back pain, he received treatment in our hospital.

KUB(Kidney-Ureter-Bladder; Fig. 1) and CT (Computed Tomography; Figs. 1 and 2) showed bilateral duplex kidney, bilateral renal cysts, bilateral renal calculi, left ureteral calculi, and left hydronephrosis. CTU (Computed Tomography Urology) showed dilated renal pelvis and calyces in both kidneys, and two sets of renal pelvis and ureteral systems were seen in both kidneys. The right double ureters seemed to converge at the lower segment, and the left ureter was poorly filled.

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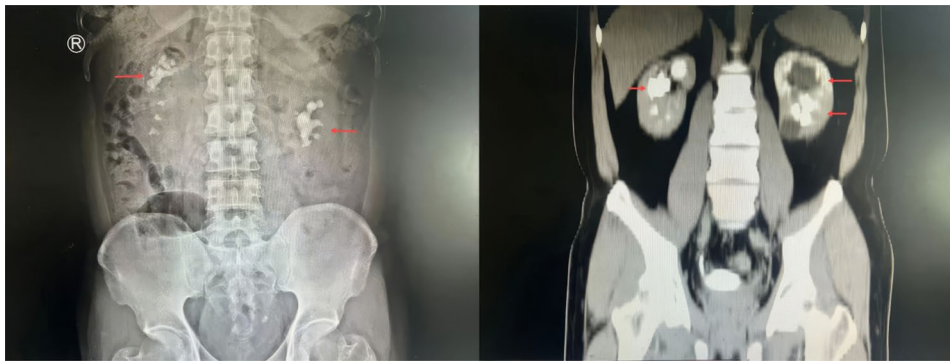
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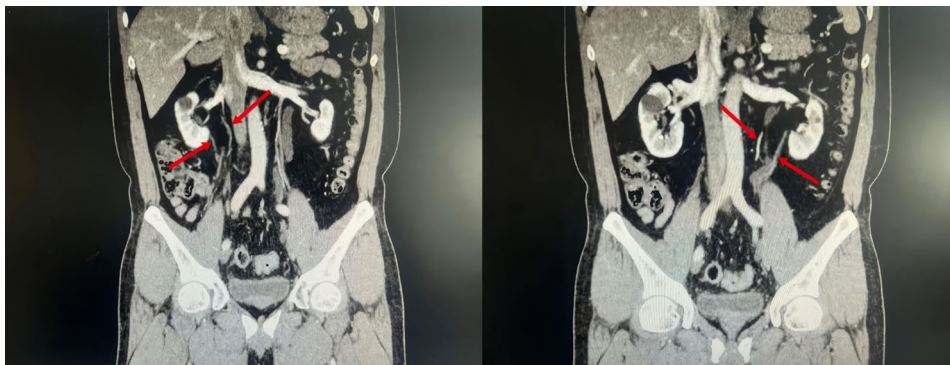
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**Fig. 1** Preoperative KUB (left) and CT examination (right): Preoperative KUB and CT examination showed that the patient had multiple stones on both sides and partial hydronephrosis on the left upper kidney



**Fig. 2** CT examination: CT showed that the patient had bilateral duplex kidney and ureter malformation, that is, the patient had 4 kidneys and 4 ureters

Complete history and relevant examination. The patient had no other systemic abnormalities, denied any family history of similar diseases or congenital anomaly history, and the test results suggested no urinary tract infections. The indicators of creatinine, electrolytes, and calcitonin were normal. Considering the patient's bilateral duplicated renal malformations, the stones are very complex, he underwent transurethral ureteroscopic lithotripsy, percutaneous nephrolithotripsy (20fr nephroscope/22fr amplatz sheath), and dual-channel percutaneous nephrolithotripsy successively in our hospital.

**1st session**—Treatment of left ureteral calculi: Two openings of the left ureter were found during the operation, and multiple stones in the renal pelvis were seen by inserting a guide wire into the upper ureteral orifice of the bladder along the left opening. A double J tube was placed in the ureter, and a guide wire was inserted into the ureteral orifice under the bladder along the left opening. The ureteral calculi (about 1.2 cm in size) were found and crushed and removed. **2nd session**—Treatment of multiple stones in the left kidney: The double J tube was removed in the second stage, and the gravel channel was established. Multiple stones in the left kidney were seen, and the larger one was about 3.0 cm. The stones were taken out after laser, ultrasonic attraction and pneumatic ballistic crushing, and the left renal fistula and double J

tube were retained. **3rd session**—After entering the ureterscope about 10 cm from the ureteral orifice on the right side, a ureteral bifurcation could be seen, with no stones visible in the medial ureteral orifice and stones visible in the lateral ureteral orifice, and double J-tubes were left in place on both sides. Ultrasound-guided routine establishment of a right renal puncture channel revealed multiple stones in the right kidney, approximately 3.0 cm in size, which were removed using routine percutaneous nephrolithotripsy. The puncture channel was re-established and a second puncture of the ipsilateral renal calyx was performed, and a stone of approximately 1.0 cm in size was successfully found and removed by the same method.

Postoperative KUB plain film was reviewed (Fig. 3). Figure 3 shows a fair position of the double J-tube and fair stone clearance. The patient was given routine treatment such as rehydration, dressing change and anti-infection, and was discharged without any special discomfort. The stone composition was detected as calcium oxalate monohydrate. The bilateral stent tubes were removed 1 month after discharge without obvious discomfort. Three months after the operation, no recurrence of stones was seen, and the patient complained of the disappearance of lower back pain.



**Fig. 3** KUB after ureteroscopy(left) and KUB before discharge(right): Postoperative left ureteral stone (left), postoperative right kidney multiple stone (right)

### Discussion and conclusions

Duplicated kidney and ureter is a relatively common malformation in urology, which can be divided into two types: complete and incomplete. The prevalence of duplicated kidneys in the general population ranges from 0.2 to 2%, and it is more common unilaterally, with females outnumbering males [2, 3]. This represents a rare instance of bilateral renal ureteral duplication anomalies, featuring fully duplicated kidneys on the left and partially duplicated ones on the right, accompanied by bilateral multiple stone formations.

The unique anatomical structure of duplicated kidney and ureteral malformation, along with ureteral stenosis and poor urine drainage, is prone to fluid reflux and urinary tract infections, which increases the probability of urinary stone complications. [4, 5]. We analysed the causes of the complex stone in this case as: recurrent urinary tract infections; ureteral stenosis due to duplicated renal malformations; and inability to expel the stone early after its formation.

We believe that PCNL (Percutaneous Nephrolithotomy) is the treatment of choice for this case of complex multiple stones, and that dual-channel PCNL allows for more stone removal in a single procedure; the key is successful puncture. In this patient, we successfully removed multiple stones from the right kidney by performing two ultrasound-guided punctures with lithotripsy. This allowed complete stone clearance in one stage compared to conventional PCNL.

In this case, the stone was so large that ureteroscopy should only be used in the management of stage I ureteral stones. In the management of duplicated renal ureteral malformations combined with smaller stones, the key is to determine the location of the ureteral opening and the location and size of the stone preoperatively. For complete duplicated renal ureteral malformations, CTU can be applied preoperatively to clarify the location of stones, and the ureteral opening should be found according to the Weigert-Meyer rule. In patients with incomplete duplicated renal malformations, the distal end of

the flexible ureteroscopic sheath should be placed in the position of ureteral fusion to avoid avulsion of the ureteral bifurcation due to passive dilatation of the sheath [4].

There is a notable scarcity of pertinent literature concerning bilateral duplicated renal malformations accompanied by multiple stones. In this particular instance, we achieved a remarkable level of stone removal via a series of surgical interventions, and the subsequent postoperative follow-up was effective. In our opinion: 1. In this case, only CTU was performed. It is recommended that patients with duplicated renal malformations should actively improve the relevant preoperative investigations, including IVU (Intravenous Urography) to determine the ureteral alignment, cystoscopy to determine the location of the ureteral opening, and MRU (Magnetic Resonance Urography) to determine the morphology of the entire urinary tract. 2. For patients with bilateral duplicated renal malformation combined with stones in both kidneys, priority is given to treating the side with severe hydronephrosis in the upper and lower kidneys. For patients with duplicated renal malformation combined with renal and ureteral stones, priority is given to treating ureteral stones, and it is not ruled out that a phase of simultaneous treatment of smaller renal stones should be carried out at the same time. 3. When bilateral duplicated renal malformations are combined with stones of similar size or when it is not possible to judge, the side with complete duplicated malformations is given priority, and the side with incomplete malformations can be placed in a double J-tube first, and if stones are present in both upper and lower kidneys, two double J-tubes need to be left in place. 4. Retaining the double J-tubes and then carrying out elective ureteral lithotripsy at a later stage can improve the success rate of the operation and reduce intraoperative complications. 5. In patients with multiple renal stones combined with upper and lower kidneys at the same time, one-stage dual PCNL is feasible, and the key lies in retrograde intubation to create artificial hydronephrosis and successful puncture. Of course, our study

has some limitations: a single case study, a short follow-up time, etc. Therefore, more studies are still needed to validate our findings.

Patients afflicted with bilateral duplicated renal malformations, coupled with bilateral multiple stones, require multiple surgical interventions for complete stone removal. For these patients, PCNL emerges as the procedure of choice, and a one-stage dual-channel PCNL approach is not only feasible but also capable of minimizing the number of required procedures. Furthermore, postoperative preventive measures, tailored according to the results of stone composition analyses, can significantly decrease the chances of stone recurrence.

#### Abbreviations

KUB	Kidney—Ureter—Bladder
CT	Computed Tomography
CTU	Computed Tomography Urology
PCNL	Percutaneous Nephrolithotomy
MRU	Magnetic Resonance Urography
IVU	Intravenous Urography

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None.

#### Author contributions

All authors reviewed the manuscript. All authors have agreed both to be personally accountable for the author's own contributions and to ensure that questions related to the accuracy or integrity of any part of the work. LIU: have made substantial contributions to the conception, design of the work the acquisition, analysis, interpretation of data. ZHANG: design of the work the acquisition, the acquisition, analysis, interpretation of data. YU: the acquisition, analysis, interpretation of data. CHEN: the acquisition, analysis, interpretation of data. XU: the acquisition, analysis, interpretation of data. LI: have drafted the work or substantively revised it. the acquisition, analysis, interpretation of data.

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#### Data availability

The datasets used during the current study are available from the corresponding author on reasonable request.

#### Declarations

##### Ethics approval and consent to participate

Not applicable.

##### Consent for publication

The article has been read by the patient himself and agreed to be published in 'BMC Urology'. Our patient gave written informed consent for their personal or clinical details along with any identifying images to be published in this study. (The specific written informed consent can be seen in the relevant documents uploaded.)

##### Competing interests

The authors declare no competing interests.

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#### References

1. Shi L, Jia J, Li C, et al. Bilateral renal pelvis duplication with ureteral ectasia: a case report[J]. *Asian J Surg.* 2023;46(12):5887–8.
2. Kozlov VM, Schedl A. Duplex kidney formation: developmental mechanisms and genetic predisposition[J]. *F1000Res.* 2020;9:F1000 Faculty Rev-2 [pii].
3. Wang SB, Wang Wanl. Laparoscopic treatment of bilateral duplex kidney and ectopic ureter: a case report[J]. *World J Clin Cases.* 2022;10(23):8344–51.
4. Pan Y, Chen G, Chen H, et al. The left ureterocele and stone of calyceal diverticulum in the patient with bilateral incomplete duplex kidneys managed by flexible ureteroscopy: a case report and literature review[J]. *BMC Urol.* 2020;20(1):35.
5. Doery A J, Ang E, Ditchfield MR. Duplex kidney: not just a drooping lily[J]. *J Med Imaging Radiat Oncol.* 2015;59(2):149–53.

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