



Endourology

Asymptomatic migration of ureteral stent to superior vena cava after ultrasound-guided percutaneous nephrolithotomy: An extremely rare case and review of the literature

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ABSTRACT

Ureteral stent migration should be considered a rare complication of urologic procedures. We report a 69-year-old woman diagnosed with ureteral stent migration two weeks after undergoing percutaneous nephrolithotomy while she was symptom-free. The stent passed through the heart and extended to the superior vena cava and right brachiocephalic vein. After excluding thrombus formation, the stent was retrieved using an endovascular approach. Stent migration to the superior vena cava while being asymptomatic is extremely rare. Considering this complication is crucial to prevent consequent fatal events. This case report highlights this rare complication of ureteral stent placement and reviews its management.

1. Introduction

In cases of urinary obstruction, a ureteral or double J (JJ) stent might be used for effective drainage of urine from the kidneys into the bladder. A JJ stent can be inserted retrogradely using a ureteroscope or antegradely during a percutaneous nephrolithotomy (PCNL) procedure.¹ JJ stenting, like any other medical procedure, is not without risks. The most frequently reported complications of JJ stenting are hematuria, urinary tract infection, encrustation, perforation of the ureters, and mispositioning of the stent, resulting in trigone irritation and dysuria.² Some rare complications of JJ stenting include renal perforation and stent migration.^{3,4} Here, we present a rare case of JJ stent migration to the superior vena cava after antegrade deployment of the stent.

2. Case presentation

A 69-year-old female opioid user with a history of ischemic heart

disease and a single functional kidney presented to our clinic with the chief complaint of progressive pain in the left flank, lower abdomen, and chest, radiating to the left shoulder, along with dysuria and frequency. She did not report urinary incontinence, cold sweats, nausea, vomiting, or dyspnea. During our workup, a spiral abdominopelvic computed tomography (CT) scan revealed a small right kidney (75 mm) with corticomedullary damage containing several tiny gravels in the upper and lower poles, as well as a prominently enlarged left kidney (146 mm) with a stone measuring approximately 20 × 11 mm in the middle pole and two other stones in the lower pole measuring up to approximately 13 × 7 mm (Fig. 1).

The patient was admitted to the hospital for a left-side PCNL. Upon admission, her laboratory studies were normal. One day later, she underwent left PCNL with post-operative antegrade placement of a JJ stent and nephrostomy under ultrasound guidance. Recovery occurred uneventfully, and the patient was discharged in stable condition four days after the operation. She was also advised to remove the stent in 4–6

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weeks.

After approximately two weeks of being asymptomatic, she underwent an abdominopelvic ultrasound as a post-operative follow-up, which surprisingly revealed that the JJ stent was not in its correct location. Consequently, she was admitted to the hospital again, and imaging and laboratory tests were conducted. The abdominopelvic and chest X-rays showed migration of the JJ stent, which had passed through the abdomen into the chest, resembling the pathway of the vessels. A CT scan of the abdominopelvic and chest revealed a foreign body passing through the left renal vein to the superior vena cava and right brachiocephalic vein, at the junction of the jugular vein (Fig. 2). The lab studies were normal, and the electrocardiogram showed normal sinus rhythm with no dynamic changes.

A cardiologic consultation was requested for the patient. The cardiologist performed a transthoracic echocardiography, which showed a foreign body in the inferior vena cava and right atrium with no clots in the heart. CT angiography ruled out thrombosis in the catheter pathway. Moreover, no retroperitoneal hemorrhage was noted in the imaging studies.

Antithrombotic and antibiotic therapy was started for the patient, and she was transferred to a cardiology center where a JJ snaring operation through the right femoral vein was performed by the interventional cardiologist. The patient was followed up two months later, and no complications were found.

3. Discussion

PCNL is usually regarded as the standard of care in the treatment of staghorn nephrolithiasis, during which a JJ stent might be placed to ensure the steady and innocuous flow of urine from the kidney to the bladder. However, this procedure is not without risks. Most frequently reported adverse events are easily manageable conservatively or medically. However, a few case reports have described the migration of a JJ stent following PCNL. JJ stent migration can occur after retrograde or antegrade insertion.⁵ In our case, the JJ stent was inserted via an antegrade route during PCNL. The previous literature regarding intravascular JJ stent migration and misplacement after antegrade stenting in PCNL is summarized in Table 1^{6–10} Such misfortune can lead to catastrophic and lethal outcomes. Here, we presented a 69-year-old female with JJ migration following PCNL, with the tip of the JJ in the junction of the right brachiocephalic and jugular vein. Our patient was asymptomatic until the diagnosis after two weeks, at which point the JJ

stent was removed via an endovascular approach by an interventional cardiologist.

During retrograde JJ stent placement, there is a risk of perforating the ureteral wall and an adjacent inter-communicating vein, which can allow the stent to directly enter the vascular system. This perforation may occur if the guide is inadvertently pushed into the ureter or during a challenging ureteroscopy complicated by poor visibility and the absence of fluoroscopic guidance.¹¹ In the case of antegrade placement, as observed in our case, the guide likely perforated a terminal branch of the renal vein before entering the main renal vein and the cardiovascular system.¹² Notably, as shown in Table 1, ultrasound guidance was predominantly used for JJ placement in PCNL in previous cases with stent migration, similar to our patient.

The symptoms of migration and displacement of JJ stents can vary from being asymptomatic to causing fatal complications, such as arrhythmia and hypotension. In a case report by Yang and Qiu,⁹ the authors reported a misplacement of a JJ stent into the inferior vena cava, which ended in the right atrium of the patient. Their patient experienced hypotension and arrhythmia. Similar symptoms were also seen in the patient reported by Chang et al.⁶ who had intracardiac migration of a ureteral stent during PCNL. However, in our case, although the stent passed through the heart and reached the superior vena cava, surprisingly, the patient had no symptoms or electrophysiologic abnormalities.

Thrombus formation is a major complication seen with JJ stent misplacement or migration. Therefore, it must be ruled out before deciding the best approach to this condition. Three main approaches can be utilized: open procedure, endovascular, and endoscopic approaches. Tilborghs et al.⁵ performed a literature review on previous cases of intravascular JJ stent migration and proposed an algorithm for its treatment, with the first step being to rule out thrombus formation. A summary of their algorithm is shown in Fig. 3.

As no parts of the JJ stent were in the urinary tract in our patient, an endovascular approach was chosen after excluding thrombus formation. Fortunately, the JJ stent did not pass through any major cardiac valve and could be removed without open surgery. However, in cases where there is a possibility of valve damage, open surgery is preferred. For instance, in the case report by Hastaoglu et al.,¹³ the authors described a case of JJ stent migration where the tip of the JJ stent was in the right ventricle. Due to the possibility of tricuspid valve damage via endovascular approaches, they used median sternotomy as the safer option.

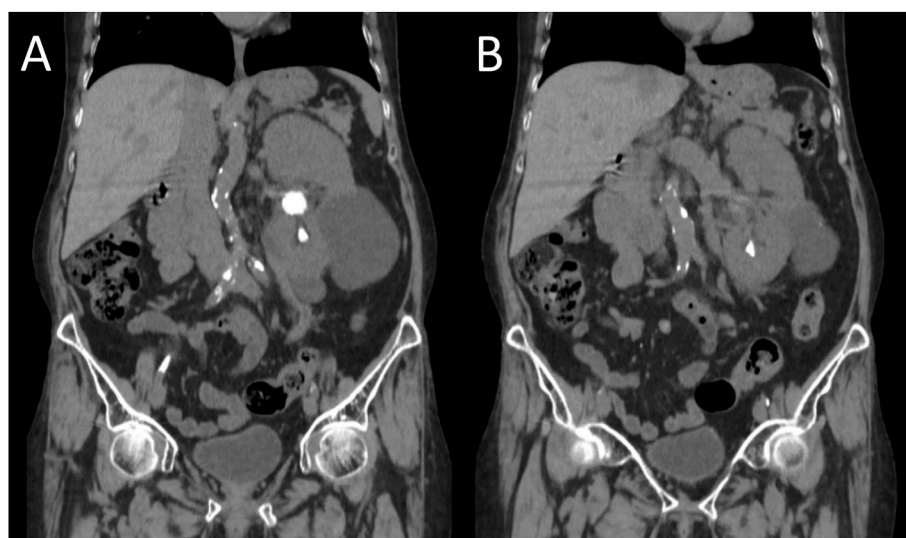


Fig. 1. Abdominopelvic computed tomography (CT) scan showing the left kidney with a stone measuring approximately 20 × 11 mm in the middle pole and two other stones in the lower pole measuring up to approximately 13 × 7 mm.

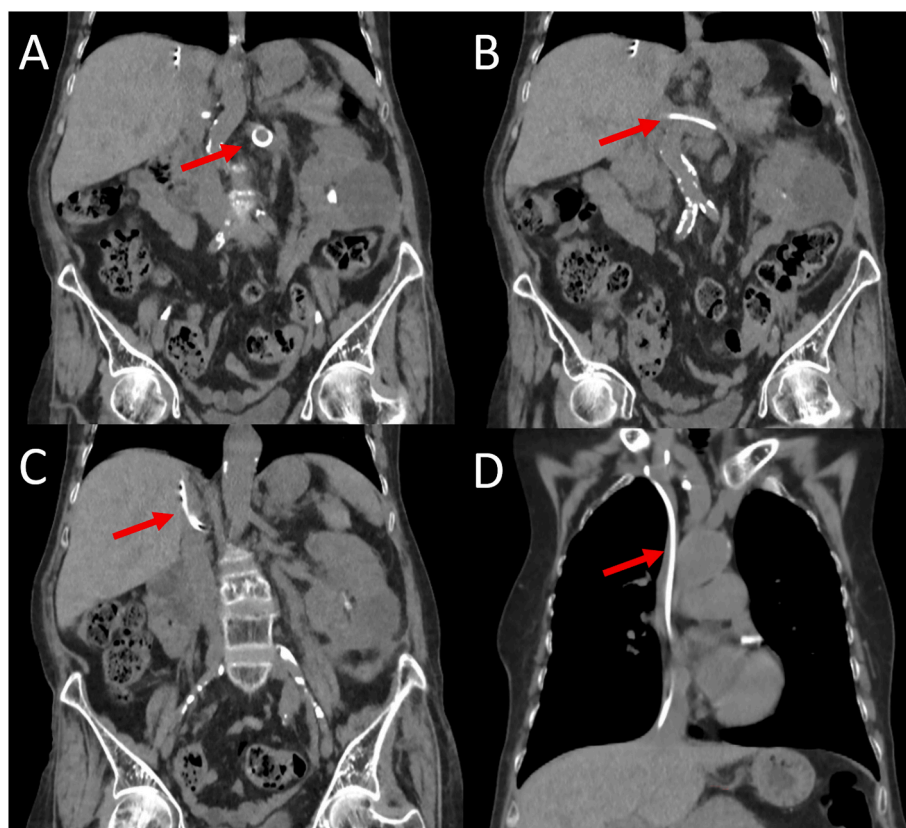


Fig. 2. A computed tomography (CT) scan of the abdominopelvic and chest revealed a foreign body passing through the left renal vein to the superior vena cava and right brachiocephalic vein, at the junction of the jugular vein; red arrows indicate the path of the migrated ureteral stent.

Table 1

Literature review of intravascular ureteral stent migration after antegrade stenting in percutaneous nephrolithotomy.

First author, Year	Type of guidance	Distal tip of stent	Signs and symptoms	Symptom presentation	Management	Follow-up
Tang, 2012	N/A	Inferior vena cava	Asymptomatic	Asymptomatic for 6 weeks	Endovascular	No problem after 3 years
Li, 2013	N/A	Inferior vena cava	N/A	N/A	Endovascular	Discharged with no symptoms
Hu, 2020	Ultrasonography	Inferior vena cava	Impingement pain in the right kidney area	N/A	Endovascular	No problem after 1 year
Yang, 2020	Ultrasonography	Right atrium	Palpitation, pain in lower limbs, hypotension, arrhythmia	Two days after the operation	Endovascular	Discharged 4 days after surgery
Chang, 2021	Ultrasonography	Pulmonary artery	Atrial fibrillation, hypotension	Intra-operation	Endovascular	No problem after 1 week
Our patient	Ultrasonography	Superior vena cava and right brachiocephalic	Asymptomatic	Asymptomatic for 2 weeks	Endovascular	No problem after 2 months

4. Conclusion

Ureteral stent migration should be considered a rare complication of urologic procedures, including PCNL. Although stent migration can cause serious intra- or post-operative symptoms, especially arrhythmia and hypotension, it can be asymptomatic even after passing through the heart, as in our case where the distal part of the stent reached the superior vena cava. To prevent this complication, radiologic imaging after stent placement is recommended. In cases where migration occurs, ruling out thrombus formation is crucial to determine the therapeutic approach.

Informed consent

Written informed consent was obtained from the patient.

CRediT authorship contribution statement

Amir Hossein Hassani: Writing – original draft, Validation, Methodology, Investigation, Data curation. **Hooman Kamran:** Writing – review & editing. **Javad Kojuri:** Methodology, Investigation. **Helia Bazroodi:** Writing – original draft, Investigation. **Hossein Fatemian:** Writing – original draft, Investigation. **Alireza Rasekhi:** Investigation. **Nima Naderi:** Investigation. **Saeed Kooshafar:** Investigation. **Anahita Dehghani:** Writing – original draft. **Abdolreza Haghpanah:** Writing – review & editing, Validation, Supervision, Methodology, Investigation, Data curation, Conceptualization.

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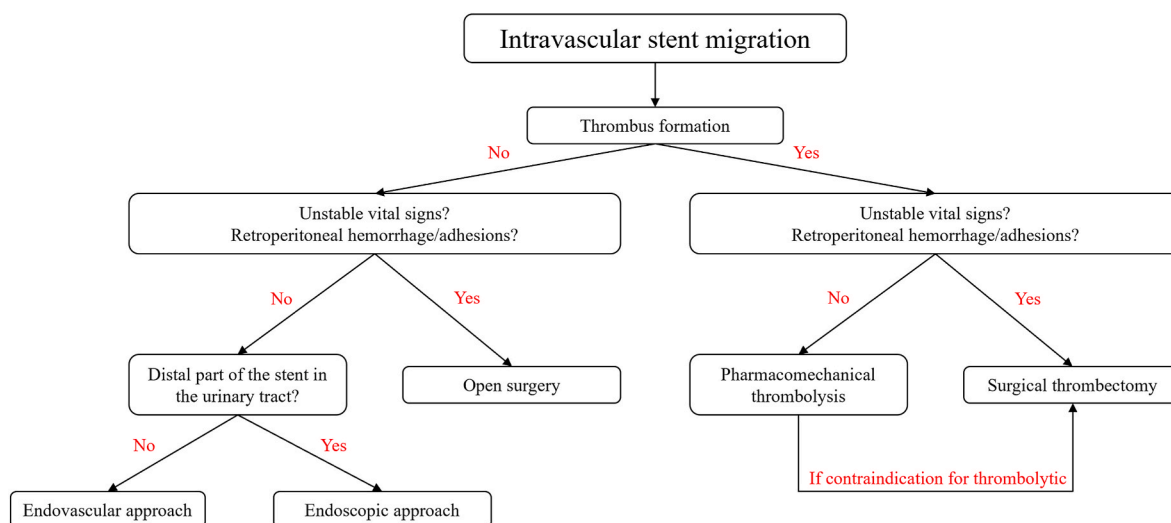


Fig. 3. A simplified algorithm for the management of intravascular ureteral stent migration according to the study by Tilborghs et al.⁵

Declaration of competing interests

None to declare.

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