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Imaging Findings of Sarcomatoid Carcinoma of the Ureter: A Case Report

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Abstract: *Background:* Sarcomatoid carcinoma of the ureter (SCU) is a highly aggressive and relatively uncommon malignant tumor of the urinary tract. Its frequency is quite low, and its prognosis is very bad when compared to other cancers of the urinary system. SCU clinical reports are still hard to come by. MRI and PEI/CT imaging of ureteral sarcomatoid cancer is presented in this case to promote diagnostic awareness and comprehension of the imaging characteristics of this uncommon illness. *Method:* The patient had ureteral sarcomatoid cancer, which was verified by pathological investigation after ureteroscopic biopsy. The patient's clinical information, imaging results, surgical outcomes, and pathological findings were gathered. A retrospective study was carried out in combinationwith pertinent national and international literature. *Results:* An 84-year-old female patient was admitted for "left flank discomfort lasting over one month." MRI revealed an irregular soft tissue mass in the middle-lower segment of the left ureter. T2-weighted imaging showed an unevenly slightly hyperintense signal. Diffusion-weighted imaging demonstrated restricted diffusion. Contrast-enhanced imaging exhibited heterogeneous enhancement. PET/CT demonstrated significantly increased fluorodeoxyglucose metabolism in the mass with secondary left upper urinary tract obstruction. Concurrent findings included a solitary metastatic lesion in hepatic segment S6 and multiple lymph node metastases along the left common iliac and external iliac arteries. Preoperative diagnosis suggested a malignant tumor of the ureter. The patient underwent left nephroureteroscopy with biopsy, and the postoperative pathological diagnosis was ureteral sarcomatoid carcinoma. *Conclusion:* Ureteral sarcomatoid carcinoma is a rare, highly malignant, and aggressive tumor with nonspecific imaging features, typically presenting as an invasively growing mass. Diagnosis relies on postoperative pathology and immunohistochemical examination. MRI and PET/CT scans are valuable for preoperative localization and characterization, tumor staging, treatment planning, and postoperative follow-up. The prognosis is extremely negative. The main treatment option is radical surgery, although constant monitoring is necessary since early recurrence and metastases are frequent after surgery.

Keywords: Ureter; Sarcomatoid carcinoma; Magnetic resonance imaging; Positron emission tomography; Imaging diagnosis

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1. Introduction

Among urinary tract malignancies, ureteral carcinoma is rather uncommon. Urothelial carcinomas account for 90% of all ureteral malignancies; squamous cell carcinoma, adenocarcinoma, and small cell carcinoma are less common [1]. The majority of instances of sarcomatoid carcinoma that start in the ureter are described as individual case studies both domestically and abroad, making it incredibly uncommon. In 1984, the first instance of sarcomatoid cancer in the renal pelvis was recorded [2]. Early detection and identification are crucial because of its very invasive nature and very dismal prognosis. The diagnosis and treatment of a patient with ureteral sarcomatoid cancer who was admitted to Guangdong Provincial Second People's Hospital in March 2025 are the subject of this retrospective investigation. It seeks to offer guidance and support for clinical management when combined with an evaluation of the literature.

2. Case data

2.1.Case summary

The patient, a female, 84 years old, was admitted on March 26, 2025, presenting with "left flank discomfort for over one month." Approximately one month prior, the patient developed left flank pain without an apparent cause. The pain was severe, intermittent in nature, and worsened with activity. There was no accompanying urinary urgency or dysuria, no chills or fever, no urinary retention, and no urinary dribbling. On March 24, 2025, the patient was treated at another hospital. An abdominal CT scan revealed a mass in the middle to upper segment of the left ureter. Antibiotic therapy was administered but proved ineffective. The patient was then transferred to our hospital for specialized evaluation and standardized treatment. Past medical history indicates hypertension and a history of appendectomy. Physical examination upon admission revealed no abnormalities.

2.2. Examination findings

(1) March 26, 2025, contrast-enhanced whole abdominal MRI (magnetic resonance imaging): An irregular abnormal signal is visible in the middle to lower segment of the left ureter, with poorly defined borders, measuring approximately 55 mm × 48 mm × 76 mm. On T1-weighted imaging sequences with small patchy areas of hyperintensity (**Figure 1**). On T2-weighted imaging and fat-suppressed sequences, it demonstrates a heterogeneous, mildly hyperintense signal (**Figures 2–3**). On diffusion-weighted imaging (DWI), band-like hyperintensity is observed (**Figure 4**). The ADC sequence shows low signal intensity (**Figure 5**), suggesting partial diffusion restriction within the lesion. Contrast-enhanced imaging reveals heterogeneous enhancement with patchy areas of non-enhancement (**Figure 6**).

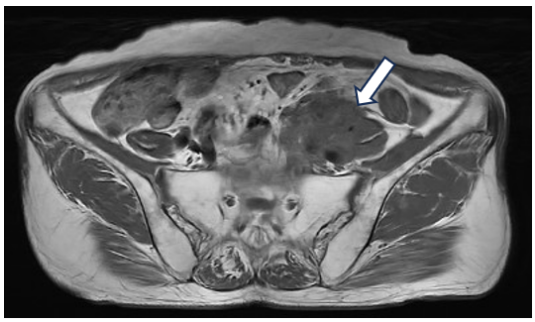


Figure 1. MRI T1W1 image.

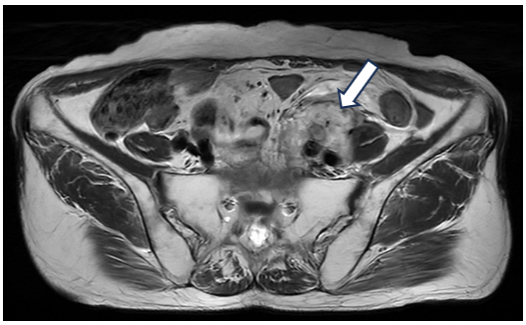


Figure 2. MRI T2W1 image.

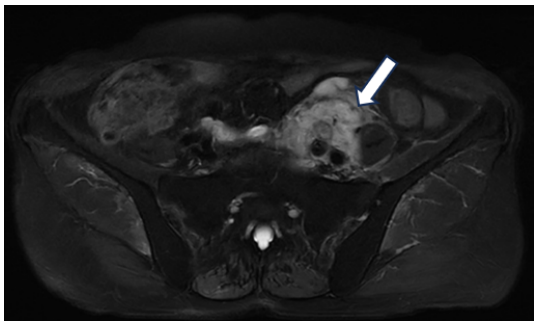


Figure 3. MRI T2-weighted imaging with fat suppression.

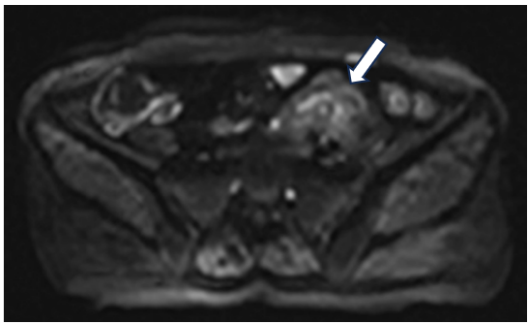


Figure 4. Diffusion weighted imaging, DWI.

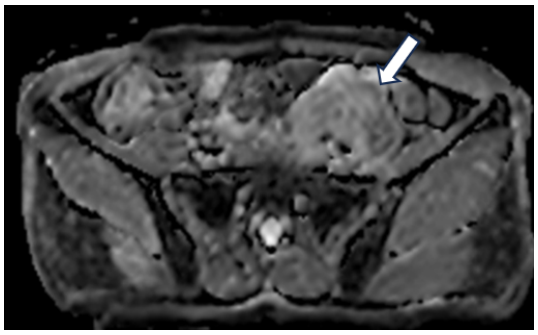


Figure 5. Apparent Diffusion Coefficient, ADC.

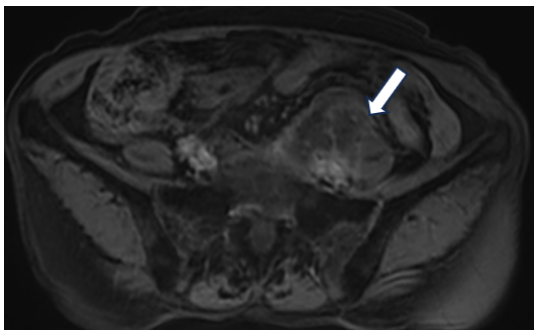


Figure 6. MRI enhanced scan image.

(2) March 28, 2025 PET-CT (Positron Emission Tomography-Computed Tomography) examination: An irregular mass-like soft tissue density shadow is observed in the middle-lower segment of the left ureteral course. The density is heterogeneous with slightly indistinct borders, measuring approximately 46 mm × 42 mm × 79 mm. Glucose metabolism shows abnormal elevation with SUVmax approximately 25.8. The lesion exhibits indistinct margins with the adjacent intestinal wall, left psoas muscle, and left pelvic wall peritoneum. At this level, the left ureter and left renal pelvis and calyces show dilatation and fluid accumulation. Partial intracapsular involvement of the right hepatic lobe is noted. An irregularly shaped, slightly hypodense nodular lesion with indistinct margins, measuring approximately 9 mm × 6 mm, is identified in hepatic segment S6. It demonstrates increased glucose metabolism with an SUVmax of approximately 5.1. Multiple lymph nodes were noted pararenally along the left common iliac and external iliac arteries. The largest measured approximately 9 mm × 8 mm with increased glucose uptake (SUVmax = 9.7). Findings suggest: - Malignant tumor of the left ureter (ureteral carcinoma? Other?) - Single metastatic lesion in liver segment S6 - Multiple metastatic lymph nodes pararenally along the left common iliac and external iliac arteries (**Figures 7–9**).

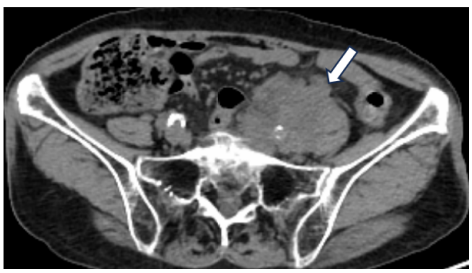


Figure 7. Plain CT scan image.

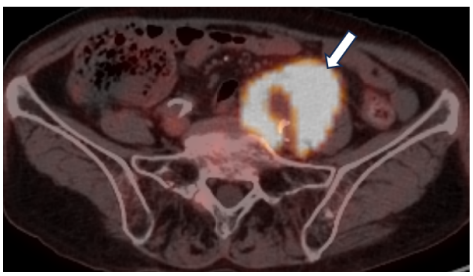


Figure 8. PET-CT image (coronal plane).

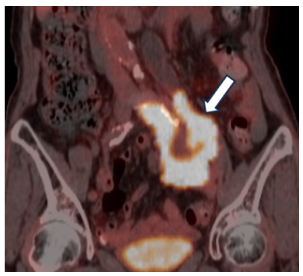


Figure 9. PET-CT image (Sagittal plane).

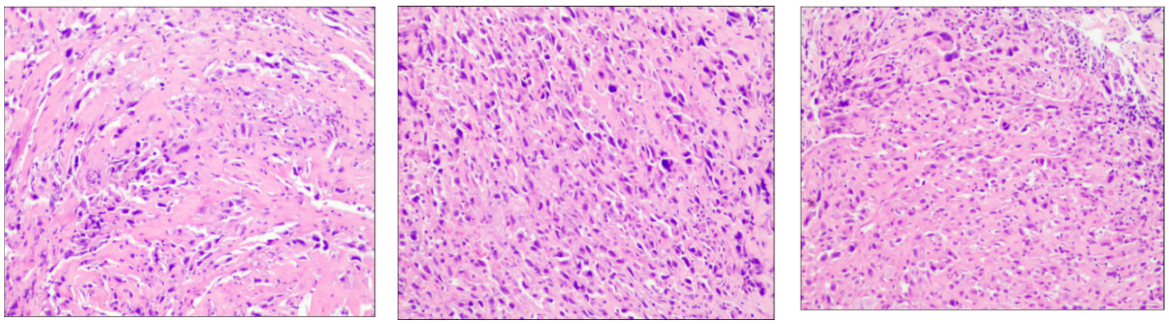
(3) Urine Cytology Examination (Routine Report) on April 3, 2025: Cytology examination revealed atypical cells, considering neoplasm. Further examination is recommended.

(4) On April 5, 2025, deep and superficial venous thrombosis assessment of the lower extremities was performed. Left side: Venous thrombosis of the left lower extremity (femoral vein, upper segment of the superficial femoral vein, tibiofibular trunk, one pulmonary vein, multiple calf intermuscular veins, complete occlusion); On April 6, 2025, underwent left lower extremity venography with filter placement: left femoral vein and iliac vein thrombosis; inferior vena cava filter placement performed.

2.3. Diagnosis and treatment

Considering the patient's age, medical history, and imaging findings, a malignant tumor of the middle to lower segment of the left ureter with multiple metastases was suspected. Due to the patient's advanced age and current conditions of hypertension and left lower extremity venous thrombosis, surgical intervention was ultimately not pursued. The patient underwent left nephroureteroscopy with biopsy on March 31, 2025. The pathological findings are as follows:

Ureteroscopy revealed a necrotic, putrid-appearing mass in the middle to lower ureter, obscuring the normal mucosal lining of the lumen. Immunohistochemistry results: CK/pan (+ in small areas), P63 (-), GATA3 (-), P53 (diffusely strong+, suggestive of mutant type), Ki-67 (hot spot ~70%+), Vimentin (+), CD34 (-), CD31 (-), s-100 (counterstained -), SMA (-), Desmin (-), E-Cadherin (+ in small areas), SMARCA4 (+), INI-1 (+), C-erbB-2 (0), HMB45 (-), CD30 (-). Special stains: Reticulum (perinestular +). (Ureteral mass) Malignant neoplasm. Based on comprehensive immunohistochemical findings and morphology, the specific type is considered sarcomatoid carcinoma (**Figures 10–12**).



Figures 10–12. Puncture pathology.

After excluding chemotherapy-related contraindications, the patient received paclitaxel 150 mg dl + carboplatin 100 mg dl every 4 weeks starting on April 9, 2025, supplemented with symptomatic treatments such as hepatoprotection and antiemesis. The process proceeded smoothly.

3. Discussion

Sarcomatoid carcinoma of the ureter (SCU) is an extremely rare and highly malignant tumor characterized by both epithelial carcinoma and mesenchymal sarcomatoid components. Since the 2004 revision of the WHO classification, it has been uniformly categorized as "sarcomatoid carcinoma" [3]. The vast majority of those affected by the illness are over 60. Unlike other literature reports indicating that primary ureteral sarcomatoid

carcinoma primarily occurs in elderly males, this case involved an elderly female. Most lesions are solitary and predominantly located in the left ureter, consistent with previous reports. Ureteral sarcomatoid carcinoma exhibits high invasiveness and rapid growth. The majority of patients had distant metastases or regional lymph nodes upon diagnosis, most frequently affecting the bones, liver, and lung [4].

3.1. Clinical manifestations

Early-stage SCU often presents with subtle symptoms, typically being diagnosed at intermediate or advanced stages. Due to ureteral lumen narrowing, tumor growth readily causes upper urinary tract obstruction. Initial presenting symptoms predominantly manifest as gross hematuria and pain in the affected flank or abdomen—symptoms characteristic of urinary tract disorders. Some patients may palpate an abdominal mass, though findings lack specificity. In this case, the patient's initial presenting symptom was flank pain.

3.2. Imaging findings

On magnetic resonance imaging (MRI), the ureteral sarcomatoid carcinoma in this case appeared as a poorly defined mass. It demonstrated isointense signal on T1-weighted imaging (T1WI) and heterogeneous, slightly hyperintense signal on T2-weighted imaging (T2WI), likely due to the tumor's heterogeneous cellular composition. Following contrast administration, ureteral sarcomatoid carcinoma typically exhibits heterogeneous enhancement with non-enhancing areas of necrosis visible within the tumor. Additionally, the apparent diffusion coefficient (ADC) values for ureteral sarcomatoid carcinoma are often low, potentially indicating a higher degree of malignancy. Consequently, MRI provides clear visualization of soft tissue structures and offers advantages in assessing local tumor infiltration.

In positron emission tomography/computed tomography (PET/CT) examinations, besides clearly displaying the location, size, and morphology of tumors, as well as identifying features such as calcification, hemorrhage, or adjacent bone destruction, it also provides direct insight into the metabolic activity of tumor cells within lesions. This enables assessment of primary tumors, metastatic sites, and systemic involvement. Ureteral sarcomatoid carcinoma typically presents as a slightly hyperdense lesion with cast-like growth patterns in the ureter, poorly demarcated from surrounding tissues. Due to varied levels of tumor infiltration in various diseased segments, the ureter may be widely affected with heterogeneous density [5]. PET imaging has important benefits for tumor diagnosis, therapy planning, and monitoring by revealing abnormally increased glucose metabolism in both primary tumors and metastatic lesions. This capacity increases survival rates and makes it easier to identify metastases early [6].

Furthermore, ureteral sarcomatoid carcinoma must be differentiated from other ureteral lesions, including: 1. Primary carcinoma of the ureters: Affected side hydronephrosis and various degrees of ureteral dilatation are the main indirect radiography findings. Soft tissue masses at the blockage level and uneven ureteral wall thickening are the main direct findings [7]; the mass appears as low or isointense on T1-weighted imaging (T1WI), slightly hyperintense on T2-weighted imaging (T2WI), and shows moderate to marked enhancement after contrast administration. Differentiating this situation may be more difficult if nearby organs are invaded by tumors [8]. 2. Nonspecific ureteritis: More commonly observed in relatively younger females. The ureteral wall typically exhibits progressive circumferential thickening with mild luminal narrowing over an extended length, featuring a smooth outer margin without evidence of local invasion or retroperitoneal lymphadenopathy. Non-contrast CT shows isodense signals, while MRI demonstrates isointense signals on T1WI and hyperintense signals on T2WI.

Contrast-enhanced imaging reveals marked enhancement of the ureteral wall in the affected segment [9].

3.3. Pathological characteristics

The definitive diagnosis of sarcomatoid carcinoma relies on histopathology and immunohistochemistry. The neoplastic components within sarcomatoid carcinoma tissue are primarily squamous cell carcinoma, adenocarcinoma, and transitional cell carcinoma, characterized by minimal composition and high differentiation. The sarcomatous components mainly include malignant fibrous histiocytoma, leiomyosarcoma, osteosarcoma, and others. Immunohistochemical staining is commonly employed to distinguish epithelial and stromal components. Markers such as cytokeratin (CK) and epithelial membrane antigen (EMA) aid in identifying epithelial elements, while vimentin is typically used to characterize stromal components [2].

3.4.Treatment approach

The main course of treatment is still radical resection, which is frequently followed by adjuvant chemotherapy or radiation. According to recent research, immunotherapy combined with chemotherapy or anti-angiogenic drugs may result in better control rates for sarcomatoid cancer [10]. The prognosis of SCU patients may be improved by using chemotherapy in conjunction with immunotherapy and anti-angiogenic treatment [11].

4. Conclusion

Ureteral sarcomatoid carcinoma (SCU) is a rare malignant tumor with low incidence and nonspecific clinical manifestations, posing significant challenges for accurate preoperative diagnosis. Currently, preoperative diagnosis of SCU primarily relies on imaging studies. However, its imaging features lack specificity and can easily be confused with other ureteral tumors, leading to a high misdiagnosis rate. Therefore, there is an urgent need to accumulate more cases, further summarize and refine the imaging characteristics of SCU, and provide more reliable evidence for definitive preoperative diagnosis in the future.

Disclosure statement

The authors declare no conflict of interest.

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