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Kidney-Sparing Percutaneous Ablation of High-Grade Upper Tract Urothelial Carcinoma in a Functionally Solitary Kidney: A 24-Month Follow-Up

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ABSTRACT

Introduction: High-grade upper tract urothelial carcinoma (UTUC) is generally treated with radical nephroureterectomy. Kidney-sparing treatment may be considered in selected patients with imperative indications.

Aim: To present the clinical course and 24-month outcome of percutaneous nephroscopic ablation of high-grade UTUC in a patient with a functionally solitary kidney and Lynch syndrome.

Materials and Methods: We describe a case of high-grade non-invasive papillary UTUC in a woman in her late seventies who declined radical surgery because it would have resulted in permanent dialysis dependence. Following unsuccessful ureteroscopic management, percutaneous holmium:YAG laser ablation and adjuvant mitomycin C instillation were performed.

Results and Discussion: The renal pelvic tumor was macroscopically ablated without major perioperative complications. During intensive surveillance with computed tomography urography, ureterorenoscopy, and selective urinary cytology, no recurrence or progression was detected over 24 months, and renal function remained stable.

Conclusion: Percutaneous kidney-sparing treatment may be a feasible option in highly selected imperative cases of high-grade UTUC when radical surgery would result in dialysis dependence. This approach requires multidisciplinary decision-making, careful counseling, and strict long-term surveillance.

Keywords: urothelial carcinoma, percutaneous treatment

Introduction

Upper tract urothelial carcinoma (UTUC) is a relatively rare malignancy arising from the urothelial lining of the renal pelvis and ureter, representing approximately 5–10% of all urothelial cancers.[1,2] Approximately 60% of UTUC cases originate in the renal pelvis, whereas 40% arise in the ureter, most commonly involving the distal ureter.[2] Despite its low incidence, UTUC is associated with substantial morbidity because many patients present with invasive disease at diagnosis.[2] Gross hematuria is the most common presenting symptom, whereas flank pain and constitutional symptoms occur less frequently.[2]

Current European Association of Urology (EAU) and American Urological Association (AUA) guidelines recommend radical nephroureterectomy with bladder cuff excision as the standard treatment for patients with high-risk non-metastatic UTUC.[1,3] Kidney-sparing treatment is generally reserved for patients with low-risk disease, characterized by unifocal tumors smaller than 2 cm, low-grade histology, negative cytology for high-grade disease, absence of radiological signs of invasion, and no evidence of metastasis, or for those with imperative indications, including a solitary kidney, bilateral tumors, severe chronic kidney disease, or hereditary cancer syndromes in which preservation of renal function is crucial.[1,3]

Advances in endoscopic and percutaneous techniques have expanded the role of kidney-preserving management in carefully selected patients.[4–7] Nevertheless, evidence supporting conservative treatment of high-grade UTUC remains limited and is largely derived from retrospective series conducted in highly specialized centers.[4–7] Consequently, management of such patients requires individualized decision-making within a multidisciplinary setting, balancing oncological safety against the consequences of radical surgery.[1,3]

We present a rare case of successful percutaneous nephroscopic management of high-grade renal pelvic urothelial carcinoma after unsuccessful ureteroscopic treatment in a patient with a functionally solitary kidney and Lynch syndrome who declined radical nephroureterectomy. The patient remains disease-free after 24 months of surveillance.

Aim

To describe the diagnostic work-up, treatment, and 24-month outcome of percutaneous kidney-sparing management of high-grade UTUC in a patient with a functionally solitary kidney and Lynch syndrome.

Case Presentation

A woman in her late seventies presented to the emergency department with painless gross hematuria accompanied by progressive generalized weakness. Her medical history was significant for a previous right-sided radical nephroureterectomy performed for upper tract urothelial carcinoma, resulting in a functionally solitary left kidney. Owing to the patient's clinical presentation and the need to exclude urothelial malignancy involving bladder, a comprehensive diagnostic work-up was initiated.

Contrast-enhanced computed tomography urography demonstrated a 3 × 2 cm enhancing papillary lesion located within the left renal pelvis. No radiological evidence of tumor involvement of the ureter or urinary bladder was identified, and no enlarged regional lymph nodes or distant metastases were detected.



Figure 1. Contrast-enhanced CT scan in the arterial phase, axial view, demonstrating a lesion within the left renal pelvis.

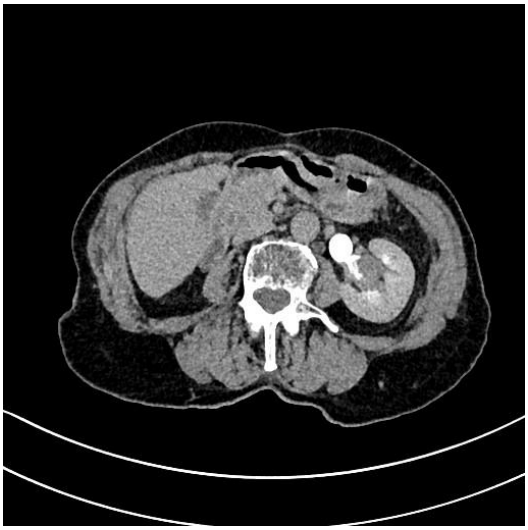


Figure 2. Axial CT urography images obtained during the excretory phase, demonstrating a filling defect within the contrast-opacified left renal collecting system corresponding to the renal pelvic urothelial tumor.



Figure 3. Coronal CT urography images obtained during the excretory phase, demonstrating a filling defect within the contrast-opacified left renal collecting system corresponding to the renal pelvic urothelial tumor.

Flexible cystoscopy revealed no visible bladder tumor or other intravesical pathology. Given the imaging findings, diagnostic ureterorenoscopy was subsequently performed. Tissue biopsies and selective upper tract urine samples were obtained for histopathological and cytological examination.

Histopathological analysis demonstrated non-invasive high-grade papillary urothelial carcinoma (pTa HG). Selective urinary cytology was reported as Paris System category V, indicating high-grade urothelial carcinoma.

Because of the diagnosis of upper tract urothelial carcinoma and the patient's previous history, genetic testing confirmed a pathogenic germline variant in an MMR gene associated with Lynch syndrome.

According to current international guidelines, radical nephroureterectomy of the remaining kidney represented the recommended oncological treatment. The patient received detailed counseling regarding the expected oncological benefits as well as the inevitable consequence of permanent dialysis following removal of her only functioning kidney. After extensive discussion, the patient declined radical surgery and expressed a clear preference for kidney-preserving treatment. Following multidisciplinary evaluation involving experienced uro-oncologists and endourologists, an endoscopic kidney-sparing approach was selected as the most appropriate individualized therapeutic strategy.

Because complete endoscopic management was not technically feasible during diagnostic ureteroscopy owing to severe bleeding and difficult tumor accessibility, an alternative kidney-sparing strategy was selected. Percutaneous access to the renal collecting system was established using an 18 Fr tract. A rigid nephroscope was introduced into the collecting system, and complete macroscopic tumor ablation was performed using a holmium:YAG laser under direct vision. The procedure was completed without major intraoperative complications. A nephrostomy tube was left in place at the end of the procedure and removed on postoperative day one. [5–7]

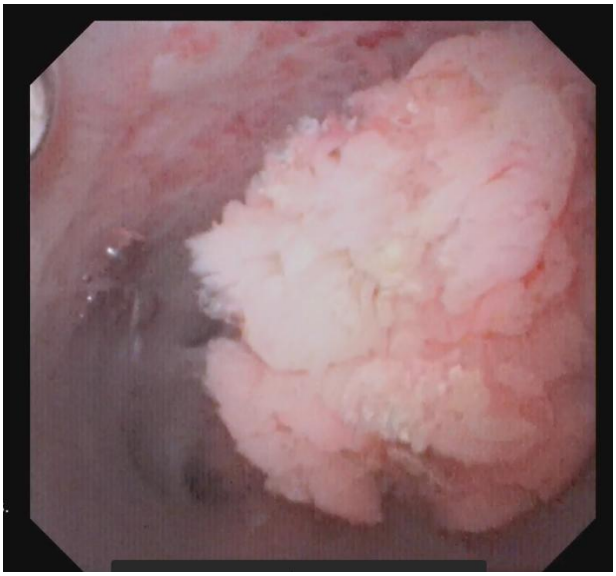


Figure 4. Endoscopic view during ureterorenoscopy demonstrating a papillary tumor arising from the left renal pelvis, with a characteristic exophytic papillary architecture consistent with upper tract urothelial carcinoma.

Following successful tumor ablation, single dose of mitomycin C was instilled into the renal collecting system as adjuvant topical chemotherapy in an attempt to reduce the risk of local recurrence[8–10].

The patient recovered uneventfully after the procedure, with preservation of renal function and no perioperative complications requiring additional intervention.

The patient entered an intensive surveillance protocol based on contemporary recommendations for kidney-sparing management of upper tract urothelial carcinoma.

Follow-up consisted of periodic computed tomography urography, diagnostic ureterorenoscopy, and selective urinary cytology performed at regular intervals. Surveillance ureteroscopies demonstrated complete healing of the renal pelvis without evidence of residual or recurrent tumor. Repeated urinary cytology specimens remained negative for high-grade urothelial carcinoma.

Serial computed tomography urography demonstrated no radiological evidence of local recurrence, upper urinary tract obstruction, lymph node enlargement, or distant metastatic disease. Renal function remained stable throughout follow-up.

At **24 months** after percutaneous tumor ablation, the patient remains free of clinical, endoscopic, cytological, and radiological evidence of disease recurrence while maintaining adequate function of her solitary kidney. She continues to undergo close surveillance with periodic imaging, ureteroscopy, and urinary cytology because of the high risk of recurrence associated with upper tract urothelial carcinoma and genetically confirmed Lynch syndrome.

Discussion

Upper tract urothelial carcinoma (UTUC) is an uncommon malignancy accounting for approximately 5–10% of all urothelial carcinomas. Compared with bladder cancer, UTUC is characterized by a higher proportion of invasive disease at diagnosis and a less favorable oncological prognosis. Radical nephroureterectomy (RNU) with bladder cuff excision remains the gold-standard treatment for patients with high-risk non-metastatic disease and provides the most reliable oncological control. Nevertheless, the increasing recognition of the adverse consequences of nephron loss has stimulated growing interest in kidney-sparing strategies in carefully selected patients[1,2,4].

According to the European Association of Urology (EAU) Guidelines on Upper Urinary Tract Urothelial Carcinoma, high-risk features include high-grade cytology or biopsy, tumor size greater than 2 cm, multifocal disease, invasive appearance on imaging, hydronephrosis, and previous radical cystectomy for high-grade bladder cancer. Our patient fulfilled several high-risk criteria, including tumor size (3 × 2 cm), high-grade histology (pTa HG), and positive urinary cytology (Paris System category V). Consequently, radical nephroureterectomy represented the guideline-recommended treatment. However, preservation of renal function became the overriding consideration because nephroureterectomy of the solitary kidney would have resulted in end-stage kidney disease[1,3].

Kidney-sparing surgery has traditionally been reserved for patients with low-risk UTUC. Over the last decade, however, advances in flexible ureteroscopy, laser technology, and percutaneous

techniques have expanded the indications for nephron-preserving treatment in highly selected patients. Several retrospective studies from high-volume referral centers have demonstrated acceptable oncological outcomes in imperative cases, particularly when complete endoscopic tumor eradication can be achieved and patients are willing to undergo lifelong surveillance[4–7].

Percutaneous access provided direct visualization of the tumor and enabled complete macroscopic ablation. Although this technique is used less frequently than ureteroscopic treatment because of concerns regarding bleeding and theoretical risks of tumor seeding, several contemporary series have demonstrated that percutaneous management remains a valuable option for selected patients with imperative indications when ureteroscopic treatment is technically impossible or incomplete. The larger working channel, superior visualization, and ability to remove bulky tumors represent important advantages of the percutaneous approach[5–7].

An additional aspect of this case was the administration of adjuvant topical mitomycin C into the renal collecting system following complete tumor ablation. Intraluminal chemotherapy has been increasingly investigated as a strategy to reduce local recurrence after kidney-sparing treatment. In our patient, mitomycin C was administered as an adjuvant measure after complete endoscopic tumor eradication rather than as primary chemoablative therapy[8–10].

Another remarkable feature of this case is the diagnosis of Lynch syndrome. Germline pathogenic variants in mismatch repair genes substantially increase the lifetime risk of upper tract urothelial carcinoma, particularly among carriers of pathogenic MSH2 variants. UTUC associated with Lynch syndrome frequently develops metachronously and may involve the contralateral upper urinary tract. Consequently, preservation of renal function is particularly important in affected individuals, who remain at lifelong risk of developing additional urothelial malignancies. Current international guidelines recommend genetic counselling and molecular testing in patients with clinical features suggestive of hereditary cancer syndromes, especially those with personal or family histories of Lynch syndrome-associated malignancies[11,12].

The favorable short-term oncological outcome observed in our patient should be interpreted with caution. High-grade UTUC is associated with substantial rates of local recurrence following kidney-sparing treatment, and long-term surveillance remains mandatory. Both EAU

and AUA guidelines recommend stringent follow-up protocols incorporating periodic computed tomography urography, diagnostic ureteroscopy, urinary cytology, and cystoscopy because recurrence may occur in both the ipsilateral upper urinary tract and the urinary bladder. Our patient has undergone surveillance every three to six months, including diagnostic ureterorenoscopy, selective urinary cytology, and CT urography. At 24 months following treatment, no radiological, endoscopic, cytological, or clinical evidence of recurrence has been identified, while renal function has remained preserved[1,3].

This case demonstrates that kidney-sparing treatment may represent a feasible alternative for highly selected patients with imperative indications who decline radical nephroureterectomy. Successful management requires careful patient selection, complete tumor ablation whenever technically feasible, multidisciplinary decision-making, and strict adherence to an intensive follow-up protocol. Nevertheless, radical nephroureterectomy should remain the standard treatment for medically fit patients with high-risk UTUC, and conservative management should not be considered oncologically equivalent[1,3,4–7].

The principal learning point from this case is that individualized treatment may occasionally provide satisfactory oncological and functional outcomes in situations where guideline-recommended radical surgery would inevitably result in dialysis dependence and substantial deterioration in quality of life. Further prospective studies evaluating kidney-sparing management in selected patients with high-risk UTUC are needed to better define the role of percutaneous treatment and adjuvant therapy in this challenging clinical setting[5,6,13–15].

Conclusions

Percutaneous nephroscopic ablation may provide a kidney-sparing treatment option for exceptionally selected patients with high-grade UTUC and an imperative need to preserve renal function. The approach should be undertaken only after thorough counseling and multidisciplinary assessment, with acknowledgment that it is not oncologically equivalent to radical nephroureterectomy and requires intensive, long-term surveillance.

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