

# Upper tract urothelial carcinoma with Oligometastasis to the right ventricle, surgical considerations, and management

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## Abstract

Right ventricular (RV) metastasis from an upper tract urothelial carcinoma without inferior vena cava or right atrial involvement is an extremely rare event which highlights the heterogeneity of this disease process. We report a case of a 43-year-old man presenting for long-standing hematuria and left flank pain. Computed tomography revealed a left renal mass with para-aortic lymphadenopathy, in addition to a potential mass in the RV. The mass involving the RV was confirmed on subsequent cardiac evaluation with magnetic resonance imaging (MRI) and echocardiography. After discussion in a multidisciplinary tumor board, the patient underwent a left nephrectomy, regional lymphadenectomy, and excision of metastatic RV tumor with bovine patch reconstruction. Final pathology reported invasive urothelial carcinoma in the left kidney with involvement of regional para-aortic lymph nodes and metastatic tumor in the RV (T4N3M1, AJCC 8<sup>th</sup> edition). The patient did well postoperatively and completed adjuvant Cisplatin-Gemcitabine systemic chemotherapy. This is an important addition to the literature as it highlights the aggressive and heterogeneous nature of urothelial carcinoma and the utility of cardiac MRI in surgical planning.

**Keywords:** Cardiac, metastasis, renal tumor, right ventricle, transitional carcinoma

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## INTRODUCTION

We report an unusual case and surgical treatment of a 43-year-old man with upper tract urothelial carcinoma (UTUC) of the left renal pelvis and synchronous metastasis to the right ventricular (RV), invading the myometrium of free wall, and outflow tract in which resection required bovine patch reconstruction. To our knowledge, this is the first reported case of solitary RV metastasis from UTUC of the kidney requiring patch reconstruction.

## CASE REPORT

A 43-year-old male presented with prolonged symptoms of intermittent hematuria with recent onset of severe left flank pain. Medical history was significant for alcohol and tobacco abuse. Cystoscopy by outside Urologist before transfer to our institution was benign and did not reveal any adverse pathology in the bladder. Renal protocol computed tomography (CT) revealed a 9 cm × 10 cm left renal mass, para-aortic adenopathy, and possible renal vein thrombus which concerned radiologist and the urology

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team for renal cell carcinoma (RCC) [Figures 1 and 2]. Contrast-enhanced head CT revealed no signs of metastasis and CT chest revealed a cardiac mass. Cardiac magnetic resonance imaging (MRI) without contrast demonstrated a 1.9 cm × 2.7 cm × 3.0 cm RV mass in the apical lateral wall [Figure 3] without regional wall abnormalities. Left ventricular systolic function was normal (55% ejection fraction). Baseline creatinine was 1.0 mg/dL and glomerular filtration rate (GFR) was 92 mL/min/1.73 m<sup>2</sup>. Preoperative staging was T3cN1M0 for presumed RCC with tumor thrombus in the RV.

A multidisciplinary tumor board decided to excise the RV and renal mass concurrently, based on the patient's age, excellent performance status, symptomology, and presumption that tumor thrombus resection may prevent outflow tract obstruction and heart failure. Initial biopsy of the renal mass was considered but ultimately not performed as tumor board felt it would not change the immediate surgical plan.

### Surgical technique

The urology team approached the abdomen through a left chevron incision. The proximal left ureter was identified in retroperitoneum and found to be grossly normal. Significant lymphadenopathy to aortic bifurcation resulted in tedious dissection. After renal hilum ligation and kidney mobilization, intraoperative ultrasound of the inferior vena cava (IVC) revealed no tumor thrombus. The renal vein was then ligated and the kidney sent for pathology. The distal ureter was left as the presumed diagnosis was RCC and the case turned to our cardiothoracic colleagues.

A median sternotomy was performed, and cannulation sutures were placed in the aorta, superior vena cava, and IVC. After heparinization, a cardiopulmonary bypass was established. An aortic cross-clamp was placed and antegrade Del Nido cardioplegia was instilled to achieve diastolic arrest and was reinstalled every 30 min. The RV mass was approached through the right atriotomy. The mass involved the anterior and free wall of the RV and papillary muscle supporting the tricuspid anterior leaflet. Due to prominent myocardial infiltration, full-thickness muscle excision was required. Next, the outflow tract and free wall were reconstructed using two bovine pericardial patches measuring 2 cm × 3 cm and 2 cm × 4 cm, respectively.

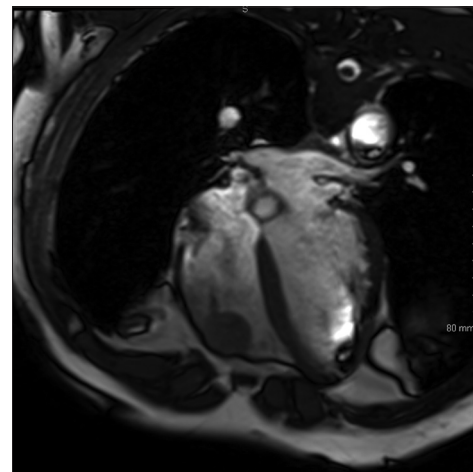
Due to invasion, the tricuspid anterior leaflet papillary muscle was replaced using a 31 mm St. Jude Epic bioprosthetic valve (Abbott Laboratories, Illinois, United States). Saline



**Figure 1:** Contrast enhanced computed tomography of abdomen and pelvis in coronal plane demonstrating a 9 cm × 10 cm left renal mass



**Figure 2:** Contrast enhanced computed tomography of abdomen and pelvis in axial plane demonstrating significant para-aortic lymphadenopathy and a 9 cm × 10 cm left renal mass



**Figure 3:** A mass in the apical lateral wall of the right ventricle measuring approximately 19 mm × 27 mm × 30 mm. The mass is isointense to myocardium on T1 and T2 weighted images and demonstrates both first pass perfusion and delayed enhancement

float showed excellent coaptation, right atriotomy was closed and cardiopulmonary bypass discontinued.

Gross examination of the renal mass revealed a 9.5 cm × 8.0 cm × 7.5 cm ill-defined yellow-tan whirled and solid mass involving the renal sinus and pelvicalyceal system. The mass occupied 75% of the left kidney with extensive necrosis and lymphovascular invasion. Pathologic analysis revealed high-grade invasive urothelial carcinoma in the left kidney, renal vein, and 3/14 lymph nodes (T4N3M1, AJCC 8<sup>th</sup> edition). Immunohistochemistry was positive for CK7, p63, GATA-3, and CK5/6. RV free wall revealed a 4.5 cm × 4.5 cm × 3.5 cm invasive urothelial carcinoma involving myocardial tissue present at the margins.

The patient met with a multidisciplinary team which explained that a nephroureterectomy is the standard of care for UTUC. Given the pathologic and surgical findings, the patient ultimately decided to manage his stage IV urothelial carcinoma with adjuvant Cisplatin-Gemcitabine. Postoperative creatinine was 1.2 mg/dL, GFR was 72 ml/min/1.73 m<sup>2</sup>.

## DISCUSSION

Urothelial carcinoma is the fourth most common solid malignancy in men in the United States, the majority in the lower urinary tract.<sup>[1]</sup> Primary UTUC represents approximately 5%–7% of all urothelial carcinomas, with most in the kidney.<sup>[2]</sup> The most common metastatic sites are the lungs, liver, and bone. Solitary cardiac metastasis in the absence of IVC involvement or widespread systemic disease is extremely rare.<sup>[3]</sup> The mechanism of cardiac metastasis in UTUC remains controversial as urothelial cancer typically invades locally and metastasizes through lymphatic pathways.<sup>[4]</sup> Cardiac metastasis in a more studied entity, RCC, is thought to occur via two mechanisms; either hematogenous micro-dissemination via the renal vein, IVC, and subsequently the right heart or through the extensive lymphatic network surrounding the kidneys propagating intrathoracically which typically affects the left heart in the presence of widespread disease.<sup>[5]</sup> The majority of patients with concomitant urothelial carcinoma and cardiac metastasis succumb to their disease shortly after diagnosis.<sup>[4]</sup>

Our patient was thought to have a stage III RCC (T3cN1M0) and preoperative plan was cytoreductive radical nephrectomy, lymphadenectomy, and cardiac metastasectomy. The distal ureter was left due to presumed preoperative diagnosis of RCC. The gold standard for UTUC is open radical nephroureterectomy (RNU) with excision of the bladder cuff.<sup>[2,6]</sup> Even with careful surgical management, up to 25% of patients may undergo incomplete urethrectomy.<sup>[6,7]</sup>

Metastatic urothelial carcinoma 5-year cancer-specific mortality is over 90%, even after RNU.<sup>[8]</sup> Due to limited data, chemotherapy regimens that have been effective against metastatic urothelial carcinoma of the bladder are applied to UTUC.<sup>[2,9]</sup> The POUT trial demonstrated improvements in disease- and metastasis-free survival for locally advanced UTUC following RNU with platinum-gemcitabine adjuvant chemotherapy.<sup>[10]</sup> Neoadjuvant therapy is the accepted standard of care for muscle-invasive urothelial bladder cancer; however, controversy remains with UTUC due to unreliable preoperative staging, although some patients may benefit as worsening renal function following nephrectomy may preclude nephrotoxic cisplatin.<sup>[10]</sup>

Our article illustrates the rare nature of UTUC with an isolated RV metastasis and surgical considerations. A multi-disciplinary discussion was had with the patient on chemotherapy, prognosis, likelihood of recurrence and metastasis, and the need for routine surveillance of distal ureter and bladder.

## Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient (s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Nil.

## Conflicts of interest

There are no conflicts of interest.

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