Five Views of Transitional Cell Carcinoma: One Man’s Journey

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Outline

• Overview: Renal Anatomy
• Our Patient’s Story
• Diagnostic Imaging Studies
  – Appearance of Transitional Cell Carcinoma (TCC) on five different imaging modalities: Ultrasound, MRI, CT Urography, Retrograde Pyelogram, and Radionuclide scan
• Diagnosis, Tumor Staging & Prognosis
• Summary
Overview: Renal & Urinary Tract Anatomy

Overview: CT Retroperitoneal Anatomy

Source: Corl, F. “Medical Illustrations: Normal retroperitoneum.”
Our Patient

John Doe, a 79-year-old obese man with hypertension, recurrent hematuria, and a 50-pack-year history of smoking, presents to an outside hospital with abdominal pain.

Is there an Abdominal Aortic Aneurysm?
Imaging: Sagittal Right Kidney Ultrasound

Patient JD

Normal Comparison

Source: Courtesy of Mara Barth, MD; BIDMC
Findings: JD’s Ultrasound

• Outside hospital performed abdominal ultrasound and ruled out aortic aneurysm.

• Findings: Hypoechoic lesion with irregular borders at upper pole of right kidney. However, kidneys were not the target organs of interest and were deemed “unremarkable.”

• Next step: MRI to examine kidneys.
Imaging: JD’s T1-weighted MRI

Coronal

Axial

Source: Courtesy of Mara Barth, MD; BIDMC
Findings: JD’s MRI

- Outside hospital performed MRI to evaluate kidneys
- Findings: Soft tissue mass with irregular borders at upper pole of right kidney
- Conclusion: Mass noted as “normal”
Patient Course

John Doe is lost to follow-up. He continues to have difficulty managing his hypertension and arrives at our hospital one year later complaining of frank hematuria. His prior hospital’s imaging studies were not yet available.

Does JD have kidney stones, or is there something else?
JD, an 80-year-old male, could have any of these underlying causes of hematuria.

Next step: CT Urography

Source: Rose, BD and Fletcher, RH. “Evaluation of hematuria in adults.” UpToDate Online 14.2
Imaging: JD’s Axial CT Urography, w/o contrast

Source: Courtesy of Mara Barth, MD; BIDMC
Imaging: JD’s Axial CT Urography, with contrast

Source: Courtesy of Mara Barth, MD; BIDMC
Findings: JD’s CT Urography

• CTU performed to evaluate renal anatomy
• Findings: Mass with soft tissue attenuation detected in upper pole of right kidney along with abnormal contrast filling in pelvis and proximal ureter of right kidney
• Next step: Retrograde Pyelogram to evaluate proximal right ureter
Imaging: JD’s Retrograde Pyelogram

Source: Courtesy of Mara Barth, MD; BIDMC
Findings: JD’s Retrograde Pyelogram

• Retrograde Pyelogram evaluated luminal anatomy of right ureter
• **Findings:** Solitary filling defect in upper pole of right kidney
• Next steps: Discuss differential diagnoses and select subsequent studies
Imaging: Differential Diagnoses

A. Mass in renal pelvis, calyx
   1. Abscess
   2. Hematoma
   3. Calculus
   4. Metastasis
   5. Neoplasm
   6. Lipomatosis

B. Ureteral filling defects
   1. Metastasis
   2. Transitional Cell Carcinoma
   3. Other neoplasm
   4. Fibroepithelial polyp
   5. Lymphoma

C. Non-visualization of part of kidney, calyx
   1. Abscess
   2. Cyst
   3. Neoplasm
   4. Post-nephrectomy or trauma
   5. Tuberculosis

D. Expanded Ddx. Neoplasm
   See next slide

D. Expanded Ddx. Neoplasm

**Epithelial tissue**
1. Inverted papilloma
2. Papilloma or Transitional Cell Carcinoma
3. Squamous cell carcinoma

**Mesodermal tissue**
1. Smooth muscle: Leiomyoma, Leiomyoblastoma, Leiomyosarcoma
2. Neural: Neurilemmoma, Neurofibroma
3. Vascular: Hemangioma, Lymphangioma, Hemangiosarcoma
4. Fibrous: Fibroepithelial polyp, Fibroma
5. Mixed: Fibromyoma, Fibromyxoma
6. Lymphoma

**Metastases**
1. Renal cell carcinoma
2. Transitional Cell Carcinoma

Patient Workup: Further Studies & Diagnosis

- **Tests:** JD underwent urinalysis, brush biopsy of Right kidney, and cystoscopy
- **Findings:** Atypical urothelium, most consistent with Transitional Cell Carcinoma

- **Diagnosis:** Transitional Cell Carcinoma

- **Treatment Plan:**
  1. Radionuclide scan: Evaluate Left kidney function before pursuing surgery
  2. Surgery: Right nephroureterectomy
Imaging: JD’s Radionuclide Scan (Tc-99m MAG3)

Source: Courtesy of Mara Barth, MD; BIDMC
Findings: JD’s Radionuclide Scan

- Radionuclide scan performed to evaluate left kidney physiology to ensure functioning prior to right nephroureterectomy
- Findings: Left kidney is normal, yet right kidney exhibits reduced uptake of Tc-99m MAG3, which is consistent with previous studies showing abnormality in that kidney
- Next step: Right Nephroureterectomy and pathology analysis
“Imaging”: JD’s Right Kidney, Gross

Source: Courtesy of Mara Barth, MD; BIDMC
Diagnosis: Transitional Cell Carcinoma (TCC)

• **TCC:** papillary or solid neoplasm of urothelium, the mucosal surface covering renal collecting ducts to urethra
• Clinical features: **hematuria** +/- flank pain +/- mass
• Epidemiology:
  – More common in men, peak incidence 50-60yo
  – Less than 5% of all renal tumors are TCC
  – Usually occur unilaterally and distally
• Risk factors: Smoking, chronic laxative use, phenacetin, certain occupational exposures (aniline dyes)
Staging: Tumor-Nodes-Metastasis for TCC

• Primary Tumor (T)
  – T0: No evidence of primary tumor
  – Ta: Papillary noninvasive carcinoma
  – T1: Invades subepithelial connective tissue
  – T2: Invades muscularis
  – T3: Invades peripelvic fat, renal parenchyma
  – T4: Invades adjacent organs

• Regional Lymph Nodes (N)
  – N0: No lymph node metastasis
  – N1: Single lymph node affected, less than 2cm diameter
  – N2: Single lymph node affected, diameter 2-5cm
  – N3: Metastasis in lymph node, diameter greater than 5cm

• Distant Metastasis (M)
  – M0: None
  – M1: Distant metastasis

Our patient T3 N0 M0

Source: Richie, JP and Kantoff, PW. “Neoplasms of the renal pelvis and ureter.” UpToDate Online 14.2
Staging: TNM Criteria

- **T1 N0 M0**
  - Central mass in pelvis
  - **Stage One**

- **T2 N0 M0**
  - TCC invades ureter wall
  - **Stage Two**

- **T3 N0 M0**
  - TCC invades parenchyma
  - **Stage Three**

- **Other TNM combos**
  - Infiltrating, large cancer
  - **Stage Four**

Prognosis

- Survival varies with extent of tumor progression
- Five-year overall survival rate for resected renal pelvis and ureteral TCC: 40%
- Better prognosis for lower stage tumor, and worse for higher stage
Summary

• JD, 79-year-old obese hypertensive male, smoker, initially presents with abdominal pain and hematuria; Dx. TCC

• Transitional Cell Carcinoma appearance across five different modalities used to evaluate the lesion and refine the diagnosis

• Tumor staging indicates that our patient’s prognosis is better since his cancer did not invade beyond the renal parenchyma
References

• Richie, JP and Kantoff, PW. “Neoplasms of the renal pelvis and ureter.” UpToDate Online 14.2
• Rose, BD and Fletcher, RH. “Evaluation of hematuria in adults.” UpToDate Online 14.2
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