Sonographic Features of Urothelial Carcinoma: A Case Study

Chelsea Robb, BS, RDMS, RVT*, Traci Fox, EdD, RT(R), RDMS, RVT+*  

* Department of Medical Imaging & Radiation Sciences, Jefferson College of Health Professions, Thomas Jefferson University, Philadelphia, PA, USA
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Abstract: The most common type of bladder cancer is urothelial carcinoma which arises from the inside lining (e.g., urothelium) of the bladder. As the disease progresses, the tumor may invade into the deep layer of the bladder wall, spread to adjacent areas of the bladder, or to other organs of the body. Common clinical symptoms of bladder cancer may present as painless hematuria. High-resolution ultrasound imaging has been used for diagnosis and differential diagnosis of bladder abnormalities. We report a case study using gray-scale and Doppler imaging to evaluate urothelial carcinoma of urinary bladder.

Key words: Urothelial carcinoma; Transitional cell carcinoma; Bladder cancer

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Urothelial carcinoma is the most common cancer found in the urinary bladder. It can also be referred to as transitional cell carcinoma (TCC). This type of cancer forms in the urothelial cells which line the inside of the urinary bladder, as well as the renal pelvis, ureters, and urethra. Urothelial tumors can be found anywhere in the presence of urothelial cells [1]. Although CT and MRI can be utilized for evaluation of the bladder tumors, high-resolution ultrasound imaging can be utilized as first line imaging modality to screen and identify tumors in the bladder and to guide clinical management [2]. We report a case study to use gray-scale and Doppler imaging for evaluation of urothelial Carcinoma of urinary bladder in a young patient.

Case Report

A 21-year-old female patient reported to the ultrasound department with recurring urinary tract infections (UTI) for over six months. Microscopic hematuria was found in her urine. The patient presented with no pain other than UTI complications. A complete ultrasound of the kidneys and bladder was ordered to evaluate the urinary system. The kidneys presented normal in size and echogenicity. There was no evidence of hydronephrosis, masses, or calculi in the upper urinary tract.

Gray-scale ultrasound with a 3.5 MHz curved linear array transducer demonstrated that the urinary bladder appeared distended with no anterior wall thickening. A 4.6 × 3.5 × 3.6 cm irregularly shaped hyperechoic mass with finger-like projections was identified on the right lateral aspect of the bladder wall. The mass was evaluated with the patient in the supine position and left lateral decubitus position, which confirmed non-mobility of the mass. Blood flow signals were seen within the mass using power Doppler, and a low-resistance spectral waveform was obtained within a feeding vessel. Both ureteral jets were seen on real time ultrasound imaging. The patient had surgery to remove the mass and obtain a pathological diagnosis. A review of the pathologic specimen found non-invasive, low-grade papillary urothelial carcinoma with inverted pattern. The deep muscle of the bladder wall was not involved.

Discussion

Urothelial carcinoma, also known as transitional...
cell carcinoma (TCC), accounts for about 90% of all bladder cancers in the U.S and Europe [3]. Urothelial carcinoma has a very good outcome if it does not involve other tissues in or around the urinary bladder wall. In this case, the cancer cells do not expand beyond the inner layer of the bladder wall, the urothelium, indicating a non-invasive carcinoma. If the cancer cells were to grow deeper into the bladder wall muscles and fatty tissue, it would be considered invasive and the possibility of metastatic carcinoma increases. This mass was protruding into the hollow space of the bladder with finger-like projections, which is suggestive of a papillary tumor [1].

The most common clinical finding of urothelial carcinoma is hematuria which can be macroscopic or microscopic. Patients with early stages of bladder cancer usually do not present with pain or symptoms. Early symptoms include frequent urination, dysuria, nocturia and a weak urinary stream, which can also be indicative of a urinary tract infection, enlarged prostate, and urinary obstruction. Symptoms of advanced urothelial carcinoma include oliguria, lower back pain, fatigue, weight loss, and bone pain [2].

Urothelial carcinoma can be classified into non-invasive and invasive types. Non-invasive types are then divided into flat and papillary subtypes. Flat and papillary types are also divided into subtypes according to their cell DNA [4]. Table 1 describes the noninvasive urothelial carcinomas based on their WHO classification [5]. Invasive urothelial carcinoma is defined by invasion beyond the bladder membranes. There are several variants of invasive urothelial carcinoma including infiltrating, nested, microcystic, micropapillary, and others [5].

Urothelial carcinoma accounts for approximately 90% of all bladder cancers in the U.S and Europe. Non-urothelial carcinoma makes up the remaining 10% but is more prevalent in other countries [8]. Non-urothelial carcinoma includes squamous cell carcinoma, adenocarcinoma, schistosomal bladder cancer, and non-epithelial tumors of the bladder, which have several subtypes [7].

### Table 1 Noninvasive classifications of urothelial carcinoma

| Noninvasive urothelial carcinomas                                      | Invasive urothelial carcinomas                                               |
|---------------------------------------------------------------------|------------------------------------------------------------------------------|
| Urothelial carcinoma in situ                                        | Infiltrating urothelial carcinoma with divergent differentiation             |
| Papillary urothelial carcinoma – low grade                          | Nested, including large nested                                               |
| Papillary urothelial carcinoma – high grade                         | Micropapillary                                                               |
| Papillary urothelial neoplasm of low malignant potential            | Lymphoepithelioma-like                                                      |
| Urothelial papilloma                                                | Plasmacytoid/signet ring cell/diffuse                                        |
| Inverted urothelial papilloma                                       | Sarcomatoid                                                                  |
| Urothelial proliferation of uncertain malignant potential (hyperplasia) | Others (e.g., giant cell, poorly differentiated, etc.)                       |

Figure 1 (A) Transverse view of gray-scale ultrasound imaging demonstrates a hyperechoic, irregularly shaped urinary bladder mass (calipers) measuring 3.6 cm; (B) Sagittal view of urinary bladder mass (calipers) measuring 4.6 × 3.5 cm; (C) Spectral and power Doppler displaying a feeding vessel (arrow) into the mass. The spectral flow is monophasic, implying low-resistance flow.
Caucasian males over the age of 65 are at the highest risk for urothelial carcinoma [6]. However, African Americans have a higher mortality rate [8]. Certain populations of the United States are more at risk for urothelial carcinoma. In the rest of the world, the highest rates of all types of bladder cancer are in Southern and Western Europe and the lowest rates recorded in Eastern Europe and Asian countries. Other risk factors include tobacco use, diabetes medication, arsenic exposure, past chemotherapy treatments, family history of bladder cancer, and prior bladder complications. Bladder cancer is extremely rare in young adults and children, and in most cases it usually presents as low-grade non-invasive carcinoma [6].

The diagnosis of urothelial carcinoma usually begins with a urinalysis. Urinary tract imaging may be used to pinpoint size and location. MRI and CT are usually preferred over ultrasound due to their ability to evaluate tumors at the base and dome of the bladder. Ultrasound is useful for detecting soft tissue masses but cannot determine invasion or nodal status. The gold standard for diagnosing bladder cancer is a cystoscopy which can be done in a doctor’s office. Any mass that is seen during a cystoscopy needs to be biopsied and resected [2]. If the tumor is non-invasive, a transurethral resection can be performed along with intravesical chemotherapy. If an invasive tumor is present, treatment is much more aggressive. An invasive tumor will require a cystectomy, systemic chemotherapy and/or radiation therapy [3].

Two to four percent of all patients with a history of urothelial carcinoma will develop future tumors within the urothelium (bladder, renal pelvis, ureters, and urethra), and these recurrences are likely to be invasive [9]. Patients with non-invasive urothelial carcinoma have a 5-year survival rate of 95%. Patients with advanced stages of urothelial carcinoma such as invasive tumors and metastatic disease have a 5-year survival rate of 5%-35%.

Conclusion
The patient in this case would typically be at low-risk for bladder cancer due to her young age and gender. It is unknown if the patient was diabetic or used tobacco, which are both risk factors of urothelial carcinoma. Family history is also unknown. Her history of chronic urinary tract infections is a risk factor, however, for this pathology. In this patient’s case, treatment involves resection and intravesical therapy and her chances of survival are high with her diagnosis. This patient will likely undergo follow-up studies in order to monitor the new formation of tumors in the bladder as well as anywhere along the urinary tract.

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Conflict of Interest
All authors concur with the submission and have no financial & commercial conflicts of interest related to this work.

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