Positive Predictive Value of CT Urography in the Evaluation of Upper Tract Urothelial Cancer

OBJECTIVE. The purpose of this study was to determine the positive predictive value of CT urography in the diagnosis of upper tract urothelial malignancies.

MATERIALS AND METHODS. Retrospective review of the records of patients who underwent 2,602 CT urographic examinations revealed that 81 (3%) examinations of 77 patients had findings suggesting upper tract urothelial cancer. Two radiologists in consensus categorized the findings as large masses (> 5 mm), small masses (≤ 5 mm), or urothelial thickening. The positive predictive value of CT urography was determined with the findings at pathologic examination (n = 42), follow-up imaging (n = 29), or clinical follow-up alone (n = 5). One patient with insufficient follow-up information was excluded. The effects of age, sex, indication for examination, imaging appearance, and urine cytology were analyzed with the Fisher’s exact test or Student’s t test. Multivariate logistic regression analysis was used to generate a model for predicting the probability of the presence of upper tract urothelial cancer in patients with positive CT urographic examinations.

RESULTS. The positive predictive value of CT urography for upper tract urothelial cancer was 53% (40/76) overall, 83% (29/35) for large masses, 0% (0/17) for small masses, and 46% (11/24) for urothelial thickening. Imaging appearance, urine cytology, and age were significant univariate predictors (p < 0.05) of the presence of upper tract urothelial cancer in patients with positive CT urographic examinations. The independent variables most likely associated with upper tract urothelial cancer were urine cytology (odds ratio, 60.0; 95% CI, 5.5–653.7) and imaging appearance (odds ratio, 24.4; 95% CI, 3.0–201.9) after adjusting for age and clinical indication.

CONCLUSION. The positive predictive value of CT urography for upper tract urothelial cancer is moderate because benign findings mimic cancer. Positive findings on a CT urogram are more likely to indicate cancer in the setting of large masses or positive urine cytology.

T urography is widely replacing excretory urography as the primary imaging technique for assessing the urinary tract [1, 2]. Several studies have shown that in addition to its proven superiority to excretory urography in the detection of renal parenchymal masses [3, 4] and urinary tract calculi [5, 6], CT urography can be useful in the detection of urothelial tumors [7–11]. Although upper tract urothelial neoplasms are rare, the incidence is increased among patients with known urothelial bladder cancer or a history of upper or lower tract urothelial cancer [12, 13]. Therefore, CT urography is being used increasingly to assess the upper urinary tract for synchronous and metachronous urothelial tumors and for primary evaluation of hematuria [8, 14–16]. Although cystoscopy is routinely performed as part of an initial hematuria evaluation or as a surveillance examination in the care of patients with a history of urothelial cancer, urotricoscopy and retrograde pyelography are technically more challenging and relatively more invasive. In this regard, upper tract imaging studies are used not only to detect tumors but also to differentiate tumors from benign urothelial abnormalities that do not warrant additional invasive testing. The purpose of our study was to determine the positive predictive value (PPV) of CT urography in the diagnosis of upper tract urothelial carcinomas. In addition, we tried to identify additional factors, such as imaging appearance, urine cytology findings, and indications for examination, that might increase the PPV of this imaging test.

Materials and Methods

Patients

Institutional review board approval for viewing images and medical records of patients undergoing CT urography was obtained before initiation
of this study, which was compliant with HIPAA. The requirement for written informed consent was waived. Medical records of patients undergoing 2,602 consecutive CT urograms at our institution from May 2000 through October 2005 were retrospectively reviewed. Clinical reports of CT urograms that described, in either the body or the impression of the report, an upper urinary tract (intrarenal collecting system and ureters) abnormality interpreted as suggesting urothelial malignancy were included in this study. Of 2,602 CT urograms, 81 (3%) had suspicious upper urinary tract findings in 77 patients (40 men, 37 women; age range, 32–88 years; mean, 66.6 years). For three patients who underwent multiple CT urographic examinations (two patients, two examinations; one patient, three examinations), only the first examination was included.

Inclusion in the study required confirmation of the detected upper tract finding as either true- or false-positive with one of three reference standards: surgical pathology; follow-up imaging that included retrograde pyelography, uroselectography, or CT urography; or clinical follow-up alone (minimum of 2.5 years). A finding was deemed true-positive only with surgical pathologic confirmation of urothelial carcinoma. Other malignant tumors of the upper tract (e.g., renal cell carcinoma) and findings that had resolved on later images or were confirmed benign at surgical pathology were considered false-negative. Patients who did not undergo further workup of a suspicious upper tract CT urographic finding but who were well for at least 2.5 years after the finding was made were considered to have false-positive results. One patient was excluded because of lack of a reference standard. The final study was composed of 76 patients with upper urinary tract findings confirmed as either true- or false-positive on the basis of surgical pathology (n = 42), imaging follow-up (n = 29), or clinical follow-up alone (n = 5; range, 2.5–7.5 years; mean, 5.4 years) (Fig. 1).

**CT Urography Technique**

CT urography was performed with a 4-, 16-, or 64-MDCT scanner (Volume Zoom, Sensation 16, and Sensation 64, Siemens Healthcare). Patients were given 900 mL of water orally and were asked to void immediately before the examination. Examinations were supplemented with either 250 mL of IV saline solution infused by gravity after contrast administration, 10 mg of IV furosemide (Lasix, Abbott Laboratories) administered 2–3 minutes before the contrast medium, or both. Patients were supine during scanning.

A three-series CT protocol included unenhanced imaging (collimation, 0.6–2.5 mm; pitch, 0.875–1.25; 120 kVp; 155–280 mA) of the abdomen and pelvis, nephrographic phase imaging of the kidneys (collimation, 0.6–2.5 mm; pitch, 0.875–1.25; 120 kVp; 155–280 mA) 100 seconds after IV administration of 100 mL iopromide (Ultravist 300, Bayer Schering Pharma) at a rate of 3 mL/s, and excretory phase imaging of the abdomen and pelvis (collimation, 0.6–1.0 mm; pitch, 0.65–1.00; 120 kVp; 160–280 mA) 15 minutes after the contrast medium was injected. Excretory phase scans were reconstructed in 3- to 5-mm-thick sections in the axial plane and 3-mm-thick sections in the coronal plane.

Beginning in January 2004, all patients younger than 40 years underwent scanning with a split-bolus, two-series protocol. This protocol consisted of an unenhanced acquisition (collimation, 0.6–2.5 mm; pitch, 0.875–1.25; 120 kVp; 155–280 mA) of the abdomen and pelvis and a combined nephrographic and excretory phase acquisition (collimation, 0.6–2.5 mm; pitch, 0.875–1.25; 120 kVp; 155–280 mA) of the abdomen and pelvis that followed an initial dose of 50 mL of iopromide, a 6-minute delay, a second dose of 100 mL of iopromide, and image acquisition 100 seconds after the second dose of contrast medium.

**Image Interpretation**

Two readers with 2 and 7 years of experience interpreting CT urography who were aware that all images in the set had been interpreted as containing an upper tract finding suggesting malignancy reviewed the CT urograms in consensus. Each finding was placed into one of three previously described imaging categories [7]: large mass (lesions > 5 mm in maximum diameter), small mass (lesions ≤ 5 mm in maximum diameter), or urothelial thickening. Images were not reinterpreted, but the initially described abnormality was simply categorized into one of the three categories.

**Urine Cytology**

The results of urine cytology if performed within 6 months of CT urography were recorded. The cytologic finding was reported as benign, atypical, suspicious, or malignant. If more than one urine sample was obtained, the higher-grade cytology result was recorded. Urine cytology results were available for 61 of the 76 patients (80%) in the study population.

**Statistical Analysis**

The PPV of CT urography in the detection of upper tract urothelial carcinoma was calculated as the ratio of CT urograms with pathologically confirmed upper tract urothelial carcinomas to all CT urograms with findings suggesting upper tract urothelial carcinomas. The PPV of CT urography also was calculated for each morphologic category of urothelial finding. The variables of age, sex, clinical indication for CT urography (hematuria, history of urothelial cancer, and urinary tract obstruction), imaging appearance, and urine cytology were tested for an association with a true-positive CT urography by Fisher’s exact test for categoric variables and Student’s t test for the continuous variable of age. A multivariate logistic regression model was generated using backward elimination to select variables useful for predicting the presence of urothelial cancer (p < 0.05). The model with the smallest Akaike information
criterion value (which is based on likelihood but adds a penalty for a large number of variables) was selected as the final model [17, 18]. During the model fitting, the variables imaging appearance and urine cytology were grouped so that small numbers of patients in individual categories would not have resulted in a large variance of coefficients in the logistic regression model. Large masses were compared with a group consisting of small masses or urothelial thickening. Urine cytology results were grouped as malignant or suspicious versus atypical or benign. Results were considered statistically significant at $p < 0.05$. The area under the receiver operating characteristic curve was used to evaluate discrimination, and the Hosmer-Lemeshow test was used to evaluate model calibration.

Results

Of 76 patients with suspicious CT urographic findings, 40 had pathologically proven upper tract urothelial carcinomas (Figs. 2–4), resulting in a PPV of 53% (40/76). The PPV varied by imaging appearance. For findings classified as large masses, the PPV was 83% (29/35). Six false-positive findings were due to hypertrophied papilla (two cases) (Fig. 5), blood clot, renal cell carcinoma, inflammatory mass due to tuberculosis, and fibroepithelial polyp. The PPV for small masses was 0% (0/17) because no small masses were found to be cancers. Causes of false-positive small masses included blood clot in nine cases, normal papilla in three cases, ureteritis cystica (Fig. 6), ureteral kink, crossing vessel, congenital megaureter, and a calyceal mass that did not change on imaging for more than 4 years. Of the 24 CT urograms with suspicious urothelial thickening, 11 were due to urothelial carcinoma, for a PPV of 46%. Causes of 13 false-positive examinations in cases of urothelial thickening were inflammation (12 cases) (Fig. 7) and peristalsis. The 10 false-positive masses (nine < 5 mm and one measuring 6 mm) due to blood clot were reviewed in retrospect to see whether the lack of enhancement could have been used to differentiate clot from tumor, but the masses were seen only on the excretory phase images and not on unenhanced images.

Urine cytology results were available for 61 patients (Table 1). Among 35 patients with large masses, 29 (83%) underwent urine cytology with the following results: six benign, seven atypical, nine suspicious, and seven malignant. All 16 patients with suspicious or malignant urine cytology had carcinomas, although one was considered false-positive because the mass was found to be renal cell carcinoma rather than urothelial carcinoma. Two of six patients (33%) with benign and five of seven patients (71%) with atypical cytologic results also proved to have upper tract urothelial carcinomas. Twelve of 17 patients (71%) with small masses, none of whom...
had upper tract urothelial cancer, underwent urine cytology, and 11 of them (92%) had benign or atypical results. The only patient with a small mass who had malignant cytology had urothelial carcinoma of the bladder. Of 24 patients with suspicious urothelial thickening, 20 (83%) underwent urine cytology, and eight with suspicious or malignant results had proven upper tract urothelial cancer. Only two of 12 patients (17%) with benign (six patients) or atypical (six patients) cytologic results had upper tract cancer.

Univariate analysis showed that age, urine cytology, and imaging appearance were statistically significant predictors of true-positive findings on CT urography (Table 2). Sex and indication for examination were not significant univariate predictors of true-positive CT urography. The average age of patients with confirmed upper tract urothelial cancers was greater (mean, 70.1 years; range, 49–88 years) than that of patients without upper tract urothelial cancers (mean, 62.8 years; range, 32–85 years). The area under the receiver operating characteristic curve for the multivariate logistic regression model was 0.927 (95% CI, 0.859–0.995). Variables selected for the final model with the Akaike information criterion backward elimination method are listed in Table 3. The final model included the two primary interest variables—urine cytology (odds ratio, 60.0; 95% CI, 5.5–653.7) and imaging appearance (odds ratio, 24.4; 95% CI, 3.0–201.9)—and variables that adjusted for age and the two major clinical indications for CT urography. According to this model, the odds that a patient with a suspicious or malignant urine cytology result had true upper tract urothelial cancer were 60 times higher than those of a patient of the same age with the same CT appearance and examination indication who had benign or atypical urine cytology. Likewise, the model predicted that the odds that a patient with CT evidence of a large upper tract urothelial mass had true urothelial cancer were 24 times those of a patient of the same age and with the same urine cytology and examination indication with a small mass or urothelial thickening detected with CT urography. In addition, hematuria was found to be a significant predictor of a true-positive CT urographic finding (odds ratio, 27.8; 95% CI, 1.2–663.1) when the other variables were taken into account.

Discussion

CT urography has become an integral tool for detecting upper urinary tract abnormalities in patients with hematuria and those with known malignant urothelial tumors. CT offers the opportunity to directly visualize the walls of the urinary tract and extrinsic masses, both of which can be seen only indirectly with IV urography. Endoluminal masses can be detected with both techniques. CT has the advantage in contrast resolution, and IV urography has the advantage in spatial resolution. With newer MDCT scanners, however, axial images can be acquired with thinner collimation than in the past, providing improved spatial resolution. The limitations of IV urography related to body habitus and bowel gas do not pose similar restrictions with CT urography. In addition to improvements in MDCT technology, refinements with CT urography have likely contributed to the increasing ability to detect urothelial abnormalities. Different techniques have been used, such as abdominal compression [19–22]; administration of IV saline solution, diuretics, or both [23–25]; and log-rolling (asking patients to roll 360°) [26] before excretory phase imaging to

![Image](image1.png)

Fig. 6—69-year-old woman with history of kidney stones and hematuria. CT urogram shows multiple small upper tract masses. Finding was believed to represent ureteritis cystica, but multifocal urothelial carcinoma could not be excluded with imaging findings alone. Ureteroscopy confirmed presence of ureteritis cystica. 

**A.** Axial CT image shows small (<5 mm), round soft-tissue mass (arrow) in proximal right ureter. 

**B.** Coronal reformatted image shows multiple small, round soft-tissue masses (arrows) in proximal right ureter and staghorn calculus (asterisk).

![Image](image2.png)

Fig. 7—49-year-old woman with chronic microscopic hematuria and intermittent gross hematuria. 

**A.** Coronal reformatted image shows circumferential urothelial thickening (arrows) throughout right intrarenal collecting system. Because of lack of risk factors for urothelial carcinoma and benign voiding urine cytology, patient underwent imaging follow-up. 

**B.** Coronal reformatted image from follow-up study 3 months after **A** shows new hydronephrosis due to obstructing stone (black arrow) in proximal ureter but interval resolution of intrarenal urothelial thickening (white arrow), which was presumed inflammation related to stone disease.
CT Urography of Urothelial Cancer

### TABLE 1: Correlation Between CT Urographic Findings and Urinary Cytologic Results (n = 61)

<table>
<thead>
<tr>
<th>CT Urographic Finding</th>
<th>Benign</th>
<th>Atypical</th>
<th>Suspicious</th>
<th>Malignant</th>
</tr>
</thead>
<tbody>
<tr>
<td>Large mass (&gt; 5 mm)</td>
<td>6 (2)</td>
<td>7 (5)</td>
<td>9 (8)</td>
<td>7 (7)</td>
</tr>
<tr>
<td>Small mass (≤ 5 mm)</td>
<td>9 (0)</td>
<td>2 (0)</td>
<td>0 (0)</td>
<td>1 (0)</td>
</tr>
<tr>
<td>Urothelial thickening</td>
<td>6 (1)</td>
<td>6 (1)</td>
<td>3 (3)</td>
<td>5 (5)</td>
</tr>
</tbody>
</table>

Note—Numbers in parentheses are cases of upper tract urothelial cancer.

### TABLE 2: Univariate Predictors of True-Positive CT Urographic Findings

<table>
<thead>
<tr>
<th>Variable</th>
<th>True-Positive</th>
<th>False-Positive</th>
<th>p</th>
<th>Odds Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (y)*</td>
<td>70.1 (49–88)</td>
<td>62.8 (32–85)</td>
<td>0.019</td>
<td>NA</td>
</tr>
<tr>
<td>Urine cytologic result</td>
<td>&lt; 0.001</td>
<td>31.937</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>Malignant</td>
<td>12</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Suspicious</td>
<td>11</td>
<td>1</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Atypical</td>
<td>6</td>
<td>9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Benign</td>
<td>3</td>
<td>18</td>
<td></td>
<td></td>
</tr>
<tr>
<td>History of urothelial cancer</td>
<td>20</td>
<td>10</td>
<td>0.115</td>
<td>2.583</td>
</tr>
<tr>
<td>Hematuria</td>
<td>24</td>
<td>19</td>
<td>0.607</td>
<td>1.341</td>
</tr>
<tr>
<td>Urinary tract obstruction</td>
<td>1</td>
<td>5</td>
<td>0.182</td>
<td>0.207</td>
</tr>
<tr>
<td>Imaging appearance</td>
<td>&lt; 0.001</td>
<td>8.091</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Large mass</td>
<td>29</td>
<td>6</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Small mass</td>
<td>0</td>
<td>17</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Urothelial thickening</td>
<td>11</td>
<td>13</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sex</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Male</td>
<td>25</td>
<td>14</td>
<td>0.202</td>
<td>2.078</td>
</tr>
<tr>
<td>Female</td>
<td>15</td>
<td>22</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*Mean with range in parentheses. NA = not applicable.

maximize urinary tract opacification and distention. As the ability to detect upper tract urothelial abnormalities with CT urography improves, it becomes increasingly important to determine which urothelial findings indicate true cancers and require further invasive or noninvasive testing and which indicate benign findings. As urinary tract imaging trends toward CT urography and away from IV urography [27], it is important to understand that a more sensitive test may have lower specificity and an increased number of false-positive results.

Our results show that the presence of an upper urinary tract finding on CT urography alone is a poor predictor of malignancy, with a PPV of 53%. However, our multivariate logistic regression model showed that the PPV of CT urography can be increased by accounting for several other factors. The area under the receiver operating characteristic curve for this model was 0.927, which implies excellent discrimination ability. For example, using imaging appearance, we found that large masses were malignant more than 80% of the time. No small masses were urothelial cancer, and urothelial thickening was as likely to be benign as malignant. In addition, urine cytology results were helpful in differentiating true-positive from false-positive CT urographic findings. All 25 patients with suspicious or malignant urine cytology had a urinary tract malignancy. Because our purpose was to assess the predictive value of CT urography in the detection of upper urothelial carcinoma, two CT urograms were considered false-positive because the abnormal cytology resulted from bladder carcinoma and renal cell carcinoma in those two patients. Therefore, when the urine cytology was suspicious or malignant and CT urography showed an upper tract urothelial abnormality, the PPV for urinary tract malignancy was 100% (25/25) but for upper tract urothelial carcinoma was 92% (23/25).

Although the sensitivity of CT urography in the detection of upper tract urothelial carcinoma has been assessed in many studies [7, 9, 14, 15, 28, 29], only one study [14] has addressed the PPV, which is essential for patient care. When a suspicious finding is encountered in clinical practice, it is important to know whether upper tract urothelial cancer can be diagnosed confidently with CT urography, so the urologist can proceed to surgery without further invasive testing. Our PPV for CT urography (53%) was similar to the 50% reported by Sudakoff et al. [14]. Their investigation, however, included only patients with hematuria and no history of urothelial cancer and was conducted with the perspective of diagnosing any upper tract neoplasm, including benign (angiomyolipoma) and malignant (renal cell carcinoma) renal parenchymal masses. Patients with a history of urothelial cancer are known to be at greater risk for developing additional urothelial cancer [12, 13]. However, these patients also can be expected to have benign postoperative findings. Upper tract infection is a known complication of cystectomy and urinary diversion for bladder cancer [30] and was found to be a benign cause of urothelial thickening in one of our patients. The PPV was actually higher in this group (69%, 22/32) than among patients with hematuria alone (49%, 17/35), likely reflecting a stronger bias toward the increased incidence of upper tract tumors in this population. This finding highlights the fact that the prevalence of disease in the population tested has a strong influence on the PPV of a test.

Our study had several limitations. First, not all patients underwent urine cytology. The multivariate logistic regression analysis included only patients who had urine cytology findings (61/76), thereby excluding almost 20% of our study group from this portion of the analysis. It is uncertain whether or how the data on the group of excluded patients would have altered the analysis, but this group included eight patients with upper tract urothelial cancers (seven of whom had large masses and one with urothelial thickening) and seven patients with false-positive CT urographic findings (four with small masses, three with urothelial thickening). In addition, all urine cytologic specimens were included in the analysis, both voided specimens and selective specimens from one ureter. It has been reported [31] that selective upper tract cytology is not useful for identifying upper tract urothelial cancer when urothelial findings are not seen on imaging. To our knowledge, however,
the value of selective urine cytologic examination has not been reported for elucidating positive upper tract imaging findings. Voided urine specimens could contain malignant cells from the upper or the lower urinary tract, explaining the false-positive malignant cytology in our patient with bladder carcinoma. The specificity of positive selective upper tract cytology of bladder carcinoma has been questioned [32], possibly because of the introduction of malignant cells into the upper tract at bladder instrumentation. Therefore, if high-grade urine cytologic findings have been made, CT urography may be of great value for localizing carcinoma to the upper or lower urinary tract or for determining the laterality of upper tract cancer.

A second limitation was that our study was a retrospective review of CT urograms prospectively read as suspicious for upper tract urothelial cancers. Therefore, findings that may have been clearly benign to one reviewer (e.g., congenital megaureter) might have been interpreted as potentially malignant to a less experienced reviewer, increasing the number of false-positive cases and therefore resulting in a lower PPV for CT urography in our study. Although this limitation affects prospective clinical readings, it provides the opportunity to generalize the PPV of the test to practicing radiologists. In addition, some upper tract abnormalities interpreted as suspicious for urothelial cancer, although not urothelial cancer, may have been the source of the problem for which the test was ordered (e.g., hematuria or signs or symptoms of urinary tract obstruction), such as renal cell carcinoma, fibroepithelial polyp, and benign strictures. Therefore, CT urography was integral to patient care, but because the purpose of the study was to determine the PPV of CT urography in the diagnosis of upper tract urothelial cancer, these findings were considered false-positive.

A third limitation of this study was that the reference standard for assessing urothelial abnormalities varied among patients. Forty-two of 76 patients underwent biopsy or surgical resection of the visualized abnormality, but 29 patients underwent only additional directed imaging, and five patients underwent clinical follow-up alone. Although imaging alone was never used to confirm a true-positive finding, resolution of the abnormality was considered confirmation of a false-positive result. Although it is possible that the initially detected abnormality may have been missed at follow-up imaging with retrograde pyelography, ureteroscopy, or CT urography, the second test was performed with direct knowledge of the location and extent of the abnormality, allowing focused attention to the area of the finding. Almost all patients who underwent imaging follow-up (25/29) also underwent clinical follow-up (mean, 5.2 years) and remained free of upper tract urothelial cancer.

A fourth limitation of our study was the small number of patients with positive findings at upper tract CT urography (n = 61) and the correspondingly small number of patients for each predictor variable tested. This limitation resulted in wide CIs for the estimated odds ratios in Table 3. Therefore, additional studies with larger samples would be helpful to validate our findings.

Upper tract urothelial carcinoma is a rare disease, and the standard treatment is major surgery. It therefore is important to know that benign findings can mimic cancer on CT urography. We found that the PPV of a suspicious upper tract CT urographic finding is low (53%) but that imaging appearance and urine cytology results can aid in the specific diagnosis of urothelial malignancy. A confident diagnosis of cancer can be made when both a large (> 5 mm) mass is found with CT urography and suspicious or malignant cells are found at urine cytology. Although benign urine cytology should be reassuring in patients with small (≤ 5 mm) masses, observation is warranted. In patients with urothelial thickening, suspicious or malignant urine cytology is highly indicative of upper tract cancer, and atypical and benign cytologic results should prompt further evaluation.

## References

15. Albani BM, Ciascini MW, Streem SB, Herts BR, Angermieier KW. The role of computerized tomographic urography in the initial evaluation of he-

## Table 3: Multivariate Logistic Regression Model

<table>
<thead>
<tr>
<th>Variable</th>
<th>p</th>
<th>Odds Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age</td>
<td>0.073</td>
<td>1.1 (1.0–1.2)</td>
</tr>
<tr>
<td>Urine cytologic result</td>
<td>0.001</td>
<td>60.0 (5.5–653.7)</td>
</tr>
<tr>
<td>Imaging appearance</td>
<td>0.003</td>
<td>24.4 (3.0–201.9)</td>
</tr>
<tr>
<td>History of urothelial cancer</td>
<td>0.089</td>
<td>15.2 (0.7–349.3)</td>
</tr>
<tr>
<td>Hematuria</td>
<td>0.040</td>
<td>27.8 (1.2–663.1)</td>
</tr>
</tbody>
</table>

Note—Values in parentheses are 95% CI.
CT Urography of Urothelial Cancer

19. Chow LC, Sommer FG. Multidetector CT urography with abdominal compression and three-dimensional reconstruction. AJR 2001; 177:849–855