Evaluation of upper urinary tract tumors with portal venous phase MDCT: a case-control study

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Objective: The purpose of this article is to assess the detection and negative prediction rate of upper urinary tract tumors in nonopacified urinary tracts on portal venous phase MDCT.
Materials and Methods: This retrospective case-control study included 20 patients with upper urinary tract tumors and 40 age- and sex-matched control subjects. All studies were assessed independently by two reviewers. Reviewers determined whether each of four segments of the upper urinary tract could be fully visualized

and whether tumor was present or absent. For each tumor, reviewers characterized its morphologic features (i.e., infiltrative or polypoid mass, urothelial thickening, and associated hydroureter or hydronephrosis).
Results: The detection rate of the proximal two upper urinary tract segments was significantly higher than that for the distal segments ($p < 0.001$). For each upper urinary tract, the sensitivity, specificity, and negative predictive value of portal venous phase MDCT for detecting tumors were 95%, 97%, and 100%, respectively. The positive predictive value for an estimated population prevalence of 0.0005-0.004 was 0.6-4.8%. The morphologic features significant for the presence of tumor were urothelial thickening and the presence of a discrete polypoid mass. Interobserver agreement for all features was good or very good, except for moderate agreement on urothelial thickening involving the ureter ($\kappa = 0.60$).
Conclusion: The detection rate of upper urinary tract tumors on nonopacified portal venous phase is high. Furthermore, in the absence of morphologic features suggestive of urothelial malignancy, a normal-appearing ureter may be reassuring.

Editorial Comment

Three-phase multidetector computed tomography urography (MDCTU) has become the method of choice for investigation patients with hematuria. Three-phase MDCT represents a complete protocol including non-contrast (through abdomen and pelvis), nephrographic/portal (through the kidneys) and excretory phases (through abdomen and pelvis). Such complete protocol is necessary when searching all possible causes of hematuria: calculi, vascular, parenchymal or urothelial abnormalities. In patients with ureteral obstruction, delayed contrast excretion by the kidney preclude contrast opacification of the ureter and sometimes the excretory phase has to be postponed or even repeated. The total amount of effective radiation dose delivered to the patients when using this three-phase protocol varies from 15-18 mSv.

The authors of this retrospective case-control study suggests that nephrographic/portal venous phase MDCT-urography obtained at 70-90 seconds after intravenous injection of contrast material has high PPV and NPV for detecting tumor in the upper urinary tract with an overall sensitivity, specificity, and NPV of 95%, 97%, and 100%, respectively. Another authors' suggestion is that of even when nonopacified, the likelihood of malignancy in a normal-appearing ureter is low and the identification rate of upper urinary tract tumors will still be high.

Any attempt to reduce the total amount of radiation in MDCT-urography should be incentivized but some points of this report deserve some comments. Since in nephrographic phase only both kidneys are imaged, consequently only the pelvocalyceal system and upper portion of the ureter is evaluated. As pointed out by the authors the mid and distal portions of ureter will not be imaged. In our institution we obtain a complete abdominal/pelvic acquisition during portal/nephrographic phase only in patients presenting hydronephrosis and hydroureter on non-contrast phase. In such situation all the urothelial surface is evaluated and urothelial cancer is readily detected. Excretory phase however is still necessary to image contralateral excretory unit due to eventual multifocal tumor, but there is no need for further delayed abdominal/pelvic acquisition(s).

Additionally, in our experience, the absence of abnormalities in the portal phase of a normal-appearing ureter does not always mean absence of tumor. Occasionally small urothelial lesions can be overlooked in nephrographic phase and be retrospectively identified based on findings of the excretory phase.

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