IMAGING

Detection of Bladder Tumors with Dynamic Contrast-Enhanced MDCT

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Objective: In a small pilot study, we assessed whether early-phase dynamic contrast-enhanced MDCT can be used to detect bladder tumors and whether thin reconstruction improves the detection rate.
Subjects and Methods: Thirty-six patients (30 with 59 cystoscopy-proven bladder cancers and six with normal bladders) underwent dynamic contrast-enhanced MDCT of the pelvis and abdomen. Images were obtained from the symphysis pubis to the diaphragm 70 seconds after injection of 100 mL of contrast medium. McNemar test was used to compare sensitivity per patient, segment, and tumor and specificity per patient and segment for each of three reconstruction methods: 5-mm sections with no overlap (i.e., 5-mm axial images), 2.5-mm sections with 1.25-mm overlap (i.e., thin-section axial images), and 2.5-mm sections with 1.25-mm overlap and multiplanar reformation (MPR) (i.e., thin-section axial images with MPR).
Results: MDCT with a combination of thin, overlapped sections and MPR depicted all but one of 47 bladder tumors larger than 5 mm but only five of 12 tumors 5 mm or smaller. There were no false-positive findings. Per-tumor sensitivity was significantly better with thin-section images with MPR (90%) and thin-section images alone (86%) than with 5-mm axial images (80%) ($p < 0.05$). Per-segment sensitivity was significantly better with thin-section images with MPR (95%) and thin-section axial images alone (87%) than with 5-mm axial images (79%) ($p < 0.05$). Per-patient sensitivity and per-patient and per-segment specificity did not differ with the three methods.
Conclusion: Dynamic contrast-enhanced MDCT of the pelvis shows promise for the detection of bladder tumors. Use of thin-section images with MPR and thin-section axial images alone had a significantly better rate of detection of bladder tumors than use of 5-mm axial images.

Editorial Comment

The authors show the ability of thin (2.5 mm) and overlapped sections and multiplanar reconstruction (MPR) to depict small bladder tumors. Thin-section images (2.5 mm) with MPR were used to detect all but one of 47 bladder tumors larger than 5 mm but only five of 12 tumors 5 mm or smaller. There were no false-positive findings. The sensitivity for detecting bladder tumors 5 mm or smaller was significantly better for thin-section images with MPR and thin-section axial images (both, 58%) than for 5-mm axial images (25%) ($p < 0.05$). Use of thin-section axial images improved the detection rate only for tumors smaller than 5 mm. MPR improved the detection of tumor in the bladder dome and tumors adjacent to normal anatomic structures.

Multidetector CT-urography has been shown to be an effective single comprehensive examination in the evaluation of patients with hematuria or with risk for the development of urothelial malignancies. Since protocols for MDCT urography varies from each institution, most MDCT urography images are obtained in the unenhanced phase (detection of calculi), nephrographic-phase (detection of renal masses) and excretory-phase (detection of urothelial lesions). Some authors recommend that MDCT urography should be performed only after adequate cystoscopy since these protocols do not allow adequate evaluation of the bladder.
Since January 2006, we have been using in our institution similar technique described by the authors as part of MDCT urography (1). This additional phase of MDCT-urography is used only in patients with macroscopic hematuria and with no previous cystoscopy. We agree with the authors that this “the bladder-wall phase” (scans at 60 or 70 seconds after intravenous injection of contrast), allows the detection of small bladder tumors. However, we need to keep in mind that this additional phase cause significant increase in the effective radiation

dose to the patients (18 to 25 mGy). For this reason, this protocol should be used with caution and primarily in older patients with macroscopic hematuria and absence of previous cystoscopy.

Reference

1. Kim JK, Park SY, Ahn HJ, Kim CS, Cho KS: Bladder cancer: analysis of multi-detector row helical CT enhancement pattern and accuracy in tumor detection and perivesical staging. Radiology. 2004; 231: 725-31.

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Can High-Attenuation Renal Cysts be Differentiated from Renal Cell Carcinoma at Unenhanced CT?

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Purpose: To retrospectively determine if renal cell carcinoma can be differentiated from high-attenuation renal cysts at unenhanced computed tomography (CT) based on Hounsfield unit measurements and heterogeneity.
Materials and Methods: The Human Investigation Committee at our institution approved this study with waiver of informed consent. This study was compliant with the HIPAA. Fifty-four pathologically proved renal cell carcinomas in 54 patients (36 men and 18 women; average age, 53 years; range, 23-90 years) and 56 high-attenuation renal cysts in 51 patients (30 men and 21 women; average age, 63 years; range, 28-86 years) were retrospectively evaluated at unenhanced CT. Two independent readers reviewed randomized unenhanced CT images and obtained Hounsfield unit readings of each mass. A subjective determination of lesion heterogeneity was also performed by using a four-point scale (1: homogeneous, 2: mildly heterogeneous, 3: moderately heterogeneous, 4: markedly heterogeneous). Statistical analysis was performed by using Bland-Altman regression tree, classification and regression tree, and Shapiro-Wilk normality test.
Results: The average attenuation of cysts for reader 1 was 53.4 HU (range, 23-113 HU) and for reader 2 was 53.8 HU (range, 21-108 HU). The average attenuation of neoplasms for reader 1 was 34.7 HU (range, 21-60 HU) and for reader 2 was 38.4 HU (range, 22-60 HU). For cyst heterogeneity, a score of 1 was given in 55 of 56 (98%) cysts for reader 1 and in 53 of 56 (95%) cysts for reader 2. For neoplasm heterogeneity, a score of 1 was given in 35 of 54 (65%) neoplasms for reader 1 and in 36 of 54 (67%) for reader 2. Given the distribution of cyst and tumor attenuation values and lesion heterogeneity, a homogeneous mass measuring 70 HU or greater at unenhanced CT has a greater than 99.9% chance of representing a high-attenuation renal cyst.
Conclusion: The findings from this study may help differentiate high-attenuation renal cysts from renal cell carcinomas at unenhanced CT and may suggest the next appropriate imaging study for definitive characterization.

Editorial Comment

A hyperdense cyst refers to a cyst that demonstrates high attenuation on nonenhanced CT scans. Hemorrhage or proteinaceous debris is the most common cause, but renal cell carcinoma may eventually demonstrate similar

findings. A hyperdense renal cyst can be considered benign if it is sharply marginated or homogeneous or demonstrates a hematocrit effect on nonenhanced and contrast-enhanced scan and demonstrates no significant enhancement on post-contrast scans. Because internal structures within a hyperdense renal cyst cannot be well evaluated by nonenhanced CT, US or MR imaging can be used for the differentiation. When sonography is performed, the mass is usually cystic but occasionally do not present all the sonographic criteria for a simple cyst. Actually internal septations and absence of posterior wall trough-transmission are frequently found.

The authors present an interesting observation, which should be useful for adequate characterization of hyperdense renal lesion found on nonenhanced CT scans particularly in those patients submitted to a non-contrast CT scans for the detection of urolithiasis. They found that the attenuation of a renal mass and its degree of heterogeneity are useful findings in distinguishing a high-attenuation renal cyst from renal cell carcinoma on unenhanced CT images. If the density of the mass is greater than 70 HU and the mass is homogeneous, there is a chance of almost 100% (99.9%) that the mass is benign hyperdense renal cyst. They concluded that in this situation there is no need for contrast enhanced CT scan and high-resolution US studies or MR imaging can be used as complimentary test.

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UROGENITAL TRAUMA

Management of High Grade Renal Trauma: 20-Year Experience at a Pediatric Level-I Trauma Center

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Purpose: In the last 20 years the management of high grade, blunt renal trauma at our institution has evolved from primarily an operative approach to an expectant nonoperative approach. To evaluate our experience with the expectant nonoperative management of high grade, blunt renal trauma in children, we reviewed our 20-year experience regarding evaluation, management and outcomes in patients treated at our institution.
Materials and Methods: We retrospectively studied all patients sustaining renal trauma between 1983 and 2003. Medical records were reviewed for mechanism of injury, assigned grade of renal injury, patient treatment, indications for and timing of surgery, and outcome. Injuries were categorized as either low grade (I to III) or high grade (IV to V).
Results: We reviewed the medical records of 164 consecutive children who sustained blunt renal trauma between 1983 and 2003. A total of 38 patients were excluded for inadequate information. Of the remaining 126 children 60% had low grade and 40% had high grade renal injuries. A total of 11 patients (8.7%) required surgical or endoscopic intervention for renal causes, including 2 for congenital renal abnormalities and 1 for clot retention. Eight patients (6.3%) required surgical intervention for isolated renal trauma, of whom 2 (1.6%) required