Prostate tumor volume measurement with combined T2-weighted imaging and diffusion-weighted MR: correlation with pathologic tumor volume

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Purpose: To retrospectively determine the accuracy of diffusion-weighted (DW) magnetic resonance (MR) imaging for identifying cancer in the prostate peripheral zone (PZ) and to assess the accuracy of tumor volume measurements made with T2-weighted imaging and combined T2-weighted and DW MR imaging by using surgical pathologic examination as the reference standard.

Materials and Methods: The institutional review board issued a waiver of informed consent for this HIPAA-compliant study. Forty-two patients underwent endorectal MR at 1.5 T before undergoing radical prostatectomy for prostate cancer and had at least one PZ tumor larger than 0.1 cm(3) at surgical pathologic examination. On T2-weighted images, an experienced radiologist outlined suspected PZ tumors. Two apparent diffusion coefficient (ADC) cutoff values were identified by using the Youden index and published literature. Image cluster analysis was performed on voxels within the suspected tumor regions. Associations between volume measurements from imaging and from pathologic examination were assessed by using concordance correlation coefficients (CCCs). The sensitivity and specificity of ADCs for identifying malignant PZ voxels were calculated.

Results: In identifying malignant voxels, respective ADC cutoff values of 0.0014 and 0.0016 mm(2)/sec yielded sensitivity of 82% and 95% and specificity of 85% and 65%, respectively. Sixty PZ cancer lesions larger than 0.1 cm(3) were found at pathologic examination; 43 were detected by the radiologist. CCCs between imaging and pathologic tumor volume measurements were 0.36 for T2-weighted imaging, and 0.46 and 0.60 for combined T2-weighted and DW MR imaging with ADC cutoffs of 0.0014 and 0.0016 mm(2)/sec, respectively; the CCC of combined T2-weighted and DW MR imaging (ADC cutoff, 0.0016 mm(2)/sec) was significantly higher (P = .006) than that of T2-weighted imaging alone.

Conclusion: Adding DW MR to T2-weighted imaging can significantly improve the accuracy of prostate PZ tumor volume measurement. Supplemental Material: http://radiology.rsnajnls.org/cgi/content/full/252/2/449/DC1.

Editorial Comment

The authors showed that the combination of anatomic information obtained with conventional T2-weighted image and functional study technique, obtained with diffusion-weighted image, significantly improves the accuracy of prostate peripheral zone tumor volume measurement. This information is interesting since multivariate analysis performed in other study showed that tumor volume, but not pathologic stage or baseline PSA level, was independently predictive of post-prostatectomy disease recurrence (1). In other words, measurement of prostate cancer tumor volume may provide information on prognosis that is independent of direct morphologic assessment of extraprostatic extension. Other studies have shown that pathologic tumor volume correlates also with pathologic stage, Gleason score, margin status, vascular invasion and metastases (2). So far, imaging estimation of prostate cancer tumor volume has been obtained with the combination of conventional MRI and spectroscopic imaging (3). This combined technique however is more effective in tumors larger than 0.5 cm3. Although the results of this study might be useful in daily clinical practice, we agree with the authors that determination of tumor volume should be better accomplished by using of multiparametric MRI prostate evaluation (combination of conventional T2-weighted image, diffusion-weighted image and dynamic contrast-enhanced studies).

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UROGENITAL TRAUMA

Radiographic predictors of need for angiographic embolization after traumatic renal injury

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Background: Although the American Association of the Surgery for Trauma Organ Injury Scale is the gold standard for staging renal trauma, it does not address characteristics of perirenal hematomas that may indicate significant hemorrhage. Angiographic embolization has become well established as an effective method for achieving hemostasis. We evaluated two novel radiographic indicators--perirenal hematoma size and intravascular contrast extravasation (ICE)--to test their association with subsequent angiographic embolization.
Methods: Among 194 patients with renal trauma between 1999 and 2004, 52 having a grade 3 (n = 33) or grade 4 (n = 19) renal laceration were identified. Computed tomography scans were reviewed by a staff radiologist and urologist blinded to outcomes. ICE was defined as contrast within the perirenal hematoma during the portal venous phase having signal density matching contrast in the renal artery. Hematoma size was determined in four ways: hematoma area (HA), hematoma to kidney area ratio (HKR), difference between hematoma and kidney area (HKD), and perirenal hematoma rim distance (PRD).
Results: Of the 52 patients, 8 had ICE and 4 of these (50%) required embolization, whereas none of the 42 (0%) patients without ICE needed embolization (p = 0.001). Likewise, all four measures of perirenal hematoma size assessed were significantly greater in patients receiving embolization [HA (128.3 vs. 75.4 cm, p = 0.009), HKR (2.75 vs. 1.65, p = 0.008), HKD (76.5 vs. 30.2 cm, p = 0.006), and PRD (4.0 vs. 2.5 cm, p = 0.041)].
Conclusion: Perirenal hematoma size and ICE are readily detectible radiographic features and are associated with the need for angiographic embolization.

Minimally invasive endovascular techniques to treat acute renal hemorrhage

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Purpose: We evaluated the effectiveness of endovascular therapy for severe renal hemorrhage.
Materials and Methods: We retrospectively reviewed cases compiled from the trauma database, billing records and interventional radiology logs at our institution from 1990 to 2007. Technical success was defined as the