## IMAGING

### Detection of prostate cancer with MR spectroscopic imaging: an expanded paradigm incorporating polyamines

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Purpose: To characterize benign and malignant prostate peripheral zone (PZ) tissue retrospectively by using a commercial magnetic resonance (MR) spectroscopic imaging package and incorporating the choline plus creatine-to-citrate ratio ([Cho + Cr]/Cit) and polyamine (PA) information into a statistically based voxel classification procedure.
Materials and Methods: The institutional review board approved this HIPAA-compliant study and waived the requirement for informed consent. Fifty men (median age, 60 years; range, 44-69 years) with untreated biopsy-proved prostate cancer underwent combined endorectal MR imaging and MR spectroscopic imaging. Commercial software was used to acquire and process MR spectroscopic imaging data. The (Cho + Cr)/Cit and the PA level were tabulated for each voxel. The PA level was scored on a scale of 0 (PA undetectable) to 2 (PA peak as high as or higher than Cho peak). Whole-mount step-section histopathologic analysis constituted the reference standard. Classification and regression tree analysis in a training set generated a decision-making tree (rule) for classifying voxels as malignant or benign, which was validated in a test set. Receiver operating characteristic and generalized estimating equation regression analyses were used to assess accuracy and sensitivity, respectively.
Results: The median (Cho + Cr)/Cit was 0.55 (mean +/- standard deviation, 0.59 +/- 0.03) in benign and 0.77 (mean, 1.08 +/- 0.20) in malignant PZ voxels (P = .027). A significantly higher percentage of benign (compared with malignant) voxels had higher PA than choline peaks (P < .001). In the 24-patient training set (584 voxels), the rule yielded 54% sensitivity and 91% specificity for cancer detection; in the 26-patient test set (667 voxels), it yielded 42% sensitivity and 85% specificity. The percentage of cancer in the voxel at histopathologic analysis correlated positively (P < .001) with the sensitivity of the classification and regression tree rule, which was 75% in voxels with more than 90% malignancy.
Conclusion: The statistically based classification rule developed indicated that PAs have an important role in the detection of PZ prostate cancer. With commercial software, this method can be applied in clinical settings.

**Editorial Comment**

The ratio of choline and creatine to citrate (Cho+Cr/Cit), is the parameter for the detection of prostate cancer on MR spectroscopic imaging (MRSI). As we know this ratio is increased in prostate cancer due to the elevation of choline (high turnover of phospho-lipid in cell membranes of the proliferating tissue) and reduction in the level of citrate (converted to a citrate-oxidating metabolism).Although there is no consensus, voxels are considered very suggestive of cancer if the ratio of choline and creatine to citrate is more than 3 standard deviations above the average ratio (1). However, using these criteria false positive results occurs due to prostatitis and prostatic atrophy. The authors of this meticulous and well-performed prospective study offers additional data regarding the possible role of another metabolite (polyamine) which may help increase the accuracy for the detection of prostate cancer by MRSI. When the polyamine peak is higher or at the same level of the peak of choline and the ratio of Cho+Cr / Cit is above 1.1, the voxel should be considered malignant. However if the ratio is below 1.1 the voxel should be considered benign. As suggested by the authors we already started to apply this method in clinical settings particularly for the detection of prostate cancer in patients with negative biopsies (at least 2) and elevated PSA. In the near future, we will present our preliminary results of this prospective study. It

would be interesting to see if this expanded paradigm will be useful to avoid false positive results with MRSI of the prostate. Other prospective studies from different institutions in similar or distinct clinical settings are warranted.

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## The incidental indeterminate adrenal mass on CT (> 10 H) in patients without cancer: is further imaging necessary? Follow-up of 321 consecutive indeterminate adrenal masses

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Objective: The objective of our study was to determine whether follow-up imaging evaluation is necessary for incidentally discovered indeterminate adrenal lesions (> 10 H) on CT in patients with no known malignancy.
Materials and Methods: A computer search of CT reports from January 2000 to December 2003 identified patients with incidentally detected, indeterminate, but benign-appearing adrenal lesions who had no known malignancy and no clinical suspicion of hyperfunctioning adrenal mass. Patients with adrenal masses diagnostic on the initial CT or heterogeneous masses were excluded. Two hundred ninety patients with 321 lesions met the study criteria. Each lesion was determined to be benign or malignant based on histopathology, characterization with diagnostic imaging studies, or a minimum of 1 year of stability on imaging follow-up or 2 years of stability on clinical follow-up.
Results: Of the 321 lesions, 318 masses (99.1%) were confirmed to be benign and clinically insignificant. These included three (0.9%) histologically confirmed adenomas, 198 (61.7%) adenomas by imaging characterization, five (1.6%) other benign lesions, 71 (22.1%) masses stable on imaging follow-up, and 41 (12.8%) masses with clinical stability. There were three (0.9%) clinically unsuspected functioning masses: one cortisol-producing adenoma and two pheochromocytomas. There were no metastatic adrenal lesions, even among the 13 patients who subsequently developed malignancy elsewhere.
Conclusion: All of the incidentally detected adrenal masses with a CT attenuation of > 10 H were benign in patients with no known malignancy. Follow-up imaging to characterize an incidental adrenal mass appears to have a limited role in this patient cohort.

**Editorial Comment**

Adrenal incidentalomas are found in up to 5% of abdominal CT examination and most of these adrenal lesions observed in patients with no known malignancy are presumed to be benign adenomas as long as they appears as homogeneous, well-defined lesion, round or oval, less than 3 cm, and with attenuation equal or below 10UH. Nowadays imaging plays an essential role for the accurate characterization of the nature of these

incidentalomas. The imaging armamentarium used for this evaluation includes unenhanced CT, chemical shift MRI, CT histogram and CT contrast washout analysis. More recently, promising results of MR spectroscopic imaging have been reported, adding to the armamentarium of adrenal imaging (1).There is still controversies regarding how to follow these patients presenting with radiologic diagnosis of adrenal adenoma; some radiologists do not suggest any follow-up, others recommends repeat dedicated imaging studies at 6, 12, and 24 months. As pointed out by the authors of this manuscript the American College of Radiology states that extensive and costly workup is usually not justified for small (< 3 cm) adrenal masses. The authors of this interesting retrospective study state that none of the adrenal masses (with CT attenuation of > 10UH) incidentally detected in patients without cancer were malignant. Similar findings have been reported in other series in the literature. The authors also did not find any case of a primary adrenal cortical carcinoma or found any enlargement of the lesion in the follow-up study, although enlargement of 1 cm over 1 year can be found in 5% of benign adenomas. Although this study has important limitation already highlighted by the authors (lack of routine biochemical screening in all patients, absence of follow-up in 32 patients, and short follow-up in 66 patients), their results are challenging and calls for further prospective studies to confirm that all small adrenal lesions incidentally found in patients with not known cancer need no follow-up imaging or at least need a less rigid scheme of imaging follow-up.

**References**

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