Adrenal Masses: Linear Correlation between Unenhanced CT Attenuation Value and Signal Intensity Loss on Opposed-phase Chemical Shift MRI

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OBJETIVES. The aims were to determine the relationship between unenhanced CT attenuation value and signal intensity loss on opposed-phase chemical shift MRI and which one of the five quantitative evaluation methods was better, when characterizing adrenal masses.

MATERIALS AND METHODS. This was a prospective study of 23 patients (24 adrenal masses: 22 adenomas, 1 metastasis and 1 pheochromocytoma). All the adrenal masses were proved by surgery, except 7 adenomas whose sizes had no change in 1-year imaging follow-up. All the patients underwent both unenhanced CT and chemical shift MRI and were scanned with GE Lightspeed Ultra 8-slice CT and GE Signa Twinspeed ExciteII MRI. Hounsfield units(HU), signal intensity index(SII), adrenal-to-spleen chemical shift ratio(ASR), adrenal-to-liver chemical shift ratio(ALR) and adrenal-to-muscle chemical shift ratio(AMR) were obtained for each adrenal tumor. With statistical software SPSS, correlation analysis was performed between Hounsfield units and the other parameters. The above five parameters were compared by use of receiver operating characteristic (ROC) analysis.

RESULTS. There was negative linear correlation between Hounsfield units (X) and signal intensity index (Y) (r^2=0.806; F=91.36, p<0.0001), and the two regression equations were Y=68.520-1.229X (Figure 1) and X=48.582-0.656Y. 95%confidence intervals for the constant and regression coefficient in the first equation were (62.427, 74.613) and (-1.496, 0.963), respectively. And those in the second equation were (40.582, 55.647) and (-0.798, -0.513), respectively. Similarly, there were linear correlations between HU and ASR, between HU and AMR, and between HU and ALR. The latter three coefficients of determination were 0.802, 0.799 and 0.625, respectively. Areas under the five ROC curves of HU, SII, ASR, ALR and AMR were 0.977, 1, 1, 0.966, 0.864, respectively.

DISCUSSION. Adrenal adenomas contain intracytoplasmic lipid, which accounts for their low attenuation on unenhanced CT and their loss of signal on opposed-phase chemical shift MRI (Figure2). The study[1] of Gary M. Israel, etc, showed correlation of unenhanced CT attenuation and signal-index index, but the retrospective nature of this study determines its limitations including unstandardized imaging protocols, long interval between CT and MRI in some cases and lack of pathologic proof. So the direct relationship between unenhanced CT and chemical shift MRI when characterizing adrenal masses is still unclear. In our prospective study, we avoided the above defects and the linear correlation coefficients were very high. As to the differentiation of adrenal adenomas from nonadenomas using unenhanced CT and chemical shift MRI, many studies[2-4] have been performed. But the comparison among HU, SII, ASR, ALR and AMR has not been done. In our study, SII and ASR were the best methods of characterization. ALR and AMR were not good, because fatty infiltration of the liver and adipose tissue in the paraspinal muscle could result in signal loss on opposed-phase images. The limitation of the study was the small number of samples.

CONCLUSIONS. With unenhanced CT, we can figure out the signal intensity index and other ratios, vice versa. There is the best correlation between unenhanced CT and signal intensity index . SII, ASR and unenhanced CT attenuation are better methods for characterizing the adrenal masses.

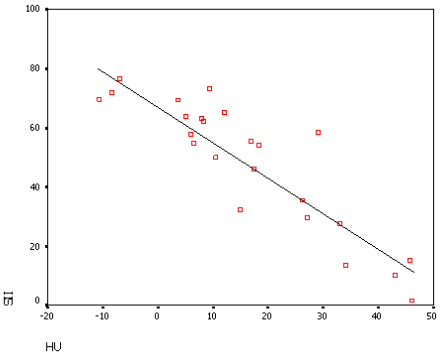

Figure 1 There is linear correlation between SII and unenhanced CT attenuation value (HU). SII declines with the increase of HU

REFERENCES.

1. Gary M. Israel, Melvyn Korobkin, Chun Wang, etc. AJR 2004; 183: 215-219.
2. Giles W. l. Boland, Michael J. Lee, G. Scott Gazelle, etc. AJR 1998; 171: 201-204.
3. Melvyn Korobkin, Frederick J. Brodeur, Gerald G. Yutzy, etc. AJR 1996; 166: 531-536.
4. Fumito Fujiyoshi, Masayuki Nakajo, Yoshihiko Fukukura, etc. AJR 2003; 180: 1649-1657.

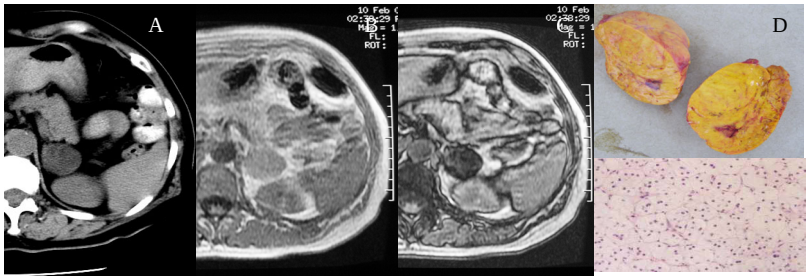

Figure2. A, Unenhanced axial CT reveals a well-defined low-density mass, which measures 5HU. B, The tumor is slightly hyperintense on axial in-phase MRI image. C, Axial opposed-phase MR image reveals lower signal intensity of mass than seen on B. SII is 63.85%. D, Photograph of gross pathologic specimen and photomicrograph of histopathologic specimen (HE, ×20) shows classic adenoma.