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Characterization of adrenal masses using CT histogram analysis, dual energy CT and chemical shift MRI: Methods comparison, first results

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Introduction & Objectives: Incidentalomas of the adrenal gland are relatively common incidental findings during CT or MRI examinations. Most imaging methods routinely used to differentiate adenomas from non-adenomas is based on detection of fat (e.g. mean unenhanced attenuation, CT histogram analysis, chemical shift MRI and DECT (Dual Energy CT). The purpose of this study was to perform interim comparison of diagnostic value of CT histogram analysis, DECT tools and chemical shift MRI in characterization of adrenal masses.

Materials & Methods: In prospective study performed in period 2017-2019, we analyzed 40 histologically confirmed adrenal lesions in 39 patients (1 patient had metastases at both sides), 10 of which were adenomas, 1 myelolipoma, 19 pheochromocytomas, 5 metastases, 4 adrenocortical carcinomas, 1 cyst. Using unenhanced CT images, we recorded mean unenhanced attenuation and percentage of negative pixels from the manually drawn region of interest (ROI). In DECT, we recorded mean attenuation at energy level of 40 keV and amount of fat using material decomposition fat/water. Chemical shift MRI was used to calculate Adrenal Signal Intensity Index (ASII) and Adrenal to Spleen Ratio (ASR). Selected variables were compared using Mann-Whitney´s U-test. We performed receiver operating characteristics (ROC) analysis to calculate area under the curve (AUC) for selected variables. For statistic analysis, we used software IBM SPSS Statistics for Windows, Version 23.0. Armonk, NY: IBM Corp., p level <0.05 was considered statistically significant.

Results: Differences between adenomas and nonadenomas were statistically significant in all methods. In CT histogram analysis, percentage of negative pixels was 32.2 for adenomas and 1.7± 3.3% for nonadenomas with p<0.0001 (AUC 0.942). In DECT analysis, the difference between adenomas and nonadenomas was significant in all analyzed parameters, for mean attenuation in monochromatic energy images at 40 keV (18.1±16.9 HU resp. 53.9±10.0 HU; p<0,001) and fat content in material decomposition images (-86.1±138.1, resp. -269.2±75.6 mg/ml, p=0.0004). AUC was 0.970 for monochromatic images at 40 keV and 0.880 for fat/water material decomposition. In chemical shift MRI, ASII for adenomas reached 47.7±23.0% and for nonadenomas 2.5±8.8%; p<0.0001; AUC was 0.937. ASR for adenomas reached -46.6±24.8% and for nonadenomas -1.7±11.9%; p=0.0002. AUC was 0.893.

Conclusions: Our preliminary results suggest that mean attenuation at energy level of 40 keV and CT histogram analysis seem to be superior to chemical shift MRI. The work was supported by grant of AZV MZ ČR reg. No. 17-31847A.