Dual-energy Computed Tomography gemstone spectral imaging: new horizons in visualization and differentiation of kidney stones composition

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Background: Optimization of viewing tools and understanding the chemical composition of renal calculi become essential for choosing the best treatment strategy. In this study we aimed to assess the localization and chemical composition of renal stones using gemstone spectral imaging (GSI) color map mode on a single-source dual-energy computed tomography (CT).
Material and methods: A total of 45 urinary stones with an unknown chemical composition were imaged with a dual-energy CT scanner using special scanning protocols with different combinations of tube voltage and conventional polychromatic imaging. The mean attenuation value (in Hounsfield units) of each stone was recorded on both low- and high-energy CT images for each protocol. The dual-energy CT ratio of the mean attenuation value of each stone was computed for each protocol. The difference between the CT numbers obtained was compared among the stone groups.
Results: The obtained data enabled us to classify the urinary stones into 3 main groups: uric acid (n = 11), oxalate (n = 24) and phosphate (n = 10) stones. The estimated sensitivity and specificity of dual-energy CT for detecting uric acid stones was 98.0 and 99.2%, calcium stones – 95.1% and 97%; and mixed stones – 93.0% and 94.5% accordingly.
Conclusions: Single-source dual-energy CT with GSI represents a perspective modality for evaluating the characteristics and chemical composition of urinary stones. The CT results were consistent with the spectral data, suggesting that spectral CT imaging techniques can be accurately used to improve the stone differentiation capability of dual-energy CT imaging.
Key words: dual-energy CT, kidney stones, spectrum optimization.

What makes the difference: revealing the neuroanatomical correlates of nocturnal and diurnal seizures

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Background: Presentation of epileptic seizures throughout the day is a non-random phenomenon that is strongly dependent on neural synchronization of locally and distantly interconnected cortical and/or subcortical networks. Here we aimed to identify the structural correlates that underlie the propensity of seizures to occur during the night- and daytime.
Material and methods: We performed brain magnetic resonance imaging (MRI) at a 3Tesla scanner in 13 patients (28 ± 9 years) with nocturnal seizures, in 12 patients (26 ± 9 years) with diurnal seizures and in 10 healthy controls (28 ± 4 years) in order to compute the cortical and subcortical volumes by using FreeSurfer processing stream.
Results: Patients with nocturnal seizures showed greater volumes of bilateral insula, superior temporal and orbitofrontal cortices compared to those with diurnal seizures. When compared to healthy controls, patients with nocturnal seizures showed smaller volumes of left postcentral and right middle temporal cortices. Patients with diurnal seizures in comparison to healthy controls displayed reduced cortical volumes mainly in frontal, temporal and parietal lobe regions of the right hemisphere. Patients with nocturnal seizures showed larger volumes of hippocampus (8208.6 ± 1006.1 mm^3) than patients with diurnal seizures (3859.1 ± 508.1 mm^3, $p = 0.02$) as well as larger volumes of amygdala (1797.3 ± 323.2 mm^3 vs 1500.5 ± 246.2 mm^3, $p = 0.03$).
Conclusions: Epileptic seizures in patients with nocturnal seizures and diurnal seizures are related to distinct neuromorphological correlates that could be regarded as potential substrates favoring the generation of seizures during the night- or daytime.
Key words: neuroanatomical correlates, nocturnal seizures, diurnal seizures.