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Comparison of Iodine Density Quantification through Three Material Decomposition between Philips iQon Dual Layer Spectral CT Scanner and Siemens Somatom Force Dual Source Dual Energy CT Scanner: An in vitro Study

Authors : Jitendra Pratap, Jonathan Sivyer

Abstract : Introduction: Dual energy/Spectral CT scanning permits simultaneous acquisition of two x-ray spectra datasets and can complement radiological diagnosis by allowing tissue characterisation (e.g., uric acid vs. non-uric acid renal stones), enhancing structures (e.g. boost iodine signal to improve contrast resolution), and quantifying substances (e.g. iodine density). However, the latter showed inconsistent results between the 2 main modes of dual energy scanning (i.e. dual source vs. dual layer). Therefore, the present study aimed to determine which technology is more accurate in quantifying iodine density. Methods: Twenty vials with known concentrations of iodine solutions were made using Optiray 350 contrast media diluted in sterile water. The concentration of iodine utilised ranged from 0.1 mg/ml to 1.0mg/ml in 0.1mg/ml increments, 1.5 mg/ml to 4.5 mg/ml in 0.5mg/ml increments followed by further concentrations at 5.0 mg/ml, 7mg/ml, 10 mg/ml and 15mg/ml. The vials were scanned using Dual Energy scan mode on a Siemens Somatom Force at 80kV/Sn150kV and 100kV/Sn150kV kilovoltage pairing. The same vials were scanned using Spectral scan mode on a Philips iQon at 120kVp and 140kVp. The images were reconstructed at 5mm thickness and 5mm increment using Br40 kernel on the Siemens Force and B Filter on Philips iQon. Post-processing of the Dual Energy data was performed on vendor-specific Siemens Syngo VIA (VB40) and Philips Intellispace Portal (Ver. 12) for the Spectral data. For each vial and scan mode, the iodine concentration was measured by placing an ROI in the coronal plane. Intraclass correlation analysis was performed on both datasets. Results: The iodine concentrations were reproduced with a high degree of accuracy for Dual Layer CT scanner. Although the Dual Source images showed a greater degree of deviation in measured iodine density for all vials, the dataset acquired at 80kV/Sn150kV had a higher accuracy. Conclusion: Spectral CT scanning by the dual layer technique has higher accuracy for quantitative measurements of iodine density compared to the dual source technique.

Keywords : CT, iodine density, spectral, dual-energy
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