Comparison Of Virtual Non-Contrast To True Non-Contrast Images Using Dual Layer Spectral Computed Tomography

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Abstract : Purpose: To validate virtual non-contrast reconstructions generated from dual-layer spectral computed tomography (DL-CT) data as an alternative for the acquisition of a dedicated true non-contrast dataset during multiphase contrast studies. Material and methods: Thirty-three patients underwent a routine multiphase clinical CT examination, using Dual-Layer Spectral CT, from March to August 2021. True non-contrast (TNC) and virtual non-contrast (VNC) datasets, generated from both portal venous and arterial phase imaging were evaluated. For every patient in both true and virtual non-contrast datasets, a region-of-interest (ROI) was defined in aorta, liver, fluid (i.e. gallbladder, urinary bladder), kidney, muscle, fat and spongious bone, resulting in 693 ROIs. Differences in attenuation for VNC and TNV images were compared, both separately and combined. Consistency between VNC reconstructions obtained from the arterial and portal venous phase was evaluated. Results: Comparison of CT density (HU) on the VNC and TNC images showed a high correlation. The mean difference between TNC and VNC images (excluding bone results) was 5.5 ± 9.1 HU and > 90% of all comparisons showed a difference of less than 15 HU. For all tissues but spongious bone, the mean absolute difference between TNC and VNC images was below 10 HU. VNC images derived from the arterial and the portal venous phase showed a good correlation in most tissue types. The aortic attenuation was somewhat dependent however on which dataset was used for reconstruction. Bone evaluation with VNC datasets continues to be a problem, as spectral CT algorithms are currently poor in differentiating bone and iodine. Conclusion: Given the increasing availability of DL-CT and proven accuracy of virtual non-contrast processing, VNC is a promising tool for generating additional data during routine contrast-enhanced studies. This study shows the utility of virtual non-contrast scans as an alternative for true non-contrast studies during multiphase CT, with potential for dose reduction, without loss of diagnostic information.