Evaluation of abdominal CT protocols using a mathematical model observer

**Introduction:**

In the last decade, technological breakthroughs in CT allow an improvement of optimization process. With the introduction of iterative algorithms, an adjustment of clinical protocols has been achieved. Classical metrics were become insufficient to assess image quality of clinical protocols. An objective method, based on a clinical task has to be used. The goal of this study is to evaluate abdominal protocols on two newest CT, using a mathematical model observer. We can also underline the impact of a fully model-based iterative reconstruction algorithm when dealing with low-contrast detectability tasks.

**Method:**

An anthropomorphic abdominal phantom (equivalent ø 24 cm) with 8 and 5 mm low contrast targets (20 HU) was scanned on two CT systems: Revolution CT and CT750 HD, GE Healthcare. Peripheral rings (2.5 and 5cm in thickness) were added to simulate different patient sizes. The phantom was scanned 15 times using a routine abdominal protocol with a slice thickness of 2.5mm (0.625 mm for VEO® (MBIR algorithm); avoiding any MPR processing). On both units, the noise index was adjusted with the phantom’s size (i.e. 20, 26 and 32 HU). Images were reconstructed using FBP, ASIR50% and VEO® for CT750HD and ASIR-V at 0% and 50% for Revolution CT. To assess low-contrast detectability, a Channelized Hotelling Observer (CHO; 10 DDOG channels) was used. The area under the curve (AUC) index was chosen as figure of merit (FOM).

**Results:**

Scanning the phantom on the CT750 HD, no significant difference appeared between FBP and ASIR50%. For the largest phantom size, a significant increase of 6% in low contrast detectability was recorded on 5mm targets using VEO (with a longitudinal spatial resolution four times higher) compared to ASIR50%. Concerning the Revolution CT no difference in detectability was noted between ASIR-V at 0% and 50%. Comparing the two CT systems the displayed CTDIvol values for the Revolution CT were systematically lower than for the CT750HD (reaching 40% for the thickest phantom). Low contrast detectability performances were comparable between ASIR-V50% and VEO®.

**Conclusion:**

Dealing with CT750HD, despite a significantly longer reconstruction time, the use of VEO® on large patients is of particular interest since it yields to high image quality performances. Lower CTDIvol values are required with the Revolution CT than CT750HD to produce comparable low contrast detectability levels.