

Dose optimization of abdominal CT protocols: Implementation of a task-based approach to assess image quality in relation to the national diagnostic reference level in Switzerland

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Purpose: To study patient dose optimization of abdominal CT that consider the dose and the image quality aspects for various CT scanners.

Material and Methods: An abdominal anthropomorphic phantom (QRM) with a module containing spherical 8mm diameter targets of 20HU contrast was scanned at 5 CTDIvol (4, 8, 12, 16 and 20mGy) to assess the image quality of a diverticulitis protocol on three different CTs scanners (BrightSpeed, CT750 HD and Revolution CT; GE HealthCare). The same phantom with a second module containing calcium targets were scanned at 5 dose levels (2, 4, 6, 10, 15mGy) on the same CTs to assess a renal stone protocol. Two model observers (a Channelized Hotelling Observer and a non prewhitening with an eye filter) were used to assess the detectability of low contrast spheres and high-contrast calcium targets. The area under the curve was used as figure of merit (FOM).

Results: For the search of diverticulitis, the AUC is similar between the two newest CT scanners, except at the lowest dose. Furthermore, the Brightspeed CT had an AUC 10% inferior than the two others CTs wherever the CTDIvol used. In the clinical dose range used when dealing with renal stones protocol, the dose variation has no major impact on the detection (AUC equal to 1.0).

Conclusion: A comparable image quality cannot be reached on different scanners facilities at the same dose level for specific clinical questions. Therefore, the image quality requirements, related to the clinical question to be answered, should be the starting point for patient dose optimization.