Conclusions. Dose metrics reported in a large number of patients can contribute to the creation of representative benchmarks that can be used for dose optimization efforts and institutional evaluation of CT radiation doses to know if their doses routinely exceed these benchmarks. Additional work should be undertaken to explore the reasons that doses are higher in the US than Europe.

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[OA138] Organ dose estimate in CT exams: Inter-comparison of four commercial software and characterization of the main CT procedures used in asst Niguarda (Milan, Italy)

Cristina De Mattia^a, Federica Rottoli^a, Marina Sutto^a, Paola Enrica Colombo^a, Andrea Pola^b, Alberto Torresin^{a,*}

^a Asst Grande Ospedale Metropolitano Niguarda Hospital, Department of Medical Physics, Milano, Italy

^b Politecnico DI Milano, Department of Energy, Milano, Italy

* Corresponding author.

Purpose. To compare organs dose evaluation from different commercial software and to characterize the main CT procedures of our hospital to provide data for radiation risk estimation.

Methods. We collected the information regarding the exposure for the main CT procedures used in our hospital through the RDIM system Nexo[DOSE][®] (Bracco, Italy). We analysed the main CT protocols and clustered them in macro-groups, considering scan region and phases number. For each group, we defined a stylized protocol, which summarizes the most common exam features and mean dosimetric parameters, so that it can represent the whole macro-cluster. In the stylized protocol, some CT parameters were set equally to the most frequent values (axial/spiral mode, voltage, collimation, pitch, slice thickness), while the remaining were defined as the median values (mAs, CTDI_{vol}, DLP, scan length). The scan region for each phase was deduced from the CT images of a patients' sample under the specific procedure. Then, we calculated organ dose using four commercial software: CT-Expo, NCICT, NCICTX and Virtual Dose. Each software uses its own phantom family. CT-Expo uses the first generation of computational mathematical phantoms. NCICT, NCICTX and Virtual Dose use a hybrid-voxel phantom, more realistic and, for the last two software, adaptable to the patient habitus.

Results. Starting from about 35000 CT exams and 595 protocols, we obtained 13 macro-groups. In comparison with the mean value, the average range of dose values from different software is 25% for organs inside the scan region and 80% for organs partially irradiated. CT-Expo is the only software that shows dependence from collimation, pitch, slice thickness and scanner model. For the others software, the only parameters affecting organ dose calculation are voltage and CTDI_{vol}. In this study, the discrepancies obtained changing voltage are within 15% for all software. On the other hand, the scan length is the primary source of variability in the dose calculation.

Conclusions. Organ dose estimate is the first step to calculate effective dose and to evaluate radiation risk: a deep and critical interpretation of the results is necessary since the values range can cause a large variation in final estimate.

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[OA139] Evaluation of two model based iterative reconstruction algorithms in computed tomography

Nadia Oberhofer^{a,*}, Raffaele Villa^b, Nicoletta Paruccini^b

^a Health Service South Tyrol, Bolzano Hospital, Medical Physics Dep., Bolzano, Italy

^b Asst-Monza, Medical Physics, Monza, Italy

* Corresponding author.

Purpose. To investigate the mode of action of two commercial model based (MB) CT reconstruction algorithms by studying several standard Fourier and alternative metrics.

Methods. Three CT systems featuring two statistical and two MB reconstruction algorithms were studied: Brilliance Elite iCT 256 (iDose4/IMR; Philips, The Netherlands), Somatom AS64 (Safire) and Somatom Drive (Admire; Siemens, Erlangen). Three phantoms were used for acquisitions (Catphan, The Phantom Laboratory, USA; body-shaped commercial density phantom; cylindrical water-filled phantom) varying dose (CTDI_{vol}) and kV. Images were reconstructed at 5 different thicknesses with Filtered Back Projection (FBP), statistical and MB iterative reconstruction algorithms of different type (soft, medium, sharp) and strength.

Spatial resolution was evaluated with Modulation Transfer Function (MTF) and Target Transfer Function (TTF), noise with Standard Deviation. Noise behaviour was analysed with 3D and 2D Noise Power Spectrum. Furthermore, Blur and Low Contrast Detectability (LCD) were investigated.

Image quality of MB reconstruction algorithms has been compared to the clinically corresponding FBP and statistical reconstruction algorithms.

Results. Both MB reconstruction algorithms exhibited a slight improvement for MTF, being the difference larger for IMR. For Admire the difference is kernel independent and increases slightly with iterative strength. TTF curves and Blur confirm this trend for high density objects end present a sharpness reduction for low density details. For Admire noise reduction is dose neutral, increases only slightly with kernel sharpness (difference <15%), but strongly with iterative strength (from -10% to -55%). For both MB algorithms, the NPS displays a shift towards lower frequencies, more pronounced for IMR. LCD curves demonstrate an average reduction of the threshold contrast (-35 to 45%) in MB reconstructed images compared to FBP reconstructions. With Admire the improvement is lowest for a reconstructed slice thickness of 1 mm, whereas with IMR the improvement increases for the thinnest slice.

Conclusions. MB reconstruction algorithms produce an improvement in image quality and allow dose reduction. To optimize image quality each algorithm requires vendor specific reconstruction parameters. Although MB reconstruction algorithms are non-linear, LCD evaluation demonstrated partially meaningful. Further investigation regarding model observer applications and other metrics as the detectability index d' should be carried out.

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[I140]

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