Reviewer’s report

Title: Value of Virtual Monochromatic Spectral Image of Dual-Layer Spectral Detector CT with Noise Reduction Algorithm for Image Quality Improvement in Obese Simulated Body Phantom

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Reviewer: Jeong Hee Yoon

Reviewer’s report:

This is a phantom study which investigated image quality and lesion conspicuity of liver CT using different dose, different size phantom, and spectral CT. Authors created two size of phantoms including eight focal liver lesions with different attenuation. Authors found that virtual monoE images showed superior CNR, less image noise, and better lesion conspicuity, subjective image quality (diagnostically acceptable) than conventional images at the same radiation dose. This is an interesting study which investigated relationship between image quality, patients' (simulated) size, radiation dose, and reconstruction (conventional vs. monoE). Spectral CT has been released recently, and there have not been many reports for body imaging. With that regard, this study has a scientific merit. However, there are some issues which need to be addressed before publication. I would recommend authors add the information of keV value range for qualitative analysis- which keV reviewers scored the best image quality or lesion conspicuity. It is because low monoE and high monoE have different values in clinical practice. In addition, availability of low monoE (better than 70keV) is clinically more relevant. Image noise, SNR or CNR at monoE of 120-200keV are rarely clinically relevant and I am sure that reviewers did not evaluate lesion conspicuity or image quality on monoE images higher than 70keV. In addition, authors need to clarify how analyze lesion conspicuity using an appropriate statistical method. Otherwise, there are only minor issues.

Abstract

Background is too long.

Method is not clear. Please mention the range of monoE values. Please add that phantom has high and low contrast FLL.

Key word: please change dual energy scan to dual energy.

Introduction

p.5, line 10-12: because some are disadvantages of one type (for example, lack of dose modulation is only for rapid kV switching), and some of them are addressed in newly released scanner. So please tone it down.
p.5, line 12-p.6, line 2: this part can be reduced. Please address the anticipated main advantage related with this study design (probably not increased radiation dose in obese patients). Please consider removing the last sentence (however~to reduce noise) because it sounds a bit against to your hypothesis in following sentence. In addition, it is also against to recent papers reporting low image noise which allows low monoE images at spectral CT (Kalisz et al, EJR 2018).

p.6, line 3-9: the purpose is not clear enough- comparison of VMI and conventional images is too vague because VMI with different energy level has different imaging characteristics. Based on the sentence (…the higher contrast resolution of VMI…), I assume that authors intended to compare low monoE images with conventional images. However, in study method (p.10, line 1-2), readers were allowed to change energy level, so it is not clear which energy level was chosen by reviewers and what score they gave to.

Methods

p.7, line 19-20: please remove the sentence (the top~ higher energies (1)).

p.8, line 8-14: To improve readability, please consider simply showing reconstructed images (iDose and VMI using spectral level 4) in addition to monoE levels.

p.10, line 1-2: so any monoE levels were not determined? Please specify it.

In addition, please explain the number of FLLs in table 4 (eight FLLs, five reviewers, one conventional images, and how many VMIs??)

p.10, line 15: Is the McNemar test appropriate for lesion conspicuity analysis?

p.10, line 15: Meaning of pooling the data is not clear to me. Does this mean that authors pooled all data from low monoE to high monoE? And then compared it with conventional images? If so, I have concerns about it may not reflect advantage of low monoE images with higher CNR appropriately (because low monoE would perform better than conventional images whereas high monoE would perform poorly than conventional images). Please specify it.

Results

As authors mentioned in introduction, the primary purpose is comparison of VMI and conventional polychromatic images. Then it should be shown first, followed by changes of image quality and noise in accordance of monoE change. Then show the changes of image noise, SNR or CNR according to monoE level, which would be easy to follow the study flow.

Discussion

Ok
p. 14, line 7-10: please consider revise the sentence to improve readability. Authors can compare conventional image of DRI 19 and low monoE (50keV…) of DRI 16 regarding to CNR or image noise.

Table 1. Please add phantom size (25cm, 35cm). Please revise 'percentage of increase' to clarify the meaning. Does it refer radiation dose?

Tables 2-4: please specify monoE level, if there is.

Table 4: there is a discrepancy between total number of FLLs (180) and subgroups (n=60 x4). Please explain how 60 FLLs were included in each DRI group.

Figures

ok

Minor comment

In abstract (and some part of main body), SDCT is not corresponding to dual-layer spectral CT. Do authors mean spectral detector CT as it is in Introduction?

please avoid uncommon abbreviations (VMSI). VMI is more commonly used term.

p.7, line 17-18: IQon (Philips Healthcare, Cleveland, OH, USA)

p.9, line 1: please correct typo (detail data)

p.11, line 5: please correct typos in the sentence (When the same radiation dose level…)

p.11: I would suggest replacing 'hypervasular' or 'hypovascular' with 'hyperattenuating or hypoattenuating'.

p.9, line 13: please consider replacing 'attending radiologist' with 'fellowship trained body radiologist'.

p.14, line 10: do not refer figure or table in Discussion.

Overall, too many decimals throughout the manuscript. Please reduce it.

Are the methods appropriate and well described?
If not, please specify what is required in your comments to the authors.

No
Does the work include the necessary controls?
If not, please specify which controls are required in your comments to the authors.

Unable to assess

Are the conclusions drawn adequately supported by the data shown?
If not, please explain in your comments to the authors.

Yes

Are you able to assess any statistics in the manuscript or would you recommend an additional statistical review?
If an additional statistical review is recommended, please specify what aspects require further assessment in your comments to the editors.

I am able to assess the statistics

Quality of written English
Please indicate the quality of language in the manuscript:

Needs some language corrections before being published

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