Reviewer's report

Title: Radiation Dose Reduction at a Price: the Effectiveness of a Pediatric Male Gonadal Shield During Helical CT Scans

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Reviewer: Dianna D Cody

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General
BioMed Central Medical Imaging Journal
Title: Radiation dose reduction at a price: the effectiveness of a pediatric male gonadal shield during helical CT scans
Dauer, Casciotta, Rothenberg

1. Is the question posed by the authors new and well defined?
   Not really. It appears that similar work has already been done and the motivation behind this study is not clearly stated.

2. Are the methods appropriate and well described, and are sufficient details provided to replicate the work?
   Not really – more detail is needed, especially regarding the use of modulated tube current during the exposure measurements.

3. Are the data sound and well controlled?
   Data appears reasonable.

4. Does the manuscript adhere to the relevant standards for reporting and data deposition?
   As far as I can tell.

5. Are the discussion and conclusions well balanced and adequately supported by the data?
   There is one statement in the conclusion that is irrelevant and another that is not covered in the discussion.

6. Do the title and abstract accurately convey what has been found?
   The abstract could be clearer.

7. Is the writing acceptable?
   It is acceptable.

I would consider all the edits outlined below to be mandatory. Some would be considered major, some minor. This manuscript warrants publication AFTER ALL of these comments have been thoroughly addressed.

Specific comments:

A few of the statements near the end of the first paragraph of the introduction do not ring true. If the pediatric body CTDI phantom is used to measure dose at the same technique as the adult body CTDI phantom, we have seen differences of 3-4 fold in measured dose. The article states that these are different by only a factor of two. Also, the following statement about a difference in head dose when the adult technique is used on a pediatric head do not make any sense. There is just one CTDI phantom to use for head CT exams and it is the same one for adults and pediatrics. So if the same technique is used for adult and pediatric the dose should come out exactly the same. Something was either misquoted or not explained clearly.

The references cited for the statement of how much pediatric doses could be reduced by relative to adult doses are all fairly old [9-14]. Please replace these with more contemporary citations.
The center paragraph on page 4 reports weighting factors for the gonads at 0.20. Presumably only male gonads are being described here – please clarify.

Bottom paragraph on page 4 – please provide vendor information for the Flexible gonad shield product ( Vendor name, city, state).

Please state clearly the motivation for the study. The work described that was previous published appears to have already covered this ground. Why was this study undertaken? What was the goal relative to what has already been done?

Methods on page 5. The first sentence describing the anthropomorphic phantom should include that it was an adult male, if this was the case. (Discussion should include the discrepancy in the phantom size relative to a pediatric patient, for whom the shields were designed.) Figure 2 does not show sufficient information to define the position of the chamber. Also the chamber (and phantom) appear to be pretty far away from iso-center (2 cm perhaps). This should be acknowledged, and any expected impact it might have on the measurements and image quality should be discussed.

Please add a scale to figure 3 so that the size of the shields can be more readily appreciated.

It would be very helpful if there were a brief description of the overall scan plan prior the second paragraph under the Methods heading. Something that clearly states that the abdomen scans were done to examine the effect of the shielding on scattered radiation only, and that the pelvis scans were done to examine the effect of shielding on direct radiation (both primary and exit).

Please state explicitly how far outside the scan range the shields were placed (in cm).

In Table 1 there is an entry for ‘Average mA,’ which implies that x-ray tube current modulation was utilized for these scans. If this is true, a lot more information must be provided about the scan set up. (Please include the modulation parameters of Noise Index, the minimum & maximum mA used, and if any dose steps were applied.) This also brings up a few more issues, such as, was the shield in place during the scout view? This would be expected to have a big impact on the tube current value selected for the images which include the shield. (use of 140 kVp may have resulted in a better image quality result?)

Near the end of the first paragraph on page 7, a statement is made about the shield reducing exposure by a factor of 35. Please also report this as a percentage (94-97%).

Figure 5 - The use of a display field of view that is too small for the anatomy scanned in combination with the set up being off-center may have increased the intensity of the artifacts shown. Can the artifact evaluation scan please be repeated with a more appropriate set up?

End of the first paragraph on page 8, the last sentence lists the reasons why this study results may be different from other published results. Please add x-ray beam spectrum to this list.

Page 10, first sentence under conclusion. The statement that the phantom & chamber can be useful for shielding evaluation is not helpful – please delete this sentence. Please reword the last sentence. I don’t think the paper provided any guidance regarding how technique factors (or exposure levels) should be used to guide the decision regarding shielding. Please either add more regarding this issue or restate your conclusion.

Table 2 – why was only one measurement done for the medium and small shields? This should be addressed in the methods description. All data looks pretty consistent for the large shield except for one outlier. What happened there? There is an error in the standard deviation reported for the large shield data in this table.

Table 3 - why was only one measurement done for the medium and small shields? This should be addressed in the methods description.

Table 4 – please present all techniques in effective mAs units, where effective mAs = (rotation time x tube current)/pitch. Also include kV.
Minor Essential Revisions (such as missing labels on figures, or the wrong use of a term, which the author can be trusted to correct)

Discretionary Revisions (which the author can choose to ignore)