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OPEN PEER REVIEW

A Body Navigation-Loaded Ultrasound Acquisition Technology: A Pilot Comparison with Conventional Ultrasound

Ki Choon Sim, Beom Jin Park, Byungjun Kim, Yeo Eun Han, Na Yeon Han, Min Ju Kim, Deuk Jae Sung, Sang Hyun Park, Kwang-Sig Lee, Yongwon Cho

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About this report

This open peer review (OPR) report shows the public comments made on this article during peer review, by the reviewers, the associate editor and the editor-in-chief, for every revision round, together with the authors' replies. Comments appear only with the consent of the people who wrote them. Reviewers who chose to sign their report are named; the others are shown as "Referee". Comments are edited for language only, and confidential remarks to the editors are not included.

More about open peer review: brieflands.com/knowledgebase/opr

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1 Original submission

1 comment · 24 Apr 2022

Editor-in-Chief

MINOR REVISION 24 Apr 2022

Dear authors,
Your article needs Minor Revision.
Regards

2

Revision 1

AUTHORS' RESPONSE TO REVIEWERS

Authors' reply to reviewers

The next pages contain the authors' point-by-point reply to the comments of this revision round, as submitted with the revised manuscript. It is published as the authors wrote it.

> Reviewers' Comments

Reviewer 1:

Thank you for submission of your manuscript to the Iranian journal of radiology.

This pilot study developed a new technique to add body navigation to routine ultrasound images. The authors used a 3D depth camera to capture pictures of the operator's hand and body surface at the time of image acquisition during the ultrasound study.

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The authors concluded that the newly developed ultrasound technique helps radiologists interpret images.

Author response) Thank you for your comment and authors agree with your exact summary.

Major drawbacks of this article include:

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Revised)

3.2. Concept of body navigation-loaded ultrasound acquisition technology and technical considerations

This technology uses a commercial 3D depth camera positioned to capture the ultrasound scene within the ……. automatically transmitted to the picture archiving and communication system (PACS) server (Figure. 1).

The body navigation-loaded ultrasound technology developed by us did not require highly advanced skills or equipment, but there were some issues that had to be addressed during its development. The first issue was to protect patients' privacy, such as faces or breasts. This study aimed to minimize the exposure of sensitive areas of the body by applying a 3D mesh filter while maintaining the shape, size, and ratio of the body taken by the 3D depth camera. A 3D depth camera allows utilize an object recognition function that cannot be implemented with a general camera, thereby the body can be animated. Additionally, the location of the transducer could appear as it was, without modification. The result was a more intuitive understanding of the navigation-loaded ultrasound image.

The second issue was to determine how to simultaneously acquire ultrasound images and 3D depth images to increase operator convenience. Because it is not efficient to use the ultrasound image acquisition button and the camera capture button separately, this problem was solved by setting the camera to simultaneously capture an image when the ultrasound image acquisition button was pressed, using the MeshGateway software on a computer connected to the ultrasound system. In addition, the Meshgateway software developed by the authors included the Ultrasound Navigation Image Convergence System. Thus, navigation-loaded image could be transmitted directly to the PACS server. (Figure 2).

The third issue was to determine how much inspection site and transducer information should be included in the ultrasound image in photos taken with a 3D depth camera. With the camera fixed in a position above the patient's head, body parts other than the inspection site were cropped, and adjustments were required before starting the ultrasound examination so that the inspection site and location of the transducer did not deviate from the cropped area. After this issue was resolved, it was necessary to decide where to place a navigation-loaded image on the conventional ultrasound image. Care was taken not to overlap the information regarding the ultrasound parameters or scanned ultrasound images. Depending on the ultrasound vendor and specific model, it was expected to be variable, but we considered it better to insert the thumbnail in the upper right part of the ultrasound image. ~~While using convex transducers, navigation-loaded image could be properly inserted into the empty portion of the ultrasound image that appeared to be radial.~~

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Reviewer 2:

The manuscript entitled'' Body Navigation-loaded Ultrasound Acquisition Technology: A Pilot Comparison with Conventional Ultrasound'' is a well conducted study investigate the usefulness of body navigation-loaded ultrasound including a real time transducer location and the inspection site compared with conventional ultrasound images and discuss well its advantages and disadvantages

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Revised) First paragraph in Discussion (line 192-195)

…….. Thus, this navigation-loaded ultrasound image is expected to assist in interpreting ultrasound images where the distinction between the right and left sides is important, or where the marking of specific locations is required such as

ultrasound-guided procedures. The disadvantage of the author’s semi-automated……

Reviewer 3:

Thanks from authors for their submission to the IJR.

In this study, researchers compared two methods of ultrasound technique. It can be mentioned that the study design, scientific writing structure, statistical analysis and results presentation is appropriate; but there are some limitations as follows:

1. Small Sample size: 29 sample is very small for study objective. It must be clarified using by statistical assumptions and sample size formula.

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the authors do not have BMI information. Authors would appreciate it if you could understand this.

In general, age or BMI (especially in the case of obesity) can affect the ultrasound image quality, but these factors were the circumstances that all reviewers received. In this study, no information other than ultrasound was given to reviewers, and almost identical images were repeatedly evaluated in both the primary and secondary analysis. Also, in Spearman's rank correlation coefficient, which was directly conducted by a medical statistician, the result that age and sex had no effect on image analysis was obtained.

Table 1 was modified by adding median scores and interquartile ranges to better explain the authors' research results.

Authors hope this is a sufficient answer to your comment. Thank you.

Revised Table 1)

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	Mean ± SD	Median (IQR)	P-value
Reviewer A, first	4.10 ± 1.50	5 (4–5)	< .001
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Reviewer B, first	3.82 ± 1.53	5 (3–5)	< .001
Reviewer B, second	4.40 ± 0.90	5 (4–5)	
Reviewer C, first	3.43 ± 1.60	4 (2–5)	< .001
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SD, standard deviation; IQR, interquartile range

3. Important point: Is this manuscript currently under reviewing or rejected from BMC Medical Imaging?

Author response) It is true that the authors submitted this journal to BMC medical imaging (BMIM-D-21-00203R1) in Fall 2021. However, the review could not be even progressed because no suitable reviewer could be invited, and it was returned on October 6, 2021. The authors submitted the study to the IJR in January 2022.

Associate Editor's Comments:

Associate Editor 1:

This manuscript was studied by three expert reviewers and by me. I agree with the reviewers' comments and the manuscript can have the opportunity to be published in IJR. I add two minor comments:

1- Please add standard deviations for reviewer C in the result section on line 168.

Author response) Thank you for your kind suggestion. Author will edit it according to the comments.

Revised)

For reviewer C, the first and second analysis scores were 3.43±1.60 and 4.19±1.01 points, respectively.

2- Figure 4 is out of the scope of this study as the target organs are not the abdomen and pelvis. While the images are interesting for the reader, adding them to this original article (not a review article) is not professional. The authors can add more sample images from their investigated cases instead of figure 4 and keep them from another publication.

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A new figure 3 will be added at the end of the section 3.5 Ultrasound image analysis and scoring of patients and methods.

Figure 3 will be renumbered as figure 4.

Revised)

in line 82-84 of 3.1 study population

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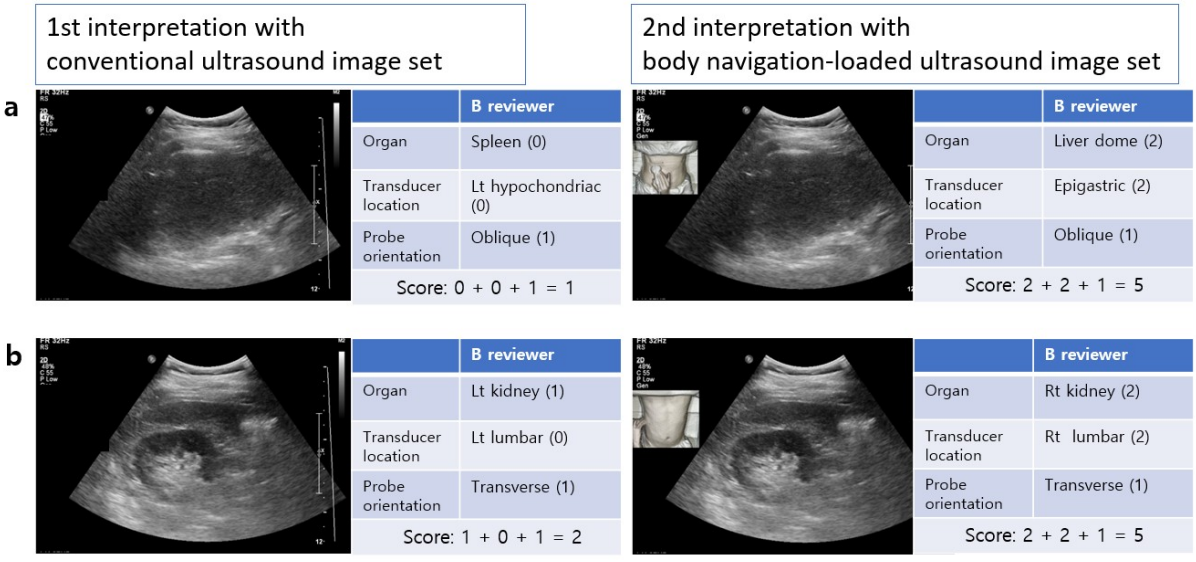
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2 Revision 1

1 comment · 7 May 2022

Editor-in-Chief

MINOR REVISION 7 May 2022

Dear authors,
Before starting the review process for your article, it is necessary to clarify the following items:

Please provide the ethics approval code and its web address. If the web address (link) for the ethics committee approval is not available, please upload the official approval document from the ethics committee.

Please clarify the source of funding and provide its web address or upload the official grant approval number.

Regarding the importance of "conflict of interest" clarification, the corresponding author should fill out the "ICMJE form" and upload it during the submission process. (The form is available in the "conflict of interest" section of the site:
https://brief.land/iranjradiol/knowledgebase/category/tree.html#conflicts_of_interest.html).
Regards

3

Revision 2

AUTHORS' RESPONSE TO REVIEWERS

Authors' reply to reviewers

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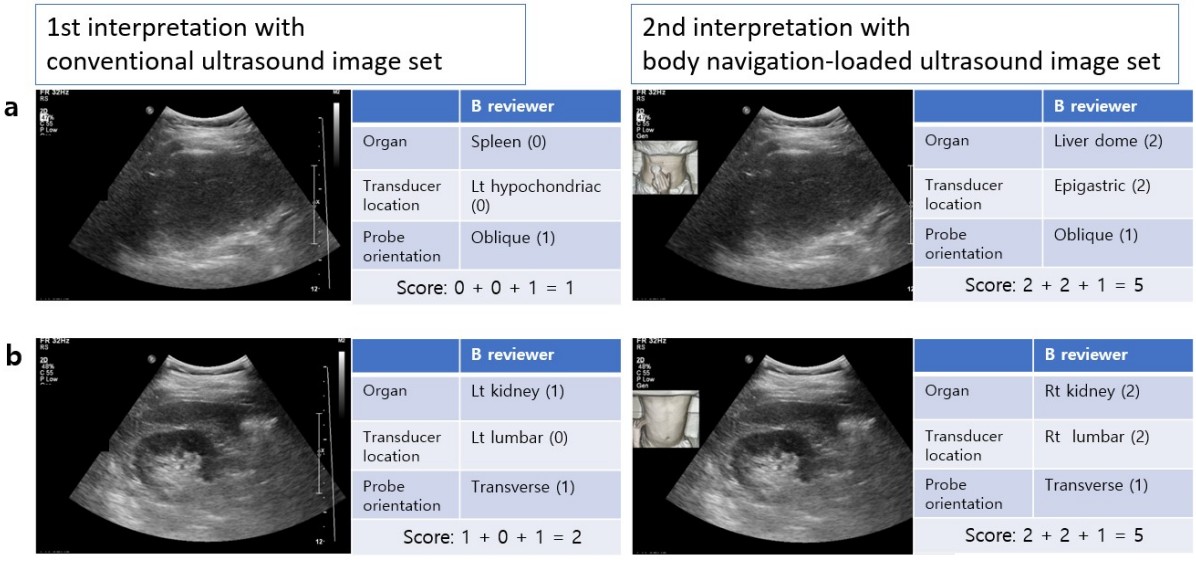
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3 Revision 2

1 comment · 13 Jun 2022

Editor-in-Chief

MINOR REVISION 13 Jun 2022

Dear authors,
Your article needs Minor Revision.
Regards

4

Revision 3

AUTHORS' RESPONSE TO REVIEWERS

Authors' reply to reviewers

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Reviewers' Comments in Minor Revision 2

Reviewer 1:

Thanks from authors for their appropriate editions, and their detailed explanation about each comment. It can be mentioned that this manuscript is ready for publication in IJR according to methodology.

Author response) Thank you for your comment. Thank you for giving us a great opportunity.

Reviewer 2:

About figure 4; Please add labeling each figures with a,b,c, and relevance them with the legend.

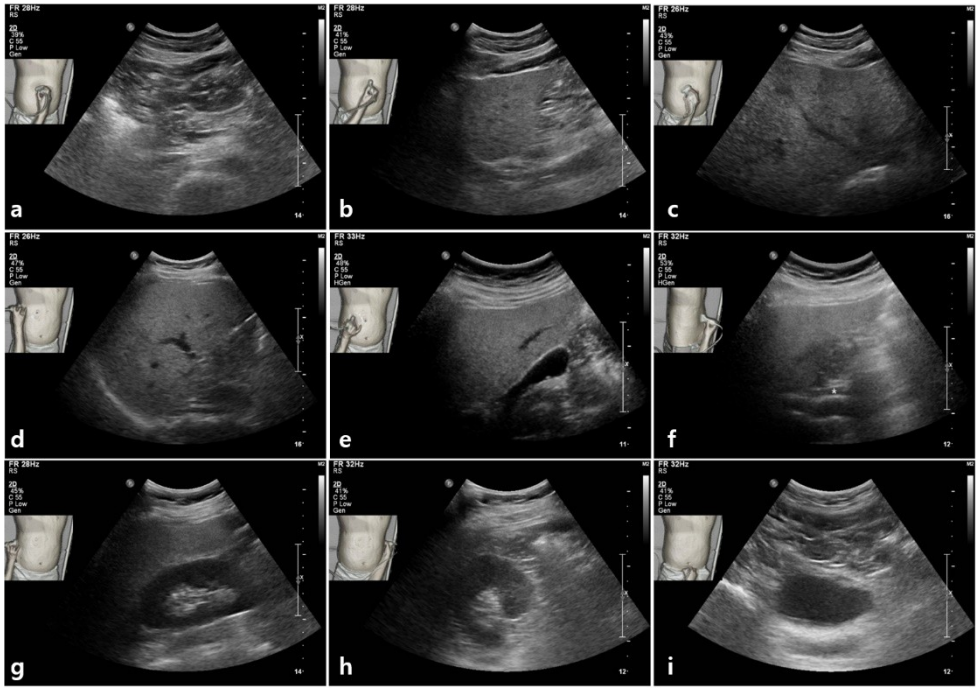
Author response) Thank you for your kind comment. Associated editor 2 also pointed out the same. Authors will insert labeling for each of the 9 subfigures using lowercase latters and modify the legend appropriately.

Revised)

Figure legend

Figure 4. Application of body navigation-loaded ultrasound in the abdomen of one of the participants. *(a)* pancreatic body, *(b-d)* several hepatic regions, *(e)* gallbladder, *(f)* extrahepatic bile duct, *(g)* right kidney, *(h)* left kidney, and *(i)* urinary bladder are shown in order. *In addition to the imaged organs, it includes information about the inspection site, probe location, and orientation.* The last ultrasound in the middle row is an image of the extrahepatic bile duct (*f*, asterisk), indicating that it has been taken in the left lateral decubitus position.

Revised figure 4.


a
b
c
d
e
f
g
h
i

Associate Editor’s Comments

Associate Editor 1:

The suggested corrections and modifications have been done completely as far as possible.

Author response) Thank you for your comment. Thank you for giving us a great opportunity.

Associate Editor 2:

1-in line 11: please correct: " ..... enrolled totally 29 healthy ....."

Author response) Thank you for your comment. Considering the intentions of the authors, it seems that deleting the word "total" makes the sentence more concise.

> **Revised)** Methods: Under the approval of institutional review board, we prospectively enrolled ~~total~~ 29 healthy adult volunteers.

2-in line 54, is "To complement" correct? [to complete seems better]

3-in lines 56-58, the following pat seems incomplete: ".....and a tracking system that can monitor the position of a device within a subject and superimpose a graphic symbol on the diagnostic image of the subject (2-4)." may be, we need a verb. it is unclear somehow.

Author response) Thank you for your comment. Authors will reply to comments 2 and 3 at once.

The authors used the word "complement" to mean “add to ~” and “supplement”. Even when the author looks at it again, that one sentence (from line 54 to 58) seems long and the meaning is ambiguous, thus authors will divide it into two sentences and revise part of the sentence.

> **Revised)** In line 54-58 of background
>
> ..... *Several methods have been developed to install equipment that enables three-dimensional (3D) position calculation, as supplement for the existing body mark system of ultrasound (2-4). These methods install equipments on the ceiling of the ultrasound room or the probe itself and a tracking system that can monitor the position of a device within a subject and superimpose a graphic symbol on the diagnostic image of the subject. ...*

4-please name different parts of figure 4 [9 images] with english characters [A, B, C, ...,I]

then please correct the legend based on this naming and addres each photo in legend by apropriate alphabetic character.

Author response) Thank you for your kind comment. Reviewer 2 also pointed out the same. Authors will insert labeling for each of the 9 subfigures and modify the legend appropriately. Since the subfigures of figure 2 and figure 3 have already been labeled with

lowercase letters, the subfigures of figure 4 have also been labeled with lowercase letters. Please check the figure attached to the comment of reviewer 2 for the revised figure 4. Thank you for your understanding.

Revised)

Figure legend

Figure 4. Application of body navigation-loaded ultrasound in the abdomen of one of the participants. *(a)* pancreatic body, *(b-d)* several hepatic regions, *(e)* gallbladder, *(f)* extrahepatic bile duct, *(g)* right kidney, *(h)* left kidney, and *(i)* urinary bladder are shown in order. *In addition to the imaged organs, it includes information about the inspection site, transducer location, and orientation.* The last ultrasound in the middle row is an image of the extrahepatic bile duct (*f*, asterisk), indicating that it has been taken in the left lateral decubitus position.

5-please correct table 1 legend [for example: Mean and Median of Difference of Scores in first and second analyses]

Author response) Thank you for your kind comments. In Tables 1, author will change “analysis” to “analyses”.

4 Revision 3

1 comment · 19 Jun 2022

Editor-in-Chief

ACCEPT 19 Jun 2022

Dear authors,
Your article is acceptable for publication in IJR.
Regards