

## **Peer Review File**

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### **Reviewer Comments**

#### **Reviewer A**

Comment 1: Authors reviewed current insights in conventional methods and innovative developing techniques for preoperative imaging of pectus excavatum.

Preoperative evaluation for pectus excavatum is important for disease severity and treatment planning. Postoperative examination is important to evaluate symptom improvement and treatment effectiveness. Each of these evaluation methods has its own advantages and disadvantages, such as radiation exposure and cost. New evaluation methods are being considered to overcome these problems, but there are still issues to be addressed.

The authors have well organized and described the evaluation methods for pectus excavatum.

Reply 1: Thank you for reviewing our manuscript and highlighting the key subjects of our paper. We are pleased to hear that the evaluation methods for pectus excavatum have been clearly presented.

#### **Reviewer B**

Comment 1: Congratulations on their work. This paper deals with nearly all issues about the preoperative image studies for pectus excavatum. Many image modalities and many indices for pectus excavatum are reviewed. Current advancements in preoperative imaging focusing on radiation reduction, automatic quantification of pectus indices and surgical planning are also discussed. I recommend that they had better provide the table showing properties of each image modality in terms of radiation reduction, automatic quantification of pectus indices,

and surgical planning, etc. This table will be helpful in understanding this topic. This study is clear and easy to read. I really enjoyed this paper.

Reply 1: Thank you for your kind words. We greatly appreciate your time to review our manuscript. We trust that the added table showing the properties of each image modality facilitates further understanding of this topic, as justly suggested.

Changes: We have added Table 1 to the manuscript and referenced to it in line 75.

## **Reviewer C**

This study reports a review of preoperative imaging of pectus excavatum. For this purpose, a description of all published imaging modalities was performed and is reported in this article. This is a well written description with a complete imaging diagnosis modality landscape.

Major comments

Comment 1: In the introduction section, the authors could shortly enumerate the treatment modalities as the none irradiant imaging protocols have to be fitted with more or less invasive therapy (Ravitch, Nuss, vacuum bell, prothesis, follow-up).

Reply 1: Thank you for your kind words and highlighting the key subjects of our paper. We greatly appreciate your time to review our manuscript. We acknowledge that the varying degrees of (less) invasive therapy should be clarified.

Changes: We have added a phrase that highlights this distinction to line 47 in the manuscript.

Comment 2: We have no comments about the Methods section even if the authors did not describe the database used for their research.

Reply 2: Thank you for reviewing the Methods section.

The authors could also modify their paper according to the following points:

Comment 3: Echocardiography and 3D imaging section: until now, those X-free imaging modalities do not allow 3D calculation in case of customized prosthesis implantation or complex reconstructive surgery.

Reply 3: Thank you for pointing out this limitation of echocardiography and 3D imaging. The echocardiography section is focussed on its application for cardiac evaluation, but this limitation should indeed be mentioned for completeness. To offer a comprehensive overview encompassing limitations, we have incorporated this into Table 1 which illustrates the properties of each imaging modality. In case of 3D imaging, we would like to point out that this modality is still advancing, and such 3D calculations may be possible in the future. We consider these 3D calculations as a specific part of surgical planning in general which we have added to the 'Future developments' column in Table 1.

Changes: The above-mentioned properties are included in Table 1.

Comment 4: A different order for description of the imaging could be used, with a growing pertinence, for example: medical photography, Chest X ray, sonography, tomodensitometry, MRI and the promising 3D scanning.

Reply 4: We appreciate your suggestion to change the order of the subsections and believe that an order with growing pertinence aligns with a medical application perspective. However, we believe that the current order of subsections (starting with computed tomography) allows us to introduce key concepts before comparing the different imaging techniques. We feel that this contributes to the flow of reading and enhances reader comprehension.

Comment 5: Could the authors add a table summarizing the main characteristics, advantages, drawbacks, potential of each modality?

Reply 5: We agree that a table showing the properties of each image modality enhances the paper by summarizing the main topics.

Changes: We have added Table 1 to the manuscript.

Comment 6: A recent article could be added to the references. It offers a relevant description of the 3D scanning efficiency underlining the good correlation between HI and EHI: Efficiency of non-operative management for pectus deformities in children using an X-ray-free protocol. Belgacem et al, Interdiscip Cardiovasc Thorac Surg. 2023 Jun 1;36(6); PMID: 37294838

Reply 6: We appreciate your notification regarding this recent article. We have added it to the reference list.

Changes: The respective article has been added to the references (lines 264 and 487-488).

## **Reviewer D**

Comment 1: This article summarizes the diversity and importance of imaging data in the preoperative diagnosis of pectus excavatum.

Various historical indexes in the commonly used CT examinations are discussed, as well as recent efforts to reduce radiation dose. The usefulness of 3D CT imaging is also discussed.

The usefulness of cardiac MRI and echocardiography has been described. In addition, 3D optical surface imaging has been introduced as a new, less invasive method, and this is an area where further technological development is expected.

This paper is a high quality of a review article for imaging diagnosis of pectus excavatum.

Reply 1: Thank you for your kind words and highlighting the key subjects of our paper. We greatly appreciate your time to review our manuscript.

## **Reviewer E**

I would say in advance that I cannot evaluate the images, which are not included in the draft received. Congratulation to the authors for the great work of reviewing the existing literature on this topic. My observations are:

Comment 1: should be given greater prominence to MRI especially in the conclusions because it is the only diagnostic tool without radiation that allows the evaluation of traditional indices (even with semi-automatic methods) and cardiac function in a single examination. MRI is therefore the investigation of choice both in preoperative imaging (subject of this review) and for research purposes (new volumetric indices of depression, and cardiac compression estimation).

Reply 1: Thank you for reviewing our paper and we greatly appreciate your feedback on our manuscript.

We do acknowledge that MRI is an important imaging modality in the assessment of pectus excavatum and has great advantages over CT and the other imaging methods. With this paper, we aim to provide an overview of the properties of the imaging methods available for preoperative evaluation. The selection of imaging methods ultimately relies on patient-specific characteristics, available resources, national and institutional regulations, etc. Therefore, strategies for preoperative evaluation of pectus deformities may vary between medical centers. We have mentioned this in lines 72-74. Nevertheless, your fair comment highlights the need for a general consensus in preoperative imaging strategies for pectus excavatum.

Still, in this paper we would like to highlight that, because of the mentioned advantages, MRI is a valuable imaging technique in the preoperative assessment of pectus excavatum.

Therefore, we have emphasized the relevance of MRI in the conclusions by rephrasing lines 284-291.

Changes: Lines 284-291 in the conclusion have been rephrased.

Comment 2: it should be described that the semi-automatic calculation of traditional indices can also be performed with MRI, not only with CT (see the article: -A new tool for assessing Pectus Excavatum by a semi-automatic image processing pipeline calculating the classical severity indexes and a new marker: the Volumetric Correction Index-).

Reply 2: Thank you for your fair comment. We agree that this property of MRI has not been clearly mentioned, but was buried between the lines. We decided to rephrase the first paragraph of the section on MRI to explicitly describe that the (semi-automatic) calculation of pectus indices can also be performed with MRI. We also included the suggested article as a reference.

Changes: The first paragraph of the section on MRI (lines 169-175) has been rephrased and a reference has been added (line 409-411).

Comment 3: it should be better clarified that so far the investigation to be preferred in the preoperative imaging of Pectus is MRI, not CT (unless there are contraindications to MRI, unless there are a few selected cases in which it is necessary to obtain 3D reconstructions of the rib cage or virtual imaging or 3D printing)

Reply 3: We agree that the statement that CT is the most frequently used imaging modality to assess pectus excavatum suggests that this is (or should be) the preferred method. To put less emphasis on the usage of CT and to avoid any misinterpretation that CT is the preferred method, we have reworded the sentence in line 79.

Changes: The sentence in line 79 has been changed accordingly.

Comment 4: line 288: -Chest radiography and echocardiography are commonly used procedures-. In our center we do not perform chest Xrays for Pectus excavatum. Or rather, we perform chest Xray only as an investigation for pre-operative general anesthesia, not for the evaluation of the malformation. To clarify better.

Reply 4: Thank you for pointing out this clarification. Chest radiography and echocardiography are possible imaging methods to evaluate pectus excavatum. The word ‘commonly’ is of course relative and we agree that this may cause confusion in this context. We have rephrased the sentence to clarify.

Changes: The sentence in line 291 has been changed accordingly.