Author's response to reviews

Title: A shallow chest correlates with the aortic position in the normal spine: Features resembling those observed in structural scoliosis

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Author's response to reviews: see over
Dear Scoliosis Editorial Team,

Thank you for your email dated July 30, 2014, regarding our manuscript, “A shallow chest correlates with right thoracic curvature in the normal spine: Features resembling those observed in structural scoliosis”, and the valuable comments from the two reviewers. I have attached a revised of our manuscript, as well as our point-by-point responses to the reviewers’ comments.

(today, we got PDF file from BioMed Central office by reviewer 4, we have attached additional comment to reviewer 4)

We feel that the revised manuscript has been significantly improved over the initial submission based on the constructive comments and suggestions made by the editorial team and reviewers. We hope that it is now suitable for publication in Scoliosis. Thank you in advance for your kind consideration of this revised manuscript.

Respectfully yours,

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RESPONSE TO Reviewer 2:
Comment: I am happy with the revisions and would agree now that the article can be published.
Response: We wish to express our appreciation to the Reviewer for his insightful comments, which have helped us to significantly improve the paper.

RESPONSE TO Reviewer 3:
We wish to express our appreciation to the Reviewer for his insightful comments, which have helped us to significantly improve the paper.

Comment: The description of the measurement of ribcage rotation angle (page 7, last three lines), is not clearly expressed. I suggest consideration of the following as replacement: “The ribcage rotation angle was defined as the angular divergence of a line drawn at right angles to a line joining the posterior inner chest wall bilaterally, form the line joining the neural canal to the sternum.”
Response: We thank the Reviewer for this pertinent comment. We have changed sentences in “Material and methods” section as following:

The ribcage rotation angle (∠θ) was defined as the angular divergence of a line drawn at right angles to a line joining the posterior inner chest wall bilaterally, from the line joining the neural canal to the sternum. the divergence from a right angle between the line from the sternum to the neural canal (basal line) and the line running along the bilateral posterior inner chest wall. Rightward ribcage rotation was defined as positive.

Comment: The term “thoracic side curvature” is used, evidently as the preferred alternative the Cobb angle (see Figure 5) in these normal females. The writing should be consistent, using one or other, and so stated.
Response: Thank you for the valuable comment. As it is important to consistent writing, we use the term “thoracic side curvature” in Results and Figure 2, and Figure 5 as following:

To evaluate the curvature in the normal spine, Cobb’s angles were measured from T5 to T12 using standing chest radiographs. The mean Cobb’s angle thoracic side curvature (T5 to T12) was 3.0 ± 3.0 degrees (Fig. 2). The anteroposterior chest dimension was 83.8 ± 10.8 mm, the aortic position was 15.1 ± 6.6 mm and the rib cage rotation was 1.8 ± 2.6 degrees in the normal spine.

Comment: In the Results section on page 5, Cobb angle, rib rotation angle and anterior chest dimension are reported without stating that these were degrees or mm.

Response: Thank you for the valuable comment. We have added degrees and mm in the Results section on page 5 as following:

The mean Cobb’s angle was 3.0 ± 3.0 degrees (Fig. 2). The
anteroposterior chest dimension was 83.8 ± 10.8 mm, the aortic position was 15.1 ± 6.6 mm and the rib cage rotation was 1.8 ± 2.6 degrees in the normal spine.

Comment: In Figures 3-5, P values are given: the Spearman rho values should also be presented.
Response: Thank you for the valuable comment. We have added Spearman rho values in results section. We overlooked other mistakes that we had presented Pearson’s correlation p value data in former revised version, so we have changed to Spearman correlation p value as following:

The correlations between the anteroposterior chest dimension, aortic left shift, rib cage rotation and thoracic side curvature were analyzed. Among these variables, there were correlations between the anteroposterior chest dimension and aortic left shift (r = 0.53, p < 0.0001) (Fig. 3), aortic left shift and rib cage rotation (r = -0.284, p = 0.0005 p < 0.0001) (Fig. 4) and rib cage rotation and thoracic side curvature (r = 0.175, p = 0.033 p = 0.022) (Fig. 5).

Comment: In the References, numbers 5&6 have only one initial for each author and not two as in the publications. Single initialed authors are recorded as different individuals from the same individuals with two initials.
Response: I am very sorry only writing one initial. We have corrected the authors with two initials.

Comment: In the References, number 6 does not have the complete list of authors – two names are missing.
Response: I am very sorry to miss two authors. We added two missing names in reference 6.

Comment: In Background end of first sentence, reference 6 is also appropriate.
Response: We added reference 6 in Background end of first sentence.
Comment: The aorta is described as having a “left shift”. This is relative to the vertebral body of T8. Is it not there is a “right shift” of the vertebra? If so, the “left aortic shift” is a relative shift –possibly- without causal significance?

Response: Thank you for the important comment. We have not measured the vertebral right shift in this study. Kouwenhoven et al. previously reported (reference 11) that there are 2.365 degrees of T8 vertebral right rotation in the normal spine. We measured the aortic position relative to the left rib head. The aortic position ranged from -3.0 mm to 31.8 mm relative to the rib head. We think that the influence of right vertebral rotation, if any, is relatively minor, especially with regard to effects on the left side. Our measurements using the rib head as a baseline measured the left-posterior direction. We agree with the reviewer that there may be a partial influence from the “right shift of the vertebra”, but we think that the main cause of the aortic position is the aortic left shift.

Comment: On page 5, it is stated that “Recently, has been reported that the normal spine exhibits right thoracic curvature…” These findings have been known for many years. The word “confirmed” or “established” should replace “reported”.

Response: Thank you for the important comment. We have replaced the word “reported” to “confirmed” on age 5 as following:

Recently, it has been reported confirmed that the normal spine exhibits right thoracic curvature[9, 10], vertebral rotation[11] and rib cage deformities[12] and that these deformities worsen during the adolescent period.

Comment: The title states, “A shallow chest correlates with right thoracic curvature in the normal spine…”

In the Abstract (page 2), it is stated that “Right thoracic side curvature and right ribcage rotation correlate with a shallow chest and the aortic position…”

In the Conclusions (page 11), it is stated that, “A shallow chest and aortic position are correlated with ribcage rotation and thoracic side curvature…”

Yet, in the result section (page 9) for the thoracic curvature, a statistically significant correlation is recorded only for “ribcage rotation and right thoracic curvature (P = 0.02)” – with no record for a significant correlation of shallow chest and right thoracic curvature although stated to have been analysed.
Response: We thank the Reviewer for this pertinent comment. A statistically significant correlation was noted between the anteroposterior chest dimension and aortic position, the aortic position and rib cage rotation angle and between the rib cage rotation angle and the thoracic side curvature. However, the correlation between the anteroposterior chest dimension and the thoracic side curvature was not significant ($r = -0.1427$, $p = 0.0836$), and the correlation between the aortic position and thoracic side curvature was also not significant ($r = 0.1491$, $p = 0.0706$). It is possible that a correlation might be found if the number of patients was increased. Regardless, the reviewer is correct that the title and Abstract did not accurately express what we found in this study. We have changed the Title, Abstract, Results, Discussion and Conclusions sections as follows:

Title: A shallow chest correlates with the aortic position right thoracic curvature in the normal spine: Features resembling those observed in structural scoliosis

Abstract (p 3):
There was a correlation between a shallow chest and the aortic position, between the aortic position and the rib cage rotation and between the rib cage rotation and the thoracic side curvature in the normal spine. Right thoracic side curvature and right rib cage rotation correlate with a shallow chest and the aortic position, as observed in patients with adolescent idiopathic scoliosis.

Results (p 9)
The correlation between the anteroposterior chest dimension and thoracic side curvature ($r = -0.1427$, $p = 0.0836$) and the correlation between the aortic position and thoracic side curvature were not significant ($r = 0.1491$, $p = 0.0706$).

Discussion (p 9):
In the present study, the correlation between a shallow chest, rib cage rotation, right thoracic curvature and the aortic position was confirmed.

Conclusions (p 11):
A shallow chest and the aortic position are correlated with rib cage rotation and thoracic side curvature. The anteroposterior chest dimension exhibited a correlation with the aortic left shift, even in the normal spine.

Comment: How many right curves were there? For on page 7 it is stated there were right and left convex curves.
Response: The distribution of the curves is shown in Fig 2. Among the 148 patients, 130 patients had straight to right convex curves, and 18 patients had left convex curves.

We wish to thank the Reviewer again for his valuable comments.

RESPONSE TO Reviewer 4:
We wish to express our appreciation to the Reviewer for his insightful comments, which have helped us to significantly improve the paper.

Comment: The authors provided adequate responses to the reviewers.

But still the result is not convincing to me as to the relation between shallow chest, rib cage rotation, aortic shift to the left and the progression of right thoracic scoliosis in their subjects. Only thing that the authors can conclude is that “A shallow chest and the aortic position are correlated with rib cage rotation and right thoracic scoliosis in patients without idiopathic scoliosis. This relationship may be one of the causative factors of adolescent idiopathic scoliosis, but requires further cross sectional clinical studies of both normal subjects and AIS patients with less invasive measures.”

The authors mentioned the use of animal models for future investigation in the last sentence, but I think it is too far from the content of this manuscript. There is a huge leap in this manuscript between this human study and experimental animal studies with other species. Since it is a pure clinical study, it is better to stay focus on human clinical
issues in their conclusion. There are a lot to do in further clinical studies before conclusion. Due to this reason, the last sentence should be deleted.

Response: Thank you for the important comment. We have the same comment by reviewer 3. The reviewer is correct that the title and Abstract did not accurately express what we found in this study. We have changed the Title, Abstract, Results, Discussion and Conclusions sections. Furthermore, we agree that this study is not direct link to animal model, so, we deleted the last sentence from Conclusion section:

Title: A shallow chest correlates with the aortic position right thoracic curvature in the normal spine: Features resembling those observed in structural scoliosis

Abstract (p 3):
There was a correlation between a shallow chest and the aortic position, between the aortic position and the rib cage rotation and between the rib cage rotation and the thoracic side curvature in the normal spine. Right thoracic side curvature and right rib cage rotation correlate with a shallow chest and the aortic position, as observed in patients with adolescent idiopathic scoliosis.

Results (p 9)
The correlation between the anteroposterior chest dimension and thoracic side curvature (r = -0.1427, p = 0.0836) and the correlation between the aortic position and thoracic side curvature were not significant (r = 0.1491, p = 0.0706).

Discussion (p 9):
In the present study, the correlation between a shallow chest, rib cage rotation, right thoracic curvature and the aortic position was confirmed.

Conclusions (p 11):
A shallow chest and the aortic position are correlated with rib cage rotation and thoracic side curvature. The anteroposterior chest dimension exhibited a correlation with the aortic left shift, even in the normal spine.

These findings support the hypothesis that a flat chest and an aortic left shift are causal factors of AIS. In the future, conducting studies using a nonoperative scoliosis animal model would therefore be helpful for exploring the pathomechanism of AIS.

We wish to thank the Reviewer again for his valuable comments.