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Reviewer A

Authors performed lung volumetry before and after surgery for chest wall tumors to evaluate the effects of chest wall surgery on lung expansion. They observed that changes in lung volume were generally well preserved, regardless of the resected area and that lung volumes were well maintained in most patients who underwent chest wall reconstruction. Their study demonstrated that lung volumetry as a novel method to evaluate chest wall surgery because lung expansion is directly attributed to thoracic deformity and rigidity and affects pulmonary function.

Comment 1:

- Abstract and Methods (page 3, line 9-11) (page 6, line 16-17)
  You defined the calculation of rate of change in LV in abstract and methods, but they don't seem to match.

Reply 1:

- **Thank you for bringing this point to our attention. As you indicated, we made a mistake in describing the calculation of the rate of change in the LV in the method. We have made the following corrections by swapping the descriptions of the denominator and numerator.**

Change in the text:

- (Page 7, lines 19-20) The rate of change in LV was calculated as the corrected postoperative LV of the operative side/ preoperative LV of the operative side.

Comment 2:

- 2. Methods (page 6, line 16-17)
  "The rate of change in LV was calculated as the corrected postoperative LV/preoperative LV of the operative side" rather than "The rate of change in LV was calculated as the preoperative LV/corrected postoperative LV of the operative side" seems to be your intention. is that right?

Reply 2:

- **We hope that we have addressed this comment in Reply 1.**
- **We made a mistake in describing the calculation of the rate of change in LV in the Methods section and corrected the sentence.**

Change in the text:

- (Page 7, lines 19-20) The rate of change in LV was calculated as the corrected postoperative LV of the operative side/ preoperative LV of the operative side.

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Comment 3:

- 3. Results (page 8, line 10)
  Supplemental Table 1 is an important result for resected chest-wall area and lung volume change, so it would be better to use it as Table 2.

Reply 3:

- **You have raised an excellent point:**
  Supplemental Table 1 has been revised to Table 2.

Change in the text:

- (None)

Comment 4:

- 4. Results (page 9, line 6)
  Supplemental Figure 1 is more important than Figure 2, so it would be better to use it as a figure and delete figure 2.

Reply 4:

- **Thank you for bringing this point to our attention.**
  As you indicated, we have changed Supplemental Figure 1 to Figure 5 and Figure 2 to Supplemental Figure 1. The other figure have been corrected accordingly.

Change in the text:

- (None)

Comment 5:

- 5. Discussion (page 9, line 17-19) ‘The postoperative LV was maintained in cases of non–rigid reconstruction and non–reconstruction. In contrast, the postoperative LV in rigid reconstruction cases tended to be lower than that in non–rigid reconstruction cases.’ explanations and references are needed for these results.

Reply 5:

- **This is a great point.**
  This sentence explains Figure 3B of our results; there is no reference because there has been no previous report exploring the LV in chest wall surgery. We have added the phrase "in Figure 3B" at the end of the sentence.

Change in the text:

- (Page 10, line 4-5) In contrast, the postoperative LV in rigid reconstruction cases was lower than that in non–rigid reconstruction cases in Figure 3B.

Comment 6:

- 6. Discussion (page 9, line 22-23) (page 10, line 1)
  ‘In the case of performing an ideal reconstruction method, because the LV of the lung tumor volume extending into the CW is restored, the LV after surgery

is generally believed to recover from the preoperative condition.'
Please rewrite this sentence to make it easier to understand.

Reply 6:

- **This is an excellent point.**
  The text has been revised as follows.

Change in the text:

- (Page 11, line 8-11) If the ideal reconstruction method completely reconstructs the thorax, the tumor that has extended into the thorax and is compressing the lungs will be removed, resulting in restoration of lung expansion. Thus, postoperative LV should theoretically be equal to or greater than preoperative LV.

Comment 7:

- 7. Figure (page 18)
  The picture of Figure 1 and that of Figure 2 are swapped. Please correct.

Reply 7:

- **Thank you for bringing this point to our attention.**
  The figures and their captions have been corrected accordingly.

Change in the text:

- (None)

Reviewer B

Comment 1:

- Thank you for submitting an interesting topic about chest wall surgical evaluation. Creating new evaluation methods for clinical outcomes is always challenging.
- However, the sample size of this study is too small to thoroughly evaluate the surgical outcome. It may also be a problem that the disease of the patient group is too diverse and the location of the lesion is not clear. Another problem is the lack of lung function tests in patients before and after surgery. If a multicenter study for additional data collection is conducted, positive results can be expected.

Reply 1:

- **We appreciate your kind feedback regarding our manuscript, and we agree with our major limitations. We confirmed that the small sample size of this study and the fact that postoperative pulmonary function tests were only performed in a selected group of patients had been described as limitations.**

Change in the text:

- **(None)**

Reviewer C

Comment 1:

- In your submitted manuscript, entitled ´The Effect of Chest Wall Surgery on Lung Volume: A New Evaluation Concept´ you aim to retrospectively evaluate the effect of chest wall (CW) surgery on lung volume. Twenty-three patients who underwent the surgery over a 13-year period for primary benign or malignant CW tumors and CW metastases were included in the study. Pre- and postoperative lung volumes were measured based on CT image reconstruction using special software and the CW resection area was calculated. You observed that only in 3 patients who underwent tumor extirpation without CW resection lung volume decreased after surgery. The size of the resection area had no effect on postoperative lung volume changes. Based on your results you concluded that your proposed method of lung volumetry could be implemented to assess the effectiveness of chest wall surgery. I find the idea of assessing changes in lung capacity after CW resection surgery very interesting. However, the value of this manuscript would have been greater if pre- and postoperative lung function testing had been performed in all patients. It would also be interesting to analyse the CW motion before and after surgery and compare it with the results of your proposed method. As you have pointed out, the limitation of this manuscript is also its retrospective nature and the small number of patients studied. However, these operations are not very common. In my opinion, the most important thing missing from this manuscript, which was submitted in a journal for thoracic surgeons, is an explanation of the clinical relevance of your proposed method of lung volumetry. What clinical implications does your proposed method have? In summary, I think the manuscript would require major revision before possible publication in the ´Journal of Thoracic Disease´.

- Your Sincerely.

Reply 1:

- **We appreciate your feedback on our manuscript.**
  As you pointed out, we would agree that because of the retrospective analysis, respiratory function was not tested in all patients, which was a major limitation in validating the effectiveness of this new approach. We confirmed that the small sample size of this study and the fact that postoperative pulmonary function tests were only performed in a selected group of patients had been described as limitations.
  A major advantage of our proposed method is the use of imaging studies that facilitate comparison of test results between institutions. Currently, there is no standardized method for reconstructive materials and methods in chest wall surgery, and most surgeons perform chest wall reconstruction based on case series reports from different centers. There is no way to compare the superiority or inferiority of these methods. However, our method has the potential to bring together a large number

of centers and test the superiority or inferiority of reconstruction methods in a relatively simple manner. As Reviewer B pointed out, the next step would be to conduct a multicenter study for additional data collection, which would provide better results.

Change in the text:

- (None)

Reviewer D

Comment 1:

- The authors have submitted a series of 23 patients who underwent isolated chest wall resection and reconstruction for chest wall tumors. 3-D lung volumes (LVs) were measured before and after surgery using Synapse Vinsent to determine the rate of LV change based on the size of the CW defect and type of reconstruction material. Chest wall reconstruction (CWR) methods included rigid reconstruction (combination of titanium mesh and extended polytetrafluoroethylene sheet) in four patients, non–rigid reconstruction (extended polytetrafluoroethylene sheet only) in 11, no reconstruction in five, and no chest wall resection in three. The study was a retrospective series over a 13-year period, averaging, < 2.0 cases per year.
- Preoperative lung volume evaluation was performed at a median of 12 days before CWR and at a median of 347 days postoperatively.

- Changes in lung volume were generally well preserved, regardless of the amount of resected area. Lung volumes were well maintained in most patients who underwent chest wall reconstruction. However, in some cases, decreased lung expansion was observed because of migration and deflection of the reconstructive material into the thorax due to postoperative lung inflammation and shrinking. They concluded that lung volumetry can be used to evaluate the effectiveness of chest wall surgery.

- I have a few comments and several questions:

- When evaluating the effects of CWR on QOL, pulmonary function and chest wall mechanics, several modalities can be used such as full set PFT's, cardiopulmonary exercise testing, six-minute walk, dynamic MRI of the chest and 36-item Short Health Survey. The authors state that 3-D lung volumetry can also be used to evaluate the effectiveness of chest wall surgery. In this series only 7 patients (30%) had PFTs performed, and no other modalities were investigated.

- The ideal material does not exist for CWR. The authors to compare to synthetic

options (titanium mesh plus PTFE patch vs PTFE patch only) in 4 and 11 patients, respectively. Extensive statistical analysis was exhausted for possible significance of the lung volumetry to determine effectiveness of this new modality. Remove Table 1

- Questions:
- What is the authors' definition of "effectiveness" of chest wall surgery?

Reply 1:

- **Thank you for bringing this point to our attention.**
  We defined the effectiveness of chest wall surgery as maintaining adequate rigidity of the chest wall and preserving lung expansion and implemented this new approach.
  I have added this information to the Introduction section.

Change in the text:

- (Page 5, line 13-14) Therefore, we defined the effectiveness of chest wall surgery as maintaining sufficient rigidity of the chest wall and lung expansion and sought a new imaging evaluation method by measuring the lung volume (LV) before and after the resection of CW tumors.

Comment 2:

- What is mechanism of migration and deflection of the reconstructive material into the thorax due to postoperative lung inflammation and shrinking?

Reply 2:

- **Thank you for bringing this point to our attention.**
- **Some reasons for this are unavoidable, such as oxidation of the metal or rebuilt material, foreign body removal reactions, mechanical friction, and contact allergies. However, there are also avoidable causes, such as the selection of reconstructed materials that are not sufficiently rigid or inadequately sized.**

Change in the text:

- (None)

Comment 3:

- Did any of the patients have more than one lung volume calculation during the postoperative period and if they did was there an improvement over time?

Reply 3:

- **This is a great point.**
  However, there were no cases in which the lung volume calculations were performed more than once.

Change in the text:

- (None)

Comment 4:

- Why was the volume of CW resection only calculated in 2-dimension and not 3-D with addition of depth?

Reply 4:

- **Thank you for pointing this out to us.**
  This study was a retrospective analysis, and the depth (thickness of the resected specimen) could not be examined in many cases.

Change in the text:

- (None)

Comment 5:

- What was the ratio of the CW resection volume to BMI?

Reply 5:

- **You have brought up a great point. A correlation figure between BMI and excised CW area has been added as Supplemental figure 3. There was no correlation between these two parameters.**

Change in the text:

- (Page10, lines 13-14) In addition, there was no significant correlation between the excised CW area or the rates of change in LV and body mass index (Supplemental Figure 3A and 3B).

Comment 6:

- Did the location of the CW resection (posterior, lateral or anterior) make a difference in lung volume rate of change?

Reply 6:

- **This is an excellent point.**
  The rate of change in lung volume by resection site was compared and added to Supplemental figure 2. As a result, there was no difference in the rate of change in the lung volume at the resection site.

Change in the text:

- (Page10, line 11-13) The excised CW area tended to be larger in the anterior sites than in the posterior site, but the rates of change in LV were almost equivalent among the resection sites (Supplemental Figure 2A and 2B).

Comment 7:

- Was any of the patients still experiencing pain which good decrease chest wall mechanics and thus lung volumes?

Reply 7:

- **Thank you for pointing this out to us. As you have indicated, pain is one of the factors contributing to a decreased lung volume. In fact, we observed a few cases in which the lung volumes decreased on both the operative and opposite sides. Therefore, considering the possibility of insufficient inspiration, we calculated the corrected lung volume using the lung volume of the other side and used it for the present analysis.**

Change in the text:

- (None)

Comment 8:

- Are the authors planning on a prospectively study using the lung volume determination with any of the other modalities mentioned above?

Reply 8:

- **Thank you for bringing this point to our attention.**
  As chest wall tumors are relatively rare, we believe that prospective studies are difficult to conduct. However, taking advantage of the easy availability of preoperative and postoperative CT images, we plan to examine the relationship between respiratory function, lung volume, reconstruction method, and excised CW area in a multicenter retrospective case series.

Change in the text:

- (None)

Comment 9:

- What was the ratio of Lung Volume to BMI for each of the patients and was there a difference related to type of CWR?

Reply 9:

- **This is a great point. A correlation chart between BMI and lung volume change rate has been added in Supplemental Figure 3B. The results showed no correlation between the two, and there were no differences related to the CW reconstruction method.**

Change in the text:

- (Page10, lines 13-14) In addition, there was no significant correlation between the excised CW area or the rates of change in LV and body mass index (Supplemental Figure 3A and 3B).

Comment 9:

- What was the significance of determining the lung volume of the contralateral lung?
- Did any patient have a split ventilation and perfusion scan to correlate with lung volumes?

Reply 9:

- **The ratio of the opposite lung to the measured lung was used because a certain number of patients had lung volumes that changed depending on the respiratory phase during the imaging.**
- **It was assumed that the lung volumes in the opposite lung would not change before or after the procedure if adequate inspiration was achieved at the time of measurement.**
- **No patient underwent split ventilation or perfusion scans.**

Change in the text:

- (None)