Peer review file

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Reviewer A

Comment 1. The introduction and methods describe the technology well. The definition of postoperative complications is not well established in the methods (i.e. how are air leak and atelectasis defined?).

Reply 1: Thank you for your valuable suggestion.

We have added a definition of complications using the Clavien-Dindo classification (CTCAE5.0) and the STSGTSD guidelines.

Changes in the text:

Page 10-11: Defined the postoperative complications

Possible postoperative complication related to chest wall motion were defined as follow: air leakage, atelectasis, pneumonia, wound infection, pulmonary embolism, subcutaneous emphysema, ischemic heart disease, and bradyarrhythmia by the Clavien-Dindo classification (CTCAE5.0) and the STSGTSD guidelines. Postoperative complications were analyzed to grade 3a or higher within 30 days after surgery.

Comment 2. The results section could be strengthened by providing specific measurements and p-value in the text to support statements particularly in the “Analysis for peak value” section.

Reply 2: Thank you for your valuable suggestion. We have added specific measurements and p-value in the “Analysis for peak value”.

Changes in the text:

Page 12-13:

In the analysis of this study, regarding the overall peak value, the peak value of operated side was 0.195±0.05 and 0.18±0.06 in non-operated side, there was no significant different overall envelope peak value.

There was no significant different peak value in surgical approach, procedure relation to operated side and non-operated side.

In contrast, there was a significantly high peak value in the presence of postoperative complications than in their absence relation to R-peak peak value, L-peak peak value , Non-operated side peak value (0.173±0.05 versus 0.222±0.1, 0.173±0.06 versus 0.225±0.041, 0.168±0.06 versus 0.217±0.07; p = 0.034, 0.048, 0.031)(Table 3).

Regrading to the air leakage, the peak value of air leakage presence was 0.229±0.09 and 0.179±0.05 in air leakage absence at operated side, there was a significantly higher peak value in air leakage presence than air leakage absence(Table3).

Furthermore, there was no significant peak value with atelectasis relation to Operated side, non-operated side, R-peak peak value, L-peak peak value.

Comment 3. A list of complications (including non-pulmonary) is required to better understand the utility of the device. For example, did patients with postoperative A. fib have changes in peak value? Providing a summary of post-operative complications using the STS definitions and Clavien-Dindo classification as a separate table would better define the patient population under study.

Reply 3: We appreciate the Reviewer's comment. In this study, other than respiratory complications, for example, atrial fibrillation, wound infection, subcutaneous emphysema, ischemic heart disease, and bradyarrhythmia were not observed. Because there were a small number of study.

Changes in the text:

Page 10-11: Defined the postoperative complications

Possible postoperative complication related to chest wall motion were defined as follow: air leakage, atelectasis, pneumonia, wound infection, pulmonary embolism, subcutaneous emphysema, ischemic heart disease, and bradyarrhythmia by the Clavien-Dindo classification (CTCAE5.0) and the STSGTSD guidelines. Postoperative complications were analyzed to grade IIIa or higher within 30 days after surgery.

Add in the table:

Table 1. List of possible postoperative complication related to chest wall motion

Comment 4. Table 1 is quite clear; however, Table 2 is unclear. It is difficult to interrupt if the peak side values are for the procedures (i.e. VATS vs. thoracotomy) or operative vs. non-operative side. To help organize the results a separate table describing the complications and the peak values (perhaps on operative and non-operative side) is required.

Reply 4:

Thank you for your valuable suggestion. We have modified Table 2. We have also described the relationship between postoperative complications and the peak values as Table 3.

Add in the table: Table 2 and Table 3

Reviewer B

Comment 1. There should be more details on the methods used for clinical variables.

Was data collected prospectively? What variables were collected (extent of resection, surgical approach, etc).

Reply 1: Thank you for pointing out this issue. In this study, we have collected clinical data, prospectively. We have added clinical variables in patient section.

Changes in the text:

Page 9

Overall, 50 patients who underwent lung resection with segmentectomy or lobectomy for resectable lung tumors at Tokyo Medical and Dental University Hospital between September 2018 and April 2019 were enrolled. For surgical approach, open thoracotomy was selected for patients with low lung function and preoperative treatment. For segmentectomy, we included patients with pure GGO of 15 mm or less, or metastatic lung tumors or lung tumors that anatomically required segmentectomy.

Comment 2. Please define postoperative complications: what was criteria for pneumonia, air leak, hypoxia?

Reply 2: Thank you for your valuable suggestion. We have added a definition of complications using the Clavien-Dindo classification (CTCAE5.0) and the STSGTSD guidelines.

Changes in the text:

Page 10:

Defined the postoperative complications

Postoperative complications were defined by the Clavien-Dindo classification (CTCAE5.0) and the STSGTSD guidelines. Postoperative complications were analyzed to grade 3a or higher within 30 days after surgery.

Comment 3. What was the indication for operation?

Reply 3: We appreciate the Reviewer's comment. Our indication for operation indicated

as a resectable lung tumors.

Changes in the text:

Page 9

Overall, 50 patients who underwent lung resection with segmentectomy or lobectomy for resectable lung tumors at Tokyo Medical and Dental University Hospital between September 2018 and April 2019 were enrolled. For surgical approach, open thoracotomy was selected for patients with low lung function and preoperative treatment. For segmentectomy, we included patients with pure GGO of 15 mm or less, or metastatic lung tumors or lung tumors that anatomically required segmentectomy.

Comment 4. Is there any data to substantiate the following statement in the results "Sensor twisting and tension problems due to body movement over short terms were 167 observed but there were no sensor defects or measurement failures" **.**

Reply 4: We appreciate the Reviewer's comment. As for "there were no sensor defects or measurement failures", we have modified it.

Changes in the text:

Page 10-11:

Sensor twisting and tension problems due to body movement over short terms were observed but there was no affected to analysis of respiratory and peak value.

Comment 5. The manuscript uses the term 'peak value' to describe some of its main outcomes. This term is unclear to me and would be improved if it was more descriptive. You defined high peak value as the maximum value of the envelope in the frequency characteristics. This definition is also unclear to me.

Reply 5: Thank you for pointing out this issue. As you pointed out, we defined the peak value as the maximum value of the envelope. And the peak value picks up the maximum respiratory amplitude, as shown in the Fgire3. In a normal respiratory state, the envelope

is gradual curve. In this study, we found that the amplitude of the envelope curve is larger in the envelope judged to be abnormal respiratory, due to the disturbance of the respiratory pattern. We have added supplementary text and figures on peak value to the recording and analysis.

Changes in the text:

Page 8:

We defined the peak value as the maximum value of the envelope. And the peak value picks up the maximum respiratory amplitude, as shown in the Fgire4A. In a normal respiratory state, the envelope is gradual curve (Figure 4A). On the other hands, the abnormal respiratory state showed that the amplitude of the envelope curve is larger in the envelope due to the disturbance of the respiratory pattern. (Figure 4B).

Comment 6. Why do the authors think the peak value was elevated in patients who developed complications? What is their physiologic explanation for their finding.

Reply 6: We appreciate the Reviewer's comment. The increase in peak value in the complication group is thought to be due to the marked disturbance and discontimue of respiratory amplitude due to hypokinesia of the chest wall.

Changes in the text:

Page 14:

Furthermore, the increase in peak value in the complication group is thought to be due to the marked disturbance and discontimue of respiratory amplitude due to hypokinesia of the chest wall.

Comment 7. Page 6 lines 121-122 have several x's, which appear to be typos. "This study was approved by the ethics committee of xx University in March 2018 122 (M2017-255) and registered as a clinical trial (xxIN0000xxxxx)"

Reply 7: Thank you for pointing out this issue. We have revised about the ethics committee in text.

Changes in the text:

Page 9:

This study was approved by the ethics committee of the Tokyo Medical and Dental University in March 2018 (M2017-255).

Reviewer C

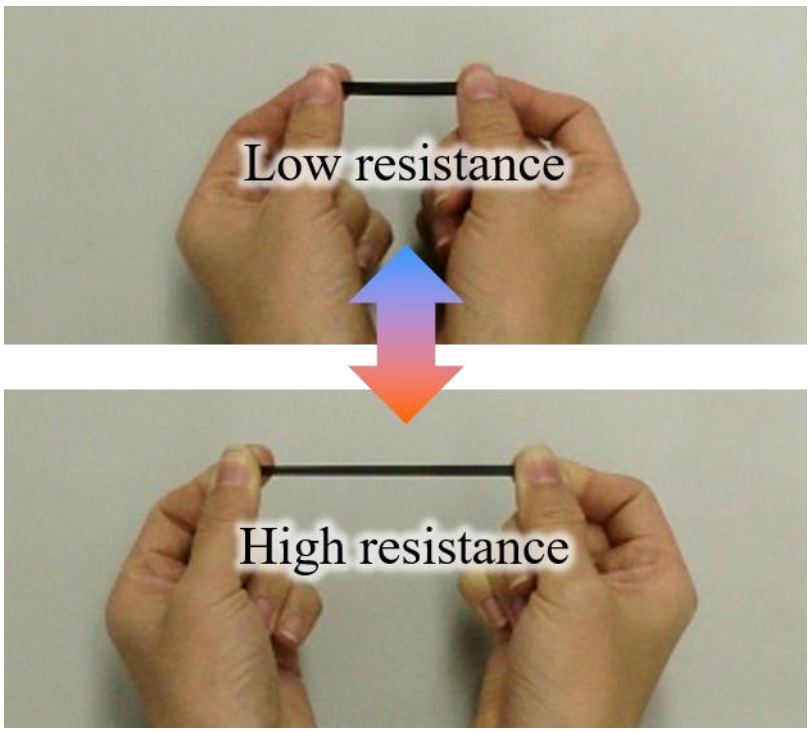
Comment 1.

-In the beginning, I got the impression that thoracic impedance would be measured (which is fluid distribution between electrodes). Respiratory sound patterns were also mentioned but not developed.

Reply 1: Thank you for pointing out this issue. In the present study, the thoracic motion is assessed by a linear increase in electrical resistance as the sensor is stretched. Respiratory sound method is only the basic stage. We only introduce the literature in the introduction.

Comment 2.

-Alongside Figure 1B you could visualize the working mechanism of the CNT sensor to give the reader a better understanding of it (example in the below picture).



Reply 2: Thank you for your helpful comments. We have added a picture of the CNT sensor to Figure 1C.

Add in the figure: Figure 1C

Comment 3.

-Perhaps it would be appropriate to clarify patient selection. I imagine that patients with a high body mass index would have little to no chest wall motion due to greater distance between skin and ribs (unlike the patient in Figure 2).

Reply 3: We appreciate the Reviewer's comment. As you pointed out, the sensor does not work well if the subcutaneous fat is thick. We have added Body Mass Index in Table 1.

Changes in the table: Table 1

Comment 4.

-It would be interesting to know the range and median values of Normal lung function and low lung function groups. At least FEV1 and VC.

Reply 4: We appreciate the Reviewer's comment. We have added the range and median FEV1, VC and DLCO of both groups in Table1.

Changes in the table: Table 1

Comment 5.

-line 102: should it not be ´raw data´ instead of ´law data´?

Answer:

Reply 5: Thank you for pointing out this issue. Therefore, it has been revised.

Changes in the text:

Page 8:

Next, raw data were analyzed using the Hilbert transform.

Comment 6.

-The patients who received epidural anesthesia may have blurred the results due to rib cage muscle paralysis and compensatory diaphragm contraction.

Reply 6: Thank you for your valuable suggestion. We added ’The effect of epidural anesthesia on chest wall movement has not been analyzed due to the small number of cases.’ in Limitations.

Changes in the text:

Page 15:

Fourth, the effect of epidural anesthesia on chest wall movement has not been analyzed due to the small number of cases;

Comment 7.

-I didn't understand why the time scale in Figure 3 had to be in reverse?

Reply 7: Thank you for pointing out this issue. We modified the time scale.

Changes in the figure:

Figure 3

Comment 8.

-It is a thrilling article, that raises more goals and opens new frontiers:

8-1 What kind of surgery was performed and on which side of patients A and B in Figure 4?

Reply 8-1: We appreciate the Reviewer's comment. We have added comment in Figure 5.

Changes in the text:

Figure 5B: VATS lobectomy, operation side: left side

Figure 5D: VATS lobectomy operation side. right side

8-2 Would it be possible to show the 10 minutes of preoperative pattern in Figure 4? In future studies, this period would probably be extended just for a better understanding of the pattern.

Reply 8-2: We appreciate the Reviewer's comment. We have added the 10 minutes of preoperative pattern in Figure 5A and 5C.

Add in the figure:

Figure 5A and 5C

8-3 What would an average normal waveform pattern look like?

Reply 8-3: Thank you for your valuable suggestion. We think that normal lung function

appeared a continuous and uniform respiratory waveform in the heat map and respiratory pattern look like figure5B.

Comment 9.

I would like to congratulate You on choosing the experimental science field. This Article would be a nice addition to the current trend, which was last depicted in: Tukanova K, Papi E, Jamel S, Hanna GB, McGregor AH, Markar SR. Assessment of chest wall movement following thoracotomy: a systematic review. J Thorac Dis. 2020;12(3):1031-1040. doi:10.21037/jtd.2019.12.93

Reply 9: We appreciate the Reviewer's comment. We have cited the literature.

Changes in the text:

Page 5: Recently, the review by Tukanova et al reported the usefulness of that the respiratory inductive plethysmography and compartmental analysis of the chest wall volume by means of an optoelectronic plethysmography (11).