Peer Review File

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Reviewer A

The authors analyzed clinical data of 120 patients who underwent single-port thoracoscopic segmentectomy for early lung cancer at a single institution from January 2019 to July 2019 who underwent a procedure that used the application called "the bronchus-vein-artery triad" and the simulation intersegmental plane (ISP) using the IQQA-3D system. Patient background and surgical outcomes were evaluated in the ISP (N=61) and non-ISP (N=59) groups according to the presence or absence of IQQA-3D simulation preoperatively. There were no significant differences between groups in patient characteristics, operation characteristics and postoperative recovery, except the duration of chest drainage and the rate of gross margin insufficiency. In the ISP group, the accuracy of the IQQA-3D ISP simulation was evaluated using the location of the intersegmental pulmonary veins on the ISP. The accuracy of intersegmental plane simulation was 56/61 (91.8%).

The authors' preoperative 3D simulation of the ISP and the surgical results appear to be excellent.

However, when generalizing this finding to readers, it is unclear what information can be shared; the message that IQQA-3D software should be used alone seems to be of little benefit to the reader.

There are some points of minor criticism that need to be addressed:

Comment 1: Page 3, line75-79, "However, great deficiencies persist in the simulation of the intersegmental plane (ISP). We sought to evaluate ISP prediction performed with 3D imaging reconstruction of the bronchus–vein–artery triad in patients undergoing segmentectomy for early peripheral lung cancer."

The above text is difficult to understand. Specifically list the drawbacks of ISP-simulation. Describe which of them you did to improve, what methods you used, and what you aimed to evaluate in this study.

Reply 1: Thank you for your valuable suggestions. In most preoperative simulation procedures, the intersegmental plane is formed by connecting the intersegmental veins (judged by the operator based on clinical experience) using a three-dimensional reconstructor. The disadvantage of this approach is that it is greatly affected by the operator's experience with poor repeatability. We have improved this process using the bronchus–vein–artery triad to simulate the ISP and judge the accuracy of ISP simulation. This process is not affected by the operator's experience; thus, it has good repeatability and wide applicability. This study aimed to examine the value of the bronchus–vein–artery triad in segmentectomy.

Changes in the text: We have made some modifications according to your suggestions (Page 4, Lines 74–83).

Comment 2: "The bronchus-vein-artery triad" is an uncommon term. Clarify the definition of the structure. It may be helpful to illustrate it as a supplementary figure.

Reply 2: The bronchus–vein–artery triad refers to use of the segmental bronchus to preoperatively simulate the ISP, the intersegmental vein to determine the accuracy of ISP simulation, and the segmental artery to present the ISP during surgery. The three segmental structures are fully used in the whole operation.

Changes in the text: We have added the relevant content as suggested (Pages 5, Lines 85–90).

Comment 3: In five patients, ISP-simulation was uncertain. Author commented that the reason for this is that the CT-image was unclear. What CT images are needed for this IQQA-3D-simulation? Was the subject patient subjected to a CT scan under special imaging conditions?

Reply 3: The IQQA-3D system requires clear CT images, similar to other reconstruction systems. However, due to insufficient inspiration during CT in some patients, the lungs were not fully dilated, which led to an unclear bronchus. Moreover, failure of patients to hold their breath during CT may cause artefacts. With our procedure, there are no special imaging conditions needed during CT. In other words, conventional enhanced scanning can meet the requirements.

Changes in the text: None.

Comment 4: Page 7, Line 197-199, “Thus far, no reliable strategies have been reported for preoperative ISP simulation. Here we summarized a strategy for accurate preoperative planning.”

This expression seems to be an exaggeration. You need to use understatement or provide specific references and indicate what is missing.

Reply 4: We completely agree with your suggested amendment. We revised the expression to “Thus far, there are few reports of a good preoperative ISP simulation process. Here, we introduced an accurate preoperative ISP simulation process that could meet clinical needs.”

Changes in the text: We have modified the text as advised (Page 11, Lines 218–222).

Comment 5: For Table 2, there seems to be a bias in the area of resected segment between the ISP and non-ISP groups. Please mention this in the results or in the comment session.

Reply 5: Thank you for your advice. We divided the resection range into segment, segment + segment, segment + subsegment, subsegment + subsegment, and subsegment + sub-subsegment according to the different segmental combinations. The statistical analysis showed no significant difference between the two groups.

Changes in the text: We have added the relevant content as suggested (Page 10, Lines 191–195).

Comment 6: For **Table 3**, please show the actual number of surgical margins measured as well as the gross margin sufficiency. One of the problems with pulmonary segmentectomy is late onset pulmonary fistula. Please indicate the frequency of pneumonia at 30 days and 90 days postoperatively.

Reply 6: Thank you for your advice. Unfortunately, we did not record the actual number of surgical margins measured. During surgery, we used a ruler to measure the margin. If the margin was greater than the tumor diameter or ≥2 cm, the gross margin was considered to fulfil the requirements. If the margin did not meet the requirements, further extended wedge resection of adjacent lung tissue was performed. We will strengthen this area in our future work.

Late-onset pulmonary fistula is rarely encountered in our daily work. Recently, a patient was re-admitted because of an alveolar fistula. This patient was cured by a second operation after conservative treatment failed. However, no late-onset pulmonary fistula occurred in this study.

The pneumonia cases listed in Table 3 all appeared within 30 days after surgery. After reviewing the data, there were no cases of pneumonia within 90 days after surgery.

Changes in the text: None.

Comment 7: Regarding Figs. 1 and 3, the classification of S8a, S8b, and S9 is different, although it may be necessary to refer to HRCT and bronchoscopy as well. Difficult case presentations risk confusing the reader. Therefore, the image in Fig. 1 is not suitable for this journal. Please present images that are typical and help the reader to understand them.

Reply 7: Thank you for your suggestion. We have replaced Fig. 1 according to your suggestion.

Changes in the text: We have replaced Fig. 1 and modified the legend as advised (Page 21-22, Lines 435–445, and Fig. 2).

Comment 8: For Fig. 5, the relationship between V2c and the S2-S3 area is hard to understand. Try to make it easier to understand.

Reply 8: Thank you for your advice. We have modified this passage to make it easier to understand: "Anatomically, V^2C is normally located on the ISP between S^2 and S^3; however, in this case, due to poor imaging of B^2b, part of the bronchus was missing, which made the simulated ISP deviate to S^2b. Therefore, V^2C did not fall on the ISP."

Changes in the text: We have modified the figure legend as advised (Page 22-23, Lines 460–466).

Comment 9: As there is duplication and redundancy in the session of comment, please keep it short and to the point.

Reply 9: We rewrote the relevant content, deleted parts of Lines 275–277, and modified Lines 317–324.

Changes in the text: We have modified the text as advised (Page 14, Lines 275–277; Pages 16, Lines 317–324).

Comment 10: Number of reference, 12 is wrong.
Reply 10: We apologize for this oversight. We have corrected the error.
Changes in the text: We have modified the text as advised (Page 15, Line 296).

Reviewer B

Comment 11: This is an interesting paper regarding ISP evaluation for segmentectomy planning.
The authors state that the aim of the study is to evaluate the technology`s ability to assist in operative planning, however, the authors do not discuss it.
Reply 11: Thank you. In the Conclusion section, we described the use of this technique in surgical planning and its advantages and disadvantages in detail, but there may still be some shortcomings, which we will improve in future work.
Changes in the text: None.

Comment 12: There was no significant difference between groups, but the authors still conclude that ISP planning can assist in surgical planning.
Reply 12: In this study, there was no significant difference between the two groups in terms of baseline and postoperative recovery. However, there was a significant difference in the rate of insufficient margins between the two groups. This strategy can help to reduce the occurrence of insufficient surgical margins. Thus, we believe that this strategy is helpful for planning and implementation of segmentectomy.
Changes in the text: None.

Reviewer C

Xu et al, in their manuscript, "Intersegmental plane simulation based on the bronchus-vein-artery triad in pulmonary segmentectomy," describe their experience with using intersegmental plane simulation (ISP). Overall, I think that this is a timely and interesting topic.
Reply: We thank the reviewer for the favorable analysis of our original submission and for highlighting the significance of our studies.

I think this manuscript has potential, but as a surgeon without experience in 3D reconstruction/software, I was left somewhat confused after reading it. Comments and questions below:

Comment 13: I thought that the technique was a bit hard to follow. To clarify I have the following suggestions. In the methods section, I think the Non-ISP group should be

described first. This should be accompanied by a figure that shows what this looks like on the software. Next, discuss the ISP group. If my interpretation is correct, this is comprised of 1) ISP simulation and 2) Nodular analysis. These two items should be discussed separately, if possible. I understand that there are figures accompanying this part of the method section. However, ideally a reader can just look at the two figures and without much effort, understand the differentiation between the two groups. It is unclear to me exactly how the two groups are different in a "real world" scenario, as the 3D reconstruction of the target segments alone seems like it would create a visualization of the intersegmental planes. Perhaps a video, if able to be included in the manuscript, would be helpful.

Reply 13: Thank you for your advice.

It is more reasonable to describe the non-ISP group first. We have modified this.

ISP simulation and nodular analysis are part of the process of ISP simulation. We explained them separately in Fig. 2.

According to your suggestion, we added a preoperative planning picture of the non-ISP group to show the results of 3D reconstruction to help explain the difference between the two groups.

Changes in the text: We have modified the text and added a figure as advised (Page 6, Lines 122–140, and Fig. 2).

Comment 14: Another somewhat confusing issue is how the procedure in the ISP and non-ISP group differed. Was it purely a planning difference? Or were the ISP and/or vessels handled differently? I am struggling to understand if the intervention was purely a cognitive difference in the way the operation was approached (ie. taking 2 segments instead of 1, to make sure an adequate margin was achieved), or if there was actually something different about the intraoperative performance of the surgery. This should be clarified. As it stands, it is a bit difficult to understand how/why the ISP group were able to have improved gross margin status and decreased duration of chest tube drainage.

Reply 14: Thank you for your suggestion. As you said, the difference between the two groups is mainly in preoperative planning. The ISP group underwent more detailed preoperative planning. Therefore, we explored whether this more detailed process can improve preoperative planning accuracy to achieve tumor resection and sufficient surgical margins. Preoperative planning in the non-ISP group is not comprehensive enough, and preoperative planning errors may occur, leading to the embarrassing outcome of insufficient surgical resection or even failure to resect the tumor. The intraoperative approach is performed routinely, and there was no difference between the two groups.

Changes in the text: None.

Comment 15: I think that the reader would benefit from a clearer idea of the order and approach to ligating the different structures. In many cases, the vein is the first and easiest structure to see. How does the surgeon tell whether a vein is central or intersegmental?If the goal is to propagate your technique and replicate its success, more

detail should be provided about the actual performance of this complex operation.I think that the nature and role of identifying intersegmental veins in segmentectomy is underappreciated. A good, clear picture depicting the location of the segmental vs intersegmental veins in an example case would be appreciated.

Reply 15: In the surgical process, we have no requirements on the processing order of the structures. The processing order is mainly determined according to the specific anatomical characteristics. As you said, the veins are often treated first because they are superficial. We determine the intersegmental veins or internal veins based on preoperative 3D reconstruction results. We then compare them with the 3D reconstruction results in real-time during surgery. For some veins that cannot be distinguished, we confirm them after the intersegmental boundary is revealed by the modified inflation–deflation method. The veins that enter the expanded segment are central veins. In our study, we separated the intersegmental plane along the intersegmental vein and the inflation–deflation line. The newly provided example in Fig. 2 shows the location of the segmental versus intersegmental veins.

Changes in the text: We have modified the text and added a figure as advised (Page 8, Lines 163–165, and Fig. 2).

Comment 16: What was the temporal relationship between cases in the ISP and non ISP group? If the cases in the non ISP group were done first, and the cases in the ISP group done later, could some of the differences in results be explained by an "era" effect? That is to say, was additional surgeon experience a factor? Also, was there a difference in terms of which surgeon was doing the cases in the ISP group vs the cases in the non-ISP group? In that case, there could have been an effect related to the surgeon as a variable.

Reply 16: These cases were completed within the same period, and there was no difference in time sequence. The surgeon was from the same surgical team, and the surgical procedures were the same. However, this study was retrospective and may have been affected by certain factors. Although the procedure was performed by the same surgical team, it may still be affected by the experience of different surgeons. Therefore, more convincing prospective controlled studies are needed.

Changes in the text: None.

Comment 17: Are the intersegmental veins divided or preserved? If divided, how were they divided? Stapler or ultrasonic knife?

Reply 17: In this study, we retained the intersegmental veins as much as possible. In daily surgery, intersegmental veins may be divided due to the needs of the disease. If divided, intersegmental veins are generally divided using an ultrasonic knife after ligation with #1 or #4 suture.

Changes in the text: None.

Comment 18: What does "insufficient margin" (line 265) mean exactly?Does that mean positive margin? Close margin? If a close margin, what does that entail (within how many mm)?

Reply 18: In this study, an insufficient margin meant that the tumor was close to the surgical resection margin and did not meet oncology requirements; that is, the distance was <2 cm or less than the tumor diameter.
Changes in the text: None.

Comment 19. Lines 279-296 are confusing to me. The authors state that "delineation of the ISP using the intersegmental vein is not sufficiently accurate," but then go on to say that they check whether or not the simulated ISP fell on the simulated intersegmental vein to determine accuracy, and that 94.7% of the time the intersegmental veins fell on the simulated ISP. You can't have it both ways! Also, how did you respond when the intersegmental veins did not fall on the simulated ISP? I could not tell if lines 326-329 refer to this situation. Also lines 330-331 should probably precede the text beginning "Five cases were inconsistent."; lines 330-331 seem to refer to what happens when ISP simulation and intersegmental vein location a
re concordant, not when there are discordant.
Reply 19: Thank you for your advice.
The description of the ISP using the intersegmental vein mentioned here refers to the first of the three ISP description methods mentioned in the article (Lines 220–224).
The method we used was the third of the three ISP description methods.
When the intersegmental veins did not fall within the simulated ISP, we adjusted the resection range to ensure adequate surgical margins; when the simulated intersegmental vein fell within the target segment and the safe resection margin sphere exceeded the intersegmental vein, we increased the wedge resection of the adjacent segment to ensure adequate surgical margins; when the simulated intersegmental vein fell within a non-target segment, we performed resection according to the intraoperative ISP.
Regarding the third point, the statement here is wrong, we deleted the words "on the ISP or…".
Changes in the text: We have made some changes according to your suggestions to avoid misunderstanding (Page 14, Lines 280–281). With regard to your second point, we agree with your suggestion and have made the corresponding changes (Lines 296–300). We have modified the text as advised (Page 16, Lines 319–324 and Line 329).