

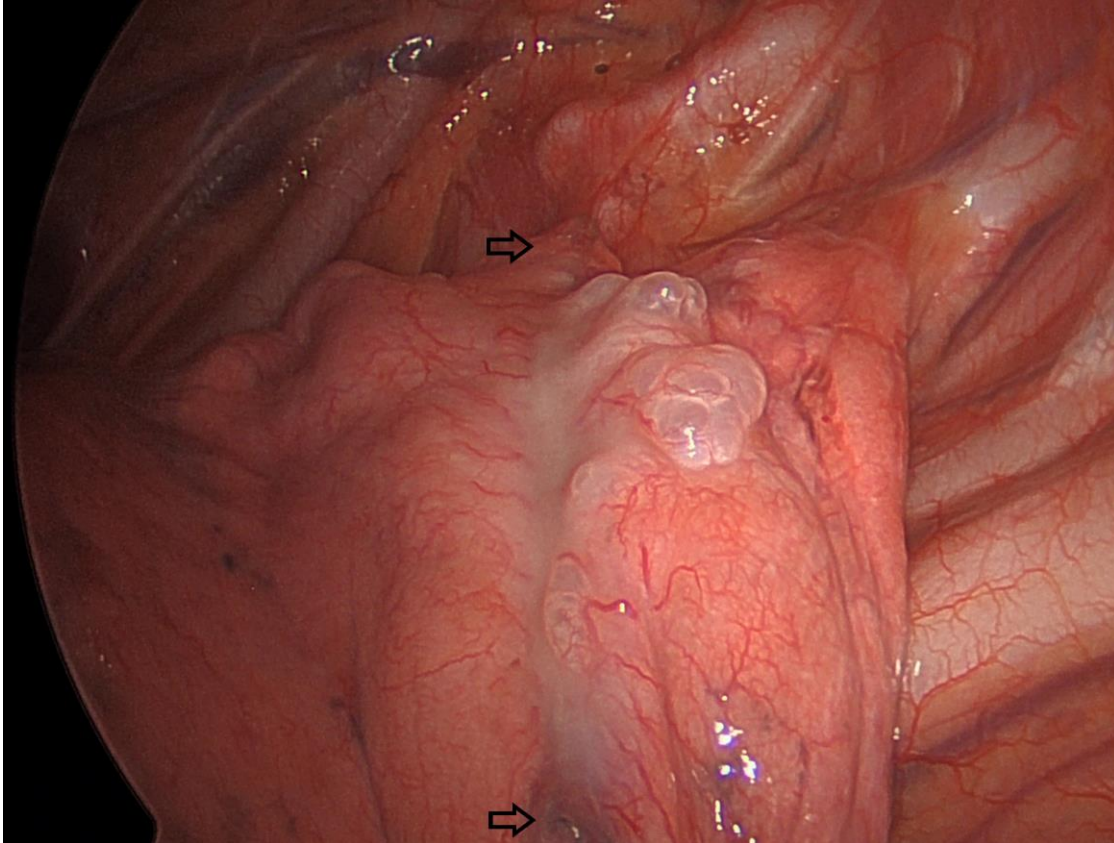
2023 대한심장혈관흉부외과학회

제55차 추계학술대회 & APELSO 2023

2023. 11. 02 (Thu) - 11. 04 (Sat), 그랜드 인터컨티넨탈 파르나스 서울

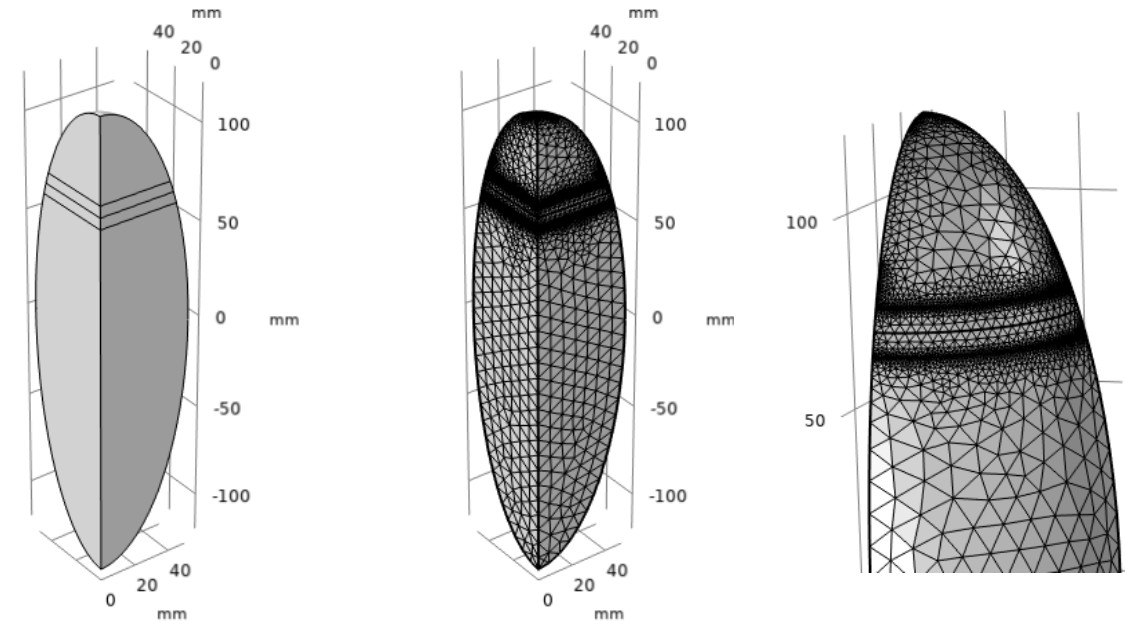
**Mechanical analysis of recurrence mechanism
after video-assisted thoracoscopic surgery for
primary spontaneous pneumothorax**

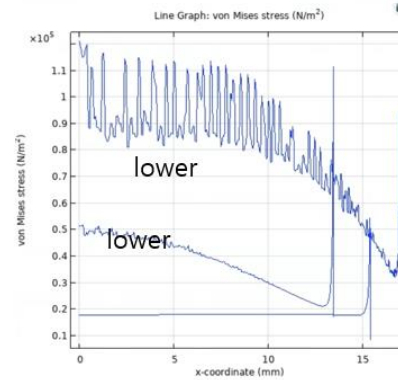
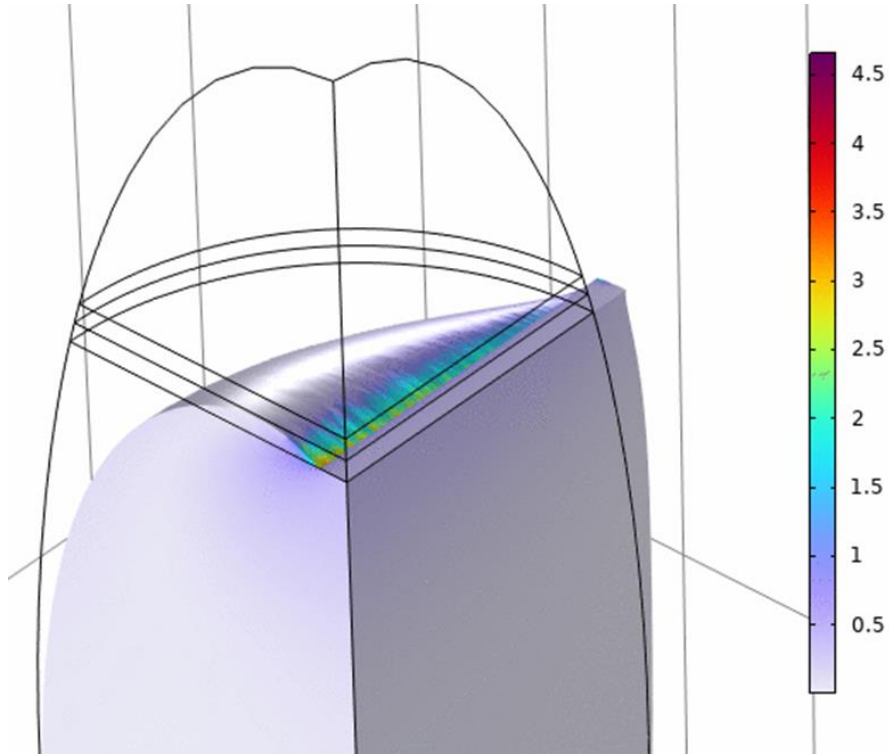




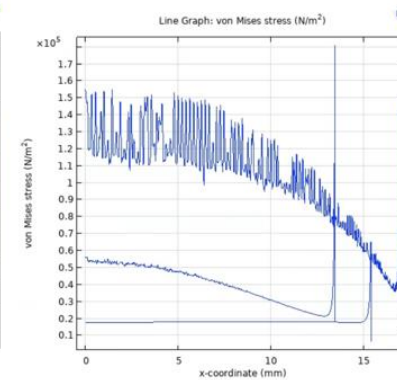
- Recurrence after video-assisted thoracoscopic surgery for primary spontaneous pneumothorax constitutes a major concern for surgeons.
- Recent studies have indicated that the newly formed bullae plays an important role in the development of recurrent pneumothorax.
- Despite the proposition of tension surrounding the stapling line as a contributing factor to the origin of new bullae, the precise mechanism underlying the formation of new bullae remains unclear.

- For the assessment of the stress distribution along the stapling line, we employed the Finite Element Method through the utilization of COMSOL Multiphysics software. We constructed a model of a solid ellipsoid lung (Young's modulus $E = 20$ kPa, Poisson's ratio $\nu = 0.3$) designed to replicate the volume of the actual lung. Subsequently, simulations were conducted to assess the tension applied along the stapling line after lung resection.
- To elucidate the manifestation of a wrinkling phenomenon, we conducted animal experiments and procured canine lung samples subsequent to resection employing a stapler device.

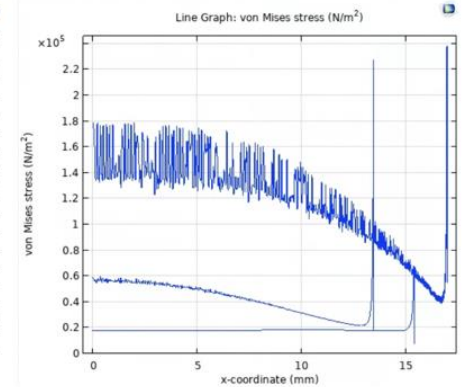




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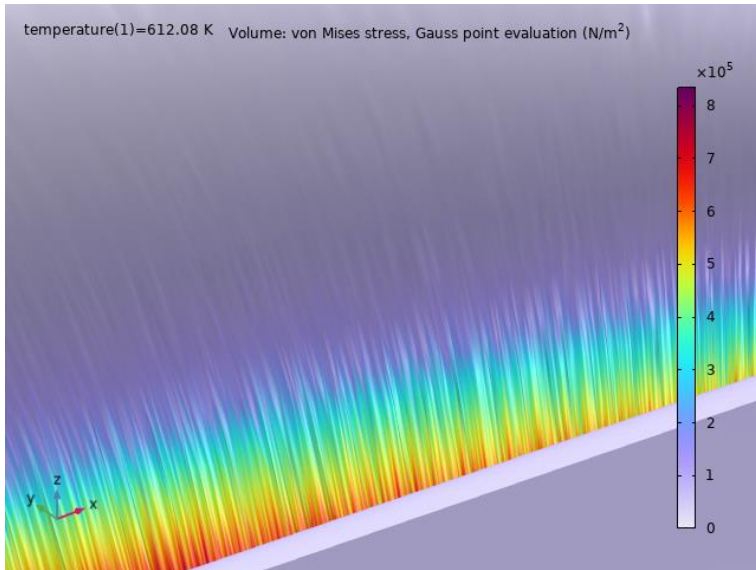


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- Stress levels progressively increase with the inflation of lung, and the area exhibiting the maximum stress demonstrates a dual-peak pattern.
- One of these peaks is prominent at the central area of the stapling line, which can be attributed to its greater thickness compared to other regions. The second peak occurs at the edge of the stapling line, which stress levels in this area is surpassing those of central area.



- A phenomenon characterized by wrinkling occurs adjacent to the stapling line, and this phenomenon is replicated in the animal study.

- The stress surrounding the stapling site gradually increased, reaching a dual-peak pattern during maximal inflation.
- Elevated stress during inflation leads to uneven and distorted expansion of lung, characterized by a wrinkling phenomenon along the stapling line. The concurrent presence of increased stress and the occurrence of a wrinkling phenomenon contributes to the development of new bullae formation.
- The advancement of a novel stapler material and refinement of the stapler's design hold the promise of augmenting the alignment between stapled and non-stapled lung tissue. These enhancement could result in a more efficient procedure characterized by reduced stress levels.