Editorial

Will bubbling decrease the muddling?—a promising technique to detect air leak intra-operatively

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Air leak is a common complication post lung resection. It delays chest tube removal and increases the length of hospital stay. Recognizing air leak intra-operatively and implementing measures to repair it might lead to decreased hospital stays and decreased costs. During video assisted thoracoscopic surgery (VATS), we presently have a limited ability to detect air leaks intraoperatively. A commonly used test is the water submersion test (WST) which requires inflation of the operated lung while submerged under sterile irrigation fluid. In the era of VATS pulmonary resection, the WST is of questionable reliability in identifying parenchymal air leak given the reduced visibility resulting from the loss of lung isolation. A WST can definitely detect the presence of an air leak. However, the actual location of the leak may be challenging to identify since the irrigation fluid often has to be at least partially drained to access the leak for repair. Once the area of leak is no longer submerged, it becomes challenging to pinpoint its exact location. As an alternative test, Brunelli *et al.* have suggested using the ventilator parameters to quantify the air leak intraoperatively (1). The group recommended implementation of intraoperative air leak preventive measures when the measured air leak is >500 mL/min (1). With both of these maneuvers, visibility is significantly hampered when using VATS.

The ventilator equipment and spirometry measures required to perform the air leak test intraoperatively, as described by Brunelli *et al.* (1), are present on contemporary anesthesia machines used for thoracic surgery. As such, implementation of this intraoperative test after pulmonary resection would be practical and not complicate usual care.

Yang and Chang have suggested a novel technique to intraoperatively assess for air leak post VATS using surfactants (2). In an *ex-vivo* porcine lung model, multiple formulas of surfactant were tested to determine a suitable air leak detection solution. Indocyanine green was added to the solution for visualization purposes. Results indicated that Pluronic® F-127 (PF127, poloxamer 407, Sigma P2443) was the most suitable formula in the setting of VATS to detect an air leak. The surfactant concentration of 15% formed bubbles of suitable size where there was air leak.

The experimental results may be a promising method to facilitate detection of air leak intraoperatively, however, some issues need to be addressed before applying these findings to clinical practice.

Yang and Chang mentioned in their paper that the constituents of the solution were approved by Food and Drug Administration (FDA) and have been used in medical practice like drug manufacturing process and cell culture. (2) A previous *in vivo* and *in vitro* study has used PF127 as a synthetic scaffold for seeding and culturing lung progenitor cells (3), however, to the best of our knowledge, the safety and potential effects on human lung healing have not been analyzed. According to our research, we could not determine if this product is approved for use in the pleural space, at least in North America.

Another important consideration is the thermo-reversible hydrogel properties of PF127. As mentioned in the article, further tests will be necessary to determine if the proposed 15% PF127 solution will form a gel when applied

to the human lung during surgery. The consistency or viscosity of the solution in the pleural space milieu remains unknown. Finally, the cost of this solution was not provided. Since WST is widely accessible and cheap to use, future studies comparing the efficacy and cost benefit of both tests will need to take the cost of the chemical agent into consideration.

In conclusion, the approach proposed by the authors to detect and locate a parenchymal air leak intra-operatively is promising. It is an important step toward improving upon what is commonly used in thoracic surgical practice. Further studies are needed to test its efficacy and safety.

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Footnote

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