Advancing the science of predicting air leaks

Chi-Fu Jeffrey Yang, MD

From the Division of Thoracic Surgery, Department of Surgery, Duke University Medical Center, 3496 DUMC, Durham, NC.

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Address for reprints: Chi-Fu Jeffrey Yang, MD, Duke University Medical Center, Box 3443, Durham, NC 27710 (E-mail: chifu.jeffrey.yang@dm.duke.edu).

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Although advances have been made in thoracic surgical technique and perioperative care, prolonged air leaks continue to be an important complication after pulmonary resection and occur in approximately 8% to 15% of all lung resections.¹ Prolonged air leaks are associated with increased patient discomfort due to prolonged chest tube duration, increased length of hospital stay and costs, and increased risk of developing empyema and other cardiopulmonary complications.^{2,3}

Accurate clinical prediction models to help thoracic surgeons and physicians determine a patient's risk of developing prolonged air leaks are much needed. These models can help improve patient care by improving patient expectations and facilitating assignment to fast-track discharge pathways.⁴ In addition, these models may help identify which patients may benefit from preventive interventions (eg, sealants, buttressed staples, pleural tents).⁴ A prognostic tool also can be used to improve patient selection for randomized trials that evaluate efficacy of treatment strategies focused on reducing prolonged air leaks.

Attaar and colleagues⁵ report the development of a prediction nomogram that can be used to predict which patients are at low or high risk of developing a prolonged air leak. The final model variables included in the nomogram were (1) percent forced expiratory volume in 1 second, (2) procedure type, (3) body mass index, (4) right-sided thoracotomy, (5) preoperative hospitalization, (6) annual surgeon caseload, (7) wedge resection by thoracotomy, (8) reoperation, (9) smoking history, and (10) Zubrod score.

Attaar and colleagues⁵ have performed a rigorous set of analyses to create this model. The strengths of the study include its sound statistical analysis and study design. The model was internally validated using bootstrapping. Both the final regression model and the nomogram had a concordance index of 76%, meaning that the nomogram could discern a patient with a prolonged air leak from a patient without a prolonged air leak approximately 76% of the time.

Chi-Fu Jeffrey Yang, MD

Central Message

Models predicting a patient's risk of developing a prolonged air leak after pulmonary resection are needed. In this study, an accurate risk prediction model for prolonged air leaks is reported.

See Article page 690.

The study does have limitations that may be addressed with future investigation and external validation. The database used by the authors does not include numerous important variables, including the presence of pleural adhesions, predicted postoperative forced expiratory volume in 1 second, actual and predicted postoperative diffusing capacity of carbon monoxide, emphysema, active infection, fibrosis, tumor size, single versus multiple wedge resections that would require multiple parenchymal staple lines, and details regarding the lesion (eg, benign vs malignant vs infectious). In addition, lobectomy and segmentectomy were grouped and analyzed together. The database also does not have details on intraoperative variables (eg, use of sealants) and postoperative management (eg, water seal vs suction preference).

Of note, Attaar and colleagues⁵ found a higher rate of prolonged air leaks for surgeons with higher volumes, even after risk adjustment; however, risk adjustment did not include numerous important variables, as discussed earlier. As the authors state, future investigation should include all of the potential risk factors for prolonged air leak, currently not captured in the Society of Thoracic Surgeons General Thoracic Surgery Database.

Attaar and colleagues⁵ should be commended for developing a reliable prediction nomogram for prolonged

air leaks. Perhaps the biggest challenge may be the actual implementation of it in daily clinical practice. It is commonly cited that it takes approximately 17 years for research evidence to translate into daily practice.⁴ At the time of this writing, there have been several prognostic models developed for prolonged air leaks,^{1,6-8} but whether they gain widespread use remains to be seen. The authors may consider taking a page from KēlaHealth and other tech groups that have made it easy to act on prediction models by linking predictive analytics with evidence-based interventions through simple apps that surgeons can use in their daily practice. In the future, the authors may consider increasing the clinical utility of their tool by working with developers who can use the model as a basis for an app that can be used at the point of care to assist with clinical practice or trial development.

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