Editorial Commentary

Assessment of emphysema in patients undergoing major lung resections

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Despite the advances in surgical techniques and the perioperative care, prolonged air leak (PAL) after major lung resection is still a frequent and vexing postoperative complication that all thoracic surgeons face in their daily practice (1). PAL is a common complication that occur in 8% to 15% of all lung resections (2), that may increase hospital stay, increase the risk of empyema, cardiopulmonary complications (3) and as a consequence increase costs (4).

Knowing that most of the uncomplicated cases may be resolved with simple chest drain and time, but this situation is still frustrating to the patient and creates discomfort due to the lack of the predictability of the time of treatment. For this reason patient's air leak risk factors must be pointed out and the patient must be informed about the probability of having a PAL, adequate informed consent may reduce patient's perioperative stress (5).

Surgeons must identify patient risk factors for air leak after lung resections in order to plan carefully surgery to minimize this risk and may inform better the patients.

Patient risk factors are mainly, patients with emphysema (6), with extensive intra-pleural adhesions (7), presence of incomplete and fused fissures (8), patients undergoing resection of a large volume of lungs (2), patients with risk of poor wound healing (2,3).

Careful surgery is necessary to reduce air leak, that means avoiding dissection in fissures when possible and performing fissureless lobectomy may be helpful (8).

For this reason it is very important to identify patients with emphysema preoperatively.

We have two main types of emphysema: the centriacinar (centrolobular) type and the panacinar (panlobular) type. The centriacinar is usually associated with the destruction of alveolar walls in the central portion of acinus, it is more often found in upper lung zones (upper lobes-superior segments of lower lobes) and is commonly associated with cigarette smoking. While the panacinar type is recognized as a destruction involving all portions of the lobule out to the periphery, it is found mainly in the lower lobes and is often associated with alfa-1-antitrypsin deficiency (9). Sometimes in very severe cases the two subtypes of emphysema appear together.

We must keep in mind that, patients with early emphysema are usually asymptomatic and may have clinical symptoms and pulmonary function tests (PFTs) changes only after 30% destruction of the total lung parenchyma (10). This means that in order to detect early emphysema we have to assess patients by CT scan. In patients undergoing lung resections we have to look at the extent and site of emphysema (for instance, if it is near to the fissure of the lobe to be resected).

Quantitative assessment of emphysema patients by CT scans is more advantageous and reliable than visual CT scan assessment and this is due to reproducibility and the absence of the inter observer variability. A lot was learned from the lung reduction volume procedure (LVR) and the importance of the CT scan assessment (11) where precise

quantitative evaluation of the extent of emphysema has been used for treatment purposes.

In literature we have few articles that included the CT scan quantification of emphysema as a variable and then checked whether it predicts air leak after lobectomy. We have different techniques of quantitative CT scan assessment of emphysema, unfortunately has not been standardized.

In Murakami *et al.*'s paper "Grading of emphysema is indispensable for predicting prolonged air leak after lung lobectomy" (12), they reported their experience by assessing the utility of CT based grading of emphysema after VATS lobectomy for predicting PAL. They performed a retrospective analysis on 284 patients who underwent VATS lobectomy. PAL definition was air leak lasting 7 days or longer. To evaluate emphysema distribution they calculated the Emphysema index, the proportion of the emphysematous lung volume (less than –910 HU) to the total lung volume (–600 to –1,024 HU). After anatomical resection water seal test was performed to check the presence of air leak, and if air leak was detected they performed pneumostasis with thin type (0.15 mm) polyglycolic acid (PGA) mesh (Neoveil; Gunze, Osaka, Japan) and fibrin glue (Beriplast; CSL Behring, Tokyo, Japan). They had 15 patients (5.3%) with PAL. They found that an emphysema index of 35% or greater was the best cut off value for predicting PAL.

Moreover they showed that emphysema index was the only significant predictor of the length of chest tube drainage.

The study does have limitations that may be addressed with future investigation and need external validation with different settings. The authors didn't include in the analysis important variables: the presence of pleural adhesions, the presence of intraoperative fused fissure, diffusing capacity of carbon monoxide (Dlco), predicted postoperative forced expiratory volume in one second, predicted postoperative Dlco and number of multiple parenchymal staple lines. Moreover the author's intraoperative technique for identifying air leak was water seal test, knowing that this test is subject to large inter-observer variability due to the difficulty in standardizing and quantifying the air leak; for instance an alternative way may be the objective assessment of air leak (with ventilator spirometer), expressed as mL/min, by measuring the difference of the fixed inspired volume and expired volume using a tidal volume of 8 mL/kg, respiratory rate of 10 and a peak-end-expiratory pressure of 5 cmH_2O (13). They calculate the emphysema index for the whole lung, may be quantifying the emphysema of the lobe to be removed is more specific and visual CT scan assessment of emphysema near the fissure of the lobe to be removed is also helpful.

Despite this, Murakami and colleagues were able to point out that measuring emphysema index may be helpful in identifying patients at risk of having postoperative PAL after lobectomy in a very specific setting.

Though we need randomized trials and the validation of these results in different settings, grading of emphysema by CT scan must be included in future studies. Knowing that early emphysema is silent, PFTs changes and clinical symptoms, appear only after 30% destruction of total lung parenchyma (10). The only way to detect early emphysema is by CT scan assessment.

Quantification of emphysema may be helpful for the surgeon to inform adequately his patient about the risk of having PAL after major lung resection and to adopt all intraoperative measures to reduce this risk.

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Footnote

Conflicts of Interest: The author has no conflicts of interest to declare.

Ethical Statement: The author is accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved.

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