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INVITED COMMENTARY

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Prolonged air leak following lung resection: a common but often underestimated problem

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The study from Hoeijmakers *et al.* [1] is an interesting snapshot of the current incidence of prolonged air leak (PAL) following lung resection in the Netherlands as collected in the Dutch Lung Cancer Audit for Surgery registry. The overall incidence of PAL in the registry is similar to what reported in previous series from other Countries and in organizational registries. Despite the increased utilization of minimally invasive surgery to approach lung resections, it appears that the occurrence of this complication has remained substantially stable over the time. One possible explanation is the fact that minimally invasive techniques [Videoassisted Thoracoscopic Surgery (VATS) or robotic surgery] have allowed for a broader inclusion of more borderline patients with increased rate of underlying co-morbidities such as Chronic Obstructive Pulmonary Disease (COPD), which are known risk factors for PAL. One of the most important findings in this study was the wide variation of PAL reported from the different participating hospitals. Even after adjusting for several confounders, the hospital PAL rates ranged from 2.6% to 19%. The reason for this large variability is likely to be multifactorial. There may be additional unaccounted patient-related factors explaining a different PAL risk in different units. Surgical technique and experience may also vary and influence the occurrence of air leak following lung resection (i.e. the use of fissureless technique has been proved to reduce the incidence of air leak or different technique of parenchymal division in segmentectomies). The use of preventative measures such as pleural tent, buttressed staple line and sealants may have influenced the occurrence of PAL.

In the survey, 18% of surgeons used sealants routinely, which is a remarkable finding especially in the time of health care financial constraints, while 69% used them selectively. Unfortunately, as honestly discussed by the authors, there are no patient-level information to clarify which patients actually received sealant and whether this application was actually associated with a reduction of PAL. There is also no information on the indication for applying sealants in those hospitals using them selectively: i.e. whether this was based on specific patient risk factors or risk scores, or the presence of large intraoperative air leak.

The fact the majority of surgeons used sealants selectively is in line with a recent Delphi European Society of Thoracic Surgeons survey [2] showing a consensus in using sealants only in high-risk patients showing an air leak at the end of the operation. The main reason against a routine use was a financial one.

Another factor that could explain the variability of PAL among hospitals could be the under-recording of PAL. It is surprising that 30% of surgeons underestimated their actual hospital PAL rate when responding the survey. The mis-perception of a low rate of complication may ensue by a lack of audit of their data which is an important practice to improve quality of care. It should be noted that in 61% of the hospitals, patients were managed in a respiratory ward rather than a surgical one. Unfortunately, there is no information on the direct involvement of surgeons in the postoperative care of their patients and how postoperative complications were actually recorded in the system and by whom.

Another important element which was not captured in this survey/registry was the proportion of patients with prolonged air leak who were discharged home with a portable drainage system. Although this is thought to be a common and safe practice to save on costs and improve patient satisfaction with care, in reality recent studies have shown that patients discharged home with a drain still have a longer hospital stay compared to patients without PAL [3] and face increased rate of re-admission and empyema [3, 4]. Therefore, trying to minimize this complication remains an important matter. One of the most interesting aspects reported in this study was the presumed association between 'water seal' and shorter duration of air leak. As discussed by the authors, the main problem with this assumption is its extrapolation from a reported hospital policy rather than actual patient-level information/data.

In addition, the term 'water seal' should be used with cautiousness. In fact, a recent multisocietal definition paper on chest tube management recommended to replace this term with 'no external suction applied' [5] as it better reflects the fact that the actual water seal may in reality exert some form of external suction due to the siphoning effect if the system is placed at a level lower than the patient chest and the tube is filled of fluid [6]. In this regard, the use of digital drainage systems with a regulated negative pressure has been shown to be advantageous to ensure a stable level of intrapleural negative pressure and even reduce the incidence of prolonged air leak (compared to analogue systems) [7]. In the Hoeijmakers *et al.* study [1], >60% of hospitals used digital devices and only 13% used only traditional systems.

The conclusions that water seal is associated with a 3% reduction in PAL incidence needs to be interpreted taking into account the fact that the 'water seal' group included both those patients managed with an analogue system without external suction (therefore, with an uncontrolled type of negative pressure) and those managed with digital systems and a negative pressure set at a level of 8 cmH_2O or lower.

There have been several studies comparing different levels of regulated suction. While one of them found a benefit in applying very low levels of pressure (-2 cmH_2O) in terms of reducing the air leak duration and incidence of PAL [8], others have not found the same results [9, 10] and actually reported an increased rate of chest tube re-insertion [9].

The authors should be congratulated for designing and nicely reporting results about this frequent and clinically relevant outcome in our specialty. It will certainly contribute to increase awareness in their community, which is the mainstay to implement strategies to improve clinical outcomes.

Conflict of interest: Dr. A. Brunelli is an Advisory Board member of Ethicon, Medtronic, BD, Astra Zeneca.

REFERENCES

[1] Hoeijmakers F, Hartemink KJ, Verhagen AF, Steup WH, Marra E, Röell WFB *et al.* Variation in incidence, prevention and treatment of persistent air leak after lung cancer surgery. Eur J Cardiothorac Surg 2022;61:110–7.

[2] Brunelli A, Bölükbas S, Falcoz PE, Hansen H, Jimenez MF, Lardinois D *et al.* Exploring consensus for the optimal sealant use to prevent air leak following lung surgery: a modified Delphi survey from The European Society of Thoracic Surgeons. Eur J Cardiothorac Surg 2021; 59:1265–71.

[3] Brunelli A, Chapman K, Pompili C, Chaudhuri N, Kefaloyannis E, Milton R *et al.* Ninety-day hospital costs associated with prolonged air leak following lung resection. Interact CardioVasc Thorac Surg 2020; 31:507–12.

[4] Konstantinidis K, Woodcock-Shaw J, Dinesh P, Brunelli A. Incidence and risk factors for 90-day hospital readmission following video-assisted thoracoscopic anatomical lung resection. Eur J Cardiothorac Surg 2019; 55:666–72.

[5] Brunelli A, Beretta E, Cassivi SD, Cerfolio RJ, Detterbeck F, Kiefer T *et al.* Consensus definitions to promote an evidence-based approach to management of the pleural space. A collaborative proposal by ESTS, AATS, STS, and GTSC. Eur J Cardiothorac Surg 2011;40:291–7.

[6] Miserocchi G, Beretta E, Rivolta I. Respiratory mechanics and fluid dynamics after lung resection surgery. Thorac Surg Clin 2010;20:345–57.

[7] Pompili C, Detterbeck F, Papagiannopoulos K, Sihoe A, Vachlas K, Maxfield MW *et al.* Multicenter international randomized comparison of objective and subjective outcomes between electronic and traditional chest drainage systems. Ann Thorac Surg 2014;98:490–6.

[8] Holbek BL, Christensen M, Hansen HJ, Kehlet H, Petersen RH. The effects of low suction on digital drainage devices after lobectomy using video-assisted thoracoscopic surgery: a randomized controlled trial. Eur J Cardiothorac Surg 2019;55:673–81.

[9] Lijkendijk M, Licht PB, Neckelmann K. The influence of suction on chest drain duration after lobectomy using electronic chest drainage. Ann Thorac Surg 2019;107:1621–5.

[10] Brunelli A, Salati M, Pompili C, Refai M, Sabbatini A. Regulated tailored suction vs regulated seal: a prospective randomized trial on air leak duration. Eur J Cardiothorac Surg 2013;43:899–904.