Letter to the Editor

All things are created twice, but the surgeon only gets one chance: bronchoscopy marking may help the surgeon to perform sublobar resection

Samy Lachkar[1], Jean Marc Baste[2], Mathieu Salaün[1,3], Luc Thiberville[1,3]

[1]Department of Pulmonology, Thoracic Oncology and Respiratory Intensive Care & CIC- CRB 1404, [2]Department of Thoracic Surgery, Rouen University Hospital, Rouen, France; [3]QuantIF- LITIS EA 4108, IRIB, Rouen University, Rouen, France

Correspondence to: Dr. Samy Lachkar. Department of Pulmonology, Thoracic Oncology and Respiratory Intensive Care, Hôpital Charles Nicolle, CHU de Rouen, 1 rue de Germont, 76031 Rouen Cedex, France. Email: samy.lachkar@chu-rouen.fr.

Provenance: This is an invited article commissioned by the Section Editor Laura Chiara Guglielmetti (Cantonal Hospital Winterthur, Kantonsspital Winterthur, Switzerland).

Response to: Sato M. All things are created twice: the importance of planning and reproduction in sublobar lung resection. J Thorac Dis 2018;10:S3200-2.

Submitted Sep 06, 2018. Accepted for publication Sep 11, 2018.
doi: 10.21037/jtd.2018.09.67
View this article at: http://dx.doi.org/10.21037/jtd.2018.09.67

We would like to thank Professor Sato for his interest and positive comments regarding our work. In an era of minimally invasive thoracic surgery [video-assisted thoracoscopic surgery (VATS) or robotic-assisted thoracoscopic surgery (RATS)], minimally invasive sublobar resection (SLR) represents a serious challenge especially for small peripheral nodules (SPNs) or ground glass opacities (GGOs). Indeed these latter may be difficult to localize, especially because VATS or RATS does not always enable optimal palpation of the lung in comparison with open thoracotomy (1). Moreover, it can be difficult to delimit the intersegmental plane because of altered and or reduced spatial landmarks or anatomical variation.

To overcome this difficulty, various percutaneous CT-guided techniques have been developed to localize SPNs (2). Because these percutaneous localization techniques are often performed in radiology departments located far from the operating room (OR), good coordination is mandatory between radiologists, anesthesiologists, and thoracic surgeons. These logistic issues can be difficult to overcome in certain settings. In addition, CT-guided transthoracic localization procedures are not without risk and may result in pneumothorax (16–35%) and hemorrhage (6–16%) (2).

The ideal method for nodule localization before surgical resection should be accurate, easy and safe and should be performed in the same operative setting as the resection itself. Indeed, various bronchoscopy methods have been reported; most of them concern nodule localization using electromagnetic navigation bronchoscopy (ENB)-guided dye marking followed by minimally invasive resection (3-5). If results are good, this technique presents some limitations: (I) localization is not performed in real time, (II) a therapeutic bronchoscope must be used which results in a proximal bronchial progression of the bronchoscope and hence less selective catheterization of the subsegmental bronchus, (III) ENB requires specific OR preparation, fluoroscopy and expensive disposable material. For all of these reasons we decided to use virtual bronchoscopy and Radial EBUS for pleural dye marking (6) as these techniques are easy to perform in the OR, less costly, and reproducible especially for wedge resection: indeed the purpose is not so much to mark the nodule but more to help the surgeon be more confident regarding the nodule localization. Moreover, as in most cases the nodule is far from the pleura, it does not seem mandatory to visualize the nodule with the radial probe because we push methylene blue dye beyond the lesion into the pleural space in order to stain the area around the nodule to be resected.

We agree however with Professor Sato (editorial) that dye marking does not provide an intersegmental plane.

However, for segmentectomy, the surgeon can also use an online service that allows 3D modeling of CT-scans from medical DICOM images [Visible Patient™, Strasbourg, France)] that identifies the intersegmental plane preoperatively (7).

Sato and al reported the use of virtual bronchoscopy and a bronchoscopic multispot dye marking technique using three-dimensional virtual imaging, for precise thoracoscopic sublobar lung resection with safe surgical margins. Their technique requires a second CT scan to confirm the localization of markings within 2 hours of the mapping procedure (8).

To date, Sato's technique appears to be the most precise one for preoperative localization of small peripheral lung nodules. However, it cannot be performed immediately before the surgery or during the same surgical procedure, leading to increased time and resources for each procedure. Therefore while being highly efficient, Sato's technique, appears difficult or even impossible to implement at least in the near future in most surgical centers, which contrasts with the growing issue of peripheral lung nodules that are to be resected.

We believe that in the future, bronchoscopy procedures should be able to target the nodule or the margin of segmentectomy, easily, precisely and during the same surgical procedure by using new smart dye and fluorescence. The use of indocyanine green (ICG) could be promising (9). ICG has been used as a contrast agent for the intraoperative detection of diverse tumor types; this is based on two characteristics of ICG: first, ICG and protein complex may passively accumulate in solid tumors due to increased vasculature and dysfunctional lymphatics [known as the enhanced permeability and retention effect (EPR)], second, ICG fluoresces at 800 nm, and is the only near infrared (NIR) contrast agent approved by the Food and Drug Administration (FDA) and the European Medicines Agency (EMA) for a small number of indications in surgery. NIR fluorescence imaging is a promising technology, which can aid in intraoperative imaging. NIR light is non-invasive and non-radioactive. Moreover, it has relatively deeper tissue penetration, lower autofluorescence, and lower scattering. These advantages make NIR fluorescence imaging suitable for intraoperative imaging. Some bronchoscopy case series have shown the efficiency of this marking (10) but more studies will be needed in the future. Moreover other fluorescent dyes have been used in clinical trials to target patients with thoracic malignancies (11).

Because of their simplicity and availability, we believe that bronchoscopic dye marking procedures performed just before surgery represent an ideal complement to minimally invasive small lung nodule resection, that could be easily implemented in clinical practice.

Acknowledgements

The authors are grateful to Nikki Sabourin-Gibbs, Rouen University Hospital, for her help in editing the manuscript.

Footnote

Conflicts of Interest: The authors have no conflicts of interest to declare.

References

1. Zaman M, Bilal H, Woo CY, et al. In patients undergoing video-assisted thoracoscopic surgery excision, what is the best way to locate a subcentimetre solitary pulmonary nodule in order to achieve successful excision? Interact Cardiovasc Thorac Surg 2012;15:266-72.
2. Park CH, Han K, Hur J, et al. Comparative Effectiveness and Safety of Preoperative Lung Localization for Pulmonary Nodules: A Systematic Review and Meta-analysis. Chest 2017;151:316-28.
3. Awais O, Reidy MR, Mehta K, et al. Electromagnetic Navigation Bronchoscopy-Guided Dye Marking for Thoracoscopic Resection of Pulmonary Nodules. Ann Thorac Surg 2016;102:223-9.
4. Luo K, Lin Y, Lin X, et al. Localization of peripheral pulmonary lesions to aid surgical resection: a novel approach for electromagnetic navigation bronchoscopic dye markingdagger. Eur J Cardiothorac Surg 2017;52:516-21.
5. Bolton WD, Howe H 3rd, Stephenson JE. The utility of electromagnetic navigational bronchoscopy as a localization tool for robotic resection of small pulmonary nodules. Ann Thorac Surg 2014;98:471-5; discussion 475-6.
6. Lachkar S, Baste JM, Thiberville L, et al. Pleural Dye Marking Using Radial Endobronchial Ultrasound and Virtual Bronchoscopy before Sublobar Pulmonary Resection for Small Peripheral Nodules. Respiration 2018;95:354-61.
7. Baste JM, Soldea V, Lachkar S, et al. Development of a precision multimodal surgical navigation system for lung robotic segmentectomy. J Thorac Dis 2018;10:S1195-204.

8. Sato M, Yamada T, Menju T, et al. Virtual-assisted lung mapping: outcome of 100 consecutive cases in a single institute. Eur J Cardiothorac Surg 2015;47:e131-9.
9. Zhou J, Yang F, Jiang G, et al. Applications of indocyanine green based near-infrared fluorescence imaging in thoracic surgery. J Thorac Dis 2016;8:S738-S43.
10. Anayama T, Hirohashi K, Miyazaki R, et al. Near-infrared dye marking for thoracoscopic resection of small-sized pulmonary nodules: comparison of percutaneous and bronchoscopic injection techniques. J Cardiothorac Surg 2018;13:5.
11. Newton AD, Predina JD, Nie S, et al. Intraoperative fluorescence imaging in thoracic surgery. J Surg Oncol 2018. [Epub ahead of print].

Cite this article as: Lachkar S, Baste JM, Salaün M, Thiberville L. All things are created twice, but the surgeon only gets one chance: bronchoscopy marking may help the surgeon to perform sublobar resection. J Thorac Dis 2018;10(10):E758-E760. doi: 10.21037/jtd.2018.09.67