Interventional radiology suite or hybrid operating room: Which is the best for lung nodule localization?

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Identification of a lung tumor by near infrared fluoroscopy.

Central Message

Lung nodule localization may be performed in an interventional radiology suite or hybrid operating room depending on available facilities/expertise, but perhaps the ideal technique avoids lung puncture altogether.

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Lung cancer screening and a general overall shift toward increasing numbers of minimally invasive lung adenocarcinomas¹ has fueled a demand for improved techniques for localization of small lung nodules undergoing thoroscopic biopsy/resection. Different techniques for nodule localization have been described since thoracoscopy became the preferred option for such biopsies,² and have been shown in randomized trials to decrease the need for thoracotomy.³ The majority of localization procedures involve percutaneous placement of a wire, fiducial, radiotracer, or visual dye to mark the site of disease. Most of these common localization methods involve puncture of the lung followed by general anesthesia with positive pressure ventilation with the inherent risks of significant bleeding and pneumothorax. Chao and colleagues⁴ evaluated the effect of shortening the time interval between lung puncture and thoroscopic biopsy (defined as the “time at risk”) on potential overall biopsy morbidity by shifting the localization process from a separate preoperative procedure performed by an interventional radiologist using an interventional radiology suite to an

intraoperative procedure performed by the surgical team in a hybrid operating room immediately before thoroscopic biopsy. Their data for nodules < 15 mm showed a dramatically decreased time at risk (13.06 minutes vs 215.83 minutes; $P < .001$), a decreased pneumothorax rate (2.9% vs 46.7%; $P < .001$) but a longer global operating room time and time under anesthesia (163.1 and 93.14 minutes vs 80.5 and 120.61 minutes, respectively) without a significant difference in the rate of bleeding complications (2.9% vs 13.3%) or benefit in terms of outcomes.

This intriguing report by Chao and colleagues⁴ highlights a number of issues that clearly influence the use of localization procedures. First, surgeons using a hybrid operating room were able to localize nodules in the same amount of time as experienced interventional radiologists

FIGURE 1. Identification of a lung tumor by near infrared fluoroscopy. Adapted from Ujiie and Colleagues.⁷ Used with permission.

(17.68 minutes vs 19.63 minutes). This raises the possibility that surgeons can coordinate and perform the entire procedure from localization to biopsy. Second, the prolonged time at risk documented by the study was primarily due to an administrative scheduling issue in terms of coordinating the separate schedules of an interventional suite and operating room with somewhat limited access to the hybrid operating room. Third, the concern that an increase in potential morbidity (and possibly mortality) would occur stemming directly from a time delay between localization and definitive surgical biopsy was not realized. Therefore, localization procedures could be performed with either approach; however, cost considerations (not studied) may become the primary driving factor favoring the significantly shorter operating room use times with preoperative procedures. One additional aspect that was not included in this study was the potential use of localization procedures not requiring lung puncture. Procedures utilizing electromagnetic navigation bronchoscopy, intraoperative ultrasound, and real-time on-table cone-beam computed tomography scans during image-guided thoracoscopy may offer superior localization of small pulmonary nodules without the risks and delays of other methods.^{5,6}

Finally, future technological enhancements, such as near-infrared fluoroscopic imaging with indocyanine green (Figure 1), may offer thoracic surgeons methods of further reducing the challenges in biopsying these increasingly small nodules and opacities.⁵

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