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Commentary: Exploring new directions using radiofrequency identification

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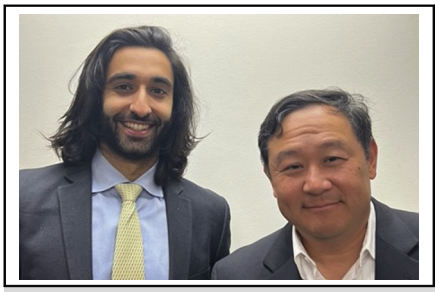

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CENTRAL MESSAGE

Radiofrequency identification (RFID) wireless communication has the potential to facilitate the localization and complete surgical resection of smaller and deeper pulmonary lesions.

Incomplete or inadequate surgical resection of malignant lung lesions can lead to disease recurrence, worse patient outcomes, and additional health care expenditures stemming from repeat interventions. This challenge is complicated by nodules that cannot be confirmed solely by vision and are difficult to palpate owing to a location well below the visceral pleural surface. For subcentimeter nodules deep to the visceral pleura surface by >5 mm, the probability of localization failure is 63%.[1] Resection failure increases with tumors farther from the pleura.[2] The challenges of localizing and reliably measuring surgical margin depth—especially for those deeper tumors—have led to thoracic surgeons operating on the lung to function much like explorers without an adequate map, sextant, or compass sophisticated enough to match the needs required to circumnavigate the globe.

In this issue of the *JTCVS Techniques*, Yutaka and colleagues[1] describe their bronchoscopic deployment of a radiofrequency identification (RFID) marker in a hybrid operating suite using cone-beam computed tomography immediately before surgery to enable precise wedge resections of small and deep lung lesions. Intraoperatively, the point on the pleura closest to the marker was identified by following tone changes corresponding to the probe-marker distance, and then 3-dimensional coordinates were established while triangulating the lesions after elevating the previously identified pleural point. Across the 12 RFID markers placed in 11 patients between September 2019 and October 2020 at 2 institutions, the markers were placed at a mean distance of 6.7 ± 5.2 mm (range, 0-13.0 mm) from the lesion and 14.4 ± 10.2 mm (range, 3-42.0 mm) from the pleura. All surgical margins following wedge resections were negative with a mean lesion size of 6.8 ± 2.7 mm (range, 3.0-11.0 mm) at a mean depth from the pleura of 11.4 ± 8.2 mm (range, 0-26.0 mm). All of the patients remained recurrence free 1 to 2 years after their original resection.

Despite the implantation of RFID chips in humans being approved by the Food and Drug Administration in 2004, its application as outlined by the authors is unique to thoracic surgery. This study establishes the safety and efficacy of this technology as another approach to tumor localization. The authors indicate that they employed the RFID markers only in bronchi measuring <1.8 mm and to localize only subcentimeter tumors. On the surface, the current iteration of the RFID marker may appear to have limited uses; however, further refinement and adoption of this underlying technology can expand its applicability. Despite the small sample size performed by 2 surgeons, this retrospective study was based on very early clinical experiences and has set the precedent for additional investigation. This promising clinical tool has the potential to enhance intraoperative navigation—much like how cellular map software such as Waze (Mountain

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View) enhanced the use of global positioning system map applications—and thus provide surgeons different ways to approach parenchymal lesions deep to the visceral pleural surface.

Yutaka and associates have developed a novel technique that couples RFID technology with cone-beam computed tomography to provide real-time 3-dimensional positioning of deep subpleural tumors. While just in its nascency, the RFID-based localization may soon become another integral component of all thoracic surgeons' toolkits and potentially eliminate resections in which either a missed resection of a lesion or lack of achievement of an adequate margin occurs. This new technique can help expedite the evolution of localizing smaller and deeper lung lesions from a paper maps era where operations are guided by advanced imaging to exploring a new world of precision with RFID technology.

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