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SIMULTANEOUS LOCALIZATION AND REMOVAL OF LUNG NODULES THROUGH EXTENDED USE OF THE HYBRID SUITE

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Abstract

The ability to attain high-definition imaging for preoperative planning, intraoperative execution, and postoperative evaluation is instrumental in surgical practice. Hybrid room computed tomography (CT) allows for faster, less invasive diagnostic and therapeutic options for patients. We present our diagnostic workup and therapeutic intervention with hybrid CT imaging in a 71-year-old female with a growing lung nodule after previous lobectomy for lung cancer.

Case Report

The patient is a 71-year-old female with a past medical history that included T2N2 lung adenocarcinoma status post upper-left lobectomy and breast cancer status post bilateral mastectomy and chemoradiation. Following her lobectomy, the patient underwent serial computed tomography (CT) surveillance. Her two latest CT scans revealed a lung nodule in the right lower lobe that increased from 6 mm to 10 mm over a 9-month period. The small nodule was located in the lung parenchyma, and we suspected that it could be difficult to find. Positron emission tomography (PET) indicated moderately elevated standardized uptake values (SUV). At the time, the patient complained of chronic cough but denied any shortness of breath, dyspnea on exertion, hemoptysis, chest pain, or fevers.

We decided to schedule a video-assisted thoracoscopy (VATS) with resection of her right lower lobe nodule with CT-guided localization in the hybrid room. The patient was taken to the hybrid room, where an on-table chest CT was taken. This image was fused with a pre-existing CT angiogram, allowing for 3-dimensoinal (3D) reconstruction and localization of the mass (Figure 1). We used a lung needle to percutaneously penetrate through the chest wall while using the intraoperative CT for guidance to the lung mass. The needle was placed inside the mass and confirmed by CT (Figure 2). A 6-mm GORE-TEX® coil was then placed within the mass under fluoroscopic guidance. Once this was accomplished, a 5-cm incision was made and soft tissue retractors were placed. Careful palpation of the inserted coil within the lung parenchyma allowed for accurate wedge resection with the stapler. The surgical

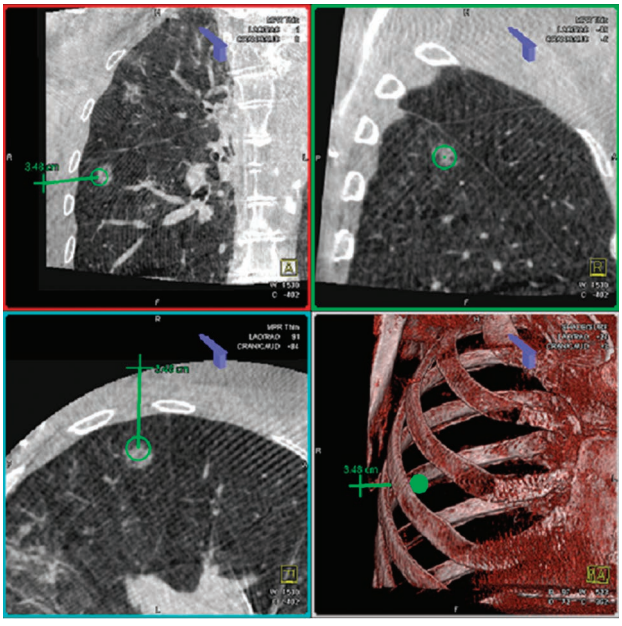

Figure 1. Intraoperative computed tomography localization with 3-dimensional reconstruction.

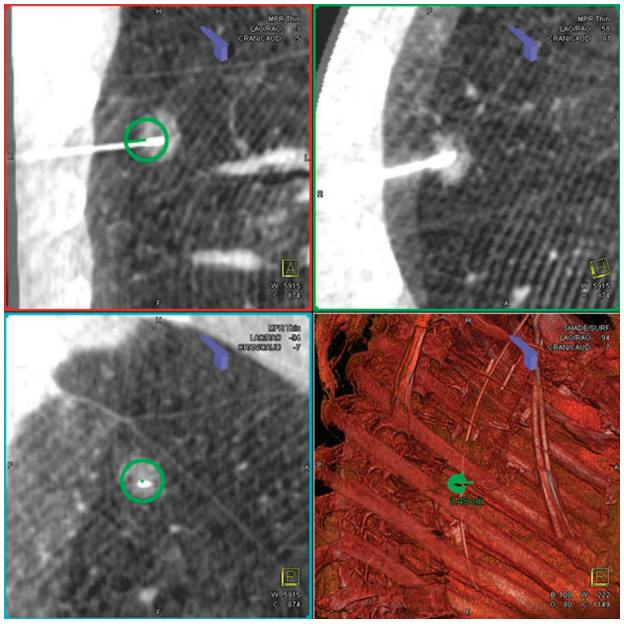

Figure 2. Intraoperative computed tomography guided needle placement inside the mass.

specimen was taken to the pathology lab, which confirmed that negative margins were attained. Frozen section revealed that the mass was adenocarcinoma. The patient had no complications in the postoperative period and was soon discharged.

Discussion

Studies have suggested that screening with low-dose CT can detect lung nodules smaller than 10 mm in diameter and that early detection has been shown to reduce mortality.[1] The utility of the intraoperative CT system in this case allowed for exact localization of a relatively small mass in a minimally invasive setting. Toba et al. demonstrated the safety and efficacy of preoperative fluoroscopy-assisted coil marking for subsequent thoracoscopic resection in 63 small peripheral pulmonary lesions.[2] In one case (1.7%) they experienced coil migration, leading them to perform a lobectomy. This possible complication is entirely avoided with intraoperative coil placement as there is no patient movement that could allow for possible migration, and the target mass and coil are under constant surveillance. In addition, preoperative localization and subsequent VATS pulmonary nodule resection is an approach that increases the cost, risk, and complexity of care while presenting a considerable logistical burden.[3]

McKenna et al. found that VATS over the past decade has demonstrated outcomes equivalent to open surgery while having improved morbidity, faster recovery, and better preservation of normal lung function through lung-conserving approaches such as segmentectomy or wedge resection.[4] In our case, precise intraoperative localization of the mass allowed for safe resection while conserving as much unaffected lung tissue as possible. In addition, cone-beam CT has demonstrated sub-mm spatial resolution combined with soft tissue visibility at a low radiation dose (4.3 mGy) per scan in the thorax, making it relatively safe for the patient and surgical staff.[5]

Conclusion

Intraoperative CT allows for more efficient and less invasive diagnostic and therapeutic options for patients. In a 71-year-old female with significant history of lung and breast cancer, we were able to precisely target a small suspicious mass within the lung parenchyma and resect it moments later.

Conflict of Interest Disclosure: The authors have completed and submitted the *Methodist DeBakey Cardiovascular Journal* Conflict of Interest Statement and none were reported.

Keywords: hybrid computed tomography, hybrid CT, lung adenocarcinoma, intraoperative CT, video-assisted thoracoscopy

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