Research reported in this publication was supported by the National Center for Advancing Translational Sciences of the National Institutes of Health under Award Number UL1TR001117 (to C.P.H. and K.D.H.) and by the National Heart, Lung, and Blood Institute under Award Number K08HL103631 (to S.K.P.). The content is solely the responsibility of the authors and does not necessarily represent the official views of the National Institutes of Health, which had no role in study design; the collection, analysis, and interpretation of data; the writing of the report; or the decision to submit the manuscript for publication. Authors have nothing to disclose with regard to commercial support.

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<http://dx.doi.org/10.1016/j.jtcvs.2015.08.006>

A NEW LUNG-MARKING TECHNIQUE FOR ROBOTIC CASES

To the Editor:

We enjoyed the recent article "Efficiency and Feasibility of a Novel and Noninvasive Computer Tomography-Guided Marking Technique for Peripheral Pulmonary Nodules" by Matsuura

and colleagues, in the April 2015 edition of the *Journal*.¹

We agree with the authors that an improved technique is necessary for localization of nonvisceral surface pleural nodules. Improvement of the intraoperative localization of ground-glass nodules is especially important, and they are often difficult to palpate, even when the specimen has been resected. In addition, a selected number of biopsies are being performed using robotic techniques, which depend on visual cues to locate a lung mass, but lack tactile cues to pinpoint it.

The described technique has the limitations that the patient must visit the hospital 1 day before the operation to have a CT scan, have the CT performed in the thoracotomy position, and have markers tattooed on the skin. In addition, if the lesion to be resected is beneath the scapula, the shortest point to the lesion may not be a straight vertical line, but rather would require an extrapolated angle when marking the visceral pleura.

The author's technique avoids inserting a wire or needle into the lung parenchyma and therefore should not cause air emboli. Air embolism as a complication of placing a CT-guided hook wire that punctures the visceral pleura, or of CT-guided needle biopsies, which also involve puncture of the visceral pleura, have rarely been reported. Avoidance of this complication is one advantage of the described methodology.

Due to the limitations of other marking techniques, we have developed a technique to be used on the morning of robotic surgery for resection of lung lesions that do not abut the visceral pleura and therefore are not easily visualized. Two hours before the robotic resection, the patient is taken to the interventional radiology suite, and the lesion in question is located with CT fluoroscopy. Lidocaine 1% is used for local anesthesia of the chest wall.

A pasty solution comprised of 1 cc of methylene blue, mixed with collagen and saline to form a gelatinous material, is injected with a 19-gauge trocar needle adjacent to the lesion and in the track leading to the visceral pleura. By adding collagen to the solution, the material remains in the vicinity of the lesion and does not dissipate throughout the lung. The injection of the methylene blue collagen solution along the needle's tract provides identification of the entry site to the visceral pleura overlying the lesion. Should a moderate or large pneumothorax occur, an 8 French pigtail catheter is left in place. The small pneumothorax is monitored conservatively. This technique has been utilized successfully in 18 patients, with pneumothorax as the only minor complication in 2 patients, and only 1 in a patient with moderate chronic obstructive pulmonary disease requiring pigtail catheter placement. This technique demonstrates the location of the nonvisceral surface lung lesion, decreases the time to locate the lesion in robotic cases, and helps in obtaining

a negative surgical margin in patients who are having a wedge resection.

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MAIN OBJECTIVES OF PREOPERATIVE MARKING TECHNIQUE FOR HARDLY PALPABLE LUNG NODULES

Reply to the Editor:

Thank you for your letter to the Editor, “A new lung marking technique for robotic cases.”¹ During thoracoscopic surgery or robotic surgery, it is sometimes difficult to identify the exact location of small lung nodules. In such cases, preoperative marking may be required. In thoracoscopic surgery, we can palpate the target nodules using a finger through the port; thus, preoperative marking near the nodule is useful for localization. In robotic surgery, however, there is no sense of touch. Therefore, greater accuracy of preoperative marking for localization is required in robotic surgery than in thoracoscopic surgery.

The main objectives of the marking technique are accuracy, technical ease, and minimal invasiveness of the procedure. The authors’ technique exhibits acceptable accuracy because they used methylene blue paste under computed tomography (CT) fluoroscopy on the operation day. However, the described technique is limited in terms of technical ease and minimal invasiveness because the patients must be punctured with a 19-gauge trocar needle under local anesthesia, and moderate or large pneumothorax occurred in 3 of 18 patients (17%). In our report, 20 patients underwent noninvasive CT-guided marking. No complications were observed during the marking procedure.²

The authors pointed out that if the lesion is located beneath the scapula, the shortest distance to the lesion may not be a straight vertical line, but would require an extrapolated angle when marking the visceral pleura for noninvasive CT-guided marking. In such situations, we performed a 2-point noninvasive CT-guided marking method. Two marks were placed on the patient’s skin at the same axial line in the CT examination room 1 day before the operation. During the operation, 2 marking points were placed in the routine manner, and we palpated the tumor on the line extending to these 2 points.

Sato and colleagues³ reported a novel bronchoscopic multiple marking technique to assist with resection of hardly palpable lung nodules. They named this technique virtual assisted lung mapping. In their report, virtual bronchoscopy was used for marking and bronchoscopy was conducted with the patient under local anesthesia. Indigo carmine was injected into a catheter inserted into a selective bronchus. CT after virtual assisted lung mapping was used to visualize the location of the marking. Of the 95 marking attempts made for 37 tumors in 30 patients, 88 (92.6%) were identified and contributed to the thoracoscopic surgery with no complications. However, their method is expensive and complicated.

Preoperative marking techniques for peripheral pulmonary nodules require a balance among accuracy, technical ease, and minimal invasiveness. In this aspect, the authors’ marking technique is a useful option for cases where robotic surgery is indicated.

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<http://dx.doi.org/10.1016/j.jtcvs.2015.08.005>