ACS 2023 Surgeons and Engineers: A Dialogue on Surgical Simulation Meeting

Research Abstracts

Assessing the Accuracy of Robotic Bronchoscopy in Localizing and Targeting Small Pulmonary Lesions

Jessica Copeland, MD; Fumitaro Masaki, MS; Mehida Rojas-Alexandre, MD, MS; Lillian Tsai, MD, and Nobuhiko Hata, PhD,

Harvard School of Public Health, Cambridge, MA; Massachusetts General Hospital, Boston, MA; The Johns Hopkins Hospital, Baltimore, MD; Brigham and Women's Hospital, Boston, MA

Introduction: Guidelines expanding lung cancer screening eligibility are expected to result in 4 million Americans being diagnosed with a new pulmonary nodule annually, wherein 160,000 will require definitive diagnosis via biopsy. Although screening allows for early detection of suspicious lesions, definitive diagnosis remains challenging. Evidence estimates success rates for electromagnetic-navigational bronchoscopy (EM-NB) at 39% for lesions ≤2cm located in the outer third of the lung. Emerging evidence suggests robotic bronchoscopy (RB) has improved overall accuracy. However, there remains an urgent need to quantitatively evaluate the accuracy of RB in localizing and targeting small peripheral pulmonary nodules.

Methods: A prospective, single-blinded, randomized-controlled study that quantitatively compared the accuracy of RB against EM-NB during lesion localization and targeting was performed. The dependent variable was accuracy. Accuracy was measured as a rate in terms of localization and targeting success, distance from the center of pulmonary targets (<1cm), and according to anatomic location. The independent variable was navigation system, RB was compared to EM-NB using 1:1 randomization. Differences in accuracy in terms of distance from the center was assessed using Wilcoxon-Rank-Sum. Kruskal-Wallis was used to assess differences in accuracy according to anatomic location. An adjusted regression model was used to assess accuracy in terms of distance and time across navigation systems.

Results: Of 75 attempts, 72 were successful in lesion localization and 60 were successful in lesion targeting. The success rate for lesion localization was 100% with RB and 91% with EM-NB. The success rate for lesion targeting was 93% with RB and 80% for EM-NB. RB demonstrated superior accuracy in terms of distance from the center of the lesion at 0.62mm compared to EM-NB at 1.28mm (p=0.001). Accuracy was improved using RB compared to EM-NB for lesions in the LLL (p=0.025), LUL (p<0.001), and RUL (p<0.001). Accuracy with respect to distance and time varied according to navigation system in an adjusted model.

Conclusions: RB demonstrates superior accuracy and success rates in the localization and targeting of small peripheral lung nodules.