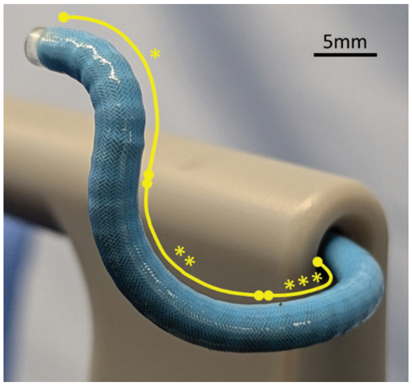

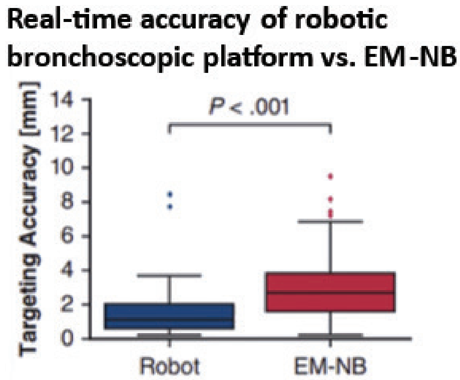

"Snake" Robotic Bronchoscope: Improving Maneuverability to Diagnose & Treat Hard-to-Reach Lung Cancers

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Lung cancer is the most common cause of cancer-related death worldwide with >225,000 new cases diagnosed in the US last year. Although lung cancer screening can increase survival by 20%, differentiating cancerous lung nodules from benign lesions is overwhelming our healthcare systems. Rapid, definitive diagnosis of suspicious lung nodules is a critical unmet need with significant impact on financial and health outcomes worldwide.

Definitive diagnosis of suspicious lung lesions previously required surgery to remove the lesion for analysis. Surgery has high morbidity, removing functional lung tissue with no benefit in cases that are ultimately benign. Further, surgery often fails to localize small, indistinct, or deep lesions and is inappropriate for patients with multiple nodules. CT-guided core biopsy and air electromagnetic navigational bronchoscopy (EM-NB) are less invasive than surgery but also have high failure rates. State-of-the-art robotic bronchoscopy (RB) offers higher biopsy success rates, but peripheral, small (≤2 cm), or upper lobe lesions, which represent the majority of lung nodules, remain quite challenging with reported failure rates as high as 20%.

At MGB, Dr. Colson (a thoracic surgeon) and Dr. Hata (an engineering researcher), in collaboration with Canon USA, have developed a novel RB platform that "snakes" through the airway in a flexible follow-the-leader fashion with three bending sections. We are developing equipment and tools for direct in situ interventions to perform complex therapeutic tasks not currently possible. Large animal and ergonomic evaluations are ongoing.

We are also exploring how increasing autonomy can enhance the effectiveness of lung biopsies, reduce cognitive and kinematic challenges for physicians, and shorten the learning curve. Autonomous capabilities could allow physicians to operate safely regardless of their experience with robotic systems, potentially boosting the adoption of transbronchial biopsies in under-resourced settings.

The integrated intelligent transbronchial biopsy robot is expected to enable accurate navigation and biopsy of difficult peripheral and upper lobe lesions leading to improved lung cancer diagnosis and earlier intervention opportunities, which are crucial for effective lung cancer care.