

Novel Robotic-Assisted Cryobiopsy for Peripheral Pulmonary Lesions

Background and goals

Tissue biopsy in lung cancer is critical for diagnosis, histologic subtyping, and identifying driver mutations. Yet, in many patients tissue quality and amount of tumor cells provided by the biopsy are insufficient, so that molecular target testing cannot be performed. Robotic bronchoscopy is a new tool for peripheral pulmonary lesion sampling. However, diagnostic yield using traditional sampling tools together with robotic bronchoscopy remains imperfect, possibly due to nodule location adjacent to or outside of the airway.

Challenges and goals

The 1.1 mm Erbe cryoprobe is a novel diagnostic tool, which accesses tissue in a 360 degree manner. This may be specifically beneficial for sampling lesions with eccentric or adjacent locations to the airway as seen on radial endobronchial ultrasound (rEBUS). Traditional tools, on the other hand, only biopsy in one plane, so that these lesions may be missed. Furthermore, despite freezing, tissue architecture is preserved in cryobiopsy samples, including nuclear details, such as mitotic activity and nuclear-cytoplasmic ratio.

This study examined the diagnostic yield of the 1.1 mm Erbe cryoprobe using the Ion robotic bronchoscopy system (Intuitive, Sunnyvale, CA) compared to standard needle aspiration and forceps biopsy in the same patients. In cases of lung cancer it additionally evaluated yield for molecular markers.

Methods

This retrospective analysis included 112 consecutive patients with 120 peripheral pulmonary lesions at the University of California, Los Angeles (UCLA). Procedures were performed under general anesthesia with flexible intubation and the Ion robotic system was used in all cases. rEBUS and conventional

two-dimensional fluoroscopy were used to confirm lesion location. First, at least three passes of needle biopsy were performed. Second, at least five forceps biopsies were taken. Finally, the 1.1 mm cryoprobe was used to take three to four additional biopsies. The cryobiopsy sample was removed through the working channel, leaving the robotic catheter in place eliminating the need to renavigate. Given the size of the biopsies it is notable that these procedures were done through an 8.5 mm endotracheal tube and no balloon occlusion device was placed prophylactically as has been described for cryobiopsy in idiopathic pulmonary fibrosis.

Results and key findings

The median short and long axes dimensions of all lesions were 15.5 mm and 22 mm, respectively. A bronchus sign was present in 48 % of patients. Lesions were located a median of 6 mm from the pleural surface. rEBUS signal was present in 87 % of lesions, including 56 % concentric, and 31 % eccentric locations. The overall diagnostic yield was 90 %. Of the 108 diagnostic nodules, the needle sample was diagnostic in 31.5 %, transbronchial forceps in 77.8 %, and cryobiopsies in 97.2 %. Forceps were the only diagnostic modality in 2 (1.9 %) and cryobiopsies were the only diagnostic modality in 19 lesions (17.6 %). All cryobiopsy samples were adequate for both immunohistochemistry, fluorescence in-situ hybridization and next-generation sequencing, while this was not the case for forceps and needle biopsies. Digital imaging software confirmed an increase in quantity and quality of samples taken via cryobiopsy compared to needle aspirate and traditional forceps biopsy.

6 (5.4 %) patients developed post-procedure pneumothorax, of which 3 (2.7 %) required chest tube placement. There was no bleeding requiring further interventional steps in any case.

Key takeaways

The study by Oberg and colleagues demonstrates that:

- The Erbe 1.1 mm cryoprobe can be used in combination with the Ion robotic system for sampling peripheral pulmonary lesions.
- The sample obtained with the Erbe 1.1 mm cryoprobe can be removed through the working channel. If required, further biopsy can be taken without the need to renavigate.
- Compared to forceps biopsies and needle biopsies cryobiopsies can increase the overall diagnostic yield, in this particular investigation the increase was 17.6 %.
- In the study all cryobiopsy cases were adequate for both IHC/FISH and NGS, which was not true for samples obtained with forceps biopsy and needle aspiration.
- Consequently, the authors conclude that: "Using the 1.1 mm cryoprobe to biopsy peripheral pulmonary nodules combined with the Ion robotic bronchoscopy system is safe, feasible, and provides more diagnostic tissue than needle aspirates or traditional forceps biopsies. The combination of cryobiopsy with robotic-assisted bronchoscopy increased diagnostic yield, probably due to its 360 degree tissue acquisition, which is beneficial when targeting extraluminal lesions adjacent to the airway."

Products

The ERBECRYO® 2 cryosurgical generator was used along with the flexible single-use 1.1 mm cryoprobe without the accompanying overshield.



*Flexible cryoprobe for single use, 1.1 mm
(20402-401)*



Tissue sampling with the cryoprobe in different positions towards the target tissue

Reference

Novel Robotic-Assisted Cryobiopsy for Peripheral Pulmonary Lesions; Catherine L Oberg, Ryan P Lau, Erik E Folch, Tao He, Reza Ronaghi, Irawan Susanto, Colleen Channick, Rodrigo Garcia Tome, Scott Oh
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