Advances in Interventional Pulmonology: Highlights from ATS 2026

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THERE WERE many incredible cases and exciting trials presented at this year's American Thoracic Society (ATS) International Conference, work that is helping to push the boundaries of the field. Key areas of focus included the use of the small 1.1 mm cryoprobe, which allows for biopsies to be taken through the bronchoscope working channel, as well as several trials involving bronchoscopic biopsy of peripheral lung lesions. Highlighted here is some of the fantastic work people are doing in this rapidly growing field.

1.1 MM CRYOPROBE FOR TRANSBRONCHIAL BIOPSIES, READY FOR PRIMETIME?

Presented as a late-breaking abstract, the FROSTBITE-2 trial presented results of their multicenter prospective study comparing diagnostic yield of the 1.1 mm cryoprobe to 2.0 mm forceps for transbronchial biopsies.[1,2] Thiboutot et al.[1,2] impressively showed that biopsies using the cryoprobe had a significantly higher diagnostic yield, with larger and higher-quality biopsy specimens without significant bleeding, post-procedural pneumothorax, or post-procedural respiratory failure. The study, which was conducted at nine US academic medical centers, randomized 490 patients to either forceps (n=245) or cryoprobe (n=245). Randomization was stratified by indication (lung transplant, lung nodule/mass, and diffuse parenchymal lung disease). All biopsy samples were sent for centralized review, with pathologists blinded to intervention. The cryoprobe group had a significantly increased overall diagnostic yield (89% versus 79%; p=0.003). Subgroup analysis showed improvements of diagnostic yield in both the lung transplant (96% versus 89%; p=0.03) and lung nodule/mass (83% versus 70%; p=0.04) groups, but not in the parenchymal lung disease subgroup (72% versus 63%; p=0.55).

In a multicenter prospective trial at four institutions in Japan, Takashima et al.[3] evaluated that the addition of cryobiopsy (CB) to forceps biopsy (FB) improves diagnostic yield of small peripheral lesions compared to FB alone. Three hundred and thirty patients with peripheral pulmonary lesions (≤30 mm) were randomized to either FB alone or FB plus CB (FB/CB). Similarly to the FROSTBITE-2 trial, the 1.1 mm cryoprobe was also utilized. The diagnostic

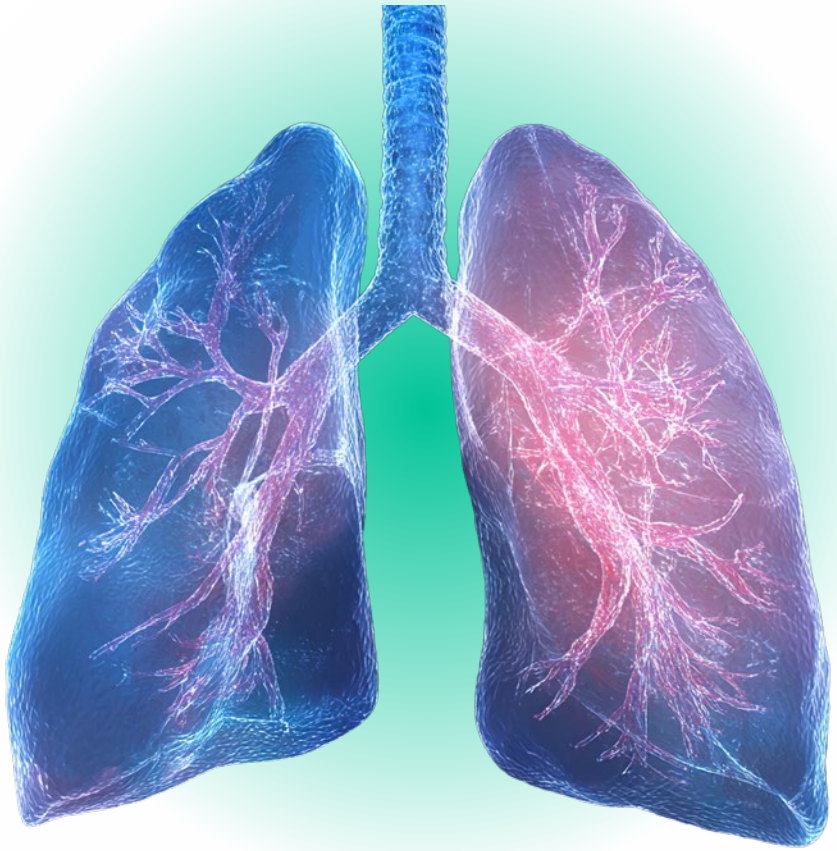
yield was significantly higher in the combined FB/CB group compared to the FB alone group (73.2% versus 56.1%; p=0.001). Bleeding complications were higher in the FB/CB group (Grade 2: 42.1% versus 6.1%; Grade 3: 0.6% versus 0%), but significant bleeding was rare.

ADJUNCTS TO EBUS-TBNA FOR LYMPH NODE EVALUATION

Gershman et al.[4] investigated the diagnostic yield of endobronchial ultrasound (EBUS)-guided CB compared to EBUS-guided transbronchial needle aspiration (EBUS-TBNA) in patients with suspected mediastinal lymphoproliferative disorders. Fifty patients underwent EBUS-TBNA followed by EBUS-guided CB from the same lymph node. CB was diagnostic in 88% of cases, while diagnosis via TBNA occurred in only 60% of cases. In those with non-diagnostic TBNA biopsy, 80% were diagnostic by CB (odds ratio: 4.89; 95% CI: 1.76–13.60). No major procedural complications were reported.

Stübler et al.[5] similarly evaluated the addition of EBUS-guided CB to standard EBUS-TBNA for the evaluation of mediastinal/hilar lymphadenopathy. Of 28 patients with a non-diagnostic rapid onsite exam following TBNA, diagnosis was made via CB in 19 patients (67.9%; p<0.001), with only mild oozing or self-limited bleeding reported with either diagnostic modality.

Alternatively, Kumar et al.[6] retrospectively reviewed 82 patients who underwent EBUS-TBNA of 290 mediastinal lymph node stations. EBUS-TBNA alone was compared to TBNA plus 1.2 mm intra-nodal FB (IFB). The addition of IFB led to a significant reduction in inadequate sampling compared to TBNA alone (4.83% versus 14.14%; p<0.001). TBNA plus IFB significantly increased overall diagnostic yield (38.28% versus 26.55%; p=0.003) and diagnostic yield in benign disease (49% versus 19%; p<0.001). Improvement in malignant diagnosis was not statistically significant.



PUSHING THE BOUNDARIES OF ROBOT-ASSISTED BRONCHOSCOPY AND BIOPSY OF PERIPHERAL LUNG LESIONS

In a single-center retrospective cohort study, Ghodrati et al.[7] set out to characterize the effects of prolonged discrete breath holds (BH) during robot-assisted bronchoscopy. The group retrospectively analyzed 615 bronchoscopy procedures, 321 with prolonged BH ≥5 minutes (BH group) and 294 contemporaneous non-BH controls (non-BH group). Procedures with BHs had a higher number of cone-beam CT spins (3 versus 2; p<0.001), which resulted in higher radiation doses (132 mGy versus 105 mGy; p=0.005). Prolonged BHs were well tolerated, with no difference in hypotension and significantly less hypoxia events in the BH group (6.9% versus 12.9%; p=0.014). Median lesion size in the BH group was smaller compared to the non-BH group (17 mm versus 19

mm; p=0.029). There was no difference in diagnostic yield between the groups, with 84.1% and 81.6% for BH and non-BH groups, respectively (p=0.41). Looking at only cases with BHs ≥15 minutes, the same group found 137 cases, with 154 unique prolonged BHs. The duration of each apnea episode was up to 42 minutes (median: 19 minutes). Peak post-BH end-tidal CO_2 was 106.4 mmHg (mean: 63.3 mmHg; median: 60.3 mmHg). Despite significant hypercarbia, prolonged BHs were well tolerated.

Results were presented from the MULTIBRANCH study, a multicenter retrospective observational study of patients with multifocal pulmonary nodules that were biopsied during the same procedure.[8] The data from six US medical centers included demographic, radiologic, procedural, pathologic, and safety data that were collected in a central registry. In cases of nodule pairs having the same histology, each center submitted biopsy samples for review by an independent molecular pathologist. Of the 191 patients, 177 had biopsies of two and 14 had biopsies of three nodules. Overall diagnostic yield was 72.2% and remained high irrespective of the biopsy count. One hundred and twenty-two (63.9%) patients had two diagnostic nodules. Eighty-five (44.5%) patients had two nodules positive for malignancy. Of these patients, 44 (51.8%) were found to have intrapulmonary metastasis, with the remainder having either histopathologic heterogeneity (17.6%) or molecular heterogeneity (30.6%). Of the 167 patients (87.4%) who underwent lymph node sampling, 18 (10.8%) were positive for nodal metastases. Seventeen (94%) of those patients had at least one fully solid nodule. Sufficient tissue for next-generation sequencing was collected in 91% of malignant nodules. Although there were slightly above-standard procedure complication rates, these procedures were overall well tolerated, with complications occurring in 20 patients (10.5%).

In the first-in-human INSPECT trial, Hanna et al.[9] evaluated the use of an impedance-based sensor built into a biopsy needle. This in situ information on lung lesions would complement the spatial navigation provided by cone-beam CT. The team previously designed and validated a prediction model from an ex vivo dataset. In this study, impedance data was taken from 26 patients just prior to lung biopsy, and their prediction model was used to differentiate healthy lung tissue and lesions. In differentiating healthy tissue from lesional tissue, the model had an accuracy of 80%, a sensitivity of 88.5%, and a specificity of 71.4%. Additionally, the model was able to differentiate cancer from all other tissues, including necrosis, with an accuracy of 78.7%, a sensitivity of 78.3%, and a specificity of 79.2%. Their initial results show that the prediction model is in a linear growth phase, suggesting continued improvement in performance with increasing numbers in their training set. Although in its infancy, these results show the potential for tissue impedance to be an additional tool to help confirm tool-in-lesion during bronchoscopic lung biopsy.

CONCLUSION

The studies mentioned above highlight some new technologies and techniques and offer a glimpse into where the field of interventional pulmonology is headed. On the whole, CB continues to show impressive results for biopsy of both peripheral lesions and lymph nodes, without sacrificing safety. However, its use for biopsy in diffuse interstitial lung disease remains uncertain. Other studies offer insights into innovative ways of improving diagnostic accuracy, both in early-stage development and with some already being utilized in clinical practice. As noted by the genetic diversity of nodules in the MULTIBRANCH study, clinical significance of next-generation sequencing will only continue to increase. Future studies are needed to determine which biopsy modality is best for obtaining sufficient tissue for testing.

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