PHILIPS

Image guided therapy

Cone Beam CT

Cone Beam CT guided endobronchial biopsy

assisted by 3D live fluoroscopy overlay with tumor segmentation

Patient history

This is a 54 y.o. female presenting with a 10 mm lesion in the left lower lobe (Figure 1). She was a non-smoker and had a history of breast cancer. She was scheduled for endobronchial biopsy to achieve adequate tissue sampling for pathology analysis and diagnosis.

Procedure

Subsequent to patient intubation, the ceiling mounted C-arm system (Allura Xper FD20, Philips) was positioned on the left side of the patient, centering the field of view of the detector to include both lungs. Cone Beam CT data (XperCT, Philips) was acquired during an 8-second roll protocol, while temporarily suspending mechanical ventilation. Using the

Cone Beam CT data, the lung nodule was highlighted by the physician using commercially available software (OncoSuite, Philips)[1] during a process known as segmentation. During the biopsy procedure, this 3D nodule segmentation was visualized in an overlay with live fluoroscopy (3D Roadmap, Philips) parallel to standard fluoroscopy imaging and electromagnetic navigation bronchoscopy (ENB) (SuperDimension, Medtronic) (Figure 2). This was particularly critical in this patient as the lesion was fluoroscopically invisible. Geometric correspondence of live fluoroscopy and 3D tumor segmentation was maintained throughout the case while manipulating C-arm angulation, table position, and image-zoom settings.

Results from case studies are not predictive of results in other cases. Results in other cases may vary.
[1] OncoSuite is a commercial software package which includes XperCT Dual, XperGuide and EmboGuide.

Subsequent to lesion segmentation, an Olympus BF-P180 bronchoscope (Tokyo, Japan) was introduced into the airway. A curved steerable catheter (Edge Firm Tip, Medtronic) was inserted into the working channel and then navigated to the lesion using the ENB system. After navigating close to the lesion, fluoroscopy was used as usual but showing the segmented lesion overlaid on the regular fluoroscopic image. Final catheter position was then verified in multiple planes (i.e. LAO, RAO, and 90 degrees lateral) with 3D live fluoroscopy overlay and confirmed with an additional Cone Beam CT scan.

Tissue samples were obtained using multiple biopsy tools with rapid on-site pathologic examination (ROSE). ROSE was consistent with adenocarcinoma and this was suspicious for primary lung cancer, despite her non-smoking status. Final pathologic examination determined this was indeed a primary lung cancer based on immunohistochemistry. She went on to have a left lower lobectomy for her primary lung cancer. She continues to do well and has no evidence of recurrence of her breast or lung cancers.

Dr. Michael Pritchett

is a pulmonologist and Director of the Chest Center of the Carolinas, and is affiliated with FirstHealth Moore Regional Hospital and Pinehurst Medical Clinic. He is one of the pioneers in the use of Cone Beam CT imaging and augmented fluoroscopy during endobronchial procedures.

Conclusion

Intra-procedural Cone Beam CT imaging with 3D live fluoroscopy overlay is feasible and effective in achieving high diagnostic yield during endobronchial biopsy procedures. As the field of bronchoscopy advances towards therapeutics there will be increased demand for high-yield bronchoscopic biopsy techniques. Additionally for anyone considering the future application of endobronchial microwave ablation, Cone Beam CT scanning will most likely be required to confirm placement of the probe in the center of the lesion. Collaborative efforts focused around the lung cancer patient should be considered to initiate cross-discipline programs and open the doors of Cone Beam CT systems to pulmonary specialists.
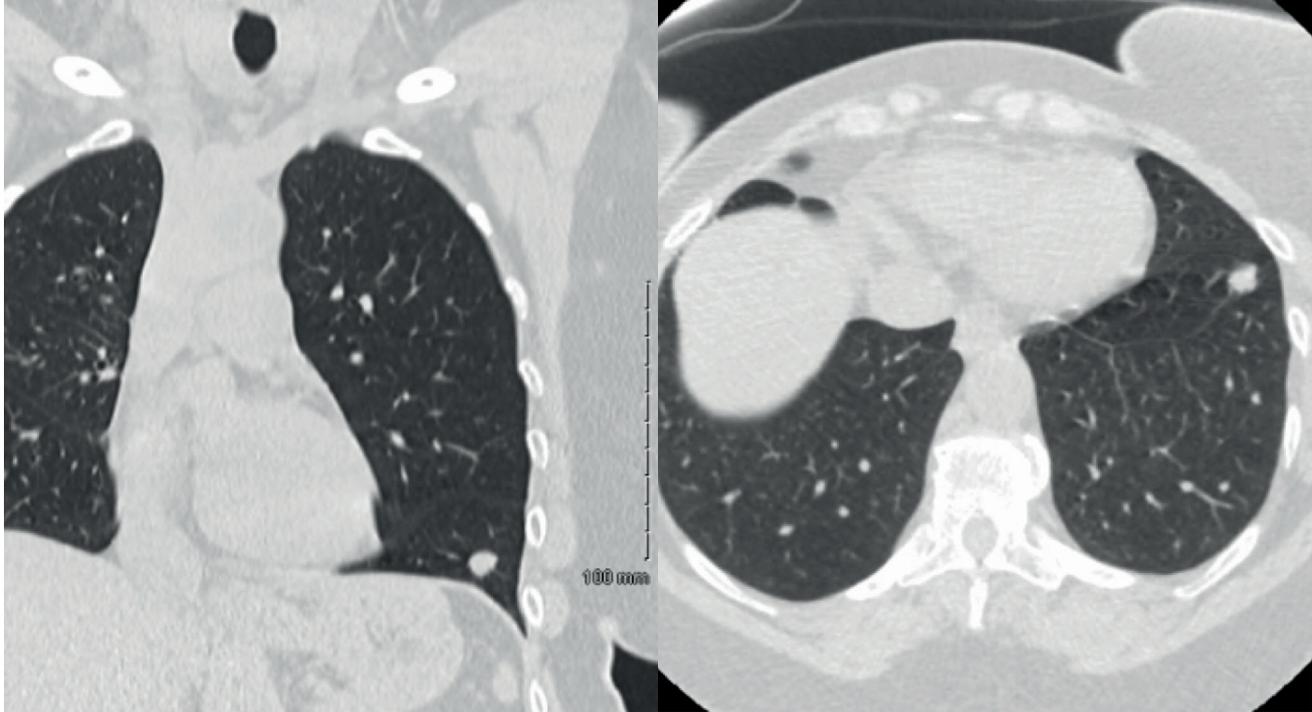
Figure 1: Pre-operative CT (Brilliance CT 64 slice, Philips) shows small pulmonary lesion in the left lower lobe.
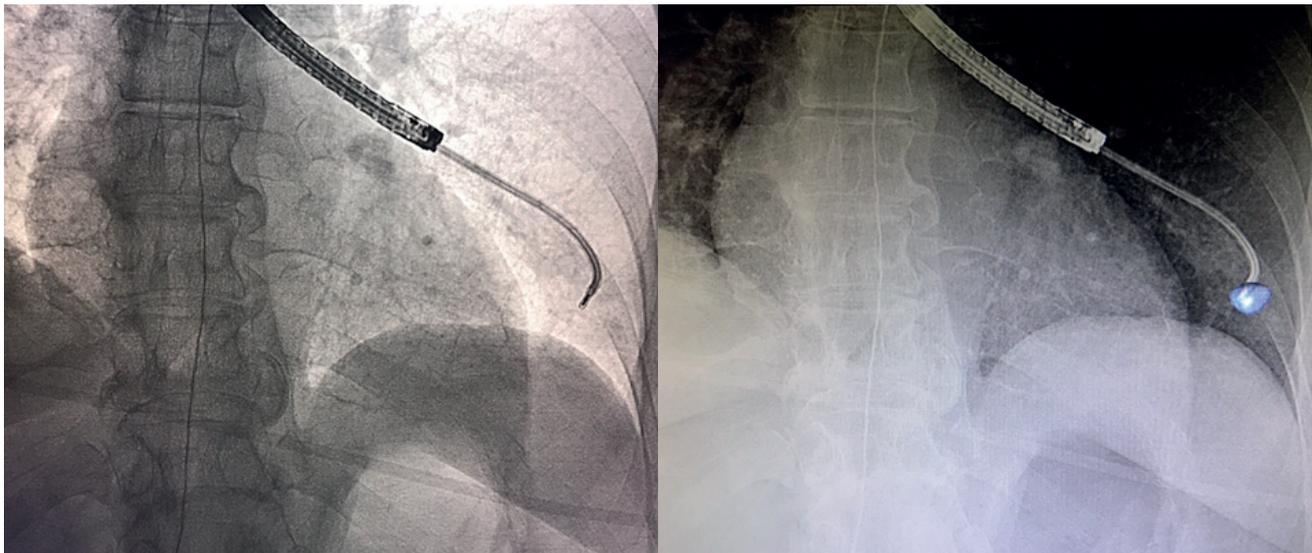

Figure 2: Comparison of standard fluoroscopy (left) and 3D live fluoroscopy overlay with tumor segmentation (right) for this fluoroscopically invisible nodule. The blue volume was segmented from Cone Beam CT data and automatically projected using dedicated software (OncoSuite, Philips).

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