PHILIPS

Image guided therapy

Lung suite

Cone beam CT guided endobronchial tumor ablation

assisted by 3D ablation planning and tumor segmentation overlay with live fluoroscopy

Patient history

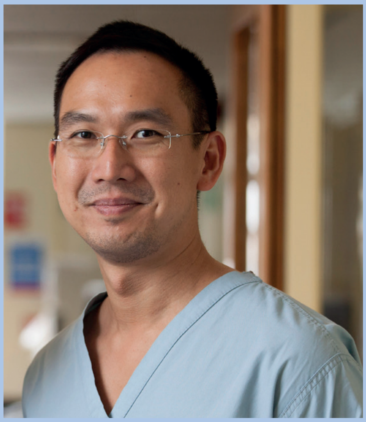
This is an 81 year old male patient with a history of smoking. He also has a history of ischaemic heart disease and atrial fibrillation with severe left ventricular dysfunction and an ejection fraction of 15%, requiring a cardiac resynchronisation device, and previously a cerebrovascular accident treated with carotid endarterectomy. As part of his cardiac investigations, he was found to have a 10 mm nodule deep in the right upper lobe, 38 mm from the pleural surface. It was only mildly avid on PET-CT with no nodal or distant uptake.

Navigation bronchoscopy biopsy of the lesion confirmed a TTF-1 positive adenocarcinoma. EBUS confirmed no mediastinal nodal involvement. The case was discussed in the lung multidisciplinary meeting and it was decided to offer endobronchial ablation due to significant comorbidities and the fact that the lesion was small, deep and located adjacent to two bronchi, thus making it difficult to palpate and localize during surgery.

Procedure

The procedure was carried out in the hybrid operating suite. The patient was ventilated through a laryngeal mask under general anaesthetic and initial electromagnetic navigation bronchoscopy (SuperDimension™ Navigation System, Medtronic) was carried out to advance a catheter towards the lesion. The ceiling mounted C-arm system (Allura Clarity FD20 Flexmove, Philips) was positioned on the left side of the patient, centering the field of view of the detector to include the region of the interest. A cone beam CT scan was acquired using the 8-second roll protocol (XperCT Dual, Philips) while temporary suspending mechanical ventilation.

Using the cone beam CT data, the 10 mm lesion was segmented and fine adjustments of the catheter were guided by augmented live fluoroscopy with 3D nodule segmentation overlay (Lung suite, Philips) to accurately position the endobronchial catheter at the lesion. Correct positioning at the small lesion was further confirmed with a cone beam CT scan (XperCT Dual, Philips). The locatable guide was removed and a flexible microwave catheter (Emprint™, Medtronic) was inserted into the working channel and advanced towards the lesion under live augmented fluoroscopy. A collimated cone beam CT scan was then acquired to confirm the position of the ablation catheter in 3D and ensure complete coverage of the ablation zone with respect to the target pulmonary lesion and a 1 cm margin. Ablation planning was performed using commercially available software (Lung suite, Philips) with ablation parameters defined by the probe manufacturer (Emprint™, Medtronic). The ablation power and time were set at 100 W for 10 minutes and intermittent fluoroscopy was performed during activation to monitor the catheter position during the ablation. A control cone beam CT scan was performed 10 minutes following the ablation to monitor the extent of the ablation zone observed as an area of ground glass opacity. This confirmed satisfactory tumor coverage with a margin of 1 cm around the lesion.



Dr. Kelvin Lau

is a consultant and lead thoracic surgeon at St Bartholomew's Hospital, London. He has been at the forefront of his field utilising cutting-edge technology promising to revolutionise the diagnosis and treatment of lung cancer. He is one of the pioneers in using cone beam CT for iVATS and endobronchial ablation.

Conclusion

Cone beam CT offers not only the distinct advantage of intra-procedural 3D real-time imaging for ablation probe planning and confirmation but also the ability to verify treatment completeness and detect any potential minor or major intra-procedural complications. In addition, cone beam CT based augmentation of live fluoroscopy and dedicated ablation planning software (Lung suite, Philips) helps to streamline the procedural workflow and limits the number of cone beam CT scans to manage radiation exposure to achieve a satisfactory probe position. Cone Beam CT is the only modality that offers the required precision for performing these procedures and can be considered a must for current and future endobronchial therapies.

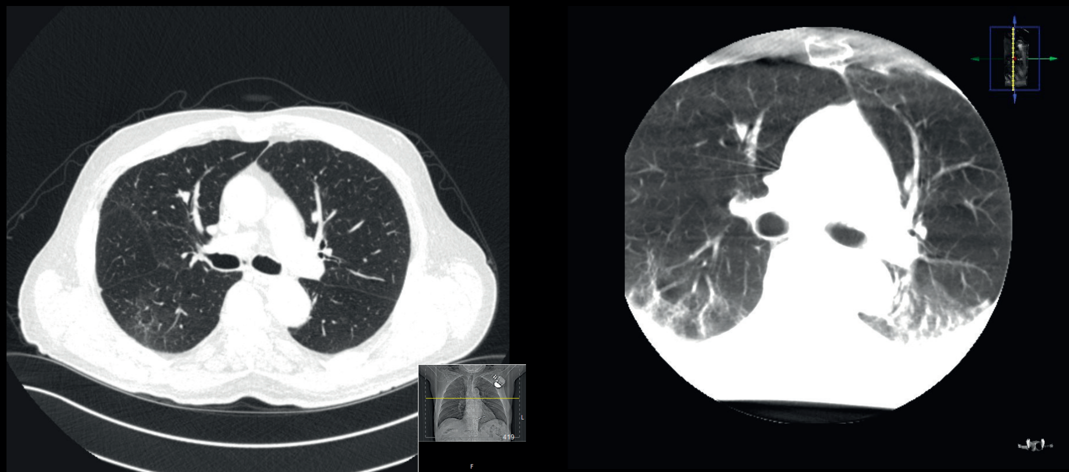


Figure 1: Pre-operative CT (left) and Intra-operative cone beam CT(right) showing small right upper lobe pulmonary nodule.

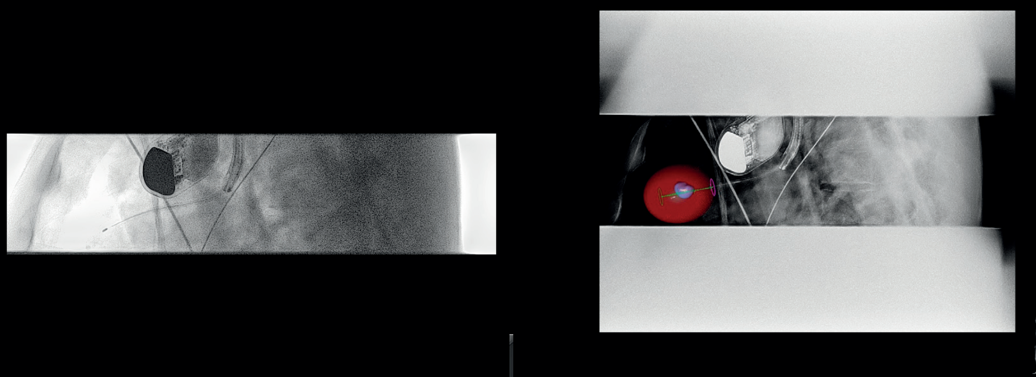


Figure 2: Standard 2D live fluoroscopy (left) versus corresponding augmented live fluoroscopy (right).

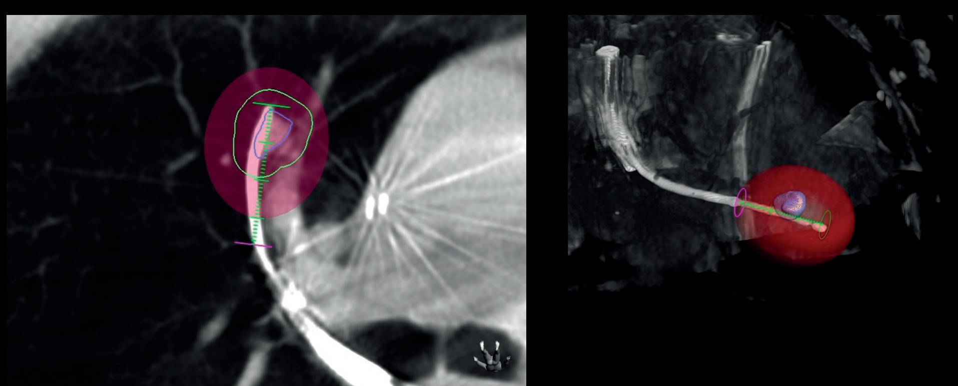


Figure 3: Ablation planning in 2D slice view (left) and 3D visualization of planned ablation probe and segmented nodule (right).

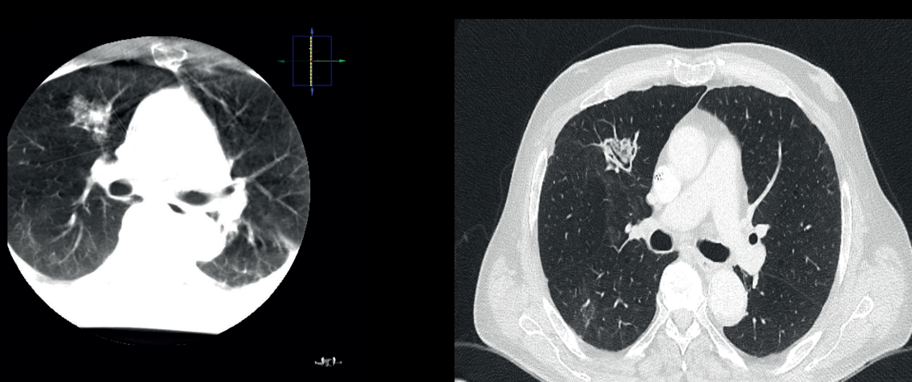


Figure 4: Post ablation cone beam CT to visualize extent of ablation (left). One month post ablation CT showing complete coverage and scarring around the targeted lesion (right)

Results from case studies are not predictive of results in other cases.
Results in other cases may vary.

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