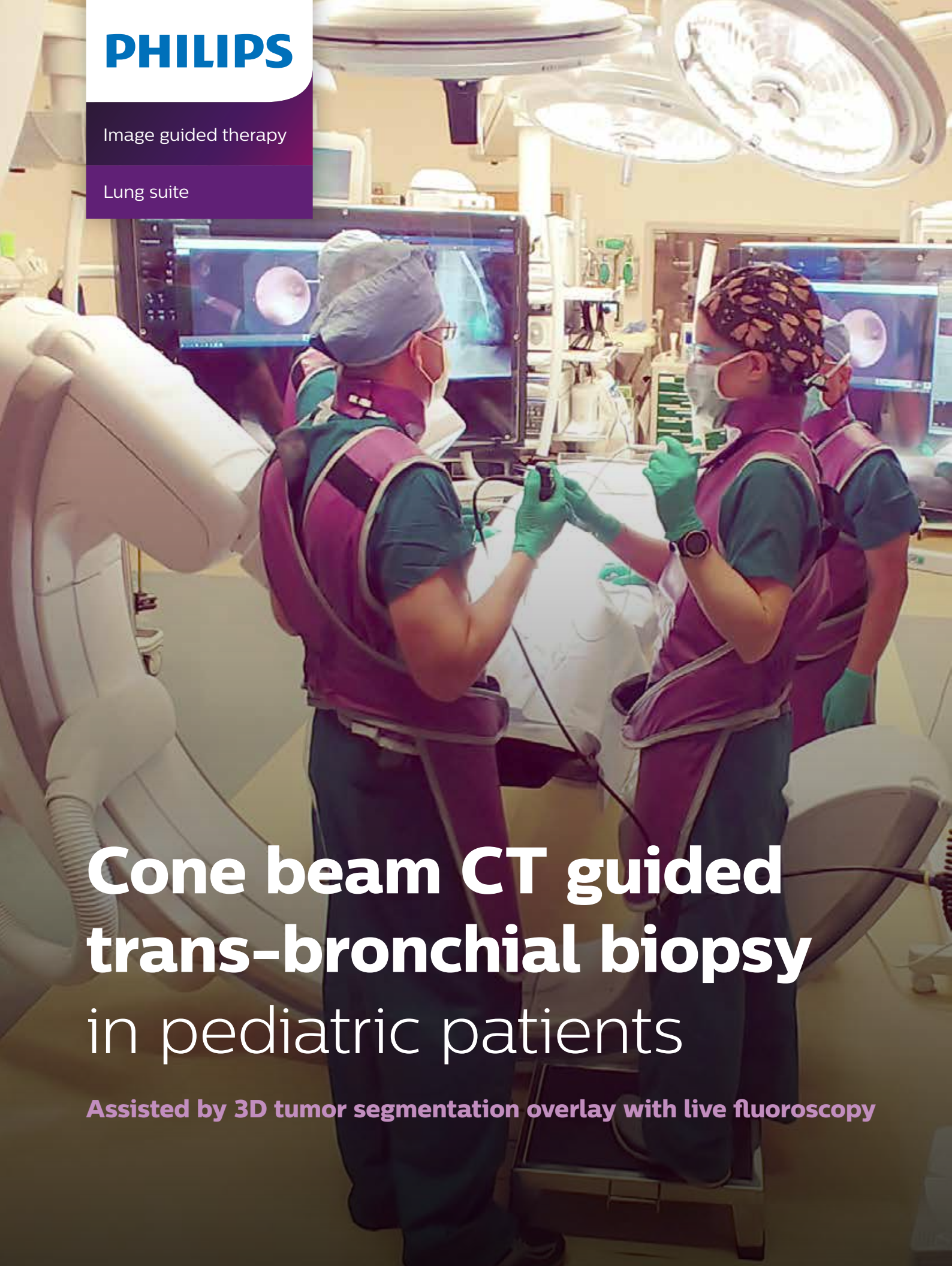
PHILIPS

Image guided therapy

Lung suite



Cone beam CT guided trans-bronchial biopsy in pediatric patients

Assisted by 3D tumor segmentation overlay with live fluoroscopy

A Hybrid OR Collaborative approach
of Interventional Radiology and Pediatric Pulmonology

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Patient history
This is a 17-year-old male patient with a history of respiratory papillomatosis and lung lesions. On previous CT imaging, a solid-appearing soft tissue nodule was identified, within the posterior aspect of the left lower lobe, which appeared to have increased in size in the interval measuring 2.3 x 2.0 cm compared to 1.6 x 1.6 cm on the prior study. The patient was scheduled for a flexible bronchoscopy, with trans-bronchial biopsy, to obtain tissue sampling for pathology analysis and diagnosis.

Procedure
With the patient under general endotracheal anesthesia and in the supine position with arms by the patient's side, a C-arm cone beam CT (XperCT, Philips) of the chest was performed during a tidal breathing breath hold at mid inspiration. The left lower lobe mass was identified and segmented using the commercially available software (XperCT, Philips) and a roadmap overlay of the 3D segmented cone beam CT dataset with fluoroscopy was performed (3D Roadmap, Philips) . The Philips Flexvision monitors were positioned and configured to display all the imaging needs (bronchoscopy, 2D live fluoroscopy, and 3D roadmap augmented fluoroscopy) to support the collaborative approach.

Subsequently, pediatric pulmonology performed bronchoscopy and navigated with a small (2.8mm) bronchoscope (BF-XP160F, Olympus) to localize the left lower lobe lesion. Identification of the mass was made under live augmented fluoroscopy with the movement of the C-arm from an anteroposterior (AP) to a lateral position confirming that the bronchoscope was indeed always superimposed over the segmented left lower lobe lesion. Geometric correspondence of the augmented live fluoroscopy with the 3D tumor segmentation was maintained throughout the case while manipulating C-arm angulation, table position and image-zoom settings.

A larger (6.2mm) bronchoscope (BF-ITH190, Olympus) was then used and advanced towards the posterior basilar segment supplying the left lower lobe mass. The reason for this change of scope was to provide us a larger working channel for the advancement of our guide catheter and biopsy system. Interventional radiology then advanced a 7 French (90cm) bright tip catheter and 0.035 Newton guidewire through the working channel of the bronchoscope, and under fluoroscopy, the guidewire and catheter were advanced into the left lower lobe bronchus supplying the mass. In a similar fashion as earlier, geometric correspondence of augmented fluoroscopy with the movement of the C-arm and a confirmatory cone beam CT confirmed that the position of the guidewire and catheter were within the segmented left lower lobe mass.

The guidewire was then removed, and under augmented live fluoroscopy guidance, multiple forceps biopsies were taken using a 1.8 mm distal insertion tip forceps (Standard 2.0mm Radial Jaw 4 Single-use biopsy forceps, Boston Scientific) through the catheter. Bronchoalveolar lavage (BAL) with aspiration was also performed.

Following the procedure, the catheter was removed and bronchoscopy demonstrated minimal bleeding that was easily controlled with intermittent suctioning. Post biopsy fluoroscopy demonstrated no pneumothorax or other complication. The patient was discharged home the day of the procedure.

Diagnostic outcome
The trans-bronchial biopsy samples were diagnostic for invasive non-small cell lung carcinoma. After staging, the patient underwent a therapeutic lobectomy and subsequent chemotherapy treatment with a good response.

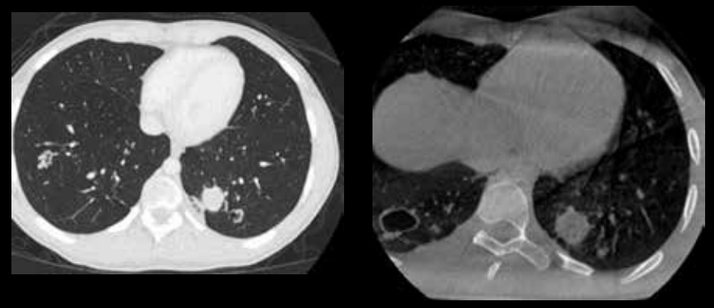

Figure 1: Pre-operative CT (left) and intra-operative cone beam CT (right) showing the lower left lobe nodule

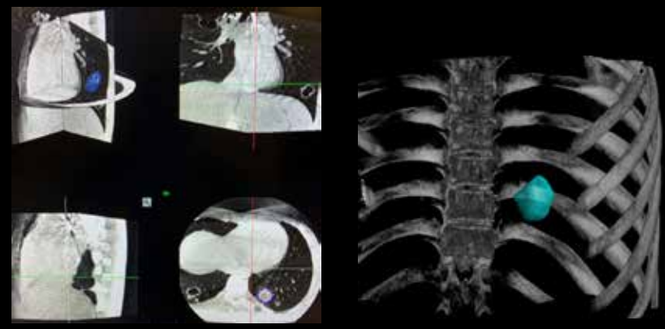

Figure 2: 3D segmentation of the lower left lobe nodule in orthogonal planes(left) and 3 D view of the nodule in histogram (right)

Figure 3: Augmented live fluoroscopy for verifying the lesion targeting position

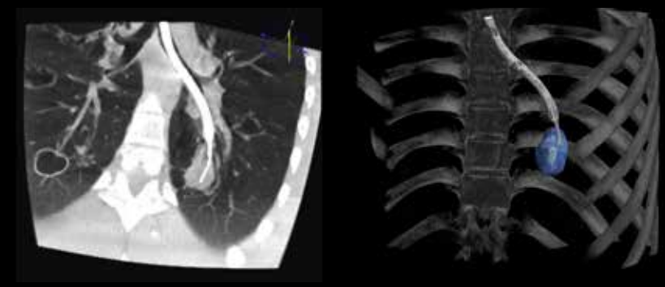

Figure 4: 2D (left) versus 3D (right) confirmation of the accurate lesion targeting position

Figure 5: Augmented live fluoroscopy guidance while performing biopsy

Conclusion

The Hybrid OR provides an ideal environment for multi-modality and multi-disciplinary image guided therapy. Combining the expertise, skill sets, supplies (in this case IR catheters and wires) and technologies of different divisions, creates opportunities for improving care for children (all patients). With the intra-operative cone beam CT imaging and 3D segmentation overlay on our fluoroscopic images, our Interventional Radiology and Pediatric Pulmonology teams are able to work collaboratively to successfully localize and navigate to a distal left lower lobe cavitary nodule for subsequent trans-bronchial biopsy.

The image guidance allowed for a minimally invasive procedure to be safely preformed while yielding diagnostic tissue samples to confirm a diagnosis.

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

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