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Artificial Intelligence driven diagnosis of lung cancer in patients with multiple pulmonary nodules

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Abstract

Background:
Lung cancer is the lead cause of cancer-related deaths worldwide. Smoking is the primary risk factor for lung cancer. About 80% of lung cancer deaths are accounted for smoking. A longer smoking period and a higher number of cigarettes packages smoked a year are associated with a greater risk.

A 76 years old female patient was referred to a CT scan due to a history of nodules with previous negative CT-guided needle biopsy. The CT scan has identified 2 suspicious nodules in her lungs. A 12mm nodule in the left lower lobe (LLL) and a 10mm nodule in the left upper lobe (LUL). The patient had no cancer history. The patient is a current smoker of 20 packages a year.
The patient was referred to bronchoscopy to biopsy the two suspicious nodules in order to determine patient management care.

Methods:
The patient was scheduled for navigational bronchoscopy guided by the AI-driven navigation system. (LungVision, Body Vision Ltd, Israel). The patient's CT scans were imported into the LungVision planning software and Artificial Intelligence assisted to identify the suspicious nodules and the pathway leading to each of the two nodules. The procedure was performed under moderate sedation. The AI-driven navigation system was used for real-time localization of the airways

and nodules using fluoroscope images. When the navigation catheter guided by AI has reached the suspicious nodule, a radial EBUS (r-EBUS) probe was advanced down the catheter to verify nodule location prior to taking a biopsy. During the biopsy stage, the tools were guided by LungVision into the lesion visualized over the fluoroscopic screen. ROSE confirmation utilized after the biopsy was performed. Each of the eight biopsy samples assisted by AI-guidance was performed with forceps and a brush from the LLL nodule. Using the same approach two additional biopsy samples were acquired from the LUL using a brush. All samples were marked and sent to the pathology.

Results:
The total time of the procedure was 58 minutes. Although ROSE was non-diagnostic in both nodules, the LLL nodule was adenocarcinoma at the final path and LUL nodule showed only reactive bronchoalveolar cells. No peri-procedural adverse event was reported.

Conclusion:
Detection of lung nodules at an early stage allows for potentially curative treatment for patients. The ability of AI-driven LungVision system to guide tools into small pulmonary nodules allows a safe non-invasive diagnostic procedure, opening a new avenue in the management of solitary pulmonary nodules.

The AI capabilities to track pulmonary nodules in real time under moderate sedation and present live augmented images of the nodule and airways to enable real-time guided endobronchial navigation and biopsy of pulmonary nodule may increase the diagnostic yield of bronchoscopy.

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METHODS

The patient was scheduled for navigational bronchoscopy guided by the AI-driven navigation system. (LungVision, Body Vision Medical Ltd, Israel). The patient's CT scans were imported into the LungVision planning software and Artificial Intelligence (AI) assisted to identify the suspicious nodules and the pathway leading to each of the two nodules. The procedure was performed under moderate sedation. The AI-driven navigation system was used for real-time localization of the airways and nodules using fluoroscope images. When the navigation catheter guided by AI has reached the suspicious nodule, a radial EBUS (REBUS) probe was advanced down the catheter to verify nodule location prior to taking a biopsy. During the biopsy stage, the tools were guided by LungVision into the lesion visualized over the fluoroscopic screen. ROSE confirmation utilized after the biopsy was performed. Each of the eight biopsy samples assisted by AI-guidance was performed with forceps and a brush from the LLL nodule. Using the same approach two additional biopsy samples were acquired from the LUL using a brush. All samples were marked and sent to the pathology.

TABLE 1
Patient Demographics

Gender	Age	History of cancers	Smoking History
Female	76 y/o	No	Current (20 packs a year)

FIGURE 1
LungVision™ platform

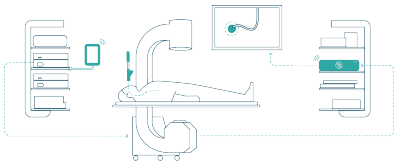
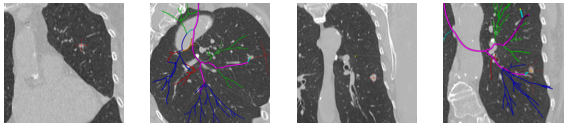


TABLE 2
Pulmonary Lesions Characteristics

	Nodule 1	Nodule 2
Location	LUL	LLL
Size	10 mm	12 mm
Type	Solid	Solid

FIGURE 2
Planning - Nodules on CT and Navigation Pathways



CT- LUL, 10 mm Nodule | LUL, Navigation Pathway | CT- LLL, 12 mm Nodule | LUL, Navigation Pathway

FIGURE 3
Navigation to Nodules and REBUS Verification

LUL Nodule | REBUS Verification | LLL Nodule | REBUS Verification

RESULTS

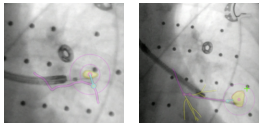
The total time of the procedure was 58 minutes. Although ROSE was non-diagnostic in both nodules, the LLL nodule was adenocarcinoma at the final path and LUL nodule showed only reactive bronchoalveolar cells. No peri-procedural adverse event was reported.

CONCLUSION

Detection of lung nodules at an early stage allows for potentially curative treatment for patients. The ability of AI-driven LungVision system to guide tools into small pulmonary nodules allows a safe non-invasive diagnostic procedure, opening a new avenue in the management of solitary pulmonary nodules.

The AI capabilities to track pulmonary nodules in real time under moderate sedation and present live augmented images of the nodule and airways to enable real-time guided endobronchial navigation and biopsy of pulmonary nodule may increase the diagnostic yield of bronchoscopy.

FIGURE 4
Biopsy Under LungVision Guidance



LUL Nodule | LLL Nodule

LUL Diagnosis:
Reactive bronchoalveolar cells

LUL Diagnosis:
Adenocarcinoma

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