Real-time Image-guided Electromagnetic Navigational Bronchoscopy Dual-marker Technique to Localize Deep Pulmonary Nodules in A Hybrid Operating Room

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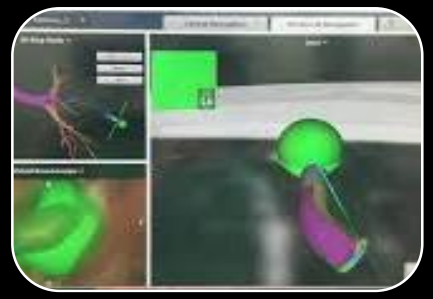
Localization of lung nodules

CT-guided percutaneous



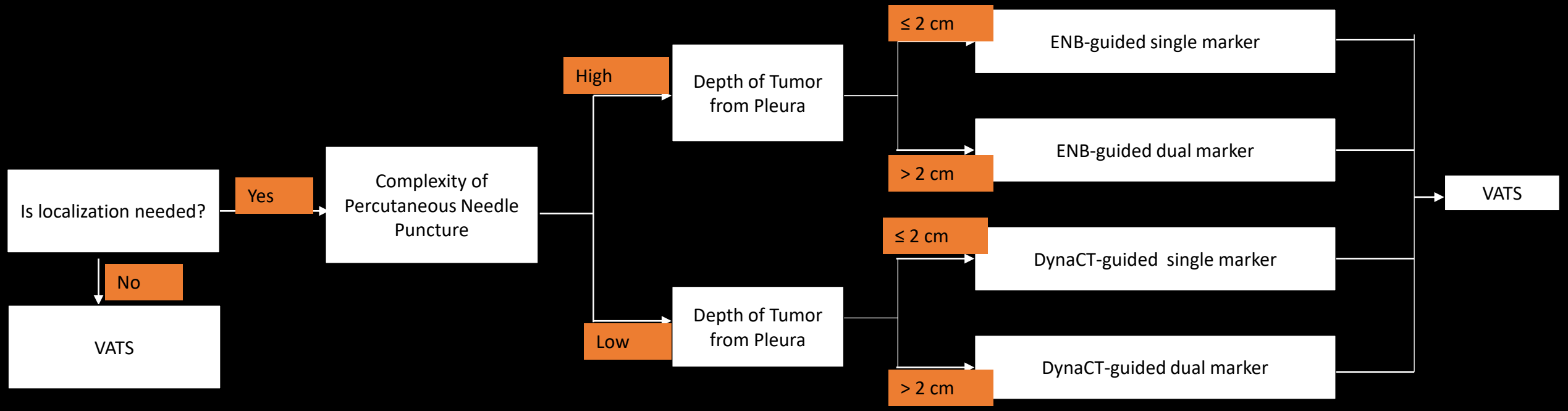
ENB-guided

Zeego

ENB Guide dual localization

Location	CT room	OR	Hybrid OR	Hybrid OR
Puncture	Percutaneous	Bronchoscopy	Percutaneous	**Bronchoscopy**
Image guide	Real-time	Virtual	Real-time	**Real-time**

Personalized Approach for Small Lung Tumor Localization & Surgery



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Localization of lung nodules

CT-guided percutaneous puncture

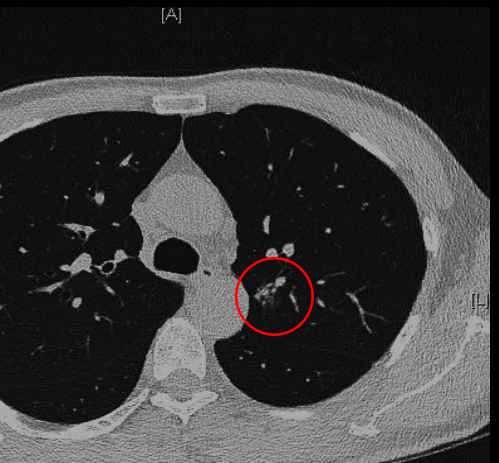
Location	**CT room**
Puncture	**Percutaneous**
Image guide	**Real-time**

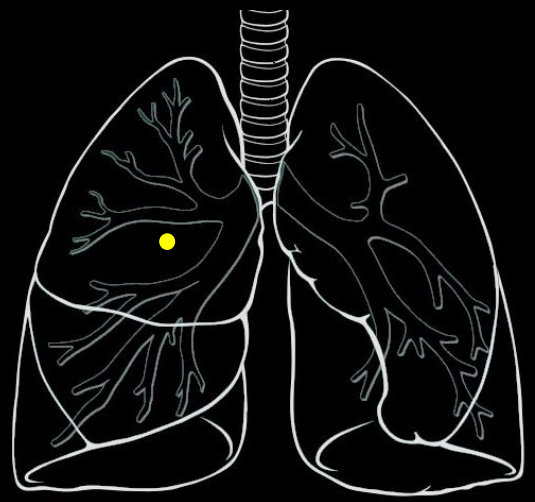
Pneumothorax

Small and deep pulmonary nodules are sometimes difficult to localize percutaneously

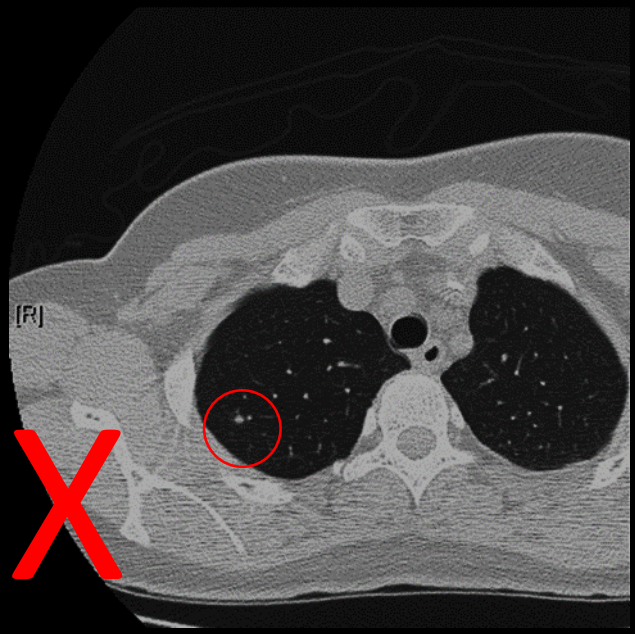
Difficulties in percutaneous localization

Risk of puncture central nodules near pericardium& major vessels

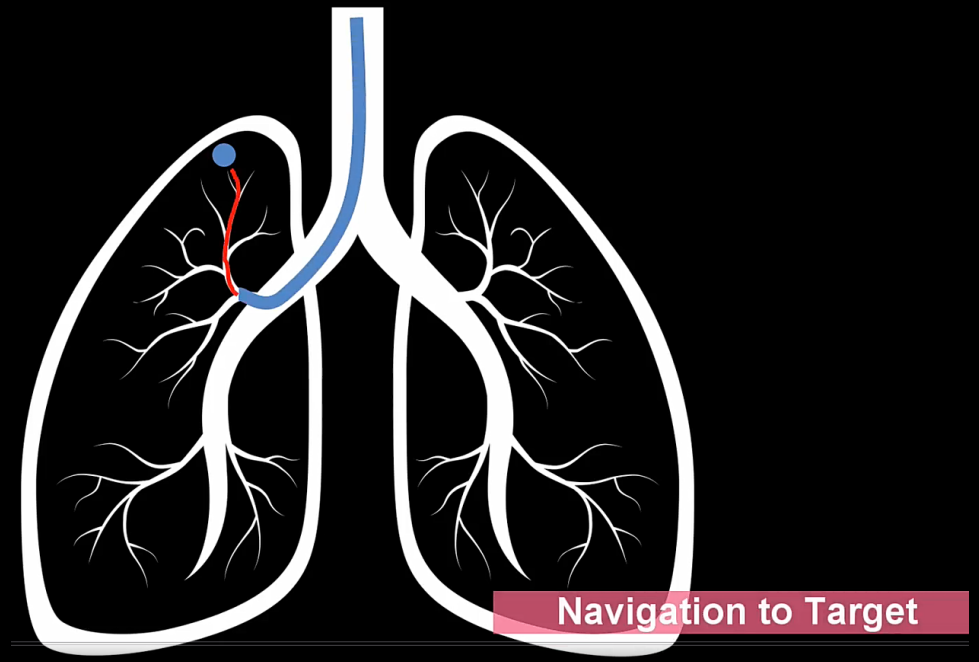


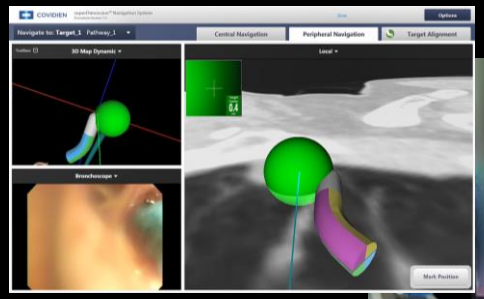


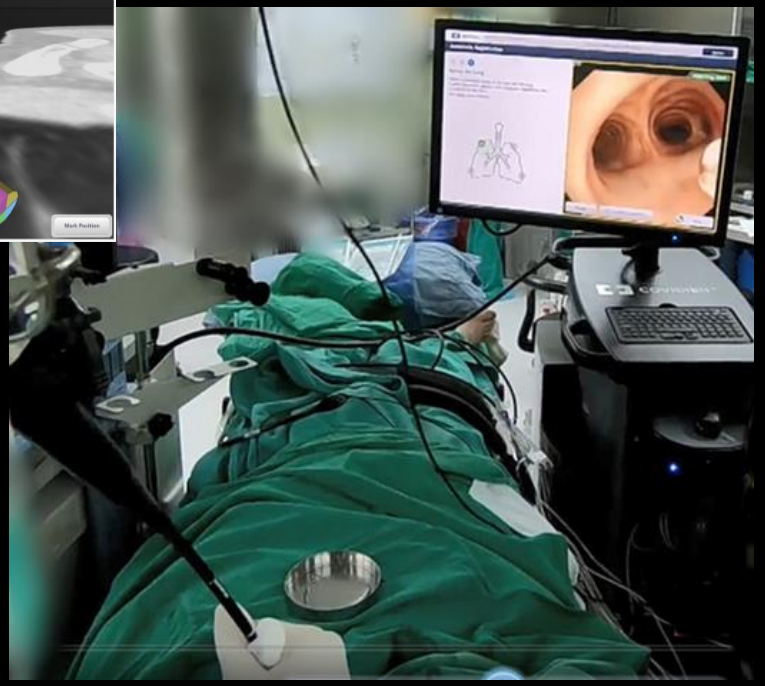
Scapula impediment under the puncture site



ENB-guided localization







Location	OR
Puncture	Bronchoscopy
Image guide	Virtual

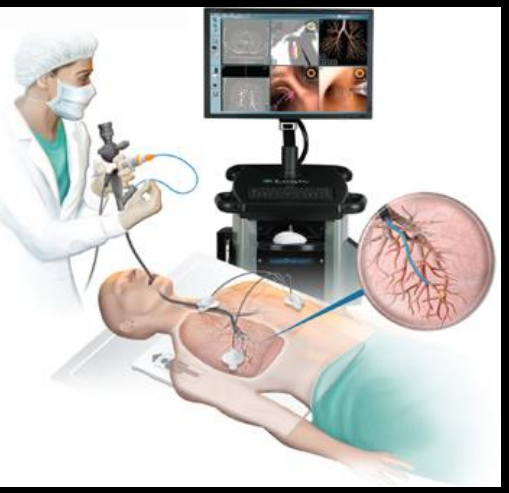
Accuracy affected by Respiratory movement

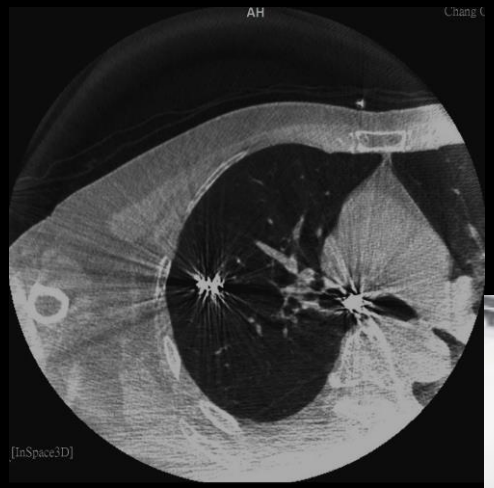
Small and deep pulmonary nodules are sometimes difficult to localize percutaneously

ENB-guided localization

Real-time?

ENB + Dyna CT + Flouroscopy





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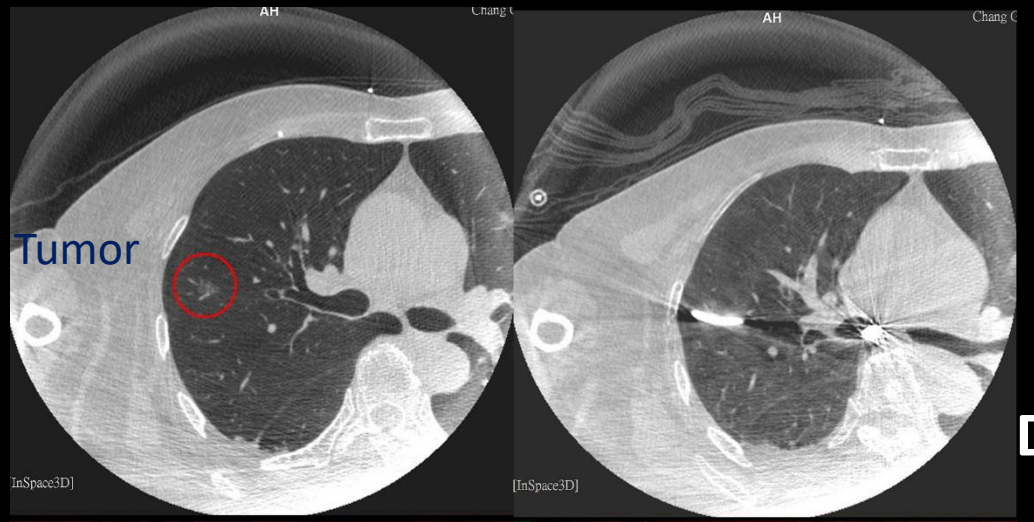
Real-time Image-guided Electromagnetic Navigational Bronchoscopy

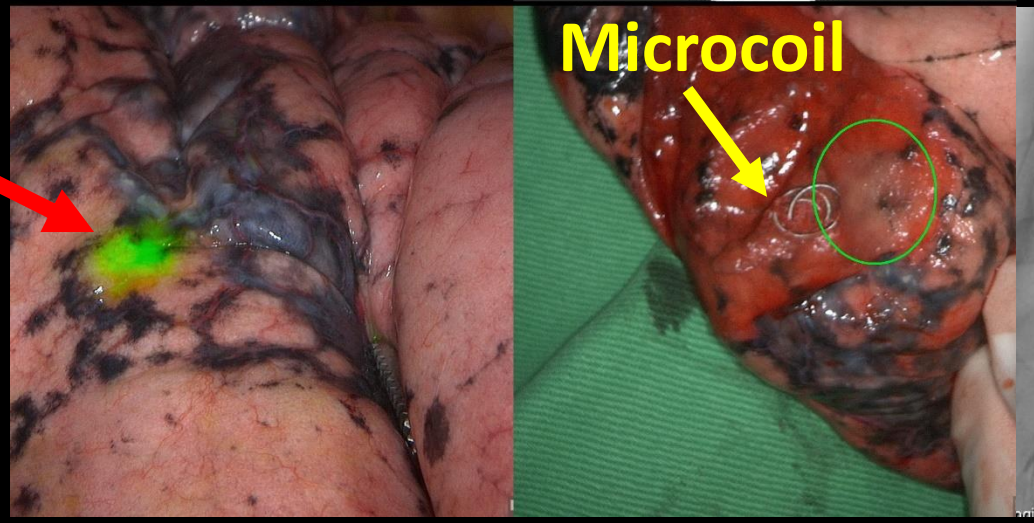
Real-time ENB-guided dual marker localization

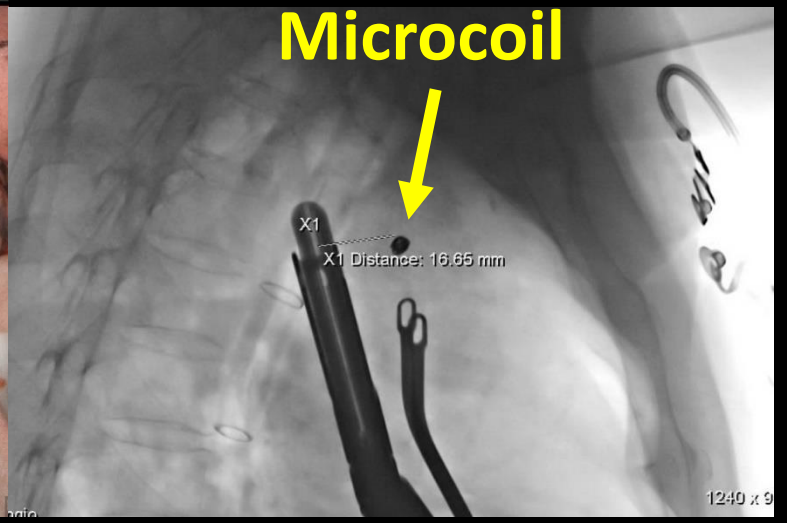


Deep marker

Superficial marker

ICG





Study aim

- The goal of this study was to evaluate the safety and effectiveness of this **real-time image-guided electromagnetic navigational bronchoscopy dual-marker technique.**

Material and methods

Patient recruit

Single center retrospective study

- Chang Gung Memorial Hospital (Linko, Taiwan)

Duration

- August 2018 to January 2019

Case number

- N=15

Operation method

- Patient underwent real- time **ENB dual marker localization** for resections of single lung nodule

Equipment

- **Hybrid OR** and **ENB system**

Inclusion and exclusion

Inclusion criteria

- deep locationed nodules(>1cm from the visceral pleural surface)
- solid nodules with small size (<1cm)

Exclusion criteria

1) nodules <1cm deep from pleural surface

2) pulmonary lesion that are not amenable to wedge resection (ie. pure GGO>2cm and lung nodule with solid part>1cm)

Dyna-CT guided Electromagnetic Navigation Bronchoscopic Dual marker Placement for Deep Pulmonary Tumor

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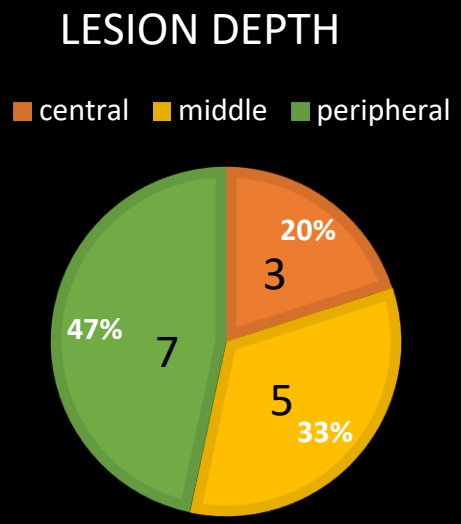
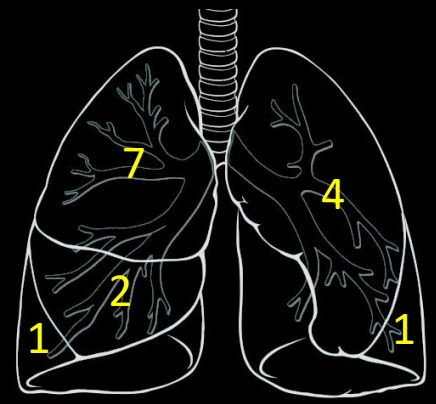
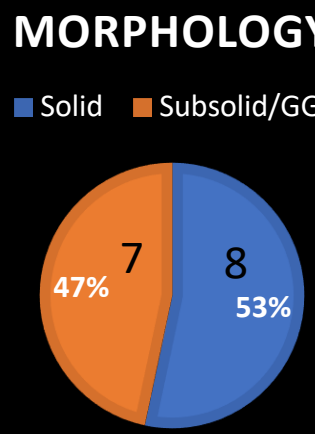
Result

Demographic result

N=15	Median (IQR)
Age, years (median; IQR)	58 (45-64)
Sex, number	
Male	9
Female	6
Lesion size, cm	1.0 (0.6-1.3)
Lesion depth, cm	1.8 (1.6-3.4)
Depth-to-size ratio	2.83 (1.78-3.10)







Localization Result

	Median (IQR)
Localization procedural time, min	35 (26-44)
Time from 1st DynaCT to needle puncture, min	8 (5-15)
Time from localization to surgery, min	40 (32-49)
Number of DynaCT scans	
2	9 (60%)
3	4 (27%)
4	2 (13%)
Radiation effective dose, mSv	15.97 (8.98-21.6)
Distance from coil to nodule center, cm	0.8(0.4-1.4) (max: 1.5)
Pneumothorax	nil

Surgical Result

	Median (IQR)
Operating time, min	74 (57-125)
Resection method	
Wedge resection	9 (60%)
Wedge->Lobectomy	2 (13%)
Segmentectomy	4 (27%)
LOS, days	3 (2-4)
Pathological diagnosis	
Benign	6 (40%)
Primary malignancy	7 (47%)
Metastatic tumor	2 (13%)
Margin, cm	1.5 (1.0-1.7) (min:0.5; max:7.6)

Discussion

Features of real-time ENB dual localization

ENB guide localization does not require skin puncture / wires

- Pneumothorax ↓

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Real-time image guidance(Zeego system) during ENB

- Minimizing discrepancies induced by respiratory movements

Features of ENB dual localization

ENB guide localization does not require skin puncture / wires

- Pneumothorax ↓

Real-time image guidance(DynaCT +fluoroscopy) during ENB

- Minimizing discrepancies induced by respiratory movements

Easier to approach **deep** lesions (difficult /risky for percutaneous puncture)

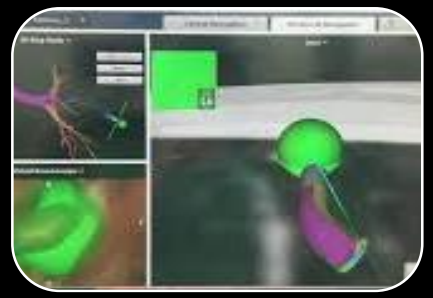
- Lesions located in the lung apex, in proximity of the diaphragm or major mediastinal organs, or behind the scapula

Limitation

- Small case number (N=15)
- Relative longer localization time
- Radiation exposure (Dyna-CT and fluoroscopy)

localization of lung nodules

CT-guided percutaneous



ENB-guided

Zeego

Real-time ENB Guide localization

Location	CT room	OR	Hybrid OR	Hybrid OR
Puncture	Percutaneous	Bronchoscopy	Percutaneous	**Bronchoscopy**
Pnuemothorax	Possible	Less	Possible	**Less**
Image guide	Real time	Virtual	Real time	**Real time**
Radiation exposure	Yes	Nil	Yes	**Yes**
Time delay(puncture-OP)	Longer	Shorter	Shorter	**Shorter**

Conclusion

- This study indicates that real-time ENB Dual Marker localization is a safe and accurate intraoperative modality for targeted sublobar resection of pulmonary nodules that are deemed difficult to localize.

Thank you for listening!