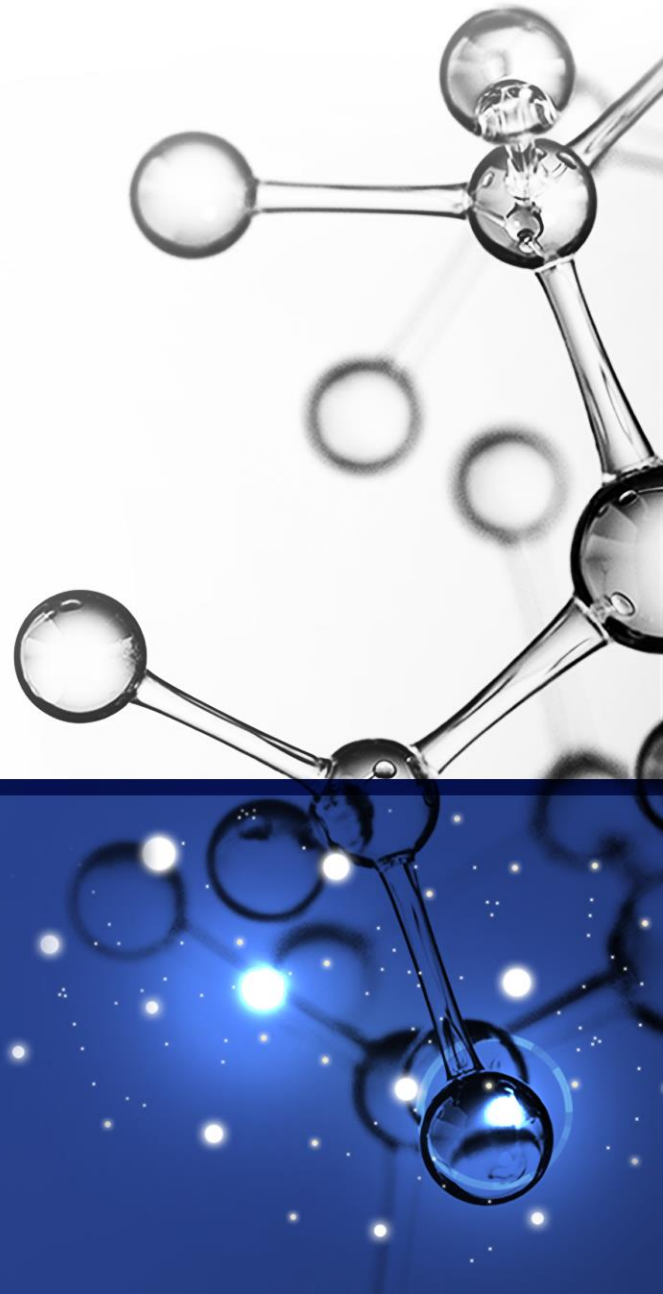
SAMSUNG MEDICAL CENTER

New techniques for Diagnosis & Treatment in pulmonology



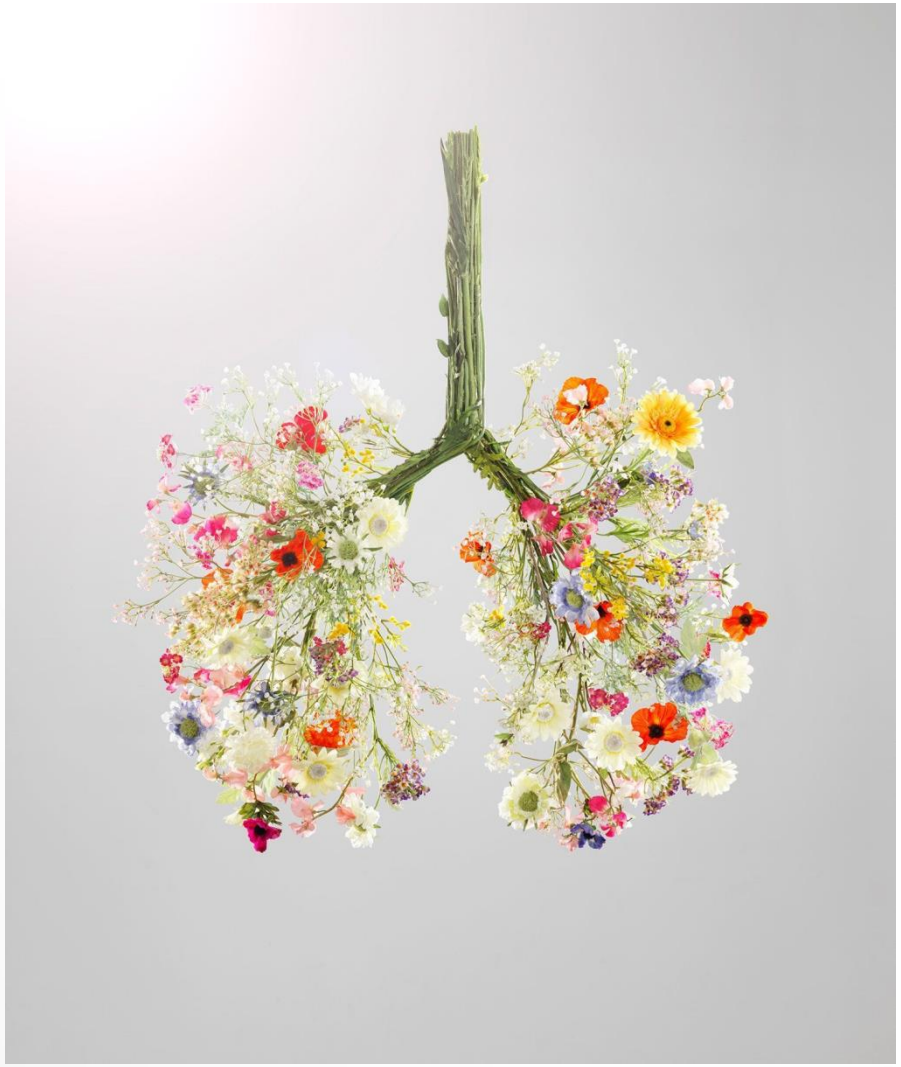
Kyungjong Lee

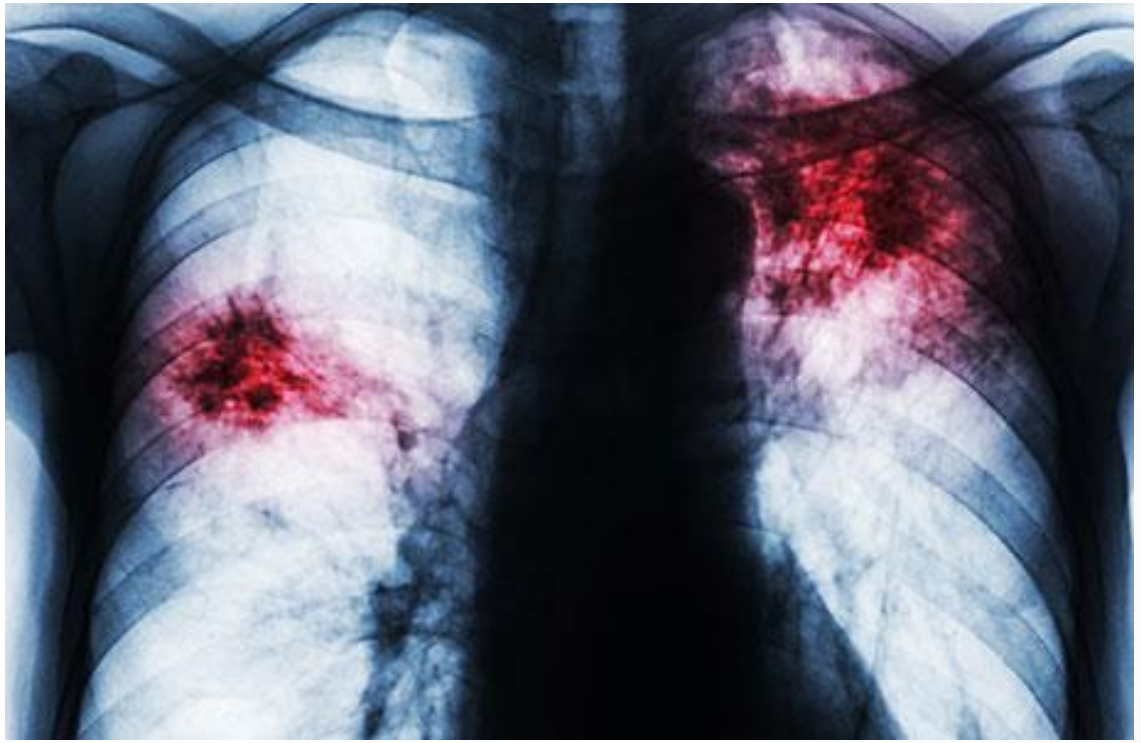
Division of Pulmonary and Critical Care Medicine, Department of Medicine,
Samsung Medical Center, Sungkyunkwan University School of Medicine

I

Diagnosis of lung nodule

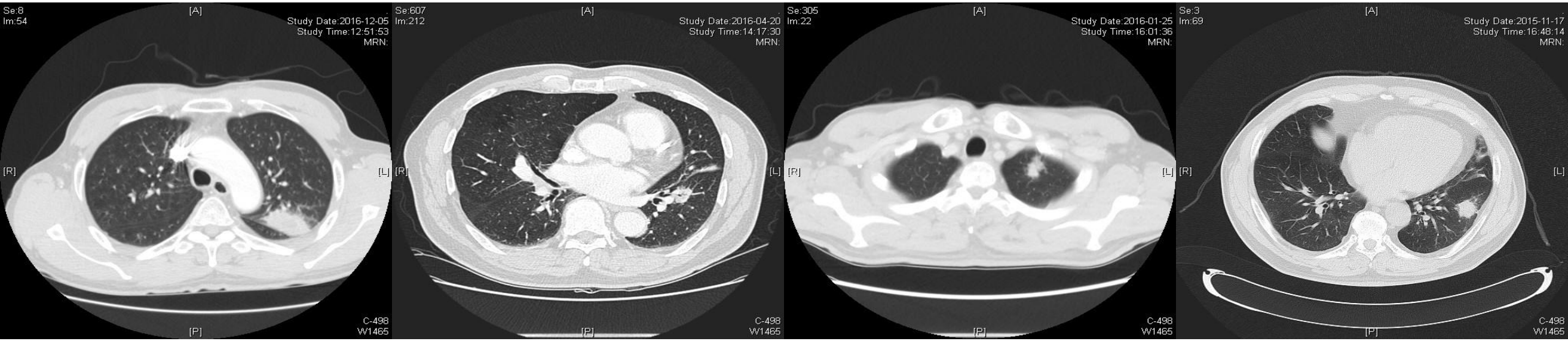
Human Lung





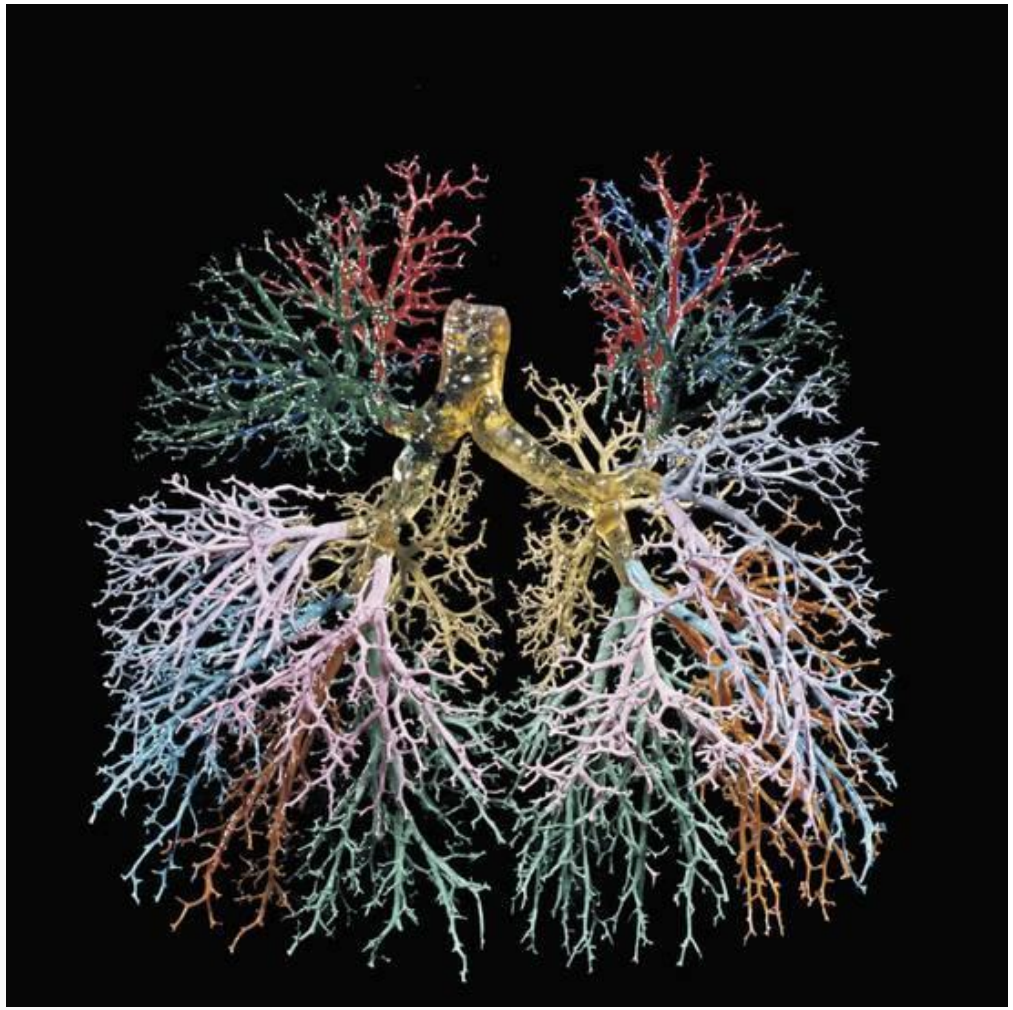
https://www.pinterest.com
https://mdspiro.com/a-chronic-rare-lung-disease-causes-more-than-just-irreversible-scarring-of-the-lungs.html

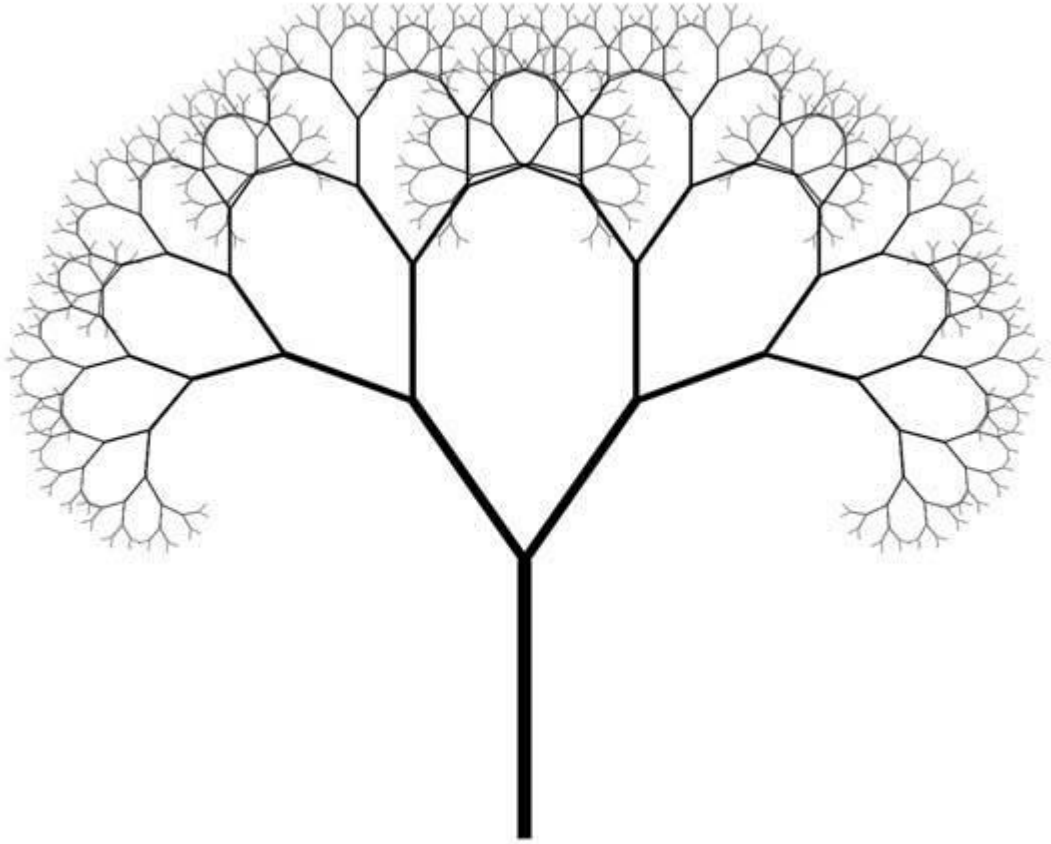
Human Lung



Chest CT에서 폐암 의심 소견을 주었으나 양성 폐질환으로 판명됨

Tissue sampling from the lung





The fractal tree

(Photo: Manuel Noah Angeja)

In the past…

Percutaneous needle aspiration

- Risk of pneumothorax
- Hemoptysis
- Air embolism

Surgical resection

- Morbidity: 4.53%
- Mortality : 1.21%

Conventional bronchoscopy +/- fluoroscopy guided TBLB

Low diagnostic yields : 14-62%

Chest, 117 (2000), pp. 1049-1054

Ann Thorac Surg 2014;98:1705–12

Guided Bronchoscopy

Radial endobronchial ultrasound

- Distance measure
- Guide sheath + Fluoroscoy

Virtual Navigation Bronchoscopy

- Lung point (Bronchus)
- Virtual bronchoscopy navigation (Olympus)

Electromagnetic Navigation Bronchoscopy

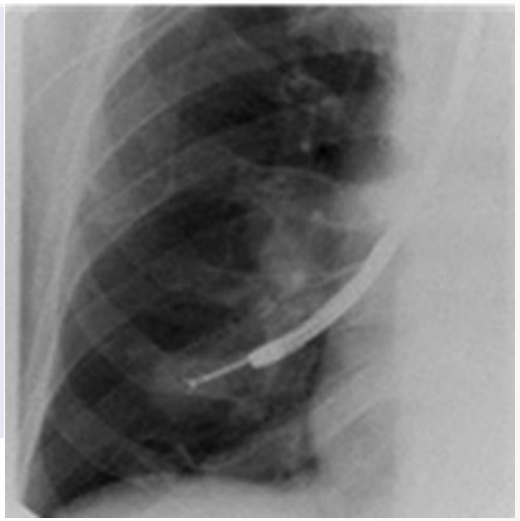
- Super Dimension (Medtronics)
- Spin Drive (Veran Medical)

Guided Bronchoscopy

Radial endobronchial ultrasound

Guide sheath + Fluoroscopy





Guided Bronchoscopy

Radial endobronchial ultrasound

Distance measure method at SMC first

어떻게 하면 최소한의 장비를 가지고 폐 결절의 조직검사를 할 수 있을까?

Can Computed Tomography Characteristics Predict Outcomes in Patients Undergoing Radial Endobronchial Ultrasound-Guided Biopsy of Peripheral Lung Lesions?

Matthew Evison,† Philip A.J. Crosbie,*† Julie Morris,‡ Julie Martin,* Philip V. Barber,* and Richard Booton*†*

Introduction: Percutaneous computed tomography (CT)-guided lung biopsy is a standard minimally invasive technique for sampling peripheral lung lesions. Radial endobronchial ultrasound (EBUS) offers an alternative approach but it has yet to be defined which patients are most suited to this procedure. The primary aim of this study was to investigate whether CT characteristics could predict the success of radial EBUS-guided sampling.

Methods: The University Hospital South Manchester provides a radial EBUS service, under conscious sedation without fluoroscopy, double-hinged curettes, or guide sheaths, to a large cancer Network in the United Kingdom. This retrospective analysis of a prospectively maintained database included all patients undergoing radial EBUS from January 2011 to June 2013. Lesion size, structure, location, and presence of a bronchus sign on thoracic CT were analyzed against predefined outcomes using multivariate analysis.

Results: One-hundred and seventeen patients underwent radial EBUS in the study period (mean age 69.5, mean lesion size 36.6 mm). The presence of a bronchus sign on CT was the only independent predictor of all predefined outcomes: (1) lesion identification with radial EBUS, (2) positioning of probe within the center of the lesion, and (3) accurate pathological diagnosis; odds ratio (OR) 31.1 (7.8–123.9, $p < 0.0001$), OR 44.8 (5.6–354.9, $p < 0.0001$) and OR 46.6 (11.1–195.3, $p < 0.0001$) respectively. The sensitivity and diag-

Key Words: Endobronchial ultrasound, Bronchoscopy, Computed tomography, Lung cancer, EBUS, EBUS-TBB, Radial probe

(*J Thorac Oncol.* 2014;9: 1393–1397)

Radial endobronchial ultrasound (EBUS), performed during flexible bronchoscopy, has gained increasing acceptance as a feasible method of locating and facilitating sampling of peripheral lung lesions. The associated literature supported the publication of an Interventional Procedure Guidance by the National Institute for Clinical Excellence in 2010 (N2124) and a meta-analysis of 1420 patients from 16 studies in 2011.[1] The favorable safety profile of radial EBUS-guided sampling is a consistently reported advantage over percutaneous computed tomography (CT)-guided biopsy where the risk of pneumothorax is up to 25%.[2–4] The complication rate from radial EBUS is considerably lower including a risk of pneumothorax of approximately 1%.[1,5–10] In contrast, meta-analysis report a higher pooled sensitivity for percutaneous CT-guided biopsy compared with radial EBUS; 90% versus 73%, respectively.[1,11]

Patient selection and the place of radial EBUS in the diagnostic pathway have not been clearly defined. The techniques and environment used by expert groups around the

this study was to prospectively evaluate which factors, based on pre-procedure CT imaging, were associated with: (1) lesion identification, (2) location of the probe within the center of the lesion and (3) increased diagnostic accuracy in a population of patients undergoing radial EBUS without any adjuncts (fluoroscopy, curettes, guide sheaths or general anesthesia).

MATERIALS AND METHODS

The University Hospital of South Manchester provides the only radial EBUS service within Manchester Cancer, a large cancer Network in the United Kingdom that includes a regional cancer center. Respiratory physicians, thoracic surgeons, medical and clinical oncologists can all refer patients for radial EBUS. The accepted indication for radial EBUS is a target pulmonary lesion, located distal to the central airways unlikely to be visible with standard diagnostic bronchoscopy

anesthetic support. Endobronchial disease is excluded using a standard diagnostic bronchoscope (Olympus BFF260 or BF6C260) before the selective cannulation of the target lobe (and subsegmental airways) using a 1.7 mm 20 MHz radial ultrasound probe. If the target lesion is identified, the distance from the lesion to the tip of the bronchoscope is measured using the same method previously described by Fuso et al.[9] The radial probe is removed and biopsy forceps introduced into the same subsegmental bronchi and biopsies taken at the appropriate distance from the bronchoscope. Fluoroscopy, guide sheaths, and double-hinged curettes are not used. Rapid on-site evaluation of specimens is unavailable. A minimum of five biopsies per lesion are taken assuming safety, patient comfort and tolerance. A post procedure chest x-ray is only performed if: (1) a patient reports any symptoms suggestive of a pneumothorax including breath-

Lung Cancer 81 (2013) 60–64

Contents lists available at SciVerse ScienceDirect

Lung Cancer

journal homepage: www.elsevier.com/locate/lungcan

Role of ultrasound-guided transbronchial biopsy in the diagnosis of peripheral pulmonary lesions☆,☆☆

Leonello Fuso[a], Francesco Varone[a], Daniele Magnini[a], Fabiana Baldi[a], Guido Rindi[b], Gabriella Pagliari[a], Riccardo Inchingolo[a,*], Andrea Smargiassi[a]

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Endobronchial ultrasound
Transbronchial biopsy
Peripheral pulmonary lesions
Lung cancer
Guide sheath

ABSTRACT

Introduction: Endobronchial ultrasound (EBUS) can be used as an alternative to fluoroscopy to visualize a peripheral pulmonary lesion (PPL) and to provide an image guidance for transbronchial biopsy (TBB). The aim of this study was to verify the accuracy of EBUS-guided TBB in the diagnosis of PPLs.

Methods: All the patients with CT-scan evidence of PPL who underwent bronchoscopy with EBUS in the period between 2008 and 2011 were retrospectively evaluated. EBUS was performed using a radial-type miniature ultrasound probe. Once obtained an EBUS image of the PPL, we measured the distance of the PPL from the outer orifice of the working channel of the bronchoscope in order to perform TBB at PPL site.

Results: A total of 662 patients were examined. The mean diameter of lesions was 36 ± 20 mm. PPLs were visualized in 494 patients (75%) and the TBB was performed in 479 patients. Thirty-two patients were lost in follow-up and data from 447 patients were analyzed. TBB results were 255 cancers and 192 non-malignant lesions. The final diagnosis reported was 359 cases of cancer and 88 of benign lesion. EBUS-guided TBB had a sensitivity of 71% for the diagnosis of cancer, a negative predictive value of 46% and an overall diagnostic accuracy of 77%.

Conclusions: These data obtained from a large series of patients and using an original method show that EBUS represents a valid support to bronchoscopy and that the EBUS-guided TBB has a high diagnostic yield in the diagnosis of PPLs.

1. Introduction

A peripheral pulmonary lesion (PPL) can represent a real diagnostic challenge. Solitary nodules are visualized in the lung parenchyma of asymptomatic subjects with increasing frequency because of a larger use of imaging procedures such as CT-scan. Although lung cancer might be suspected on some radiological features of the lesion, a histological diagnosis is often mandatory

☆ Dr. Fuso is the guarantor of the paper; he had full access to all of the data in the study and takes responsibility for the integrity of the work and the accuracy of the data analysis.

☆☆ Ongoing early results of this work have been presented as poster at ERS congress, Amsterdam, 27th Septemper 2011.

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http://dx.doi.org/10.1016/j.lungcan.2013.04.004

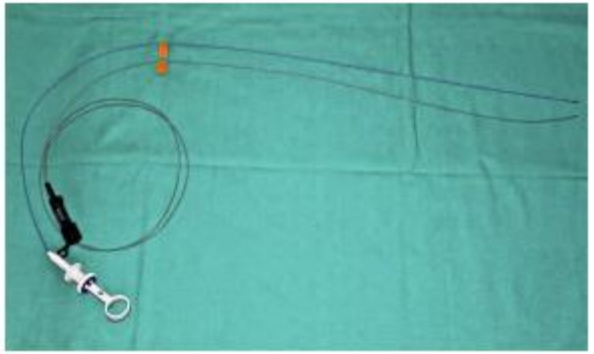


Fig. 1. Once the lesion was identified by EBUS, the distance measured on the probe was computed on the biopsy forceps.

Guided Bronchoscopy

Radial endobronchial ultrasound

Distance measure method at SMC first

- No guide sheath Kit
- No fluoroscopy
- Radial ebus + disposable forcep

Easy and convenient method !!

Guided Bronchoscopy

- **Radial endobronchial ultrasound with distant measure**

Thin bronchoscopy approach with DM

Thin bronchoscopy

4.0 mm outer diameter

보통 4차 기관지 까지 접근이 가능

GS가 없이 targeting하기 위해서는 최대한 병변 가까이 접근해서 bronchus tip wedging을 시도해야 함.

장점

방사선에 노출을 피하기 위해 납가운을 입을 필요가 없어서 몸이 매우 가볍다.

시술을 준비하는 시간이 안걸린다.

Radial probe handling이 매우 쉽다.

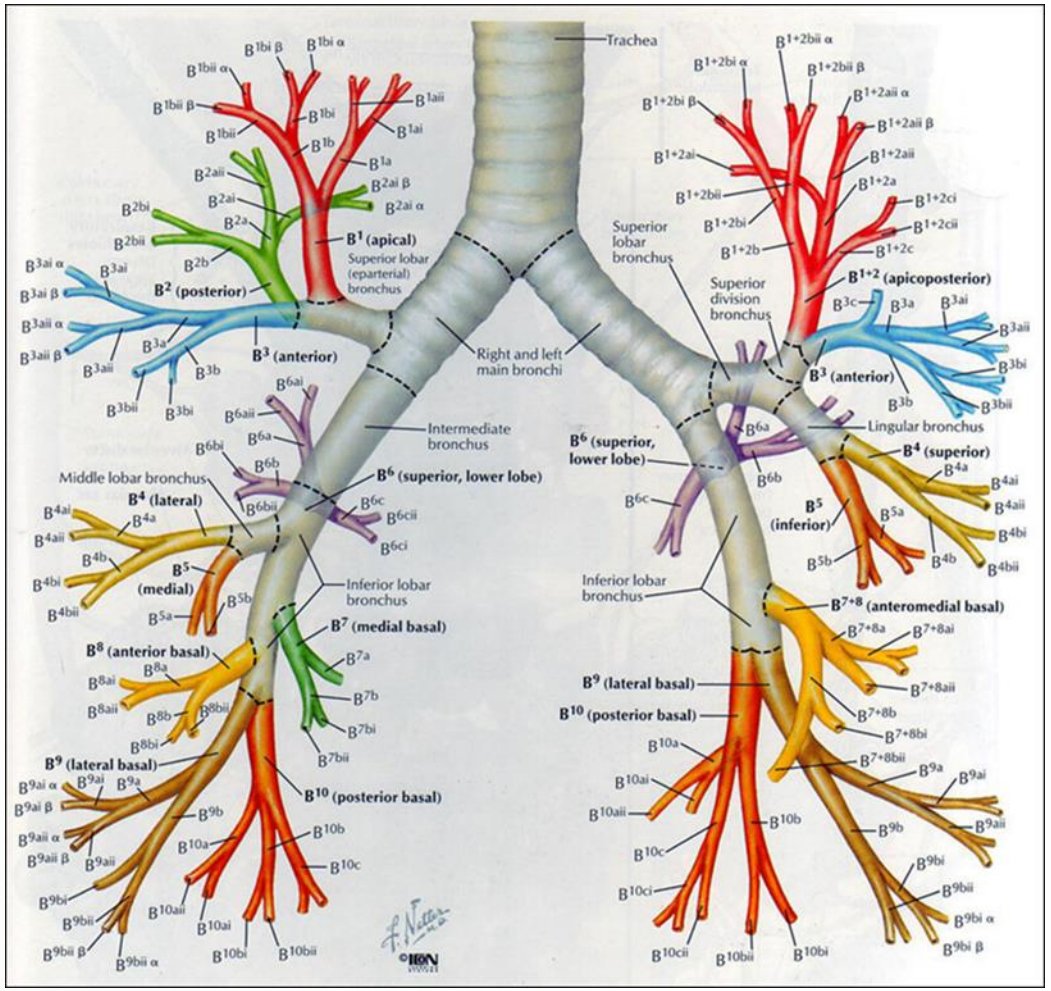
1.8 mm disposable forcep 사용
매우 큰 조직 채취가 가능

단점

조직검사후 출혈로 시야 확보가 어려움

기침을 하는 경우 내시경 wedging이 안되어 쉽게 target bronchus를 이탈함.

Mapping of Bronchus



1968년 일본 기관식도 학회

II차 기관지 : 1, 2, 3

III차 기관지 : a, b, c

IV차 기관지 : i, ii

V차 기관지 : α, β, γ

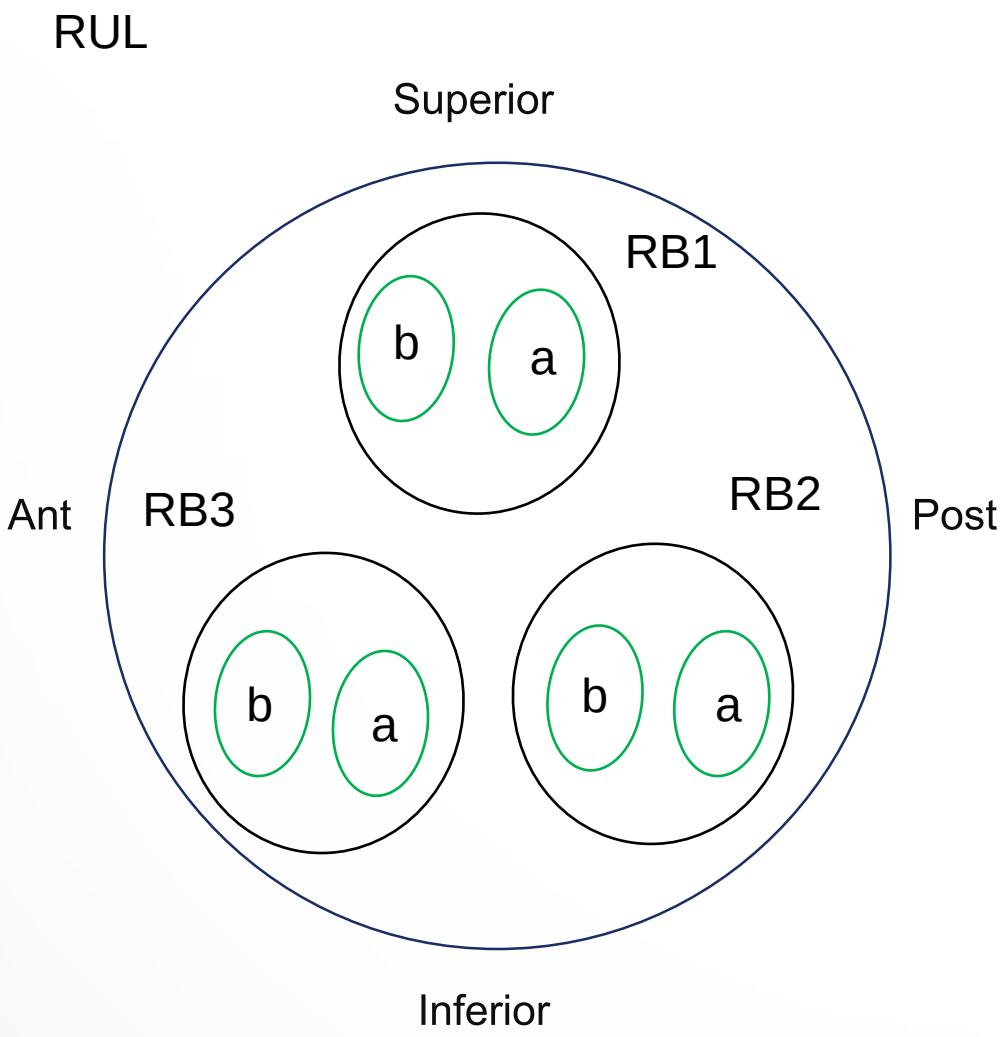
Lateral → Medial

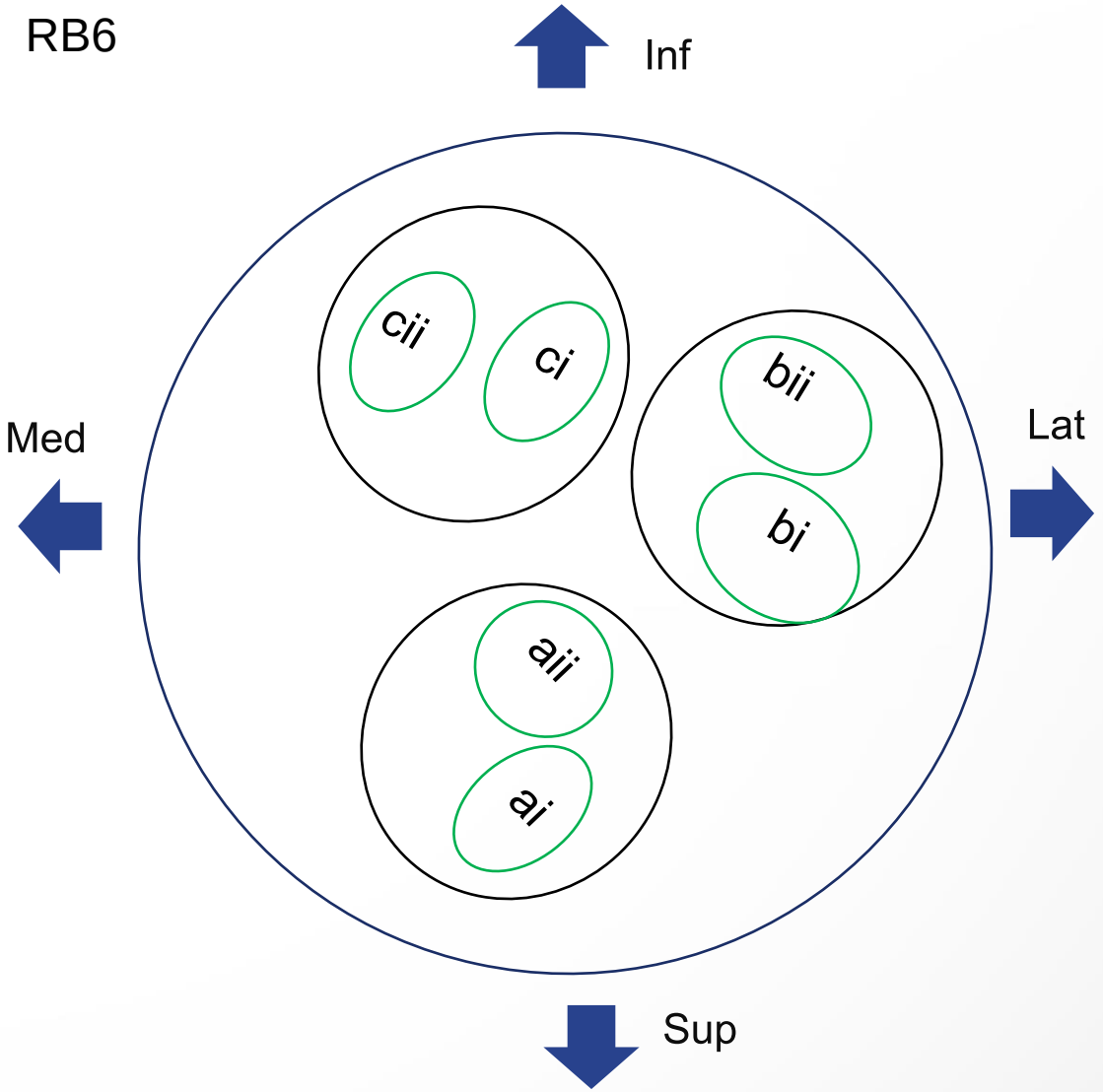
Superior → Inferior

Posterior → Anterior

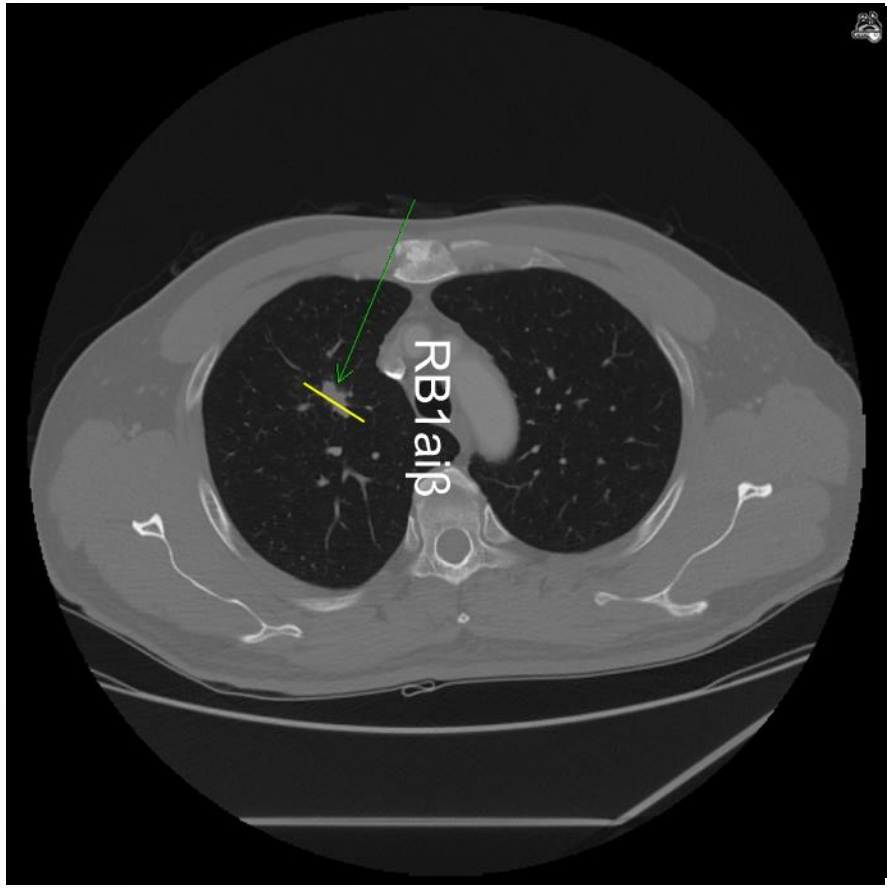
순으로 명명을 함

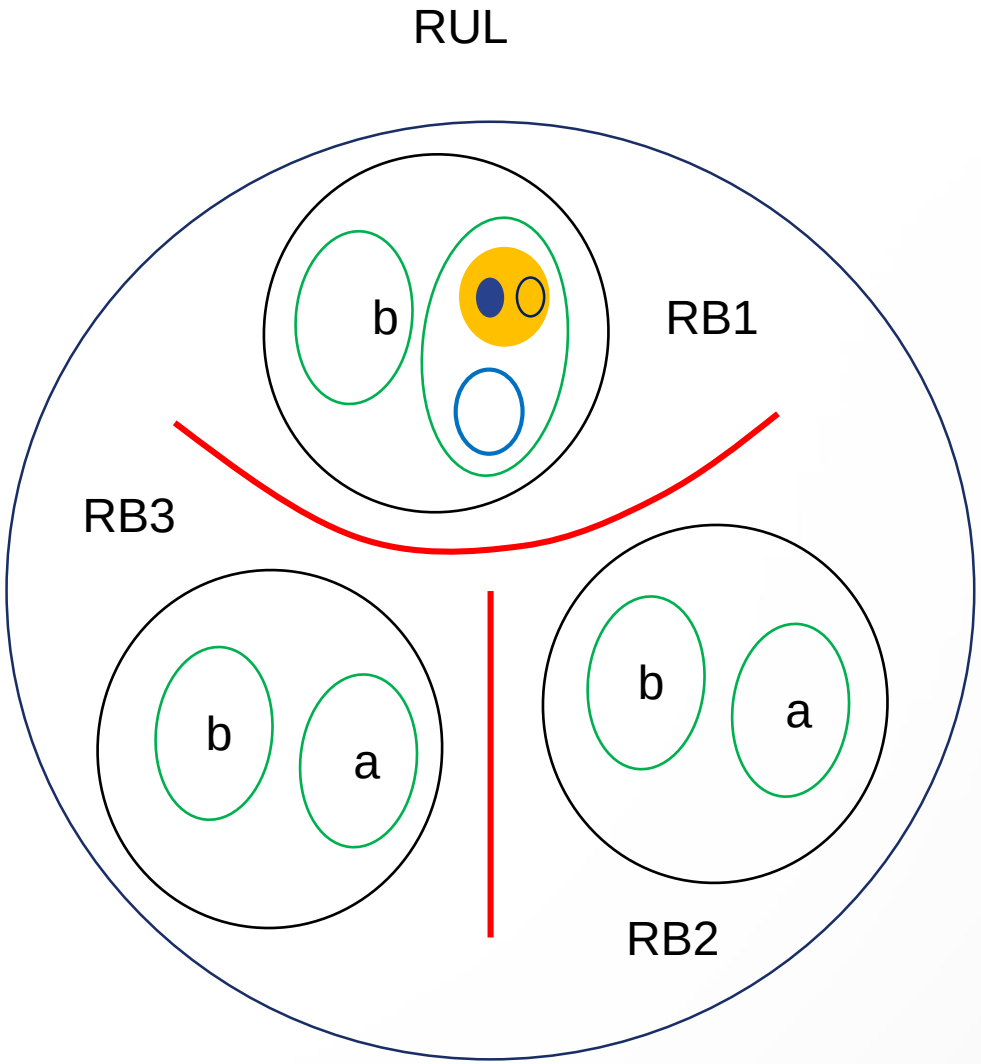
Mapping of Bronchus





Mapping of Bronchus





Case

46/F

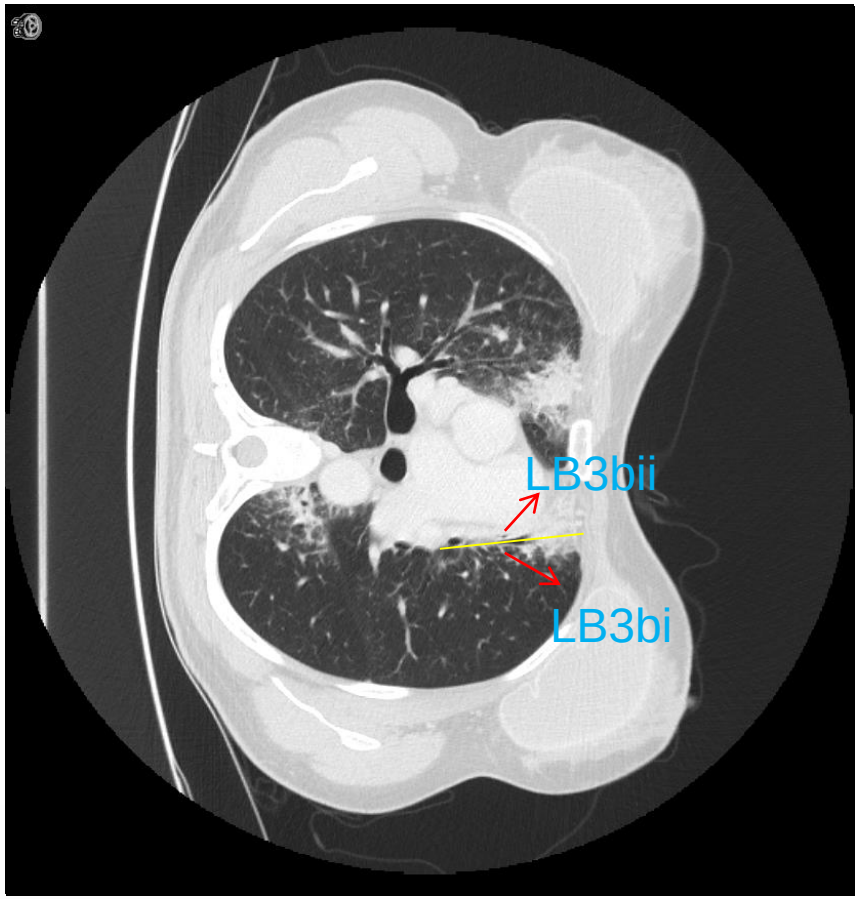
러시아 병원에서 검사후 내원

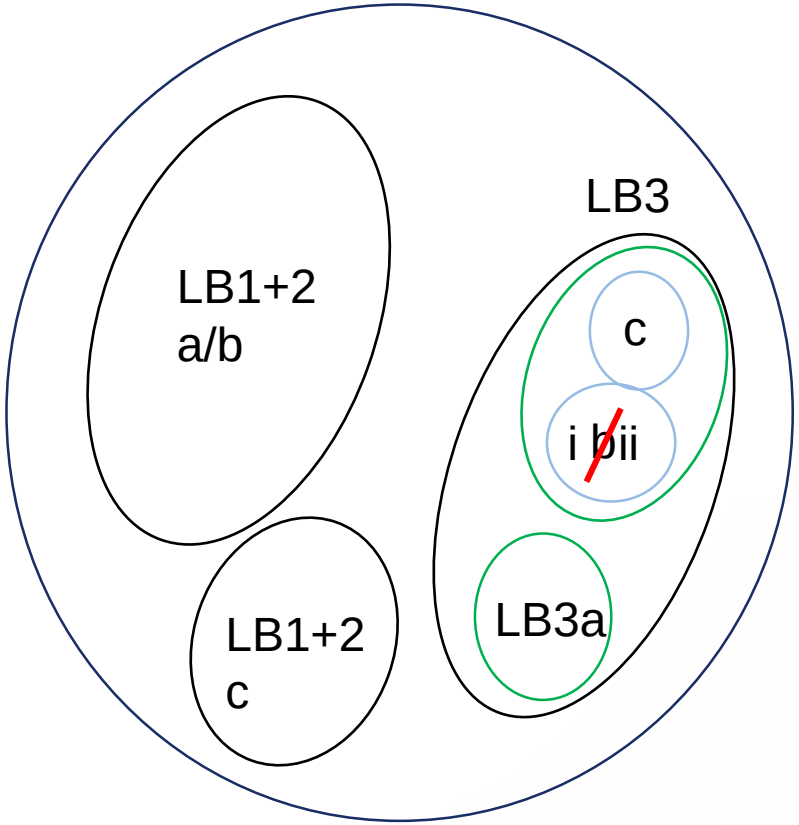
러시아 병원 진료 기록

Patch lung consolidation

TBLB : sclerotic cell

Navigation





LB1-3

Radial EBUS guided TBLB

Radial EBUS guided TBLB

Pathology Report

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【검사명】생검 1~3개 [BP1A101] 【구분】입원
【처방일】2017-08-10【접수일】2017-08-10 16:19【검사일】2017-08-10 16:19【보고일】2017-08-14 11:39
==========
****【최종보고】****
【판독의1】고영혜
【검체】Lung【병리번호】S1731940
▣ 결론 및 진단

(PP4489)

1. Lung, LB3biibeta.#1, EBUS-transbronchial biopsy :

. Extranodal marginal zone lymphoma

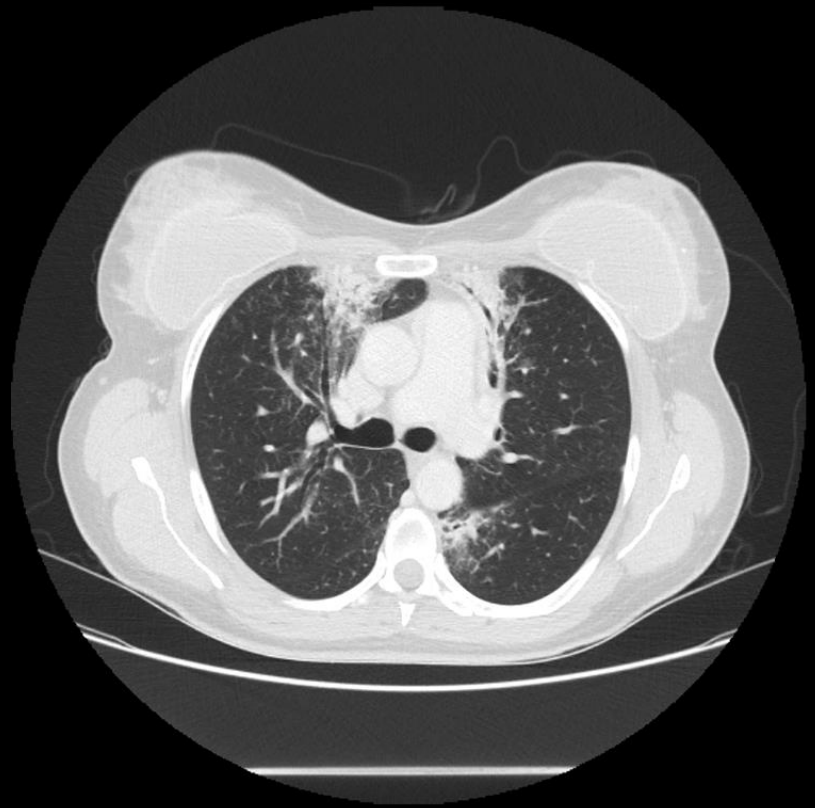
<< Result of immunohistochemistry (I1719187 - 단) 2017-08-14 >>
. Ki-67 : Positive in 5% of tumor cells
. CD 3 T-CELL : Negative in tumor cells
. CD 20 L26 : Positive in tumor cells

<< Result of immunohistochemistry (I1719236 - 단) 2017-08-14 >>
. CD 5 (Leu-1) : Negative in tumor cells
. Lambda light chain :
. Kappa light chain :
. Cyclin D-1 : Negative in tumor cells

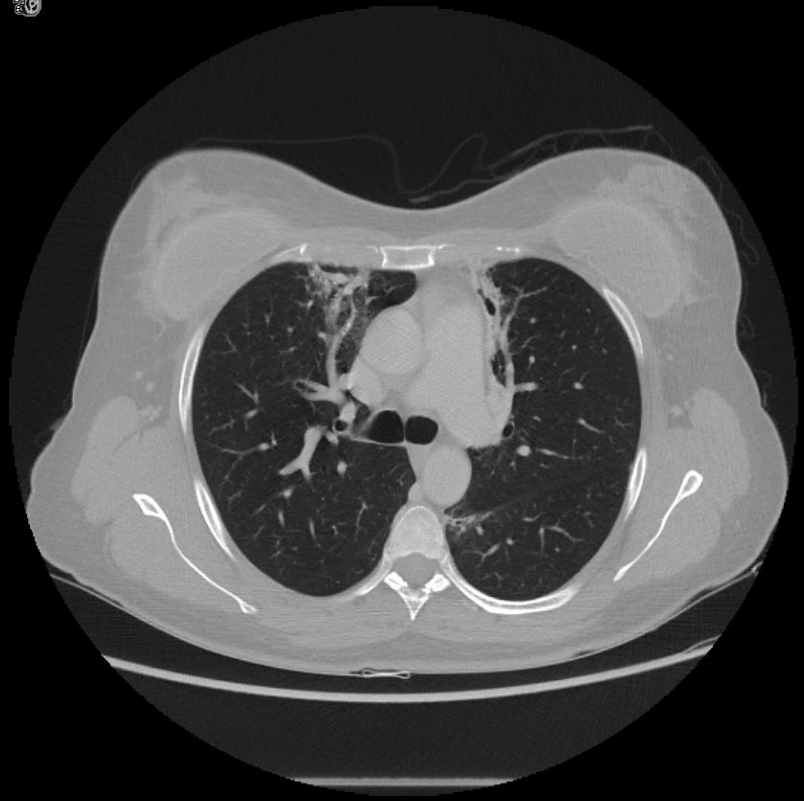
. Kappa:Lambda=1:2, polyclonal pattern

R-CHOP#4 Chemotherapy

Before



After



Guided Bronchoscopy

Radial endobronchial ultrasound

Distance measure

Guide sheath + Fluoroscoy

Virtual Navigation Bronchoscopy

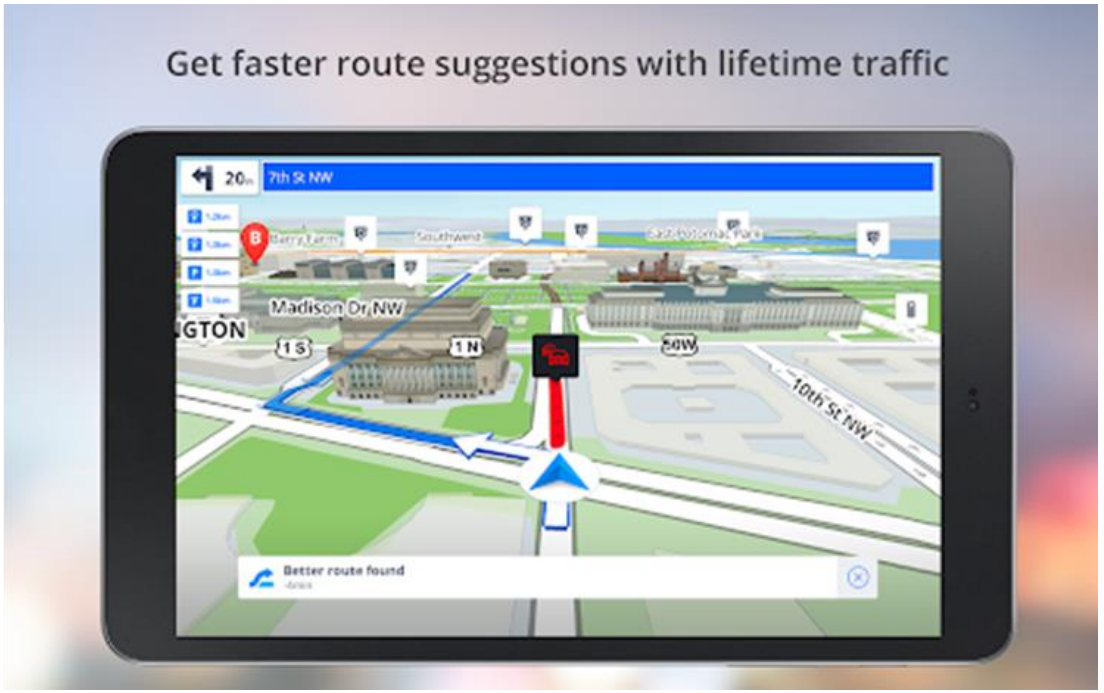
- Lung point (Bronchus)
- Virtual bronchoscopy navigation (Olympus)

Electromagnetic Navigation Bronchoscopy

Super Dimension (Medtronics)

Spin Drive (Veran Medical)

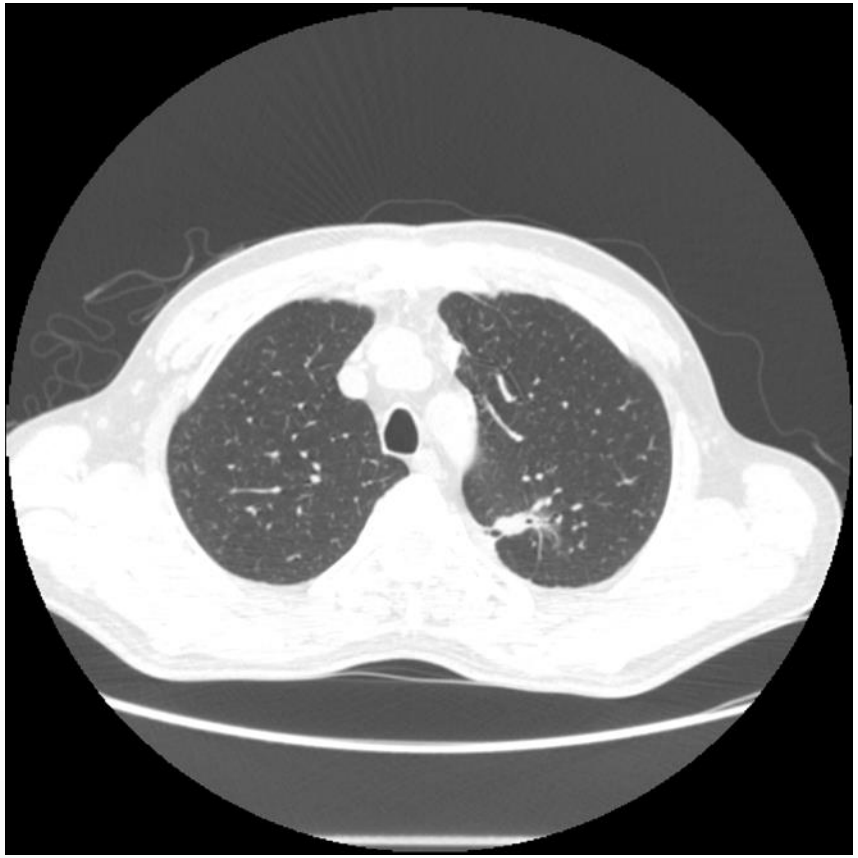
Naviation Bronchoscopy

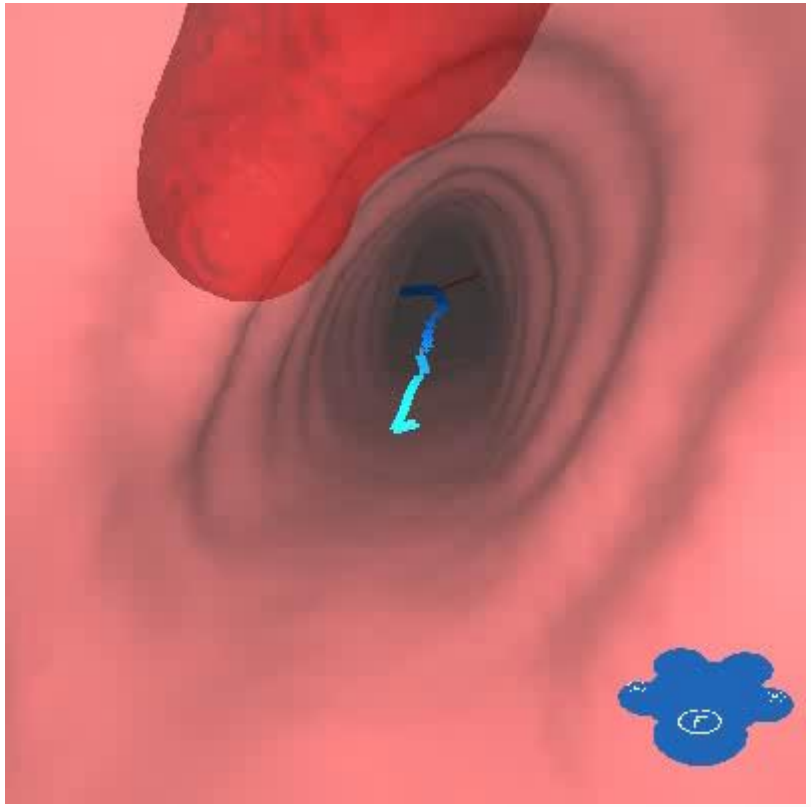


Virtual Naviation Bronchoscopy

Lung Point (Bronchus)

67/M 홍00

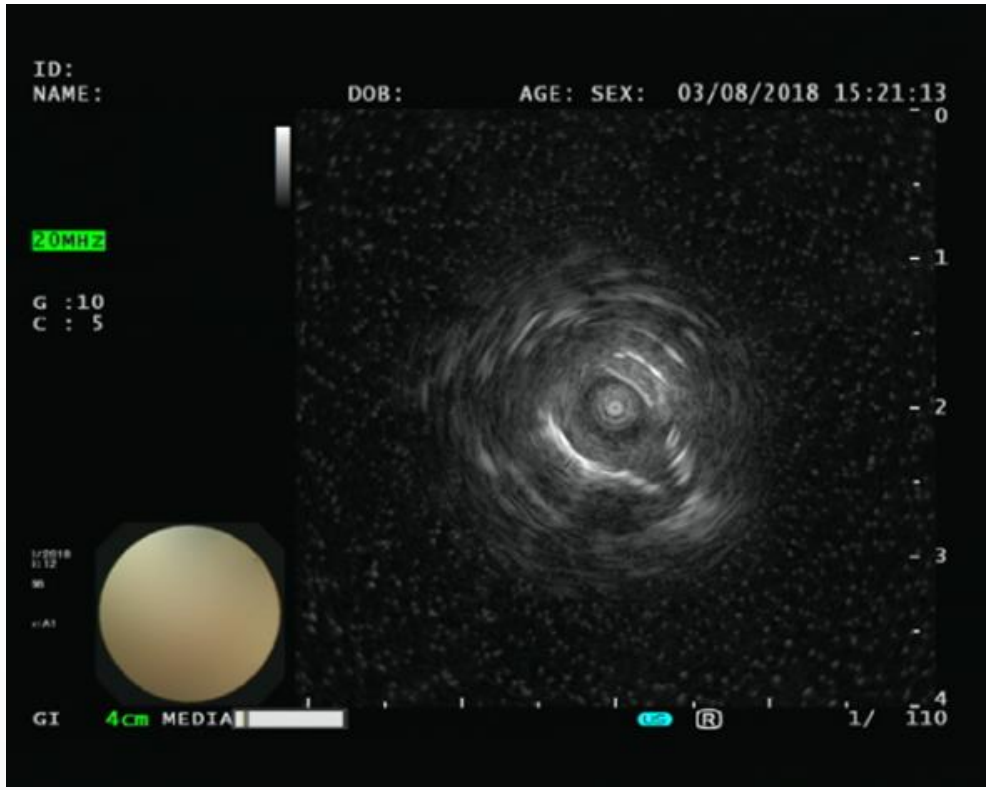




Virtual Naviation Bronchoscopy

Lung Point (Bronchus)

67/M 홍00



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【검사명】 생검 4~6개 [BP1A102] 【구분】 입원
【처방일】 2018-03-08 【접수일】 2018-03-08 17:44 【검사일】 2018-03-08 17:44 【보고일】

==========

**** 【최종보고】 ****
【판독의1】 조수연
【검체】 Lung 【병리번호】 S1809978
▣ 결론 및 진단

(507011)

Lung, LUL, EBUS-transbronchial biopsy :

. ADENOCARCINOMA

Guided Bronchoscopy

Radial endobronchial ultrasound

Distance measure

Guide sheath + Fluoroscoy

Virtual Navigation Bronchoscopy

Lung point (Bronchus)

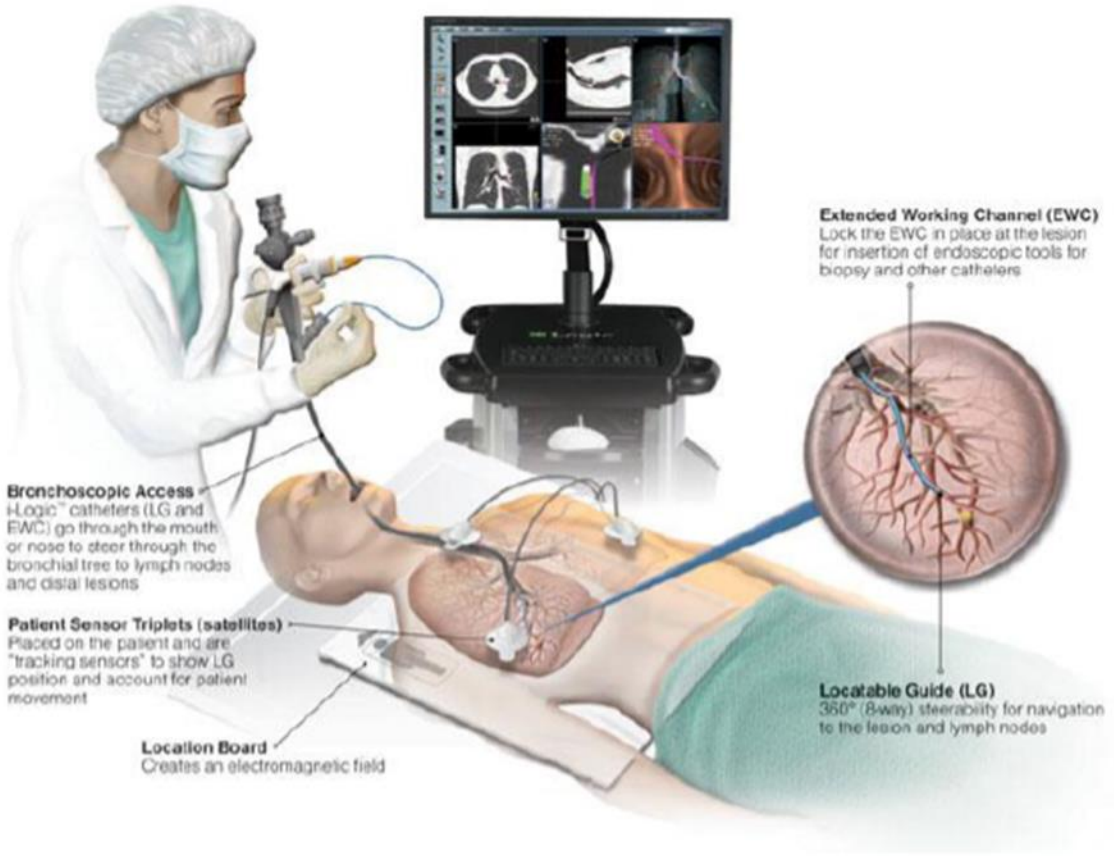
BF navigation (Olympus)

Electromagnetic Navigation Bronchoscopy

- Super Dimension (Medtronics)
- Spin Drive (Veran Medical)

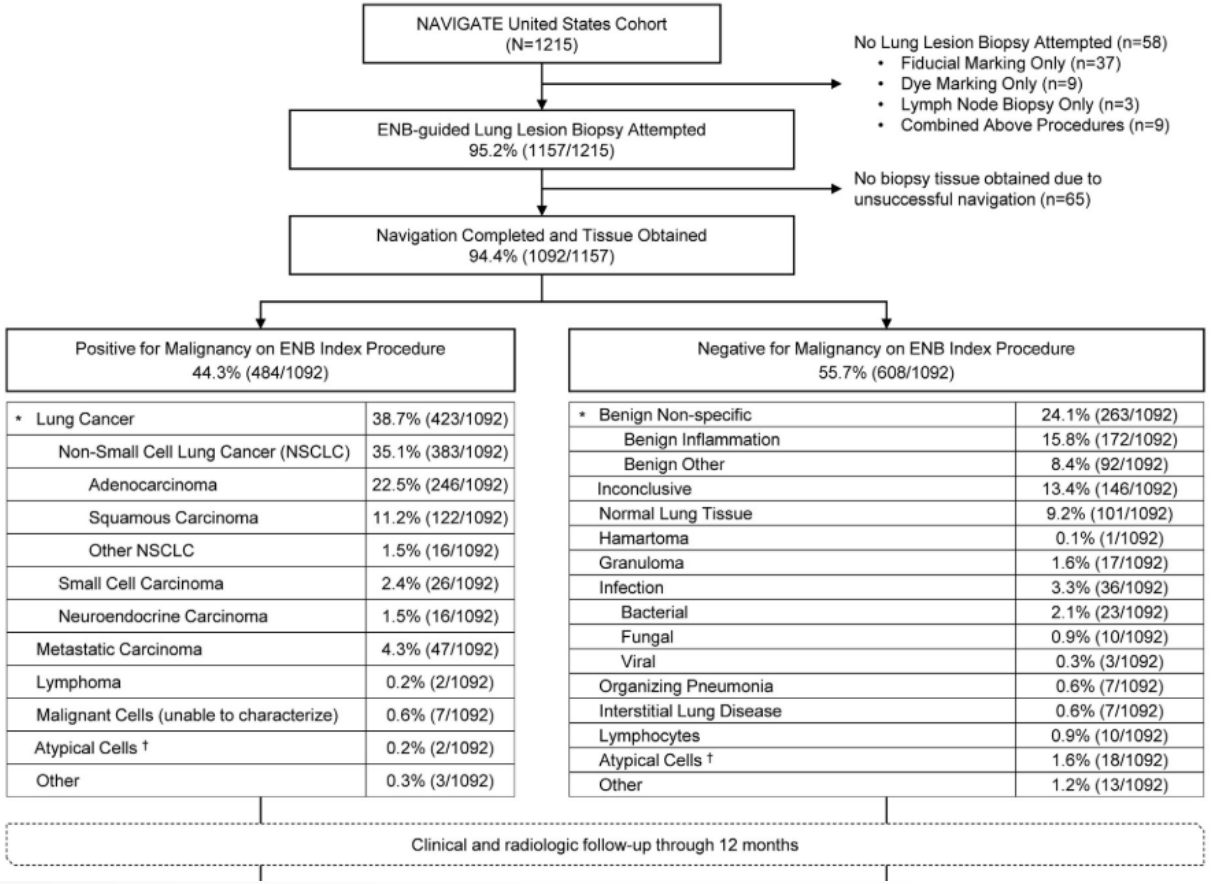
Electromagnetic Navigation Bronchoscopy

SuperDimension, Covidien



Prospective, Multicenter NAVIGATE Study

SuperDimension, Covidien



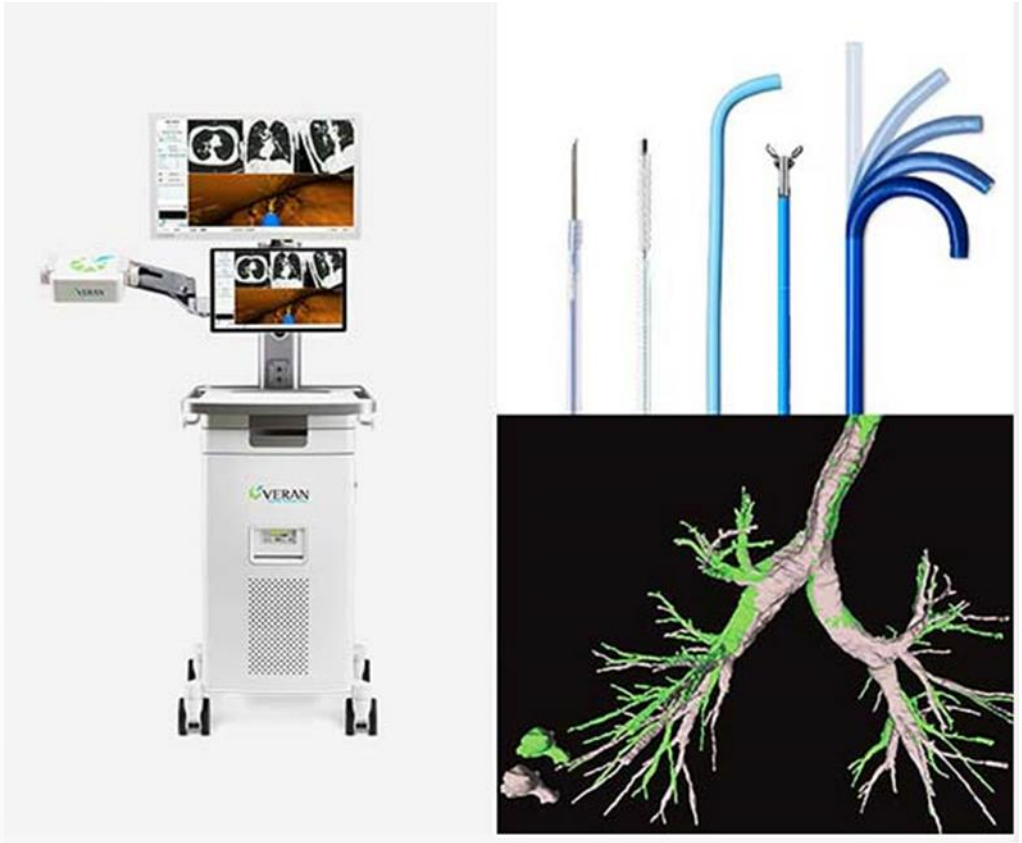
	SuperD
TP	484
FP	0
TN	284
FN	220

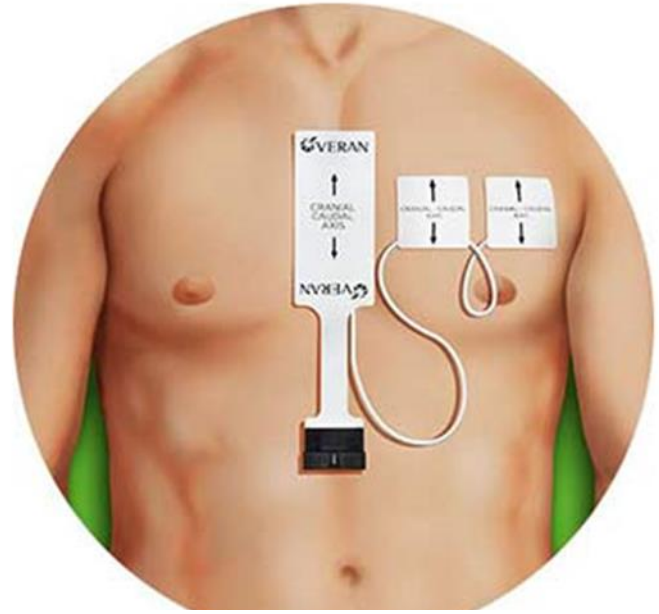
12 month diagnostic yields : 72.9%

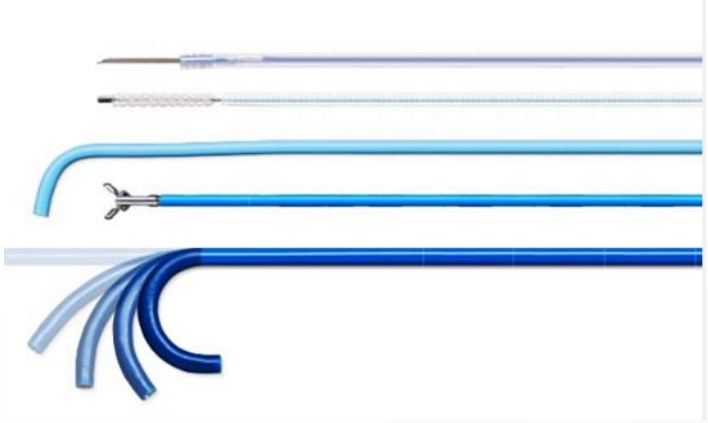
2018 Journal of Thoracic Oncology Vol. 14 No. 3

Electromagnetic Navigation Bronchoscopy

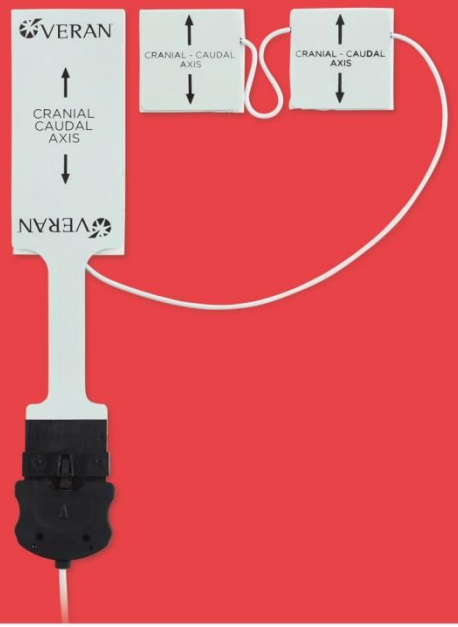
Spin Drive (Veran Medical)







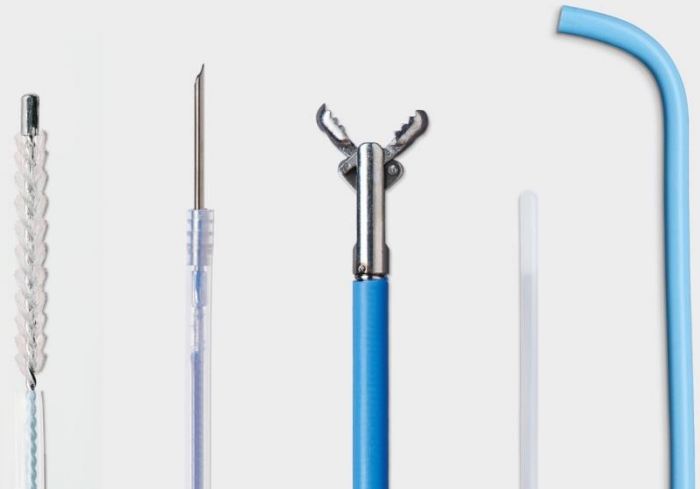
1: Scan



2: Plan

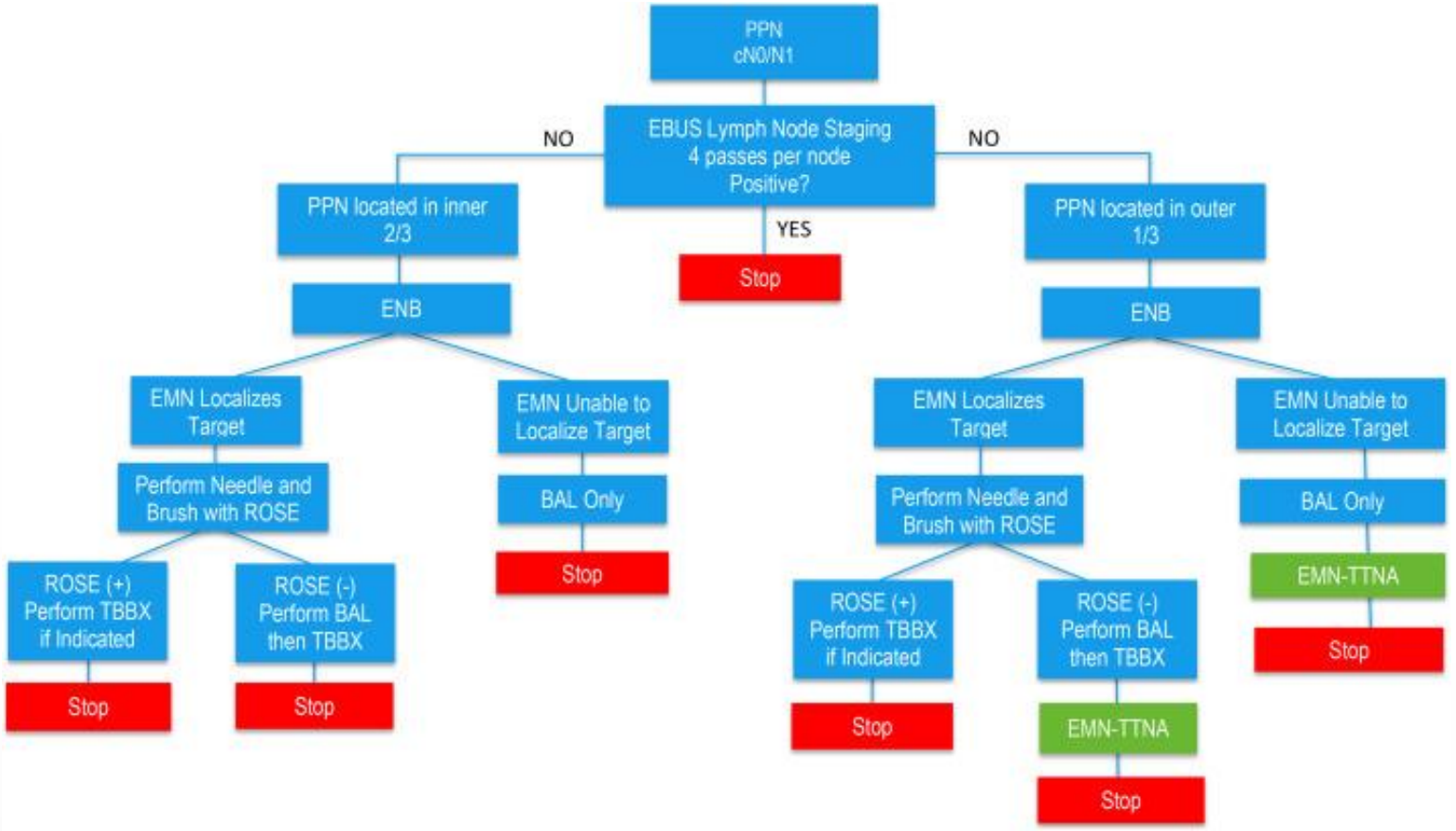
3: Access

4: Biopsy and Guide Treatment



Multicenter, Prospective ALL IN ONE trial

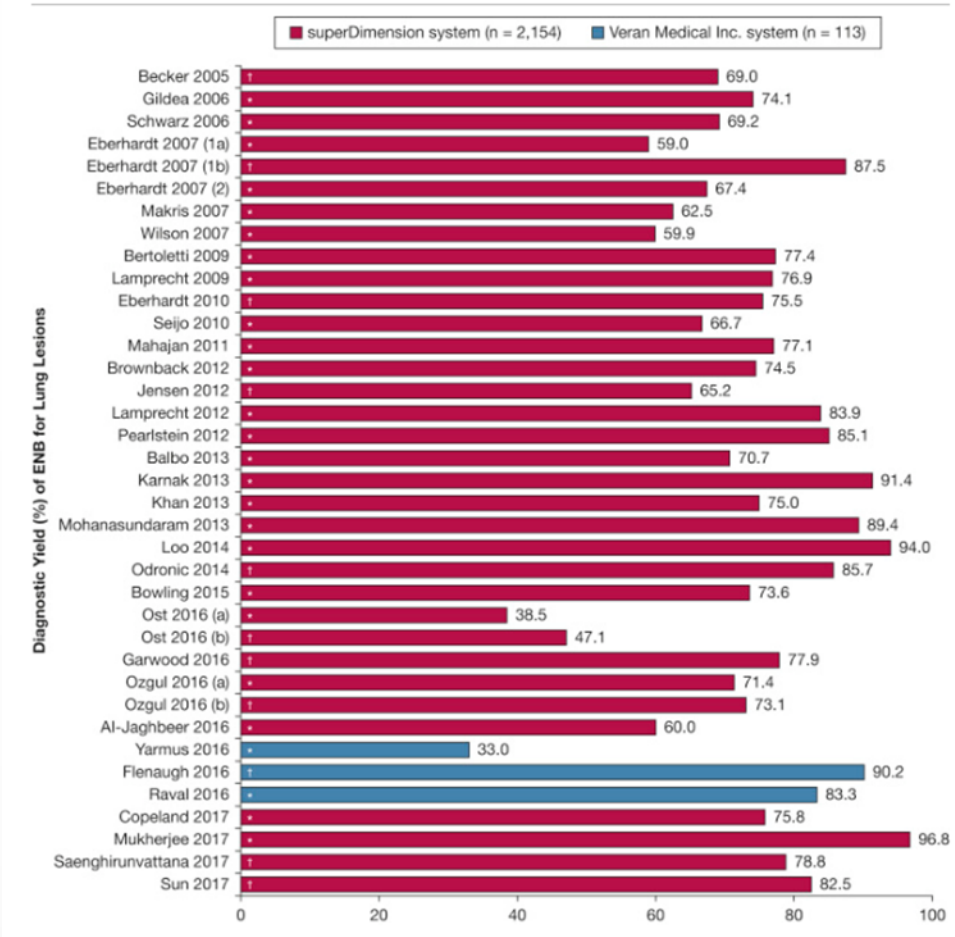
Spin Drive (Veran Medical)



Contemporary Clinical Trials, 2018-08-01

Electromagnetic Navigation Bronchoscopy

Diagnositc yields



	SuperD	Veran
High	96.8%	90.2%
Low	38.5%	33.0%

Chest 2018 Oct;154(4):935-947

Guided Bronchoscopy

Meta-analysis of Diagnositc yields

Table 2—*Inverse Weighted Diagnostic Yield Overall and by Modality*

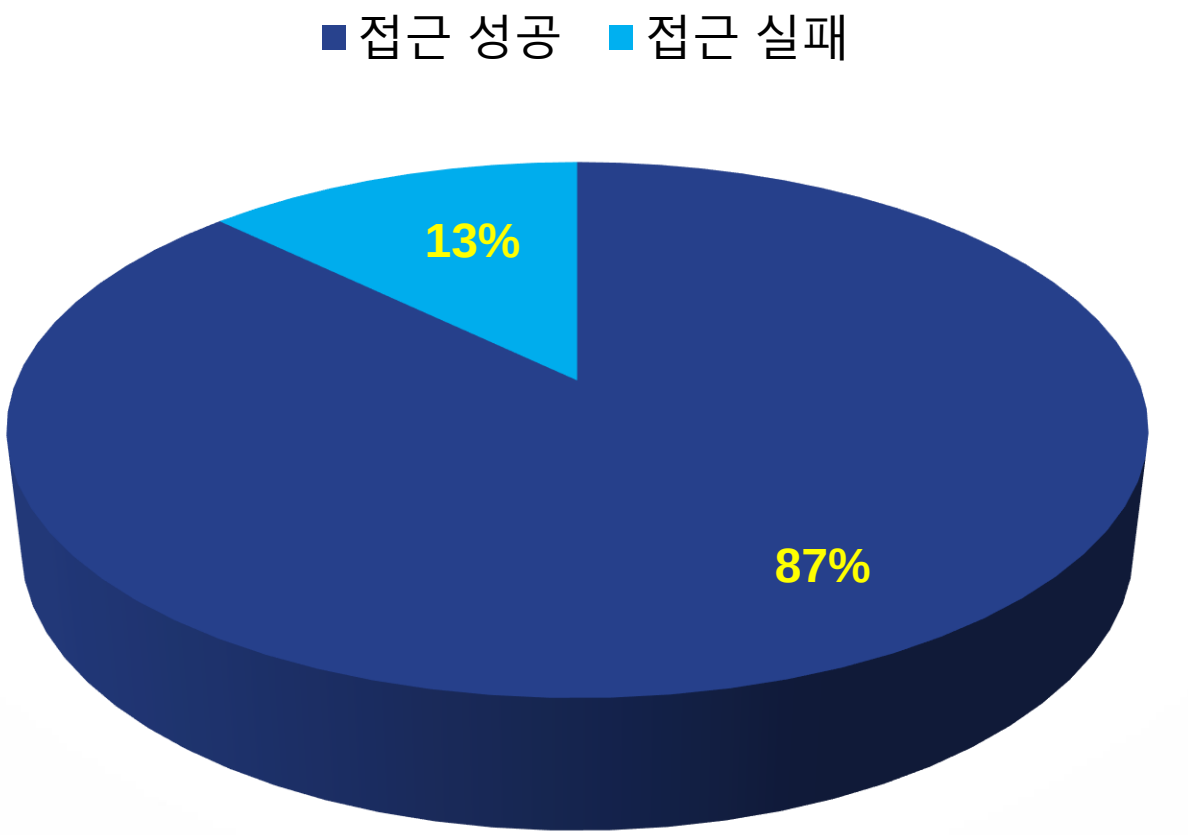
Technology	Studies, No.	Weighted Proportion, %	95% CI	Q Statistic	Q *P* Value
VB	10	72.0	(65.7-78.4)	21.0	.01
ENB	11	67.0	(62.6-71.4)	13.3	.21
GS	10	73.2	(64.4-81.9)	63.8	< .0001
U	11	70.0	(65.0-75.1)	15.2	.12
R-EBUS	20	71.1	(66.5-75.7)	84.2	< .0001
All	39	70.0	(67.1-72.9)	119.4	< .0001

See Table 1 legend for expansion of abbreviations.

CHEST 2012; 142(2):385–393

Radial EBUS at SMC

2016.06 ~ 2017.05 211 cases



Radial EBUS at SMC (접근 가능한 case)

» **2016.06 ~ 2017.05 211 cases**

	Final diagnosis: malignant	Final diagnosis: benign	Total
R-EBUS: Positive for malignancy	109 True positive	0 False positive	109
R-EBUS: Negative for malignancy	34 False negative	27 True negative	61

Diagnostic accuracy: 80%

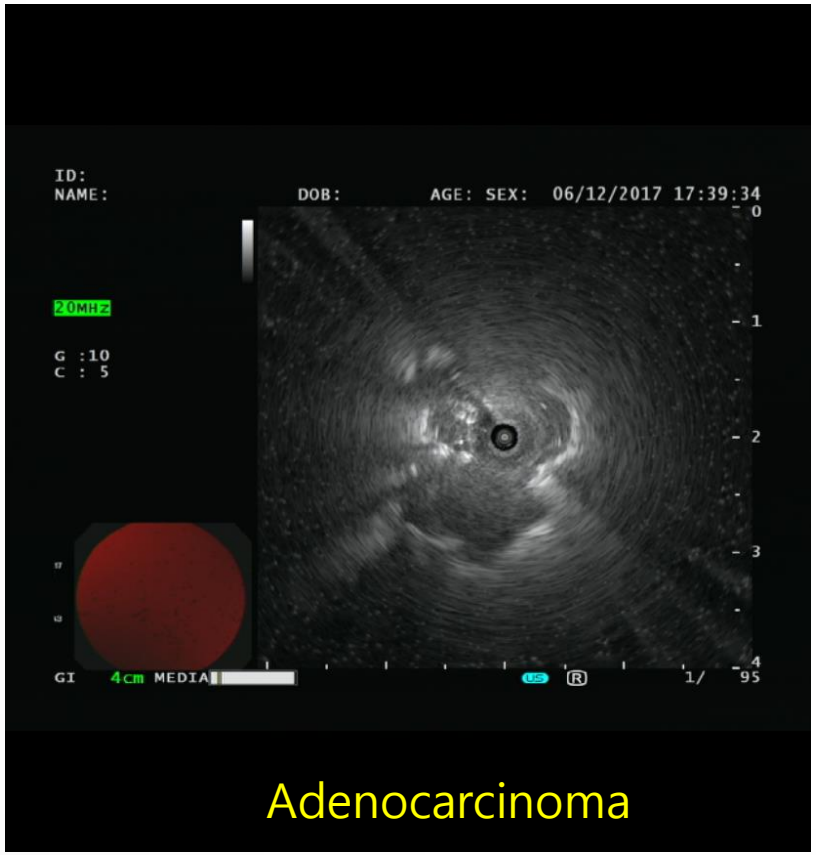
Sensitivity 76%

NPV 44%

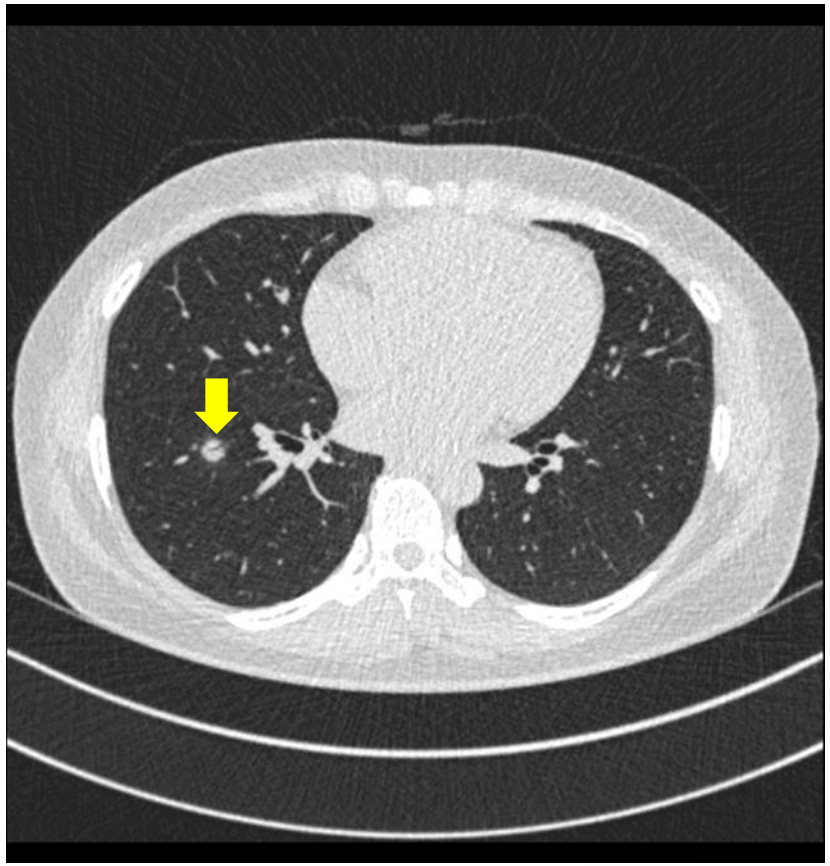
Guided Bronchoscopy

Thin slice Chest CT의 필요성

Thin slice Chest CT가 필요함 (적어도 1mm cut)



5 mm

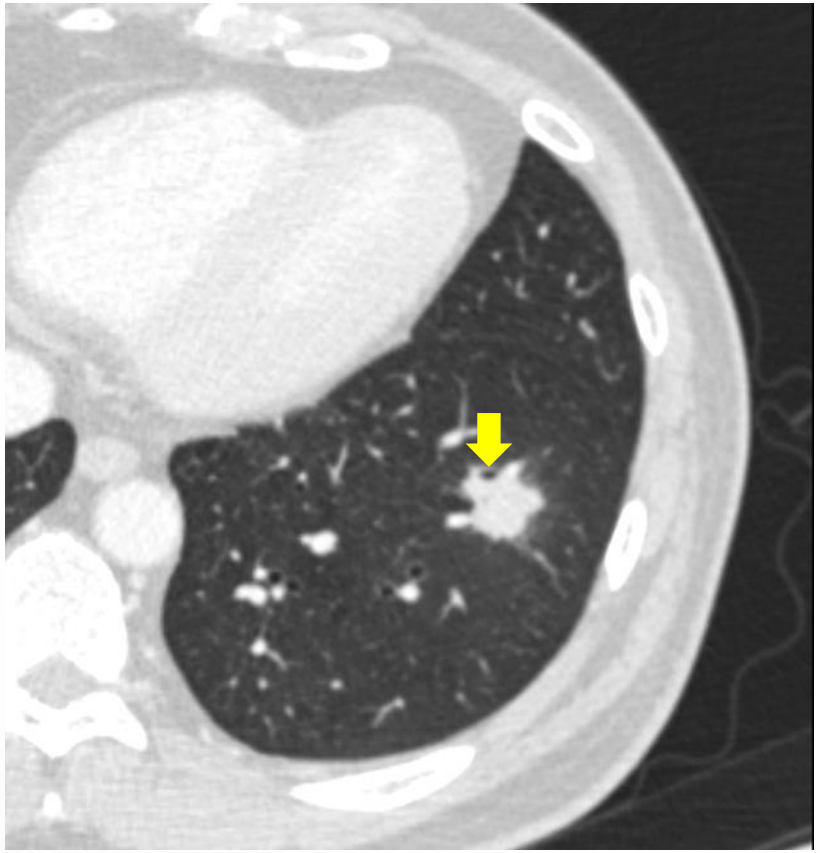


0.6 mm

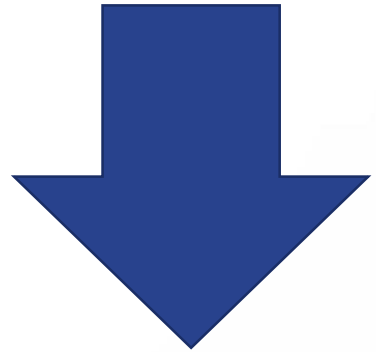
Guided Bronchoscopy

» 어떤 경우에 의뢰 되어야 하는가?

전제 조건 : 병변이 기관지 안에 있어야 함, 기관지로 접근이 가능 해야 함



진단율



Extrabronchial location하는 경우는?

Bronchoscopic TransParenchyma Nodule Access (BTPNA)

ARCHIMEDES
– TOTAL LUNG ACCESS PLATFORM

Extrabronchial location하는 경우는?

» Bronchoscopic TransParenchyma Nodule Access (BTPNA)

Lung cancer

Editor's choice
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ORIGINAL ARTICLE

Bronchoscopic transparenchymal nodule access (BTPNA): first in human trial of a novel procedure for sampling solitary pulmonary nodules

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[5]Department of Thoracic Surgery, Thoraxklinik, University of Heidelberg, Heidelberg, Germany
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ABSTRACT

Introduction The promise of benefits from lung cancer screening is tempered by the false positive rate and the need to perform diagnostic procedures to determine the aetiology of the solitary pulmonary nodules (SPN) identified. We have developed a novel procedure allows sampling of SPNs via a transparenchymal approach, and report the results from this as a fi human trial.

Methods This study was a prospective single-a interventional study. We recruited patients with a detected on CT imaging, which was suspicious f cancer, who were suitable for surgical resection. the subject's CT, an optimal airway wall point of (POE), and an avascular path through lung tissue the POE to the SPN was calculated. A tunnel tra created from the POE to the nodule using a set catheter-based tools under fused fluoroscopy gui The patients proceeded to surgical resection imm after the biopsy. The participants were followed- 6 months after the procedure. The primary endpoint of the study was to evaluate the feasibility to access and biopsy the nodule.

Results Twelve patients were recruited, and a tunnel

Key messages

What is the key question?

ripheral

new
monary

access
heral
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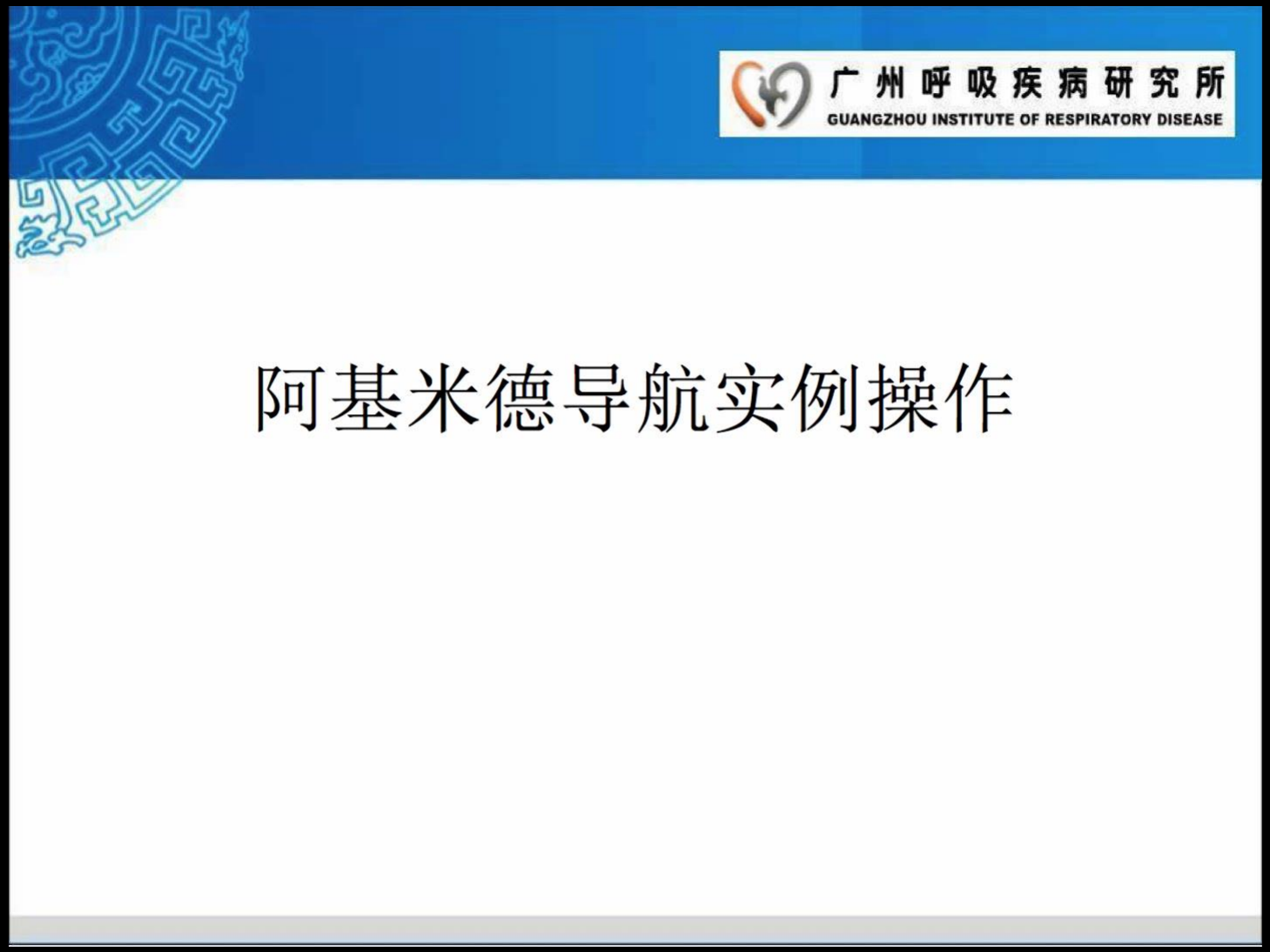
ally

feasible with a high success rate.

12 patients recruited

10 patients Success

1st case in China



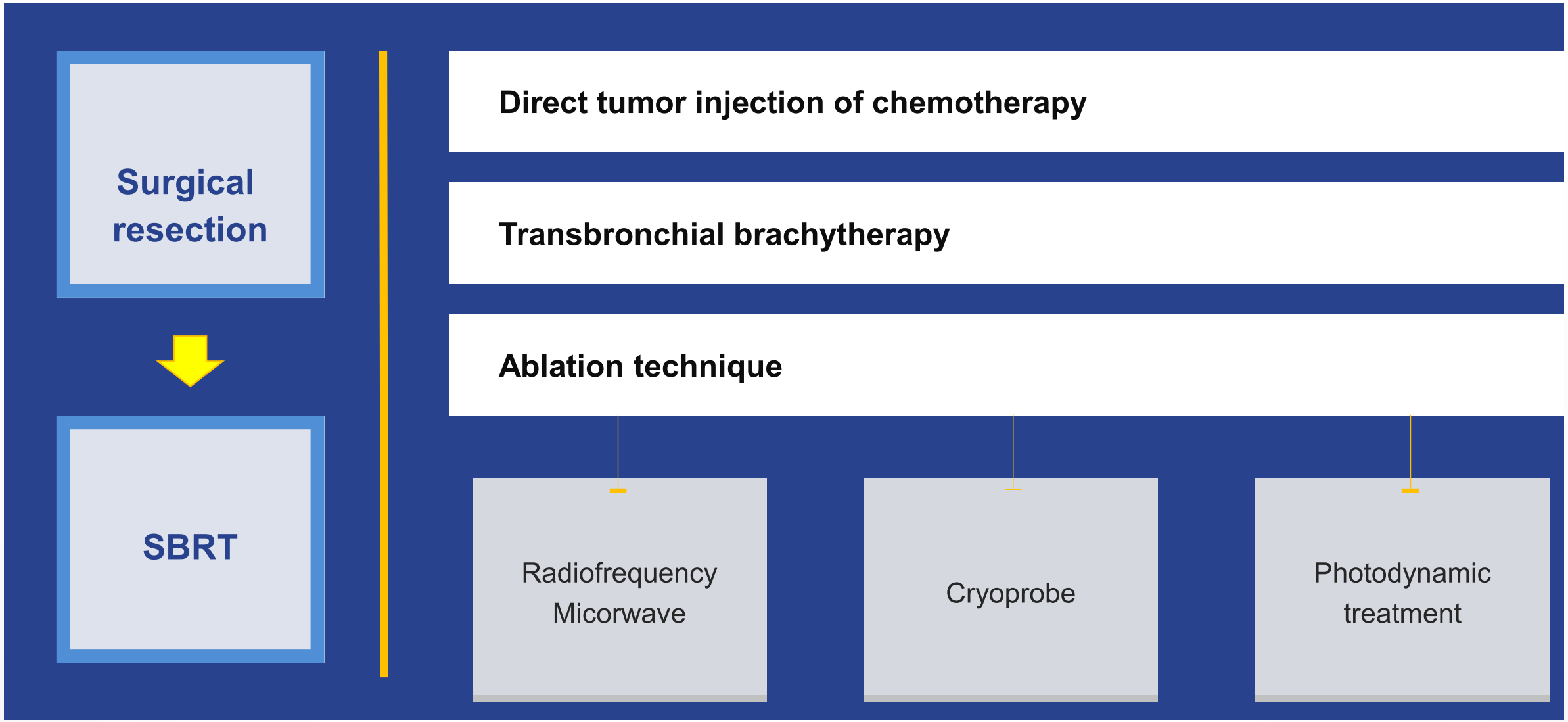
Diagnostic Bronchoscopy

	Radial ebus	Radial ebus+GS	Lung point navigation	EMN	TBA
Cost	+	++	+++	++++	NA
Pure GGO	-	-	-/+	++	-
Navigation	+	+	+++	++	++++
TBLB	+++	++	++	+ ~ +++	++
Fluoroscopy	-	++	++	-	+++
Maintenance	+	+++	NA	++	NA
Outside the bronchus	-	-	-	++	+++
Sedation	Conscious	Conscious	Conscious	Conscious/General	General

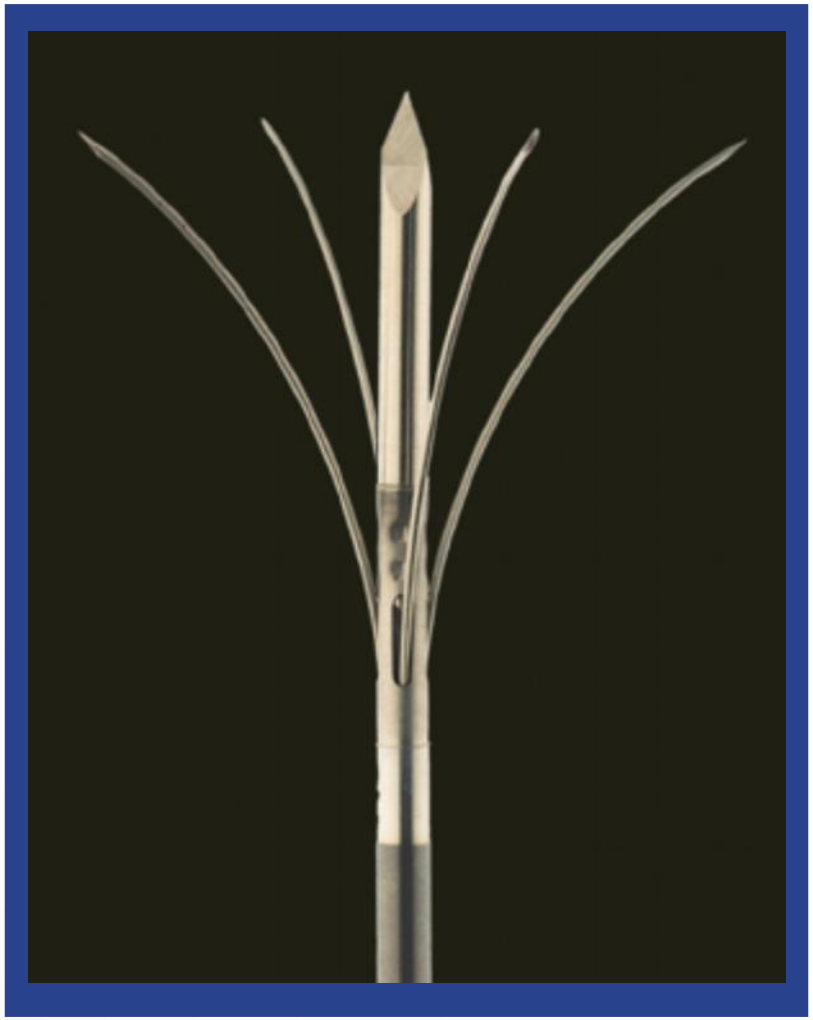
II

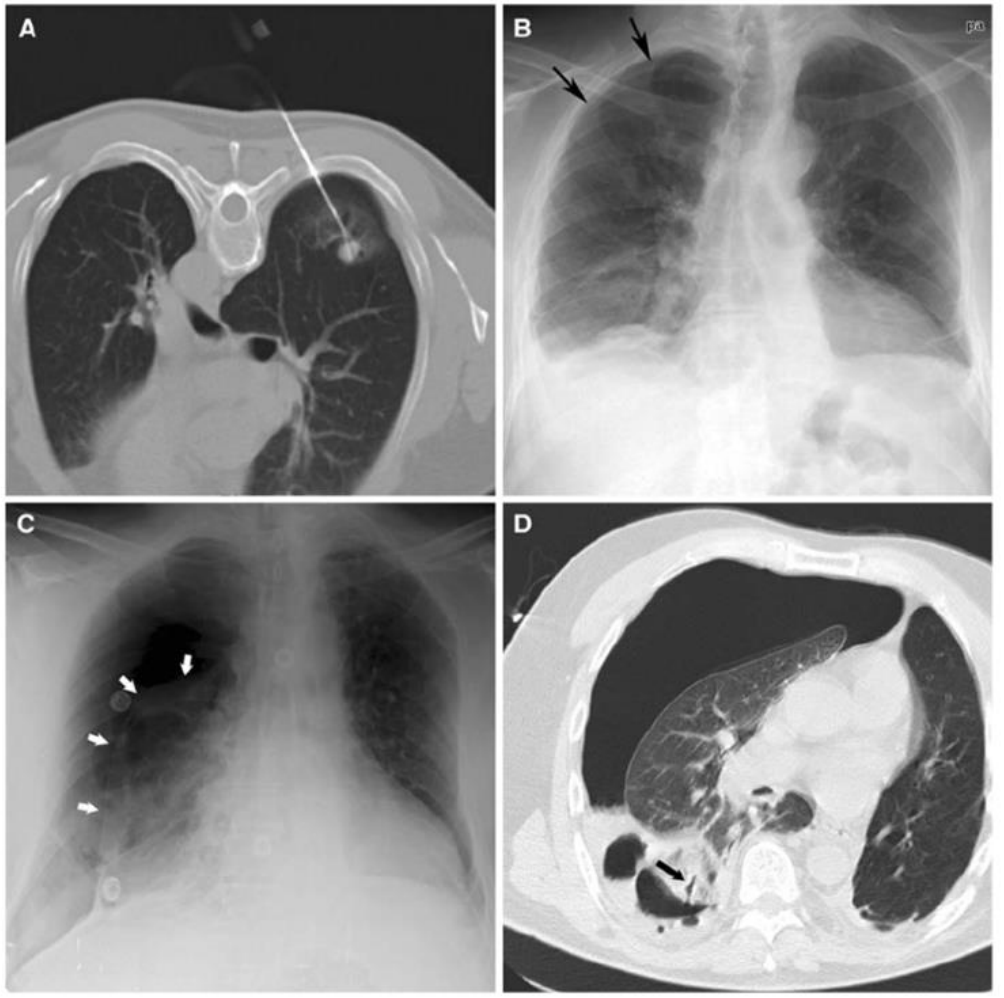
Bronchoscopic treatment of lung cancer

Treatment of peripheral lung cancer (cT1 No Mo)



Percutaneous ablation of peripheral lung cancer





Cardiovasc Intervent Radiol (2009) 32:484–490

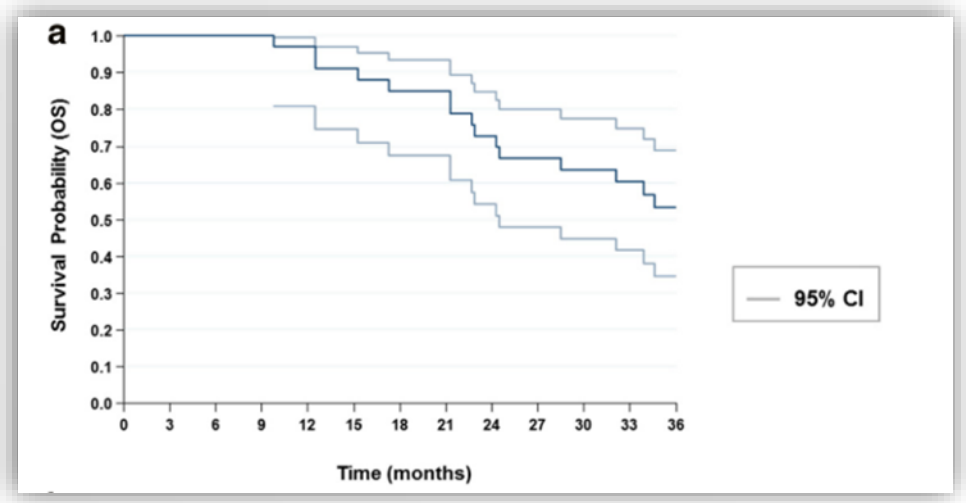
RF ablation of stage IA NSLCL

Ineligible for surgery

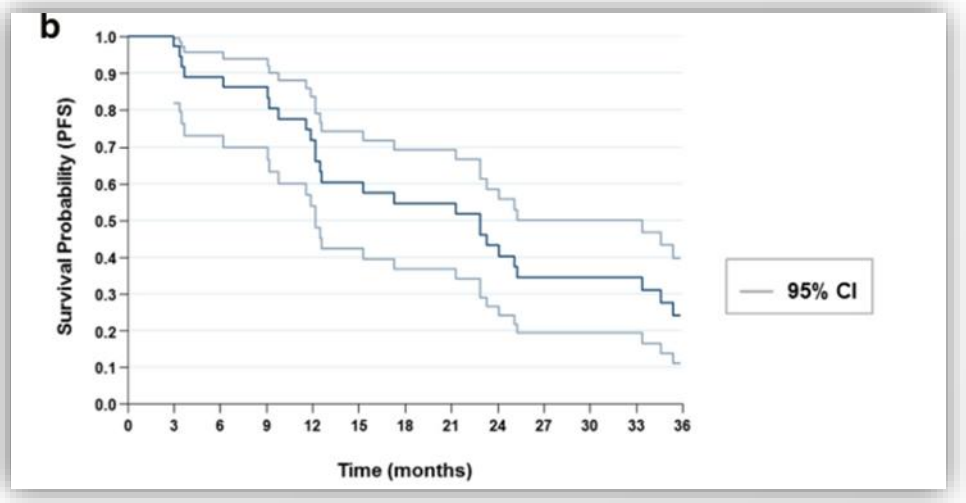
Prospective multicenter phase II trial

biopsy-proven stage IA NSCLC with a maximum tumor diameter ≤ 3cm

Under CT-guided percutaneous ablation



1yr OS: 91.67%, 3yr OS: 58.3%



1yr PFS: 71.76%, 3yr PFS: 25%

Journal of Cardiothoracic Surgery (2018) 13:91

Question for bronchoscopy guided ablation

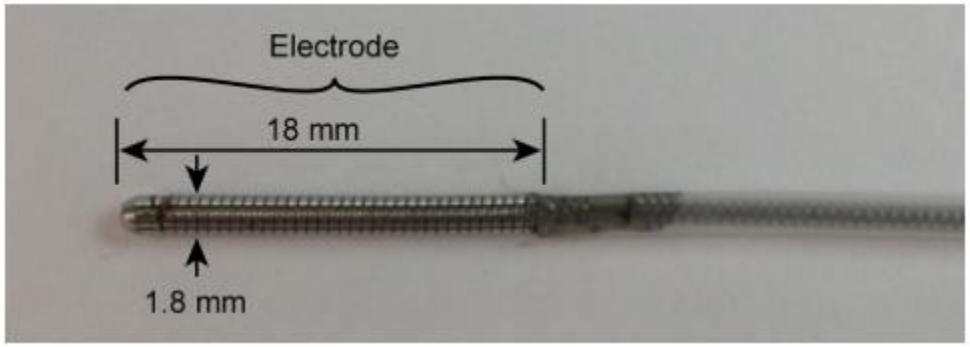
Biopsy and ablation simultaneously

Recent advancer of bronchosocpy technique for peripheral lung nodule

To access peripheral lung nodules in combination with the simultaneous bronchoscopic ablation

→ Least invasive treatment

New ablation device for bronchoscoy



Monopolar RF catheter

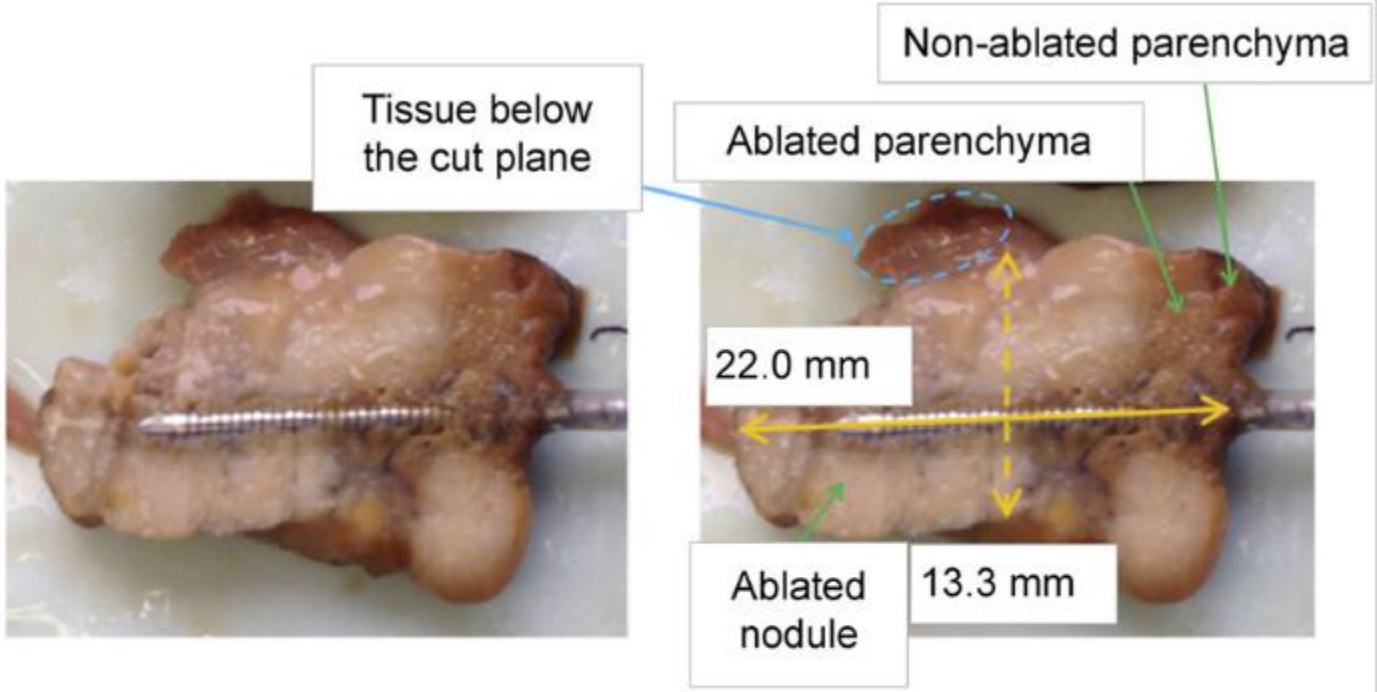
18 mm length

1.8 mm diameter

good flexibility → Upper lober 접근 가능

Lung Cancer 124 (2018) 125–129

New ablation device in the resected lung tumor



- Both radial ablation distances reached the edge of tissue

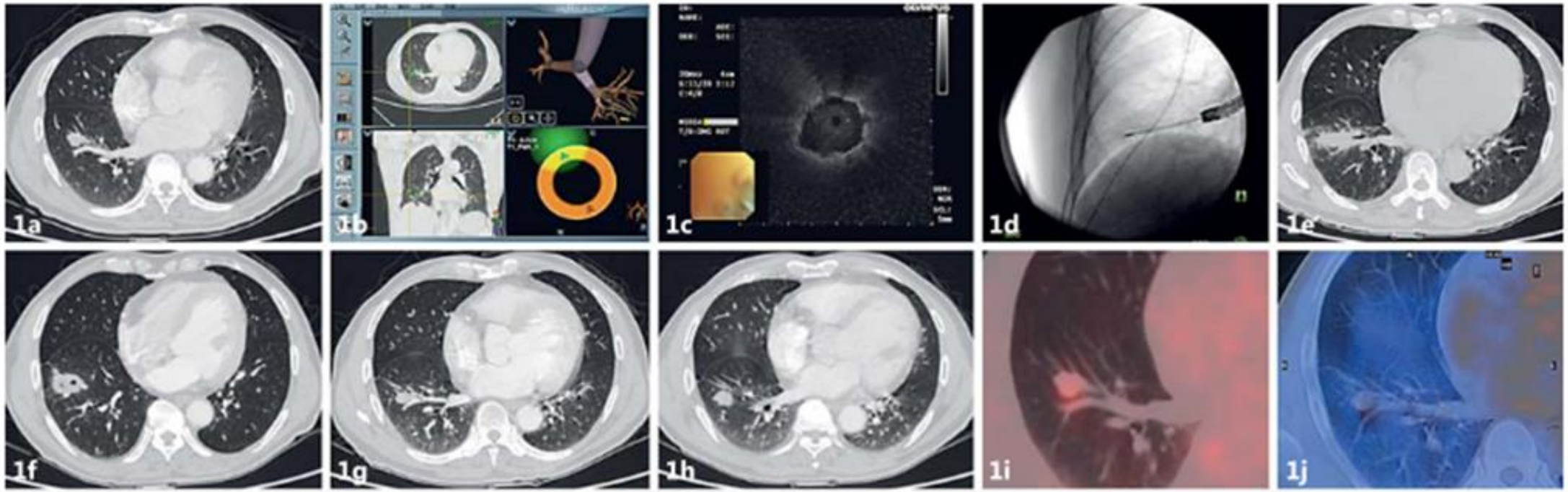
Five resected lung tumor

	Ablation zone
Major axis length	18.9 ~ 22.8 mm
Minor axis length	13.3 ~ 18.0 mm

Lung Cancer 124 (2018) 125–129

Navigation guided RF ablation

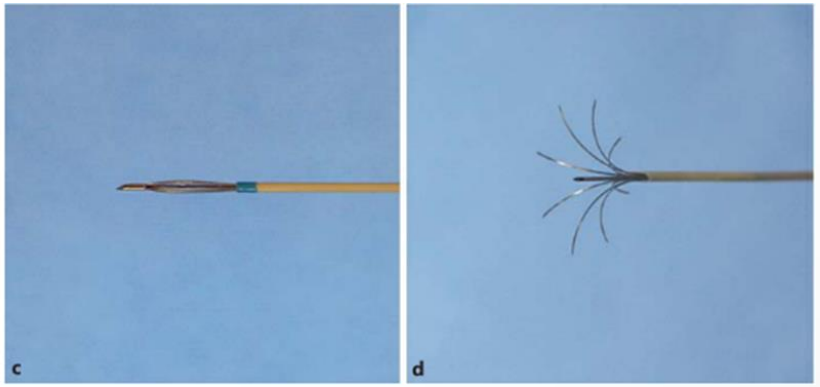
Case 1



13X11 mm sized lung nodule in the RLL

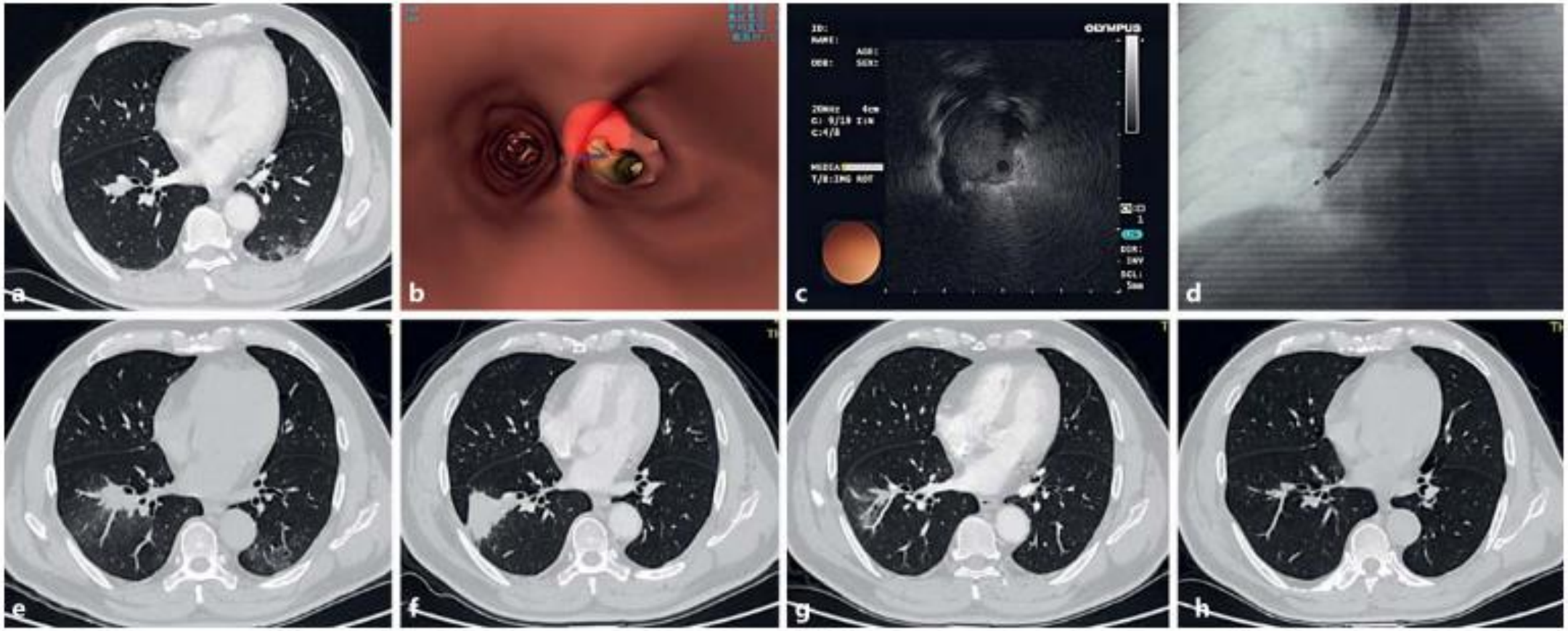
TBLB: SQC

EMB guided bronchoscopic RFA



Navigation guided RF ablation

Case 3

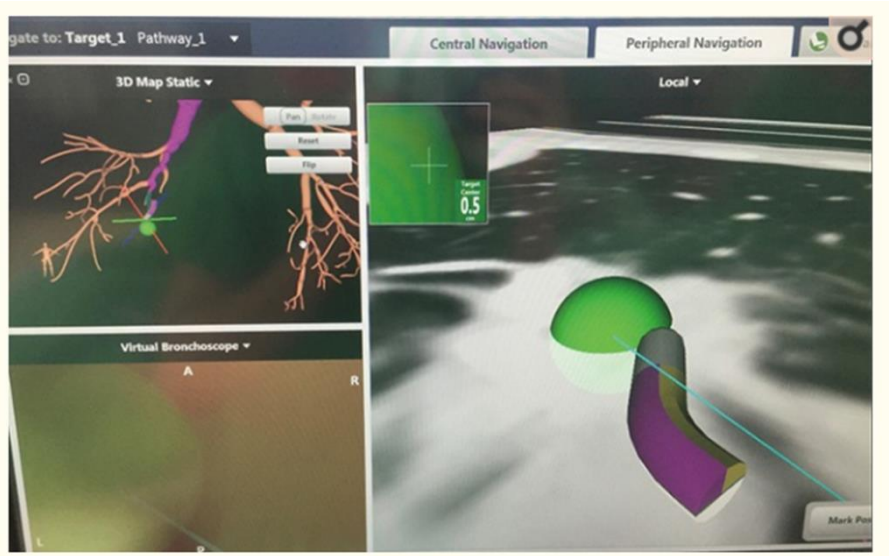


21.8X11.9 mm sized lung nodule in the RLL

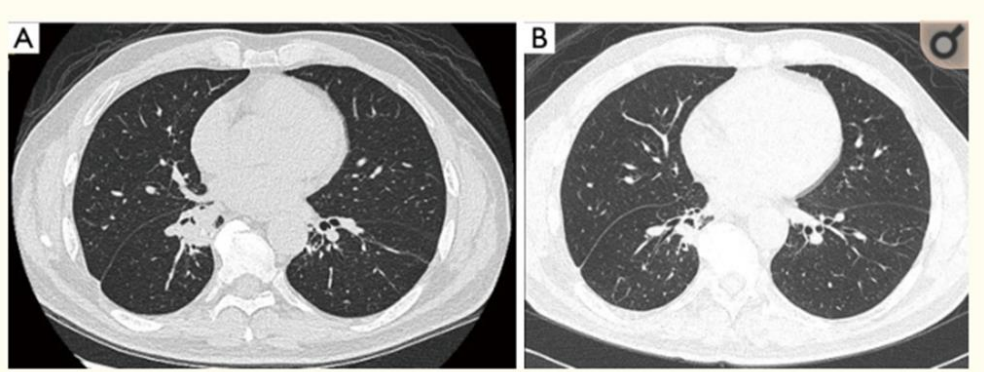
Lung metastasis of RCC

Respiration. 2017;94(3):293-298

Navigation guided PDT for lung nodule

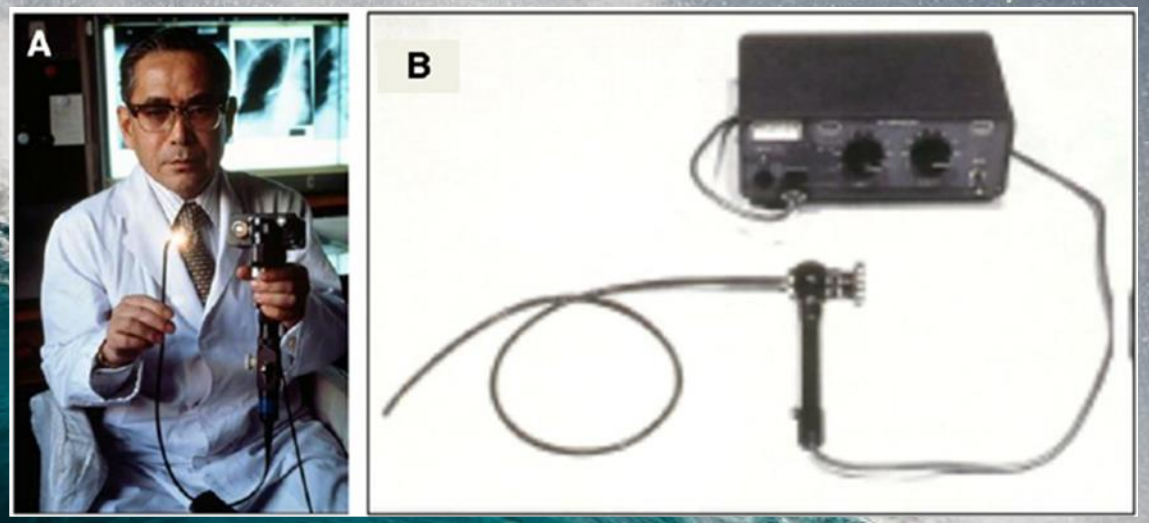


No	Age/sex	Diagnosis	Location	Size (mm)	Admission day	Follow time (months)	Progression-free survival	Complications
1	75/M	Lung metastasis from colon cancer	RLL	36	5	16	+ (PR)	–
2	57/F	Lung metastasis from colon cancer	RUL	20	4	14	+ (PR)	–
3	65/F	Lung adenocarcinoma	RLL	8	3	12	+ (CR)	Skin hypersensitivity, grade I



J Thorac Dis. 2018 Apr

Gustav Killian
The first bronchoscopy in 1897



Shigeto Ikeda
fiberoptic bronchoscopy Invented in 1966

Convex probe EBUS

Radial probe EBUS

Radial balloon EBUS

Future of the bronchoscopy

Diagnostic bronchoscopy

Development of transbronchial biopsy technique

- needle aspiration under real time ultrasound guidance

Robotic bronchoscopy

Limitation of bronchoscopy guided treatment

SBRT, generally acceptable in case of surgical contraindication

- SBRT vs Guided therapy

Confirmation of RF zone

Advantage of bronchoscopy guided treatment

Less complication than percutaneous approach

Repeat treatment

- Progression after SBRT
- Progression after previous RF ablation

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Thank you for your attention