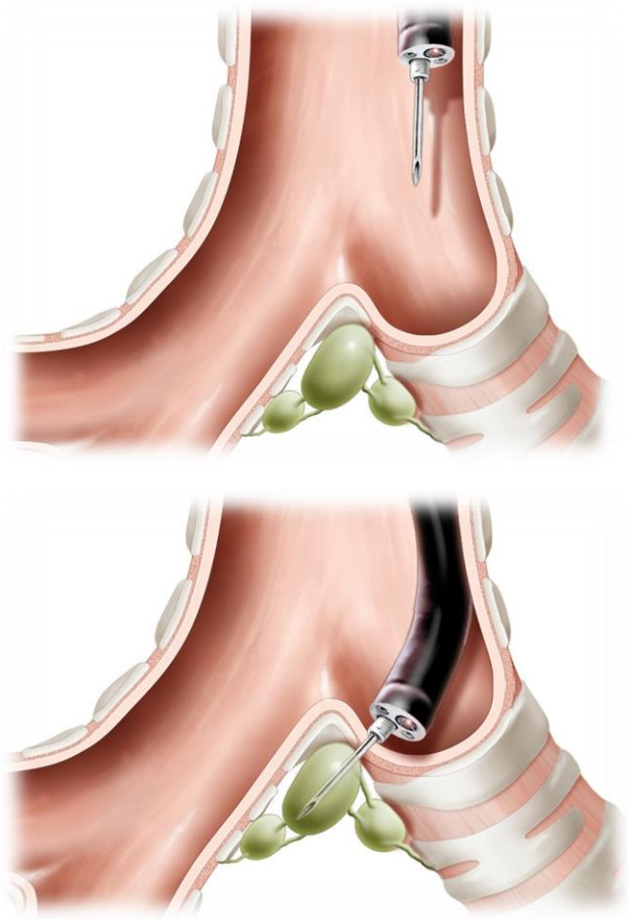
Convex and Radial Probe EBUS for Lung Cancer Diagnosis & Staging

부산대병원
호흡기내과/폐암센터
엄중섭

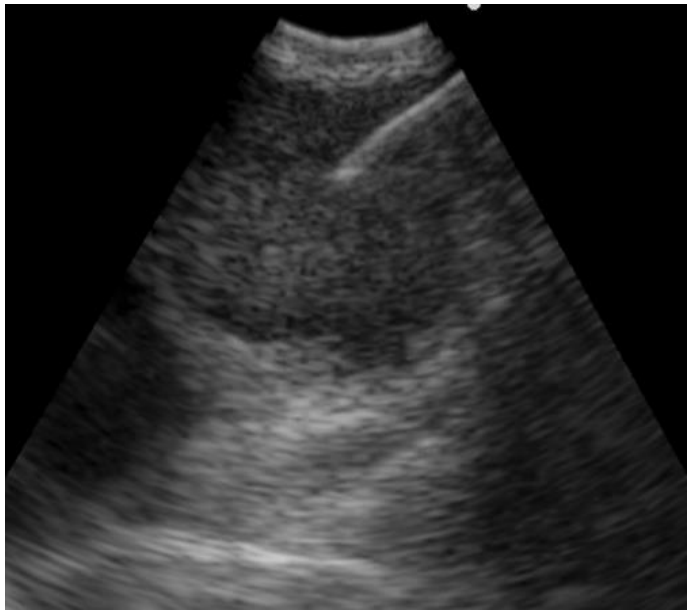
TBNA for mediastinal LNs

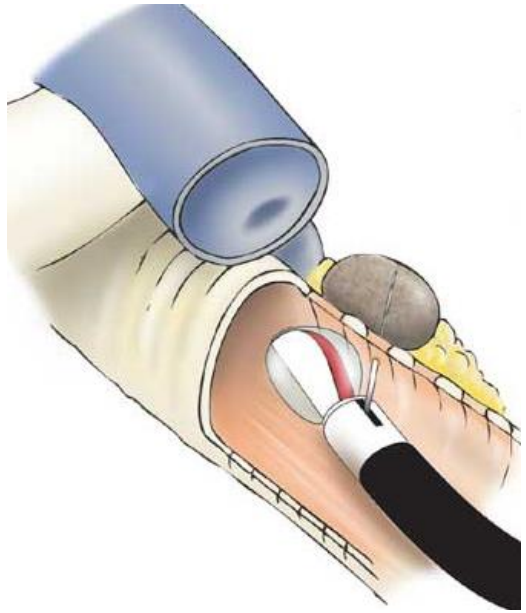
Conventional TBNA

- Conventional TBNA
  - Sensitivity: 78 %?
  - Specificity: 99 %
  - Factors contributing to successful TBNA
    - Lymph nodes > 20 mm in the short axis
    - 4R and 7 lymph node location
    - 5-7 aspirates per node



Convex probe EBUS



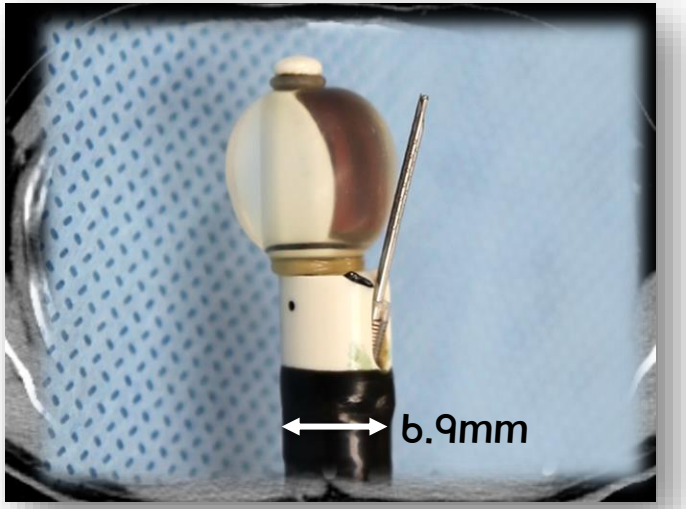


Convex probe EBUS

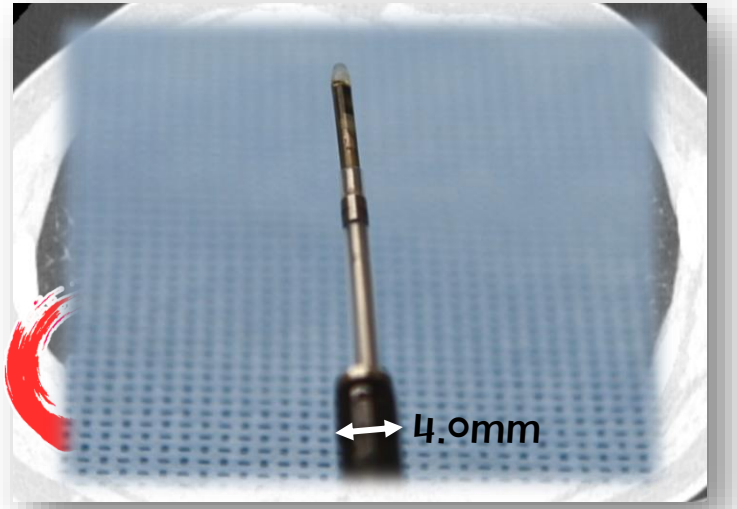
Versus

Radial probe EBUS

TBNA
for mediastinal structures



TBLB
for peripheral lung lesion



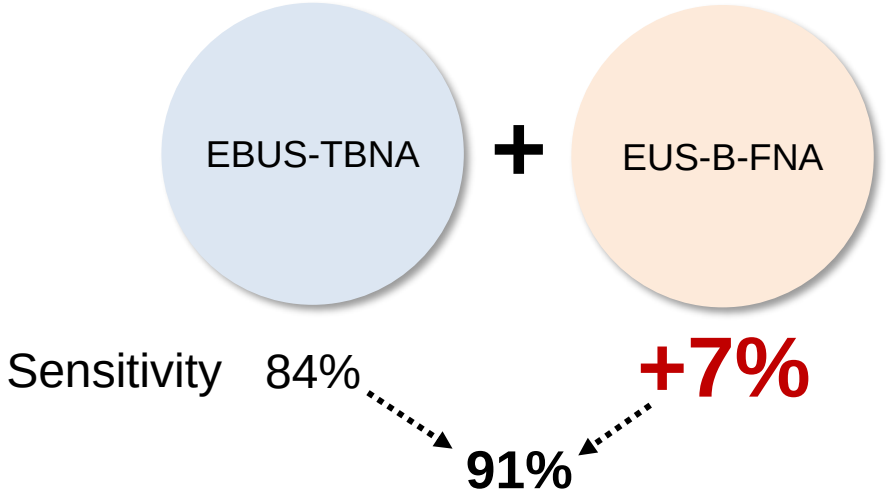
CHEST

Original Research

INTERVENTIONAL PULMONOLOGY

Transbronchial and Transesophageal Fine-Needle Aspiration Using an Ultrasound Bronchoscope in Mediastinal Staging of Potentially Operable Lung Cancer

Bin Hwangbo, MD, PhD; Geon-Kook Lee, MD, PhD; Hee Seok Lee, MD; Kun-Young Lim, MD; Soo-Hyun Lee, MD; Hyae-Young Kim, MD, PhD; Hyun Sung Lee, MD, PhD; Moon Soo Kim, MD; Jong Mog Lee, MD; Byung-Ho Nam, PhD; and Jae Ill Zo, MD, PhD

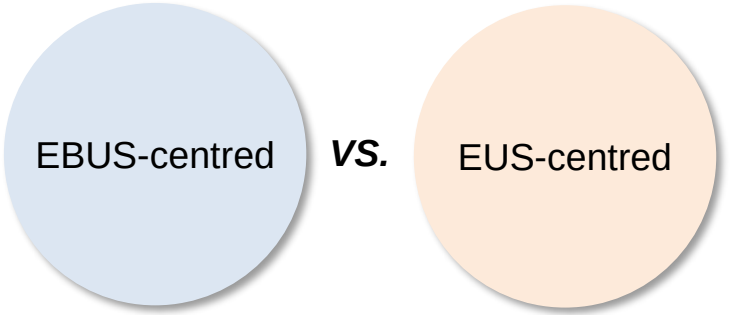


Hwangbo B, et al. Chest. 2010;138(4):795-802.

ORIGINAL ARTICLE

EBUS-centred versus EUS-centred mediastinal staging in lung cancer: a randomised controlled trial

Hyo Jae Kang,[1] Bin Hwangbo,[1] Geon-Kook Lee,[2] Byung-Ho Nam,[3] Hyun-Sung Lee,[1] Moon Soo Kim,[1] Jong Mog Lee,[1] Jae Ill Zo,[1] Hee Seok Lee,[1] Ji-Youn Han[1]

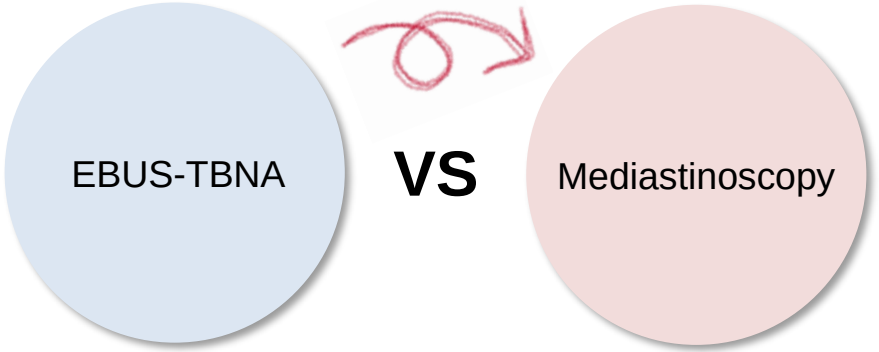


Kang HJ, et al. Thorax. 2014;69(3):261-8.

Endobronchial Ultrasound versus Mediastinoscopy for Mediastinal Nodal Staging of Non–Small-Cell Lung Cancer

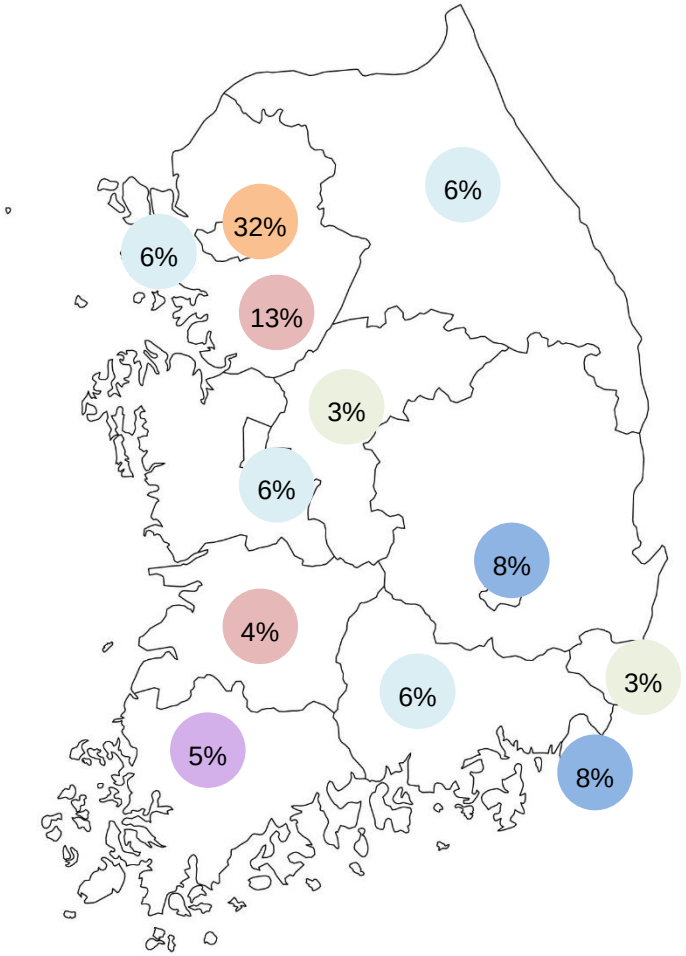
Sang-Won Um, MD, PhD, Hong Kwan Kim, MD, PhD,† Sin-Ho Jung, PhD,‡ Joungho Han, MD, PhD,§ Kyung Jong Lee, MD,* Hye Yun Park, MD, PhD,* Yong Soo Choi, MD, PhD,† Young Mog Shim, MD, PhD,† Myung-Ju Ahn, MD, PhD,‖ Keunchil Park, MD, PhD,‖ Yong Chan Ahn, MD, PhD,¶ Joon Young Choi, MD, PhD,# Kyung Soo Lee, MD, PhD,** Gee Young Suh, MD, PhD,* Man Pyo Chung, MD, PhD,* O Jung Kwon, MD, PhD,* Jhingook Kim, MD, PhD,† and Hojoong Kim, MD, PhD**

- Prospective study (N = 127)

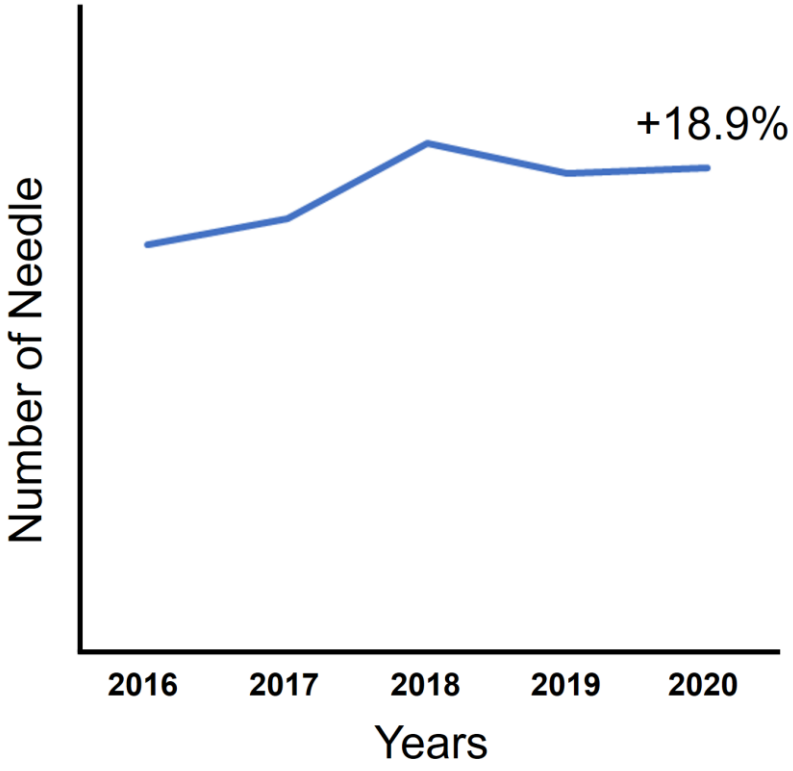


Sensitivity	88%	81%	$P < 0.001$
Accuracy	93%	89%	$P < 0.001$

Um SW, et al. J Thorac Oncol. 2015;10(2):331-7.



- CP-EBUS scope distribution

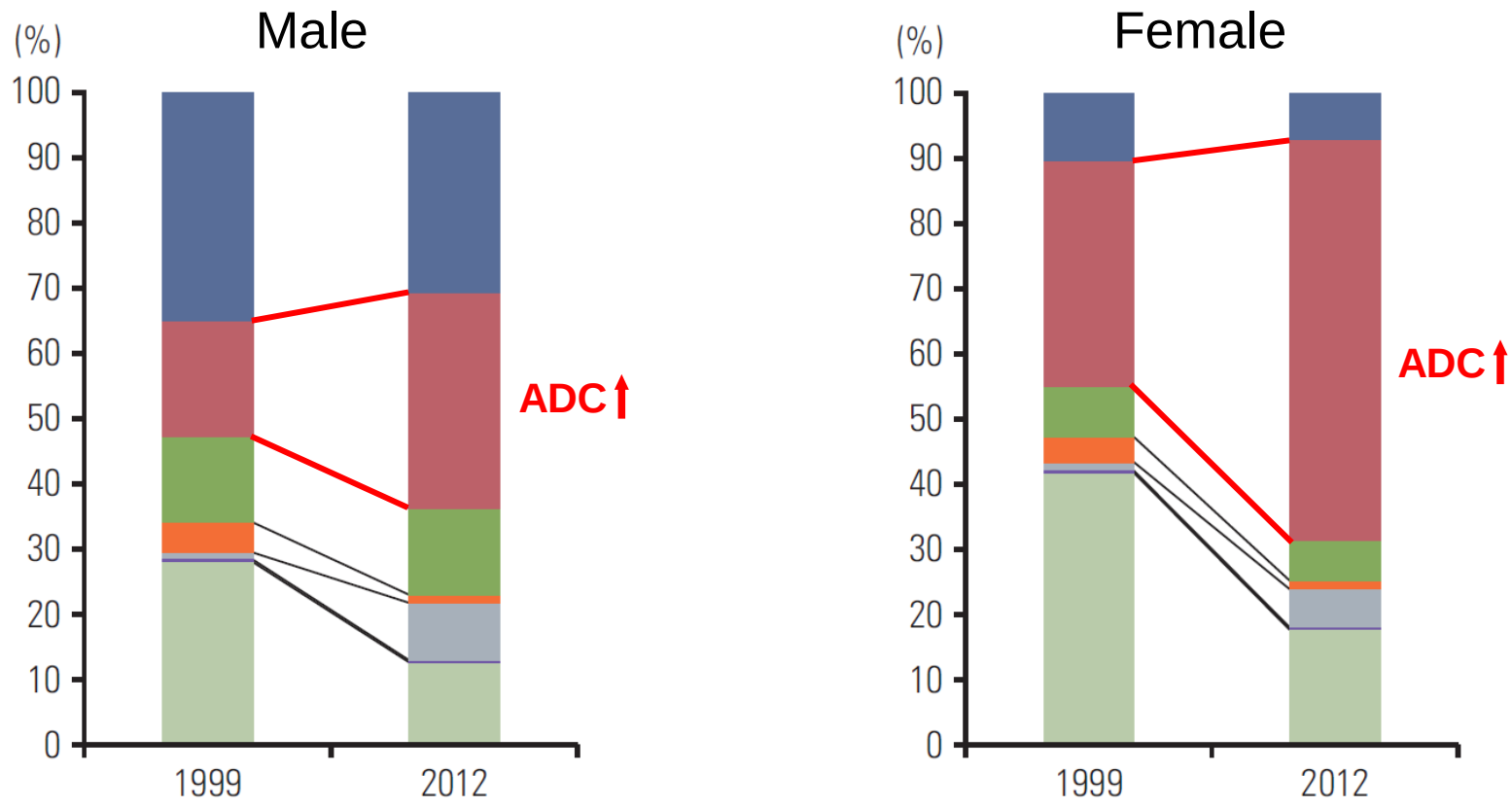


- Trend in the number of TBNA needle sales

Data from Olympus Korea, 2021

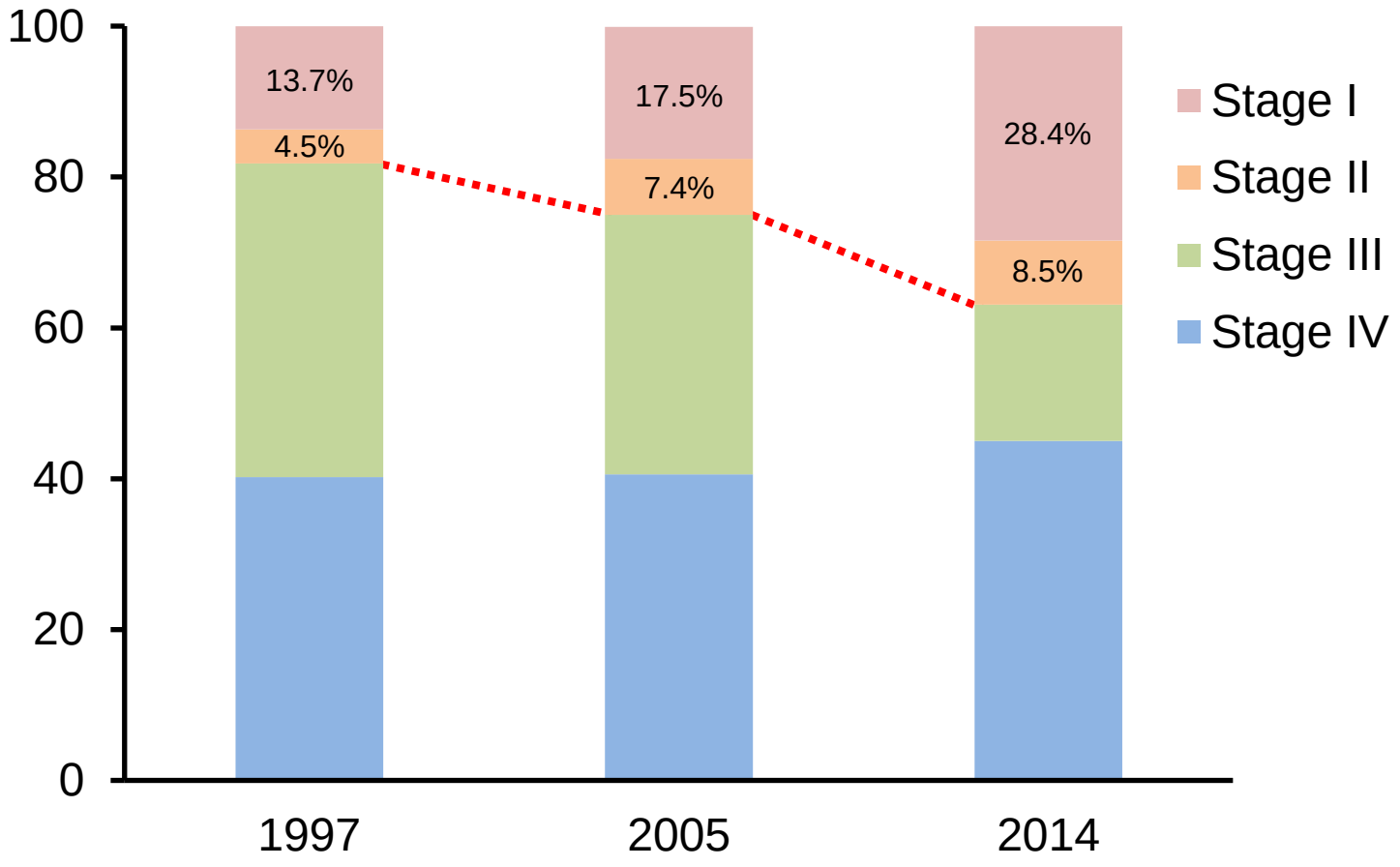
Bronchoscopy for PLL

Changes in Lung Cancer Pathology



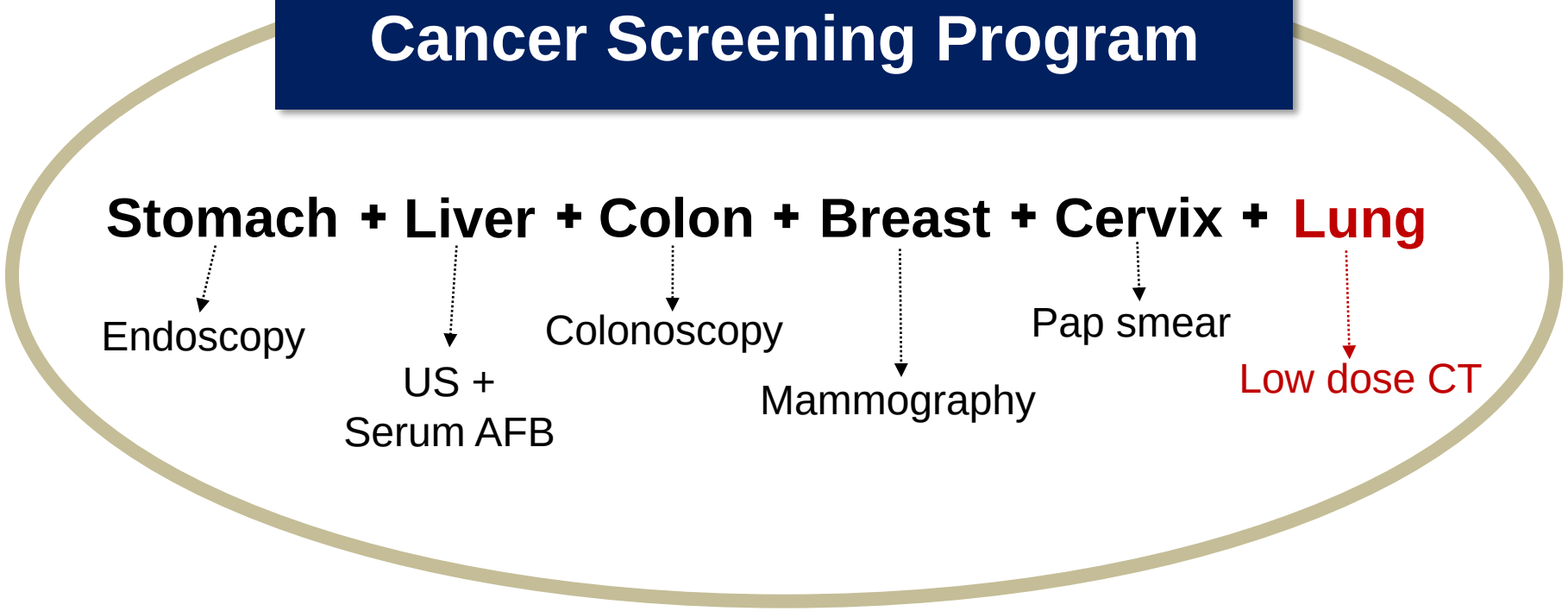
Cancer Res Treat. 2017 Jul;49(3):616-626.

Changes in Lung Cancer Stages



Tuberc Respir Dis (Seoul). 2021 Apr;84(2):89-95.

Korean National Cancer Screening Program



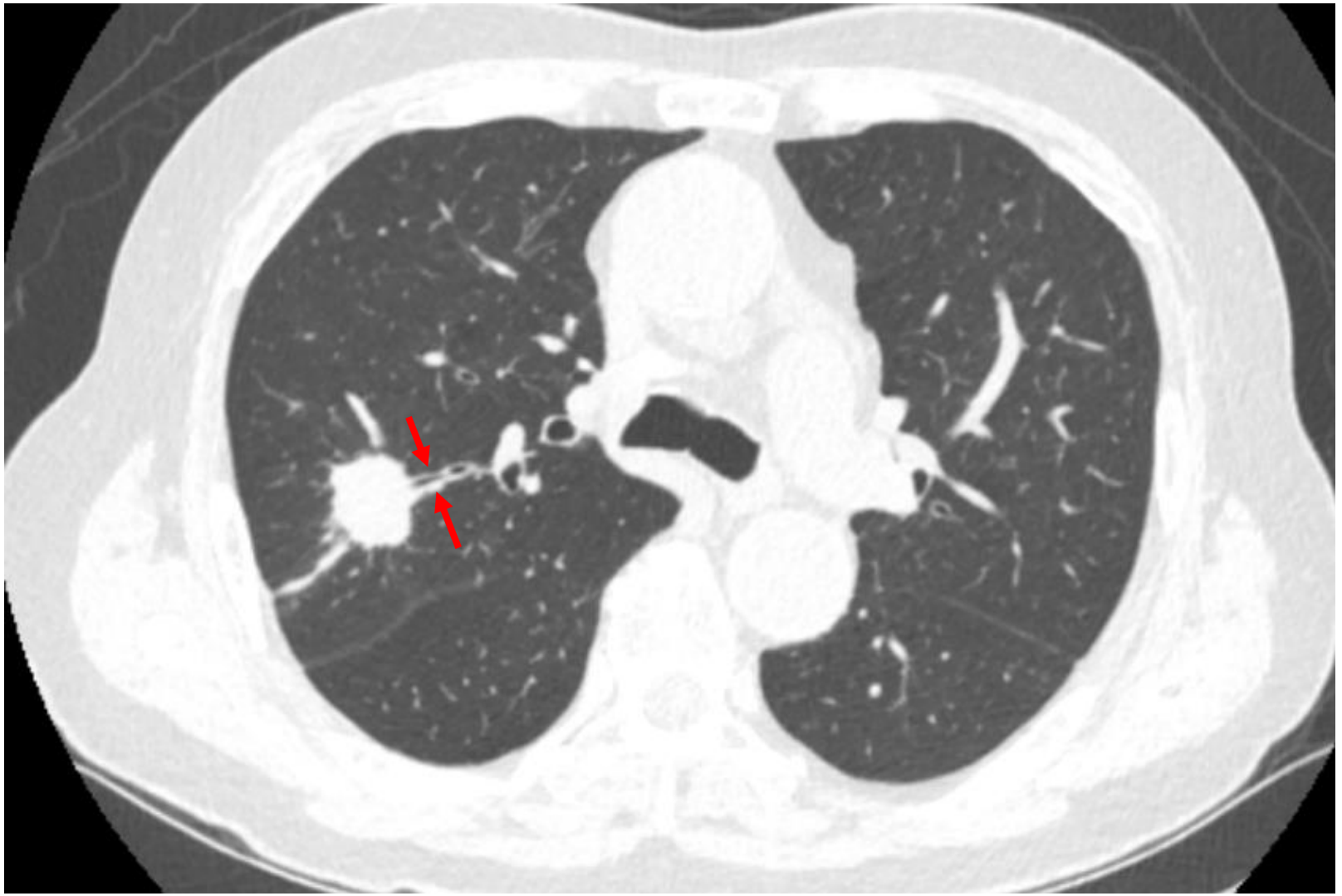
Bronchoscopy

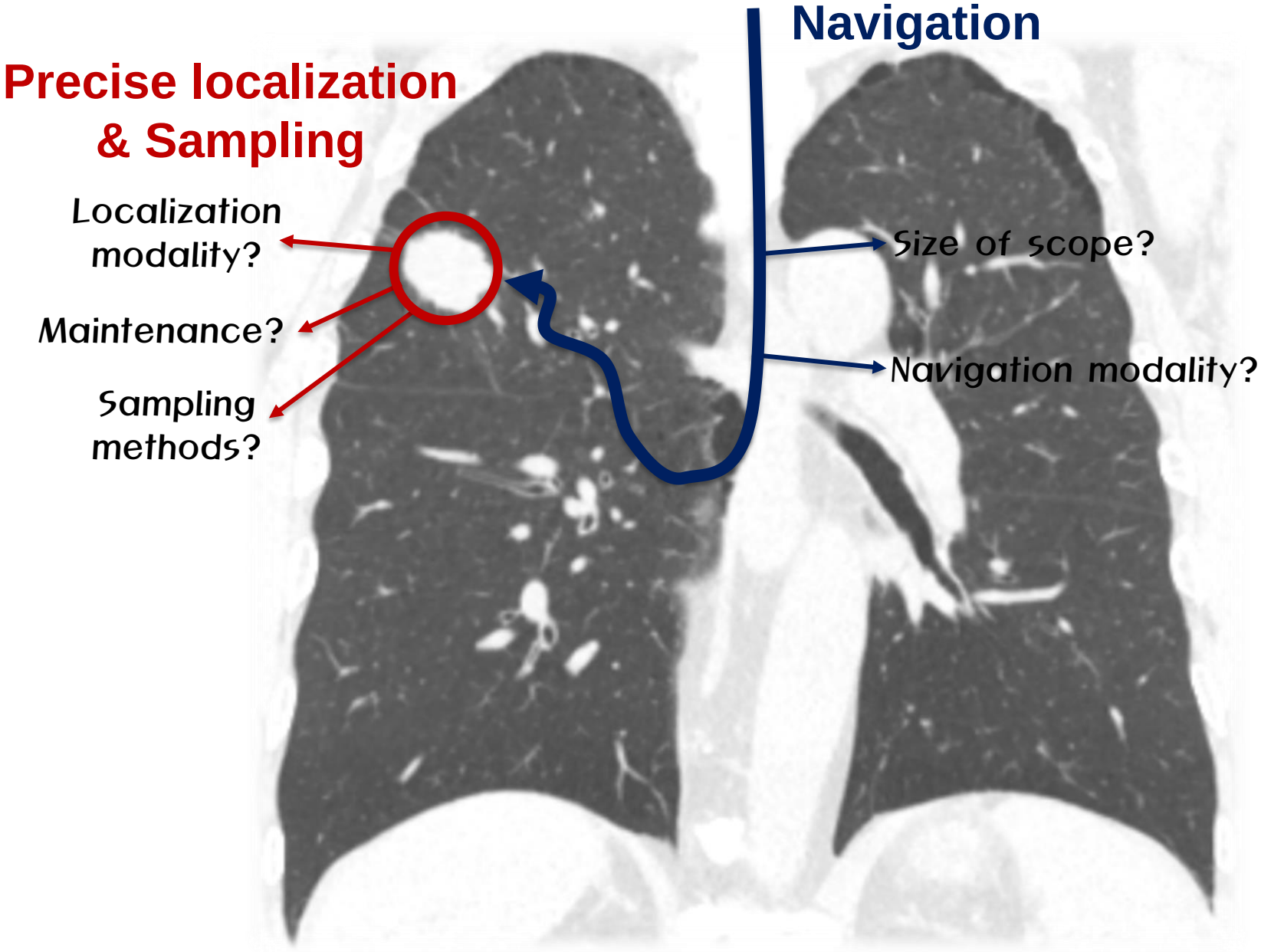
Percutaneous approach

Surgical resection

말초 폐병변의 조직조직검사로
어떤 방법이 가장 좋을까?

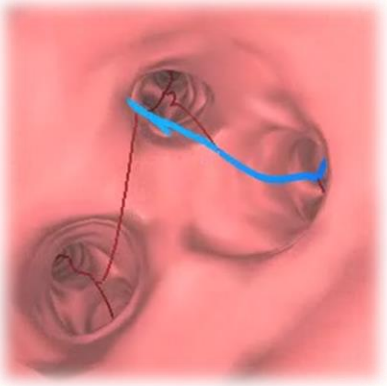
Bronchus sign

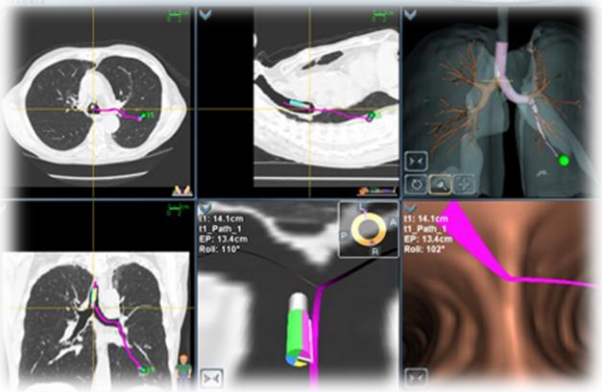


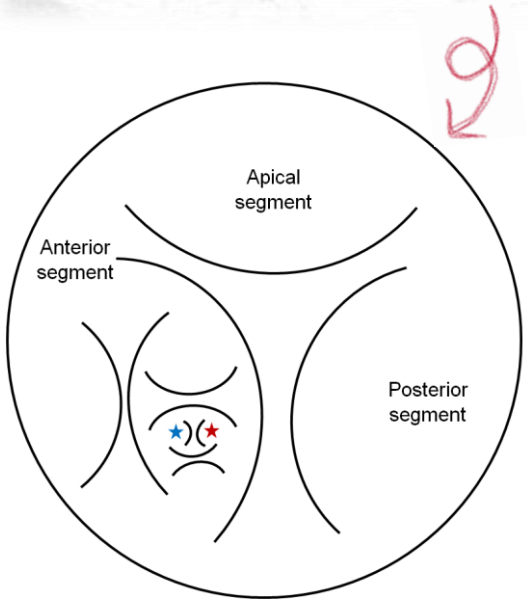

Navigation
Precise localization & Sampling
Localization modality?
Maintenance?
Sampling methods?
Size of scope?
Navigation modality?


기관지내시경을 어느
방향으로 넣어야 하나?
Target
lesion

- Bronchial branch tracing
- VBN
- ENB





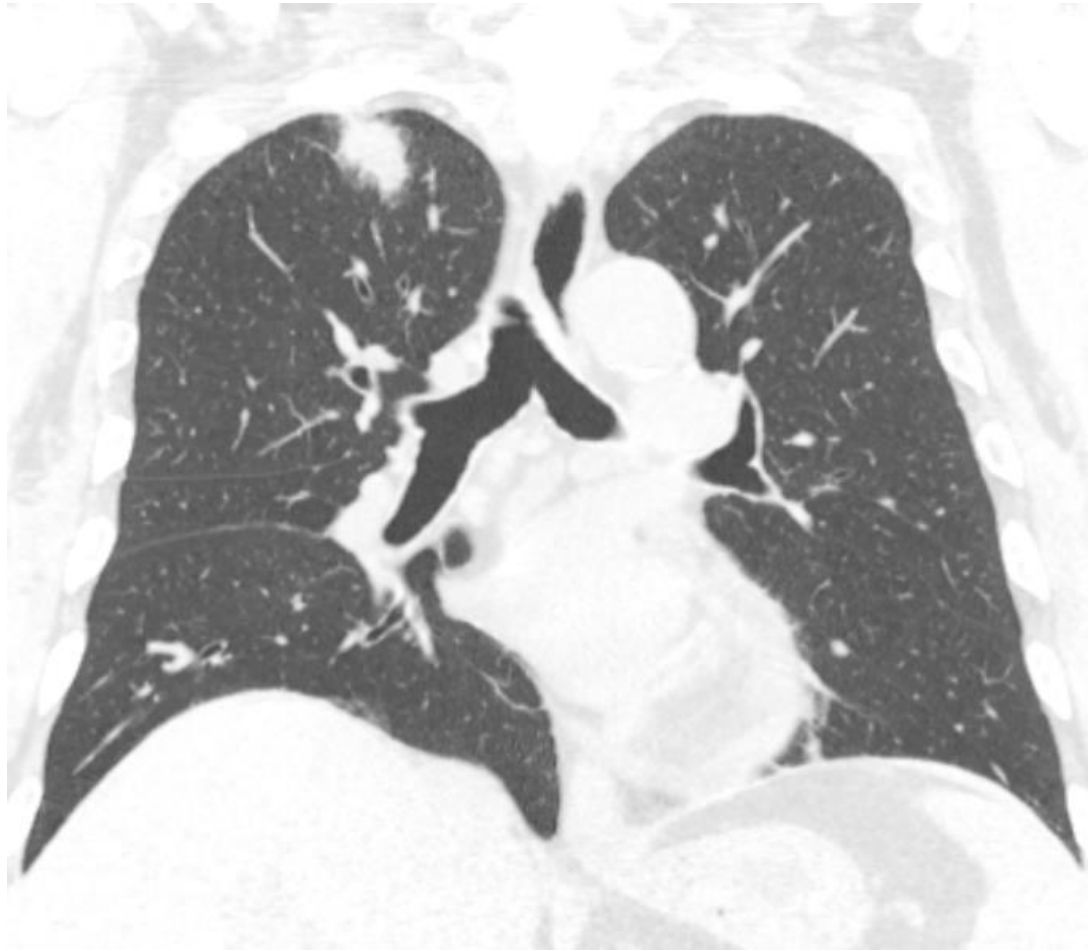


Google map

Versus

Car Navigation System

ENB = electromagnetic navigation bronchoscopy
VBN = virtual bronchoscopy navigation



▪ **기본환자 정보**

이름: [redacted]

성별: 남자(O) 여자 ( )

나이: 66

차트번호: [redacted]

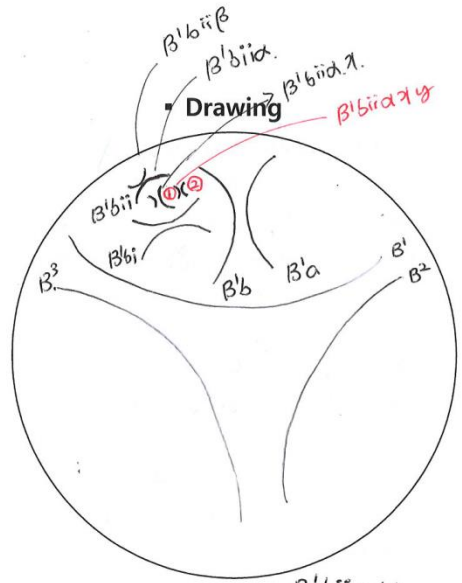
검사일: 2017년 12월 19 일

▪ **시술의사**

담당 교수님: 안 강성

시술 교수님: "

▪ **Drawing**



Target lesion 1: B'6ii α1γ

Target lesion 2: _____

▪ **흉부 CT 소견**

1) 흉부 CT 검사일: 2017년 12월 14일

2) Lesion location: RUL 3) Lesion size: 27.33 x 20.88mm

4) Distance from costal pleura: 8.05mm

5) Lesion character: Solid (O) Mixed ( ) GGO ( ) Cavity ( )

6) Bronchus sign: Yes (O) No ( ) Equivocal ( )

공유하기

소득공제 수입

직수입양서 **Bronchial Branch Tracing** [Paperback] 바인딩 & 에디션 안내

Kurimoto, Noriaki / Morita, Katsuhiko | Springer | 2021년 03월 14일

첫번째 리뷰어가 되어주세요.

정가 229,230원

판매가 **206,300원** (10% 할인)

YES포인트 ? 10,320원 (5% 적립) + 마니아추가적립

5만원이상 구매 시 2천원 추가적립 ?

추가혜택쿠폰 쿠폰받기

주문금액대별 할인쿠폰

결제혜택

KakaoPay 카카오페이 **3,000원 즉시할인** 5만원 이상 결제시, 1회

에스24 현대카드 **3만원 캐시백 이벤트**
[기본혜택] YES포인트 1~3% 적립

KB KB페이 **1,000원 즉시할인** 1만 5천원 이상 결제시, 일 1000명

N Pay 네이버페이 **5천 포인트 적립** 1천명 추첨, 5만원 이상

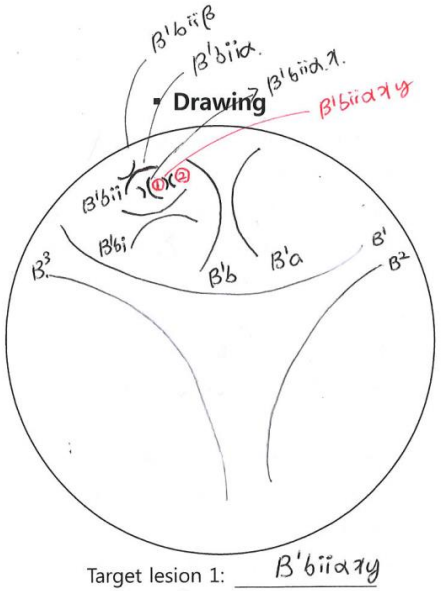
mobile POP **모바일팝 모바일 6% 즉시할인** 모바일 결제시

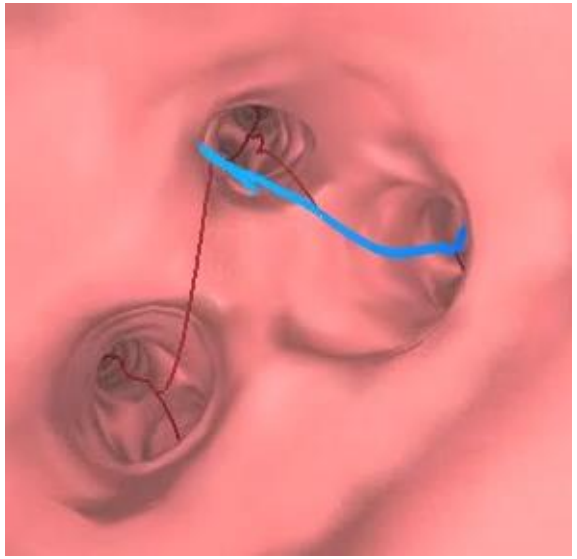
배송안내 서울특별시 영등포구 은행로 11(여의도동,일신빌딩) 지역변경

일반배송 **21일 이내(1/25, 목)** 출고예정 ?

· 배송비 : 무료 ?

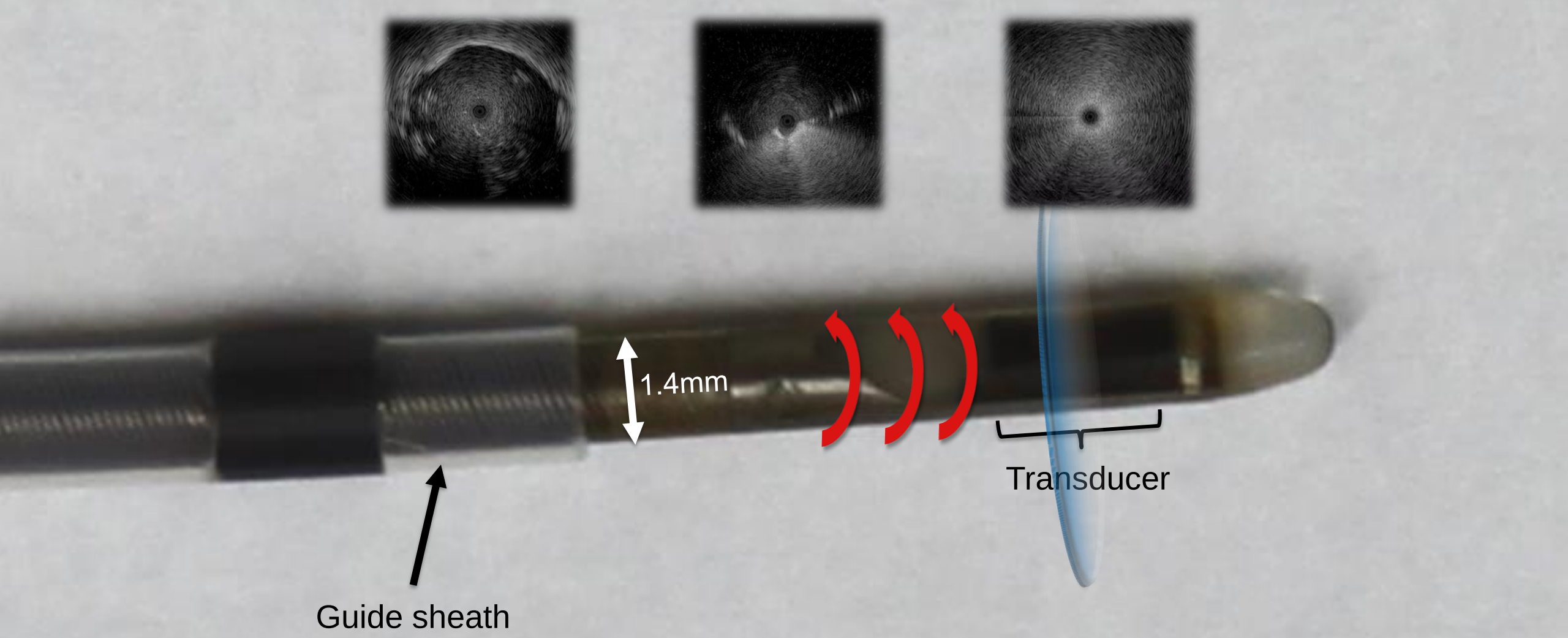
중고상품 판매요청하기 | 이 상품을 팔기



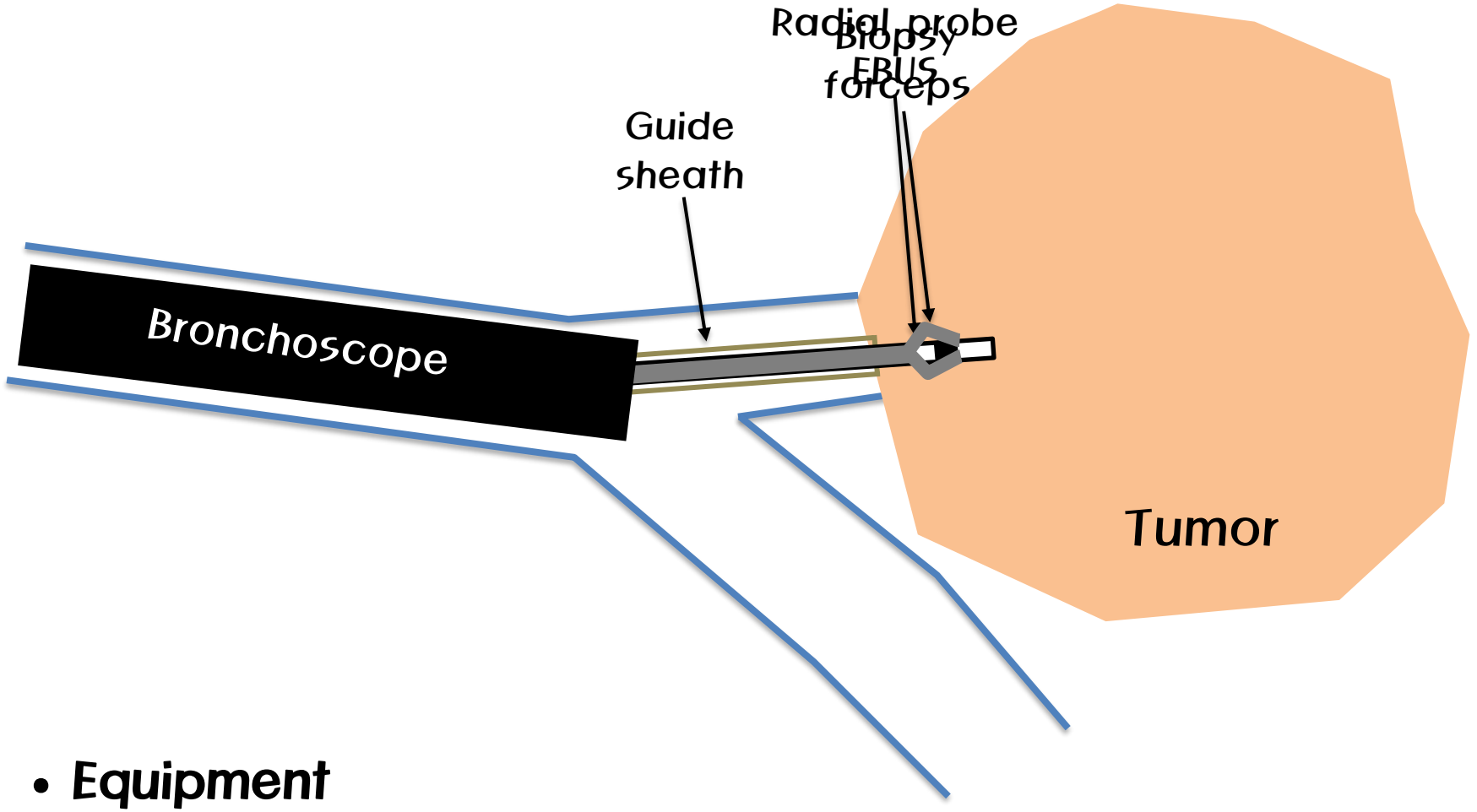


		Reading CT anatomy	Navigation system (VBN or ENB)
Accuracy	Proximal area	**++**	**+++**
	Peripheral area	**++**	**+**
Cost		Free	Expensive (VBN < ENB)
Learning		Trial and error during learning curve period	Easy

Courtesy of Dr. Noriaki Kurimoto



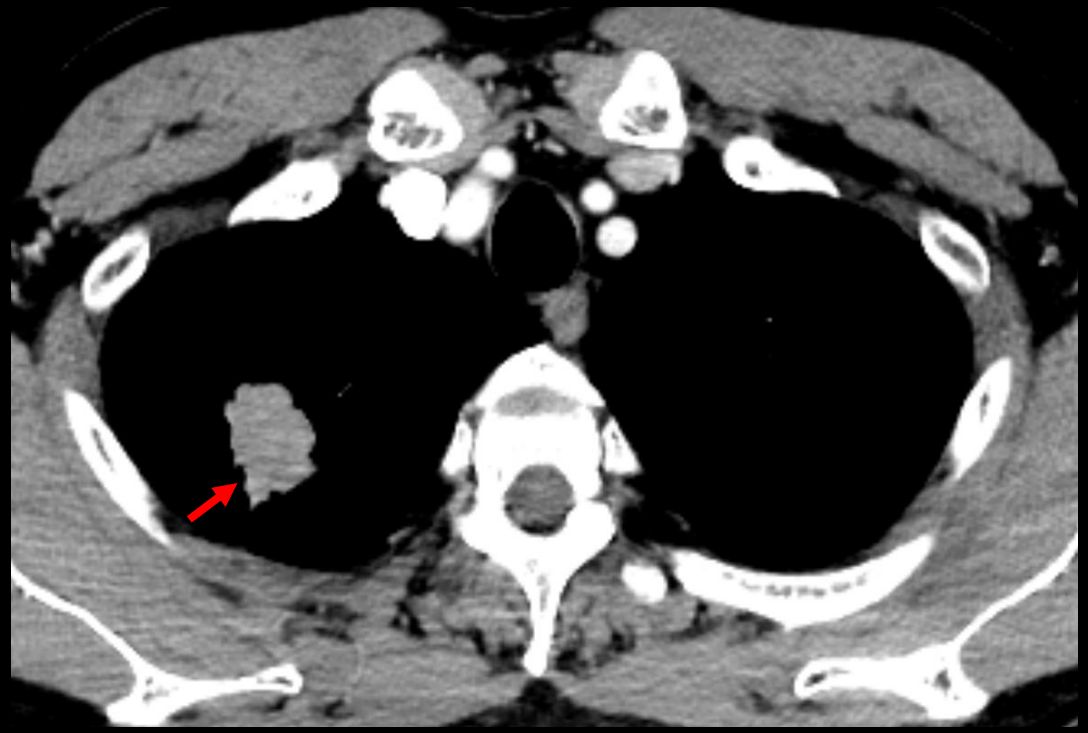
Radial probe EBUS

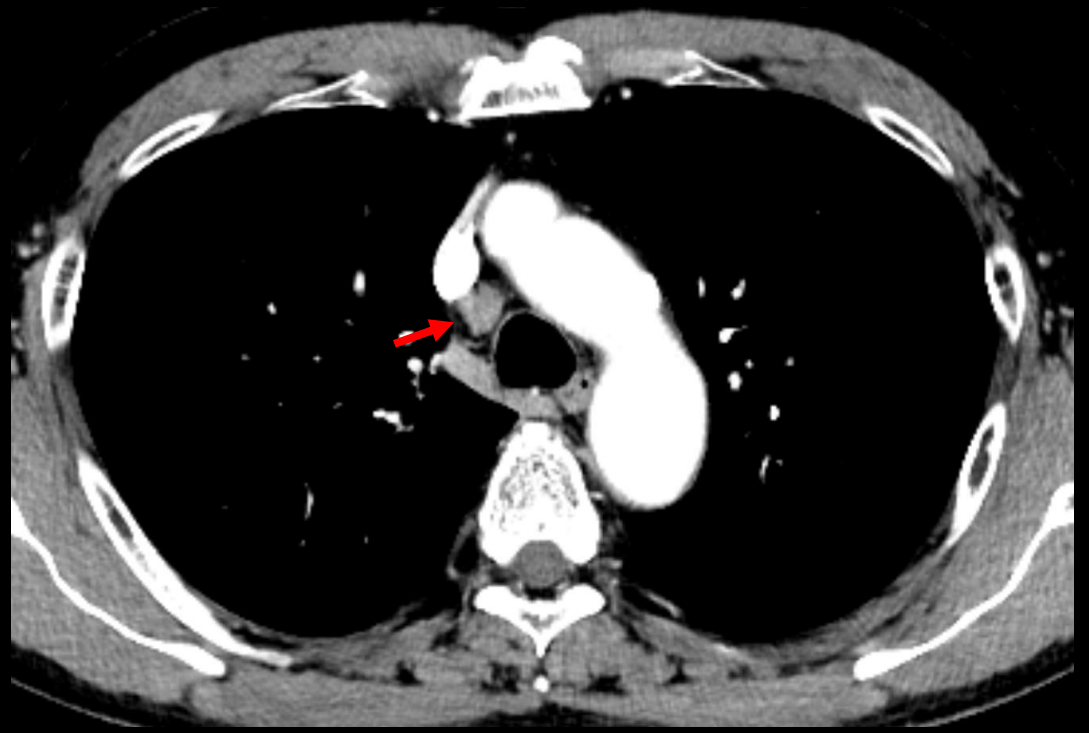


- **Equipment**
  1) Bronchoscope
  2) Guide sheath kit: guide sheath, cytology brush, biopsy forceps
  3) Radial probe EBUS (mini-probe), driving unit, ultrasound center

Combined RP- and CP-EBUS

Case





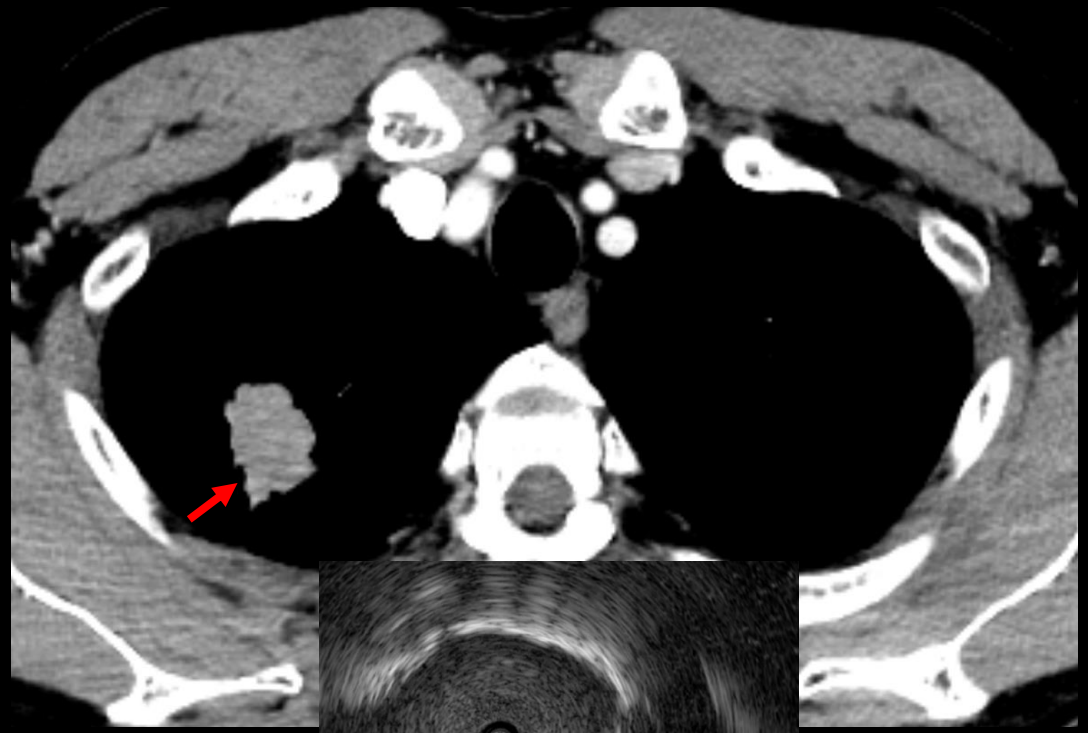
Chest CT

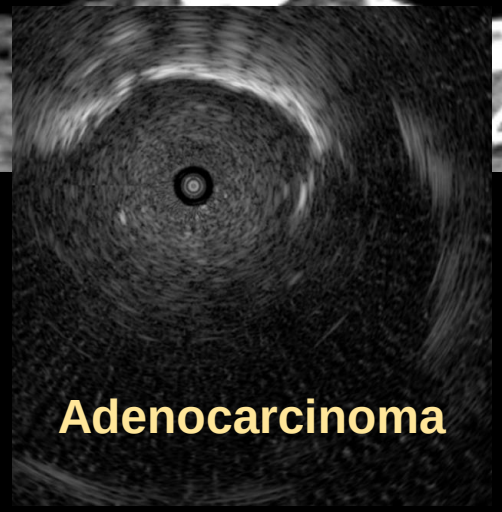
CONCLUSION
A 31x20mm sized lobulated enhancing mass with pleural tagging at LUL Enlarged LNs at right upper paratracheal, hilar and interlobar area → lung cancer, T2a N2 Mx Bullae in right apex No definite evidence of abnormality in both adrenal glands and liver

PET

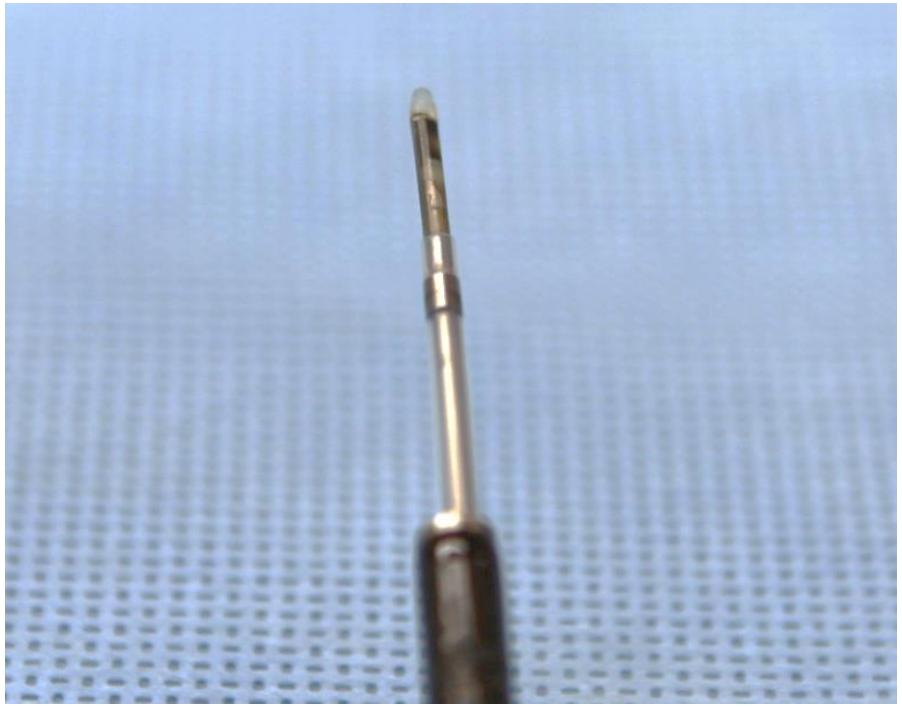
CONCLUSION
1. Lung cancer in RUL 2. Suspicious for metastatic lymph node at right lower paratracheal and hilar area 3. No evidence of distant metastasis

Case





RP-EBUS + CP-EBUS



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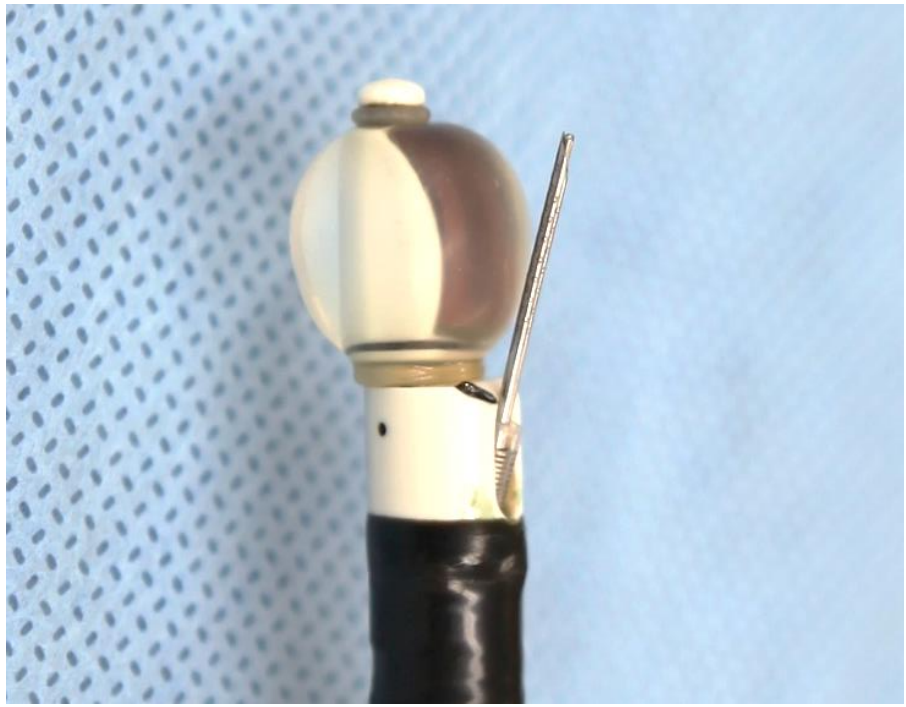
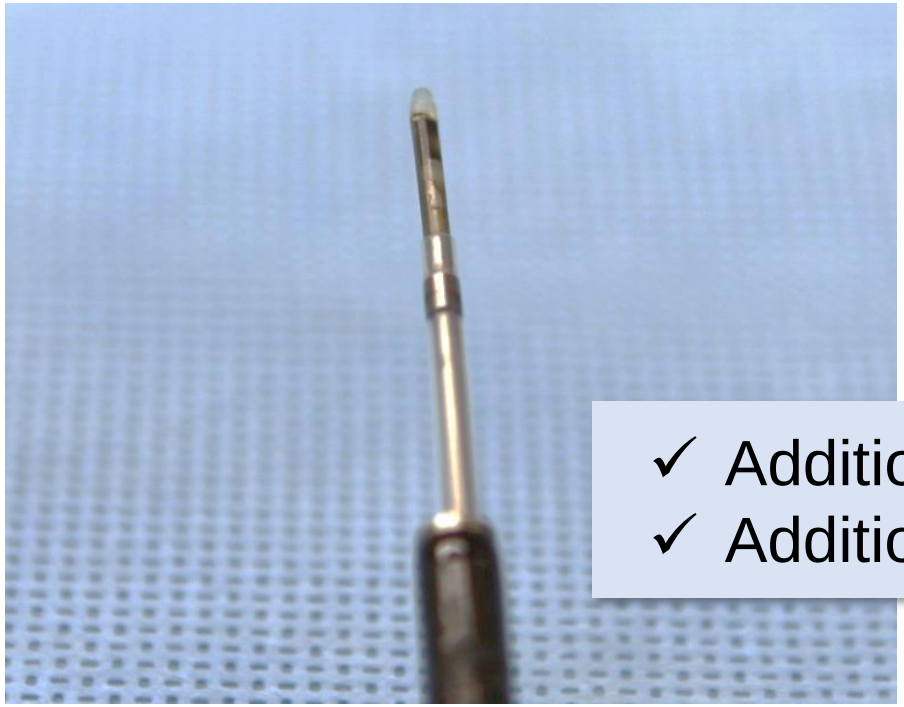


RP-EBUS + CP-EBUS



- ✓ Additional sedatives
- ✓ Additional topical lidocaine

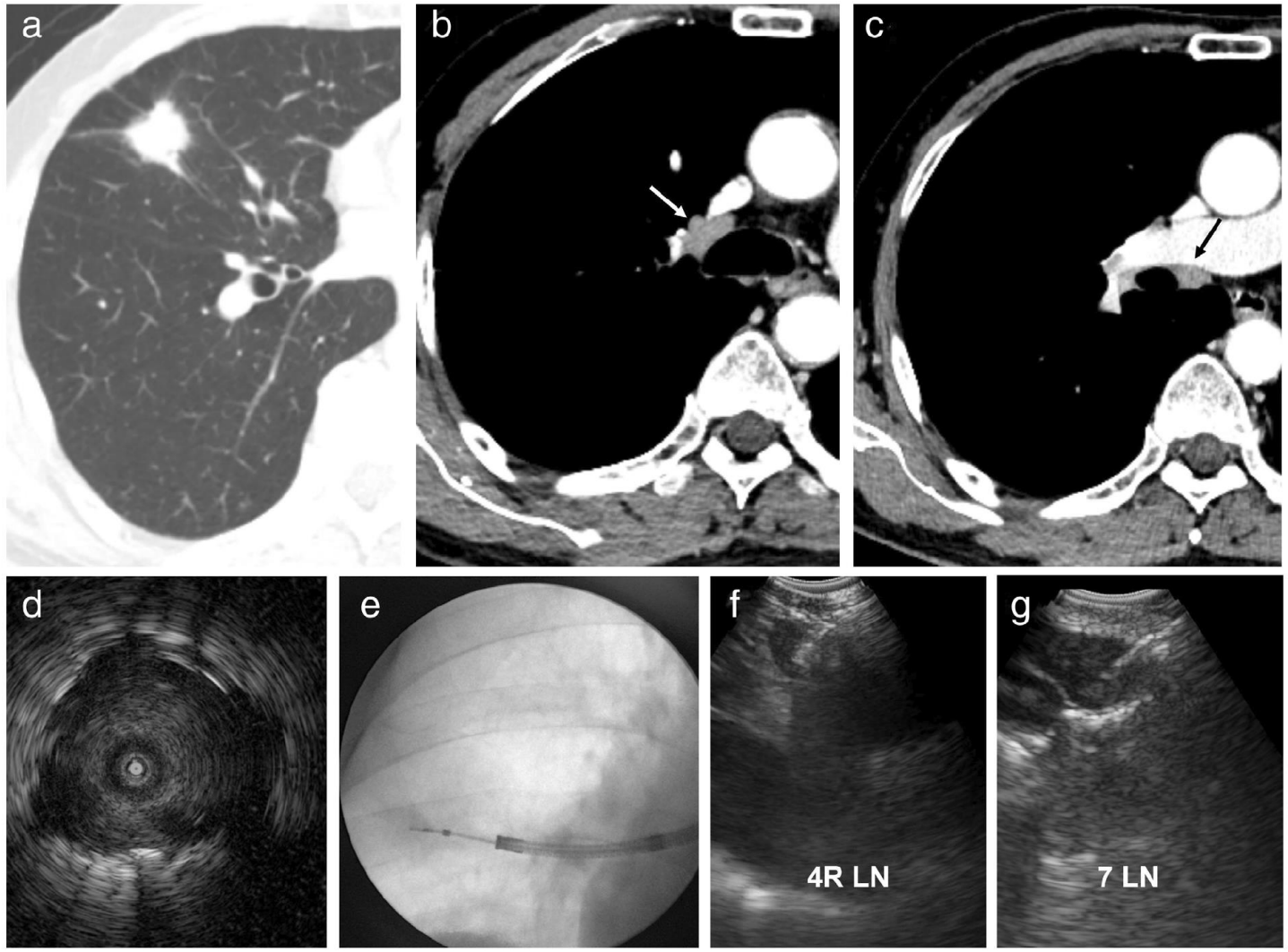


FIGURE 1 A representative case of the combined procedure with RP- and CP-EBUS. (a) An 18-mm peripheral lung lesion was found in the right middle lobe. (b, c) Axial CT images with a mediastinal window showing enlargements in 4R (white arrow) and 7 (black arrow) lymph nodes. (d) The peripheral lung lesion was found to be "within" on the ultrasonographic image during RP-EBUS. (e) Transbronchial biopsy was performed under fluoroscopy guidance. (f, g) Subsequent transbronchial needle aspiration with CP-EBUS was performed at 4R and 7 lymph nodes. As a result, an adenocarcinoma was found in the right middle lobe, but there was no evidence of mediastinal lymph node metastasis. The patient underwent thoracoscopic surgery and was diagnosed with stage IA lung adenocarcinoma (T1bN0M0). CP-EBUS, convex probe endobronchial ultrasound aspiration; CT, computed tomography; LN, lymph node; RP-EBUS, radial probe endobronchial ultrasound.

Chung HS, et al. Thorac Cancer. 2022 Oct;13(20):2837-2843.

▪ Baseline characteristics

Variables	RP-EBUS group ($n = 506$)	Combination group[a] ($n = 97$)	p-value
Male sex	310 (61.3)	80 (82.5)	<0.001
Age, years	68.1 ± 10.1	70.4 ± 8.9	0.021
Location of PLL			0.251
Right upper lobe	154 (30.4)	24 (24.7)	
Right middle lobe	34 (6.7)	11 (11.3)	
Right lower lobe	108 (21.3)	26 (26.8)	
Left upper lobe	138 (27.3)	21 (21.6)	
Left lower lobe	72 (14.2)	15 (15.5)	
Mean diameter of PLL, mm	29.7 ± 14.2	36.9 ± 17.2	<0.001
Distance from pleura to PLL, mm	12.9 ± 14.4	12.8 ± 14.9	0.922
Positive bronchus sign on CT scan	426 (84.2)	91 (93.8)	0.022
Character of PLL on CT scan			0.039
Solid	436 (86.2)	92 (94.8)	
Mixed	68 (13.4)	5 (5.2)	
Ground-glass opacity	7 (1.4)	0 (0)	

Abbreviations: CT, computed tomography; PLL, peripheral lung lesion; RP-EBUS, radial probe endobronchial ultrasound.
[a]The combination group included patients who underwent a combined procedure using RP-EBUS and convex probe EBUS.

▪ Diagnostic yields and safety profiles

	RP-EBUS group ($n = 506$)	Combination group[a] ($n = 97$)	p-value
Diagnostic yields			
RP-EBUS-TBB	70.0%	81.4%	0.021
Overall diagnostic yield	70.0%	90.7%	<0.001
Complications			
Pneumothorax	5 (1.0)	1 (1.0)	0.310
Infection	2 (0.4)	0 (0.0)	0.651
Massive bleeding	0 (0.0)	0 (0.0)	N/A
Life threatening event	0 (0.0)	0 (0.0)	N/A
Overall complications	7 (1.4)	1 (1.0)	0.766

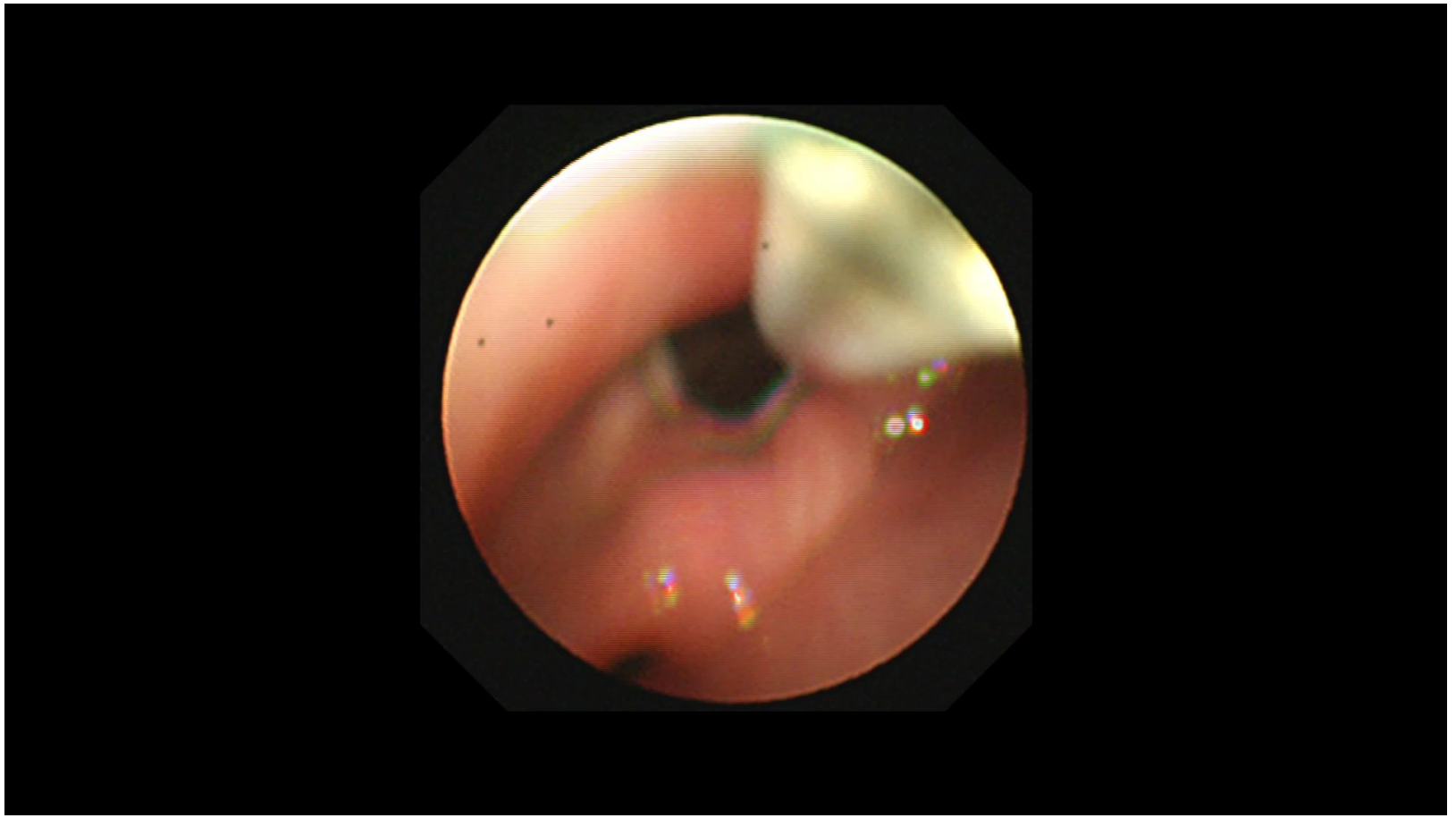
Abbreviations: CP-EBUS-TBNA, transbronchial needle aspiration using convex probe EBUS; RP-EBUS, radial probe endobronchial ultrasound; RP-EBUS-TBB, transbronchial biopsy using RP-EBUS.
[a]The combination group included patients who underwent a combined procedure using RP-EBUS and convex probe EBUS.

Chung HS, et al. Thorac Cancer. 2022 Oct;13(20):2837-2843.

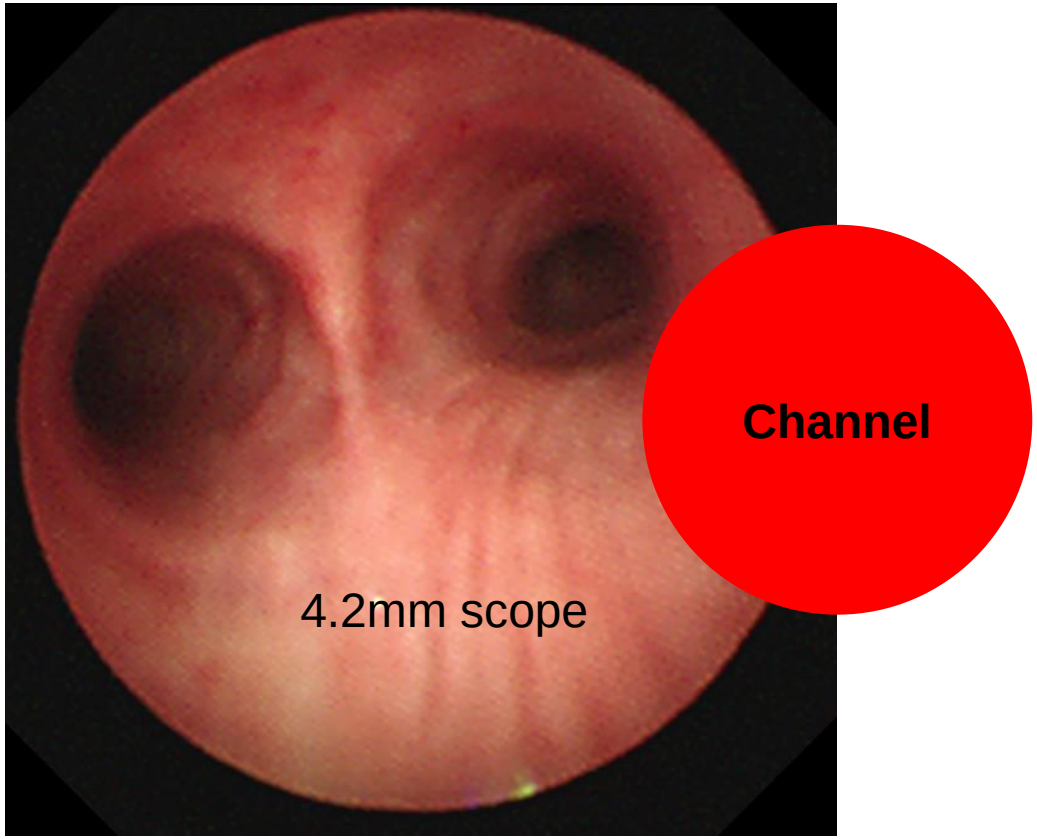
Tips in RP-EBUS

Lidocaine spray before procedure

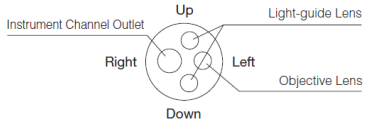
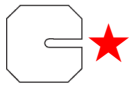
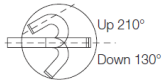
Spray catheter



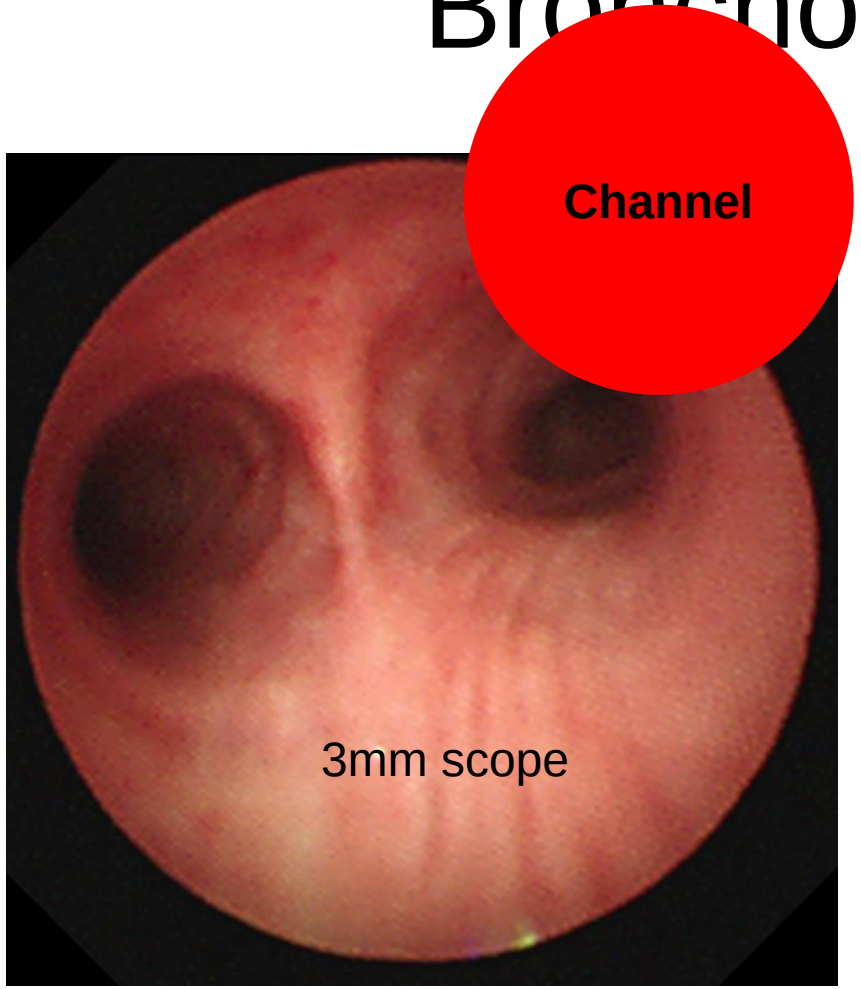
Bronchoscopy channel

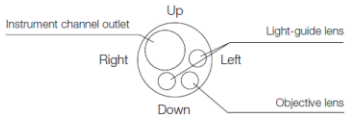
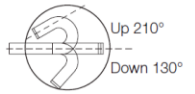


BF-P190

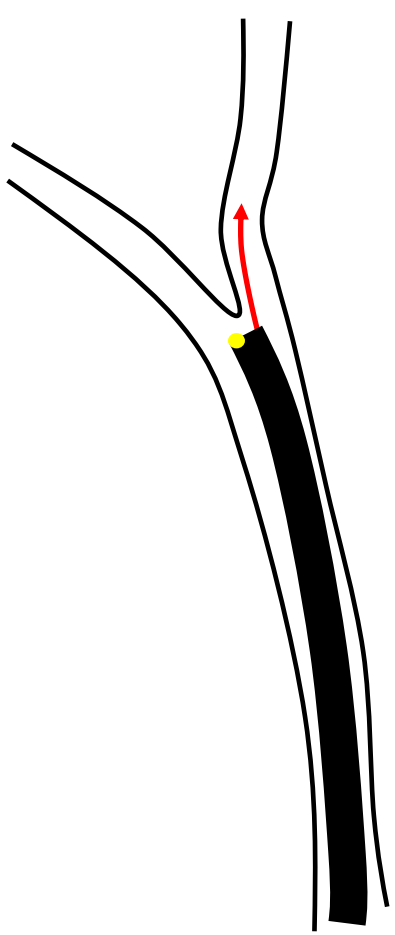
Specifications		
Optical System	Field of View	110°
	Direction of View	Forward Viewing
	Depth of Field	2 to 50 mm
	Image Quality	SDTV
Insertion Tube	Distal End Outer Diameter	4.2 mm
	Distal End Enlarged	
	Insertion Tube Outer Diameter	4.1 mm
	Working Length	600 mm
	Rotary Function	Yes
Instrument Channel	Channel Inner Diameter	2.0 mm
	Minimum Visible Length	3.0 mm from the distal end
	Direction from which endoscopic devices enter and exit the endoscopic image	
Bending Section	Angulation	
Total Length	880 mm	
Electrocautery Instrument Compatibility	Yes	
Laser Compatibility	No	
Autoclave Compatibility	No	
Compatible EVIS EXERA System	Video System Center Xenon Light Source	Olympus CV-190 Olympus CLV-190

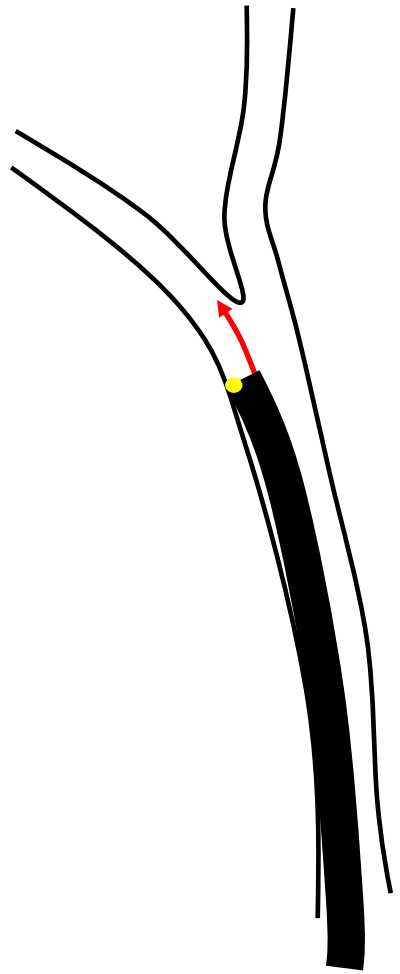
Bronchoscopy channel



Specifications		
Optical System	Field of view	90°
	Direction of view	Forward viewing
	Depth of field	2–50 mm
Insertion Section	Distal end outer diameter	3.0 mm
	Distal end enlarged	
	Insertion tube outer diameter	3.7 mm
	Working length	600 mm
	Insertion tube rotation function	Yes
	Rotation range	Right: 120°, left: 120°
Instrument Channel	Channel inner diameter	1.7 mm
	Minimum visible length	2 mm from the distal end
	Direction from which EndoTherapy accessories enter and exit the endoscopic image	
Bending Section	Angulation range	
Compatible System	EVIS EXERA III Video System Center OLYMPUS CV-190 / Xenon Light Source OLYMPUS CLV-190	
Additional Information	Insertion tube rotation function	Yes
	Compatibility with radial EBUS	Yes (UM-S20-17S)
	Compatibility with GuideSheath	Not available
	Narrow Band Imaging (NBI)	Not available
	HF/laser compatibility	Not available

BF-MP190F





GS broken

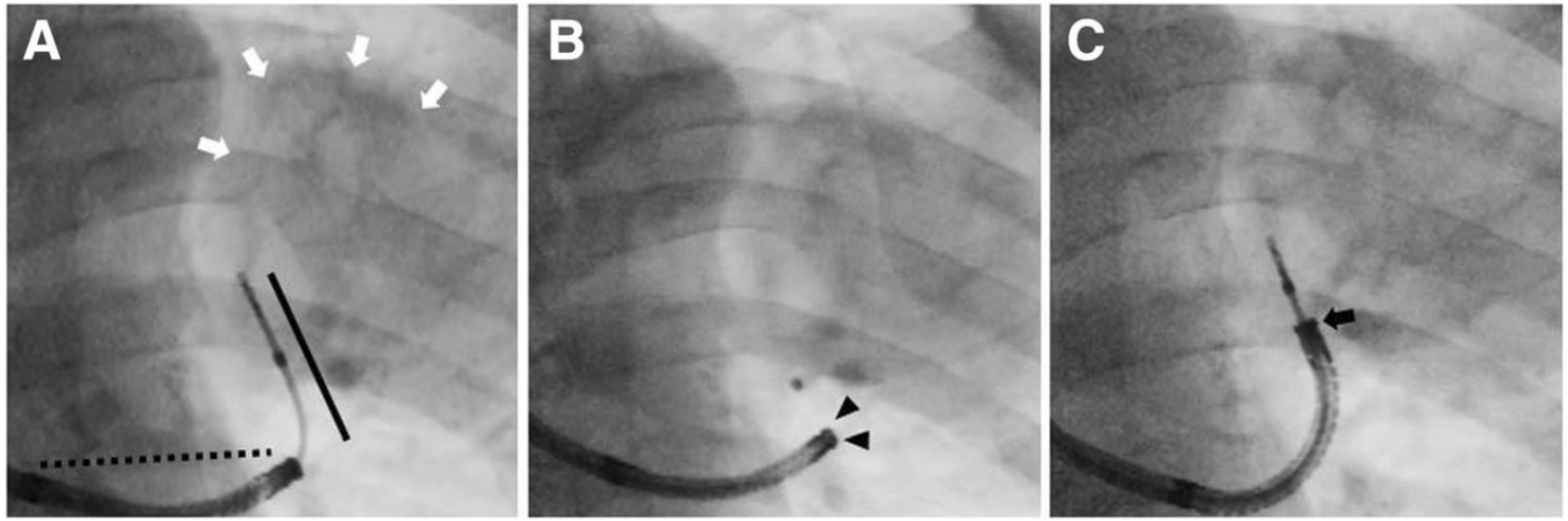
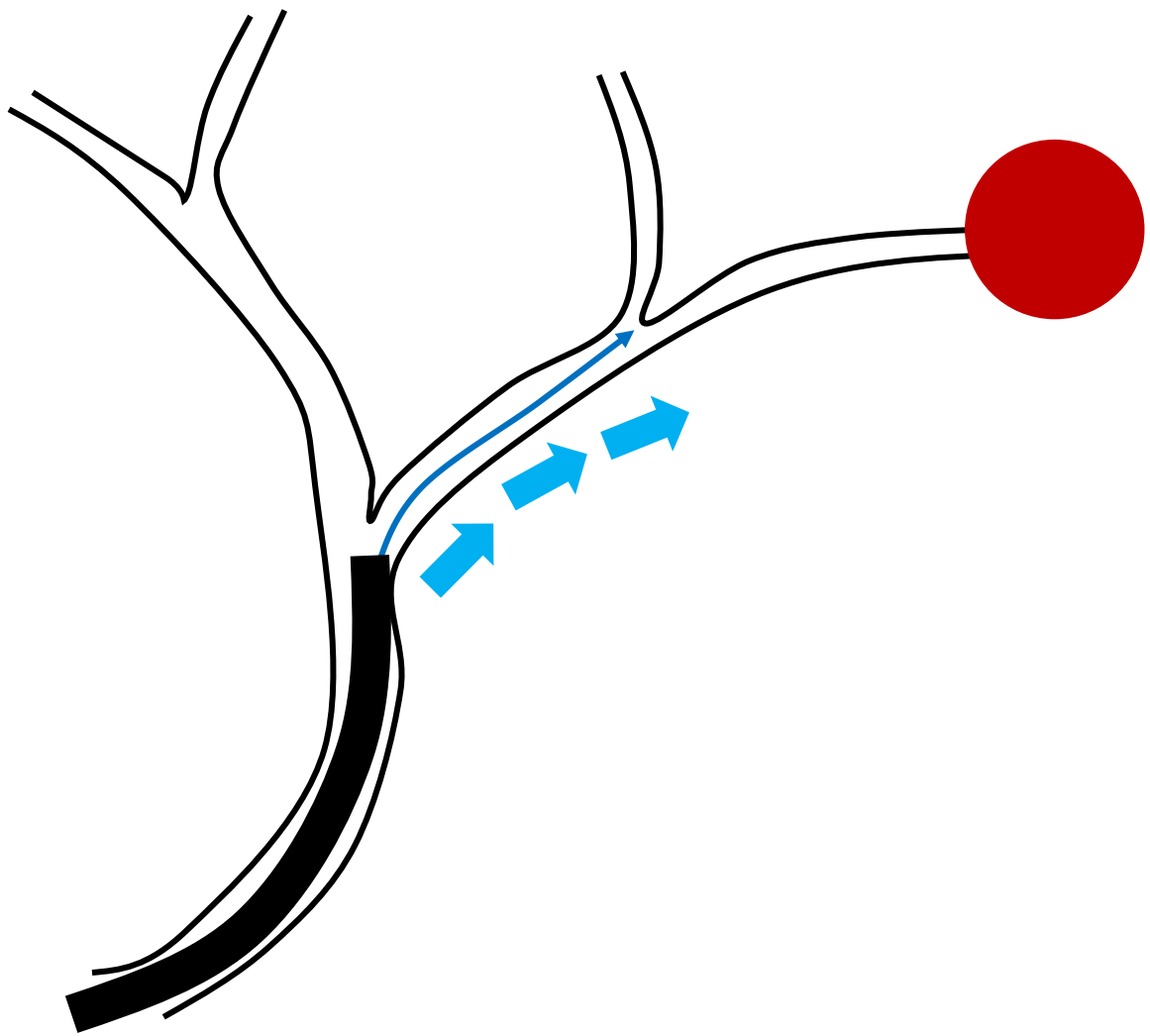
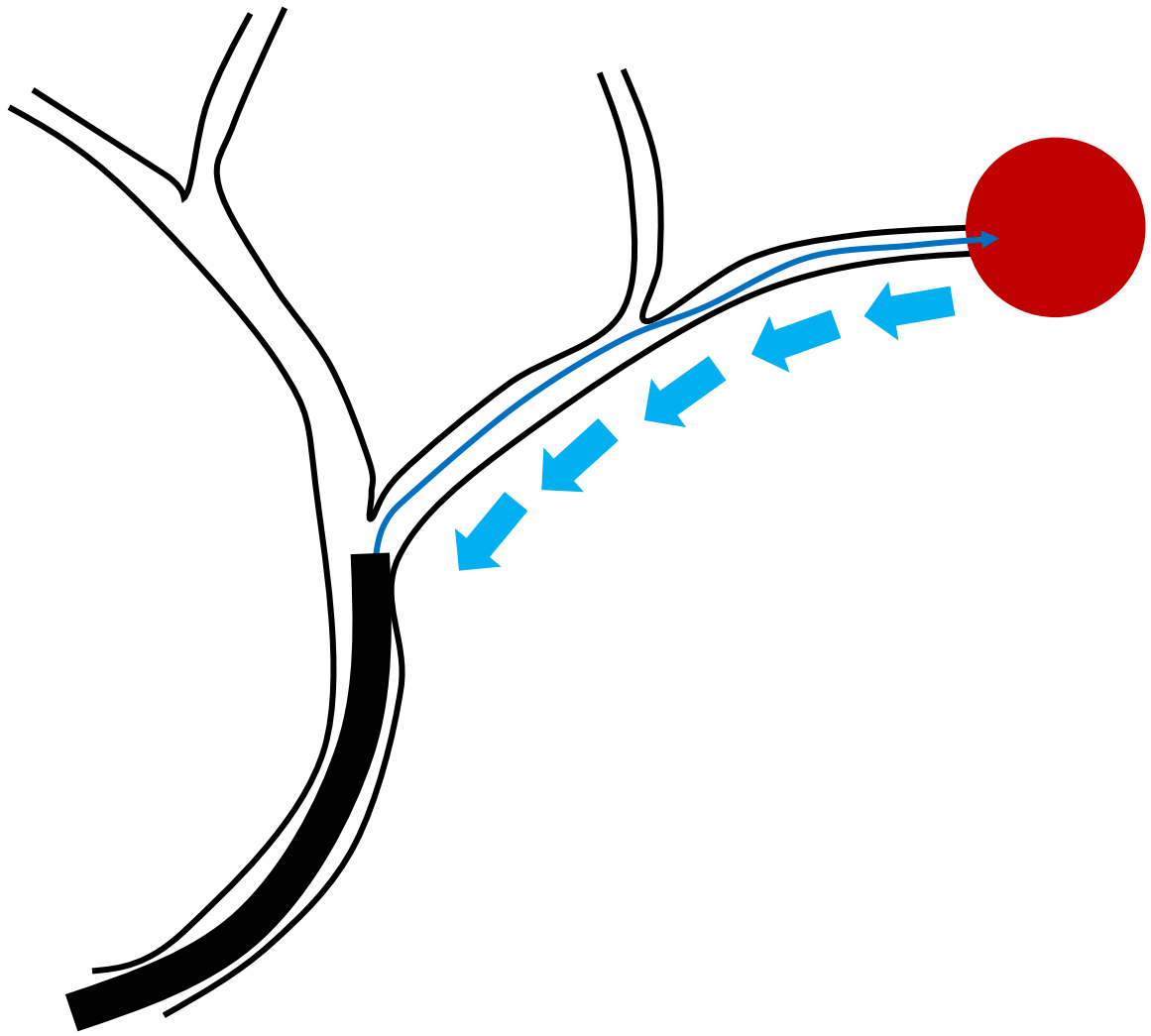


Fig. 4 Breakage of the guide sheath (GS). **a** Forceps biopsy via the GS was performed under fluoroscopic guidance after precise identification of the tumor using a radial probe EBUS (white arrow). **b** A kink in the GS (arrowhead) resulting in its dislocation was seen on fluoroscopy. The kink may have been caused by a discordance between the long axes of the bronchoscope (dotted line, **a**) and the GS (black line, **a**). **c** To prevent additional breakage of the GS, a thin bronchoscope was introduced as far as possible close to the target lesion (arrow). Thereafter, the two long axes of the bronchoscope and GS were aligned and the procedure was successfully completed

Eom JS, et al. BMC Pulm Med. 2018 Aug 13;18(1):137.

How to prevent damage to RP-EBUS

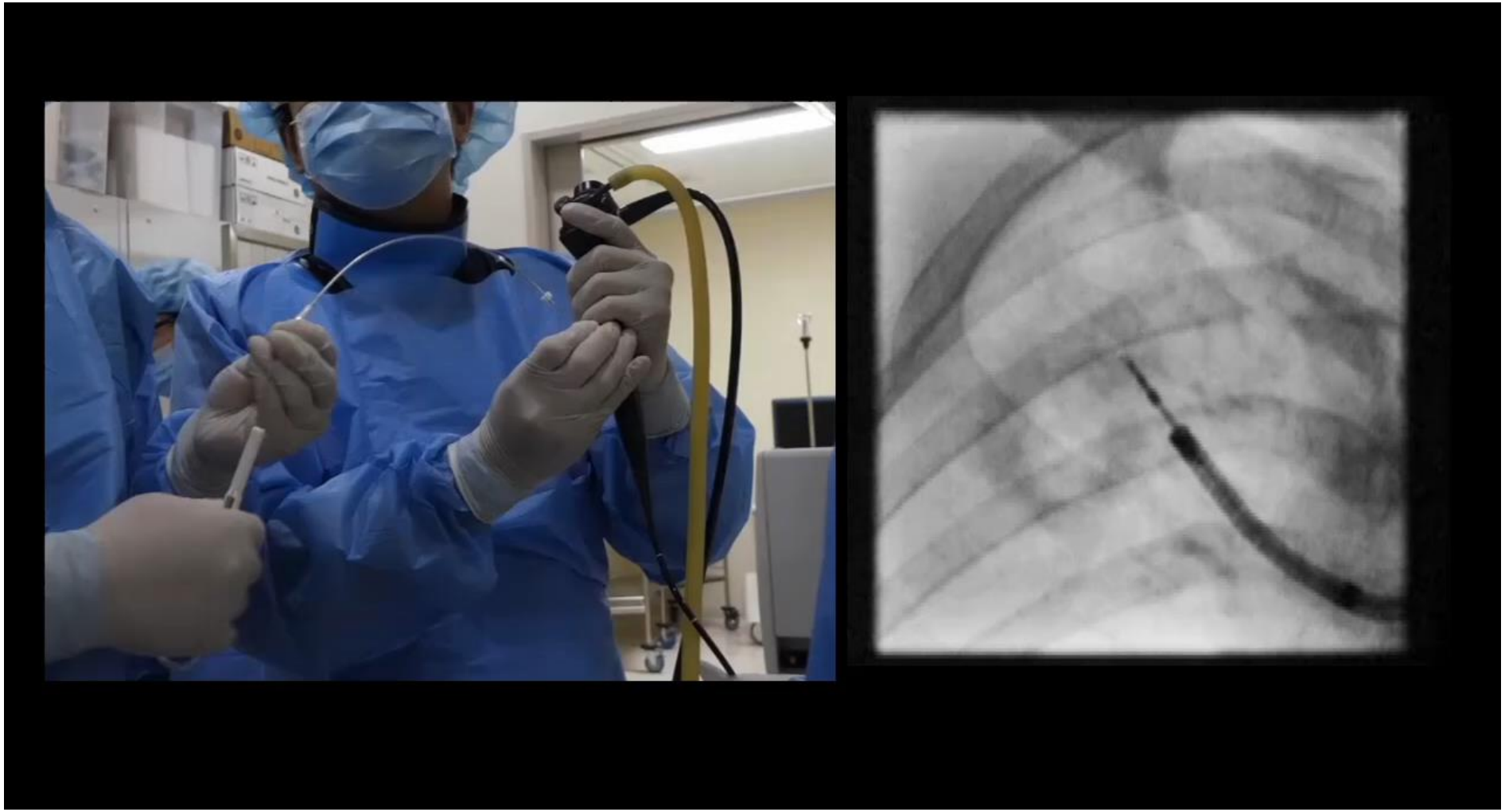




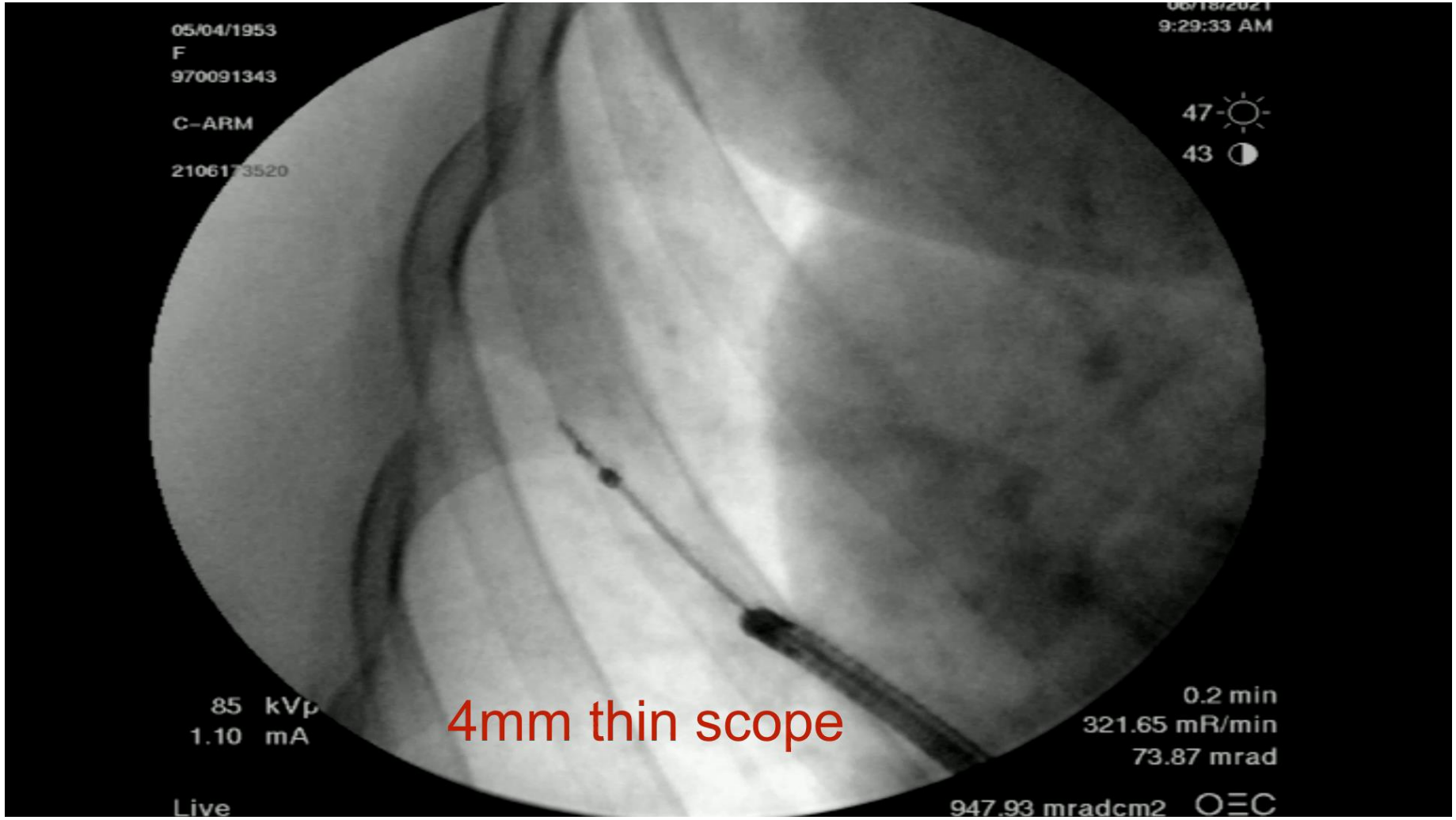
Benefit of Fluoroscopy

1. Forceps cup이 열렸는지 확인
2. Guide sheath, forceps의 위치 확인
3. 병변위치 확인

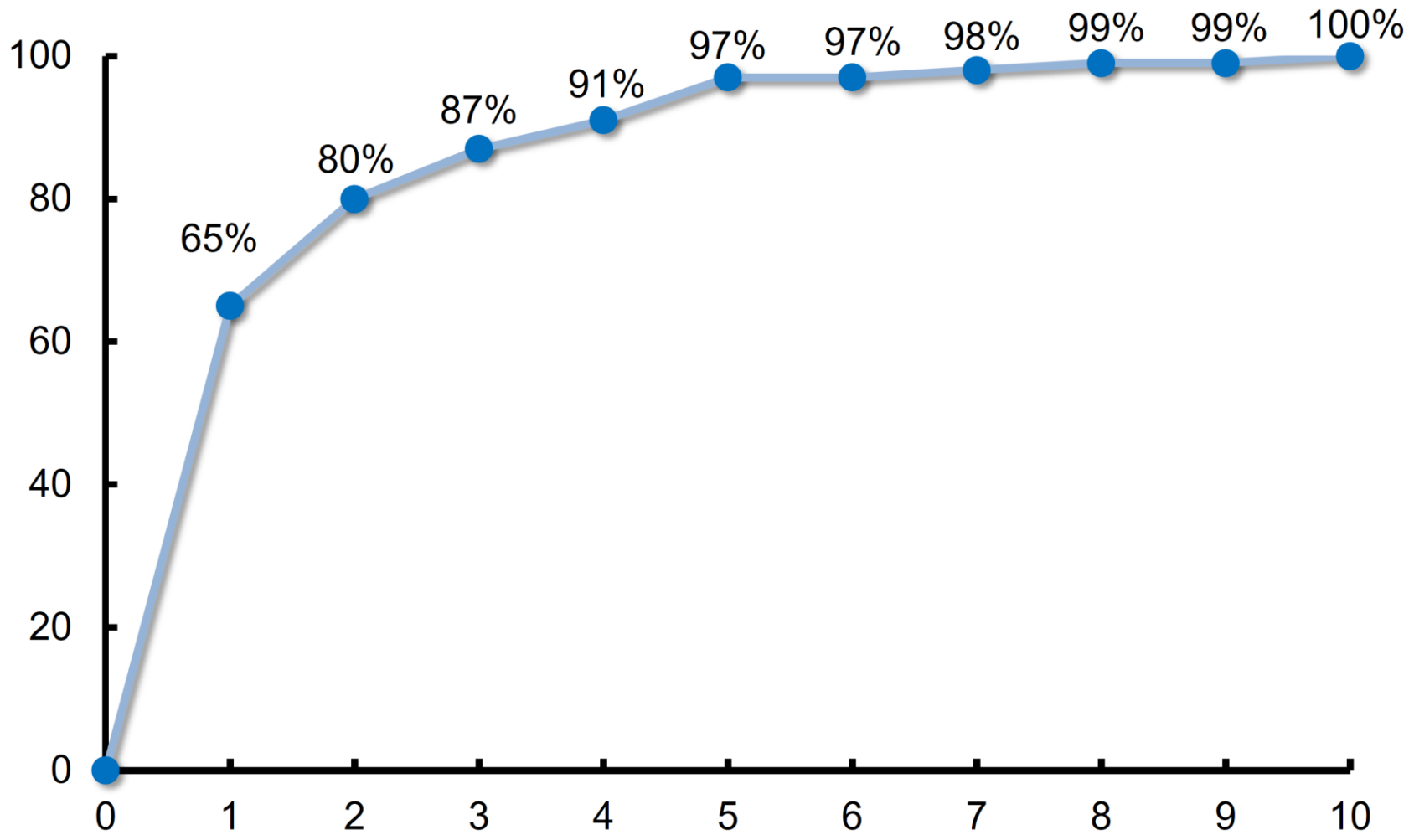
Opening of forceps – Jabbing



Searching under fluoroscopy



Optimal number of biopsy



Yamada N, et al. Chest. 2007 Aug;132(2):603-8.

Multimodal approach I

	EBUS-GS (n = 39)	**SuperD** (n = 39)	**EBUS-GS** + **SuperD** (n = 40)	*P*-value
Diagnostic yield	**69%**	**59%**	**88%**	0.02

EBUS-GS = endobronchial ultrasound using a guide sheath
SuperD = Superdimension®

Eberhardt R, et al. Am J Respir Crit Care Med. 2007 Jul 1;176(1):36-41.

Multimodal approach II

Non-VBN group

VBN group

Ishida T, et al. Thorax. 2011 Dec;66(12):1072-7.

Multimodal approach II

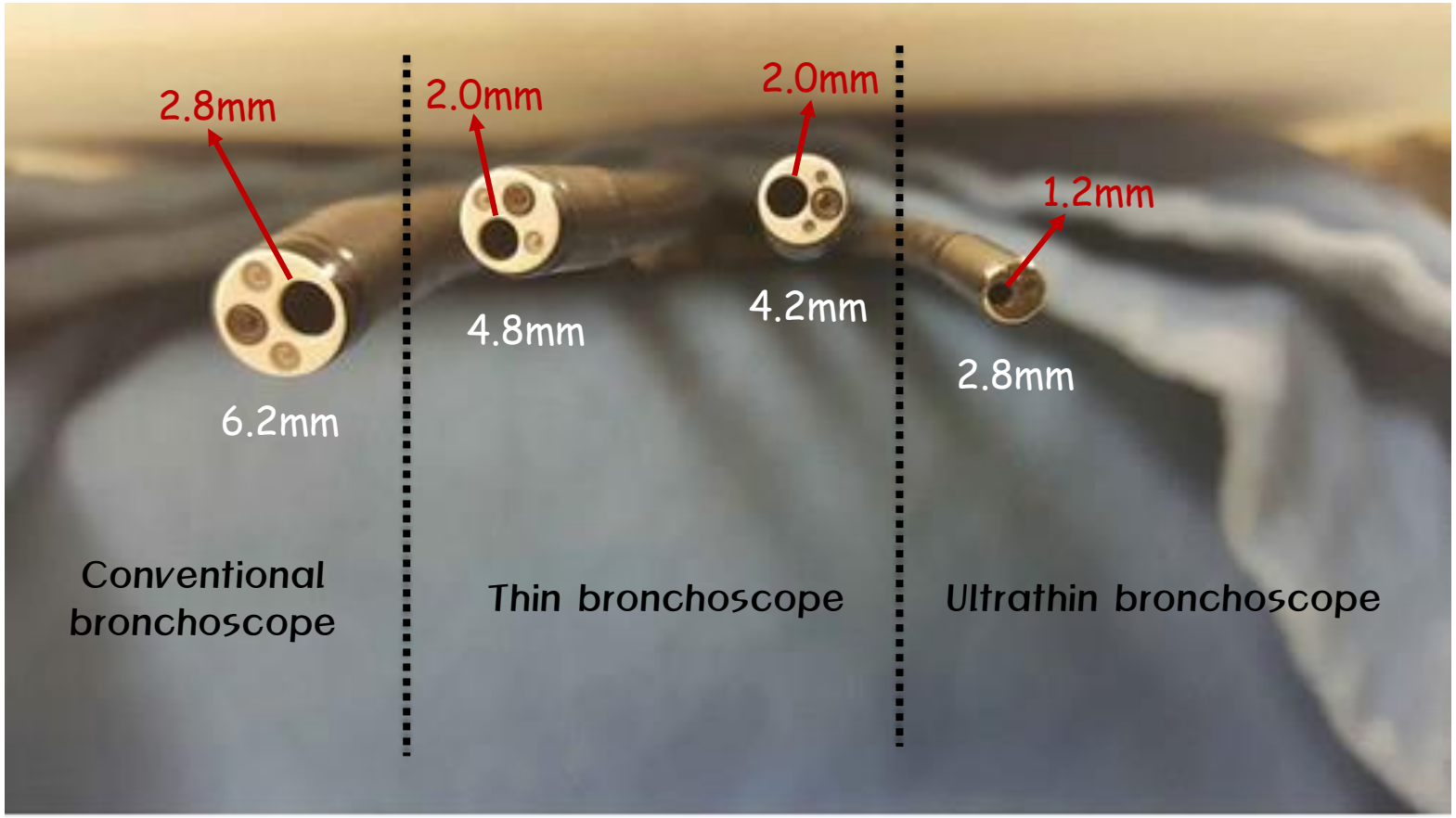
- Diagnostic yield according to lesion size

Lesion size	VBNA (n=99)	NVBNA (n=95)	*P*-value
< 20 mm	76%	59%	0.056
20-30 mm	88%	81%	0.382
Total	**81%**	**67%**	0.032

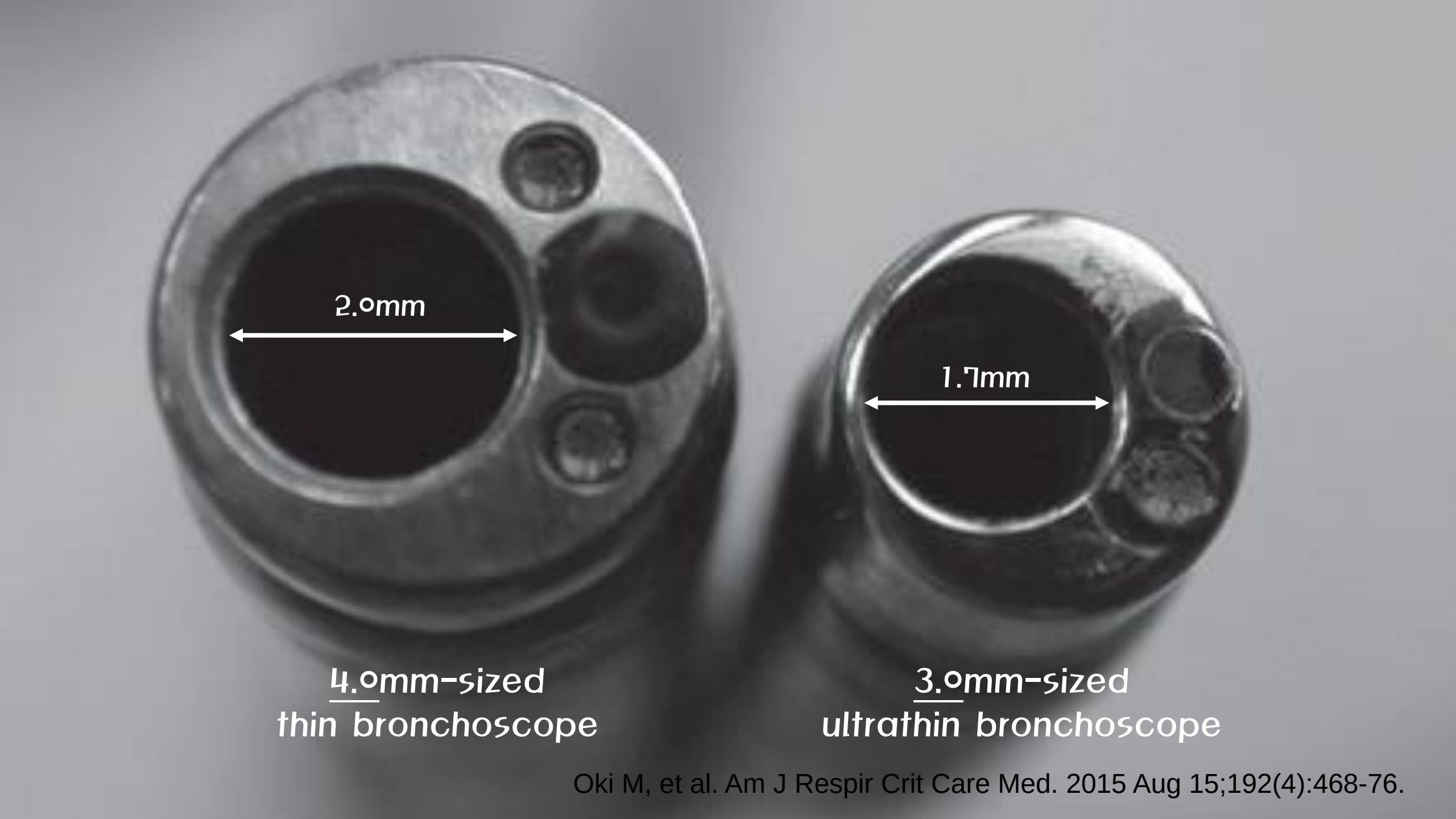
VBNA = virtual bronchoscopic navigation-assisted.
NVBNA = non- virtual bronchoscopic navigation-assisted.

Ishida T, et al. Thorax. 2011 Dec;66(12):1072-7.

Ultrathin bronchoscope

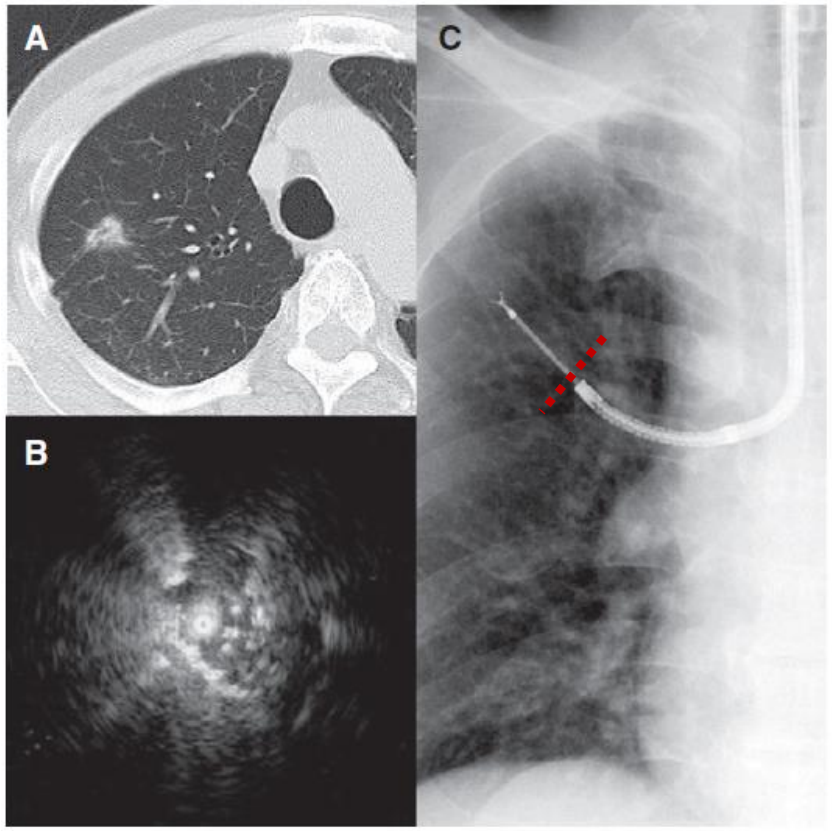


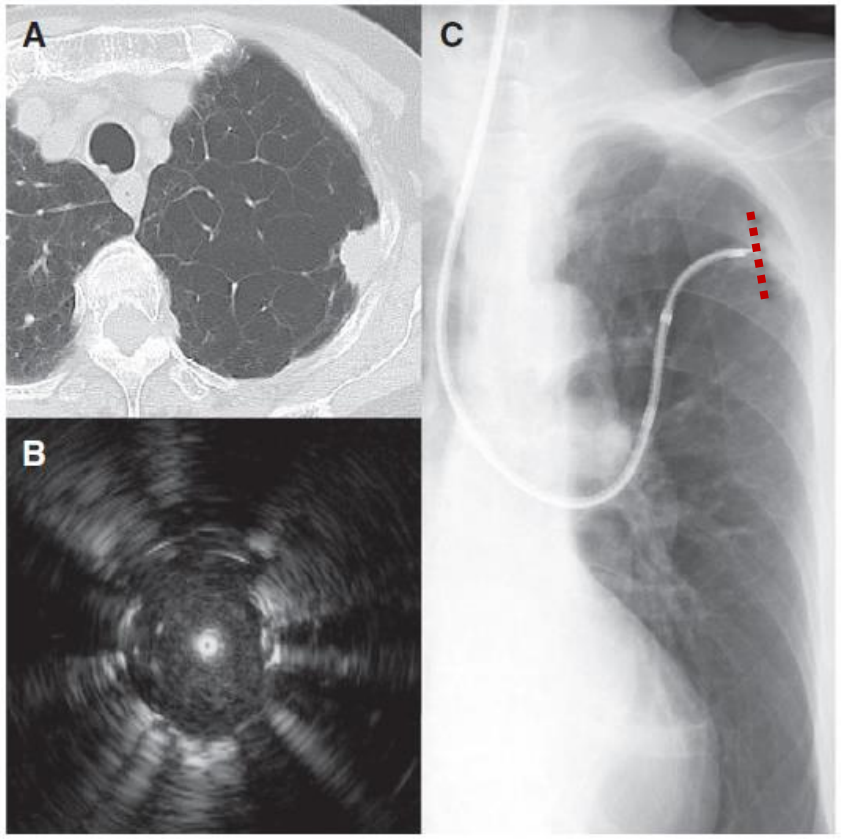
Ong PG, et al. J Thorac Dis. 2016 Dec;8(12):3808-3817.



Oki M, et al. Am J Respir Crit Care Med. 2015 Aug 15;192(4):468-76.

Ultrathin bronchoscope





Thin bronchoscope Versus Ultrathin bronchoscope

Oki M, et al. Am J Respir Crit Care Med. 2015 Aug 15;192(4):468-76.

Ultrathin bronchoscope

Lesion size, mm	UTB	EBUS-GS	*P*-value
≤ 20	65%	49%	0.037
20~30	84%	71%	0.061
Total	74%	59%	0.044

UBT = ultrathin bronchoscopy
EBUS-GS = endobronchial ultrasound using guide sheath

Oki M, et al. Am J Respir Crit Care Med. 2015 Aug 15;192(4):468-76.

Respiration

Interventional Pulmonology

Respiration
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Ultrathin Bronchoscopy for the Diagnosis of Peripheral Pulmonary Lesions: A Meta-Analysis

Soo Han Kim[a, b] Jinmi Kim[b, c] Kyoungjune Pak[b, d] Jung Seop Eom[a, b]

[a]Department of Internal Medicine, Pusan National University School of Medicine, Busan, Republic of Korea; [b]Biomedical Research Institute, Pusan National University Hospital, Busan, Republic of Korea; [c]Department of Biostatistics, Pusan National University Hospital, 179 Gudeok-ro, Seo-gu, Busan, Republic of Korea; [d]Department of Nuclear Medicine, Pusan National University Hospital, 179 Gudeok-ro, Seo-gu, Busan, Republic of Korea

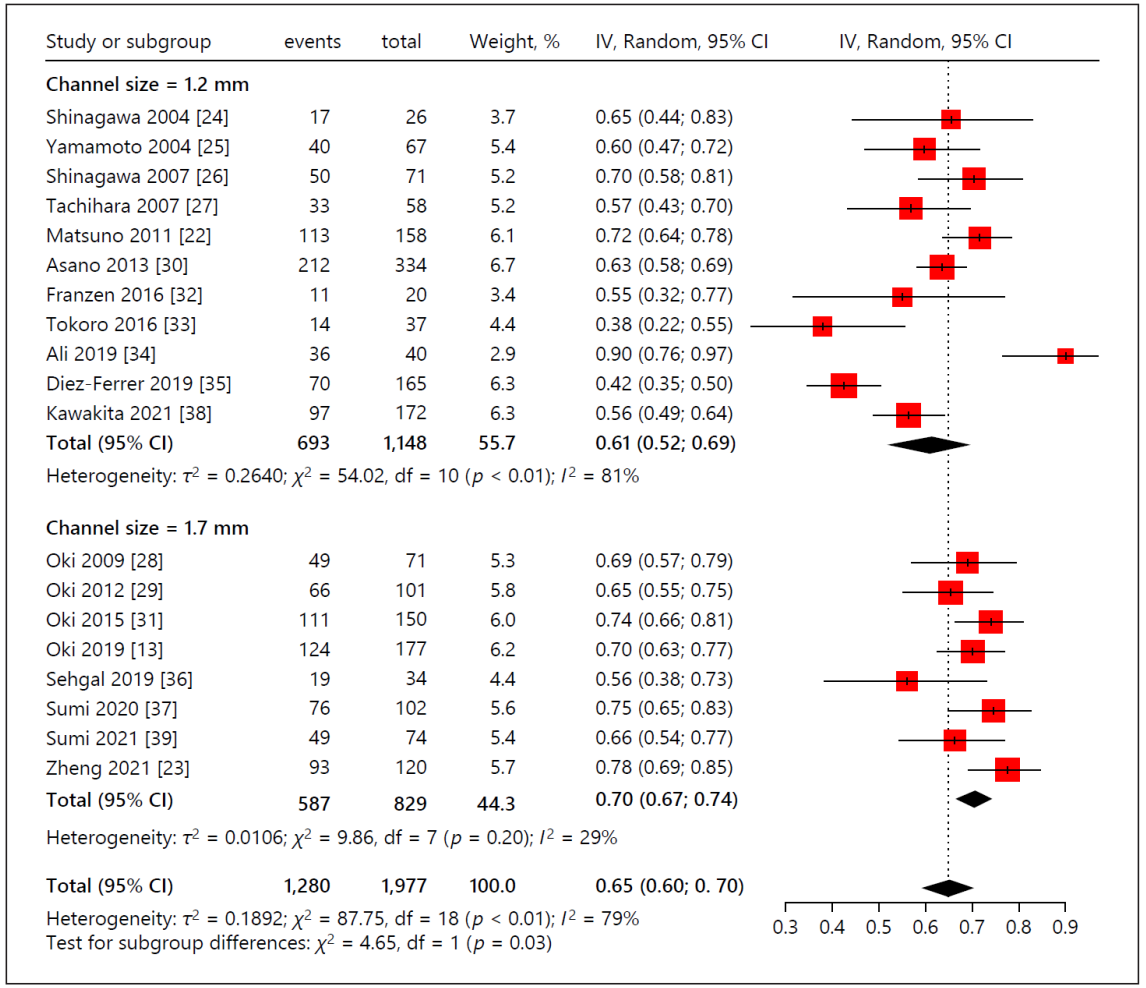
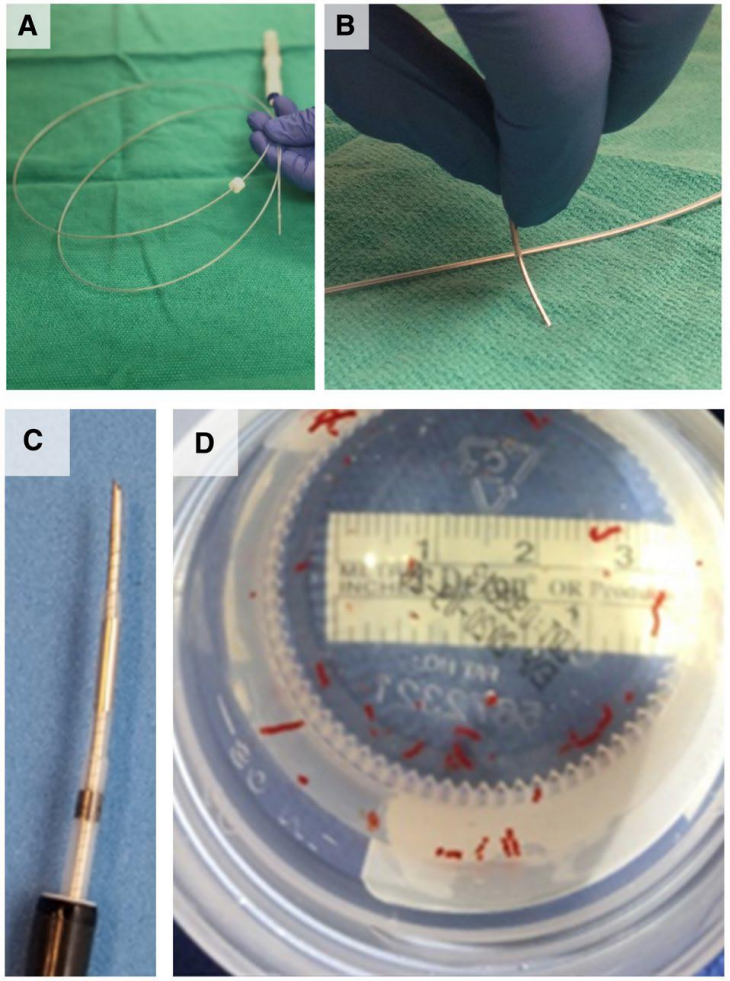


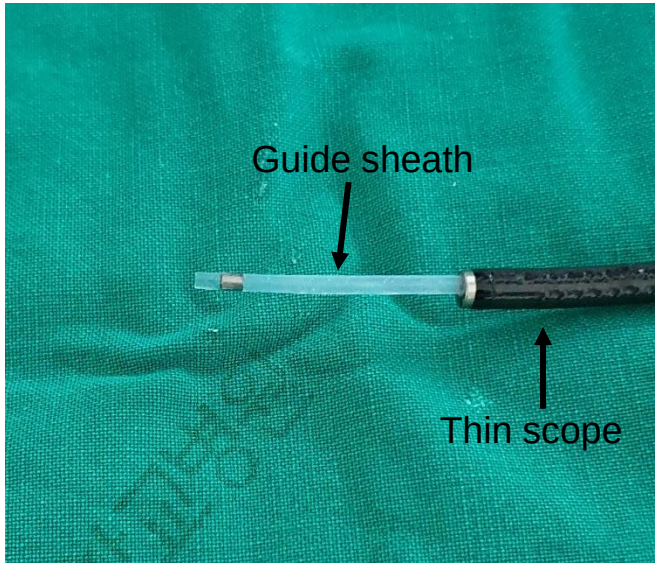
Fig. 4. Diagnostic yield of ultrathin bronchoscope based on channel size (1.2 mm vs. 1.7 mm). CI, confidence interval; IV, inverse variance.

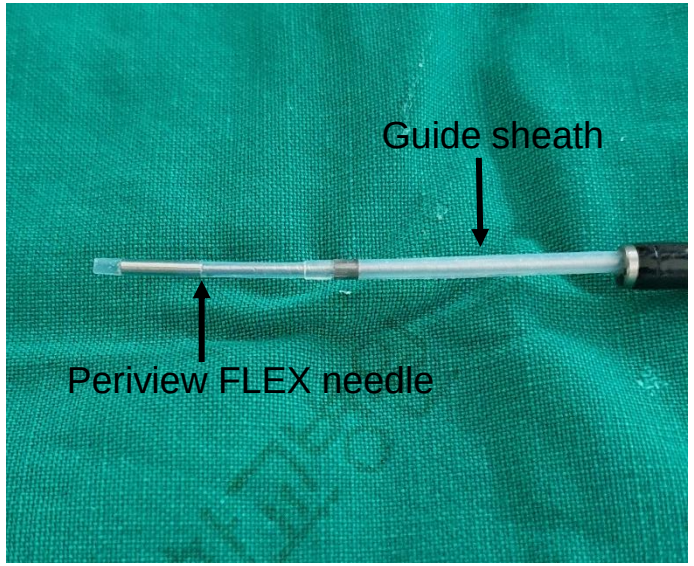
Kim SH, et al. Respiration . 2023;102(1):34-45.

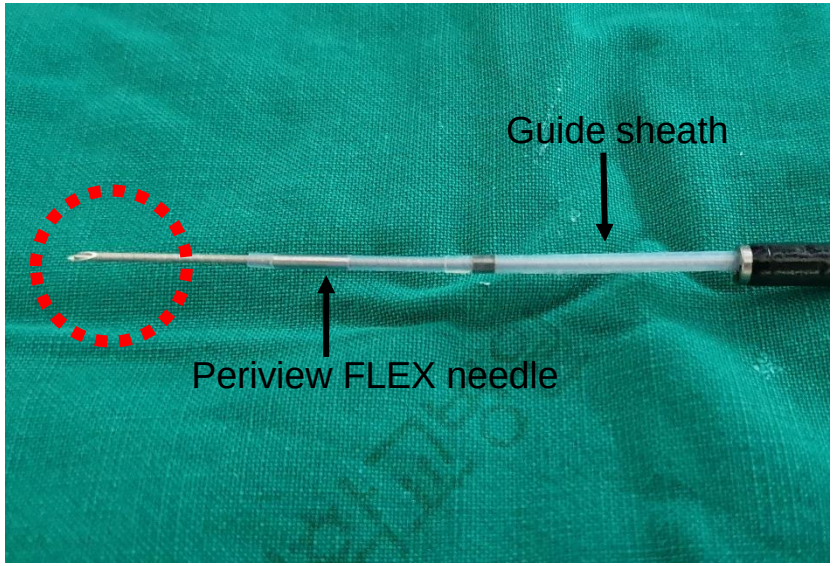
Needle technique



Naso J, et al. Cancer Cytopathol. 2020;128:333-340.


Guide sheath
Thin scope

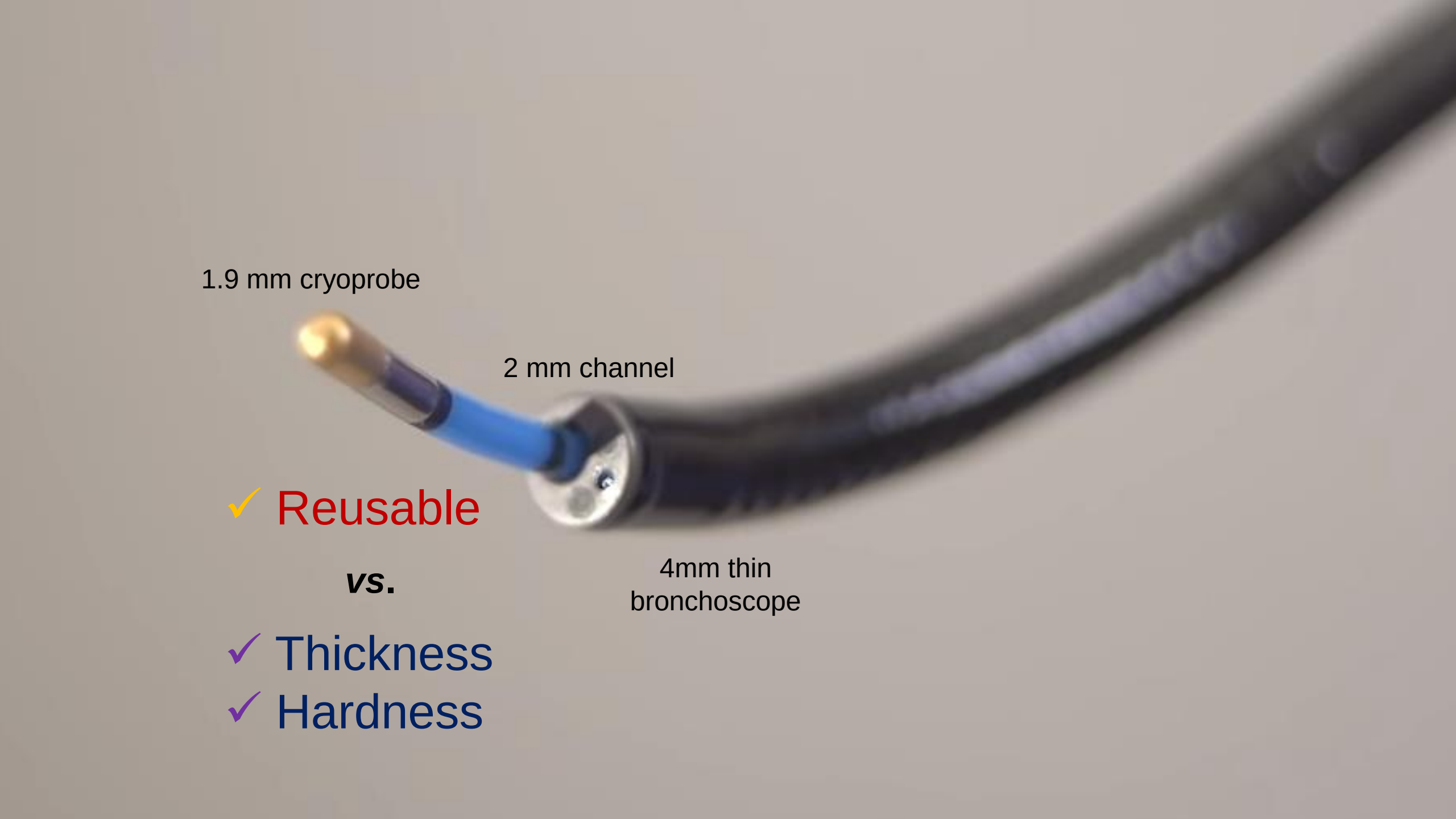

Guide sheath
Periview FLEX needle


Guide sheath
Periview FLEX needle

Needle for peripheral lesions

Diagnosis yield	Without FLEX needle	With FLEX needle	Benefit of FLEX needle
Malignancy	78%	83%	**4.3%**
Overall	72%	78%	**6.3%**

Naso J, et al. Cancer Cytopathol. 2020;128:333-340.



✓ Reusable

vs.

✓ Thickness

✓ Hardness

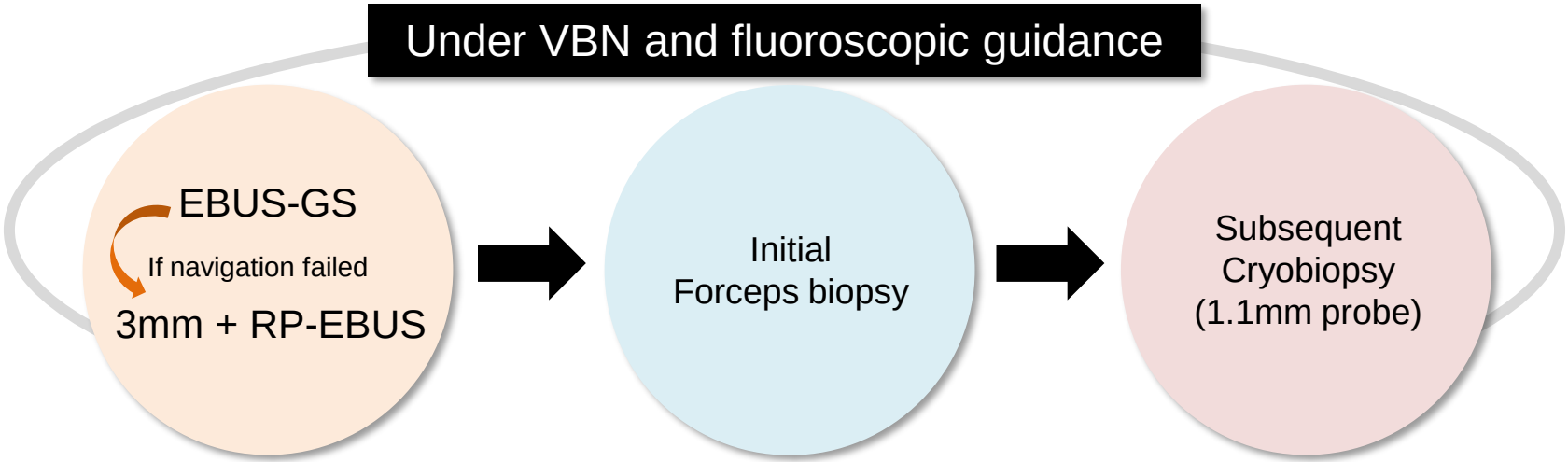
pISSN 1598-2998, eISSN 2005-9256
https://doi.org/10.4143/crt.2022.1008
Cancer Res Treat. 2022 Nov 1 [Epub ahead of print]

Original Article

The Additive Impact of Transbronchial Cryobiopsy Using a 1.1-mm Diameter Cryoprobe on Conventional Biopsy for Peripheral Lung Nodules

Soo Han Kim[1,2], **Jeongha Mok**[1,2], **Eun-Jung Jo**[1], **Mi-Hyun Kim**[1], **Kwangha Lee**[1], **Ki Uk Kim**[1], **Hye-Kyung Park**[1], **Min Ki Lee**[1], **Jung Seop Eom**[1,2]

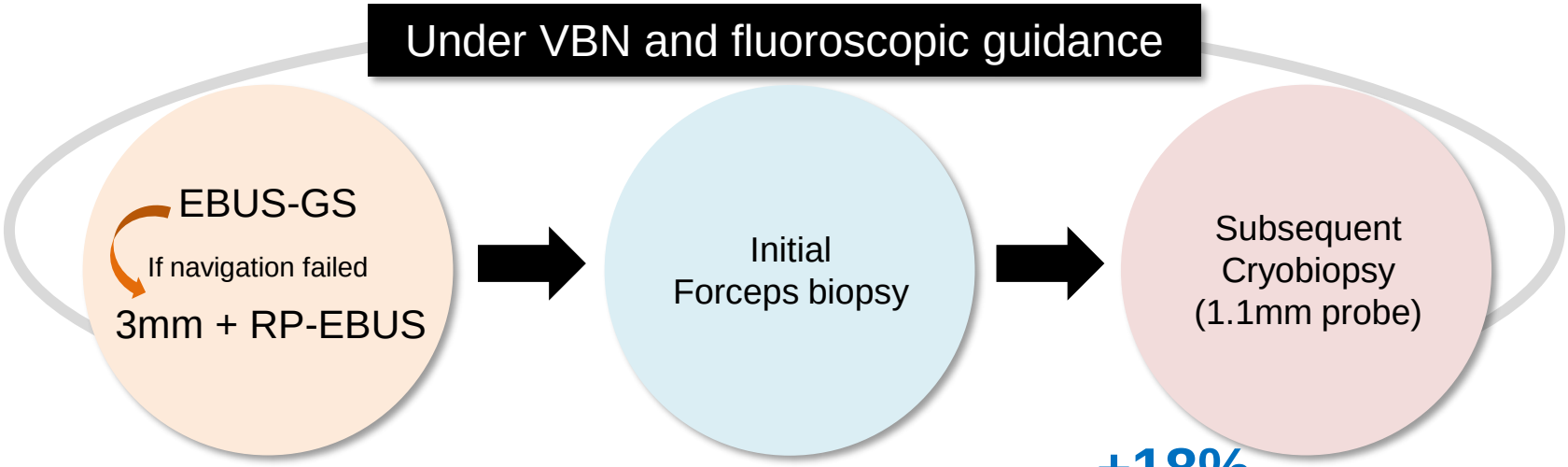
[1]Department of Internal Medicine, Pusan National University School of Medicine, Busan, [2]Biomedical Research Institute, Pusan National University Hospital, Busan, Korea



Kim SH, et al. Cancer Res Treat. 2023 Apr;55(2):506-512.

Performance of 1.1mm cryoprobe

- Bronchoscopy Registry of Pusan National University Hospital
- Inclusion criteria: Peripheral lesion < 30 mm
- N = 106 (From Jan to Oct 2021)
- Median lesion size = 22 mm
- Positive bronchus sign = 60%



- Diagnostic yields

+18%

61% ⋯→ 79% ←⋯ 66%

Kim SH, et al. Cancer Res Treat. 2023 Apr;55(2):506-512.

Contents lists available at ScienceDirect

Respiratory Medicine

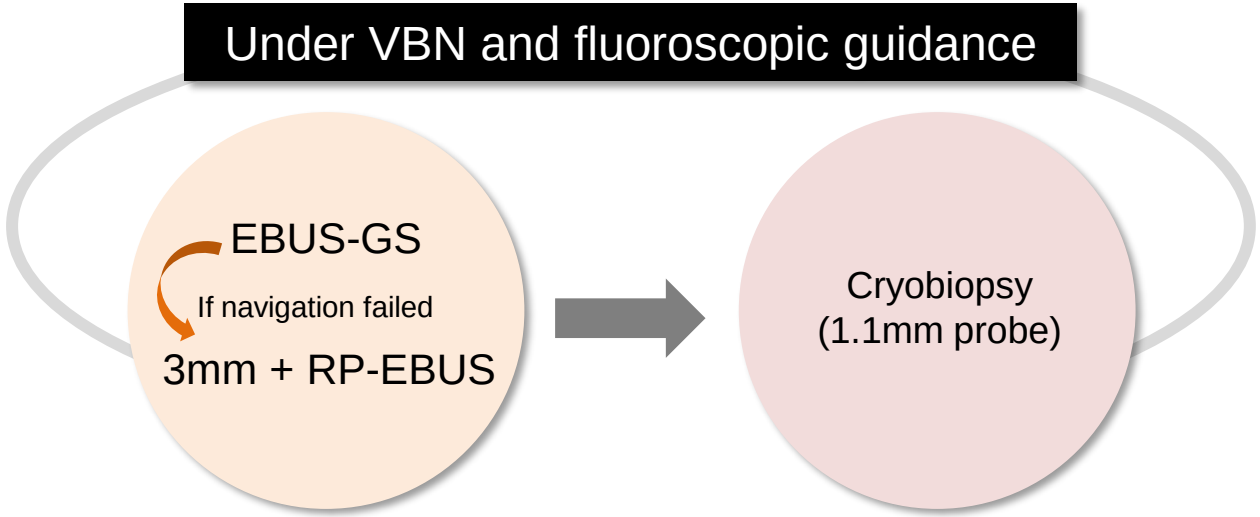
journal homepage: www.elsevier.com/locate/rmed

Original Research

Clinical outcomes of transbronchial cryobiopsy using a 1.1-mm diameter cryoprobe for peripheral lung lesions - A prospective pilot study

Soo Han Kim [a,b,c,1], Jeongha Mok [a,b,c,1], Saerom Kim [a,b], Wan Ho Yoo [a,b], Eun-Jung Jo [a,b], Mi-Hyun Kim [a,b], Kwangha Lee [a,b], Ki Uk Kim [a,b], Hye-Kyung Park [a,b], Min Ki Lee [a,b], Jung Seop Eom [a,b,c,*]

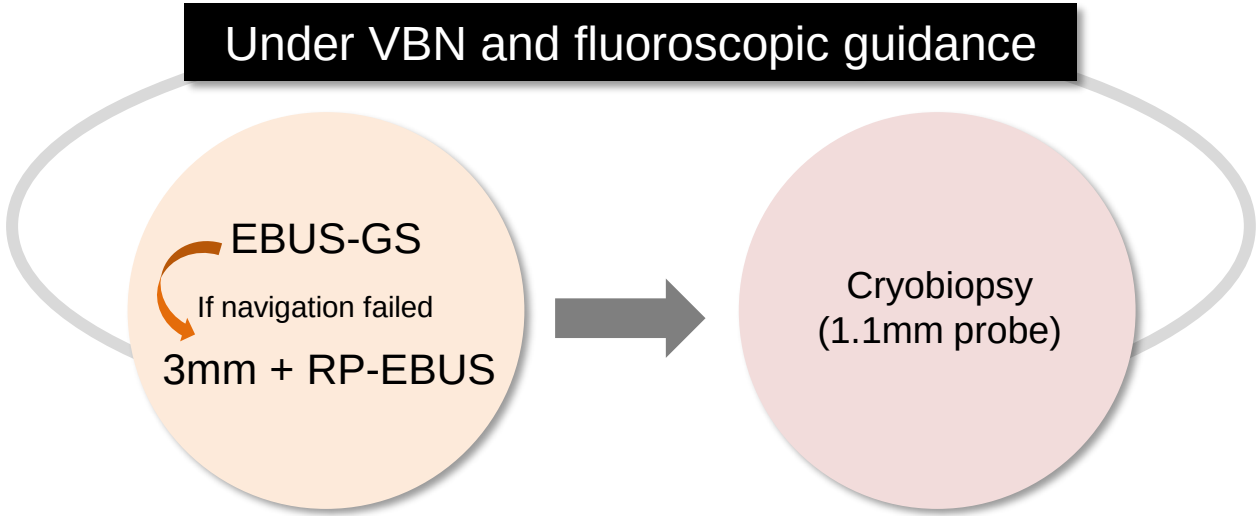
[a] Department of Internal Medicine, Pusan National University School of Medicine, Busan, Republic of Korea
[b] Department of Internal Medicine, Pusan National University Hospital, Busan, Republic of Korea
[c] Biomedical Research Institute, Pusan National University Hospital, Busan, Republic of Korea



Kim SH, et al. Respir Med. 2023 Oct:217:107338.

Performance of 1.1mm cryoprobe – II

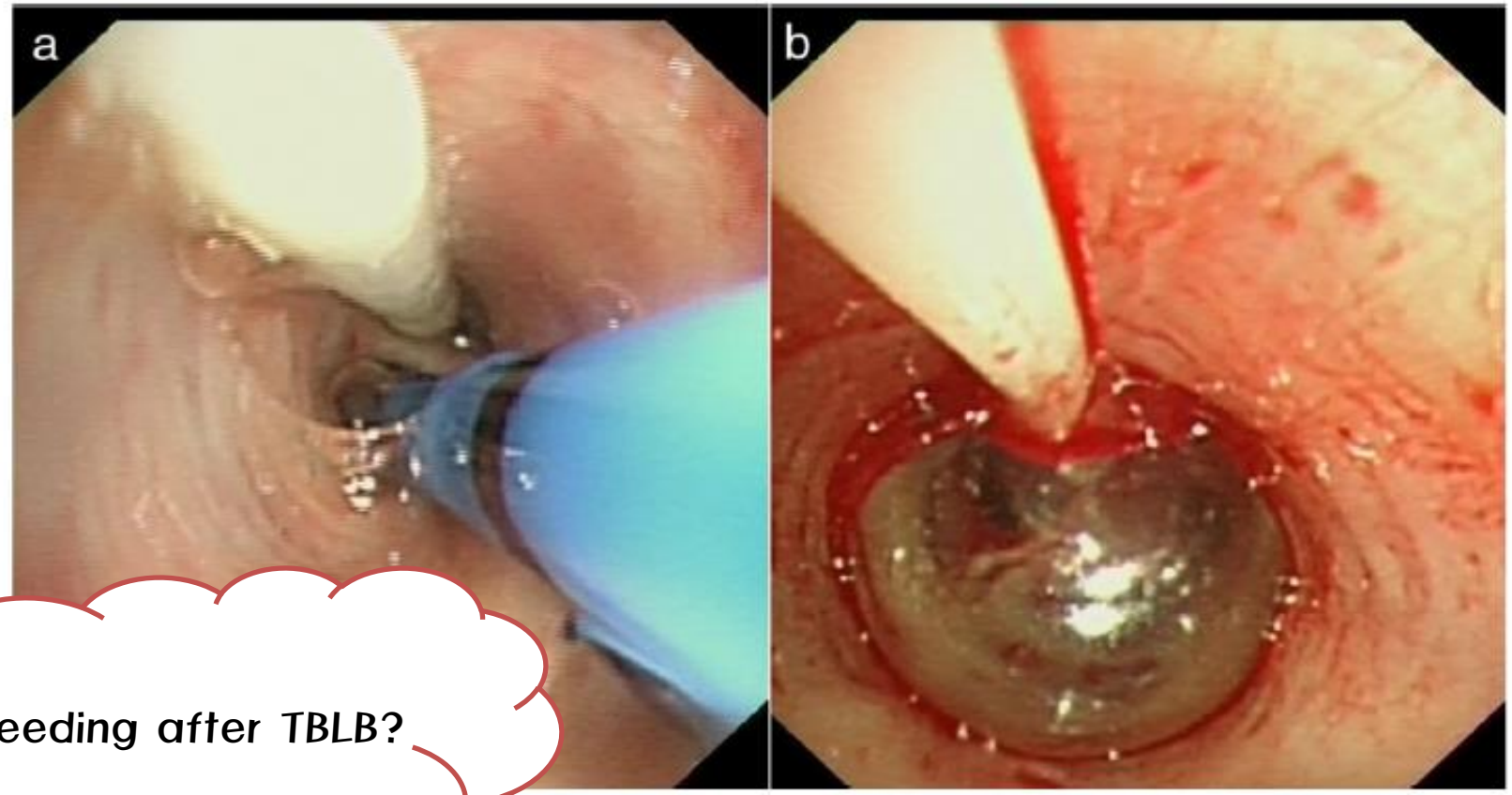
- Prospective study at Pusan National University Hospital
- Inclusion criteria: Peripheral lesion ≤ 30 mm
- N = 50 (From Dec 2021 to July 2022)
- Mean lesion size = 21 mm (range, 12−30 mm)



- Overall diagnostic yields
- Diagnostic yields of TBC

45/50 = **90%**
45/49 = **92%**

Kim SH, et al. Respir Med. 2023 Oct:217:107338.



Bleeding after TBLB?

Pajares Ruiz V, et al. Arch Bronconeumol. 2014 Jul;50(7):309-10.

출혈에 대한 처치

1. 시술 전 intubation 고려
2. 대량출혈 시 일단 동료를 불러야 함.
3. 치료내시경으로 변경 (large channel)
4. 출혈된 혈액이 반대측으로 안 흘러가도록..
5. 병변입구를 막거나 에서 지속적인 흡인
6. 필요 시 풍선지혈술, Two scope-techenique

Medical resource

Cost (affordability)

Expertise of the physician

우리 병원에서는 어떠한 조합으로 검사를 할 수 있을까?

경청해 주셔서 감사합니다!