

支氣管鏡及Radial-Probe EBUS概論

天主教輔仁大學附設醫院 胸腔內科 一般內科

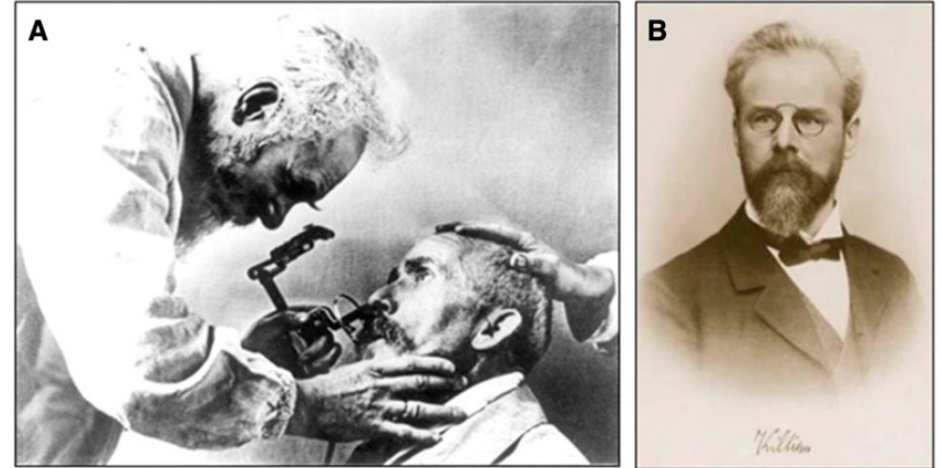
沈祥熙醫師

大綱

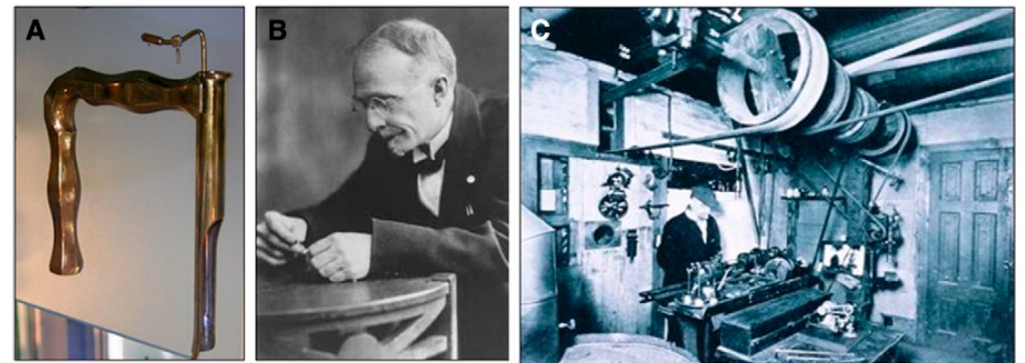
- Introduction of bronchoscopy
- Introduction of endobronchial ultrasound (EBUS)
- Introduction of Radial-probe endobronchial ultrasound (RP-EBUS)

History of Bronchoscopy

1876 Gustav Killian removed a pork bone from a farmer's airway using an esophagoscope, leading him to coin the term "directe bronkoscopie"



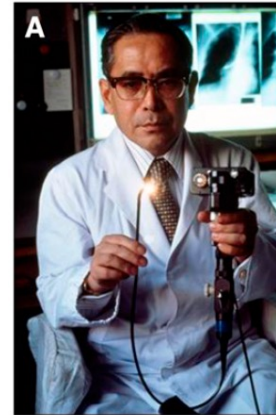
1904 Chevalier Jackson developed a direct ocular mechanism that evolved into the modern rigid bronchoscope



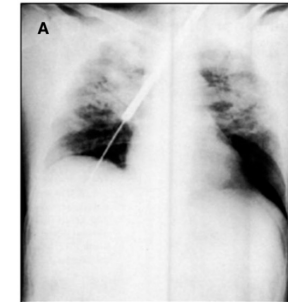
Ref: Panchabhai TS, et al., Historical perspectives of bronchoscopy. Connecting the dots. Ann Am Thorac Soc. 2015 May;12(5):631-41.

History of Bronchoscopy

✚ **1967 Shigeto Ikeda** revolutionized the field by innovating the fiberoptic bronchoscope.



✚ **1972 Howard Anderson** and colleagues performed the first transbronchial lung biopsy (TBBx) for histological analysis, initially reporting on 450 cases.



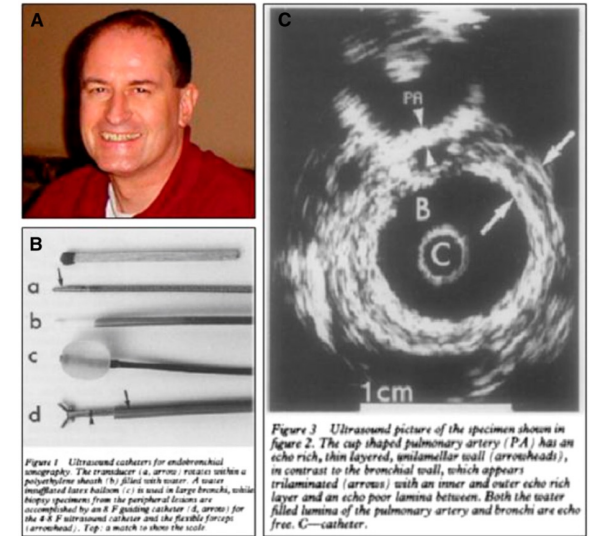
✚ **1978 Ko-Pen Wang** performed the first bronchoscopic needle aspiration biopsy of paratracheal tumors through a flexible bronchoscope



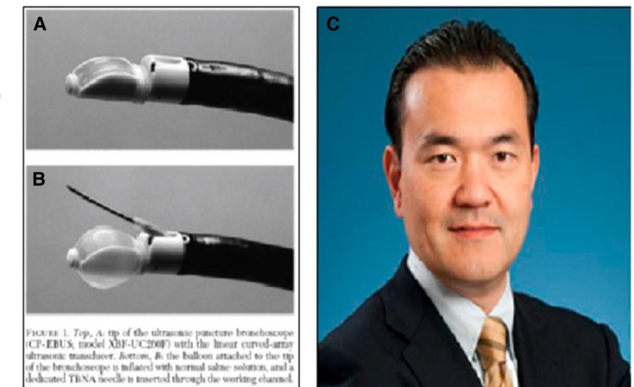
Ref: Panchabhai TS, et al., Historical perspectives of bronchoscopy. Connecting the dots. Ann Am Thorac Soc. 2015 May;12(5):631-41.

History of Bronchoscopy

1992 Heinrich Becker introduced RP-EBUS. **Hürter and Hanrath** first reported the usefulness of RP-EBUS

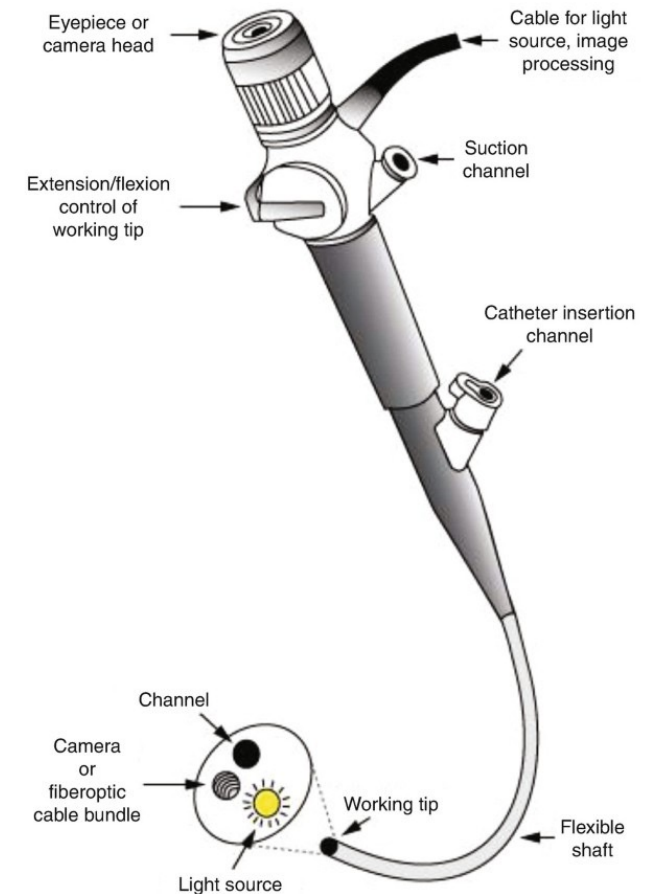
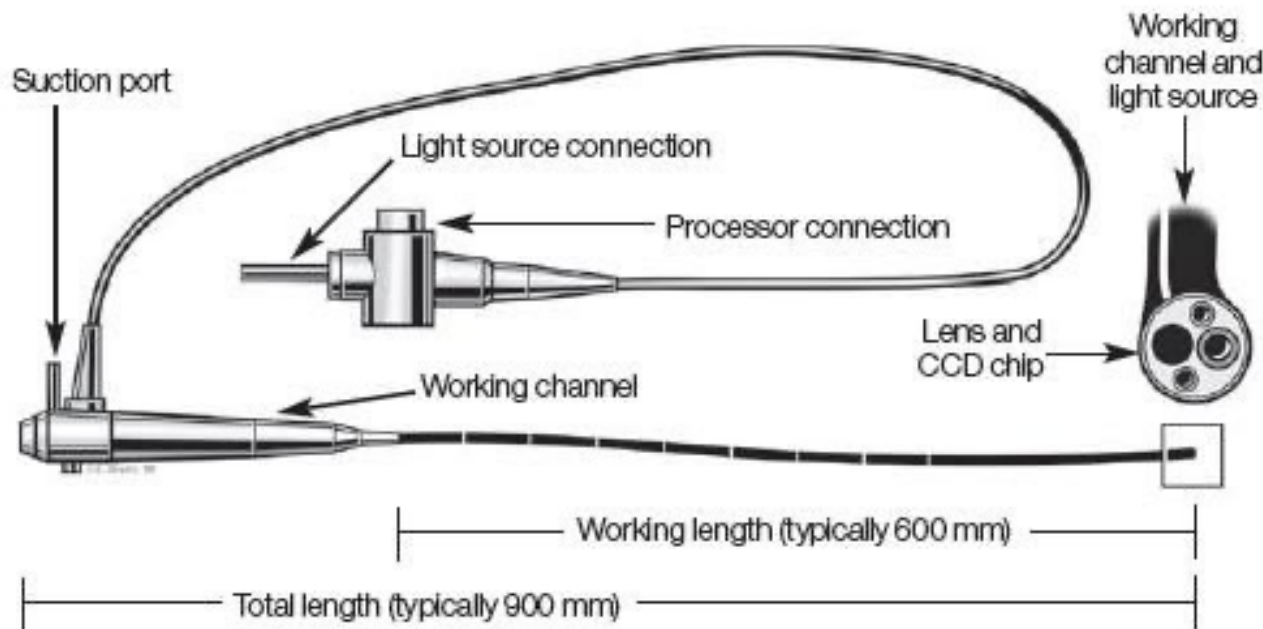


2003 Kazuhiro Yasufuku demonstrated the high diagnostic yield of the convex probe EBUS (CP-EBUS) in sampling mediastinal lesions

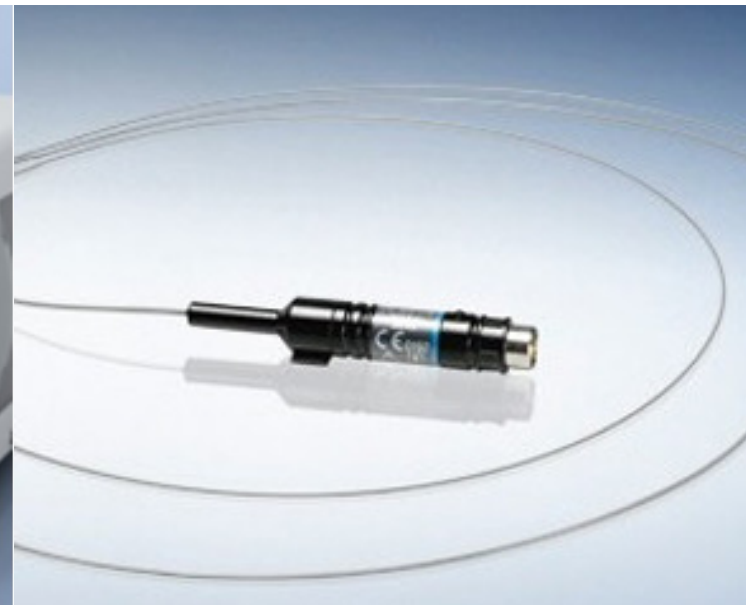


Ref: Panchabhai TS, et al., *Historical perspectives of bronchoscopy. Connecting the dots.* Ann Am Thorac Soc. 2015 May;12(5):631-41.

Types of Bronchoscopy



Ref. https://media.springernature.com/lw685/springer-static/image/chp%3A10.1007%2F978-3-030-64661-5_9/MediaObjects/323414_2_En_9_Fig3_HTML.jpg
<https://cdn.sanity.io/images/0vv8moc6/patientcare/7f8765f0d8a84e99dd4a504945a28ebf5e087e5e-504x280.jpg?w=504&max-h=280&fit=crop&auto=format>



內視鏡影像成像



Ref. 林敬凱 支氣管鏡與支氣管鏡超音波概論 June 29, 2024

Major Diagnostic and Staging Methods

- Conventional Biopsy and Cytology
- Bronchoalveolar lavage (BAL)
- Central Airway Visualization/Diagnosis
 - Autofluorescence Bronchoscopy (AFB)
 - Narrow-Band Imaging (NBI)
- Peripheral Lesion Localization and Biopsy
 - Radial-Probe Endobronchial Ultrasound (RP-EBUS)
 - Electromagnetic Navigation Bronchoscopy (ENB)
 - Virtual Bronchoscopic Navigation (VBN)
- Mediastinal Lymph Node Sampling (EBUS-TBNA)
 - Convex-probe endobronchial ultrasound (CP-EBUS)
- Cryobiopsy

Major Therapeutic Applications

- Airway Tumor Ablation
 - Nd:YAG Laser
 - Electrocautery (EC), Argon Plasma Coagulation (APC)
 - Cryotherapy/Cryoablation
- Brachytherapy
- Airway Stenting
- Foreign Body Removal
- Asthma Treatment
 - Bronchial Thermoplasty
 - Radiofrequency ablation (RFA)
- Emphysema Treatment
- Fistula Closure

Contraindication to Bronchoscopy

Table 6.4 Contraindications to bronchoscopy

Absolute contraindications

Inadequate oxygenation during the procedure

For rigid bronchoscopy

Unstable neck

Severely ankylosed cervical spine

Restricted temporomandibular joint

Relative contraindications

Malignant arrhythmia

Unstable cardiac status

Refractory hypoxemia

Bleeding diathesis or severe thrombocytopenia (if biopsy is anticipated)

Factors associated with increased risk of complications

Uncooperative patient

Recent or unstable angina

Unstable asthma

Moderate to severe hypoxemia

Hypercarbia

Uremia

Thrombocytopenia

Pulmonary hypertension

Lung abscess

Immunosuppression

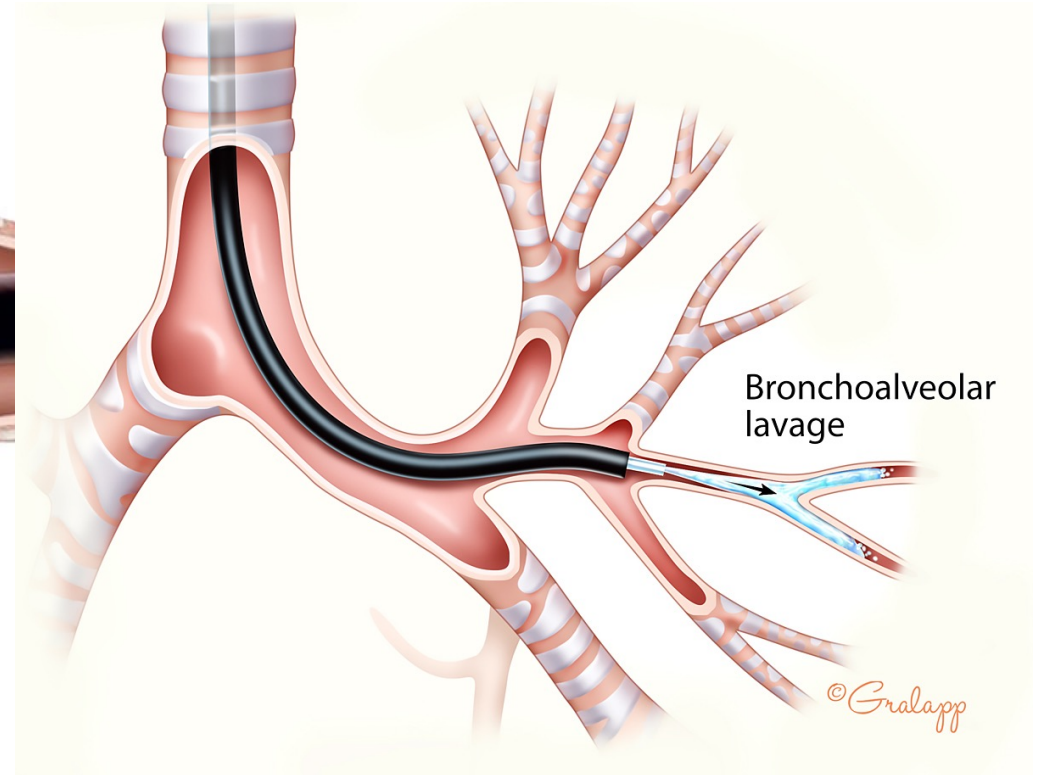
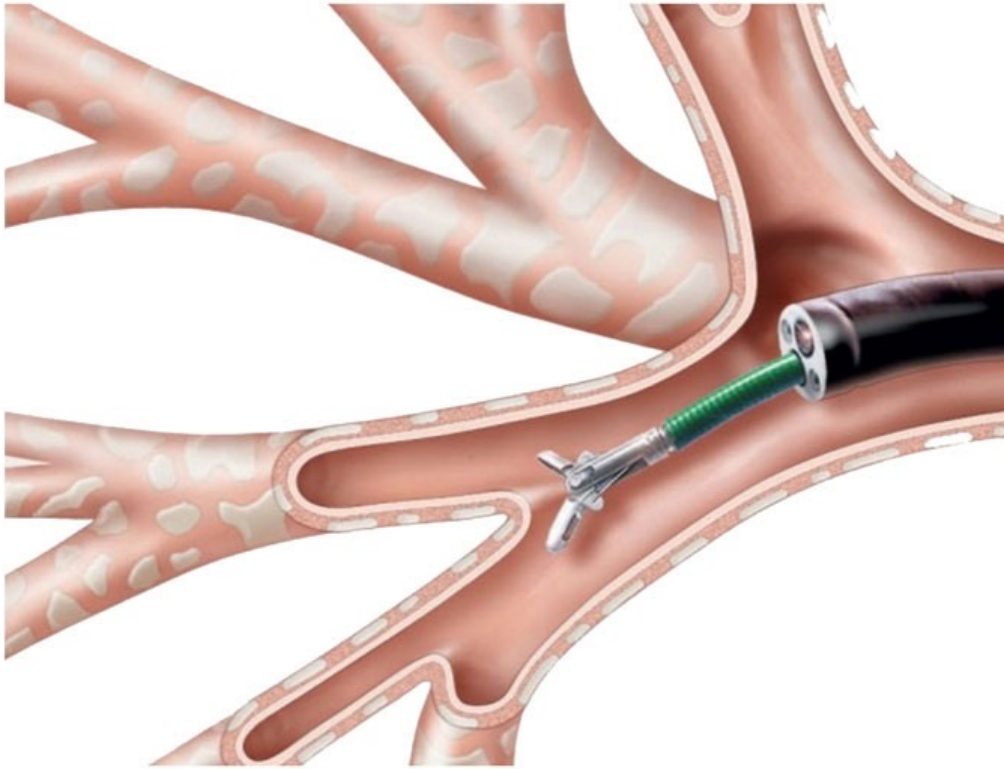
Superior vena cava obstruction

Debility, advanced age, or malnutrition

Recent use of clopidogrel

Complication of Bronchoscopy

- Pneumothorax
 - Air embolism, pneumomediastinum
- Hemorrhage
- Respiratory failure
- Bradycardia
- Infection



- Conventional Biopsy and Cytology
- Bronchoalveolar lavage (BAL)

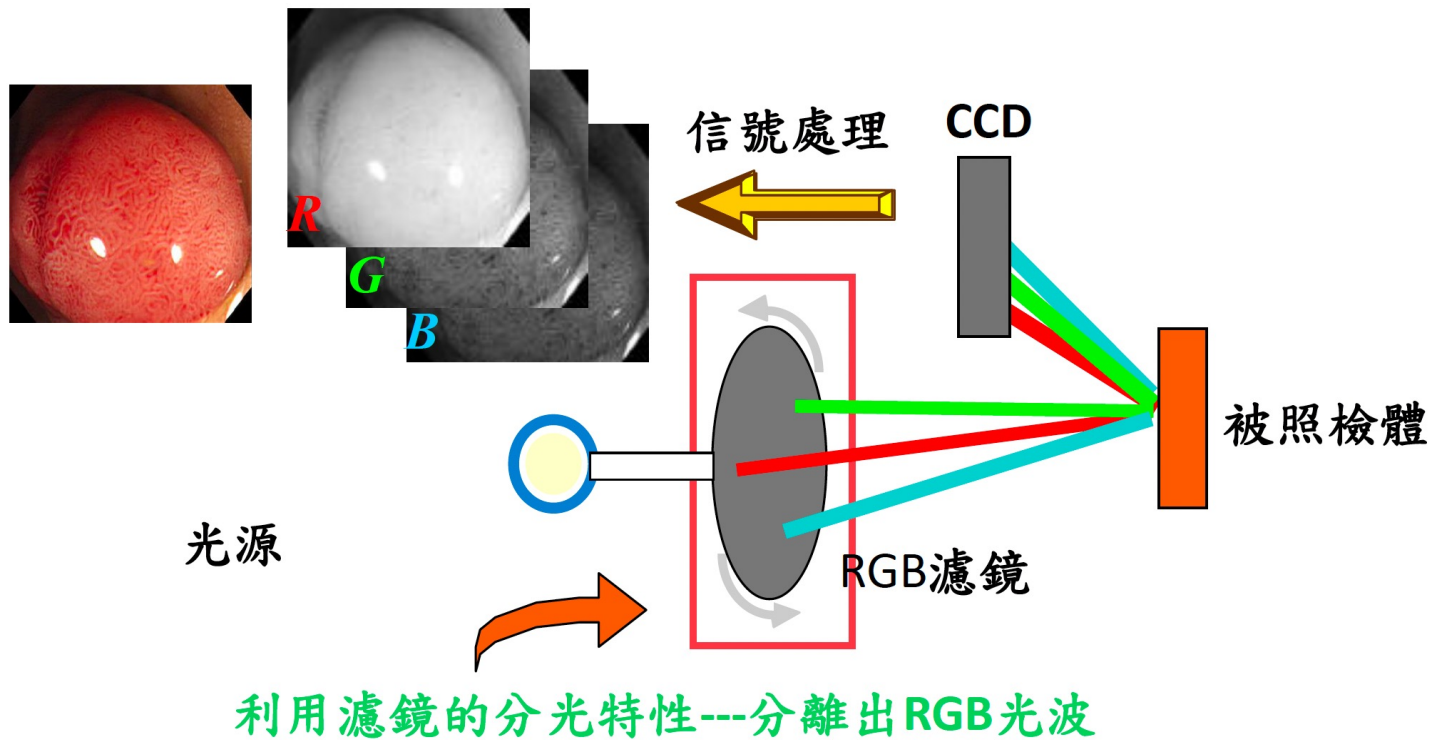
Ref: <https://share.google/images/QctYnisyKC3MDLy7C>

<https://psnet.ahrq.gov/web-mm/one-bronchoscopy-two-errors>

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一般內視鏡-光波原理

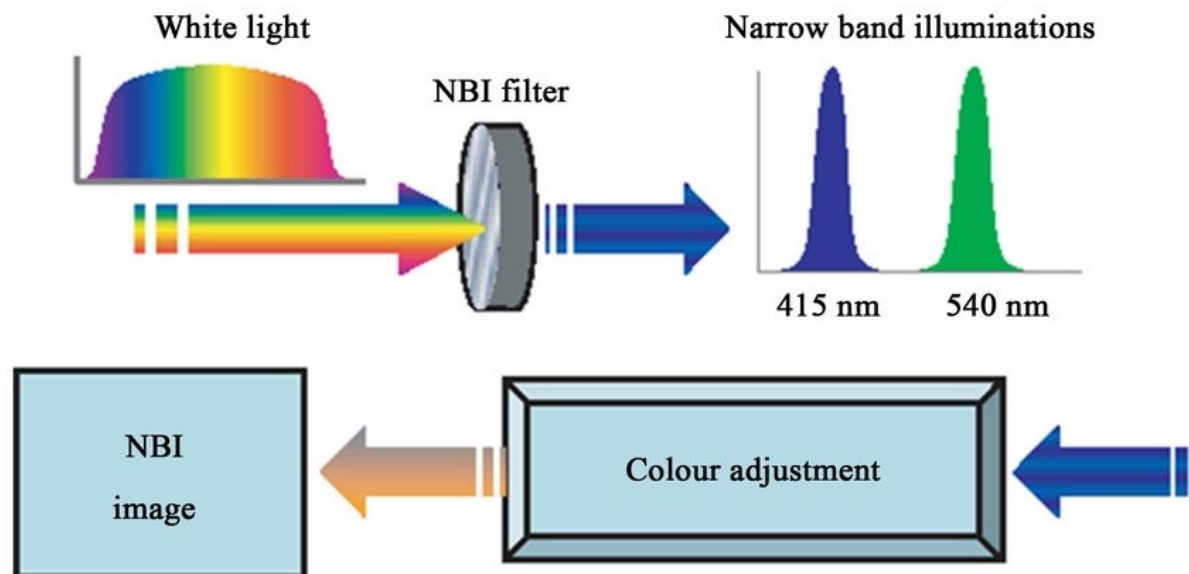


元佑實業提供

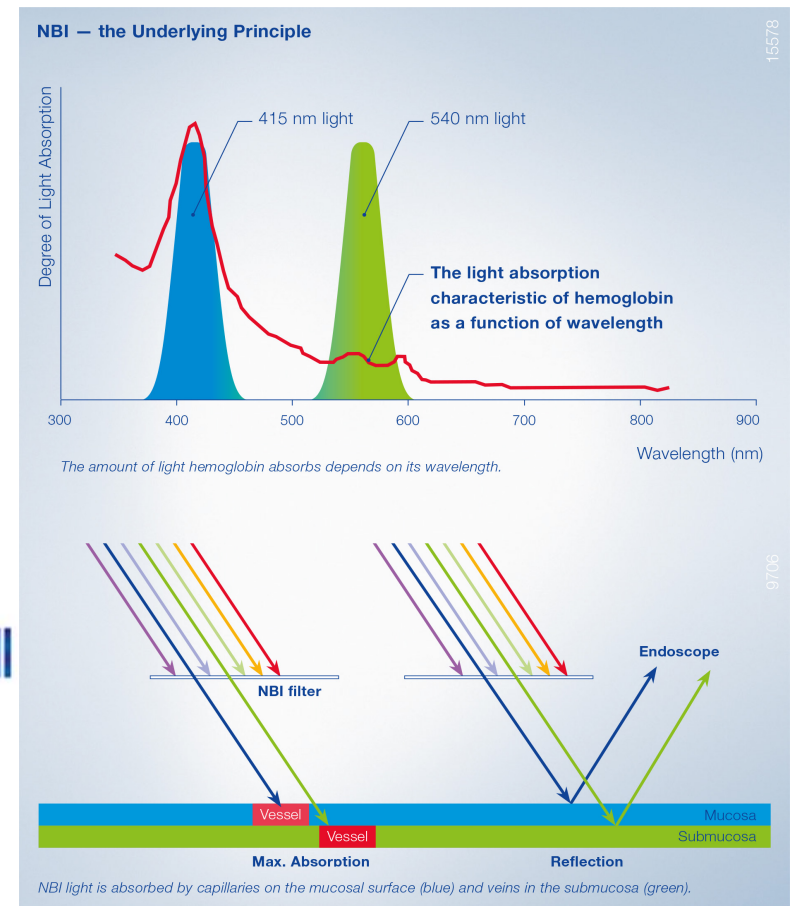
Ref. 林敬凱 支氣管鏡與支氣管鏡超音波概論 June 29, 2024

Narrow band imaging, NBI

窄波光原理

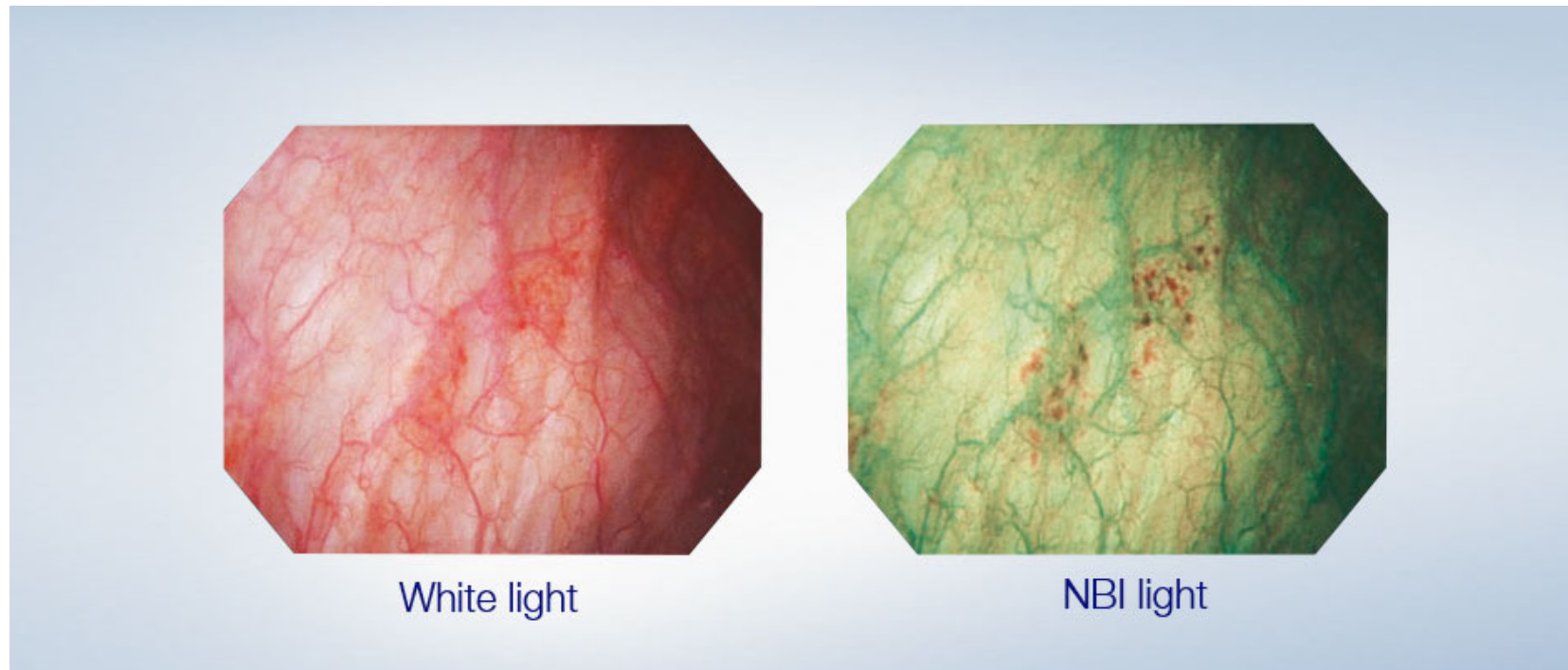


Ref. Sharad, P, et al., *Journal of Cancer Therapy*, 11, 160-171
<https://www.olympusprofed.com/ent/laryngoscopy/28603/>



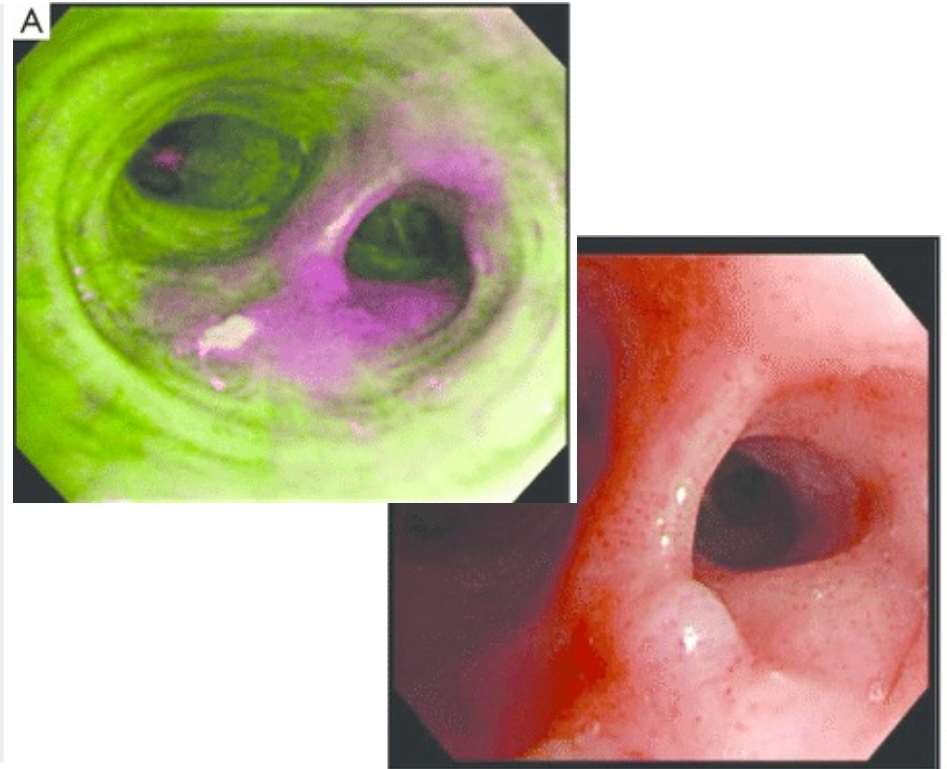
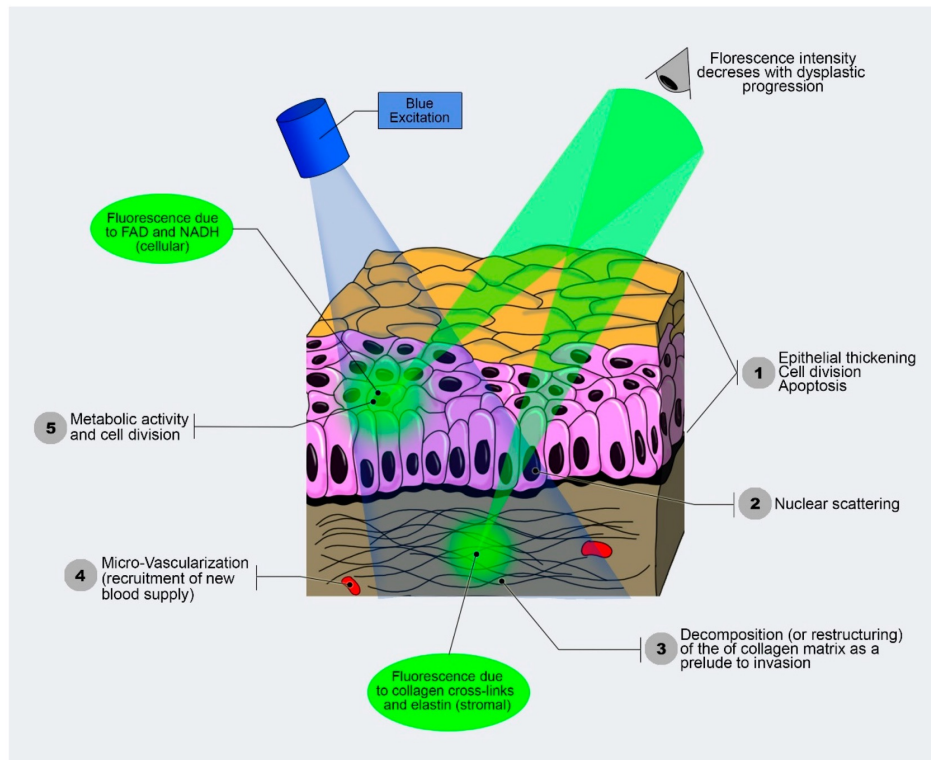
Narrow band imaging, NBI

窄波光原理



Ref. https://www.olympus-europa.com/medical/rmt/media/Content/Content-MSD/Images/ContentHub/NBI/nbi_story_main.jpg

Auto-Fluorescence Imaging, AFI



Ref. Andolfi, M. et al., *Journal of Thoracic Disease*, 8(11): 3329-3337

https://www.mdpi.com/ijerph/ijerph-20-00159/article_deploy/html/images/ijerph-20-00159-g001.png

Types of Bronchoscopy



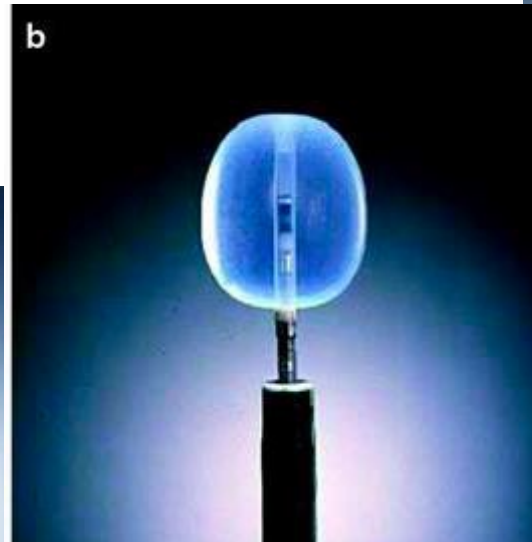
	前端部外徑 (mm)	軟性部外徑 (mm)	Working channel (mm)	
BF-Q290	4.8	4.9	2.0	標準型
BF-1TQ290	5.9	6.0	3.0	處置型
BF-H290	6.0	5.7	2.0	高畫質(HD)
BF-P290	4.2	4.1	2.0	小兒型
BF-MP290F	3.0	3.7	1.7	極細型
BF-XP290	3.1	3.0	1.2	極細型
BF-F260	5.5	5.4	2.0	字體螢光(AFI)

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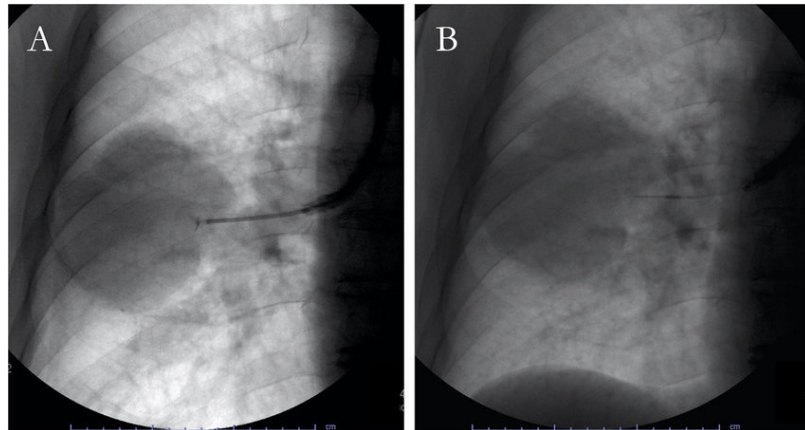
Endobronchial Ultrasonography, **EBUS**

- Radial probe
- Convex probe



Peripheral Intrapulmonary Lesion

- Transbronchial biopsy often performed for peripheral intrapulmonary lesions
- For small and distal lesion
 - Fluoroscopy-guided biopsy
 - Percutaneous needle aspiration: pneumothorax, air embolism, tumor seeding



Chest 2000;118;1630-1638
Pulmonology, 28(6), 461–471
Diagnostics 2022, 12, 359.

Radial-Probe EBUS

- EBUS-Transbronchial Biopsy (TBB) vs TBB only

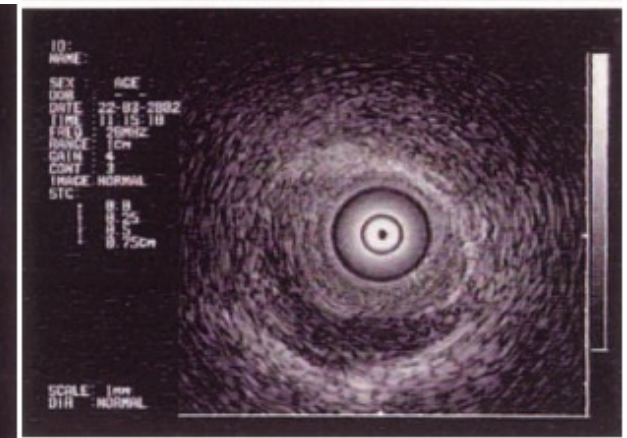
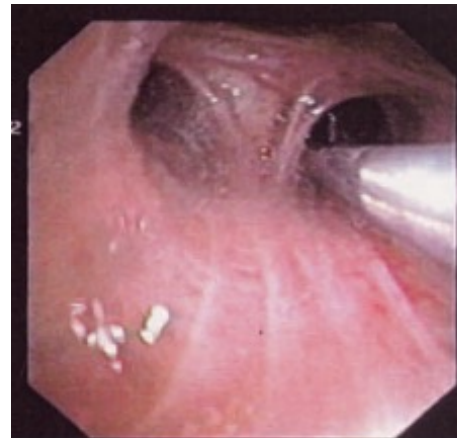


Table 2—Comparison Between Sensitivity, Specificity, Predictive Values, and Accuracy Observed in Study and Control Groups*

Variables	EBUS-TBB (n = 87)	TBB (n = 119)	p Value
Sensitivity	78.7 (68.4–89)	55.4 (44.7–66.1)	0.004
Specificity	100	100	NS
NPV	66.7 (53.3–80)	49.3 (34.9–63.8)	NS
PPV	100	100	NS
Accuracy	85 (77.9–92.5)	69 (60.6–77.2)	0.007

Paone et al. Chest 2005;128;3551-3557

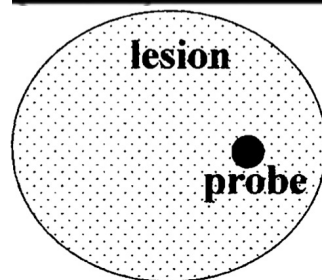
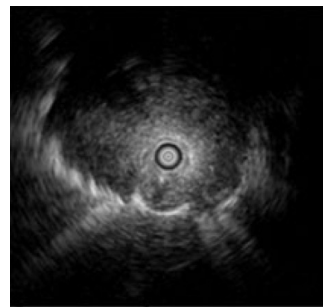
Table 3—Comparison Between Sensitivity, Specificity, Predictive Values, and Accuracy Observed in a Subset of Study and Control Groups: Patients With Lesions > 3 cm in Diameter*

Variables	EBUS-TBB (n = 40)	TBB (n = 61)	Significance
Sensitivity	82.8 (69–96.5)	77.3 (64.9–89.7)	NS
Specificity	100	100	NS
NPV	68.8 (50.2–87.3)	63 (46.7–79.2)	NS
PPV	100	100	NS
Accuracy	88 (77.3–97.7)	84 (74.3–92.9)	NS

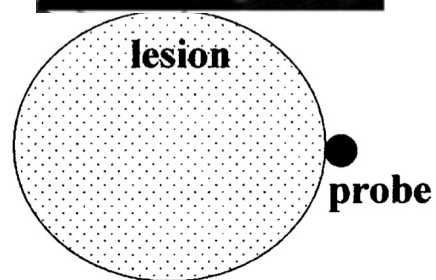
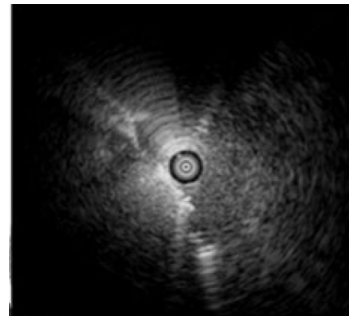
Table 5—Comparison Between Sensitivity, Specificity, Predictive Values, and Accuracy Observed in a Subset of Study and Control Groups: Patients With Lesions ≤ 2 Cm in Diameter*

Variables	EBUS-TBB (n = 25)	TBB (n = 31)	p Value
Sensitivity	71 (47–95)	23 (3–43)	< 0.001
Specificity	100	100	NS
NPV	73 (46–100)	52 (3–100)	0.18
PPV	100	100	NS
Accuracy	84 (12–65)	58 (40–75)	0.07

The Location of the Probe



within



adjacent to

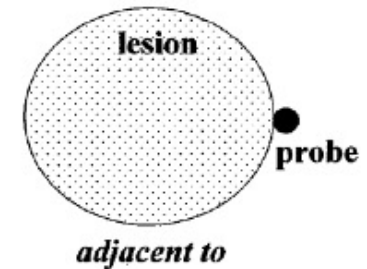
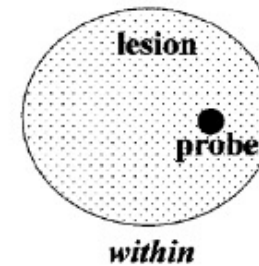
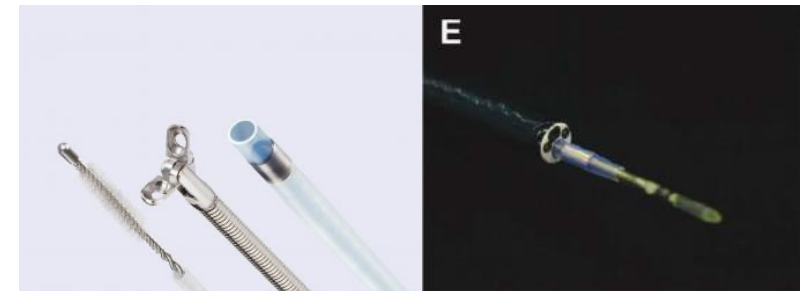
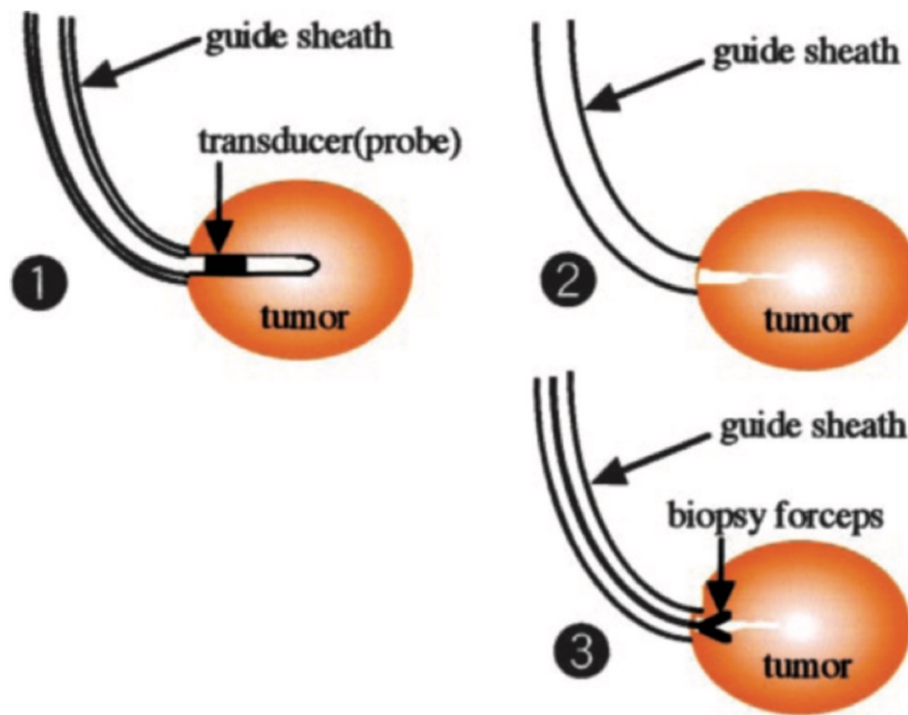
TABLE 2. RESULTS OF LOGISTIC REGRESSION OF DETERMINING THE FACTORS AFFECTING THE DIAGNOSTIC YIELD OF ENDOBRACHIAL ULTRASOUND-GUIDED TRANSBRONCHIAL LUNG BIOPSY

	<i>Odds ratio (95% confidence interval)</i>	<i>P value</i>
Age	0.96 (0.90, 1.02)	.178
Gender		
Male	1.43 (0.32, 6.39)	.641
Female	1.00	
VS experience		
Inexperience	1.00	
Experience	2.44 (0.26, 22.97)	.437
Location		
Left lower lobe	1.00	
Right lower lobe	0.48 (0.04, 5.58)	.555
Right middle lobe	—	
Left upper lobe	0.10 (0.01, 1.50)	.094
Right upper lobe	0.57 (0.04, 7.74)	.674
Angle		
Difficult	1.00	
Easy	2.16 (0.48, 9.47)	.318
CT bronchus sign		
Negative	1.00	
Positive	1.43 (0.32, 6.39)	.641
EBUS feature		
Parabronchial infiltration	1.00	
Peribronchial infiltration	8.17 (1.41, 47.22)	.019 ^a

Noriaki et al. *Chest* 2004;126:959-965
J Laparoendosc Adv Surg Tech A. 2012 May;22(4):319-23

Problem of EBUS Radial Probe
Not Real Time !!

Miniature Probe with Guide-Sheath



location of the probe	brushing (140)	TBB (110)	total (140)
within (121)	81/121 (67%)	79/96 (82%)	105/121 (87%)
adjacent to (19)	7/19 (37%)	1/14 (7%)	8/19 (42%)

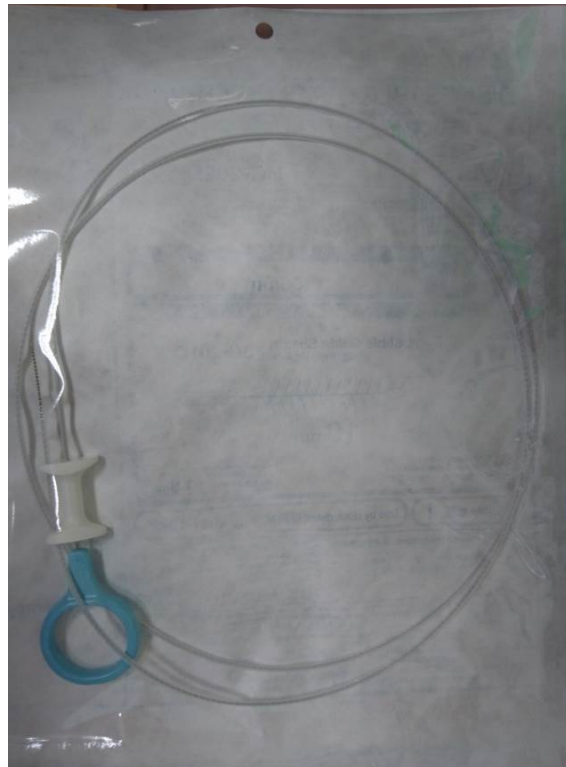
Advantage of EBUS-GS

- The position of lesions can be accurately determined
- Forceps can be introduced **any number of times** to the same bronchial segment
- The internal structure of lesions can be analysed
- There is **very little** post-transbronchial biopsy **bleeding**

EBUS-GS Kits

型號	外徑	內徑	搭配之RP-EBUS	搭配之支氣管鏡	備註
<u>K201</u> , K202	2.0 mm	1.7 mm	UM-S20-17S	BF-260, BF-Q290, BF-P260F, BF-P290	切片夾小，不易取得足夠檢體
<u>K203</u> , K204	2.6 mm	2.0 mm	UM-S20-20R	BF-1T260, BF-1TQ290	Guide sheath較硬，周邊或特殊位置(B1, B6)不易到達

EBUS-GS Kits



細胞刷



切片夾



Guide sheath

- Thanks for your attention~