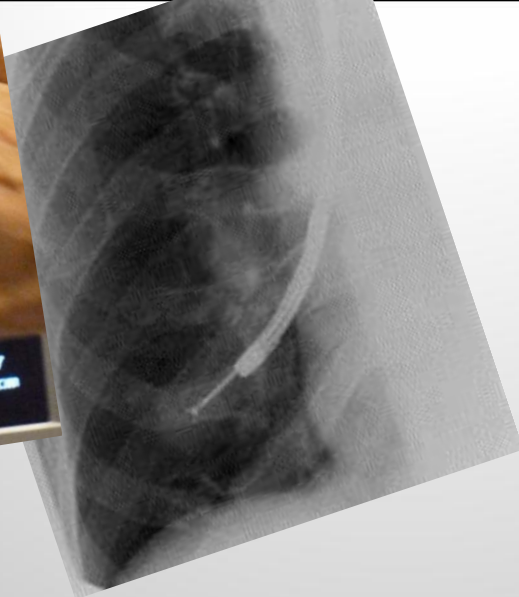
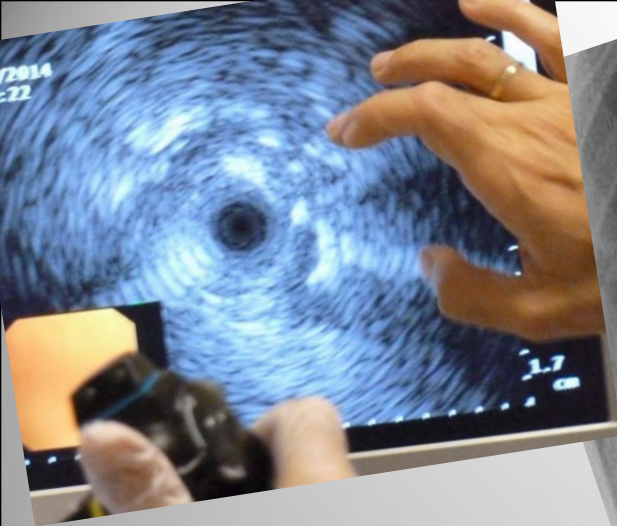




Επεμβατικές τεχνικές στη διάγνωση και αντιμετώπιση του πνευμονικού όζου

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*Χαράλαμπος Ζήσης, MD, FETCS, Νοσοκομείο Ευαγγελισμός,
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ΕΝΩΣΗ ΕΠΙΣΤΗΜΟΝΙΚΟΥ ΠΡΟΣΩΠΙΚΟΥ
Γ.Ν.Α. «Ο ΕΥΑΓΓΕΛΙΣΜΟΣ» (Ε.Ε.Π.Ν.Ε.)

25^ο ΕΤΗΣΙΟ ΣΕΜΙΝΑΡΙΟ
ΣΥΝΕΧΙΖΟΜΕΝΗΣ
ΙΑΤΡΙΚΗΣ ΕΚΠΑΙΔΕΥΣΗΣ
Γ.Ν.Α. «Ο ΕΥΑΓΓΕΛΙΣΜΟΣ»

Δεν υπάρχει σύγκρουση συμφερόντων με τις Χορηγούς Εταιρείες:

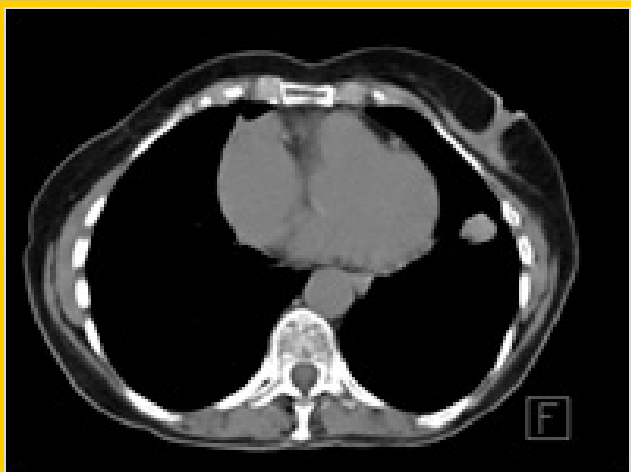


Πνευμονικοί όζοι και οζίδια: μία νέα επιδημία

- Με την καθιέρωση του προσυμπτωματικού ελέγχου για τον καρκίνο του πνεύμονα και την εξελιγμένη τεχνολογία και χρήση της θωρακικής απεικόνισης, η ανίχνευση των πνευμονικών οζιδίων ειδικά στην περιφέρεια του πνεύμονα, έχει αυξηθεί θεαματικά
- Αυτή η τάση θα διευρυνθεί καθώς το screening υιοθετείται διεθνώς όλο και περισσότερο
- Απεικονιστική παρακολούθηση είναι η ενδεικνυόμενη πρακτική για τα περισσότερα εξ αυτών, αλλά πολλά θα χρειαστούν περαιτέρω διαγνωστική αξιολόγηση

SPN, Solitary Pulmonary Nodule: round or oval shaped lesion

$d \leq 3\text{cm}$ surrounded by normal lung parenchyma



- 27.3% pts (53.454) participating in the National Lung Screening Trial (NLST) had at least one SPN

NEJM. March 2015

**Vast majority
>90% was benign**

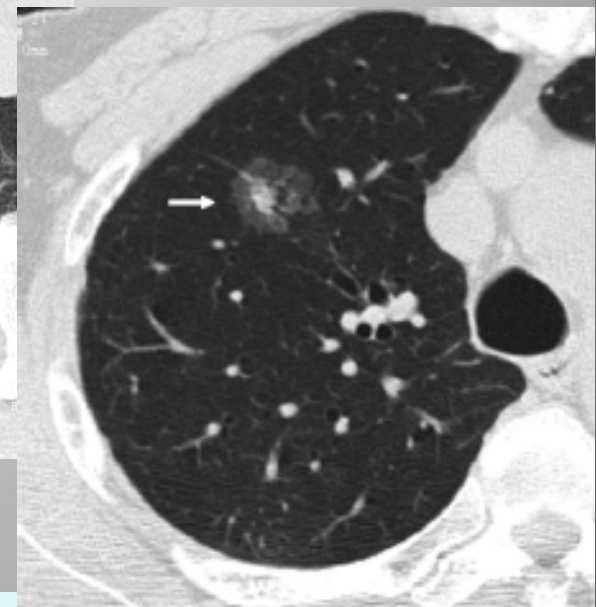
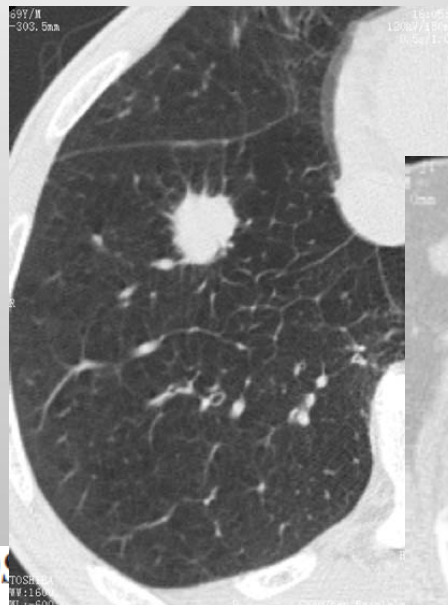




Evaluation of Individuals With Pulmonary Nodules: When Is It Lung Cancer?

- **Solid node $d \leq 8\text{mm}$**
- **Subsolid node-GGO**
- **Solid node $d > 8\text{mm}$**

CHEST 2013; 143(5)(Suppl):e93S–e120S



PET-CT has not optimal PPV or NPV

Identification of new subcentimeter nodule (< 8 mm in diameter)

Yes

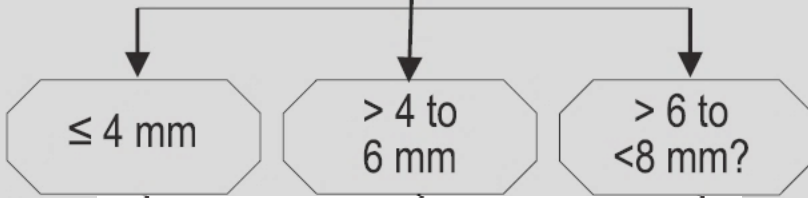
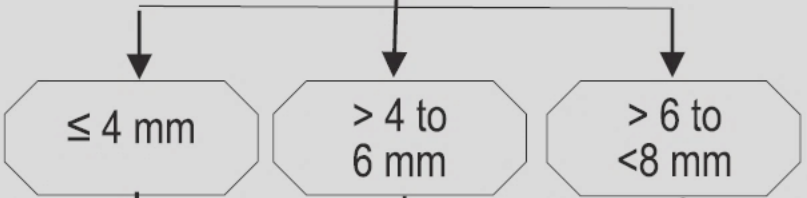
Does the patient have risk factors for lung cancer?

No

Yes

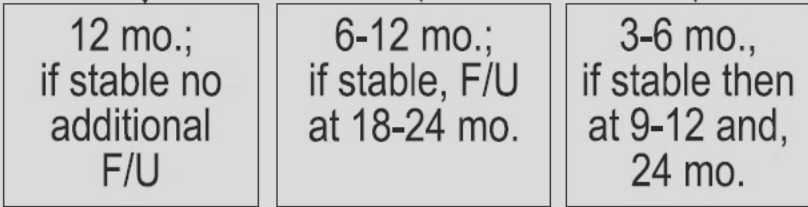
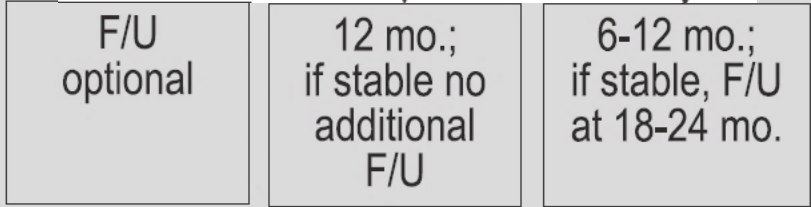
Characterize according to nodule size

Characterize according to nodule size

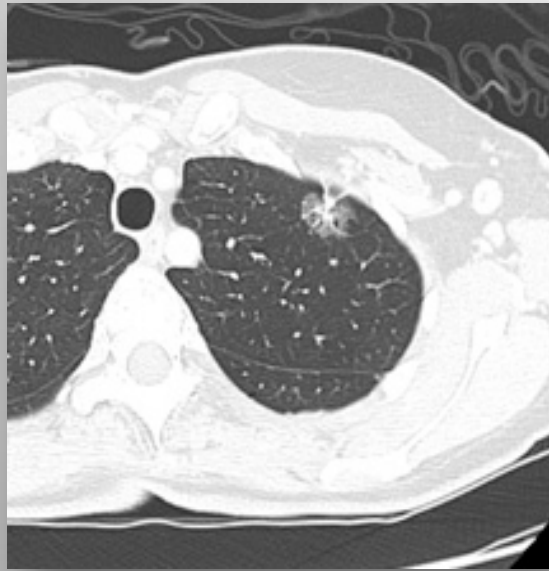


Follow-up Imaging in:

Follow-up Imaging in:



Diagnosis and treatment of sub-solid SPNs



Solitary part-solid nodule

<5 mm: Initial follow-up CT at 3 months; if persistent, annual CT for ≥ 3 years

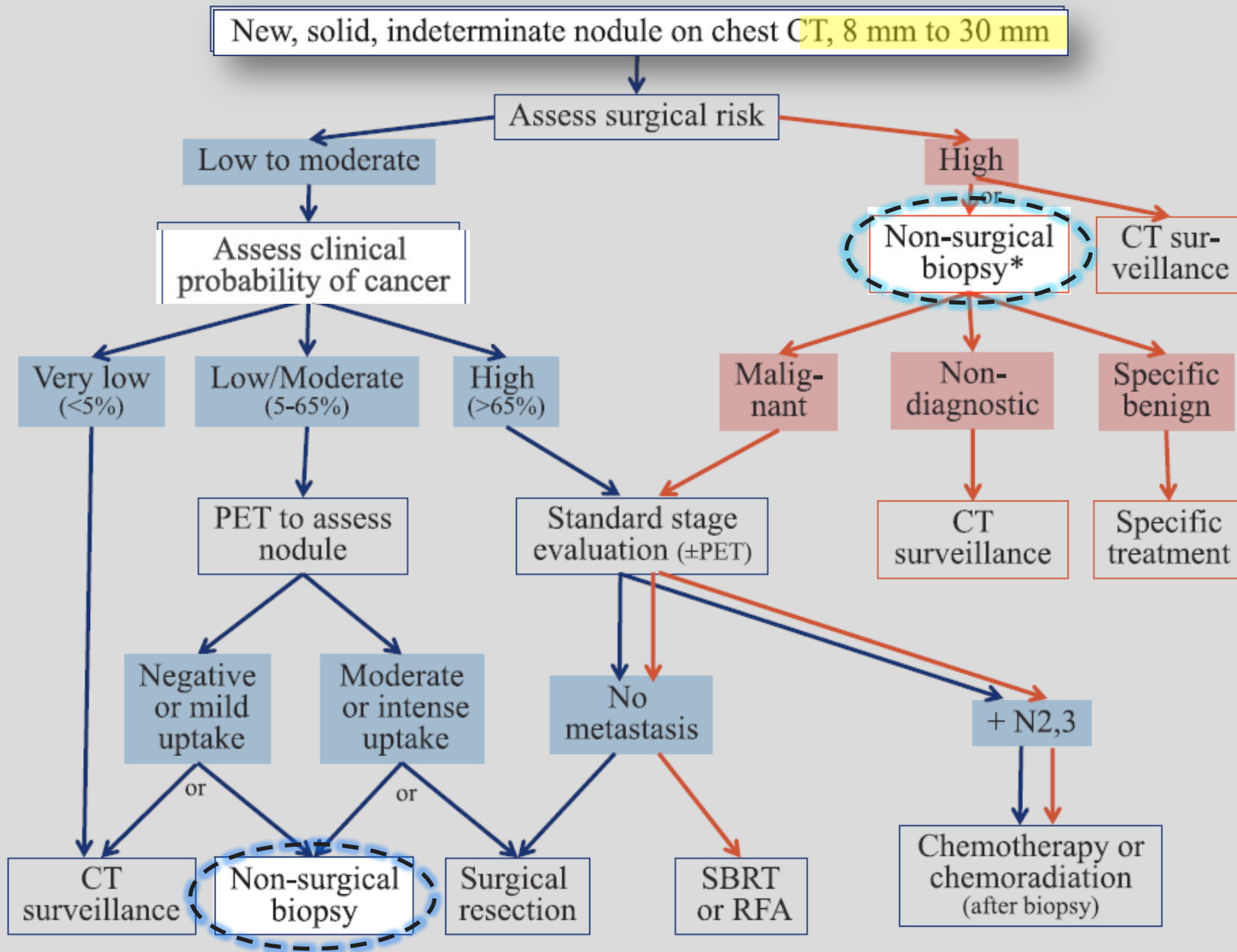
>5 mm: Initial follow-up CT at 3 months; if persistent, biopsy or surgical resection (consider PET/CT for part-solid nodules with a solid component >8 mm)



Solitary pure ground-glass nodule

<5 mm: No follow-up needed (obtain contiguous 1-mm-thick sections)

>5 mm: Initial follow-up CT at 3 months; if persistent annual CT for ≥ 3 years (FDG PET potentially misleading, not recommended)



Estimating the probability of cancer

Solitary Pulmonary Nodule Malignancy Risk (Mayo Clinic model) Share

Input:

Age

65

yr

Smoker

Current or former (1)

Never smoker (0)

Cancer

Extrathoracic cancer more than 5 years prior (1)

None (0)

Nodule Diameter

3

mm

Spiculation

Yes (1)

No (0)

Upper Lobe

Yes (1)

No (0)

Results:

X

-0.99

Malignancy Probability

27.11

%

Decimal Precision:

2

Formula

Notes

References

$$X = (0.0391 * \text{Age}) + (0.7917 * \text{Smoker}) + (1.3388 * \text{Cancer}) + (0.1274 * \text{NoduleDiameter}) + (1.0407 * \text{Spiculation}) + (0.7838 * \text{UpperLobe}) - 6.8272$$

$$\text{MaligProbability} = 100 * e^{(X)} / (1 + e^{(X)})$$

4.1.1 Recommendation

4.1.1.1. In the individual with a solid, indeterminate nodule that measures > 8 mm in diameter, we suggest that clinicians estimate the pretest probability of malignancy either qualitatively by using their clinical judgment and/or quantitatively by using a validated model (Grade 2C).

Solitary Pulmonary Nodule Malignancy Risk (Mayo Clinic model) Share

Input:

Age

65

yr

Smoker

Current or former (1)

Never smoker (0)

Cancer

Extrathoracic cancer more than 5 years prior (1)

None (0)

Nodule Diameter

3

mm

Spiculation

Yes (1)

No (0)

Upper Lobe

Yes (1)

No (0)

Results:

X

0.05

Malignancy Probability

51.29

%

Decimal Precision:

2

Formula

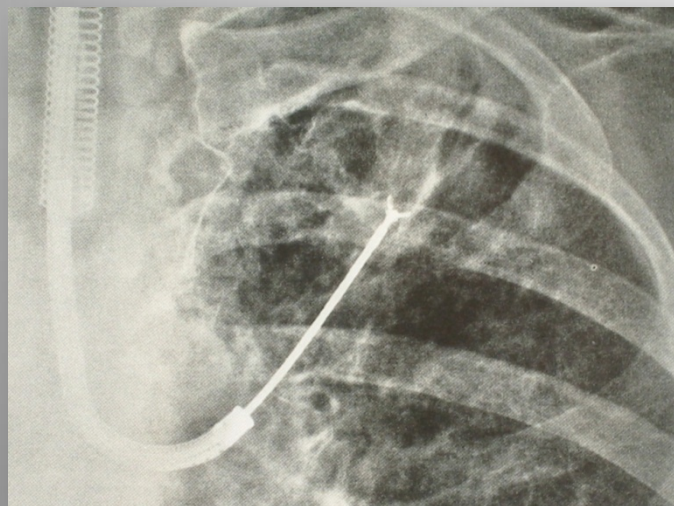
Notes

References

$$X = (0.0391 * \text{Age}) + (0.7917 * \text{Smoker}) + (1.3388 * \text{Cancer}) + (0.1274 * \text{NoduleDiameter}) + (1.0407 * \text{Spiculation}) + (0.7838 * \text{UpperLobe}) - 6.8272$$

$$\text{MaligProbability} = 100 * e^{(X)} / (1 + e^{(X)})$$

Diagnostic Yield of Fiberoptic Bronchoscopy in Evaluating Solitary Pulmonary Nodules*



(CHEST 2000; 117:1049-1054)

**Sensitivity 14-30%
for lesions 2-2.5 cm**

Table 4—Bronchoscopy Yield by Distance From the Hilum Within Different Nodule-Size Groups*

Variables	Total
≤ 2 cm intermediate	5/16 (31)
≤ 2 cm peripheral	2/14 (14)
2.1 to 2.5 cm central	1/2
2.1 to 2.5 cm intermediate	4/8 (50)
2.1 to 2.5 cm peripheral	3/10 (30)
> 4 cm central	4/5 (80)
> 4 cm intermediate	21/23 (91)
> 4 cm peripheral	23/30 (77)

There must be something better– CT fine needle aspiration

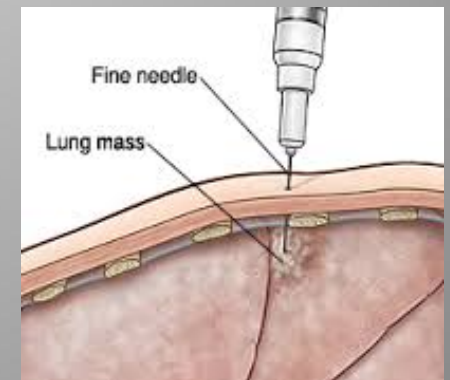
- CT-FNA έχει υψηλή ευαισθησία περί το 90%, με ελαφρώς μικρότερη ευαισθησία 68–78% σε μικρότερες βλάβες (≤ 15 mm in diameter).
- Η ευαισθησία πέφτει πιο χαμηλά όσο αυξάνει η απόσταση μεταξύ οζιδίου και υπεζωκότα

Complication rate for distance from the thoracic wall ≥ 20.5 mm was 48% comparing to 18% for distance < 20.5 mm ($p < 0.001$)."

Hofmann et al. Clin Lung Ca 2009.

Ost D et al. Chest 2008

Hautmann H et al. Respirology 2010



Diagnostic techniques – CT fine needle aspiration

EUROPEAN JOURNAL OF
RADIOLOGY

April, 2016

Complication rates of CT-guided transthoracic lung biopsy: meta-analysis

W. J. Heerink^{1,2} • G. H. de Bock^{1,3} • G. J. de Jonge² • H. J. M. Groen^{1,4} •
R. Vliegthart^{1,2} • M. Oudkerk¹

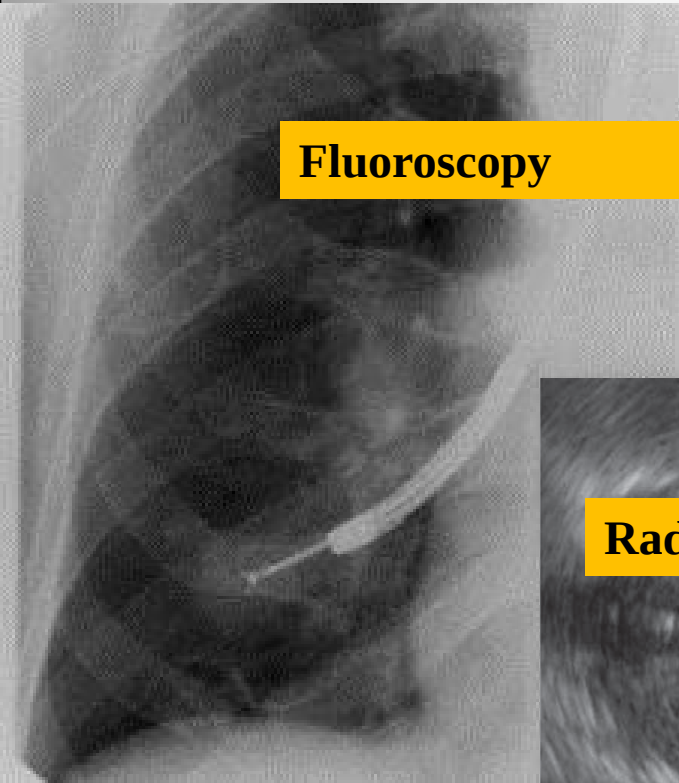
Pooled complication rates of CT-guided transthoracic lung biopsy

	Complication rates (95 % confidence intervals)		Odds ratio ^a	<i>p</i> -value
	Core biopsy	FNA		
Pneumothorax	25.3 % (22.2–28.6 %)	18.8 % (14.6–23.9 %)	0.69 (0.50–0.96)	0.027
Pneumothorax intervention	5.6 % (4.3–7.3 %)	4.3 % (2.7–7.0 %)	0.76 (0.48–1.37)	0.430
Pulmonary haemorrhage	18.0 % (13.4–23.8 %)	6.4 % (2.5–15.2 %)	0.33 (0.15–0.72)	0.005
Hemoptysis	4.1 % (2.8–6.1 %)	1.7 % (0.9–3.1 %)	0.38 (0.17–0.85)	0.019
Overall complications	38.8 % (34.3–43.5 %)	24.0 % (18.2–30.8 %)	0.50 (0.35–0.73)	<0.001
Major complication	5.7 % (4.4–7.4 %)	4.4 % (2.7–7.0 %)	0.80 (0.48–1.36)	0.416

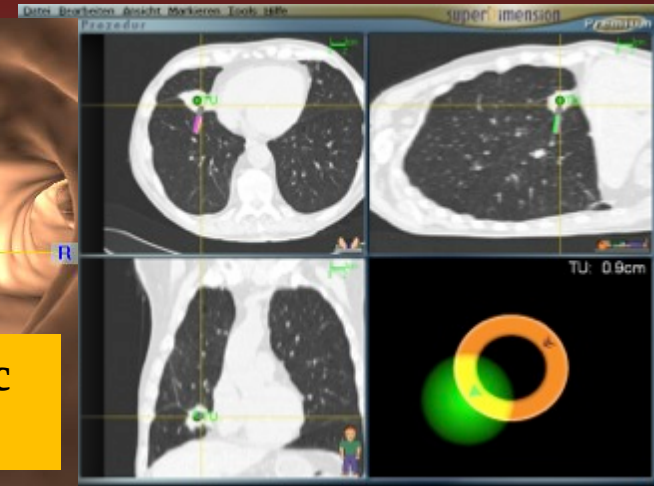
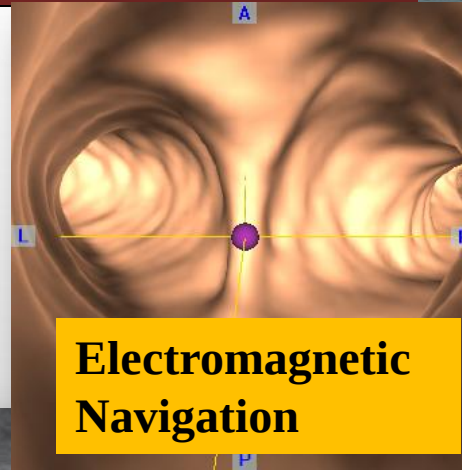
^a Core biopsy is reference

Guided bronchoscopy

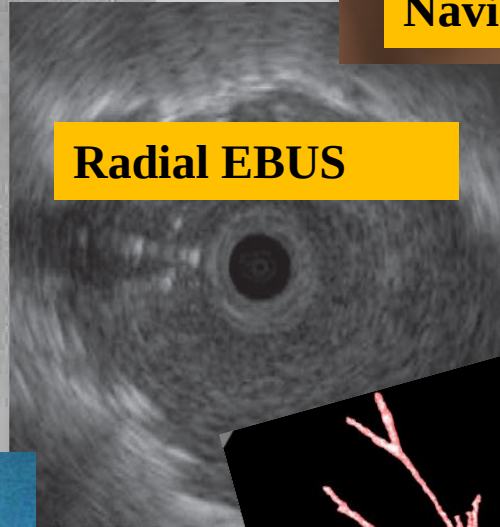
Fluoroscopy



**Electromagnetic
Navigation**



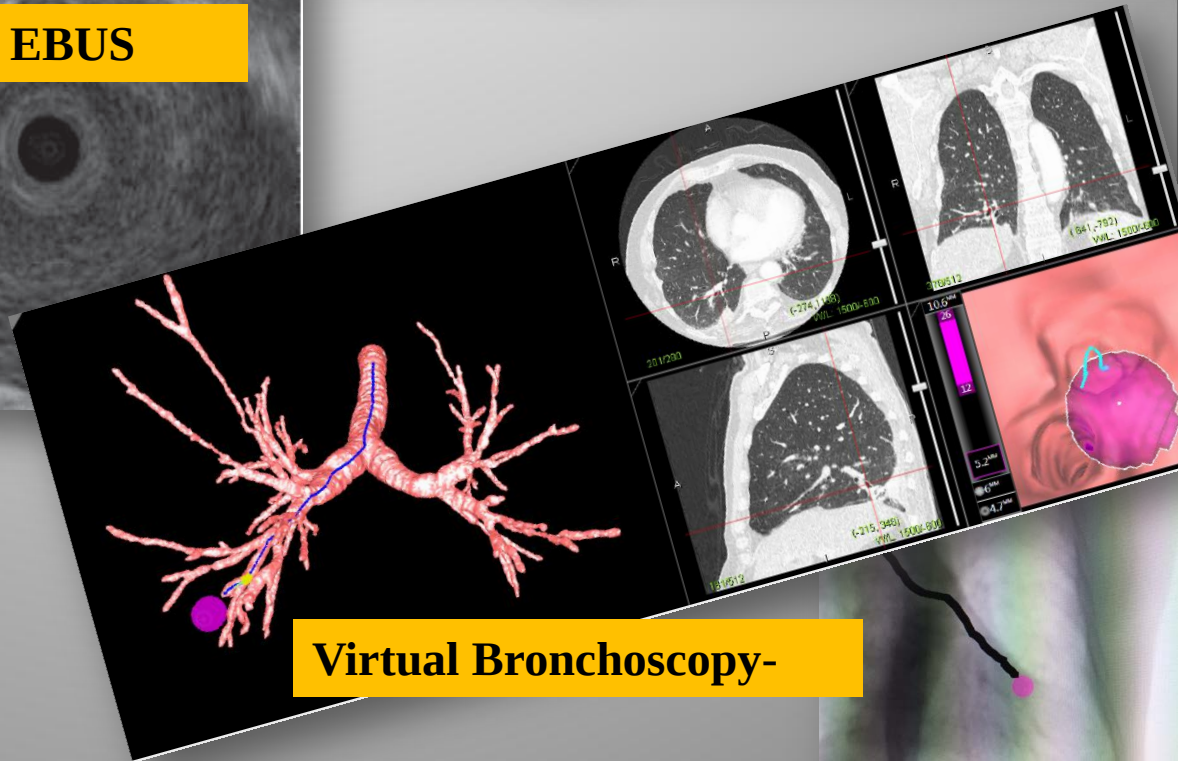
Radial EBUS



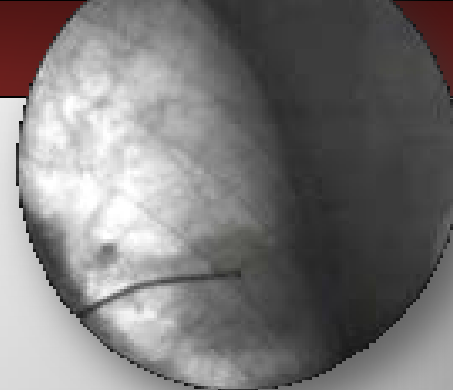
**Ultrathin
bronchoscope**



Virtual Bronchoscopy-



Fluoroscopic guided TBBx



CHEST 2013; 143(5):e142S–e165S

All Methods:		< 2 cm LESION				> 2 cm LESION			
First Author	Year	N	Pos	Neg	Sens	N	Pos	Neg	Sens
Gasparini ¹¹⁰	1995	195	82	113	42	300	169	131	56
Hattori ⁷⁶	1971	17	13	4	76	182	150	32	82
Baaklini ⁸⁸	2000	16	4	12	25	135	93	42	69
Wallace ¹²²	1982	65	3	62	5	78	24	54	31
Bandoh ¹³⁰	2003	25	8	17	32	72	50	22	69
Radke ¹⁰⁶	1979	21	6	15	29	76	49	27	64
Naidich ¹²¹	1988	15	4	11	27	46	26	20	57
Trkanjec ¹²⁹	2003	17	9	8	53	33	27	6	82
McDougall ¹⁰⁵	1981	9	1	8	11	36	21	15	58
Stringfield ¹⁰⁷	1977	3	1	2	33	26	13	13	50
Summary		383	131	252	34	984	622	362	63

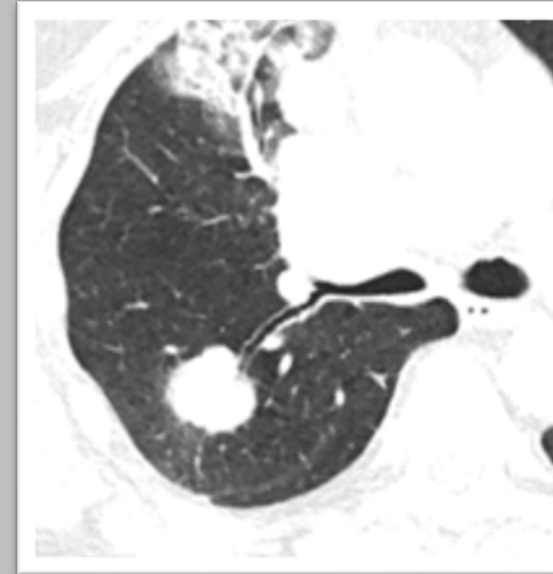
Transbronchial needle aspiration in peripheral pulmonary lesions: a systematic review and meta-analysis

Mondomi M et al. Eur Respir J 2016

Michele Mondoni¹, Giovanni Sotgiu², Martina Bonifazi^{3,4}, Simone Dore², Elena Maria Parazzini¹, Paolo Carlucci¹, Stefano Gasparini^{3,4} and Stefano Centanni¹

► Υψηλότερη διαγνωστική ακρίβεια όταν :

- Υπάρχει bronchus sign 0.70 vs. 0.51
- Υπάρχει ROSE 0.62 vs. 0.51
- Κακοήθεια 0.55 vs. 0.17
- Βλάβη > 30 mm 0.81 vs. 0.55
- Συνδυασμένη εφαρμογή με TBNA στο μεσοθωράκιο



Fluoroscopic CT guided TBBx

Πλεονεκτήματα

- Άμεση εικόνα
 - Διαγνωστική απόδοση **70-73%**¹
 - Εξαρτώμενη από:
Μέγεθος, Εντόπιση
- Ost D et al. Chest 2008 δεν προσθέτει σημαντικά στην κλασική βρογχοσκόπηση



courtesy of D Feller-Kopman

Μειονεκτήματα

- Ακτινοβολία για γιατρό και ασθενή
 - Χρονοβόρος διαδικασία στο CT department
 - Κόστος...
- Duhig N et al. J Bronchol 2002
 - Shinagawa N et al. Chest 2004
 - Ost D et al. Chest 2008
 - Hautmann H et al. Respiriology 2010

Cone beam CT

Thorac Surg Clin 27 (2017) 347–355





Meta-analysis of Guided Bronchoscopy for the Evaluation of the Pulmonary Nodule

Jessica S. Wang Memoli, MD; Paul J. Nietert, PhD; and Gerard A. Silvestri, MD, FCCP

- **R-EBUS:** radial EBUS +/−
- **ENB:** Electrocautery-guided bronchoscopy
- **VE:** Videoendoscopy
- **EBUS:** Endobronchial ultrasound

COMBINE

CHEST 2012; 142(2):385–393

EBUS-radial

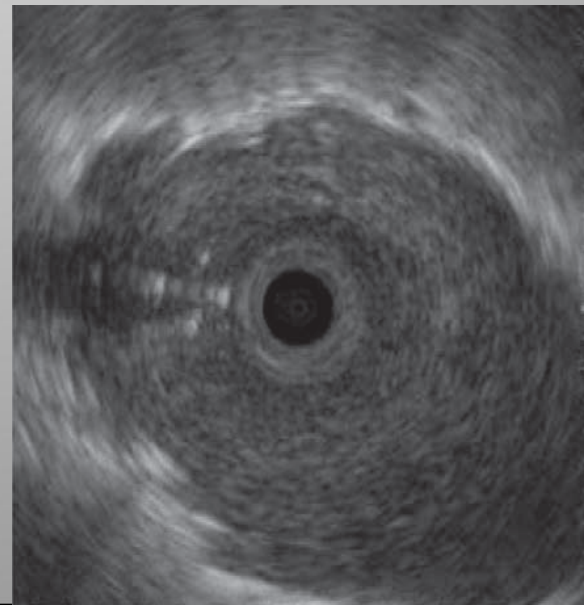
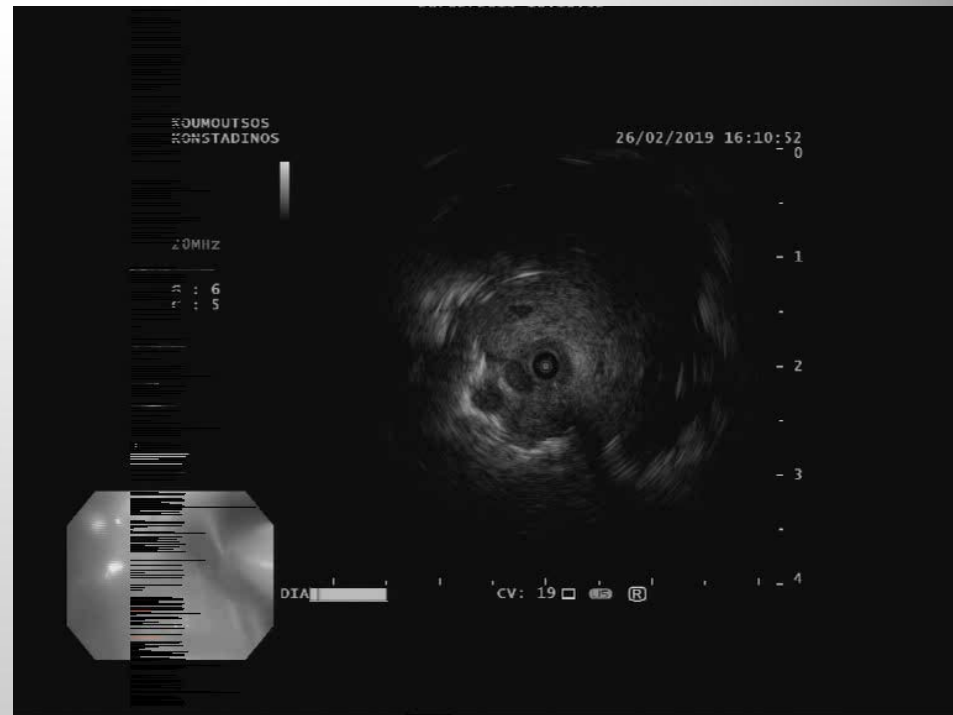


Table 1. Studies evaluating the diagnostic yield of radial probe endobronchial ultrasound since 2014

Study	Year	Pro/Retro*	Number of lesions	Diameter mean	Diameter median	Diagnostic yield %	Guide sheath	Fluoro*	Other tools*
Boonsarngsuk <i>et al.</i> [26]	2014	Retro	174	25.1 mm (SD 10.7 mm)	NR	79.9% overall	+	+	Forceps, brush, BAL
Ikezawa <i>et al.</i> [27]	2014	Retro	67	21 mm (SD 8 mm)	NR	57% overall	+	+	Double-hinged curette, forceps, brush
Chen <i>et al.</i> [28]	2014	Retro	467	NR	NR	69% overall	+/-	-	Forceps, brush, TBNA
Hayama <i>et al.</i> [29]	2015	Retro	965	NR	25 mm (range 6-107)	64.4% overall, 77.1% for malignancy	+	+	Forceps, brush, TBNA, VNB, ROSE
Durakovic <i>et al.</i> [30]	2015	Retro	147	28 mm (SD 18 mm)	NR	26.5% for malignancy	-	-	Forceps, brush, BW
Casutt <i>et al.</i> [31]	2015	Retro	51	25.8 mm (range 8-67 mm)	NR	72.5% overall	-	+	Forceps, brush, BAL/BW, TBNA
Chavez <i>et al.</i> [32]	2015	Retro	212	20.45 mm (SD 5.45 mm)	NR	67.5% for malignancy	+	+	Forceps, brush, TBNA, ROSE

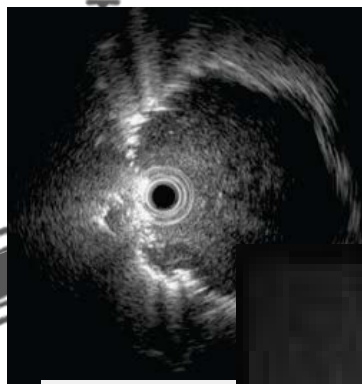
*Pro, prospective; Retro, retrospective.

BAL, bronchoalveolar lavage; BW, bronchial washing; Fluoro, fluoroscopy; GS, guide sheath; NR, not reported; r-EBUS, radial probe endobronchial ultrasound; ROSE, rapid on-site evaluation; TBNA, transbronchial needle aspiration; VNB, virtual navigational bronchoscopy.

Variability 26,5-79,9% (depends on the size but mostly location regarding the bronchus)

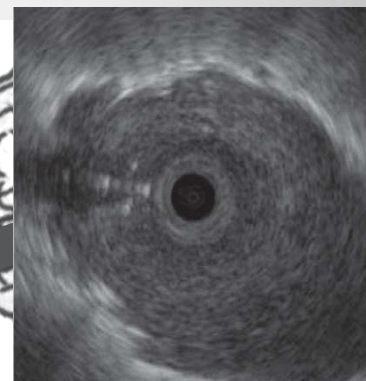
Type I

Bronchus



Ultrasound

Type II



n,

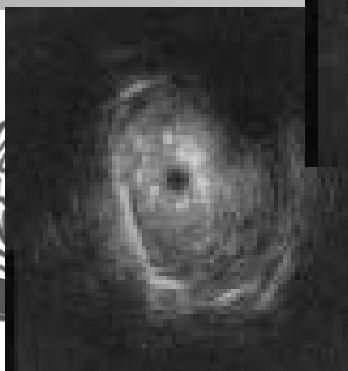
Tumor

Annals
of Thoracic Medicine

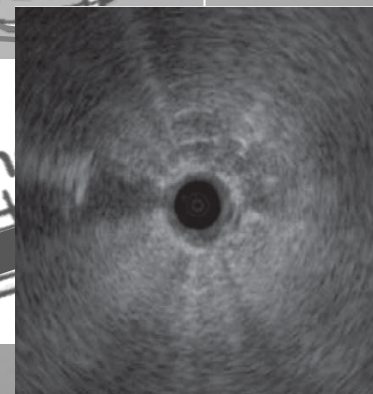
2017;12:162-70.



Type III



Bron



Ultrasound radial probe adjacent to the lesion
(from 4 o'clock to 9 o'clock),

EBUS guided TBBx

Πλεονεκτήματα

- Αυξημένη απόδοση
- Με/χωρίς fluoroscopy 69 - 75 %

Μειονεκτήματα

- Ευελιξία καθοδήγησης (steerability)
- Πρόσθετο κόστος διαδικασίας (probe, guide sheath)
- Η απόδοση πέφτει για SPN < 2 cm

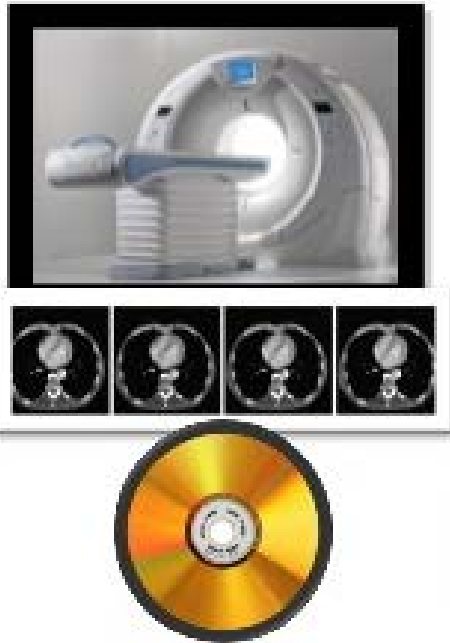
- Schwarz Y et al. Chest 2006,
- Gildea TR et al. Am J Respir Crit Care Med 2006,
- Eberhardt R et al. Chest 2007,
- Makris D et al. Eur Respir J 2007,
- Eberhardt R et al. Am J Respir Crit Care Med 2007,



Navigated bronchoscopy – Electromagnetic navigation

- Lead tools to peripheral target
- Using CT "roadmap" for real time navigation
- Enable tool: real-time location and steerability

CT-Scan → DICOM CD



Software → Planned Pathway File



Navigation → Biopsy → Treatment



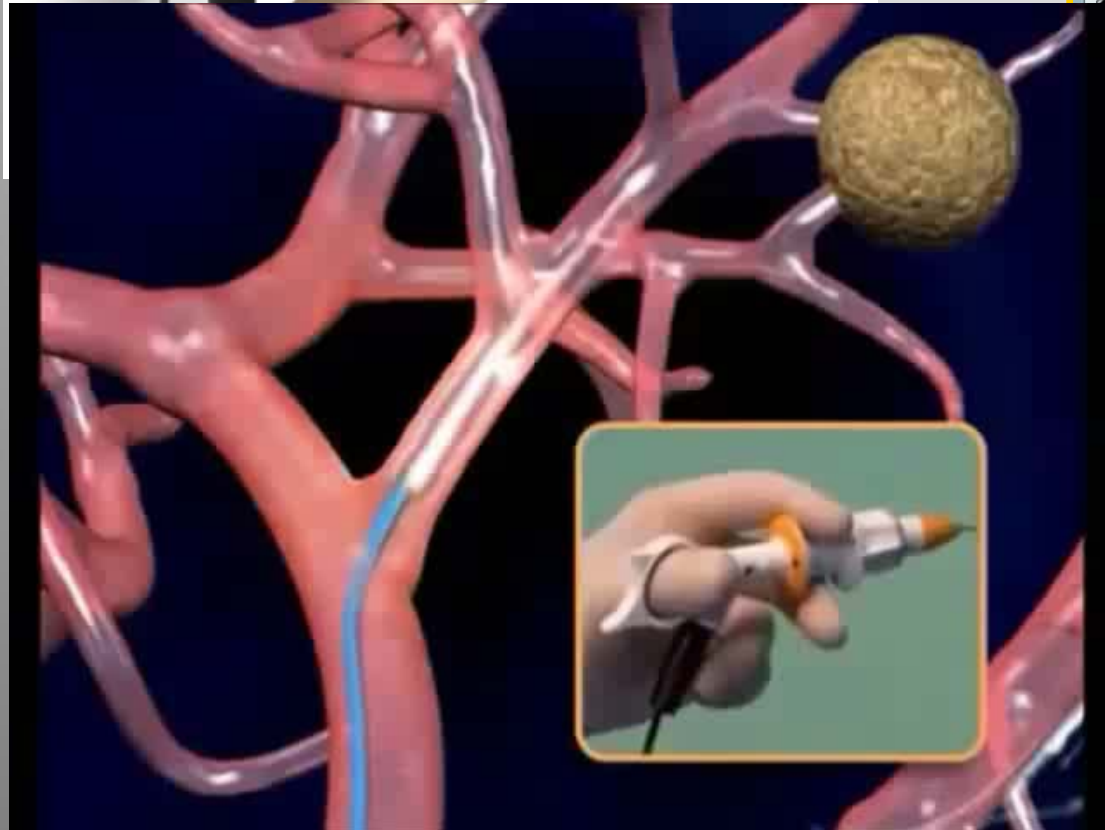


Table 2. Large studies evaluating the diagnostic yield of EMN since 2012

Study	Year	Pro/ Retro*	Number of lesions	Diameter mean	Diameter median	Diagnostic yield %	Other tools*
Brownback <i>et al.</i> [40]	2012	Retro	55	NR	30 mm (range 1.1–7.8 cm)	74.5% overall, 69.4% for malignancy	Forceps, brush, BW, TBNA, F, ROSE
Jensen, <i>et al.</i> [41]	2012	Retro	92	26.1 mm (SD 14.2 mm)	NR	65.2% overall	Forceps, brush, BAL, TBNA
Lamprecht <i>et al.</i> [42]	2012	Pro	112	27.1 mm (SD 1.3 mm)	NR	83.9% overall	Forceps, brush, TBNA
Pearlstein <i>et al.</i> [43]	2012	Retro	101	NR	28 mm (range 8–10 mm)	85.1% overall	Forceps, brush, TBNA, ROSE
Loo <i>et al.</i> [39]	2014	Retro	50	26 mm (range 3–80 mm)	NR	94% overall	Forceps, brush, TBNA, ROSE
Bowling <i>et al.</i> [44]	2015	Retro	91	NR	NR	74% overall	Forceps, brush, BAL, TBNA, F
Steinfort, <i>et al.</i> [45 [■]]	2015	Pro	57	19.1 mm (SD 6.8 mm)	NR	15.8% overall	r-EBUS with GS, forceps, brush, BW, F

*Pro, prospective; Retro, retrospective.

BAL, bronchoalveolar lavage; BW, bronchial washing; F, fluoroscopy; GS, guide sheath; NR, not reported; r-EBUS, radial probe endobronchial ultrasound; ROSE, rapid on-site evaluation; TBNA, transbronchial needle aspiration.

Great variability: 15,8-94% (depending on the size, location and patient selection)

Multimodality Bronchoscopic Diagnosis of Peripheral Lung Lesions

A Randomized Controlled Trial

Ralf Eberhardt¹, Devanand Anantham², Armin Ernst², David Feller-Kopman², and Felix Herth¹

¹Department of Pneumology and Critical Care Medicine, Thoraxklinik, University of Heidelberg, Heidelberg, Germany; and ²Interventional Pulmonology, Beth Israel Deaconess Medical Center, Harvard Medical School, Boston, Massachusetts

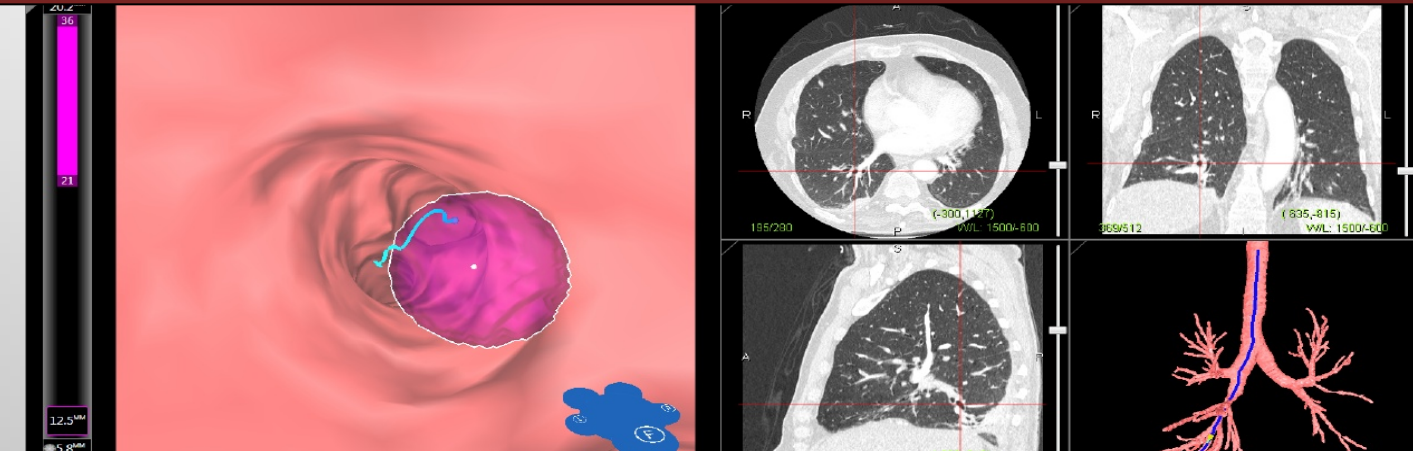
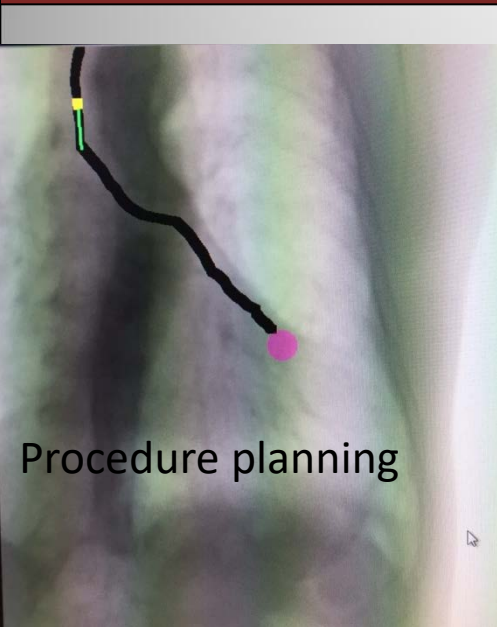
If combined....

	EBUS n (%)	ENB n (%)	EBUS and ENB n (%)	p
EBUS n (%)	ENB n (%)	EBUS and ENB n (%)	p	
27/39 (69)	23/39 (59)	35/40 (88)	0.02†	
Yield by lobar location:				0.01†
Bilateral upper lobes	16/27 (59)	17/22 (77)	17/20 (85)	
Right middle lobe	3/3 (100)	2/3 (67)	2/2 (100)	
Bilateral lower lobes	8/9 (89)	4/11 (29)	16/18 (89)	
	p=0.18		p=0.01†	
			p=0.99	
Sensitivity	23/32 (72)	16/29 (55)	28/31 (90)	0.009†
Specificity	7/7 (100)	10/10 (100)	9/9 (100)	----
Positive predictive value	23/23 (100)	16/16 (100)	28/28 (100)	----
Negative predictive value	7/16 (44)	10/23 (44)	9/12 (75)	0.16
Yield for benign disease:				
Sensitivity	4/7 (57)	7/10 (70)	7/9 (78)	0.79
Specificity	32/32 (100)	29/29 (100)	31/31 (100)	----
Positive predictive value	4/4 (100)	7/7 (100)	7/7 (100)	----
Negative predictive value	32/35 (91)	29/32 (91)	31/33 (94)	0.90
Pneumothorax rate	2/39 (5)	2/39 (5)	3/40 (8)	0.99

Table 5: Diagnostic yields by size, location and disease type; and pneumothorax rate

† p < 0.05

Non electromagnetic Virtual Bronchoscopy- Lungpoint® and Synapse ®



VBN published data

First author	Year	Study design	VBN system	Bronchoscope external diameter	Confirmation of arrival	Lesion size selection	Lesions, n	Diagnostic yield	Lesions <2 cm, n	Diagnostic yield for lesions <2 cm	Complications, n	Complication rate	Complications
Shinagawa [16]	2004	Pro	Not used	2.8 mm	CT	<2 cm	26	65.4%	26	65.4%	0	0.0%	None
Asahina [26]	2005	Pro	Not used	4.0 or 5.3 mm	EBUS	≤3 cm	30	63.3%	18	44.4%	0	0.0%	None
Asano [11]	2006	Pro	Bf-NAVI	2.8 mm	CT	≤3 cm	38	81.6%	26	80.8%	n/a	n/a	n/a
Shinagawa [17]	2007	Pro	Bf-NAVI	2.8 mm	CT	<2 cm	71	70.4%	71	70.4%	1	1.4%	1 PTX
Tachihara [29]	2007	Pro	Bf-NAVI	2.8 or 5.2 mm	Flu	≤3 cm	96	62.5%	77	54.5%	0	0.0%	None
Asano [10]	2008	Pro	Bf-NAVI	4.0 mm	EBUS	n/a	32	84.4%	15	73.3%	0	0.0%	None
Eberhardt [33]	2010	Pro	LungPoint	2.8 mm	Non-Flu	n/a	25	80.0%	n/a	n/a	1	4.0%	1 PTX (0 CTI)
Omiya [30]	2010	Retro	Bf-NAVI	2.8 and 4.0 mm	Flu	≤3 cm	37	75.7%	13	76.9%	n/a	n/a	n/a
Iwano [31]	2011	Retro	Not used	2.8 mm	Flu	n/a	122	78.7%	30	73.3%	n/a	n/a	n/a
Oshige [27]	2011	Pro	Bf-NAVI	4.0 or 5.9 mm	EBUS	n/a	57	84.2%	22	72.7%	0	0.0%	None
Ishida [24]	2011	RCT	Bf-NAVI	4.0 mm	EBUS	≤3 cm	99	80.8%	58	75.9%	0	0.0%	None
Asano [32]	2013	RCT	Bf-NAVI	2.8 mm	Flu	≤3 cm	167	67.1%	114	64.9%	4	2.4%	1 PTX (0 CTI), 2 Hemo, 1 Brad
Tamiya [28]	2013	Pro	LungPoint	4.0 mm	EBUS	≤3 cm	68	77.9%	27	74.1%	n/a	n/a	n/a
Summary							868	73.8%	497	67.4%		1.0%	

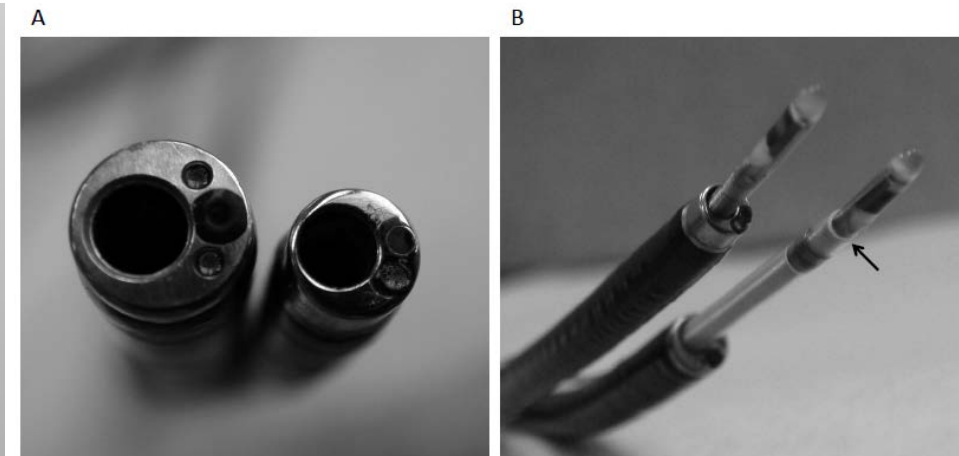
Brad = Bradycardia; CTI = chest tube insertion; Flu = fluoroscopy; Hemo = hemorrhage; n/a = not available; Pro = prospective study; PTX = pneumothorax; Retro = retrospective study.

Asano F et al. Respiration 2014

Ultrathin Bronchoscopy with Multimodal Devices for Peripheral Pulmonary Lesions

A Randomized Trial

Masahide Oki¹, Hideo Saka¹, Masahiko Ando², Fumihiro Asano³, Noriaki Kurimoto⁴, Katsuhiko Morita⁵, Chiyoe Kitagawa¹, Yoshihito Kogure¹, and Teruomi Miyazawa⁶

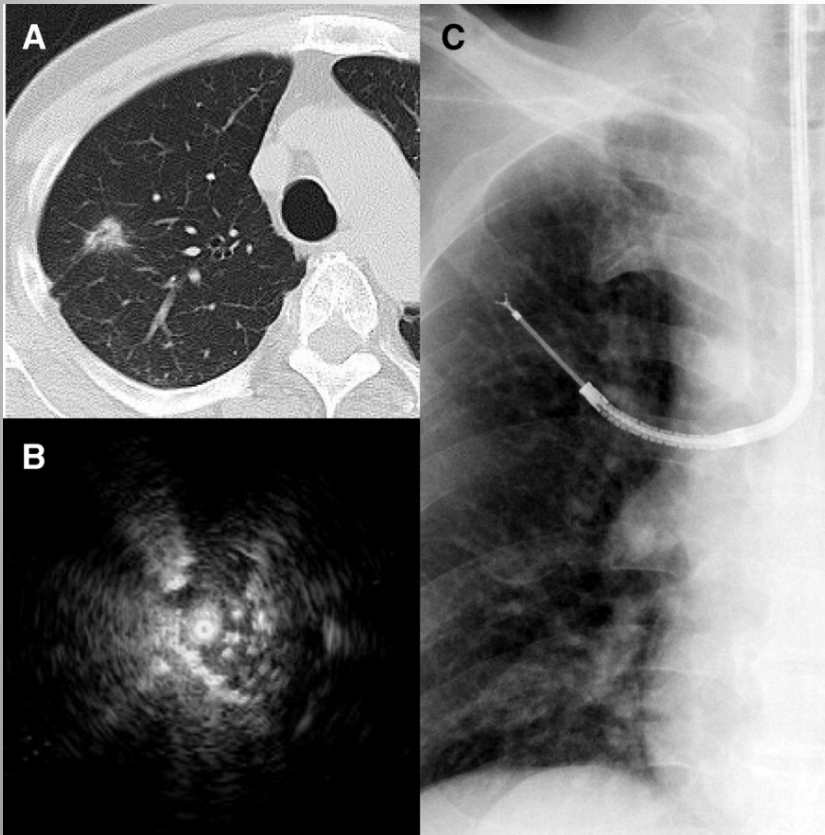


sensitivity
59% vs 74%

Thin bronchoscope (4.00 mm and working channel 2.0 mm) with rEBUS inside GS n=150 vs

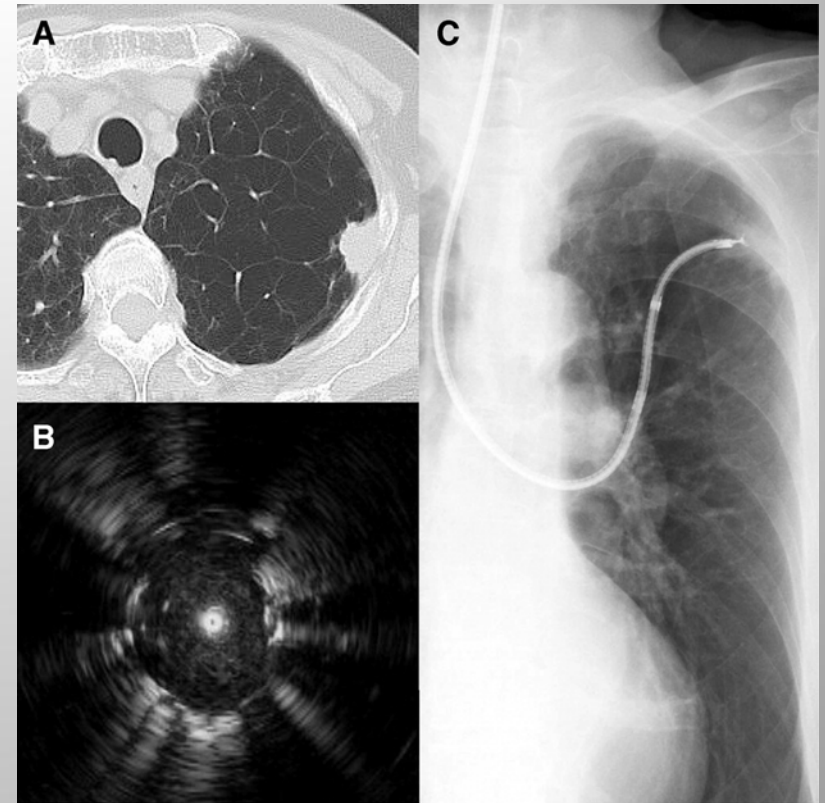
Ultrathin bronchoscope (3.00 mm and working channel 1.7 mm) with rEBUS alone n=155

STANDARD



Thin bronchoscope (4.0 mm and channel 2.0 mm) with rEBUS and sheath

NEW



***Ultrathin* bronchoscope (3.0 mm and channel 1.7 mm) with rEBUS without sheath**

Virtual Bronchoscopic Navigation Combined with Ultrathin Bronchoscopy

A Randomized Clinical Trial

Fumihiro Asano¹, Naofumi Shinagawa², Takashi Ishida³, Joe Shindoh⁴, Masaki Anzai⁵, Akifumi Tsuzuku¹, Satoshi Oizumi², and Satoshi Morita⁶



Bf-NAVI (Tokyo, Japó)

TABLE 2. DIAGNOSTIC YIELD ACCORDING TO EACH PARAMETER

	VBNA	NVBNA	P Value
Total	112/167 (67.1)	100/167 (59.9)	0.173
Lesion size			
≤10 mm	9/12 (75.0)	6/11 (54.5)	0.278
>10–20 mm	65/102 (63.7)	56/99 (56.6)	0.300
≤20 mm	74/114 (64.9)	62/110 (56.4)	0.190
>20–30 mm	38/53 (71.7)	38/57 (66.7)	0.568
Lobe			
Right upper	39/48 (81.3)	25/47 (53.2)	0.004
Right middle	12/15 (80.0)	9/13 (69.2)	0.412
Right lower	21/41 (51.2)	30/44 (68.2)	0.111
Left upper	24/38 (63.2)	23/41 (56.1)	0.523
Left lower	16/25 (64.0)	13/22 (59.1)	0.730
Posterior–anterior radiograph			
Invisible	24/38 (63.2)	17/42 (40.5)	0.043
Visible	88/129 (68.2)	83/125 (66.4)	0.758
Bronchus sign			
Absent	9/18 (50.0)	14/30 (46.7)	0.823
Present	103/149 (69.1)	86/137 (62.8)	0.257
Location			
Central	10/13 (76.9)	3/4 (75.0)	0.700
Intermediate	25/35 (71.4)	34/42 (81.0)	0.325
Peripheral	77/119 (64.7)	63/121 (52.1)	0.047
Final diagnosis			
Primary lung cancer	93/130 (71.5)	92/144 (63.9)	0.177
Metastatic lung tumor	5/13 (38.5)	4/7 (57.1)	0.370
Benign infection	10/14 (71.4)	3/10 (30.0)	0.055
Benign noninfectious disease	4/10 (40.0)	1/6 (16.7)	0.346

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

Felix JF Herth,^{1,2} Ralf Eberhardt,^{1,2} Daniel Stermann,³ Gerard A Silvestri,⁴
Hans Hoffmann,⁵ Pallav L Shah^{6,7,8}



BTPNA procedure was successfully completed in 10 patients (83%), and a positive biopsy was successfully obtained in all 10 cases in which a tunnel was successfully created from the POE

Herth FJF, et al. *Thorax* 2015;**70**:326–332.

Electromagnetic navigation transthoracic needle aspiration for the diagnosis of pulmonary nodules: a safety and feasibility pilot study

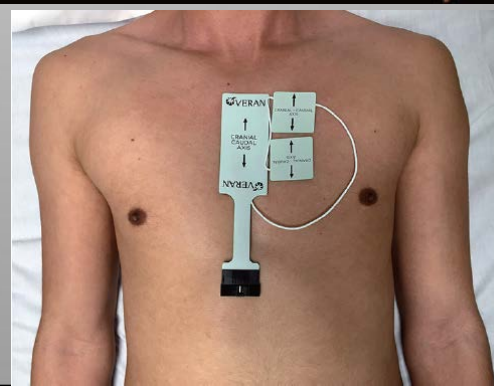
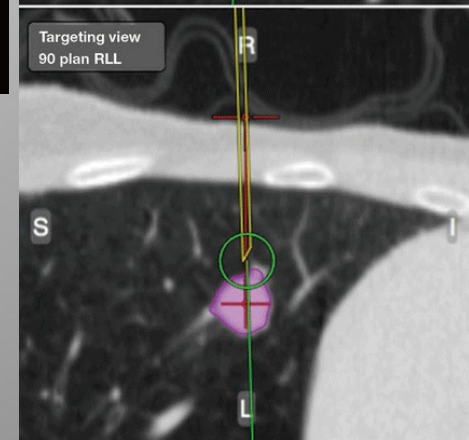
J Thorac Dis 2016;8(1):186-194

Lonny B. Yarmus¹, Sixto Arias¹, David Feller-Kopman¹, Roy Semaan¹, Ko Pen Wang¹, Bernice Frimpong¹, Karen Oakjones Burgess¹, Richard Thompson², Alex Chen³, Ricardo Ortiz¹, Hans J. Lee¹

1. Conventional Bronchoscopy + EBUS TBNA systematic assessment
2. EMNB+ Ultrathin Bronchoscopy +ROSE
3. ETTNA+ROSE

Diagnostic yield : 92%
PTX: 21%

**Complete Diagnosis combining
all available modalities:
One stop procedure**



Gaining access to the periphery of the lung: Bronchoscopic and transthoracic approaches

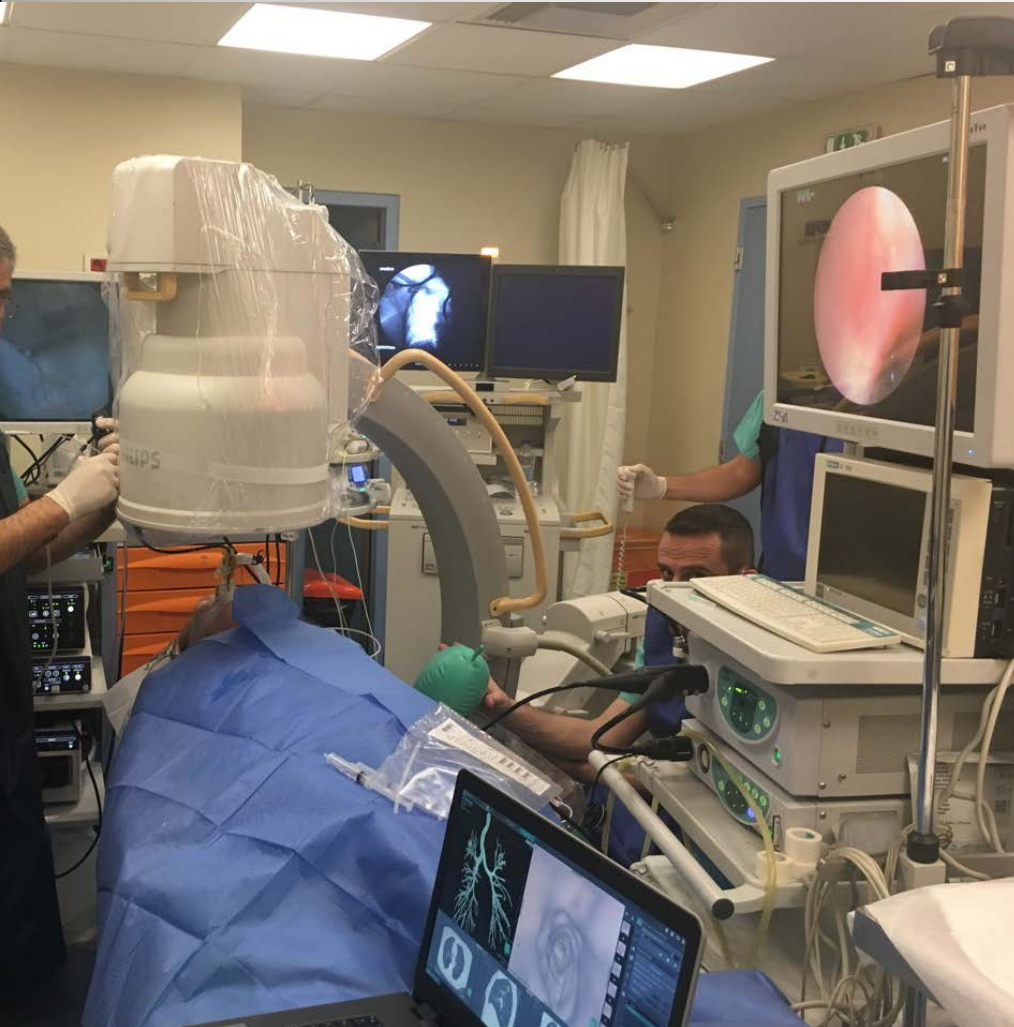
Annals of Thoracic Medicine - Volume 12, Issue 3, July-September 2017

Abdelfattah Ahmed Touman, Vlasios V. Vitsas¹, Nickolaos G. Koulouris¹, Grigoris K. Stratakos¹

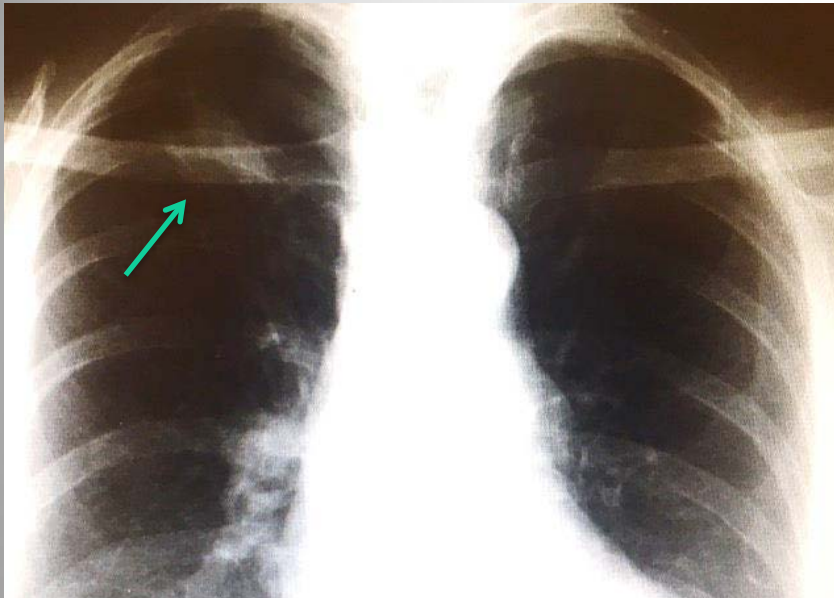
Table 2: Comparison of diagnostic performance of various combinations of bronchoscopic and guiding modalities

	CT-TTNA ^{[12]*}	Bronchoscopy with fluoroscopy ^{[6]*}	Radial probe EBUS ^{[18]*}	Electro-magnetic navigation ^{[36]*}	Combined EMN and RP-EBUS ^{[30]†}	Combined VBN and RP-EBUS ^{[32]†}	Combined VBN and UB ^{[34]†}	Combined VBN, UB and RP-EBUS ^{[35]†,‡}
Overall sensitivity (%)	92.1	78	73	62.5-77.4	90	Diagnostic yield 80.8	Diagnostic yield 67.1	Diagnostic yield 74
Diagnostic yield in nodule <2 cm (%)	92.8	Sensitivity is 34	56.3	75 ^{[30]†}	90	75.9	64.9	65
Clinically significant bleeding (%)	2.8	1-4 ^[24]	0	Minor to moderate 1	0	0	1.19	0
Pneumothorax (%)	20.5 (7.3 required chest tube)	0.2 ^[24]	1 (0.4 required chest tube)	5.8 (0.29 required chest tube)	8	0	0.59 Does not require chest tube	2

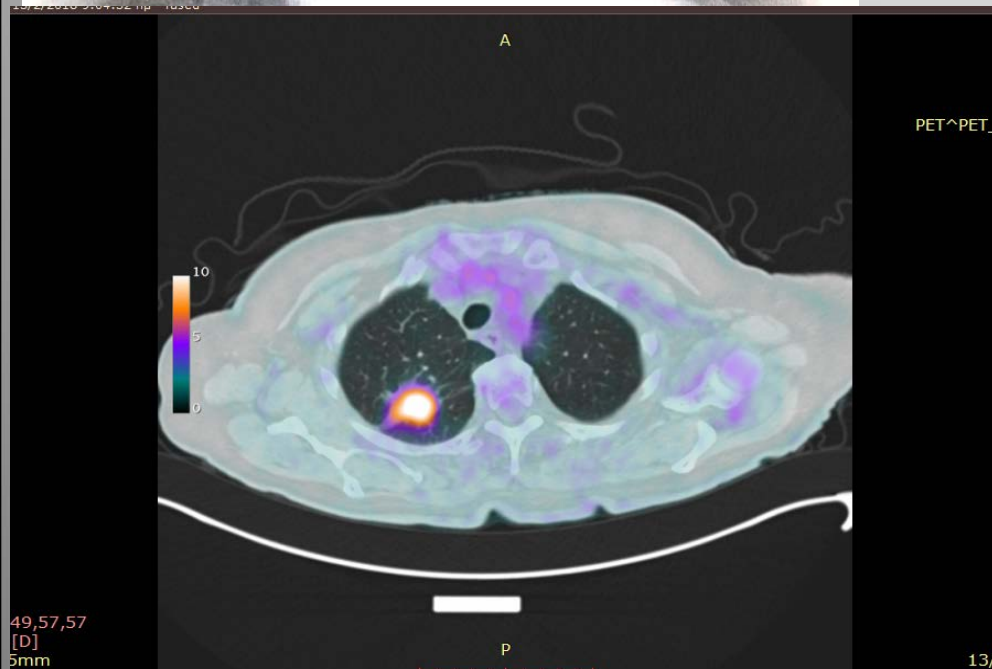
Combined Techniques used Today



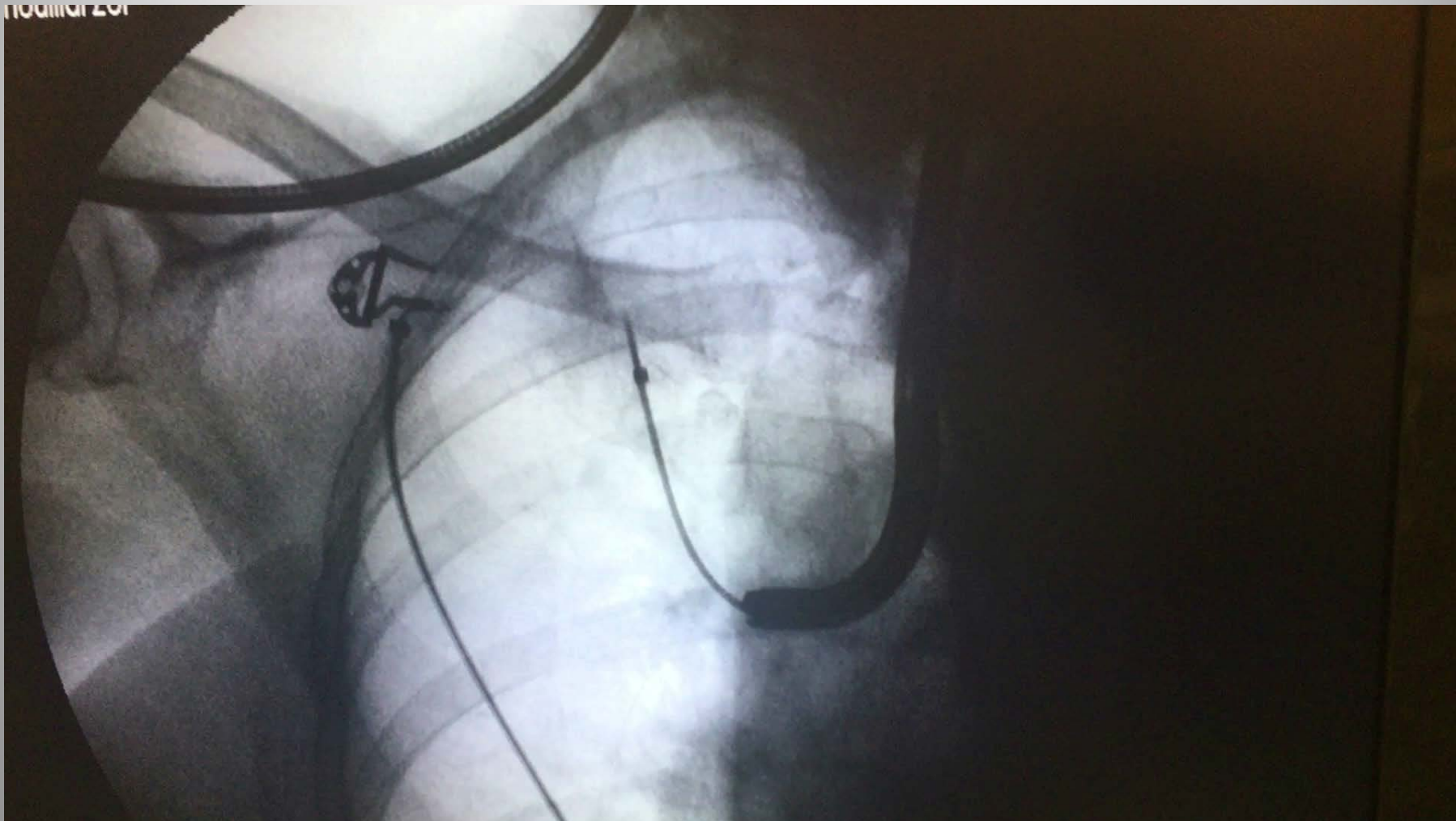
- VR mapping and pathway creation
- Fluoroscopy
- Radial mini probe assessment
- (Ultra)thin Bronchoscope
- Biopsy/Needle/Brush through the sheath



- ♀ 78 non smoker
- CD, AH, AF
- RUL node accidentally found



- PET + (SUV – 17.4)
- NO other findings in PET-CT & Brain MRI





Potential advantages:

- ☐ More precision
- ☐ Higher degree of movement of the peripheral guide sheaths

Potential disadvantages:

- ☐ Steep learning curve
- ☐ Lack of tactile feedback
- ☐ Cost

ΠΝΕΥΜΟΝΙΚΟΣ ΟΖΟΣ-ΧΕΙΡΟΥΡΓΙΚΗ ΒΙΟΨΙΑ

- Αποφυγή κόστους, χρόνου και δυσφορίας για τον ασθενή
- Προτίμηση ασθενούς προς αποφυγή αγωνίας και παράτασης εκκρεμότητας
- Όριο εκτομής 1 εκ. πέριξ του οζιδίου
- Διενέργεια ταχείας βιοψίας
- Καλοήθη 38-52%
- Κακοήθη 48-62% - το ένα τρίτο μεταστατικά

ΤΟΠΟΘΕΤΗΣΗ ΣΥΡΜΑΤΩΝ Η ΣΠΙΡΑΛ

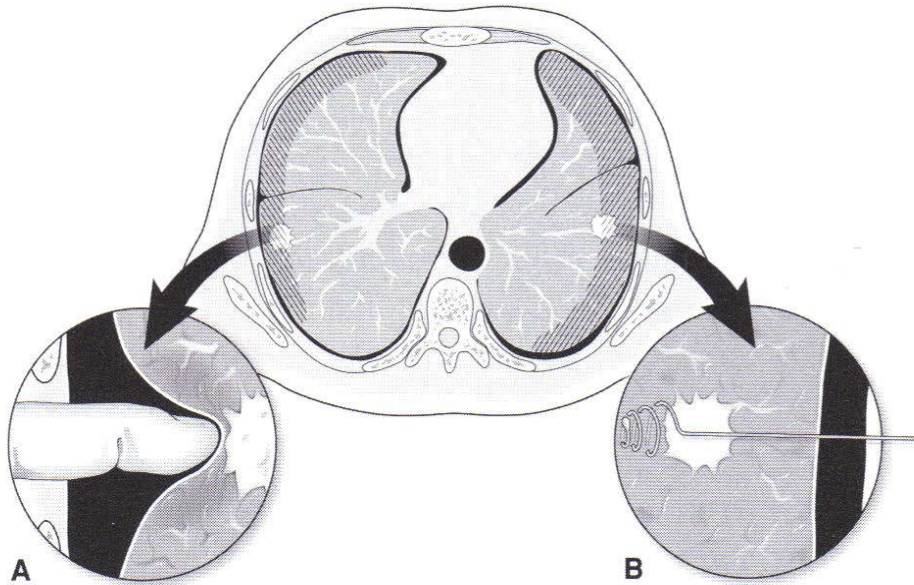
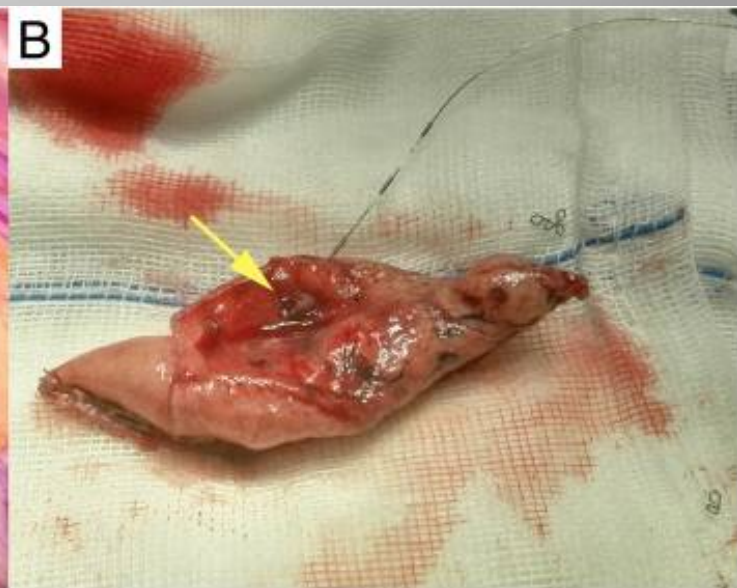
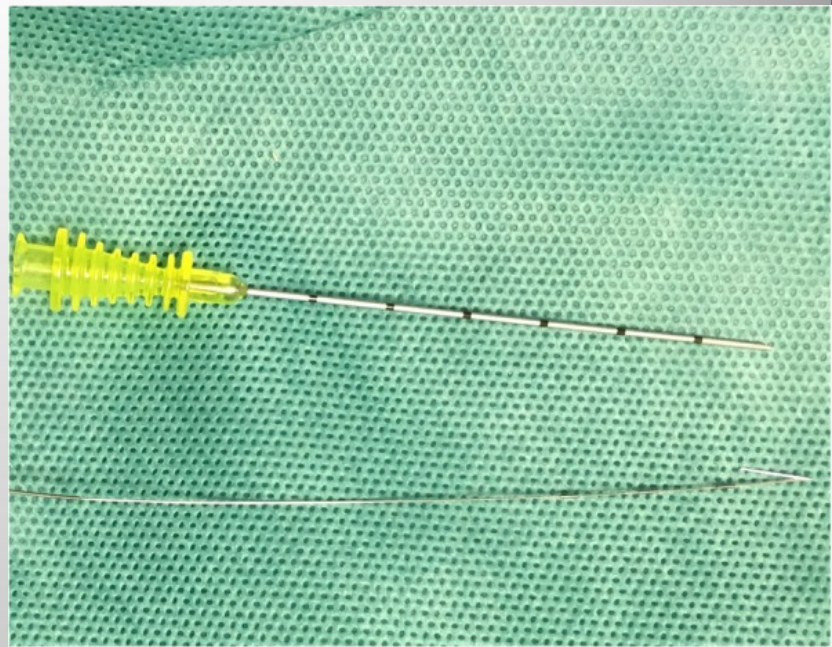
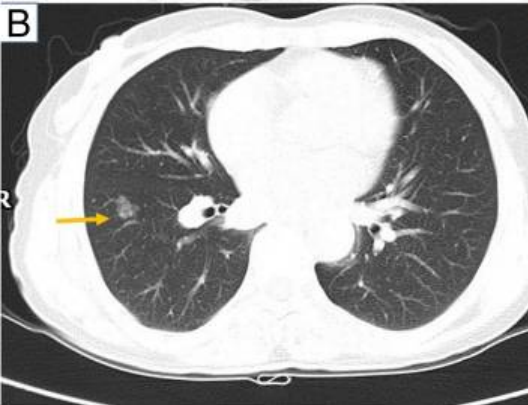
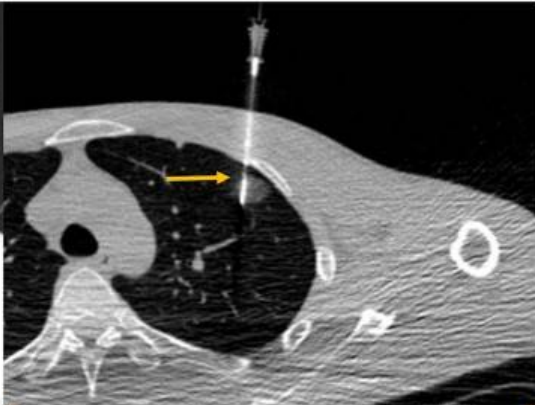
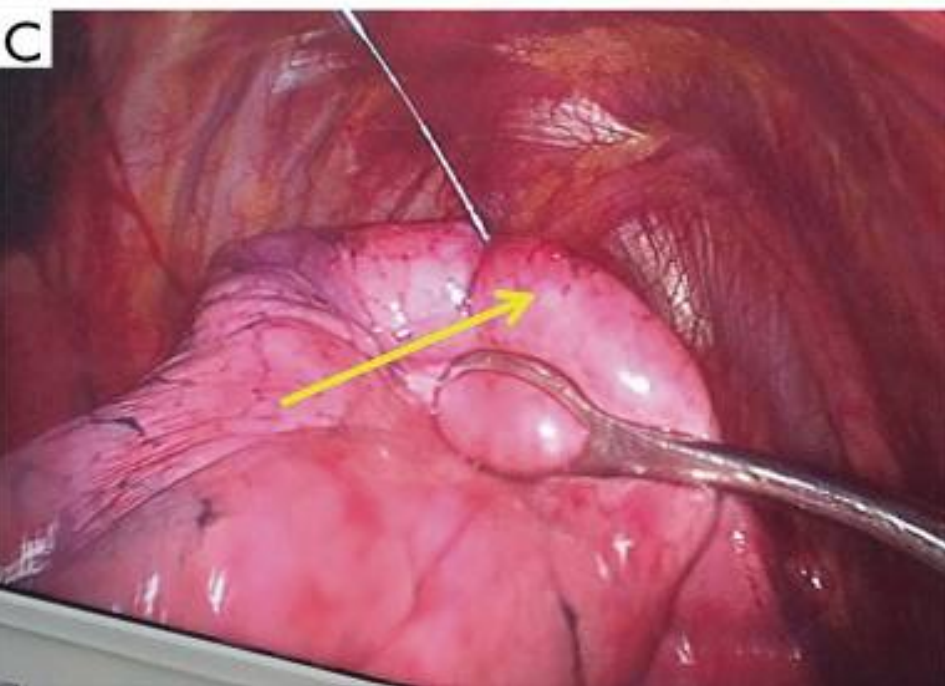
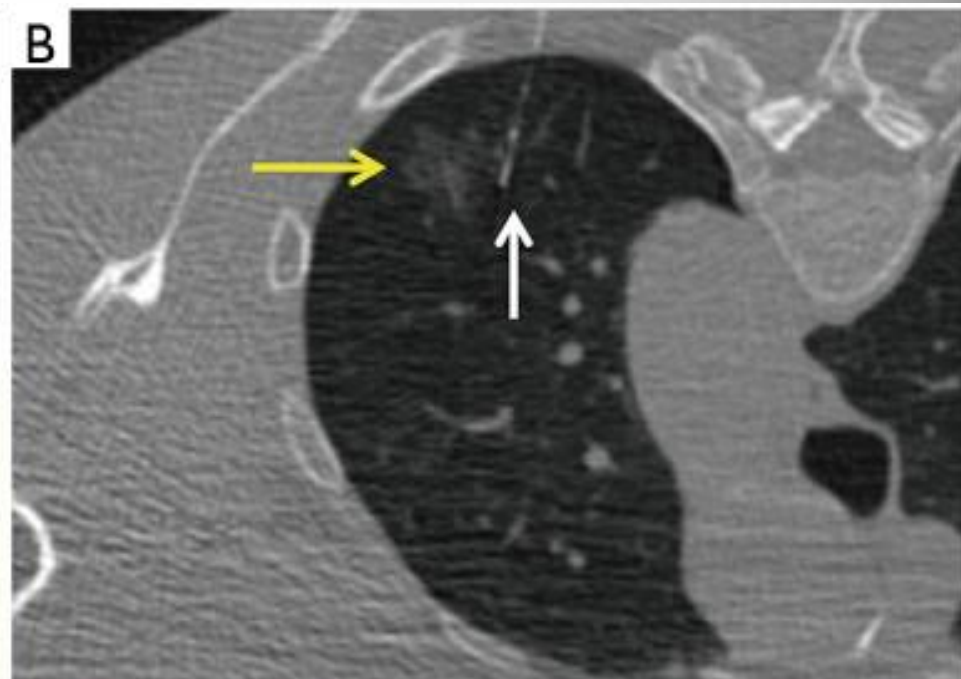


Figure 1 Representative cross section of a chest CT scan with cross-hatched areas on the left side of the figure showing regions of the lung ordinarily accessible to intraoperative finger localization of nodules. Insert A illustrates finger palpation of a peripheral nodule. Representative cross section of a chest CT scan with cross-hatched areas on the right side of the figure showing regions of the lung ordinarily accessible to preoperatively placed hooks and coils for nodule localization. Insert B shows the spiral wire localization technique with the coil placed just deep to the nodule.

- Ενδεχόμενο μετακίνησης
- Ανάγκη ακτινοσκοπικού ελέγχου
- Δυσφορία στον ασθενή





ΔΙΕΓΧΕΙΡΗΤΙΚΟ ΥΠΕΡΗΧΟΓΡΑΦΗΜΑ ΚΑΙ ΡΑΔΙΟΣΗΜΑΣΜΕΝΗ ΒΕΛΟΝΑ

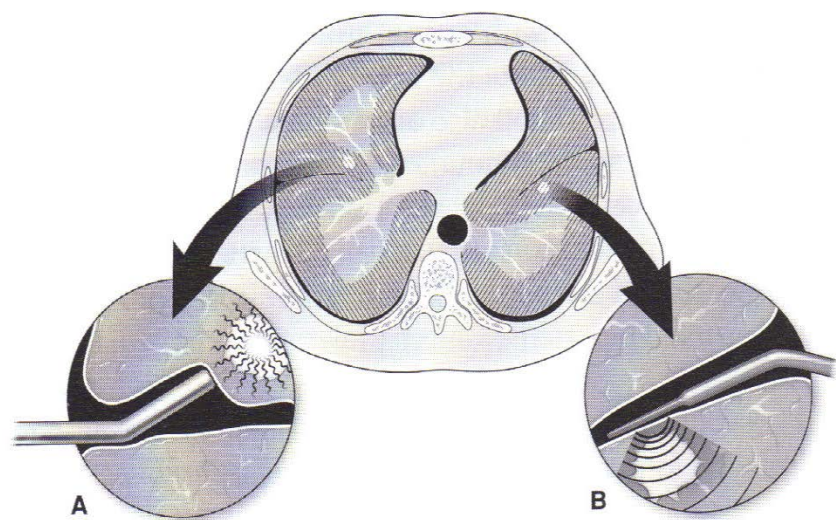


Figure 2 Representative cross section of a chest CT scan with cross-hatched areas showing regions of the lung ordinarily accessible to both the preoperative percutaneous placement of radiotracer markers in or near small nodules and intraoperative ultra sonography localization. Insert A shows the gamma radioprobe locating intraoperatively a previously marked nodule in the right middle lobe adjacent to a completely developed oblique fissure. Insert B illustrates intraoperative ultrasonographic location of a left lower lobe nodule adjacent to a completely developed oblique fissure.

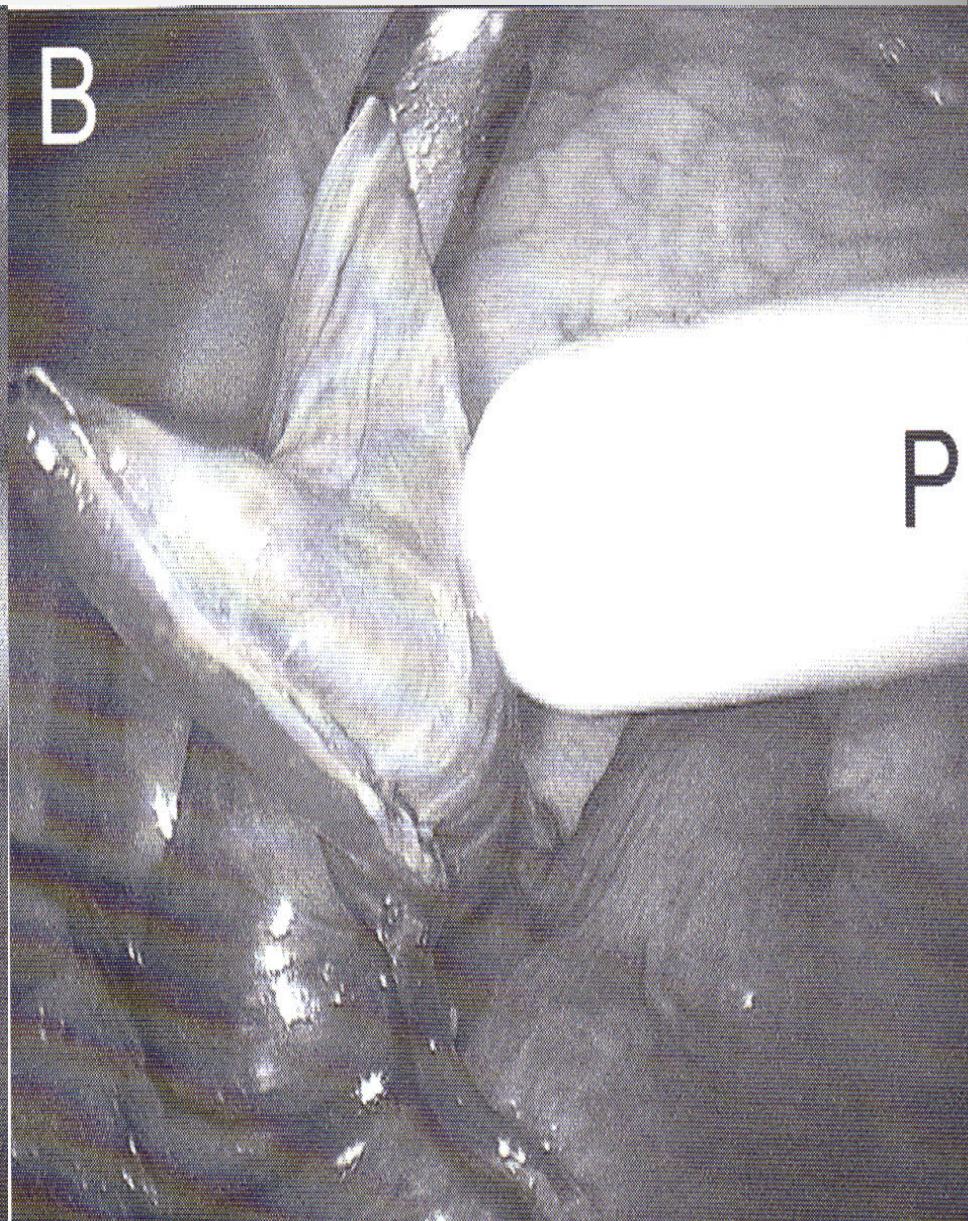
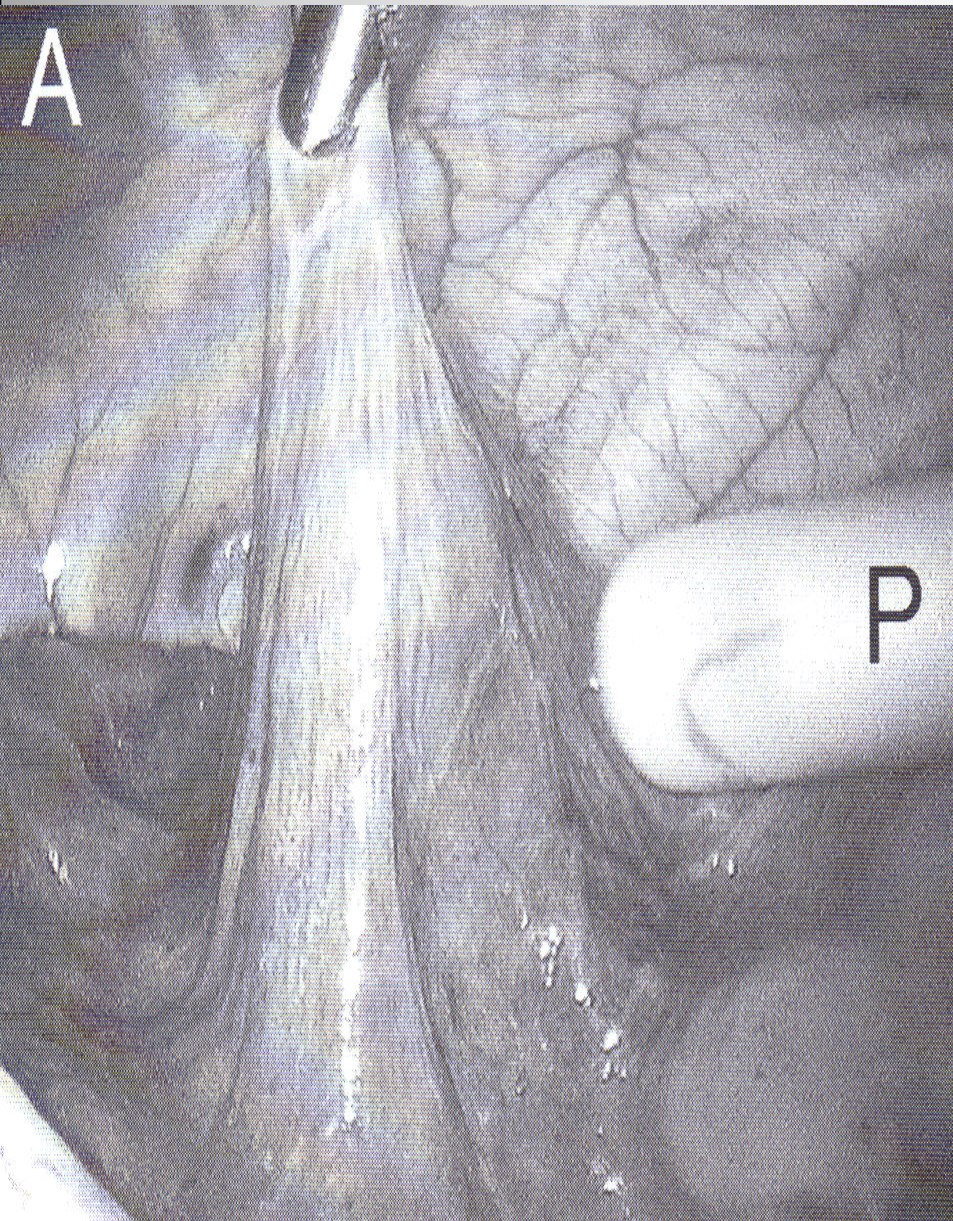
Μαλακά οζίδια, όπως του
βρογχοκυψελιδικού,
δύσκολο να εντοπιστούν
υπερηχογραφικά

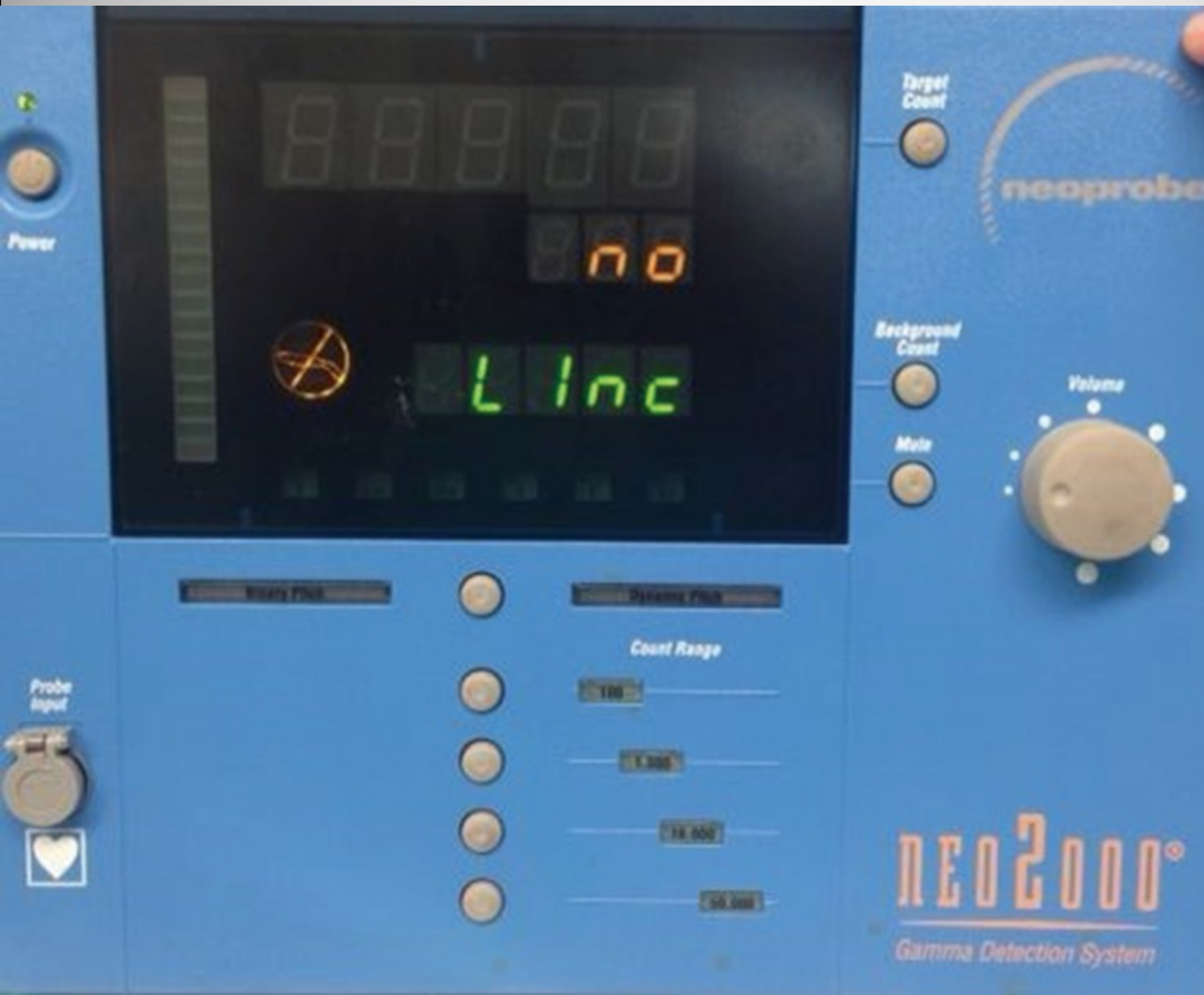
Ανάγκη εξοπλισμού-
εμπειρίας

Σημαντική η γωνία
τοποθέτησης

Περιορισμός η γειτνίαση με
μείζονες βρογχοαγγειακούς
κλάδους

ΡΑΔΙΟΣΗΜΑΝΣΗ ΚΑΙ VATS

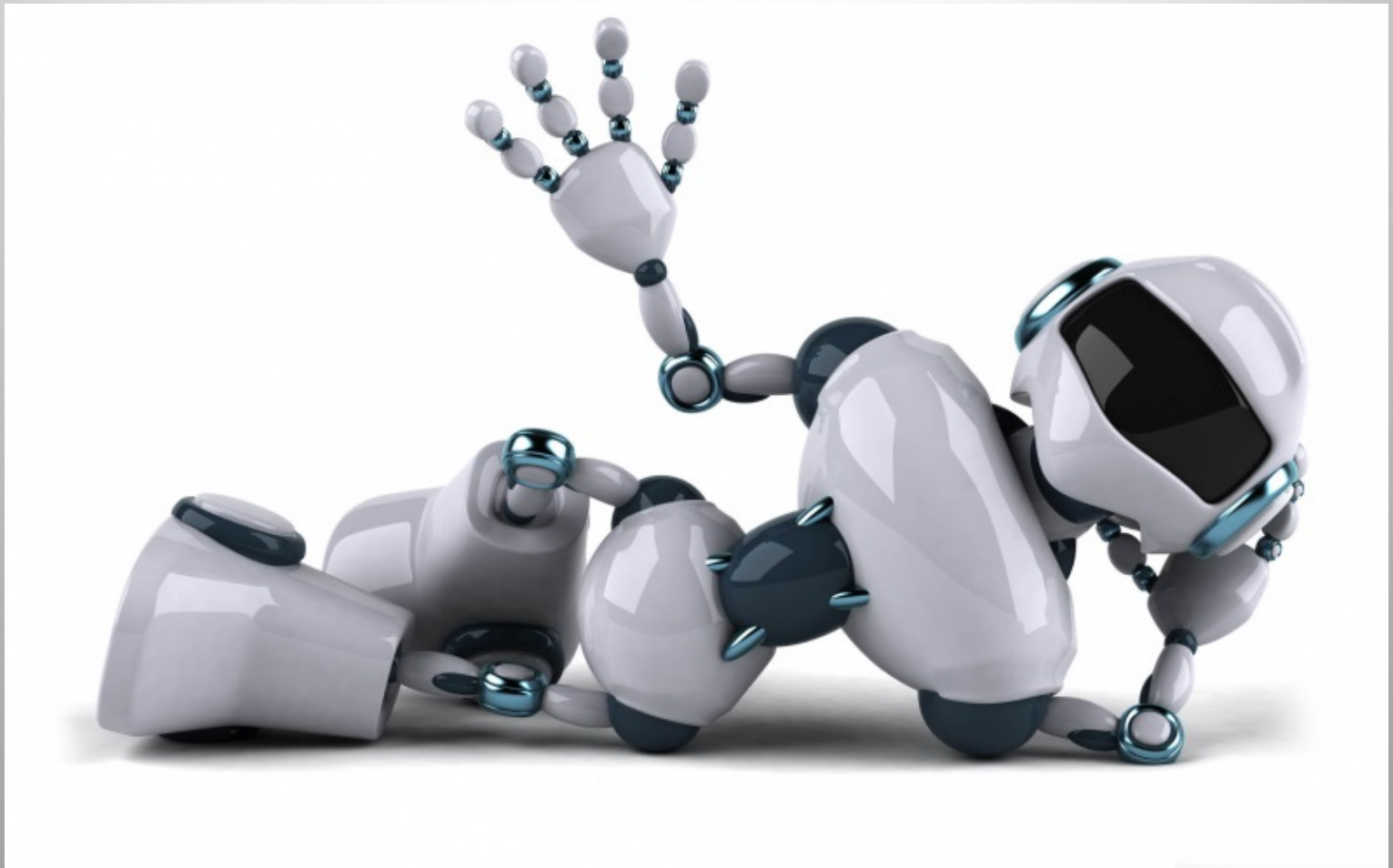




thoracoscopic hand-held 11-mm-diameter collimated gamma probe connected to a gamma ray detector unit (ScintiProbe MR 100, Pol.Hi.Tech., Carsoli, Italy) The detector unit transformed gamma ray emissions into audio-visual signals, proportional to the perceived radioactivity.

ΠΝΕΥΜΟΝΙΚΟΣ ΟΖΟΣ

- Μέση μετεγχειρητική νοσηλεία: 1.7-2.4 ημέρες
- Νοσηρότητα: 3.6 - 6.3%
- Παρατεταμένη διαφυγή αέρα: 4.9%



Ευχαριστώ!