EUROPEAN LUNG CANCER
CONFERENCE 2016

BRONCHOSCOPY IN THE ERA OF EARLY AND SCREEN DETECTED PERIPHERAL PULMONARY NODULES.

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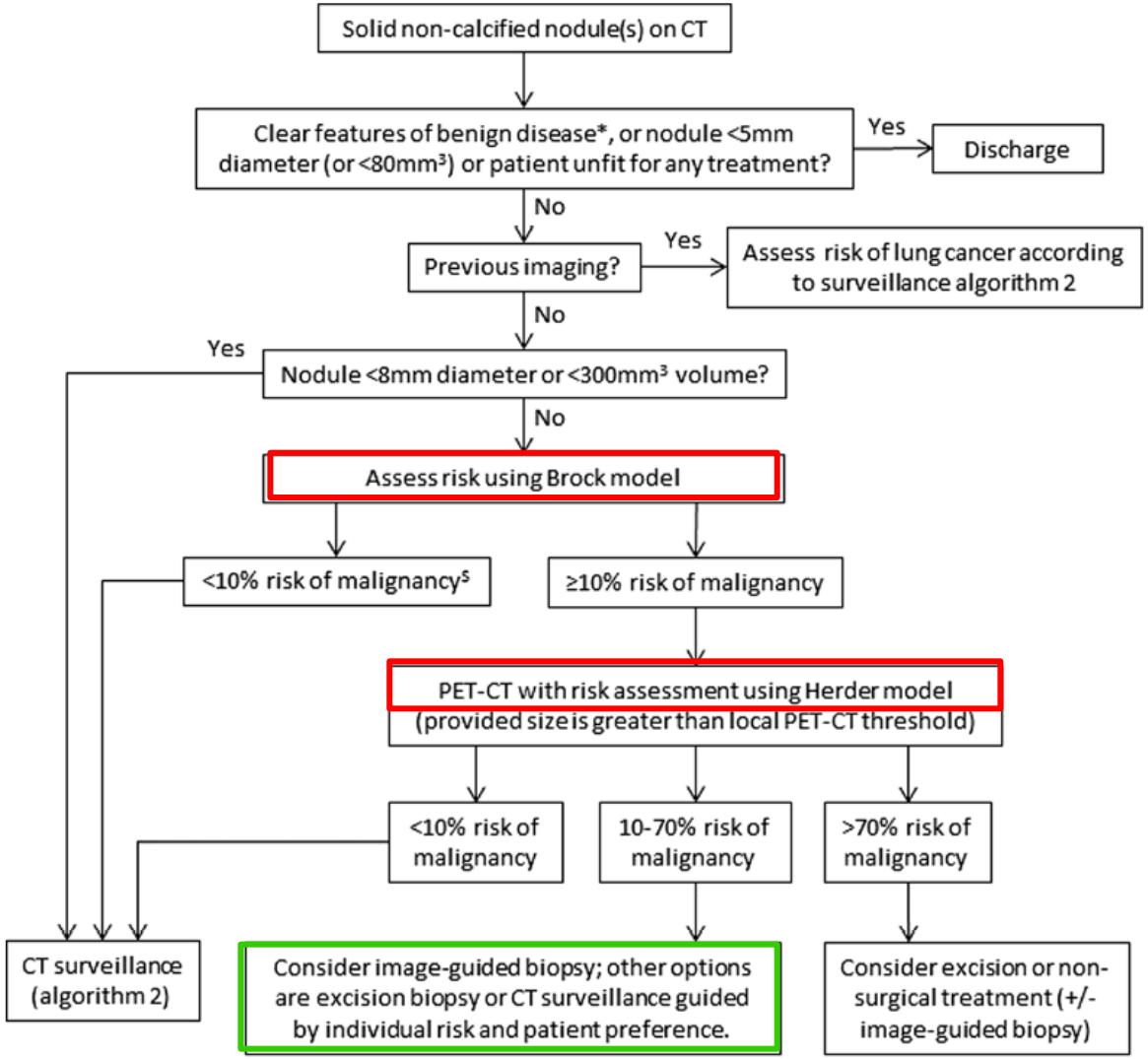
DISCLOSURE SLIDE

None.

Introduction.

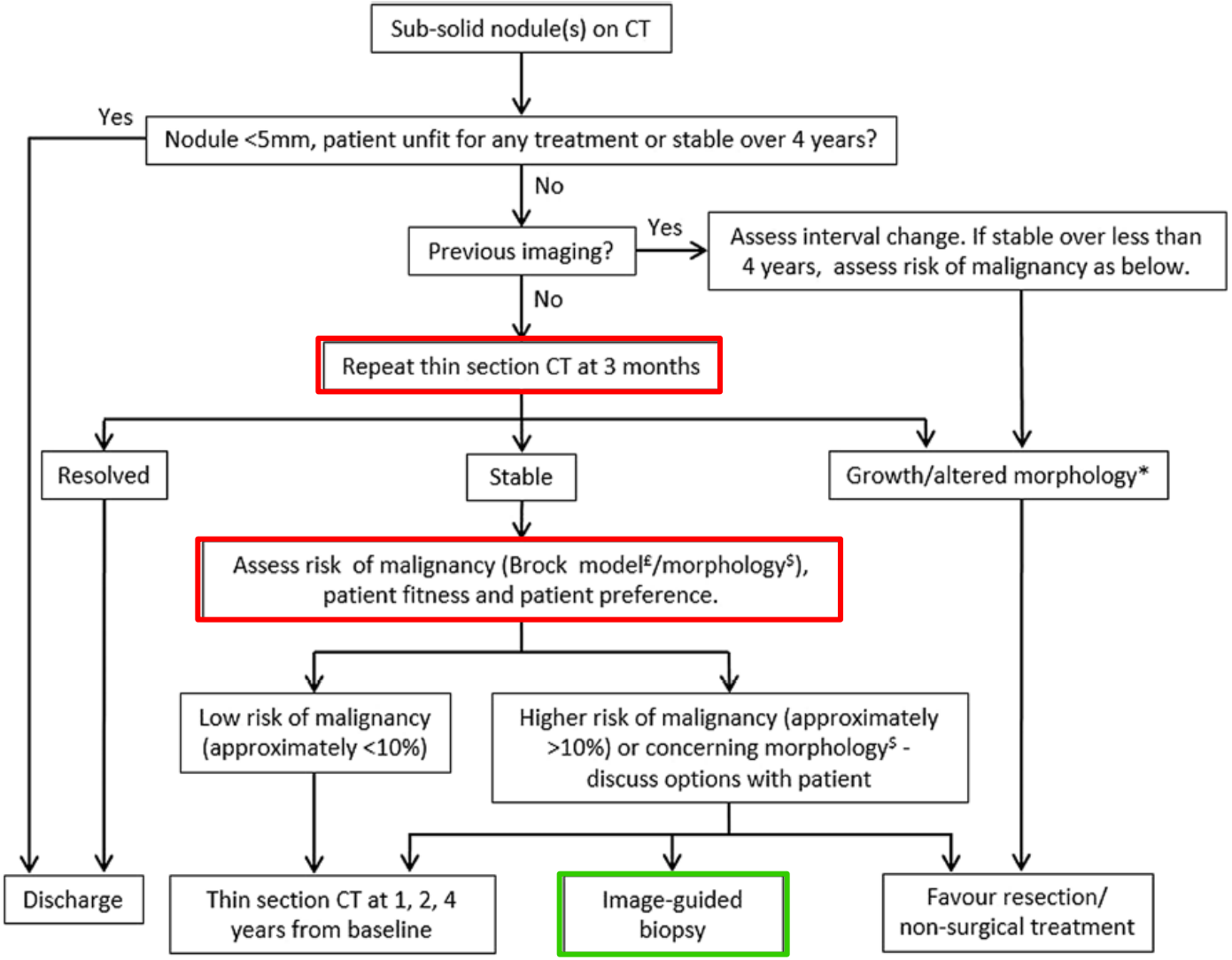
- ACCP – NCCN – Fleischner – BTS guidelines for the investigation and management of pulmonary nodules provide clarity about the place of a biopsy.
- Decision to pursue biopsy depends on radiographic characteristics and the presence of risk factors.
- No standard accepted criteria for choice between a bronchoscopic technique or percutaneous CT guided technique. Balance preference, accuracy and harms.

Initial approach for solid pulmonary nodule.



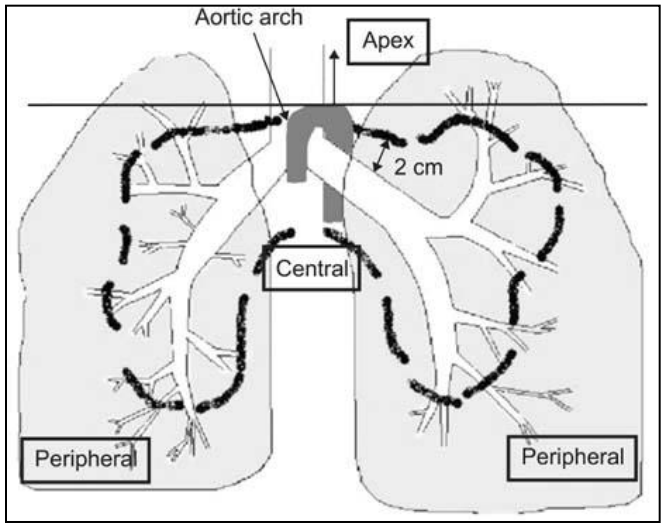
Callister et al. Thorax 2015;70:ii1-ii54.

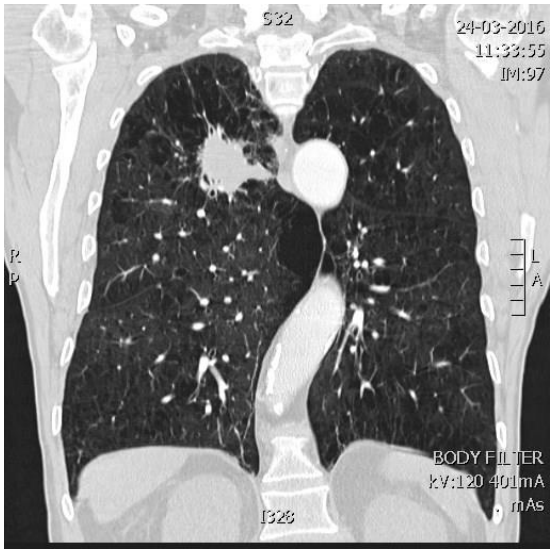
Initial approach for subsolid pulmonary nodule.

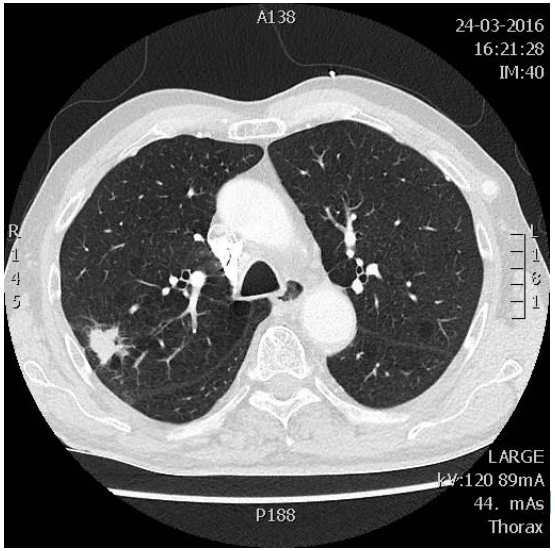


Callister et al. Thorax 2015;70:ii1-ii54.

Bronchoscopic strategy for a peripheral nodule.







Conventional bronchoscopic strategy for a PPL.

Which vehicle ? →	Which route ? →	Which target ?
= Bronchoscope	= Navigation	= Verification
OD 6mm wc 2,8mm	Mental	Fluoroscopy

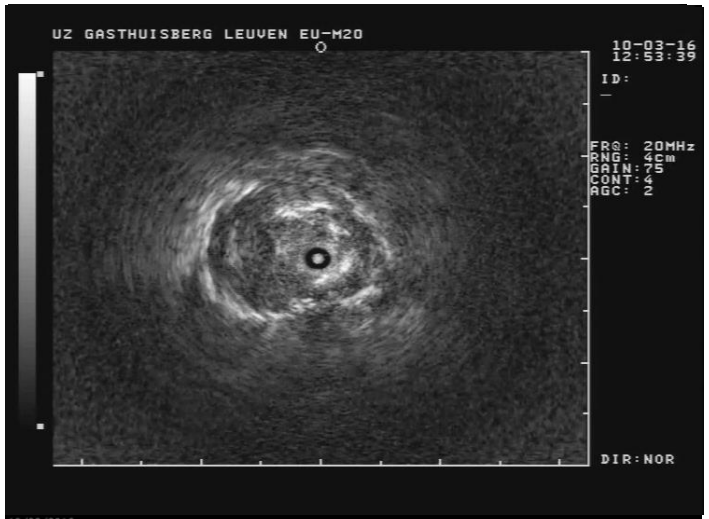
- 'clinical' setting : **ACCP evidence-based guidelines**

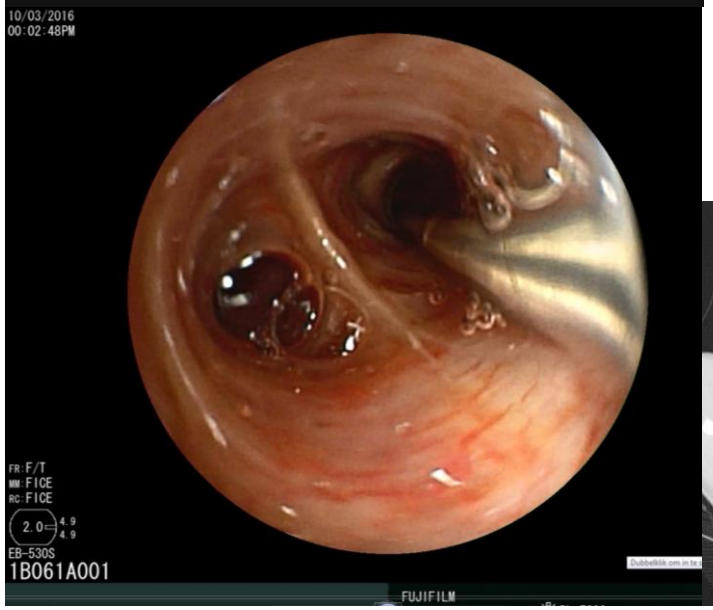
  test sensitivity = 34% Rivera M, et al. Chest 2013;143:e142S.

- 'screening' setting : **NELSON trial**

  test sensitivity = 14% van 't Westeinde et al. Chest 2012;142:377.

Advanced bronchoscopic strategy for a PPL.

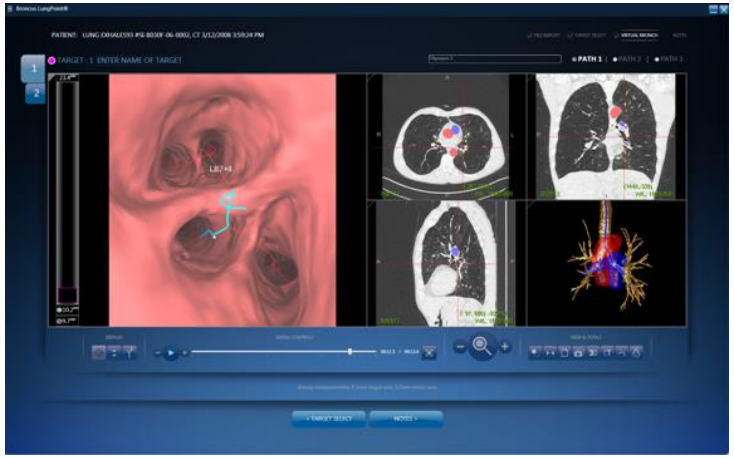


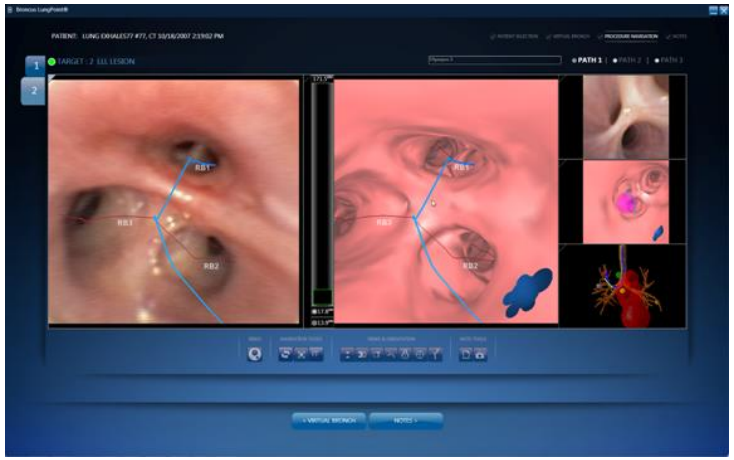


Categories of image guided techniques

1. **Radial endobronchial ultrasound.**
   - radial probe ultrasound, often + guided sheath
   - fitting through working channel of scope
   - not a navigational tool
   - provides real-time imaging of nodule
   - no real-time biopsy visualisation (unless f)
   - biopsy instruments through guided sheath

Advanced bronchoscopic strategy for a PPL.





Categories of image guided techniques

1. Radial endobronchial ultrasound.

2. **Virtual bronchoscopic navigation.**

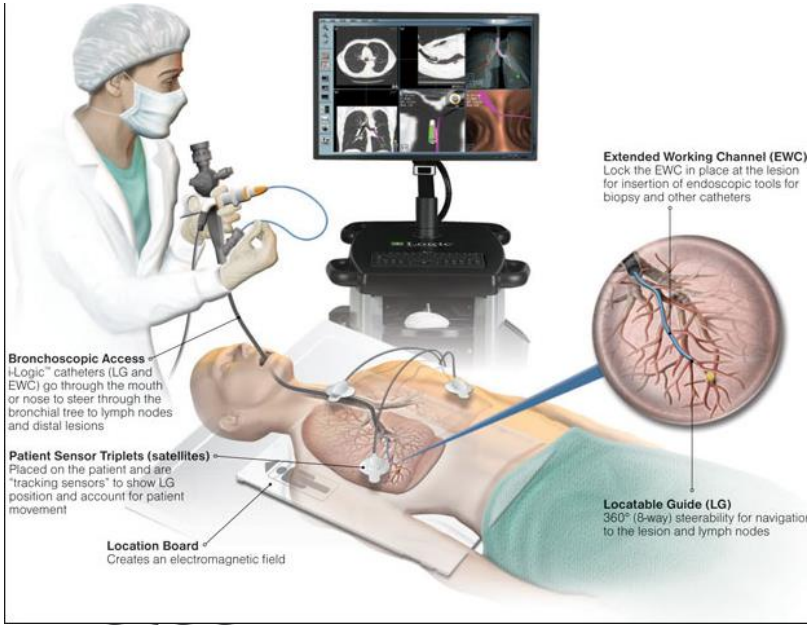
   - planning prior to procedure
   - CT scan (1mm) transferred to computer
   - virtual bronchoscopic pathway created
   - no real-time tracking during navigation
   - overlay of pathway during bronchoscopy

Advanced bronchoscopic strategy for a PPL.

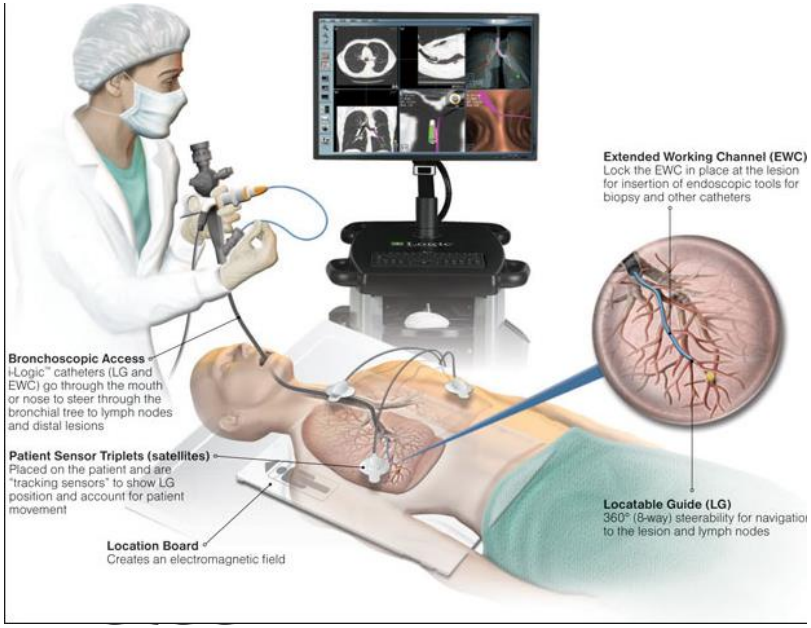
Categories of image guided techniques

1. Radial endobronchial ultrasound.
2. Virtual bronchoscopic navigation.
3. **Electromagnetic navigation bronchoscopy.**

- prior to and during procedure
- electromagnetic field allowing real-time tracking of instruments
- steerable guide and sheath on a virtual image



Advanced bronchoscopic strategy for a PPL.

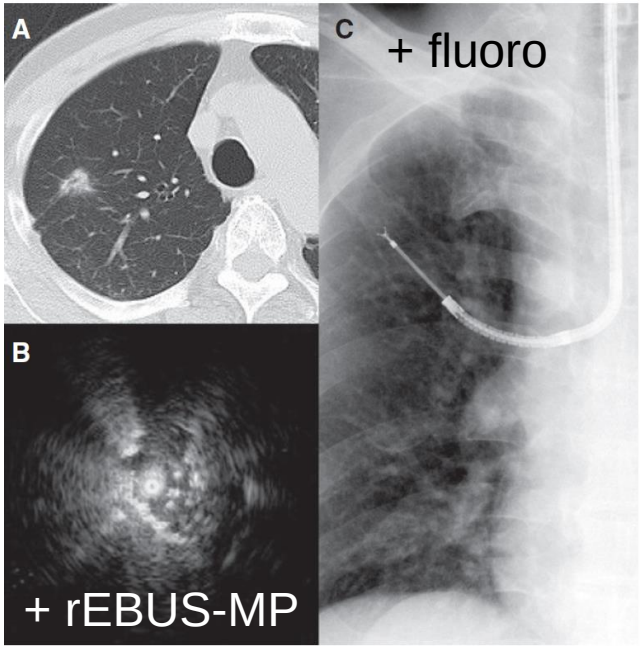


Categories of image guided techniques

1. Radial endobronchial ultrasound.
2. Virtual bronchoscopic navigation.
3. **Electromagnetic navigation bronchoscopy.**

- prior to and during procedure
- electromagnetic field allowing real-time tracking of instruments
- steerable guide and sheath on a virtual image
- **high capital cost for system**

Advanced bronchoscopic strategy for a PPL.



Categories of image guided techniques

4. Ultrathin bronchoscopy.

- size outer diameter 2.8-3.5 mm
- better maneuverability
- into smaller airways : 4.3 vs 2.3 generations
- small working channel/biopsy instrument
- relatively uncommon in clinical practice

Advanced bronchoscopic strategy for a PPL.

Which vehicle ?	Which route ?	Which target ?
= Bronchoscope	= Navigation	= Verification
OD 6mm wc 2,8mm	VBN	Fluoroscopy
OD 4mm wc 2,0mm	EMN	rEBUS-MP
OD <4mm wc <2,0mm	Mental	
+/- guided sheath		

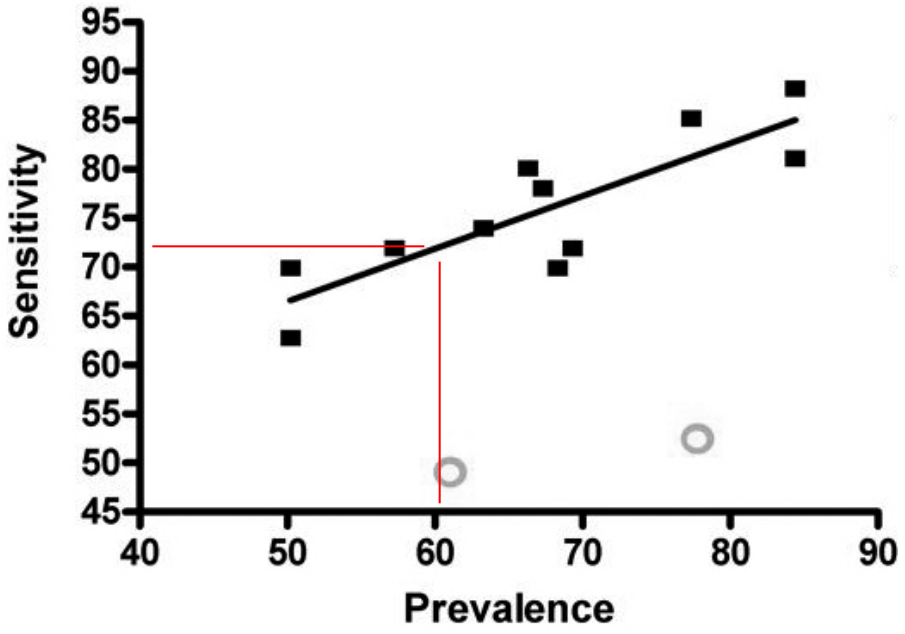
Advanced bronchoscopic strategy for a PPL.

RCT (year)	SPN	VEHICLE		ROUTE	TARGET	YIELD	
		OD scope	GS	planning	verification		
Paone (2005)	n	5-6 5-6	n n	mental mental	**none** **EBUS-MP**	55% 79%	*P*=0.004
Eberhardt (2007)	(y)	5-6 5-6	y y	mental **EMN**	**EBUS-MP** **EBUS-MP**	69% 88%	*P*=0.02
Fielding (2011)	n	na 5-6	na y	TTP mental	**CT** **EBUS-MP+f**	79% 68%	*P*=NS
Ishida (2011)	y	4 4	y y	**VNB** mental	**EBUS-MP+f** **EBUS-MP+f**	80% 67%	*P*=0.03
Oki (2012)	n	3.4 4	n y	mental mental	**EBUS-MP+f** **EBUS-MP+f**	65% 62%	*P*=NS
Asano (2013)	y	**2.8** **2.8**	n n	**VNB** mental	f f	67% 60%	*P*=NS
Oki (2015)	y	4 **3**	y n	**VNB** **VNB**	**EBUS-MP+f** **EBUS-MP+f**	61% 75%	*P*=0.008

Meta-analysis EBUS-MP. *Steinfort et al. ERJ 2011*

- 13 studies included : sensitivity 73%.
- Heterogeneity in sensitivity due to

Prevalence of malignancy Lesion size



lesion <20mm : 56%

lesion >20mm : 78%

elcc

Steinfort et al. Eur Respir J 2011; 37:902.

Meta-analysis r-EBUS-miniprobe. *Steinfort et al. ERJ 2011.*

- Selection bias ‘clinical trials’ : 13 studies included.
- Prevalence cancer 72% - diagnostic yield 73%.

Every day clinical practice. *Guvenc et al. 2014 ; Ost et al. 2015.*

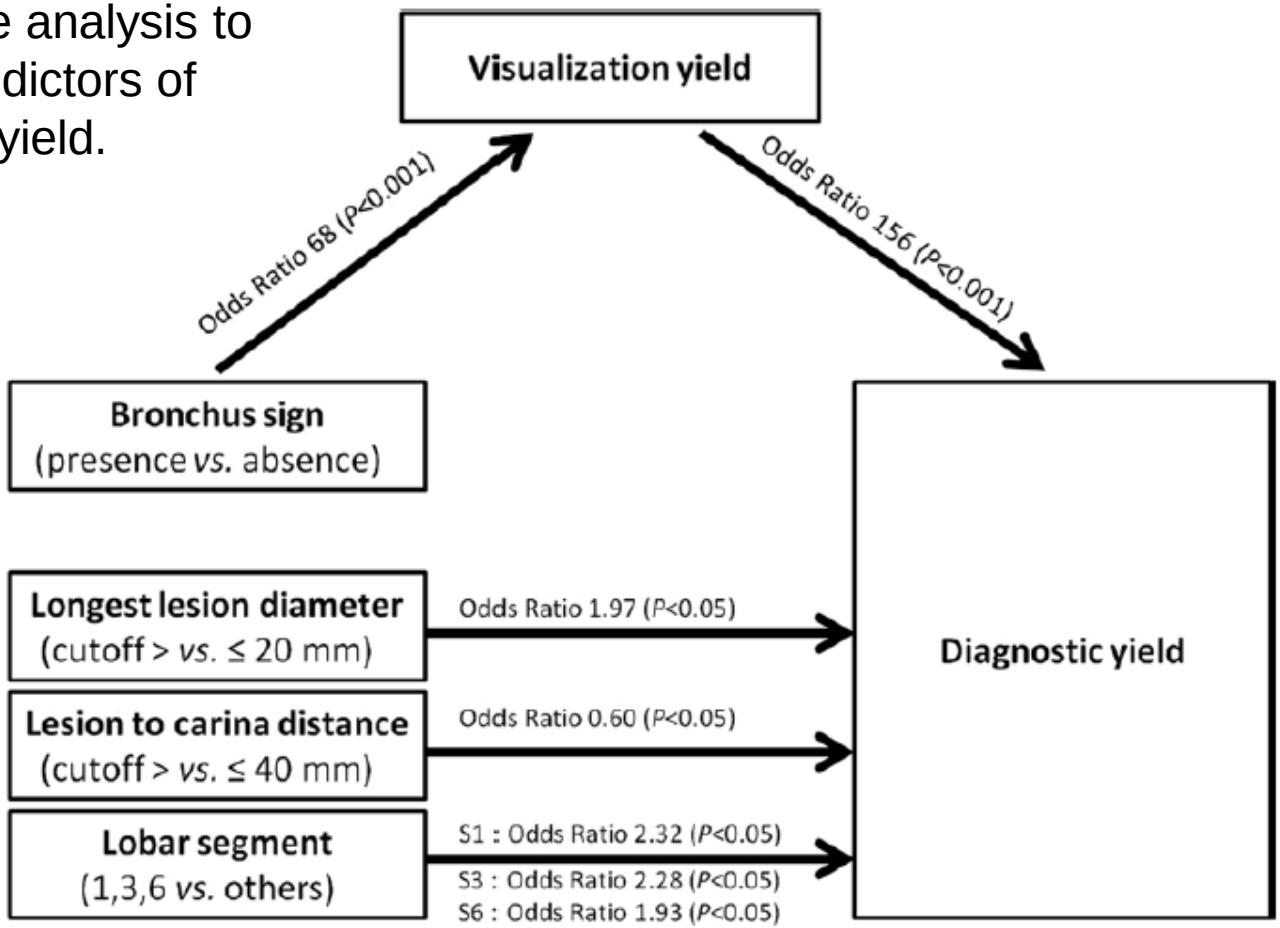
- AQuIRE (prospective web-based ACCP Quality Improvement Registry, Evaluation, Education) : 15 US centers enrolled 581 subjects : diagnostic yield TBLB by rEBUS-MP 51% ; by fluoroscopy 54% ; by any navigation 46% (prevalence cancer 58%).
- UZ Leuven registry : enrolled 760 subjects : diagnostic yield TBLB by EBUS-MP 62% (prevalence cancer 73%).
- Registries suggest that advanced techniques outside research setting do not perform as well as in clinical trial.

elcc

Steinfort *et al.* Eur Respir J 2011; 37:902. Ost *et al.* AJRCCM 2016;193:68. Guvenc *et al.* J Thorac Oncol 2015;10:472.

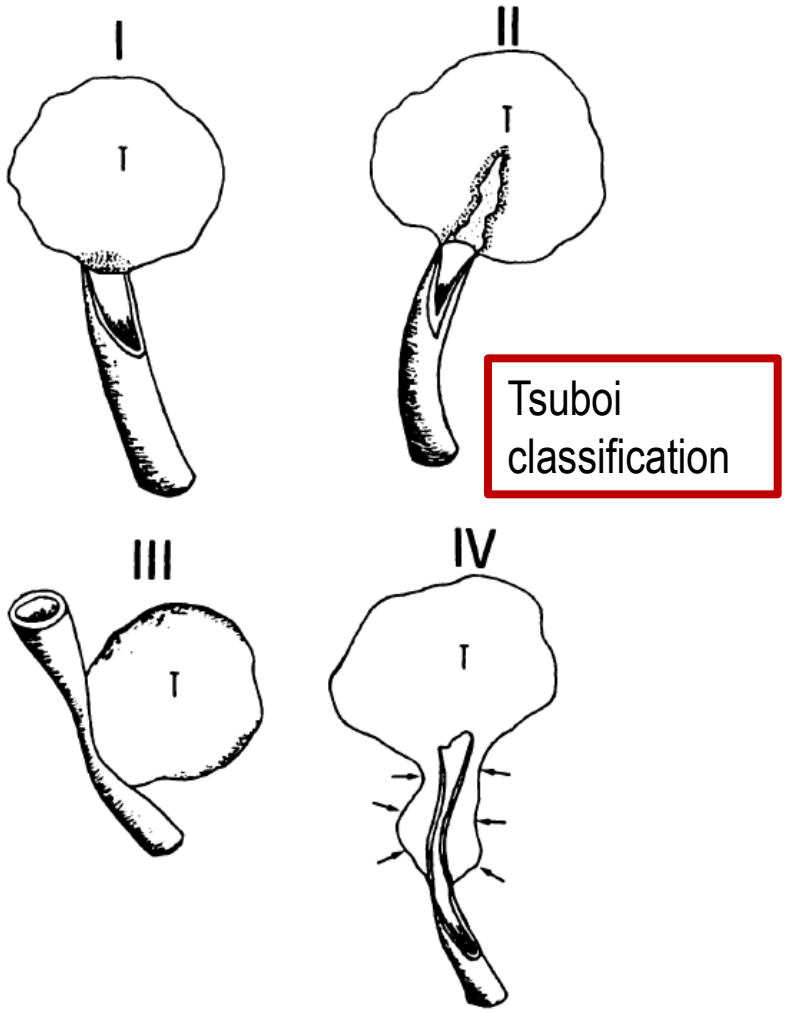
Factors affecting diagnostic yield in daily clinical practice.

Multivariate analysis to identify predictors of diagnostic yield.



Guvenc et al. JTO 2015;10:472.

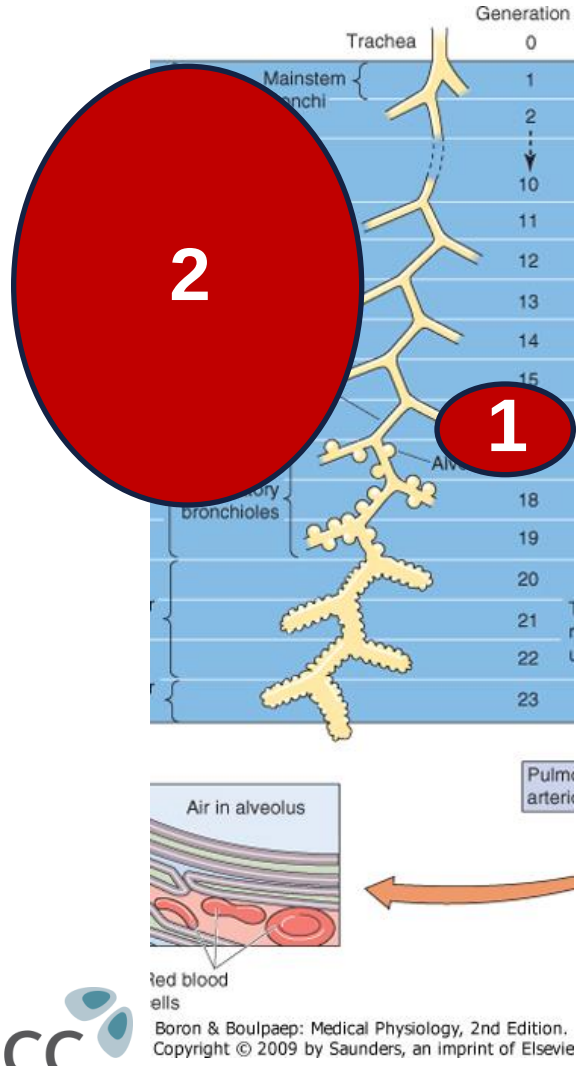
Role of bronchus sign to lesion on CT scan



Tsuboi. Cancer 1967;20:687-98.

Naidich. Chest 1988;93:595-8.

Role of lesion size



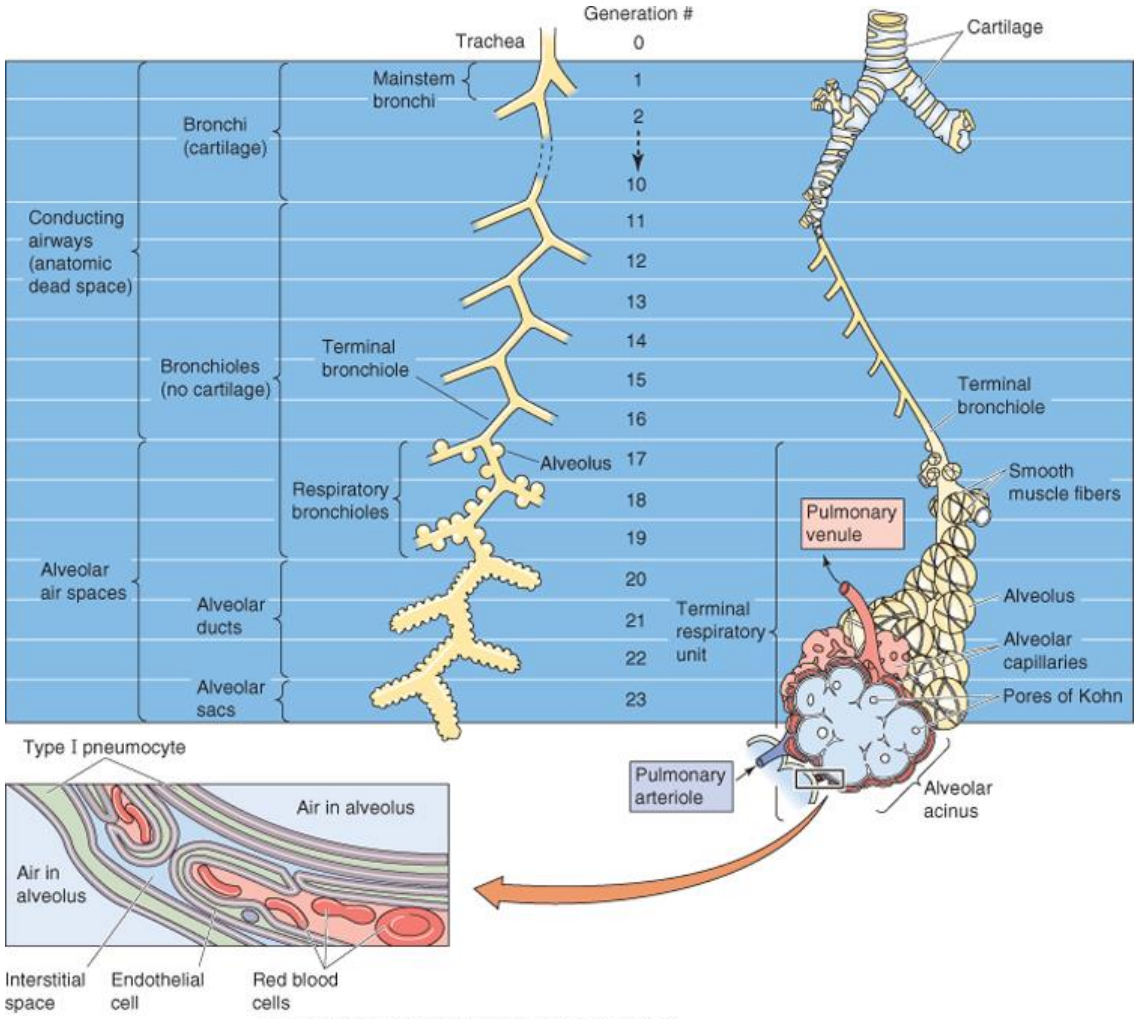
<u>Decreased yield of TBLB</u>

for small size (1) compared to large size (2)

< lower number of bronchi leading to the tumor

< more difficult to see with fluoroscopy

Role of distance from hilum



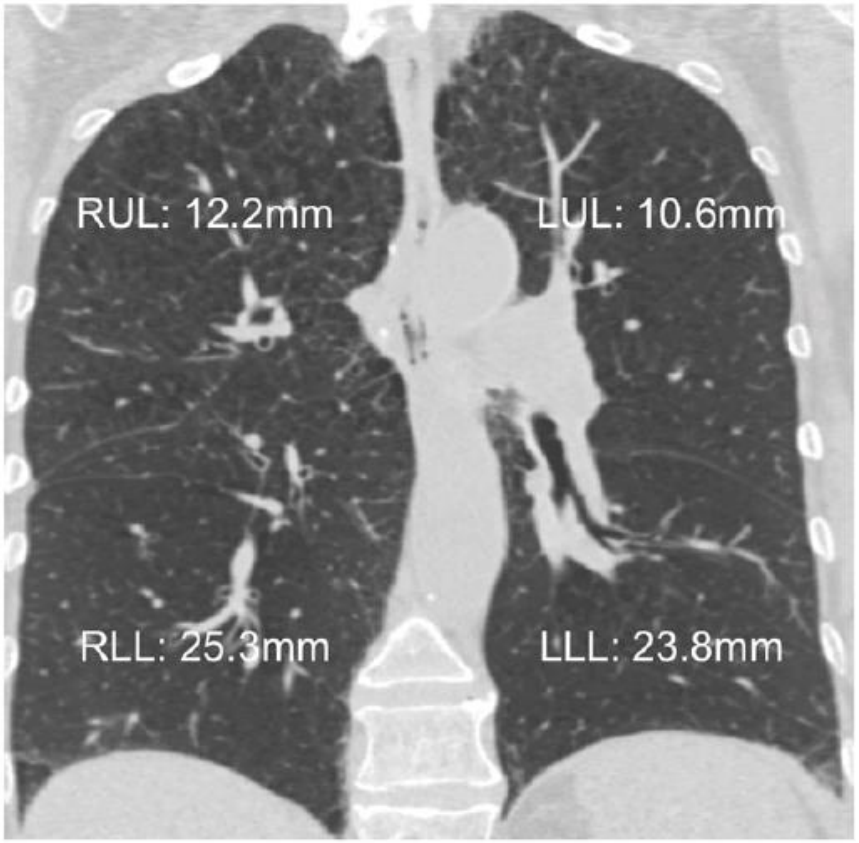
Boron & Boulpaep: Medical Physiology, 2nd Edition.

Decreased yield of TBLB

for distal location

< increasing nb of divisions

Role of respiration : lesion location on full inspiration CT does not reflect actual position at the time of bronchoscopy



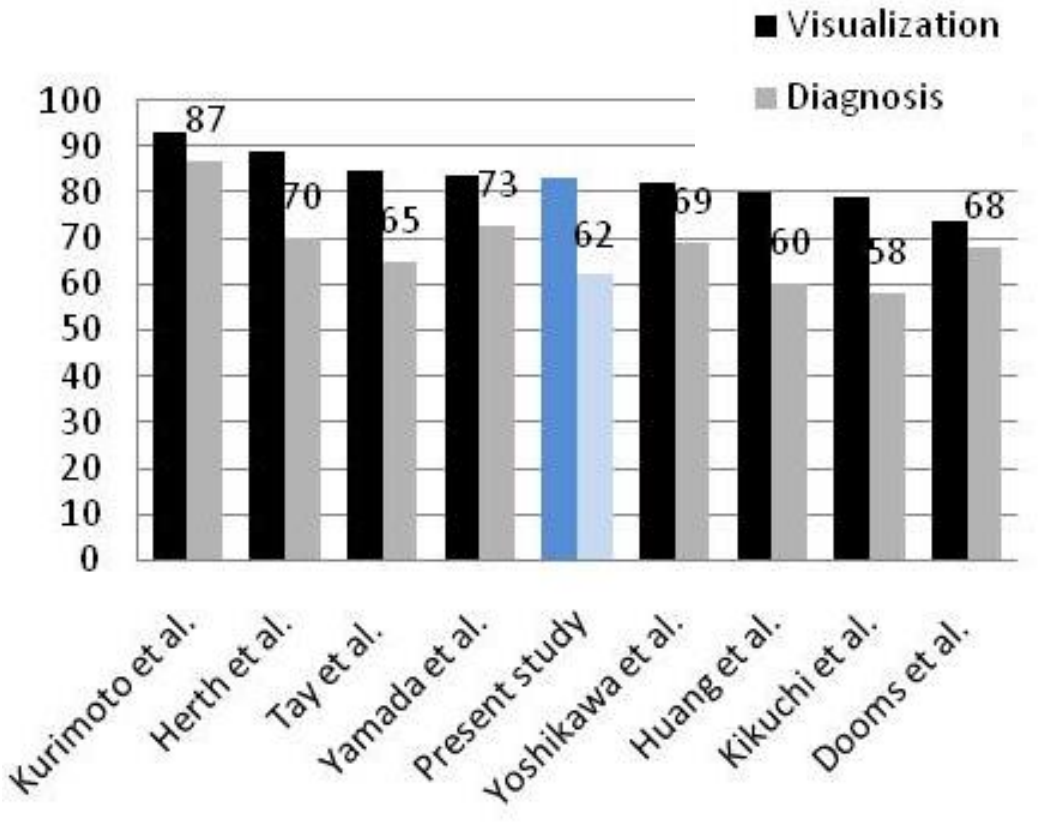
Nodule movement
- significantly influenced by lobe
- Not influenced by size or distance from pleura

Full inspiration (gray ; ~CT) versus end-exhalation during TV breathing (blue)

Chen. Chest 2015;147:1275-1281.

Detection *versus* diagnostic yield

EBUS-MP detection yield 10-20% higher than diagnostic yield :



Factors related to technique

* miniprobe positioning
* use of guided sheath
* respiration

Factors related to sample

* prevalence malignancy
* criteria specific diagnosis

How to improve diagnostic performances.

- Multiple advanced guidance modalities.
- Use of transbronchial needle aspiration (TBNA).
- Consider EBUS-TBNA in some circumstances.
- Bronchoscopic transparenchymal nodule access ?
- Novel methods for in vivo imaging ?

Multiple advanced guidance techniques.

Retrospective study multiple guidance modalities :

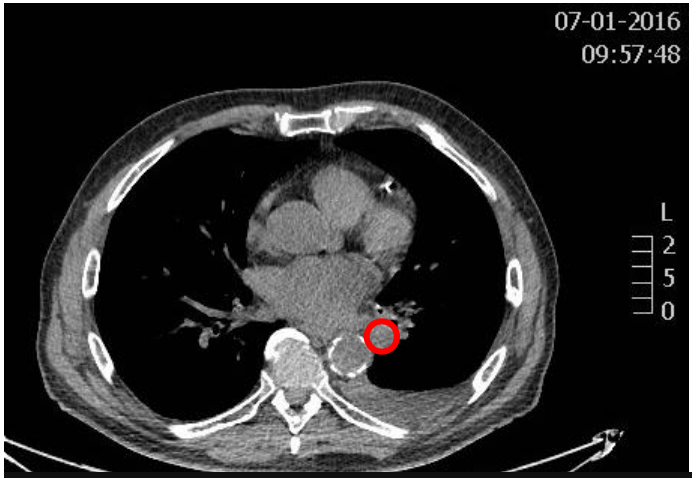
Setting : N=245 ; size 23±11mm ; prevalence cancer 77%.

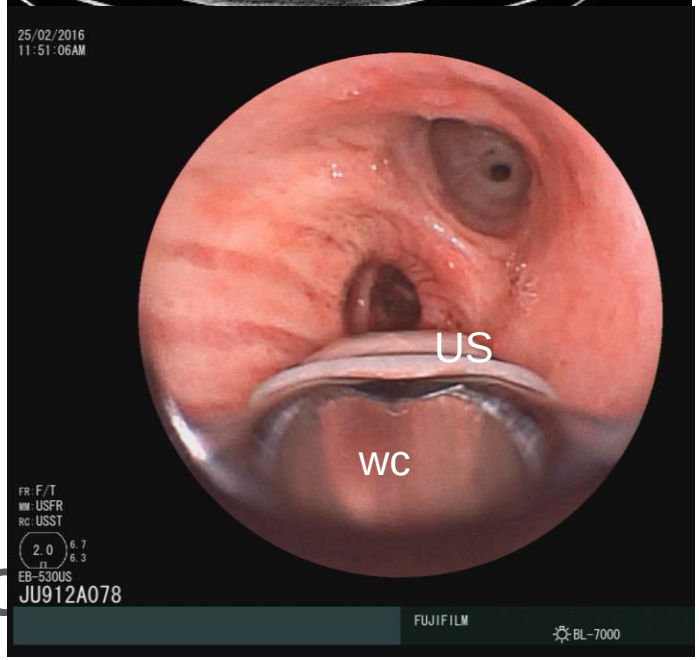
	visualization	diagnosis
rEBUS-MP + virtual bronchoscopy	77%	55%
	↓ +8%	↓ +3%
+ electromagnetic navigation	85%	58%

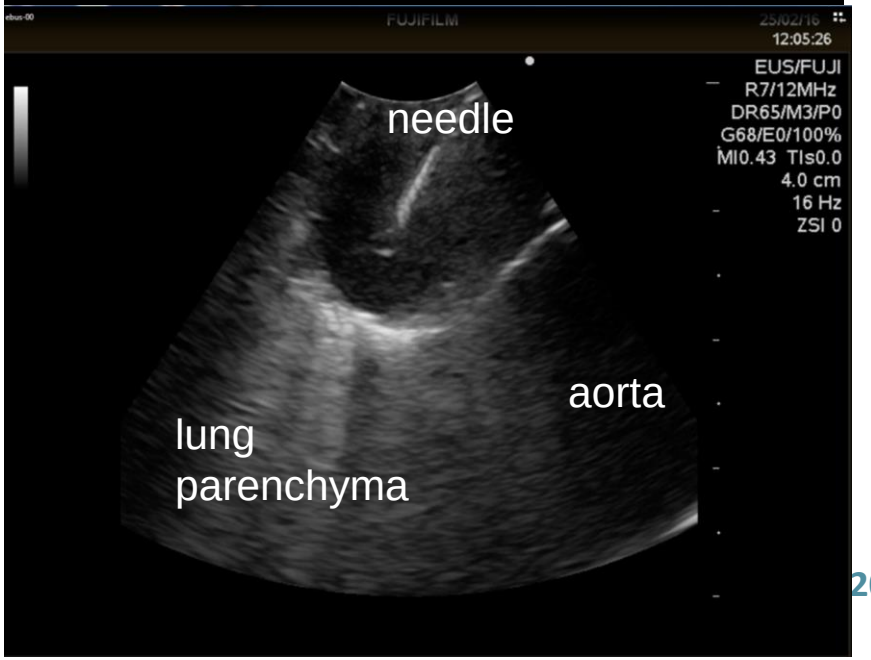
EMN only when rEBUS-MP+VB was unable to locate
n=57 (23%)

Steinfort *et al.* Eur Respir J 2016;47:607.

EBUS-TBNA of centrally pulmonary lesion.



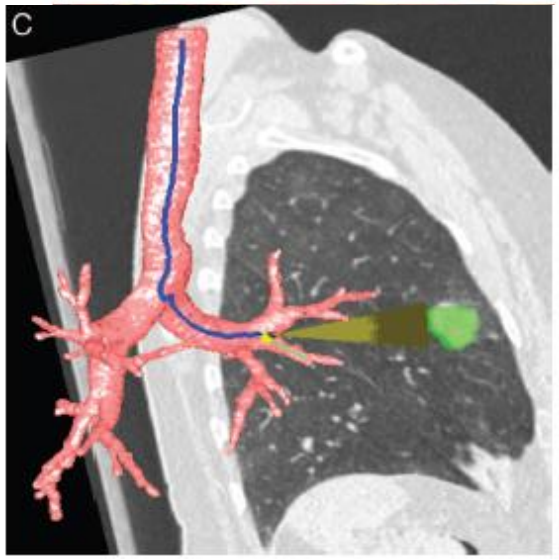


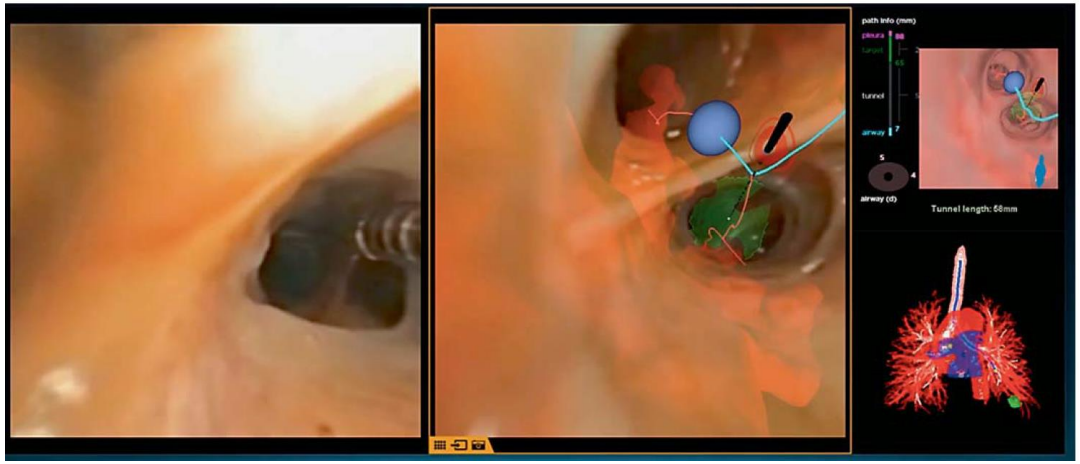


Bronchoscopic transparenchymal nodule access.

Table 1. Safety and procedural aspects of the BTPNA procedure

Site	Size, mm	Visibility on fluoroscopy	Procedure planning time, min	Nodule access time, min	Fluoroscopy time, min	Overall adverse events	Tunnel length, mm	Nodule distance to pleural surface, mm	Pathology
LUL	23	yes	8	8	1.8	no	46	20	NSCLC
LLL	20	yes	10	14	2.5	yes (pneumothorax)	13	1	SCC
RUL	15	yes	NA	25	7.5	no	NA	28	Adenocarcinoma
LUL	18	yes	20	21	2.6	no	NA	39	No histology
RUL	26	yes	14	20	6.5	no	11	13	Adenocarcinoma
RLL	17	no	20	25	1.3	yes (pneumothorax)	45	10	SCLC





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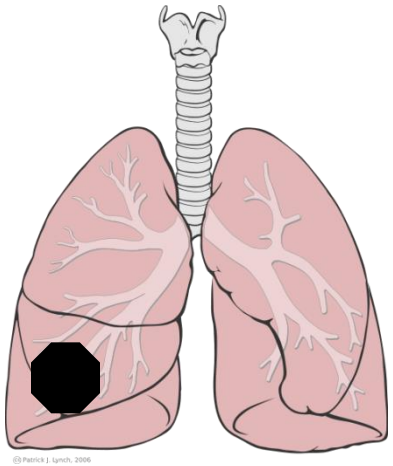
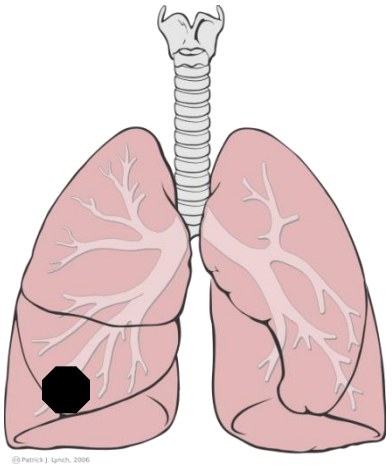
Herth *et al. Thorax 2015;70:326. Respiration 2016;Epub.*

Conclusion bronchoscopy for pulmonary nodule

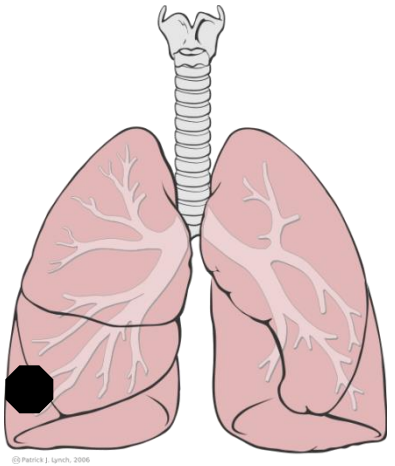
invisible >30mm | invisible central ≤30mm | true peripheral ≤30mm



rEBUS-MP (+f)
yield 60-80%



navigation rEBUS-MP+GS
yield 60-80%



CT-TTP
yield >85%

Critical elements : bronchus sign – pleural contact – lesion size.

THANK YOU FOR YOUR ATTENTION.