



Periferik lezyonlara yaklařım

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Soliter pulmoner nodül

- 150.000 / yıl SPN
- Malignite prevalansı %1-12
- Boyuta göre malignite riski:
 - %0-1 nodul < 5 mm
 - %6-28 nodul 5 - 10 mm
 - %64-82 nodul > 20 mm
- BT-TTİAB;
 - %20 non-diagnostik
 - PNX riski %25
 - KSAD % 5
- FOB (floroskopili)
 - TBB; %14 - 63 tanısal



-Jessica S . Wang Memoli Meta-analysis of Guided Bronchoscopy for the Evaluation of the Pulmonary Nodule. *CHEST* 2012; 142(2):385–393

-Wahidi M. et al. ACCP Evidence-Based Clinical Practice Guidelines. *CHEST* 2007;132:94-107

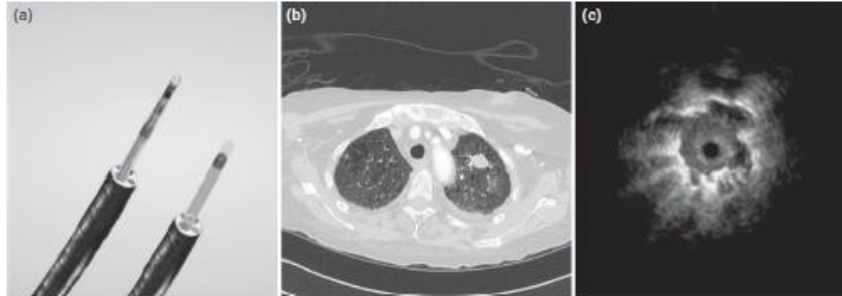
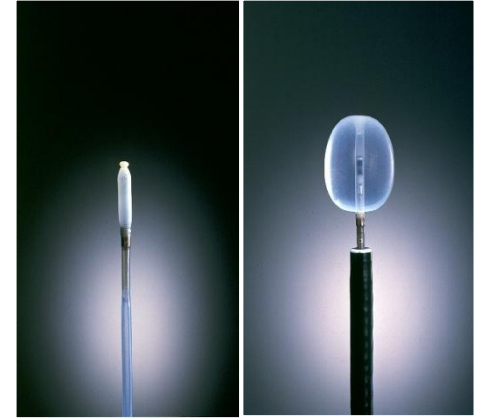
Periferik akciğer nodüllerinin değerlendirilmesi

- Radyal EBUS ve guide sheath
- Navigasyonlu bronkoskopi
 - Elektromanyetik navigasyonlu bronkoskopi
 - Sanal bronkoskobik navigasyon
- Transparankimal nodül biyopsisi
- Navigasyonlu TTİAB

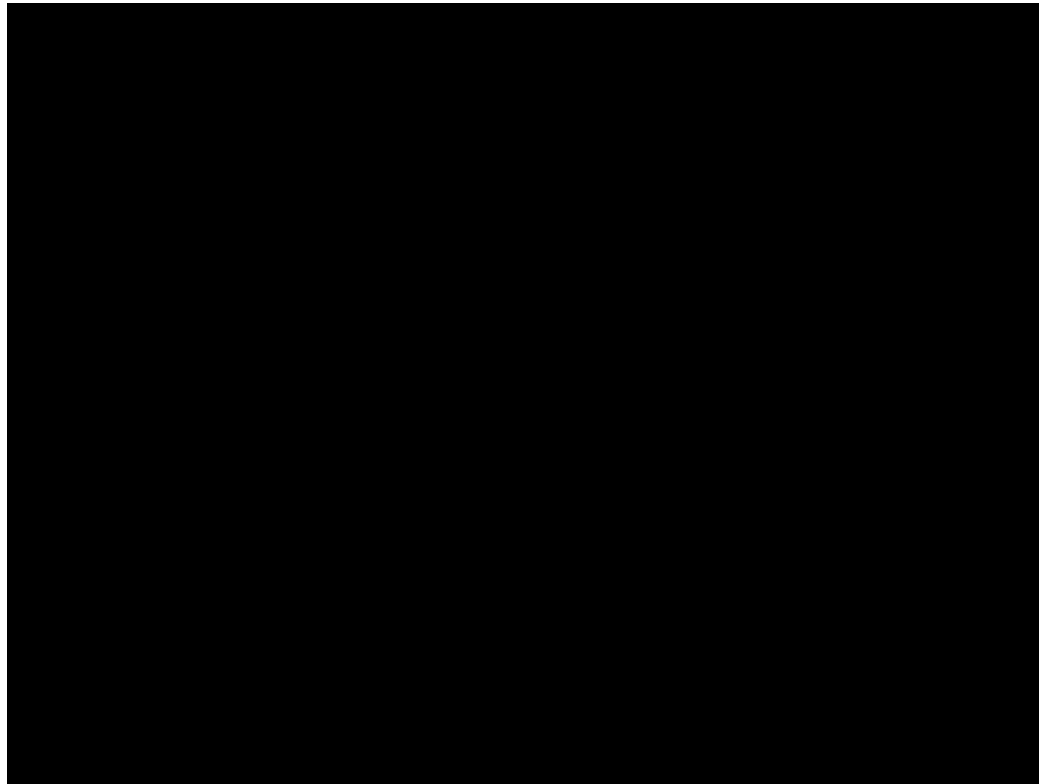
Radyal prob EBUS

FOB çalışma kanalından uygulanır
360 derecelik tarama
20-30 Mhz
1.4-1.9 mm çap

İki amaç için kullanılır;
Erken evre yüzeysel tümör değerlendirmesi
Periferik kitle /nodül saptanması



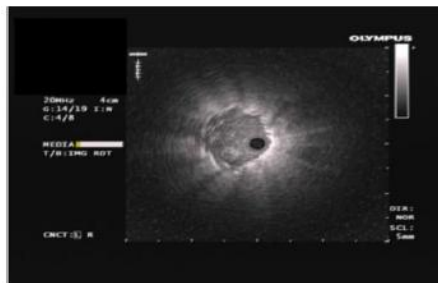
Radyal EBUS + Disposable guide sheath (DGS) periferik lezyon



Radyal EBUS + Disposable guide sheath (DGS) periferik lezyon

- R-EBUS + DGS: %58-82 tanı başarısı

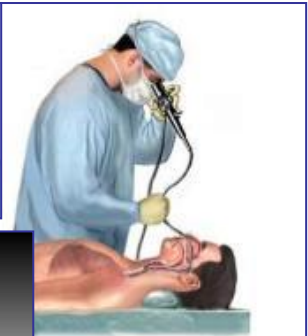
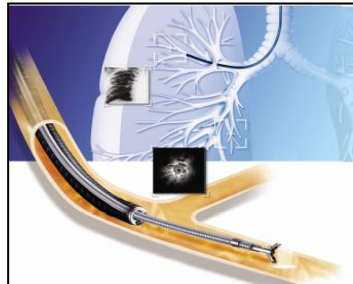
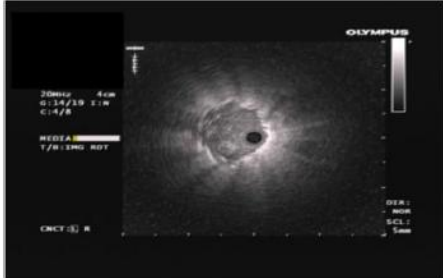
- Shirakawa T et al. Usefulness of endobronchial ultrasonography for transbronchial lung biopsies of peripheral lung lesions. *Respiration* 2004; **71**: 260–8.
- Yang MC, Diagnostic value of endobronchial ultrasound-guided transbronchial lung biopsy in peripheral lung cancers. *J. Formos. Med. Assoc.* 2004; **103**: 124–9.
- Kikuchi E, et al. Endobronchial ultrasonography with guide-sheath for peripheral pulmonary lesions. *Eur. Respir. J.* 2004; **24**: 533–7.



Radyal EBUS + DGS + Elektro manyetik navigasyon periferik lezyon

- R-EBUS + DGS: %69, EMN: %59, Kombine : %88 tanı başarısı

- Eberhardt R, et.al. Multimodality bronchoscopic diagnosis of peripheral lung lesions: a randomized controlled trial. *Am. J. Respir. Crit. Care Med.* 2007; **176**: 36–41.



Radyal EBUS + DGS + Sanal bronkoskopik navigasyon (VBN) buzlu cam opasitesi

- Retrospektif analiz
- 169 buzlu cam . 156 (%92) EBUS ile saptanmış.
- 116 (%69) tanı konmuş.
 - (pür buzlu cam 20/31; %65 , mix 96/138; %70)

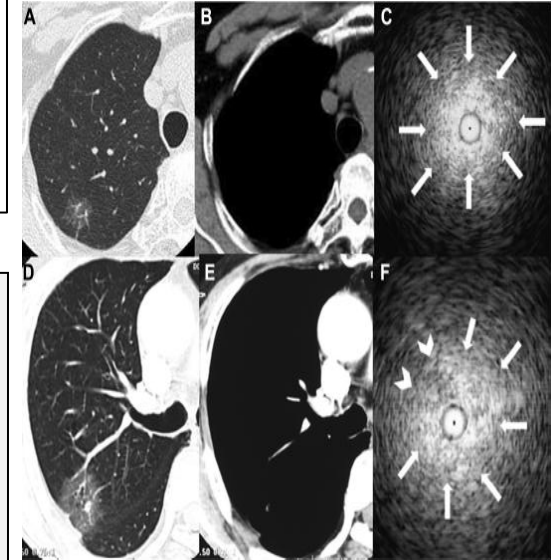


Table 4. Logistic Regression Analysis of Clinical Factors Affecting Diagnostic Yield

Variables	Univariate		Multivariate	
	HR (95% CI)	p Value	HR (95% CI)	p Value
Lesion size >20 mm versus ≤20 mm	2.6 (1.3-5.1)	<0.01	1.9 (0.8-3.7)	0.13
CT sign 1 versus others	3.1 (1.6-6.2)	<0.01	2.8 (1.1-4.9)	0.02
Visible versus invisible	1.9 (1.0-3.8)	0.059	1.4 (0.7-2.9)	0.37
Pure versus mixed GGO	1.3 (0.5-2.8)	0.59

CI = confidence interval; CT = computed tomography; GGO = ground-glass opacity; HR = hazard ratio.

Usefulness of endobronchial ultrasonography with a guide sheath and virtual bronchoscopic navigation for ground-glass opacity lesions.

Ikezawa, Y., et al. Ann Thorac Surg. 2017 Feb;103(2):470-475.

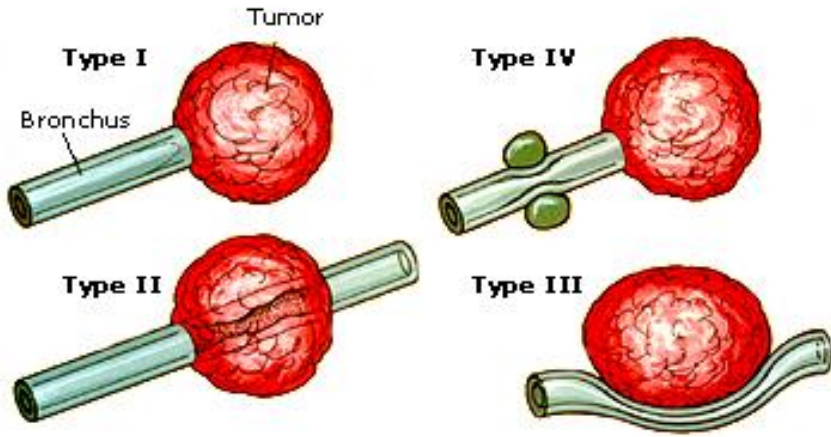
Radyal EBUS ; periferik lezyon Meta analiz

- 57 çalışma 7872 lezyon
- R-EBUS tanı değeri %70.6 (95% CI: 68-73.1%)
- Lezyon > 2 cm, Bronş işareti olması tanı değerini arttırıyor.
- Komplikasyon %2.8.

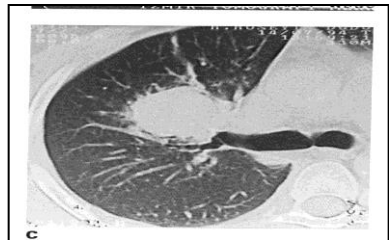
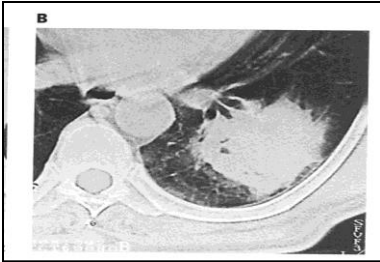
Radial endobronchial ultrasound for the diagnosis of peripheral pulmonary lesions: A systematic review and meta-analysis.

Ali, M. S., et al. *Respirology*. 2017 Apr;22(3):443-453.

Periferik nodül/kitlede BT bronş belirtisi



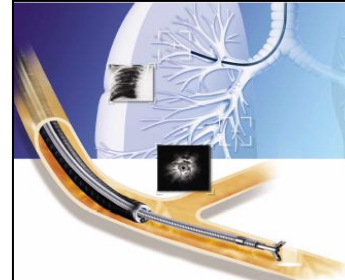
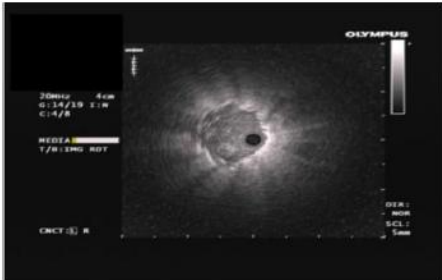
Tip 1 ve Tip 2: TBAB
Tip 3 ve Tip 4: TBİAB
Daha tanısal olabilir
(yada kombine kullanılır)



Tsuboi E, Ikeda S, Tajima M, Shimosato Y, Ishikawa S. Transbronchial biopsy smear for diagnosis of peripheral pulmonary carcinoma. *Cancer* 1967;20:687-698

Radyal EBUS kısıtlılıkları

- Lezyon büyüklüğü (<20mm %56.3, >20mm %77.7)
- Hilusa uzaklık , bronkus işareti olması
- Navigasyon olmazsa , yanlış havayolu incelemesi yapılabilir.
- USG görüntülerini değerlendirmek (özellikle buzlu cam görünümleri) belirgin bir deneyim istemektedir.
- Maliyet (disposable guide sheath, radyal problar)



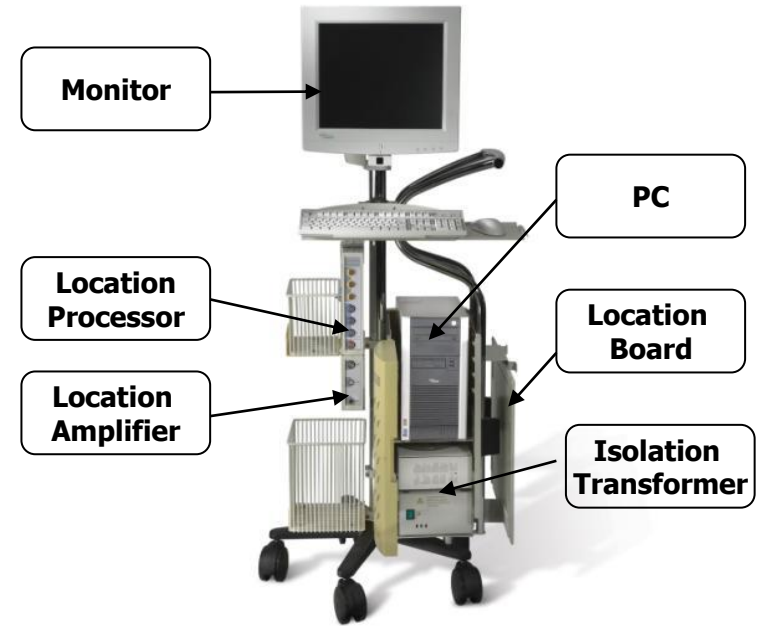
- Gilbert C. Et al. Novel bronchoscopic strategies for the diagnosis of peripheral lung lesions. *Respirology* (2014) doi: 10.1111/resp.12301

Elektromanyetik navigasyon bronkoskopi (ENB)

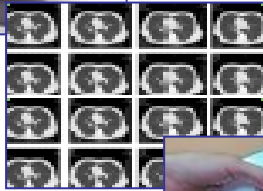
- Covidien-Medtronic; Superdimension i-Logic
- Veran Medical; SpinDrive
- Temel mekanizma;
 - Hasta etrafında manyetik alan oluşturuluyor
 - Sensör, manyetik alan içerisinde lokasyonu belirler
 - Hedef lezyonun ve mevcut pozisyonun durumu belirlenir. (GPS sistemi gibi)
 - Veriler 3 boyutlu olarak değerlendirilir.

Elektromanyetik navigasyon bronkoskopi (ENB)

- Ana işlemci
- Özel yazılımlı iki bilgisayar
- Spiral CT, DICOM
- Locatable guide
- Çalışma kanalı



ENB basamakları

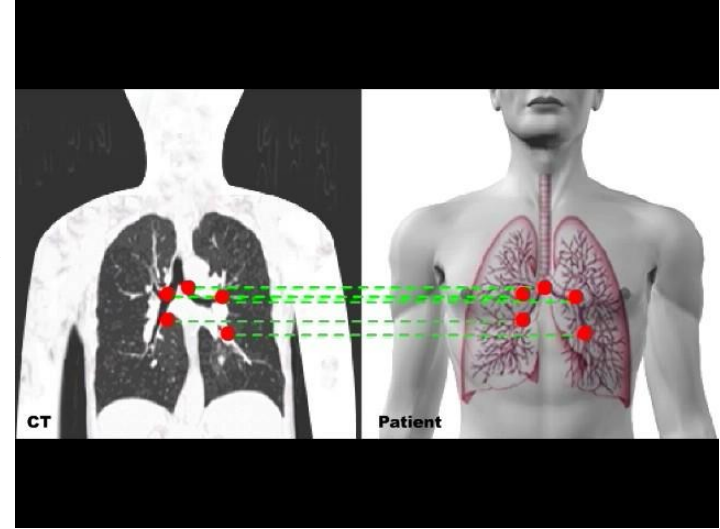


CT Scan → DICOM CD

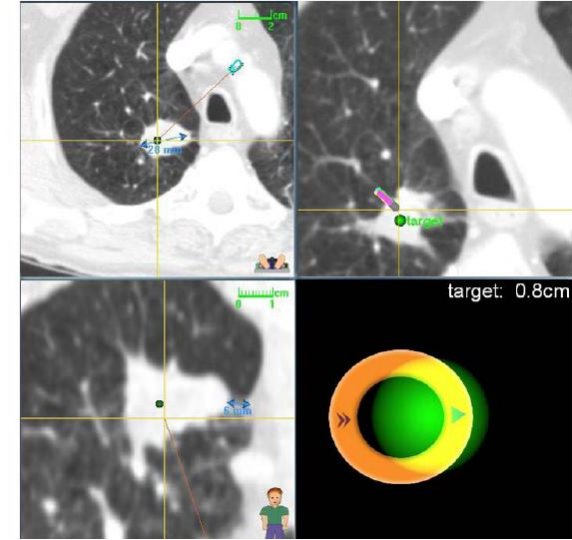
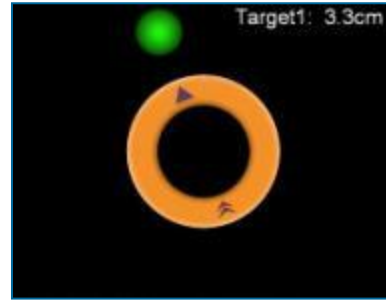
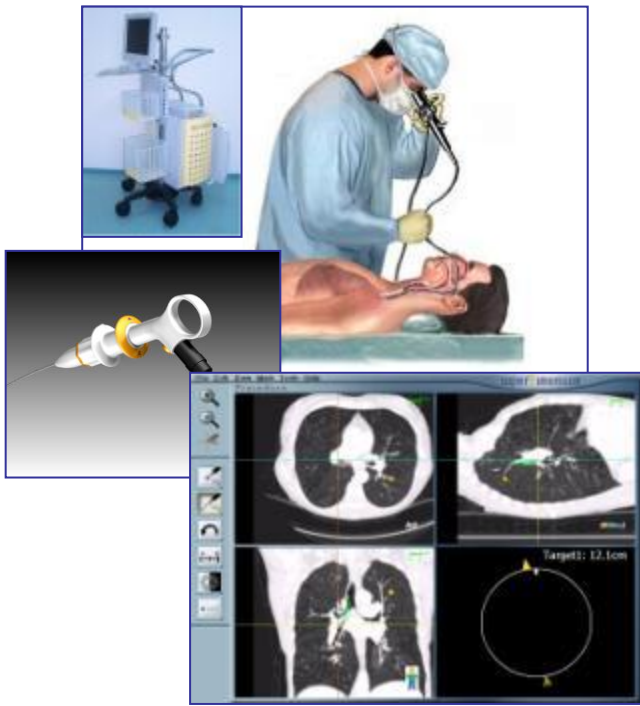


Planlama

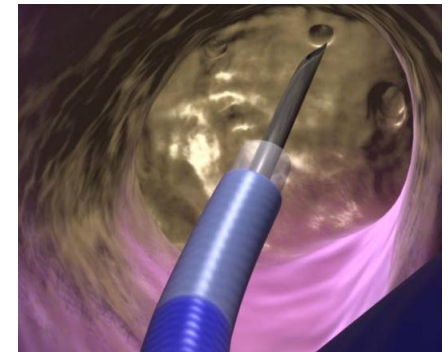
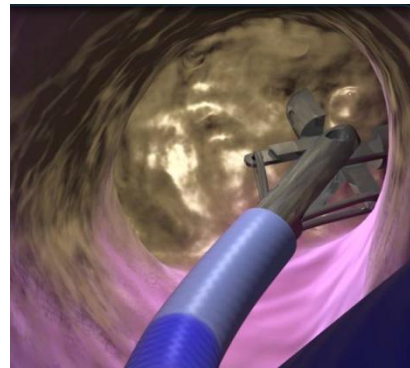
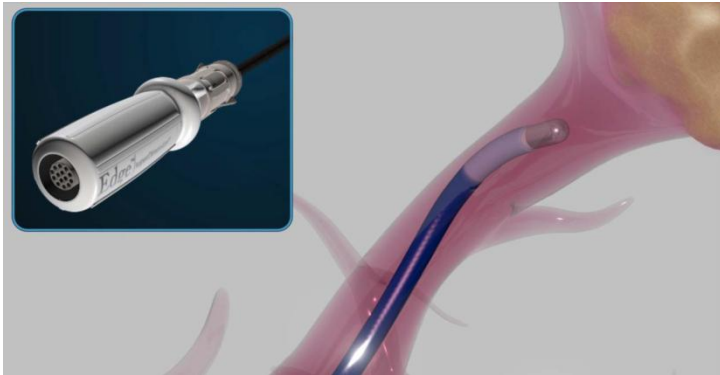




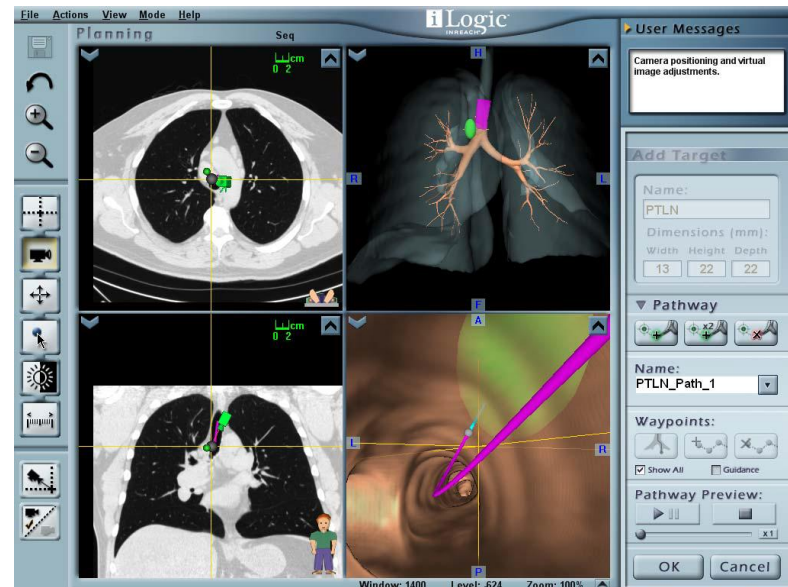
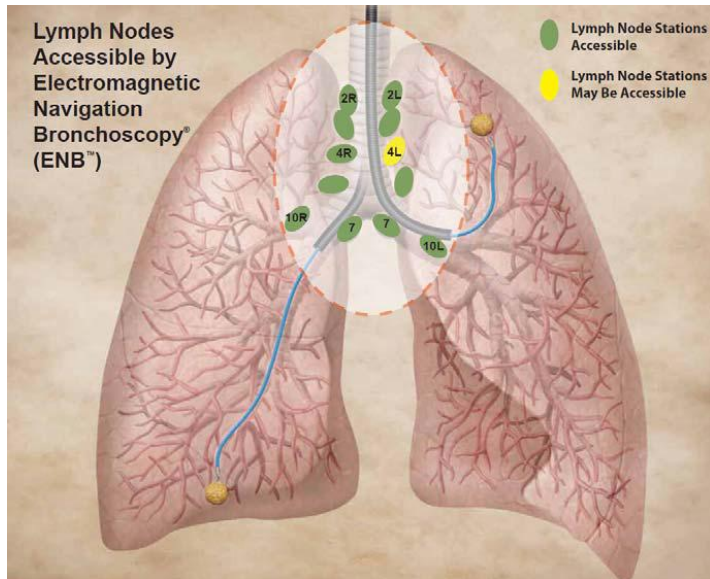
Uygulamanın başlaması-
Registration



Navigasyon ve biyopsi



ENB- mediasten lenf bezi örneklemesi



ENB- dye marker (iřaretleme)

Planlama

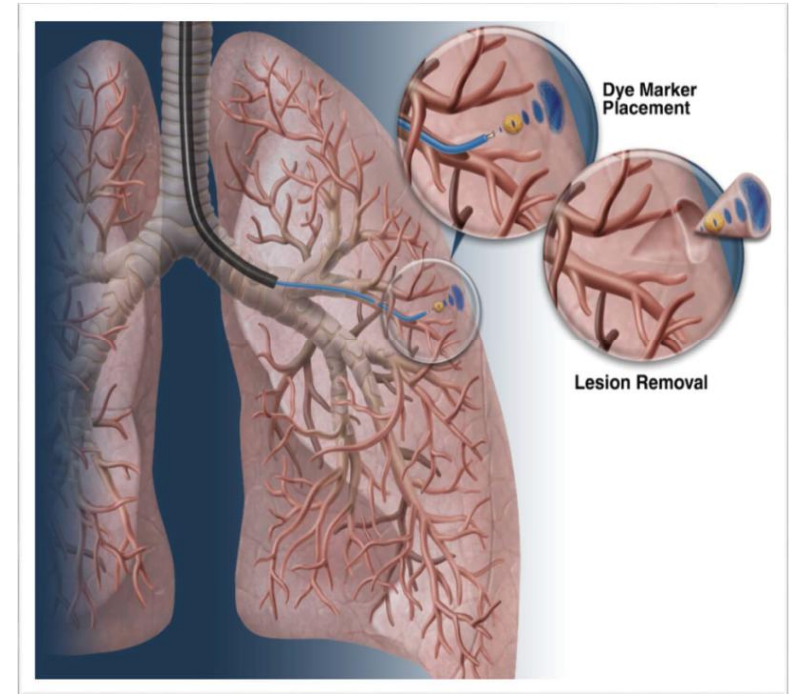
- İki hedef seçilir
 - Lezyon
 - Plevral yüzey

Navigasyon

- ENB- kateter ile hedefe ulaşılır

Dye marking (boya ile iřaretleme)

- Hedefe enjeksiyon yapılır



ENB- Fiducial marker

Planlama

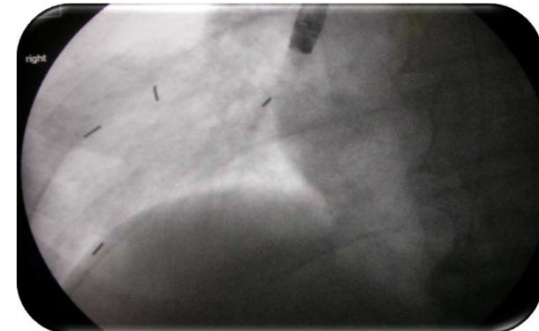
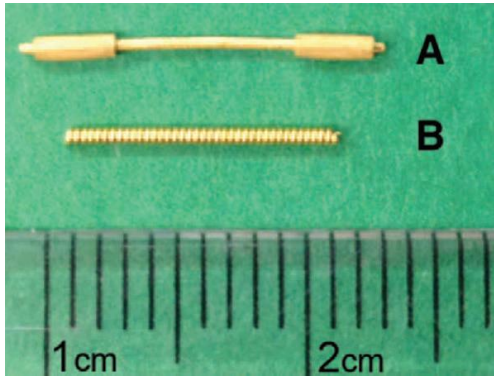
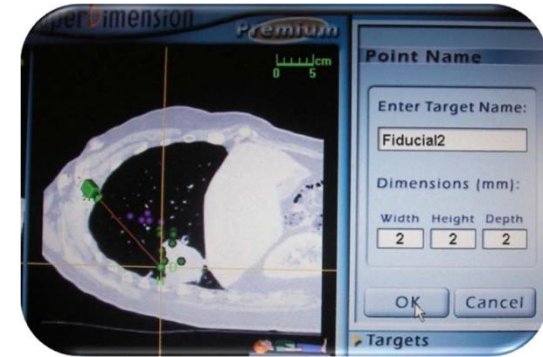
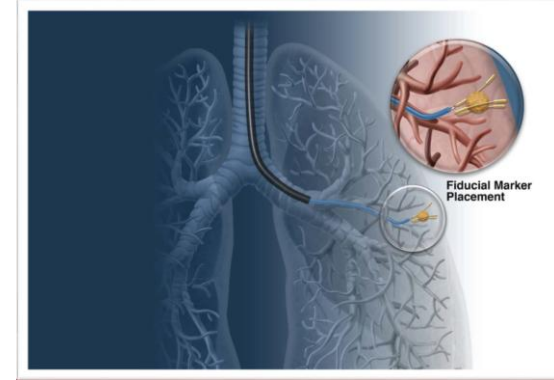
Hedef belirlenir

Navigasyon

ENB- kateter ile hedefe ulaşılır

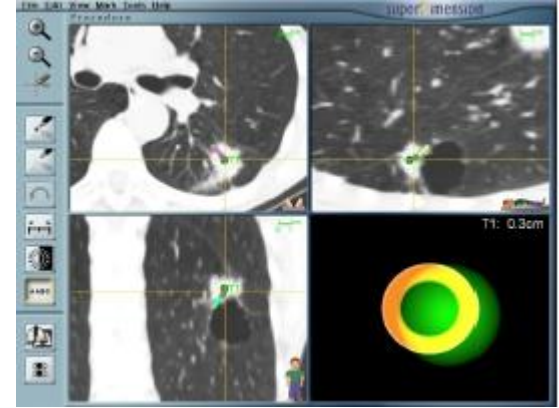
Marker yerleştirilir (TBİİAB gibi)

Stereotaktik RT uygulanır



ENB

- Tanısal değeri SPN<30mm: %54-75
- Kısıtlılıkları
 - Registrasyon hataları (3-8 mm)
 - Gerçek zamanlı değil
 - Maliyet (locatable guide)



*Schwartz et.al., Chest 2006; 129; 988 Gildea et al, Am J Respir Crit Care Med 2006; 174: 982
Eberhardt et al, CHEST 2007; 131:1800
Eberhardt et al, AJRCCM 2007; 176: 36
Eberhardt et al, AJRCCM 2007; 176: 36*

ENB- NAVIGATE alıřması

- 2015 yılında bařladı, hasta alımı tamamlandı. 2 yıllık takip yapıyor.
- İlk 1000 hasta- 1 aylık takip sonuçları
- 964 biyopsi %94.4 (910/964) doku elde edilmiř.
- 210 fiducial marker
- 17 pleural dye marking
- Lezyonlar %92.7 orta zonda
- %49.7 lezyon <20 mm,
- %48.4 bronř iřareti.
- Pnx %4.9, hemoraji %1, solunum yetm %0.6

Electromagnetic navigation bronchoscopy to access lung lesions in 1,000 subjects: first results of the prospective, multicenter NAVIGATE study.

Khandhar, S. J., et al. BMC Pulm Med. 2017 Apr 11;17(1):59.

Sanal Navigasyonlu Bronkoskopi (SNB)

- Bf-NAVI System (Olympus)
- Lung Point System (Broncus Medikal)

Bf-NAVi System (Olympus)



Gerçek FOB görüntüsü ile sanal bronkoskopik görüntü eş-zamanlı, aynı ekranda ve otomatik olarak beraber izlenemiyor

Broncus LungPoint VBN

- Broncus LungPoint VBN cihazının tasarlanmasındaki birincil amaç;
 - periferik lezyonlara ulaşabilme ve tanısal verimi arttırmaktır.
- FOB görüntüsü ile sanal navigasyonlu bronkoskobik görüntü real-time olarak senkronize olabilmektedir.

Sanal Navigasyonlu Bronkoskopi

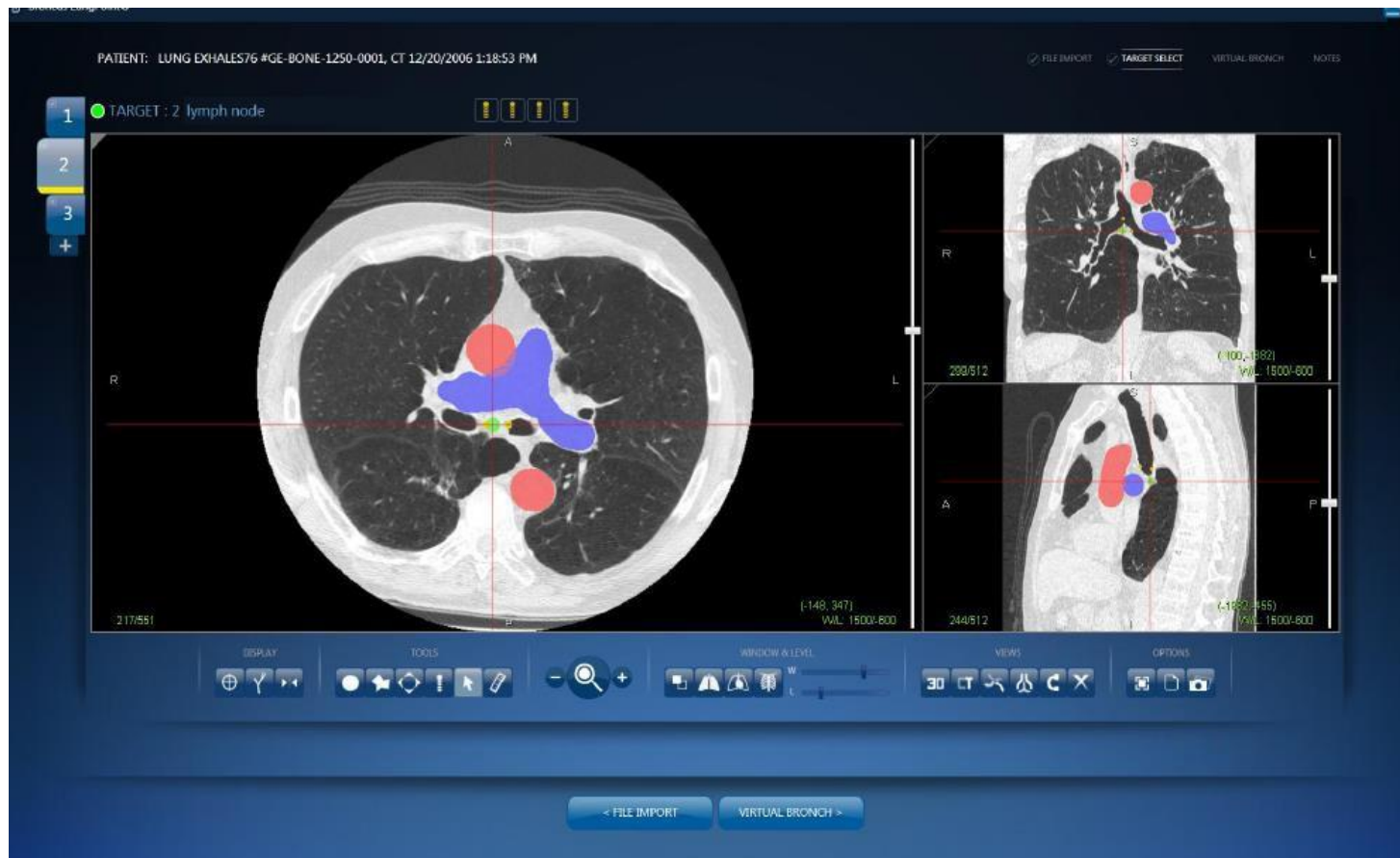
Planlama

Sistem, bir CD'den yazılıma aktarılan yüksek çözünürlükte BT taramaları gerektirmektedir. Tarama dilimlerinin kalınlığı 1.25 mm'dir. Yazılım, çapı 3 mm ya da daha fazla olan hava yollarını segmentlere ayırarak ve aort ile pulmoner arteri belirleyerek BT çalışmasını otomatik olarak analiz eder.



LungPoint VBN sistem

Hedef belirleme



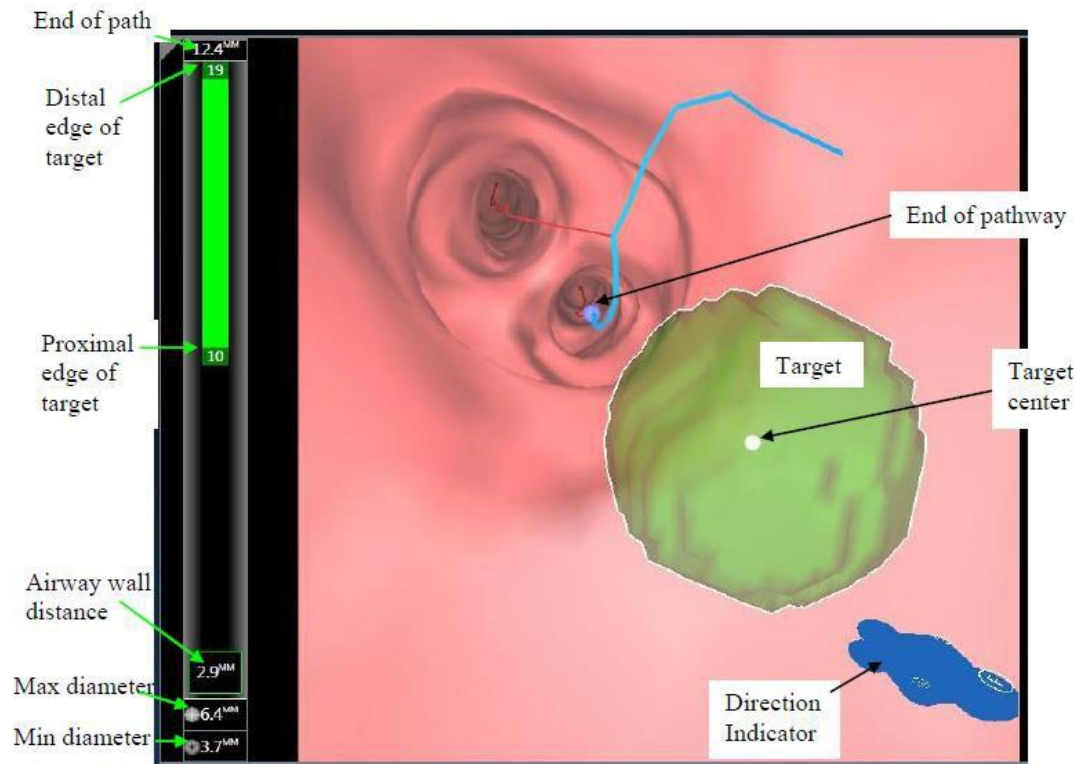
LungPoint VBN sistem

Sanal navigasyonlu bronkoskopi

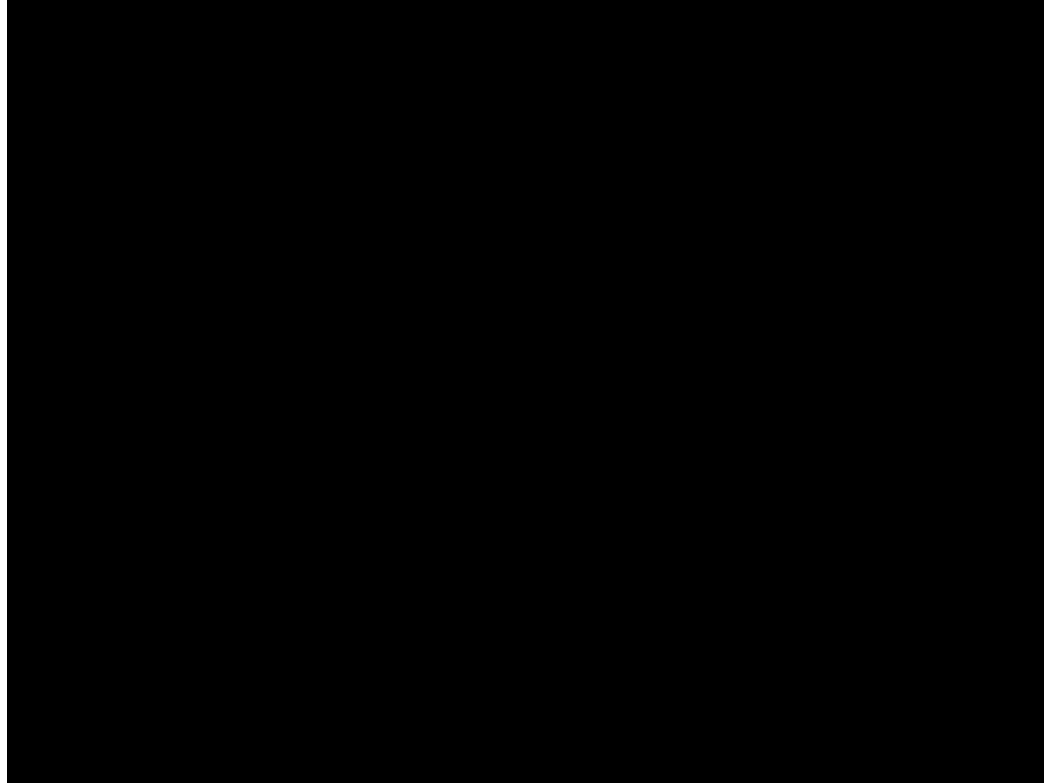


LungPoint VBN sistem

Sanal navigasyonlu bronkoskopi

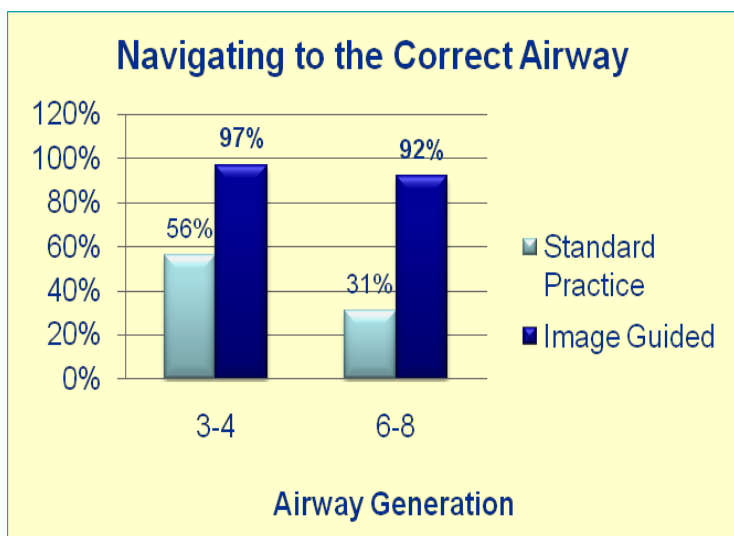


LungPoint VBN sistem
Sanal navigasyonlu bronkoskobi

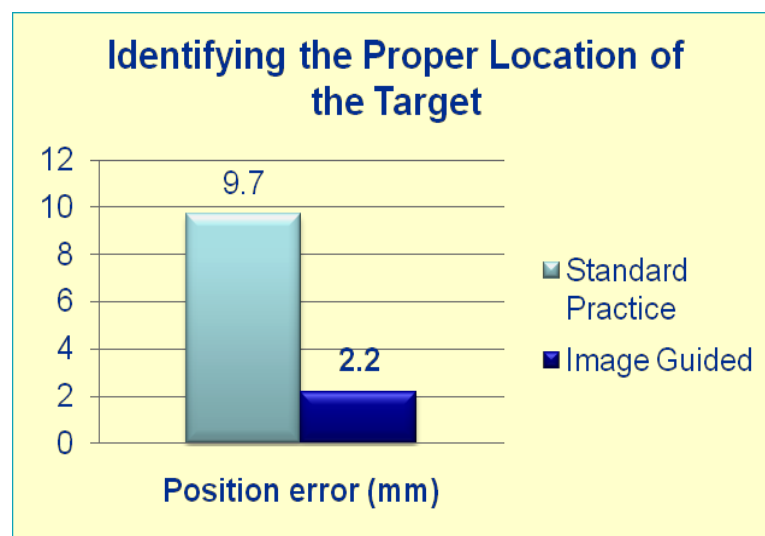


LungPoint VBN sistem

Sanal navigasyonlu bronkoskopi -doğruluk



3-4 bifurcations: Image guided was 41% more accurate
6-8 bifurcations: Image guided was 61% more accurate

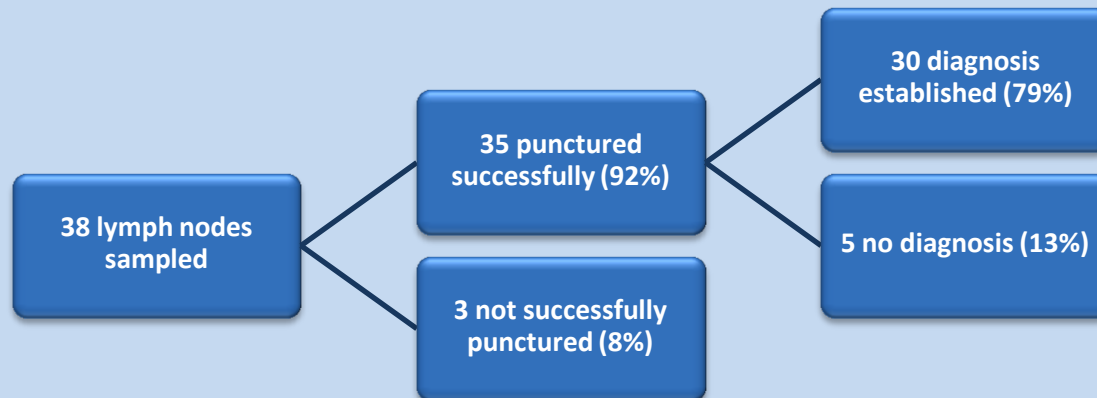


Standard practice: 9.7mm away from target
Image guided: 2.2mm away from target (4x better)

Merritt et al. Image-Guided Bronchoscopy for Peripheral Lung Lesions A Phantom Study. Chest 134(5): 1017-1026, 2008.

Sanal navigasyonlu bronkoskopi –Lenf bezi örnekleme

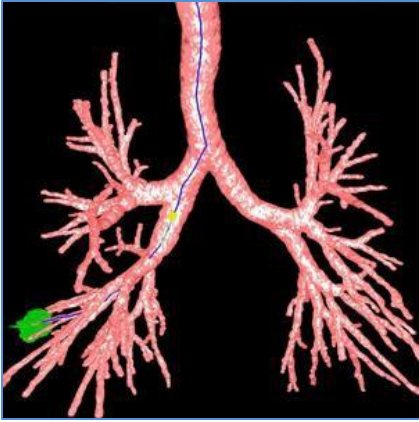
Computer Assisted navigation for transbronchial needle aspiration with the LungPoint® System – a feasibility trial.



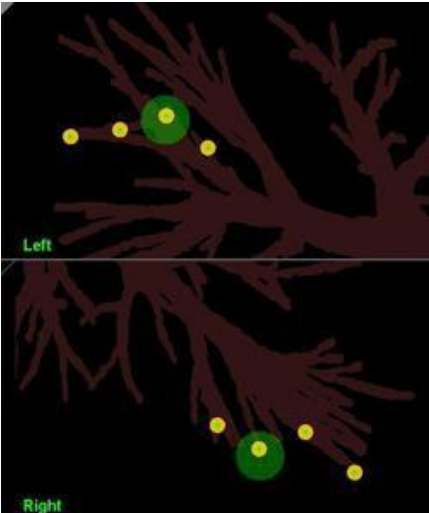
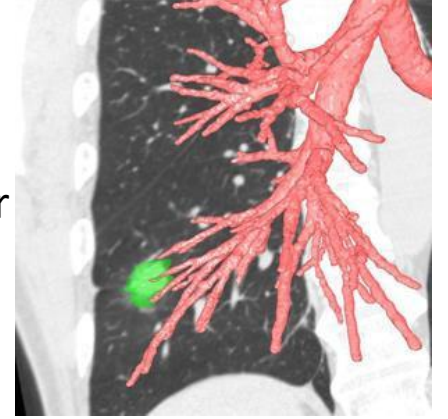
Herth FJF, Gompelmann D.
ATS 2010 IC, Session A44, poster presentation G54.

Herth FJF, Gompelmann D. ATS 2010 IC, Session A44, poster presentation

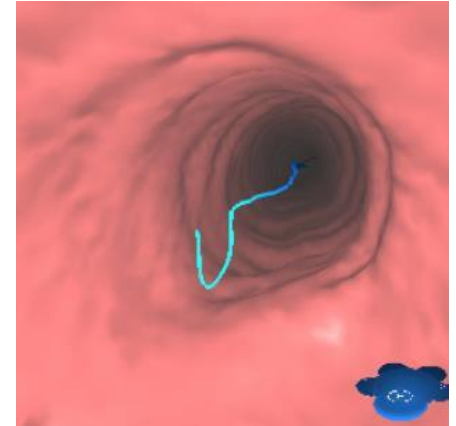
Sanal navigasyonlu bronkoskopi – Fiducial marker , dye marker



3 Boyutlu görüntüler ile lezyon –
anatomik ilişkiler net olarak izlenebilir

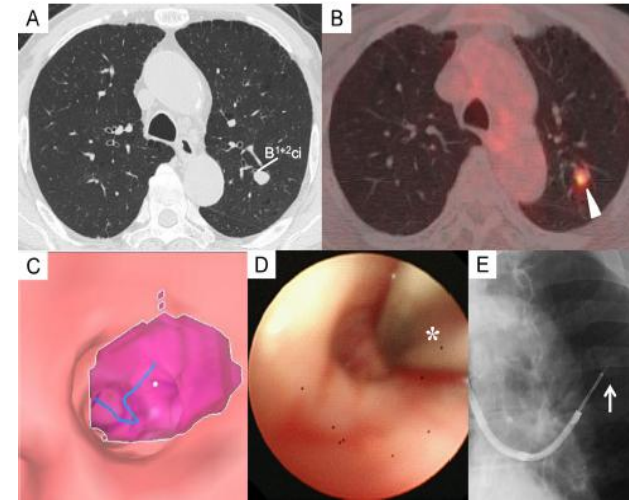
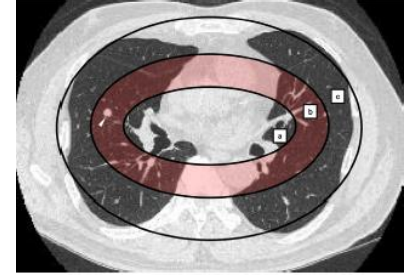


Sanal bronkoskopik görüntüler ,
fiducial marker noktaları
izlenebilir



Sanal bronkoskopik navigasyon (VBN) + konvansiyonel TBiAB

- Retrospektif analiz.
- Peribronşiyal, orta zonda yer alan lezyonlar
- 201 lezyon < 2 cm , 16 lezyon peribronşiyal ve orta zonda.
- 12 (%80) yeterli materyal alınmış.
- 7/10 (%70) malign tanısı almış.
- Minör kanama dışında komplikasyon yok.



Combination of virtual bronchoscopic navigation with conventional transbronchial needle aspiration in the diagnosis of peribronchial pulmonary lesions located in the middle third of the lungs.

Yasuo, M., et al. Respir Investig. 2016 Sep;54(5):355-63.

Meta-analiz sonuçları 2002-2010

39 çalışma-3004hasta-3052 lezyon

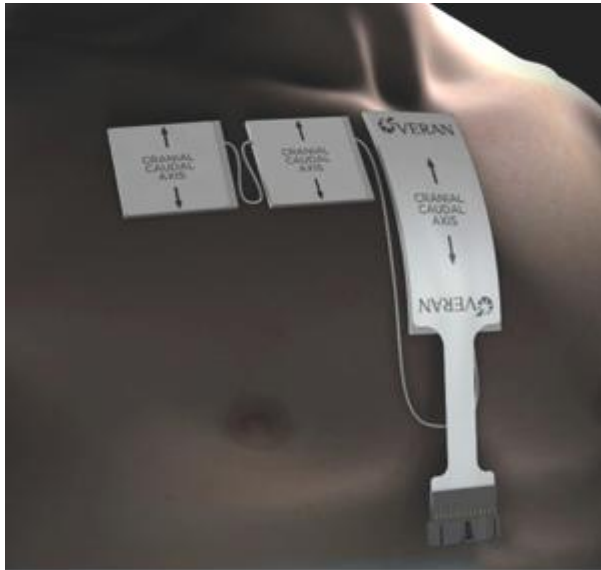
Technology	Studies, No.	Weighted Proportion, %	95% CI	Q Statistic	Q P Value
VB	10	72.0	(65.7-78.4)	21.0	.01
ENB	11	67.0	(62.6-71.4)	13.3	.21
GS	10	73.2	(64.4-81.9)	63.8	<.0001
U	11	70.0	(65.0-75.1)	15.2	.12
R-EBUS	20	71.1	(66.5-75.7)	84.2	<.0001
All	39	70.0	(67.1-72.9)	119.4	<.0001

ENB : electromagnetic navigation bronchoscopy ; GS : guide sheath
R-EBUS : radial endobronchial ultrasound; U : ultrathin bronchoscope;
VB : virtual bronchoscopy navigation

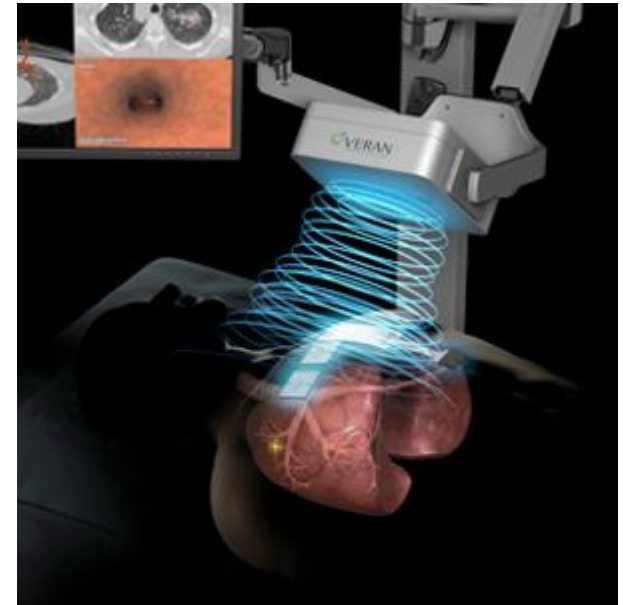
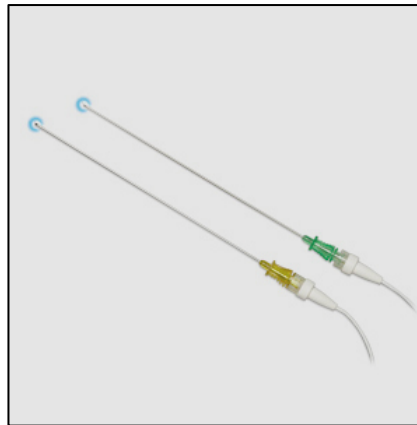
Jessica S . Wang Memoli Meta-analysis of Guided Bronchoscopy for the Evaluation of the Pulmonary Nodule. CHEST 2012; 142(2):385–393

Navigasyonlu TTiAB

Electromagnetic Navigational Transthoracic Needle Aspiration (E-TTNA, Veran Med St.Louis USA)



vPads are stationary reference points used for respiratory gating, patient movement, and proper alignment of the field generator. A CT scan is performed to automatically register the patient's unique anatomy.



The patient is placed on a bed with the vPads plugged into the navigation cart, and the Field Generator is aligned over the vPads, allowing the physician to begin to navigate to the periphery of the lung.

Yarmus LB, et al. 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.

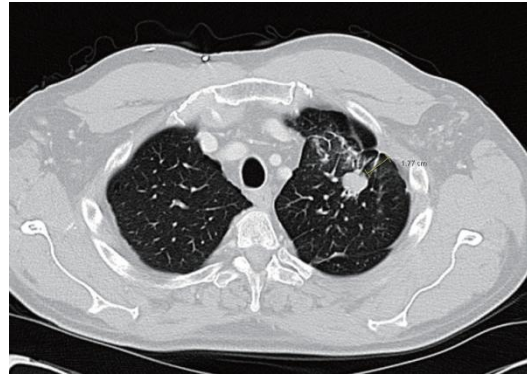
Navigasyonlu TTiAB

Electromagnetic Navigational Transthoracic Needle Aspiration
(E-TTNA, Veran Med St.Louis USA)

24 hasta 1-3 cm nodül olan hastalar. PET (+) mediasten LAP olanlar çalışmaya alınmıyor.

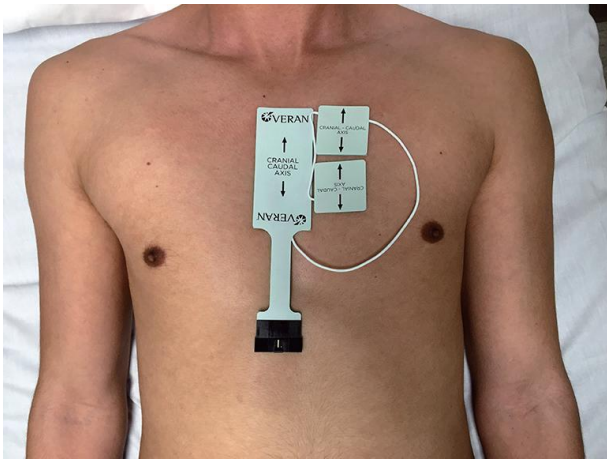
1 günlük bir prosedür planlanıyor .

1. İşlem CP- EBUS (Olympus BF-UC180F)

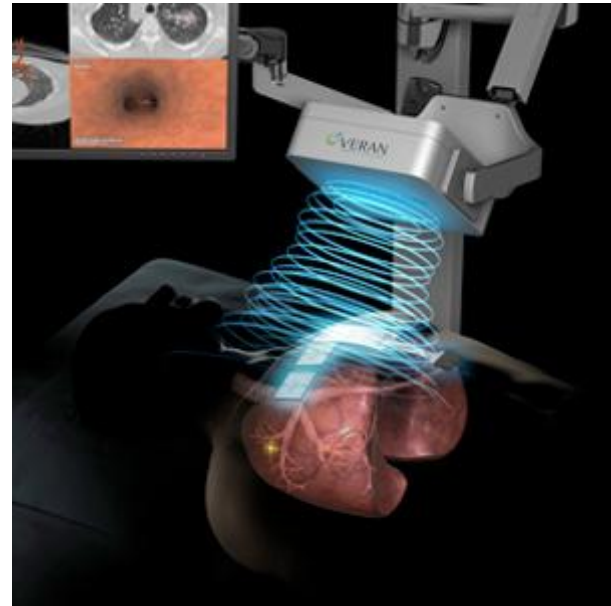


Yarmus LB, et al. Electromagnetic navigation transthoracic needle aspiration for the diagnosis of pulmonary nodules: a safety and feasibility pilot study. J Thorac Dis 2016;8(1):186-194.

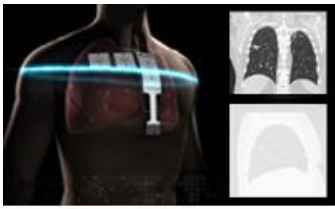
2. İşlem NB (SPiNView® Thoracic Navigation System, Veran Medical)
Thin bronkoskop 4-mm dış çaplı (Olympus BF-MP160F)
Navigasyonlu biyopsi penci için (1.8 mm OD Serrated Cup Always-On
Tip Tracked Forceps, Veran Medical) kullanılıyor



(vPAD2)



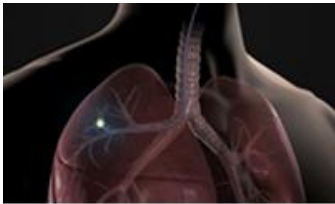
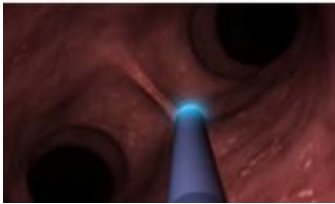
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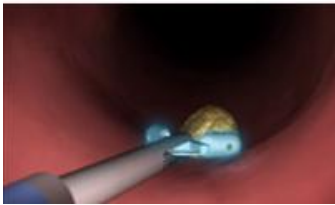
Planlama



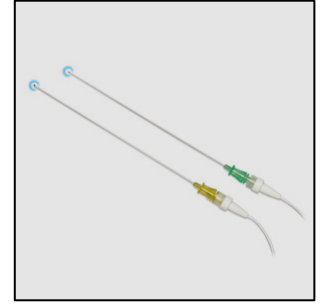
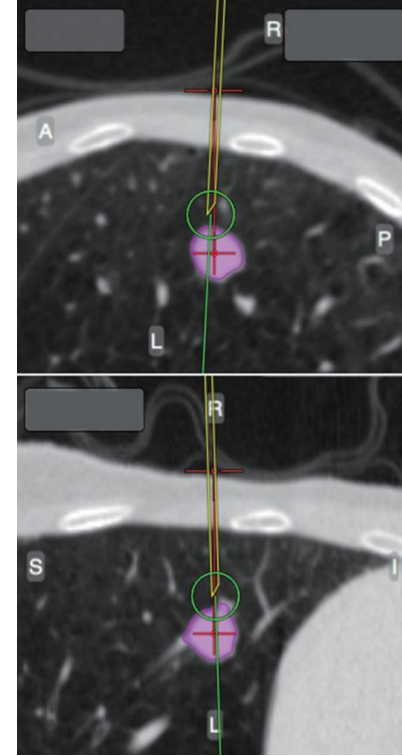
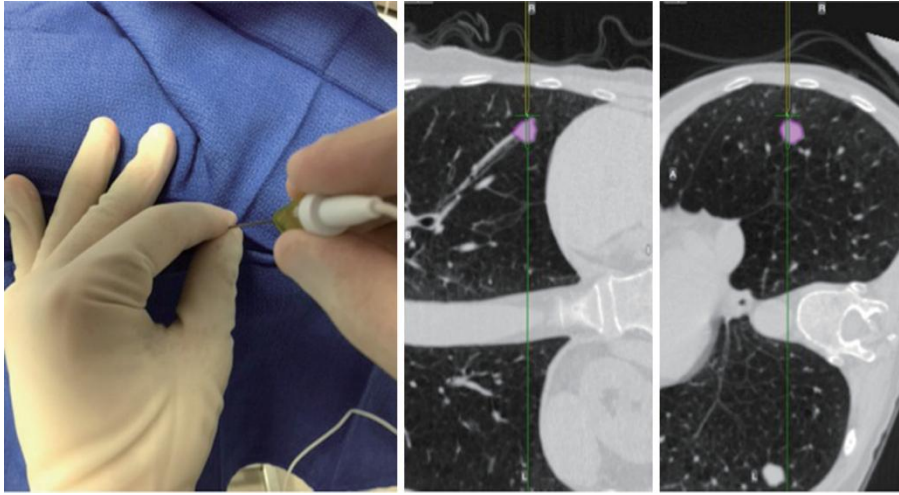
Navigasyon



Biyopsi



3. İşlem E-TTİAB (Veran Medical, SpinPerc) EMN tip iğne (19 gauges × 105 mm) ile navigasyon yapılıyor. 20-gauge coaxial core iğne ile biyopsi yapılıyor.



Yarmus LB, et al. 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.

Sonuçlar

Characteristics	All patients
Patients	24
Age (years) mean [range]	68 [52-85]
Gender [n, %]	
Male	9 [38]
Female	15 [63]
Smoking history	
Pack-years mean [range]	31 [0-210]
COPD [n, %]	
Diagnosis	
Yes	9 [38]
Gold score	
1	5 [56]
2	3 [33]
3	0 [0]
4	1 [11]

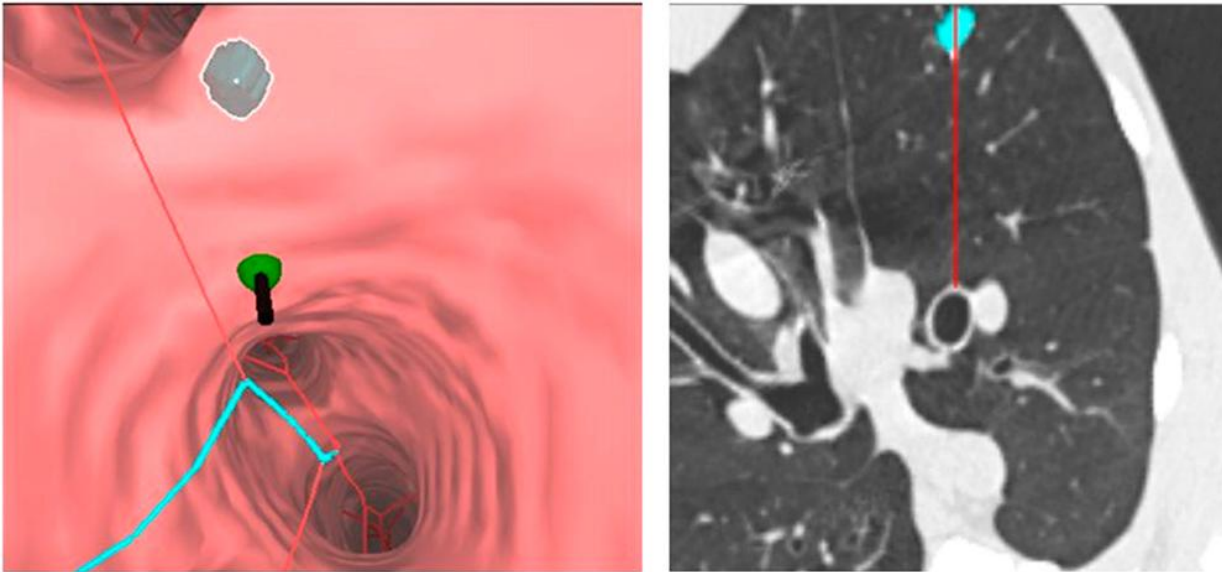
Characteristics	All patients
Size (mm) mean [range]	20.3 [12-29]
Location [n, %]	
Left lower lobe	2 [8]
Left upper lobe	10 [42]
Right lower lobe	1 [4]
Right middle lobe	2 [8]
Right upper lobe	8 [33]
Lingual	1 [4]
Distance from pleura (mm) mean (range)	12.6 (1.6-29.5)
Radiographic characteristics [n, %]	
Ground glass opacity	5 [21]
Solid	19 [79]
Pet positive	21 [88]
Air bronchus present	11 [46]

Diagnosis	All patients
Histopathology [n, %]	
Benign diagnosis	
Infection/inflammation	6 [25]
Granuloma	1 [4]
Fibrosis	3 [13]
Cancer diagnosis	
Adenocarcinoma	7 [29]
Squamous cell	3 [13]
Sarcomatoid carcinoma	1 [4]
Hurthle cell	1 [4]
Carcinoid (typical)	1 [4]
Melanoma	1 [4]

- Toplam işlem süresi 72.5 dk (EBUS 20.5 dk, NB 22.9 dk, E-TTİAB 18.3 dk)
- E-TTİAB: %83
- E-TİİAB + NB : %87
- E-TİİAB + NB + EBUS: %92
- Komplikasyonlar: %21 pnx (n:5), %8 KSAD (n:2)

Yarmus LB, et al. 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.

Archimedes Virtual Bronchoscopy Navigation (VBN) System (Broncus USA) Transparankimal tnel ile nodl biyopsisi



A. Silvestri . Feasibility and Safety of Bronchoscopic Transparenchymal Nodule Access in Canines . CHEST 2014; 145(4):833–838

Archimedes Virtual Bronchoscopy Navigation (VBN) System (Broncus USA)
Transparankimal tnel ile nodl biyopsisi

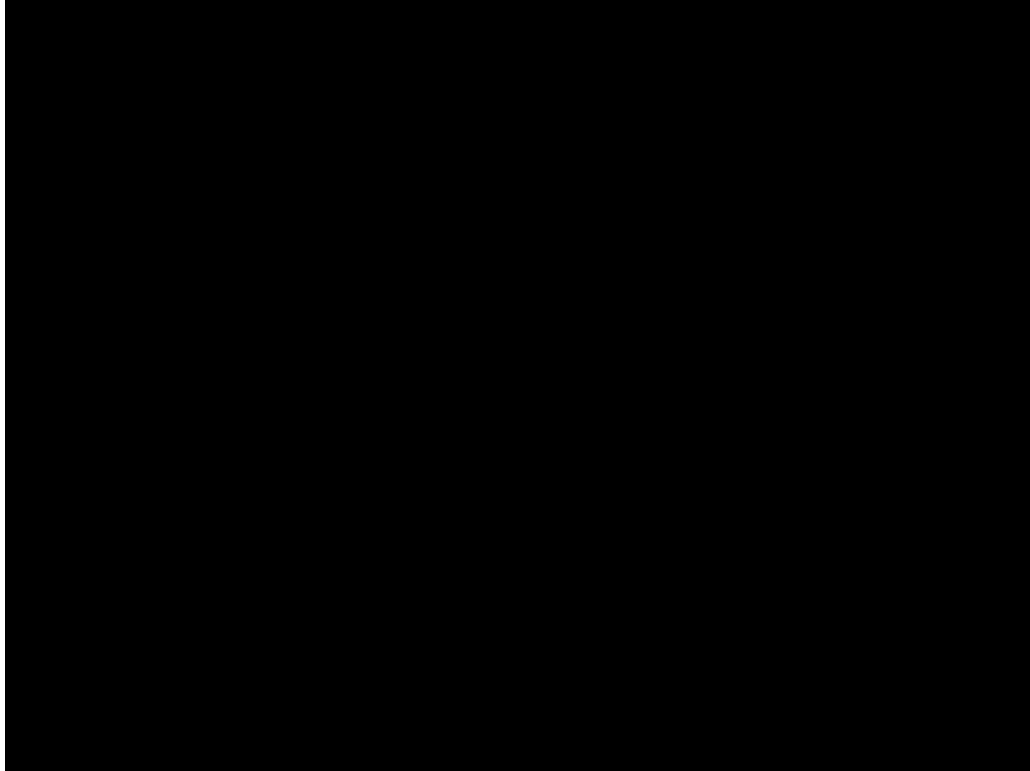


Table 1 Safety and procedural aspects of Bronchoscopic Transparenchymal Nodule Access (BTPNA) procedure

	Site	Size (mm)	Visible at fluoroscopy	Procedure planning time (min)	Nodule access time (min)	Fluoroscopy time (min)	Intra-procedural adverse events	Tunnel length (mm)	Pathology	Inspection of resection specimen	TNM	Correlation with resection specimens	Postprocedure adverse events
1	LUL	40	Yes	10	40	11.6	None	10	Large cell carcinoma	*	T2aN0M0	Yes	Raised troponin level
2	Lingula	20	Yes	15	Data not recorded	7.09	None	50	Small cell cancer	*	T1aN0M0	Yes	None reported
3	LLL	25	No	30	30	5.18	None	60	Large cell carcinoma	*	T1bN0M0		None reported
4	LUL	31	Yes	18	No sample taken	5	Sheath could not be directed along optimal path	-	N/A	*	T2aN0M0		None reported
5	RML	22	No	15	26	6.7	None	50	NSCLC	*	T1bN0M0		None reported
6	LLL	22	No	12	13	3	None	30	NSCLC	*	T1bN0M0		None reported
7	RLL	30	No	25	30	1.8	None	30	NSCLC	*	T2aN0M0		None reported
8	RLL	18	Yes	15	17	3.6	None	60	Adenocarcinoma	*	T1aN0M0		None reported
9	RLL	20	No	30	12	4.2	None	90	NSCLC	*	T1aN0M0		None reported
10	RML	28	Yes	15	13	9.8	None	70	Adenocarcinoma	*	T1bN0M0		None reported
11	LUL	17	No	14	No sample taken	N/A	Sheath could not be directed along optimal path	-	N/A	*	T1a N0M0	N/A	None reported
12	LUL	31	No	10	15	2.1	None	20	NSCLC	*	T2aN0M0	Yes	None reported

Where size is the long axis diameter.

*All areas involved in TPNA resected and no concerns identified.

LLL, left lower lobe; LUL, left upper lobe; NSCLC, non-small cell lung cancer; RLL, right lower lobe; RML, right middle lobe.

10 / 12 (%83) hastada tünel oluşturulabilmiş. Tümü cerrahi ile konfirme edilmiş. Komplikasyon yok.

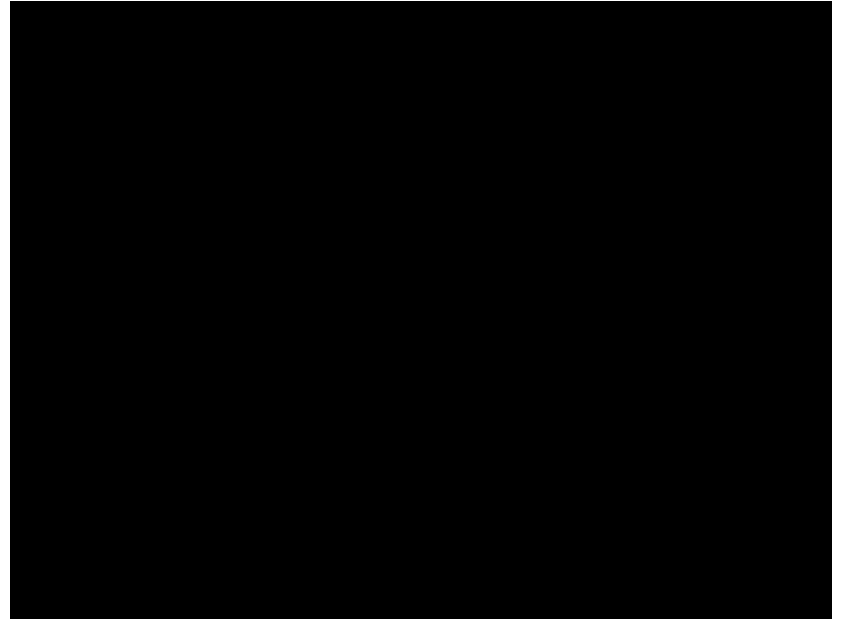
Bronchoscopic transparenchymal nodule access (BTPNA): first in human trial of a novel procedure for sampling solitary pulmonary nodules.

Herth F, Eberhart R, Sterman, Sivestri G et al. Thorax 2015 Apr;70(4):326-32

Transparankimal tünelden tanı koyduktan sonra... Açılan tünelden...

- Radyofrekans ablasyon
- Microwave ablasyon
- Kriyoterapi
- RT

vb... yapılabilir



Özet

PERİFERİK LEZYON

Endoskopik yaklaşım

Transtorasik yaklaşım

Yolu bulmak (Navigasyon)

Floroskopi
ENB
VBN
BTPNB
SPiNView



Ulaşıp örnek almak

FOB
İnce bronkoskop
R-EBUS
Guide sheath
BTPNB
Yönlenebilir biyopsi

Floroskopi
USG-TTiiAB
BT-TTiiAB
SPiNperc

SON SÖZ-1

As Chevalier Jackson said:

In the future, as at present, **the internist** will tap and look and listen on the outside of the chest; **the roentgenologist** will continue to look through the patient; but in continually increasing proportions of cases, the surgeon, the internist and the roentgenologist will ask the **bronchoscopist** to look inside the patient

SON SÖZ-2

NEYE
ihtiyacımız var

NBI

AFP

CP-EBUS

Thin EBUS

VBN

EMN

E-TTİAB

R-EBUS

E-mod

Kriyobiyopsi

OCT

CLE

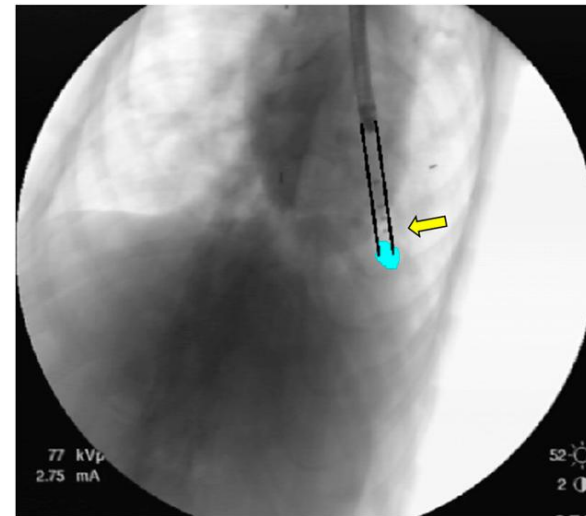
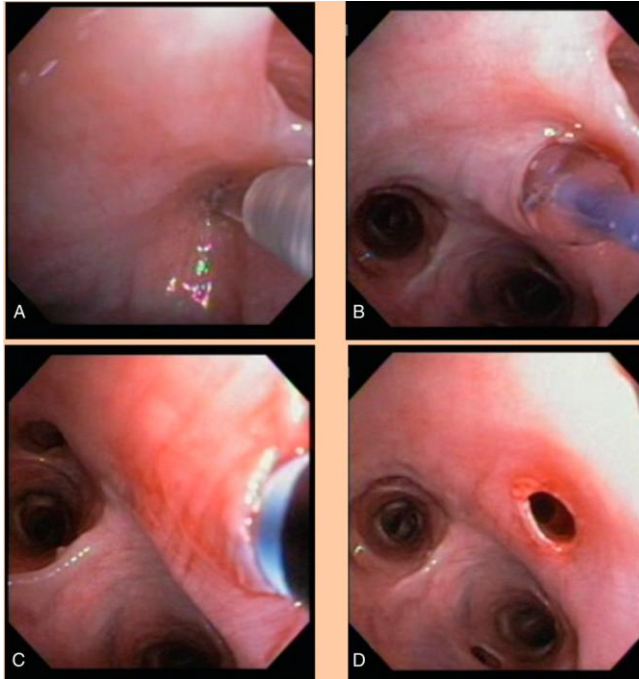
BTNA

NASIL
Organize
olalım ?

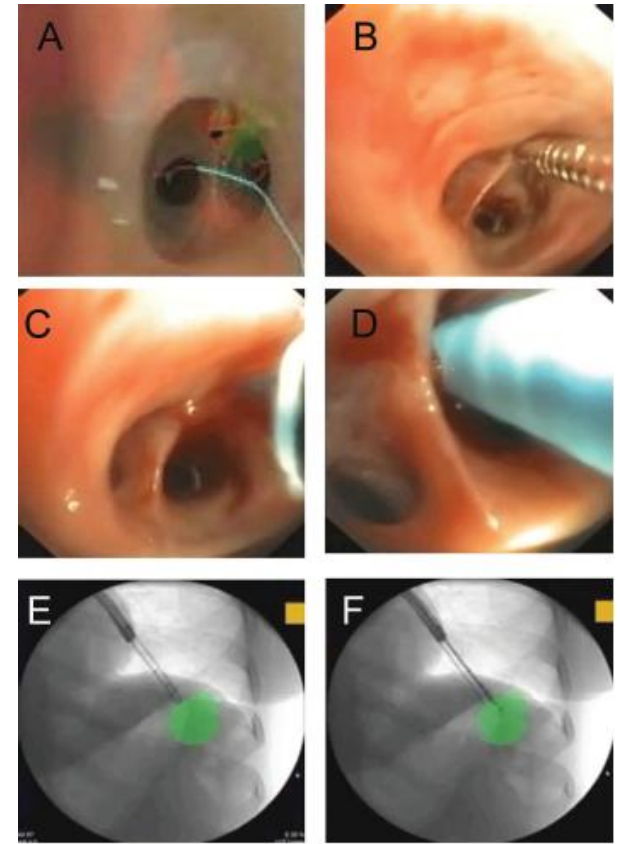
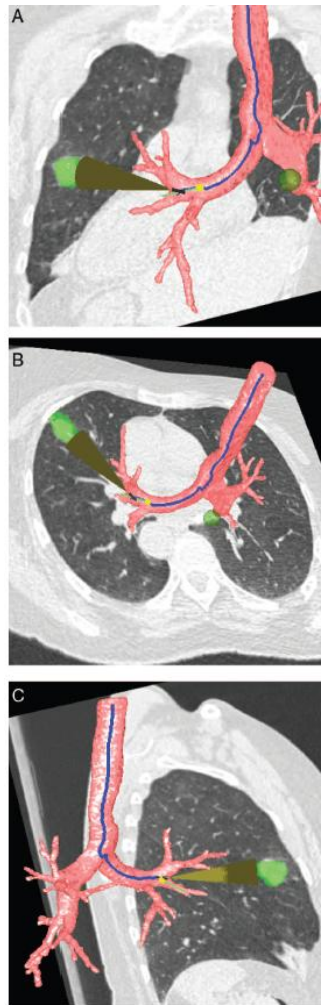
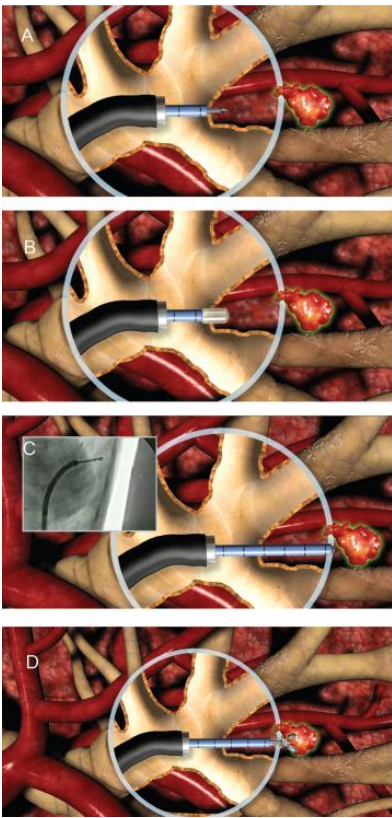
Mutlu
sonlara
bayılıyorum



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