

Uluslararası Katılımlı

AKCİĞER SAĞLIĞI KONGRESİ

Sizin Sesiniz, Sizin Kongreniz...

9-12 Nisan 2025
Sueno Deluxe Hotel,
Belek/Antalya



Sublobar Rezeksiyonlarda ICG ve 3D Modellemenin Önemi

Hasan Batırel

Biruni Üniversitesi Tıp Fakültesi,
İstanbul

Çıkar Çatışması

- Medtronic
- Johnson and Johnson

Sublober Rezeksiyonlar Nasıl Standardize edilebilir – Pratik Nasıl Arttırılır?

- Hangi hasta?
 - Kanıta dayalı karar vermek!
- Ameliyat öncesi inceleme
 - 3D modelleme
- Ameliyat tekniği
 - Indocyanine green (ICG) bunlardan biri
- Ameliyat sonrası takip ve uzun dönem sonuçlar

Neden Sublober rezeksiyon?

- Saji H, et al; West Japan Oncology Group and Japan Clinical Oncology Group. Segmentectomy versus lobectomy in small-sized peripheral non-small-cell lung cancer (JCOG0802/WJOG4607L): a multicentre, open-label, phase 3, randomised, controlled, non-inferiority trial. Lancet. 2022 Apr 23;399(10335):1607-1617.
- Altorki N, et al. Lobar or Sublobar Resection for Peripheral Stage IA Non-Small-Cell Lung Cancer. N Engl J Med. 2023 Feb 9;388(6):489-498.

Genel Sağkalım – Hastalıksız Sağkalım

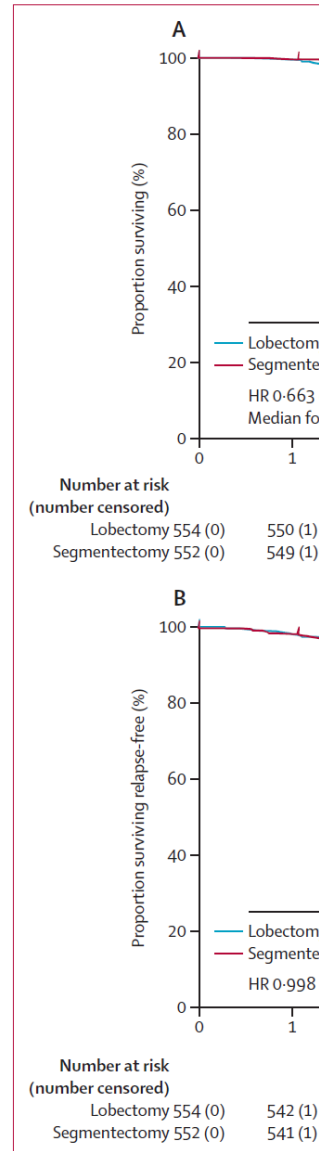
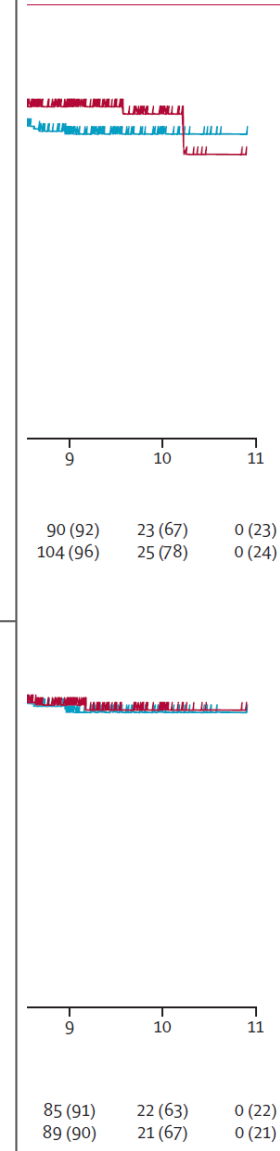
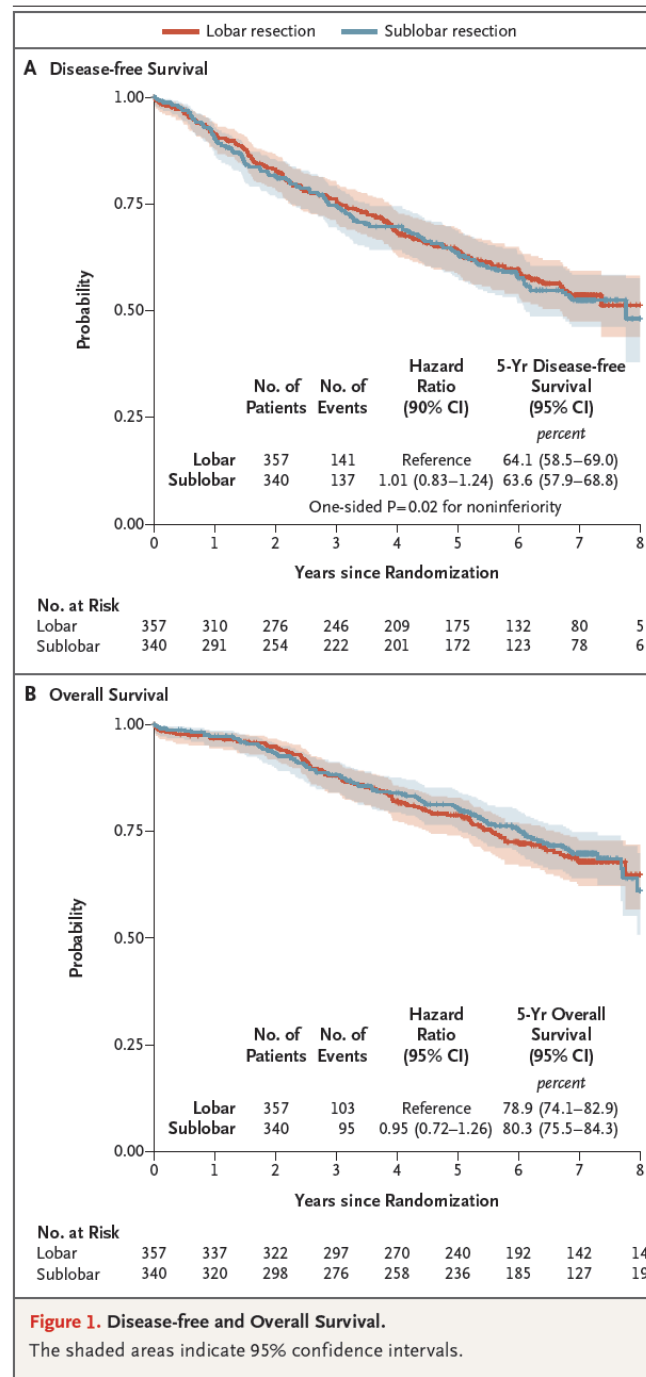
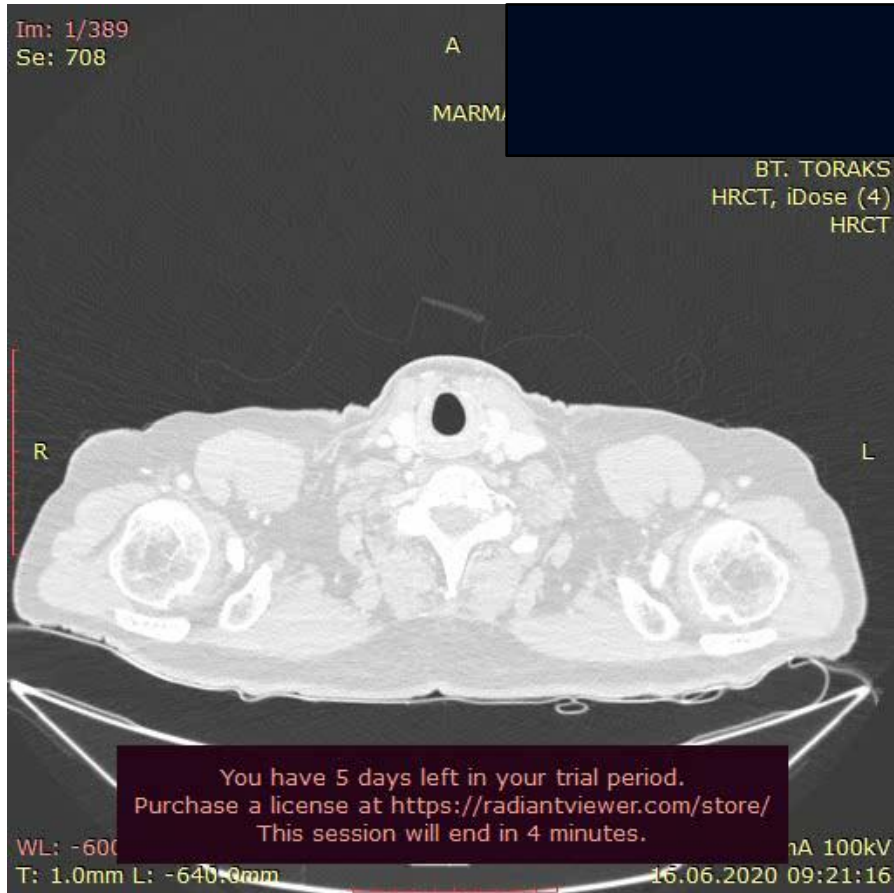


Figure 2: Kaplan-Meier estimates of overall survival (OS) and relapse-free survival (RFS). HR=hazard ratio. OS=overall survival. RFS=relapse-free survival.

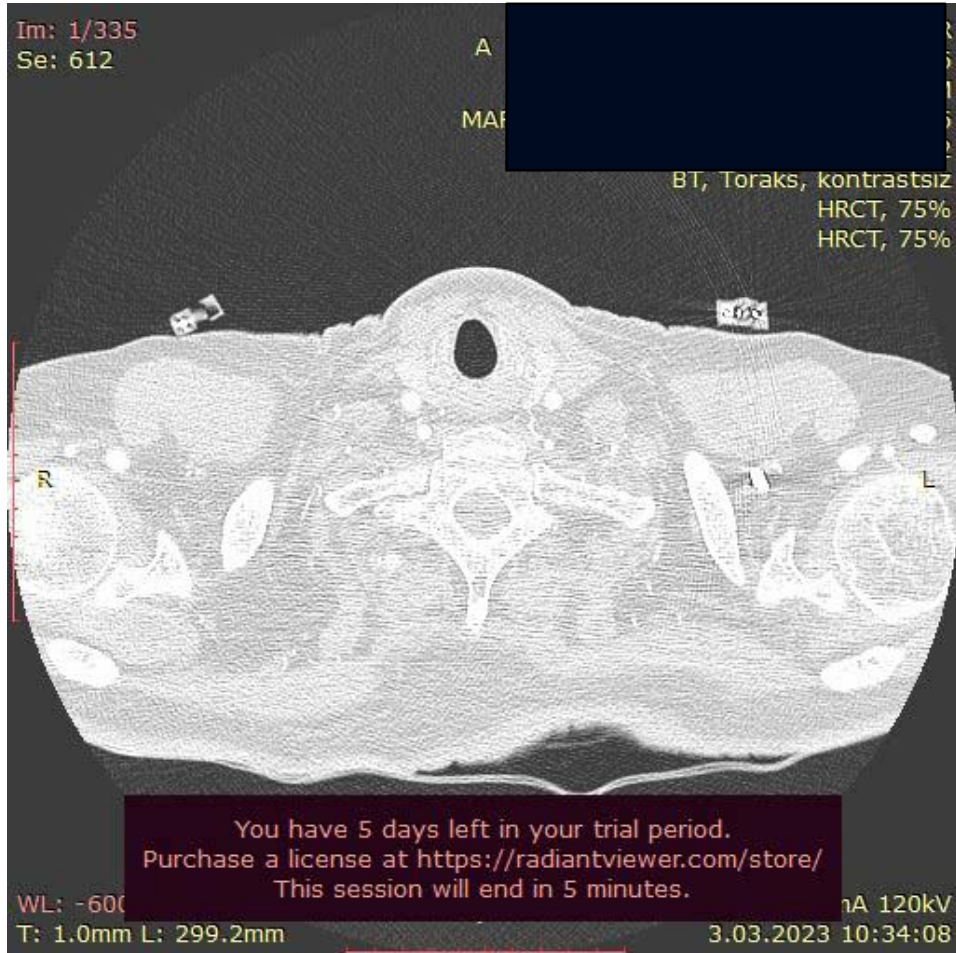


- 70 yaşında erkek.
- İş adamı
- Uniportal VATS sol alt lobektomi – 2018
- pT1bN0M0 Adenocarcinoma.
- İki ay sonra renal hücreli karsinom için parsiyel nefrektomi – Evre 1.

6 ayda bir BT takibi- 2020



BT takibi - 2023

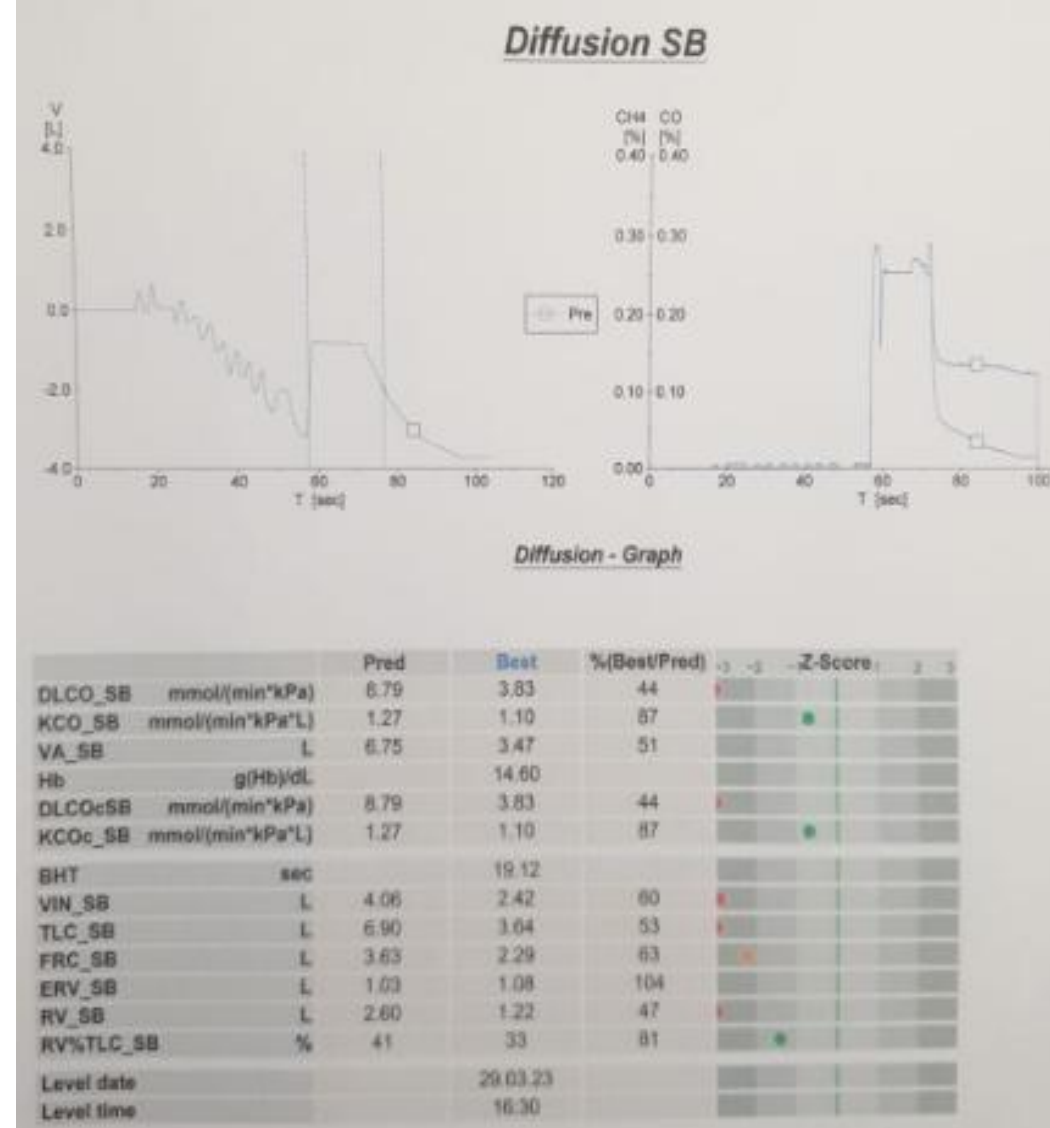


PET BT

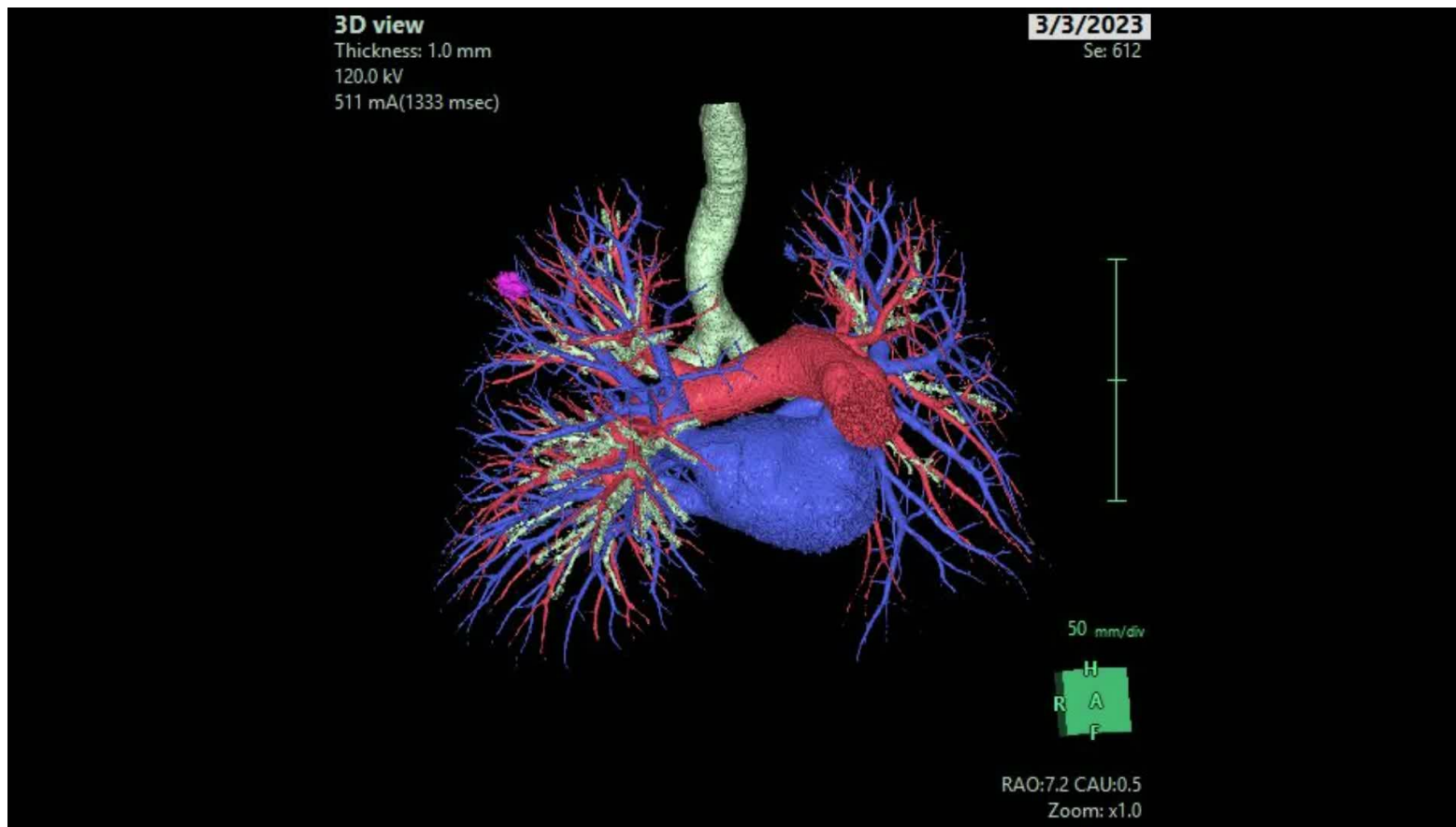
- RUL lezyon – 2020'ye göre boyutta artma – SUV 1.2
- RLL lezyon – boyutta değişim yok – SUV 1.9

Genel Durum

- 30 paket yıl. 15 senedir içmiyor.
- HT, KAH (multivessel stabil- kalsifik damarlar)
- Clopidogrel, Beta bloker, 100 mg Aspirin.



3D Planlama



Ne yaptık? – 24.4.2023

- RUL – Acinar predominant adeno, Grade 2, STAS +, Acinar 50%, Glandular 25%, Lepidic 25%. LVI +, Margin distance 10 mm. Tumor size, 2x1x1,5 cm, invasive 1x0.7cm.
- RLL – Lepidic predominant adeno, Grade 2, STAS +, Lepidic 60%, Acinar 20%, Solid 20%, LVI +, Margin Distance 2 mm. Tumor size, 2,5x1,1x1,8 cm, invasive component 1x0.7 cm.
- 2025 kontrolünde sol akciğerdeki diğer GGO'lar stabil.
- 2025 – mesane yüzeysel primer!

3D Planlama ve ICG neden önemli?

- İntraoperatif komplikasyonlar ve anomaliler
- Tümör lokasyonu – işlem kararı
- Cerrahi sınır – tam rezeksiyon
- Doğru segmental plan

Geleceği Düşünmüyoruz!

- Altorki N. et al. Lobar or Sublobar Resection for Peripheral

Table 2. Patterns of Recurrence.			
Type of Recurrence	Sublobar Resection (N = 336)	Lobar Resection (N = 351)	Difference (95% CI)*
C	in the segmentectomy group). Among second cancers, the incidences of second primary lung cancer were 36 versus 43 and other cancers were 70 versus 69 in the lobectomy group and the segmentectomy group, respectively. The incidences of carcinomas in situ were also similar (appendix pp 9–10).		oints
L			7.9)
R			3.3)
A			1.6)
N			3.9)
			8.6)

* The widths of the confidence intervals have not been adjusted for multiplicity and may not be used in place of hypothesis testing.

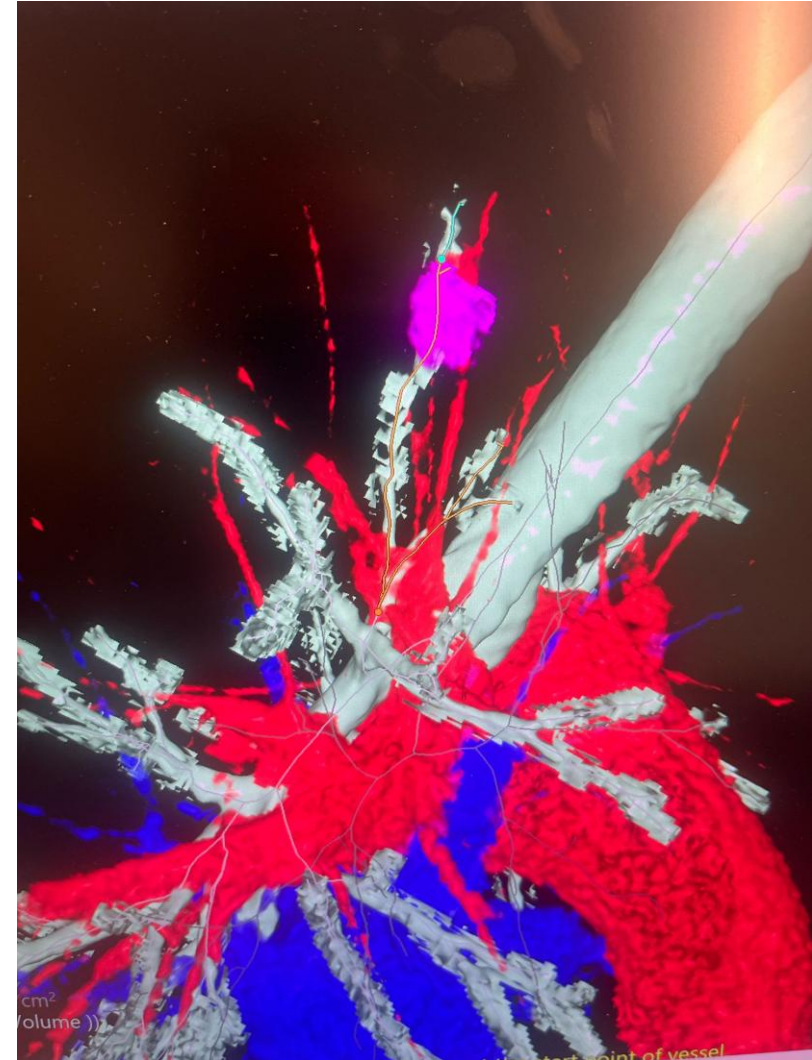
Segment Anatomisindeki Farklılıklar - Martín-Ruiz S, et al. The bronchial segmentation and its anatomical variations. A clinical-anatomic and bronchoscopy study. Ann Anat. 2021 May;235:151677.

- Yüzde kaç olabilir?
- En yüksek varyasyon oranı – sağ üst lob (%25.4). Subsüperior bronş (%19,4).
- En az varyasyon orta lob ve sol alt lob (%11.9).
- Tüm loblarda varyasyon göstermeyen hasta oranı %37.3.
- Murlimanju BV, et al. Anatomical variations of the arrangement of structures at the pulmonary hilum: a cadaveric study. Surg Radiol Anat. 2017 Jan;39(1):51-56.
- Sağ akciğerde %16.1 solda %48.2 varyasyon.

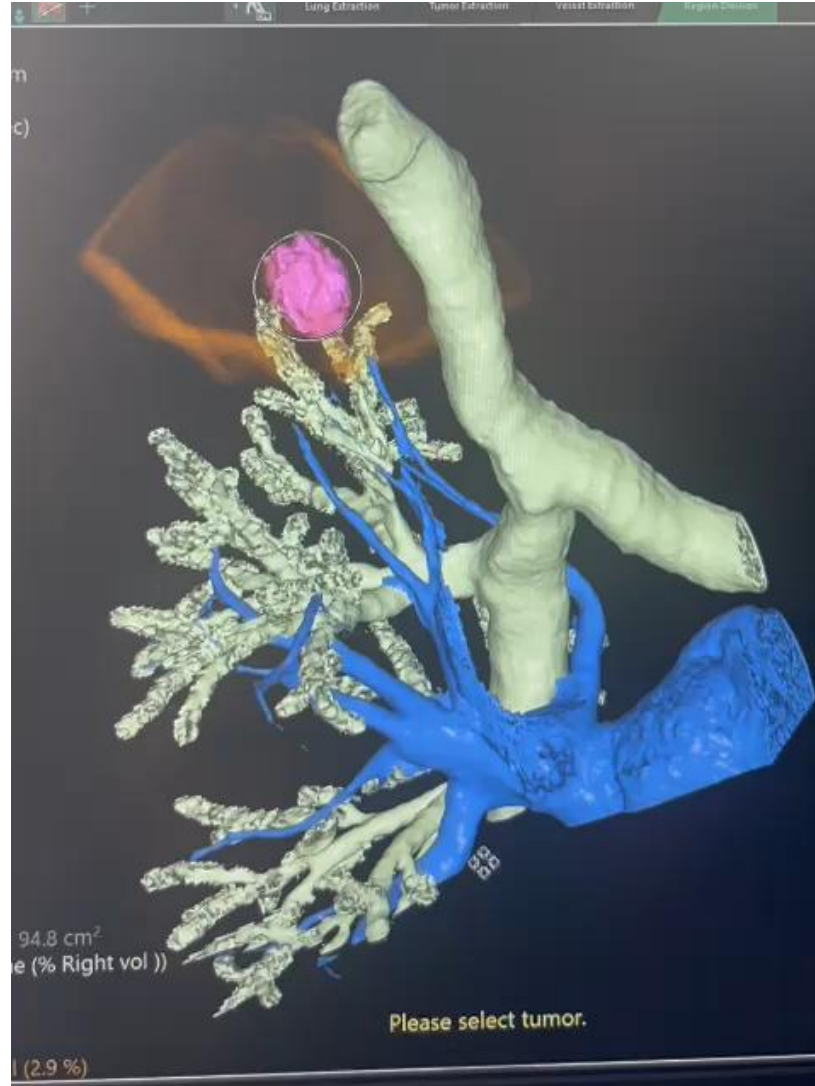
Ameliyat Öncesi İyi Planlama

- En fazla bir ay öncesine ait intravenöz kontrastlı tomografi.
- 3D rekonstrüksiyon ve planlama.
 - Tam tümör lokasyonu
 - Vasküler ve bronşiyal dallanma
 - Anomaliler

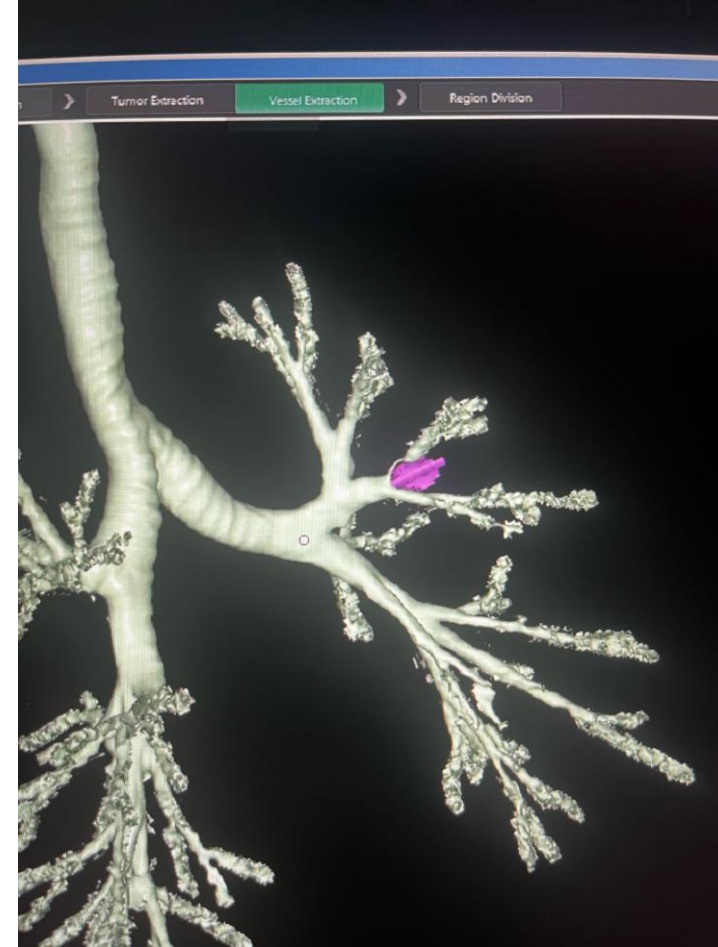
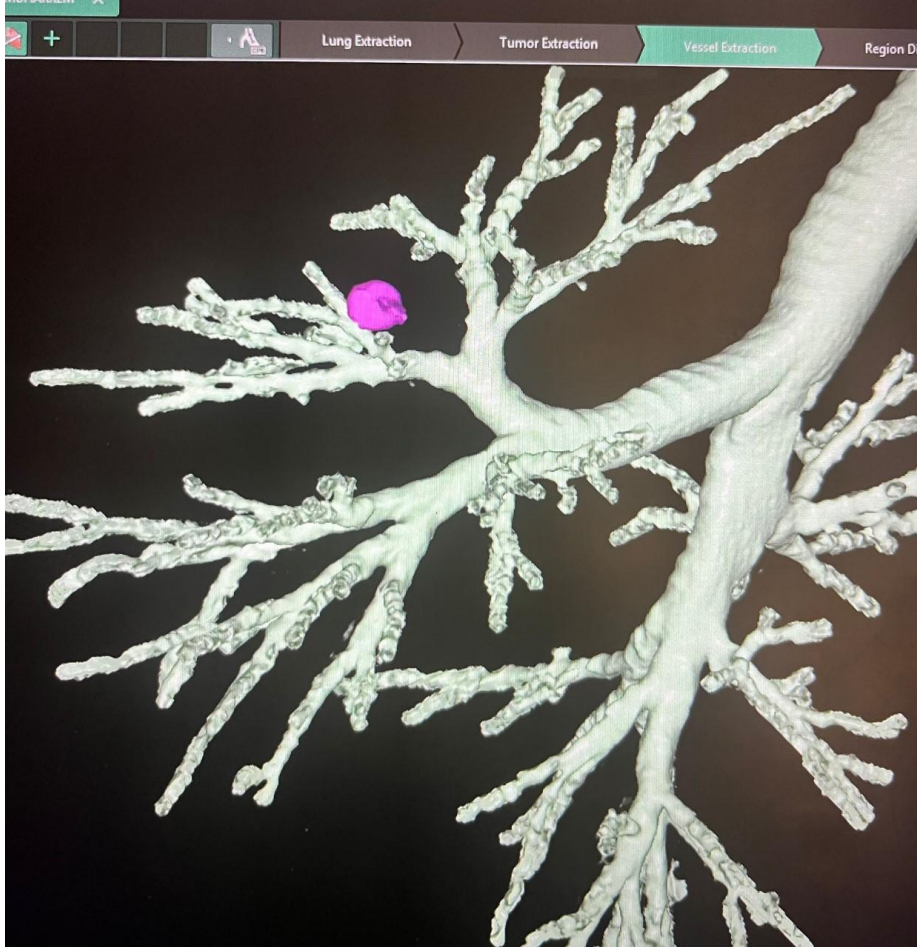
Sağ Üst Apikal Segmentektomi – İki hasta farklı anatomi



Üst lob posterior segment veni
nerede?



Lezyonlar hangi sol üst lob segmentinde?

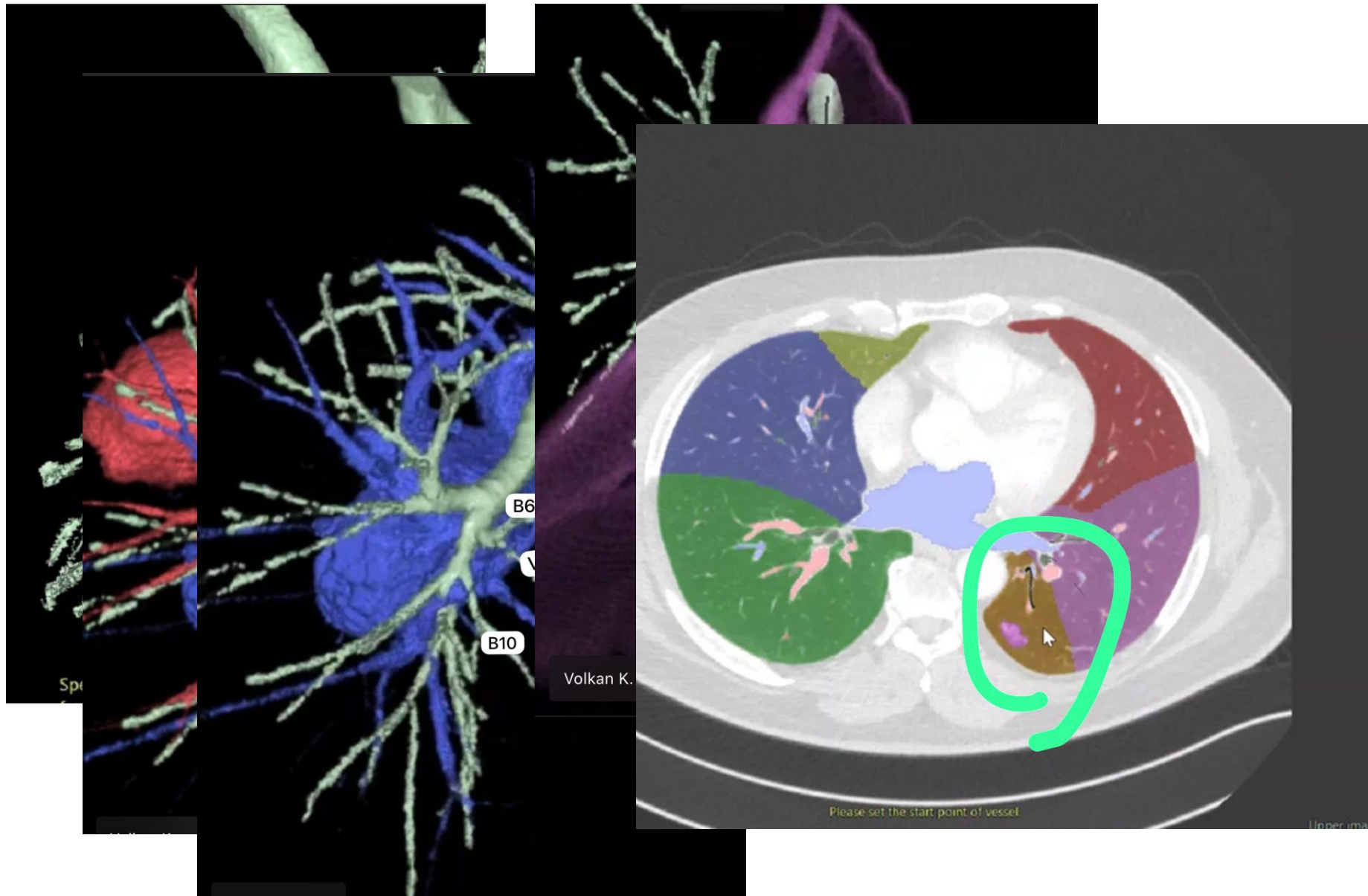


Bu Tümör nerede?

- 2018 BT'de buzlu cam görünümü.
- 09/2023 daha belirgin hale gelmiş (12x10 mm).
- PET BT – FDG tutulumu yok.

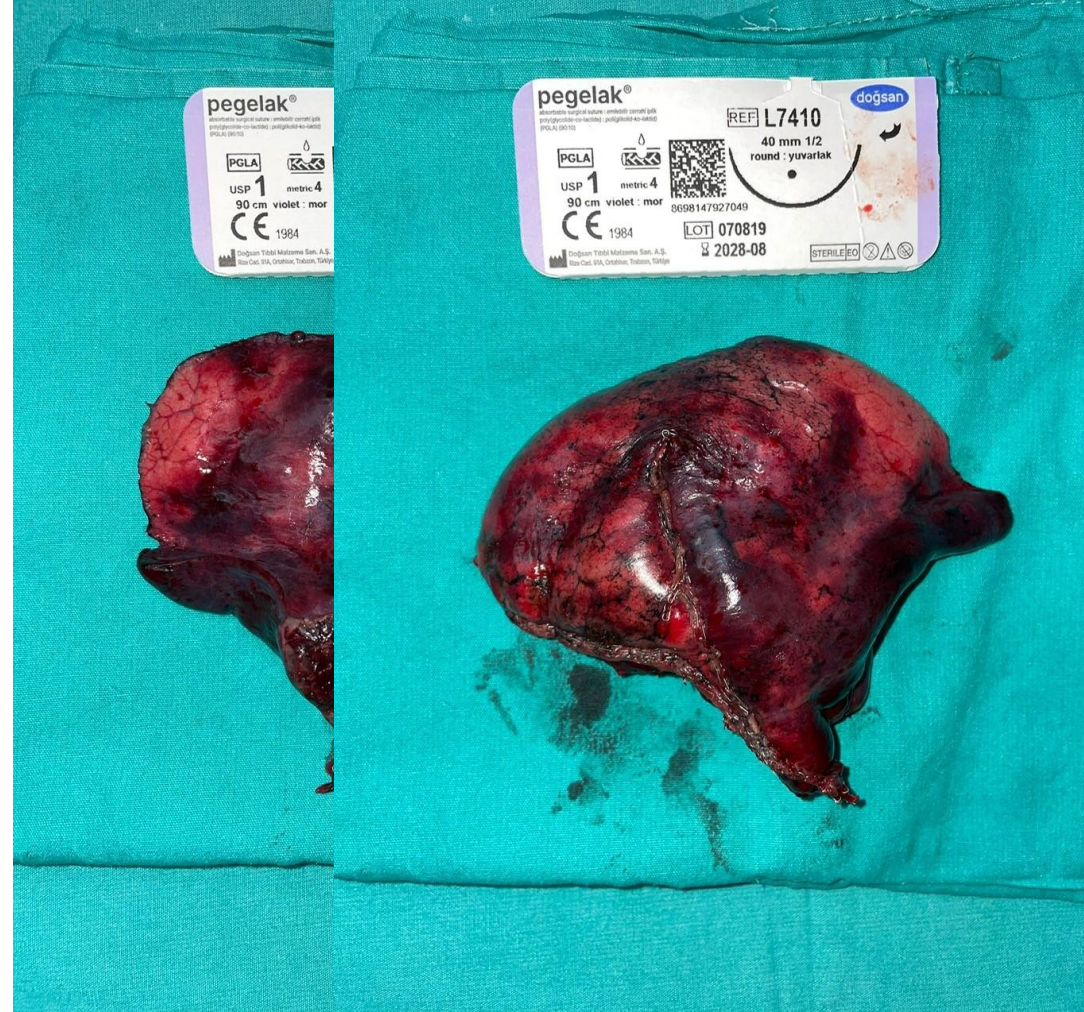


3D Planlama



Ne yaptık?

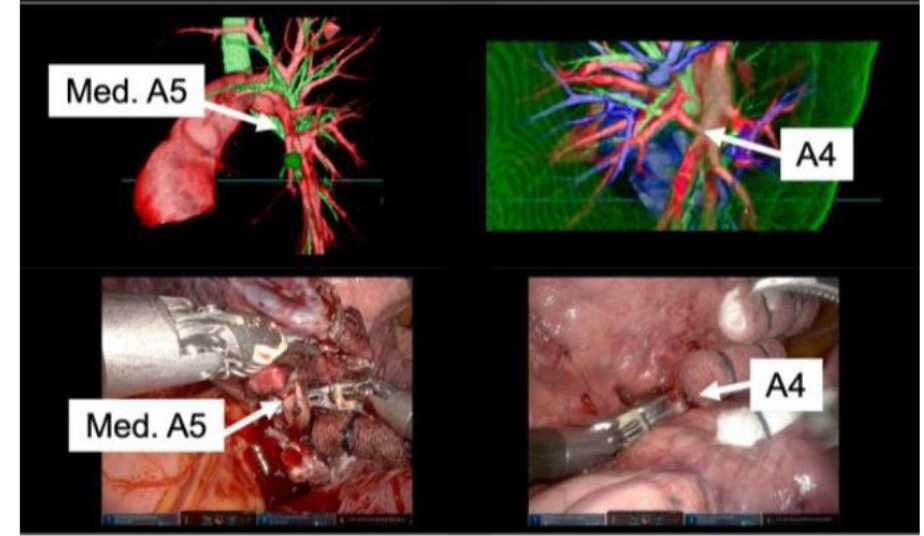
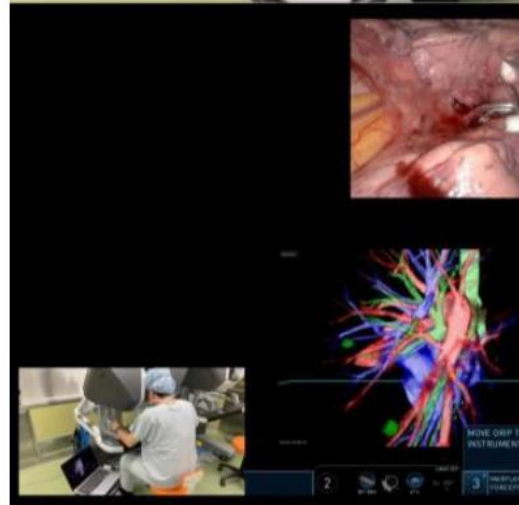
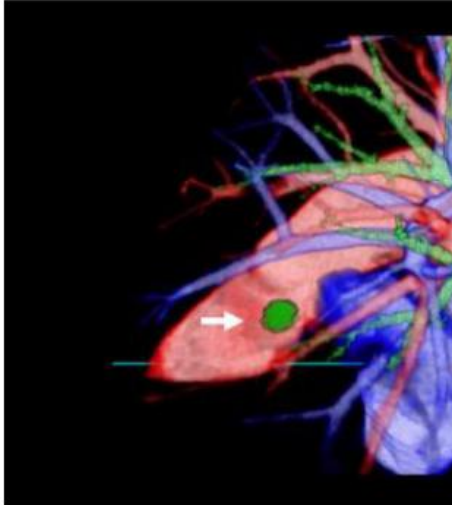
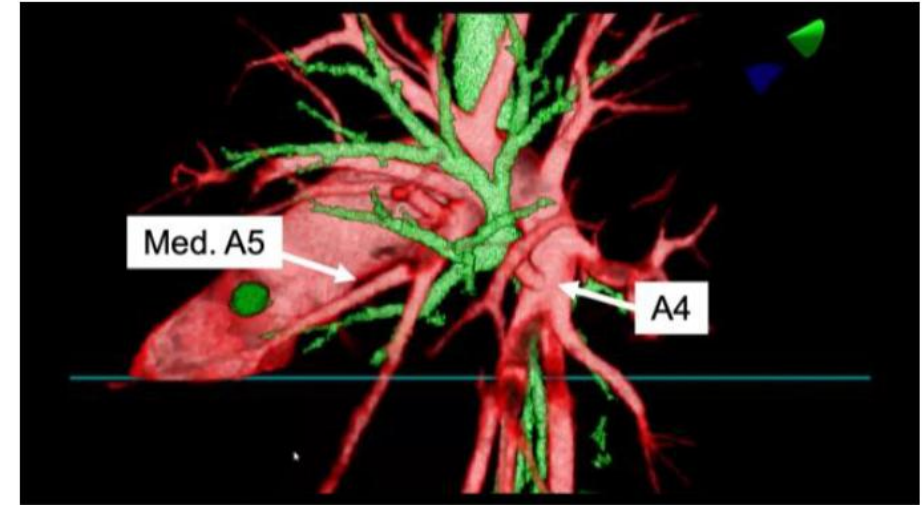
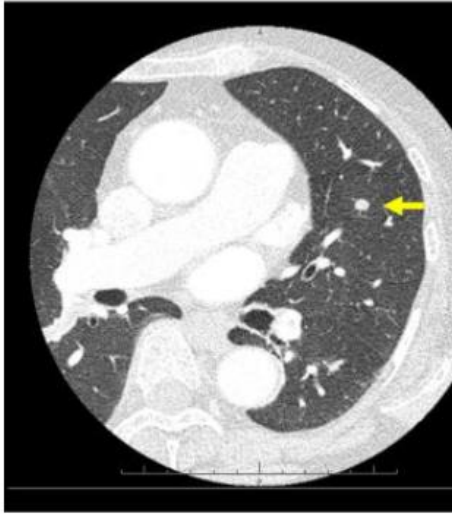
- 13.11.2023
- LLL wedge – frozen – NSCLC
- LLL S6 + S10 segmentektomi – S10 bronşu zor!



3D Modellemenin Sorunları

- Görüntü kalitesi hasta kooperasyonuna ve pixel yoğunluğuna bağlı.
- Çok varyasyon olduğu için 3 boyutlu modelleri BT ile eşleştirmek gerekiyor – AI bile 100 vaka sonra optimize oluyor.
- Segment çizgileri düz değil – resimlerde, intersegmental planlarda karışmalar olabiliyor.
- Akciğer planlama sırasında ventile durumda. Damarların yönlerinde farklılaşmalar oluyor.
- 3D resimlere 2 boyutlu ekranda bakılıyor. 3d planlama – VR?
- 3D planlama programlarının kullanımı hala çok pratik değil ve çoğu ücretli.
 - Wu Z, Huang Z, Qin Y, Jiao W. Progress in three-dimensional computed tomography reconstruction in anatomic pulmonary segmentectomy. Thorac Cancer. 2022 Jul;13(13):1881-1887.

Ujiie H et al. Developing a Virtual Reality Simulation System for Preoperative Planning of Robotic- Assisted Thoracic Surgery. J Clin Med. 2024, 13, 611.



AI bazlı anatomik modelleme - eBioMedicine 2023;87: 104422

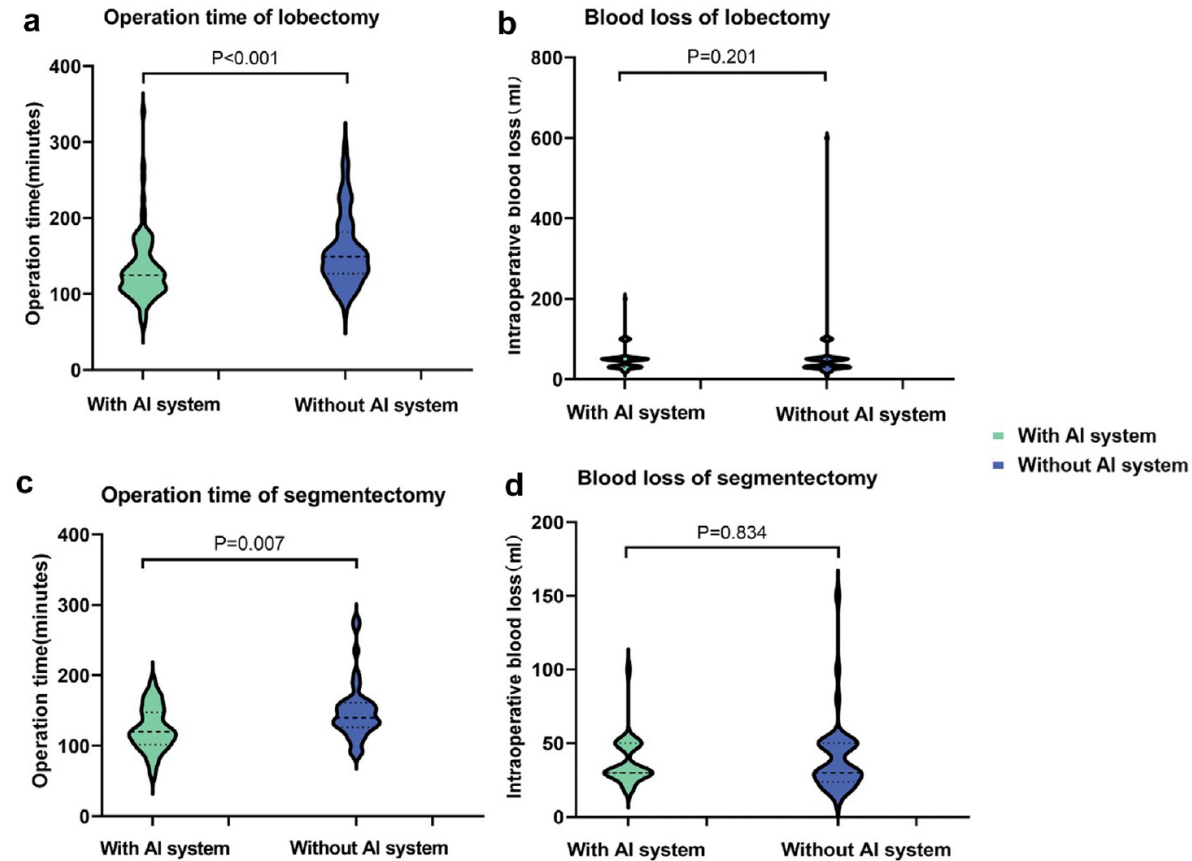


Fig. 7: Efficiency comparison of AI system and Mimics. (a) Accuracy verification of AI system and Mimics by anatomical structures standard. (b) Quality scores of AI-based and mimics-based 3D reconstruction vision demos. (c) One patient received left upper lobectomy. Of which segmental bronchi, segmental arteries, and segmental veins were labelled, the quality scores of AI system and Mimics were 5 and 4, respectively. The Mimics-based reconstruction model lose some small branches of bronchi and vessels. (d) Time consumption of AI system and Mimics.

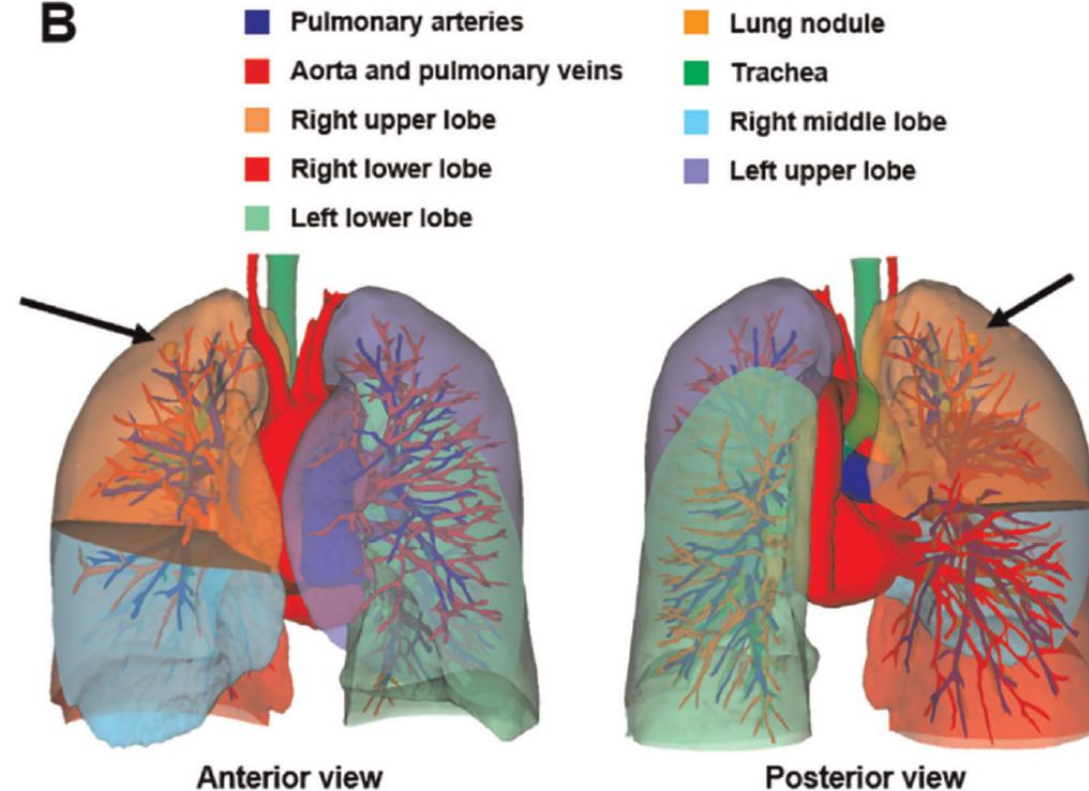
Three-dimension
assisted thoracos
multicenter rand
Jul 1;66(1):e2ae2

- 191 hasta – 95, grubu.
- Ameliyat süresi

A



B

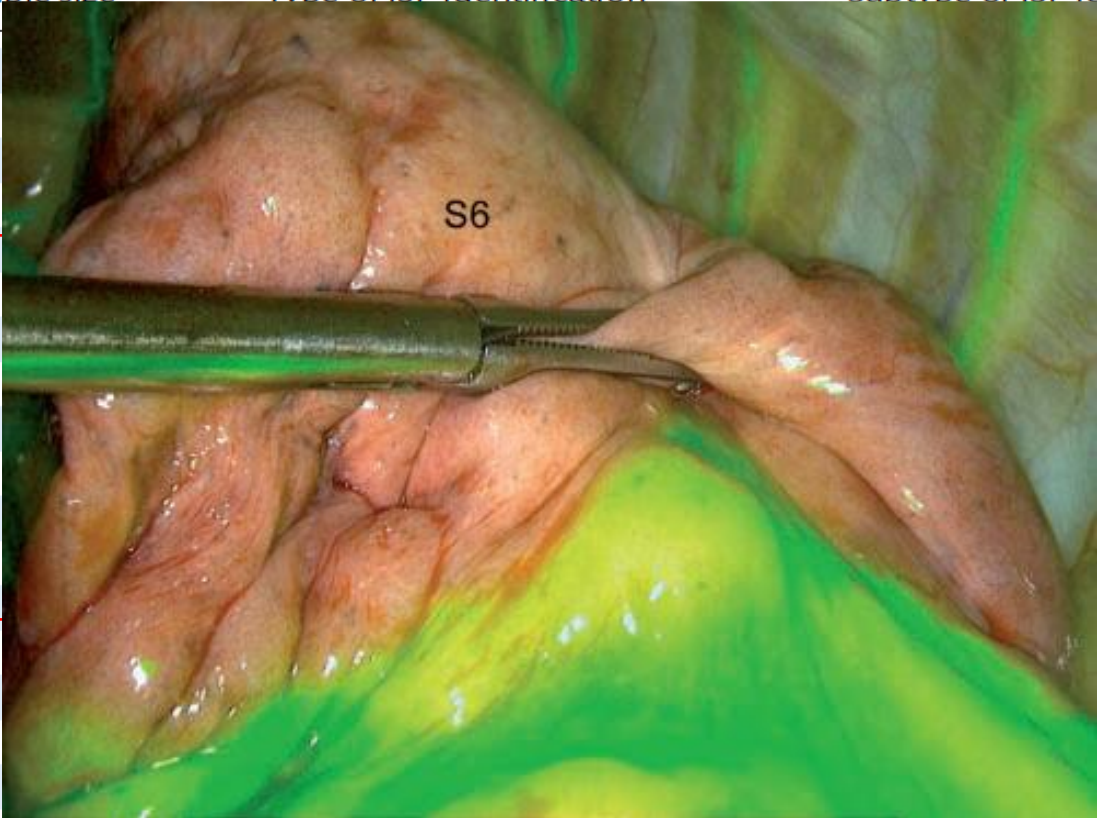


on in video-
erspective,
rac Surg. 2024

art toraks BT

/ok!

Table 1: Studies included in the systematic review

Study	Sample size	Type of ISP identification	Subtype of ISP identification	Success rate (%)
Okada <i>et al.</i> [13]	52			100
Kamiyoshihara <i>et al.</i> [14]	15		method	93.3
Oizumi <i>et al.</i> [15]	51		hial ligation	100
Wang <i>et al.</i> [16]	539		on-deflation method	98.7
Kasai <i>et al.</i> [17]	30			93.3
Iizuka <i>et al.</i> [18]	71			98.6
Kuroda <i>et al.</i> [19]	29			100
Tarumi <i>et al.</i> [20]	13			84.6
Guigard <i>et al.</i> [21]	22			100
Mun <i>et al.</i> [22]	20			95
Bédât <i>et al.</i> [23]	67			88
Pischik and Kovalenko [24]	90			95.6
Sekine <i>et al.</i> [25]	10			100
Zhang <i>et al.</i> [26]	14			100
Oizumi <i>et al.</i> [27]	52			98
Eguchi <i>et al.</i> [28]	14			100
Chang <i>et al.</i> [29]	12			100
Sato <i>et al.</i> [30]	95	VAL-MAP		92.6
Yang <i>et al.</i> [31]	24	VAL-MAP		70.3

3D MDCT: 3-dimensional multidetector computed tomography; IRT-ICG: infrared thoracoscopy-indocyanine green; ISP: intersegmental plane; SRSI: selective resected segmental inflation; VAL-MAP: virtual-assisted lung mapping.

ilk Çalışmalardan
indocyanine green
in minimal
Mav:157(5



FIGURE 2.

A, After lig
of indocyanine green, near-infrared
lung (green). Red arrows demonst

TABLE 2. Feasibility, reproducibility, and effect on oncological margin distance from the tumor to the staple line based on the 7-item rating scale

		Dt-Dp		Notes
n	%	Score*	(cm)†	
1	3.3	5	–	Tumor was not palpable in specimen
7	22.6	6	0	Predicted plane identified by surgeons is no different than real plane identified by indocyanine green injection
4	12.9	7	-1.2 ± 0.7	Predicted plane identified by surgeon was further from the tumor than the true plane identified by indocyanine green mapping
19	61.2	7	2.41 ± 1.6	True plane identified by indocyanine green mapping was further from the tumor than the predicted plane identified by the surgeon

Dt, True intersegmental plane; Dp, predicted intersegmental plane. *Out of possible 7. †Values are presented as mean $\pm$ standard deviation.

ig with
al margin length
.9
2%)
G, In-
intravascular injection
segment (dark) and remaining
pping).

Libor L, et al. (2024) Effect of transbronchial or intravenous administration of indocyanine green on resection margins during near-infrared-guided segmentectomy: a review. Front. Surg. 11:1430100. doi: 10.3389/fsurg.2024.1430100

TABLE 2 Characteristics of ICG administration and postoperative outcomes.

Study	Sekine et al. (18)	Wada et al. (22)	Sekine et al. (20)	Matsuura et al. (19)	Sun et al. (23)	Chang et al. (21)	Guigard et al. (24)	Sun et al. (15)
Year	2019	2020	2021	2022	2022	2023	2017	2019
No. of patients	65	15	28	20	35	34	22	19
ICG administration	Trans-bronchial	Trans-bronchial	Trans-bronchial	I.V.	Peritumoral/ I.V.	I.V.	I.V.	I.V.
ICG dose	2.5 mg/10 ml	1.25 mg/10 ml	2.5 mg/10 ml	0.3 mg/kg	5 mg	0.3 mg/kg	12.5mg	5 mg
ISP delineation (%)	89.2%	87%	100%	92.2%	100%	91.2%	100%	100%
Operation time (min)	212 ± 53.0	193 ± 41	69.9 ± 19.7	129 ± 34	99.43 ± 17.4	193 ± 60.8	137.2 ± 31.4	101 ± 25.8
No. of complex or extended segmentecto-my	38 (58.5%)	6 (40%)	N/A	6 (30%)	10 (28.6%)	N/A	12 (54.5%)	8 (42.1%)
Blood loss (ml)	108.9 ± 86.0	110 ± 101	24.3 ± 43.6	15 ± 21		35 ± 72.3		43.4 ± 37
Chest drainage (days)	N/A	3.1 ± 1.0	N/A	1.1 ± 0.3	3.46 ± 1.15	2.3 ± 1.5	N/A	3.5 ± 2.1
Complications	4 (air leak, pneumonia, atrial fibrillation)	2 (air leak, cerebral infarction)	2 (air leak)	1 (PTX)	1 (air leak)	No	4 (air leak, gastroparesis, ileus)	3 (air leak, pulmonary infection)
Hospital stay (days)	8.4 ± 5.7	N/A	5.3 ± 2.3	2.3 ± 0.4	4.57 ± 1.33	N/A	5.4 ± 4.5	4.79 ± 2.02
Pathological margin (mm)	23.5 ± 8.3	100% complete resection	12.2 ± 4.1	31.0 ± 11.0	20.7 ± 5.9	23.1 ± 8.3	100% complete resection	100% complete resection

N/A, not applicable; I.V, intravenous; ICG, indocyanine green; ISP, intersegmental plane.

Önemli Teknik Tehlike – Cerrahi Sınır

TABLE 3. Margin length and margin-to-tumor ratio for different tumor size categories

Parameter	Tumor size, cm			<i>P</i> value
	<1.0	1.0-1.5	>1.5-2.0	
Wedge resection	N = 19	N = 103	N = 82	
Median clinical tumor size, cm	0.9	1.3	1.8	<.0001*
Surgical margin				.5873*
Missing, n (%)	10 (9)	69 (34)	57 (25)	
Median, cm	1.7	1.5	2	
Margin-to-clinical tumor size				.0081*
Missing, n (%)	10 (9)	69 (34)	57 (25)	
Median, cm	2.3	1.3	1	
Segmentectomy	N = 9	N = 69	N = 53	
Median clinical tumor size, cm	1.2	1.3	1.8	<.0001*
Surgical margin, cm				.8935*
Missing, n (%)	6 (3)	37 (32)	33 (20)	
Median	2.5	2	2	
Margin-to-clinical tumor size				.0340*
Missing, n (%)	6 (3)	36 (33)	33 (20)	
Median	2.5	1.5	1.1	

*Kruskal–Wallis *P* value.

Basit ve Kompleks – Uzman Ellerde?

- Okubo et al.
European Journal
of Cardio-
Thoracic Surgery
61 (2022) 100

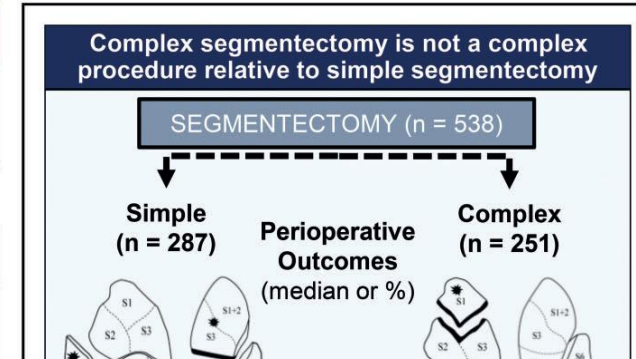
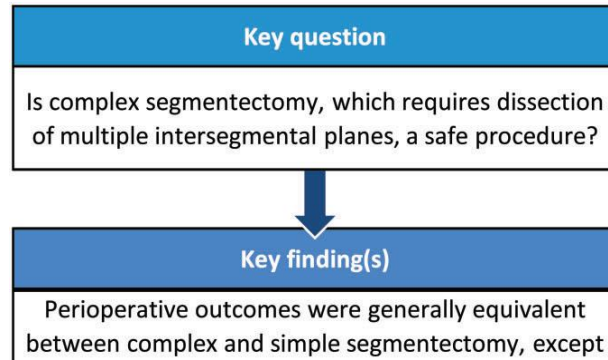


Table 3: Operative characteristics for complex and simple segmentectomy

Variables	Complex segmentectomy (n = 251)	Simple segmentectomy (n = 287)	P-value
Operative time (min)	113 (102–127)	113 (101–125)	0.51
Estimated blood loss (ml)	20 (11–35)	20 (10–34)	0.76
Surgical margin distance (mm) ^a	22 (14–30)	25 (17–35)	0.005
Surgical margin distance <20 mm ^a	93 (38.9)	80 (29.7)	0.029
Surgical margin/tumour size ratio <1 ^a	72 (30.1)	78 (29.2)	0.82
Use of PGA sheets	34 (13.4)	31 (10.8)	0.40
Use of fibrin sealants	19 (7.6)	36 (12.5)	0.058

Values are presented as median (interquartile range) or n (%).

^aSurgical margins were not evaluated for 12 of 251 cases in the complex segmentectomy group and 18 of 287 cases in the simple segmentectomy group. The median (interquartile range) values are reported for the remaining 257 cases.

PGA: polyglycolic acid.

Sonuç

- 3d modelleme – Varyasyon fazlalığı nedeniyle yapılması önerilir!
- ICG – intersegmental planı bulmak için faydalı (tekniklerden biri!)

minimum acceptable extent of nodal dissection

- | | | |
|-----|--|-----|
| 14. | In case any lymph node station is found positive for cancer at frozen section examination, a lobectomy should be performed instead of segmentectomy to reduce the risk of local recurrence | 96 |
| 15. | Intersegmental planes should be identified and defined based on the anatomy of the segment | 100 |
| 16. | The identification of the intersegmental plane can be performed preferably by vascular (i.e. systemic ICG) delineation. If not available bronchial (inflation/deflation technique) may be used | 96 |
| 17. | The division of the intersegmental plane should be performed by using staplers to decrease bleeding and postoperative air leak | 100 |
| 18. | In case of positive margin at intraoperative examination the segmentectomy should be extended to the adjacent segment or the lobe | 100 |