Segmentectomy in the Era of Randomized Trials

Thomas K Waddell, MD, MSc, PhD, FRCSC

Division of thoracic Surgery,
University Health Network/University of Toronto

tom.waddell@uhn.ca

Learning Objectives

- Review evidence supporting segmentectomy
- Compare JCOG0802 and CALGB140503
- Discuss current patient selection
- Review remaining controversies

Why This Matters in 2026

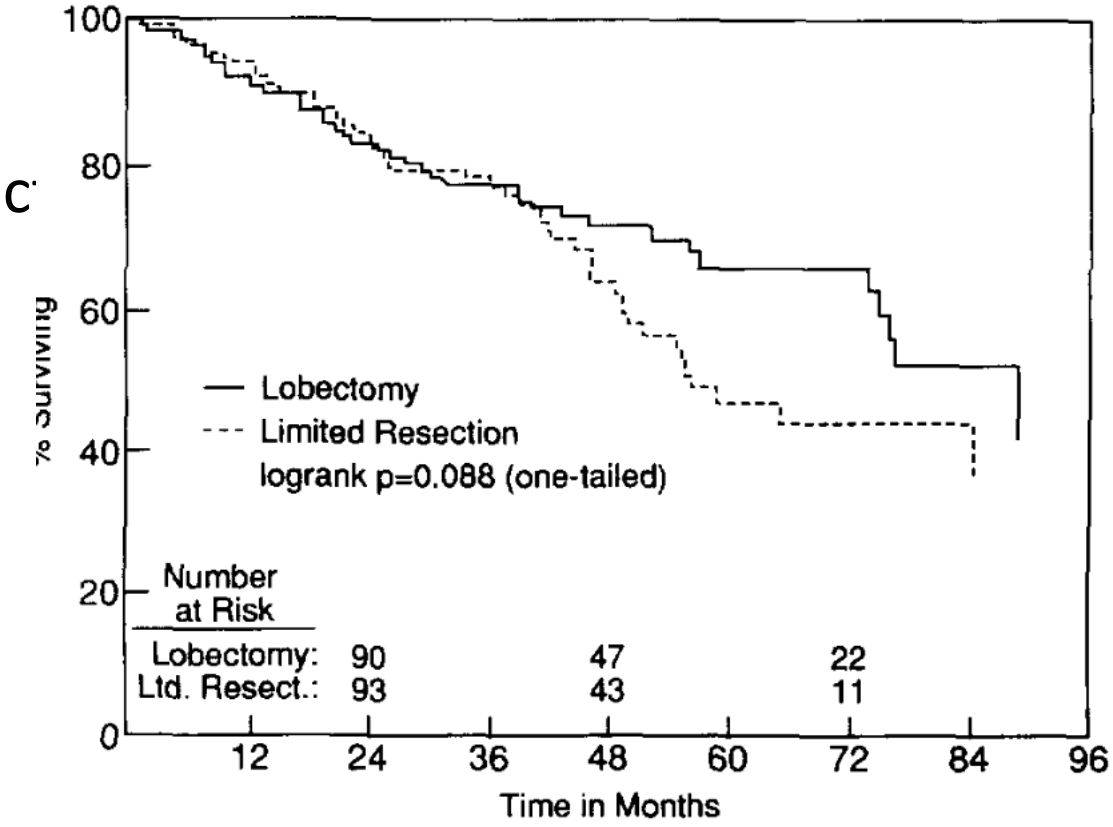
- Lung cancer screening
- More tumors ≤2 cm
- More GGO lesions
- Increased survivorship
- Need for parenchymal preservation

Doctors of Thoracic Surgery

Historical Standard: LCSG 821

Lobectomy became standard after:

- Increased recurrence after limited resec
- Increased cancer mortality
- Increased overall mortality



Ginsberg RJ. Ann Thorac Surg. 1995;60:615-622.

UHN Canada's Hospital

Doctors of Thoracic Surgery

Limitations of LCSG 821

- Included wedge resections
- Limited imaging
- No PET
- No EBUS
- No robotic surgery
- No screening population

Ginsberg RJ. Ann Thorac Surg. 1995;60:615-622.

UHN Canada's Hospital

Evolution of Segmentectomy

Technological advances:

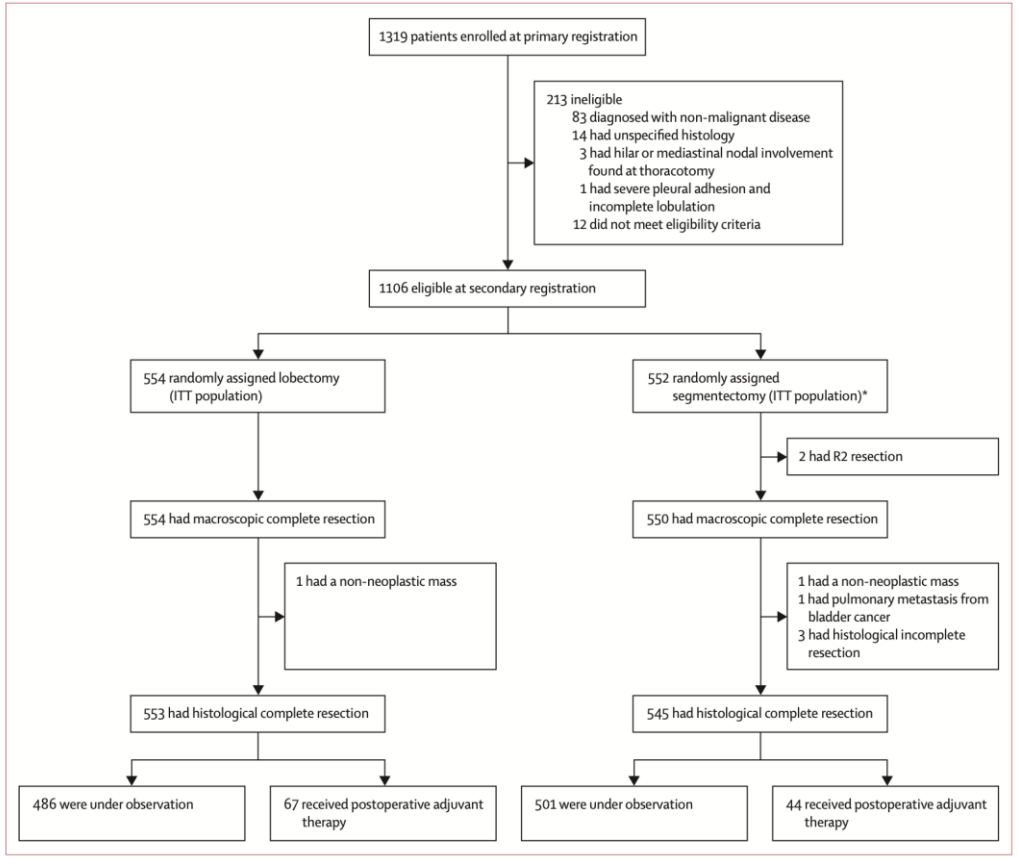
- HRCT
- 3D reconstruction
- ICG fluorescence
- VATS
- Robotic surgery

JCOG0802 Trial Design

Population:

- cIA NSCLC
- ≤2 cm
- CTR >0.5

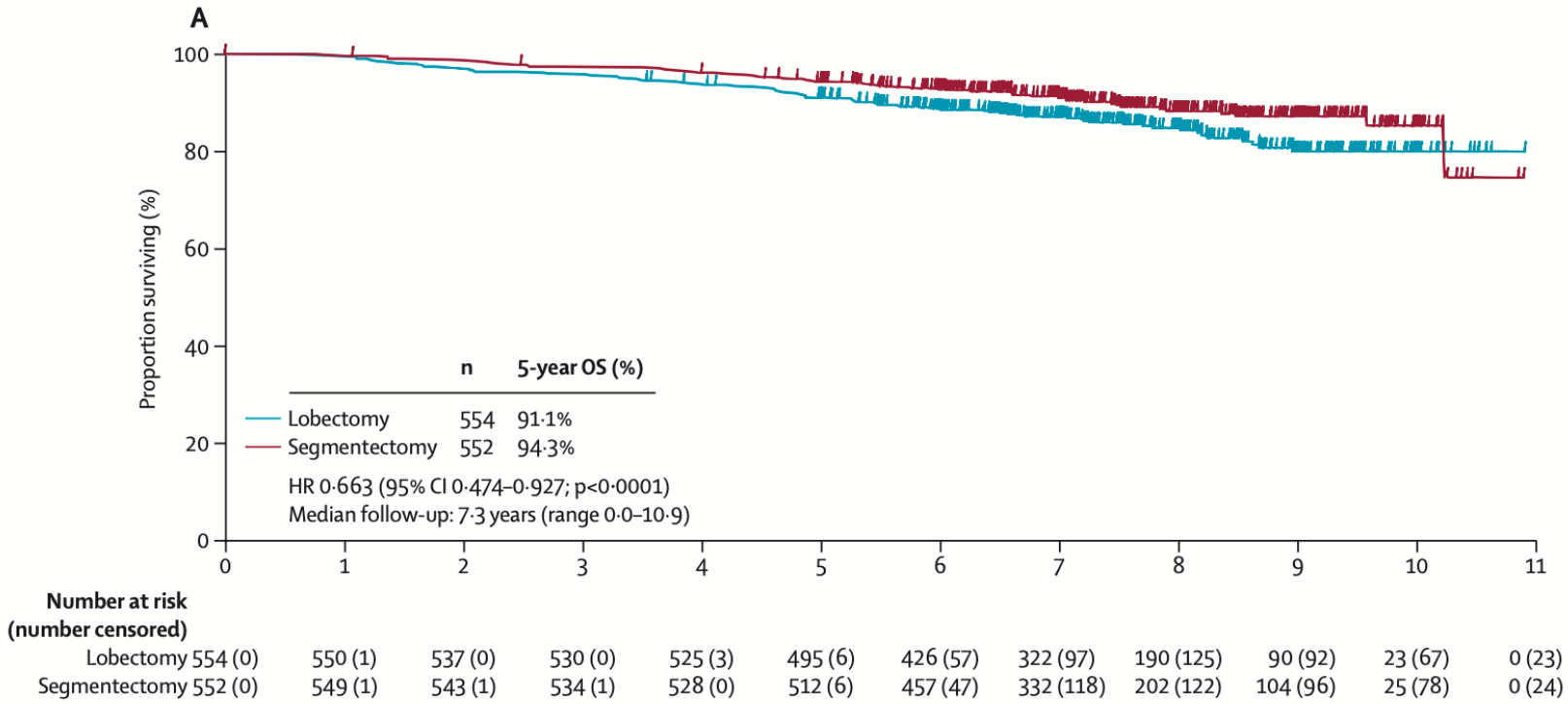
n=1106



Saji H. Lancet. 2022;399(10335):1607-1617.

JCOG0802 Results: Overall Survival

- 5-year OS
- Segmentectomy 94.3%
- Lobectomy 91.1%
- HR 0.663



Saji H. Lancet. 2022;399(10335):1607-1617.

JCOG0802 Results: Recurrence

- Local recurrence:
- 10.5% vs 5.4%

	Lobectomy (n = 554)	Segmentectomy (n = 552)*
Relapse	n = 44 (7·9%)	n = 67 (12·1%)
Proportion of local relapse**	30/554 (5·4%)	58/552 (10·5%)
Relapse pattern		
Locoregional	17 (3·1%)	38 (6·9%)
Distant	14 (2·5%)	7 (1·3%)
Both	13 (2·3%)	20 (3·6%)
Unknown	0	2 (0·2%)
Locoregional relapse site		
Surgical margin	0	11
Bronchial stump	0	2
Ipsilateral mediastinal LN	9	21
Contralateral mediastinal LN	2	13
Ipsilateral hilar LN	5	7
Contralateral hilar LN	2	3

Saji H. Lancet. 2022;399(10335):1607-1617.

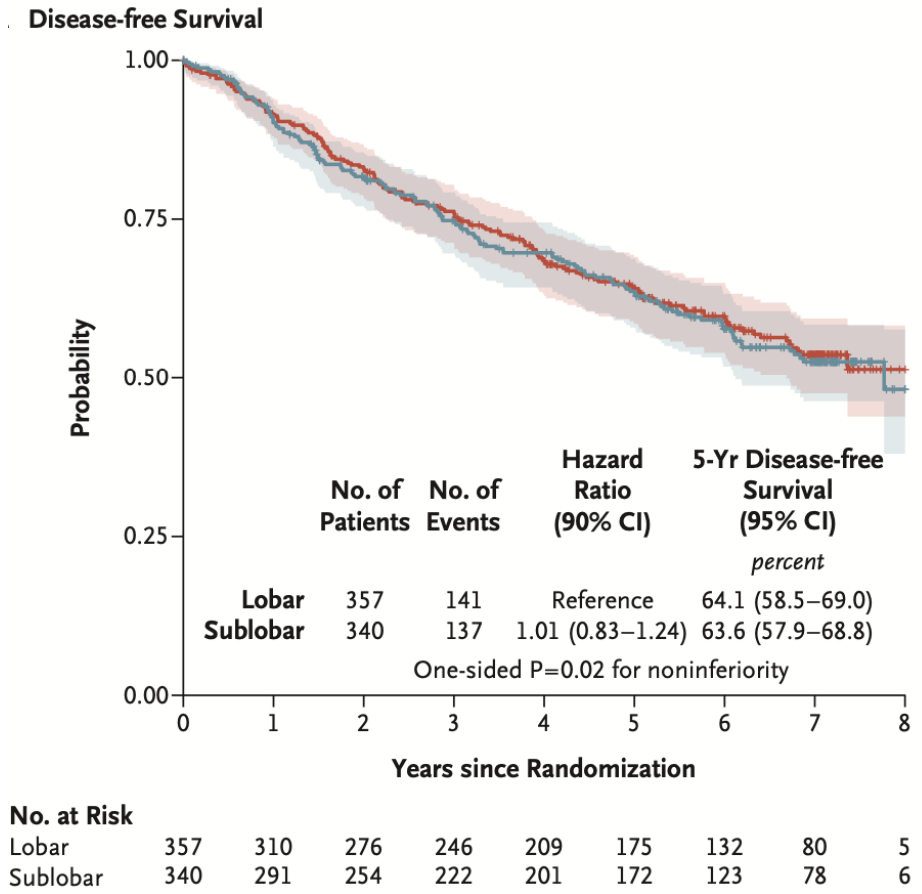
CALGB140503 Trial Design

- Peripheral T1aN0 NSCLC
- ≤2 cm
- Mandatory nodal assessment
- n=697

Altorki NK. N Engl J Med. 2023 Feb 9;388(6):489-498.

CALGB140503 Results

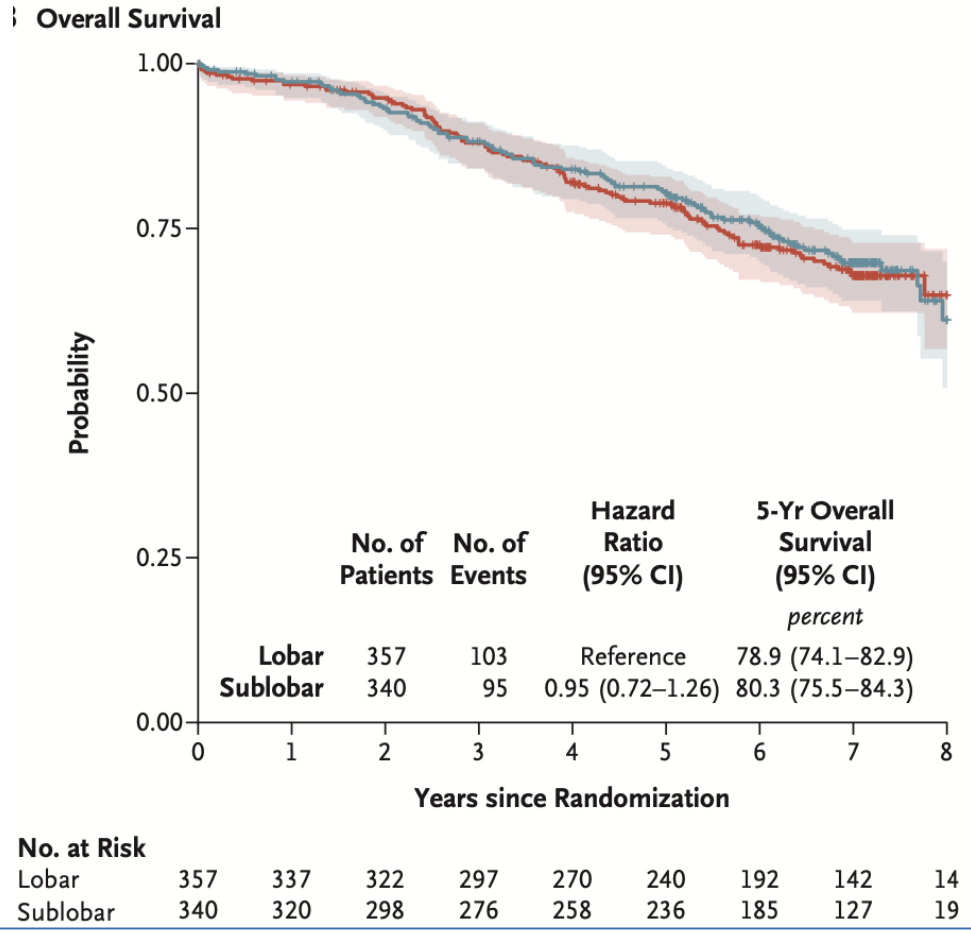
- Primary Endpoint
- DFS Noninferior
- HR 1.01



Altorki NK. N Engl J Med. 2023 Feb 9;388(6):489-498.

CALGB140503 Overall Survival

- Overall survival equivalent



Altorki NK. N Engl J Med. 2023 Feb 9;388(6):489-498.

Comparing JCOG and CALGB

Feature	JCOG	CALGB
Primary endpoint	OS	DFS
Comparator	Segmentectomy	Sublobar
Result	Superior OS	Noninferior DFS

Doctors of Thoracic Surgery®

Pulmonary Function Outcomes

	JCOG		CALGB		
Group	LR	SR	LR	SR	WR
FEV1 decline @6month	13.1	10.4	6	3	5

UHN Canada's Hospital

Learning Objectives (in the Era of Randomized Trials?)

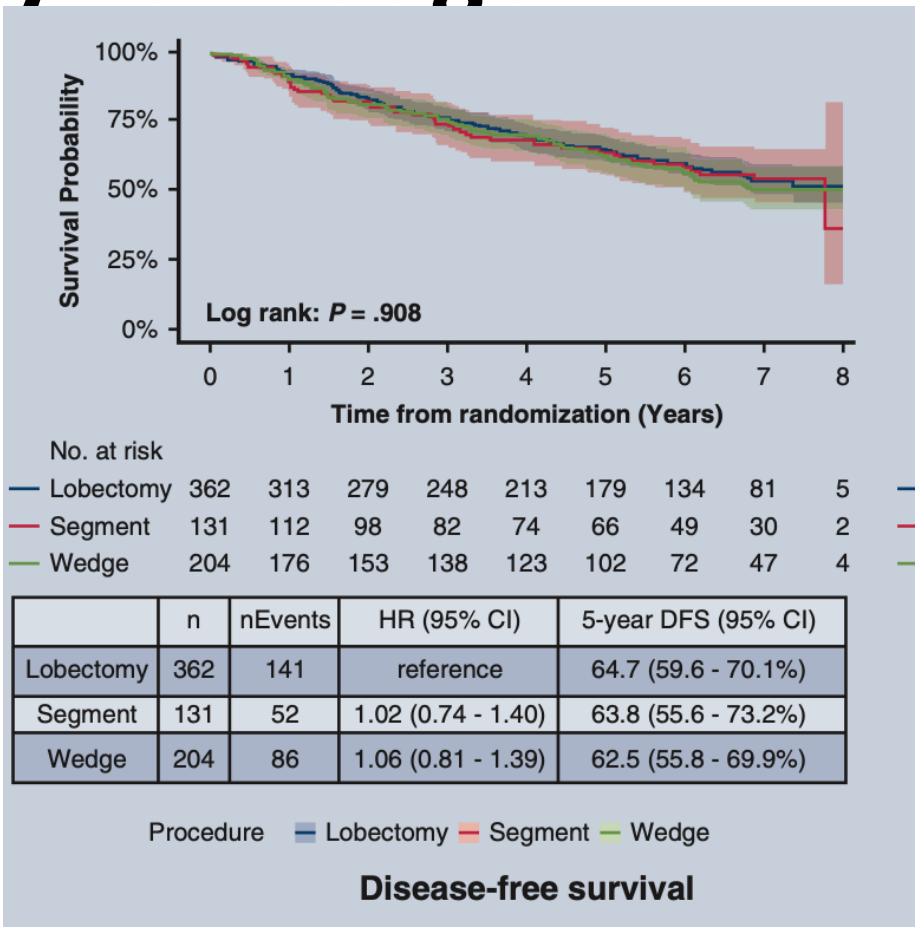
- Review evidence supporting segmentectomy
- Compare JCOG0802 and CALGB140503
- Discuss current patient selection
- Review remaining controversies
  - Segment vs Wedge
  - GGOs
  - IA3 tumours
  - STAS

Segmentectomy vs Wedge

CALGB Post-hoc Analysis

Similar:

- DFS
- OS
- Recurrence



	n	nEvents	HR (95% CI)	5-year DFS (95% CI)
Lobectomy	362	141	reference	64.7 (59.6 - 70.1%)
Segment	131	52	1.02 (0.74 - 1.40)	63.8 (55.6 - 73.2%)
Wedge	204	86	1.06 (0.81 - 1.39)	62.5 (55.8 - 69.9%)

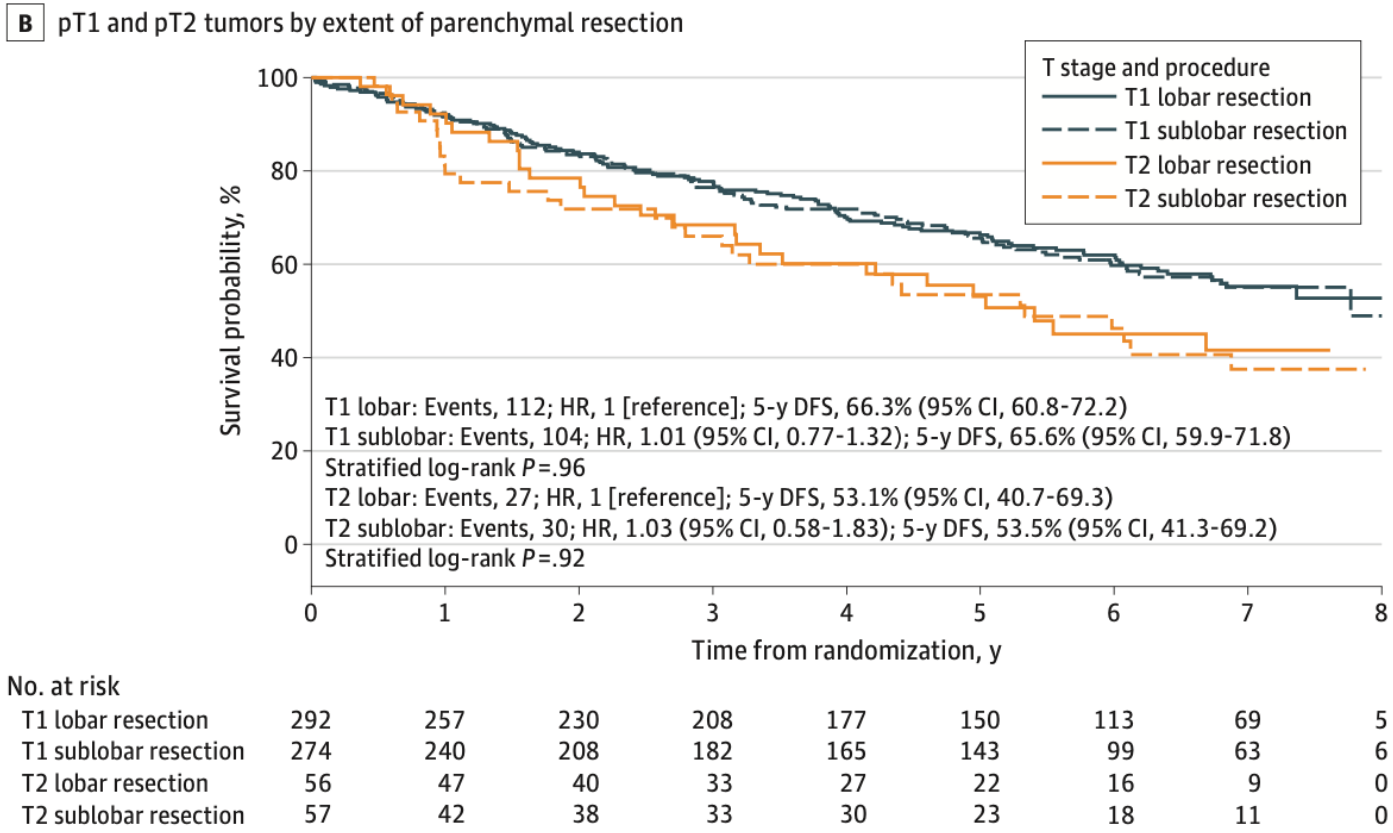
Altorki NK. JTCVS 2024;167(1):338-347.

Visceral Pleural Invasion

CALGB Secondary Analysis

VPI associated with:

- Worse DFS
- Worse RFS

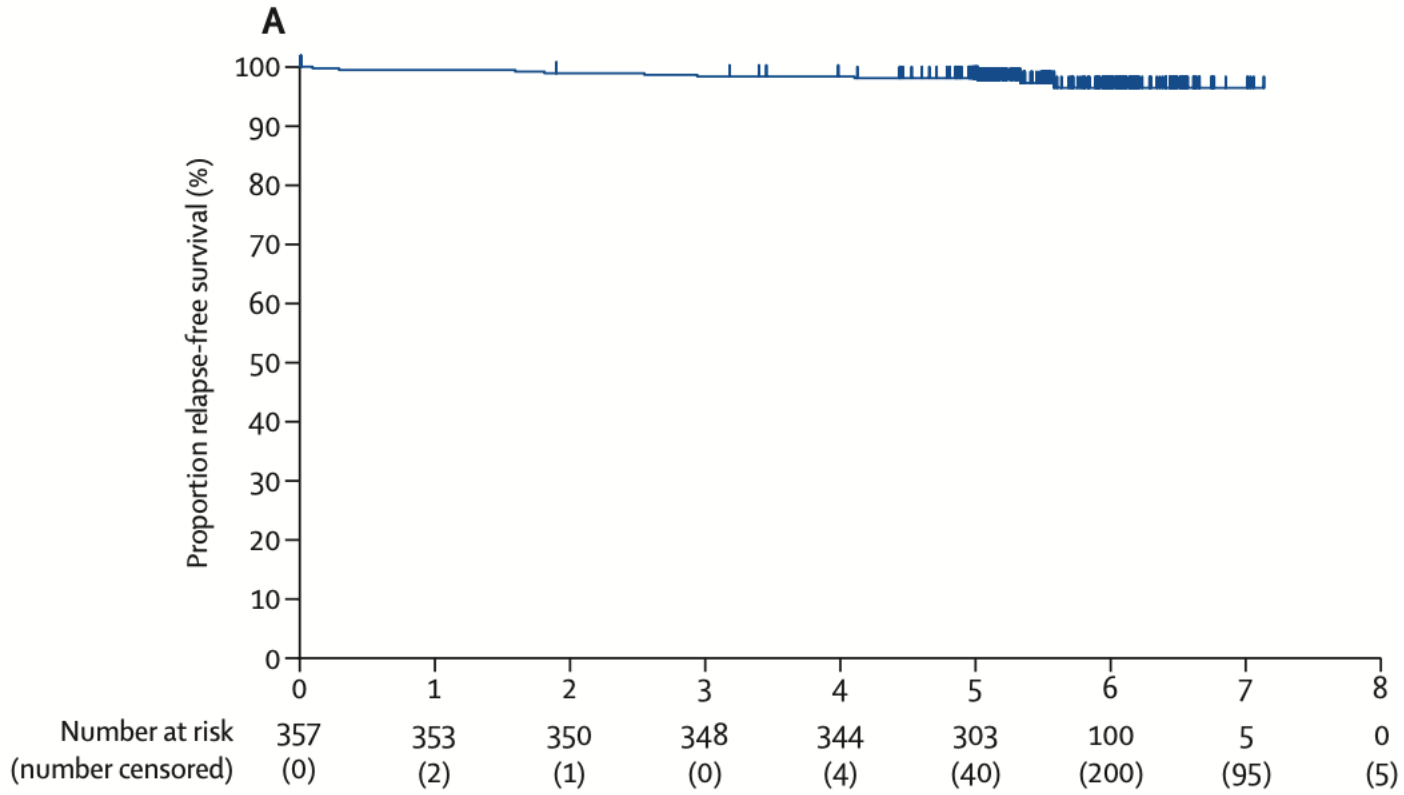


Altorki NK. JAMA ONCOLOGY 2024;10;(9):1179-1186.

IA3 (>2 cm) TUMOURS

JCOG1211

- Single arm
- Three groups
  - Between 2-3 cm, CTR <0.5
  - <2 cm, CTR 0.25-0.5
  - <2 cm, CTR<0.25 but not peripheral

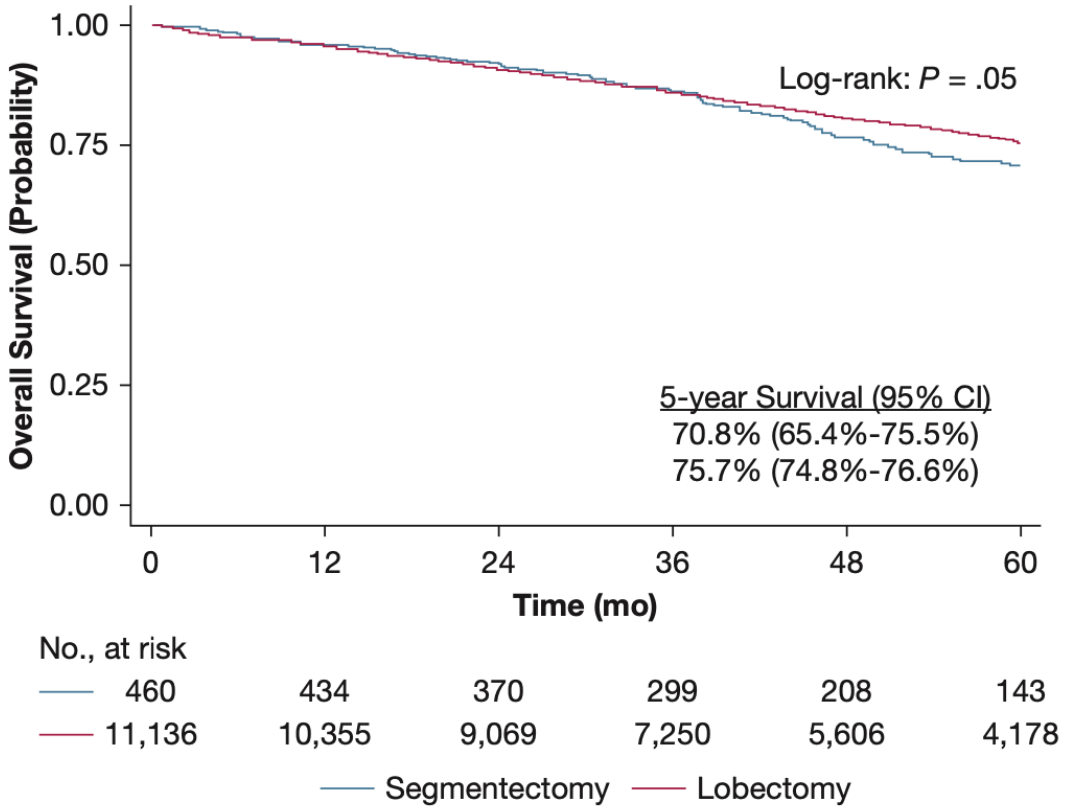


Aokage. Lancet Respir Med 2023 Jun;11(6):540-549

IA3 (>2 cm) TUMOURS

National Cancer Database

- 12814 patients
- 526 cT1cN0
- No difference in DFS or OS
- With or without propensity matching

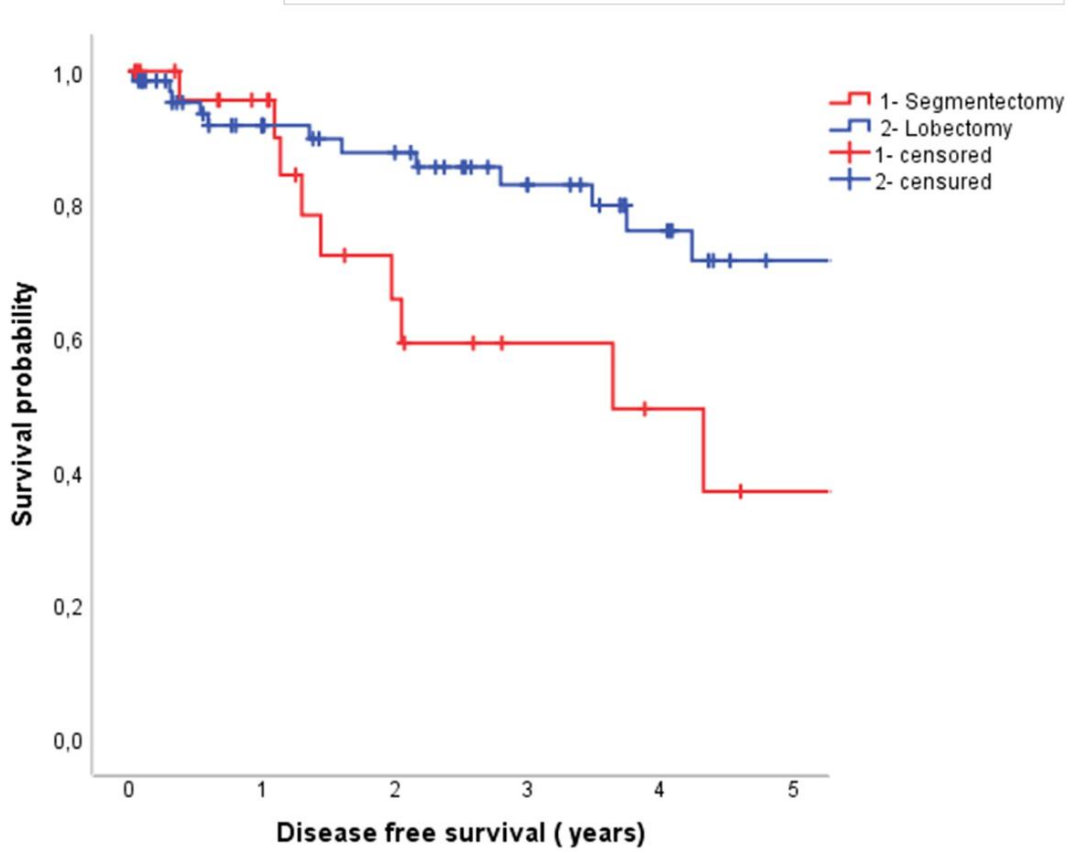


Mathey-Andrews. Chest 2025; 168(6):1506-1516

IA3 (>2 cm) TUMOURS

Single centre

- 2013-2023
- 699 lung cancer resections
- 95 pIA3
- 27 SR, 68 LR
- Big increase in recurrence



Hafsa. Langenbeck's Archives of Surgery (2025) 410:247

Doctors of Thoracic Surgery

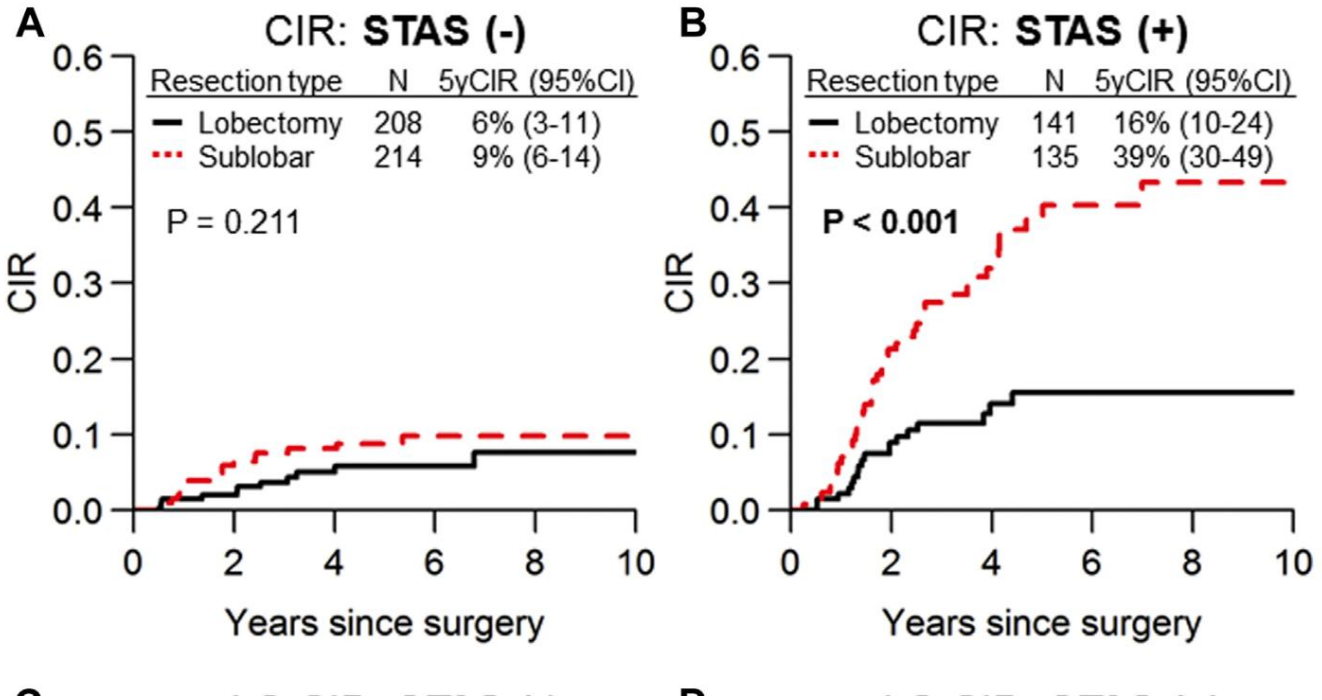
STAS

Single centre, retrospective

- 1497 T1 ADC (1995-2014)
- 40% had STAS

Created 349 matched pairs

Increased local recurrence in sublobar resection group



Eguchi. 2019 Journal of Thoracic Oncology, 14: 87-98

UHN Canada's Hospital

Doctors of Thoracic Surgery

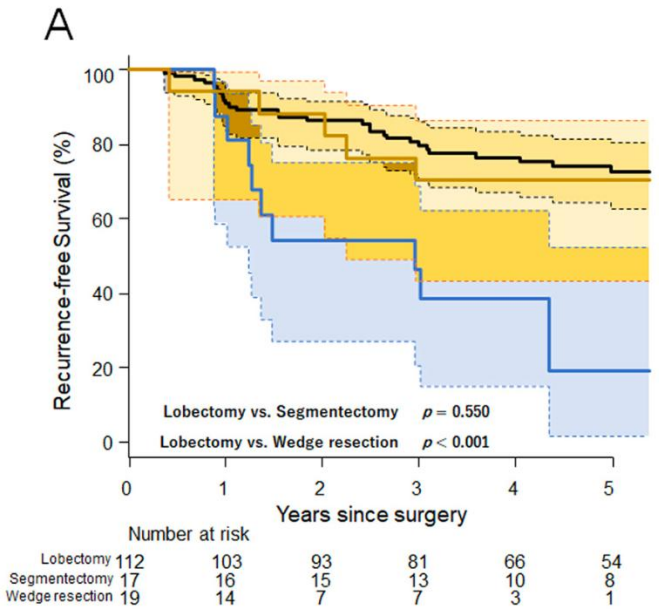
STAS

Single centre, retrospective

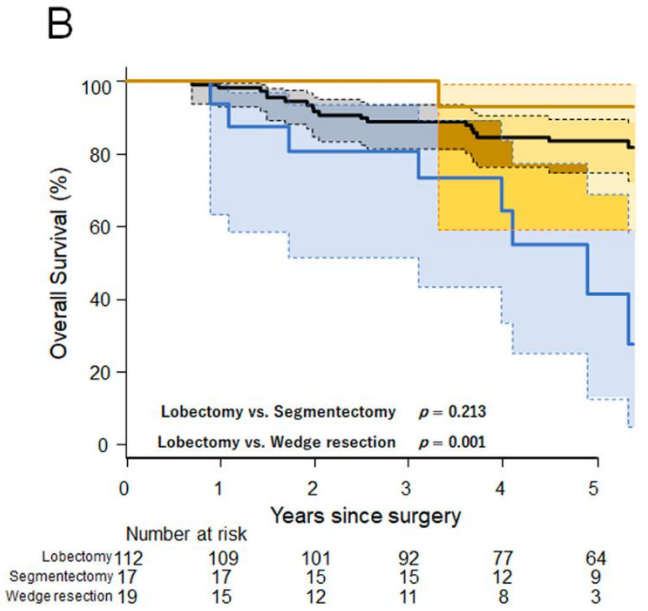
- 555 IA NSCLC (2005-2016)
- 27% had STAS

Segmentectomy similar to lobectomy

Worse RFS in WR



Surgical procedure		N	5-yr RFS	p
—	Lobectomy	112	72.6%	<0.001
—	Segmentectomy	17	70.6%	
—	Wedge resection	19	19.3%	



Surgical procedure		N	5-yr OS	p
—	Lobectomy	112	83.6%	0.001
—	Segmentectomy	17	92.9%	
—	Wedge resection	19	41.3%	

Ikeda. 2022 Semin Thoracic Surg 35:156–163

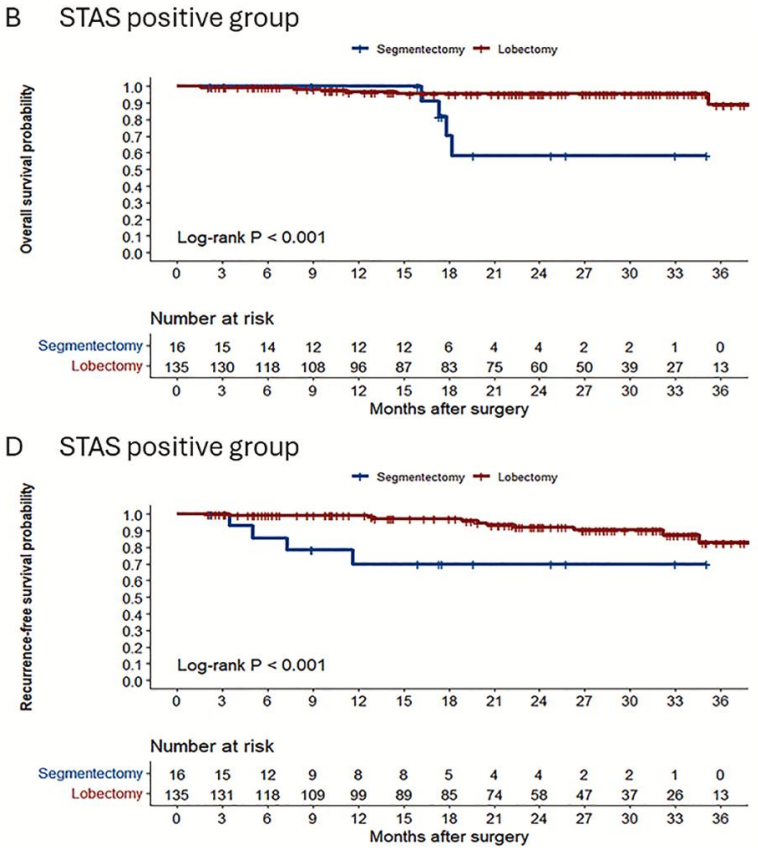
UHN Canada's Hospital

Doctors of Thoracic Surgery

STAS

Single centre, retrospective

- 785 NSCLC (2020-2023)
- 19% had STAS
- 3 y OS 58 vs 89%
- Only 16 in SR group



UHN Canada's Hospital

Technical Considerations

- ✓ Anatomic resection, division of artery and bronchi
- ✓ Adequate margins
  - Role for 3D-CT “virtual margin” assessment
- ✓ Hilar nodes (routine in JCOG, frozen in CALGB)
- ✓ Mediastinal nodes

Current UHN Algorithm

Peripheral NSCLC ≤2 cm

↓

Node negative on CT/PET

↓

Adequate margin achievable (Team review)

↓

Segmentectomy preferred

Current UHN Algorithm

If adequate margin not achievable by segmentectomy

↓

Lobectomy if good PFTs, PS, young age, high SUV

↓

Wedge resection

Take Home Messages

- Segmentectomy is now evidence-based standard therapy.
- JCOG demonstrated superior OS.
- CALGB confirmed oncologic safety.
- Margins and nodal staging remain critical.
- Adequacy of segmentectomy for STAS-positive lesions uncertain (data emerging from JCOG0802)

Doctors of Thoracic Surgery

Division of Thoracic Surgery, Toronto General Hospital







UHN Canada's Hospital