

Surgery for Early-Stage NSCLC

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**2020 World Conference
on Lung Cancer Singapore**

JANUARY 28-31, 2021 | WORLDWIDE VIRTUAL EVENT

DISCLOSURES

Commercial Interest	Relationship(s)
Oncocyte Corp	Consultant
Razor Genomics	Consultant, Patent Holder
Intuitive Surgical	Consultant
Auris Surgical	Consultant

Ms. Y



- 68F found to have a RUL nodule on screening CT
- PMH significant for arthritis, s/p TAH/BSO
- Meds: NSAIDs prn
- Social Hx
 - 40 pk-yr smoking history, quit 10 years ago
 - Social EtOH
 - Works as a beekeeper in CA



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*1.7cm spiculated RUL nodule, no mediastinal LAD
Percutaneous biopsy = lung adenocarcinoma*



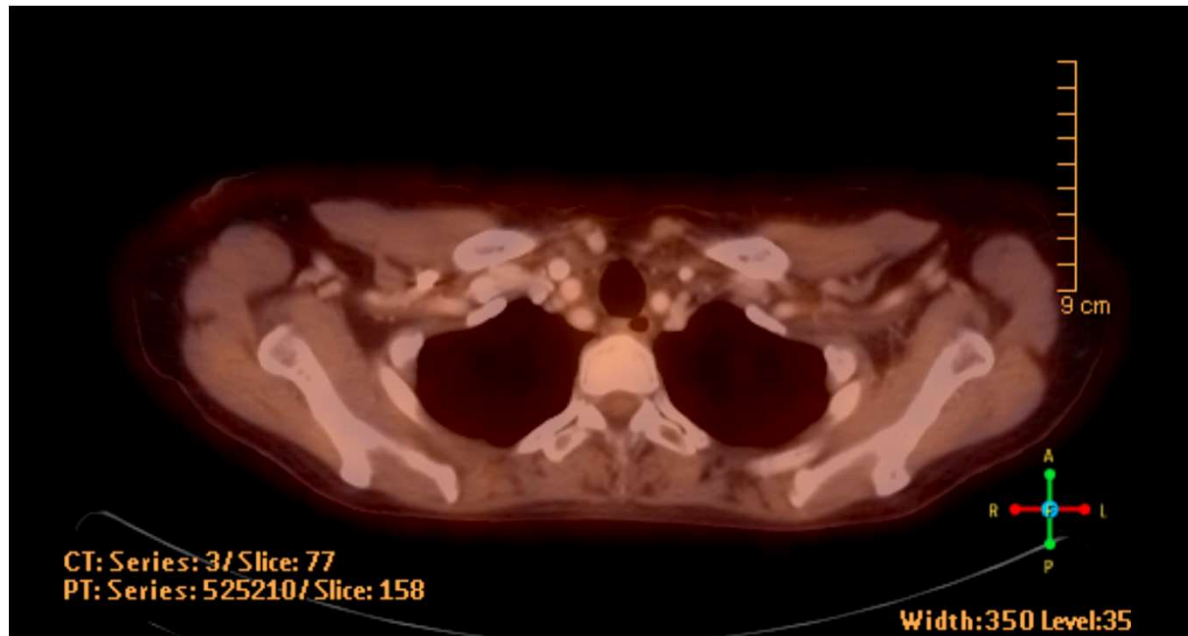
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KJ1

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UCSF



*FDG-avid RUL nodule
No regional or distant uptake*



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Slide 5

KJ1

Kratz, Johannes, 3/13/2021

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- Clinical stage IA lung cancer
- What kind of surgical resection?
 - Open resection
 - VATS resection
 - Robotic-assisted resection

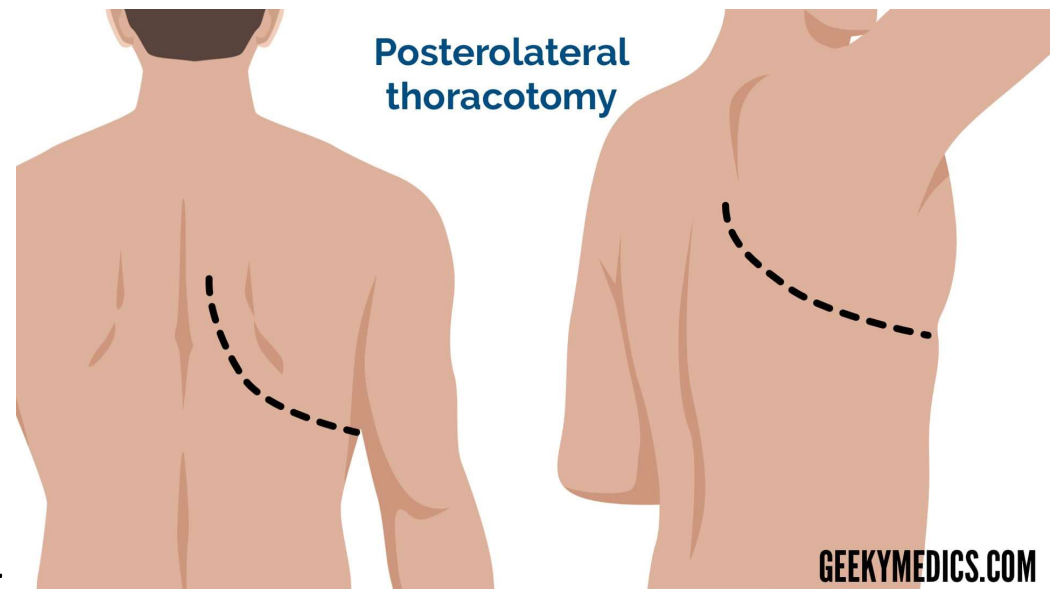


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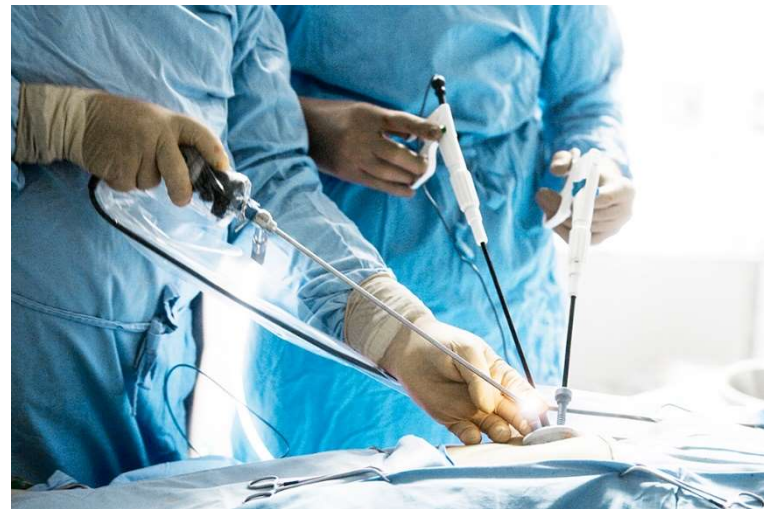
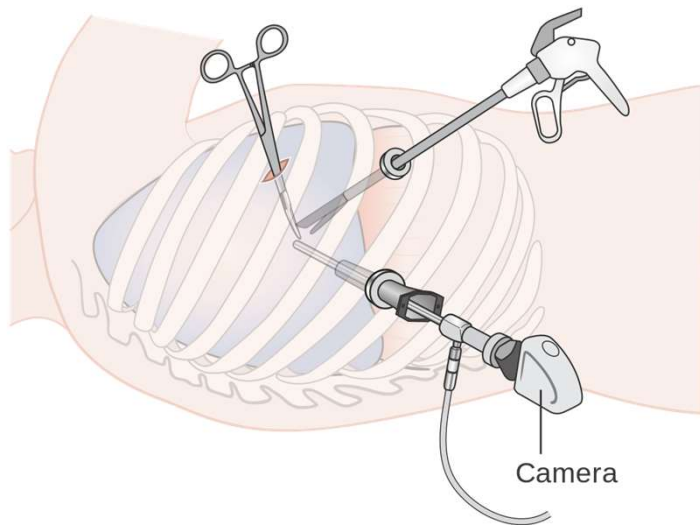
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Open thoracotomy

- 5th interspace
- Allows for most lung manipulation
- Preferred for complex tumors (near hilum, involving vessels)
- Longest recovery, most complications, most pain



Video-Assisted Thoracoscopic Surgery **UCSF**



VATS

- Advantages
 - Less pain
 - Shorter LOS
 - Reduced infection risk
 - Decreased physiologic insult
 - Better post-op immune function
 - Improved cosmesis
- Disadvantages
 - 2D visualization
 - Decreased dexterity (non-wristed instruments)
 - Loss of natural hand-eye coordination (fulcrum effect)
 - Physiologic tremors amplified
 - “Bedside” surgery

UCSF



Robotic-assisted VATS



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Robotic-assisted VATS



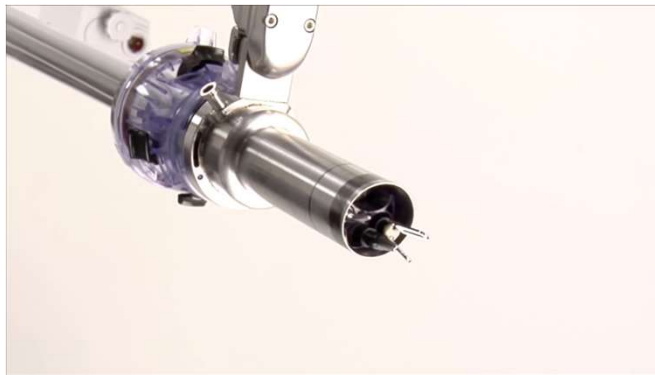
- Better dexterity
- Advanced instrumentation
- Digital vs. manual instrumentation
- Finer control, more complex MI procedures

Mohr, C. (2009, February). *Surgery's past, present and robotic future* [Video file].
Retrieved from https://www.ted.com/talks/catherine_mohr_surgery_s_past_present_and_robotic_future

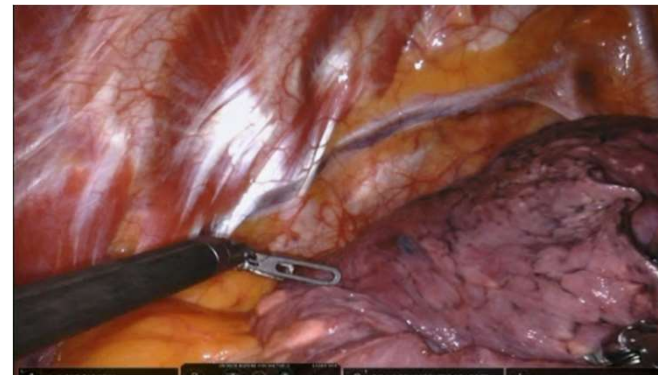
Robotic Surgery – Digital Revolution



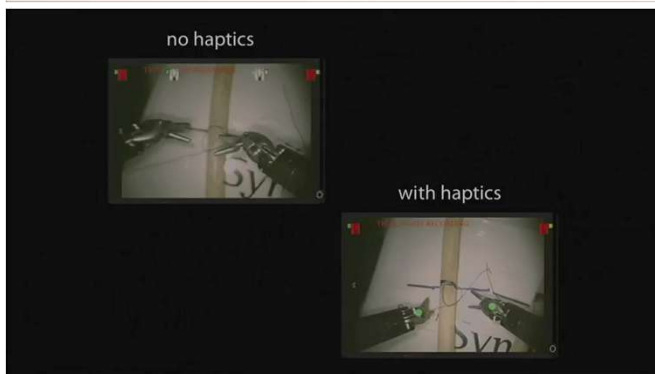
Single-Port



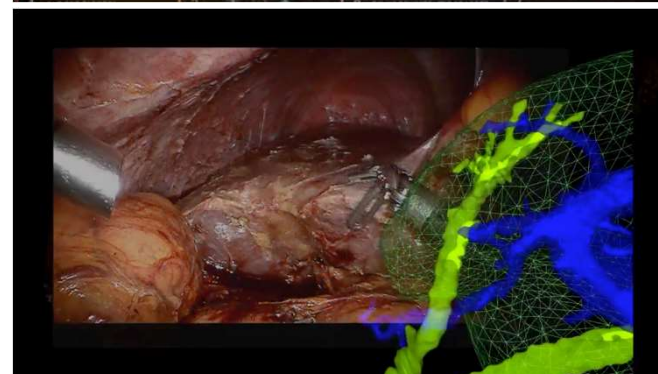
Hybrid Procedures



Haptic Feedback



Augmented Reality



Okamura, A. (2013, June). *Touch, Engineered*. [Video file]. <https://www.youtube.com/watch?v=pKqW3tdWCGQ>
Team Mimesis. *Image-guided Simulation for Augmented Reality during Hepatic Surgery* [Video file].
https://www.youtube.com/watch?v=fH_RD3p4vMM



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Robotic vs. VATS vs. Open



Long-term Survival Based on the Surgical Approach to Lobectomy
For Clinical Stage I Nonsmall Cell Lung Cancer

*Comparison of Robotic, Video-assisted Thoracic Surgery, and Thoracotomy
Lobectomy*

Hao-Xian Yang, MD,† Kaitlin M. Woo, MS,‡ Camelia S. Sima, MD, MS,‡ Manjit S. Bains, MD,*§
Prasad S. Adusumilli, MD,*§ James Huang, MD, MS,*§ David J. Finley, MD,*§ Nabil P. Rizk, MD, MS,*§
Valerie W. Rusch, MD,*§ David R. Jones, MD,*§ and Bernard J. Park, MD*§*

Ann Surg 2017;265:431–437

- 470 patients who underwent lobectomy for Stage I NSCLC
- 172 robotic, 141 VATS, 157 open
- Propensity-matched retrospective analysis



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Robotic vs. VATS vs. Open

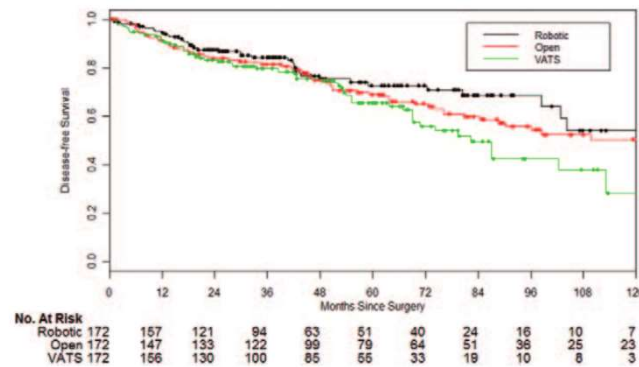


FIGURE 2. Disease-free survival in the matched cohort (N = 516), by surgical approach (VATS vs robotic, $P = 0.047$; open vs robotic, $P = 0.34$).

TABLE 4. Surgery-related and Postoperative Outcomes of the Propensity Score-matched Groups (N = 470)

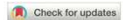
Characteristics	Approach			P
	Robotic (n = 172)	VATS (n = 141)	Open (n = 157)	
Sampled LN stations, median (range)	5 (0–8)	3 (0–7)	4 (1–8)	<0.001

*does robotic nodal
upstaging ultimately
lead to a difference in
outcomes?*

Robotic vs. VATS vs. Open



Robotic-Assisted Lobectomy for Non-Small Cell Lung Cancer: A Comprehensive Institutional Experience



David B. Nelson, MD MSc, Reza J. Mehran, MD, Kyle G. Mitchell, MD, Ravi Rajaram, MD, Arlene M. Correa, PhD, Roland L. Bassett, Jr, MS, Mara B. Antonoff, MD, Wayne L. Hofstetter, MD, Jack A. Roth, MD, Boris Sepesi, MD, Stephen G. Swisher, MD, Garrett L. Walsh, MD, Ara A. Vaporciyan, MD, and David C. Rice, MB, BCh

Department of Thoracic and Cardiovascular Surgery and Department of Biostatistics, University of Texas MD Anderson Cancer Center, Houston, Texas

Table 3. Adjusted Operative and Perioperative Outcomes

Variables	RAL (n = 106)	VAL (n = 301)	OL (n = 424)	P Value vs VATS	P Value vs OL	(Ann Thorac Surg 2019;108:370-6)
Operative time, min	226 (181-258)	173 (139-215)	148 (120-179)	<.001	<.001	
Estimated blood loss, cc	100 (50-200)	150 (100-300)	150 (100-250)	<.001	<.001	
R1/R2 status	0	<1	1	
Conversion to open	8	11479	...	
Pathologic stage				.183	.257	
yp0	0	1	2			
I	59	57	53			
II	24	19	27			
III	17	23	19			
Nodal stations harvested						
Mediastinal	3.1 ± 1.0	2.4 ± 0.9	2.7 ± 0.9	<.001	<.001	
Hilar or intrapulmonary	2.5 ± 0.9	1.8 ± 0.6	1.8 ± 0.7	<.001	<.001	



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Robotic vs. VATS vs. Open



Table 2. Number of Lymph Nodes Examined, Incidence of Nodal Upstaging, Positive Surgical Margins, and Pathologic Stage

Variable	Open (n = 7452)	Robotic (n = 7452)	P
Nodes examined, No.	8 (5-13)	10 (6-15)	<.001
0	68 (0.9)	57 (0.8)	<.001
1-5	1933 (25.9)	1559 (20.9)	
6-10	2407 (32.3)	2234 (30.0)	
11-15	1430 (19.2)	1537 (22.1)	
>15	1200 (16.1)	1648 (22.1)	

Robotic Approach Offers Similar Nodal Upstaging to Open Lobectomy for Clinical Stage I Non-small Cell Lung Cancer



Andrew Tang, MD, Siva Raja, MD, PhD, Alejandro C. Bribriescio, MD, Daniel P. Raymond, MD, Monisha Sudarshan, MD, MPH, Sudish C. Murthy, MD, PhD, and Usman Ahmad, MD

Department of Cardiothoracic Surgery, Heart Vascular and Thoracic Institute, and Taussig Cancer Institute, Cleveland Clinic Foundation

(Ann Thorac Surg 2020;110:424-33)



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- Clinical stage IA lung cancer
- What kind of surgical resection?
 - Open resection
 - VATS resection
 - Robotic-assisted – Wedge resection? Lobectomy?



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Lobectomy vs. sublobar resection



decreased perioperative mortality and morbidity, and the ability of the patient to undergo further resections in the future if a second primary lung cancer should develop [13, 14]. The theoretical disadvantage would be the po-

Accepted for publication April 1, 1995.

were able to tolerate a lobectomy as assessed by car pulmonary function. Patients were ineligible if they h history of previously treated cancer other than basa squamous cell carcinoma of the skin. In addition, be registration, there had to be no evidence of metast disease as determined by history, physical examinat and blood chemistry analysis including a normal alka phosphatase and serum glutamic-oxaloacetic transa

- Ann Thorac Surg 1995;60:615-23
- Prospective, randomized, multi-institutional trial
- 276 patients with T1N0 disease randomized to lobar vs. sublobar resection
- Sublobar resection = segmentectomy or wedge with 2cm margin



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Lobectomy vs. sublobar resection



- Limited resection
 - 75% increase in recurrence rate (tripling of local recurrence)
 - 30% increase in mortality; 50% increase in cancer-specific mortality ($p \sim 0.09$)

LUNG CANCER STUDY GROUP 619
LOBECTOMY VS LIMITED RESECTION IN T1 N0 LUNG CANCER ER

Ann Thorac Surg
1995;60:615-23

Second Primary Cancer

Second primary cancers developed in 13 of the 247 eligible patients, a rate of 0.017 per person/year. Among these second primary tumors, nine occurred in the lobectomy group and four in the limited resection group. There were five second pulmonary malignancies (four in the lobectomy group and one in the limited resection group) and eight new primary malignancies in other sites.

This observed increase in recurrence rate is 50% when the entire population of 276 randomized patients is considered but it maintains statistical significance ($p = 0.06$, one-sided). The approximate doubling of the recurrence rate, among eligible patients, associated with the limited resection arm appears to apply regardless of whether the intended resection was wedge or segmental ($p < 0.10$ more than two-sided, with or without inclusion of second primaries).

Lobectomy is currently the gold standard of surgical care for lung cancer



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Lobectomy as the gold standard



Ginsberg study

Original article
General thoracic
Outcomes of Sublobar Resection Versus Lobectomy for Stage I Non-Small Cell Lung Cancer: A 13-Year Analysis

Presented at the Forty-first Annual Meeting of The Society of Thoracic Surgeons, Tampa, FL, Jan 24-26, 2005.
Amgad El-Sherif MD*, William E. Gooding MS¹, Ricardo Santos MD*, Brian Pettiford MD*, Peter F. Ferron
Miron C. Fierman MD¹, Susan J. Hobbins MD*, James D. L. Hirsch MD*, Rodman J. Landrum MD¹, & D.



The Journal of Thoracic and Cardiovascular Surgery
Volume 114, Issue 3, September 1997, Pages 347-353



Intentional limited resection for selected patients with T1 N0 M0 non-small-cell lung cancer: A single-institution study ☆, ☆☆

Ken Kodama MD, Osamu Doi MD, Masahiko Higashiyama MD, Hideoki Yokouchi MD, From the Department of Thoracic Surgery, Osaka Medical Center for Cancer & Cardiovascular Diseases (The Center for Adult Diseases, Osaka), 1-3-3 Nakamichi, Higashinari-ku, Osaka 537, Japan.

Original article
General thoracic
Oncologic Outcomes of Segmentectomy Versus Lobectomy for Clinical T1a N0 M0 Non-Small Cell Lung Cancer

Comparison of Different Types of Surgery in Treating Patients With Stage IA Non-Small Cell Lung Cancer

ClinicalTrials.gov Identifier: NCT00499330

Recruitment Status ⓘ : Active, not recruiting

First Posted ⓘ : July 11, 2007

Last Update Posted ⓘ : July 24, 2020

Current practice

- Tumors < 2cm
- Peripheral tumors
- GGOs / mixed density nodules
- Biopsy histology (eg. lepidic adeno on path)
- Segmentectomy



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Lymph node sampling vs. dissection



The Journal of Thoracic and Cardiovascular Surgery

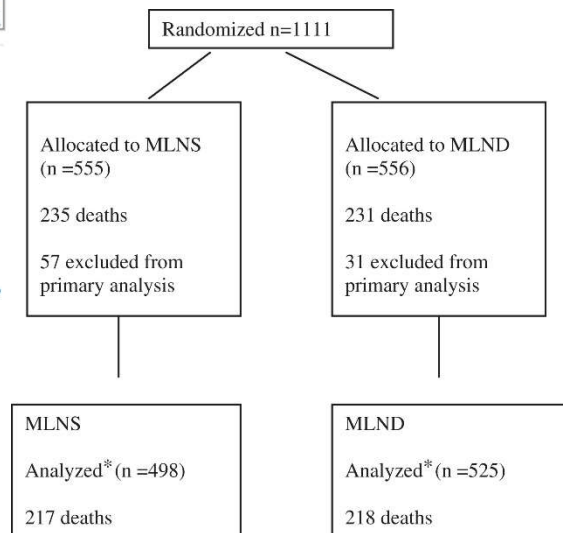
Volume 141, Issue 3, March 2011, Pages 662-670



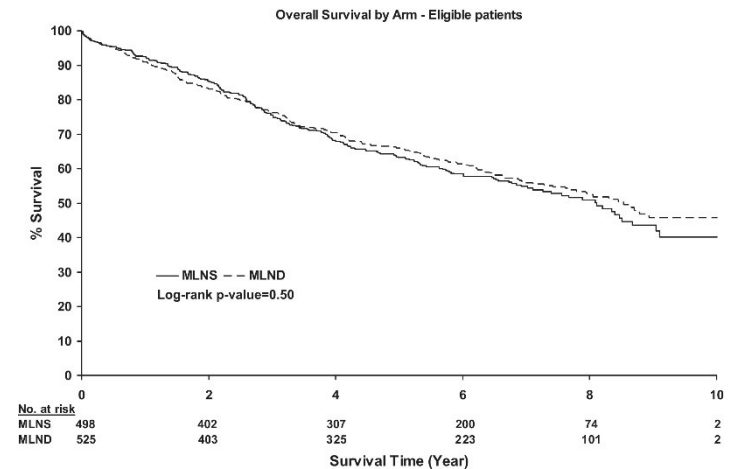
General thoracic surgery

Randomized trial of mediastinal lymph node sampling versus complete lymphadenectomy during pulmonary resection in the patient with N0 or N1 (less than hilar) non-small cell carcinoma: Results of the American College of Surgery Oncology Group Z0030 Trial

Read at the 90th Annual Meeting of The American Association for Thoracic Surgery, Toronto, Ontario, Canada, May 1-5, 2010.
 Gail E. Darling MD¹, R. S. Mark S. Allen MD², Paul A. Decker MS³, Karla Ballman PhD⁴, Richard A. Malthaner MD⁵, Richard I. Inoulet MD⁶, David R. Jones MD⁴, Robert J. McKenna MD⁷, Rodney J. Landreneau MD⁸, Valerie W. Rusch MD⁹, Joe B. Putnam Jr. MD⁹



* Note: intent to treat analyses were also performed.



Most studies do not show a difference between sampling vs. dissection; tumor biology is king!



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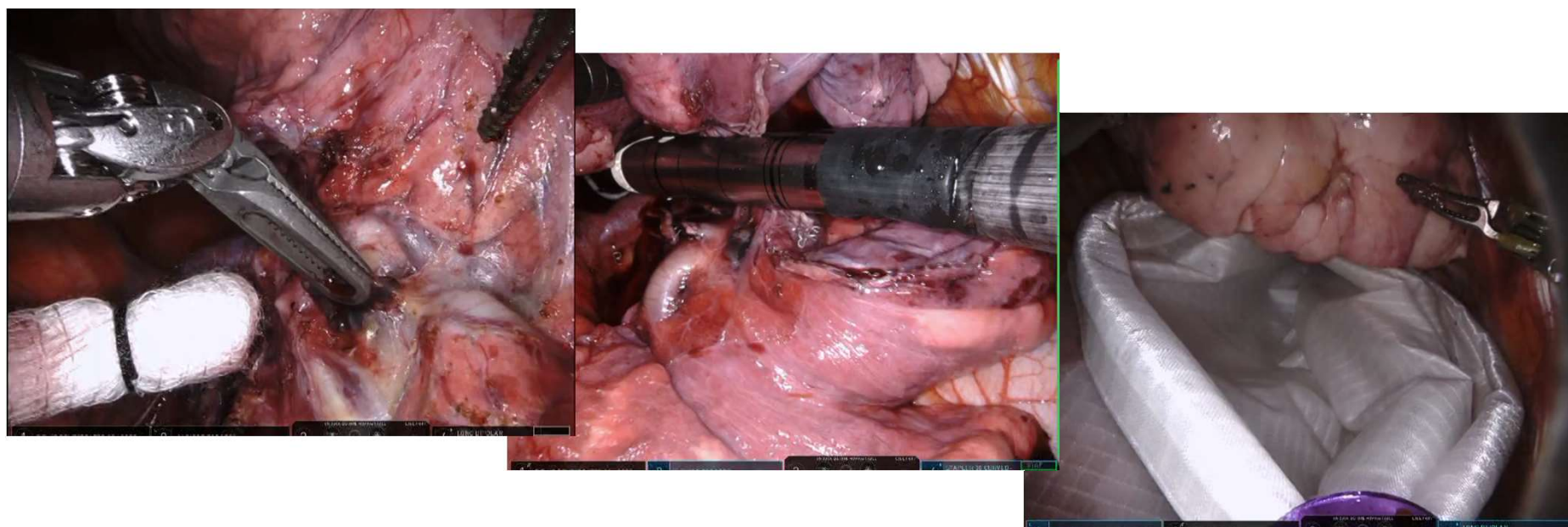
- Clinical stage IA lung cancer
- What kind of surgical resection at UCSF?
 - Open resection
 - VATS resection
 - Robotic-assisted lobectomy with full MLND



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Robotic-assisted VATS lobectomy



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- 2 week post-op appt
- Doing well, no more opiates
- Path
 - 1.6cm lung adenocarcinoma
 - +visceral pleural invasion
 - 0/16 positive lymph nodes
 - T2aN0 / Stage IB
- **“Do I need anything else?”**



Poll

What next steps would you take for this T2aN0 / Stage IB patient?

- Observation
- Send for molecular risk assay
- Send for molecular risk assay + EGFR testing
- Send for molecular risk assay + EGFR testing + next-generation sequencing (driver mutation analysis)
- Send to oncology for adjuvant chemotherapy

Ms. Y



National
Comprehensive
Cancer
Network®

NCCN Guidelines Version 2.2021 Non-Small Cell Lung Cancer

FINDINGS AT SURGERY

Stage IB (T2a, N0)
Stage IIA (T2b, N0)

Margins negative (R0)^v

ADJUVANT TREATMENT

Observe _____
or
Chemotherapy^f for high-risk patients^s
and consider osimertinib^w _____

^s Examples of high-risk factors may include poorly differentiated tumors (including lung neuroendocrine tumors [excluding well-differentiated neuroendocrine tumors]), vascular invasion, wedge resection, tumors >4 cm, visceral pleural involvement, and unknown lymph node status (Nx). These factors independently may not be an indication and may be considered when determining treatment with adjuvant chemotherapy.

- **High-risk / EGR+:** 4 cycles of carboplatin / taxol
- Currently doing well



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State of the art surgical care



- Treatment in a multi-disciplinary setting
- VATS / Robotic-assisted VATS procedures
- Lobectomy remains gold standard but should consider size, location, radiographic appearance, path, procedure
- Surgeons should be knowledgeable about risk-stratification and EGFR testing in case their patients may benefit

Presented by Johannes Kratz; UCSF



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thank you