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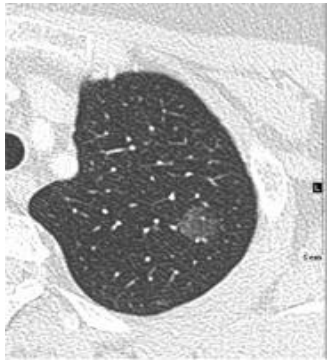
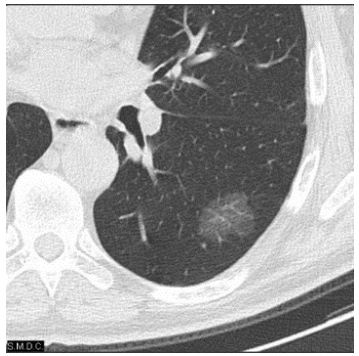
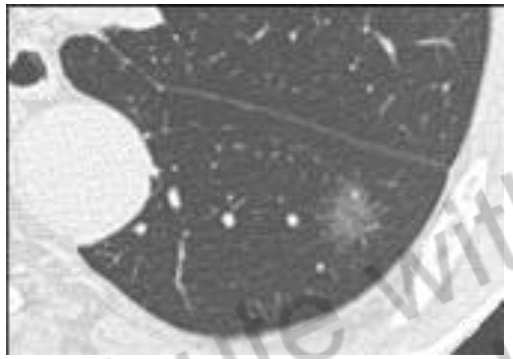
2023 literature update of lung cancer surgery

Expert: **Prof Calvin Sze Hang NG,** The Chinese University of Hong Kong, Hong Kong SAR, China

Discussant: **Dr Luca Bertolaccini,** IEO European Institute of Oncology IRCCS, Milan, Italy

e-ESO 2023 Literature Review

Is Less the new More for Lung cancer

2nd March 2023

Calvin S.H. Ng

BSc(Hons), MBBS(Hons)(ICSM), MD(Res.)(Lond), FRCSEd, FCCP, FAPSR

Professor, Thoracic Surgery

The Chinese University of Hong Kong,

Prince of Wales Hospital

Is Less the new More for Lung cancer ….

- Surgical Access
- Resection (treatment size)
- Localization

Is Less the new More for Lung cancer

Surgical Access

Open / thoracotomy

Video Assisted Thoracic Surgery (VATS) – 3-port
1994 PWH

Yim APC et al. One hundred and sixty-three consecutive video thoracoscopic procedures: Hong Kong experience. Australian & New Zealand J Surg 1994; 64(10):671-5
Yim APC et al. One hundred consecutive cases of video-assisted thoracoscopic surgery for primary spontaneous pneumothorax. Surg Endoscopy 1995; 9(3):332-6

VATS Advantages (compared with open)

Retrospective studies

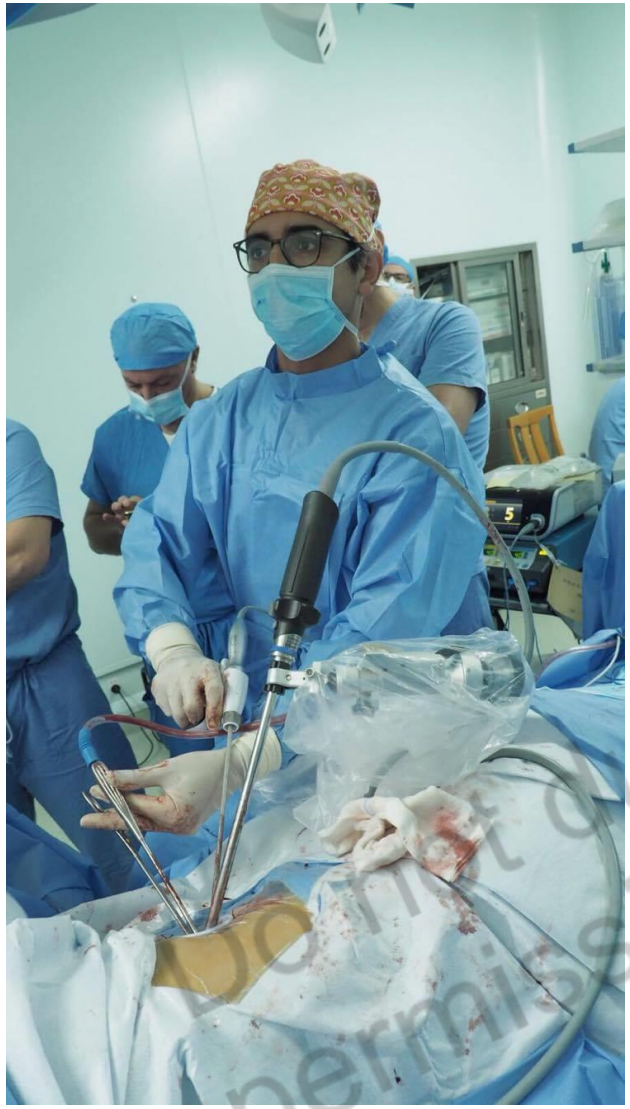
- Lower morbidity, Less blood loss, less pain
- Reduced post-op duration for chest drainage
- Shorter hospital stay
- Patient satisfaction (cosmesis), QOL
- Better preserved shoulder function
- Better preserved immune function
- Quicker surgical recovery = earlier adjuvant (Chemo) therapy
- ***Controversial:*** Improve survival in lung CA compared with thoracotomy

Li WWL, Lee TW, Lam SSY, Ng CSH, et al. Quality of life following lung cancer resection: VATS versus thoracotomy. *Chest* 2002;122:584-9
Li WWL, Lee RLM, Lee TW et al. The impact of thoracic surgical access on early shoulder function: VATS versus posterolateral thoracotomy. *Eur J Cardiothorac Surg* 2003;23:390-6
Ng CSH, Whelan RL, Lacy AM, Yim APC. Is Minimal Access Surgery for Cancer Associated with Immunologic Benefits? *World J Surg* 2005;29:975
Ng CSH, Wan S, Hui C, et al. VATS lobectomy for lung cancer is associated with less immunochemokine disturbances than thoracotomy. *Eur J Cardiothorac Surg* 2007;31:83-7

Single Port VATS Lobectomy for CA Lung

Single port / Uniportal VATS lobectomy- 2012 PWH 1st in HK

Ng CSH, et al. Minimizing Chest Wall Trauma in Single Port VATS. *J Thorac Cardiovasc Surg* 2014 Mar;147(3):1095-6
Ng CSH, et al. Uniportal and Single Incision VATS- The State of the Art. *Interact Cardiovasc Thorac Surg* 2014 Oct;19(4):661-6
Ng CSH, et al. Hybrid DynaCT Guided Localization Single Port Lobectomy. *Chest* 2015 Mar 1;147(3):e76-8
Ng CSH, et al. Single Port VATS Major Lung Resections: Experience with 150 Consecutive Cases. *Thorac Cardiovasc Surg* 2016;64:348-3
Ng CSH, et al. Single Port VATS: Advancing Scope Technology. *Eur J Cardiothorac Surg* 2015 Apr;47(4):751
Ng CSH et al. A novel narrow profile articulating powered vascular stapler provides superior access & hemostasis equivalent to conventional devices. *EJCTS* 2016;48(S1):i73-8

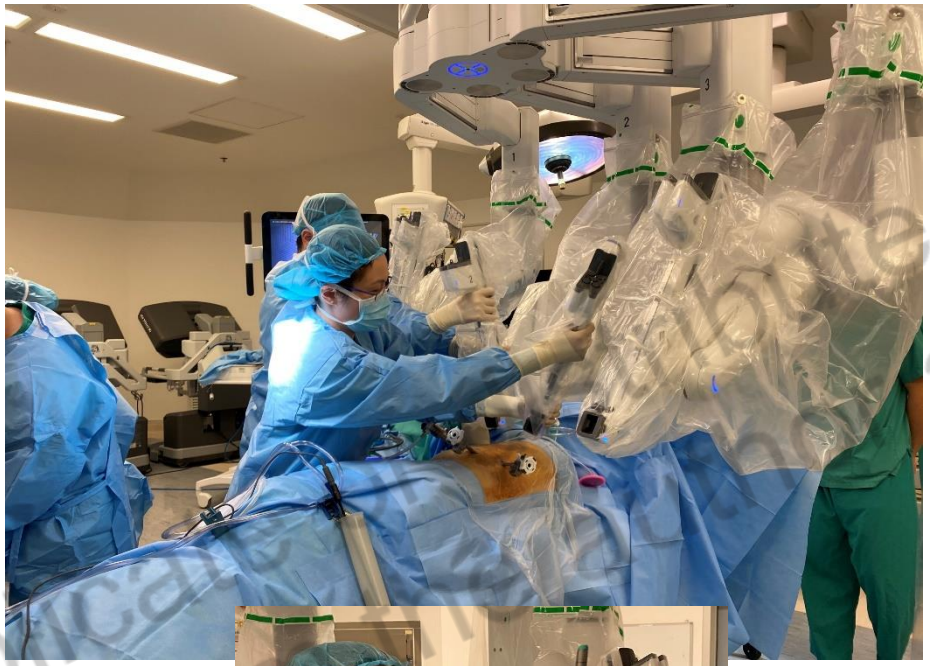


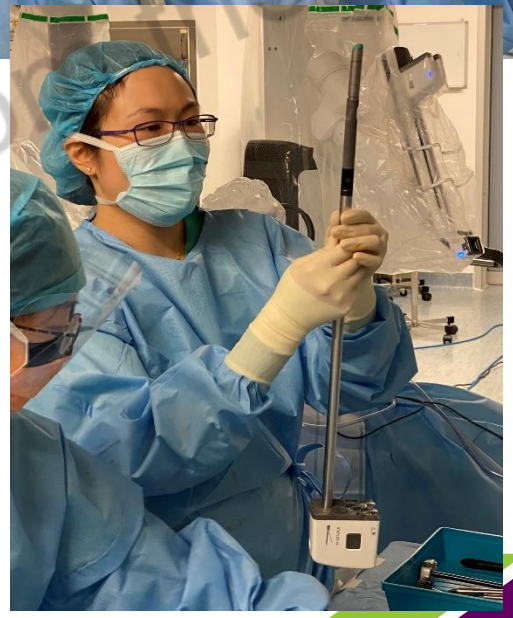
Robotic arm “camera man”: Uniportal Uni-surgeon VATS

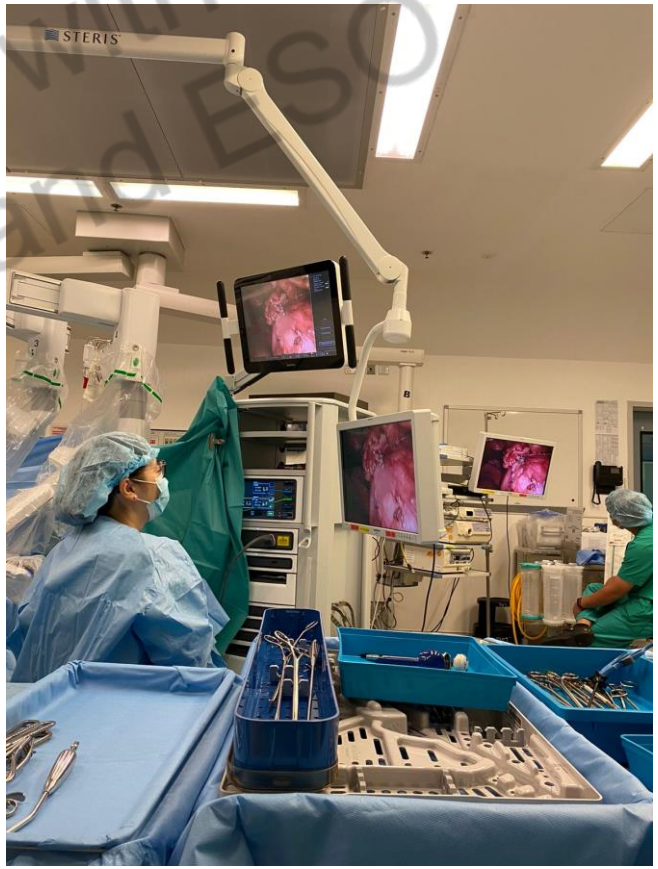
Photos courtesy of Dr Diego Gonzalez-Rivas

Gonzalez-Rivas D. Unisurgeon' uniportal video-assisted thoracoscopic surgery lobectomy. J Vis Surg. 2017 Nov 7;3:163

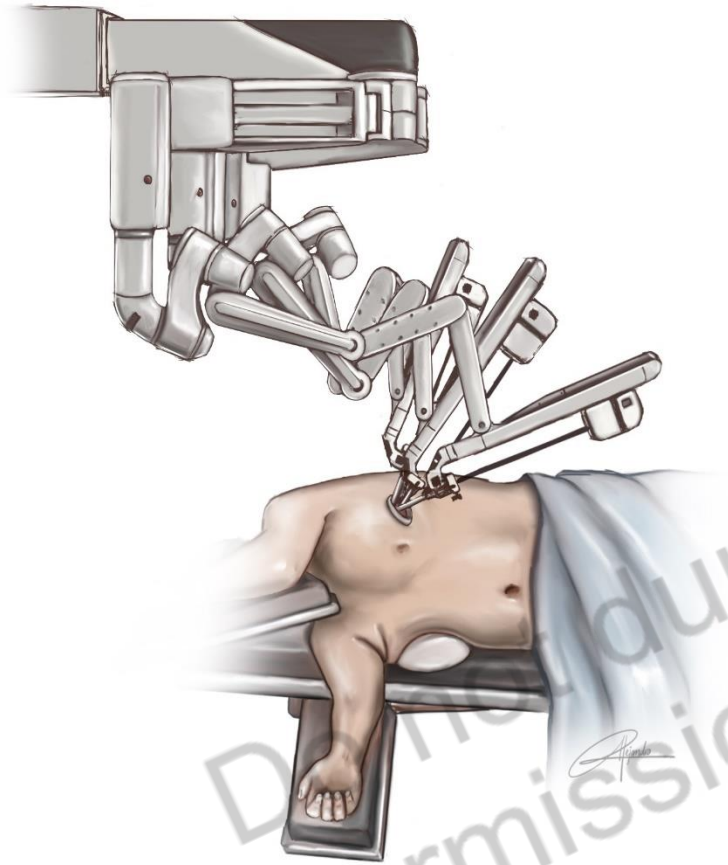
Robotic Assisted Thoracic Surgery (RATS) – Conventional 3 or 4 ports

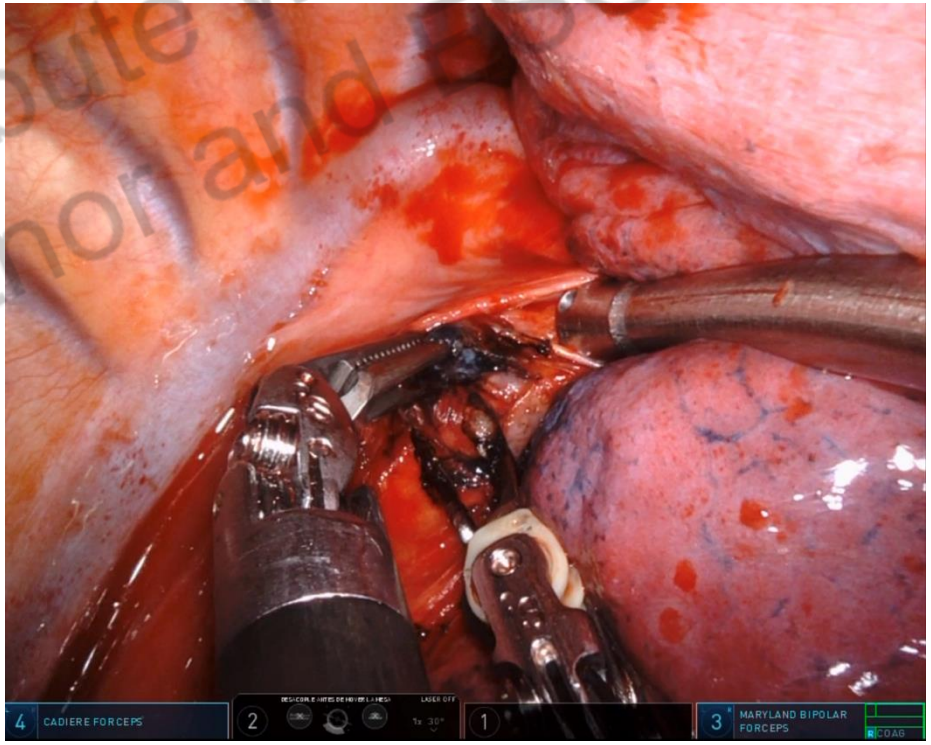






Uniportal Robotic Assisted Thoracic Surgery (URATS)





Gonzalez-Rivas D, et al. Uniportal pure robotic-assisted thoracic surgery—technical aspects, tips and tricks. Ann Transl Med 2022. doi: 10.21037/atm-22-1

Innovations
Volume 14, Issue 2, March/April 2019, Pages 90-116

https://doi.org/10.1177/1556984519837027

The International Society for Minimally Invasive Cardiothoracic Surgery

Expert Consensus Statement

Optimal Approach to Lobectomy for Non-Small Cell Lung Cancer: Systemic Review and Meta-Analysis

Calvin S.H. Ng, MD, FRCS (CTh)[1], John K. MacDonald, BA, MA[2], Sebastien Gilbert, MD, FRCSC[3], Ali Z. Khan, MS, FRCS(CTh)[4], Young T. Kim, MD, PhD[5], Brian E. Louie, MD[6], M. Blair Marshall, MD[7], Ricardo S. Santos, MD, PhD[8], Marco Scarci, MD, FRCS(Eng)[9], Yaron Shargal, MD, FRCSC[10], and Hiran C. Fernando, MBBS, FRCS[11]

Retrospective :

Open v. multiport VATS (mVATS) v. uniport VATS (uVATS) v. robotic VATS (rVATS)

- 145 studies included in meta-analysis.
- Oncological outcomes (survival, recurrence, lymph node evaluation),
- Safety (adverse events),
- Function (pain, quality of life, pulmonary function),
- Cost-effectiveness

Ng CSH et al. Expert Consensus Statement on Optimal Approach to Lobectomy for NSCLC. *Innovations* 2019;14(2):87-89.
Ng CSH et al. Optimal Approach to Lobectomy for NSCLC: Systemic Review and Meta-Analysis. *Innovations* 2019;14(2):90-116

Open v. multiport VATS (mVATS) v. uniport VATS (uVATS) v. robotic VATS (rVATS)

V.

Most significant findings:

Adverse events : (n=88460) ↑ ↓

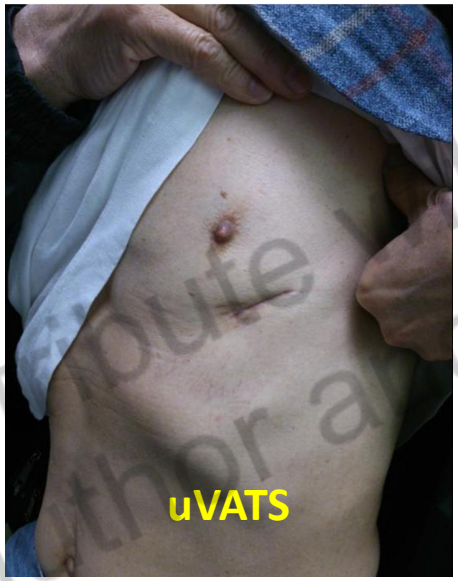
Pain ↑ ↓

Overall Survival : (n=16200) **poorer (67% 5-yr)** **Better (71% 5-yr)**

Ng CSH et al. Expert Consensus Statement on Optimal Approach to Lobectomy for NSCLC. *Innovations* 2019;14(2):87-89
Ng CSH et al. Optimal Approach to Lobectomy for NSCLC: Systemic Review and Meta-Analysis. *Innovations* 2019;14(2):90-116

Open v. multiport VATS (mVATS) v. uniport VATS (uVATS) v. robotic VATS (rVATS)

v.



Most significant findings:

Pain & analgesic requirement ↑ ↓

Conclusions:

- Meta-analysis supports the role of VATS lobectomy for NSCLC.
- Apart from potentially less pain and analgesic requirement with uVATS, different minimally invasive surgical approaches appear to have similar outcomes.

Ng CSH et al. Expert Consensus Statement on Optimal Approach to Lobectomy for NSCLC. *Innovations* 2019;14(2):87-89
Ng CSH et al. Optimal Approach to Lobectomy for NSCLC: Systemic Review and Meta-Analysis. *Innovations* 2019;14(2):90-116

VATS versus open lobectomy in patients with early-stage lung cancer: One-year results from a randomized controlled trial (VIOLET)

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Meeting Abstract | 2021 ASCO Annual Meeting I

LUNG CANCER—NON-SMALL CELL LOCAL-REGIONAL/SMALL CELL/OTHER THORACIC CANCERS

Video-assisted thoracoscopic versus open lobectomy in patients with early-stage lung cancer: One-year results from a randomized controlled trial (VIOLET).

Check for updates

Eric Kian Saik Lim, Tim J.P. Batchelor, Joel Dunning, Michael Shackcloth, Vladimir Anikin, Babu Naidu, ...

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NEJM Evidence

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ORIGINAL ARTICLE

Video-Assisted Thoracoscopic or Open Lobectomy in Early-Stage Lung Cancer

Eric Lim, F.R.C.S. (C-Th)[1,2], Tim J.P. Batchelor, F.R.C.S. (C-Th)[3], Joel Dunning, F.R.C.S. (C-Th)[4], Michael Shackcloth, F.R.C.S. (C-Th)[5], Vladimir Anikin, F.R.C.S. (C-Th)[1,6], Babu Naidu, F.C.R.S. (C-Th)[7], Elizabeth Belcher, F.C.R.S. (C-Th)[8], Mahmoud Loubani, F.R.C.S. (C-Th)[9], Vipin Zamvar, F.R.C.S. (C-Th)[10], Rosie A. Harris, M.Sc.[11], Lucy Dabner, M.Sc.[11], Holly E. McKeon, M.Res.[11], Sangeetha Paramasivan, Ph.D.[12], Alba Realpe, Ph.D.[12], Daisy Elliott, Ph.D.[13], Paulo De Sousa, P.G.Dip.[1], Elizabeth A. Stokes, D.Phil.[14,15], Sarah Wordsworth, Ph.D.[14,15], Jane M. Blazeby, F.C.R.S. (Gen. Surg.)[13], and Chris A. Rogers, Ph.D.[11] for the VIOLET Trialists*

Tweet

Published January 18, 2022
NEJM Evid 2022; 1 (3)
DOI: https://doi.org/10.1056/EVIDoa2100016

Issue >

VATS versus open lobectomy in patients with early-stage lung cancer: One-year results from a randomized controlled trial (VIOLET)

Multi-centre RCT (9 centres in UK)
July 2015 to February 2019,
503 patients randomized: VATS (n=247) or open (n=256) lobectomy

- VATS : less post-op pain (VAS) despite less analgesic consumption.
- VATS : less incision pain up to one-year.
- VATS : Better physical functional recovery at 5 weeks, and overall improvement in global health status. *

* Lim et al. NEJM Evid 2022; 1 (3)

VATS versus open lobectomy in patients with early-stage lung cancer: One-year results from a randomized controlled trial (VIOLET)

VATS fewer in-hospital post-op complications, with no difference in serious adverse events.

VATS shorter median hospital stay by 1 day (4 vs 5 days)

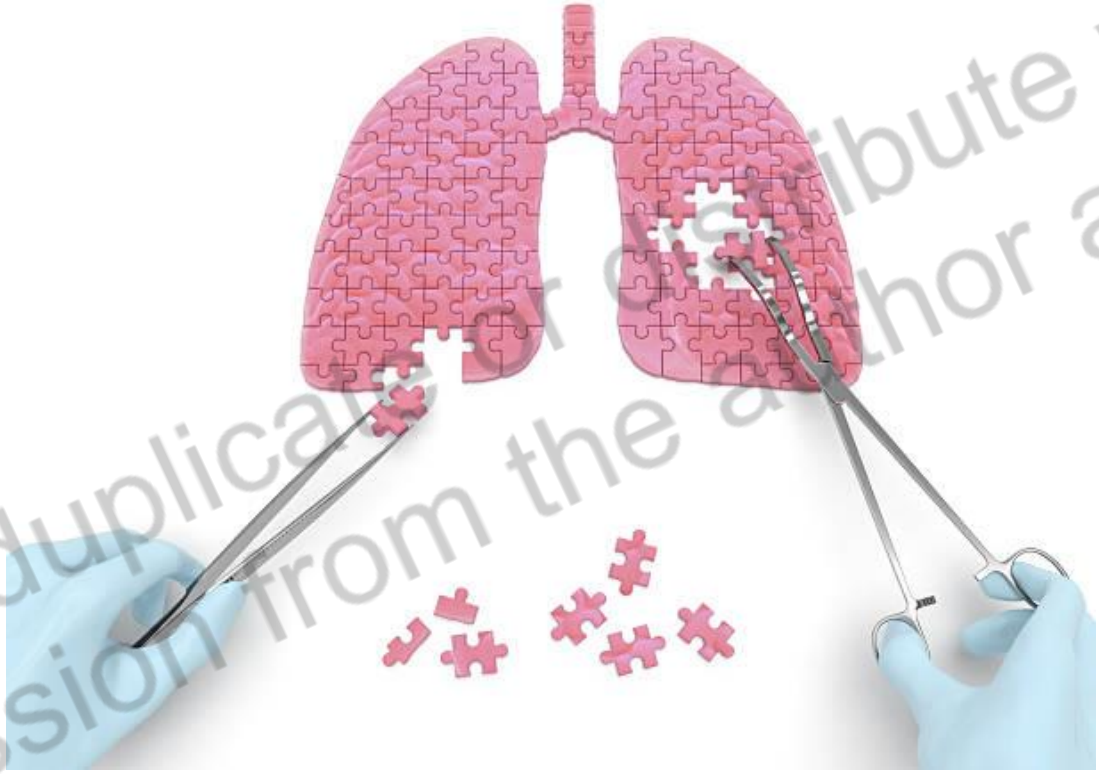
After discharge VATS less serious adverse events and lower readmission rates (VATS 29.0% vs. Open 35.9% respectively) to one-year.

VATS versus open lobectomy in patients with early-stage lung cancer: One-year results from a randomized controlled trial (VIOLET)

Those requiring post-op adjuvant chemotherapy-
no difference in the time to uptake of adjuvant chemotherapy.

Recurrence, Progression-free survival and Overall survival at 1-year was ***not*** different in VATS and open groups.

Is Less the new More for Lung cancer



How Much to Resect ?

Lobectomy: Gold Standard: 1980s till recently …..

Randomized Trial of Lobectomy Versus Limited Resection for T1 N0 Non–Small Cell Lung Cancer

Lung Cancer Study Group (Prepared by Robert J. Ginsberg, MD, and Lawrence V. Rubinstein, PhD)

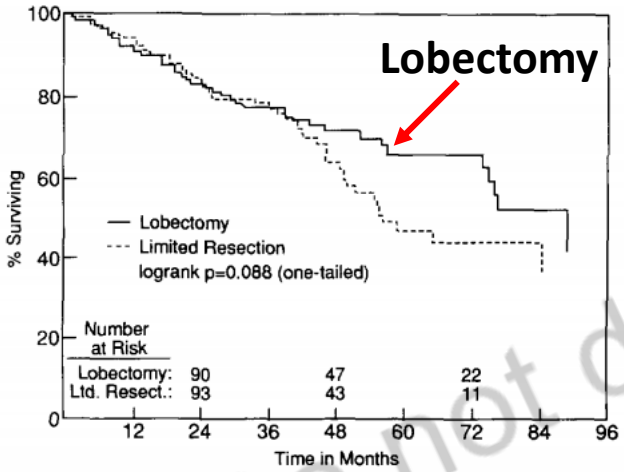


Fig 1. Time to death (from any cause) by treatment for 247 eligible patients.

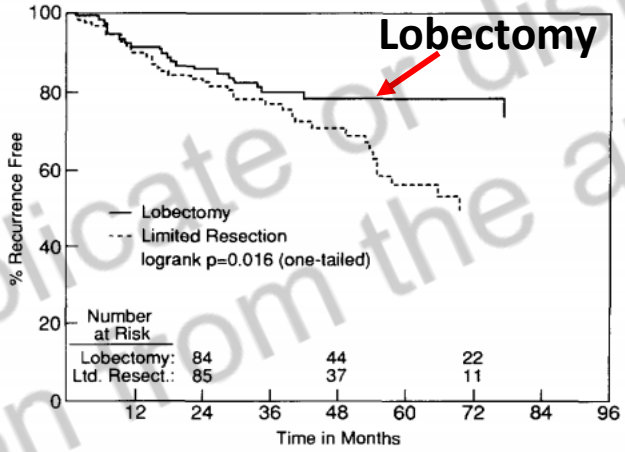


Fig 2. Time to recurrence (excluding second primaries) by treatment for 247 eligible patients.

- only RCT conducted during 1982-1988 [LCSG trial]

Some of the many criticisms

- CT scan not routine & no PET (some cases only had CXR)
- 25% squamous cell lung CA
- Most " limited resections" were simple wedge
- Stage migration, resection margin not reported

BRIEF REPORT

Comparison of Segmentectomy and Lobectomy in Stage IA Adenocarcinomas

Ze-Rui Zhao, MD,[a] Dong-Rong Situ, MD,[b] Rainbow W. H. Lau, MbChB.,[a] Tony S. K. Mok, MD, FRCPC,[c] George G. Chen, PhD,[a] Malcolm J. Underwood, MD,[a] Calvin S. H. Ng, MD[a,*]

[a]*Division of Cardiothoracic Surgery, Department of Surgery, The Chinese University of Hong Kong, Prince of Wales Hospital, Hong Kong Special Administrative Region, People's Republic of China*
[b]*State Key Laboratory of Oncology in Southern China, Collaborative Innovation Centre for Cancer Medicine, and Department of Thoracic Surgery, Sun Yat-Sen University Cancer Centre, Guangzhou, People's Republic of China*
[c]*Department of Clinical Oncology, The Chinese University of Hong Kong, Prince of Wales Hospital, Hong Kong Special Administrative Region, People's Republic of China*

Received 16 November 2016; revised 18 December 2016; accepted 9 January 2017
Available online - 19 January 2017

Personalized therapy: Size of tumour
Lobectomy v. segmentectomy v. wedge

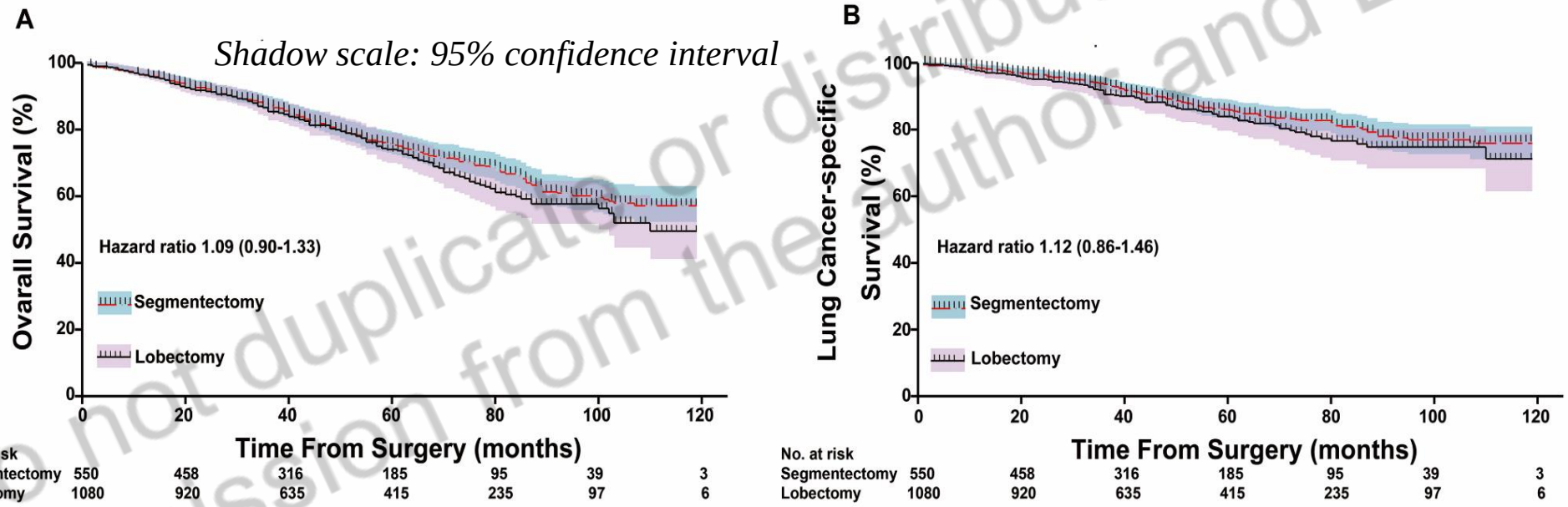
- SEER registry 7989 patients
- Compare survival 8th Ed Stage 1A adenocarcinoma (0-2 cm)

Zhao Z, Situ D, Lau R, Mok T, Chen G, Ng CSH. Comparison of segmentectomy & lobectomy in stage IA adenocarcinomas. *J Thorac Oncol* 2017;12:890-6

Adjusted for age, sex, lymph node quantity, and histology subtypes (Cox proportional model):

segmentectomy (ADCs > 1and ≤ 2cm) was not associated with worse

- **overall survival** (5-y: 74.45% versus 76.67%, HR: 1.09, 95% CI: 0.90–1.33)
- **lung cancer-specific survival** (5-y: 83.89% versus 86.11%, HR: 1.12, 95% CI: 0.86–1.46) ***compared with lobectomy***



Retrospective study: Segmentectomy survival similar to lobectomy for ≤2cm adenoCA

Zhao Z, Situ D, Lau R, Mok T, Chen G, Underwood M, Ng C. Comparison of Segmentectomy & Lobectomy in Stage IA AdenoCA. *J Thorac Oncol* 2017;12:890-6

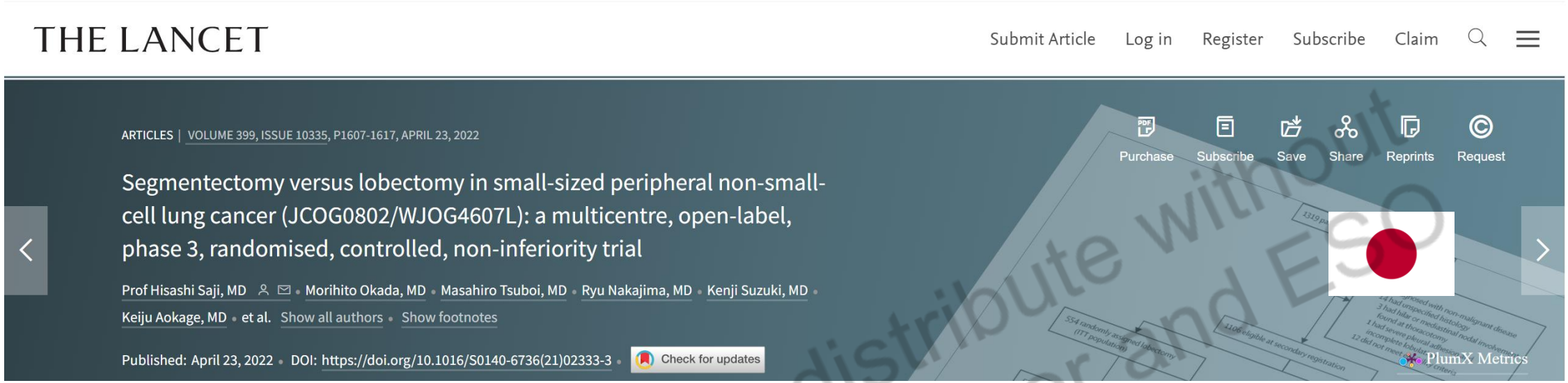
Prospective Randomized trials- Sublobar Resection

JCOG 0802 ● Phase III, RCT, n=1,100 ● Adenocarcinoma ≤2 cm ● GGO with 50-100% solid component		Lobectomy Segmentectomy	End points • OS • Pulmonary function
CALGB 140503 ● Phase III, non-inferior trial, n=1,300 ● Peripheral carcinoma ≤2 cm with negative hilar nodes ● Stratification: smoking, histology, size		Lobectomy Sublobar resection: wedge/seg	End points • Primary: DFS • Secondary: OS, local/systemic recurrence, pulmonary function

Accrual period

JCOG (Japan Clinical Oncology Group) 0802: 2009-2014

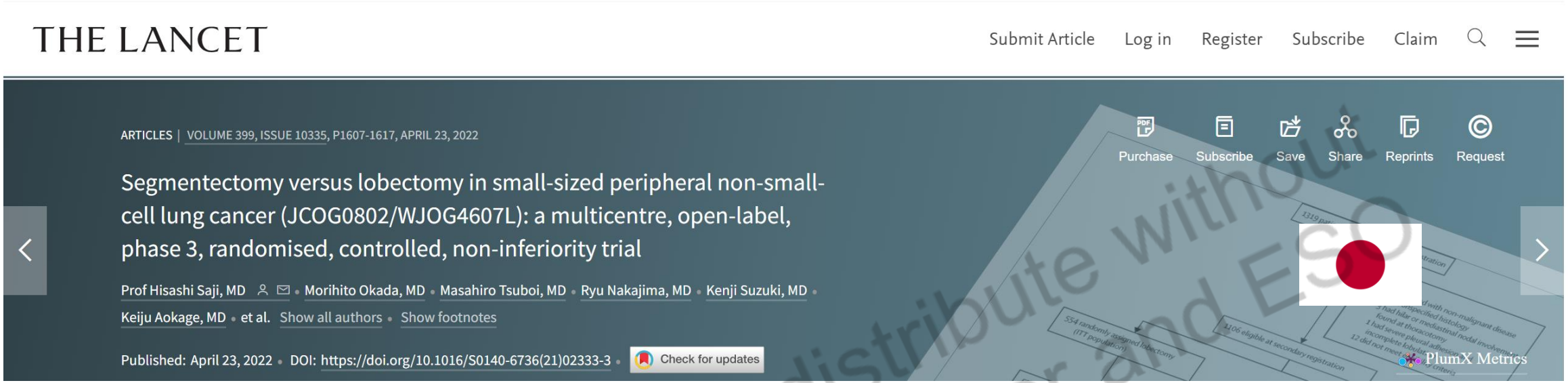
CALGB 140503: 2007-present (ClinicalTrials.gov: Active, non-recruiting) → up to 7-yrs DFS. (2024)



-2009-2014, 1106 patients, randomized segmentectomy v lobectomy (peripheral ≤2cm, C/T ratio ≥0.5)
-Median FU 7.3 years

- No 30-day or 90-day mortality
- Complication rates (grade 2 or worst) same.

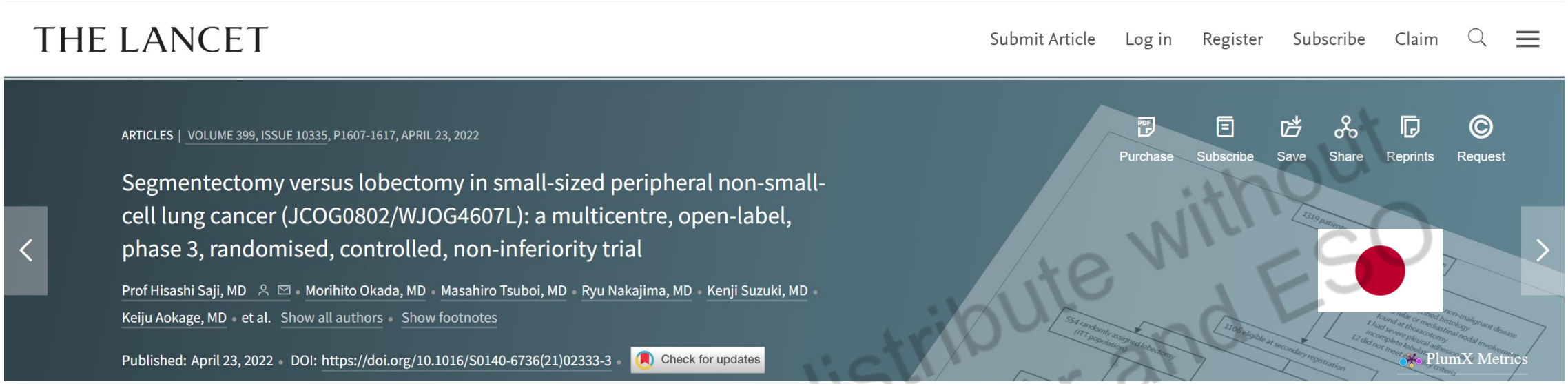
- At 1 year, lung function (FEV1) 3.5% less lobectomy v. segmentectomy



- 5-year overall survival: **94·3% for segmentectomy** versus 91·1% for lobectomy
  (p<0·0001 for non-inferiority; p=0·0082 for superiority)

- Reasons for Deaths: Lobectomy 63% due to other diseases
  Segmentectomy 47% due to other diseases

- 5-year relapse-free survival: 88% for segmentectomy versus 87·9% for lobectomy (p=0·9889)
- Proportion patients with local relapse: 10·5% for segmentectomy versus **5·4% for lobectomy** (p=0·0018)



Conclusion: The Phase III trial show benefits of segmentectomy versus lobectomy in overall survival of patients with small-peripheral NSCLC.

The findings suggest that segmentectomy should be the standard surgical procedure for this population of patients.

PL03 PLENARY 3: PRESIDENTIAL SYMPOSIUM - TOP RATED ABSTRACTS, MONDAY, AUGUST 8, 2022 - 08:30 - 10:20 | VOLUME 17, ISSUE 9, SUPPLEMENT , S1-S2, SEPTEMBER 01, 2022

PL03.06 Lobar or Sub-lobar Resection for Peripheral Clinical Stage IA = 2 cm Non-small Cell Lung Cancer (NSCLC): Results From an International Randomized Phase III Trial (CALGB 140503 [Alliance])

N.K. Altorki • X. Wang • D. Kozono • ... L.J. Kohman • T.E. Stinchcombe • E. Vokes • Show all authors

DOI: https://doi.org/10.1016/j.jtho.2022.07.012 •

The NEW ENGLAND JOURNAL of MEDICINE

ESTABLISHED IN 1812 FEBRUARY 9, 2023 VOL. 388 NO. 6

Lobar or Sublobar Resection for Peripheral Stage IA Non–Small-Cell Lung Cancer

Nasser Altorki, M.D., Xiaofei Wang, Ph.D, David Kozono, M.D., Ph.D., Colleen Watt, B.S., Rodney Landrenau, M.D., Dennis Wigle, M.D., Ph.D., Jeffrey Port, M.D., David R. Jones, M.D., Massimo Conti, M.D., Ahmad S. Ashrafi, M.D., Moishe Liberman, M.D., Ph.D., Kazuhiro Yasufuku, M.D., Ph.D., Stephen Yang, M.D., John D. Mitchell, M.D., Harvey Pass, M.D., Robert Keenan, M.D., Thomas Bauer, M.D., Daniel Miller, M.D., Leslie J. Kohman, M.D., Thomas E. Stinchcombe, M.D., and Everett Vokes, M.D.

Cancer and Leukemia Group B (CALGB) 140503

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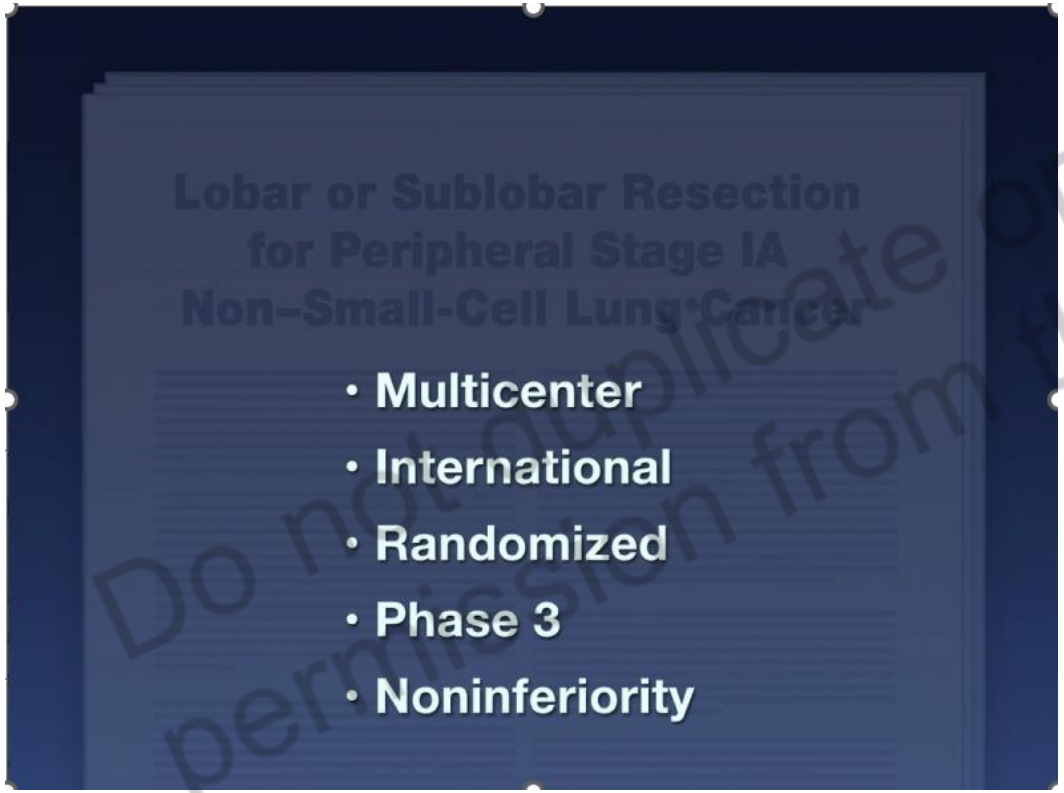
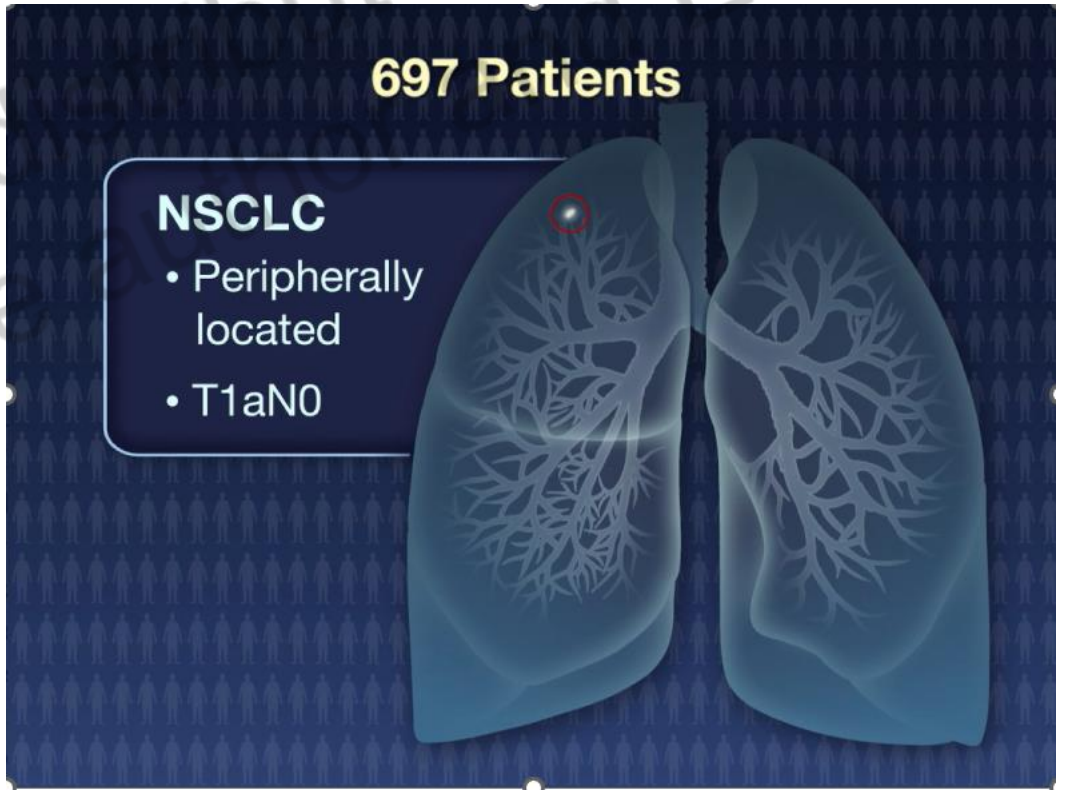
Lobar or Sublobar Resection for Peripheral Stage IA Non–Small-Cell Lung Cancer





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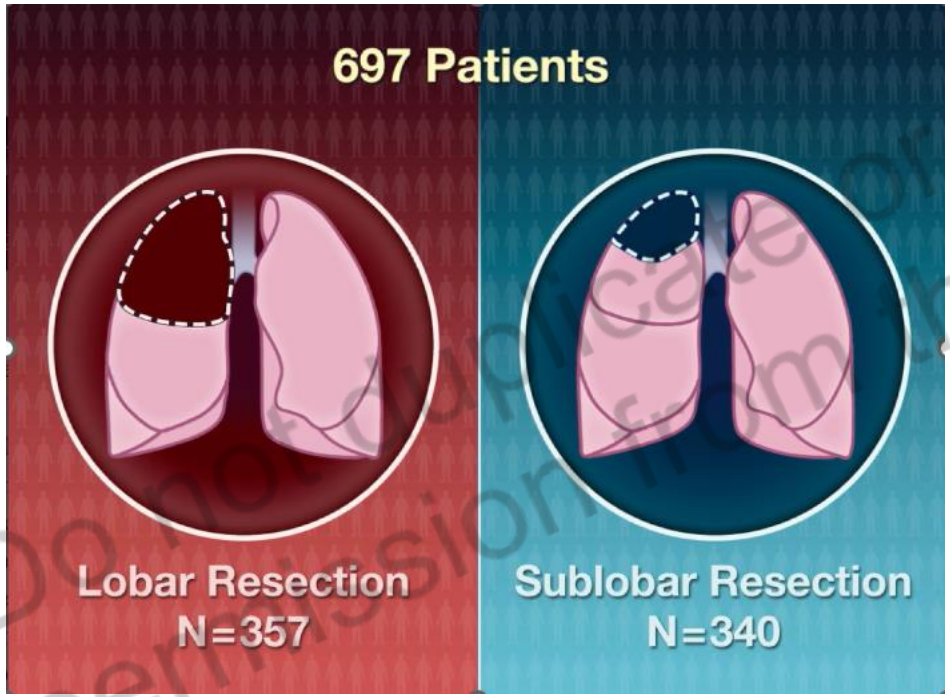

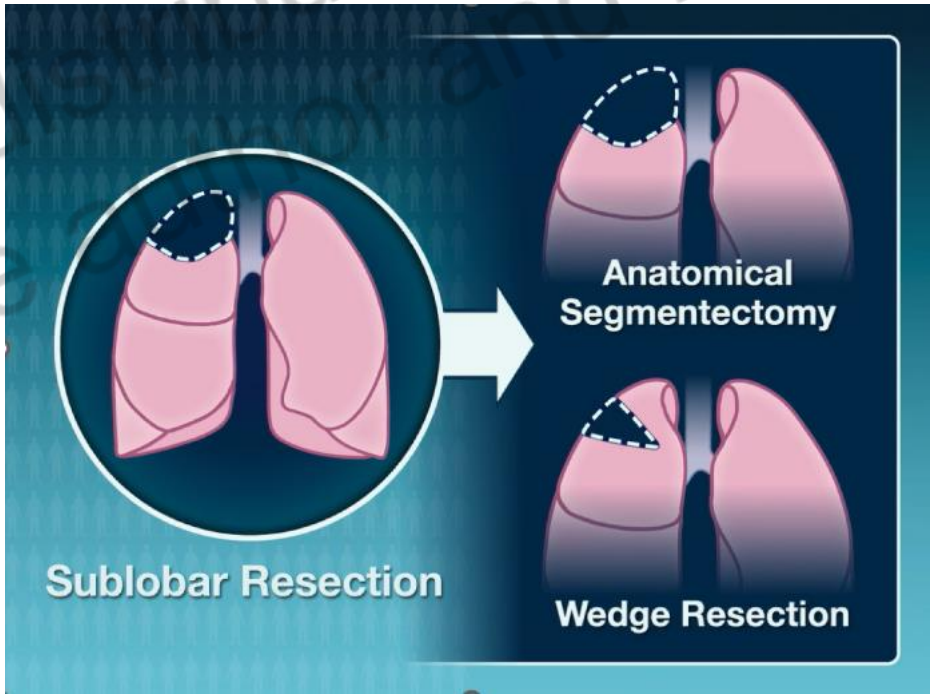

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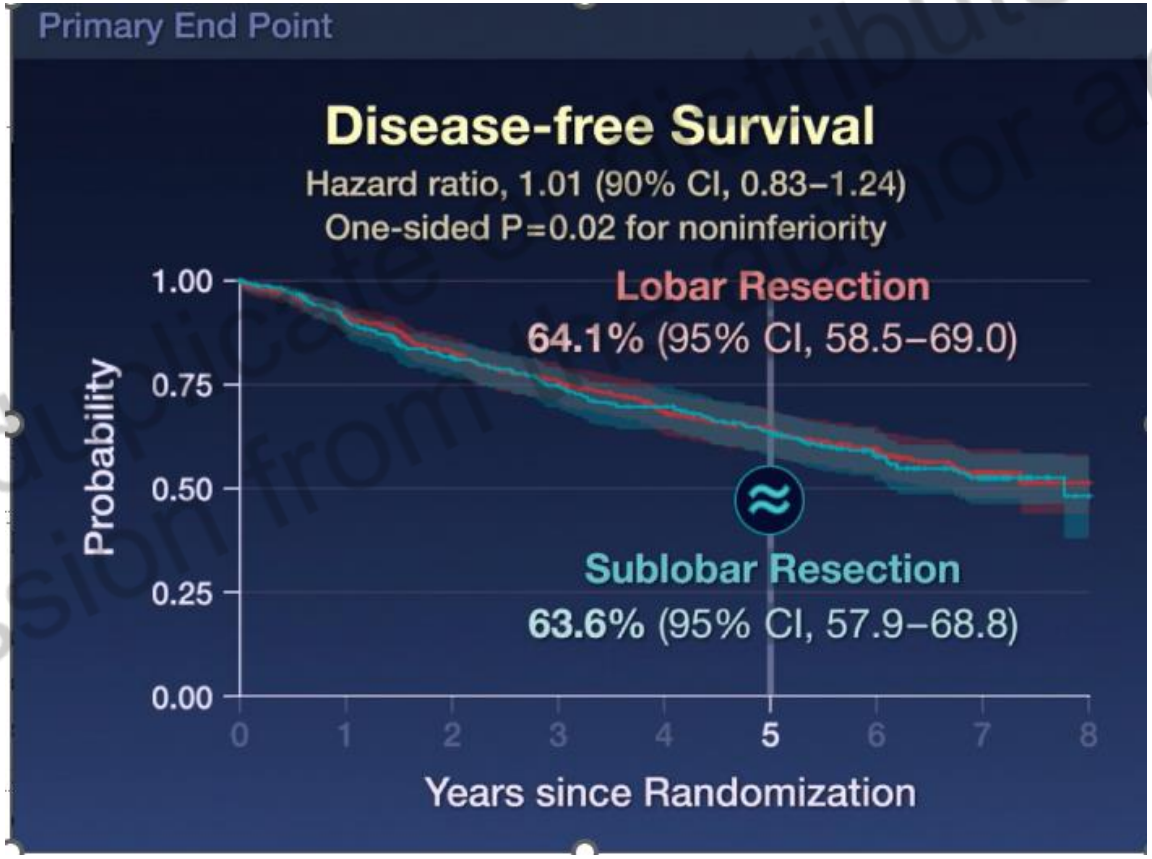

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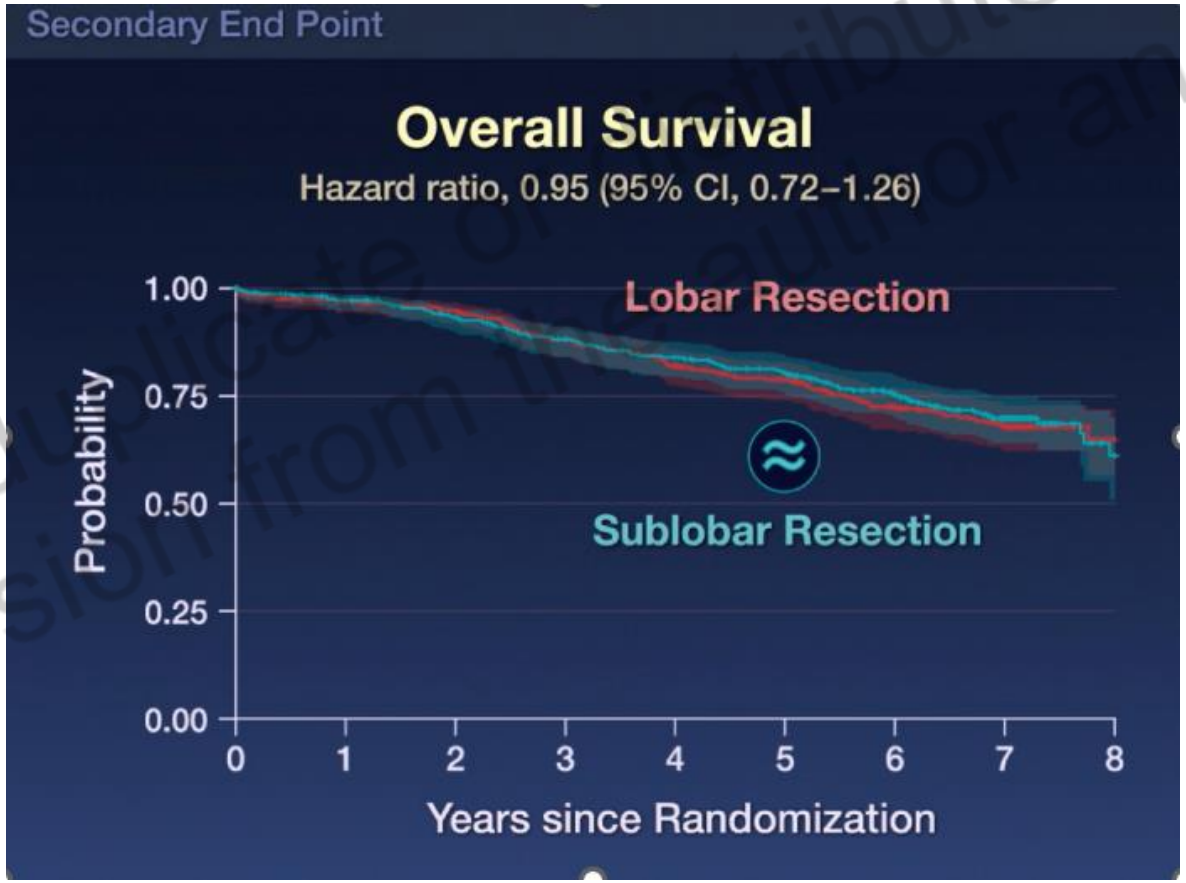

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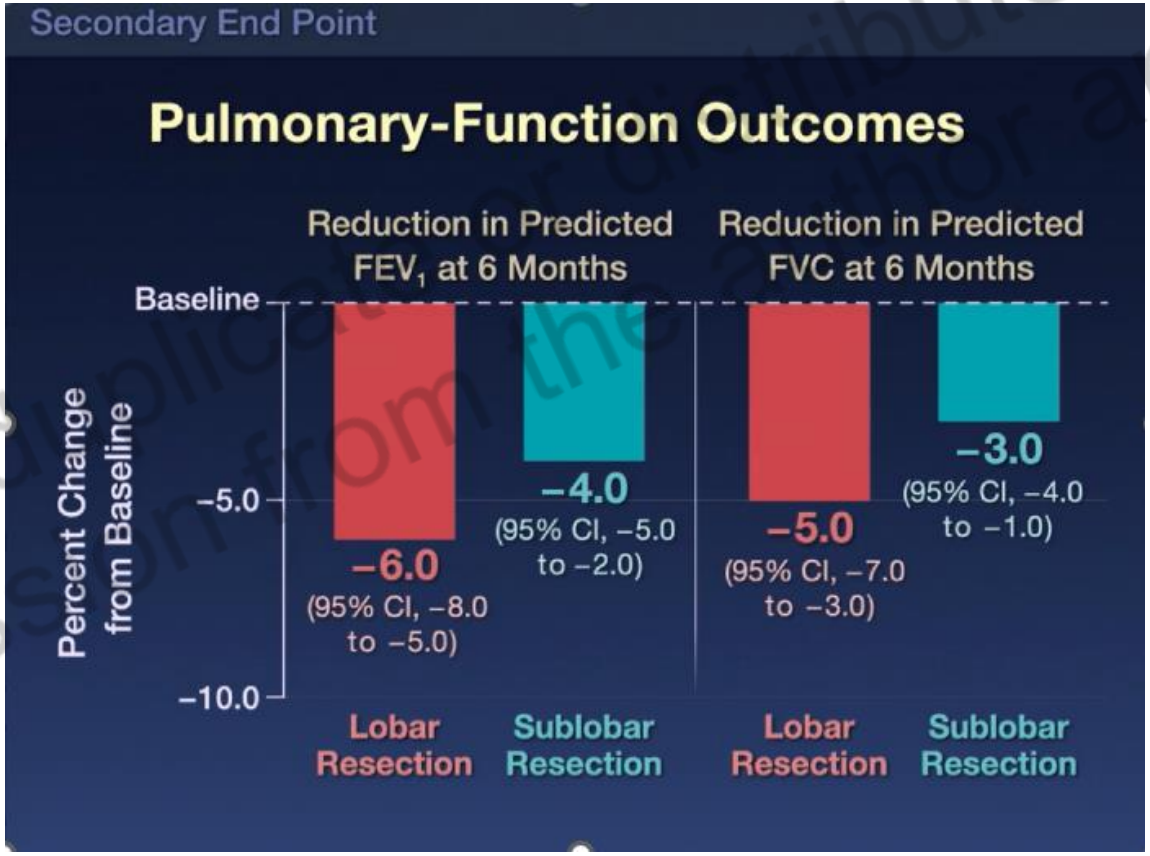

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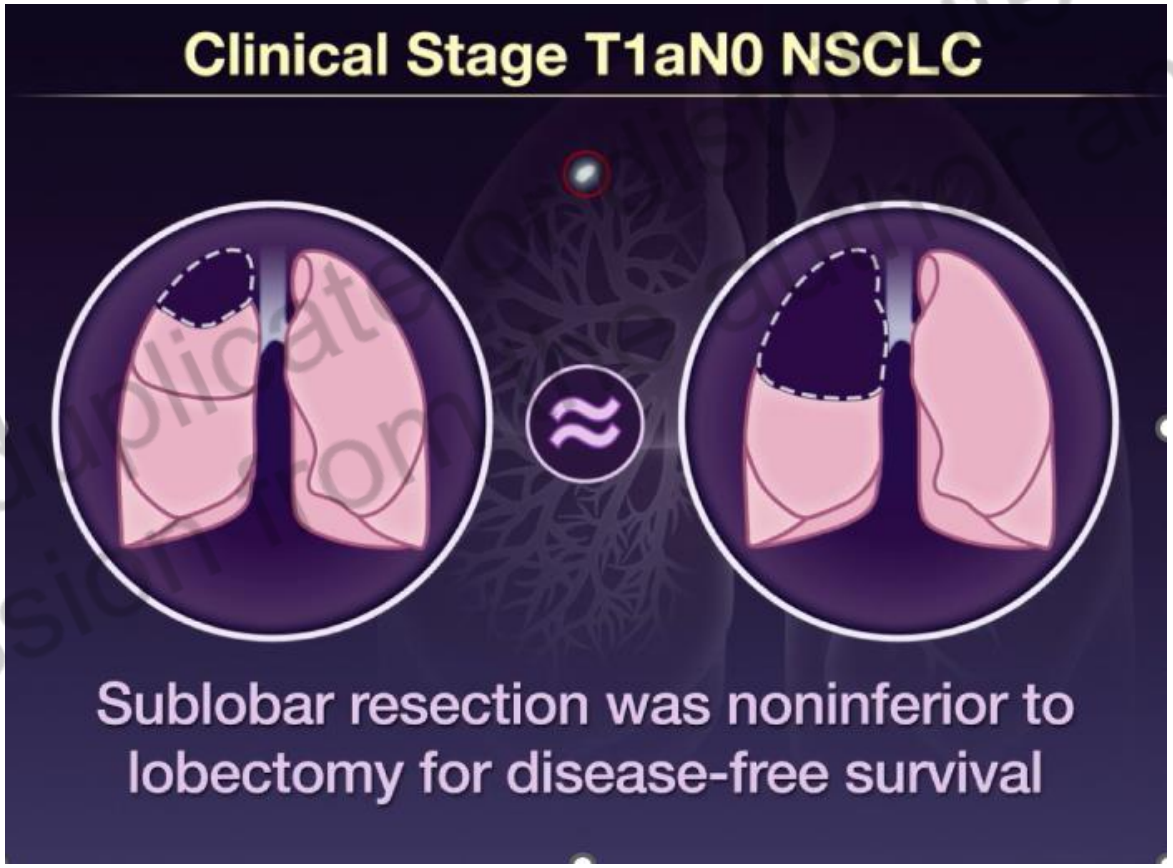
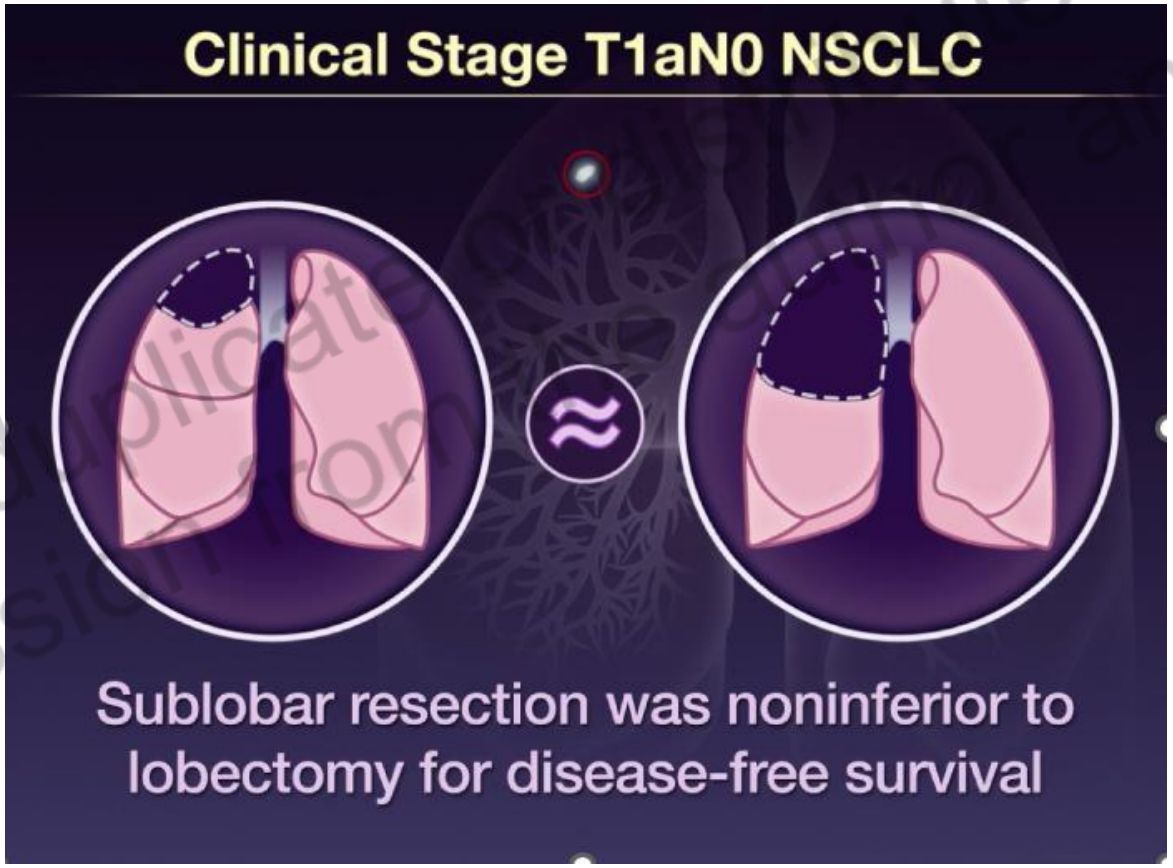


The NEW ENGLAND JOURNAL of MEDICINE

ESTABLISHED IN 1812 FEBRUARY 9, 2023 VOL. 388 NO. 6

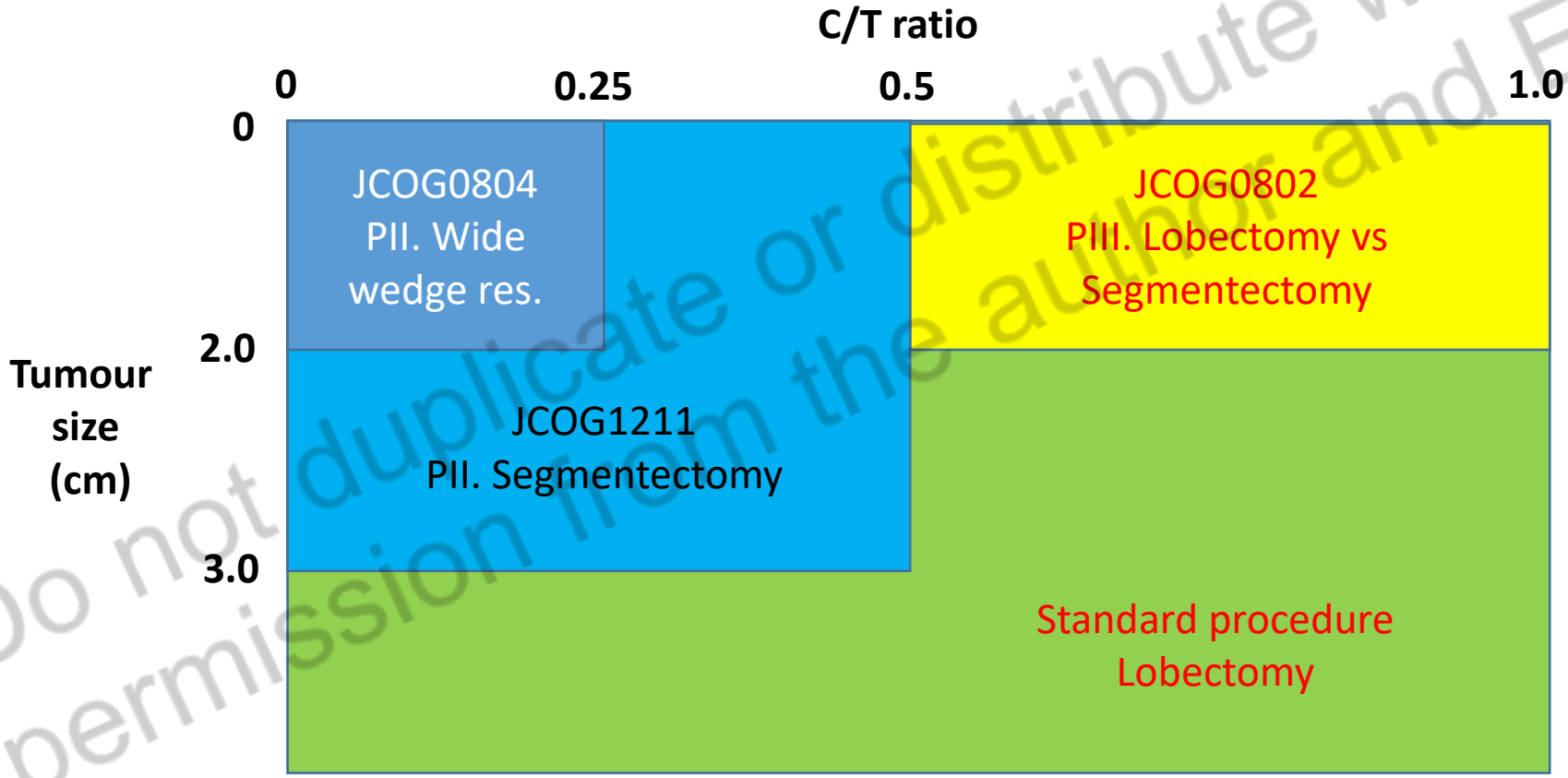
Lobar or Sublobar Resection for Peripheral Stage IA Non–Small-Cell Lung Cancer

- **The sublobar resection group, nearly half had wedge resection (rather than segmentectomy)**

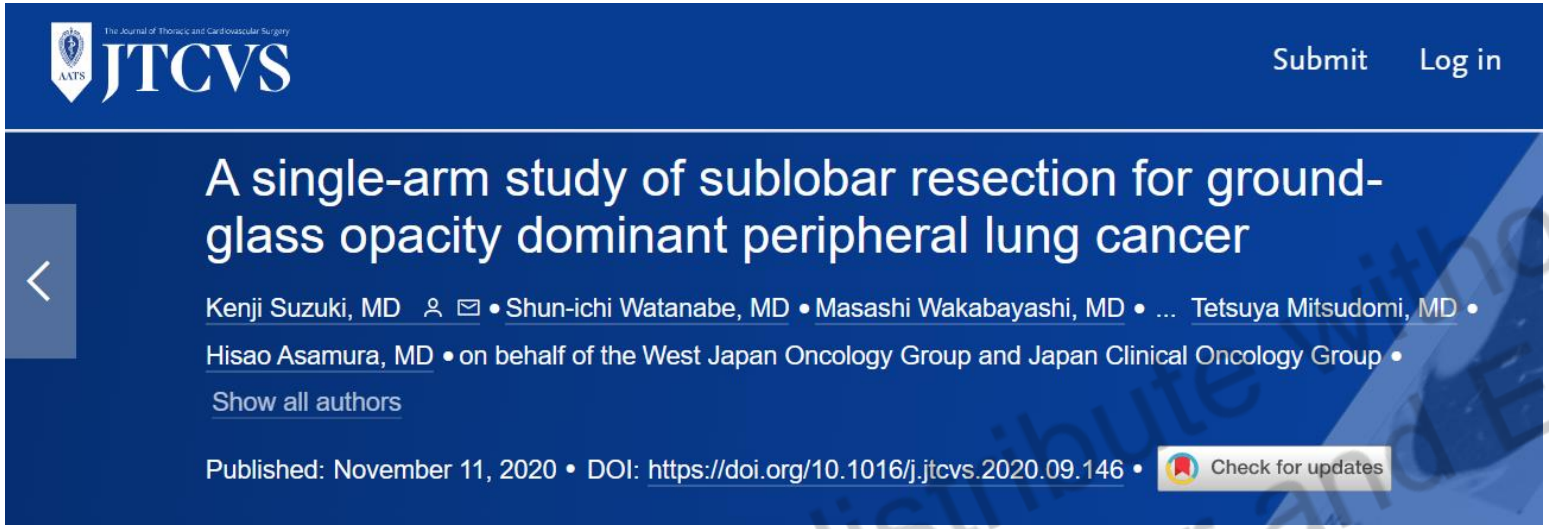


- **?? Can smaller select lung cancers be wedged and achieve similar outcomes as segmentectomy or lobectomy ??**
- **→ Other trials going …..**

Surgical Resection:
Sublobar resection
C/T ratio ≈ Solid : GGO ratio



Modified & Courtesy of Korean & Japanese Surgeons

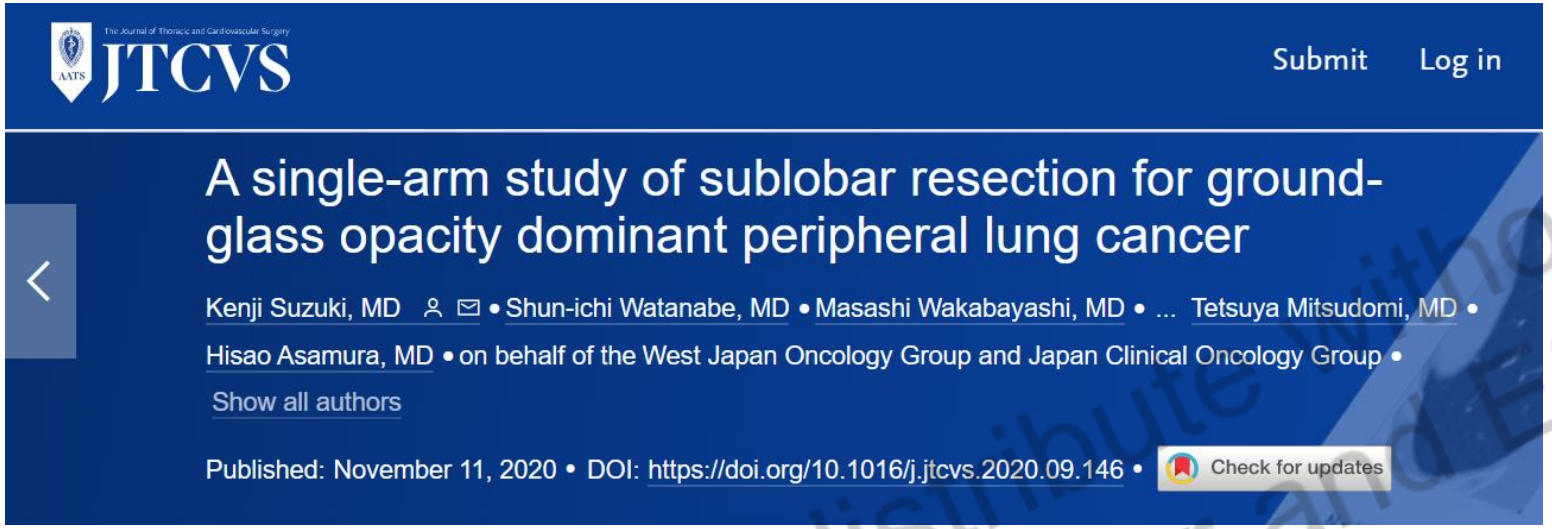


- Evaluate efficacy and safety of sublobar resection for GGO dominant peripheral lung cancer

- Lung cancer ≤ 2.0 cm consolidation tumor ratio ≤ 0.25.

- May 2009 and April 2011, 314 CA lung patients underwent sublobar resection (258 wide wedge resections and 56 segmentectomies)

Suzuki K, et al.. A single-arm study of sublobar resection for ground-glass opacity dominant peripheral lung cancer. *J Thorac Cardiovasc Surg.* (2020) 163:289–301



- Median max. tumor Ø 1.2 cm (1.00-1.54) Median max. tumor Ø of consolidation 0 (0.00-0.20)

- Median pathological surgical margin 15 mm (0-55)

Suzuki K, et al.. A single-arm study of sublobar resection for ground-glass opacity dominant peripheral lung cancer. *J Thorac Cardiovasc Surg.* (2020) 163:289–301

JTCVS
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A single-arm study of sublobar resection for ground-glass opacity dominant peripheral lung cancer

Kenji Suzuki, MD • Shun-ichi Watanabe, MD • Masashi Wakabayashi, MD • ... Tetsuya Mitsudomi, MD • Hisao Asamura, MD • on behalf of the West Japan Oncology Group and Japan Clinical Oncology Group •

- **5-year relapse-free survival 99.7%**
- There was **no local relapse**.
- Grade 3 or higher CTCAE v3.0 postop complications in 17 pts (5.4%), without any grade 4 or 5.

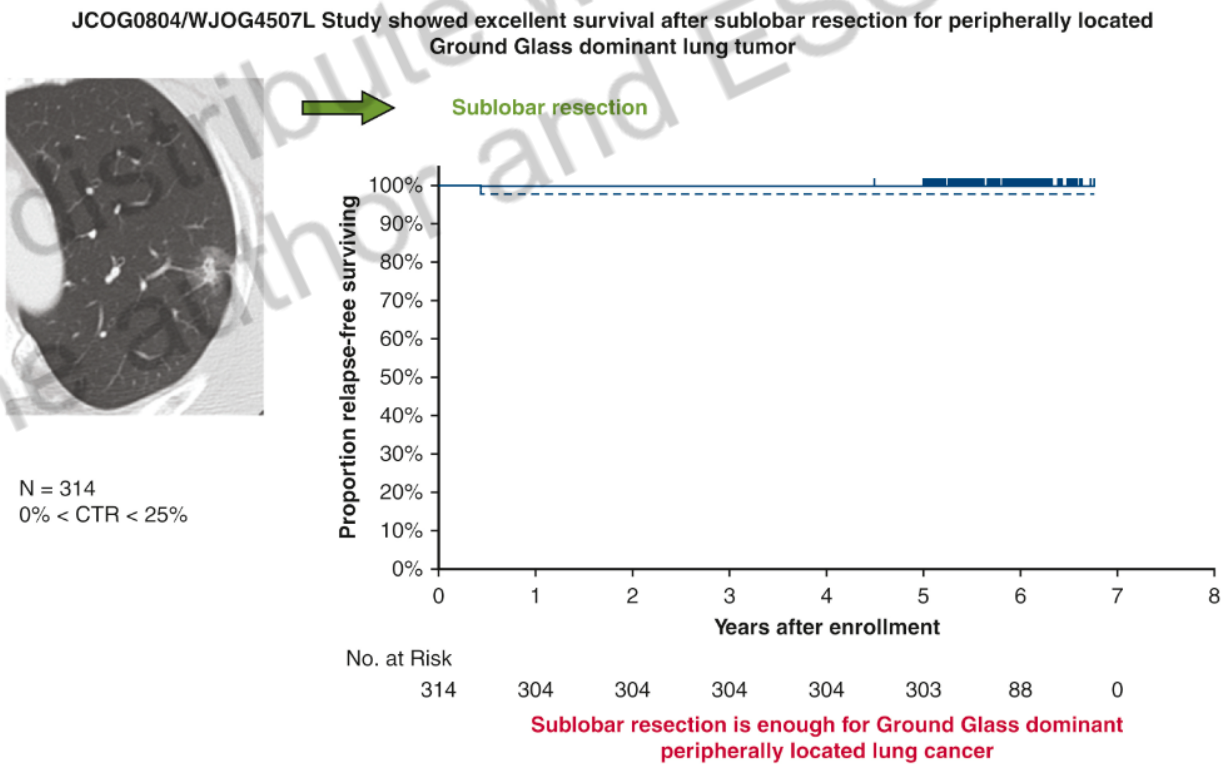
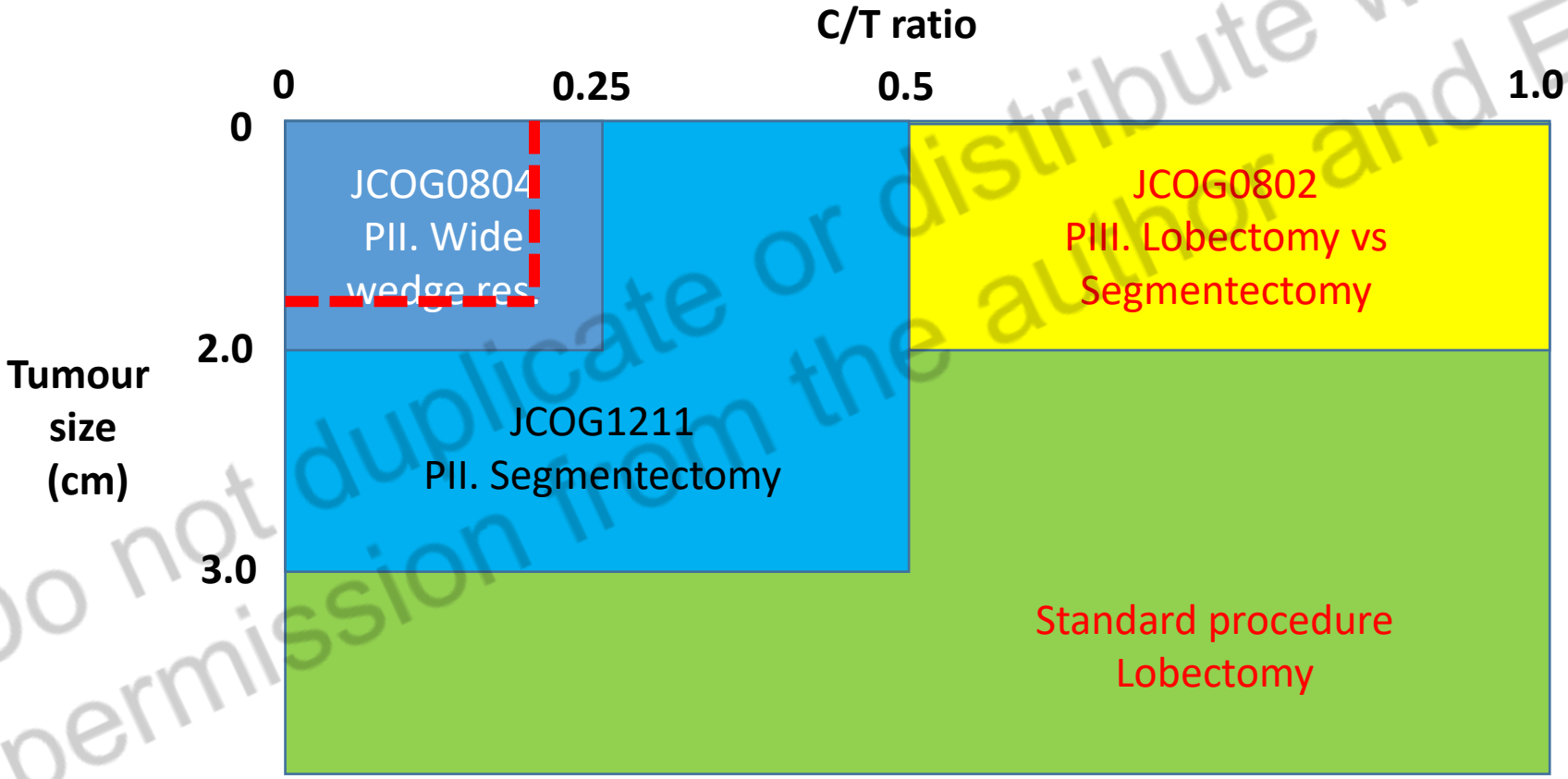


Figure 2

The 5-year relapse free survival for all patients except benign lesions and atypical adenomatous

Suzuki K, et al.. A single-arm study of sublobar resection for ground-glass opacity dominant peripheral lung cancer. *J Thorac Cardiovasc Surg.* (2020) 163:289–301

Surgical Resection:
Sublobar resection
C/T ratio ≈ Solid : GGO ratio



Modified & Courtesy of Korean & Japanese Surgeons

Wedge resection

ELSEVIER

The Journal of Thoracic and Cardiovascular Surgery

Volume 163, Issue 2, February 2022, Pages 456-464

Thoracic: Lung Cancer

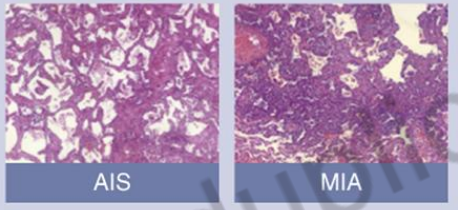
Surgery for pre- and minimally invasive lung adenocarcinoma

Yang Zhang MD [a, b, c], Xiangyi Ma MD [a, b, c], Xuxia Shen MD [b, c, d], Shengping Wang MD [b, d, e], Yuan Li MD [b, c, d], Hong Hu MD [a, b, c], Haiquan Chen MD, PhD [a, b, c]

Surgery for pre- and minimally invasive lung adenocarcinoma

Methods

- Retrospective cohort of 1644 resected AIS/MIA, 2012-2017.



- Date collection

Clinical characteristics

Radiological features

Surgical types & complications

Survival outcomes

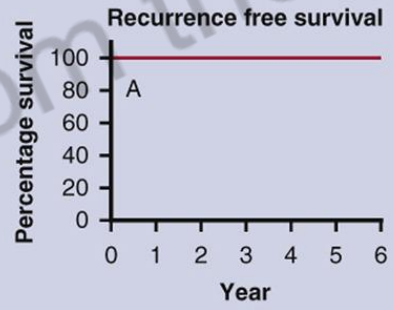
Results

- Unique cohort

74.1% Women

84.4% Non-smokers

- 100% 5-year RFS



- Wedge resection group: less surgical complications (1.0%) compared with segmentectomy (3.3%) and lobectomy (5.6%).

Implications

- Sublobar resection, especially wedge resection without lymph node dissection may be the preferred surgical procedure for patients with AIS/MIA.
- If there are no risk factors, postoperative follow-up intervals may be extended.

AIS, adenocarcinoma in situ; MIA, minimally invasive adenocarcinoma; RFS, recurrence-free survival.

Wedge resection (local therapy)

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Surgery for pre- and minimally invasive lung adenocarcinoma

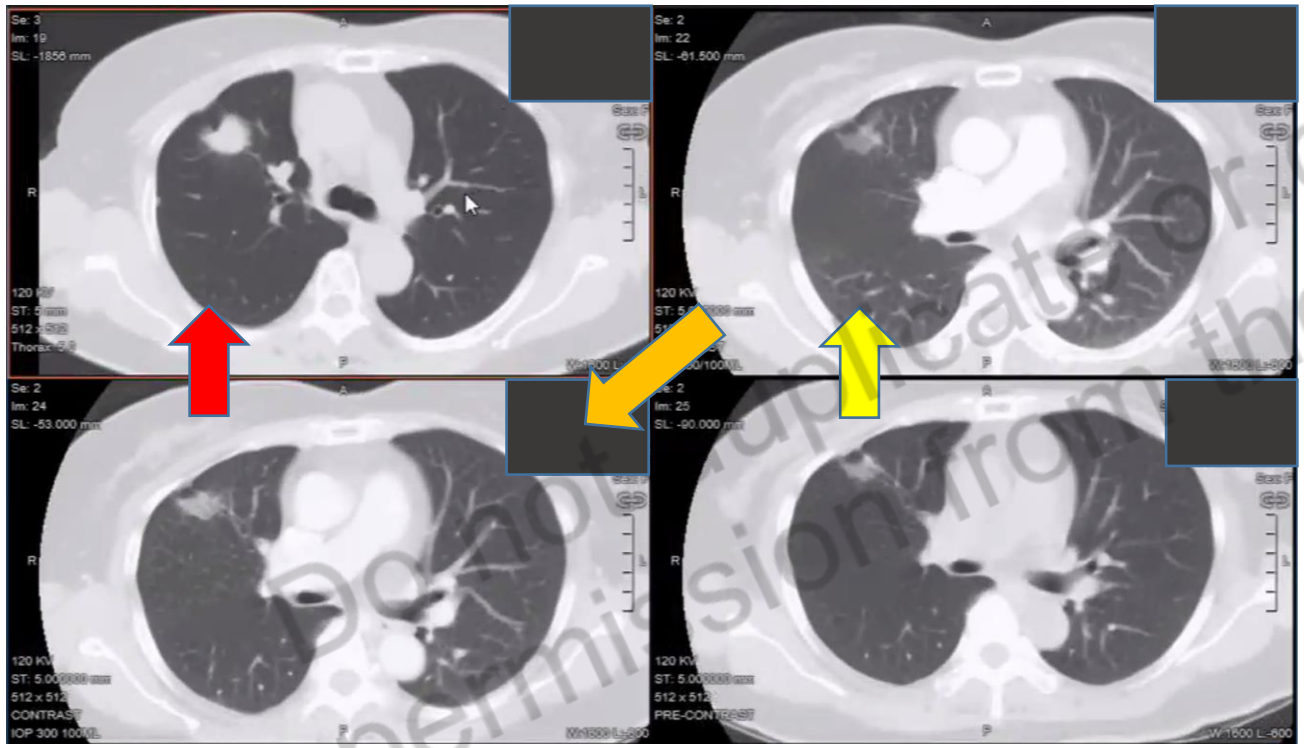
Yang Zhang MD [a, b, c], Xiangyi Ma MD [a, b, c], Xuxia Shen MD [b, c, d], Shengping Wang MD [b, d, e], Yuan Li MD [b, c, d], Hong Hu MD [a, b, c], Haiquan Chen MD, PhD [a, b, c]

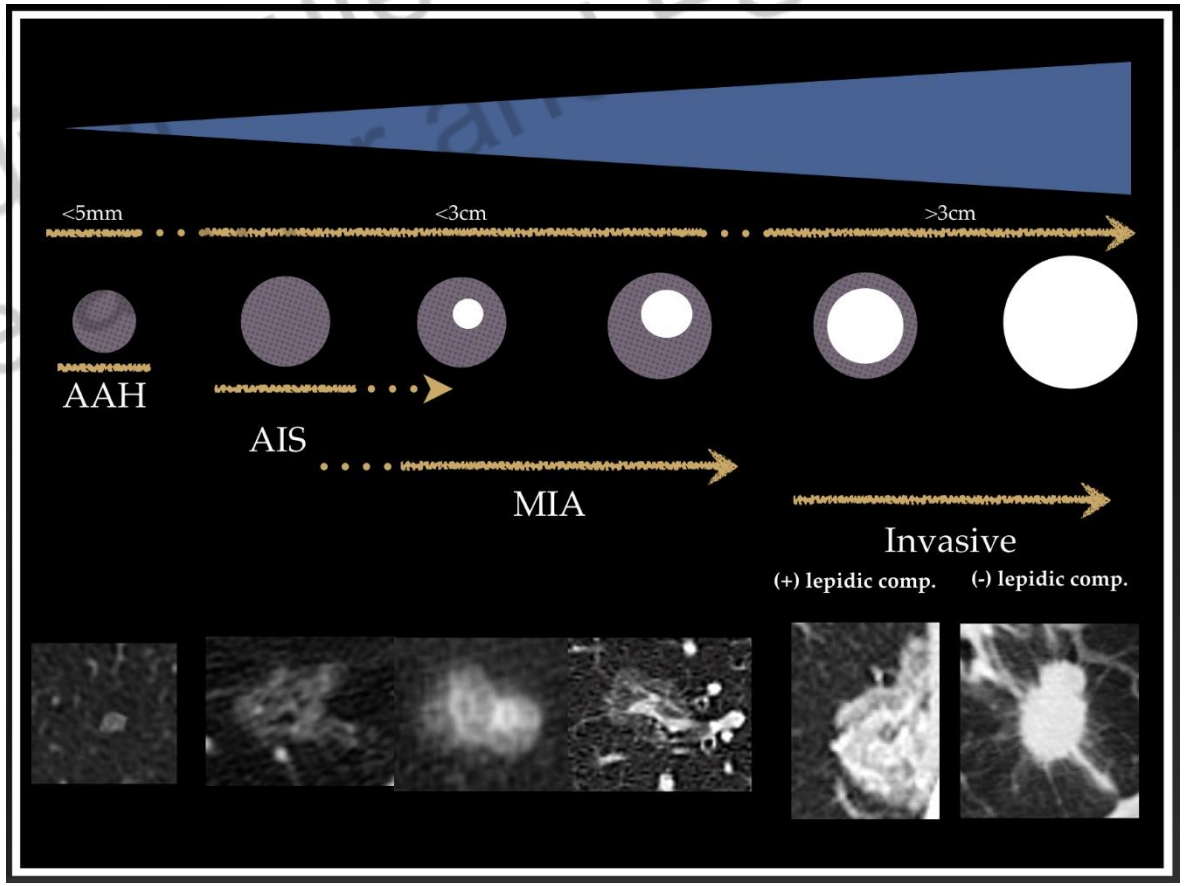
TABLE 1. Characteristics of 1644 patients with adenocarcinoma in situ (AIS) or minimally invasive adenocarcinoma (MIA)

Characteristic	Total (N = 1644)	AIS (n = 422)	MIA (n = 1222)
CT size (mm)	9.0 (7.0-11.0)	8.0 (6.3-9.0)	9.0 (7.0-12.0)
CT GGO component (%)			
Pure GGO	1254 (76.3)	364 (86.3)	890 (72.8)
Part-solid GGO	372 (22.6)	56 (13.3)	316 (25.9)
Solid	18 (1.1)	2 (0.5)	16 (1.3)

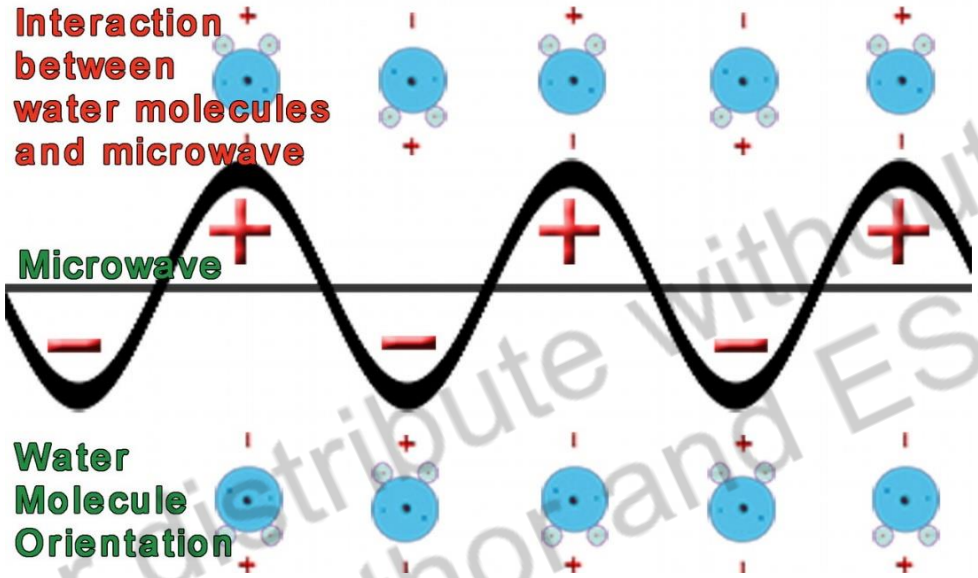
Indications: *The Future* – Transbronchial Microwave Ablation

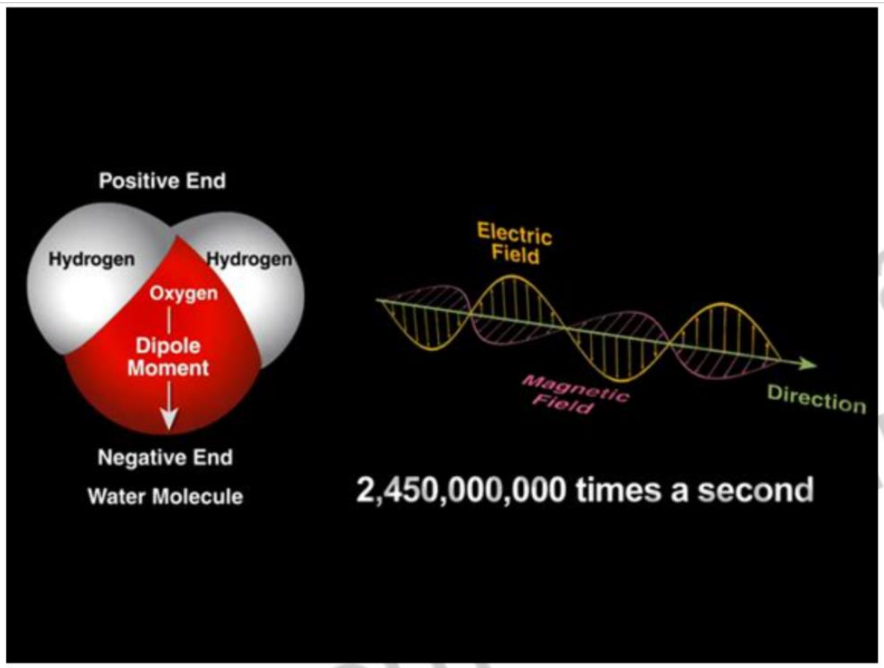
Lung Adenocarcinoma Sequence



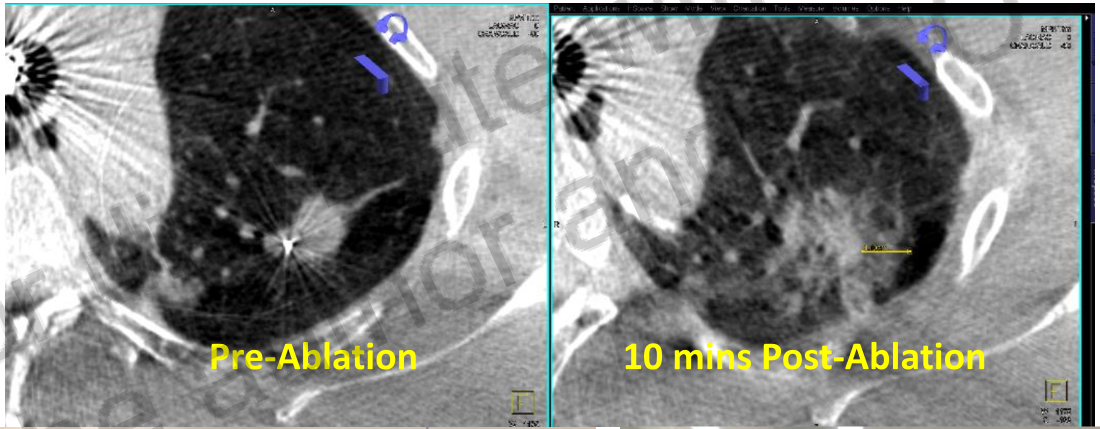


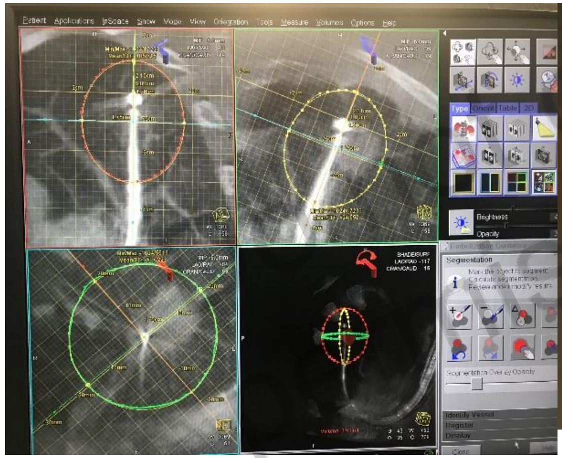
Microwave Ablation

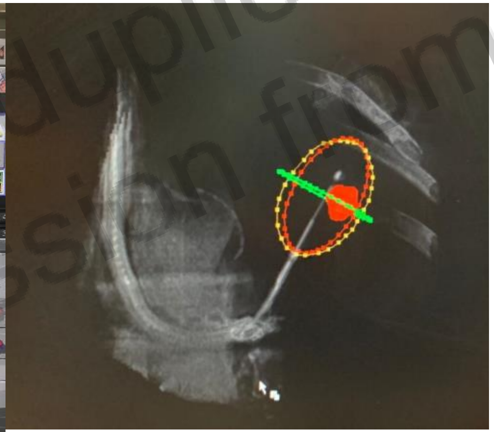




Our First Hybrid OR CBCT Guided bronchoscopic microwave ablation of lung cancer, March 2019





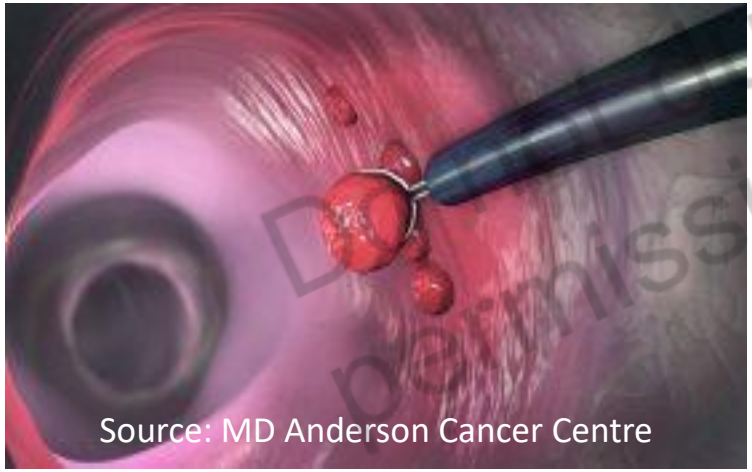


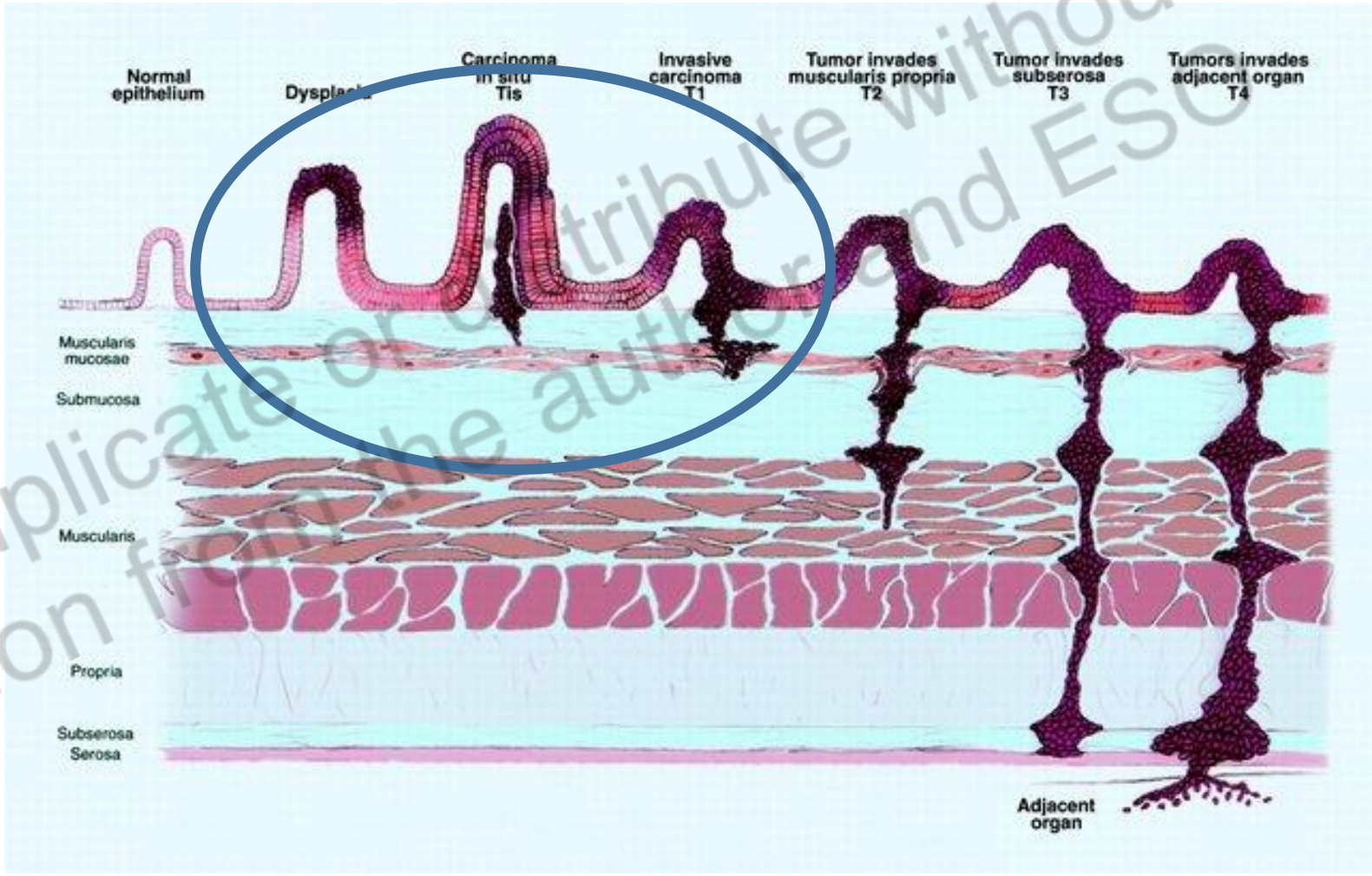
Colorectal Adenocarcinoma Sequence

Indications

Colonoscopy
Local treatment

Polypectomy
ESD





Iyer RB et al. Imaging in the Diagnosis, Staging, and Follow-Up of Colorectal Cancer. Am J Roent. 2002;179: 3-13

Complications

Lung ablation- our updated data (unpublished): (n=124)

- Pneumothorax ≈ 3.4%
- Effusion require drainage ≈ 1.7%
- Infection ≈ 2.6%
- Bleeding ≈ 0.9%

- Recurrence ≈ 6%
- 30-day mortality 0%
- Mortality related to ablation 0%

Therapeutic Colonoscopy:

- Perforation rate 0.04 – 0.2% (assoc. 7-25% mortality)

- Bleeding 0.98 -6.1%
- Others: pain , Post-polypectomy syndrome (PPS), bacteraemia etc

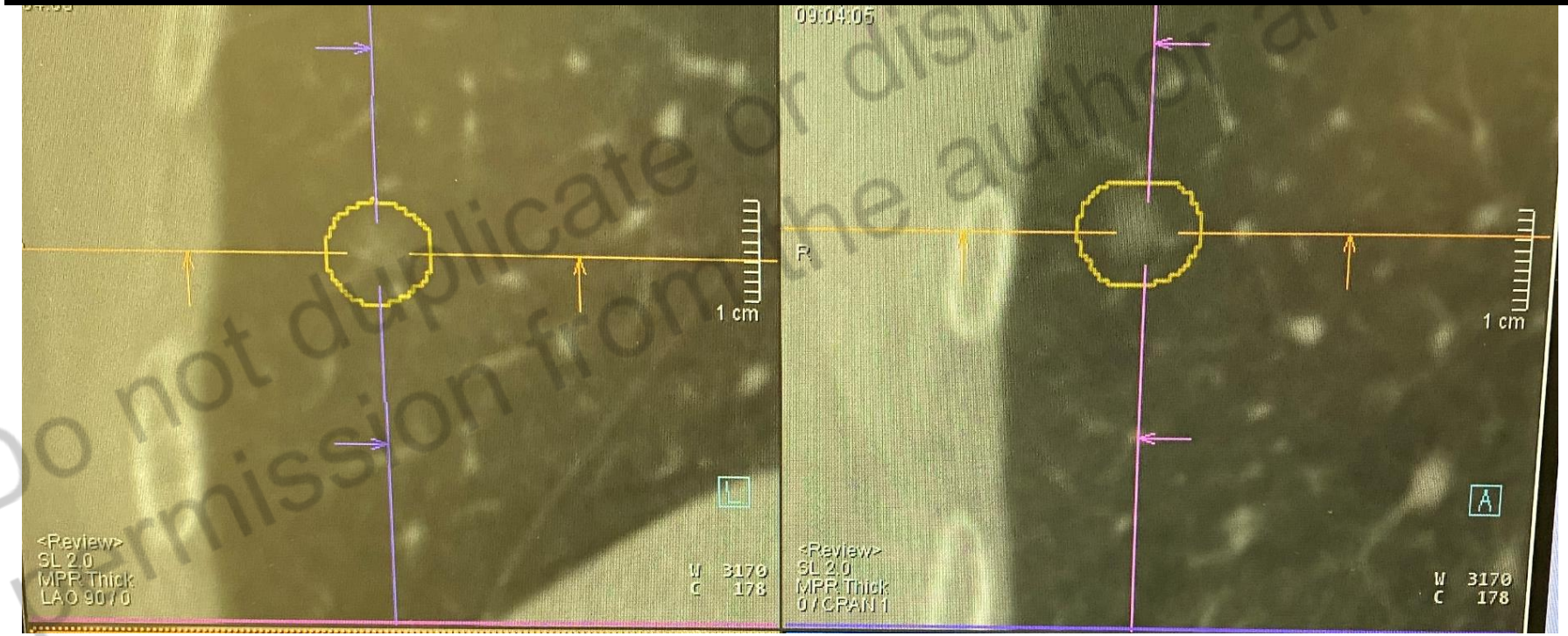
- Mortality related to colonoscopy 0.007-0.7%

Kim et al. World J Gastroenterol. 2019 Jan 14; 25(2): 190–204

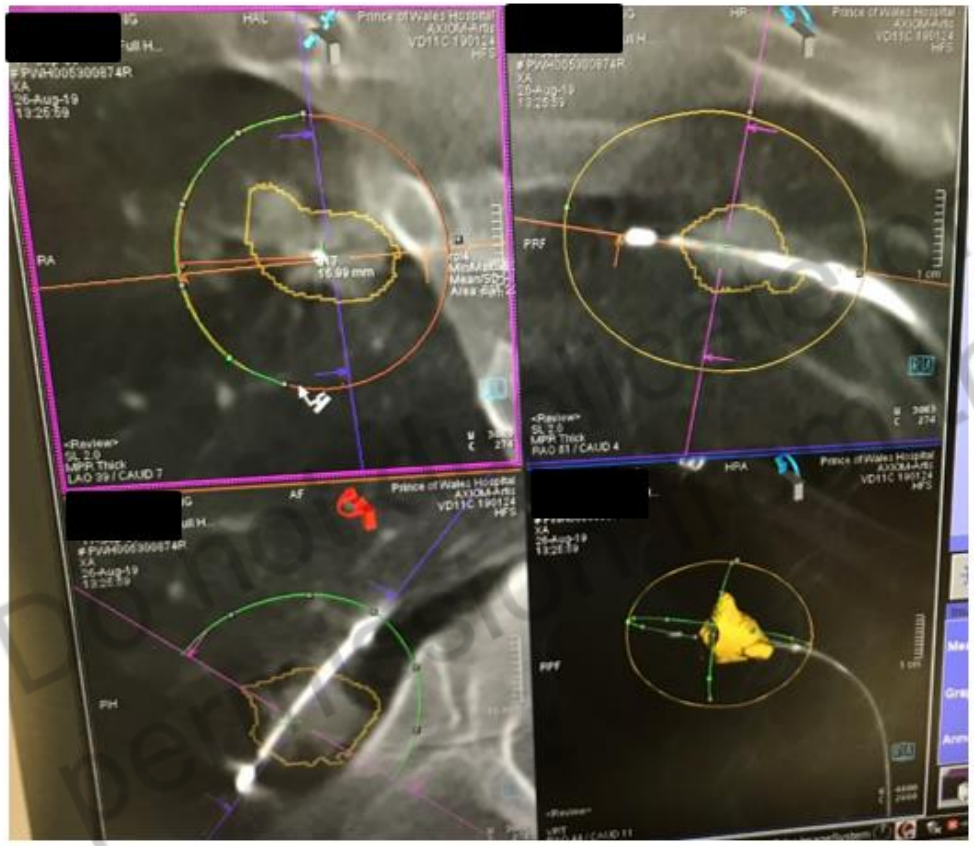
Indications
Why are we not ablating, treating & curing ?

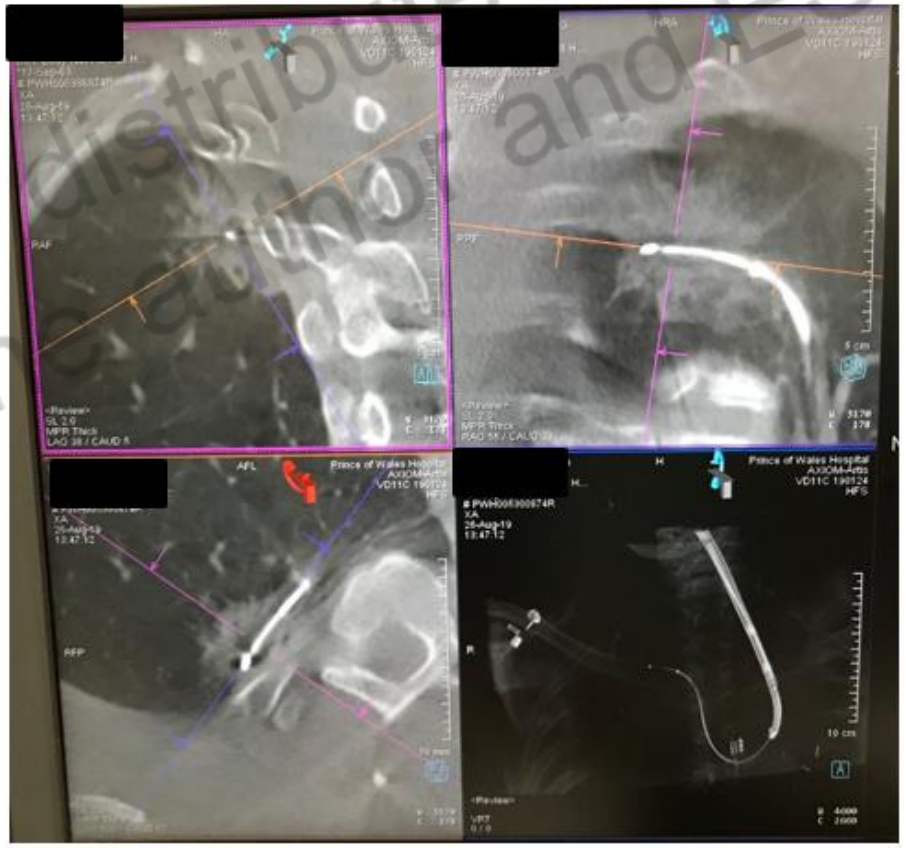
8mm GGO:

Biopsy: atypia, cannot exclude AIS/ MIA, Molecular: EGFR L858+



Case B: 55/M, Post Lt Pneumonectomy
RUL Bx proven SqCC 1.5cm





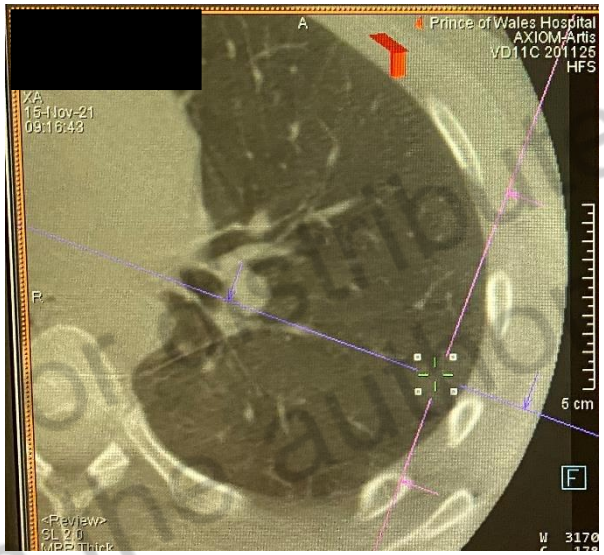
Case Background: 40-yr-old/ F. Multifocal Lung Adenocarcinoma
Hx of RLL lobectomy & RUL segmentectomy

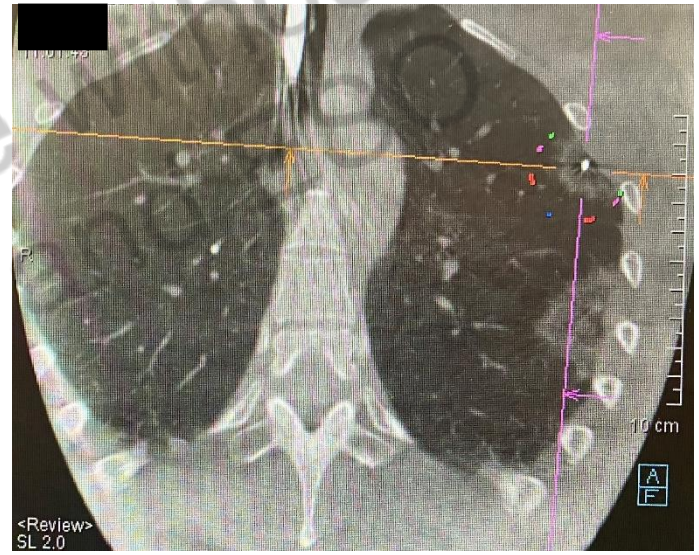
Recent & persistent:

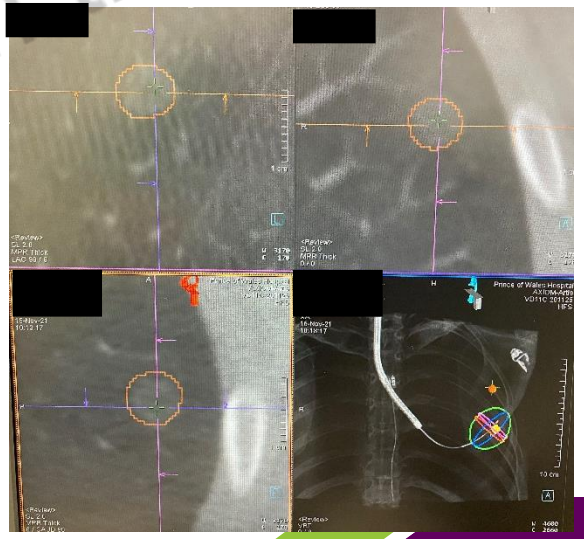
LLL <1 cm pure GGO

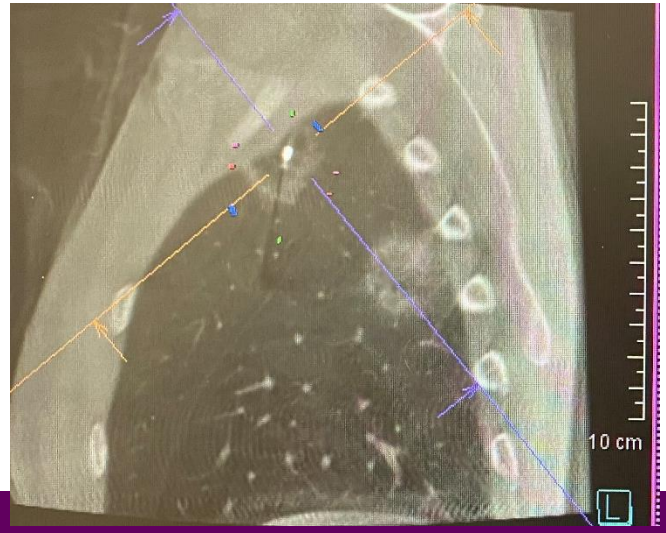
LUL <1 cm pure GGO

Solution:
Transbronchial microwave ablation

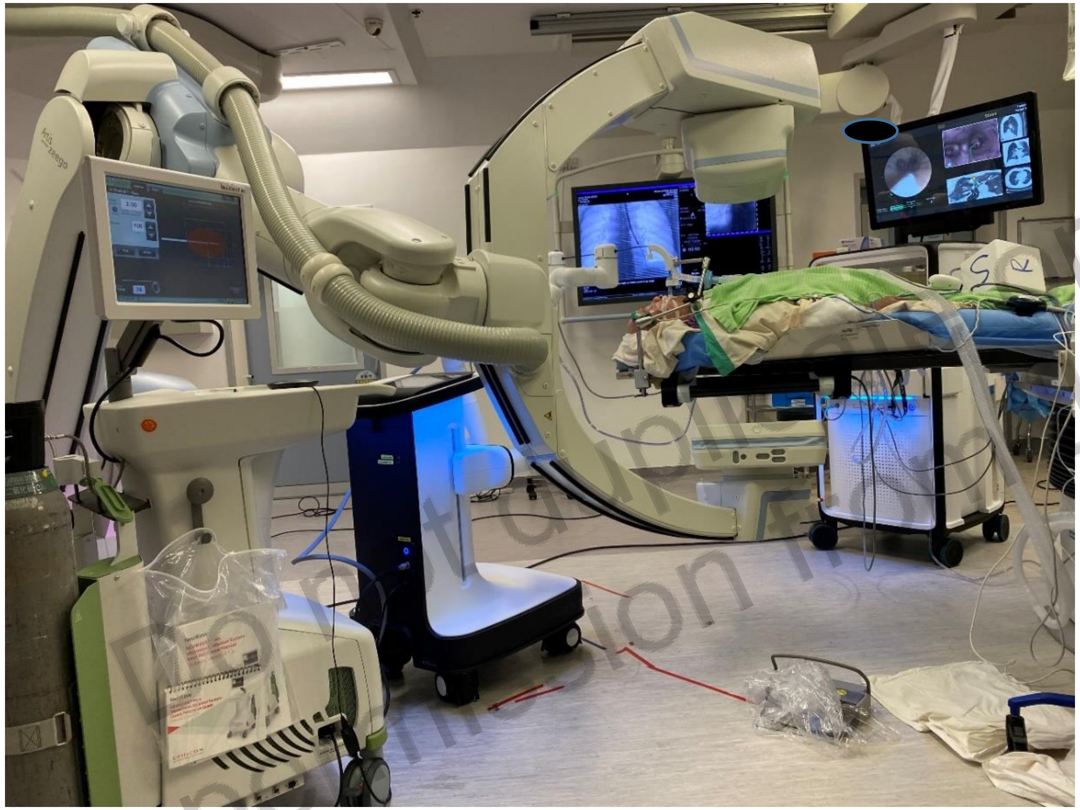


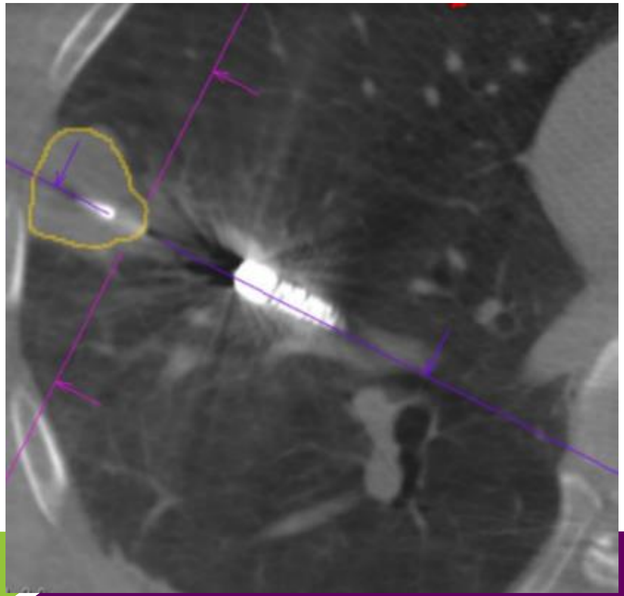






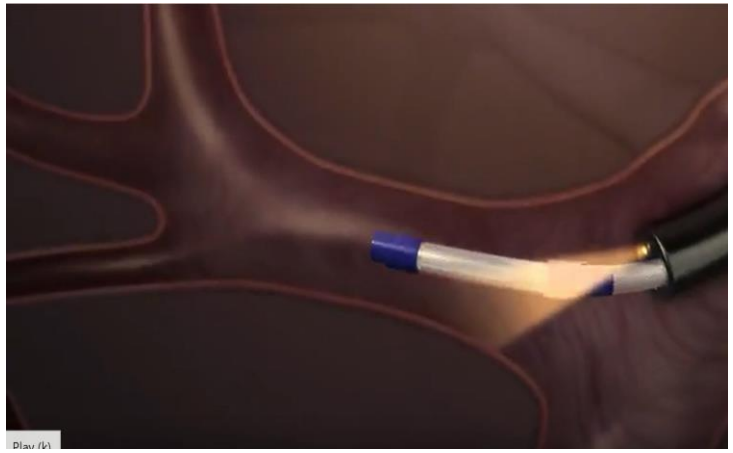
First Auris Monarch Neuwave Flex Microwave ablation - 24th Oct 2022 → POWER Study





Endoscopic Treatment of Lung Cancer

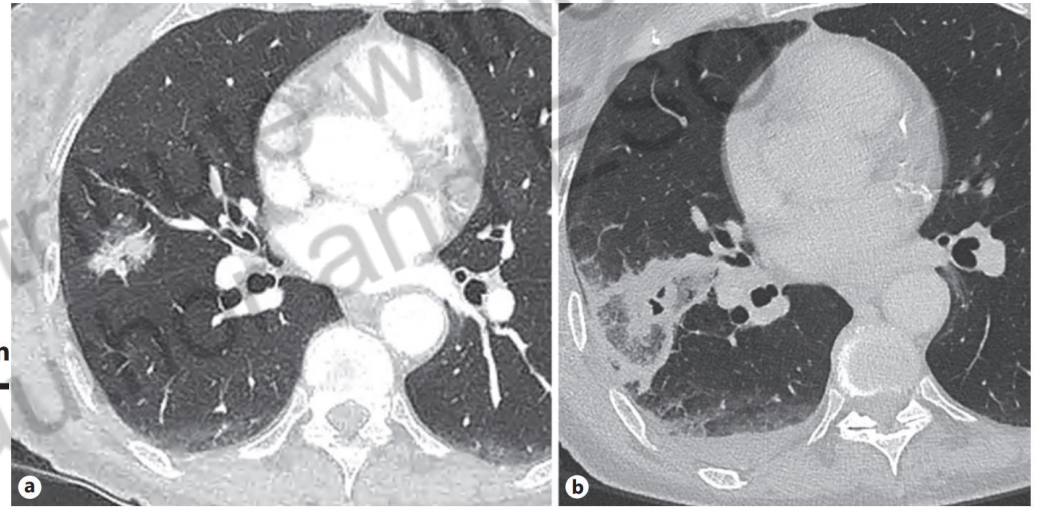
Bronchoscopic Thermal Vapor Ablation



Respiration

Interventional Pulmon

Respiration 2021;100:432–442
DOI: 10.1159/000514109

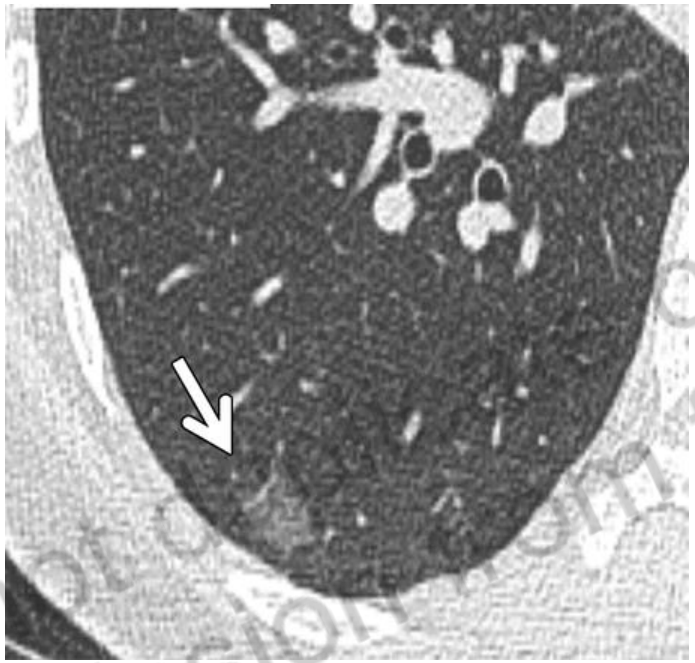


Bronchoscopic Thermal Vapour Ablation for Localized Cancer Lesions of the Lung: A Clinical Feasibility Treat-and-Resect Study

Daniel P. Steinfort[a, b] Michael Christie[c] Phillip Antippa[d]
Kanishka Rangamuwa[a, b] Robert Padera[e] Michael Rolf Müller[f]
Louis B. Irving[a, b] Arschang Valipour[g]

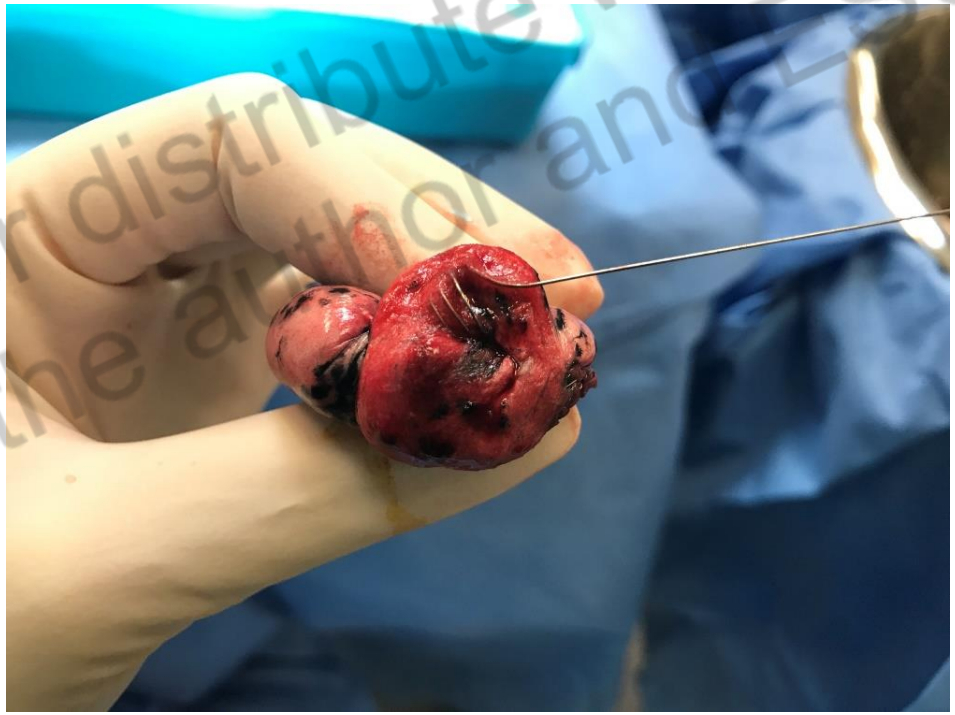
[a]Department Respiratory Medicine, Royal Melbourne Hospital, Parkville, VIC, Australia; [b]Department of Medicine, Faculty of Medicine, Dentistry & Health Sciences, University of Melbourne, Parkville, VIC, Australia; [c]Department of Pathology, Royal Melbourne Hospital, Parkville, VIC, Australia; [d]Department of Cardiothoracic Surgery, Royal Melbourne Hospital, Parkville, VIC, Australia; [e]Department of Pathology, Brigham and Women's Hospital, Boston, MA, USA; [f]Department of Thoracic Surgery, North Clinic Vienna, Karl-Landsteiner-Institute of Thoracic Oncology, Sigmund-Freud-University Medical Faculty, Vienna, Austria; [g]Department of Respiratory and Critical Care Medicine, Karl-Landsteiner-Institute for Lung Research and Pulmonary Oncology, Klinik Floridsdorf, Vienna, Austria

Is Less the new More for Lung cancer



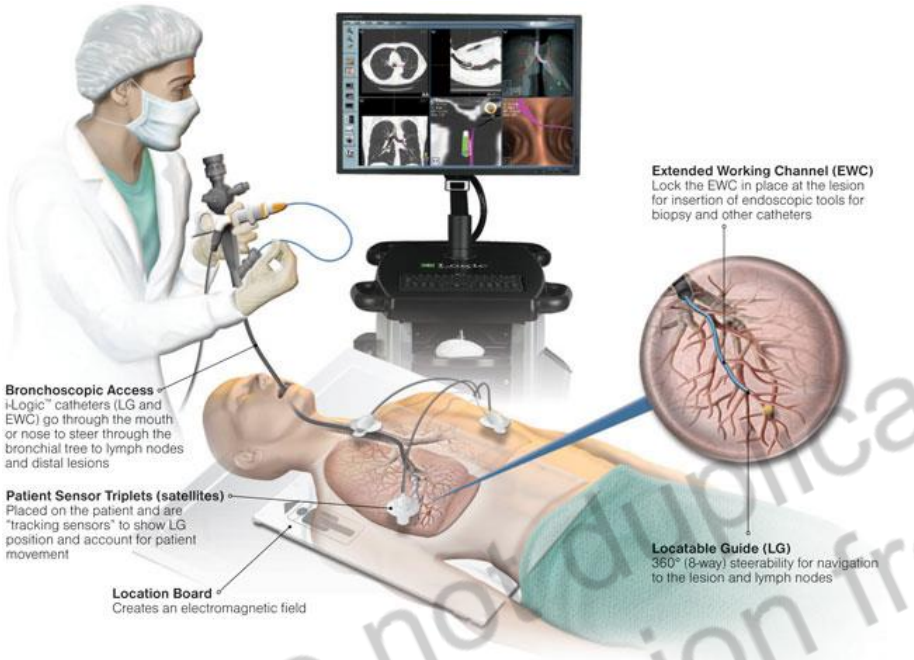
Where is the nodule / GGO ?

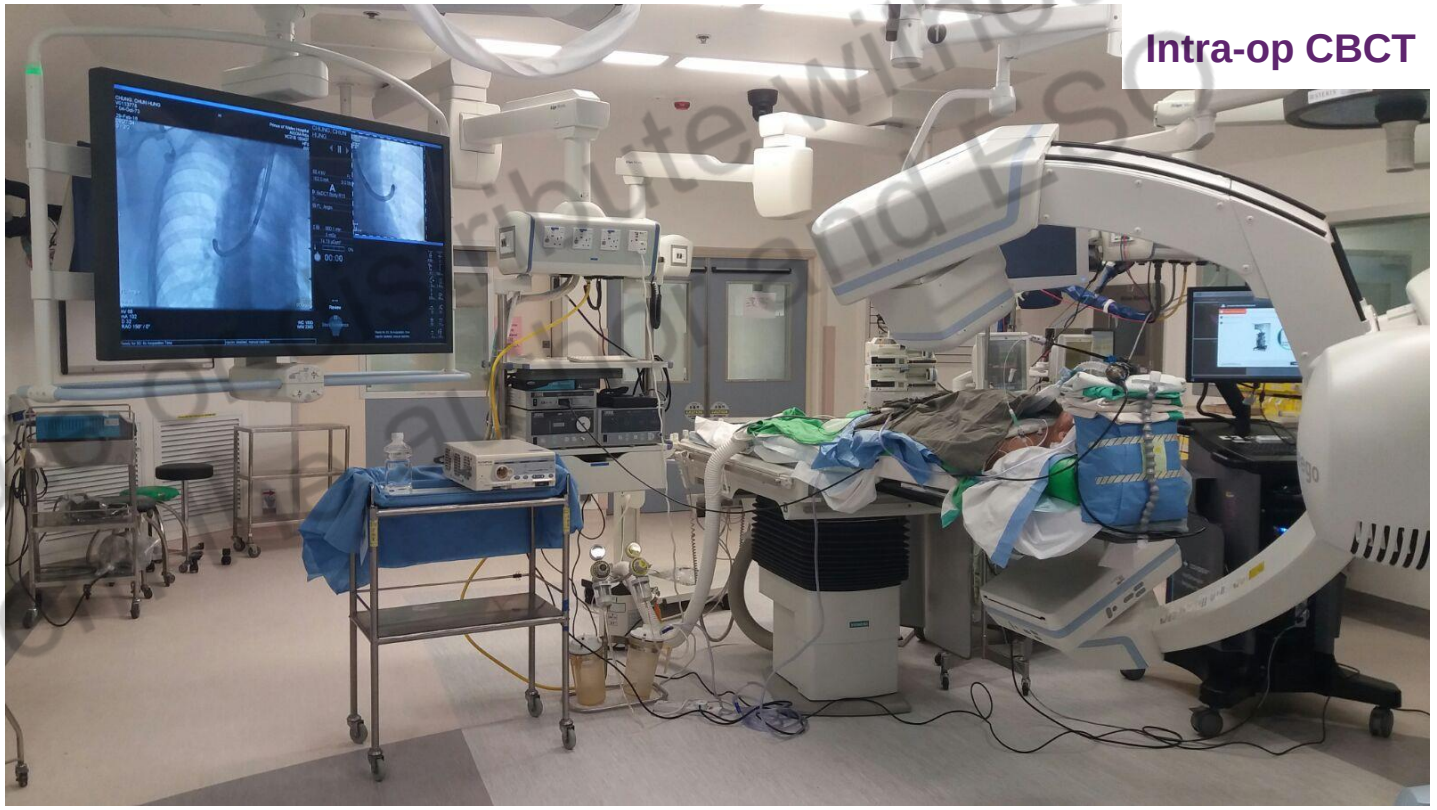
Localization of lung lesion



Ng CSH, Hui JWY, Wong RHL. Minimizing Single Port Access in VATS Wedge Resection by Hookwire. *Asian Cardiovasc Thorac Annals* 2013;21(1):114-115
Hookwire localization of Pulmonary Nodules in Uniportal VATS. In: Diego Gonzalez-Rivas, Calvin Sze Hg, Gaetano Rocco, Thomas A D'Amico (eds). *Atlas of Uniportal Video Assisted Thoracic Surgery.* Springer Science 2019

Image guided Electromagnetic Navigation Bronchoscopy (iENB) by CBCT dye marking since 2016





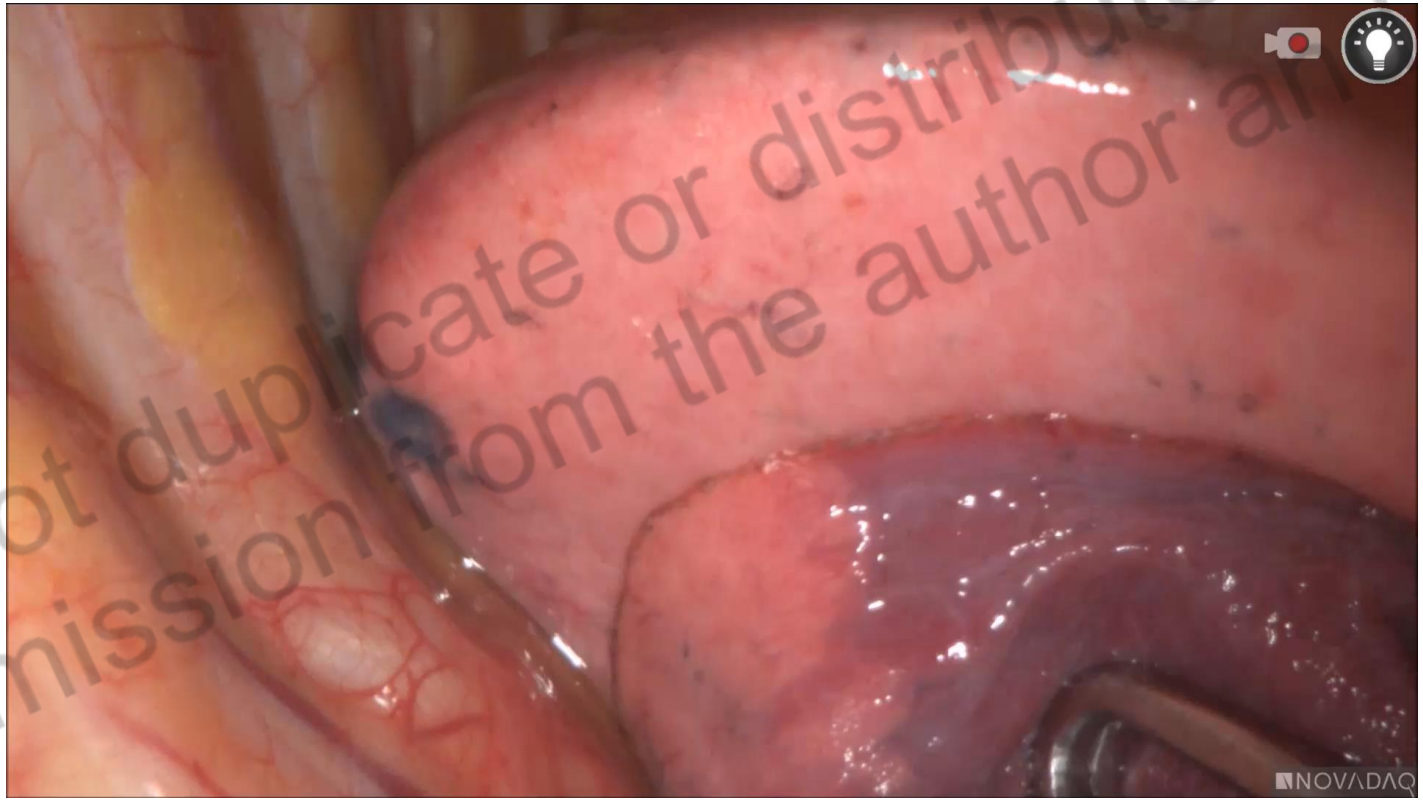
Ng CS, et al. Hybrid DynaCT Guided Electromagnetic Navigation Bronchoscopic Biopsy. *Eur J Cardiothorac Surg* 2016;48:i87-8

Lau WH, Chow CY, Chu C, Ng CS. Hybrid OR DynaCT Real-Time Image Guided ENB Biopsy–The Initial Experience. *Respirology* 2016;21:(S3)74

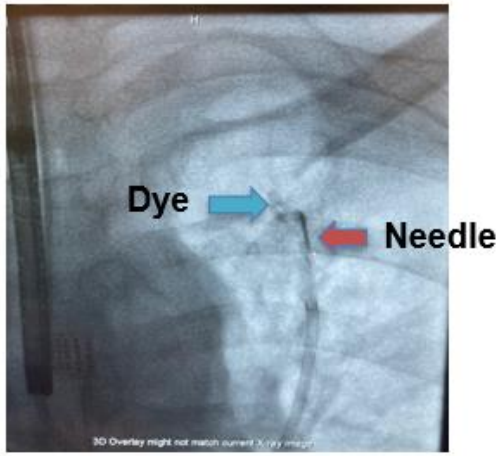
Ng CSH, et al. Electromagnetic Navigation Bronchoscopy Triple Contrast Dye Marking for Lung Nodule Localization. *Thorac Cardiovasc Surg* 2020;68(3):253-5

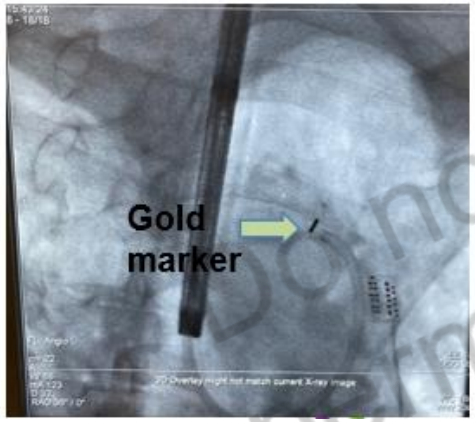
Ng CSH, et al. Hybrid operating room Dyna-CT combined image-guided ENB dye marking and hookwire localization VATS metastasectomy. *ICVTS* 2018;26:338-40

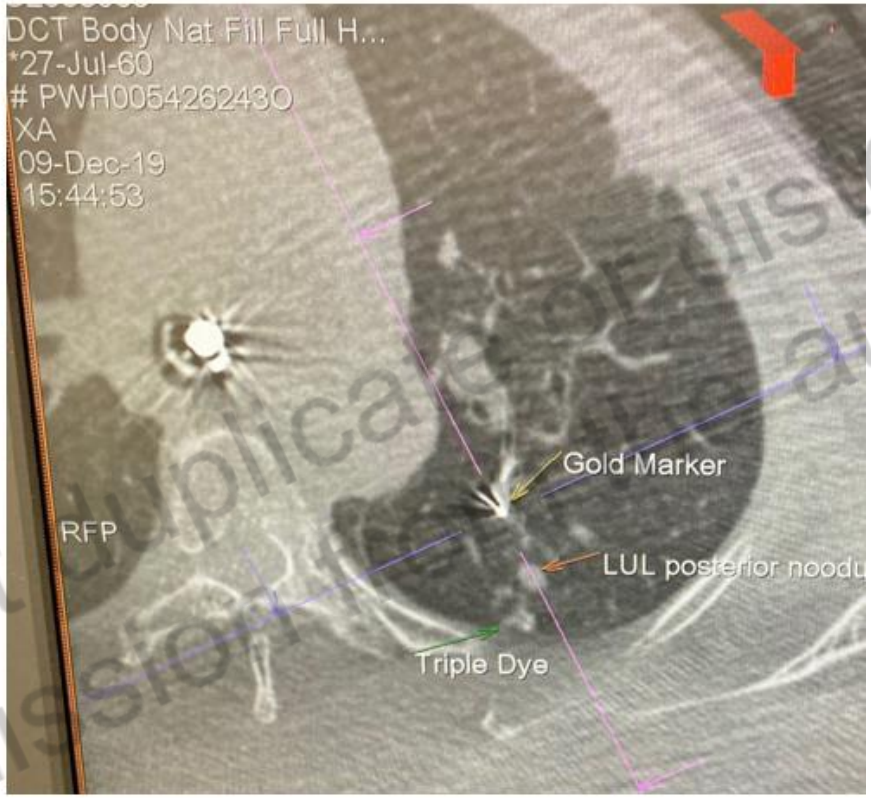
iENB Hybrid OR Triple Dye *ICG* Marking

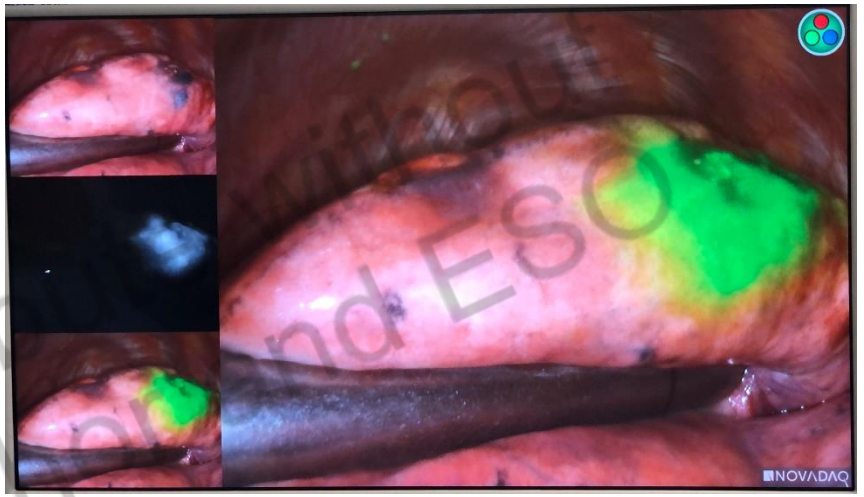


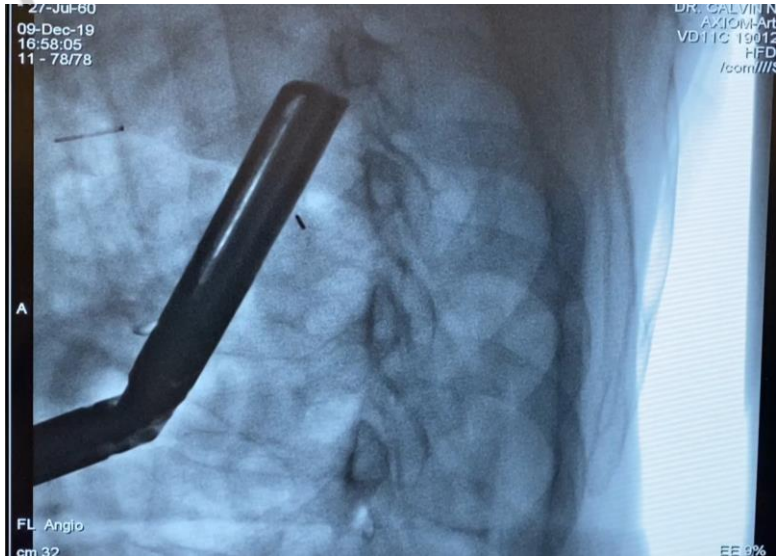
Deep LUL lesion – ENB Peripheral ICG dye marking & Deep Metallic Fiducial Marking





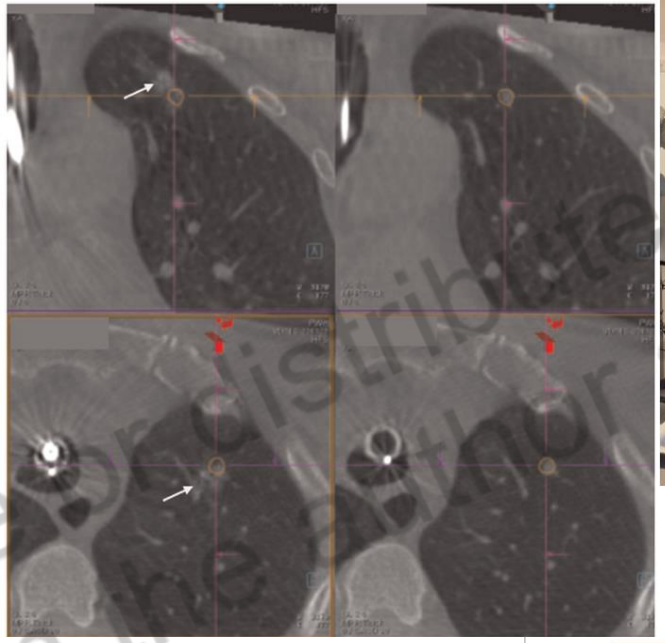






Chan JWY, Lau RWH, Ng CSH. Electromagnetic Navigation Bronchoscopy Fiducial Marker Margin Identification plus Triple Dye for Complete Lung Nodule Resection. *J Thorac Cardiovasc Surg Techniques* 2020 Sept;3:P329-33

Robotic Bronchoscopy Dye & Fiducial marking



Robotic Assisted-Bronchoscopy With Cone-Beam CT ICG Dye Marking for Lung Nodule Localization: Experience Beyond USA

*Joyce W. Y. Chan, Aliss T. C. Chang, Peter S. Y. Yu, Rainbow W. H. Lau and Calvin S. H. Ng**

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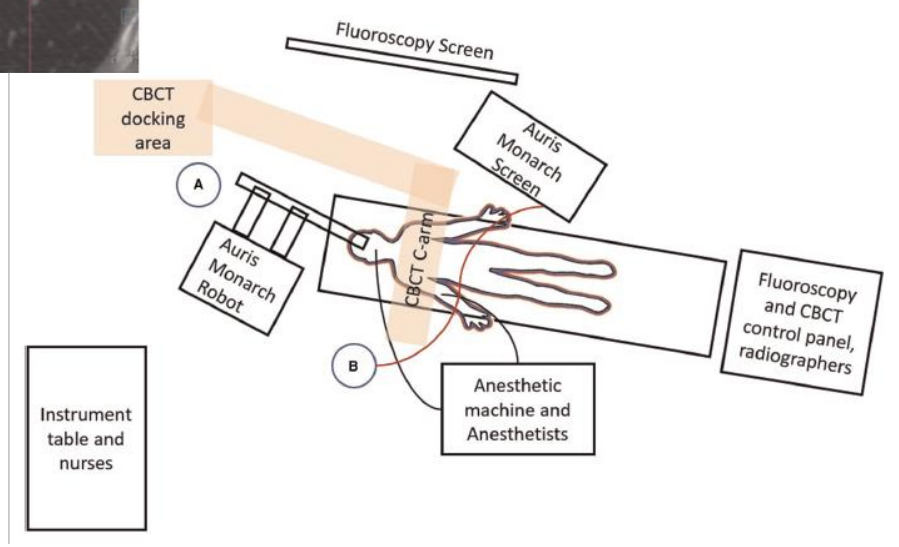
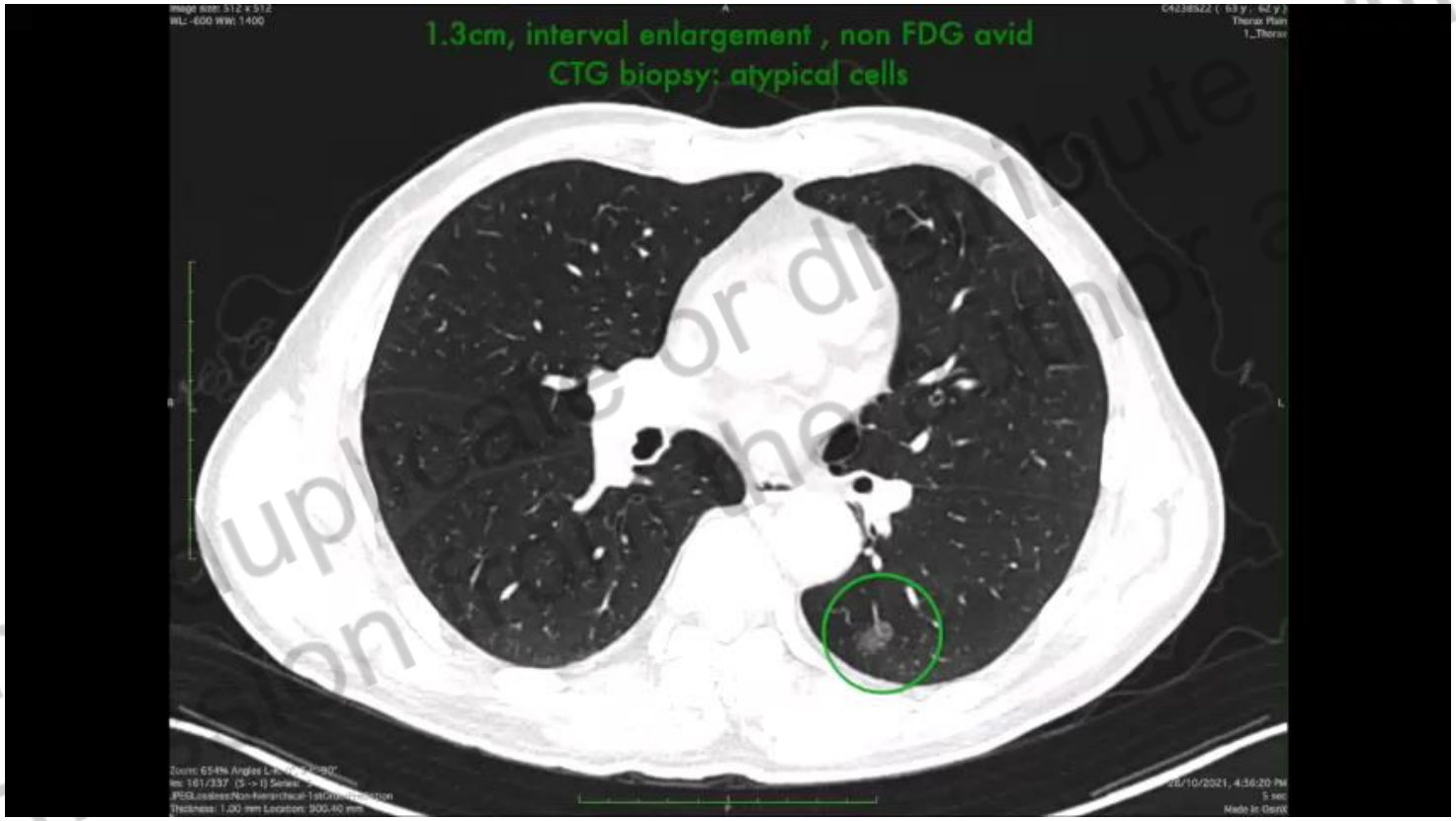
Specialty section:

Electromagnetic navigation bronchoscopy (ENB)-guided indocyanine green (ICG) fluorescence dye marking of subsolid, small and deep lung lesions facilitates subsequent minimally invasive lung resection surgeries. The novel robotic-assisted bronchoscopy (RAB) platform can improve the accuracy and yield of ENB biopsy, and the use of RAB has been extended to ICG dye marking. However, performing this procedure in the hybrid operating room guided by cone-beam CT (CBCT) with immediate proceed to lung surgery has not been well reported. We studied the safety, feasibility and clinical outcomes of 5 consecutive cases performed between December 2021 and March 2022. Navigation success was 100% while localization success using ICG was 80%. The benefits and pitfalls of robotic bronchoscopy procedures, and challenges of combining with hybrid operating room CBCT were discussed in detail. In conclusion, robotic-assisted bronchoscopy is a promising and useful tool for ICG fluorescence dye-marking, providing accurate navigation, superior maneuverability and improved ergonomics compared to conventional bronchoscopy-guided ENB procedures. Learning curve is reasonable, but meticulous system set up to incorporate the robotic system into existing CBCT platform may be required to ensure a smooth procedure.

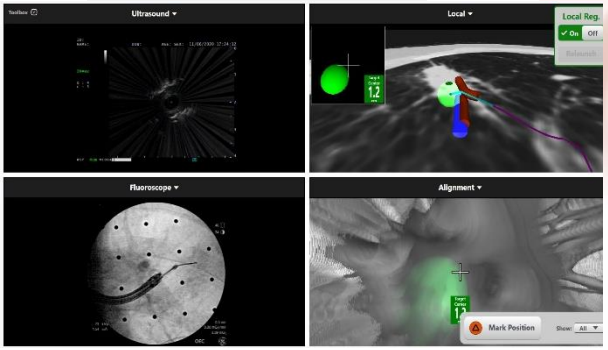


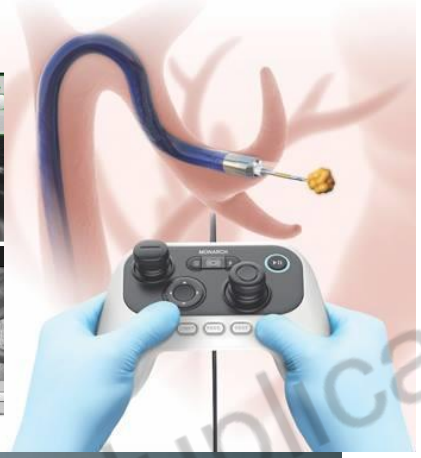
Chan JWY, et al. Robotic Assisted-Bronchoscopy with CBCT ICG Dye Marking for Lung Nodule Localization: Experience Beyond USA. *Frontiers in Surgery* 2022 28;9:943531

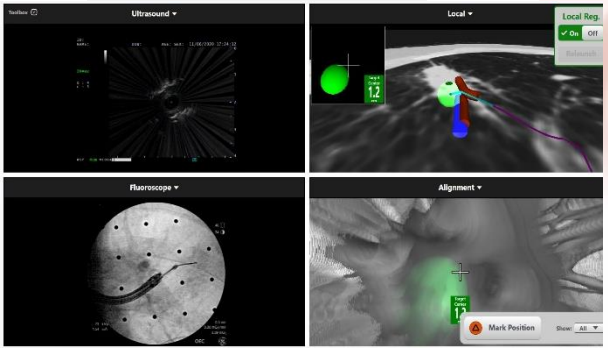
Hybrid OR CBCT-guided Robotic Bronchoscopy (iRAB) Dye & Fiducial marking of LLL apical segment GGO

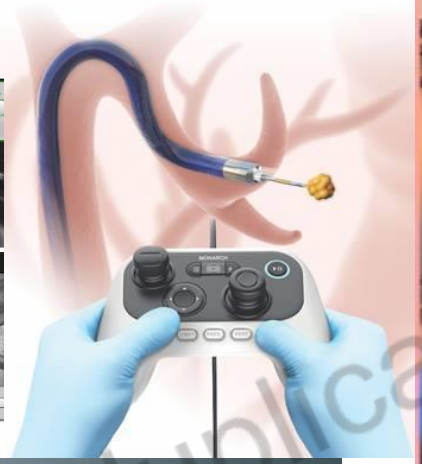


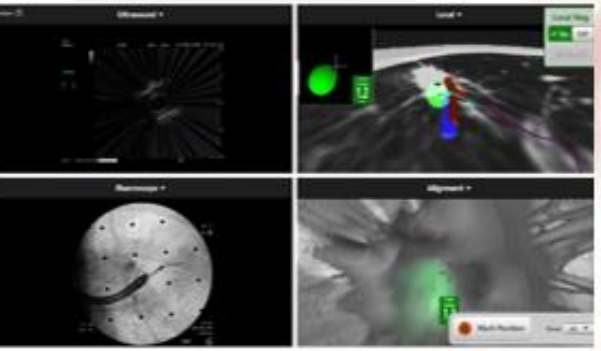
Siu IC, Chan JW, Chang AT, Lau RW, Ng CS. Robotic-Assisted Bronchoscopic Dye Marking & VATS Left Lower Lobe Apical Segmentectomy. Jul 2022. CTSnet. doi:10.25373/ctsnet.20402379











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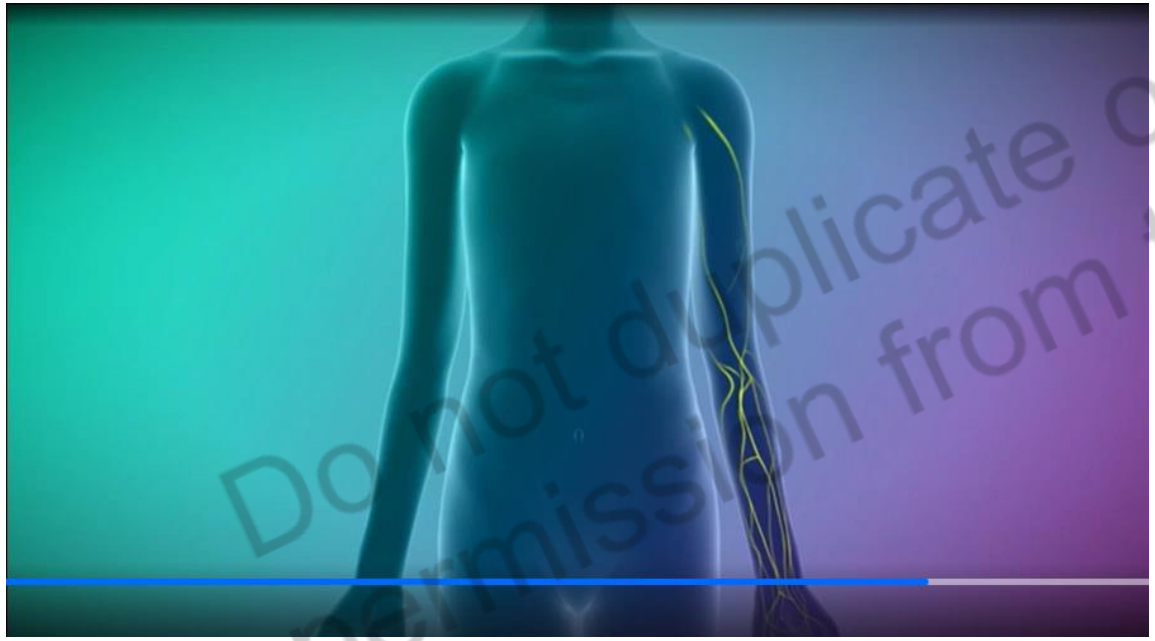
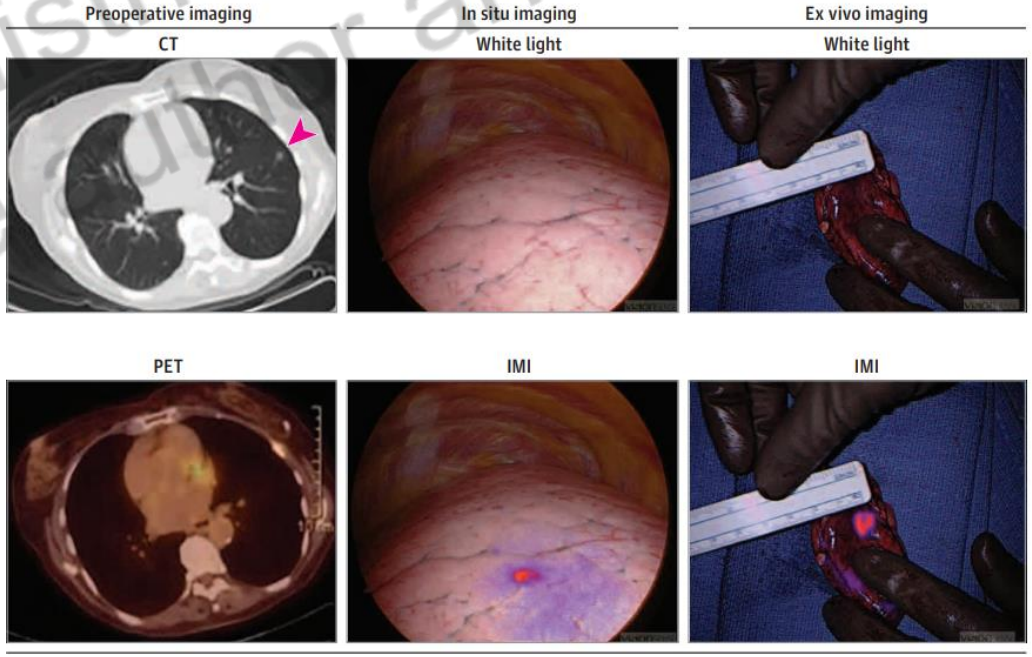
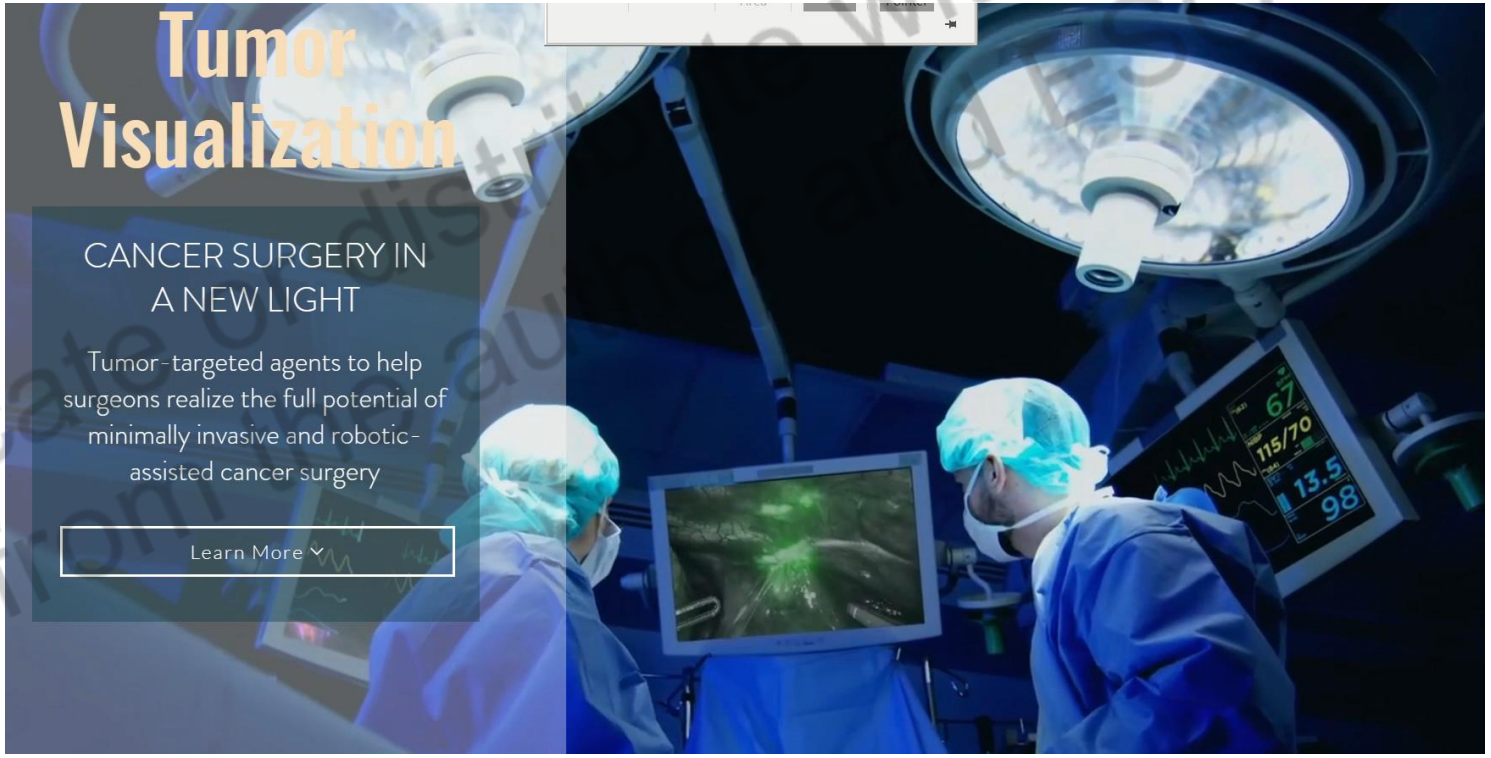
- ***CYTALUX is now approved as the first and only targeted molecular imaging agent that illuminates lung cancer intraoperatively, enabling the detection of more cancer for removal.***





Gregory Kennedy et al. Targeted Intraoperative Molecular Imaging for Localizing Nonpalpable Tumors and Quantifying Resection Margin Differences. JAMA Surg 2021;156:1043-50. doi:10.1001/jamasurg.2021.3757

- **VGT-309 fluorescence is only visible once the agent is “activated” by cathepsin protease activity in tumor tissue.**
- **This binding-dependent activity increases the tumor-specific signal provided by VGT-309 while minimizing the possibility of background fluorescence.**



Kennedy G et al.. A Cathepsin-Targeted Quenched Activity-Based Probe Facilitates Enhanced Detection of Human Tumors during Resection. Clin Cancer Res. 2022;28:3729-41

Is Less the new More for Lung cancer …. Summary

- VATS has ***more*** favorable clinical outcomes than Open lung surgery
- Segmentectomy has ***more*** favorable outcomes than lobectomy (up to 2cm)

- Wedge & other local therapies may have a role in select smaller tumours and preserve ***more*** lung parenchyma/ lung function

- New compounds to localize small lung cancers require less equipment/ resources and may identify ***more*** (unsuspecting) lung cancers

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