

Lung Cancer: The Multidisciplinary Approach to Detection and Diagnosis

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Multidisciplinary Cancer Update

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Disclosures:

Nothing to disclose.

LUNG CANCER: Statistics

Worldwide

- Most common cancer diagnosed – 12.4%
- Most cancer related deaths – 17.6%

United States

- 225,000 new cases of lung cancer annually
- 160,000 lung cancer deaths annually
- Since 1987 lung cancer deaths exceeds breast cancer deaths in women

LUNG CANCER: Risk Factors

90% of lung cancer cases are attributable to smoking and geographically coincides with cigarette smoking prevalence

- 20-30% increase with passive smoke, responsible for 3,000 lung cancer deaths/yr in US
- Synergistic with radon and asbestos exposure

Host Factors:

- Radiation exposure with Hodgkin's and Lung Cancer
- Acquired lung disease: COPD, TB, pneumoconiosis, IPF, Systemic Sclerosis
- HIV

LUNG CANCER: Risk Factors

Table 1—Summary of Findings: Key Factors Associated With Risk of Lung Cancer

Factor	Description
A. Single most important causal determinant of individual and population risk, most valuable indicator of clinical risk^a	Active smoking of cigarettes and other tobacco products: Individual risk increases with greater number of cigarettes smoked per day and greater number of years of smoking. Population risk increases with the prevalence of current smokers because population prevalence predicts lung cancer occurrence with a latency period of about 20 y.
B. Other risk factors causally associated with lung cancer^a	Secondhand smoke exposure Ionizing radiation, including radon Occupational exposures, eg, arsenic, chromium, nickel, asbestos, tar, and soot Indoor and outdoor air pollution
C. Additional clinical risk indicators^b	The risk factors noted above, plus: Older age Male sex, particularly among those of African American ancestry Family history of lung cancer Acquired lung disease, eg, COPD, TB, pneumoconioses, idiopathic pulmonary fibrosis, and systemic sclerosis Occupational exposures, such as to silica dust HIV infection
D. Examples of associations with consistent evidence but causal role not presently established	Fruit and vegetable intake (decreased risk) Physical activity (decreased risk) Marijuana smoking (not associated with risk)

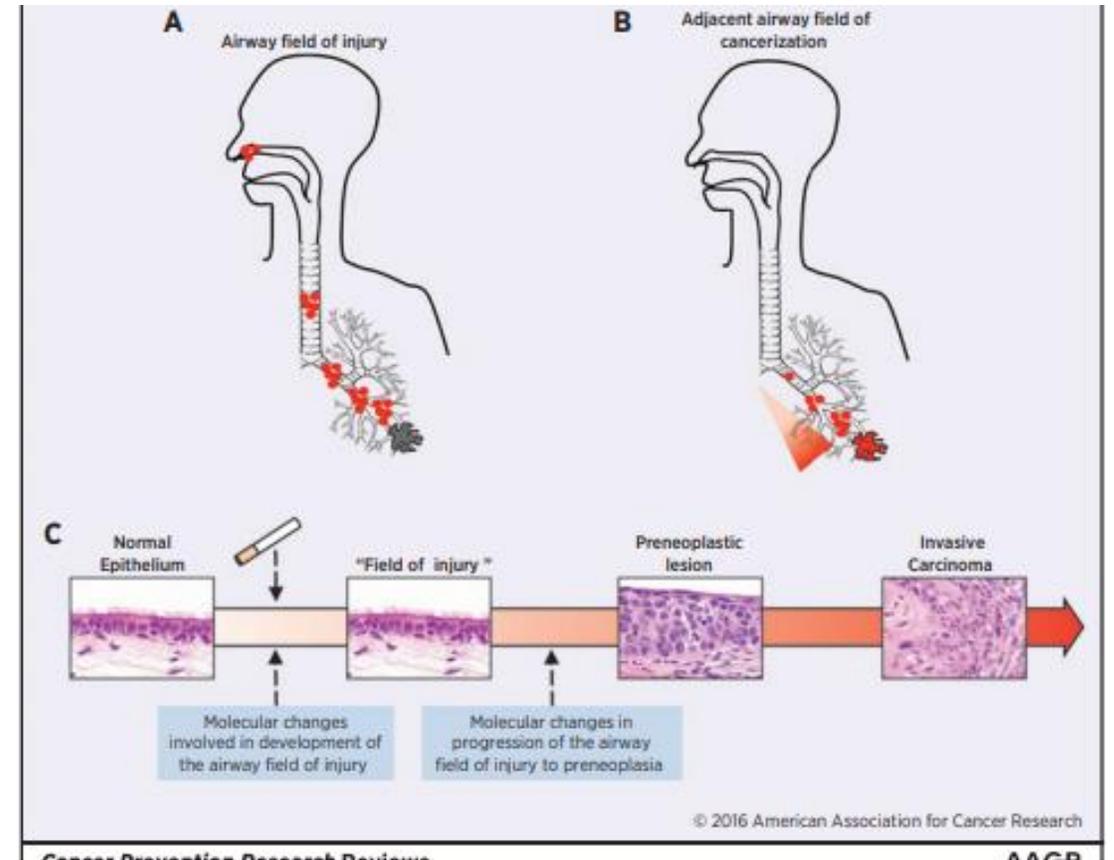
^aThe evidence for factors listed in these categories is extremely strong to meet epidemiologic criteria for causality.

^bThe factors listed under clinical risk indicators are all strongly associated with increased risk of lung cancer but are listed in this category either because they are intrinsic characteristics of the patient (age, sex, ethnic ancestry, family history) or are factors with consistent evidence of increased risk that presently falls short of being rated as causal.

LUNG CANCER: Pathophysiology

Different lung cancer subtypes develop through diverse and unique molecular pathways as suggested by divergent anatomic locations and cell type

- Squamous and small cell arise from major bronchi and are centrally located
- Adenocarcinoma from small bronchi, bronchioles and alveolar epithelial cells with peripheral location.



PATHOPHYSIOLOGY: Airway Field of Injury

Molecular pathways have been studied as targets for early detection, chemoprevention and treatment but many studies are largely null.

The best demonstration of molecular pathways involved in development of lung cancer is the development of invasive adenocarcinoma.

- KRAS – Kirsten rat sarcoma viral oncogene
- EGFR – epidermal growth factor receptor

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LUNG
CANCER:
Early
Detection is
Key

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Reduced Lung-Cancer Mortality with Low-Dose Computed
Tomographic Screening

The National Lung Screening Trial Research Team*

	Low-dose CT 26,722 people		Chest X-ray 26,732 people
Benefit: How did CT scans help compared to chest X-ray, an ineffective screening test?			
3 in 1,000 fewer died from lung cancer	18 in 1,000	versus	21 in 1,000
5 in 1,000 fewer died from all causes	70 in 1,000	versus	75 in 1,000
Harm: What problems did CT scans cause compared to chest X-ray?			
223 in 1,000 more had at least one false alarm	365 in 1,000	versus	142 in 1,000
18 in 1,000 more had a false alarm leading to an invasive procedure, such as bronchoscopy, biopsy, or surgery	25 in 1,000	versus	7 in 1,000
2 in 1,000 more had a major complication from invasive procedures	3 in 1,000	versus	1 in 1,000

LUNG CANCER: NLST

- CMS agreed to reimburse in 2015, 2 years after USPTF made it a Grade B recommendation, with several provisions in place that include counseling and education on smoking cessation, false +/- results and follow up.
- LDCT annually in current or former smokers who:
 - Age 55 – 77
 - Smoked for 30 pack-years
 - Continue to smoke or have quit within the past 15 yrs

ACR Lung-RADS

Summary of Lung-RADS categorization for baseline screening

Category	Baseline Screening	Malignancy
1	No PNs; PNs with calcification	Negative <1% chance of malignancy
2	Solid/part-solid: <6 mm GGN: <20 mm	Benign appearance <1% chance of malignancy
3	Solid: ≥6 to <8 mm Part-solid: ≥6 mm with solid component <6 mm GGN: ≥20 mm	Probably benign 1-2% chance of malignancy
4A	Solid: ≥8 to <15 mm Part-solid: ≥8 mm with solid component ≥6 and <8 mm	Suspicious 5-15% chance of malignancy
4B	Solid: ≥15 mm Part-solid: Solid component ≥8 mm	>15% chance of malignancy
4X	Category 3 or 4 PNs with suspicious features (e.g. enlarged lymph nodes) or suspicious imaging findings (e.g. spiculation)	>15% chance of malignancy

ACR: American College of Radiology
Lung-RADS: Lung CT Screening Reporting and Data System

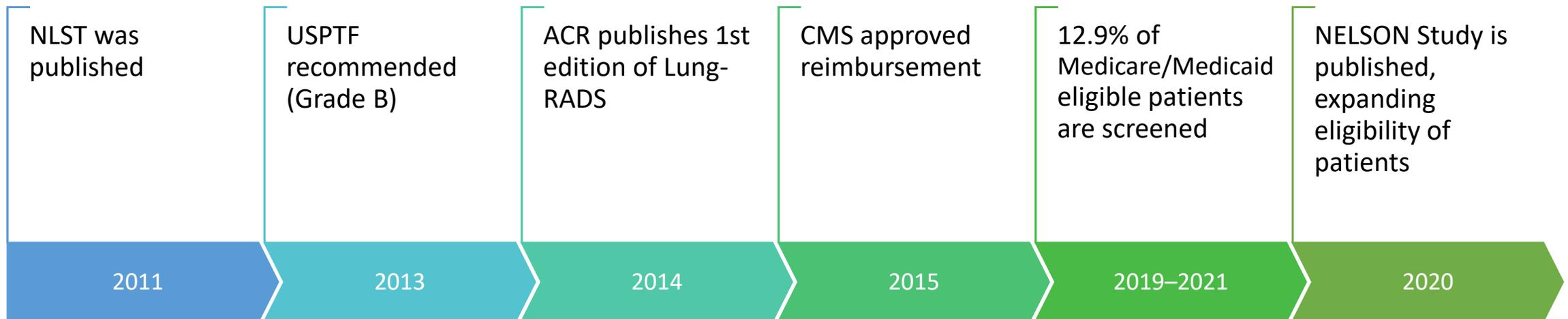


Memorial Sloan Kettering
Cancer Center

No false negatives were detected when reclassifying the 4-6 mm nodule as benign. It is safe to follow solid nodules <6 mm and nonsolid nodules <20 mm in high-risk patients with annual CT surveillance.

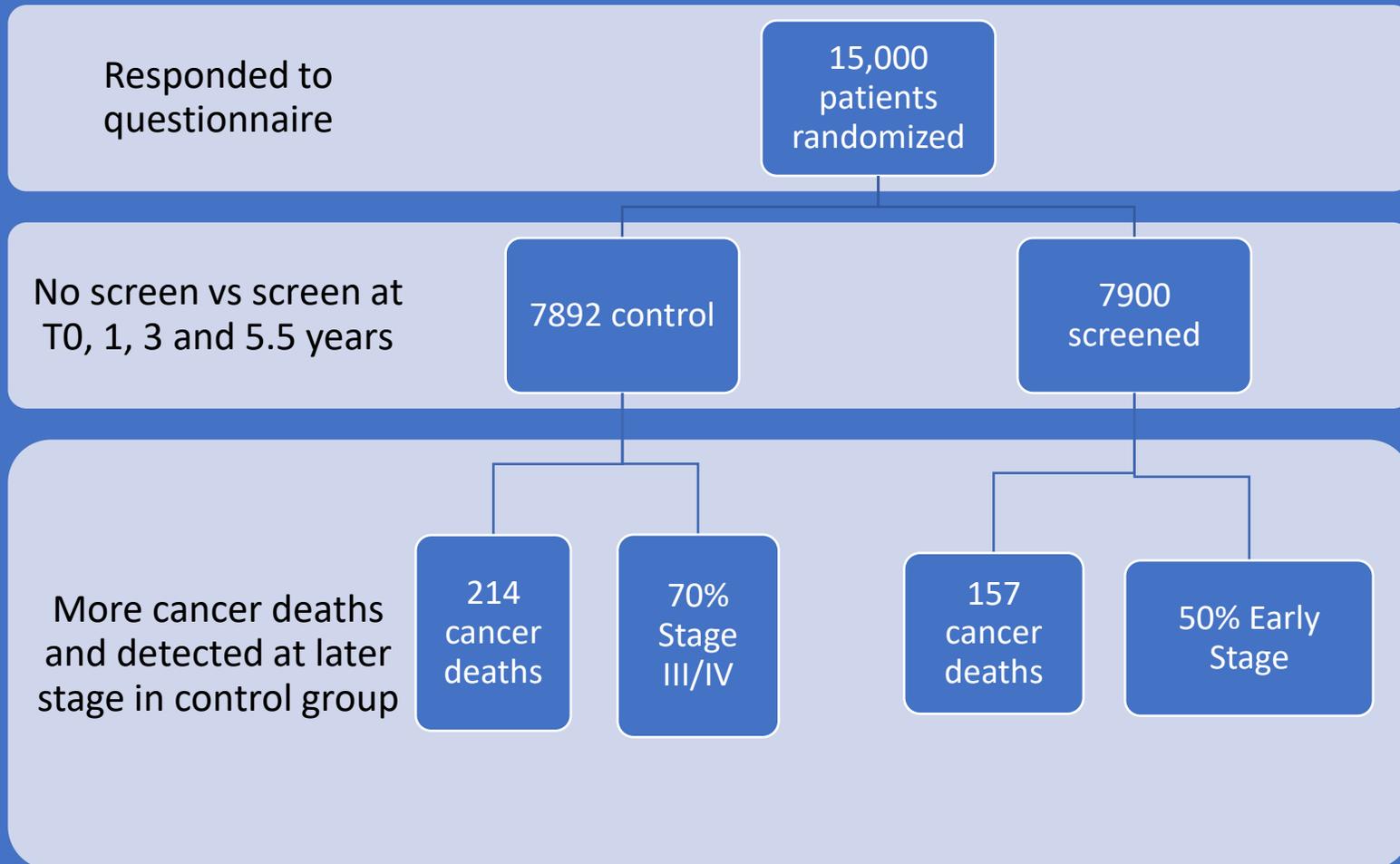
Increase the cost-effectiveness of CT lung screening by secondarily decreasing the number of interval scans recommended and performed.

NLST: 10 Years Later



SCREENING: NELSON Study

- 600,000 current or former smokers aged 50-75 with a 20-30 pack year hx
- Study was powered to show reduction in mortality by 25% at 10 years (NSLT 20% over 3 years).
- Used volumetrics to assess size and volume doubling time



Lung Cancer Screening: 10 Years Later

NLST used diameter of nodules

- One extremely small study (n=54) found 1.7 mm change to be considered true growth.

Nelson used semiautomated nodule volume.

- Introduced an intermediate test result of volume between 50-500 mm³
- Received a short term follow up:
 - Growth of 25% in volume and had a VDT <400 days were considered positive
- Still awaiting final recommendations

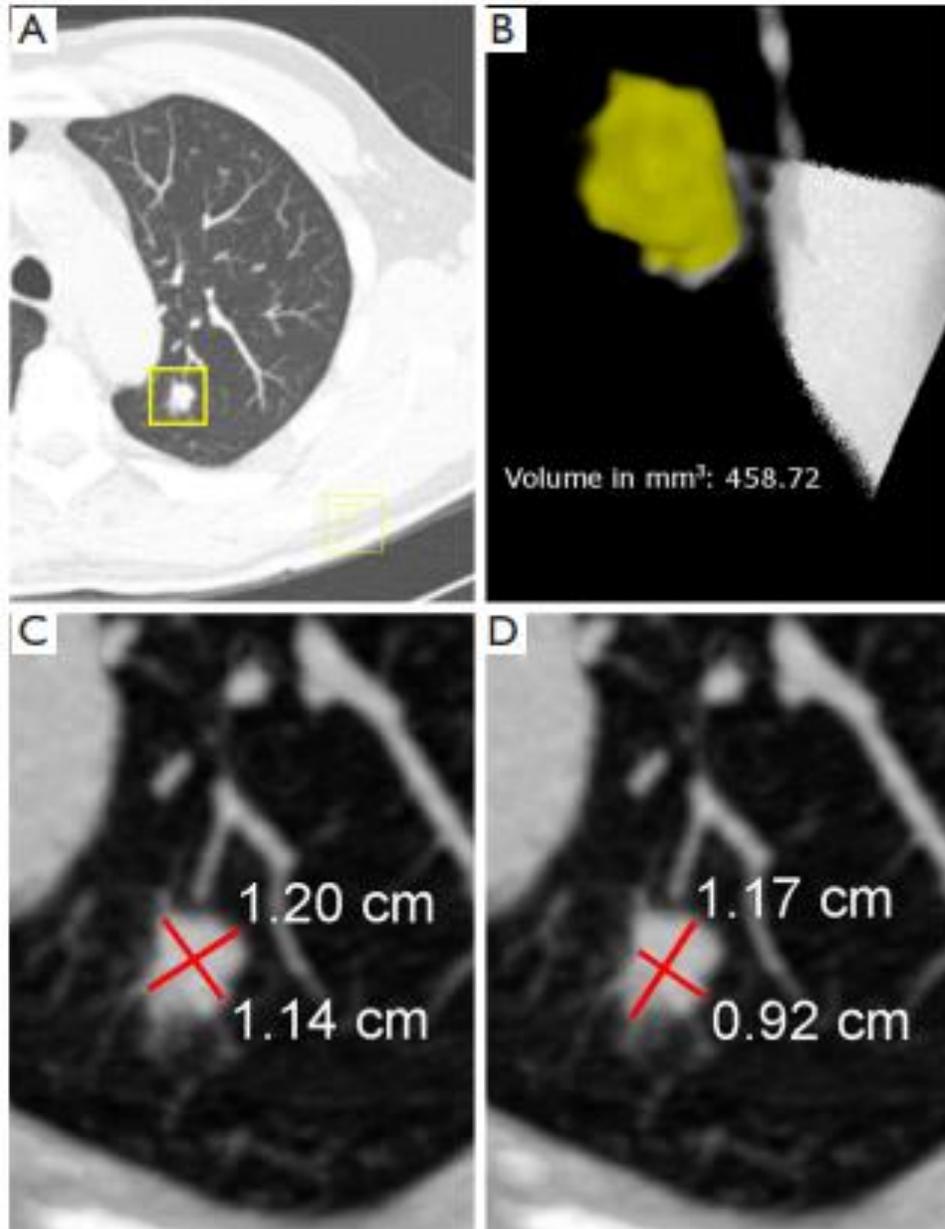
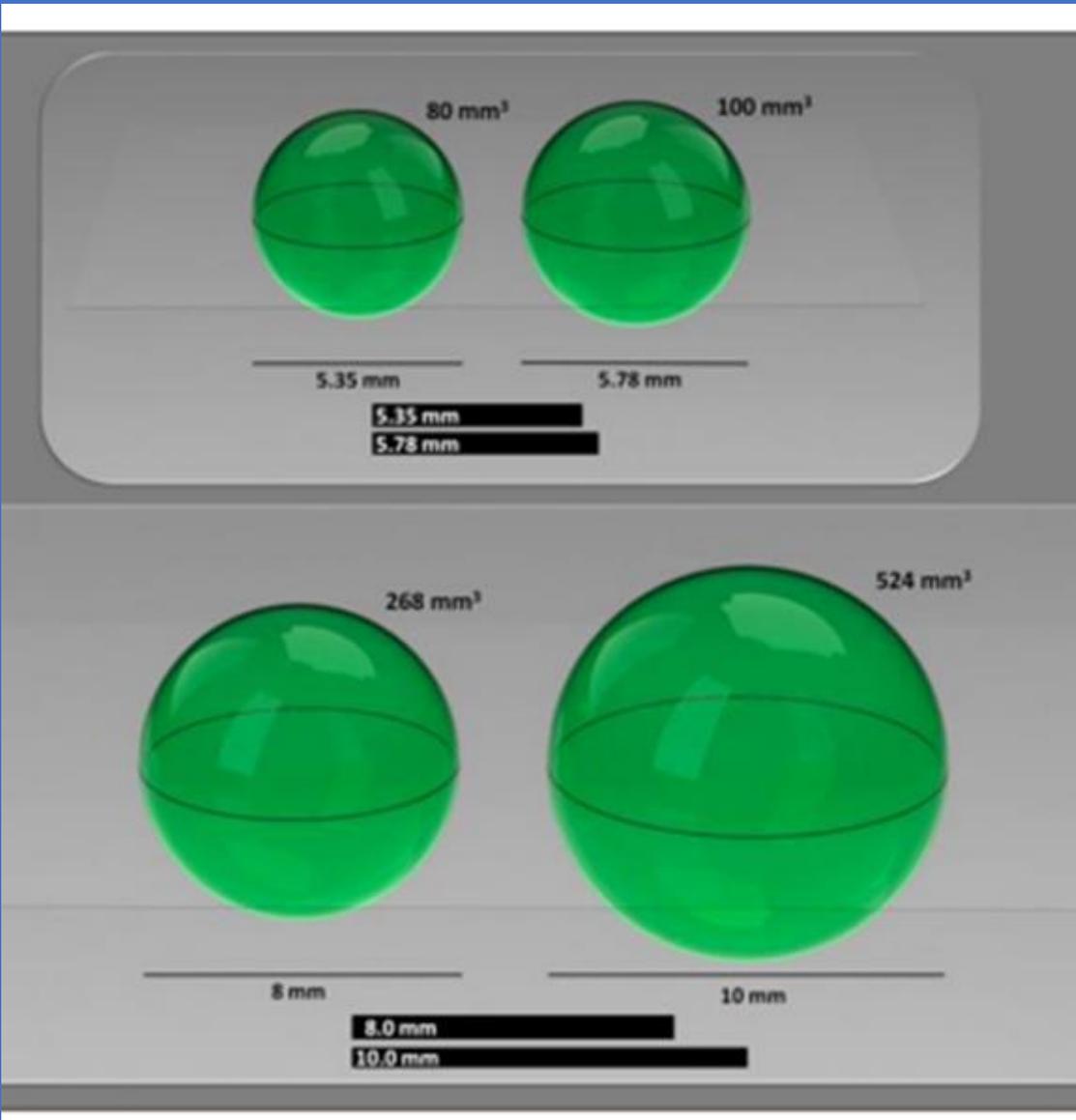


Figure 1 Transverse images of a solid pulmonary nodule and its location (A), semi-automatically assessed volume (B) and two possible manual diameter measurements (C) and (D).

Lung Cancer Screening: 10 Years Later

Current recommendations consider a 25% increase in diameter to be considered “positive” growth

In the second image there is a 25% diameter increase but a 95% increase in VDT



Lung Cancer Screening: 10 Years Later

Eligibility:

- 50-80 years
- 20 pack year history of tobacco
- Current or former smoker who has quit in the past 15 years.

Expanding eligibility may capture healthier patients in earlier stages to include more women and African Americans.

Lung Rads and Volumetrics reduced false positive results.

Lung Cancer Screening: Risk Factors

Overdiagnosis:

5 year survival for eligible patients:

- NLST trial participants 89%
- USPTF 87%
- Medicare eligible 80%

Lifetime Risk of Lung Cancer due to radiation exposure, 10 year follow up:

- 1 radiation induced lung cancer for every 108 lung cancers diagnosed.
- 0.07% Males
- 0.14% Females

SUSPICIOUS FOR MALIGNANCY

The overall goal is a timely diagnosis and accurate staging

ACCP guidelines state that the initial evaluation should be complete in 6 weeks.

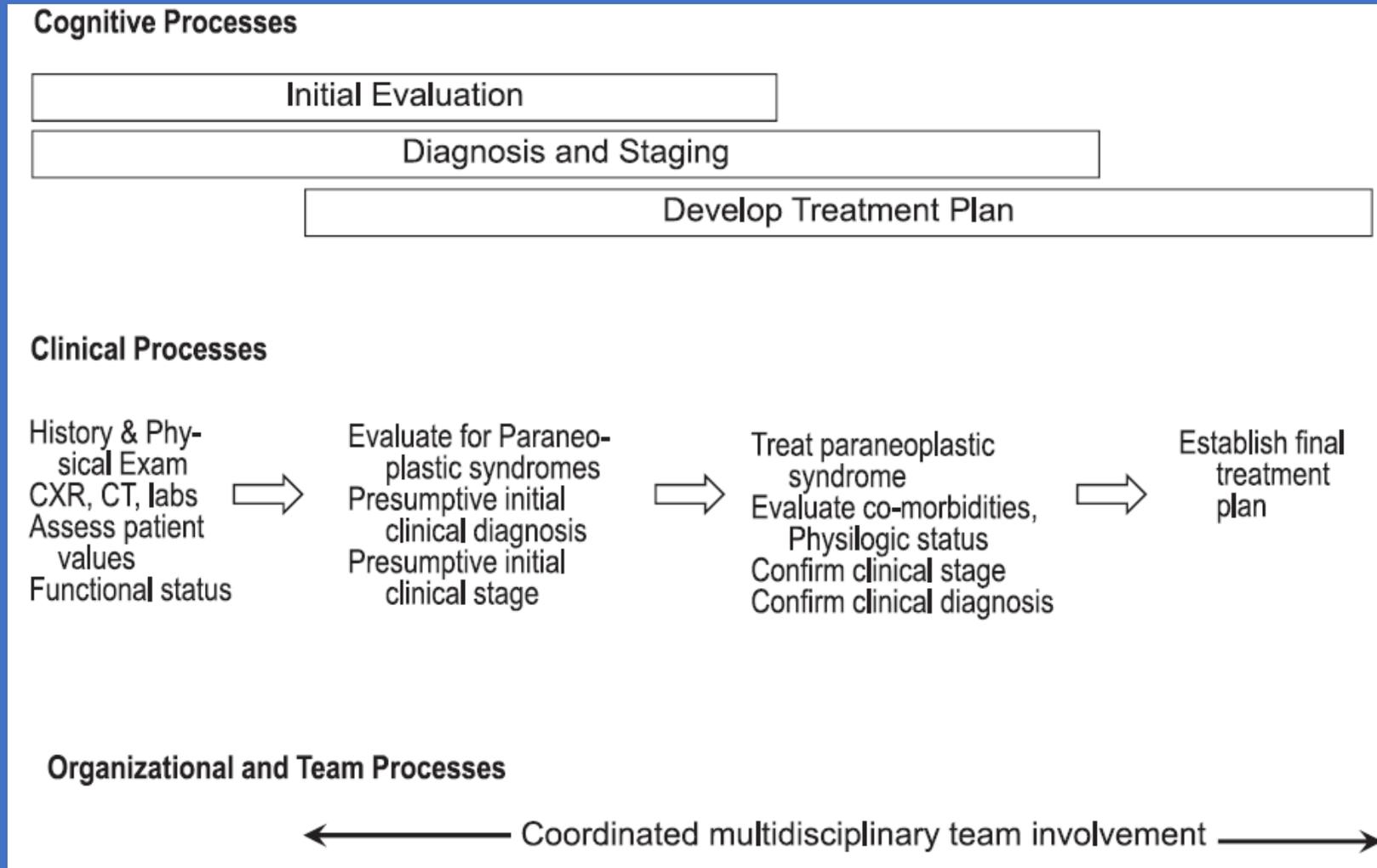
Lung Cancer evaluation considerations

1. Radiologic Stage
2. Invasive Staging

Suspicion: Goals of Initial Evaluation

- Clinical extent and stage of disease
- Optimal target site and modality of 1st tissue biopsy
- Specific histologic subtypes
- Presence of co-morbidities, para-neoplastic syndromes
- Patient values and preferences regarding therapy

ESTABLISHING THE DIAGNOSIS



ESTABLISHING THE DIAGNOSIS

Factors found to be associated with less timely care

- Atypical symptoms
- Less advanced disease stage
- At least one comorbidity
- Initial referral to nonrespiratory clinician
- Public vs teaching hospital
- Need for multiple diagnostic tests

DIAGNOSIS: The One Stop Shop

The most distant target in order to obtain the most information is best

- When distant metastasis is present/obvious, biopsy

Bulky adenopathy and/or unresectable tumor without a chance for surgery

- Flexible Bronchoscopy +/-EBUS

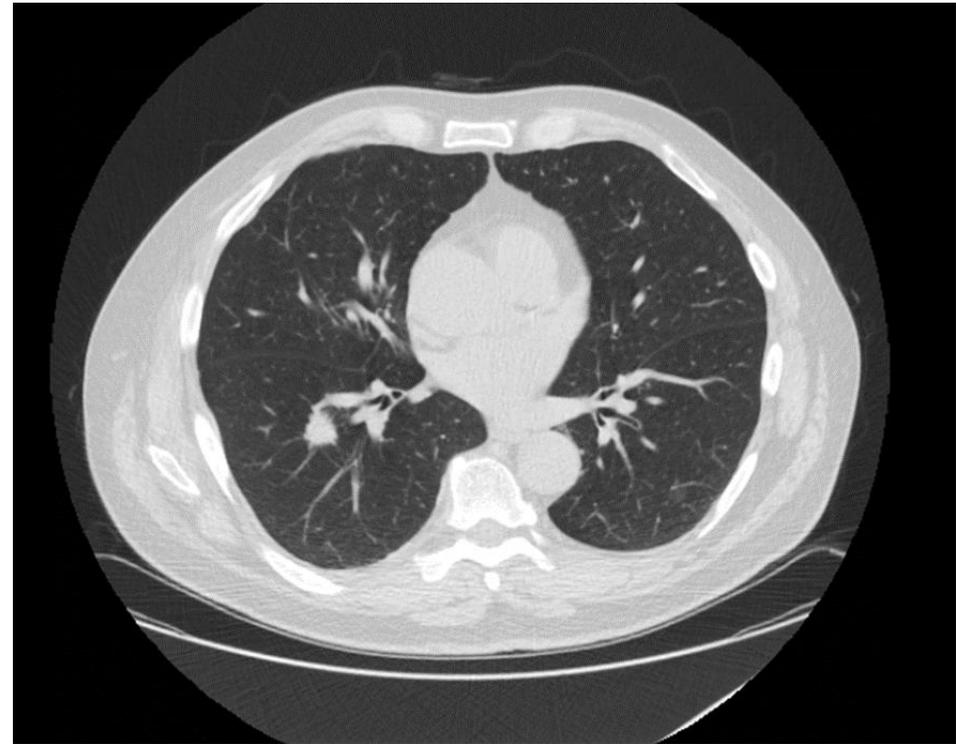
Single nodule or mass without obvious lymph node or distant metastasis

- Consider Advanced Bronchoscopy with EBUS

The Suspicious Pulmonary Nodule

Three Management Strategies

- Serial Imaging to detect change
- Surgical excision for diagnosis and definitive treatment
- Minimally Invasive Diagnostic Procedures
 - Percutaneous Needle Aspirate (80% yield)
 - Bronchoscopy (25% yield)



The Suspicious Pulmonary Nodule Watch and Wait?

Malignant nodules represent a curable form of lung cancer.

- There is a reported 5-year survival for patients with malignant SPN 65% to 80%.
- Unless they are in a central airway the majority of these nodules are asymptomatic
- Patient anxiety

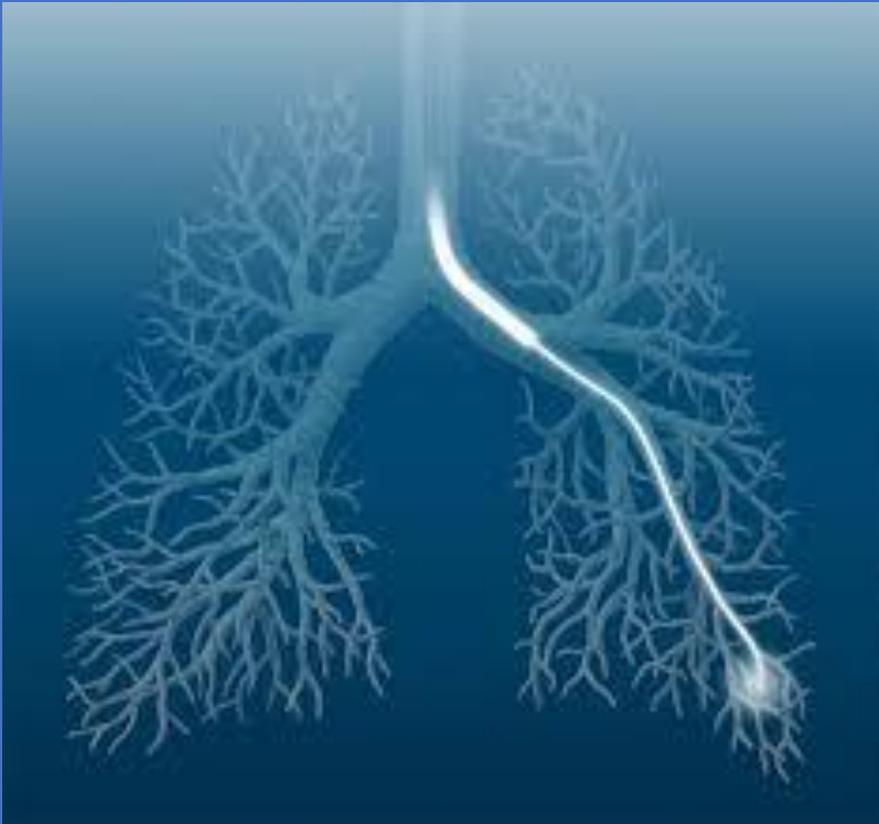
The Suspicious Pulmonary Nodule Surgery?

Approximately 20% of patients that undergo a surgical excision are found to be benign. Placing the patient at risk for developing operative risks and decline in lung function.

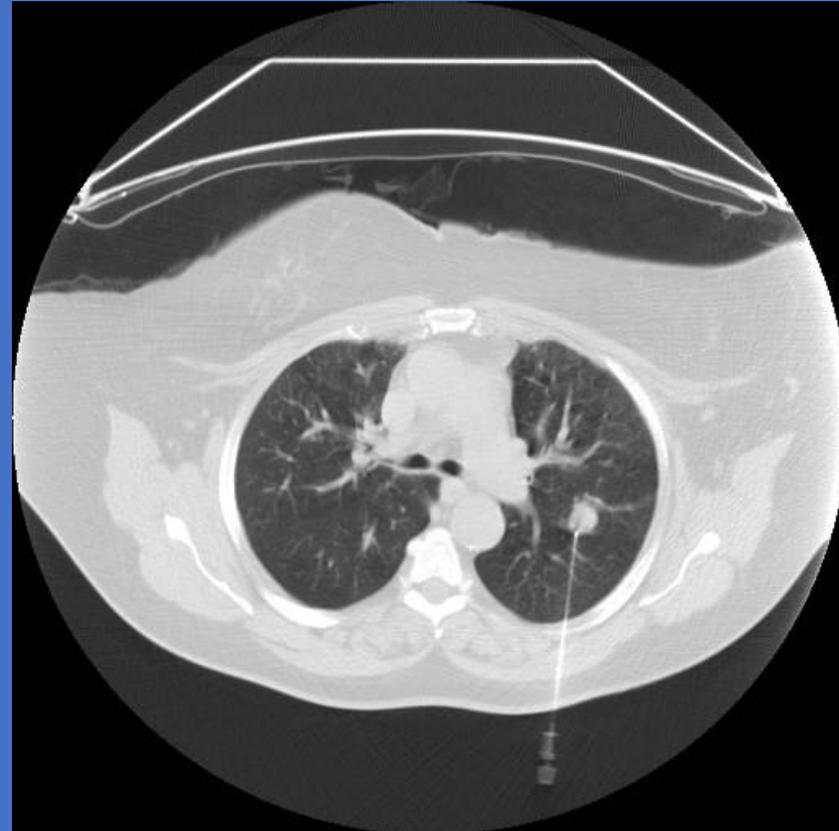
Safe alternatives for confirmation of a malignant diagnosis should be considered.

The Suspicious Pulmonary Nodule

Endobronchial



Percutaneous



Yield and Complications for Minimally Invasive Techniques

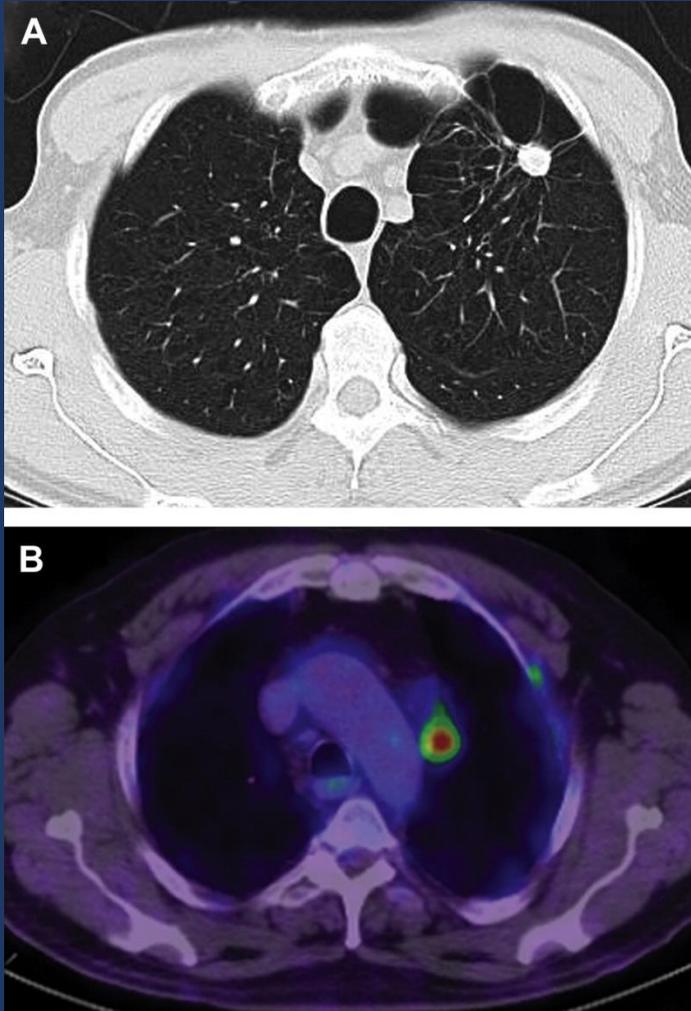
PERCUTANEOUS BIOPSY:

- Pneumothorax in up to 25% of patients
 - 5% large requiring chest tube
 - 46% in those with radiographic or physiologic evidence of COPD.
- Pulmonary Hemorrhage in 4-27%.
- Air Embolism 0.06%

NAVIGATION BRONCH BIOPSY:

- Pneumothorax up to 11% with conventional bronchoscope and decreased to 1.5% with an ultrathin bronchoscope.
- Hemoptysis or hemothorax is reported to be rare. One study reported 1/49 (0.02%) patients.

The Suspicious Pulmonary Nodule

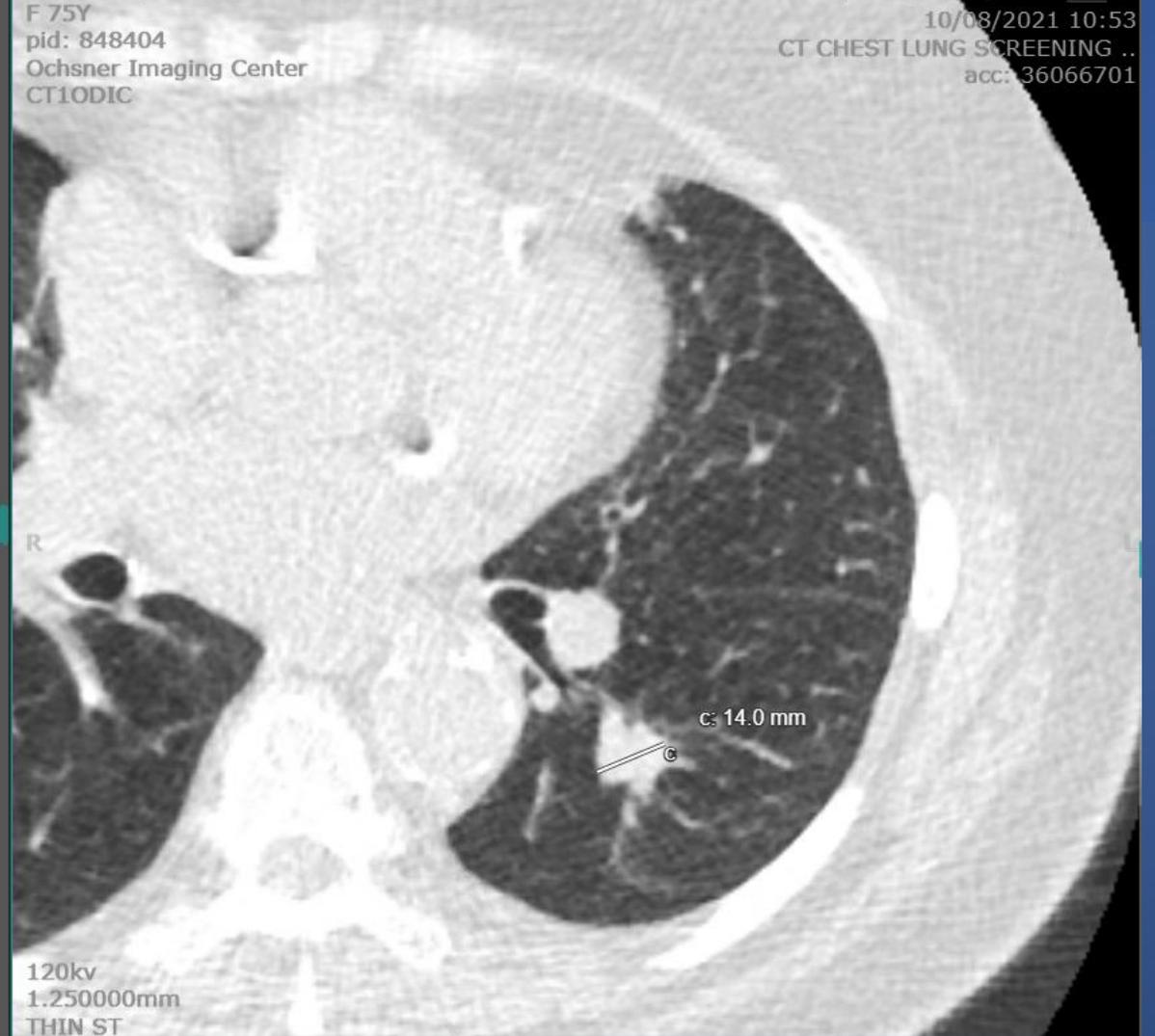


- CT screening programs increases the need for tissue diagnosis.
- Diagnostic accuracy and complication rates will influence a clinician's decision of which study is best for individual patients.

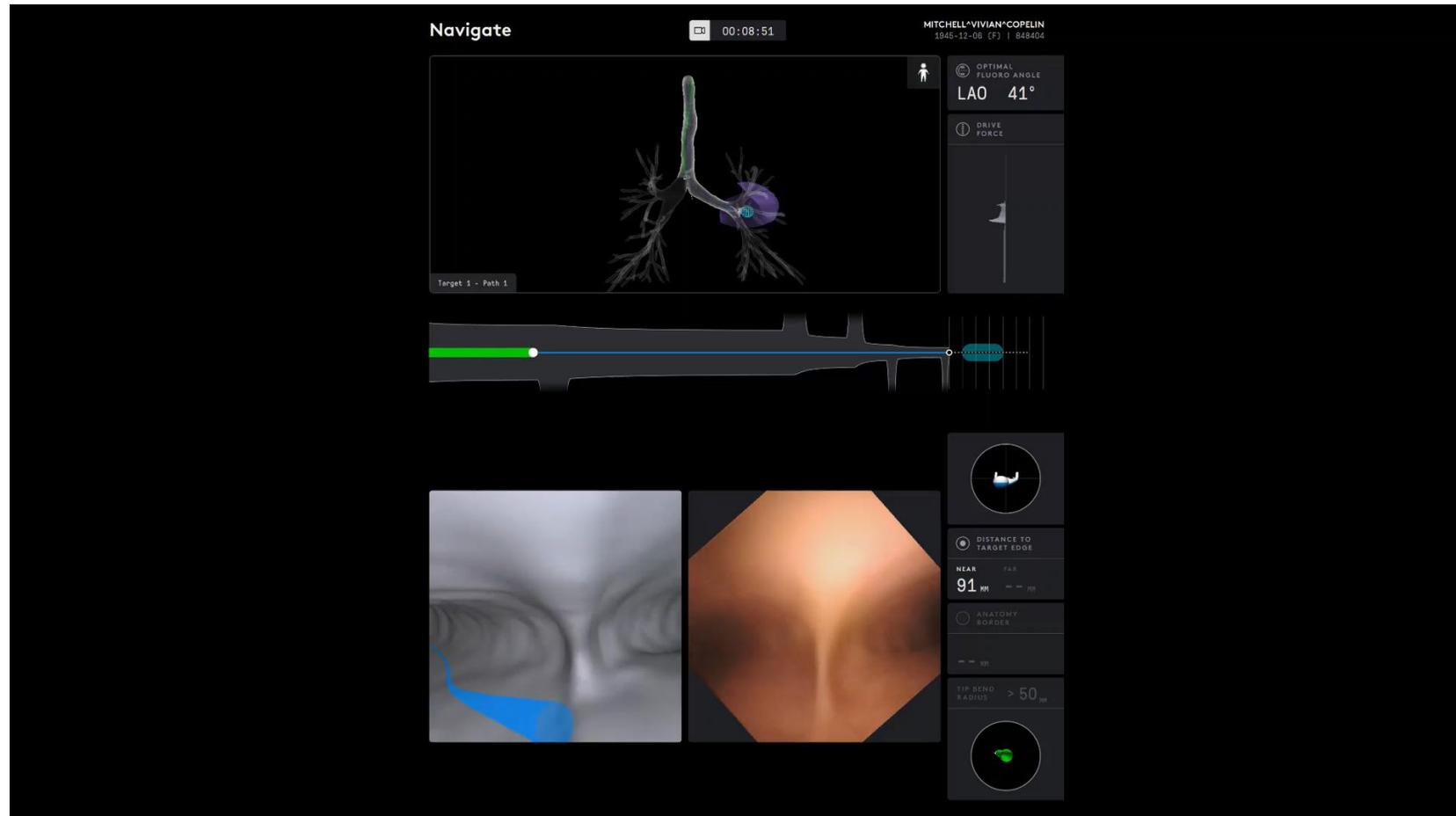
Yield of Bronchoscopy AQuIRE Registry

Yield was highest when bronchoscopy was performed with no advanced technology (63.7%)

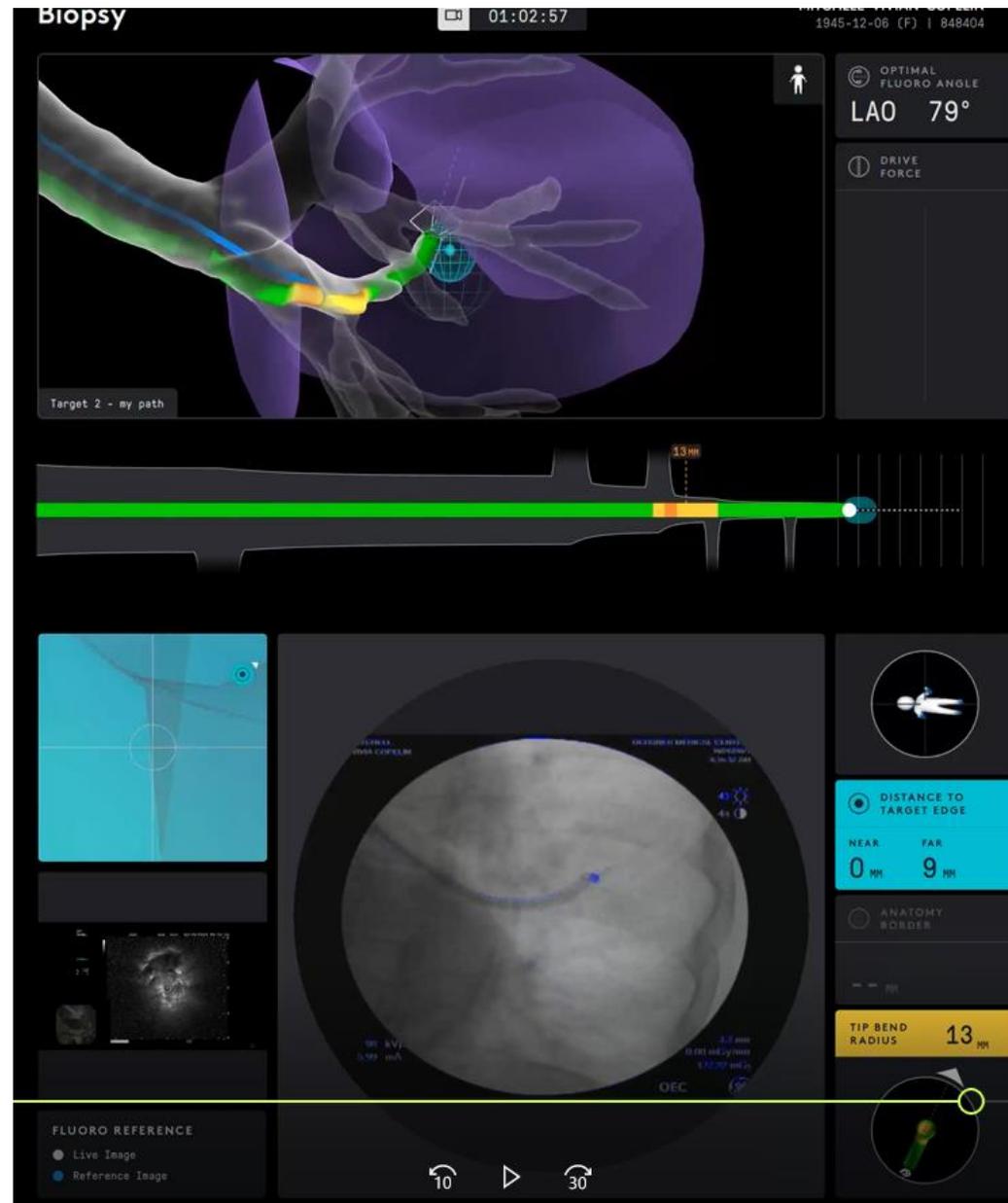
- 57% with radial EBUS alone – 49.5% use
- 38.5% with EMN alone – used in less than half of cases (46.3%)
- 47.1% with EMN and r-EBUS

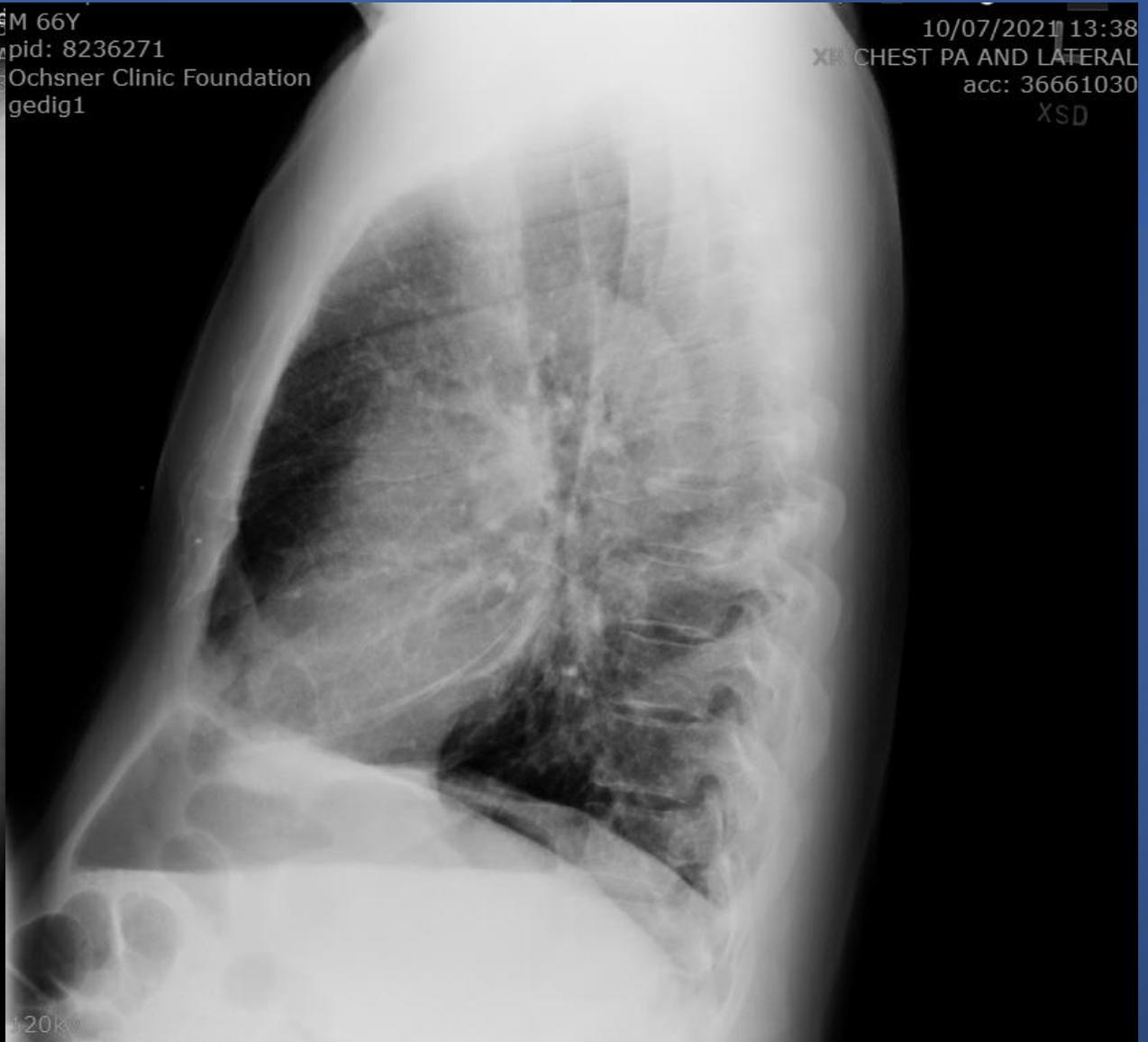


Robotic Bronchoscopy: Extend the reach



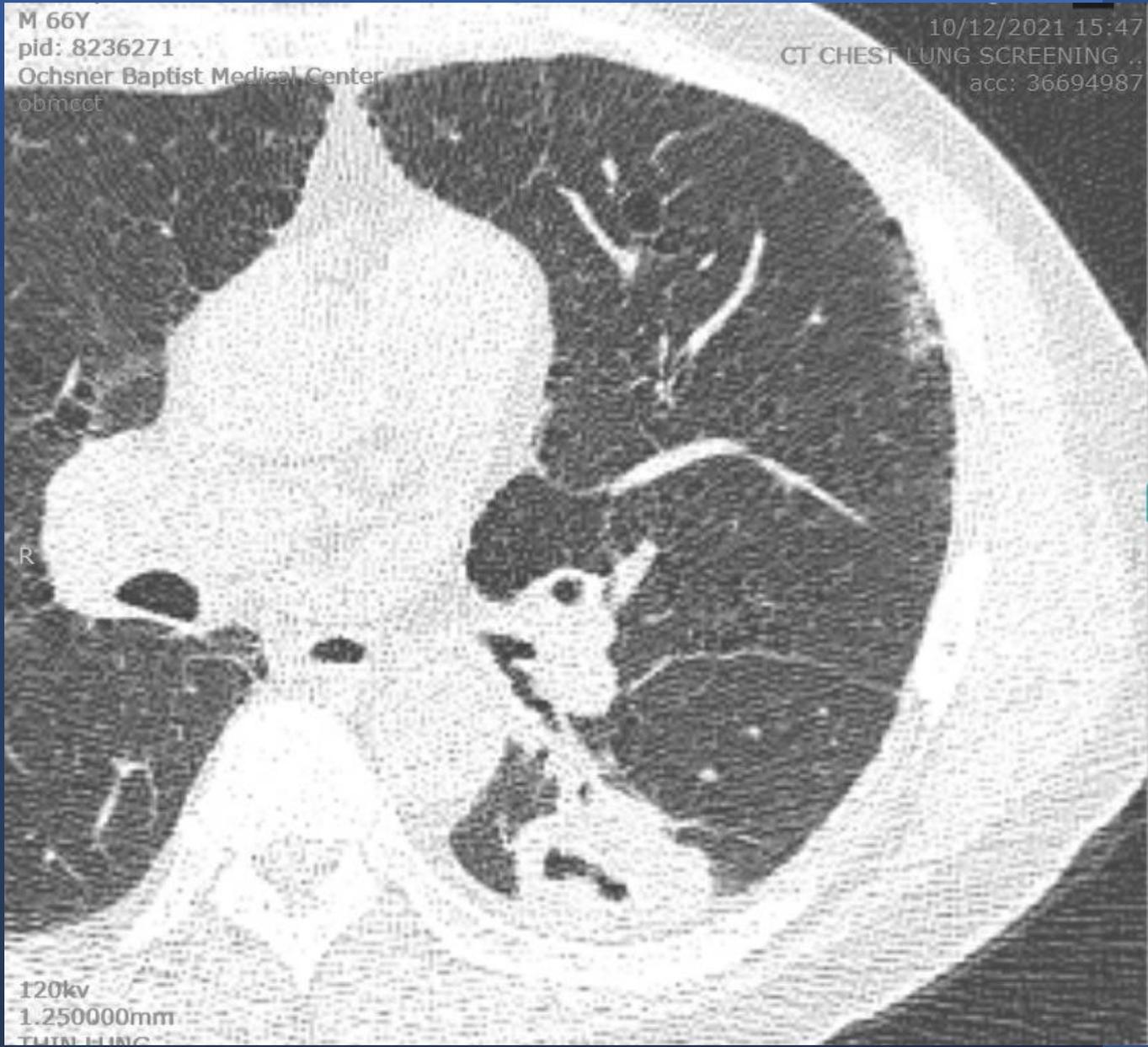
Robotic Bronchoscopy: Extend the Reach





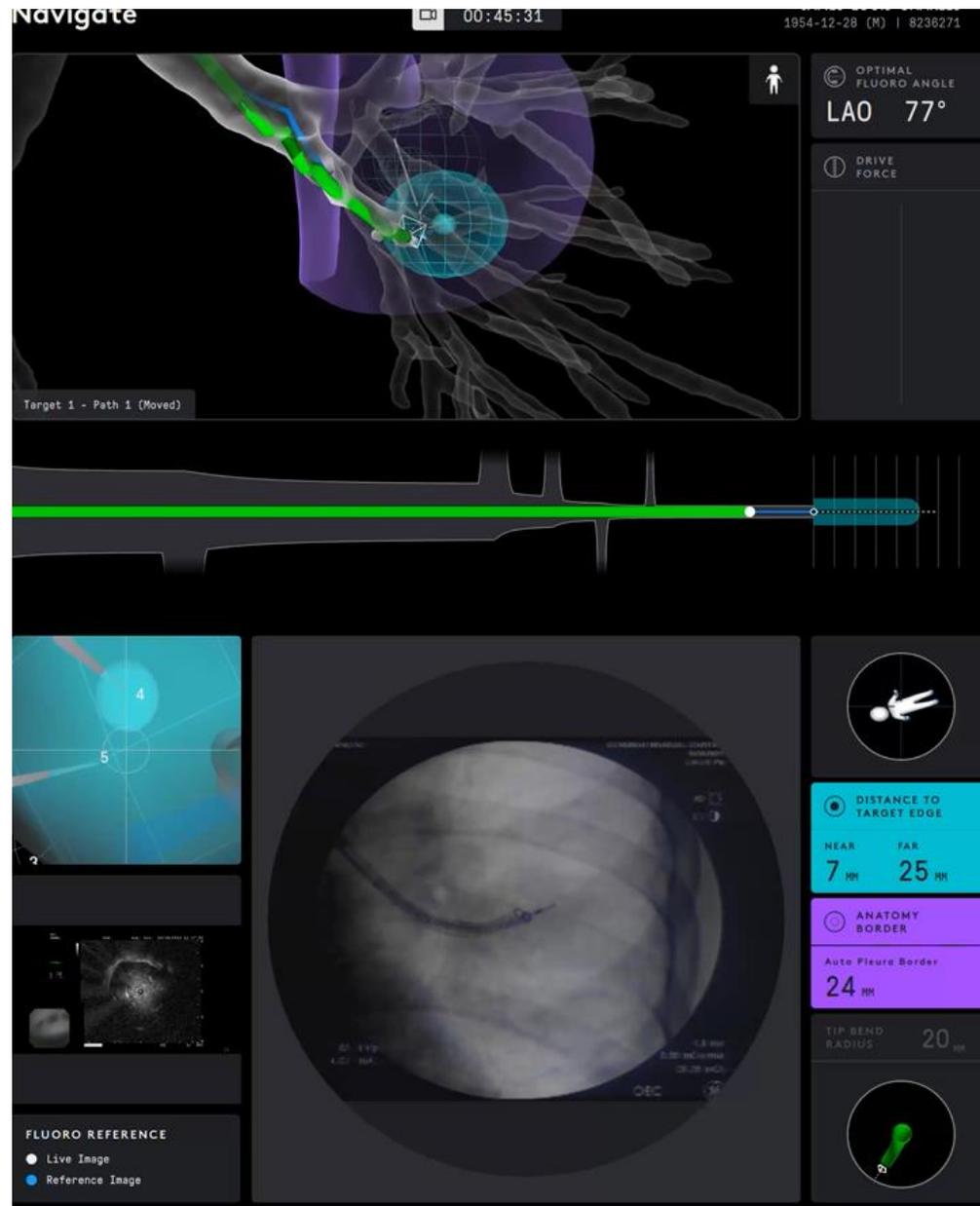
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CT CHEST LUNG SCREENING ..
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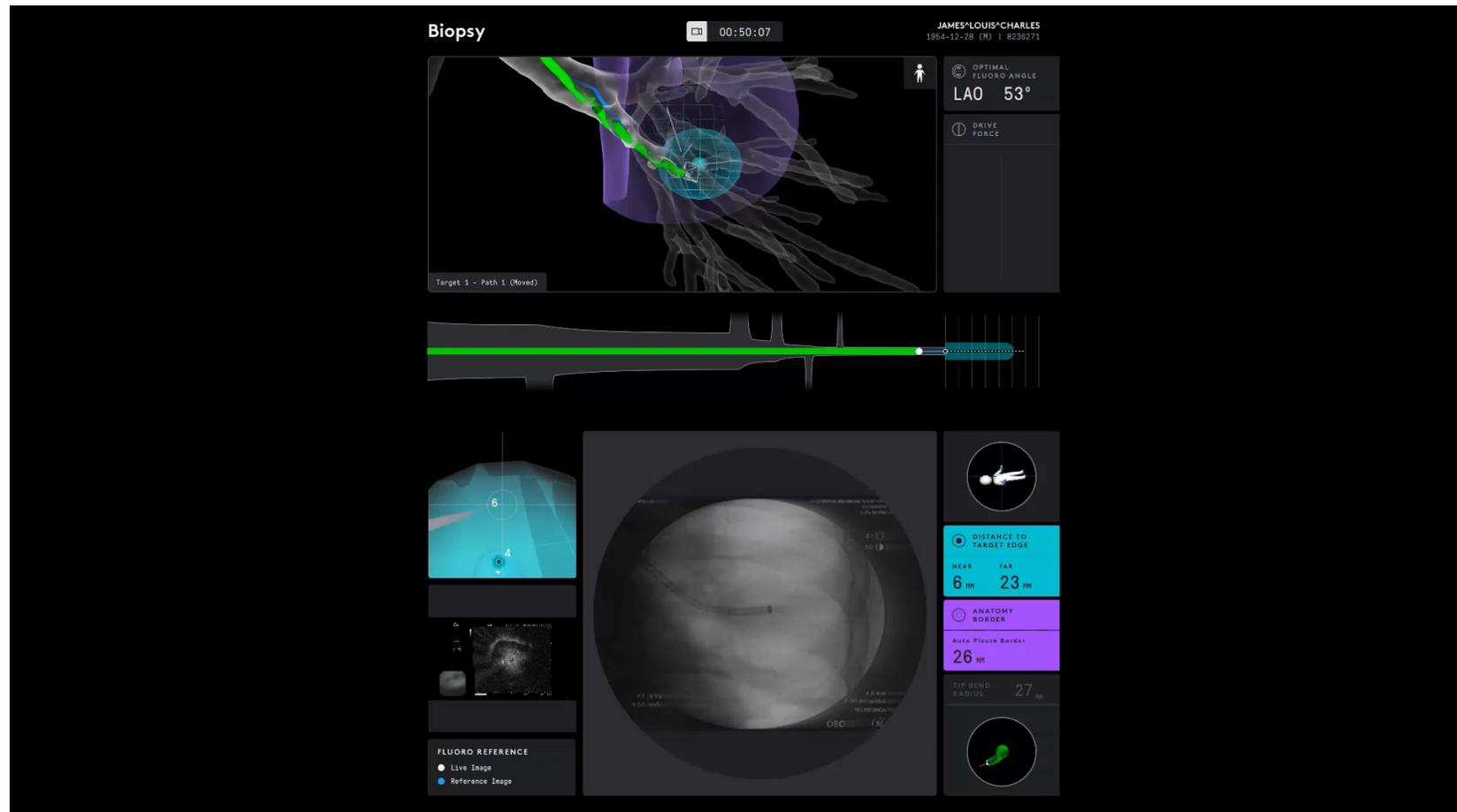


120kv
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THIN LUNG

Robotic Bronchoscopy: Extend the Reach



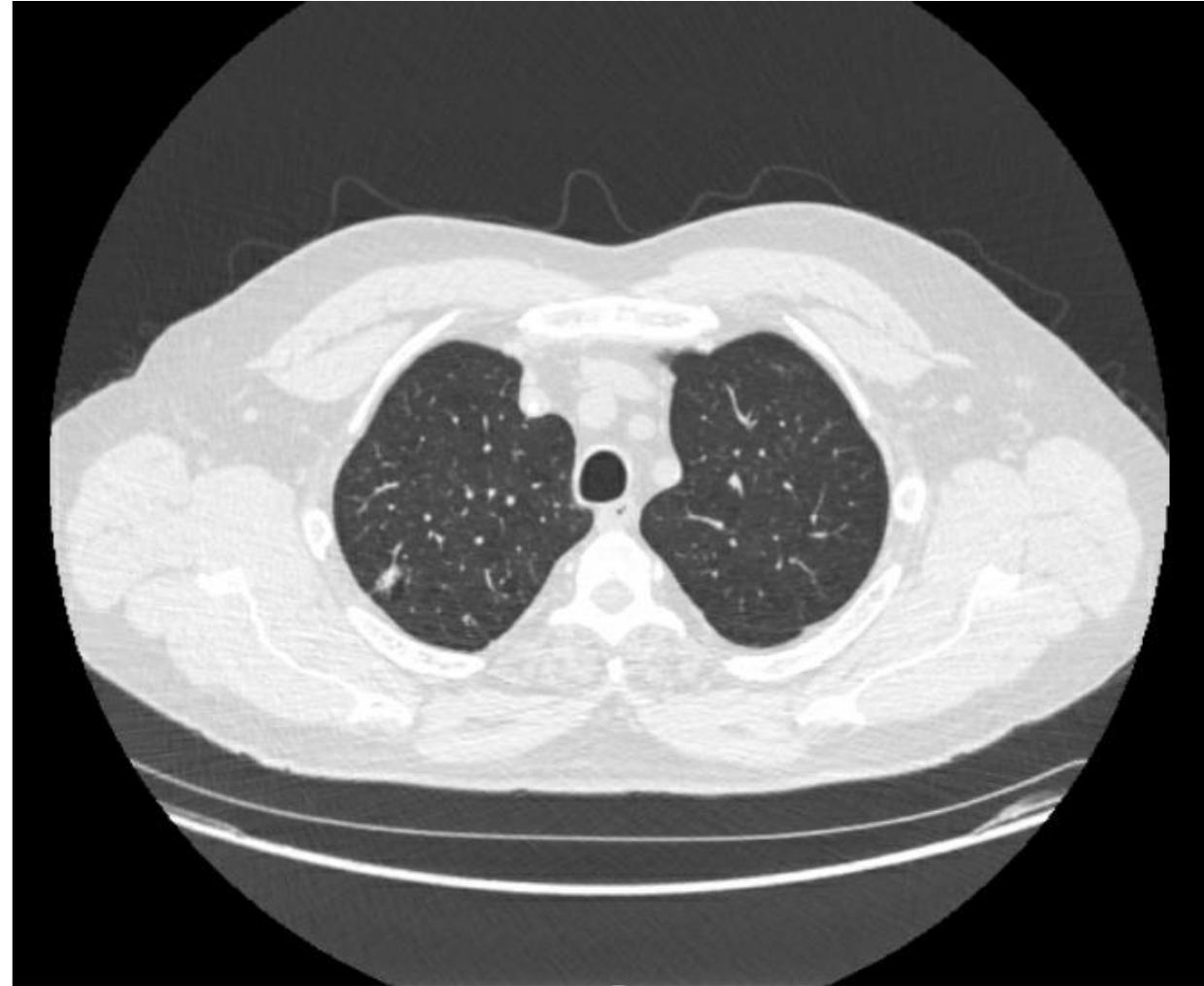
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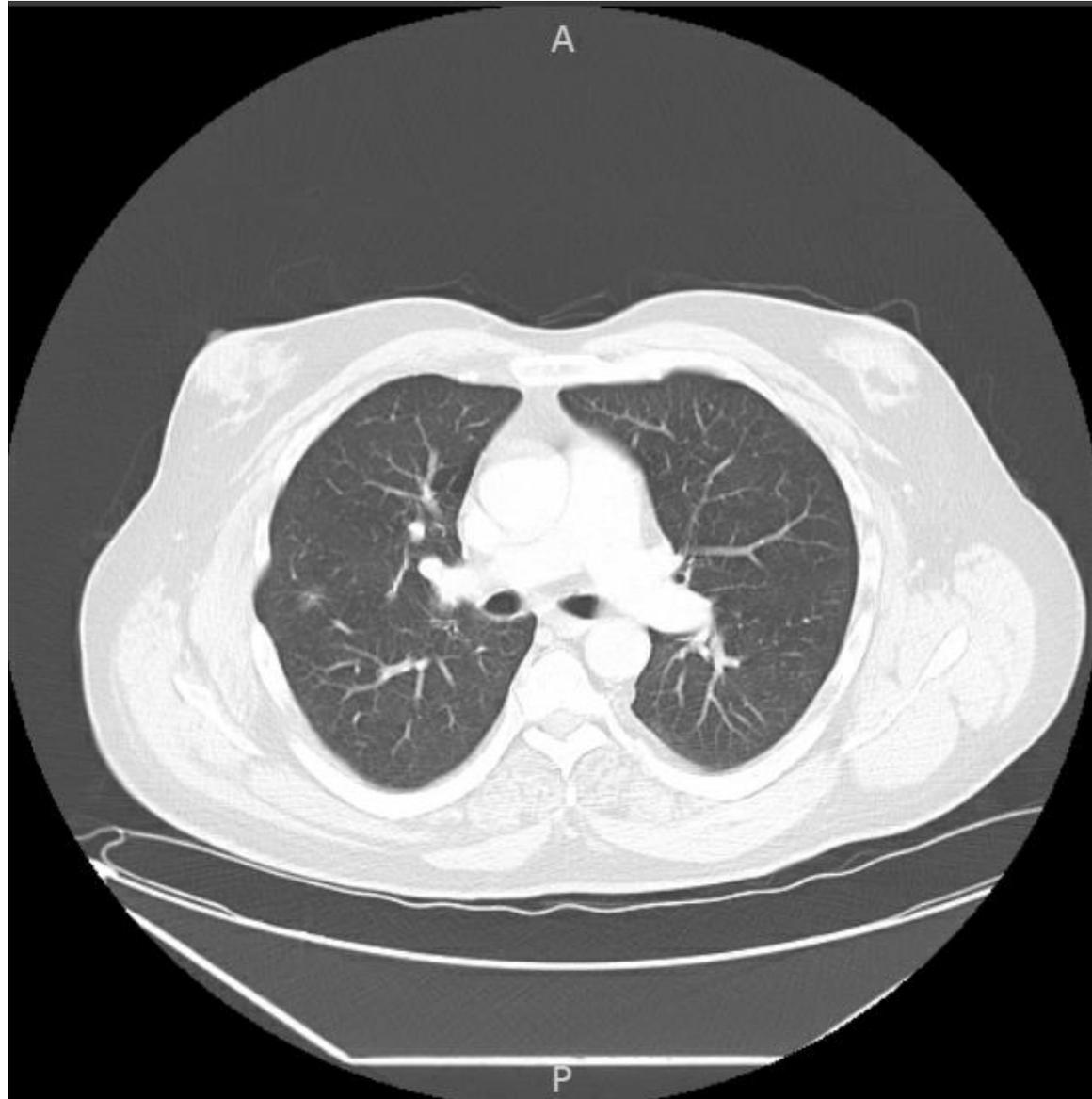


62yo M s/p right minithoracotomy middle lobectomy with MLND Sep 2019

4.2cm poorly diff adenoCA (pT2bN0)

Surveillance chest CT imaging: persistent ground-glass opacities including RUL GGO with solid component





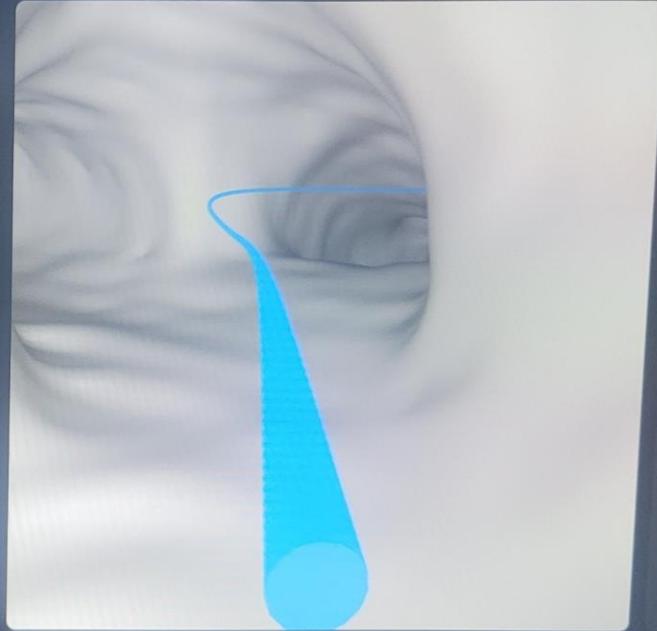


PLAN

REVIEW

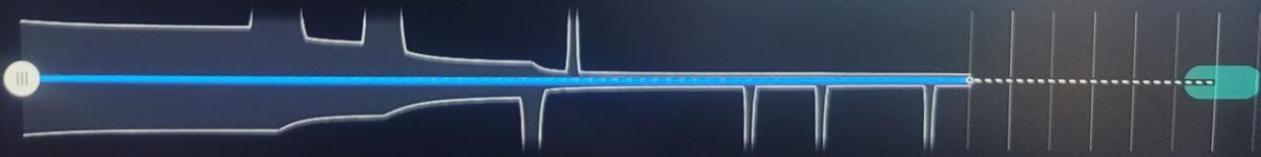


AIRWAY TREE AXIAL CT CORONAL CT SAGITTAL CT



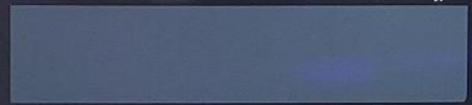
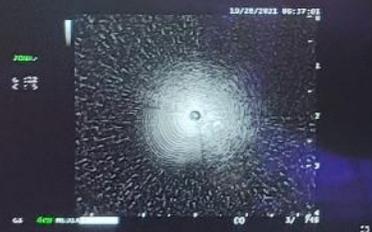
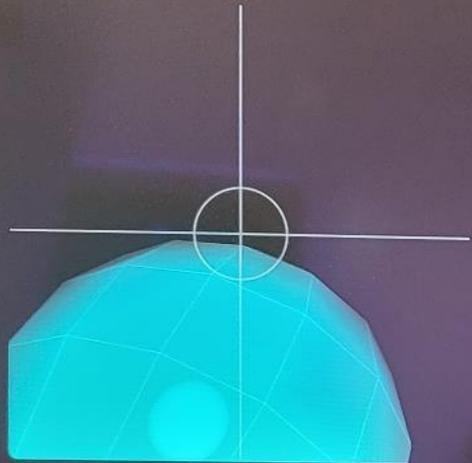
NEAR EDGE 77 FAR EDGE ANA BOR

Select Target & Path: RUL | Path 1



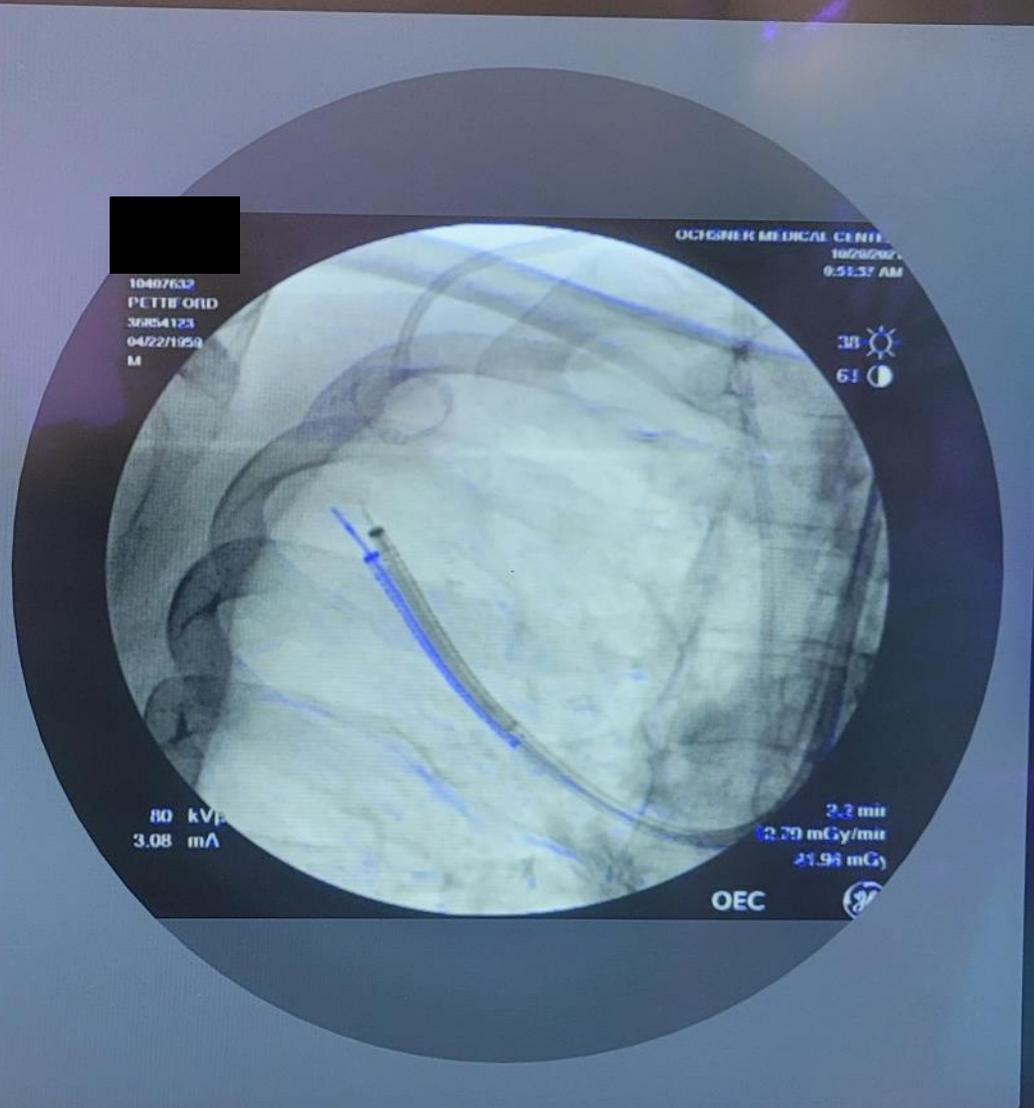
EXPOR





FLUORO REFERENCE

- Live Image
- Reference Image



DISTANCE TO TARGET EDGE

NEAR 6 MM FAR 16 MM

ANATOMY BORDER

Auto Pleura Border 22 MM

TIP BEND RADIUS 23 MM



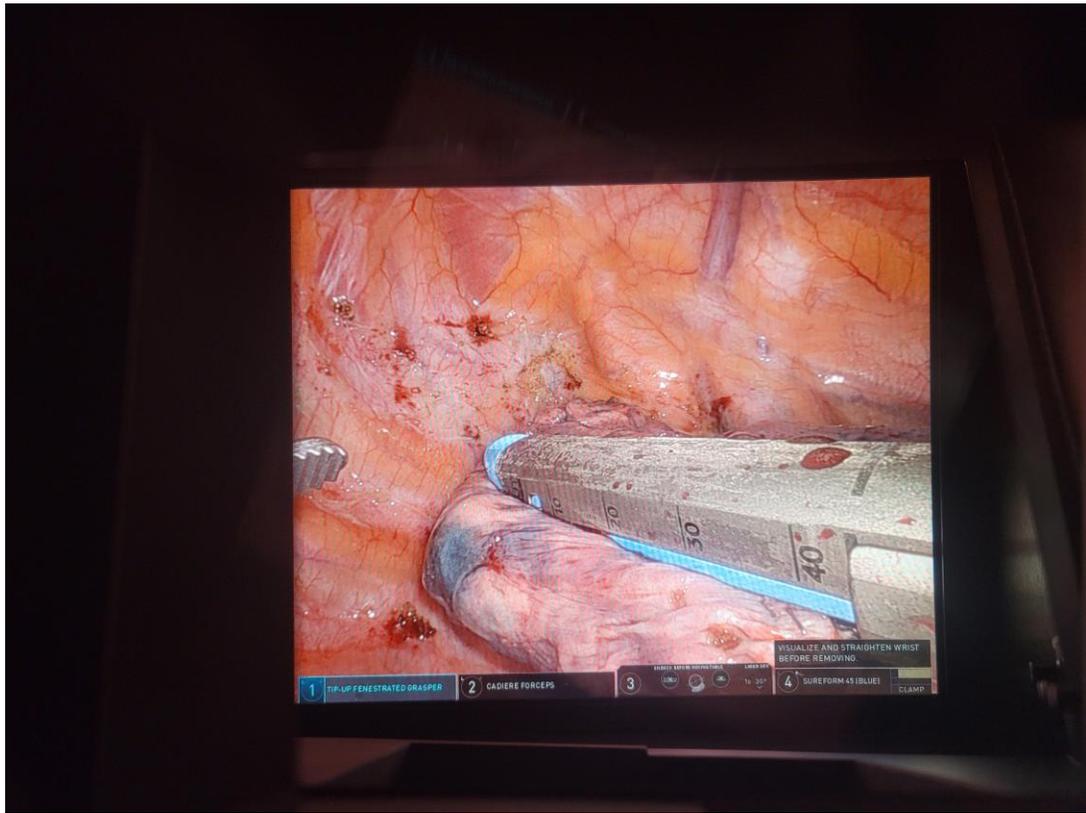
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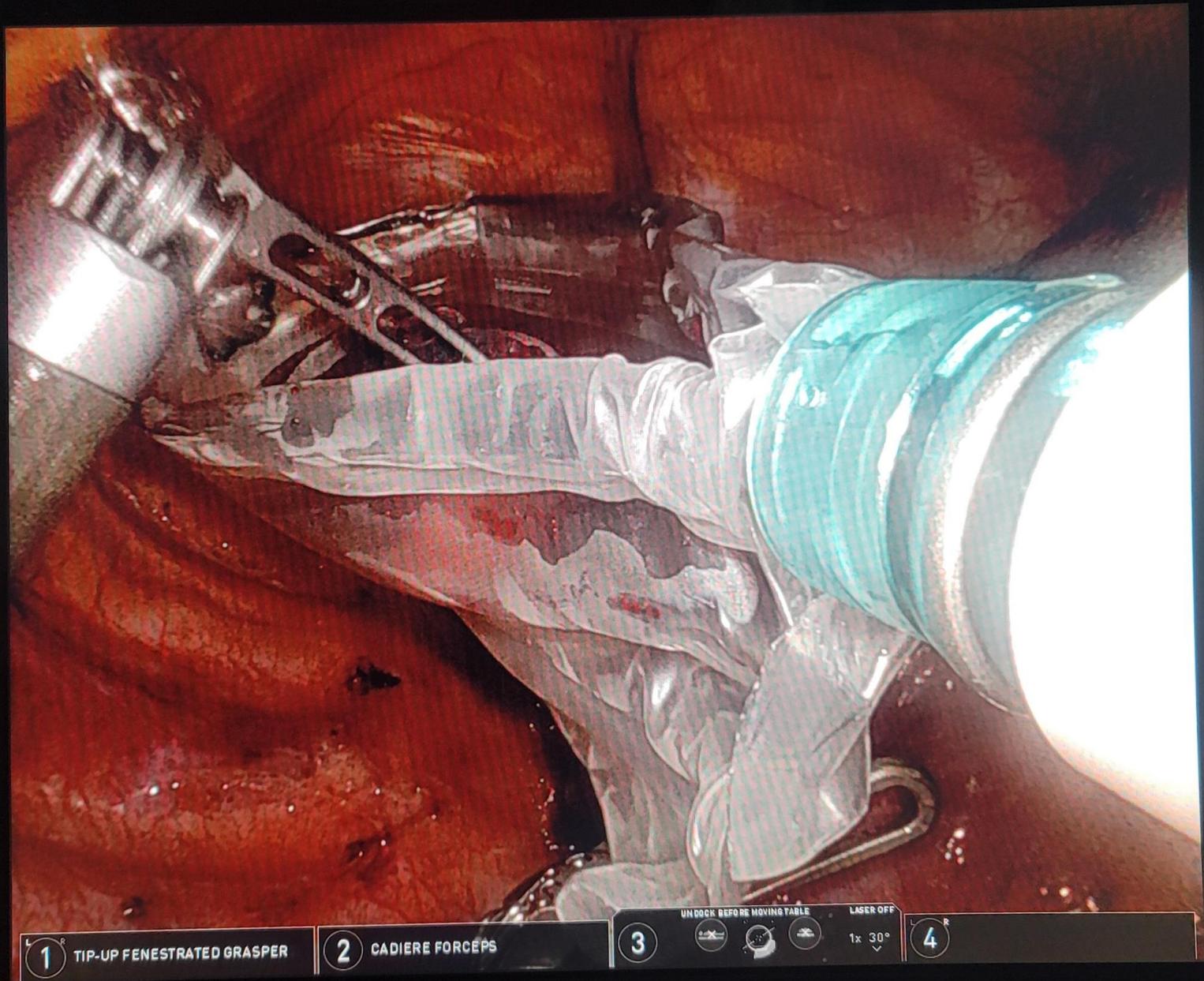
SN 965012

EN 0108

MATT EVANS 985-791-6608







1 TIP-UP FENESTRATED GRASPER

2 CADIERE FORCEPS

3

UNDOCK BEFORE MOVING TABLE

LASER OFF

1x 30°

4



- Final path
 - Invasive adenocarcinoma
 - Tumor size: 0.7cm
 - Resection margin: free of tumor

