Protecting Yourself From Lung Cancer: No. 1 Cancer Killer

Risks, Screening, and Diagnosis

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Lung Cancer Scope

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- #1 cause of cancer related deaths in the US
- More death from lung cancer than breast, colon and prostate combined
- All comers (smokers and nonsmokers) lifetime risk
  - 1 in 15-17 men and women
  - Significantly higher in smokers
- 2.1 million cases 2018, 1.8 million deaths worldwide
- 130,000-160,000 annual US deaths

Lung Cancer Scope

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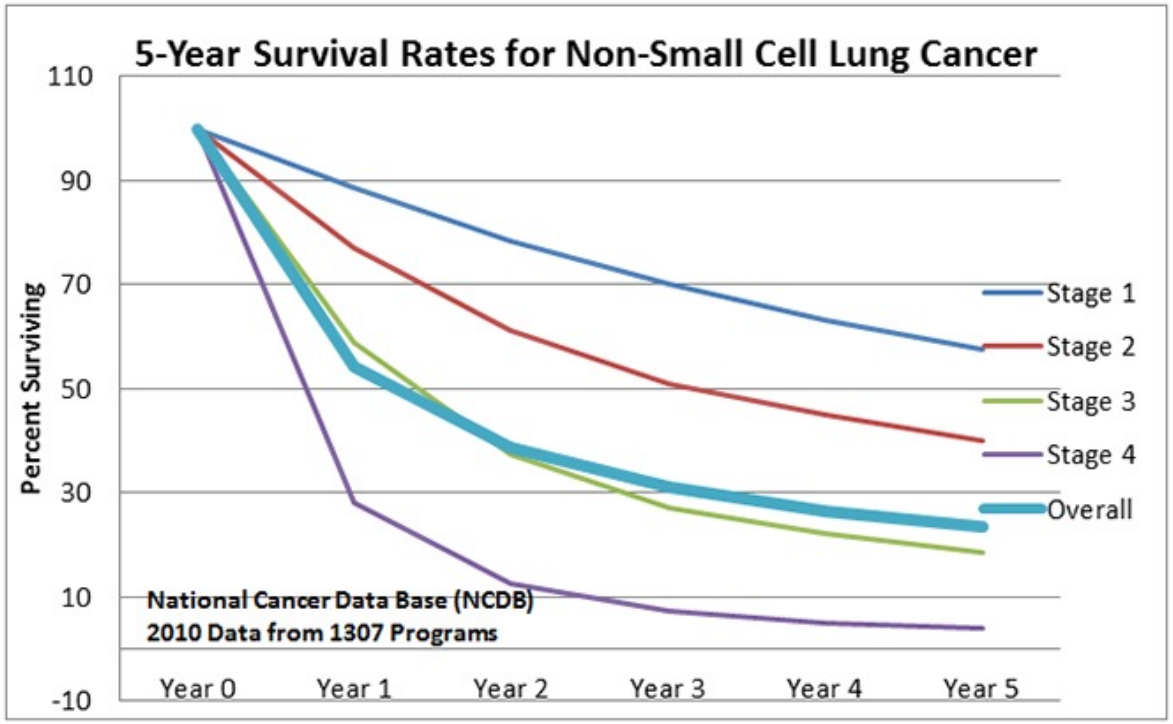
- Most lung cancers are caught at a later stage
- Poor survival associated with late-stage diagnosis



RISK

Lung Cancer Risk- top three risks

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Smoking
Smoking
Smoking

Lung Cancer Risk

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- 90% of lung cancers, 1st suggested **1912**
- 10-30 fold risk compared to non-smokers
- Risk correlates with number cigarettes daily, lifetime duration, depth of inhalation, tar and nicotine content, unfiltered

Lung Cancer Risk

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- Reduced within five years of smoking cessation
- 80-90% risk reduction with 15-year abstinence
- Will not achieve same risk as never-smoker
- Cut back >50% will reduce risk by 27% (if >15/day)
- Ongoing smoking with treatment increases mortality, recurrence development of second primary

Second hand smoke

- Side stream (smoldering) versus mainstream (exhaled)
  - either is sufficient to raise risk
- Far less intense, but often longer duration of exposure
- No controversy
  - US Surgeon General
  - US National Research Council
  - International Agency for Research on Cancer (IARC)

Second hand smoke

- 1.3 times more likely overall to develop cancer than non-SHS
- 1.2 times as likely with spouse or workplace
- Double risk in children with >25 smoker years
  - =years x number of smokers in household
- More commonly associated with small cell carcinoma
- Influenced by genetics

Cigars/Pipes

- One study of >1500 cigar smokers
  - 2.1 relative risk of lung cancer among cigar only
  - Dose-response effect (>5/day)
- Second study of >130,000 men
  - 5.1 relative risk of cancer and death
- Pipe
  - 5.0 relative risk of death from lung cancer
  - Associated with intensity and duration

Electronic cigarettes

- No clear risk, but largely unknown
- Contain nicotine and other carcinogens at lower concentrations
- Other concerns such as serious lung injury or nicotine dependence

Lung Cancer Risk- non-smokers

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- Radon
- Recreational Drugs
- Indoor cooking and heating
- Air pollution
- Lung disease
- Occupational exposures
- Diet

Radon

- Leading cause of lung cancer in non-smokers
- Odorless, gaseous decay of Uranium-238 and Radium-226
- EPA "action level" is 4.0 pCi/L (pico curies/liter of air; average 1.3 pCi/L)
- 50 % of Colorado homes with levels higher than EPA action
- Radon levels can be high in all homes regardless of age or foundation type.
- Synergistic with smoking

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Radon

- Testing
  - 48 hours in low point of home
  - Average of hourly reports
- Mitigation
  - Typical cost $800-$1,200
  - Methods vary by home
    - Basement, crawl space, slab

Recreational drugs

- Marijuana and cocaine
  - Less clear- small studies, not adjusted for tobacco
  - Changes in lung cells to precancer, but magnitude of risk not defined
- Opium
  - Increased risk when smoked or ingested
  - Dose dependent
  - Not the same as morphine, heroin, codeine, fentanyl

Indoor cooking and heating

- Biomass fuels such as wood or coal
- 20% increase risk of lung cancer with bituminous coal versus anthracite (smokeless coal)
- Wood smoke less clear but suggested

Air pollution

- Tiny contribution compared to smoking
- Large, European prospective study (ESCAPE) showed clear risk
  - Associated with increase in road traffic within 100 m
- Diesel exhaust proportional to extent of exposure

Other

- Radiation therapy (e.g., for Breast, Hodgkins)
- Lung disease
  - COPD, IPF, TB, alpha-1 (S or Z allele), asbestosis
- Genetics- first degree relative
- Race/ethnicity- lower in Hispanic?

Asbestosis

- Interstitial fibrosis associated with asbestos exposure
- Increased with occupational exposure, not buildings
  - Plumbers, pipefitters, electricians, insulators, boilermakers, welders
- Asbestosis
  - Dose dependent
  - Increased with amphibole versus chrysolite
  - Increased with tobacco use

Lung Cancer Risk

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- Mesothelioma
  - Cancer of the pleura (lung lining) associated with asbestos
  - Average age 69, M>F, rare cause of cancer
  - 17 years mean duration of exposure
  - 20-30 year latency, depending on exposure

Diet

- Not likely a factor, including red meat
- Conflicting studies showing reduced risk in high fruits/veggies
- No foods increase risk (e.g., sugars)
- No reduction with anti-oxidants (American Lung Assoc)

Diet

- B6, B12- possible in men; limited data as supplement, but not in multivitamin
- Beta-carotene- promoted as chemoprevention
  - Some trials show INCREASED risk, especially smokers

Chemoprevention

- No convincing evidence that any approach other than smoking cessation can decrease the risk of lung cancer everything else investigational
- Aspirin, vitamin E-only trend incidence, but reduced mortality
- Inhaled steroids- small VA cohort showed decreased risk
- Others- Selenium, iloprost, Celebrex, Canakinumab
  - Unclear benefit

SCREENING

Why Screen for Lung Cancer?

- Because it saves lives
- Recommended by NCCN, ACR, ACS, ASCO, ACCP, etc
- Relative numbers needed to screen to prevent one cancer related death
  - Lung cancer 320
  - colon 800
  - breast 1500
- However, not without risk
  - False positives (10%)
  - Incidental findings (possible benefit)
  - Biopsy related morbidity
  - Radiation exposure?

USPSTF Recommendations

- Annual screening with low dose CT (LDCT)
  - Adults aged 55-80
  - 30+ pack year history
  - Currently smoking or quit within the last 15 years
  - Stop screening once they have not smoked for 15 years or has life limiting condition

CMS – Criteria for lung cancer screening: Beneficiary eligibility

- Age 55 – 77 years
- Asymptomatic (no signs/symptoms of lung cancer)
- 30-plus pack-year smoking history
- Current smoker or quit within the last 15 years
- Counseling on smoking cessation, risks and benefits of screening (decision tree tools available)

http://www.cms.gov/medicare-coverage-database/details/nca-decision-memo.aspx?NCAId=274

DISCOVERY

Lung Cancer- symptoms

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- Cough 50-70% (<2% of chronic cough)
- Coughing up blood (hemoptysis) 25-50%
- Short of breath 25%
- Chest Pain 20%
- Unintentional weight loss
- Poor appetite
- Others

Lung Cancer- discovery

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- Chest X-ray
- CT scan- includes upper abdomen
- PET scan (positron emission tomography)
  - Insufficient for staging alone, even PET/CT
  - FP- infection, inflammation, granulomas
  - FN- too small lesions, normal lymph nodes

Lung cancer- CXR

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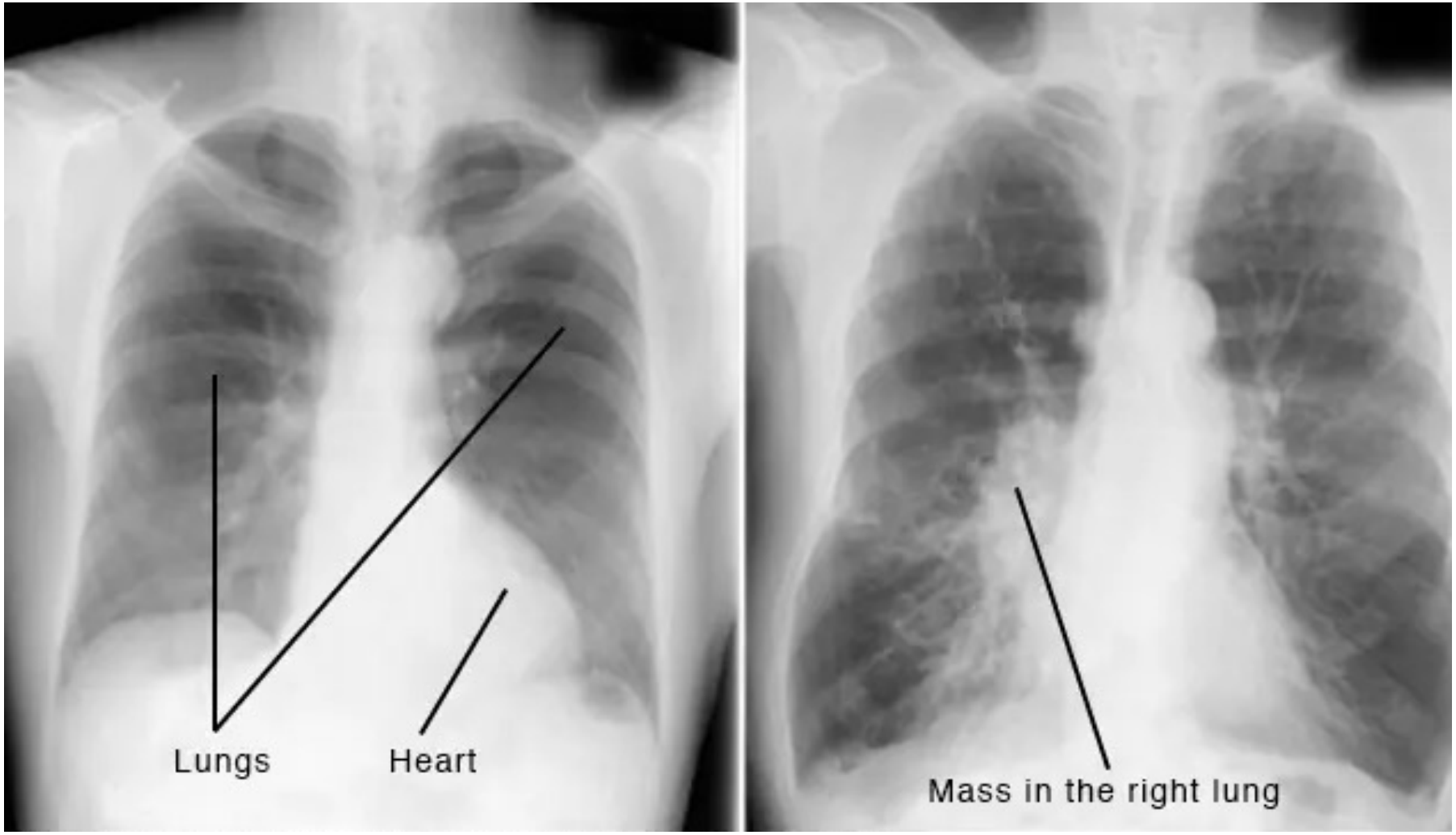

Lung cancer- CT and PET scan

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CT scan

PET scan

CT scan

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CT scan of small lung tumor, left upper lobe.

PET scan

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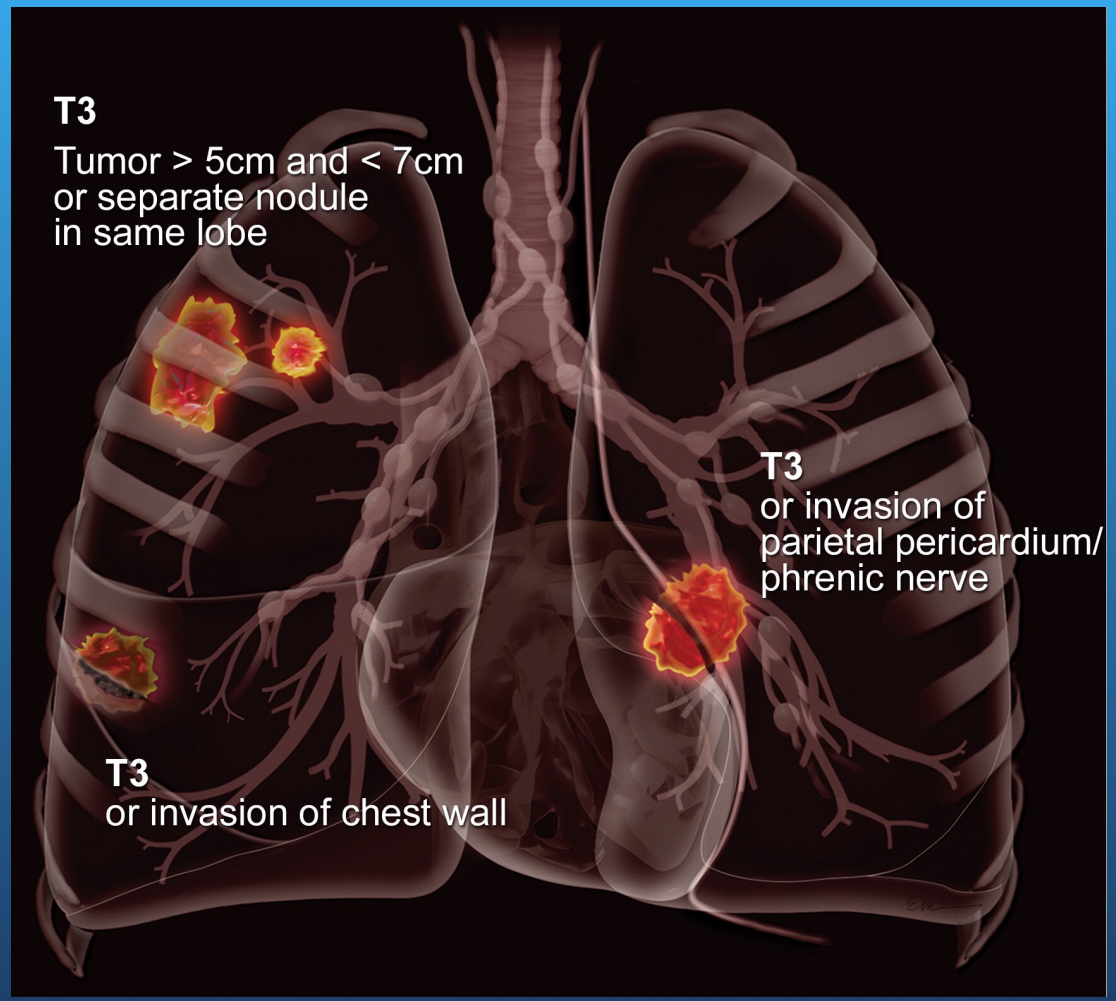
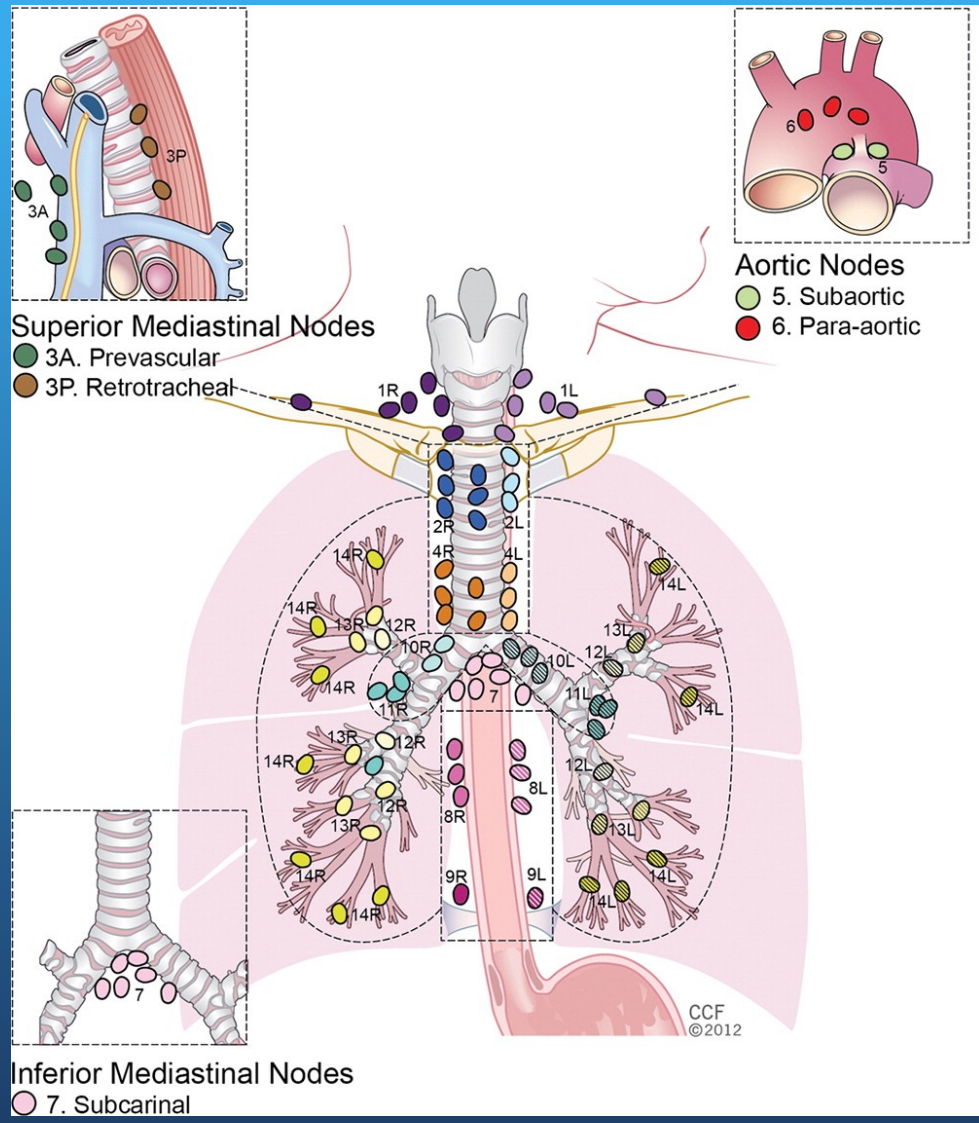
Staging

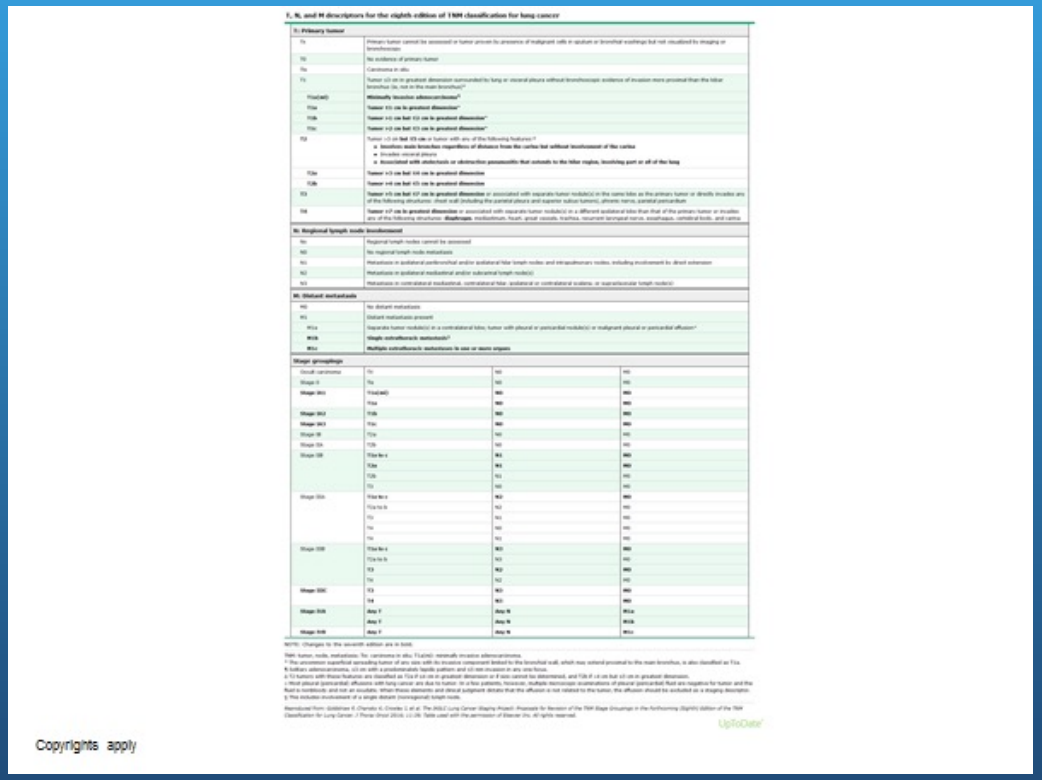

T3
Tumor > 5cm and < 7cm
or separate nodule
in same lobe
T3
or invasion of
parietal pericardium/
phrenic nerve
T3
or invasion of chest wall

Lung Lymph nodes



Right	Left
Low Cervical Nodes	**Low Cervical Nodes**
1R. R. Low cervical Supraclavicular Sternal notch nodes	1L. L. Low cervical Supraclavicular Sternal notch nodes
Superior Mediastinal Nodes	**Superior Mediastinal Nodes**
2R. R.Upper paratracheal	2L. L. Upper paratracheal
4R. R. Lower paratracheal	4L. L. Lower paratracheal
Inferior Mediastinal Nodes	**Inferior Mediastinal Nodes**
8R. R. Paraesophageal	8L. L. Paraesophageal
9R. R. Pulmonary Ligament	9L. L. Pulmonary Ligament
Pulmonary Nodes	**Pulmonary Nodes**
10R. R. Hilar	10L. L. Hilar
11R. R. Interlobar	11L. L. Interlobar
12R. R. Lobar	12L. L. Lobar
13R. R. Segmental	13L. L. Segmental
14R. R. Subsegmental	14L. L. Subsegmental

Lung Cancer - Staging



T, N, and M descriptors for the eighth edition of TNM classification for lung cancer

T: Primary tumor	
Tx	Primary tumor cannot be assessed or tumor proven by presence of malignant cells in sputum or bronchial washings but not visualized by imaging or bronchoscopy
T0	No evidence of primary tumor
Tis	Carcinoma in situ
T1	Tumor ≤3 cm in greatest dimension surrounded by lung or visceral pleura without bronchoscopic evidence of invasion more proximal than the lobar bronchus (ie, not in the main bronchus)[a]
T1a(mi)	**Minimally invasive adenocarcinoma**[b]
T1a	**Tumor ≤1 cm in greatest dimension**[c]
T1b	**Tumor >1 cm but ≤2 cm in greatest dimension**[c]
T1c	**Tumor >2 cm but ≤3 cm in greatest dimension**[c]
T2	Tumor >3 cm **but ≤5 cm** or tumor with any of the following features:[d] ▪ **Involves main bronchus regardless of distance from the carina but without involvement of the carina** ▪ Invades visceral pleura ▪ **Associated with atelectasis or obstructive pneumonitis that extends to the hilar region, involving part or all of the lung**
T2a	**Tumor >3 cm but ≤4 cm in greatest dimension**
T2b	**Tumor >4 cm but ≤5 cm in greatest dimension**
T3	**Tumor >5 cm but ≤7 cm in greatest dimension** or associated with separate tumor nodule(s) in the same lobe as the primary tumor or directly invades any of the following structures: chest wall (including the parietal pleura and superior sulcus tumors), phrenic nerve, parietal pericardium
T4	**Tumor >7 cm in greatest dimension** or associated with separate tumor nodule(s) in a different ipsilateral lobe than that of the primary tumor or invades any of the following structures: **diaphragm**, mediastinum, heart, great vessels, trachea, recurrent laryngeal nerve, esophagus, vertebral body, and carina
N: Regional lymph node involvement	
Nx	Regional lymph nodes cannot be assessed
N0	No regional lymph node metastasis
N1	Metastasis in ipsilateral peribronchial and/or ipsilateral hilar lymph nodes and intrapulmonary nodes, including involvement by direct extension
N2	Metastasis in ipsilateral mediastinal and/or subcarinal lymph node(s)
N3	Metastasis in contralateral mediastinal, contralateral hilar, ipsilateral or contralateral scalene, or supraclavicular lymph node(s)
M: Distant metastasis	
M0	No distant metastasis
M1	Distant metastasis present
M1a	Separate tumor nodule(s) in a contralateral lobe; tumor with pleural or pericardial nodule(s) or malignant pleural or pericardial effusion[e]
M1b	**Single extrathoracic metastasis**[f]
M1c	**Multiple extrathoracic metastases in one or more organs**

Stage groupings			
Occult carcinoma	Tx	N0	M0
Stage 0	Tis	N0	M0
Stage IA1	**T1a(mi)**	**N0**	**M0**
	T1a	N0	M0
Stage IA2	**T1b**	**N0**	**M0**
Stage IA3	**T1c**	**N0**	**M0**
Stage IB	T2a	N0	M0
Stage IIA	T2b	N0	M0
Stage IIB	T1a-b-c	N1	M0
	T2a	N1	M0
	T2b	N1	M0
	T3	N0	M0
Stage IIIA	T1a-b-c	N2	M0
	T2a-b-c	N2	M0
	T3	N1	M0
	T4	N1	M0
	T1a-b-c	N2	M0
Stage IIIB	T2a-b-c	N3	M0
	T3	N2	M0
	T4	N2	M0
Stage IIIC	T3	N3	M0
	T4	N3	M0
Stage IVA	Any T	Any N	M1a
	Any T	Any N	M1b
Stage IVB	Any T	Any N	M1c

NOTE: Changes to the seventh edition are in bold.

TNM, tumor, node, metastasis; Tis, carcinoma in situ; T1a(mi), minimally invasive adenocarcinoma.

[a] The uncommon superficial spreading tumor of any size with its invasive component limited to the bronchial wall, which may extend proximal to the main bronchus, is also classified as T1a.

[b] Solitary adenocarcinoma, ≤3 cm with a predominantly lepidic pattern and ≤5 mm invasion in any one focus.

[c] T1 tumors with these features are classified as T1a if ≤1 cm or greatest dimension or if size cannot be determined, and T1b if >1 cm but ≤2 cm in greatest dimension.

[d] Most pleural (pericardial) effusions with lung cancer are due to tumor. In a few patients, however, multiple microscopic examinations of pleural (pericardial) fluid are negative for tumor and the fluid is nonbloody and not an exudate. When these elements and clinical judgment dictate that the effusion is not related to the tumor, the effusion should be excluded as a staging descriptor.

[e] This includes involvement of a single distant (nonregional) lymph node.

Reproduced from: Goldstraw P, Chansky K, Crowley J, et al. The IASLC Lung Cancer Staging Project: Proposals for Revision of the TNM Stage Groupings in the Forthcoming (Eighth) Edition of the TNM Classification for Lung Cancer. J Thorac Oncol 2016; 11:39. Table used with the permission of Elsevier Inc. All rights reserved.

UpToDate

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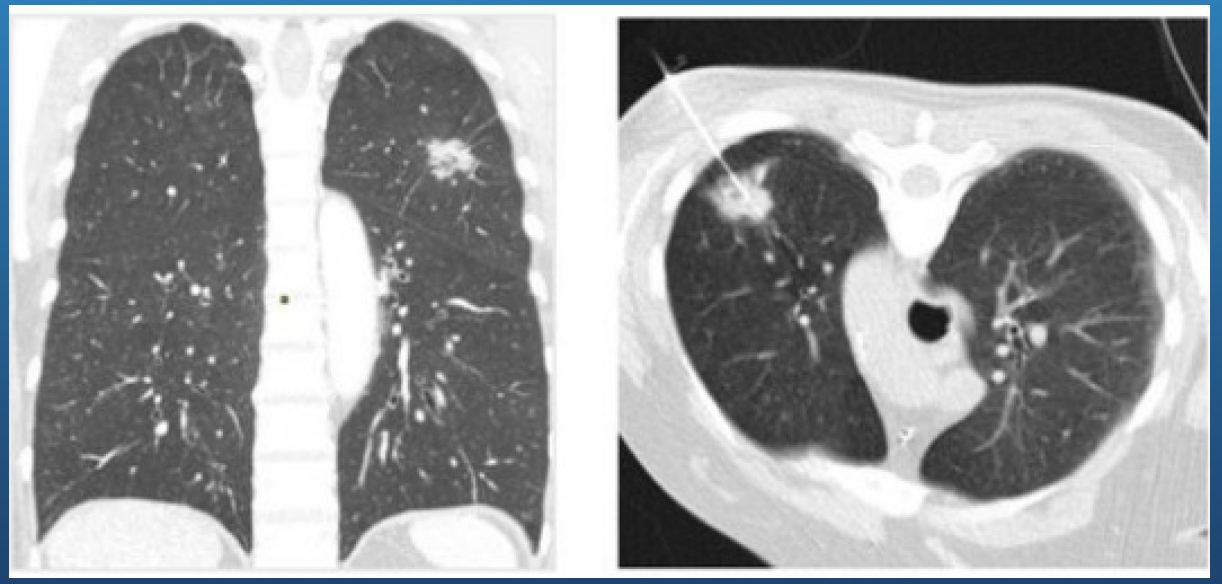
- TNM
- Tumor
- Node
- Metastasis

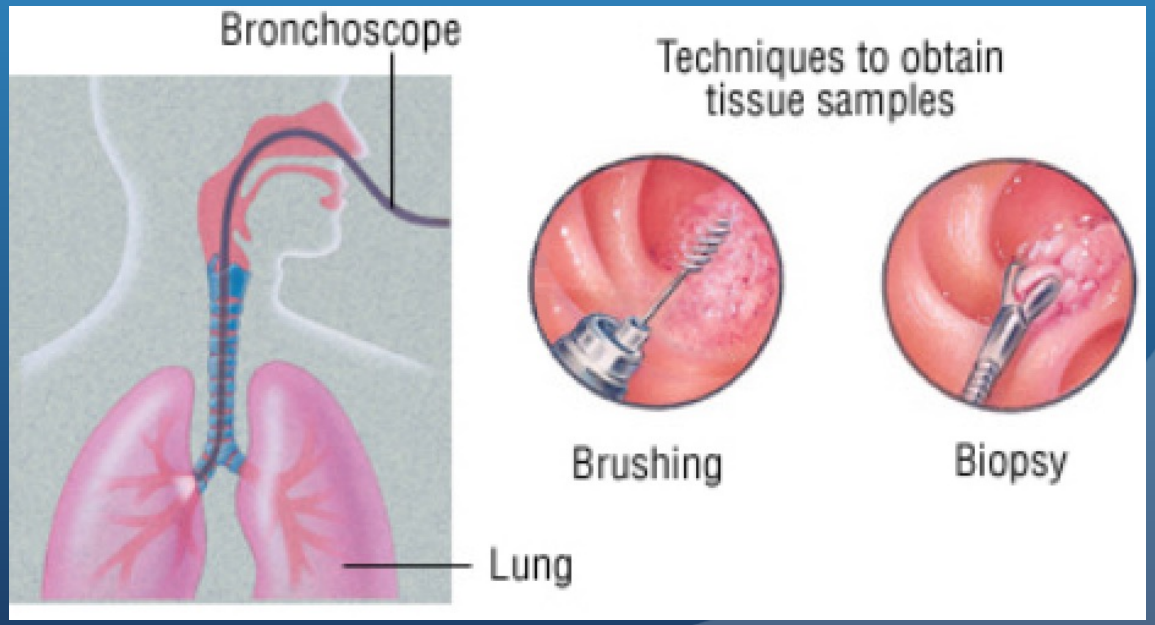
CT guided needle biopsy

- Peripheral based nodules
- Caution in moderate to severe emphysema
  - Increased risk of pneumothorax and persistent bronchopleural fistula

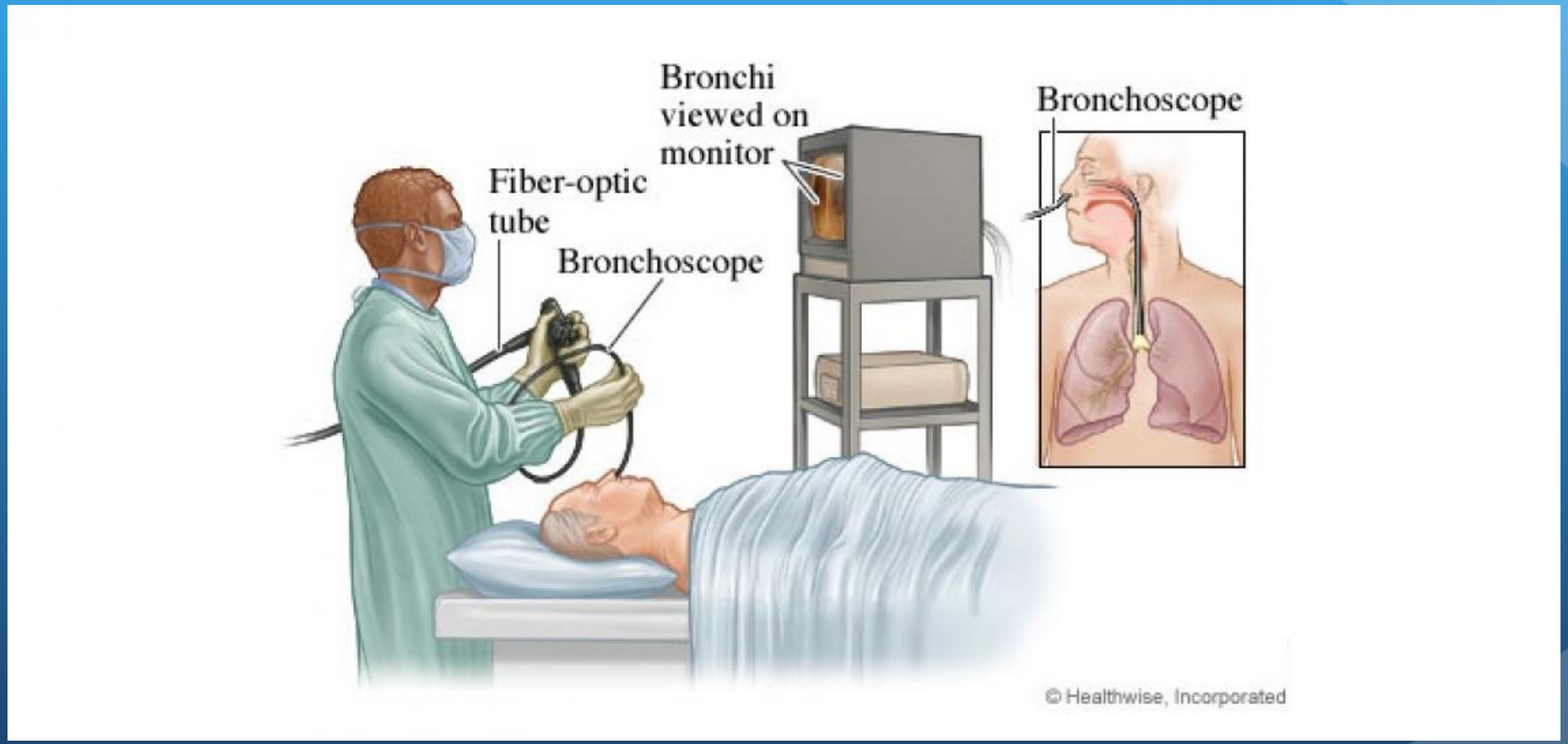


Bronchoscopy

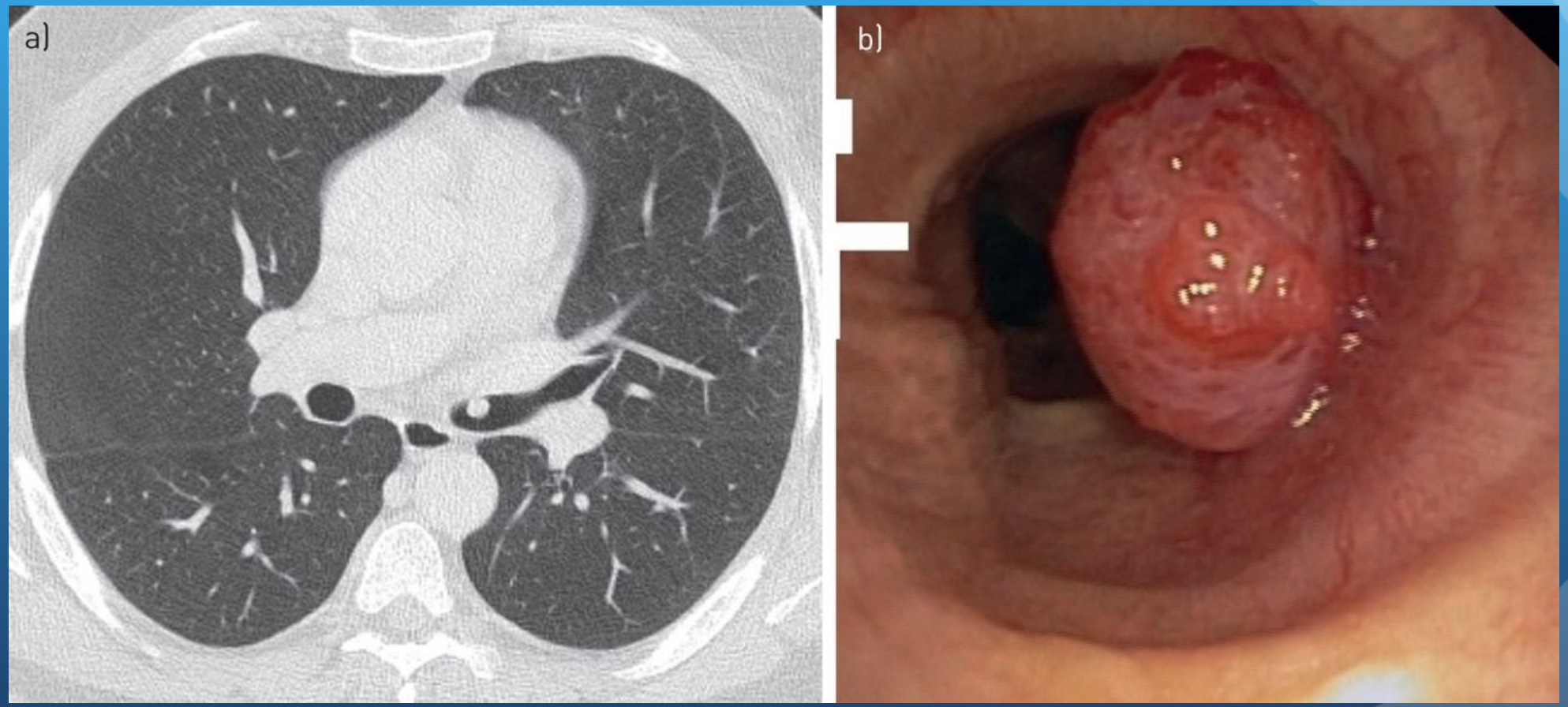
- Larger size lesions
- Airway leading out to lesion
- Airway centric tumors
- Fluoroscopy



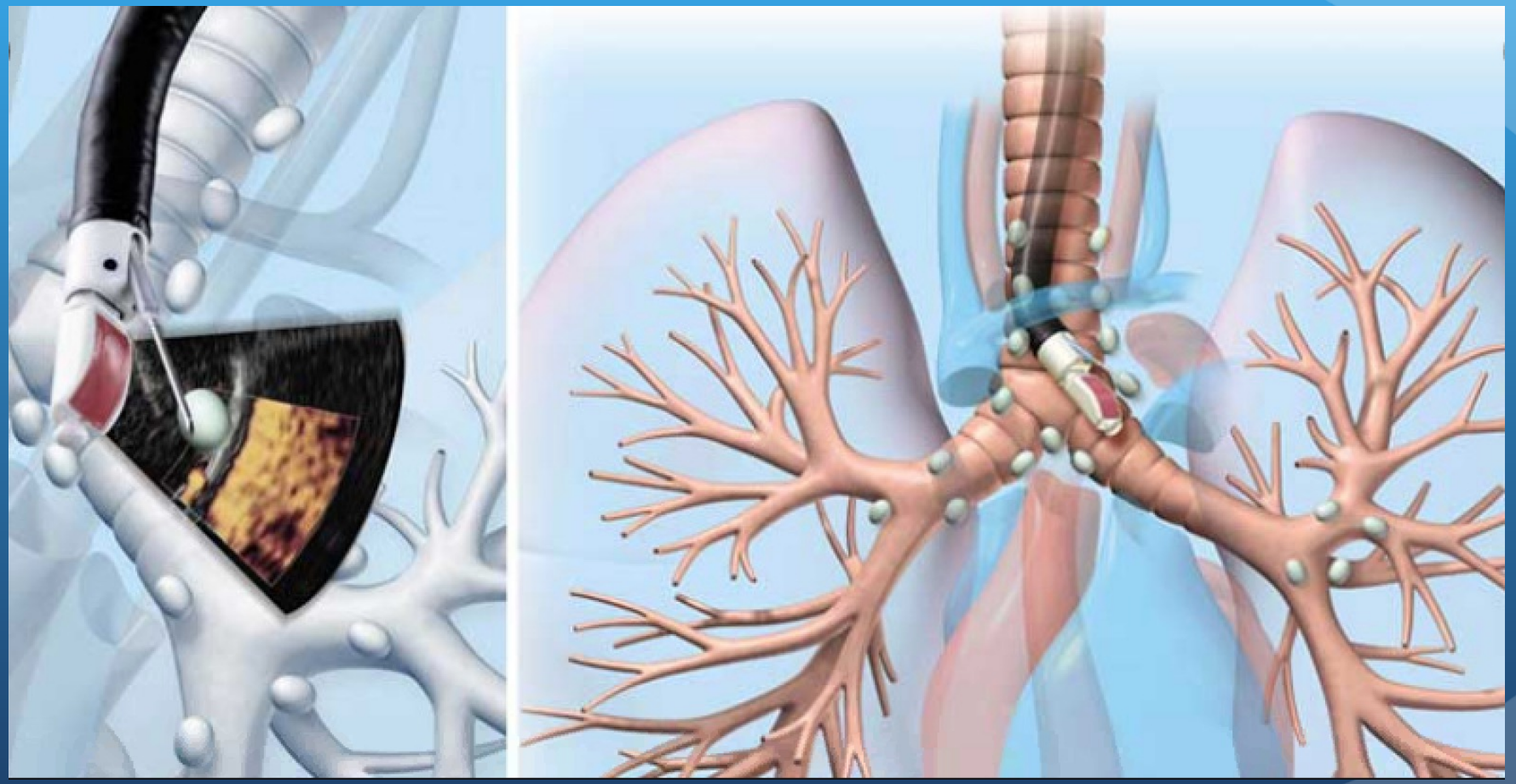
Bronchoscopy



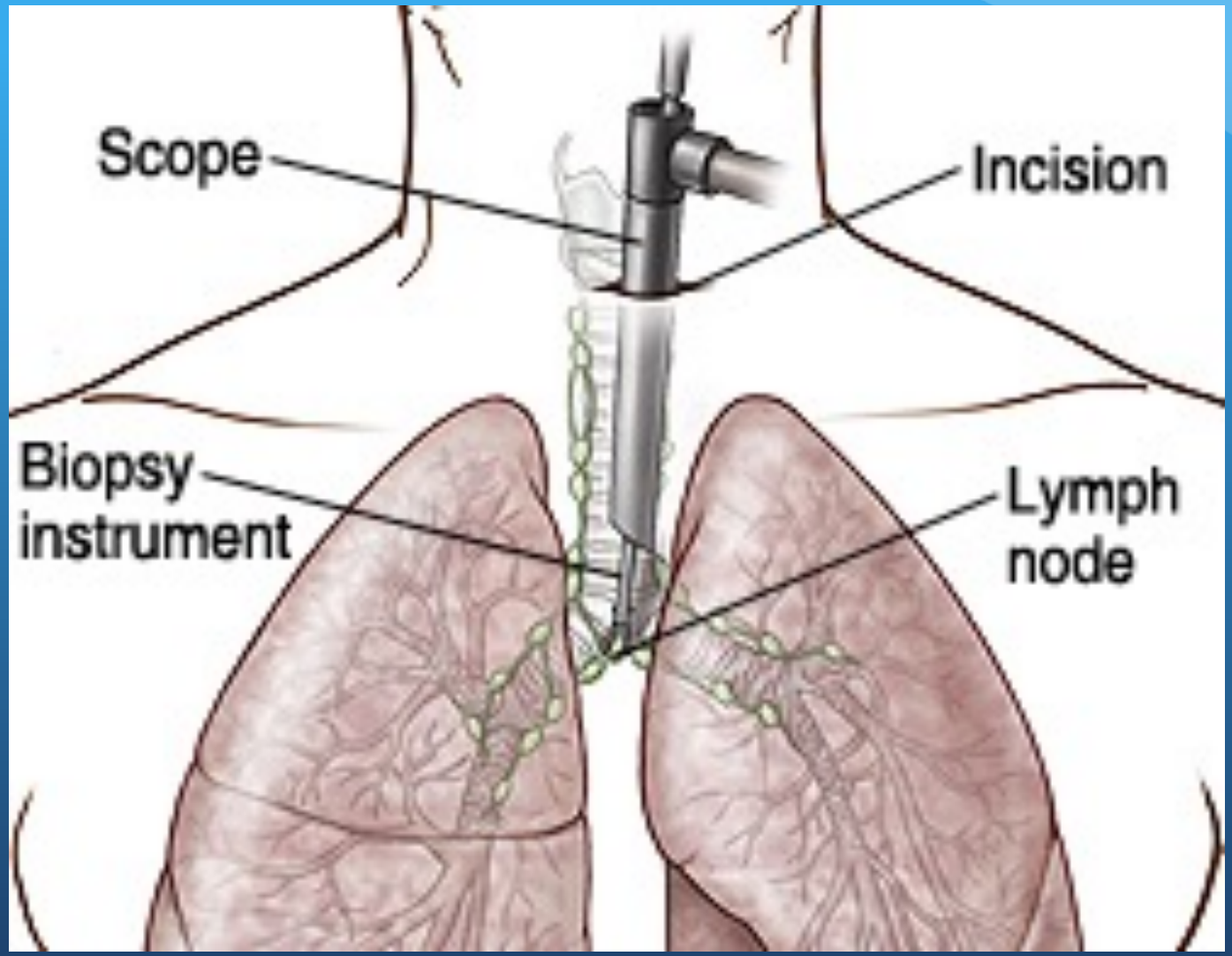
Endobronchial lung cancer



Endobronchial Ultrasound (EBUS)



Mediastinoscopy



Lung Cancer- types

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- Small cell carcinoma
- Non-small cell carcinoma (85%)
  - Adenocarcinoma
    - Genetic subtypes
  - Squamous cell carcinoma
- Other (about 5%)

Lung Cancer- treatment

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- Surgical resection
- Chemotherapy and immunotherapy
- Radiation
  - Stereotactic/cyberknife
  - External beam
  - Brachytherapy- inside

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