LUNG CANCER:
Detection, Diagnosis, and Treatment

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DISCLOSURES

Consultant/Instructor: Medtronic

Clinical Advisory Committee: Softek Illuminate, Inc.

BASICS:

Lung Cancer is the leading cause of cancer death worldwide, responsible for 21% of the cancer deaths in both men and women.

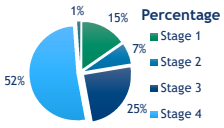
1 in 16 people will be diagnosed with lung cancer in their lifetime.

20 percent of lung cancers occur in patients who have never smoked.

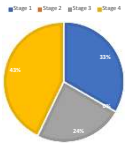
While the 5 year survival rate for lung cancer has improved, it is still a dismal 22% (up from 15% 5 years ago).

American Lung Association. State of Lung Cancer, 2023 Report

BASICS



One of the major drivers for survival is the stage of lung cancer at presentation.



BASICS

5 Year Survival based on Stage

Stage 1: 73 – 90%

Stage 2: 56 - 65%

Stage 3: 12 - 41%

Stage 4; 0 - 10%

NCI SEER Program 2023 Data

LUNG CANCER

"The Last Great Frontier of Cancer Care"

Large amount of interest from industry in both diagnosis and treatment

Detection

Benefits of AI driven evaluation

Need for greater population monitoring

Diagnostics

Noninvasive diagnostic testing to aid prognosis

Devices for diagnosis

Treatment

Personalized treatment

Role of Targeted Therapy and Immunotherapy

Future state of local therapy

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DETECTION

Lung Cancer Screening

Age 50 – 77 years of age

20 pack year smoking history

Current smoker or quit in the past 15 years

Problems with Current Screening

Aging population

Increasing number of lung cancers detected more than 15 years after quitting

Racial Bias (Minorities have a higher percentage of cancers at an earlier age)

Only 4.5% of those eligible were screened in 2022.

Majority of patients screened are lost to follow-up scanning.

American Lung Association. State of Lung Cancer, 2023 Report

DETECTION

Lung Cancer Screening Misses the Majority

Only about 13% of Lung Cancers are found by Lung Cancer Screening

Incidental Lung Nodule Programs

Review all CT scans done in your institution.

25 – 30% of all CT scans will have a lung nodule

Identify patients with incidental nodules that need follow-up or intervention.

Provides a "safety net" for the patients and your institution.

Creates a stage shift in diagnosed lung cancers since most incidental lung cancers are asymptomatic.

Will find 85% of the new lung cancer diagnoses.

LeMense, et. al., Development and Outcomes of a Comprehensive Multidisciplinary Incidental Lung Nodule and Lung Cancer Screening Program. BMC Pulm Med, 2020.

DETECTION

Logistics

Computerized review of CT scan reports

Lung nodule nurse navigator

Interventional pulmonologist/Interventional radiologist

Lung nodule clinic

Guideline driven care

Focus on rapid detection and move to treatment

DETECTION

Development and Outcomes of a Comprehensive Multidisciplinary Incidental Lung Nodule and Lung Cancer Screening Program

LeMense, et. al., BMC Pulmonary Medicine, 2020

Comprehensive lung nodule program monitoring both lung cancer screening scans and incidental lung nodules.

Increased the number of lung cancers found per quarter by 24% in the first year.

Increased the number of stage 1 and 2 lung cancers from 21% to 38% in the first two years.

Shortened the time from detection to treatment from 41 days to 28 days.

Increased the number of patients undergoing lung cancer screening scans steadily each quarter (both new and follow-up)

Increased number of referrals and procedures and treatments.

WIN – WIN – WIN

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DETECTION

Current State Of Nodule Programs

Computerized scanning of radiology reports to detect nodules.

Natural language processing to “weed out” false positives.

Risk calculators based on size and other CT characteristics as well as patient demographics

Use of risk calculators to guide intervention vs. observation

Database management of patients to confirm follow-up.

DETECTION

Future State

Radiomics (Use of AI to risk stratify nodules)

CAD programs to detect and characterize nodules

Genomic sequencing to further risk stratify patients (bronchial, nasal)

DIAGNOSIS

HISTORICAL

Prior to CT scans, diagnosis usually made at surgery, usually late stage.

Delay in diagnosis, followed by delay in starting treatment.

5 years ago, average time to starting treatment after diagnosis was greater than 100 days.

Many patients had progression of their disease while waiting to start treatment

Every week of delay before surgical resection results in a mortality risk of 0.4 – 4.0%[1,2]

Viewed as a "smoker's disease".

[1]Samson, et al., Effects of Delayed Surgical Resection on Short- and Long-Term Outcomes in Clinical Stage I Non-Small Cell Lung Cancer. Ann Thorac Surg. 2015 Jun: 99: 1906-1913.
2Kanarek, et al., Survival After Community Diagnosis of Early-stage Non-Small Cell Lung Cancer. Am J Med. 2014;127:443-449.

DIAGNOSIS

BRONCHOSCOPY

Low diagnostic yield (<40%)

Minimal risk of pneumothorax

Useful for central lesions or obvious endobronchial lesions

CT GUIDED NEEDLE ASPIRATION

Diagnostic yield of about 85%

Risk of pneumothorax is 20-50% depending on degree of emphysema

More difficult deeper in the lung or at the lung bases due to motion.

Gets the diagnosis, but doesn't stage the mediastinal lymph nodes.

DIAGNOSIS

NAVIGATION BRONCHOSCOPY

Electromagnetic Navigation Bronchoscopy (Computer Guided bronchoscopy)

Can reach any area of the lung as long as the airway is not occluded

Diagnostic yield of 64 – 92% depending on study (skill of user, ?patient selection)[1]

Low risk of pneumothorax (2-5%)

Allows staging of the mediastinal lymph nodes at the same time.

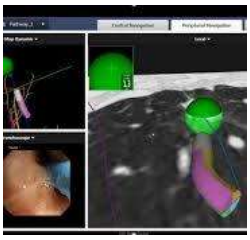
Sampling size is greater for additional testing.

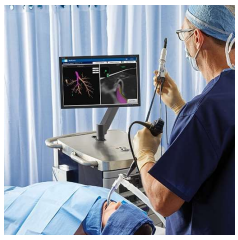
Requires general anesthesia

[1]Folch, et al. Electromagnetic Navigation Bronchoscopy for Peripheral Pulmonary Lesions: One-Year Results of the Prospective, Multicenter NAVIGATE Study. J Thorac Oncol. 2019 Mar; 14(3):445-458.

NAVIGATION BRONCHOSCOPY

NAVIGATION BRONCHOSCOPY





DIAGNOSIS

ROBOTIC BRONCHOSCOPY

- Physician driven, robotic bronchoscope
- Smaller diameter, so able to reach more peripherally than a standard scope.
- Theoretical advantage of being able to see more peripherally
- Able to maintain a specific angle at the end of the scope
- Location determined either by electromagnetic navigation technology or shape sensing fiberoptics
- Limited data on diagnostic yield, but early data lower than expected
- Similar problem of CT to body divergence
- Does not move with the moving lung during respiration
- Longer duration of procedure = more general anesthesia
- Cost prohibitive for many institutions

ROBOTIC BRONCHOSCOPY

DIAGNOSIS

FUTURE STATE

Solution to CT to body divergence vs. real time radiologic confirmation

Genomic sequencing to assist with non-diagnostic biopsies, and potentially avoid biopsies on non-malignant tissue

"Tissue is the issue" – more tissue is always better as more and more molecular testing is done

Potential benefit of circulating tumor DNA

Radiomics or other AI-driven protocols to reduce the number of true negative biopsies

Improvements in electromagnetic navigation or newer guidance technology

TREATMENT

SURGERY

Pneumonectomy

Lobectomy

Segmentectomy

Wedge Resection

CHEMOTHERAPY

Standard Chemotherapy (2-3 drugs)

Neoadjuvant Chemotherapy

Adjuvant Chemotherapy (Post-op)

RADIATION

External Beam Radiation

Stereotactic Radiation (SBRT)

TREATMENT

SURGERY

Robotic > VATS > Open Thoracotomy

Lobectomy > Segmentectomy > Wedge Resection[1]

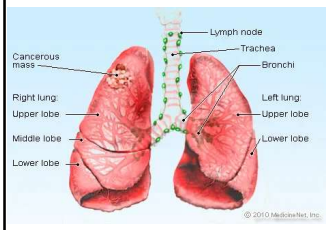
In very small lung cancers within a segment of lung, segmentectomy may be equivalent to lobectomy (small number of patients qualify)

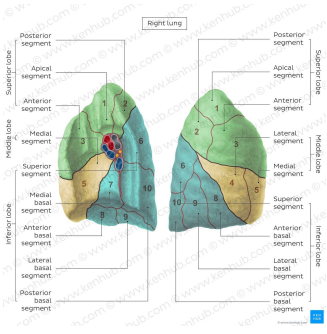
In an even more highly selected population, wedge may be equivalent (even fewer patients qualify)

Lung sparing surgery is attractive, but only if it doesn't increase the recurrence rate

Lobectomy is still the standard of care and technically easier than segmentectomy

[1]Shi, et al. Comparison Between Wedge Resection and Lobectomy/Segmentectomy for Early Stage Non-small Cell Lung Cancer: A Bayesian Meta-analysis and Systematic Review. Ann Surg Onc. 2022; 29:1868-1879.





CHEMOTHERAPY

STANDARD CHEMO

2 or 3 drug regimens, 6 cycles, 3-4 weeks apart

Higher toxicity (bone marrow, loss of hair, GI side effects)

Used for later stage disease, modest survival benefit

Neoadjuvant use to downstage a patient and potentially make them a surgical candidate

Post-operative if positive lymph nodes at time of surgery

IMMUNOTHERAPY

Stimulates patient's immune system to fight against cancer cells

Targets specific mutations on the cancer cells

Limited duration of effect

May cause a generalized immune hyperresponse

Much better tolerated than standard chemotherapy

Can cause pneumonitis

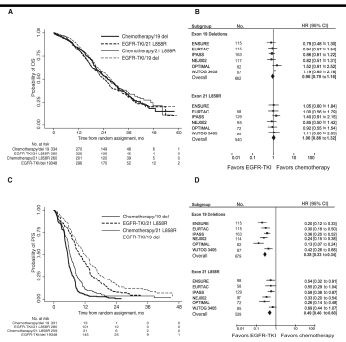
TARGETED THERAPY

Certain mutations identified in a minority of lung cancers

Drugs target only cells with the specific mutation

Duration of effect usually 2-3 years before additional mutation

Can cause pneumonitis



Lee, CK, et al, Gefitinib or Erlotinib vs Chemotherapy for EGFR Mutation-Positive Lung Cancer: Individual Patient Data Meta-Analysis of Overall Survival, JNCI, Vol 109, Issue 6, June, 2017

TREATMENT

CHEMOTHERAPY

CURRENT GUIDELINES ARE RAPIDLY CHANGING

- Combination of chemotherapy plus immunotherapy for more advanced disease
- Immunotherapy alone for stage 4 disease (better tolerated, similar outcomes)
- Use of preoperative chemotherapy or chemo/immunotherapy in earlier stage disease associated with better 5 year survival
- Use of targeted therapy in mutation positive patient as first line vs. second line therapy
- Use of targeted therapy post-operatively in early stage disease

TREATMENT

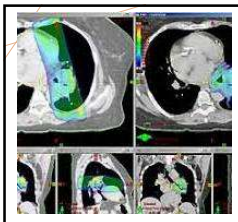
RADIATION

STANDARD EXTERNAL BEAM

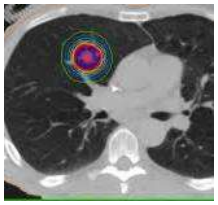
- Single direction of beams
- Larger area of injury
- Limited by degree of injury to surrounding normal lung
- Only beneficial if all of disease is within the radiation field (local therapy)
- Effective for palliation (hemoptysis, airway obstruction, bony pain)
- Still part of combined therapy for stage 3 disease, in conjunction with chemotherapy

STEREOTACTIC RADIATION (SBRT)

- Multiple beams from multiple directions
- Less injury to surrounding tissue with higher dose delivered to target
- Excellent option for early disease (stage 1) in a nonoperative candidate
- Can be repeated several years later if recurrence
- Can treat multiple lesions in the lungs
- Injury to nearby tissue (rib fractures, bronchial wall injury, vascular)



RADIATION



TREATMENT

FUTURE STATE

Bronchoscopic ablation (RFA, Microwave, Cryotherapy, PDT), done at the same time as the biopsy.

Biopsy and Surgical resection during the same anesthesia event.

Newer Targeted Therapies/Combinations of Therapy

Single anesthetic lung surgery pathway: Diagnosing, staging and treating stage 1 lung cancer in a single procedure

Dec. 15, 2023

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SUMMARY

- Lung Cancer Diagnosis and Treatment is an industry focal point.
- Combination of Lung Cancer Screening and Incidental Lung Nodule Detection and Management will create a "phase shift" that will impact survival more than any other intervention.
- Newer technologies for diagnosis and staging of lung cancer will replace CT guided biopsy in most cases.
- Minimally invasive surgery (robotic/VATS) should be the standard of care. However, minimal resection is frequently not best.
- Newer modalities of chemotherapy improve 3 year survival, but not 5 year survival.
- Newer radiation modalities result in fewer side effects, and rival surgical resection in some early stage cancers

SUMMARY

We have come a long way,

but we still have a long way to go!

QUESTIONS?