Lung Cancer Detection and Prevention

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Medical Director – Center for Thoracic Disease
Center for Advanced Care – Lutheran General Hospital
Objectives

• Determine the trends in incidence and mortality of lung cancer
• Describe the types of lung cancer and surgical options for treatment
• Determine who qualifies for a lung cancer screening and be able to explain the risks vs benefits of participation
• Be able to discuss emerging therapies for lung cancer
Lung Cancer Statistics
Lung cancer is the most common cause of cancer mortality worldwide for both men and women.
Trends in Cancer Incidence Rates* Among Men, US, 1975-2010

*Age-adjusted to the 2000 US standard population and adjusted for delays in reporting.
†Includes the intrahepatic bile duct.
Source: Surveillance, Epidemiology, and End Results (SEER) Program, National Cancer Institute, 2013.
Trends in Cancer Incidence Rates* Among Women, US, 1975-2010

*Age-adjusted to the 2000 US standard population and adjusted for delays in reporting.
†Includes the intrahepatic bile duct.
Source: Surveillance, Epidemiology, and End Results (SEER) Program, National Cancer Institute, 2013.
Trends in Cancer Death Rates* Among Men, US, 1930-2010

*Age-adjusted to the 2000 US standard population.
Source: National Center for Health Statistics, Centers for Disease Control and Prevention, 2013.
Trends in Cancer Death Rates* Among Women, US, 1930-2010

*Age-adjusted to the 2000 US standard population.
Source: National Center for Health Statistics, Centers for Disease Control and Prevention, 2013.
Estimated New Cancer Cases & Deaths 2014

Leading New Cancer Cases and Deaths – 2014 Estimates

**Estimated New Cases**

<table>
<thead>
<tr>
<th>Male</th>
<th>Female</th>
</tr>
</thead>
<tbody>
<tr>
<td>Prostate 233,000 (27%)</td>
<td>Breast 232,670 (29%)</td>
</tr>
<tr>
<td>Lung &amp; bronchus 116,000 (14%)</td>
<td>Lung &amp; bronchus 108,210 (13%)</td>
</tr>
<tr>
<td>Colon &amp; rectum 71,830 (8%)</td>
<td>Colon &amp; rectum 65,000 (8%)</td>
</tr>
<tr>
<td>Urinary bladder 56,390 (7%)</td>
<td>Uterine corpus 52,630 (6%)</td>
</tr>
<tr>
<td>Melanoma of the skin 43,890 (5%)</td>
<td>Thyroid 47,790 (6%)</td>
</tr>
<tr>
<td>Kidney &amp; renal pelvis 39,140 (5%)</td>
<td>Non-Hodgkin lymphoma 32,530 (4%)</td>
</tr>
<tr>
<td>Non-Hodgkin lymphoma 38,270 (4%)</td>
<td>Melanoma of the skin 32,210 (4%)</td>
</tr>
<tr>
<td>Oral cavity &amp; pharynx 30,220 (4%)</td>
<td>Kidney &amp; renal pelvis 24,780 (3%)</td>
</tr>
<tr>
<td>Leukemia 30,100 (4%)</td>
<td>Pancreas 22,890 (3%)</td>
</tr>
<tr>
<td>Liver &amp; intrahepatic bile duct 24,600 (3%)</td>
<td>Leukemia 22,280 (3%)</td>
</tr>
<tr>
<td>All sites 855,220 (100%)</td>
<td>All sites 810,320 (100%)</td>
</tr>
</tbody>
</table>

**Estimated Deaths**

<table>
<thead>
<tr>
<th>Male</th>
<th>Female</th>
</tr>
</thead>
<tbody>
<tr>
<td>Lung &amp; bronchus 86,930 (28%)</td>
<td>Lung &amp; bronchus 72,330 (26%)</td>
</tr>
<tr>
<td>Prostate 29,480 (10%)</td>
<td>Prostate 40,000 (15%)</td>
</tr>
<tr>
<td>Colon &amp; rectum 26,270 (8%)</td>
<td>Colon &amp; rectum 24,040 (9%)</td>
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<tr>
<td>Pancreas 20,170 (7%)</td>
<td>Pancreas 19,420 (7%)</td>
</tr>
<tr>
<td>Liver &amp; intrahepatic bile duct 15,870 (5%)</td>
<td>Liver &amp; intrahepatic bile duct 14,270 (5%)</td>
</tr>
<tr>
<td>Non-Hodgkin lymphoma 10,470 (3%)</td>
<td>Non-Hodgkin lymphoma 10,050 (4%)</td>
</tr>
<tr>
<td>Oral cavity &amp; pharynx 8,450 (4%)</td>
<td>Uterine corpus 8,590 (3%)</td>
</tr>
<tr>
<td>Leukemia 8,890 (3%)</td>
<td>Leukemia 8,520 (3%)</td>
</tr>
<tr>
<td>Kidney &amp; renal pelvis 8,900 (3%)</td>
<td>Kidney &amp; renal pelvis 7,130 (3%)</td>
</tr>
<tr>
<td>All sites 310,010 (100%)</td>
<td>All sites 275,710 (100%)</td>
</tr>
</tbody>
</table>

*Excludes basal and squamous cell skin cancers and in situ carcinoma except urinary bladder.*

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## Trends in Five-year Relative Cancer Survival Rates (%), 1975-2009

<table>
<thead>
<tr>
<th></th>
<th></th>
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<tbody>
<tr>
<td>All sites</td>
<td>49</td>
<td>55</td>
<td>68</td>
</tr>
<tr>
<td>Breast (female)</td>
<td>75</td>
<td>84</td>
<td>90</td>
</tr>
<tr>
<td>Colon</td>
<td>51</td>
<td>60</td>
<td>65</td>
</tr>
<tr>
<td>Leukemia</td>
<td>34</td>
<td>43</td>
<td>59</td>
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<tr>
<td>Lung &amp; bronchus</td>
<td>12</td>
<td>13</td>
<td>18</td>
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<tr>
<td>Melanoma of the skin</td>
<td>82</td>
<td>88</td>
<td>93</td>
</tr>
<tr>
<td>Non-Hodgkin lymphoma</td>
<td>47</td>
<td>51</td>
<td>71</td>
</tr>
<tr>
<td>Ovary</td>
<td>36</td>
<td>38</td>
<td>44</td>
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<tr>
<td>Pancreas</td>
<td>2</td>
<td>4</td>
<td>6</td>
</tr>
<tr>
<td>Prostate</td>
<td>68</td>
<td>83</td>
<td>100*</td>
</tr>
<tr>
<td>Rectum</td>
<td>48</td>
<td>58</td>
<td>68</td>
</tr>
<tr>
<td>Urinary bladder</td>
<td>72</td>
<td>79</td>
<td>80</td>
</tr>
</tbody>
</table>


*99.5%

Source: Surveillance, Epidemiology, and End Results (SEER) Program, National Cancer Institute, 2013.
Lung Cancer
Risk Factors

• The primary risk factor for the development of lung cancer is cigarette smoking, which is estimated to account for approximately 90 percent of all lung cancers
• Secondhand smoke
• Environmental factors
• Radiation in the home
• Age
• Family and genetic risk factors
Clinical Manifestations

• The majority of patients with lung cancer have advanced disease at clinical presentation. This may reflect the aggressive biology of the disease, the frequent absence of symptoms until locally advanced or metastatic disease is present, and the lack of an effective screening test.
• Cough
• Hemoptysis
• Chest pain
• Dyspnea
• Hoarseness
• Trouble breathing, or wheezing
• Headache and swelling of the face, arms, or neck
Diagnosis

- Lung biopsy
- PET scan
- Pathology
- Staging
Types of Lung Cancer

There are two main categories:

- Small cell lung cancer is found in about 10 to 15 percent of patients.
- Non-small cell lung cancer is found in the remaining 85 to 90 percent of patients. There are subcategories of NSCLC, the most common of which are adenocarcinoma, squamous cell carcinoma, and large cell carcinoma.
Treatment Options

Most people with lung cancer have 1 or more of the following treatments:

• Surgery
• Radiation therapy
• Chemotherapy
• Targeted therapy
Center for Thoracic Disease
The goal of the Center is to provide state of the art thoracic care

Thoracic care will be provided for the following diseases:

- Acute Respiratory Disease Syndrome (ARDS)
- Chest Wall Tumors
- Esophageal Cancer
- Lung Cancer
- Massive Pulmonary Embolus
- Mediastinal Tumors
- Pleural Disease (benign and malignant effusions, empyema, mesothelioma and paraneumonic effusions)
- Thoracic Spine Procedures
Advantages

The center will develop protocols for all types of chest malignancies such as:

- Bronchial Tumors
- Esophageal Cancers
- Lung Cancers
- Thymus Cancers

One location will be provided for the multidisciplinary group of doctors ensuring:

- Diagnosis and Staging
- Expeditious Consultations
- Patient Convenience /Compliance
Resources Available

Advocate Lutheran General Hospital Staff:

- Anesthesiologists
- Hematologists
- Gastroenterologists
- Medical Oncologists
- Neurologists
- Pathologists
- Pulmonologists
- Radiologists
- Radiation Oncologists
- Surgeons
- Perfusionists
Surgical Aspects of Lung Cancer
Surgical Options

- Wedge resection
- Segmental resection
- Lobectomy
- Pneumonectomy
State of the art treatment options at Lutheran General Hospital

- VATS
- Robotic surgery
- Advanced radiation techniques
- Oncologic advancements
Video-Assisted Thoracoscopic Surgery (VATS)

A minimally invasive surgical technique using a thoracoscope (tiny camera) and surgical instruments, inserted into the chest through tiny incisions, to diagnose and treat problems.

VATS provides:

- Faster recovery time
- Less pain and need for medication
- Shorter hospital stay
- Smaller scar
Interoperative View with VATS
Da Vinci – Si Surgical System

The Da Vinci can perform procedures through tiny openings with the least amount of risk, pain and recovery time for patients. The Da Vinci can be used to create 4 tiny incisions in the patient’s chest instead of surgically opening the chest cavity.

The Da Vinci has:
Advanced 3D HD visualization with up to 10x magnification and an immersive view of the operative field.

EndoWrist instrumentation enables dexterity and range when operating.
Interoperative View with Robotic Surgery
CyberKnife

CyberKnife treats patients with stereotactic radiosurgery, a noninvasive method of treating tumors and other medical conditions.

The robotic arm moves around the patient delivering high-dose radiation, aiming radiation beams directly at the tumor site and minimizing damage to surrounding health tissue.

No cutting or anesthesia is involved, and requires no recovery time or overnight hospital stay.
Advances in Lung Cancer Treatment
Low Dose CT Screening
Background

- NLST – published “Reduced Lung-Cancer Mortality with Low-Dose Computed Tomographic Screening”
  - Compared Low Dose CT to CXR to screen for lung cancer
  - 94 million current or former smokers remain at elevated risk for lung cancer *
  - Lung cancer remains the leading cause of death from cancer in this country*
  - 5 year survival rates are 15.6%, partly because most patients have advanced-stage lung cancer at initial diagnosis**

*National Lung Screening Trial, New England Journal of Medicine, 8.4.2011
** NCCN Lung Cancer Screening: Clinical Practice Guidelines, JNCCN 02.2012
Target Population

• Age 55-74 years
• ≥ 30 pack year history of smoking
• and smoking cessation < 15 years

OR

• Age ≥ 50 years
• ≥ 20 pack year history of smoking
• And one additional risk factor
  – History of COPD or pulmonary fibrosis
  – Radon exposure
  – Occupational exposure
  – History of smoking related cancer
  – Family history of lung cancer
Benefits of Lung Cancer Screening

• Decreased lung cancer mortality; NLST showed a 20% reduction in lung cancer specific mortality

• Theoretically less disease and treatment related morbidity with early diagnosis resulting in improved quality of life

• The number needed to prevent 1 lung cancer death was 219 over 6 years
  – Mammography number needed to screen = 1339
  – Sigmoidoscopy number needed to screen = 817
Risks of Lung Cancer Screening

- False positive/overdiagnosis
- Anxiety
- Morbidity associated with invasive diagnostic procedures
- Exposure to radiation
ALGH Lung Screening Program

• Call 847-723-LUNG (5864) to inquire about a lung screening

• The Advanced Practice Nurse Navigator will review a lung-screening questionnaire with the patient to determine appropriateness for participation

• Patient will have the low dose CT scan with subsequent review by a multidisciplinary team

• Patient will also be scheduled for a consultation appointment with a physician to review results and discuss smoking cessation and additional recommendations
LUNG CANCER SCREENING FLOW CHART

Patient interested in getting a Lung Screening (PCP referral or self-interest)

Patient calls 21-LUNG

Patient is walked through a lung-screening questionnaire

Is patient qualified for program?  
No  
APN provides counseling to patients  
Does patient still wish to receive lung scan?  
No  
Patient does not participate in program

Yes  
APN will schedule CT scan on Tues or Wed and their follow-up appointment for Friday

Patient receives CT Scan on Tues or Wed

CT Scan reviewed by designated Radiologist. Report generated within 4 hours.

Patient's results (questionnaire, scans, etc.) discussed with Medical Review Team on Thursday

Patient returns Friday for follow-up. Results reviewed and education provided to patient by multi-disciplinary team.

Patient referred to appropriate physician or intervention

Updated 2/5/2013
Patient Presentation

• 58 Year old female
• Hypertension
• 40 Pack year smoking history
• Prolonged cough
• CXR Normal
• Lung cancer screening, low dose CT scan of chest
CHEST XRAY PA/LAT
LOW DOSE CHEST CT SCAN
PET CT Scan
SURGICAL PROCEDURE

- Bronchoscopy
- Left thoracoscopy
- Left upper lobectomy
- D/C home post op day 6
PATHOLOGY REPORT

- Primary tumor 9 mm (1/3 of an inch)
- Margins all clear
- Lymph nodes all negative
- Stage IA

- Survival 5 years, 85-90 %
LGH Lung Cancer Screening: the first 18 months

Results through September, 2014
Number of Patients Scanned
Total = 125 (101 NLSP, 24 F/U)

- Scanned 2013 (38 NLSP, 3 F/U)
- Scanned 2014 (63 NLSP, 21 F/U)
Gender Distribution of Lung Screening Participants

Total Patients = 101

- Male: 64%
- Female: 36%
Smoking Data for Participants

- Smoker: 52%
- Former Smoker: 48%
Smoking History

Pack year

- < 20
- 20-29
- ≥ 30
- unknown

Advocate Lutheran General Hospital
Inspiring medicine. Changing lives.
Risk Status: according to NCCN guidelines

- **High Risk:**
  - Age 55-74y and
  - ≥ 30 pk yr hx of smoking or
  - Smoking cessation < 15 y
  - Or
  - Age ≥ 50 y and
  - ≥ 20 pk yr hx of smoking
  - One additional risk factor

- **Moderate Risk:**
  - Age ≥ 50 y and
  - ≥ 20 pk yr hx of smoking or second-hand smoke exposure
  - No additional risk factor

- **Low risk:**
  - Age < 50 y and/or
  - < 20 pk yr hx of smoking
Risk Status

- Low: 74%
- Moderate: 4%
- High: 13%
- Unknown: 9%
LDCT Results

<table>
<thead>
<tr>
<th>Condition</th>
<th>Unknown (4)</th>
<th>High (75)</th>
<th>Moderate (9)</th>
<th>Low (13)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Emphysema</td>
<td>2</td>
<td>47</td>
<td>2</td>
<td>4</td>
</tr>
<tr>
<td>CAC</td>
<td>0</td>
<td>33</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Pulmonary Nodule</td>
<td>1</td>
<td>31</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>Adenopathy</td>
<td>1</td>
<td>3</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Pleural Effusion</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Other</td>
<td>2</td>
<td>39</td>
<td>4</td>
<td>8</td>
</tr>
</tbody>
</table>
Recommendations

- Surgery
- Pulmonary
- Smoking Cessation
- ENT
- Cardiology
- GI
- Urology

Referrals:
- Surgery: 4
- Pulmonary: 42
- Smoking Cessation: 10
- ENT: 10
- Cardiology: 2
- GI: 1
- Urology: 1
Recommendations for Repeat LDCT

- 54%: 1 year
- 35%: 6 months
- 7%: 3 months
- 4%: No further screening
What % quit smoking at f/u?

- Smoker: 64%
- Quit w/ Relapse: 14%
- Unknown: 22%
- 0%
What % comply with recommendations for f/u LDCT?

- 64% Received scan
- 36% Declined
F/U scan results...

- 1/24 had a new nodule on follow up scan
- 3/24 showed improvement in nodularity or GGO
- 20/24 showed no change
Other Interventions

2013
- Recommended PCP monitor PFTs
- EBUS vs MRI
- US of liver
- PET scan x6
- MRI of liver

2014
- PET scan x3
- Pt underwent coronary artery stenting
- Surgical resection of pericardial cyst
- MRI x1
- CT scan w/ contrast
- Possible bronchoscopy
Positive Scan #1

• PET scan w/ possible biopsy or wedge resection for 8mm LUL spiculated nodule. PET positive, mild FDG activity, SUV 3.76. Pt underwent LUL lobectomy. Adenocarcinoma, Stage 1a.
Positive Scan #2

• PET scan with possible biopsy for 4.2cm RLL lobulated mass. PET scan demonstrated SUV of 12 in lesion. No evidence of mets. FNA positive for Small Cell Carcinoma vs Atypical Carcinoid. Surgery recommended by MDC. Final path showed 8.5 cm small cell carcinoma.
Positive Scan #3

• PET, RLL nodule has SUV 4.99; Second faintly FDG avid nodule in RML, SUV 2.0. Pt received second opinion at Rush and underwent surgery there. Pathology results showed 1.0 cm well differentiated neuroendocrine carcinoma (typical carcinoid).
Positive scan #4

- PET scan; Superior segment LLL mass, 6.07x5.52 cm; SUV 19.39. FNA and core biopsy revealed invasive moderately differentiated squamous cell carcinoma. Pt underwent left pneumonectomy.
The first 18 months...

- 0% biopsies for benign lesions
- 5% surgery
- 36% nodules

• Requirements for a successful screening
The Future of Lung Cancer

• Screening
• Screening
• Screening
• Minimally invasive surgical techniques
• New treatment modalities (RAD RX)
• Chemotherapies targeted to molecular level
• Genetic testing
• Chemoprevention