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Lung Cancer Medical Documentation Paper

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Contents

1. Overview of Lung Cancer

1.1 Definition and Classification

Lung cancer is a malignant tumor characterized by the uncontrolled growth of abnormal cells in one or both lungs. These abnormal cells do not carry out the functions of normal lung cells and do not develop into healthy lung tissue. Instead, they divide rapidly and form tumors that can interfere with the lung's primary function of providing oxygen to the body via the bloodstream. Without treatment, these tumors can spread within the lungs and to other parts of the body, further impairing lung function and overall health.

Lung cancer is broadly classified into two main categories based on the appearance of the cancer cells under a microscope:

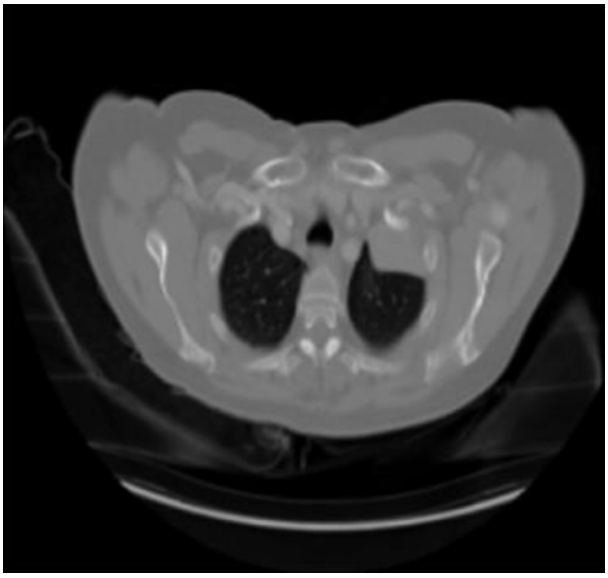
- **Non-Small Cell Lung Cancer (NSCLC)**: This is the most common type, accounting for approximately 85% of all lung cancer cases.
- **Small Cell Lung Cancer (SCLC)**: Less common and more aggressive, accounting for about 15% of cases.

These classifications are crucial as they guide the therapeutic strategy and have different prognosis and biological behaviors.

1.2 Histological Types: NSCLC vs. SCLC

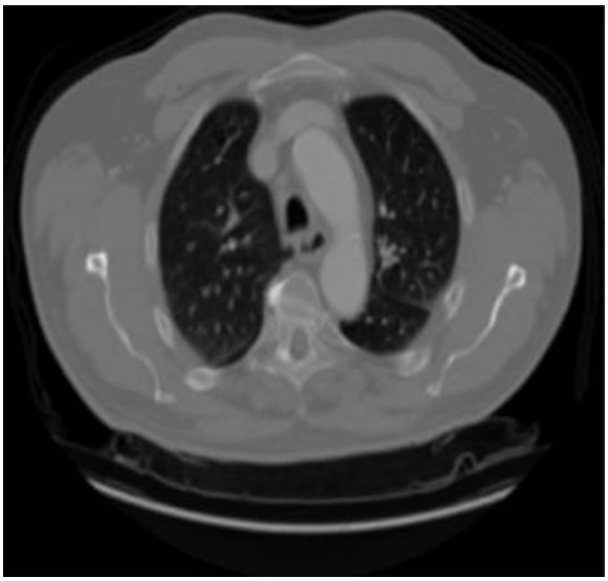
NSCLC comprises several histological subtypes, each with distinct pathological and clinical characteristics:

- **Adenocarcinoma**: The most prevalent subtype of NSCLC, particularly among non-smokers and younger individuals. It originates from glandular epithelial cells and is frequently located in the lung periphery. Adenocarcinomas exhibit significant histological heterogeneity and may present mixed patterns, such as acinar, papillary, solid, or bronchioloalveolar features. The WHO/IASLC classification recognizes several variants, including mucinous, fetal, and signet ring types. [4]



CT scan of patient diagnosed with lung Adenocarcinoma. [7]

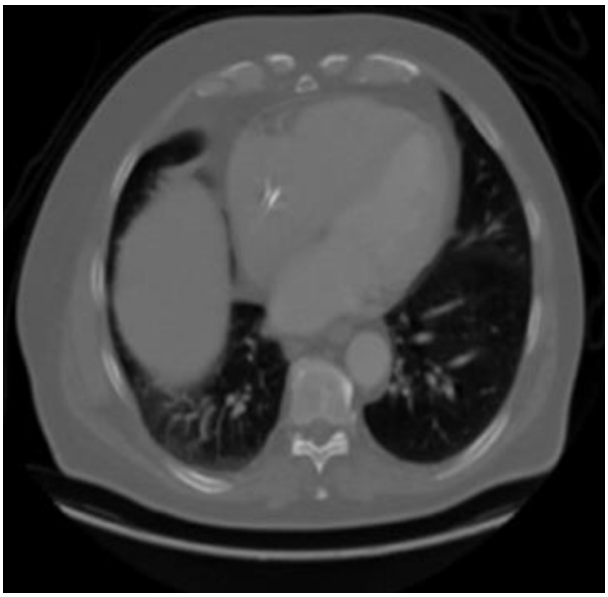
- **Squamous Cell Carcinoma**: Commonly found in the central airways, this subtype arises from squamous epithelial cells and is strongly associated with tobacco smoking. It is characterized histologically by keratinization and intercellular bridges. The incidence of squamous cell carcinoma has declined in recent years due to reduced smoking rates. [4]



CT scan of patient diagnosed with lung Squamous Cell Carcinoma. [7]

- **Large Cell Carcinoma**: A heterogeneous group of poorly differentiated tumors lacking glandular or squamous characteristics. It is often aggressive and located in peripheral lung tissue. The WHO/IASLC classification includes variants such as large cell neuroendocrine carcinoma (LCNEC), basaloid carcinoma, and large cell

carcinoma with rhabdoid phenotype. [4]



CT scan of patient diagnosed with lung Large Cell Carcinoma. [7]

- **Others**: This category encompasses a diverse group of rare or poorly differentiated NSCLC histologies.

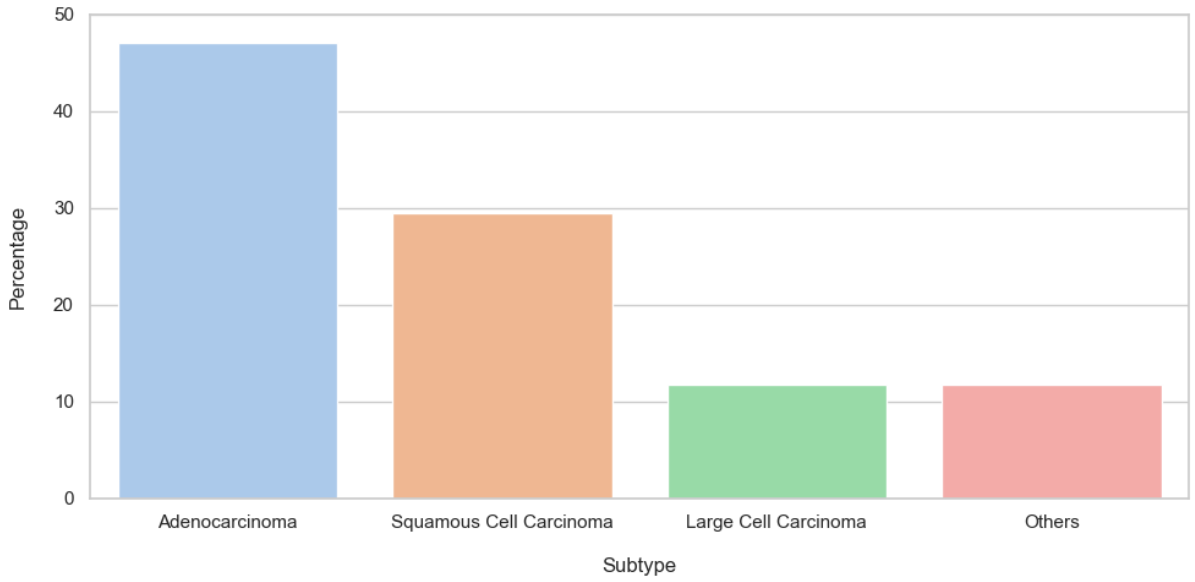
  Adenosquamous carcinoma exhibits both glandular (adenocarcinoma) and squamous components, and is typically more aggressive than either component alone.

  Sarcomatoid carcinomas are poorly differentiated tumors that show sarcoma-like features and include pleomorphic carcinoma, spindle cell carcinoma, and giant cell carcinoma. These are rare and generally associated with a poor prognosis.

  Salivary gland-type tumors, such as mucoepidermoid carcinoma and adenoid cystic carcinoma, are histologically similar to tumors of the salivary glands and are extremely rare in the lungs.

  Carcinoid tumors are neuroendocrine in origin and tend to be less aggressive, although atypical variants can exhibit more malignant behavior.

  Finally, some tumors remain *unclassified* due to ambiguous histological features or inadequate sampling, and are grouped as NSCLC not otherwise specified (NOS). [9]



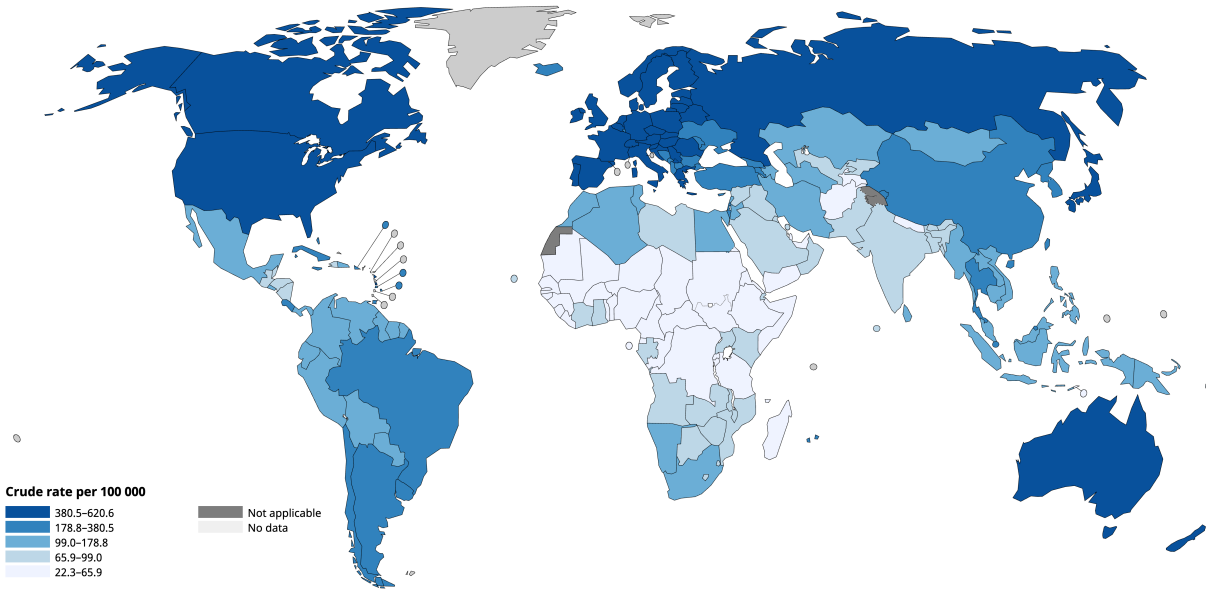
Distribution of NSCLC histological subtypes. Data source: [4].

SCLC, in contrast, tends to grow rapidly and spread early to distant body sites. It is strongly associated with cigarette smoking and is often diagnosed at an advanced stage.

1.3 Epidemiology and Global Burden

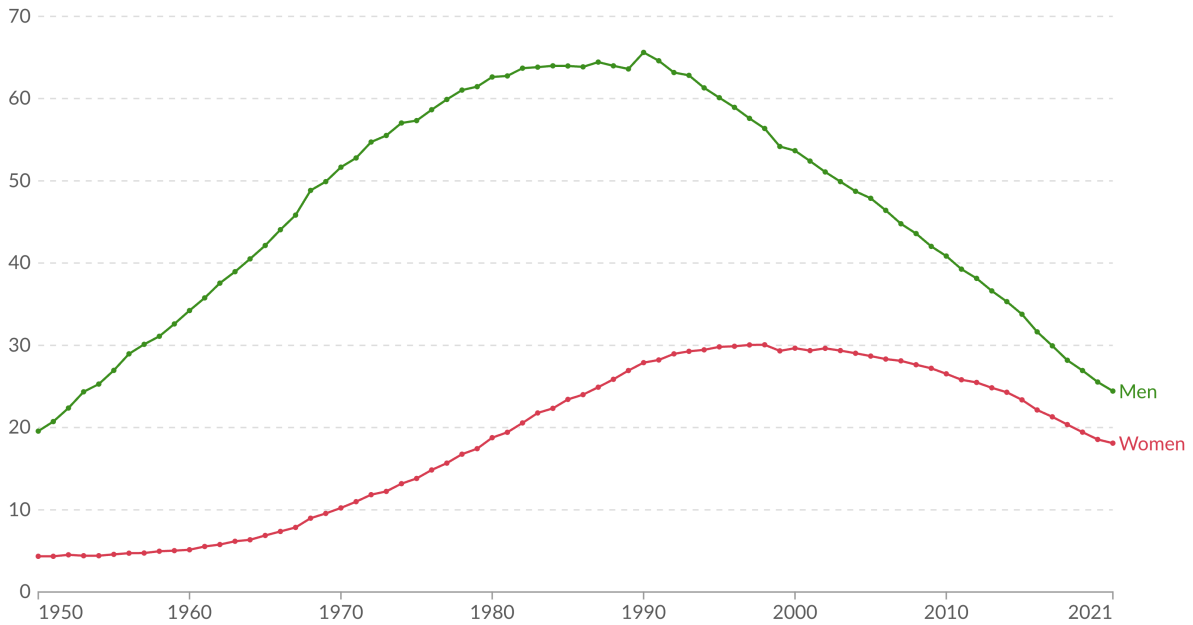
Lung cancer remains one of the leading causes of cancer-related deaths worldwide. According to the World Health Organization (WHO), lung cancer causes approximately 1.8 million deaths annually, making it the most lethal form of cancer. [12]

- **Incidence**: Varies globally, significantly depending by region, often reflecting differences in tobacco use, environmental exposure, and socioeconomic status. High-income countries generally show declining trends in incidence due to successful tobacco control efforts, while many low and middle-income countries are seeing rising rates due to increased smoking prevalence and industrial pollution.



Lung cancer estimated incidence crude rate (per 100.000 people). [12]

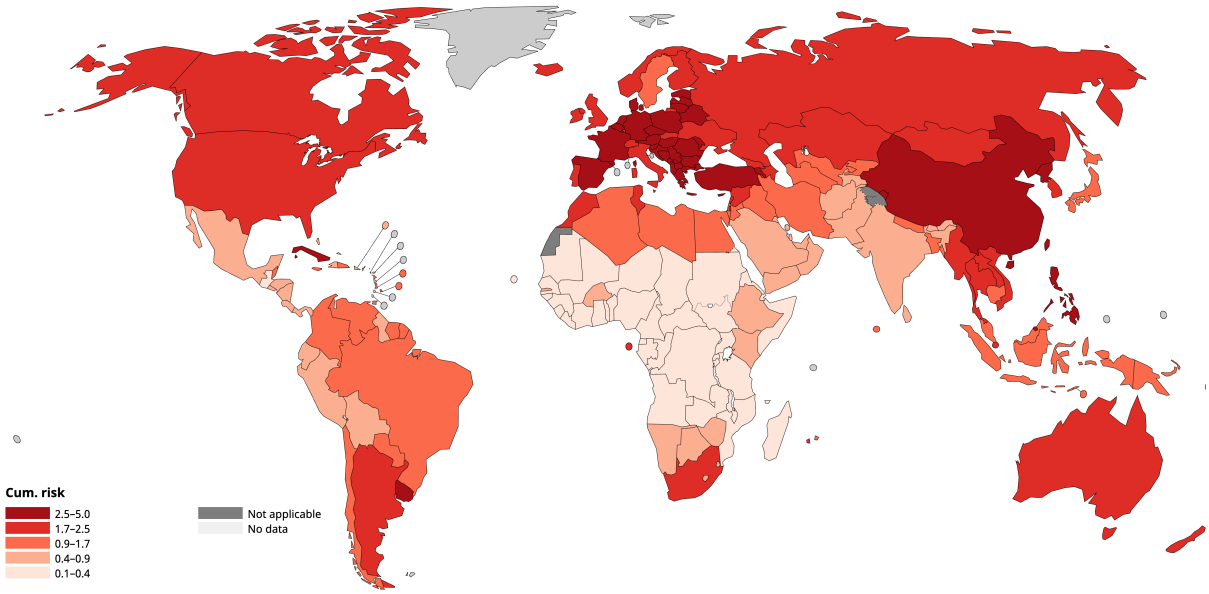
- **Gender Distribution**: Historically more prevalent in men, but the gap is narrowing due to increased smoking rates among women over time. Biological differences, including hormonal and genetic factors, may also contribute to distinct patterns of disease development and progression between sexes.



Lung cancer death rates (per 100.000 people). [5, 12]

- **Survival Rates**: The 5-year survival rate remains low (around 20%) [4], especially for cases diagnosed at a late stage. Mortality closely mirrors incidence rates, with lung cancer accounting for nearly one in five cancer deaths. Non-small cell lung

cancer (NSCLC), the most common type, generally has better outcomes than small cell lung cancer (SCLC), especially when diagnosed early.



Lung cancer estimated mortality cumulative risk (per 100.000 people). [12]

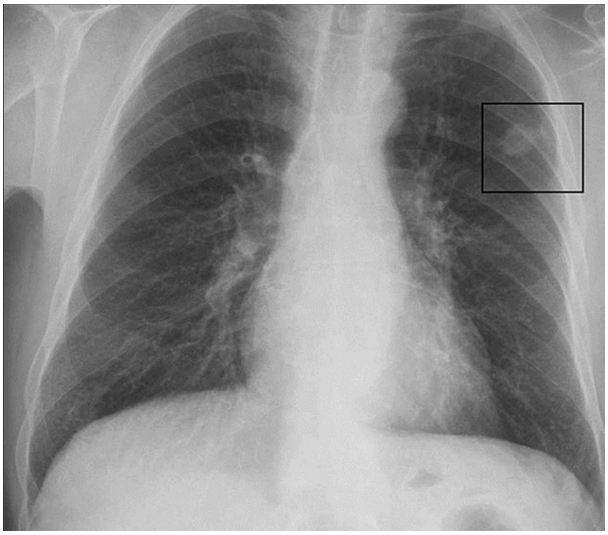
The global burden of lung cancer is not only reflected in mortality rates but also in the economic and social costs of treatment and loss of productivity. Prevention and early detection remain critical in reducing this burden.

2. Diagnostic Approaches

2.1 Imaging Techniques: CT, PET, and X-ray

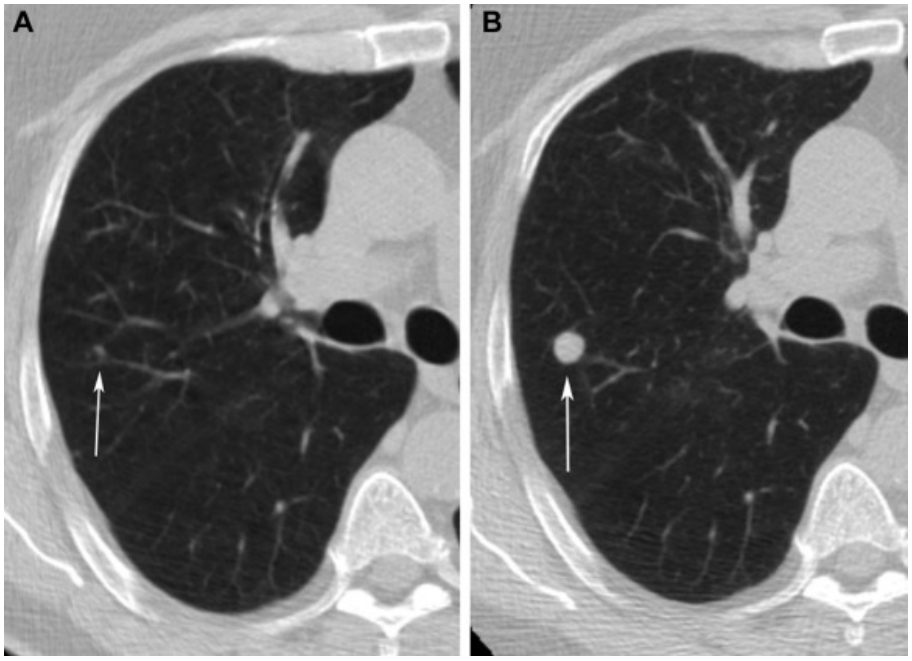
Imaging plays a pivotal role in the diagnosis and management of lung cancer, offering insights into the size, location, and extent of the tumor, which helps guide therapeutic decisions. Three common imaging techniques used are computed tomography (CT), positron emission tomography (PET), and chest X-rays.

- **Chest X-ray**: Often the first imaging test that primary care providers perform when lung cancer is suspected. Although less detailed than CT or PET, X-rays can provide quick information about the presence of abnormal masses in the lungs. However, small tumors or early-stage lung cancer may not be visible on an X-ray chest scan. [11]



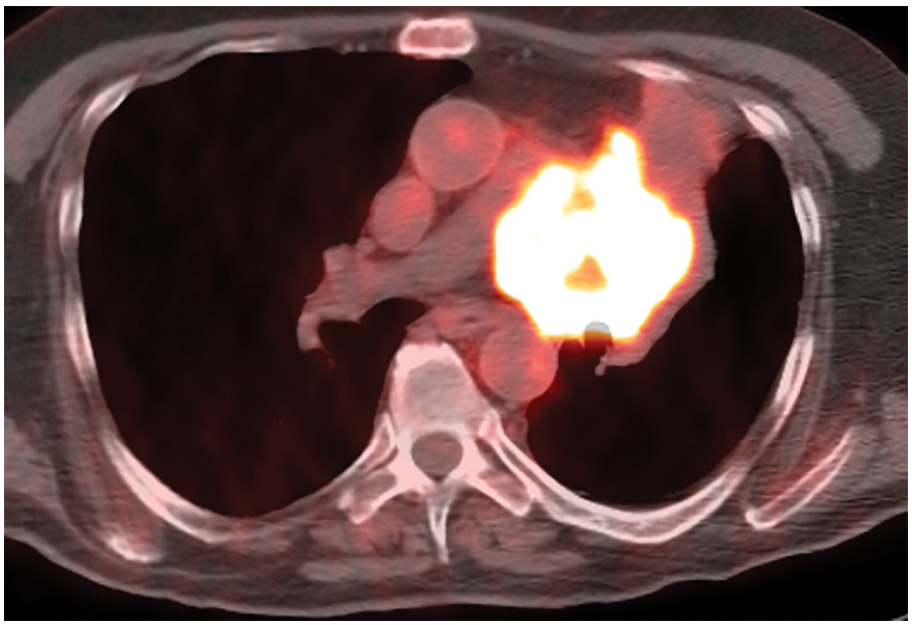
Chest X-ray scan of patient diagnosed with lung cancer. [2]

- **Computed Tomography**: Often used to monitor treatment response and check for recurrence. Provides detailed cross-sectional images of the lungs, allowing for the detection of tumors that may not be visible in a standard chest X-ray. They are particularly valuable for assessing the tumor's size and whether it has spread to nearby lymph nodes or other parts of the body.



CT scan showing growth of a micronodule (arrows) in the right upper lobe between baseline (A) and 1-year follow-up (B). [6]

- **Positron Emission Tomography**: Employed to assess the metabolic activity of a tumor. Tumors typically exhibit higher metabolic activity than normal tissue, which is visualized as areas of increased uptake of radioactive tracers. PET scans are especially useful in determining the spread of lung cancer and for assessing whether a tumor is benign or malignant.



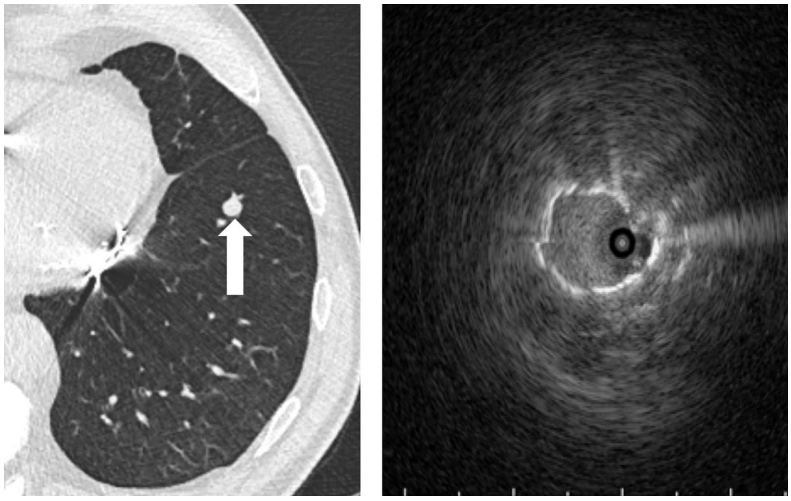
PET scan showing growth of a nodule (lighten area). [8]

2.2 Biopsy and Cytological Analysis

A definitive diagnosis of lung cancer is often confirmed through a biopsy, where a small sample of tissue is taken from the suspected tumor and examined under a microscope.

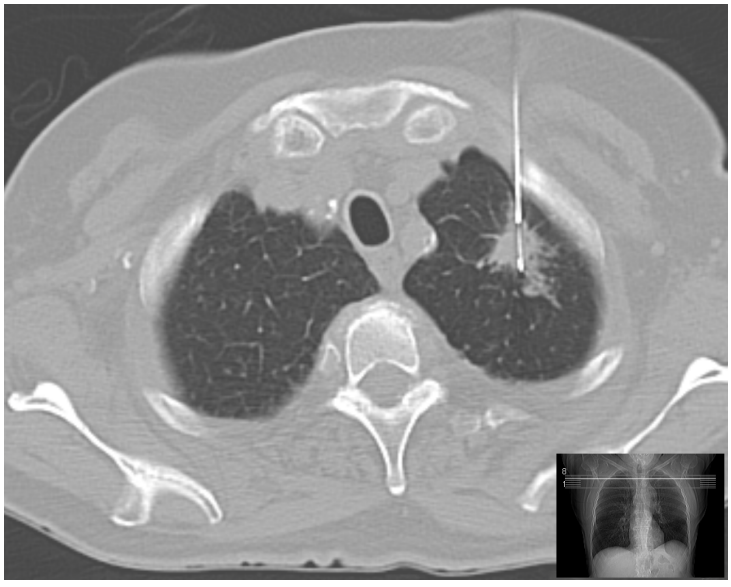
The biopsy can be obtained through various methods, including:

- **Bronchoscopy**: A procedure in which a thin, flexible tube is inserted through the mouth or nose into the lungs to collect tissue samples from the airways.



Bronchoscopy lung biopsy in a case of suspected lung cancer. [1]

- **Needle Biopsy**: A needle is inserted into the lung to obtain tissue or fluid samples, typically guided by imaging techniques like CT or ultrasound.



Percutaneous lung biopsy in a case of suspected lung cancer under control of computed tomography. [10]

- **Thoracentesis**: This method involves using a needle to remove fluid from the pleural space around the lungs, which can be tested for cancer cells.

Thoracentesis lung biopsy procedure. [3]

Once a tissue sample is obtained, it is analyzed through cytological examination. The analysis determines the presence of cancerous cells and provides insights into the type of lung cancer. This information helps in staging and treatment planning. In some cases, molecular tests are performed to identify genetic mutations that may influence treatment choices.

2.3 Tumor Staging and Grading

Staging and grading are essential for determining the prognosis and optimal treatment strategy for lung cancer patients. Staging refers to the extent of cancer spread, while grading assesses how aggressive the cancer cells are.

Staging is generally performed using the TNM system, which evaluates:

- **T (Tumor)**: The size and extent of the primary tumor. For example, T1 indicates a small tumor, while T4 indicates a larger, more invasive tumor.
- **N (Nodes)**: Whether cancer has spread to nearby lymph nodes. N0 indicates no lymph node involvement, while N3 indicates extensive nodal spread.
- **M (Metastasis)**: Whether the cancer has spread to distant organs. M0 indicates no distant metastasis, while M1 indicates the presence of metastasis.

Together, these three categories allow for the classification of lung cancer into various stages, ranging from stage 0 (localized) to stage IV (advanced).

Grading evaluates how abnormal the cancer cells look under a microscope, which helps

predict how quickly the cancer may grow and spread. The grade ranges from low-grade (well-differentiated) to high-grade (poorly differentiated). High-grade tumors tend to grow and spread more aggressively.

Both staging and grading are critical for determining the appropriate treatment approach, whether it involves surgery, radiation, chemotherapy, or targeted therapies. Early-stage cancers (stages I and II) may be treatable through surgery, while more advanced cancers (stages III and IV) often require systemic treatments like chemotherapy and immunotherapy.

2.4 Summary and Importance of Diagnostic Approaches

Accurate and timely diagnosis of lung cancer is essential for selecting the most appropriate treatment and improving patient outcomes. Imaging techniques, biopsy and cytological analysis, and tumor staging and grading are crucial components in this process. Early detection, particularly in high-risk individuals, can significantly improve survival rates and quality of life. Continued advancements in diagnostic technology, along with more personalized approaches to treatment, offer hope for better management of lung cancer in the future.

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