The lung is the major organ of the respiratory system and used to inhale oxygen and remove the metabolic waste in the form of CO\textsubscript{2} from the body. Malfunctioning of the lungs can lead to serious complications and disturbs the normal living conditions. Lung cancer is one of the severe conditions which have a relatively high mortality risk. Previously, it was the leading cause of death among men in more than 25 developed countries. Now it has become a worldwide cause of death among men. Most common cause of lung cancer is smoking, especially in men. Prognosis of this condition is still poor for malignant tumors. Read everything important about it here.
The bronchial carcinoma is defined as a malignant tumor of the lung, originating from the respiratory epithelium of the bronchi, bronchioles and alveoli. In 90% of men and 80% of women, the bronchial carcinoma appears associated with the inhalation of tobacco smoke. The term bronchial carcinoma and lung carcinoma is non-uniform, this is because the English term lung carcinoma is increasingly preferred. The disease is also known under the term lung cancer.

**Epidemiology, Risk Factors, and Etiology of Lung Cancer**

**Proliferation of lung cancer**

The incidence of lung cancer is over 200,000 new cases per year in the USA. It affects approximately 52% in men and 48% in women. This is so due to different smoking habits. However, the proportion of affected women is rising steadily. In Great Britain and Poland lung cancer is already the most common terminal cancer in women. In both sexes, it is the second most common cancer disease.

The peak age of new cases is between the 55-65 years. Studies prove that the incidence correlates negatively with the socioeconomic status. This is related to the incidence of smoking with low incomes and poor education.

**Spread and causes of lung cancer**

Lung cancer is rare below the age of 40 years and its risk increases with age up to 80 years. Major and minor risk factors related to lung cancer are listed below:

- Cigarette smoking
- Passive smoking
- Occupational lung diseases
  - Exposure to asbestos
  - Exposure to radon gas
  - Exposure to uranium
  - Chromium and nickel refining
  - Welders, coal miners, tar refiners, roofers
Secondary lung metastasis can occur from any primary tumor elsewhere in the body (e.g., liver).
Lung cancer is the second most common cancer for both men and women in England, accounting for 14% of...
There is **no role of genetics** in the etiology of lung cancer. This condition is not familial, this means that it is rarely caused by inherited mutations. In the US, roughly 3400 deaths from lung cancer occur in non-smokers every year. This usually occurs in people with occupational lung diseases like in coal, heavy metal miners or workers who are exposed to halogenated hydrocarbons, asbestos, etc. Passive smokers unintentionally inhale **smoke** from their surroundings which increases the risk.

Some benign etiologies for lung nodules and cancer include:

- Hamartomas
- Slow resolving local **pneumonia**
- Granulomas after previous chronic infections like TB, histoplasmosis, coccidiomycosis

**Etiology of Bronchial Carcinoma**
Causes of bronchial carcinoma

The major risk factor for the development of a bronchial carcinoma is smoking. 95 % of cancer patients are smokers or former smokers. The inhalation of carcinogens such as benzopyrene and tar, which are contained in cigarettes, results in mutations of the DNA.

There is a direct correlation between the quantity of consumed cigarettes and the mortality of lung cancer. The risk is estimated in pack years. A pack year is the year, where a patient smoked a pack of cigarettes daily (about 20 pieces). At 40 pack years, the risk of dying from bronchial carcinoma increases 60 to 70 times as compared to a non-smoker. The risk decreases continuously when the patient stops smoking.

![Image: "Asbestos body in a cytological slide" by Alex Brollo. License: CC BY-SA 3.0](Image)

Significant rare causes of lung carcinoma are exposure to asbestos and radon in houses, polycyclic hydrocarbons, nickel, chromates and inorganic arsenic compounds. Also lung scarring (for example after a tuberculosis or silicosis) may be origin of carcinoma.

**Note:** The term pack years is used in pulmonology for risk assessments. If a patient smokes daily a pack of cigarettes for one year, it is a so-called pack year. If a patient smokes 2 packs of cigarettes daily for 40 years, he has accumulated 80 pack years.

**Pathogenesis of Lung Cancer**

Bronchial carcinomas are of **monoclonal origin**. This means that a single cell is formed by several mutation steps to a tumor cell and multiplies unhindered by proliferation. The mutations are activated by dominant **oncogenes** or inactivated by tumor suppressor genes.
The dominant oncogenes need only a mutation of one allele. For example, point mutations of K-ras gene or oncogenes of the myc-family are present by the bronchial carcinoma. Both alleles have to be inactivated at tumor suppressor genes, so that the mutation becomes effective. The most frequent mutations are mutations of the gene p53 and rb. If an allele of a tumor suppressor already mutated in the germline, the bronchial carcinoma may have a family disposition.

A significant feature of malignant cells of bronchial carcinomas is the expression of nicotine receptors. If nicotine binds onto a cancer cell, it inhibits apoptosis and promotes growth. Therefore, the nicotine abstinence is an essential part of the therapy. Nevertheless, about 50 % of the patients with newly diagnosed lung carcinoma keep smoking.

Metastasis occurs in the regional lymph nodes, in the liver, adrenal glands, bones and the brain.

**Signs and symptoms of lung cancer**

Usually, lung neoplasm is an **incidental finding on routine imaging studies**. Patients usually do not have severe symptoms. Tumor or cancerous cells can be anywhere in the **lungs**; either benign or malignant. Usually, symptoms develop when the tumor has
reached an advanced stage (invasive/malignant stage).

Common symptoms include a **persistent cough, hemoptysis, shortness of breath, chest pain, decreased appetite, unexplained weight loss, and wheeze**. If the carcinoma has already spread, it can present with jaundice, bone pains, constipation or bloody stools. **Breast cancer**, colon cancer, prostate cancer, and bladder can metastasize to the lungs. Lung cancer can spread in the body to the **bones**, brain, liver, and adrenal glands.

**Types of Lung Cancer**

The classification of bronchial carcinoma is made in small-cell and non-small cell lung carcinomas. The distinction is made with regard to biological behaviour, prognosis and treatment options.

Lung cancer is a broad term used to describe tumors which arise in the respiratory system from the respiratory epithelium i.e. bronchi, bronchioles and alveoli. Broadly on the basis of histology, we classify lung tumors into two types:

1. Small cell lung cancer
2. Non-small cell lung cancer
   - Adenocarcinoma
   - Squamous cell carcinoma
   - Large cell carcinoma
   - Bronchial carcinoid
   - Mesothelioma

**Adenocarcinoma** is the most common of the lung cancers, followed by **squamous** and small cell carcinoma and then large cell carcinoma.

**Small cell (oat) cell carcinoma of the lung**

[Image: "Histopathologic image of small cell carcinoma of the lung. CT-guided core needle biopsy. H & E stain." by KGH. License: CC BY-SA 3.0]

Small cell carcinoma, also called oat cell cancer, is a **poorly differentiated neuroendocrine tumor** of the lungs. It is highly prevalent in the smokers. The lesser differentiated the cells among the tumor cells are, the more invasive and aggressive the cancer will be. It is **more common in males than in females**.
It appears as a central nodule or mass with endo-bronchial growth on the chest X-ray. Tumor cells in some patients start producing peptide hormones like adrenocorticotropic hormone (ACTH), arginine vasopressin (AVP), atrial natriuretic factor (ANF), and gastrin-releasing peptide (GRP) which can be a part of paraneoplastic syndromes. Tumor cells can spread to other sites and cause cervical or axillary lymphadenopathy. Histological examination shows islands of small deeply basophilic cells with areas of necrosis. Kulchitsky cells appear as small dark blue cells.

Small cell lung cancer can complicate into: paraneoplastic syndrome, Lambert-Eaton myasthenic syndrome, myelitis, encephalitis and sub-acute cerebral degeneration.

Non-small cell lung carcinoma

The non-small cell lung carcinoma (NSCLC) is divided into three subgroups:

The adenocarcinoma accounts for about 30 % and is particularly common in non-smokers. It often develops based on scar tissue, as given in the case of old tuberculosis. The carcinoma is usually peripheral and metastasizes early. The adenocarcinoma is often counted to the bronchiole-alveolar carcinoma.

Carcinoma of the glandular epithelium of the lungs is most common type of lung cancer among non-smokers. Smoking is the major risk factor for this type of cancer as well. These tumors are located at the peripheries lung tissue. Histologically cancer tissues have papillary structure and bronchio-alveolar pattern with glandular cells and cellular mucin i.e differentiated cells.

If the tumor contains poorly differentiated cells, they are arranged in a micropapillary pattern; this type of cancer has a worse prognosis. Bronchioloalveolar carcinoma is a subtype of adenocarcinoma which grows along the alveoli without invasion and appears as hazy infiltrates, similar to consolidation on the x-ray. It has a relatively better prognosis.

The squamous cell carcinoma accounts approximately 40 % and is often centrally located. It is believed that chronic irritation of the mucous membrane leads to dysplasia of the squamous epithelium. It grows rather slowly and metastasizes late. Histologically, it is divided into the keratinizing and non-keratinizing type.
Just like at other places, squamous cell carcinoma of the lungs occur after squamous dysplasia at the bronchus. They are identified as hilar mass associated with the cavitation and located at the central of the chest X-ray. This type of tumor is associated with serum hypercalcemia due to PTH secretion causing a paraneoplastic syndrome. Histological analysis shows keratin pearls and intercellular bridges. An infiltrating nest of tumor cells shows central necrosis resulting into cavitation. This type of cancer is also associated classically with smoking.

The large cell carcinoma is rare with 10%. These carcinomas are likely dedifferentiated adeno- or squamous carcinoma.

This type of cancer also occurs in the peripheral lung tissue. Large cell cancer occurs in less than 10% of the lung cancers. It is a poorly differentiated tumor, having sheets of large malignant cells, and is often associated with necrosis. Usually, tumor cells are arranged in syncytial groups. Variants of large cell carcinoma include basaloid carcinoma and lymphoepithelioma-like carcinoma related with EBV. The basaloid variant resembles high-grade neuroendocrine tumor.

The rest are undifferentiated carcinomas, carcinoid tumors and rare types of tumors.

Note: In the absence of risk factors such as smoking, radon or asbestos exposure, metastases of squamous-cell carcinomas other localizations need to be considered in the differential diagnosis. Ear, nose and throat carcinomas, skin- and cervix-carcinomas are therefore possible.

Classification of Lung Cancer

Benign vs. malignant tumor

Lung cancer can be a localized nodule of benign nature or invasive metastatic carcinoma. Various types of cancers which involve lungs are discussed below. Before that, we will discuss various clues favoring benign or malignant nature of the tumor.

<table>
<thead>
<tr>
<th>Features</th>
<th>Mostly benign</th>
<th>Mostly malignant</th>
</tr>
</thead>
<tbody>
<tr>
<td>Growth</td>
<td>Not growing</td>
<td>Rapid growth in serial chest scans</td>
</tr>
<tr>
<td>Size</td>
<td>Less than 1 cm</td>
<td>More than 1 cm</td>
</tr>
<tr>
<td>Calcification</td>
<td>Calcified</td>
<td>Non-calcified or speculated calcification</td>
</tr>
<tr>
<td>Smoking</td>
<td>Non-smoker</td>
<td>Smoker</td>
</tr>
<tr>
<td>Pleural effusion</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Lymphadenopathy</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>-----------------</td>
<td>----</td>
<td>-----</td>
</tr>
<tr>
<td>PET scan</td>
<td>No glucose avid in PET scan</td>
<td>Glucose avid on PET scan</td>
</tr>
</tbody>
</table>

### Localization of Bronchial Carcinoma

For treatment planning, the localization and spread of lung cancer is very important as it determines the operability.

Hilar tumors are defined by endobronchial growth, which can even lead to stenosis of a bronchus. Beyond the stenosis arises an emphysema and with complete closure an atelectasis with a tendency to develop a retention-pneumonia.

Abscesses often arise from retention-pneumonia, which are difficult to treat with antibiotics. This lung carcinoma is the most common localization.

Peripheral nodules can disintegrate into tumor caverns, resulting in typical haemoptysis. If this cavern collapses, it comes to malignant effusion or empyema.

A special form is the Pancoast-syndrome. It is defined by a tumorous outbreak at the lung apex, which grows into the brachial plexus and the vessels.

The Stokes-collar is a tumorous outbreak into the upper mediastinum with relocation of the superior vena cava. This results in upper inflow congestion.

The diffuse bronchial-carcinoma arises in alveolar carcinomas, often impressed radiographically as pneumonia.

### Symptoms of lung cancer
Cough is one of the primarily symptoms of lung cancer. In smokers, this cough is often trivialized, because it is typical for COPD or the so-called smoker’s lung. Other possible symptoms are haemoptysis, dyspnoea, bronchospasm and circumscribed pneumonic processes with fever and productive cough. When the tumor spreads to the pleura and ribs, the patients are suffer from chest pain.

Many patients also report B-symptoms with fever, night sweats and weight loss of more than 10 % of body weight in the last 6 months.

In the Pancoast syndrome, neuritic pain and vasomotor crises in hands and arms are of importance. If the tumor process is advanced, it can cause hoarseness by recurrent paresis and the Horner syndrome caused by paresis of the sympathetic nervous system.

If the cancer has metastasized, metastases can cause discomfort. Brain metastases can cause neurological deficits and personality changes. Bone metastases can cause pain and pathological fractures. If the bone marrow is infiltrated, the patient will suffer from leukopenia and that results in infections.

Para-neoplastic syndromes are typical for lung cancer. They can occur initially and are clinically important. Small cell lung cancer can produce ACTH, whereby it comes to hypokalemia and Cushing’s syndrome. In addition, the inadequate ADH formation with hyponatremia is possible and is called Schwartz-Bartter-syndrome. The Lambert-Eaton-syndrome, also typical for small cell lung cancer, is characterized by myasthenia in the pelvic girdle.

Squamous cell carcinomas can cause the ectopic parathyroid hormone, which leads to hypercalcemia and hypophosphatemia. Hippocratic fingers and periostitis are rather found in adenocarcinoma.

Regardless of the cancer sub-type are polymyositis, dermatomyositis, thrombophlebitis migrans and nephrotic syndrome possible.

A rare variant is the Pierre-Marie-Bamberger-syndrome with pulmonary hypertrophic osteoarthropathy.

Investigations of Lung Cancer

Diagnosis of lung cancer

After a detailed history regarding chronic disease systems, proper clinical examination of
the whole body is carried out to look for signs related to malignancy, especially lymph nodes, next laboratory investigation, and radiology investigations are done.

Usually, lung cancer is diagnosed incidentally while treating some other disease or condition or during routine medical checkups. Cancer cells can be detected in sputum on sputum analysis. Lung tissue biopsy can be done using needle biopsy, or can be taken under vision through bronchoscopy biopsy. Other non-invasive investigations include CT scan, chest x-ray, MRI, and PET scan. Various antigens called carcinogenic antigens can be detected in the serum like cytokeratin 19 fragments. Fluctuating levels of parathormone are also checked in some types of lung cancers.

Usually, lung cancer is diagnosed at a later stage, which makes it difficult to treat when cancer has already metastasized to other organ systems. The advanced stage of lung carcinoma has a poor prognosis and a poor five years survival rate.

Early Detection and screening

Two screening studies are on-going in major parts of the world:

1. The National Lung Cancer Screening Trial (NLST), a prospective comparison of spiral CT and standard chest x-ray used in 50,000 current or ex-smokers
2. Study in Europe comparing CT scanning with standard of care in subjects with a history of heavy smoking

Profile of a patient who should be referred for a chest X-ray to rule out cancer

Unexplained hemoptysis or any of the following persistent signs and symptoms lasting more than 3 weeks or less than 3 weeks in patients with risk factors for lung disease:

- Chest and/or shoulder pain
- Shortness of breath
- Weight loss
- Loss of appetite
- Abnormal chest signs
- Hoarseness
- Finger clubbing
- Cervical and/or supra-clavicle lymphadenopathy
- Persistent cough
- Features suggestive of metastatic lung disease (secondary cancer from the brain, bone, skin or liver)

Profile of a patient who should be referred urgently to a specialist

- Finger clubbing
- Severe weight loss
- SVC obstruction
- Persistent hemoptysis and are smoker or ex-smoker for many years; now of more than 40 years old age
- Smoker with cervical lymphadenopathy

Staging According to TNM-Classification

The staging is based on the TNM-classification after UICC (Union Internationale Contre le Cancer).
Tis  | Carcinoma in situ  
---|---  
T1  | Tumor 3 cm or smaller in diameter, surrounded by lung or visceral pleura, distal to the main bronchus.  
T2  | Tumor > 3 cm in diameter or involvement of the main bronchus 2 cm or more distal of the carina or associated with atelectasis to the hilus, but not the entire lung.  
T3  | Tumor invasion of the chest wall, diaphragm, mediastinal pleura or pericardium or tumor in the main bronchus < 2 cm distal to the carina or atelectasis of the entire lung.  
T4  | Tumor invasion into the mediastinum, heart, great vessels, oesophagus, spinal or carina, or intralobular tumor nodules or malignant pleural effusion.  
NO  | No regional lymph node metastasis  
N2  | Ipsilateral peribronchial or hilar lymph node involvement  
N2  | Ipsilateral mediastinal lymph nodes or subcarinal lymph node involvement  
N3  | Contralateral mediastinal lymph nodes, scalenus- or supraclavicular lymph node involvement  
M0  | No distant metastases  
M1  | Distant metastases  

Non-small cell lung cancer is classified based on the TNM-classification in IV staging groups, which decide the therapy.

In small cell lung carcinoma, there is a distinction in two stages. In 30% it is the limited stage, in which the tumor is confined to one hemithorax and the lymph node metastases are located in the radiation field. 70%, however, have an extensive stage, where the tumor extension exceeds the limited stage.

**Note:** Crucial for the operability is the FEV1-value. The FEV1-setpoint is set for a planned pneumonectomy > 2,5 l, in lobectomy > 1,75 l and segmental resection > 1,5 l. If this setpoint is undershot, a perfusion scintigraphy is mounted in order to assess the foreseeable postoperative FEV1-value.

**Complications of Lung Cancer**

Smoking leads to neoplasm of the lungs which is diagnosed in advanced stage and is difficult to treat. Following major complications can occur in various types of lung cancers due to its advanced stage:

- Paraneoplastic syndrome
- Superior sulcus syndrome leading to Horner’s syndrome
- Superior vena cava syndrome
- Compression of the recurrent laryngeal nerve can lead to hoarseness of voice
- Pleural effusion bloody
- Pericardial effusion often bloody
- Secondary metastasis to liver, bones, stomach, adrenal, brain etc.

**Lung cancer metastasis**

- **Adrenals:** Roughly 50% of lung cancers metastatize to adrenal glands
- **Liver:** 30–50% of lung cancers metastatize to liver
- **Brain and bones:** 20% of lung cancers metastatize to brain and bones
Symptoms secondary to regional metastases

- Esophageal compression leads to dysphagia
- Laryngeal nerve paralysis leads to hoarseness
- Symptomatic nerve paralysis leads to Horner’s syndrome (enophthalmos, ptosis, miosis, and anhidrosis)
- Cervical/thoracic nerve invasion leads to Pancoast syndrome
- Lymphatic obstruction leads to pleural effusion
- Vascular obstruction leads to SVC syndrome
- Pericardial/cardiac extension leads to effusion, tamponade

Therapy of Lung Cancer

Treatment of lung cancer

As with most cancers, treatments for lung cancer include **surgery, chemotherapy, and radiation**. The choice of treatment depends on the patient’s general health, the stage or extent of the disease, and the type of cancer. The type of treatment an individual patient receives may also be based on the results of genetic screening, which can identify mutations that render some lung cancers susceptible to specific drugs. Surgery involves:

- Segmentectomy
- Lobectomy
- Pneumonectomy

Radiation may be used alone or in conjunction with surgery—either before surgery to shrink tumors or following surgery to destroy small amounts of cancerous tissue.

Non-small cell lung cancer
In early stages and in good general condition of the patient, the surgery is indicated. The tumor is resected by **lobectomy** or **pneumonectomy**, including the resection of regional lymph nodes. Even solitary nodules without calcification in smokers should be resected due to the suspicion of a carcinoma.

If an operation is not reasonable due to the general condition of the patient, radiation therapy with curative intent is indicated. The median survival time of irradiated non-operable patients is, however, less than a year. Subsequent chemotherapy improves life expectancy.

The chemotherapy is performed with cisplatin or carboplatin in combination with **vinorelbin**, **gemcitabine**, **paclitaxel**, **docetaxel** or **topotectan**. Under chemotherapy, the average survival time of inoperable patients is 9 - 10 months.

Palliative treatment options for advanced tumors in bronchostenosis to reduce symptoms of dyspnoea can be palliative radiation therapy and endoscopic laser therapy with stent placement.

**Small cell lung cancer**

Small cell lung cancer is usually disseminated and inoperable at the time of diagnosis. 80% of the patients respond well to the chemotherapy. Mostly there is a therapy with etoposid plus cisplation or carboplatin. The median survival during chemotherapy is 40 - 70 weeks.

In the detection of brain metastases, a whole brain radiotherapy is indicated. It is also prophylactically indicated after chemotherapy with complete remission. Only 1 - 5% of the patients get healed, mostly in the extensive stage of small cell lung cancer.

**Follow-Up and Aftercare**

The follow-up involves the physical examination, a chest X-ray in 2 planes and abdominal **ultrasonography**. As a tumor marker, the neuron-specific enolase is used in small cell lung cancer. For non-small cell lung cancer, CEA and CYFRA21-1 are used.
Prevention of Lung Cancer

The probability of developing lung cancer can be greatly reduced by avoiding smoking. Smokers who quit also reduce their risk significantly. Testing for radon gas and avoiding exposure to coal products, asbestos, and other airborne carcinogens also lower the risk.

Special Types of Bronchial Carcinoma

Bronchioalveolar carcinoma

The bronchio-alveolar carcinoma accounts about 3% of pulmonary malignancies and probably comes from type II pneumocytes of the alveoli. It is characterized by a slow growth along the alveolar and bronchial wall. Rarely infested are lymph nodes and the interstitial. Women and men are diagnosed with equal frequency.

Note: There is no association between the bronchioalveolar carcinoma and the smoking of cigarettes. Symptoms of the bronchioalveolar carcinoma are diffusion disorder with hypoxia and restrictive ventilator disorder by tumor growth. Some patients complain about large quantities of mucous sputum. The material extraction for cytological examination is carried out via bronchoscopy. Solitary lesions can be resected. The tumor is resistant to radio- and chemotherapy.

Semimalignant and benign bronchial tumors

Bronchial adenomas

Bronchial adenomas are a collective term for histologically differentiated, emanating from the epithelium intrabronchial tumors that spread invasively and can metastasize. 80 – 90% of all cases are carcinoids. They proceed from endocrine cells of the APUD-system of the bronchial mucosa. Occasionally they produce the carcinoids ACTH or ADH, which lead to paraneoplastic syndromes. In case of metastases in the liver, a typical carcinoid-syndrome can occur.

15% make the adenoid cystic tumors. They are also called cylindromas and grow endobronchial. It is important to ensure that the adenoid cystic tumors are vascular, and
therefore bleed profusely after punctures.

The mucoepidermoid tumors are with 2–3 % the rarest form of bronchial adenomas. They proceed from mucous glands and grow locally destructive but rarely metastasize.

**Benign bronchial tumors**

The benign bronchial tumors include: chonromas, haematomas, osteomas, fibromas and hemangiomatas. They go out from mesenchymal tissue and grow mainly in the central bronchi, thereby leading to stridor and dyspnoea with coughing. The semi malignant and benign bronchial tumors can be cured by resection.

**Note:** The benign bronchial tumors have significance mainly in the demarcation to bronchial carcinoma.

**Review Questions**

The correct answers can be found below the references.

1. A 57 years old male adult smoker, mechanic by profession, came with a persistent cough, fever, shortness of breath and hoarseness of voice. He has a history of vomiting which was dark in color. On examination he was pale and jaundiced with 100/70 mmHg blood pressure, 100 degree Fahrenheit temperature, heart rate 110 bpm and respiratory rate 38/min. He also complains of itching on his whole body off and on along with burning micturition. Auscultation of the chest showed bilateral crepitation with rhonchi and decreased breath sounds on the left side of the chest. His x-ray chest is shown in the figure. Which of the following could be the most probable cause of these symptoms?
   - Chronic liver disease leading to liver cancer
   - Congestive cardiac failure
   - Squamous cell lung cancer with liver metastasis
   - Adenocarcinoma of the lungs with Horner syndrome

2. A 62 years old male hypertensive with 50 pack years of smoking history came with one month history of shortness of breath and 3 episodes of hemoptysis in the last 10 days. He claims that he has lost about 4-5 kg weight but no loss of appetite and no cough at night. He is a known case of asthma (allergic to pollens) but no recurrant symptoms since last 4-5 years. He is taking atenolol for hypertension. Physical examination showed clubbing and pallor. His chest xray showed left sided pleural effusion and bronchoscopy showed a lesion at the left main bronchus. Biopsy showed poorly differentiated carcinoma. Which of the following is the best choice for management?
   - Chemotherapy plus radiotherapy
   - Tumor debulking
   - Segmentectomy
   - Bronchoscopic laser

3. How big should be the FEV1-setpint at least be at planned pneumonectomy due to a large operable lung carcinoma?
   - 0.5 l
   - 1 l
4. A 78-year-old man say that he smokes since is 24th or 25th year of age one and a half packs of cigarettes daily. How many pack years has he accumulated roughly?

A. 54 py  
B. 80 py  
C. 30 py  
D. 108 py  
E. 45 py

5. What is not a typical symptom of the Lambert-Eaton-Syndrome in small cell lung carcinoma?

A. Leg stressed proximal muscle weakness  
B. Impotence  
C. Accommodation disturbance  
D. Hypohidrosis  
E. Sensory disturbances of the thighs

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Non-small cell lung cancer stages via cancer.org

Lung Cancer via britannica.com

Types of Lung Cancer via webmd.com

Lung Cancer Pathology Updates via iap-ad.org

Correct answers: 1C, 2A, 3E, 4B, 5E

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