Tumors of the Lung and Bronchi

Includes the following pathologies:
1) Carcinoma of the Lung
2) Carcinoid Tumors
3) Benign Tumors of the Lung
4) Secondary Tumors of the Lung

1) LUNG CANCER

DEFINITION
The term lung cancer usually applies to neoplasms arising from the respiratory epithelium called bronchogenic carcinoma. It accounts for more than 90% of pulmonary tumors: Two main subtypes forming the majority:
1) Non–small cell lung carcinoma (NSCLC) 75% of cases includes adenocarcinoma, squamous cell carcinoma, large-cell carcinoma, and their subtypes.
2) Small-cell lung carcinoma (SCLC)

Incidence and Epidemiology:
It is the second most common malignant disease diagnosed among both men and women around the world. At present, 170,000 to 180,000 new cases are diagnosed each year, an incidence of approximately 60 per 100,000 of the population.
Lung cancer is most commonly diagnosed between 55 to 75 years of age. Diagnoses before the age of 35 years are rare.
Adenocarcinoma has increased in incidence in recent years faster than any other cell type. One-third of all cancer deaths are attributable to lung cancer.

ETIOLOGY
TOBACCO SMOKING
Tobacco smoking is the leading risk factor for lung cancer. It is estimated that smoking is responsible for 80% to 90% of cases of lung cancer.
The risk of lung cancer is related to the number of cigarettes smoked, age at starting to smoke, and the duration of smoking. The relative risk for death of lung cancer is 9 to 15 times greater among current smokers than among never smokers, and may be as high as 25 times greater among persons who smoke more than 25 cigarettes per day.
Women appear to be more susceptible to the carcinogenic effects of cigarette smoking.

ENVIRONMENTAL TOBACCO SMOKE
Environmental tobacco smoke is composed of sidestream (Second hand) smoke that emanates from the burning end of cigarettes and of mainstream smoke exhaled by smokers.
Some components of tobacco smoke may be more concentrated in sidestream smoke than in mainstream smoke.
CLINICAL FEATURES
Most cases of lung cancer are symptomatic at diagnosis. Locoregional effects of lung cancer, metastasis, or paraneoplastic phenomena may cause symptoms and physical signs.
Cough, the most common symptom of lung cancer, occurs among as many as 75% of patients and may be caused by invasion of the bronchial mucosa by tumor, atelectasis, tumor cavitation, or pleural effusion.
Fifty percent of patients with lung cancer have dyspnea, which may arise from large airway obstruction with or without pneumonitis or atelectasis. Patients also may have pleural effusion, lymphangitic metastasis, pericardial effusion, thromboembolism, or concurrent COPD.
Hemoptysis also occurs among 50% of patients and usually consists of blood-streaked sputum. Causes include tumor necrosis, mucosal ulceration, erosion into thoracic blood vessels, Lung cancer occurs among only 2% to 9% of patients who have hemoptysis and a normal chest radiograph.
Forty percent of patients have chest pain. Tumor involvement of the parietal pleura, chest wall, and mediastinum may cause aching chest pain. Pleuritic pain may be caused by infection, extension of tumor into the chest wall, or thromboembolic disease. Extension of the lung cancer to the mediastinum also may cause ipsilateral diaphragmatic paralysis due to phrenic nerve involvement or hoarseness due to entrapment of the left recurrent laryngeal nerve along its intrathoracic course.
Pleural effusion occurs among 10% of patients with lung cancer because of impaired lymphatic drainage, pleural metastasis.
Non resolving pneumonia in chronic smoker should be always taken with caution and underlying cancer should be excluded.
Pain in the ipsilateral shoulder and scapula, pain with or without muscle atrophy in the ulnar nerve distribution, and Horner's syndrome (ptosis, miosis, and ipsilateral facial anhidrosis) resulting from invasion of the chest wall, brachial plexus, and sympathetic ganglion by tumors in the superior sulcus characterize Pancoast's syndrome. NSCLC is the most common histologic type of superior sulcus tumor.

METASTATIC EFFECTS
Common sites of metastatic spread are the adrenal glands, liver, central nervous system (CNS), and bone. Adrenal metastasis usually is asymptomatic and is detected as unilateral adrenal enlargement during staging chest CT extended to the upper abdomen. This scenario occurs in approximately 8% of lung cancer evaluations, and 2% of lesions found to be metastatic.
Liver metastasis is more common with SCLC. It is present in 25% of patients when they come to medical attention as opposed to 5% of patients with NSCLC.
Metastases to the CNS may involve the cerebral hemispheres, spinal cord, or meninges. The most common cause of cerebral metastasis is lung cancer. SCLC and adenocarcinoma are most likely to metastasize to the brain; squamous cell carcinoma is least likely.
Skeletal metastatic lesions typically take the form of osteolytic lesions of the vertebral bodies, ribs, and long bones of the extremities.
DIAGNOSIS
The essential aspects of the lung cancer evaluation are histologic distinction of SCLC from NSCLC, accurate staging, and determination of the patient's performance status. This information is obtained through a combination of clinical findings, imaging modalities, and procedures to procure specimens for cytologic or histologic analysis.

IMAGING STUDIES

1) CHEST RADIOGRAPHY PA & Lateral views: 50% to 70% accurate in the detection of lung cancer. Squamous cell carcinoma often manifests as a large peri-hilar (Central) mass that may cavitate, adenocarcinoma as a peripheral solitary nodule or mass.

2) CT SACN OF THE CHEST AND UPPER ABDOMEN: provides further definition of the appearance of the primary lesion, may depict concurrent parenchymal or pleural disease, and guides diagnostic maneuvers.

3) SPUTUM CYTOLOGY: Sensitivity is highest for central squamous cell carcinoma but less than 20% for peripheral nodules.

4) FLEXIBLE FIBEROPTIC BRONCHOSCOPY
Flexible fiberoptic bronchoscopy is used for diagnostic and staging purposes. Diagnostic techniques include endoscopic biopsy, brushing, and bronchial lavage. The diagnostic yield depends on tumor location and size.

5) POSITRON EMISSION TOMOGRAPHY (PET) with fluorodeoxyglucose (FDG18) may help detect malignant lesions with 90% to 100% sensitivity and 80% to 89% specificity.

6) TRANSTHORACIC NEEDLE ASPIRATION BIOPSY
Peripheral lesions or those with extension to the mediastinum, pleura, or chest wall may be sampled by means of fluoroscopically or CT-guided transthoracic needle aspiration biopsy (TTNA).

7) MAGNETIC RESONANCE IMAGING (MRI) more accurately defines the local magnitude of the superior sulcus tumor than does computed tomography (CT).

8) THORACIC SURGICAL DIAGNOSTIC PROCEDURES
Pathologic evaluation of mediastinal lymph nodes larger than 1 cm in diameter should be performed for any NSCLC patient who is considered a candidate for thoracotomy and surgical resection. Right paratracheal and subcarinal lymph nodes traditionally have been approached with cervical mediastinoscopy. Biopsy of left paratracheal, supraaortic, and aortopulmonary window nodes has been through anterior mediastinotomy. Indeterminate peripheral nodules and pleural abnormalities can be explored by means of video-assisted thoracoscopic surgery (VATS).

STAGING
NON–SMALL CELL LUNG CANCER
Staging for NSCLC is based on the TNM classification. The T component refers to the size, location, and extent of locoregional invasion of the primary tumor. The N element describes locoregional lymph node involvement. The M constituent identifies whether distant metastatic lesions are present.

The TNM stage is the most important prognostic factor in NSCLC.
If NSCLC is believed to be resectable, the patient must be assessed for medical contraindications to surgical treatment. It must be determined whether there is adequate pulmonary reserve for curative lung resection. Any patient subjected to preoperative spirometry (Pulmonary Function Testing) and measurement of the diffusing capacity of the lung for carbon monoxide are strongly recommended. Patients with forced expiratory volume in one second (FEV$_1$) less than 1.5 to 2 L or more than 60% of predicted normal value, maximal voluntary ventilation more than 50% of predicted normal value, and diffusing capacity greater than 60% of predicted value can proceed directly to thoracotomy and all types of pulmonary resections.

Patients with lower values need quantitative ventilation-perfusion lung scanning, measurement of arterial blood gases, or exercise testing. Although no value categorically precludes surgery, predicted postoperative FEV$_1$ less than 0.8 L or less than 40% of predicted value, hypercapnia (P$_{CO_2} > 45$), or maximal exercise oxygen consumption less than 10 mL per kilogram per minute indicate high risk of postoperative complications and renders surgery not applicable.

SMALL-CELL LUNG CANCER
The TNM staging system of NSCLC usually is not applied to SCLC because of the limited role of surgery and because more than 90% of patients have locally advanced (stage III) or metastatic (stage IV) disease when they come to medical attention. SCLC is classified with the Veterans Affairs staging system of limited and extensive disease. Limited disease refers to tumor confined to one radiation port (disease within one hemithorax and its regional lymph nodes). Extensive disease encompasses everything else.

STRATEGIES FOR OPTIMAL CARE
NON–SMALL CELL LUNG CANCER STAGES 0 THROUGH II
Stage 0 (carcinoma in situ) is uncommon, and the recommended treatments range from surgery to photodynamic therapy, external beam radiation therapy, or brachytherapy (intraluminal radiation therapy).

Surgical resection with curative intent is the therapy of choice for stage I and II cancer. Stage 0 to II categorization can only be applied to 20% to 25% of patients with NSCLC when they come to medical attention.

The standard operation is either lobectomy, bilobectomy, or pneumonectomy via a posterolateral thoracotomy with mediastinal lymph node dissection combined. Less extensive resections are associated with higher rates of local recurrence and should be reserved for patients whose lung status will not allow lobectomy.

Operative mortality is 2% to 3% for lobectomy and 5% to 6% for pneumonectomy. Patients who have undergone resection have a 3% to 4% risk per year of development of a second primary lung cancer, so follow-up chest radiographs every 3 to 4 months for the first 2 years and every 6 to 12 months thereafter are recommended.
SECONDARY TUMORS OF THE LUNG
Lungs are one of the common sites for secondary metastasis form breast, renal cell cancers, colonic cancers, upper airway. The current for surgical treatment of a pulmonary metastasis are:

1. Control of the primary site
2. No other distant extrapulmonary metastatic disease or, if present, immediate plans to control it with surgery or another treatment modality
3. Pulmonary metastases that are thought to be completely resectable, even if located in both lungs
4. Adequate cardiopulmonary reserve of the patient
5. A technically feasible operation