Brochogenic carcinoma is by far the number one cause of cancer death. This disease burden is a fairly recent phenomenon, arising first in western countries in the 1930s, and rising sharply in subsequent years . Since 1950 , lung cancer mortality has risen 197% in men, and 612% in women. In 1998, 20,000 more women died of lung cancer than breast cancer . The survival rate is poor, because lung cancer is usually diagnosed at an advanced stage. A cure can only be achieved by surgery, which is feasible only in patients who present in an early stage. Lung cancer is rare before the age of 40, after which age-specific rates rise sharply. The ages with the greatest incidence are between 65 and 79.

There are several extrinsic risk factors, but bronchogenic carcinoma is unique among all malignancies in that a single risk factor accounts for approximately 90% of the risk, specifically, tobacco smoking. The smoker is not the only one at risk.

Bronchogenic carcinoma is a broad term for cancers arising in epithelial tissue in the lining of the bronchi, and also in the trachea, bronchioles, and alveoli . Approximately 90% to 95% of all primary lung cancers are bronchogenic carcinomas . Histologically , about 20% of these cancers are small-cell carcinomas. The other 80% are grouped together as nonsmall-cell lung cancers (NSCLC) , which are divided into three subtypes : (1) adenocarcinoma (30% to 40%), (2) sequamous cell carcinoma (30% to 40%), and (3) large cell undifferentiated carcinoma (10%) . These three subtypes are grouped together because NSCLCs overall have similar treatment options, as well as a better prognosis when disease is still localized at diagnosis.

Approximately 90% of small-cell carcinomas are located centrally, and tend to invade longitudinally along submucosal and intramural portions of the bronchial walls and in the supporting tissues and lymphatics. They are often characterized by extensive, bulky, mediastinal lymphadenopathy. Small-cell lung cancer is considered a nonsurgical disease, with the majority of cases presenting in an advanced stage. The majority of sequamous cell carcinomas is also located centrally, and is more frequently associated with bronchial obstruction. This is in contrast to large-cell tumors and adenocarcinomas, which tend to be peripheral. A specific subtype of adenocarcinoma, known as bronchioalveolar carcinoma, can appear as a single nodule, segmental or lobar consolidation, or as diffuse nodules.

Thoracic Spiral CT scanning plays several vital roles in the evaluation of patients with known or suspected lung cancer. One is to further characterize a suspicious abnormality seen on a chest radiograph, and to provide a more complete evaluation of a primary neoplasm. A second and indispensable role is that of pretreatment or pre-operative staging, for which spiral CT is the primary imaging modality. Additionally, chest spiral CT helps provide a roadmap for other staging procedures such as bronchoscopy, mediastinoscopy and transthoracic needle biopsy. Most, if not all, of the various manifestations of lung cancer described for chest radiography can be better evaluated with spiral CT. Cross-sectional imaging can help further clarify a tumor's location, whether in a central or peripheral location, and delineate its relationship to pleura, chest wall, and mediastinal structures. The level and degree of obstruction by central tumors leading to atelectasis and postobstructive pneumonitis can be visualized easily with cross-sectional imaging.

Imaging features used to characterize a primary lung lesion on a chest radiograph are equally as useful on spiral CT , including size and growth rat, calcification, shape and margins, and cavitations, along with the additional characteristics of density and contrast enhancement. As with chest radiography, increasing size, especially > 3cm, correlates with an increasing chance of malignancy. Spiral CT enjoys the added advantage of more accurate measurement of a nodules size to better detect and quantify interval growth. Spiral CT can better detect and evaluate calcifications within a nodule.

A smooth peripheral margin on CT is associated more frequently with benign lesions. An ill defined, lobulated or speculated margin is associated more frequently with malignant lesion.

The wall thickness of a cavitary lesion can be measured more accurately with spiral CT. The majority of cavitary solitary pulmonary nodules with a wall thickness less than 5 mm were benign, and the majority with a wall thickness greater than 15 mm was malignant. Spiral CT also has the added advantage of better evaluating the contour of a cavity's wall. A smooth inner wall is more commonly associated with a benign etiology, while a nodular internal margin reflects focal tumor.

Several other characteristics of a primary lung lesion can be evaluated with spiral CT, such as attenuation and contrast enhancement. Homogenous attenuation has been found to be associated more often with a benign, rather than a malignant lesion. Thin collimation spiral ct is more sensitive than standard CT for assessment of attenuation.

A newer technique for the assessment of the primary lung lesion is based on differential nodule enhancement with IV contrast material, as measured with thin-slice spiral CT. It relies on qualitative and quantitative differences in the blood supply to benign and malignant nodules. The malignant nodules tend to enhance significantly more (15 HU increase). The malignant nodules with the most diagnostically important measurement made at 2 minutes post injection.

Of all newly diagnosed cases of bronchogenic carcinoma, approximately 80% are NSCLC. Surgical respectability, chemotherapy and radiation options, and survival rates are all related to the stage of disease. Small-cell lung cancer remains a nonsurgical disease, with the majority of patients of patients presenting in advanced stages. The intrathoracic and extrathoracic staging of lung cancer involves assessment of the primary tumor and potential sites for metastases. The TNM staging system is the most widely accepted and utilized classification for preoperative staging. Accurate and reproducible staging is crucial in the clinical management of this disease. Since the development of spiral CT scanning, this modality has become the mainstay in radiologic staging of chest malignancies.

With spiral CT, the primary tumor is evaluated for initial size and location, as well as possible extension beyond the lung parenchyma. The primary tumor may involve the pleura, chest wall, mediastinal structures, or vertebral bodies. Hilar tumors may invade the trachea or carina. Metastatic sites include mediastinal lymph nodes, as well as distant sites such as liver, adrenals, brain, bone, and soft tissue.

Spiral CT has demonstrated a wide range of results when assessing for chest wall invasion of tumor. Sensitivity ranges from 38% to 87%, and specificity ranges from 40% to 59%. The best criterion for diagnosing chest wall invasion with spiral CT is bony destruction, with or without tumor extension into the chest wall. Other signs of chest-wall invasion include pleural thickening, loss of the extra-plural fat plane, an obtuse angle between the mass and the chest wall, and > 3cm of contact between the mass and the chest wall. Chest-wall invasion does not necessarily exclude resection, but there is increased morbidity and mortality associated with en bloc resection and chest-wall reconstruction in this setting.

Mediastinal structures that can be invaded by tumor extention include the trachea and carina, esophagus, mediastinal vessels, heart and pericardium, and vertebral bodies. Disease involving these mediastinal structures is classified as T4. Although gross mediastinal invasion by bronchogenic carcinoma can be diagnosed confidently on spiral CT. There are certain spiral CT criteria that suggest mediastinal invasion. These include tumor contact more than 3cm with the mediastinum, more than 90 of contact with the aorta, and obliteration of fat planes.

Spiral CT is the preferred imaging technique for evaluating adenopathy. The accurate localization of abnormal lymph nodes, whether peribronchial, hilar, mediastinal or supraclavicular, is important in determining the N classification of the disease.

Lymph nodes are generally identified on spiral CT as nonenhancing soft-tissue densities surrounded by mediastinal fat. Several studies have shown that the short axis diameter is the best predictor of actual nodal volume. In practice, increased nodal size is the only useful criterion for malignancy, and

a node measuring >1cm is generally considered abnormal. Increased nodal size is not an absolute indicator of malignant disease, however, as nodes < 1 cm in size may contain microscopic metastases, and enlarged nodes may represent benign reactive adenopathy to an unrelated process in the chest. Central low density can represent fat in a normal node, or necrosis in a malignant node. The accurate description of abnormal nodal location is essential information in assisting the surgeon, bronchoscopist, or radiologist in planning a more invasive staging procedure.

The most frequent sites of hematogenous metastases are bone, brain, contralateral lung, liver and adrenals. Distant metastatic disease implies surgical unresectability. At most institutions, a chest spiral CT in patients with suspected lung cancer in extended inferiorly to include the superior portion of the liver and the adrenal glands. A careful review of bone windows is also necessary in these circumstances, to exclude metastatic deposits in ribs, the sternum, the scapula, and the vertebral column.

In Conclusion

Bronchogenic carcinoma is an extremely prevalent disease that most radiologists will encounter on a frequent basis. Familiarity with the various manifestation of lung cancer on chest radiography may help suggest the initial diagnosis, especially in an older patient with a history of cigarette smoking. Once a suspicious abnormality is detected, spiral CT is the next step in the diagnostic work-up. This is necessary to help confirm the diagnosis by identifying CT features of an abnormality that would more likely suggest cancer, and to stage the disease.

The emerging role of PET offers an exciting new diagnostic tool that can quantify the metabolic activity of a tumor or node, and can reveal additional sites of disease unsuspected on CT, thereby increasing the accuracy of the staging process. The role of MRI generally is limited.