

Answer to this month's Radiological Conference

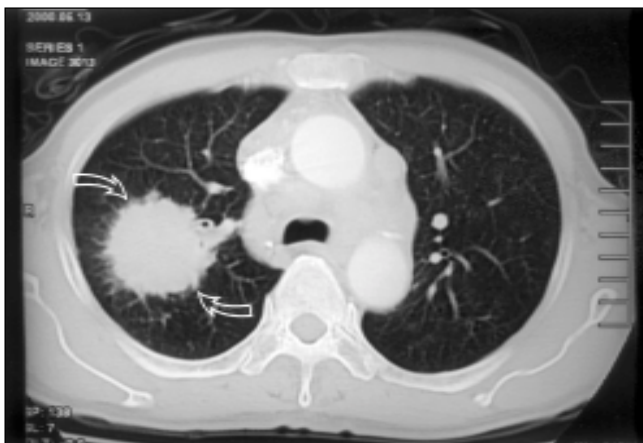
Answer:

c) Bronchogenic carcinoma

Radiological findings

Computed tomography (CT) scan of the thorax taken using lung window (**Figure 3**) shows a 4.5 cm × 4.0 cm soft tissue mass with spiculated margins in the right upper lobe. No evidence of air bronchogram or calcification is seen. CT scan of the thorax using mediastinal window (**Figure 4**) shows multiple enlarged mediastinal lymph nodes in the pre-tracheal area and aorto-pulmonary window. The largest node present in the pretracheal area measures 2.5 cm in diameter.

Figure 3: Same CT image as Figure 1 with addition of arrows. A 4.5 × 4.0 cm soft tissue mass with spiculated margins (curved open arrows) is seen in the right upper lobe. There is no air bronchogram or calcification

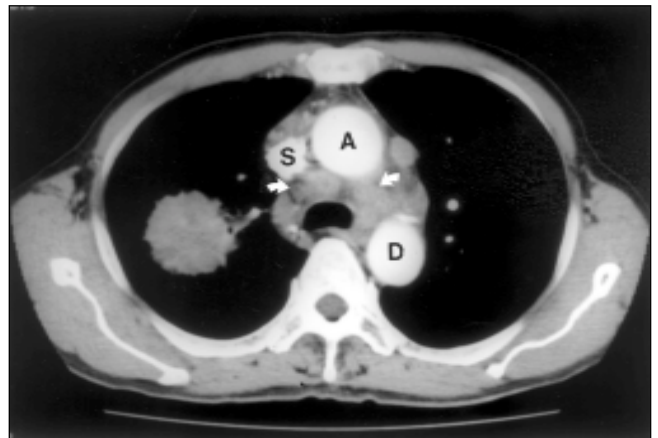


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Figure 4: Same CT image as Figure 2 with addition of arrows. There are enlarged lymph nodes (small arrows) in the pre-tracheal area and aorto-pulmonary window. The following vascular structures are markedly enhanced by the injected intravenous contrast agent: superior vena cava (S), ascending aorta (A), and descending aorta (D)



Discussion

Bronchogenic carcinoma

This is the most common cancer in men and the third commonest cancer in women. Age at diagnosis ranges from 40 to 80 years, with the 6th decade being the most common. It accounts for less than 15% of all solitary nodules at 40 years and 100% at 80 years. Bronchogenic carcinoma can be classified into four main cell types: squamous cell carcinoma, adenocarcinoma, small (or oat) cell carcinoma and large cell carcinoma. Regardless of cell type, diagnosis is often late. Surgical removal of a “small” lesion ensures longer patient survival. The earliest possible detection and evaluation are aimed for. Unfortunately, small tumours are usually asymptomatic, giving no clinical clue to their presence.

Central tumours account for 60% of all bronchogenic carcinomas. Most central lesions are squamous or small cell types histologically. Approximately 40% of bronchogenic carcinomas originate as a peripheral mass. Most peripheral lesions are adenocarcinoma and large cell carcinoma. The patient with bronchogenic carcinoma may be asymptomatic (10-50%), and these are mostly peripheral tumours. Common symptoms are cough (75%) and haemoptysis (50%). Other symptoms include

wheezing, pneumonia, dyspnoea, chest pain (local or pleuritic), pancoast syndrome, superior vena caval syndrome and hoarseness. Lung cancer patients may also have symptoms of metastatic disease or paraneoplastic disease.

Approximately 60-80% of lung cancers arise in segmental bronchi. The most common site is the anterior segment of the right upper lobe. CT is able to accurately identify a hilar/perihilar mass or a peripheral mass. Lesions over 4cm in diameter are statistically more likely to be malignant.

Malignant lesions nearly always show lobulated, notched or spiculated margins. Even if only one small portion of the lesion has an ill-defined edge, the diagnosis of primary carcinoma should be seriously considered. If the shadow is perfectly spherical and the edge is very well defined, it is likely to be a metastasis or a benign lesion such as hamartoma or tuberculoma. Cavitation is seen in 16% of cases and is usually thick-walled with an irregular inner surface. Most cavitating tumours are squamous cell carcinomas.

Mediastinal lymph node spread of bronchogenic carcinoma is best routinely evaluated by CT. Lymph nodes larger than 1 to 1.5 cm in greatest diameter are considered to be abnormal. Other radiological features encountered include segmental, lobar or whole lung atelectasis (37%), persistent peripheral infiltrate (30%), pleural effusion (8-15%), bone erosion of the ribs and spine, local hyperaeration, and involvement of the main pulmonary artery or lobar segmental arteries. Calcification is found in 7% of carcinomas on CT and is usually eccentric or finely stippled. CT is superior to radiographs in detecting number of nodules and smaller nodules. Thus CT can detect primary tumours in patients with negative chest radiographs.

Malignant mesothelioma

Malignant mesothelioma is nearly always due to asbestos exposure. Occupational exposure to asbestos is found in 80% of all cases. Five to ten percent of occupationally – exposed subjects will develop mesothelioma. There is no relation to the duration or degree of exposure, or to the smoking history. The usual latent period is 20-40 years. The peak age incidence occurs in the 6th to 7th decades of life. Histologically,

malignant mesothelioma may be epithelial, mesenchymal and mixed. Intracellular asbestos fibres are seen in 25% of cases. Pleural mesothelioma may be associated with peritoneal mesothelioma. The patient usually complains of dyspnoea and chest pain. CT scan shows an extensive irregular lobulated bulky pleural-based mass with pleural thickening. Pleural effusion is found in 80%-100% of patients. It is associated with pleural plaques in 50%. All pleural surfaces (mediastinum, pericardium, fissures) may be involved. Adjacent bone destruction is seen in 12%, ascites in 35% and metastases to the ipsilateral lung in 60% of cases. There may be hilar or mediastinal adenopathy, and the chest wall and diaphragm may be involved. There is no evidence of pleural-based mass or pleural thickening characteristic of malignant mesothelioma in our patient. Therefore, the possibility of this diagnosis does not arise.

Hamartoma

A hamartoma is a benign tumour composed of the tissues normally present in the organs in which it occurs, but in which tissues are disorganised. In hamartoma of the lung, the predominant tissues are masses of cartilage with clefts lined by bronchial epithelium. There is some debate as to this lesion should be classified as a congenital anomaly or a neoplasm. Hamartoma is the most common type of benign lung tumour. It behaves as a totally benign slow-growing neoplasm, and is found in 0.25% of the population at autopsy. It also constitutes 6-8% of all solitary pulmonary lesions. Ninety percent of cases occur over the age of 40 years. The peak age is in the 5th and 6th decades of the life. It is very rarely seen in children. It is more common in males (M : F = 3:1).

Patients are usually asymptomatic. Sometimes they may present with cough, vague chest pain and fever as a result of obstructive pneumonitis. Haemoptysis is rare. The mass is usually less than 4 cm in diameter. Ninety percent of hamartomas are peripheral, presenting as a solitary nodule, while the remaining 10% are endobronchial in a major bronchus. Hamartomas are very occasionally multiple. Diagnosis is suggested by chest radiographic or more clearly by CT features. It is seen as a spherical or slightly lobulated very well-defined nodule, usually less than 4 cm in diameter, with surrounding normal lung. Hamartomas often show calcification which may be spotty, linear or show a characteristic “popcorn” configuration. The “popcorn”

type of calcifications is considered to be almost pathognomonic of hamartoma. CT is very useful to search for calcification when it is not clearly seen on radiographs. CT can detect fat in 50% of hamartomas. As none of these features are found in our case, this diagnosis can be excluded.

Pulmonary metastases

Most pulmonary metastases are blood borne. They account for 3-5% of asymptomatic pulmonary nodules. Metastases may occur from almost any malignant tumour. The commonest primaries are breast, sarcomas, seminoma, renal cell carcinoma and choriocarcinoma. Eighty-seven percent of the patients are over 50 years of age. Metastatic nodules are usually round, well-defined, multiple and bilateral. Twenty-five percent are solitary. They predominate in the outer third of the lung and lower lung zones. Chest radiographs are unable to routinely demonstrate nodules smaller than 1 to 1.2cm in diameter. In many studies, the median nodule detected by CT is 3 mm in diameter. CT eliminates confusion produced by overlapping structures. CT produces better density discrimination compared to chest radiographs, and is able to detect more nodules in the subpleural region and diaphragmatic recesses. This is important as the subpleural region is a common site of metastases. Patients with malignancies having a high incidence of lung metastases should therefore be considered for CT scan, regardless of whether the radiograph is normal or abnormal. The typical spiculated margins, size and site of the pulmonary mass found in our case and absence of clinical history of a known primary tumour makes the diagnosis of metastasis unlikely.

Arteriovenous malformation (AVM)

In pulmonary arteriovenous malformation (AVM), there is abnormal vascular communication between the

pulmonary artery and vein (95%), or between a systemic artery and the pulmonary vein (5%). AVM may be congenital or acquired. It usually manifests in adult life and is most common in the 3rd and 4th decades of life. Only 10% of cases occur in childhood. Pulmonary AVM may occur as an isolated abnormality (40%) or may be associated with the Rendu-Osler-Weber Syndrome (30-88%) or hereditary haemorrhagic telangiectasia. Only 15% of the patients with the Rendu-Osler-Weber Syndrome have pulmonary AVMs. Pulmonary AVMs are of two types, namely: simple (79%) and complex (21%). In the simple type, a single feeding artery empties into a non-separated aneurysmal segment with a single draining vein. In the complex type, more than one feeding artery empty into a separated aneurysmal segment with more than one draining vein.

The CT detection rate of AVM is very high (98%). On CT, AVMs are seen as a homogeneous well-circumscribed non-calcified nodule or as a serpiginous mass measuring up to several centimetre in diameter. The mass is connected to an enlarged feeding artery and draining vein. The vascular nature of this lesion can be confirmed using dynamic CT scanning after an intravenous bolus injection of contrast agent, and noting that the nodule enhances and fades as rapidly as the heart and pulmonary arteries. With the absence of these characteristic radiological features of AVM in our case, this diagnosis can be excluded. ■

Further readings

1. Armstrong P, Wastie ML. *Diagnostic Imaging*. 3rd ed. Blackwell Scientific Publications, Oxford, 1992;37-40.
2. Chapman S, Nakielny R. *Aids to Radiological Differential Diagnosis*. 3rd ed. WB Saunders, London, 1995;130-132.
3. Dähnert W. *Radiology Review Manual*. 2nd ed. Williams & Wilkins, Baltimore, 1993;296-297,308,316,320-321.
4. Sider L. *Introduction to Diagnostic Imaging*. Churchill Livingstone, Edinburgh, 1986;77.