RADIOLOGICAL QUIZ

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A 55 year old male, essentially asymptomatic was admitted for review to Malignant Diseases Treatment Centre. He was subjected to CT scan chest (Fig 1 &

2) to document complete response to treatment.

What is your diagnosis?

Figs. 1 & 2 : CT scan chest, sections through trachea & carina in lung window

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Answer to Radiological Quiz

RADIOLOGICAL DIAGNOSIS : Radiation induced Fibrosis.

KEY WORDS : Radiation fibrosis

A 55 year old male was diagnosed as a case of small cell carcinoma lung. He had presented with superior mediastinal mass engulfing and involving superior vena cava resulting in superior vena cava syndrome. He was treated with 6 courses of chemotherapy and radiotherapy with 44 Gy/22 fractions/30 days with good clinical and radiological response. He was subjected to CT scan chest after 15 months of radiotherapy to document complete response. On CT scan chest there was complete resolution of mediastinal mass but there was paramediastinal fibrosis involving medial part of both upper lobes and medial part of apical basal segment of both lower lobes. The area of fibrosis had well defined linear lateral margin with adjacent well aerated lung, this geometric definition corresponding to the treatment portal is typical of radiation-induced fibrosis.

Ionizing radiations ionize atoms and molecules in human tissues through the deposition of energy. This ionization is the first step in a series of events that may lead to a biologic effect. Radiation-induced pulmonary injury is common following treatment of pulmonary, mediastinal and breast cancer by radiotherapy. The changes seen on the X-ray and CT scan are often remarkably geometric and correspond to the shape of treatment portal [1].

The effect of radiation on the lungs depend upon several factors, healthy lung tissue is more resistant to damage than diseased lung. Previous radiotherapy and associated chemotherapy increases the likelihood of fibrosis. The risk of developing significant lung injury appears to be most dependent upon radiation dose and volume of lung irradiated. Radiographic changes are rare at the rate 20 Gy(2000 rad) over 2-3 weeks, but are usual with doses of 50 Gy or more over 5-6 weeks [1,2] as seen in the case.

The earliest pathological changes in the lung are alveolar and bronchiolar desquamation and accumulation of exudate in the alveoli. The radiological changes correspond to the pathology with acute radiation pneumonitis demonstrated as patchy, confluent regions of increased pulmonary attenuation [3] with usually some volume loss. It is not segmental or lobar, but corresponds to the shape of radiation portal. An

air bronchogram may be visible. Radiation pneumonitis usually occurs 6 to 16 weeks after radiation therapy [4], the patient is usually asymptomatic, but may have pyrexia or cough. It is detected more often by CT than by chest X-ray (39% vs 11% at the end of the irradiation) [5]. This is followed by clinical remission except in the most severe cases and gradual radiological progression to the stage of radiation fibrosis over the next 6 to 12 months [2] seen as soft tissue density linear strands. It may have a bronchiectatic component with distortion of normal intrathoracic anatomic relationship. Both the acute and chronic changes usually make linear lateral margins with adjacent aerated lung [3].

Necrosis of the ribs or clavicle may be seen on the chest X-ray following radiotherapy, pleural effusion as a result of irradiation is rare and radiation-induced sarcomas are well recognised but rare [6].

CT scan helps in accurate differentiation between radiation fibrosis and recurrent tumor, in case of radiation fibrosis or consolidation, CT scan presents with a straight lateral margin and ectatic air-containing bronchi whereas with recurrent tumor it shows a soft tissue mass with a convex lateral border and without air-containing bronchi [7].

The diagnosis of radiation pneumonitis and fibrosis is usually easy based on the history and characteristic shape on imaging. CT scan is the method of choice for demonstrating these morphological changes, however follow-up can be done with conventional X-rays.

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