RADIOLOGICAL CASE BOOK

TWO PROBLEMS IN RADIODIAGNOSIS

I. UNILATERAL TOTAL HOMOGENEOUS OPACITY OF THE CHEST WITH DISLOCATION OF THE MEDIASTINUM

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A unilateral massive total opacity of the hemithorax usually presents a diagnostic problem. Gross displacement of the mediastinal contents to the other side away from the opacity indicates either a massive pleural effusion or a gross malignant neoplasm. On the other hand, displacement to the same side as the opacity indicates either massive fibrosis of the lung or complete lung atelectasis due to occlusion of a main bronchus. Occasionally a unilateral homogeneous opacity may be due to a combination of a massive pleural effusion associated with complete obstructive atelectasis. In such a case there may be little or no shift of the mediastinal contents.

RADIOLOGICAL FINDINGS

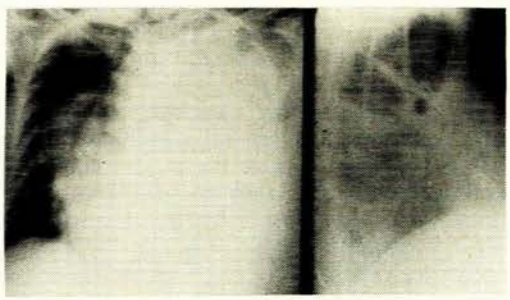
Chest. There is obvious gross dislocation of the mediastinum with displacement of the trachea and bronchi towards the mid-lung zone of the right hemithorax. There is a massive total homogeneous opacity of the left hemithorax producing some widening of the intercostal spaces, depression of the left leaf of the diaphragm, and a shift of the heart shadow to the right. The right lung is being compressed. The differential diagnosis lies between a massive pleural effusion and a gross malignant neoplasm (Fig. 1).

HISTORY OF THE PATIENT

Mrs. A.M.N., 56 years of age, first noticed a swelling in the right axilla in March 1963. On examination a vague mass was found in the axillary tail of the right breast associated with a hard nodule in the axilla. A diagnosis of a stage II breast carcinoma was made and a radical (Halsted) mastectomy performed on 22 March 1963. The histological report was most revealing. Dr. I. W. Simson, pathologist, reported: 'Mammary tumour—fibro-adenosis. Axillary lymph node—Hodgkin's sarcoma.'

RADIOTHERAPY

Postoperative deep X-ray therapy was advised and administered to the supraclavicular and axillary areas on the right side. No other lymph nodes were palpable or could be demonstrated in the chest by radiological means at that time. A radical dose of 3,500 rads in 3 weeks using deep X-ray therapy (220 kV, 16 mA, 50 cm. f-s-d with a filter of 1·0 mm. Cu plus 1·0 mm. Al) through two opposing 10 x 15 cm. fields directed over the supraclavicular and axillary areas was administered from 5 to 25 April 1963. The patient remained symptom-free until 3 years later when in July 1966 she was admitted to hospital with severe dyspnoea. On clinical examination the left hemithorax was completely dull to percussion and no respiratory sounds could be heard. No lymph nodes were palpable in the neck, axillae or groins. The liver and spleen were not enlarged. The radiological findings already discussed were then observed.



P-A view *Lateral view*

Fig. 1. Unilateral total opacity before treatment.

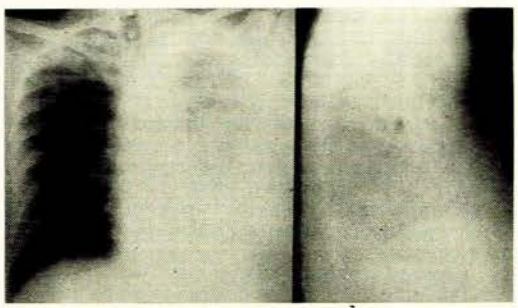
PARACENTESIS PLEURALIS

Under a local anaesthetic administered with a dental syringe a needle was inserted in the 9th intercostal space, that is, the second space under the inferior angle of the scapula, and at approximately the costal angle. The needle was inserted just above the lower rib, touching the upper edge to avoid the intercostal vessels and nerve which lie along the under-surface of the ribs.

The needle was then adjusted until fluid could be freely withdrawn, after which it was connected to the suction apparatus attached to the wall in the ward. A careful watch was then kept on the suction applied to prevent the fluid from being drained too rapidly. A bloody fluid (2,800 ml.) was withdrawn in this way in about 30 minutes. We had estimated that there must be about 4,000 ml. present. It is our policy never to empty the fluid in the cavity, because this usually leads to a great deal of discomfort afterwards with a troublesome dry cough and some pain in the chest which is difficult to alleviate. About 50 ml. of the aspirated fluid was sent for cytological diagnosis. After the paracentesis the patient was considerably relieved of her severe dyspnoea.

RADIOLOGICAL FINDINGS AFTER PARACENTESIS

Chest. The dislocated mediastinum is back in its normal position. There is still a fair amount of fluid present in the left hemithorax filling up the lower half of the left hemithorax estimated at about 1,000 ml. There are some vague circular opacities, about 1·5 cm. in diameter, discernible in the underlying left lung which could be due to metastases from a Hodgkin's sarcoma, but it is unusual for a Hodgkin's sarcoma to metastasize to the lungs. On the other hand, one cannot exclude metastases from a breast carcinoma which has the peculiar tendency to favour the opposite lung and pleura for some unexplainable reason (Fig. 2).



P-A view *Lateral view*

Fig. 2. Radiological findings after treatment.

FINAL DIAGNOSIS

The final diagnosis is a massive pleural effusion caused by metastases to the lung and pleura of the left hemithorax from a primary Hodgkin's sarcoma localized to a right axillary lymph node surgically removed 3 years ago and followed by radical radiotherapy to the right supraclavicular and axillary lymph nodes. Malignant cells were found in the aspirated pleural fluid. Dr. I. W. Simson reported that some of these cells have an appearance compatible with those of Reed Sternberg. This finally clinches the diagnosis of Hodgkin's sarcoma with lung and pleural metastases. The patient is undergoing cancer chemotherapy, administered by Dr. G. Falkson.

II. A LARGE OVAL HOMOGENEOUS OPACITY IN THE LEFT LUNG

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A large oval homogeneous opacity in the hilar region of the lung may cause a diagnostic problem which can be quite formidable. However, any recent opacity in the lung of a man over 50 years of age should be diagnosed as malignant until otherwise proved. If, following a course of radiotherapy, such a hilar opacity should rapidly dissolve, the diagnosis that would then be favoured would be either an oat-cell carcinoma of the bronchus or one of the reticuloses (giant-cell lymphoma, lymphosarcoma, lymphadenoma and reticulum-cell sarcoma).

DIFFERENTIAL DIAGNOSIS

In the differential diagnosis a long list of possible causes may have to be considered. Only a few will have to suffice here such as:

(*i*) *Primary bronchial cancer.* This is by far the commonest cause of a homogeneous opacity in the lung of an elderly male. The opacity may be well-defined, but usually reveals some irregularity in outline, either a localized bulge or a distinct lobulated appearance. If there is associated mediastinal adenopathy heralded by widening of the mediastinal shadow or paralysis of either leaf of the diaphragm through phrenic nerve involvement, the diagnosis is almost certain to be a primary bronchial carcinoma; but sometimes the distinction of a primary bronchial carcinoma from a solitary secondary deposit or a hydatid cyst with its oval shape and clearly defined margin may cause considerable difficulty from a purely radiological point of view.

(*ii*) *An isolated secondary deposit.* A secondary deposit in the lung may be single and grow to a large size. Usually it is circular and well-defined, often more so than the primary bronchial carcinoma. Such a secondary deposit may make its appearance soon after the discovery of the primary lesion or it may appear only years later, up to 20 years or more. Secondary deposits, however, are more commonly multiple and distributed throughout both lungs.

(*iii*) *Primary atypical hilar pneumonia.* Consolidation around the hilar shadow following atypical viral pneumonia can produce an irregular oval homogeneous shadow which may be impossible to distinguish from a primary bronchial carcinoma, especially if associated with diminished diaphragmatic movement of the affected side as a result of diaphragmatic pleurisy. Fortunately it tends to clear up rapidly.

(*iv*) *A hydatid cyst.* A sharply defined circular or oval opacity in the lung suggests a hydatid cyst as the foremost possibility. In malignant disease the outline of the opacity, in comparison with a hydatid cyst, is usually somewhat blurred and irregular. The circular shape of the hydatid cyst is said to change to that of an oval shape on deep inspiration (Escudero-Nemenow sign).

(*v*) *An encysted effusion.* This may cast a well-defined opacity in the lung field on a postero-anterior projection of the chest, but if the effusion is interlobar a lateral view should suffice to clear the diagnosis. An encysted mediastinal effusion is uncommon, but when present can cause a difficult problem in diagnosis. As a rule it produces a convex shadow jutting out from the heart shadow into either translucent lung field. It has to be differentiated from an encysted pericardial effusion, a tumour of the heart, and mediastinal adenopathy.

(*vi*) *Mediastinal adenopathy.* Primary mediastinal adenopathy caused by one of the reticuloses or secondary deposits from malignancy elsewhere may produce confusing shadows jutting out from the hilar regions into the lung fields and of varying sizes. They generally have a lobulated appearance and one should have no difficulty in diagnosing their true nature.

(*vii*) *Assmann's focus.* The tuberculous lesion known as Assmann's focus may attain a size of about 3·0 cm. in diameter. It represents a post-primary tuberculous focus. Its sharply defined circular appearance may closely resemble a primary or metastatic malignant growth, and more rarely a cyst, infarct or abscess. Assmann emphasized that a tuberculous aetiology cannot be assumed in the presence of a focus of this nature.

(*viii*) *A toruloma.* (Fungus infection—*Cryptococcus neoformans.*) A toruloma is also the cause of a large oval or circular, well-defined homogeneous opacity in the lung. The lesion is usually silent and discovered accidentally, and when seen on an X-ray film is diagnosed as a primary bronchial carcinoma. With a productive cough the fungus may be found in the sputum. Sometimes there is also an intracranial lesion present, and this may cause the neurological symptoms to predominate, leading to the faulty diagnosis of a primary bronchial carcinoma with brain metastases.

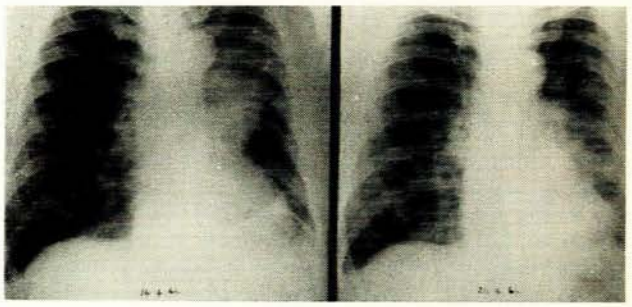
(*ix*) *An infarct* may have a circular form and be well-defined. Resolution usually occurs rapidly.

(*x*) *A hamartoma.* Confusion still reigns as to whether a hamartoma is a developmental anomaly or a mixed benign tumour. This particular type of benign lung mass is said to appear in adult life and is usually observed in old age. On surgical removal the diagnosis is made histologically.

HISTORY OF PATIENT

R.V.B., a male, aged 70, suffered a coronary thrombosis in December 1942 from which he made a complete recovery. Then 21 years later he suffered a second attack in August 1963, from which he made an excellent recovery, but he has been on maintenance Dindevan and Digoxin therapy ever since. He was a heavy cigarette smoker in his day, up to 40 cigarettes per day, but after the first coronary thrombosis he was advised to give it up and he has not smoked since.

In January 1966 he became aware of a shortness of breath on slight exertion, and this gradually got worse. In March 1966 he developed a cough with blood-stained sputum. The shortness of breath was now becoming troublesome. He was seen by Dr. F. Ziady, physician, who made a clinical diagnosis of bronchial carcinoma and referred him for radiotherapy in the absence of bronchoscopic investigation or histological confirmation of the diagnosis in view of the patient's reluctance to submit to such examination and to the general and rapid deterioration of his condition. The patient was wheeled into the department of radiotherapy, obviously very short of breath, but otherwise his general condition appeared to be fair. It was decided to give the patient combined telecobalt and cancer chemotherapy on the clinical and radiological diagnosis of a primary bronchial carcinoma. The radiological findings reveal the lesion in the chest before and after treatment (Fig. 1).



14.4.66 *Before treatment* 26.4.66 *After treatment*

Fig. 1. A large oval homogeneous opacity in the left lung.

RADIOLOGICAL FINDINGS

Before Treatment (14 April 1966)

Chest. There is a large oval, rather homogeneous opacity with ill-defined upper margin occupying the left hilar region and merging into the left lung with lessened loss of translucency as it extends upwards towards the left apex. The left leaf of the diaphragm is raised, and on screening paradoxical movement was observed due to paresis of the left leaf of the diaphragm. The large gas bubble in the stomach can, of course, also be the cause of a raised left leaf of the diaphragm, but in this case there was definite paresis present. The heart shadow is moderately enlarged with unfolding of the aorta and calcification of the aortic knuckle. The right lung field reveals no evidence of pathologic changes. The ribs appear to be quite normal.

After Treatment (26 April 1966)

Chest. The large left hilar shadow has dissolved to one-third of its original size, and the function of the left leaf of the diaphragm during screening was almost normal in its excursions.

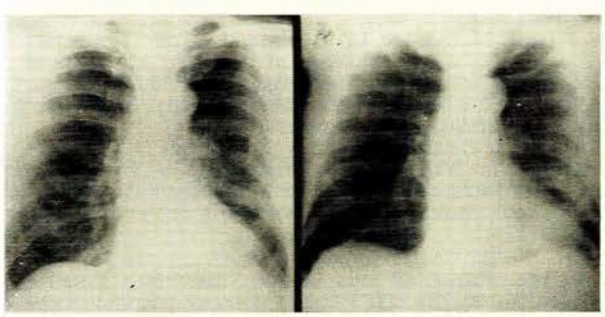
DETAILS OF THE TREATMENT ADMINISTERED

A course of combined telecobalt and cancer chemotherapy was administered.

Telecobalt therapy. A course of telecobalt therapy with the 3,000 curie Siemen's Gammatron was commenced on 14 April 1966. Three 13 × 13 cm. fields at a source-tumour-distance of 65 cm. were used and arranged anteriorly, laterally and posteriorly and directed towards the tumour in the left hilar region. A tumour dose of 2,000 rads at a depth of 10·5 cm. was administered in 2 weeks from 14 April to 27 April 1966.

Cancer chemotherapy. At the same time Dr. Geoffrey Falkson, cancer chemotherapist, prescribed 3 tablets of 500 mg. each of S.Q. 1089 (Hydroxy urea) to be administered 15 minutes before telecobalt therapy, and the blood picture was watched carefully.

Comment. The patient tolerated the combined treatment very well and was able to attend daily (except Saturdays and Sundays) as an outpatient. Within a week there was a decided improvement in his breathing, and by the end of the treatment he was no longer dyspnoeic. The cough had cleared up completely and there was no further evidence of blood-stained sputum. He was out of the wheel-chair and moved about without discomfort.



17.5.66 13.6.66

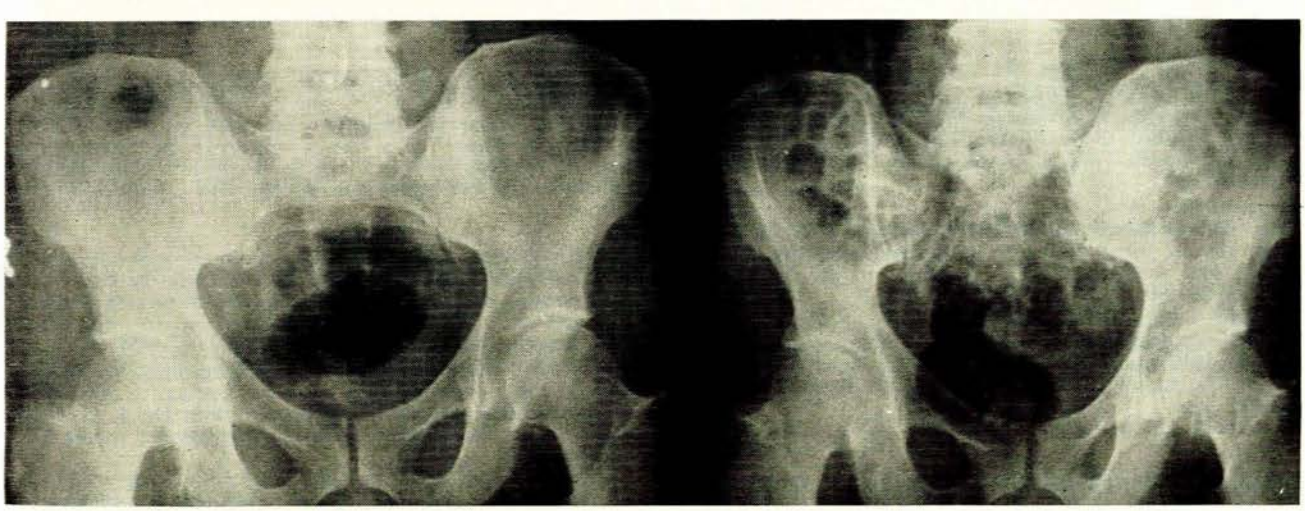
Fig. 2. Complete dissolution of the opacity in the left lung. on follow-up X-rays.

Radiological Evidence of the Response to Treatment

Follow-up X-rays of the chest. 17 May 1966: There is evidence of further dissolution of the hilar opacity with general improvement of the appearance of the left lung field. 13 June 1966: The left lung field is almost normal in appearance and there is now no evidence of the left hilar opacity—it has dissolved completely (Fig. 2).

Relapse with Bone Metastases

The patient started his treatment on 14 April 1966 when the lesion in the lung was treated. He completed his treatment on 27 April 1966. One month later, on 24 May 1966, the patient suddenly collapsed with excruciating pain in the lower lumbar region while arranging books in his library. X-rays of the lumbar spine and sacro-iliac joints showed no evidence of bone metastases. But, as bone metastases are not always shown radiologically in the early stages and as we were rather convinced that the pain was due to metastases, we decided to give a short course of therapy. After the second treatment with deep X-ray therapy, the pain was however so much worse that the treatment was stopped, and we believed that the pain was due to lumbago since this is often aggravated by treatment, whereas radiotherapy usually causes a dramatic response with the disappearance of pain if bony metastases are present. He was treated at home, but the pain got worse instead of better, and by 13 June 1966 the patient was in agony and could hardly move in bed. He was admitted to ward 21, and follow-up X-rays of the lumbar spine and sacro-iliac joints were taken. In comparison with the X-rays taken on 24 May 1966, which showed no obvious evidence of bony metastases, the X-rays taken on 13 June 1966, 3 weeks later, showed obvious metastases to the sacrum especially towards the left sacro-iliac joint (Fig. 3).



24.5.66 13.6.66

Fig. 3. No bony metastases in the sacrum on 24.5.66. Obvious bony metastases in the sacrum on 13.6.66.

Second Course of Combined Therapy to Primary and Secondary Lesions

On this occasion (1) a second course of telecobalt and cancer chemotherapy was administered as on the previous occasion to the primary lesion; it is our policy to do this even in the absence of the presence of a lesion in cases of bronchial carcinoma, and (2) deep X-ray therapy (220 KV, 16 mA, 50 cm. f-s-d., and a filter of 1·0 mm. Cu plus 1·0 mm. Al) was used to treat the lumbo-sacral region. A dose of 2,000 rads was given through one large posterior field 15 × 15 cm. in 10 treatments.

Comment. On this occasion the response was most dramatic. Within a week the excruciating pain had subsided and the patient could turn around in bed and sit up, something which was quite impossible for him to do during the previous 3 weeks. He is now getting up and sitting in a chair.

DISCUSSION

The rapid dissolution of the opacity in the left hilar region with full restoration of movement of the left leaf of the diaphragm, following combined telecobalt and cancer chemotherapy in this elderly patient, favours a diagnosis of an oat-cell carcinoma of the left upper lobe bronchus associated with mediastinal lymphadenopathy causing phrenic nerve involvement and the paresis of the left leaf of the diaphragm. The subsequent development of severe pain in the lower lumbar region, with radiological evidence of bony metastases to the sacrum which responded dramatically to a course of radiotherapy to this region, supports the clinical diagnosis of bronchial carcinoma.

FINAL DIAGNOSIS

Radiotherapy and cancer chemotherapy administered concurrently helped to clinch the diagnosis of an oat-cell carcinoma of the left upper lobe bronchus as the only possible diagnosis in this case, because it is well-known that an oat-cell carcinoma is very sensitive to radiotherapy and that it has a great tendency to metastasize early to bone and to the suprarenal glands.