



DIAGNOSTIC APPROACH

TO

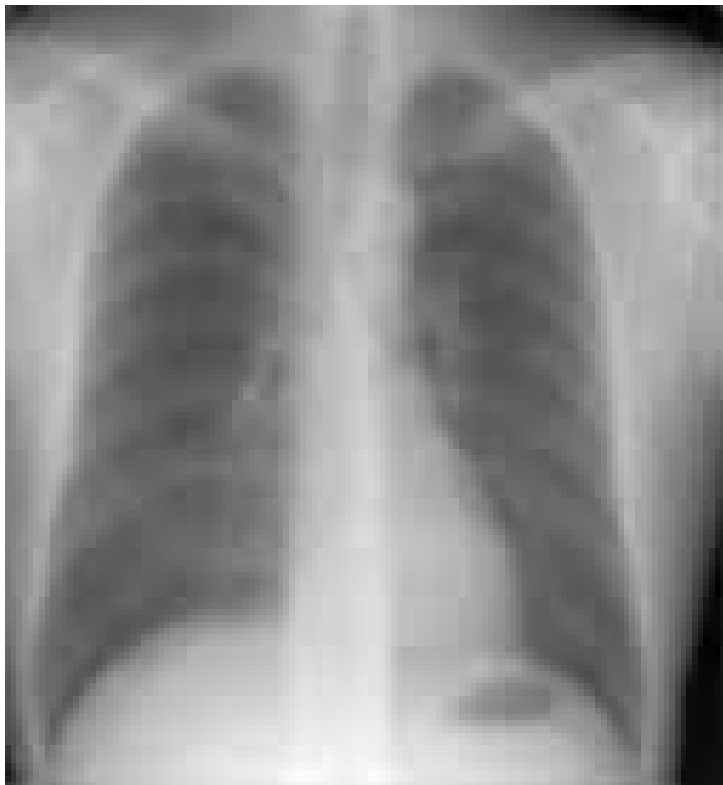
MILIARY OPACITIES.

INTRODUCTION

The term '*miliary*' derives from the **radiographic** picture of **diffuse, discrete, nodular** shadows about the size of a '*millet*' seed ($\approx 2\text{mm}$).

CHEST X-RAY

NORMAL v/s MILIARY



CAUSES OF THIS APPEARANCE

1. Those opacities having **SOFT TISSUE** density:-
 - a) Miliary tuberculosis
 - b) Sarcoidosis
 - c) Fungal diseases
 - d) Coal-miner's pneumoconiosis
 - e) Acute extrinsic allergic alveolitis
 - f) Tropical pulmonary eosinophilia
 - g) Fibrosing alveolitis

- Fungal diseases include-
 - Histoplasmosis
 - Coccidioidomycosis
 - Blastomycosis
 - Cryptococcosis

Contd...

2. Those opacities having **GREATER-
THAN-SOFT-TISSUE** density:-

- a) Pulmonary haemosiderosis
- b) Silicosis
- c) Siderosis

3. Opacities(2-5mm) tending to remain
DISCRETE:-

- a) Miliary carcinomatosis
- b) Lymphoma
- c) Sarcoidosis

4. Opacities(2-5mm) tending to
COALASCE:-

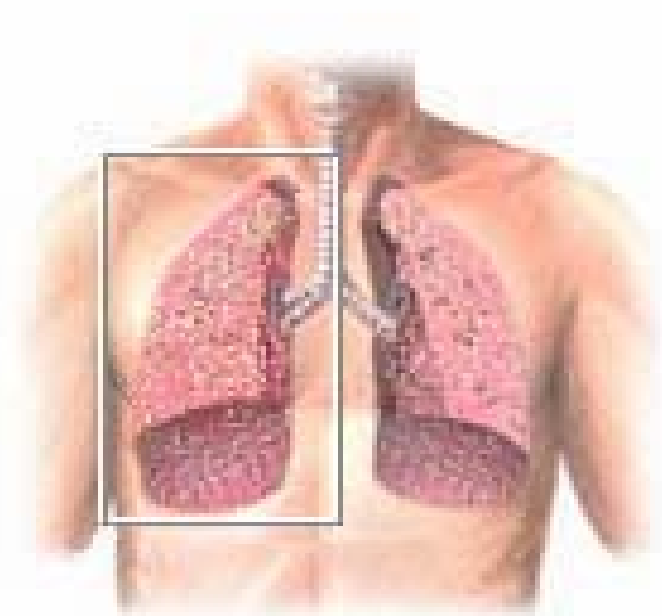
- a) Multifocal pneumonia
- b) Pulmonary edema
- c) Extrinsic allergic alveolitis
- d) Fat emboli

Miliary Tuberculosis

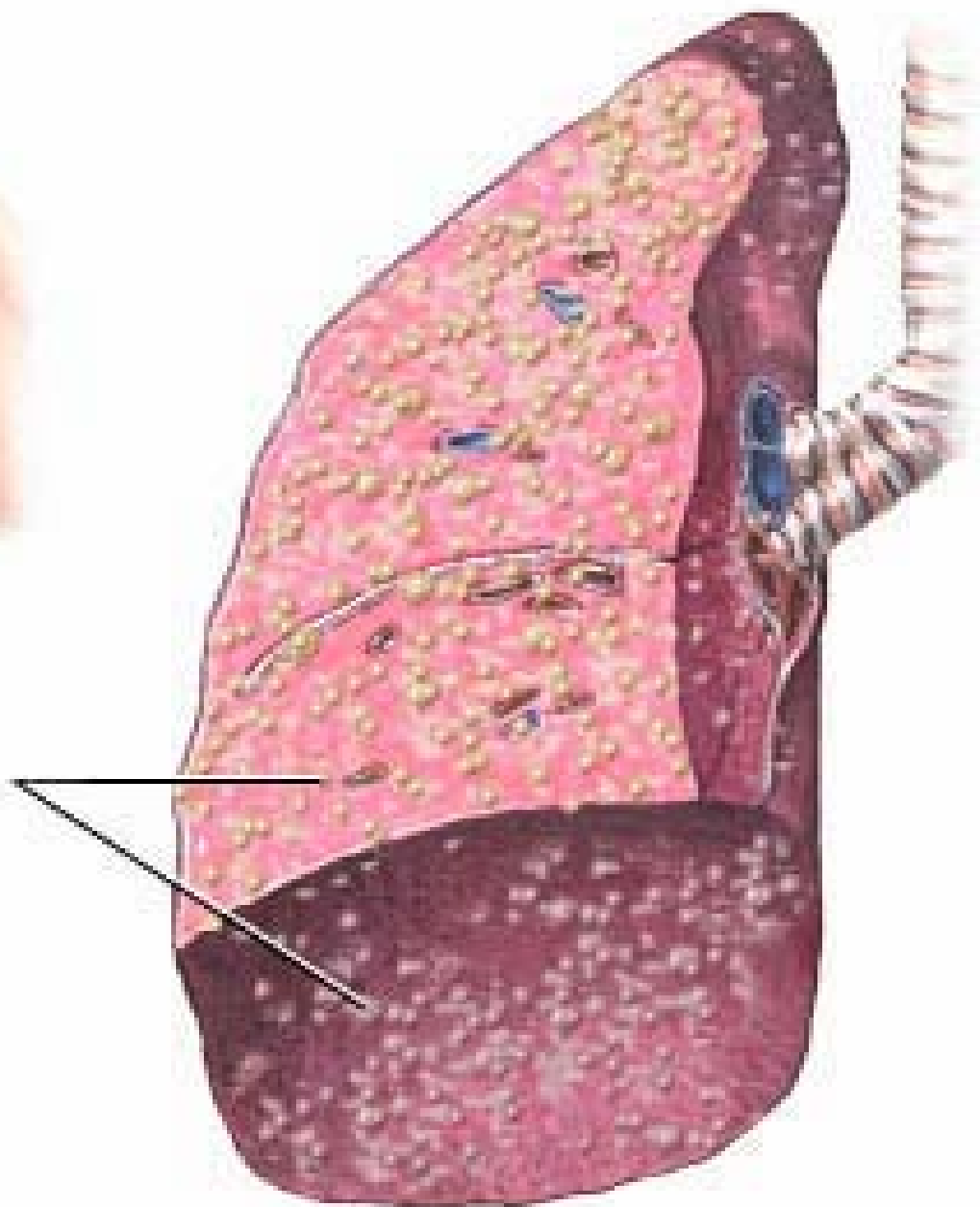
Miliary Tuberculosis is produced by acute dissemination of tubercle bacilli via the blood stream(veins).

If the initial infection is overwhelming or the patient is in any way immunocompromised, then the hematogenous phase of the primary infection may give rise to acute miliary tuberculosis.

More commonly seen in the middle aged and the elderly.



Granulomas from
Mycobacterium
tuberculosis





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- The distribution of the lesions in the body is variable but the **lungs are always affected.**
- The lesions consist of clumps of epithelioid cells, lymphocytes and Langerhans' giant cells with or without central caseation.
- The “non-reactive” pathological type.



Contd..

- **Clinical features:-**
 - **Fever**
 - **Constitutional symptoms**
 - **Chest normal on auscultation**
 - **Choroidal tubercles**
 - **Splenomegaly**
 - **Hepatomegaly, lymphadenopathy.**

Investigations in miliary tuberculosis

- **BLOOD**

- **Haemogram –anaemia,leukopenia, pancytopenia, leukamoid reactions and polycythemia.**
- **ESR- elevated**
- **Liver function tests-deranged(elevated levels of transaminases and alkaline phosphatases.**
- **Electrolytes- hyponatremia and hypokalemia.**

- **RADIOLOGY:-**

The chest radiograph may be quite normal in the presence of miliary tuberculosis, since the lesions are sometimes too small to be seen

- **TUBERCULIN TEST:-**

It may be positive but can be negative in disseminated tuberculosis.

MILIARY TUBERCULOSIS



- **SPUTUM FOR AFB:-**

Sputum, if present may help to confirm the diagnosis.

- **BRONCHOSCOPY:-**

Bronchoscopic biopsy or lavage specimens or even transtracheal aspirates can be obtained for microbiological examination.



SARCOIDOSIS

- It is a **multisystem** granulomatous disorder of unknown etiology most commonly affecting young adults and presenting most frequently with bilateral lymphadenopathy, ***pulmonary infiltration*** and skin or eye lesions.
- Pulmonary infiltration can be of many types with disseminated miliary lesions as one of them.

Clinical features of sarcoidosis

- The **hilar glands and the lungs** are the organs **most commonly** affected in sarcoidosis and **intrathoracic involvement** is the most frequent accompaniment of sarcoidosis affecting other organs.
- The average time for spontaneous resolution of pulmonary opacities has been noted to be around 11 months.

SARCOIDOSIS



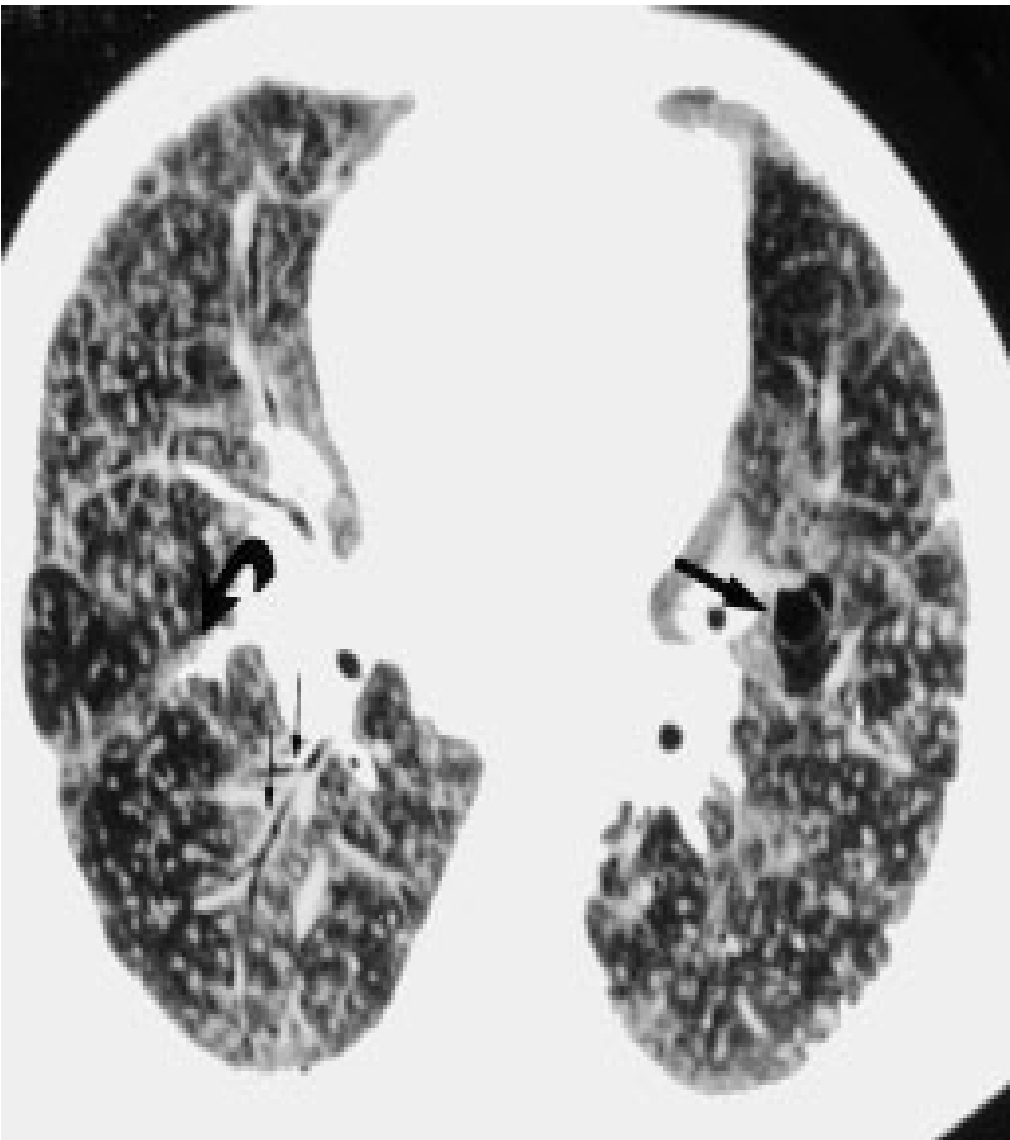
Scattered nodules resembling military pattern in a 40-year-old man with sarcoidosis. Postero-anterior chest radiograph (A) shows bilateral diffuse micronodular shadows along with mediastinal lymph nodes

THE X RAY PLATE FOLLOWS

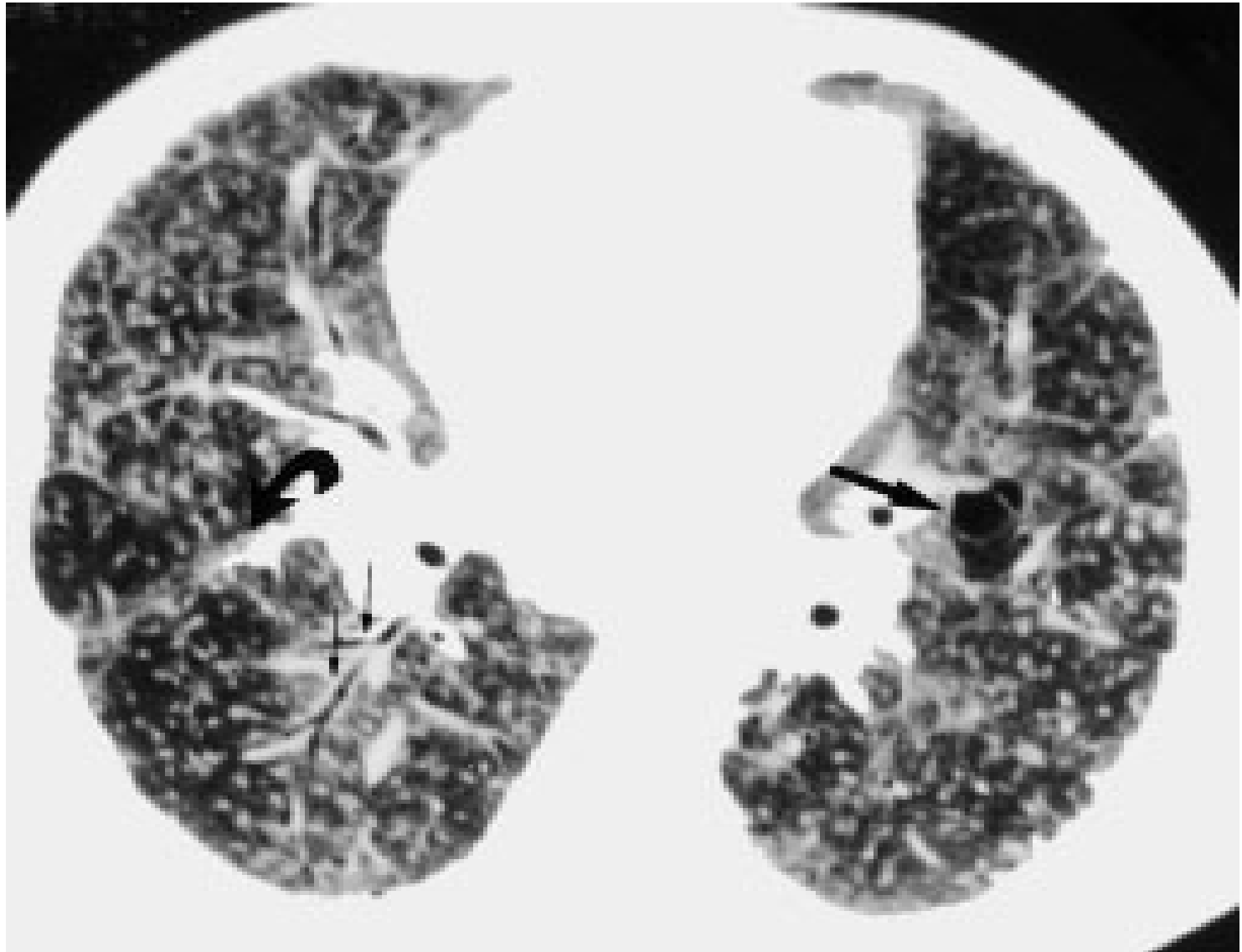
Miliary sarcoidosis (A)



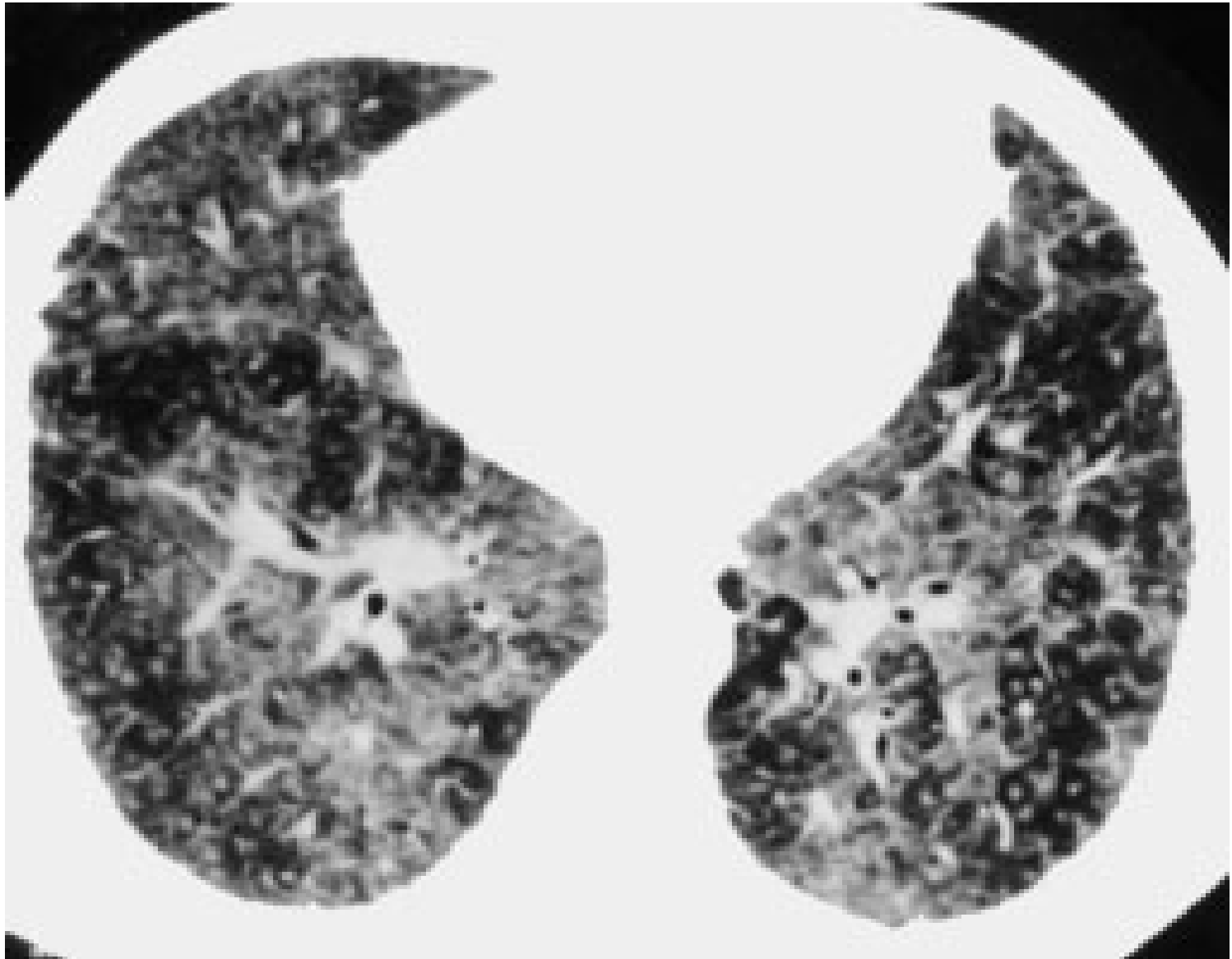
- CECT of the same patient (B) shows scattered nodules along with thickened bronchovascular bundle (**short arrows**) and nodularity of interlobar septum (**curved arrow**). A cavity is also visible near the left hilum (**bold arrow**). Another CECT window of the same patient (C) shows bilateral extensive ground glass opacities.



(B)



(C)





Investigations

- **PULMONARY FUNCTION TESTS:-** baseline measurement of lung volumes (the **most subtle** indication of lung function abnormality appears to be a decrease in DLco).
- **TUBERCULIN TESTING:-** 2/3rd patients fail to react to 100TU(only 1 in 20 react to 1TU).
- **FIBREOPTIC BRONCHOSCOPY:-** BAL AND BIOPSY
- **SERUM ACE LEVELS**
- **SERUM AND 24Hr URINARY CALCIUM LEVEL**



FUNGAL DISEASES

- **HISTOPLASMOSIS:-**
 - **Stay in endemic areas with clinical features(influenza like illness)**
 - **Positive compliment fixation test: four fold rise in titres.**
 - **Histoplasma IgG and IgM antibodies.**
 - **Blood culture positive in acute disease.**
 - **Liver and bone marrow biopsy.**
 - **Transbronchial biopsies and washings**
 - **BAL radioimmunoassay for capsular antigen**

HISTOPLASMOSIS

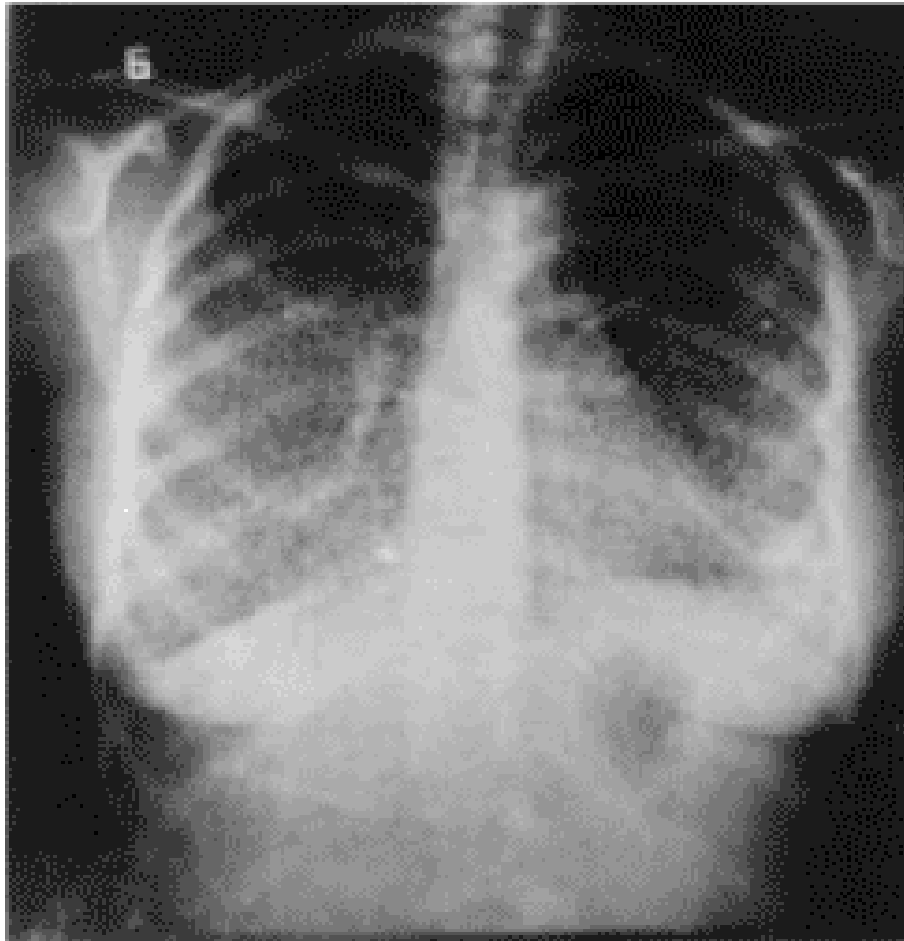


Figure 1 Chest X-ray showing disseminated minute miliary deposits in both lung fields, mostly at the hilum and the middle and lower zones

- **BLASTOMYCOSES:-**
 - **Stay in endemic areas.**
 - **Serological tests.**
 - **Enzyme immunoassay for the A antigen of blastomycosis.**
 - **Diagnosis depends on demonstration of organisms in SPUTUM OR LAVAGE.**



- **COCCIDIODOMYCOSIS:-**
 - **Stay in an endemic area with an acute systemic illness with pulmonary features**
 - **Diagnosis is by demonstration of the characteristic spherule from the sputum, bronchoscopic washing/brushing.**
 - **culture should be done on mycological media only in specialized labs**
 - **Demonstration of specific IgG or IgM antibodies.**

TROPICAL PULMONARY EOSINOPHILIA

- **A condition of spasmodic bronchitis associated with leucocytosis, marked eosinophilia.**
- **It represents a hypersensitivity reaction to filarial infestation.**
- **Clinical features:-**
 - **males most commonly affected**
 - **Cough, sputum, wheeze, dyspnoea and chest pain with remissions and recurrences.**
 - **Fever and weight loss also seen**



INVESTIGATIONS

- BLOOD:- there is nearly always an elevated absolute eosinophil count.
- Increased IgE concentration.
- Radiology:-
 - **May be normal but typically shows military mottling uniformly distributed in both lung fields and involving mainly the MIDDLE and LOWER zones.**
- The filarial compliment test is positive
- The lavage fluid/sputum may contain predominantly eosinophils

- **PULMONARY FUNCTION TESTS:-**
 - **They show an obstructive pattern in the early stages of the disease, progressing to a predominantly restrictive pattern with a decrease in DLco in long standing cases.**

PNEUMOCONIOSIS

- **COAL WORKERS' PNEUMOCONIOSES**
 - A disease virtually confined to underground coal miners
 - The earliest sign on a chest X ray is 'nodular' shadowing which when $< 1.5\text{mm}$ can be referred to as miliary opacities. (the nodules are commonly of 1.5-3mm)
 - Lesions are most profuse in **upper** and **middle** zones



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- **CLINICAL FEATURES:-**

patients of simple coal workers pneumoconioses have **no symptoms and signs** attributable to the disease.

- The breathlessness in these patients is attributable to some other disease like asthma or emphysema.
- There is absence of any physical signs in simple coal workers pneumoconioses



- LUNG FUNCTION TESTS:-

In simple pneumoconioses(with no emphysema) there is no change in either Forced expiratory volume in the 1st second or the FVC.

Diffusion capacity is also normal.

MULTIFOCAL PNEUMONIA

- Pneumonias caused by:-
 - Haemolytic Streptococcus
 - Staphylococcus
 - Mycoplasma pneumoniae

can present with **fever** and **miliary shadows** on chest Xray.



INVESTIGATIONS

- **BLOOD:-**
 - **Leucocytosis with neutrophilia**
 - **Increased blood urea levels**
 - **Deranged LFT-incr. enzymes and bilirubin**
 - **Culture positive for organism.**
- **Urine:-**
 - **Positive for pneumococcal antigen**
- **CHEST X RAY:-**
 - **There could be 'confluent' military opacities seen.**



Contd..

- SPUTUM:-
 - MICROSCOPY-gram staining
 - CULTURE
- OTHER INVASIVE METHODS:-
 - TRANS TRACHEAL ASPIRATION
 - BAL FLUID
 - PLEURAL FLUID ASPIRATION
- SEROLOGICAL TESTING
 - CFT
 - Mycoplasma specific ig M
- DNA probes

ACUTE EXTRINSIC ALLERGIC ALVEOLITIS

- HISTORY:- generally acute episodes bear a clear relationship to the exposure and are recognized by the patient.
- Physical examination:-
 - The crucial finding is of repetitive **INSPIRATORY CREPITATIONS.**
 - **Finger clubbing is a strong pointer against allergic alveolitis**



INVESTIGATIONS

- **BLOOD:-**
 - **Precipitins to the suspected antigen detected by radioimmunoassay.**
- **LUNG FUNCTION TESTING:-**
 - **A reduced DLco**
- **BAL FLUID AND BIOPSY:-**
 - **Lymphocytes predominate with plasma cells sometimes present**
 - **Biopsy should include a large specimen to demonstrate granuloma.**

- **RESPONSE TO CESSATION OF EXPOSURE.**
- **CHALLENGE TESTING:-**
 - **Exercise minute ventilation +**
 - **Body temperature +**
 - **Neutrophil count +**
 - **Lymphocyte count -**
 - **Vital capacity -**

MILIARY CARCINOMATOSIS

- **Metastasis from:-**

- **Breast**
- **Thyroid**
- **Prostrate**
- **Pancreas**
- **Melanoma**

Can all lead to miliary shadows in the chest x ray.

- **A thorough check up of all these systems is required and is generally a late presentation**

PULMONARY HAEMOSIDEROSIS

- Generally secondary to chronic raised venous hypertension(seen in patients of mitral stenosis)
- Also seen in patients having repeated pulmonary haemorrhage (goodpasture's disease) or idiopathic.

HOW TO APPROACH A PATIENT PRESENTING WITH MILIARY SHADOWS ON CHEST X RAY

- The chest x ray itself should be able to give away a lead.
 - **Density of shadows**
 - **Whether discrete or coalescent**
 - **Size**
 - **Number**
 - **Distribution**
 - **Enlarged nodes**

The following guidelines help to narrow down the differentials

- **SIZE**

A) Those < **2mm** include

Tuberculosis, coal miner's pneumoconioses, fungal diseases.

B) Those > **2mm** include

Miliary carcinomatosis, sarcoid, eosinophilia, multifocal pneumonia.

- **DISTRIBUTION:-**

Tuberculous lesions predominate in the **upper zones**, though, very often they are scattered throughout both lung fields

Sarcoid and pneumoconioses lesions tend to start in the **upper and mid-zones.**

- **NUMBER:-**

In tuberculosis, pneumoconioses and sarcoid the lesions are **too numerous** to count.

Fewer lesions are more frequent in carcinomatosis, pulmonary edema and pneumonia

- **ENLARGED NODES:-**

They are seen in

- **Sarcoid**
- **Carcinomatosis, fungal diseases,**
- **Calcified lymph nodes are often seen in tuberculosis, silicosis.**

- **PLEURAL EFFUSION:-**

If seen almost rules out miliary tuberculosis.

- A DETAILED HISTORY
- A THOROUGH EXAMINATION
- A SET OF INVESTIGATIONS:- all done sequentially with a plausible differential in mind should help to arrive at a diagnosis.

- **HISTORY**
 - **Sex- tropical pulm eosinophilia**
 - **Residence/ visit to an endemic area**
 - **Occupational history.**
 - **Presenting complaints:-**
 - **Fever:- infective?**
 - **Asthma like symptoms- tropical pulm eosinophilia**
 - **Sick(toxic)- miliary TB, pneumonia**
 - **Extra pulmonary complaints- metastasis, miliary TB,sarcoidosis**
 - **Weight loss**
 - **Past history:- koch's, immunosuppressed**

- **Personal history- residence, occupation, socio-economic strata, smoking, alcohol intake**
- **Family history**
- **EXAMINATION:-**
 - **General physical examination:-**
 - **Disoriented/ toxic appearance**
 - **Pallor- pulmonary haemosiderosis**
 - **Clubbing- against ac. Extrinsic allergic alveolitis**
 - **Lymphadenopathy- miliary TB, sarcoidosis, metastasis**
 - **Pedal odema- pulmonary haemosiderosis**

- **SYSTEMIC EXAMINATION:-**
 - **RESPIRATORY SYSTEM:- pneumoconiosis**
 - **cardiovascular:- mitral stenosis**
 - **Abdominal:- hepatosplenomegaly**
 - **Central nervous system**
 - **Ophthalmic:- sarcoidosis/ TB, histoplasmosis**
 - **Dermatological:- sarcoidosis**
 - **Locomotor/ rheumatological**

INVESTIGATIONS

- Simpler and non-invasive investigations can reveal much more and should be the first to be ordered:-
 - **Haemogram**
 - **Anaemia/polycythemia**
 - **Pancytopenia/Leucocytosis**
 - **ESR**
 - **Liver function tests**
 - **Renal function tests**

- Before ordering lung function tests
 - a **Sputum examination should be done**
 - Sputum for AFB
 - Sputum for pyogens
 - Sputum for fungus
- **LUNG FUNCTION TESTING**
 - Normal in pneumoconioses
 - Obstructive in tropical pulm eosinophilia
 - Restrictive in sarcoidosis
 - DLco

- CT scanning
- Fibreoptic bronchoscopy:-
 - **BAL FLUID:-**
 - BAL fluid for cytology
 - BAL fluid for AFB
 - BAL fluid for pyogens
 - Bal fluid for fungus
 - CD4+/CD8+ ratio
 - **Trans bronchial lung biopsy**
- Open lung biopsy

- **Disease specific tests:-**
 - **Serum ACE**
 - **Serum/Urinary calcium**
 - **immunological studies**
 - **Challenge tests**

A CASE

- **In November 1995, a 48-year-old man was officially referred for opinion from the Medical Committee Department to the Tuberculosis and Chest Disease Centre in Baghdad..**

His only presenting complaint was DYSPNOEA

His chest x ray showed miliary opacities:-

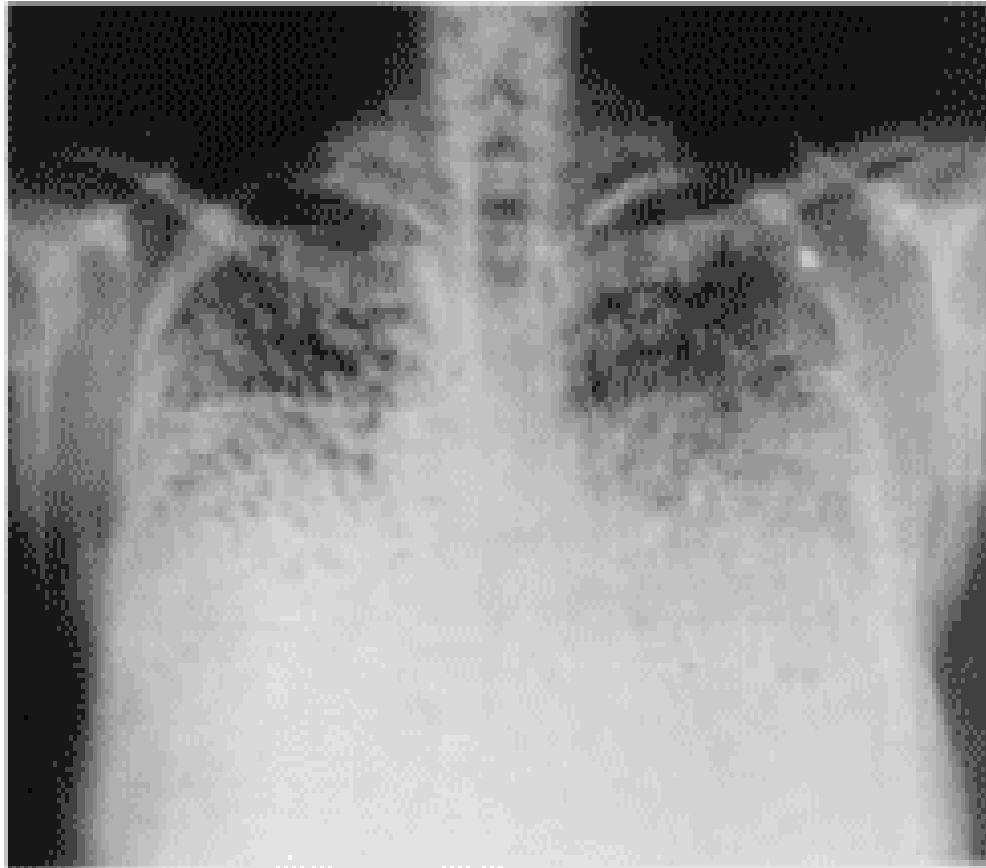


Figure 3 Chest X-ray showing confluent calcified opacities uniformly involving both lung fields

- He was evaluated thoroughly(history + examination)for any signs or symptoms
- None of the above mentioned investigations revealed any abnormality.
- He was then emperically started on ATT but no radiological improvement was seen after 2 months of treatment.



DIAGNOSIS ?

- A lung biopsy finally revealed that the patient suffered from a rare familial disease called PAM...

PULMONARY ALVEOLAR MICROLITHIASIS
(a very rare cause for miliary mottling)

- **During another follow up visit next year, he was accompanied by his 42-year-old brother. His brothers' routine chest X-ray showed minute miliary dissemination with hairline densities transversing from the hilum to the peripheral parts of both lungs . Because he had no respiratory complaints, he refused further investigations and never returned. It was later understood from the patient that he too had been mistreated as a case of miliary tuberculosis.**

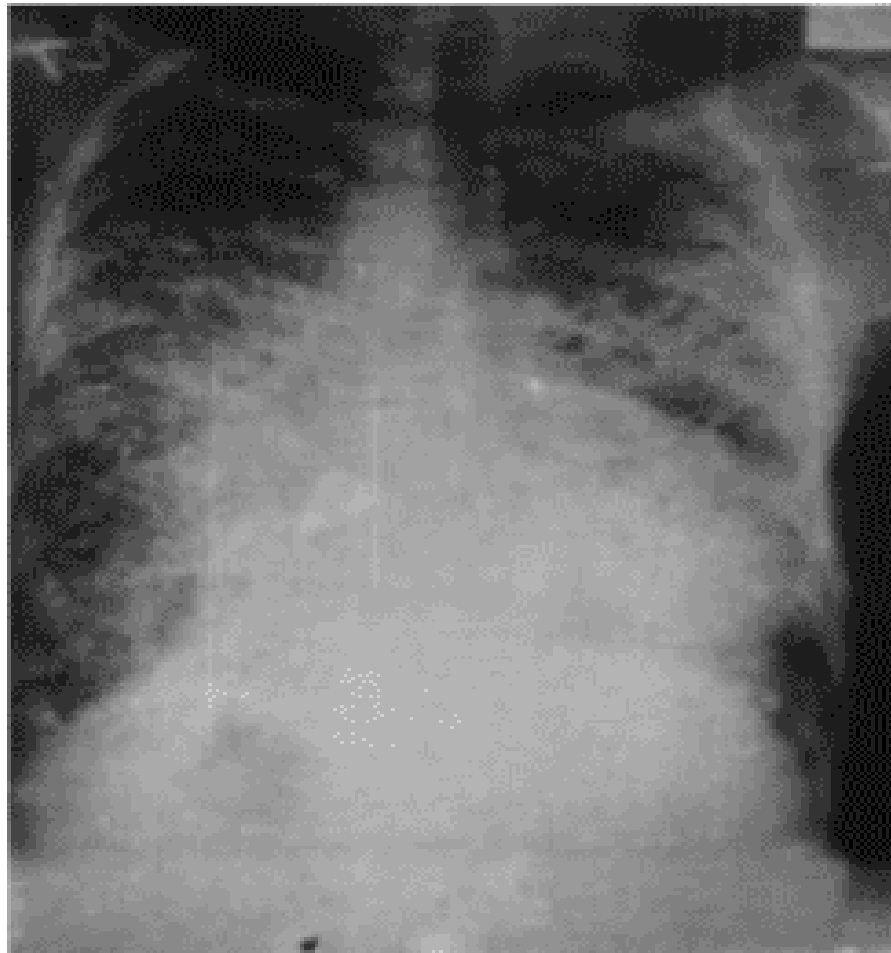


Figure 5 Chest X-ray showing hairline miliary nodular densities in both lungs transversing from the hilum to the peripheral parts

All the best..