COMPUTERIZED CHEST TOMOGRAPHY IN ASBESTOS WORKERS SUSPECTED OF HAVING PLEURAL DISEASE

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Forty-five computerized tomographic (CT) chest studies were performed on workers suspected of having pleural disease after being exposed to asbestos material. Ten of the 45 reviewed were court cases, and 32 workers acutely exposed at University of California–Los Angeles (UCLA) were studied with routine four views of the chest. CT confirmed the initial interpretation of chest films obtained at UCLA.

In 1981, a screening program using computerized tomography (CT) of the chest was instituted at University of California–Los Angeles (UCLA) for workers with a history of exposure to asbestos material. Eight of these workers were court assigned to the UCLA radiology department for evaluation. They were diagnosed as having pleural disease consistent with asbestosis on the basis of the chest radiographs from other institutions. These cases had court approval to have four views (posterior-anterior, lateral, left and right anterior oblique) and CT scans of the chest. They became the first CT scans of the chest performed on court assignment at UCLA.

A screening program for workers exposed to asbestos material had already been established by the US Department of Labor at UCLA and was administered by the Chest Medicine division. Cases suspected of having pleural disease upon review of chest radiographs were recommended for fluoroscopic examination and/or CT scans of the chest. After reviewing the chest films of 600 workers from other institutions, 32 UCLA campus employees were discovered to have been exposed to asbestos. The UCLA Campus Occupational Health Facilities immediately requested four-view chest radiographs to determine baseline studies for comparison in the event that changes, compatible with what has been described in the literature as asbestosis,[1,2] developed.

The results of 45 cases that had computerized tomographic studies because there was a question of pleural disease on chest radiographs and of the findings in those employees with a recent asbestos exposure are presented.

METHODS AND MATERIALS

Forty-five cases of CT of the chest were obtained because there was question of pleural disease on four routine views of the chest. No history, other than exposure to asbestos material, was available when the CT scan of the chest was interpreted at UCLA. Nine

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cases were court approved, one was court appointed, and 32 were formally requested by the Occupational Health Facilities at UCLA.

Thirty-one had CT scans of the chest performed on the EMI 5005, six on the mobile GE 8800, six on the mobile Siemens DR 3 unit, and two on the GE 8800.

All of the patients had four views of the chest before the CT scans were interpreted. Thirty-two patients, exposed to asbestos material on the campus at UCLA, had baseline four views of the chest as described in the introduction.

RESULTS

The chest CT scans in the nine court-approved cases were negative for any change in the status of asbestosis. One court-assigned case was positive for changes consistent with bronchiectasis and old granulomatous disease. Thirty-one cases had no evidence of disease on the CT scans as reported on four preliminary views of the chest. Two had asymmetrical pleural thickening or reaction, and two had asymmetrical thickening with calcification, cause not determined (Table 1).

The thirty-two UCLA employees had no radiographic evidence of pleural disease related to their recent exposure to asbestos material (Table 1).

The CT interpretation of 45 cases agreed with the initial reading of the chest films obtained at UCLA.

TABLE 1. SUMMARIZED RESULTS OF COMPUTERIZED TOMOGRAPHIC SCANS AND CHEST RADIOGRAPHS IN WORKERS EXPOSED TO ASBESTOS

No. (%)	Interpretation
CT Chest Cases	
31 (71.1)	Negative for asbestosis changes
9 (20.0)	Negative (court approved)
1 (02.2)	Known sarcoidosis (court assigned)
2 (04.4)	Asymmetrical pleural reaction
2 (04.4)	Asymmetrical pleural thickening with calcification
Four-View Radiographs UCLA Workers	
32* (100.0)	Negative for asbestosis changes

* Two of the patients had old rib fractures, one had a coronary bypass, and one had a severe chest injury.

DISCUSSION

The histories and outside chest films were not available on the court cases at the time the computerized chest studies were obtained. Careful analysis of the referred cases revealed that the outside radiographic films had been misinterpreted by the "B" readers.[3] The films had grease pencil marks fixed in place on copied films. The marks outlined the serratus anterior muscle overlying the lateral chest on the PA view. Gilmartin[4] has described the variable presentations of the serratus anterior muscle on the chest radiograph. He stressed that the muscle bundles in well-developed men may be visible on the frontal projection (PA view.)

Collins et al[5] had previously stressed that the serratus anterior muscle may be confused with pleural disease and that the radiologist should pay careful attention to normal gross anatomy when interpreting the chest radiograph. Although this information was available in the literature,[5-7] one case that was court assigned for a CT chest examination was overread on the outside chest film reading. The history of this case later revealed that the patient had a known diagnosis and treatment for sarcoidosis. This history was not available when the case was assigned. The PA chest and CT of this case (Figures 1 and 2) demonstrated the value of knowing the history of prior illnesses. This patient also had scoliosis of the thoracic spine, which accentuated the musculature overlying the chest wall, and chronic lung disease consistent with several diagnostic possibilities.

The 32 employees exposed to asbestos material at UCLA had baseline chest films to determine whether any radiographic evidence of disease existed. None of these workers had changes consistent with a primary diagnosis of asbestosis. The biconcave appearance of the chest wall on the PA view was present in earlier case studies and in some of the workers at UCLA.[6]

Figures 3 and 4 illustrate the PA chest and the fluoroscopic spot film of a worker suspected of having pleural disease. The muscle fibers of the serratus anterior muscle[5] are clearly visible overlying the lateral rib margins in Figure 4A. Figure 4B is slightly rotated, with the muscles rotated and now appearing to lie upon the chest wall. The arrows indicate the anatomical separation, which has been well demonstrated in the anatomy atlas by Clemente.[8] These muscles can be maneuvered by external probes during fluoroscopy

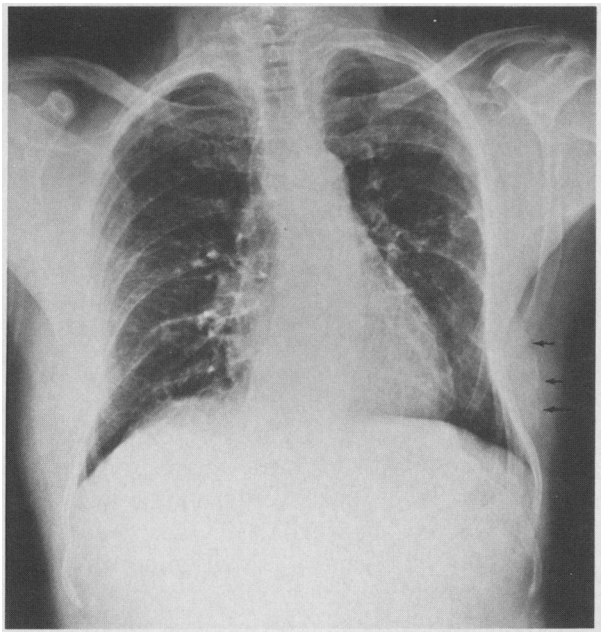

Figure 1. Log E enhanced posterior-anterior view of chest of worker with known sarcoidosis. Note the biconcave lateral chest and prominent serratus muscles (arrows)

Figure 2. Log E enhanced tomogram of chest of worker in Figure 1. Pleural adhesions are present in the upper left lung (arrow)

to demonstrate their extrathoracic anatomical location. Such a demonstration is made possible in a fully equipped radiology department.

The serratus anterior muscle as a possible misinterpretation of pleural disease has been reported in the literature by one of the authors (J.D.C.).[5] CT scans have allowed the radiology department to accurately interpret pleural irregularities when there is a question of suspected disease. The CT scan of the worker in Figure 1 was interpreted on the PA chest as interstitial disease with nodules consistent with changes of asbestosis. This interpretation was perhaps due to criteria "B" readers, used to read chest films of workers exposed to asbestos material. The authors later discovered that the radiographic changes were compatible with the known diagnosis of sarcoidosis.

The authors think that the problem of overreading still lies with the physician who interprets the chest film without the knowledge of pathological correlation. Many physicians are not trained or certified to accurately read radiologic studies. Radiologists are trained to perform special diagnostic and interventional radiologic procedures, correlate with pathology, interpret the entire image, and render a differential diagnosis. The reading of the chest radiograph deals

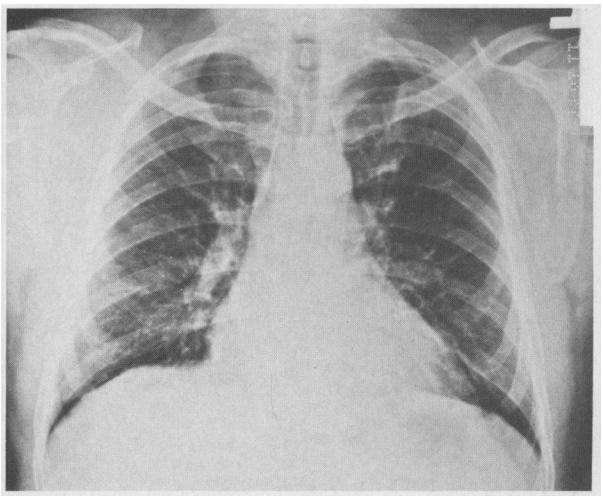

Figure 3. Log E enhanced posterior-anterior view of chest of worker who had fluoroscopic examination (same as Figure 4)

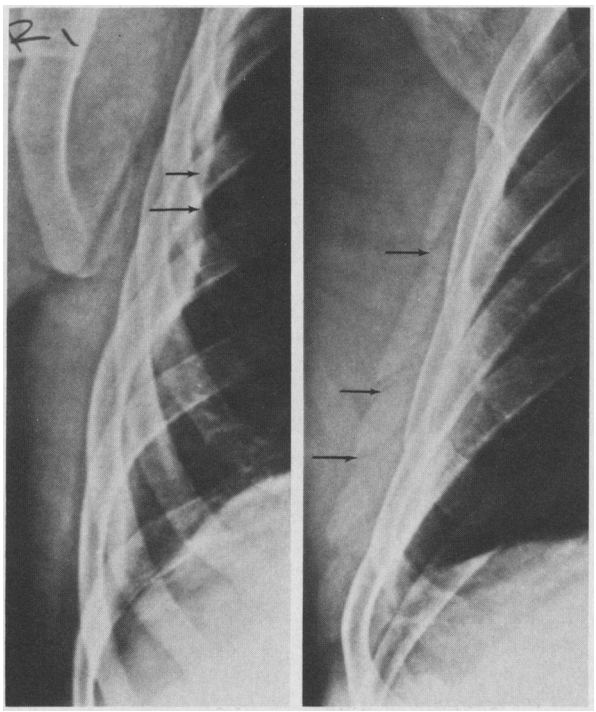

Figure 4. Log E enhanced spot fluoroscopic film. Perpendicular view (A) of the serratus muscles overlying the lateral rib margins (arrows). A slightly rotated view (B) shifting the serratus muscles laterally (arrows)

with the osseous and the soft tissues outside the lung parenchyma as well as those structures above the sternum and below the diaphragm. Consultation is needed to request the correct radiographic studies. The problem of rendering accurate consultation in the evaluation of disease is becoming increasingly difficult for the radiologist. Often, the initial interpretation is not given by a radiologist. The need to correctly interpret the entire image with anatomical and pathological correlation is even more important in new imaging modalities such as magnetic resonance (MRI) and advanced computerized techniques.

Mid-plane coronal and oblique sagittal views of the chest and the shoulder girdle were demonstrated on MRI (Figure 5). The radiologist renders images such as those illustrated in Figures 5A and 5B while evaluating soft tissues. This orchestration technique is currently in use at UCLA to teach anatomy and to explain disease in soft tissues when questions arise regarding pleural abnormalities such as those on the PA chest film.[9] Perhaps, MRI will improve the understanding of pleural disease.

In conclusion, the authors propose the following procedure in making radiologic evaluations of patients with pleural disease:

1. Routine four views of the chest should be obtained on patients with a history of exposure to asbestos-like material.
2. Computerized chest tomography should be requested when a question of pleural disease exists on routine films of the chest.
3. Histories of prior illnesses, hospitalizations, and any previous radiographic studies should be available prior to a requested CT scan.

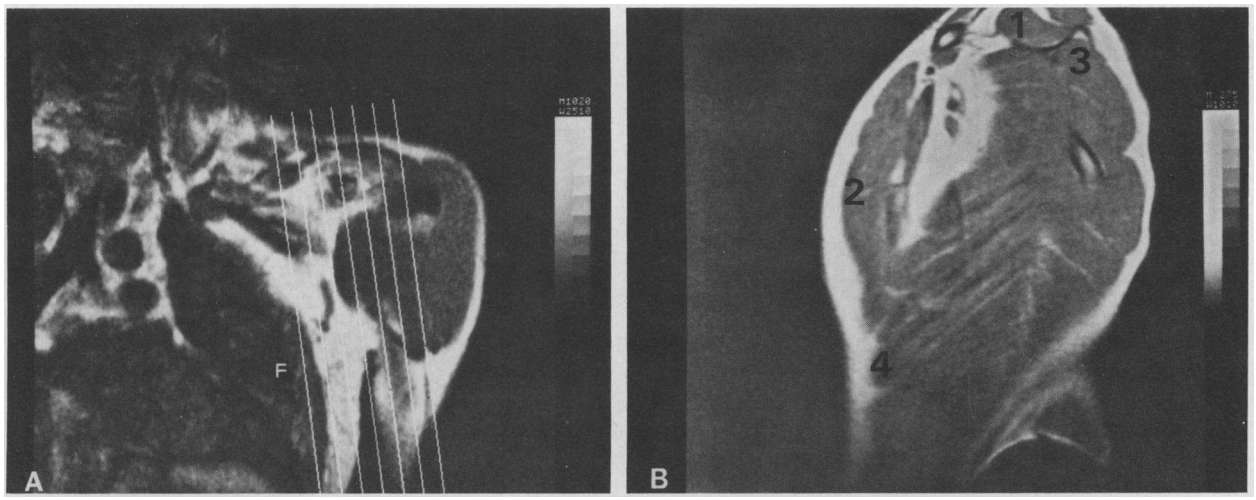

Figure 5. Magnetic resonance imaging of chest. Coronal view (A) with cursor lines in place to demonstrate the level of the image (arrow). Oblique shoulder view of the chest (B) demonstrating the soft tissue and muscles (Supraspinatus, Pectoralis major, infraspinatus, and serratus anterior muscles)

4. Differential possibilities should be given by a qualified radiologist.

These are suggestions based upon the authors' experience and needs for clinical information while participating in the evaluation of workers who present with a history of exposure to asbestos material.

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