HIGH-SPEED, HIGH-RESOLUTION X-RAY COMPUTED TOMOGRAPHS IN THE DIAGNOSIS OF PNEUMOCONIOSIS

HISAO SHIDA,* M.D. • Keizo Chiyotani,† M.D. • Yutaka Hosoda,‡ M.D.

*Div. of Radiology, Rosai Hospital for Silicosis, Japan
†Div. of Internal Medicine, Rosai Hospital for Silicosis
‡Radiation Effect Foundation

INTRODUCTION

Improvement in CT scanner technology now allows imaging of the lung with excellent anatomic detail demonstrating both normal and abnormal interstitium, patterns of pulmonary abnormalities caused by dust inhalation and morphologic characteristics of localized or generalized parenchymal processes, by circumventing the summation of lung structures in complex anatomic regions such as apices, paratracheal, perihilar, pericardiac, lateral margin of chest walls and diagphragmatic regions. The Fourth generation CT (TOSHIBA TCT 900S) can confirm the presence of pneumoconiotic nodular or interstitial fibrosis associated with areas of lung destruction and disorganization of lung architectures results in a cystic appearance to the lung, bulla, bleb, pulmonary emphysema, broncho-bronchiolectasis, pneumothorax, pleural thickening or plaque and effusion, even if conventional plain chest radiographs cannot visualize these abnormalities.

METHOD

A comparative study between CT and P-A view of computed radiography or conventional chest radiography was made of 108 cases of pneumoconiosis including silicosis, asbestosis, welder's lung, foundry worker's lung and activated carbon pneumoconiosis, the profusion of which ranged from 0/1 to 3/3 according to the ILO 1980 International Classification of Pneumoconiosis.

Special filter function of FC3 and FC4 were provided to visualize detailed images of pulmonary parenchymal or interstitial abnormalities.

RESULTS

The high-speed, high-resolution CT has a high detectability for the abnormalities of pulmonary parenchyma or interstitium and pleura. The presence of emphysematous changes including bulla, bleb, honeycombing, pleural thickening or plaque, septal thickening, subpleural strand, broncho-bronchiolectasis and very small rounded or very fine irregular opacities, can be confirmed, as shown in Table I.

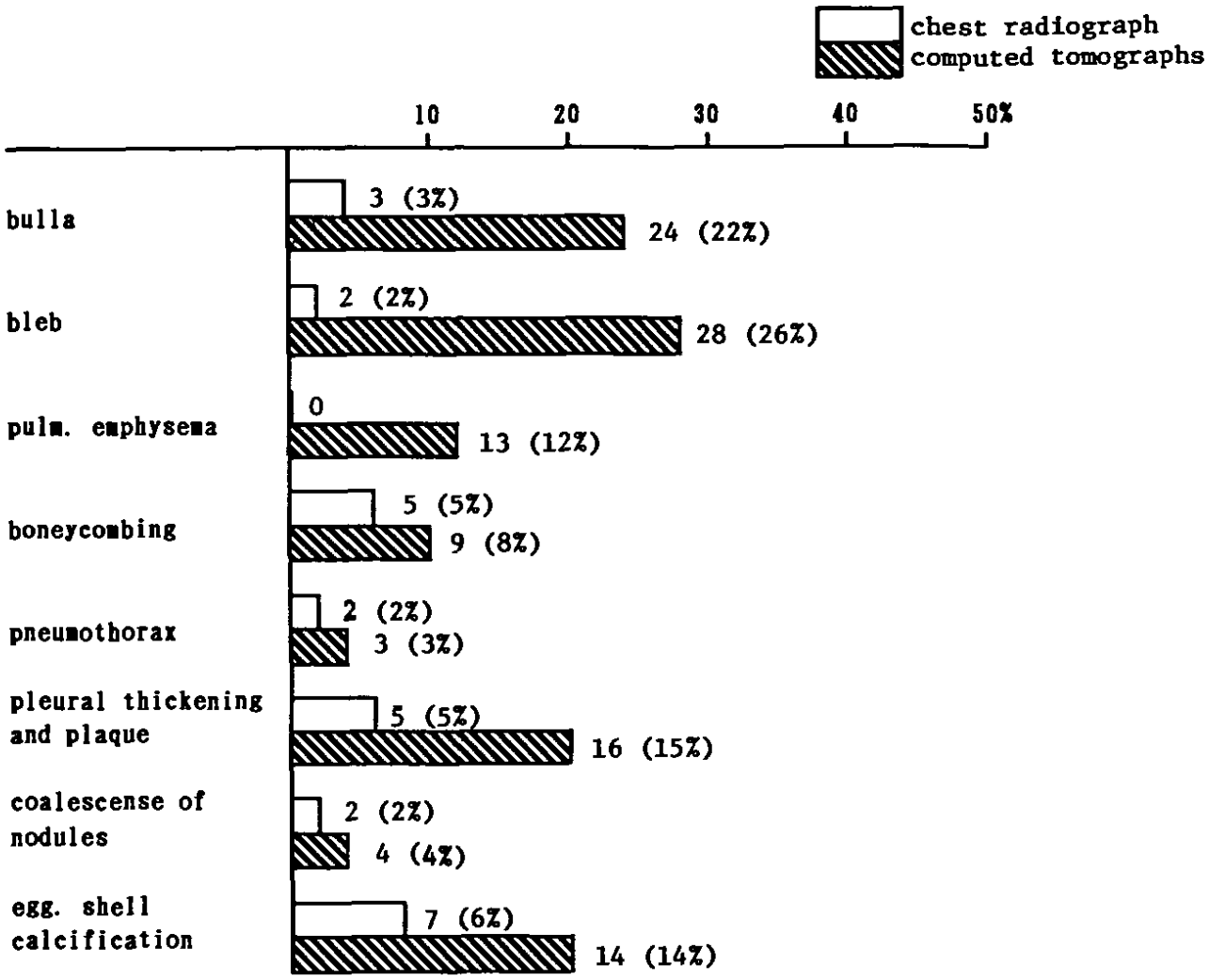
It is considered that the CT will greatly increase the sensitivity of imaging techniques in detecting pneumoconioses and it is a useful procedure in the diagnosis of pulmonary disease at present.

DISCUSSION

In some cases of pneumoconiosis, very small rounded opacities can be difficult to distinguish from vessels seen in the thin cross-section. As general use it is recommended to take image with 5.0 to 10.0 mm in slice thickness.

Table I

Detectability of CR and CT in 108 Cases of Pneumoconiosis



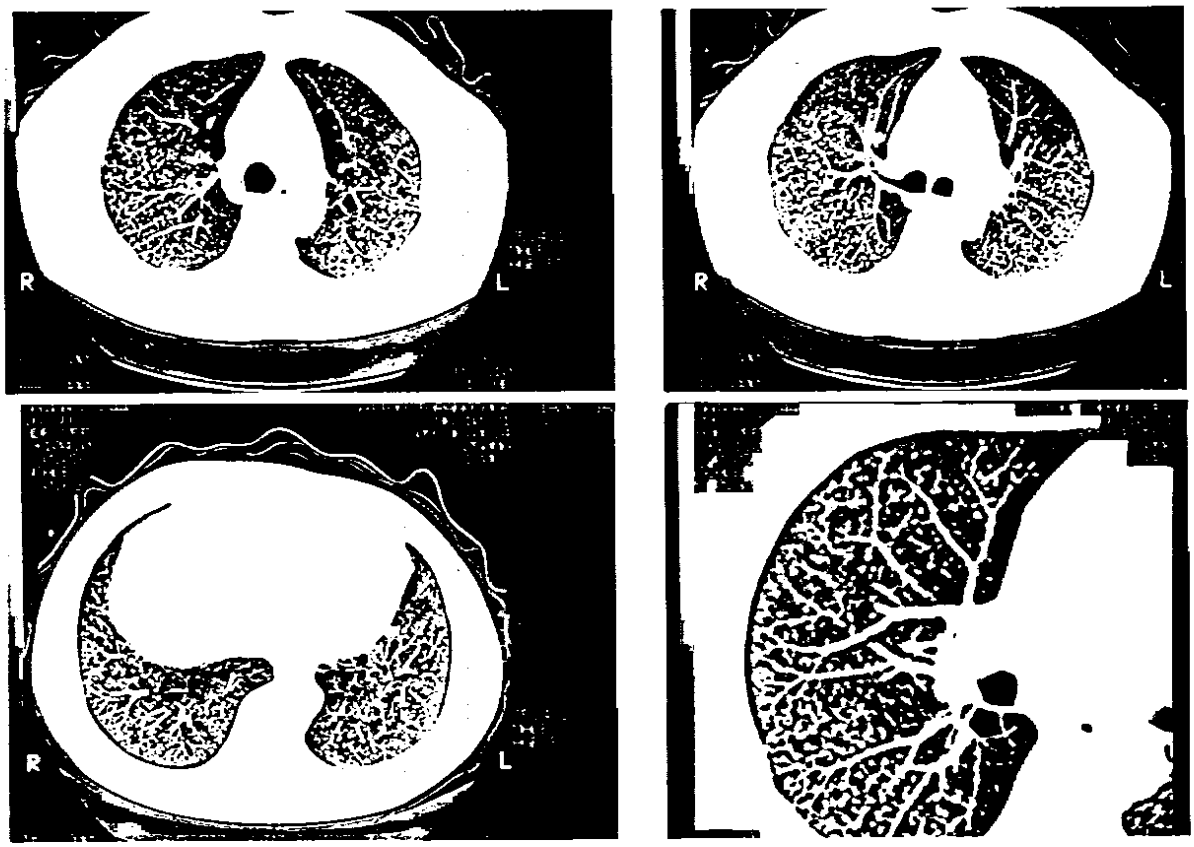


Figure 1. Case 1. 55 year-old, male, silicosis 1/1, P.
CT images demonstrate dense dissemination of fine silicotic nodular high densities throughout lungs. It is noteworthy that these nodules are more clearly and densely distributed than the conventional chest radiograph.

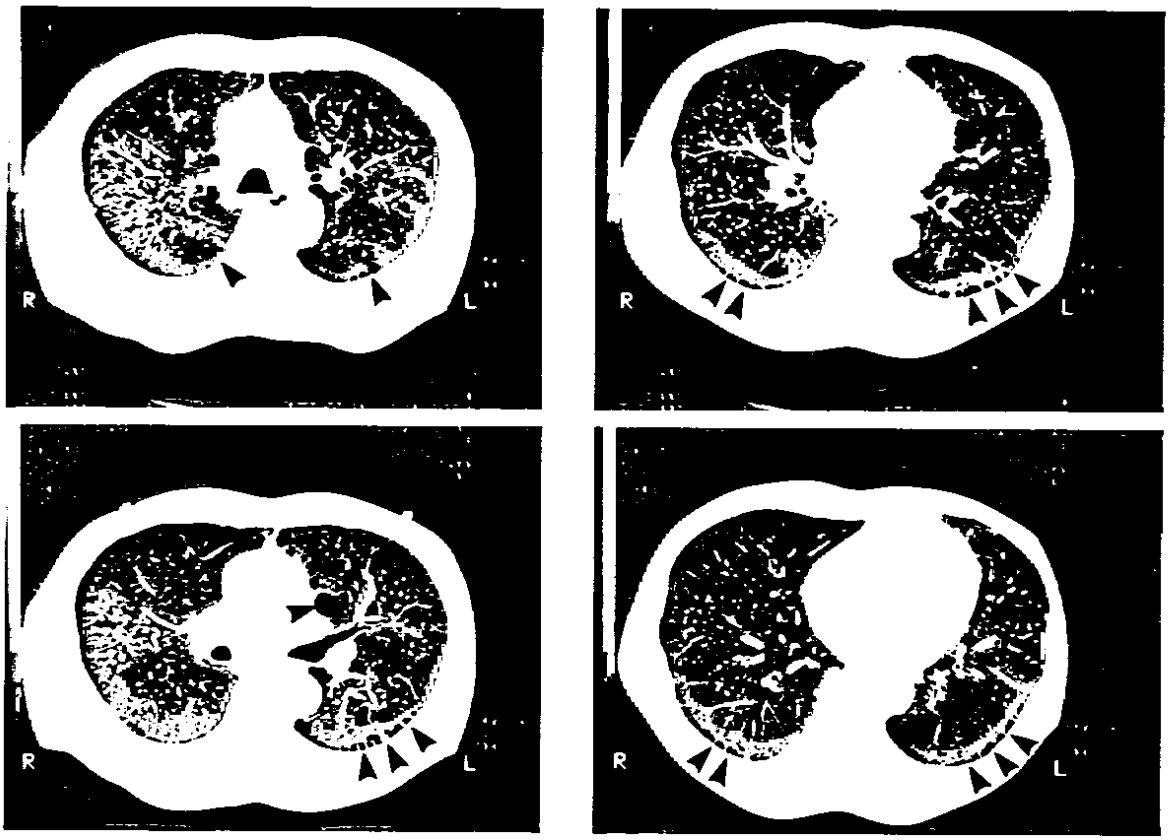


Figure 2. Case 2. 60 year-old, male, silicosis 2/2, q.
CT images reveal dense dissemination of silicotic nodular high densities throughout lungs of which diameter is larger than that of the case 1. Subpleural blebs and bullae are characterized on the CT images. (arrow)

Figure 3. Case 3. 67 year-old, male, silicosis 2/2, q, es, px.
A chest computed radiograph shows dissemination of silicotic nodular high densities throughout lungs and minimal pneumothorax of the left lower lateral margin (white arrow) associated with collapsed lobe. (black arrow)

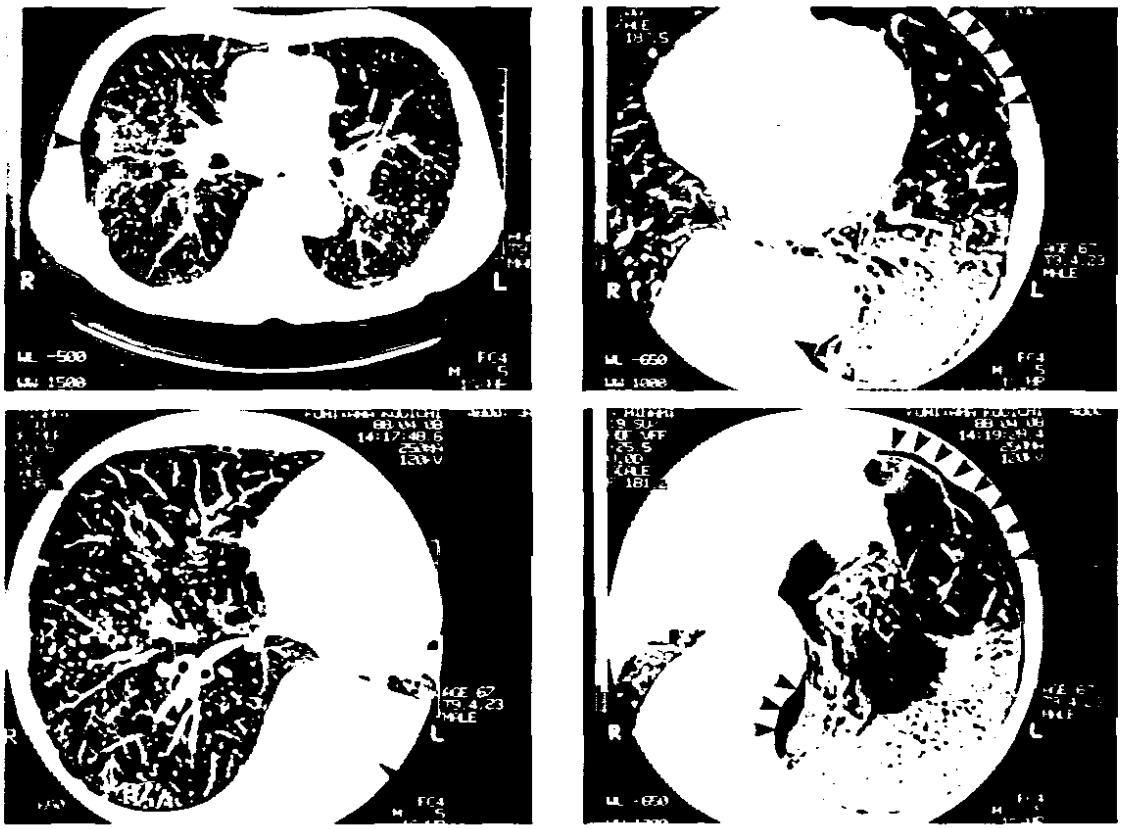


Figure 4. CT images of demonstrate more evident pneumothorax, the collapsed lower lung and bullae. (arrow) These bullae and blebs are not visualized on the conventional chest radiograph. Dissemination of silicotic nodular high densities are also clearly visualized which are located in the middle and posterior lung regions.

Figure 5. Case 4. 59 year-old, welder's lung, 2/2, s.
A chest computed radiograph shows densely distributed fine irregular opacities throughout lungs and the left lung is more hyperlucent than the right.

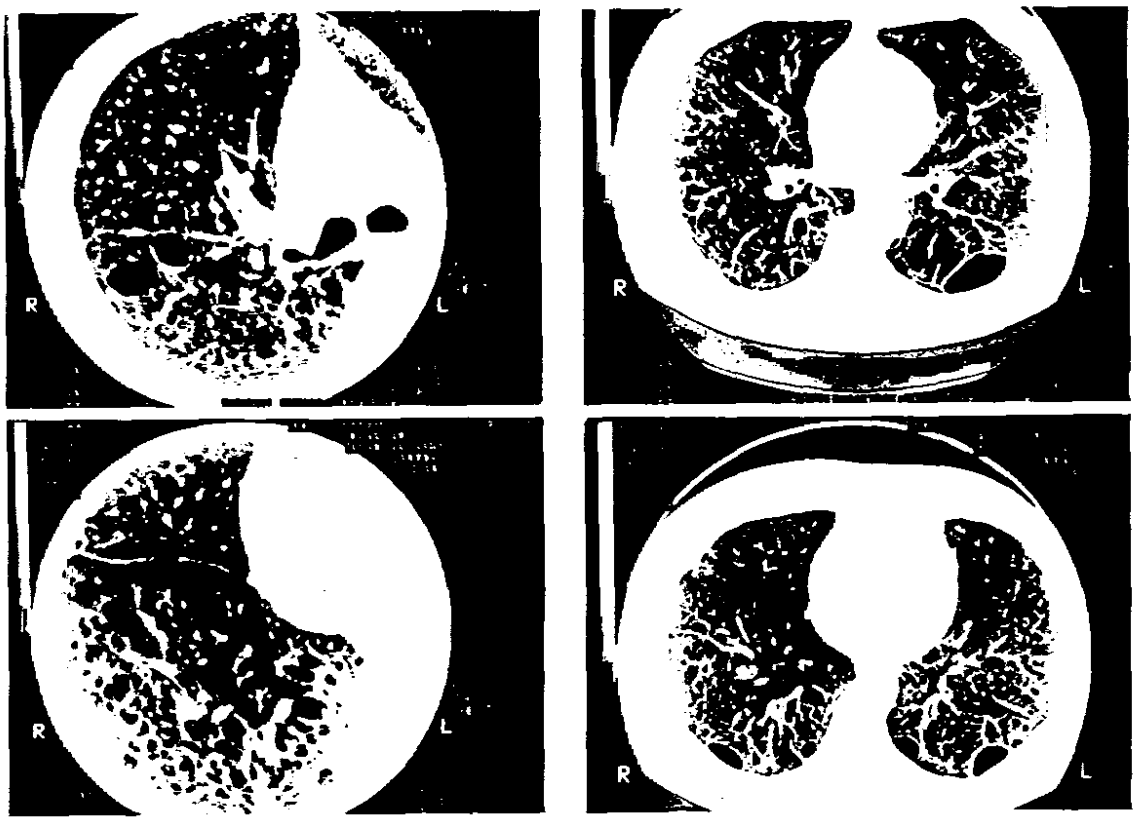


Figure 6. CT images evidently demonstrate strand or streak like interstitial fibrosis, pulmonary emphysema and bullae. On the left super resolution mode images taken by 1.0 mm slice thickness clearly demonstrate impaired lung parenchyma and pulmonary vessels caused by emphysema. The presence of large bullae of the left lung posterior region shows hyperlucency on the chest radiograph.

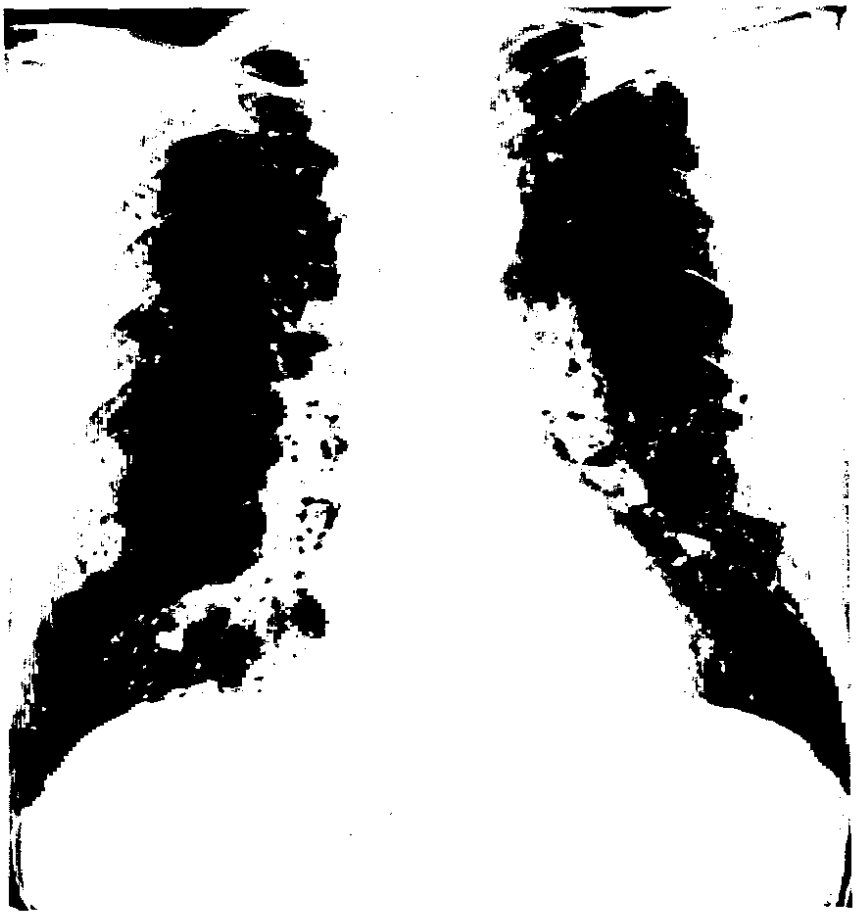


Figure 7. Case 5. 42 year-old, male, foundry worker's lung 2/2, s.
A chest computed radiograph reveals densely distributed fine irregular opacities throughout lungs and on the left upper lung hyperlucency is noted.

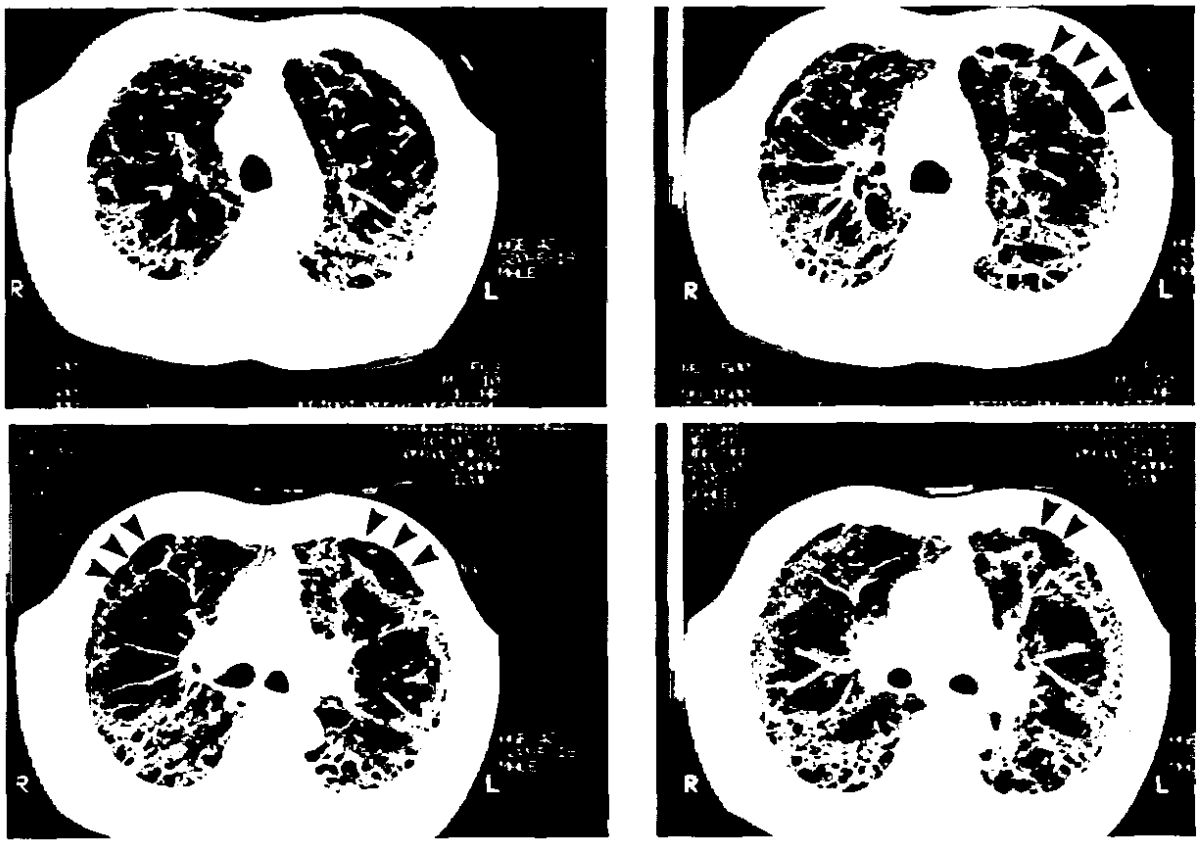


Figure 8. CT images demonstrate strand or streak like interstitial fibrosis associated with pulmonary emphysema, bullae (arrow) and honeycombing.

Proceedings of the VIIth International Pneumoconioses Conference *Part*
Transactions de la VIIe Conférence Internationale sur les Pneumoconioses *Tome*
Transaciones de la VIIa Conferencia Internacional sobre las Neumoconiosis *Parte*

II

Pittsburgh, Pennsylvania, USA—August 23–26, 1988
Pittsburgh, Pennsylvanie, Etats-Unis—23–26 aout 1988
Pittsburgh, Pennsylvania EE. UU—23–26 de agosto de 1988

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
Public Health Service
Centers for Disease Control
National Institute for Occupational Safety and Health

CDC
CENTERS FOR DISEASE CONTROL

Sponsors

International Labour Office (ILO)
National Institute for Occupational Safety and Health (NIOSH)
Mine Safety and Health Administration (MSHA)
Occupational Safety and Health Administration (OSHA)
Bureau of Mines (BOM)

November 1990

DISCLAIMER

Sponsorship of this conference and these proceedings by the sponsoring organizations does not constitute endorsement of the views expressed or recommendation for the use of any commercial product, commodity, or service mentioned.

The opinions and conclusions expressed herein are those of the authors and not the sponsoring organizations.

DHHS (NIOSH) Publication No. 90-108 Part II