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2nd Department of Radiology, Medical University of Lublin
Departament of Internal Diseases, Medical University of Lublin

GRAŻYNA ZŁOMANIEC, JERZY MOSIEWICZ, JANUSZ ZŁOMANIEC, WITOLD KRUPSKI

HRCT examinations in the course of silicosis

Silicosis is caused by inhalation of dust which contains crystalline silicon dioxide. Recognition of this condition requires a combination of adequate exposure time and characteristic radiographic changes. Exposure time should amount to over ten years (5). Fibrogenic properties of tiny silicon particles is emphasized (2, 3). The significance of HRCT in patients suspected of silicosis has not been precisely determined yet (7). However, purposefulness of using this examination instead of conventional CT imaging has been emphasized (6).

The aim of the study is to assess the diagnostic value of high-resolution computerized tomography (HRCT) in silicosis and its correlation with conventional radiography.

MATERIAL AND METHODS

The material comprised 38 patients (2 women and 36 men, mean age 51.5 years) in whom, basing on the history of long lasting exposure to silicon dust (mean 23 years) silicosis was recognized. Patients were diagnosed in the Institute of Agricultural Medicine (Zdzisław Brzeski M.D.). X-rays and HRCT exams were done in the 2nd Department of Radiology of the Medical University in Lublin.

Chest X-rays were assessed according to dust disease criteria of the International Labour Organisation set up in 1980. HRCT examinations were performed by means of 2mm thick layers with 10mm intervals using an algorithm of high resolution on the peak of deep inspiration. Short section times, high exposition parameters, narrow reconstruction field of the picture and 512 x 512 pixels matrix were used.

RESULTS

Examinations were performed in the supine position. In 4 cases increased density in the posterior part of lower lobes with reticular outline suggested the presence of fibroses (Fig.1).

Lying on the stomach position caused disappearance of condensations depending on the patient's position.

Fig. 1. Condensations in posterior lung areas caused by the so-called gravitational effect in the supine position

Similarly, in two other patients the change of position allowed to eliminate apparent condensations of posterior parts of the lungs caused by the so-called gravitational effect. The presence of nodules was the most typical symptom of silicosis found in 30 cases (80%). Tubercular (nodular) changes most commonly occurred in the peripheral area of the lung and in the upper lobes. The dominance of the posterior localization was only visible on HRCT sections (Fig. 2).

Fig. 2. Multiple nodules which fuse to form conglomerates of reticular fibroses in the posteromedial lung regions

They identified more sub-pleural micro-nodules and determined their localization, usually perilobular, more rarely intralobular. Nodular changes were usually associated with emphysema involving lobules (Fig. 3).

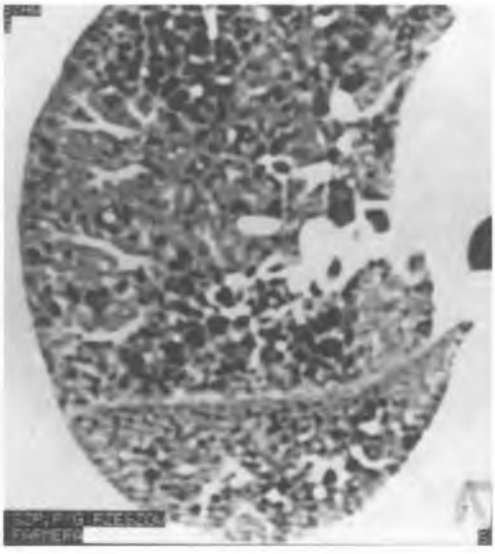

Fig. 3. Multiple nodules and foci of intralobular emphysema

Central fibrous nodules surrounded by the area of alveolar emphysema formed the picture of multiple foci of decreased density covered with intralobular dots.

In 71% cases distensions of intralobular air spaces, which were in six cases accompanied by big emphysematous bubbles peripherally localised (Fig. 4), were found.

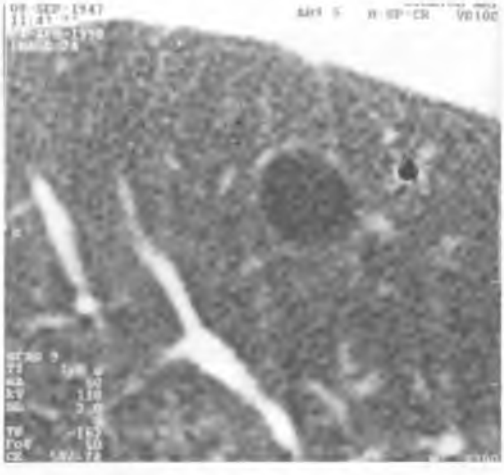

Fig. 4. Spherical clearing up of emphysematous bubble character surrounded by numerous, tiny, foci of intralobular emphysema

HRCT showed emphysema areas surrounding parenchyma fibroses and air retention on expiratory sections, the so-called air traps. Scar emphysema resulting from fibroses with irregular course was found in 11 cases. In 5 cases fusing masses of fibrous tissue formed conglomerates surrounded by emphysematous fields (Fig. 5).

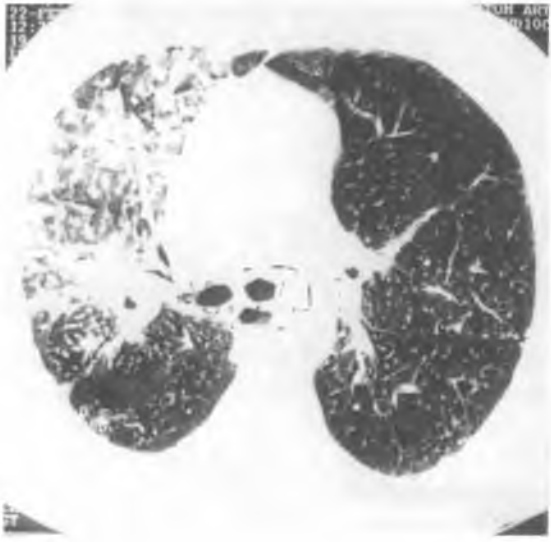

Fig. 5. A conglomerate of heterogenic, extensive bronchopneumonic condensation in the upper field of the right lung. In the left lung numerous nodules, bronchial distensions and irregular emphysemal foci

HRCT revealed mass structure, calcifications within it, formation of cavernous areas. In 8 cases sections showed milk-glass type condensations which in 6 cases were imperceptible for X-rays (Fig. 6).

Fig. 6. An area of opacity of milk-glass character in the central part of the left lung

They corresponded with the filling of alveoli comprising their conglomerates. Bronchial distensions were found in 5 patients in the fields of parenchymal fibroses (Fig.7).

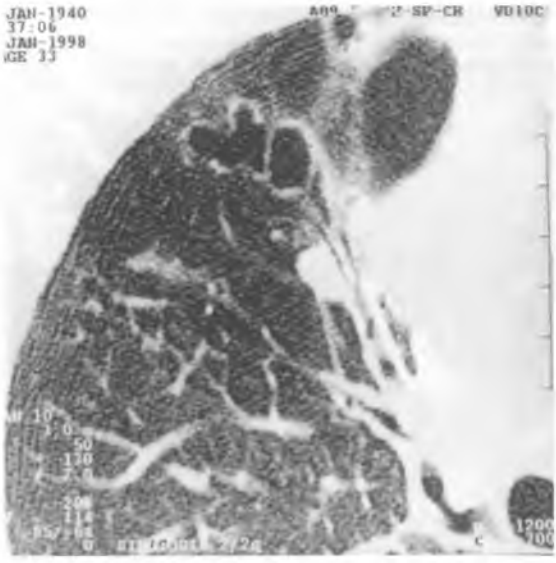

Fig. 7. Bronchial distensions form circinate opacities among linear parenchymal fibroses

Four times they gave the picture of a honeycomb in lower fields of the lungs (Fig. 8).

Fig. 8. In the lower field of the left lung a picture of honeycomb formed by numerous bronchial distensions

A thick-wall net with small cysts 5-10 mm in diameter deformed parenchymal architecture. Air bronchogram was found in 4 cases in which bronchial tree was patent and visible in the form of pipe-like branching off structures against condensed thickened walls due to inflammatory infiltrations (Fig. 9).

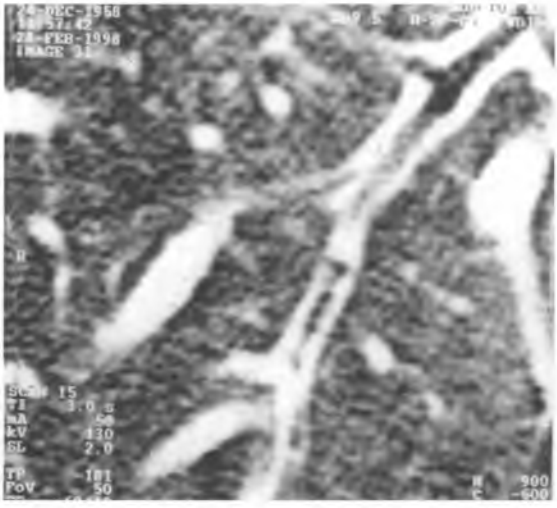

Fig. 9. Air bronchogram symptom forms an air band in the bronchial lumen with thickened walls due to chronic inflammatory changes

DISCUSSION

HRCT sections let optimalise spatial definition better visualizing tiny structures of pulmonary parenchyma (4). Higher sensitivity of HRCT is connected with the possibility to interpret changes on the level of a lung lobule (6). Visualization of the damages of lung parenchyma architecture allows to detect early and tiny lesions imperceptible on X–rays (1). It enables the determination of their character (nodular, reticular, linear, intra- and perilobular), localization, exclusion of doubtful changes. This extends the diagnostics of silicosis, especially its fully developed form, when clinical and radiographic symptoms are not homologous. HRCT reveals covered changes eliminating overlapping structures (7). It determines the range of reversible changes (active) and irreversible ones (fibrous). Assessment of the range and distribution of pulmonary abnormalities indicates a specific field for possible biopsy. Yet, detected changes are not specific and can also occur in other intraparenchymal lung diseases.

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SUMMARY

Evaluation of diagnostic possibilities of high definition computerized tomography was performed on the material of 38 patients with recognized silicosis of small opacities on the bases of long lasting exposition, clinical and radiographic picture.

Special usefulness of HRCT was shown in revealing early, scanty, radiographically imperceptible nodular changes. The presence of the so-called air traps was shown on expiratory sections.

Badanie tomografii komputerowej wysokiej rozdzielności w pylicy krzemowej

W materiale 38 chorych z rozpoznaniem pylicy krzemowej małych zacienień, ustalonej na podstawie długotrwałej ekspozycji, obrazu klinicznego i radiograficznego, dokonano oceny możliwości diagnostycznej tomografii komputerowej wysokiej rozdzielczości (TKWR). Wykazano szczególną przydatność TKWR w ujawnianiu zmian wczesnych, skąpych, nieuchwytnych na radiogramach zmian guzkowych. Na przekrojach wydechowych wykazano obecność tzw. pułapek powietrza.