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ROENTGENOLOGICAL CRITERIA FOR EARLY DIAGNOSIS OF PLEUROPULMONARY ASBESTOSIS

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According to own experience the authors suggest that classical and accepted radiographic valuation be extended to diagnosing early stages of pleuropulmonary asbestosis. Extended evaluation should include macrography, profile graphies of the thorax and tomography of the lungs. Macrography will give a better insight into the pulmonary interstitium reaction to aggressive dust, while profile graphies will provide better visualization of pleural alteration. Tomography of the lungs should be carried out in female workers exposed to asbestos dust done at the half of the AP thoracic diameter to exclude possible mammary shades or stromae.

As pathogenic mechanisms and lesion localization in occupational asbestosis are not uniformly interpreted by different authors, diagnostic evaluation of the patients exposed to asbestos dust also varies. However, the *International Labour Organization* (ILO) (1) has determined the criteria for radiographic evaluation of pneumoconiosis, and subsequently, asbestosis. Technical conditions for radiographic examination have been precisely defined and PA standard lung x-ray has been accepted as the method. The text is illustrated with diagnostic sets containing only reproductions of standard PA lung x-rays. The inconsistence between the published reports and official instructions provided by the ILO has lead us to deal with x-ray evaluation of asbestosis and with the criteria for early radiographic diagnosis of pleuropulmonary asbestosis.

Ever since 1953 numerous cases of asbestosis have been evaluated and followed-up at »Dr Dragomir Karajović« Institute of Occupational and Radiological Health in Belgrade. The studies were initiated by evaluation and monitoring of miners from the village of Korlače and workers in a manufacture of fire-proof equipment and firemen's clothes (2) to be afterwards extended to workers in metallurgy, foundry, and even in shipyards and car plants. We believe that our wide experience has been a basis for an original attitude towards early x-ray diagnosis of pleuropulmonary asbestosis.

According to our experience standard PA lung x-ray is insufficient for early diagnosis of pleuropulmonary asbestosis and it should be supplemented with other methods such as macrography, profile x-ray, and if possible, tomography at the half of the thoracic AP diameter in female workers.

Macrography or the magnified scan shows pulmonary interstitium in great detail. Naturally, on a PA lung x-ray the pulmonary interstitum shade is lost about 2 cm from the lateral thoracic walls, and cannot be seen in the pulmonary apexes. The pulmonary area is, therefore, surrounded by a light zone without pulmonary drawing which is known as the light pulmonary coat. Disappearance of pulmonary coat and occurrence of pulmonary drawing are a sign of reaction of the pulmonary interstitium to the affection which can be of asbestos origin. The disappearance of pulmonary coat can be illustrated by macrography. Therefore, macrography is indicated for establishing initial pulmonary asbestos-induced changes. Macrography with double magnification is very useful. Three-fold magnification is not recommended, because of poor optic quality of radiographs. The magnification coefficient could be calculated according to the formula $L = F/F\text{-}B$ where L is a coefficient of magnification, F focus-film and B object-film distance.Technical conditions for scanning necessitate 120 KV and 1 MAS. This is accomplished on Bucky's table of x-ray apparatus in the film size 30×40 cm, vertically positioned. One haemithorax is x-rayed after another, since the whole lungs cannot be scanned in a shot. Besides intensification of the pulmonary drawing, macrographies reveal homogenization of hylar shades which lose their characteristic radiographic structure.

Profile radiography of the thorax provides the following diagnostic data: 1. special orientation within the thorax, 2. shows parts of the lungs which are hidden behind the heart of diaphragm cones on PA radiography, 3. shows pleural interlobar incisures in total, 4. offers better insight into the mediastinum condition, 5. shows whether a process is segmentary or lobar. Technical conditions are similar to those needed for PA radiography, except for secondary voltage which should be increased by 10 KV. The patient is in the standing position in profile, with the hands vertically raised above the head. The x-ray is centred on the middle of the thorax, the point being equally distanced from the angle of scapula and the sternum.

Profile radiography supplements the information of pleural lung coat, which is noted by PA radiography. Profile radiography reveals interlobar incisures as thin, clear, sharply separated capillary lines. Each deviation from this morphology indicates pleural affection, which may be asbestos induced. Unilateral pleural lesions are less frequently caused by occupational factors. In asbestosis, therefore, pleural lesions should be bilateral, and more or less symmetrical. If asymmetry is noted, more prominent alterations should be expected on the right-hand side due to the position and gauge of the right bronchi via which larger amounts of dust enter the right lung. Those bilateral, more or less symmetrical pleural affections in asbestosis are localized usually in the posterobasal region of the thorax. This means that a unilateral, anterobasal pleural adhesion, hyaline disc or a calcification are not of asbestos origin. Bilateral, asymmetrical pleural adhesions, hyaline discs or calcifications localized at the lung tips, upper parts of parietal or visceral pleura, or anterobasally, are more likely not of asbestos origin. Finally, lesions which only touch the visceral pleura, while the parietal pleura remains intact, usually are not caused by occupational factors. According to our experience, the parietal pleura is always more seriously affected in asbestosis, the visceral pleura is damaged but could also be completely unaffected.

Tomography is a method which is basically used for further radiographic evaluation (4). It reveals lesions which cannot be clearly viewed or cannot be seen on PA lung radiography, determines the existence of colliquative processes, reveals the inner structure of massive shadows and conglomerates, determines the depth of a process in the thorax, and enables visualization of the tracheobronchial tree (known as »native bronchography«). The same films and sizes are used for lung tomography and for PA radiography. Technical conditions are the following: 58 KV, 70 mA, exposure time 2″ and the tube speed 1. In asbestosis tomography is indicated only in the case of diagnostic evaluation of women workers exposed to asbestos dust. In such cases the breast shadow, especially the mammary stroma decreases the possibility of viewing the middle and sometimes lower lung areas. In those cases the physician cannot be certain whether the linear or reticular shadow originates in the affected lung interstitium or in the mammary stroma. In that case whole lung tomography at the half AP thoracic diameter should be done with 35x35 or 35x34 cm films. Tomographic visualization of only one layer of the lung parenchyma and elimination of extrapulmonary shadows enable us to determine what really belongs to the lungs and what is the result of radiographic superposition and summation.

When we speak of tomography today it is impossible to avoid computerized tomography, especially as this method is so overwhelmingly recommended by many authors (5). Computerized tomography is a relatively new method and as such is followed by an outstanding euphoria. Realistically speaking it has the same disadvantages for which fluorography has been eliminated from occupational medicine. It offers decreased graphies in a special radiographic projection. Besides, computerized tomography is a complicated method. Being time consuming it limits the number of examinations which are imperative for worker's periodical control check-ups. Finally, non-existent diagnostic criteria for occupational pathology, lack of diagnostic sets and textbooks by competent boards are facts which indicate that the time of computerized tomography in occupational medicine has not yet come.

From own experience the use of radiographic evaluation should be extended to the initial stages of pleuropulmonary asbestosis. In initial forms of lung asbestosis macrography should be done and in suspected pleural alterations bilateral profile radiographies of the thorax (the right and the left) are recommended. In the case of suspected initial lung asbestosis in women workers whole lung tomography should be done at the half of thoracic AP diameter. Disappearance of light coat and appearance of lung drawings at the lung tips and close to the lateral thoracic wall on macrographies of patients of both sexes and on whole lung tomographies of women workers are signs of reaction of the lung interstitium to aggressive dust. Pleural alterations as seen on profile graphies are bilateral, more or less symmetrical, in the posterobasal region, affecting mainly the parietal pleura. In our opinion wider usage of computerized tomography in this field is not entirely justified which does not mean that it should not be used in individual cases as an additional method, when it is absolutely necessary and financially feasible.

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Sažetak

RENDGENOLOŠKI KRITERIJI U RANOJ DIJAGNOSTICI PLUĆNE AZBESTOZE

U skladu sa svojim iskustvima autori preporučuju da se klasična i već prihvaćena radiografska evaluacija pleuropulmonalne azbestoze proširi i na rane oblike ove bolesti. Proširena evaluacija obuhvaćala bi makrografiju, profilne snimke prsnog koša i tomografiju pluća. Makrografija bi dala bolji uvid u plućne intersticijske reakcije na agresivnu prašinu, dok bi profilna snimka omogućila bolji pregled pleuralnih promjena. Tomografija pluća primjenjivala bi se u radnica izloženih azbestu da bi se isključilo moguće prekrivanje promjena sjenama dojke.

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