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Antimoniosis: A Particular Form of Pneumoconiosis

II. Experimental Investigation

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Summary. In a pilot experiment 0.5 ml of antimony oxide (Sb_2O_3 and Sb_2O_5) dust was injected intraperitoneally and endotracheally in two groups of "Wistar" type female albino rats. After two months, the rats were sacrified and microtome slices were stained with hematoxylin-eosin and PAS.

Morphology investigation revealed changes of pneumoconiosis of a non-collagenous nature.

Key words: Antimony oxide dust – Mesenchymal reaction – Non-collagenous pneumoconiosis – Nodule

Method

Experimental investigation of the effect of antimony oxide (Sb_2O_3 and Sb_2O_5) dust in the lung was done. The experiment was to reveal whether this dust produces pneumoconiotic changes and what is the nature of the changes found.

Chemical Composition of the Applied Dust

Dust samples were taken from the sediment found in the smeltery room. The chemical composition of the dust is the same as that which smelters inhaled at the smelting plant [3].

Mode of Application

The dust was suspended in water, using detergent or ethyl alcohol to reduce aqueous surface tension and to increase the hydration of smaller dust particles. Particles smaller than 3 microns were not fractioned. The suspension contained several fractions of differing colour and sedimentation rate. As this was a pilot experiment, the whole mass with all fractions was applied. The suspension was prepared using alcohol and then was washed-out 5 times in distilled water. The mixture was made in an electromagnetic mixer and sedimentation in a centrifuge. Finally, a suspension of 100 mg dust in 1-ml water was obtained.

Experimental Animals

"Wistar" type female albino rats weighing ca. 250 g were used for experimentation and divided into two groups, twelve in each.

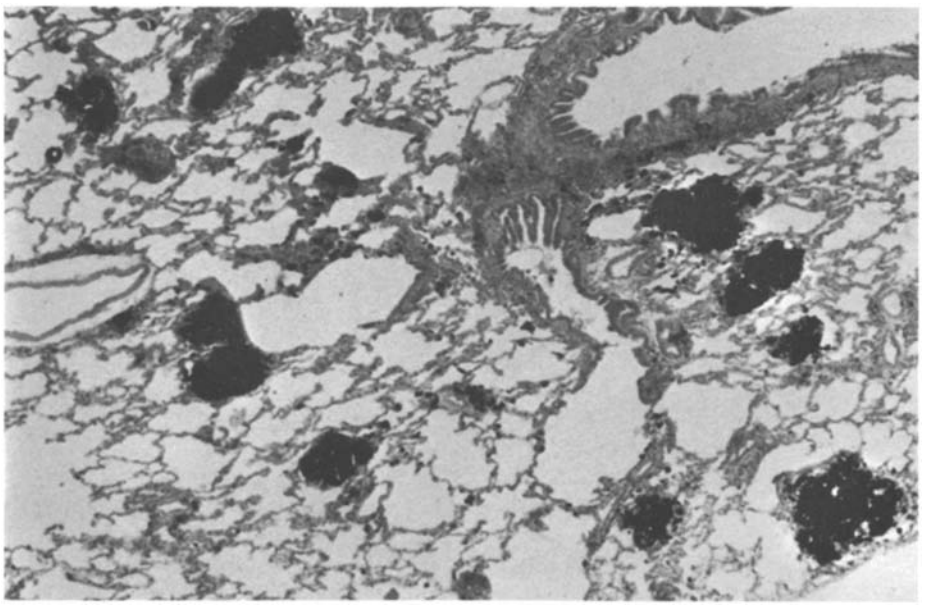

Fig. 1. Rat lung two months after intratracheal instillation of 50-mg antimony oxide dust. Paraffin sections stained with hematoxylin-eosin. Photomicrographic magnification 14.8×

Dosage and Administration

0.5 ml of suspension (50 mg of dust) was injected intraperitoneally in the 1st group and endotracheally in the 2nd group [4].

Victimization and Tissue Specimen Preparation

After two months the animals were sacrified by bleeding under ether narcosis, and lung and omentum were obratined for histologic examination. The material was fixed in 10% neutral formalin and cast in paraffin wax. Microtome slices were stained with hematoxylin-eosin and PAS.

Results

Macromorphology

In a gross inspection the lungs from several of the animals showed a few small, whitish nodules of soft consistency. Under the magnifying glass these nodules appeared greyish, irregular, and circular and when cut displayed a pasty material inside which was also greyish. In some animals, nodules, which could not be seen by the naked eye, appeared as tiny, soft whitish micronodules with a jelly-like consistency under the magnifying glass. Their cut sections revealed nothing which might correspond to the applied dust. The nodules, in general, were similar to those of classic silicosis but are of a different consistency since silicotic nodules are very hard.

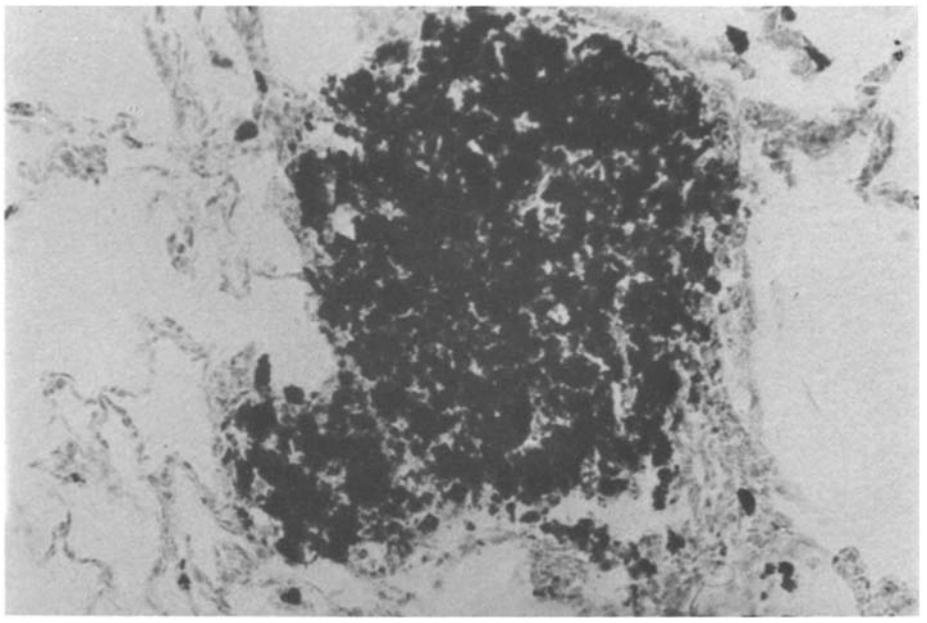

Fig. 2. Rat lung two months after intratracheal instillation of 50-mg antimony oxide dust. Hematoxylin-eosin, photomicrographic magnification 74 ×. Cell dust granulome under light microscope

The subpleral layers of the lung preparation demonstrated localised or diffuse greyish-white, irregular forms, as well as multiple small, grey spots similar to dispersed ash. All of these had sharp borders.

In the omentum of the animals the same formations were found.

Micromorphology

Light microscopy revealed a number of black pigment deposits in the lung (Fig. 1) varying in form and size, many small isolated pigmented spots and discrete black particles. These deposits correspond to small heaps of coniocytes containing phagocytized particles which obscure the cell structure (Fig. 2). The individually disseminated black pigmentations represent single coniocytes with their phagocytized contents. Between these deposits and normal lung parenchyma, histiocytic and occasional lymphoid cells were found. A mesenchymal reaction, i.e. fibrous proliferation or vascular reaction, although minimal, is apparent. Fibres were fine and reticular. Under light microscope cellular proliferation without collagen fibers, but scattered reticular fibers, were present and greyish pigment both in macrophages and free are visible. Thus, a fibrotic reaction is not visible.

The histologic findings of accumulated dust, black pigment deposits or individual pigmented spots, and numerous macrophagocytes would tend to suggest anthracosis. However, antimony dust was clearly present and although difficult to distinguish from coal dust under light microscopy showed a reddish

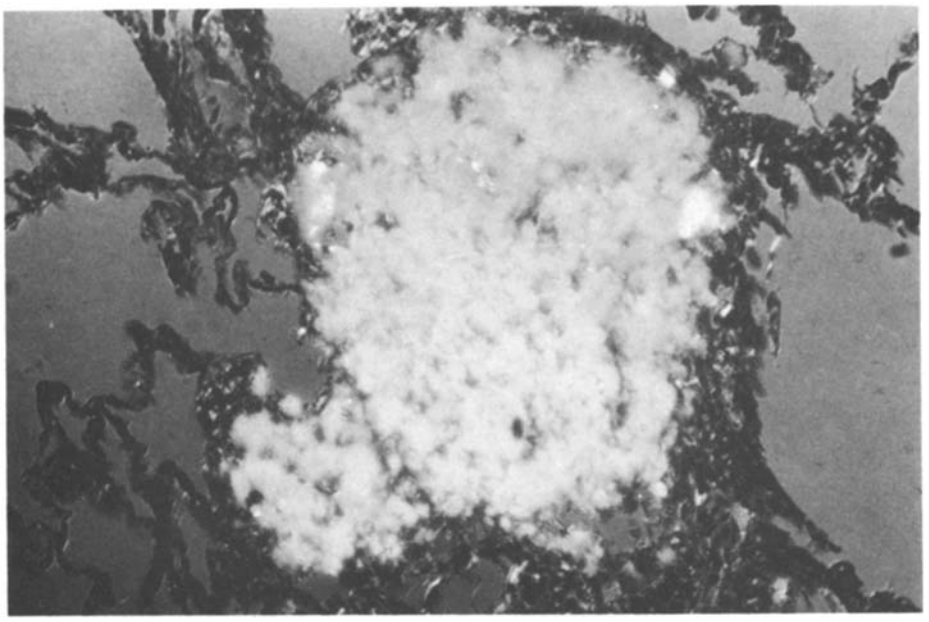

Fig. 3. Specimen from Fig. 2 under polarized light

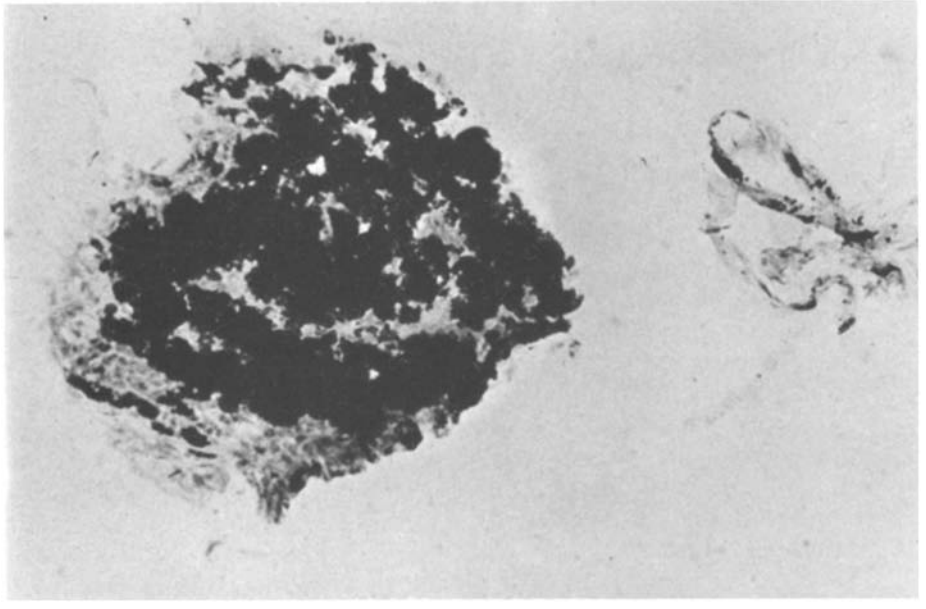

Fig. 4. Coniotic lesion in rat omentum two months after intraperitoneal instillation of 50-mg antimony oxide dust. Paraffin section, hematoxylin-eosin stain. Photomicrographic magnification 74×

fluorescence under polarized light (Fig. 3). Furthermore, minute birefringent particles could be observed.

The microscopic findings in the omentum were similar to those described for the lung (Fig. 4).

Histologic sections revealed dust deposits containing thin "precollagen" argirophilic fibers.

Conclusion

Therefore, a possible conclusion is that antimony oxide dust can produce pneumoconiosis of a non-collagenous nature [1, 2].

A more extensive experiment is to be made.

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