PHYSIOLOGICAL CHANGES WITH PLEURAL AND PARENCHYMAL ASBESTOSIS

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Pathogenesis of asbestos disease depends upon a linkage of cellular events, apparently all in consequence of the attempt to remove, digest and sequester mineral particles which are not biodegradable. Of 100 inhaled particles, fibers of asbestos, about 50 are exhaled and 50 land upon airway epithelial cells of the mucociliary escalator. The high efficiency of this removal system means much of the deposited burden is removed (1). However, cigarette smoke components, including hydrogen cyanide, formaldehyde, acrolein and nitrogen oxides and particles retard clearance (2). The fibers which escape physical removal or are deposited distal to cilia - beyond terminal bronchioles 16th to 18th bifurcations - are dealt with by alveolar macrophages. They are ingested and enzymes are liberated to digest them. These lysosomal enzymes probably cause death of part of this cell population as they do when the alveolar macrophages are stimulated by asbestos in vitro (3).

When cycles of ingestion, lysosome release and death of macrophages occurs there is stimulation of fibroblasts. They are attracted, induced to proliferate and to produce collagen. The pattern of this induced collagen deposition is specific for asbestos, differing greatly from silica and somewhat from diffuse fibrosis.

Consequently, our next consideration must be the pattern of fibrosis in the lung. Two sites are hit first, around the terminal and proximal respiratory bronchioles in the center of secondary lobules, and against or around vessels and secondly against the pleura (4). Part of the early process is within the secondary lobular septa. Elastin is replaced or surrounded by collagen. This all combines to increase the bulk and resistence to stretching of the lungs nylon stocking. As stiffness increases, the resistance to inflation, expressed as pressure required for a breath, increases and discomfort is experienced, reflected by the subject as dys pnea - literally bad breathing.

The pleural response, specific to asbestos, may stem originally from stimulation of mesothelial cells and fibroblasts of the visceral pleura by asbestos within peripleural alveoli. Pleural effusions and pleural thickening with plaques which calcify result. The responses seen in man are mimicked in experimental animals by putting asbestos, fiberous glass or other insoluble fibers into the pleural space. This modelling extends to the production of mesothelioma (5).

It appears that the physical properties including size of the particles determine the response causing disease. It is possible that the asbestos body is a Trojan horse and has no role in pathogenesis of the interstitial and septal fibrosis. In any case, the impairment of organ function logically follows from all interaction with particles.

References

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