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CLINICAL FEATURES AND INDUSTRIAL SIGNIFICANCE OF SILICOSIS

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The following definition of silicosis was promulgated by a Committee of the American Public Health Association in 1932:

Silicosis is a disease due to breathing air containing silica (SiO_2), characterized anatomically by generalized fibrotic changes and the development of miliary nodulation in both lungs, and clinically by shortness of breath, decreased chest expansion, lessened capacity for work, absence of fever, increased susceptibility to tuberculosis (some or all of which symptoms may be present), and by characteristic x-ray findings.¹

While not entirely satisfactory, this definition has been generally accepted in this country although it is probable that it will be revised in the near future. It should be understood that the definition applies to dust containing free silica, that is, silica which is not in chemical combination with other substances. As far as we know now, dusts containing silicates, with one exception—*asbestos*—do not cause a disabling pneumoconiosis.

It should also be understood that the effect of the inhaled silica dust upon the lungs is, so to speak, a mass action and quite different from an infection. The pathological effects of the inhalation of silica dust are apparent from the earliest inception of the disease throughout all of both lungs. Although x-ray films may, on account of the anatomic structure of the body, show the characteristic nodulation as more apparent in one part of the lung than in another, postmortem examinations of even the earliest cases reveal that the distinctive process is evenly distributed throughout the lungs. One does not look, therefore, for a localized area of silicosis in one lung as would be done in the case of an infectious process.

Silicosis is a truly occupational disease and does not occur except as an occupa-

tional disease. It is found among the following classes of industrial workers:

1. Those who mine in hard (silicious) rock—gold, silver, copper, lead, zinc, iron; particularly those workers who are engaged in drilling, shoveling, blasting—underground—and crushing rock and ore above ground.

2. Those whose occupation is of the nature of mining—workers in tunnels, foundations, and quarries, where the work is carried on in silicious rock. The essential process is similar to mining, that is, holes are drilled in rock with pneumatic drills, the holes are then loaded with dynamite and blasted, and the resulting broken rock and debris are shoveled away.

3. Those whose work consists of cutting and dressing highly silicious stone, for instance, granite monument works.

4. Those who work in industries where there may be processes which involve exposure to silica dust. Such processes are very numerous indeed and are to be found in glass works, pottery works, foundries, refractory works, abrasive works, and in grinding and sandblasting.

It is not possible to make more than a rough estimate of the number of industrial workers in this country who are exposed to the silica dust hazard, but it is probable that this number is at least 500,000.²

Our knowledge of silicosis is largely derived from the results of surveys and investigations undertaken in the industries where the hazard is to be found, notably the hard rock mining industry. The clinical picture, when so studied, varies according to the severity of the hazard; hence, the clinical picture in one location will differ from that in another location but will, in each case, be fairly constant. The severity of the hazard depends upon the degree of dosage of silica, and to appreciate this, one must know the amount of silica in the rock or other substance with which the individual works. This may be quartz containing practically one hundred per cent free silica, or granite



containing fifty to sixty per cent free silica, or some mixture of sand or other abrasive substance which may contain only twenty to thirty per cent free silica. The next essential point in estimating the severity of the hazard is the determination of the amount of dust present. In this country, dust samples are collected by the standard technic elaborated by the United States Public Health Service and the United States Bureau of Mines. The result is expressed in millions of particles under ten microns in size per cubic foot.

The silicious dust in any given instance, therefore, may be present in terms of hundreds of millions of particles per cubic foot or in very much smaller amounts. This, of course, has a practical bearing upon the dosage. We must consider also that the patient's exposure may be constant or intermittent—intermittent either on account of the nature of the work itself or because the workman is accustomed to seek employment in the harvest fields or other outdoor work at certain seasons of the year.

The importance, therefore, of a very careful occupational history of any patient in whom silicosis may be suspected or diagnosed is at once apparent. Remembering that silicosis takes years to develop, it must be appreciated that perhaps neither the present occupation nor the immediately previous occupation of a patient may be responsible for his condition. When a silicosis survey is carried on and the individuals examined are men still working at their daily job or perhaps recently disabled, the occupational factors can usually be determined fairly accurately. But when the individual patient is picked up in the ward of a general hospital, it is by no means so easy to determine whether his condition originates from his employment. Such a patient may be quite ignorant of any health hazard to which he may have been exposed. Even though the physician can ascertain that he was at some time exposed to silica dust, the extent of the hazard may be largely a matter of guess work. If such a ward patient has silicosis, his disability may be due to a complication of diseases not directly referable to his occupation, rather than to silicosis.

Where the silica hazard is very severe, as was formerly seen when pneumatic

drilling was carried on in a highly silicious rock without the use of water or other means to entrap or allay the dust, disability more or less complete may develop from the resulting fibrosis of the lungs without a complicating infection. Such extreme hazards are uncommon and are tending to disappear.

Generally speaking, the type of silicosis seen in American industries today does not, as a rule, cause disability unless the factor of infection is present. We still do not know why the silicotic individual tends to become tuberculous but that he does so is attested by the overwhelming evidence of every country or locality where this disease has been studied. Infection may manifest itself by the typical symptoms of night sweats, loss of weight, profuse sputum, and moist rales. On the other hand, infection may not be made evident, clinically, until it is very far advanced.

Where the silica hazard has been very severe, when tuberculosis infection occurs, the patient is apt to go down hill very rapidly. Otherwise, the silico-tuberculosis tends to pursue a chronic and slowly disabling course.

One of the dilemmas that confronts the physician is the advice that he should give his silicotic patient about continuance at his work. The situation here is complicated by various economic considerations and it is not practicable to be too dogmatic in laying down rules and regulations. If the silicotic patient has active tuberculosis, he should, of course, be advised to quit work both for his own sake as well as that of his fellow employees. If he has a definite silicosis and it is not possible in his present occupation to avoid further exposure to the hazard, evidently his best chance of holding his disease in check is to seek other employment. If, on the other hand, having been detected by the employer and adequate provisions made to control the hazard, the patient might as well continue in the work for which he is fitted and trained as to seek other employment, particularly if he is along in years. This whole matter of working or quitting work is far from a simple one and calls for very careful and conscientious thought on the part of the physician who is called upon to render a verdict.

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Needless to say, the x-ray film is the principal reliance in diagnosis, and stereoscopic films are essential, especially in the early cases. Without the characteristic appearance of nodulation, the diagnosis cannot be made. A careful occupational history will often save the diagnostician from embarrassment. Those interested might well consult the Committee Report entitled "Roentgenological Appearances in Silicosis and the Underlying Pathological Lesions," which was published in the *United States Public Health Reports* for

August 2, 1935.

There is a growing amount of evidence to show that when negroes are exposed to severe silica hazards, they may succumb quite rapidly. An overwhelming tuberculous infection may be set up even before the characteristic fibrosis due to the inhalation of silica is well-established.

1 MADISON AVE.

References

1. Committee Report: *American Public Health Ass'n. Year Book*, 1932-1933.
 2. Lanza, A. J., and Vane, R. J.: *American Review of Tuberculosis*, January, 1934.
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