Silica

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A study of a proposed association between occupational exposure to silica dust and renal disease and, arthritis.

A study population was comprised of 4626 silica exposed workers from the industrial sand industry. Their state of health was compared with US population as a whole.

The NIOSH exposure limit for silica dust currently = 50 microg/m^3 .

A history of 4000 occupational hygiene air samples was used to assign occupational exposures to a set of standard jobs. Assignment of job code was based on job last held.

Health status information for arthritis was obtained from death certificates.

Morbidity data was available for renal disease.

All job categories, bar bagging, had a geometric mean exposure lower than the NIOSHREL (50 micro grams/ m^3), Typical Geometric Mean concentrations were 20 to 30 microg/m^3.

Air quality continuously improved over the measurement period. For example, Geometric Mean in 1974 to 1979 was 51 microg/m^3 but in 1985 to 1988 it was 11.6 microg/m^3.

Personnel records indicated a relatively high level of smoking among the workforce, but this was not accurately quantified.

The study identified a number of Standardised Incidence Ratios (SIR) of statistical significance:

Outcome of interest*	SIR	95% Confidence Interval
Acute Renal disease	2.61	1.49 to 4.24
Chronic Renal Disease	1.61	1.13 to 2.22
Arthritis	4.36	2.76 to 6.54

*All were from the multiple causes section of the death certificate.

Further analysis showed that prevalence of arthritis had a clear dose response relationship, based on cumulative exposure calculations. For confirmation, the same exposure matrix shows a dose response relationship between exposure and prevalence of silicosis.

Renal disease was then further classified. The clearest contribution to the association between exposure and disease was from glomerular disease; SIR = 3.85 (95% CI = 1.55 to 7.93). [The glomerulus is the part of the kidney where the extraction process begins, and is known to be sensitive to increased activity of the immune system in the lung].

Arthritis was also further classified into rheumatoid and osteo. The dose response effect was described as being explained entirely by rheumatoid arthritis, however, the authors did not report any revised SIR for this level of analysis.

Comment

Strengths of association combined with precision of results, suggest an association between dust exposure and both arthritis and acute renal disease, to be significant.

The authors suggest an immune mechanism could explain the increased incidence of renal disease. This proposal gains support from independent studies of smoking and asbestos exposure which also tend to show associations with renal disease and from studies of genetic predisposition to renal disease, which operate via an immune system mechanism. However, this would not readily explain why chronic renal disease was less evident in these results, than acute.

Links between dust exposure and rheumatoid arthritis are less easy to explain.

The study is persuasive of causal links, but a number of doubts remain. NIOSH may be encouraged to revise downwards, permitted exposure levels.