Silicosis and silicotuberculosis: Ancient diseases that are still not conquered

When the history of 'miners' phthisis' (silicotuberculosis) is described, authors often refer to the classical writings of the Greek physician, Hippocrates (460 - 370 BC), who described breathlessness in persons exposed to dust in mines and stone quarries. However, these diseases have been recognised since more ancient times. The Egyptians depicted the respiratory tract anatomy in texts dating back to the 30th century BC.[1] Using modern paleopathological techniques, evidence of silicosis and tuberculosis can be found in civilisations across the world.

Silicotic nodules were observed in the lungs of Egyptian mummies, presenting on autopsy with 'areas of diffuse and nodular fibrosis'.[2] In affluent individuals from that time (for whom mummification was available), this lung pathology is generally thought to result from silica exposure during sandstorms.[3] However, quarry mining and stone masonry were common occupations back then, and these occupations are associated with silicosis even in modern times. As long ago as the Neolithic period, flint miners (using deer antlers as picks and ox tibias for making axes for mining) probably suffered from silicosis.[4] On the European continent, silicosis has recently been described in 'Ötzi', a glacier mummy who lived more than 5 000 years ago.[5]

Compared with the evidence for silicosis, ancient tuberculosis evidence is even more prevalent, since it can be detected in bony tissues, which survive for much longer than pulmonary tissues as a viable source for diagnosis. Large numbers of cases have been identified based on the morphology of the spine ('Pott's disease') dating back to the Roman period and the Middle Ages. Nerlich and Lösch[6] reviewed the paleopathology of tuberculosis, citing numerous examples of the diagnosis being made based on spinal lesions seen in specimens dating back to the Neolithic period (approximately 3 000 - 7 000 BC), such as a frequently cited article by Morse and Brothwell[7] on tuberculosis in ancient Egypt. Even molecular diagnoses (identifying *Mycobacterium tuberculosis* DNA) were made on European skeletal remains and Egyptian mummies dated to the same periods.[6,8,9] Similarly, polymerase chain reaction testing for *M. tuberculosis* was positive when testing bone samples from a woman and infant who were buried at the (now submerged) site of Atlit-Yam, off the coast of Israel – dating back more than 9 000 years ago.[10]

Since early times, interventions to prevent these diseases were proposed. In a 1556 publication, Georgius Agricola[11] recommended proper ventilation to remove dust and quoted Pliny (from Roman times) recommending the use of respiratory protection by covering the face with animal bladder-skin to limit exposure to dusts. In the same publication, he vividly describes the grim picture of the impact of silicotuberculosis on young individuals: 'the dust has corrosive qualities, it eats away the lungs, and implants consumption in the body; hence in the mines of the Carpathian Mountains women are found who have married seven husbands, all of whom this terrible consumption has carried off to a premature death'. Yet, despite these early recommendations to prevent silicosis, Ramazzini[12] still described the problem of silicosis in stone cutters 150 years later, in 1705. Another two centuries later, in 1902, the Chamber of Mines in Johannesburg was still looking for ways to obviate or minimise the occurrence of miners' phthisis, and invited practical suggestions and plans for combating the causes, offering monetary rewards for the best practical suggestions and devices.[13] Now, more than another century later, national tuberculosis and silicosis elimination programmes have been implemented as recommended by the World Health Organization and the International Labour Organization as part of the Global Programme for the Elimination of Silicosis.[14] However, eliminating dust exposure is difficult, and it is clear that small-scale mining, artisanal mining and other entities outside of the formal mining industry may not be able to reach national prevention targets.[15]

Although the article by Dennis *et al*.[16] on silicosis in northern Tanzania in this issue of *AJTCCM* does have some epidemiological shortcomings (as pointed out by the authors), their study clearly highlights the fact that (although these diseases have been known for many millennia) we have not yet been able to curb their impact on the human population. Certain populations (such as small-scale mining employees) are impacted disproportionately, as was found in the drainage area of this Tanzanian hospital. Previous studies have indeed confirmed that small-scale miners in Tanzania are exposed to very high levels of silica dust.[17] Even remote populations may be affected if mines employ migrant workers – another group that is disproportionally affected.[18]

Affected employees and their families have the right to be supported and compensated if an occupational disease is diagnosed. South Africa (SA) was the first country in the world to compensate silicosis and tuberculosis as occupational diseases.[19] Nevertheless, a large proportion of ex-mineworkers in SA still suffer uncompensated disease.[18,20] Despite legal imperatives for reporting, many medical practitioners diagnosing silicosis and tuberculosis fail to recognise the occupational link and even refuse to complete relevant claim documents, leaving compromised employees and their families in dire situations.

Previous silica exposure, even in the absence of radiological silicosis, is known to increase the risk of developing tuberculosis.[21] In SA, 'silicotuberculosis' (tuberculosis diagnosed in an individual with radiological silicosis) is listed as an occupational disease in Schedule 3 of the Compensation for Occupational Injuries and Diseases Act (COIDA).[22] This means that silicotuberculosis is legally presumed to have occurred as a result of employment, in terms of section 66 of COIDA. Just a few months ago (May 2023), updated compensation criteria were published in SA, specifying that if an employee was exposed to free crystalline silica in the workplace for 2 years, and they are diagnosed with tuberculosis in the next 12 months, it is considered an occupational disease – even in the absence of radiological evidence of silicosis. In any employee with silica dust exposure of 15 years or more (without radiological silicosis), a diagnosis of tuberculosis is now always considered a compensable occupational disease, irrespective of the time since last exposure.[23]

All cases of occupational disease should be referred to an occupational health practitioner, who can assist with completion of the compensation documentation, but (more importantly) assess the workplace and implement appropriate preventive measures to protect the other employees too.

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