CASE REPORT

Pulmonary Siderosis in an Arc Welder

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Summary

An asymptomatic subject with radiographic changes due to welders' siderosis is described. This condition has not been well recognized and described in our community. Siderosis of the lung is generally considered to be a benign condition not associated with respiratory symptoms. However, recent reports have associated welding with various disorders of pulmonary function as well as lung cancer. There is a need for future epidemiological studies to better define the risk of long term welding.

Key Words: Pulmonary siderosis, Welders

Introduction

Pulmonary siderosis is due to deposition of iron in the lungs, usually in the form of iron oxide[1]. With the heat emitted from the arc or torch, arc welding melts and boils the iron that is being cut or welded. This process leads to the emission of fine particles of ferrous oxide which are immediately oxidized to ferric oxide and appear as blue-gray fumes. Most of the particles present in these fumes are submicron in size and are respirable. Prolonged inhalation of these fumes can lead to the development of pulmonary siderosis.

Arc welding is a fairly common occupation in Malaysia. Welders' siderosis has, however, not been described in this country. The clinical research on this disease has been small, thus contributing to the limited recognition of this condition. We report an asymptomatic subject who has radiographic changes in the lungs due to welders' siderosis.

Case Report

A 33-year-old man was found to have abnormal chest X-ray on routine medical examination prior to purchasing life insurance. He was, however, asymptomatic. He was a non-smoker and worked as an arc welder at construction sites for the past 14 years. He was neither clubbed nor cyanosed on examination. Examination of the respiratory and other systems was unremarkable.

A chest X-ray performed elsewhere revealed diffuse ill-defined small nodules of 0.5 to 1mm in diameter in both lower lobes. High-resolution computed tomogram (HRCT) of the thorax subsequently performed showed fine nodules and reticular shadows predominantly in the basal segments of both lower lobes (Fig. 1). Lung function test showed normal lung volumes and diffusing capacity. His PaO_2 and $PaCO_2$ in room air were normal. Numerous iron-laden macrophages were found in the bronchoalveolar lavage (BAL) fluid obtained at fibreoptic bronchoscopy. A diagnosis of welders' siderosis was made.

Discussion

Welders' siderosis was first described by Doig and McLaughlin in 1936. Since its original description, it is believed that provided only iron oxide is inhaled, siderosis is a benign condition not associated with respiratory symptoms and does not lead to fibrosis[1].

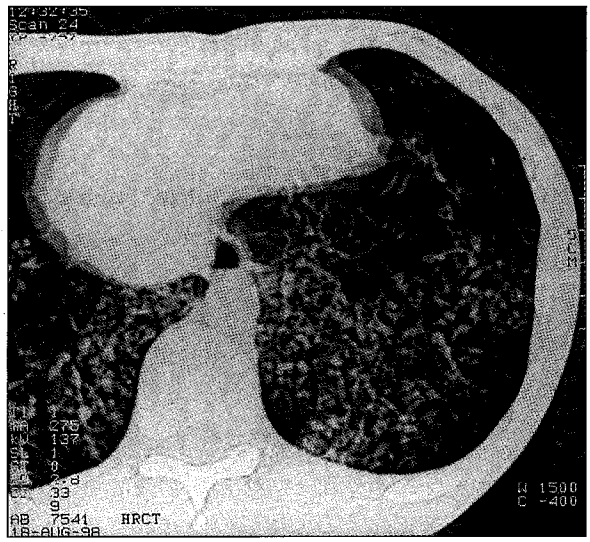

Fig. 1: High-resolution computed tomogram (HRCT) of the thorax showing diffuse fine nodules and reticular shadows in the basal segments of the lower lobes.

Although there have been sporadic case reports over the years associating welding with the development of restrictive impairment and pulmonary fibrosis, the reported subjects often had history of exposure to other inorganic dusts which are recognized to be fibrogenic such as asbestos and silica. While iron is not fibrogenic, welders are often exposed to other dusts, and thus mixed dust pneumoconiosis can occur.

It has also been claimed that long term inhalation of welding fumes leads to airway obstruction and emphysema[1]. However welders tend to smoke more than the general population, and this may explain the higher prevalence of obstructive airway disease. Studies among welders in the West showed an association between welding and death from lung cancer. However many welders studied had worked for a substantial duration in shipyards and had had significant exposure to asbestos. Asbestosis is a well-known complication of shipyard welding.

Studies of lung biopsies in welders showed that the majority of iron particles are taken up by the alveolar macrophages while some are deposited freely in the alveoli and respiratory bronchioles[1]. Fibrosis was entirely absent in subjects who had not inhaled other harmful agents. Even when the pulmonary iron content in one of the studied welders was 15 times greater than normal, absolutely no fibrosis was present.

In recent years it has been noticed that siderosis is accompanied by disorders of pulmonary function. Small functional changes of restriction and lung compliances are believed to be due to iron alone. This is contrary to earlier studies which reported no change in ventilatory capacity, respiratory mechanics and arterial blood gases in welders with grossly high iron content in their lungs[1]. In spite of more than a decade of welding, our patient showed no severe alteration of lung function. It is possible that the lung function test parameters that were performed were not sensitive enough to detect any physiological alteration that might occur as the pathological changes were purely confined to the basal segments of the lungs.

On chest X-ray, the lungs of subjects with welders' siderosis reveal small rounded opacities widely distributed throughout both lung fields[1]. Upper lobe preponderance as in silicosis is absent. In certain welders who have ceased exposure, serial observations showed improvement in their radiological appearances. Akira M reported the findings of thin-section CT scan of the chest in 21 arc welders[2]. The author noted ill-defined micronodules concentrated mainly in the centrilobular region.

A recent mortality study among iron workers shows significantly elevated mortality risks for lung cancer and other respiratory diseases[3]. Welding has also been recently associated with acute and chronic bronchitis[4]. And asthma may be a sequelae after acute bronchitis has resolved. Chemical pneumonitis and acute respiratory distress syndrome due to metal fumes from welding have also been reported.

Welders also face other forms of occupational hazards besides respiratory disorders. Welding process emits ultraviolet and visible radiation, which adversely affect the eyes and skin[5]. Welders suffer a higher proportion of optical radiation associated eye conditions than do non-welders. Erythema is a common skin condition among

welders. Non-melanoma skin cancer may develop as a result of chronic intense exposure to non-solar ultraviolet radiation.

Not all constituents of welding rods are harmless in all circumstances. The rods and other materials with which welders work may contain carbon, manganese, aluminium, silicates and free silica. The wide range of substances produced by various welding technologies, along with unfavorable working conditions, may contribute to disorders of pulmonary function. A better understanding of the health situations of welders in our community can only be furnished by data from epidemiological studies.

References

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