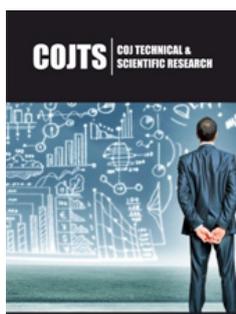


Silicosis: A Blow to Human Kind and its Breakthrough

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Abstract

The article gives an insight of respiratory disease silicosis its origin characteristics, diagnosis as well as treatment of it. More prevalent among the workers who are exposed to silica develops silicosis causing difficulty in breathing and finally leading to other health issues and sometimes being fatal. Diagnosis procedures involves X-ray of chest, parameters of lungs as well as EBUS-TBNA. Though silicosis is termed as almost incurable and prevention is the best precautions scientists have developed few drugs for it which are still under investigation.

Keywords: Silicosis; Pulmonary disease; Silica; Respiratory disease; Tuberculosis

Introduction

Constituents of nature such as soil, sand, stones, granites and many other minerals possess basic components crystalline silica (SiO_2) which is composed of Si and O_2 . Quartz is one widespread example of crystalline silica whereas cristobalite and tridymite are other two significant group of silica. Volcanic rocks and volcanic materials are major source of cristobalite and tridymite. Cristobalite is unusual in other soil but tridymite can be observed in tuffs, limestones and chalk. Presence of more open structure at cristobalite and tridymite in comparison to quartz enhances integration of other materials to the same. Significant amount of respirable silica particles from silica containing raw material evolves in every processing steps such as chip, cut, drill, or grind objects and workers get exposed to the same mostly in mining, granite, quarry work and tunneling or stone industries. Silica is hazardous to human health as silica exposure remains a serious threat to workers in the above mentioned industries along with other chronic obstructive pulmonary disease (COPD). Continuous inhalation of silica causes the nasty disease silicosis characterized by inflammation and pulmonary fibrosis. Impairment of lung function increases with disease progression, which in severe cases can be disabling, or even fatal even after the patient is no longer exposed. The respirable silica dust enters the lungs as finds its routes to distal airways of alveolus located at the bronchioles of lungs where it deposits followed by scaling and lysis and causes the scar tissue, thus reducing the lung's ability to take in oxygen. Reactive oxygen species may be generated by silica by two processes such as directly freshly cleaved particle surfaces or indirectly through its effect on the phagocytic cells. Thakur et al. [1] observed macrophage receptor with collagenous structure expressed in alveolar macro phages have a role in the recognition and uptake of silica and termed the same as scavenger receptors. The International Agency for Research on Cancer (IARC) classified crystalline silica as a human carcinogen in 1997 [2]. Based on this evidence, the US Occupational Safety and Health Administration (OSHA) lowered the occupational exposure limit for crystalline silica from 0.1 to $0.05\text{mg}/\text{m}^3$ in 2013. Silicosis generally has three clinical forms namely acute, chronic and accelerated. Intense exposure to silica leads to development of acute form within a period between a few months and 2 years whereas chronic form emerges 10 years after the beginning of exposure and more intense exposure results in development of the accelerated form develops within a shorter period (4 to 10 years) [3].

General symptoms of silicosis are shortness of breath, wheezing, chest tightness, and cough etc. and in most of the cases there is absence of symptoms in the initial stages. Study on

silicosis began many decades ago since 1930 and continued every decade [4-17] however the nasty nature of this disease remains taking thousands of lives every year from either developed/developing or underdeveloped country. Sharma et al. [18] reported crystalline silica is responsible for other few autoimmune diseases like systemic lupus erythematosus (SLE), rheumatoid arthritis (RA)-Caplan syndrome, systemic sclerosis (SSc) results from Erasmus syndrome which initiates with silica exposure and antineutrophil cytoplasmic antibody (ANCA)-related vasculitis simultaneous to silicosis. Reports are available that confirms silicosis is associated with degradation of immune system, homeostasis and metabolism, hematopoietic system affecting body blood factory, cardiovascular system (heart), integument, neoplasm a cancer characteristic, liver/biliary system renal/urinary system and/or kidney tuberculosis, lung cancer, chronic obstructive pulmonary disease, or kidney diseases and skeleton (Malacard database). Liber et al. [19] reported that silicosis being an uncommon pulmonary disease is also associated with rare gastrointestinal symptoms. They observed a Broncho esophageal fistula resulting from silicosis causing dysphagia and cough and established the fact that even common symptoms of cough and dysphagia can cover-up other pulmonary or oropharyngeal problem whereas they are gastrointestinal manifestations of a rare disease. Since silicosis affects lung function, it makes one more susceptible to lung infections like tuberculosis. Additional cigarette smoking hikes lung damage and adds to the damage caused by breathing silica dust [20].

Diagnosis

Initially autopsy of lung serum, X- ray analysis of chest played significant diagnostic measure for identifying silicosis. However, with time advance searches has evolved as detection of silicosis. Shitrit et al. [21] reported EBUS-TBNA as a useful and sufficient tool to diagnose silicosis in patients with mediastinal lymphadenopathy along compatible exposure histories. Nardi et al. [22] observed the relevance of L-selectin as a potential peripheral biomarker for monitoring crystalline silica-induced toxicity in miners after chronic exposure, before silicosis has developed. Franzblau et al. [23] reported absence of significant difference in readings of film and soft copy digital images in terms of prevalence of tuberculosis or silicosis, and intra-rater agreement across formats was fair to good and even higher prevalence appeared at hard copy images.

Treatment

Silicosis remained reported as non-curable till last few years. Still drugs are under investigation for this nasty disease. Till date there are is information of three Drugs invented namely Isoniazid, Rifapentine and Rifampicin and which are approved for this disease though still in investigated stage. Other few drugs being investigated are Nucleic Acid Synthesis Inhibitors, Antibiotics, Antitubercular, Cytochrome P-450 CYP3A Inducers, Lipid Regulating Agents, Antimetabolites, Anti-Infective Agents, Hypolipidemic Agents, Anti-Bacterial Agents, Mitogens and Respiratory System Agents (Database Malacard). Akgün & Begüm [24] termed as life-threatening occupational lung disease because of its incurable nature. Scholars and health experts suggested that prevention of

the disease should be the main target as there is no particular and accurate treatment of silicosis is evaluated. Iga N [25] reported among the silicosis group, patients treated with chest tube drainage alone tended to have a higher rate of ipsilateral recurrence than those who had pleurodesis, although this was not statistically significant [26]. The median overall survival time of patients with silicosis was 82.6 months, while that of patients with COPD was 104.1 months. Nardi et al. [22] reported relevance of L-selectin as a potential peripheral biomarker for monitoring crystalline silica-induced toxicity in miners after chronic exposure, before silicosis has developed. Akgün & Begüm [24] suggested that to assess the magnitude of the problem occupational disease registry systems would be useful. In addition to implementing the necessary regulations, a close inspection of the workplaces for potential risks is essential. Other social and economic factors related with the occurrence of disease, such as unregistered employment rate and unlicensed and uninsured work should also be considered. Finally, optimal healthcare and better living conditions for patients with silicosis should be ensured.

Conclusion

There are enormous studies on the origin and effect on the population due to silicosis. However, the treatment of this deadly horrendous disease is of immense important and workers working in the potential sites, authority should be concerned.

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