

# The Classic Pneumoconioses

## New Epidemiological and Laboratory Observations

A. Scott Laney, PhD, David N. Weissman, MD\*

### KEYWORDS

• Coal • Coal workers' pneumoconiosis • Silica • Silicosis • Asbestos • Asbestosis

### KEY POINTS

- Digital chest imaging can now be used in the International Labor Office's classification system for the presence and severity of changes of pneumoconiosis with equivalent results to classification of analog film-screen radiographs.
- The role of lung cancer screening of asbestos-exposed individuals with low-dose chest computed tomography scanning is still evolving.
- Coal workers' pneumoconiosis, including severe forms, such as progressive massive fibrosis, is still occurring in the United States and has been seen in relatively young miners.
- Emerging exposure situations include longer work hours, work in small mines, and silica exposure from thin-seam coal mining in Appalachia, construction work, and natural gas extraction by hydraulic fracturing and environmental exposures to asbestos associated with human contamination of the environment or the presence of natural deposits.
- Newly or poorly recognized adverse health effects of exposures include lower-zone, irregular opacities in coal miners; antibodies against citrullinated peptide antigens—positive rheumatoid arthritis and antineutrophil cytoplasmic antibody-positive vasculitis in silicotics; and laryngeal and ovarian cancer in asbestos-exposed individuals.
- Soluble mesothelin-related peptides can be measured in serum to monitor the course of malignant mesothelioma with epithelioid features. The test is not approved in the United States for diagnostic purposes and its diagnostic potential is limited by low sensitivity for malignant mesothelioma at threshold serum values providing good specificity.

### INTRODUCTION

The pneumoconioses are a group of lung diseases caused by the inhalation of mineral dust. They have long histories. Classic authorities, such as Agricola and Ramazzini, described silicosis and coal workers' pneumoconiosis (CWP) centuries

ago.<sup>1,2</sup> Although eliminating causative inhalation exposures can prevent pneumoconioses, they continue to occur. This brief review addresses selected issues of current interest and recent developments related to 3 types of inorganic mineral dust exposures that cause classic forms of pneumoconiosis: coal mine dust, crystalline

---

Funding sources: Dr Laney, Dr Weissman: US Government (CDC-NIOSH).

Conflict of interest: Dr Laney, Dr Weissman: Nil.

Disclaimer: The findings and conclusions in this report are those of the authors and do not necessarily represent the views of the National Institute for Occupational Safety and Health.

Division of Respiratory Disease Studies, National Institute for Occupational Safety and Health, Centers for Disease Control and Prevention, 1095 Willowdale Road, Morgantown, WV 26505, USA

\* Corresponding author.

E-mail address: [DWeissman@cdc.gov](mailto:DWeissman@cdc.gov)

Clin Chest Med 33 (2012) 745–758

<http://dx.doi.org/10.1016/j.ccm.2012.08.005>

0272-5231/12/\$ – see front matter Published by Elsevier Inc.

silica, and asbestos. More comprehensive reviews are also available.<sup>3-6</sup> Although this review has a US perspective, mineral dust exposures and the pneumoconioses they cause are an important global issue.<sup>7</sup>

## CHEST IMAGING IN PNEUMOCONIOSIS

Recent advances in chest imaging are relevant to all types of pneumoconiosis because imaging technology is critical to identifying these conditions in medical screening and surveillance and in epidemiologic research. Issues discussed in this section include use of digital chest imaging to classify the presence and severity of changes of pneumoconiosis using the International Labor Organization's (ILO) classification system and use of chest computed tomography (CT) for early detection of dust-induced disease.

### *Use of Digital Chest Imaging for ILO Classification*

The ILO classification system is used worldwide to assess the presence and severity of chest radiographic changes of pneumoconiosis.<sup>8</sup> Before 2011, the classification system could only be applied to film-based chest radiographs. However, access to film-based radiography has markedly declined in the United States in recent years because of replacement by modern digital radiographic imaging systems. This replacement has hindered access to ILO classification when it was needed in research and other settings.

To address this issue, in 2009, the National Institute for Occupational Safety and Health (NIOSH), together with partners, including the ILO, established a plan to develop the ILO classification of digital chest images.<sup>9</sup> Since then, several studies have been conducted with the goal of establishing whether and how contemporary digital chest images could be used to perform ILO classifications and yield results equivalent to classifications using film-based images.<sup>10-14</sup> Together, these studies indicate that with appropriate attention to image acquisition and when images are displayed on medical-grade monitors, direct readout digital systems and computed radiography systems provide comparable classification results to traditional film-based radiographs. In addition, a consistent finding across studies is that digital image quality is significantly better than film-screen image quality. The equivalence between digital and film radiography for the classification of pneumoconiosis has also been demonstrated using the Chinese classification system (GBZ 70-2002).<sup>15,16</sup>

Reader variability is an important source of variability in the classification of chest images. Although a variety of measures can be used to reduce within and between reader variation, human subjectivity continues to be an important issue. To address this, efforts have been made to develop computer-assisted classification of chest radiographs for findings of pneumoconiosis. Studies were initially published in the 1970s.<sup>17,18</sup> Although much remains to be done, computer-aided ILO classification of digital chest images may someday be achievable.<sup>19,20</sup>

### *Medical Screening with Chest CT*

High-resolution CT is more sensitive for detecting the earliest stages of pneumoconiosis than conventional chest radiography.<sup>21-26</sup> However, the potential benefits to patients of very early detection of pneumoconiosis, which generally progresses slowly and lacks specific curative treatment, are limited in comparison with the early detection of lung cancer, which can be life saving. A recently published, large, randomized controlled trial, the National Lung Screening Trial (NLST), has documented the effectiveness of early detection of lung cancer in older heavy smokers undergoing annual screening with low-dose chest CT scans (LDCT) as compared with annual screening with plain chest imaging. Its finding of reduced mortality in the group randomized to LDCT has been of great interest to those caring for individuals previously exposed to other carcinogens, including asbestos.<sup>27</sup> LDCT was used for screening instead of conventional CT to limit the potential harmful consequences of radiation exposure.

In the wake of the NLST, 4 medical societies collaborated to conduct a systematic review of the evidence of benefits and harms of lung cancer screening with LDCT.<sup>28</sup> The review found NLST to be the most informative study. Patients included in the NLST were smokers and former smokers aged 55 to 74 years who had smoked for 30 pack-years or more and either continued to smoke or had quit within the past 15 years. After 3 rounds of annual LDCT imaging and appropriate follow-up care for those with abnormal findings, the relative risk of lung cancer mortality was decreased by 20% and absolute risk by 0.33%. Unfortunately, screening does result in false positives. Across studies, nearly 20% of individuals had positive results requiring follow-up, whereas approximately 1% had lung cancer. The review concluded: "For smokers and former smokers aged 55 to 74 years who have smoked for 30 pack-years or more and either continue to smoke or have quit within the past 15 years, we suggest that annual

Download English Version:

<https://daneshyari.com/en/article/4207529>

Download Persian Version:

<https://daneshyari.com/article/4207529>

[Daneshyari.com](https://daneshyari.com)