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Lung Transplantation Is Increasingly Common Among Patients With Coal Workers' Pneumoconiosis

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Abstract

Background—The prevalence of coal workers' pneumoconiosis (CWP) in U.S. coal miners has increased, and severe presentations are increasingly common.

Methods—We describe trends in lung transplantation during 1996–2014 for recipients with a primary diagnosis of CWP or pneumoconiosis unspecified, and we summarize recipient characteristics and estimate survival.

Results—A total of 47 transplants were included; nearly three-quarters were performed during 2008–2014. All recipients were male, 96% were white, and the mean age was 56 years. Mean FEV_1% was 35%; mean FVC% was 53%. Mean time on a waitlist was 155 days, and 60% of transplants were bilateral. Median survival was 3.7 years.

Conclusions—These transplants reflect the use of a scarce resource for an entirely preventable disease, and highlight the need for enhanced efforts to reduce coal mine dust exposures.

Keywords

coal workers' pneumoconiosis; lung transplantation; occupational lung disease; coal mining

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AUTHORS' CONTRIBUTIONS

DJB analyzed and interpreted the data, drafted the report, approved the final version, and is accountable for its accuracy and content. CNH interpreted the data, provided critical feedback during writing, and approved the final version. KJC interpreted the data, provided critical feedback during writing, and approved the final version. ASL analyzed and interpreted the data, drafted the letter, and approved the final version.

ETHICS REVIEW AND APPROVAL

The NIOSH IRB determined this study did not require IRB review (HSRB 14-DRDS-NR05), and activities were covered by a signed data use agreement with UNOS.

DISCLOSURE BY AJIM EDITOR OF RECORD

Steven Markowitz declares that he has no conflict of interest in the review and publication decision regarding this article. This paper was prepared and written by NIOSH employees as part of their employment.

INTRODUCTION

The prevalence of coal workers' pneumoconiosis (CWP) in U.S. coal miners has increased since the late 1990s [Laney and Weissman, 2014]. This increase has been most pronounced in central Appalachia, and evidence suggests severe presentations of the disease are becoming more common. Studies of these miners during the last decade have described rapid onset and progression of CWP [Antao et al., 2005; Wade et al., 2011], increases in the prevalence of progressive massive fibrosis (the most severe form of CWP) [Blackley et al., 2014] and CWP resembling silicosis [Laney et al., 2010; Cohen et al., 2015], changes in radiographic and histopathologic disease patterns [Petsonk et al., 2013], severe disease among surface miners [Halldin et al., 2015], increases in years of potential life lost attributable to CWP [Mazurek et al., 2009], and rising numbers of state and federal black lung disability compensation claims [U.S. Department of Labor, 2014].

There is no cure for CWP and other forms of coal mine dust lung disease, which include chronic obstructive pulmonary disease (COPD) and dust-related diffuse fibrosis. Supportive therapies include bronchodilators for airflow limitation, antibiotics for respiratory infections, supplemental oxygen to manage hypoxemia, and smoking cessation programs. Those with radiographic evidence of CWP should be advised to move to a less-dusty work environment, but this is not always possible, and disease can continue to progress even after cessation of coal mine dust exposure [Kimura et al., 2010; Mason et al., 2010]. Supportive therapies do not slow progression of CWP, and recent reports have described the use of lung transplantation among patients with end-stage CWP [Enfield et al., 2012; Hayes et al., 2012].

Little is known about lung transplantation among U.S. coal miners, and trends for the procedure have not been previously reported.

METHODS

We analyzed de-identified Organ Procurement and Transplantation Network patient-level data provided by the United Network for Organ Sharing. To be eligible for inclusion, patients must have had a primary diagnosis of CWP or pneumoconiosis unspecified and received a single or bilateral lung transplant in the U.S. during 1996–2014, because the first lung transplant for CWP was performed in 1996 [Enfield et al., 2012]. We describe the trend in lung transplantations for these patients, summarize recipient demographic and clinical characteristics, and estimate median survival using the Kaplan–Meier method.

RESULTS

Twenty-four individuals with CWP and 23 with pneumoconiosis unspecified received lung transplants during the study period (Fig. 1). Thirty-four (72%) of these transplants were performed during 2008–2014. Occupational history data were not available, but 19 of the 23 patients with pneumoconiosis unspecified were residents of West Virginia, Virginia, Kentucky, or Pennsylvania—Appalachian states that are leading coal producers. All 47 patients with CWP or pneumoconiosis unspecified were male, 96% were white, and the mean age was 56 years. Mean FEV_1% predicted at transplant registration was 35%, and

mean FVC% predicted was 53%. These patients were on a waitlist for a mean of 155 days, and 28 (60%) received a bilateral transplant. Medicare paid for 14 (30%) of the procedures and private insurance paid for 16 (34%); other government insurance schemes paid for 17 transplants (36%). Twenty-two recipients were deceased as of December 31, 2014, and median post-transplant survival was 3.7 years.

DISCUSSION

Although transplants for CWP are relatively rare compared to the total number performed in the U.S., the procedure is becoming increasingly common, and its success with respect to survival is not entirely clear. Insufficient data exist to determine survival times while appropriately controlling for competing factors. Two studies on survival following lung transplantation for CWP have been reported. Hayes and colleagues identified eight cases of lung transplantation for CWP in Kentucky and reported good clinical outcomes and survivability post transplantation [Hayes et al., 2012]. In contrast, Enfield and colleagues examined data for 30 recipients determined to have CWP and reported lower survival compared to patients undergoing lung transplants for COPD, silicosis, and idiopathic pulmonary fibrosis [Enfield et al., 2012].

The pattern of lung transplants performed for patients with CWP and pneumoconiosis unspecified, which likely represents CWP, is consistent with the recent resurgence of progressive massive fibrosis in coal miners [Blackley et al., 2014]. Though commonly thought of as a well characterized disease of antiquity, novel questions regarding our understanding of this disease continue to emerge. These results add to a growing body of evidence pointing to increased severity of coal mine dust lung disease in the U.S. and highlight the mounting consequences of this ongoing epidemic. A lung transplant for end-stage CWP is an extreme intervention, but in the absence of proven curative treatments, U.S. coal miners will continue to undergo the procedure. These transplants reflect the use of a scarce resource for an entirely preventable disease, and highlight the need for enhanced efforts to reduce coal mine dust exposures.

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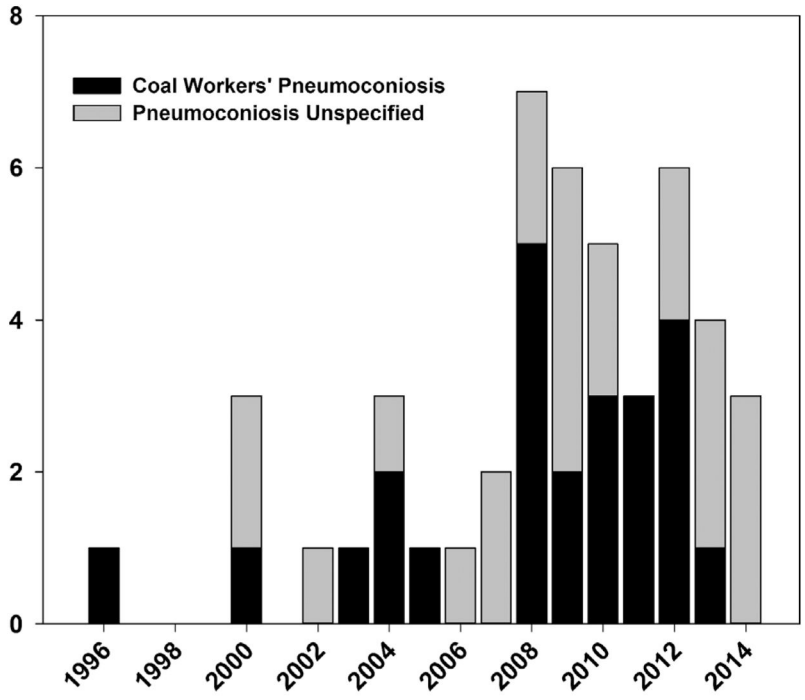

FIGURE 1.

Frequency of lung transplants in patients with a primary diagnosis of coal workers' pneumoconiosis or pneumoconiosis unspecified, United States, 1996–2014; based on organ pocurement and transplantation network data provided by the United Network for organ sharing; data current as of March 6, 2015.