



Case report

Should hut lung be called domestically acquired particulate lung disease or domestically acquired pneumoconiosis?



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ABSTRACT

Indoor air pollution appears to be a major environmental and public health hazard for large numbers of the underdeveloped world's population. A detailed environmental history is important for making diagnosis in most individuals from foreign rural settings with nonspecific respiratory symptoms. In this report, we describe an illustrative case of domestically acquired particulate lung disease (DAPLD) or “hut lung” in a 65-year-old Sudanese male who immigrated to the United States in 1986. He presented with symptoms of chronic productive cough and dyspnea. Imaging and pathology from transbronchial cryo biopsy revealed anthracosis consistent with DAPLD. This case demonstrates persistence of physiologic, radiographic, and histopathologic abnormalities years after removal from exposure. To the best of our knowledge, this is the first case of DAPLD reported from Sudan.

1. Introduction

Hut lung is a pneumoconiosis caused by exposure to smoke derived from biomass fuels used for cooking in poorly ventilated huts. Biomass serves as the major fuel source for more than 50% of the world's population and 75% of those are in developing countries [1]. Chronic exposure to biomass fuel is implicated as the leading cause of chronic bronchitis among nonsmokers in rural countries and accounts for up to 50% of the total disease burden among the rural poor [2].

Increased immigration from underdeveloped countries results in a higher incidence of the domestically acquired particulate lung disease (DAPLD) diagnosed in developed countries such as the United States, making it increasingly important for western physicians to recognize this syndrome.

2. Case presentation

Sixty five year old non-smoking Sudanese male with coronary artery disease and end stage renal disease was referred to the University of South Florida Pulmonary clinic for a secondary evaluation of chronic productive cough and worsening dyspnea since 2012. He has been complaining of dyspnea on exertion for several years in the past, however his symptoms have been progressively worsening since 2012 accompanied with intermittent productive cough. In 2013, he underwent a non-diagnostic transbronchial biopsy of the left lower lobe for interstitial changes on imaging with restrictive pattern on pulmonary

function testing. He denied any fevers, chills, sweats, weight loss, eye pain, arthralgia, rash, sinus drainage, reflux, or frequent infections. He had no pets or birds and denied recent travel, tobacco smoke or occupational exposures.

On physical examination, oxygen saturation was 96% on room air at rest and he had bilateral fine crackles at the lung bases. Routine laboratory tests revealed decreased hemoglobin and elevated creatinine consistent with his chronic kidney disease. A Chest high-resolution computed axial tomography (HRCT) was performed and displayed fine ground glass opacities bilaterally with small airways thickening and diffuse tree in bud nodularity (Fig. 1).

The patient then underwent a bronchoscopy which demonstrated hyperpigmentation of the right upper lobe, right lower lobe and left lower lobe bronchi. Right middle lobe bronchoalveolar lavage was negative for bacterial, fungal and acid fast bacilli cultures. Cryo biopsy was obtained from right lower lobe and sent to Mayo Clinic Arizona for review. Biopsy revealed prominent anthracosis (Fig. 2).

A further detailed environmental history was obtained from the patient. He lived in a rural area in Sudan with no nearby factories. His wife used to bake the bread (or what is called “Kisra” in Sudan) in a small room that fits only for the stove and the person baking. It had a very small opening for ventilation. The wife used an open mud stove fueled by firewood or sometimes charcoal for at least 5 hours daily for about 30 years. The patient reported being occasionally around while his wife bakes and getting exposed to the fumes. This room was located at the corner of a small house which consisted of one bedroom and a

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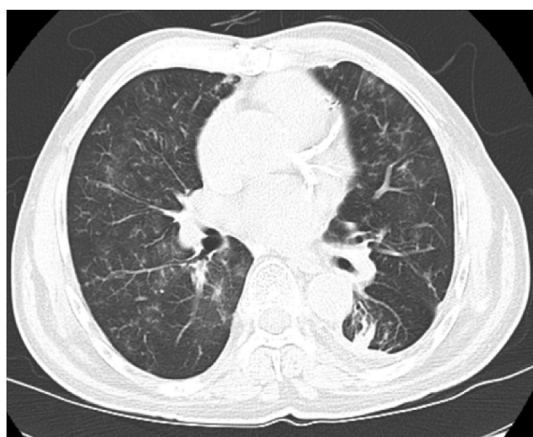


Fig. 1. High resolution chest tomography (HRCT) images of patient's lungs showing diffuse small airway thickening with cylindrical bronchiectasis. Diffuse bilateral fine ground glass opacities and diffuse tree-in-bud nodularity.

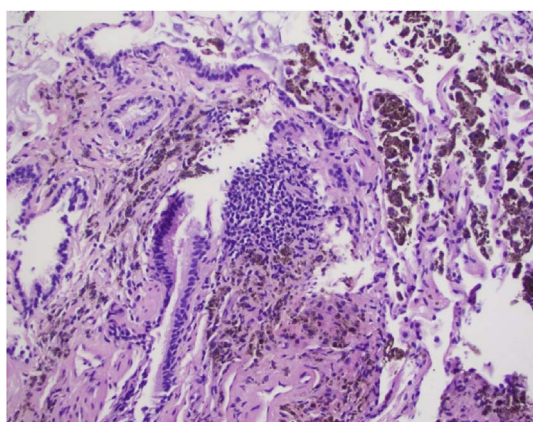


Fig. 2. Histopathologic features of Right lower lobe Cryo-biopsies. Anthracotic pigment accumulating along alveolar septae. Carbon-laden macrophages and carbon pigment deposition around the terminal bronchioles.

living room. Per patient, each room had multiple windows used for aeration. No fans or air conditioning were available back then. The patient himself used to cook on a daily basis for his family. Cooking took place using an open charcoal fueled stove on a balcony connected to the house. All meals were cooked using this stove. The patient reported occasional coughing spells during cooking in the smoky environment.

In correlation with his clinical history, imaging and pathology, the patient was diagnosed with “Hut lung” or domestically acquired particulate lung disease. Recommendations were made for avoidance of further smoke exposures and he was placed on cough suppressants.

3. Discussion

Biomass is any material derived from living or previously living material, including animal dung, twigs, grass, crop wastes, wood, and charcoal [1]. About half of the world's population, almost all in developing countries, rely on biomass fuels for domestic energy needs. Although the true incidence of domestically acquired particulate lung disease (DAPLD) is unknown likely secondary to poor access to health care, DAPLD is potentially the largest environmentally attributable disorder in the world with an estimate 3 billion at risk [3]. This condition is likely underdiagnosed because those at risk have poor access to health care resulting in significant morbidity from infancy to adulthood. This raises the importance of improved awareness, obtaining an extensive exposure history, and need for further invasive testing to

confirm the diagnosis of DAPLD.

The disease was first described by Palmer and Daynes in 1967 as Transkei silicosis, a form of domestically acquired pneumoconiosis [4]. Decades later, Grobbelaar and Bateman introduced the term “hut lung” in 1991 after they studied 25 women in this area [5]. Later, the term “domestically acquired particulate lung disease” was launched by Salvi et al., in 1994 [6].

The pathogenesis of DAPLD is attributed to the inhalation of particulates and various chemical compounds liberated from the combustion of these biomass fuel. These materials are typically burnt in simple stoves with very incomplete combustion. Larger fuel smoke particles are first filtered by the upper airways, and smaller particles will settle in the smaller bronchi and alveoli, leading to macrophage dysfunction with decreased clearance. Hut Lung manifests clinically with a broad range of disorders from chronic bronchitis with cough and dyspnea to advanced pulmonary fibrosis, cor pulmonale and massive mediastinal lymphadenopathy reported in some cases [7]. Radiologically, DAPLD manifests as ground glass opacities, pulmonary nodules, reticulation, and peri-broncho vascular thickening. Histological findings are carbon pigment deposition around the terminal bronchioles, dust laden macrophages and mixed dust fibrosis.

DAPLD is mainly observed in females, because the domestic tasks are performed by females in underdeveloped countries. It has been described in all age groups including infants and young children. In developing countries, the practice of mothers carrying infants on their backs while cooking, has been shown to be a proxy measure for infant exposure to high levels of biomass smoke from cooking fires accounting for increased mortality among infants due to respiratory failure [8].

No specific treatment is known for DAPLD. The only available form of treatment is prevention [3]. One possible solution is conversion to cleaner burning fuel sources, such as low-pressure petroleum gas or kerosene which is associated with smaller particulate counts and lower carbon monoxide levels. Additionally, these fuels are often more efficient allowing for shorter cooking times and reducing cumulative exposure. Unfortunately, these alternative fuels and modern stoves are usually more expensive and might be difficult for poor families to afford. Another option is to improve ventilation of cooking areas, by increasing number of windows or moving the stove to a separate outdoor area. The development of well controlled interventional trials and the commitment of sufficient resources to educate local populace is essential.

4. Conclusion

Indoor air pollution is a major environmental and public health hazard that can lead to several minor and major illnesses. This case clearly demonstrates persistence of physiologic, radiographic, and histopathologic abnormalities years after removal from exposure. The possibility of Hut Lung should be considered in individuals exposed to biomass-fueled stoves. This raises the importance of improved awareness, obtaining an extensive exposure history, and need for further invasive testing to confirm the diagnosis of DAPLD.

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Proprietary statement

None of the authors has commercial or proprietary interest in any drug, device, or equipment mentioned in the submitted article.

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