



Hut Lung

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Introduction

“Hut lung” is a type of pneumoconiosis found usually in non-smokers exposed to significant amounts of biomass fuel smoke over several years [1,2]. Biomass fuel or biofuel smoke is produced from burning wood, twigs, grass, charcoal, and other crops or natural residues. Biofuels are used primarily in underdeveloped countries as a main source of energy to light, heat, and cook in homes. However, most homes in underdeveloped countries also have poor ventilation, thus the residents, especially those tending or cooking over the fire, have more exposure to the biofuel smoke and increase their risk for developing “hut lung”.

Case Presentation

An 82-year-old thin Laotian woman presented to her PCP with symptoms of fatigue, weight loss and malaise. The patient’s past medical history included congestive heart failure, benign hypertension, hyperlipidemia, bronchitis, and gastric and peptic ulcers. Her surgical history was notable for bilateral tubal ligation and she had no family history of cancer. The patient also denied ever smoking in her lifetime. In work up of her symptoms a chest x-ray was obtained which was abnormal, showing mediastinal fullness. CT scans with and without contrast of the chest, abdomen, and pelvis were ordered to look for malignancy. CT of the chest displayed a 2 cm × 2.5 cm pulmonary mass in the right lower lobe in addition to bilateral hilar and mediastinal adenopathy, all of which were worrisome for malignancy. Thus, further evaluation with PET/CT was recommended. CT of the abdomen displayed a mildly dilated pancreatic duct and dilated common bile duct but otherwise no other findings were significant. CT of the pelvis was also benign. A whole body PET/CT scan was performed on the patient confirming a mass-like opacity in the right lower lung which was not FDG avid and multiple enlarged and/or prominent hypermetabolic right hilar and bilateral mediastinal nodes worrisome for a primary lung carcinoma, lymphoma or metastatic disease. The impression from the PET/CT was that the opacity may represent atelectatic lung tissue rather than a pulmonary mass and that even though it was not FDG avid, it could still be caused by some type of lung cancer. The patient was referred to the cardiothoracic surgery division for evaluation of the pulmonary mass. Mediastinoscopy was recommended and later performed in addition to lymph node biopsies. During the surgery, significant nodes were noted in the upper mediastinal region and nodes from level 4R were sampled and sent to pathology. The patient tolerated the procedure well and was safely discharged home the same day. The pathology of the two 4R nodes showed benign anthracotic lymph nodes negative for malignancy or granulomas. Due to both the CT scan and mediastinoscopy findings suggesting carcinoma, lymphoma, or metastasis, a right video-assisted thoracoscopy with mediastinal lymphadenectomy was recommended and performed. Upon VAT’s, there was a significant and considerable amount of anthracosis throughout the lung consistent with smoke exposure. Significant large anthracotic nodes were identified around 7R, biopsied and sent to pathology. Two wedge biopsies were obtained – one from the medial anterior segment of the lower lobe and one from the anterior inferior segment of the lower lobe. A 22 F right-sided pleural chest tube was left in place, and the patient was transferred to the recovery unit. The chest tube was removed a few days later the patient was safely discharged home. Pathology determined that the biopsies demonstrated pneumoconiosis consistent with mixed dust fibrosis, most likely reflecting “hut lung” (Figure 1). Sections of the biopsies showed ‘bridging’ fibrosis, dust macules, anthracosilicotic material, fibrous scarring, and silicotic nodules. Polarization also confirmed needle-shaped crystals consistent with silica (Figure 2 and 3). In addition, a few small histiocytic granulomas were found and stains for AFB, GMS and amyloidosis were performed and were found to be negative.

After the diagnosis was determined to be “hut lung”, the patient had discussions with her PCP and the surgical team. The patient had inhaled charcoal based smoke over several years while cooking and heating her home while living in Malaysia. Then after moving to New York, she and her

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Figure 1: Pathology determined that the biopsies demonstrated pneumoconiosis consistent with mixed dust fibrosis, most likely reflecting "hut lung".



Figure 3: Sections of the biopsies showed 'bridging' fibrosis, dust macules, anthracosilicotic material, fibrous scarring, and silicotic nodules.

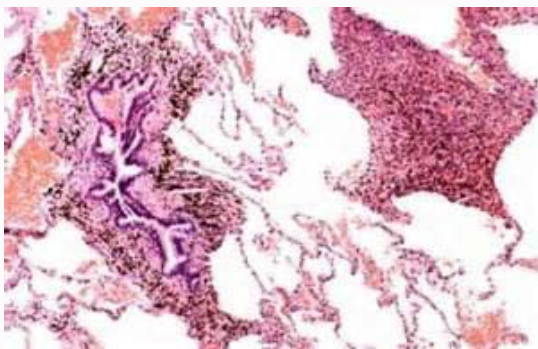


Figure 2: Sections of the biopsies showed 'bridging' fibrosis, dust macules, anthracosilicotic material, fibrous scarring, and silicotic nodules.

family used a wood burning fireplace for both cooking and heating. The patient herself had no history of smoking however she may have gotten second-hand smoke from family members that smoked.

Comments

Hut lung or Domestically Acquired Particulate Lung Disease (DAPLD) results from prolonged exposure to biomass fuel smoke causing an accumulation of anthracosis and fibrosis. Biomass fuel is used by greater than 50% of the world and includes: wood, twigs, grass, charcoal, and other crops or natural residues [1-4,6]. When burned, the smoke from the biomass fuel produces fine particles and dust that settle in the bronchioles and alveoli. In the study by Sandoval et al, [7] they discuss how wood smoke is composed of particles of varying sizes, "carbon monoxide, sulfur oxides, nitrous, oxides, [aldehydes, and polyorganic] matter, including polycyclic aromatic hydrocarbons," all of which are harmful toxins and pollutants that can irritate and damage the lung parenchyma [7]. If ventilation is poor, there is an increased risk of inhaling these fine particles and pollutants and over time, these particles accumulate and overwhelm the macrophages that normally rid the lung parenchyma of these foreign particles. Thus the particles that are not removed by the macrophages can irritate the lung parenchyma and cause fibrosis or just remain in the tissue causing anthracosis.

In this patient, her main symptoms were weight loss and fatigue rather than cough or dyspnea as in other reported cases of hut lung [1,2,4-7]. To our knowledge to date, there have been 5 other case reports involving immigrants from developing countries [1,2,4-6]. Of the 5 immigrants who developed hut lung, 4 patients reported dyspnea, 3 patients reported cough, and 2 patients reported sputum

production with 1 of the 2 having blood tinged sputum production [1,2,4-6]. Also in the studies done on groups of patients exposed to the biomass fuel smoke or wood smoke, the patients most commonly complained of cough and dyspnea [3,7,8]. However, all of the patients studied and reported all denied weight loss. In addition, several of the hut lung cases, pulmonary function tests were ordered and supported a restrictive lung disease such as hut lung pneumoconiosis but no such records for our patient were found. The pulmonary function tests would more than likely support our diagnosis if they had been performed or the records found.

A Bronchoalveolar Lavage (BAL) was not performed on our patient like some of the other hut lung patients. Patients that received a BAL had pigmented carbon laden alveolar macrophages and cultures that came back negative [1-6]. Given that our patient had significant anthracosis upon entering her chest in the thoracotomy, she would most likely have had similar results if we had performed a BAL. Her BAL would also have reflected more of hut lungs' coarser inclusions rather than the finer inclusions seen in BALs done on smoking patients, since our patient was a non-smoker [3]. The BAL might have been helpful to narrow our differential diagnosis if we had not been more concerned about the lung mass lesion.

The radiologic findings in this patient showed mediastinal lymphadenopathy, comparable to the other hut lung presentations. However this patient was the only one to our knowledge at this date to have a lung mass in addition to the mediastinal lymphadenopathy in a hut lung diagnosis. The discovery of the lung mass paired with weight loss as a symptom and the CT and PET scan findings made us more convinced that this could be a cancer or metastasis thus our more aggressive action of performing a right thoracotomy and performing wedge biopsies. In a hut lung case reported by Klaaver, et al. [4], they also performed a thoracotomy and noted significant anthracosis and black discoloration during their procedure. The standard for diagnosis of hut lung is histology performed on a transbronchial or open lung biopsy [1-6]. The pathology on this patient demonstrated fibrosis, anthracotic material contained in macrophages, small histiocytic granulomas, and silicotic nodules. These findings were consistent with the mixed-dust pneumoconiosis of hut lung. Several of the other patients with the biomass fuel smoke exposure also showed macrophages with anthracotic material and mixed dust fibrosis [1-7]. One other patient also showed silicates and silica but reported no granulomas as were found in our patient [5]. Most of the patients were also tested for mycobacteria and fungal specimens, all of which returned negative like they did in our patient [1-7].

Conclusion

Hut lung is a rare diagnosis that should be suspected in foreign immigrants presenting with cough, dyspnea and/or fatigue. A thorough history including the patient's work history, smoking history, and living conditions while in their home country should be elicited and can aid in recognizing hut lung. In work up of hut lung, chest x-ray, pulmonary function tests bronchoalveolar lavage, and bronchoscopy can help support the diagnosis. However, the gold standard for diagnosis requires histology from a transbronchial or open lung biopsy. The histology will show macrophages with anthracotic material, mixed dust fibrosis, and possibly silicates or silica, all characteristic of the mixed-dust pneumoconiosis of hut lung.

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