Fatal Hypersensitivity Pneumonitis from Exposure to *Fusarium vasinfectum* in a Home Environment: A Case Report

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Established Facts

- Hypersensitivity pneumonitis (HP) is a complex non-IgE-mediated pulmonary inflammatory disease triggered by the inhalation of multiple occupational and avocational antigens.
- The prognosis is generally favorable with early detection and prompt removal from the causative environment.

Novel Insights

- Nonoccupational cases of HP are increasing.
- Fatalities from HP are rare.
- Continuous, intense exposure to the offending antigen can lead to death.

Key Words

Hypersensitivity pneumonitis · *Fusarium vasinfectum* · Mold · Fatal case · Chronic exposure · Home environment

Abstract

**Background:** Hypersensitivity pneumonitis (HP) is a rare, non-IgE-mediated inflammatory lung disease caused by inhalational exposure to various antigens found in occupational, avocational and home environments. The prognosis is favorable with early detection and prompt removal of the causative agent, and fatalities are unusual. We present a fatal case of HP caused by chronic exposure to *Fusarium vasinfectum* mold in the home. **Case Report:** A 37-year-old white male presented with a 6-month history of progressively worsening dyspnea, cough, weight loss and fatigue associated with the self-renovation of his water-damaged, mold-infested mobile home. Evaluation included a physical examination (hypoxia, inspiratory crackles and expiratory rhonchi), baseline pulmonary function testing (mixed obstructive/restrictive pattern), chest computed tomography (bronchiectasis, fibrosis and diffuse interstitial involvement), bronchoalveolar lavage (macrophages 20%, lymphocytes 28% and neutrophils 52%) and transbronchial biopsy (interstitial fibrosis and chronic inflammatory infiltrate). Mold culture from the home grew out *F. vasinfectum*. An Ouchterlony double diffusion technique documented high antibody titer to *F. vasinfectum*. Despite aggressive intravenous corticosteroid treatment, the patient’s lung function declined to the extent that he could not be removed from ventilator support.
following an open lung biopsy, eventually resulting in death. **Conclusion:** This is the first reported case of fatal HP related to an acute exacerbation of a chronic form of HP following continuous and intense exposure to *F. vasinfectum*. Although uncommon, a high index of suspicion for HP is necessary in patients with progressive respiratory symptoms and known environmental antigen exposure. With early detection and prompt removal of the causative antigen, HP prognosis is generally favorable, but can progress to fatal disease with continued exposure.

**Introduction**

Hypersensitivity pneumonitis (HP), alternatively known as extrinsic allergic alveolitis or allergic interstitial pneumonitis, is a rare, highly complex non-IgE-mediated inflammatory disease of lung parenchyma, alveoli and airways in response to the inhalation of various antigens. The exact pathogenic mechanism is not fully understood. Both antibody- and cell-mediated immunologic responses may be involved [1, 2]. Numerous agents have been identified, including various species of fungi, bacteria and protozoa, animal and plant proteins, and inorganic low-molecular-weight chemicals. Classically, HP has been identified as a disease of specific occupations (e.g. farmer’s lung disease) and unique recreational activities (e.g. pigeon breeder’s disease). However, more recent data suggests an increase in cases of HP secondary to somewhat ordinary home exposures (e.g. pet bird antigens, feather bedding, contaminated hot tubs and household indoor molds) [2–5]. The prognosis is generally favorable with early detection and prompt removal of the causative agent, and fatalities are unusual. We present a fatal case of HP as a complication of an open lung biopsy during an acute exacerbation of chronic HP, secondary to continuous and intense daily exposure to *Fusarium vasinfectum* mold in a home environment.

**Case Report**

A 37-year-old white male presented with a 6-month history of progressively worsening dyspnea on exertion, 20 lb (9.1 kg) weight loss, fatigue and nonproductive cough. Over the 6-month period, the patient had been self-renovating his 10-year-old water-damaged mobile home in which he had lived for 5 years. He reported finding extensive mold involvement under the side panels of the mobile home. His health had significantly deteriorated to the point of having difficulty walking even short distances, prompting him to seek emergency care.

The patient’s past medical history revealed that 3 years prior an abnormal chest X-ray was found during a routine occupational medical evaluation prompting pulmonary function testing. The pulmonary function test indicated a mixed obstructive/restrictive pattern, leading to a diagnosis of possible asthma. The patient reported only minimal dyspnea with exertion at that time. The patient was advised to cease tobacco smoking and was started on daily asthma controller therapy. During the subsequent 3 years leading up to presentation, the patient reported recurrent episodes of cough and dyspnea triggered by exercise, viral upper respiratory infections, laughing and exposure to strong odors. He reported relatively stable symptoms on daily controller therapy and, as needed, use of short-acting β-agonists up until the time he began renovating the mold-contaminated mobile home.

An initial physical examination in the emergency department revealed a room air pulse oximetry of 88% and audible pulmonary inspiratory crackles and expiratory rhonchi. The examination was otherwise unremarkable. Baseline pulmonary function tests indicated a mixed obstructive/restrictive pattern (FVC 1.8/35%, FEV	extsubscript{1} 1.29/32%, FEV	extsubscript{1}/FVC 72%, DLCO 31% and TLC 32%). A high-resolution computed tomography chest scan revealed bronchiectasis, pulmonary fibrosis and diffuse interstitial involvement. Bronchoalveolar lavage revealed a predominance of neutrophils (52%), with lymphocytes (28%) and macrophages (20%) also identified. A transbronchial biopsy showed interstitial fibrosis and scant chronic inflammatory infiltrate. Mold cultures obtained from scrapings from the interior walls of the patient’s mobile home isolated *F. vasinfectum* alone. Both a commercially available serum precipitin mold panel (Northwestern University Feinberg School of Medicine) and a commercially available serum precipitin mold panel (Northwestern University Feinberg School of Medicine) were positive for mold exposure.
of Medicine CLIA Laboratory, Chicago, Ill., USA) and an Ouchterlon- 
yomy double diffusion test demonstrated the presence of serum an-
tibodies to *F. vasinfectum* (fig. 1).

The patient was placed on 2 liters of oxygen and treated with 
intravenous (IV) glucocorticoids. Despite high doses of IV gluco-
corticoids, the patient’s clinical status continued to decline prompting 
an air evacuation from Scott Air Force Base, Illinois, to Wilford 
Hall Medical Center, San Antonio, Texas, for more definitive care.

Continued deterioration of the patient’s lung status led to the 
decision to perform an open lung biopsy. Histologic findings on 
light microscopy were consistent with usual interstitial pneumonia 
(UIP). Following the open lung biopsy, the patient could not be 
weaned from ventilator support and had continued respiratory de-
cline resulting in death on hospital day 21.

### Discussion

HP is an uncommon immune-mediated pulmonary disease 
characterized by symptoms of dyspnea and cough 
due to inhalation of occupational and environmental an-
tigens. HP can present in acute, subacute or chronic forms 
depending on the type, intensity and duration of expo-
sure to the inciting agent [1]. The diagnosis of HP re-
quires a correlation between exposure history and symp-
toms supported by physical examination findings, and a 
variety of diagnostics tests to include serum precipitins, 
pulmonary function tests, radiographic findings, histol-
ogy data from bronchoalveolar lavage and lung biopsy, or 
direct inhalational provocation testing [2, 6]. The prog-
osis is generally favorable with early identification, 
prompt removal of the offending antigen and symptom-
tic treatment with corticosteroids [7]. However, contin-
ued antigen exposure can lead to a permanent loss in lung 
function, irreversible pulmonary fibrosis and even pre-
mature death [1].

Fatal HP is rare but has occurred following chronic ex-
posure to avian-protein antigens, thermophilic actinomy-
cetes in moldy hay, and following treatment with docetax-
el, an inorganic low-molecular-weight antineoplastic 
drug [1, 8, 9]. In the cases of avian-induced HP, a higher 
mortality rate was seen in males older than 44 years of age 
with prolonged antigen exposure, evidence of honey-
combining on chest imaging, and histological findings con-
sistent with an UIP pattern on lung biopsy [8, 10].

To our knowledge, we present the first reported HP 
fatality related to chronic exposure to *F. vasinfectum* in a 
home environment. *Fusarium* is a large genus of filamen-
tous fungi widely distributed on plants and in soil. The 
spores of *Fusarium* are large (about 40 μm in length) and 
sickle shaped, with pointed ends [11]. Despite their large 
size, it has been hypothesized that *Fusarium* spores re-

lease small antigenic material that can reach the terminal 
air sacs, where an immunologic response results [2, 12, 
13]. Different species of *Fusarium* have been isolated in a 
number of HP patients with exposures in both occupa-
tional and home settings [2, 4, 14–17], none of which 
were fatal. Our patient reported mild but recurrent symp-
toms of cough and dyspnea over a 3-year span, which 
were misinterpreted as asthma, while living unknowingly 
in his *F. vasinfectum*-contaminated mobile home. The di-
agnosis of HP was not suspected until after the patient 
developed significant dyspnea on exertion, daily fatigue 
and weight loss while attempting to repair the newly dis-
covered mold damage to the inner surface of the wood-
siding on his mobile home. Despite removal of the patient 
from the mobile home and aggressive IV corticosteroid 
treatment, the patient’s lung function declined to the 
point that he could not be removed from ventilator sup-
port following the open lung biopsy. The patient is be-
lieved to have died as a complication of an open lung bi-
opsy during an acute exacerbation of a chronic form of 
HP, following continuous and intense exposure to *F. 
vasinfectum* in his home, as demonstrated by a history of 
known antigen exposure, recurrent symptoms and weight 
loss, the presence of inspiratory crackles on physical ex-
amination, positive cultures obtained from the home, and 
the presence of positive precipitating antibodies to *F. 
vasinfectum* in the patient’s serum. The diagnosis of HP 
is further supported by the finding of chronic interstitial 
inflammation and diffuse pulmonary fibrosis on high-
resolution computed tomography and histologic evi-
dence of UIP on the surgical biopsy. Morell et al. [5] de-
scribed 20 out of 46 (43%) patients who had initially been 
diagnosed with idiopathic pulmonary fibrosis as per the 
current criteria [18], but were later diagnosed with chronic 
HP once exposure history and other diagnostic find-
ings were taken into consideration.

### Conclusion

Although rare, a high index of suspicion for HP is nec-
essary in the evaluation of a patient presenting with pro-
gressive respiratory symptoms and a history suggesting 
antigen exposure in the home, in addition to the more 
traditional occupational and recreational settings. Envi-
ronmental agents should also be considered in patients 
with idiopathic interstitial lung disease. Prognosis is usu-
ally favorable when detected early and the causative an-
tigen is avoided or removed. HP can progress to a fatal 
disease with continued exposure, as seen in this case.
Fatal Hypersensitivity Pneumonitis from F. vasinfectum Exposure

**Disclosure Statement**

Both authors have no conflicts of interest to declare pertaining to this article and approve its submission to *International Archives of Allergy and Immunology*. The opinions expressed on this document are solely those of the authors and do not represent an endorsement by or the views of the United States Air Force, the United States Army, the Department of Defense, or the United States Government.

**References**