RAM
Revista Alergia México

Original article

Domestic hypersensitivity pneumonitis caused by inadvertent exposure to feathers

Neumonitis por hipersensibilidad doméstica causada por exposición accidental a plumas

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Reception: 01/27/2025
Acceptance: 02/05/2025
Publication: 12/31/2025

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Abstract

Objective: Case series of patients with domestic hypersensitivity pneumonitis, focusing on hidden avian exposures or other non-suspected antigens (feather comforters and pillows).

Methods: Seven female patients diagnosed with non-occupational HP were evaluated using clinical records from La Paz University Hospital (2014–2022). Data collected included exposure history, HRCT findings, IgG antibodies, BAL, biopsies, and treatment outcomes.

Results: Patients had a median age of 53.5 years (range: 15–75), with varied exposure to birds or indirect sources like feather duvets. Diagnosis was made based on HRCT, BAL, and biopsy findings. Five patients removed the antigen source, resulting in symptom improvement and pulmonary function in non-fibrotic cases. Corticosteroid treatment was given to all, with one patient requiring oxygen therapy. The median FEV1 improvement was 50 ml, and three patients with a non-fibrotic pattern showed improved DLCO after treatment.

Conclusions: Early diagnosis and antigen avoidance are key to managing hypersensitivity pneumonitis (HP), especially in cases of hidden bird-related exposures. A multidisciplinary approach improved outcomes, particularly in non-fibrotic cases. Larger studies and broader antigen testing are needed to validate these findings and enhance diagnostic accuracy.

Keywords: Alveolitis; Extrinsic allergic; Hypersensitivity pneumonitis; Avian; Lungs, feather duvet; Interstitial lung disease.

Resumen

Objetivo: Serie de casos de pacientes con neumonitis por hipersensibilidad doméstica, enfocándose en exposiciones aviares ocultas u otros antígenos no sospechosos (edredones y almohadas de plumas).

Métodos: Se evaluaron siete pacientes femeninas diagnosticadas con neumonitis por hipersensibilidad no ocupacional. Se utilizaron los registros clínicos del Hospital Universitario La Paz (2014-2022). Se recolectaron datos del antecedente de de exposición, hallazgos en HRCT, anticuerpos IgG, BAL, biopsias y resultados del tratamiento.

Resultados: Se registró una edad media de 53.5 años (rango: 15-75). Las pacientes tuvieron diversas exposiciones a aves o fuentes indirectas (edredones de plumas). El diagnóstico se basó en los hallazgos de HRCT, BAL y biopsia. Cinco pacientes eliminaron la fuente del antígeno, lo que resultó en la disminución de síntomas y mejora en la función pulmonar en los casos no fibrosos. Se administraron corticosteroides a todas, y una paciente requirió terapia con oxígeno. La mejora media del FEV1 fue de 50 mL, y tres pacientes con patrón no fibroso mostraron una mejora en la DLCO luego del tratamiento.

Conclusiones: El diagnóstico temprano y evitar el contacto con el antígeno son importantes en el tratamiento de pacientes con neumonitis por hipersensibilidad, especialmente en quienes tienen exposiciones ocultas relacionadas con aves. El enfoque multidisciplinario mejora los resultados, particularmente en casos no fibróticos. Se requieren estudios con muestras más grandes y que realicen pruebas de antígenos más diversas para validar estos hallazgos y mejorar la precisión diagnóstica.

Palabras clave: Alveolitis; Alérgica extrínseca; Neumonitis por hipersensibilidad; Aviar; Pulmones, edredón de plumas; Enfermedad pulmonar intersticial.

Rev Alerg Mex 2025; 72 (4): 276-280
https://doi.org/10.29262/ram.v72i4.1462
www.revistaalergia.mx

INTRODUCTION

Hypersensitivity pneumonitis (HP) is an immune-mediated syndrome characterized by lung and respiratory tract inflammation caused by repeated exposure to certain antigens, such as fungi, bacteria, and chemicals, in susceptible and sensitized individuals.[1-3] Recent guidelines classify HP into fibrotic and non-fibrotic types, with diagnosis relying on the integration of clinical, radiological, serological, and pathological findings. Although underdiagnosis was previously common, it has improved due to enhanced diagnostic criteria and consensus among experts, leading to earlier diagnosis.[2,4,5]

Diagnosis involves evaluating exposure history, HRCT findings, IgG antibodies, BAL results, and pathology. Treatment emphasizes antigen avoidance and immunosuppressive drugs like corticosteroids, with symptom improvement often supporting the diagnosis.[1,4,6]

Although bird exposure is a well-known cause of HP, hidden exposures, such as feather duvets and pillows, are less frequently reported. This study aims to further evaluate patients with domestic HP, focusing on potential exposure to hidden avian or other unsuspected antigens.

METHODS

Data were gathered from electronic clinical records (DXC-HCIS) at La Paz University Hospital from 2014 to 2022. We included patients diagnosed with non-occupational HP in the Allergy Department. The following variables were documented: patient characteristics, medical history, living conditions, animal exposure, time to diagnosis, pulmonary function tests, HRCT scan findings, biopsy results, BAL findings, and treatment received.

Specific IgG antibodies to bird-related antigens were assessed using an enzyme-linked immunosorbent assay (ELISA) test. Serum samples were processed to detect antibodies against canary and parakeet feathers. Lung biopsies were obtained via thoracoscopic lung biopsy in one patient and the rest through transbronchial lung biopsy. Histopathological analysis included examination for fibrotic patterns, non-necrotizing granulomas, and ground-glass opacities. BAL was performed during bronchoscopy. A saline solution was instilled and aspirated to collect samples from the lower respiratory tract. Lymphocyte counts and CD4:CD8 ratios were measured using flow cytometry to assess inflammation and immune response.

RESULTS

We studied seven female patients with a median age of 53.5 years (range: 15–75 years), four of whom were non-smokers. Four patients had a history of seasonal allergic rhinoconjunctivitis, and one also had asthma (#2). Four patients owned pet birds. Among the three without birds, two had feather duvets and pillows with visible damp spots, and one had exposure to pigeon droppings and feathers due to living in an attic with a terrace (#1). The median duration from symptom onset to diagnosis was 8.5 months, with a median follow-up of four years (range: 1–8 years). **Table 1**

Diagnosis was made following ATS/JRS/ALAT Clinical Practice Guidelines and a multidisciplinary team approach.[3] All patients exhibited findings consistent with HP on HRCT scans. BAL was performed in four patients, with elevated lymphocyte counts in three; one had a CD4:CD8 ratio greater than 2. Lung biopsies were conducted in three patients, revealing fibrotic patterns in one and characteristic features such as ground-glass opacities and non-necrotizing granulomas in others. Serological biomarkers, such as KL-6, were not evaluated in this study due to limited availability and logistical constraints. However, the inclusion of such biomarkers could have provided additional insights into the diagnostic evaluation, since KL-6 has been suggested as a potential marker for pulmonary inflammation and fibrosis, and its assessment may aid in distinguishing between different forms of interstitial lung disease. Specific IgG antibodies to bird-related antigens were tested in all patients, and five patients removed the antigen to prevent further exposure.

All patients received oral corticosteroids, with one patient requiring continuous oxygen therapy. The patient with a fibrotic pattern maintained stable symptoms and pulmonary function tests without worsening after treatment. Three patients with a non-fibrotic pattern showed improved diffusing capacity for carbon monoxide (DLCO) after treatment, while three remained stable, and one experienced a decrease in DLCO post-treatment. The median improvement of FEV1 was 50 ml, four patients improved significantly while the rest maintained similar results of spirometry at follow-up. All patients improved reported symptoms (dyspnea, cough) after they received treatment and removed the suspected antigen to avoid exposure. Despite receiving specific treatment and removing the bird pet, one of the patients was not asymptomatic until she avoided the feather bedding.

DISCUSSION

In recent years, significant advances in understanding and diagnosing hypersensitivity pneumonitis (HP) have been made, building on the foundational work of researchers. Costabel et al.[1] emphasized the complexity of HP as a syndrome with diverse triggers, including environmental and occupational exposures, and highlighted the importance of comprehensive diagnostic criteria to improve early recognition and management.

The role of antigen diversity in HP pathogenesis has been underscored by Nogueira et al.,[2] who noted that the breadth of antigenic sources, including avian proteins and mold, contributes to diagnostic challenges. Our findings support this observation, as all patients tested positive for IgG antibodies to canary or parakeet feathers, despite some lacking direct bird exposure. This highlights the potential for indirect or unexpected sources, such as feather bedding or pigeon droppings, to contribute to underdiagnosis—a concern also raised by Enríquez-Matas et al.[8] and Alvarez-Fernández et al.[9] in their work on molds and humidifier-related antigens.

The reduction in diagnostic delay observed in our case series, with a median time from symptom onset to diagnosis decreasing to 6.5 months after 2016, reflects the impact of updated guidelines, such as those proposed by Raghu et al.[4] Early diagnosis and intervention, as demonstrated in our

Table 1. Demographic, epidemiological and clinical characteristics of the patients.

#	Age	Inadvertent exposure†	Bird pets	Lymph BAL	CD4/CD8	Chest HRCT scan‡	Biopsy pattern‡	IgG Canary℥	IgG Parakeet Droppings℥	IgG Parakeet Feathers℥
1	75	Yes	No	6	N/A	Traction bronchiectasis, cranio-caudally honeycombing	TBL: Intense honeycombing, few fibroblastic foci	43.40	50.20	42.00
2	15	Non identified	Yes	37	2.46	Bilateral mosaic attenuation and GGOs in UL	N/A	33.70	108.00	168.00
3	37	Non identified	Yes	N/A	N/A	Centrilobular nodules with GGOs in UL, air trapping	N/A	128.00	N/A	140.00
4	52	Yes	No	82	0.65	Diffuse centrilobular nodules with GGOs, air trapping	TBLB: Poorly formed NNGs, lymphocyte bronchiolitis	300.00	N/A	N/A
5	55	Yes	No	N/A	N/A	Mosaic attenuation, centrilobular nodules in UL	TBLB: lymphocyte bronchiolitis, and FM	N/A	19.40	N/A
6	62	Non identified	Yes	59	0.1	Centrilobular nodules with GGOs in medium and UL	N/A	N/A	200.00	200.00
7	43	Yes	Yes	N/A	N/A	Diffuse mosaic attenuation and GGOs in UL	N/A	8.86	N/A	9.38

† Refers to exposure to feather duvets and pillows, humidity spots at home, or contact with bird droppings or feathers without bird pets.
‡ Following ATS/JRS/ALAT Clinical Practice Guidelines.
℥ In milligrams/liters.
LymphBAL: percentage of lymphocytes in bronchoalveolar lavage; CD4/CD8: ratio of CD4 over CD8; HRTC: high-resolution computed tomography; GGOs: ground-glass opacity; UL: upper lobes; TLB: thoracoscopic lung biopsy; TBLB: transbronchial lung biopsy; NNGs: non-necrotizing granulomas; FM: foamy macrophages; IgG: immunoglobulin G; N/A: non-analyzed.

study, correlate with better patient outcomes, particularly in non-fibrotic HP, where improved DLCO was observed.

Our findings also resonate with Morell et al.[6,7] who explored the overlap between chronic HP and IPF, identifying antigen exposure as a key differentiating factor. Studies indicate that at least 43% of patients diagnosed with idiopathic pulmonary fibrosis (IPF) had chronic HP, with half of these cases attributed to occult exposure to feather bedding.[7] More recently, feather bedding use was found to contribute to HP in 26% of 127 recruited patients.[6] In our cohort, the absence of fibrosis in recent cases likely reflects quicker diagnosis and antigen avoidance strategies, underscoring the importance of heightened clinical awareness and patient education. The clinical relevance of antigen avoidance was further demonstrated by significant symptom improvement following the removal of bird-related products, reinforcing recommendations by Quirce et al. to prioritize environmental modifications in managing HP.

Finally, while the research by Fink et al.[5] highlighted gaps in understanding HP's pathophysiology and the need for targeted therapies, our study emphasizes the immediate benefits of preventive strategies and early treatment in mitigating disease progression.

This study has some limitations that should be considered when interpreting its findings. The small sample size of seven patients and its single-center, retrospective design may limit the generalizability of the findings. Additionally, relied on patient-reported exposure histories, which may introduce some recall bias. Despite these limitations, the findings provide valuable insights into the importance of early diagnosis, antigen avoidance, and treatment in managing hypersensitivity pneumonitis. This underscores the need for larger, multicenter studies to validate these observations and provide a more robust evidence base for HP diagnosis and management. Future research should also focus on identifying novel antigens and refining therapeutic approaches to address chronic and fibrotic HP.

CONCLUSIONS

This study highlights the significance of early diagnosis and antigen avoidance in the management of HP, particularly in cases involving hidden exposures to bird-related antigens such as feather bedding. Through a multidisciplinary approach and adherence to updated guidelines, most patients achieved symptom improvement, with non-fibrotic cases showing better pulmonary function outcomes. However, the study underscores the need for broader testing of potential antigens, the incorporation of biomarkers like KL-6 for enhanced diagnostic accuracy, and larger, multicenter studies to validate these observations.

DECLARATIONS

Contribution statement

All authors confirm contributions to the paper including study conception and design, data collection, analysis and interpretation of results, draft manuscript preparation and editing and revision. All authors reviewed the results and approved the final version of the manuscript.

Conflict of interest

The authors declare that they have no conflicts of interest.

Ethics responsibilities

The study was carried out in adherence to ethical standards, the Regulation of the General Health Law on Health Research, and the Declaration of Helsinki.

Human and animal rights and informed

Consent This article does not contain any studies with human, or animal subjects performed by any of the authors.

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Permissions

All figures and tables are original.

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