

A rare pediatric case of severe Bird Fancier's hypersensitivity pneumonitis presented with viral pneumonitis-like picture

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#### Abstract:

Bird Fancier's Syndrome is a rare, non-atopic immunologic response to repeated or intense inhalation of avian (bird) proteins/antigens found in the feathers or droppings of many species of birds, which leads to an immune mediated inflammatory reaction in the respiratory system. Although this is the most common type of hypersensitivity pneumonitis reported in adults, it is one of the classification of a rare subtype of interstitial lung disease that occurs in the pediatric age group of which few case reports are available in the literature. The pathophysiology of hypersensitivity pneumonitis is complex; numerous organic and inorganic antigens can cause immune dysregulation, leading to an immune related antigen-antibody response (immunoglobulin G-IgG- against the offending antigen).

Diagnosing Bird Fancier's disease in the pediatric age group is challenging, history of exposure is usually missed by health care providers, symptoms and clinical findings in such cases are nonspecific and often misdiagnosed during the acute illness with other common diseases such as asthma, or acute viral lower respiratory tract infection, and the lack of standardization of criteria for diagnosing such condition, or sensitive radiological or laboratory test.

Treatment, on the other hand, is also controversial. Avoidance of the offending antigen could be the sole or most important part of treatment, particularly in acute mild and moderate cases. Untreated cases can result in irreversible lung fibrosis.

In this case report, we highlight how children presenting with an acute viral lower respiratory tract infection can overlap with hypersensitivity pneumonitis. Early intervention with pulse steroids markedly improves the patient's clinical course.

**Keywords:** Bird Fancier's Lung (BFL); hypersensitivity pneumonitis (HP); chILD; pulse steroid.

**Abbreviations:** ILD: Interstitial lung disease, BFL: Bird Fancier's Lung, PICU: pediatric intensive care unit, HFNC: high flow nasal cannula, PPD: purified protein derivative, ESR: erythrocyte sedimentation rate, CRP: C-reactive protein, CXR: chest X ray, PCR: polymerase chain reaction, CT scan: computed tomography scan, TB: tuberculosis, BAL: broncho-alveolar lavage, ATS: American thoracic society.

**Case report:**

An 11-year-old previously healthy child presented to the emergency department with a 1-week history of dry cough, shortness of breath, and low-grade fever, with no associated symptoms of expectoration, hemoptysis, wheezing, contact with sick people, or recent travel, and no history of weight loss. His past medical history was unremarkable, and he was fully vaccinated in accordance with his age. Physical examination revealed an afebrile child with remarkable tachypnea with moderate respiratory distress, desaturation requiring oxygen, subcostal and intercostal retractions, and decreased air entry bilaterally on lung auscultation without any wheeze or crackles. A chest x-ray (CXR) showed bilateral diffuse miliary nodules (Figure1). The child required pediatric intensive care unit (PICU) admission for close observation and further management where he was started on IV cefuroxime and oral clarithromycin and tamiflu and required a high flow nasal cannula (HFNC) for oxygen support. Respiratory virus polymerase chain reaction (PCR) showed Bocavirus positive. The child remained tachypneic with persistent respiratory distress and continued to require high oxygen therapy. Repetition of his CXR imaging showed persistent diffuse bilateral military infiltrations. A CT scan of the chest showed diffusely reticular-nodular opacities in both lungs involving lung bases and the posterior segments of the right and left upper and lower lobes with irregular broncho-vascular marking (Figure2). Purified protein derivative (PPD) and QuantiFERON-Gold showed negative results. The child showed improvement of his symptoms on day 10 of his hospital admission and was able to be weaned off oxygen support and he was discharged in a stable general condition with a mild dry cough.

A few days after discharge, the child presented again to the emergency department with a worsening cough and progressive shortness of breath, also with physical findings of hypoxia and respiratory distress, he required admission to our tertiary hospital. A detailed environmental history review noted exposure to birds (pigeons) for a duration of around one year as the family were keeping them in-house. His physical examination revealed an afebrile child with tachypnea and hypoxia requiring 2 L of oxygen via nasal cannula, grade 1 digital clubbing, mild respiratory distress with nasal flaring, and decreased air entry bilaterally on lung auscultation without wheezing or crackles. A complete blood count showed leukocytosis with neutrophilia, an erythrocyte sedimentation rate (ESR) of 37 mm/h (N:0–10 mm/h) and a C-reactive protein (CRP) count of 78 mg/L (N:0–8 mg/L). Renal function and liver enzymes were normal, his arterial blood gas showed a PH of 7.39, a PCO<sub>2</sub> of 45, a PO<sub>2</sub> of 60, and a BE of 2 and he was unable to perform a pulmonary function test (PFT) initially due to poor effort. A sweat chloride test showed normal results, and measures of immunoglobulins (Ig) A,M,G,E, immunoglobulin subclasses, the flow cytometry lymphocytic subset and the HIV combo test all came back normal. Autoimmune work up showed a negative antinuclear antigen screen (ANA) and anti-glomerular basement membrane antibodies. The child underwent a flexible bronchoscopy evaluation that showed normal airway anatomy and dynamic, with no signs of chronic airway inflammation. The BAL sample showed unsatisfactory results for cell and differential counts, but the BAL microbiology and virus results were negative. An echo of the heart showed normal cardiac function and no signs of pulmonary hypertension.

The child's symptoms continued to worsen with progressive dyspnea and dry cough, and the decision was made to undergo an open lung biopsy with histopathology findings suggestive of

acute hypersensitivity pneumonitis (HP) (Figure 3,4) with the specific bird IgG to pigeon feathers (131 mcg/ml, normal <22). The patient began treatment with pulse steroid therapy (60mg/kg/day) for 3 days with the plan to give 3–6 cycles of monthly pulse steroids with follow up in outpatient clinic.

The child was seen on a monthly basis in the outpatient clinic. He showed dramatic clinical improvement after monthly pulse steroid therapy, and he was subsequently weaned off oxygen with improvement in his lung volume in his PFT results (Table 1).

## Discussion:

Bird Fancier's Syndrome hypersensitivity pneumonitis is a rare non-atopic immunologic subtype of interstitial lung disease (ILD). It occurs due to repeated or intense inhalation of avian (bird) proteins/antigens found in the feathers or droppings of many species of birds, leading to an immune mediated inflammatory reaction in the respiratory system (1).

The pathophysiology of hypersensitivity pneumonitis is complex and not well understood. Numerous organic and inorganic antigens can cause immune dysregulation, leading to an immune related antigen-antibody response (immunoglobulin G (IgG-) against the offending antigen) (2,3,4). Others have suggested underlining genetic factors that may contribute to the development of BFL (1). Pathologically, it leads to distinguishable parenchymal changes, lymphocytic plasma cell infiltration, foamy macrophages, and non-caseating granulomas, which were all identified in our patient's histopathology report (fig 3,4)(4).

Few case reports in pediatric age are available in the literature. The largest publication of pediatric Bird Fancier's Lung (BFL) was reported by Morell et al. in 2008: 86 patients, over a 30-year period, with a rate of up to 8% of children younger than 15 years (5). HP can be classified into three disease stages—acute, subacute, and chronic—all with unique clinical presentations (5). Clinical, radiological, and histopathologic findings depend on the disease stage at the time of evaluation. During the acute phase, symptoms and clinical findings are nonspecific and often misdiagnosed as asthma, acute tuberculosis (TB) infection, or acute viral lower respiratory tract infection, which share similar clinical and radiological findings with the acute phase of HP (6).

Currently, diagnosing Bird Fancier's HS disease is challenging. There is uncertainty about the significant exposure duration to such antigens leading to the clinical symptoms (3). The criteria for diagnosing HP are not well standardized with management guidelines in the pediatric age group still lacking (5,7). We believe that our patient's superimposed viral infection (Boca virus) either triggered or flared up the disease. Our case lacked careful environmental exposure history (such as birds); the patient's insidious acute presentation overlapped with the underlying viral illness, which made it difficult for the healthcare providers to make the appropriate diagnosis during the first admission. This is why the disease often goes unrecognized in the pediatric population (3).

Treatment, on the other hand, is also controversial. Environmental avoidance of the offending antigen has been reported as the sole treatment which helps the resolution of symptoms in a few patients (3). Others have tried oral steroids (5, 8,9). Another approach is treatment with intravenous pulse steroids for 3–6 month. This is considered for severe cases (3) and was recently reported in a case study poster at the latest American Thoracic Society (ATS) international conference (10). In such cases, it is crucial not to delay the diagnosis until the child's condition progresses to the chronic stage with irreversible restrictive pathology due to fibrosis (11).

Upon follow up, our patient had received 6 doses of IV pulse steroids (60 mg/kg) on a monthly basis with the first dose received within one month of the onset of clinical symptoms. He showed significant improvement of clinical symptoms after the second dose in terms of resolution of the tachypnea, SOB, and the ability to perform regular school exercise. Home oxygen therapy was successfully weaned off during outpatient follow up with improvement in his pulmonary function test results (Table 1).

#### Conclusion:

Bird Fancier's Syndrome is a rare entity of HP that occurs in children. Environmental exposure history is an important factor for early disease recognition. The initiation of pulse steroid therapy in severe cases during the acute phase dramatically improves clinical symptoms and prognosis, preventing disease progression and lung fibrosis development.

#### Conflict of interest:

The authors, Basel Habra and Atqah AbdulWahab , declare that there is no conflict of interest regarding the publication of this paper.

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Pulmonary function test	First dose therapy (Pred%)	Third dose therapy (Pred%)	Sixth dose therapy (Pred%)
FEV1	74	63	82
FVC	69	69	81
FEV1/FVC	107	91	100
DLco	51	63	69
TLC	64	60	72
RV	75	61	86
RV/TLC	111	97	112

(Table1: Pulmonary function test results after first, third, and sixth dose of pulse steroid therapy.)

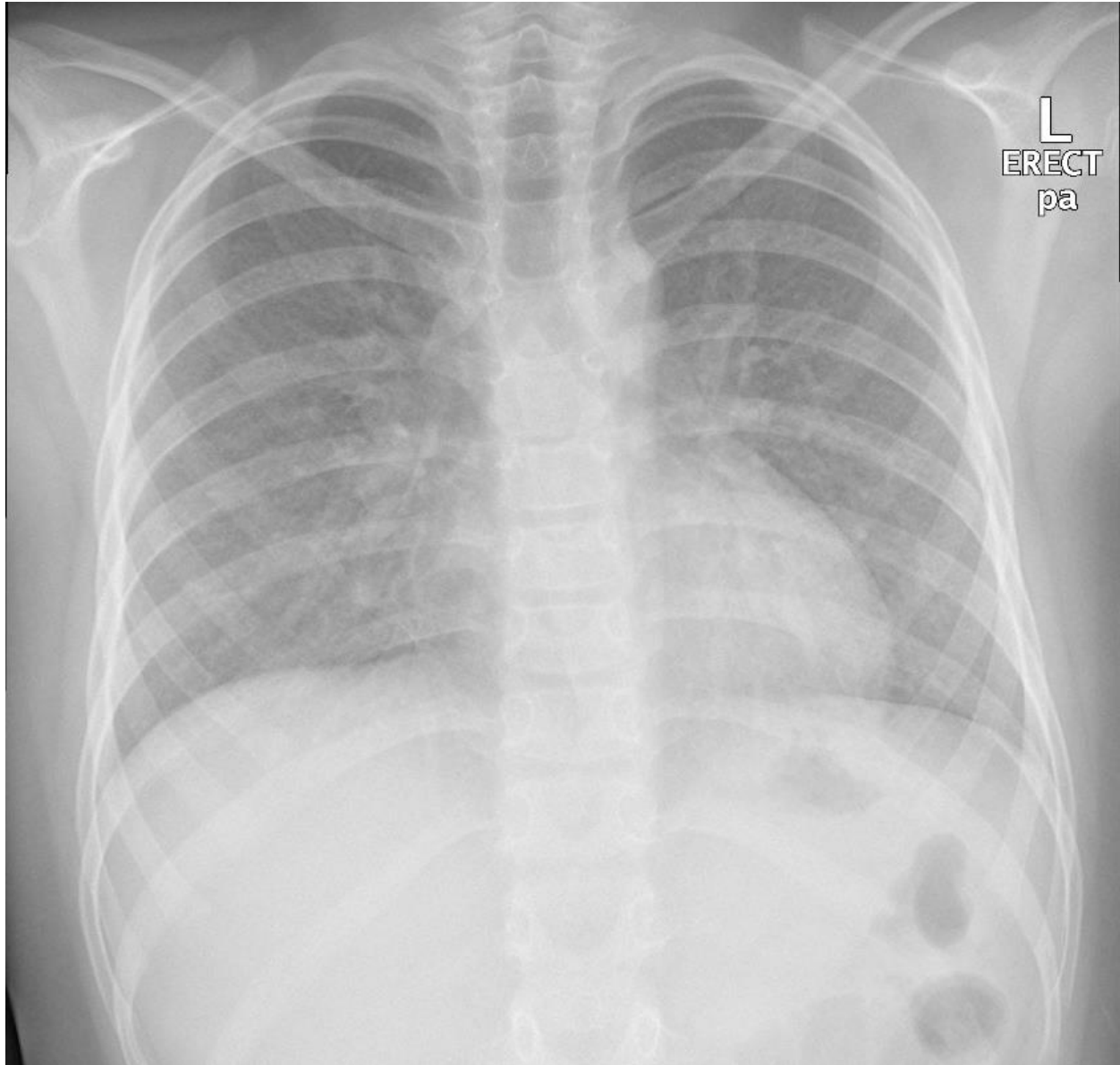


Figure 1: Patient first chest x-ray (CXR) showed bilateral diffuse miliary nodules.



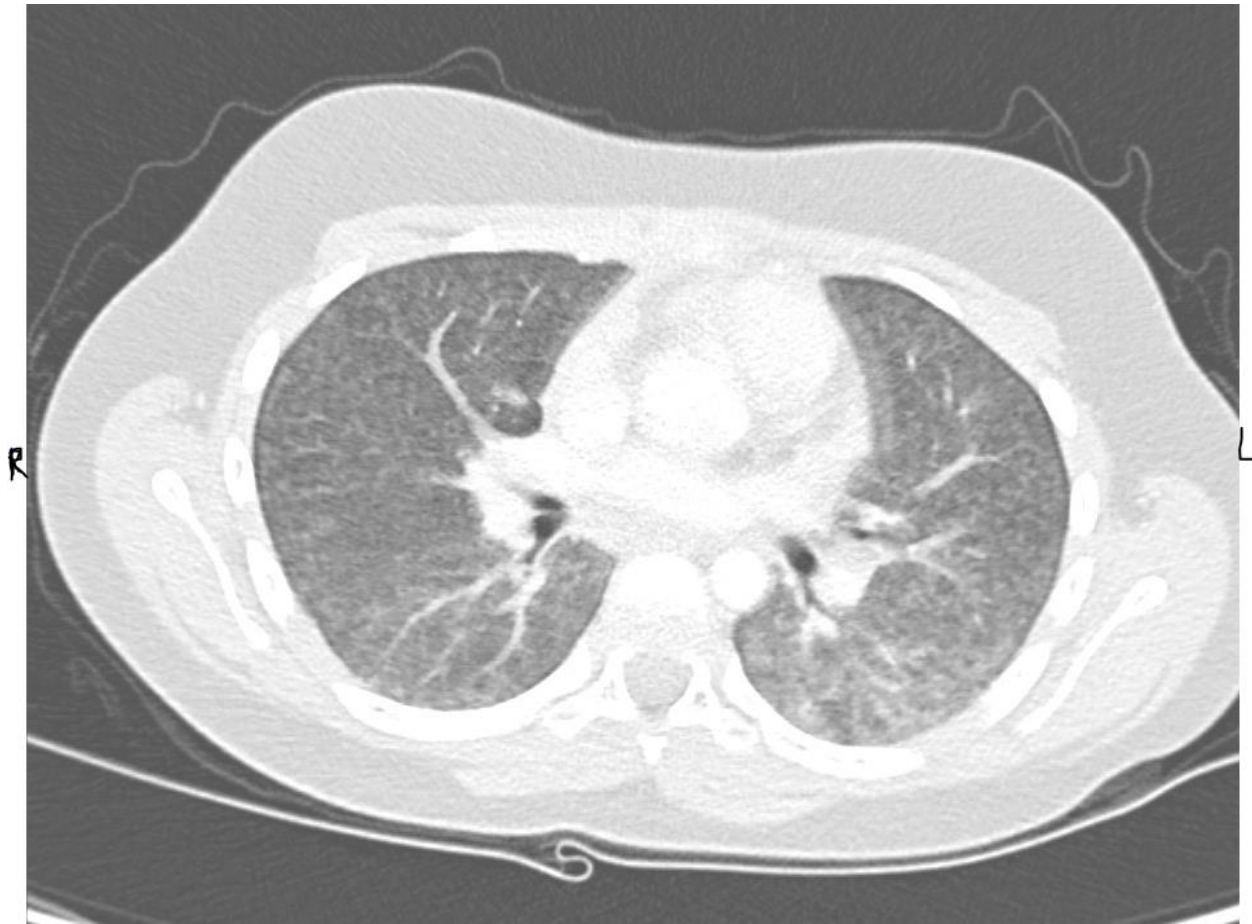


Figure 2: Patient CT scan of the chest showed diffusely reticular-nodular opacities in both lungs involving lung bases and the posterior segments of the right and left upper and lower lobes with irregular broncho-vascular marking.

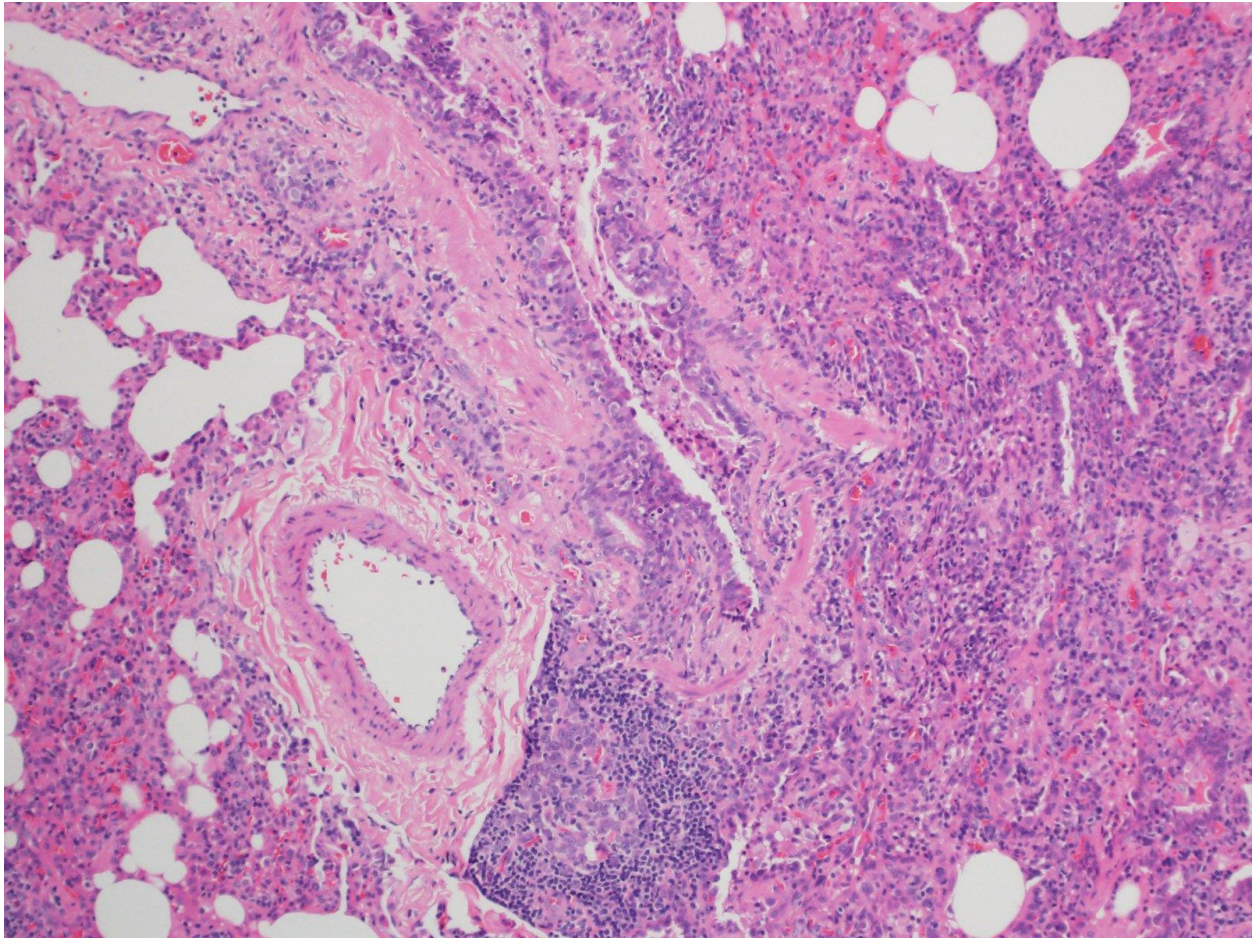


Figure 3



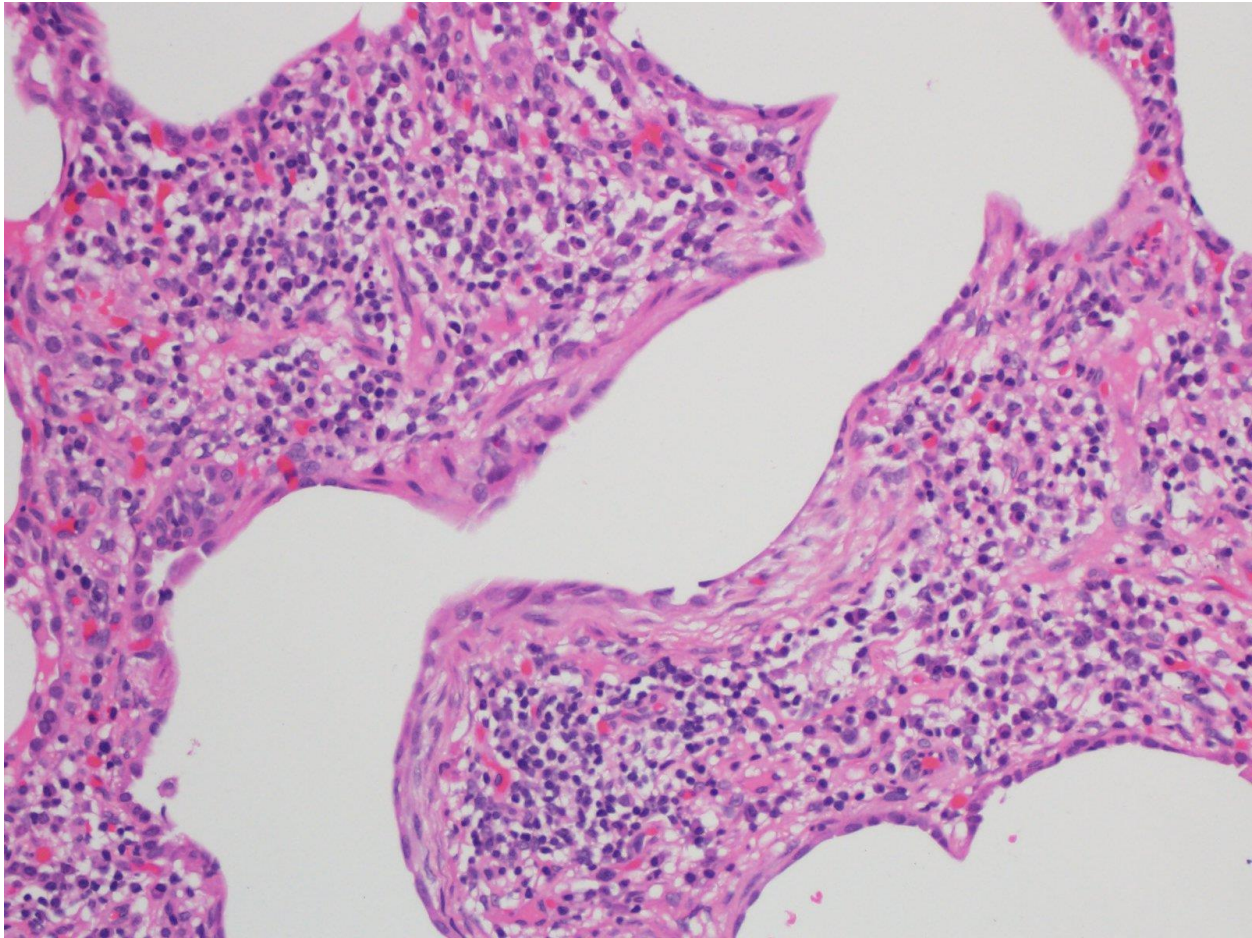


Figure 4: Sections show wedge lung biopsy characterized by patchy inflammatory process. The inflammation is bronchiolocentric (Fig. 3) with significant extension into the interstitium consisting of sheets of lymphocytes, plasma cells, foamy macrophages, and rare eosinophils as well as neutrophils (Fig. 4). No definitive granulomas, desquamation, vasculitis, significant eosinophilic infiltrate, Langerhans' cells, or fibrosis are seen. Special stains for fungi, acid-fast organisms and viral inclusions are negative.