**A Distinctive Encounter with Diffuse Alveolar Hemorrhage in Granulomatosis with Polyangiitis and Pneumonia**

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Key clinical message

Diffuse Alveolar Hemorrhage (DAH), a critical condition, often presents with hemoptysis, anemia, and diffuse pulmonary infiltrates. This case report of a 15-year-old highlights the diagnostic and therapeutic complexities, emphasizing the need for timely recognition and a multidisciplinary approach to manage autoimmune and infectious complications in pediatric respiratory distress.

Key words

* Diffuse Alveolar Hemorrhage (DAH)
* Granulomatosis with Polyangiitis (GPA)
* Pediatric pneumonia
* Respiratory distress
* Hemoptysis
* Autoimmune vasculitis

1. **Introduction**

Diffuse Alveolar Hemorrhage (DAH) represents a rare and critical clinical entity characterized by hemorrhagic involvement of the pulmonary vasculature, specifically the pulmonary arteries, pulmonary venules, and alveolar capillaries. This pathological process culminates in the accumulation of erythrocytes within the alveolar space, posing a significant and potentially life-threatening challenge to patient health1–3. The clinical spectrum of DAH varies from acute respiratory distress syndrome to more subtle presentations, such as a persistent cough. This article emphasizes the pivotal role of recognizing the classic triad of symptoms—hemoptysis, anemia, and diffuse pulmonary infiltrates—as a diagnostic framework, providing clinicians with a strategic approach to timely identification and management of this complex and high-stakes condition4,5.

Given the nuanced and diverse clinical presentations associated with DAH, healthcare professionals are urged to maintain a heightened clinical suspicion, particularly when confronted with patients displaying unexplained respiratory distress or subtle constitutional symptoms. This article underscores the critical need for an advanced understanding of the classic triad, serving as a practical tool for clinicians to navigate the diagnostic challenges inherent in DAH4. The timely application of this knowledge is imperative for facilitating accurate diagnoses and implementing appropriate therapeutic interventions in order to mitigate the potentially dire consequences of this condition6.

This case report details a 15-year-old female initially treated for severe pneumonia, who later progressed to respiratory failure due to Diffuse Alveolar Hemorrhage (DAH). Serological testing revealed the presence of Granulomatosis with Polyangiitis, underscoring the importance of considering rare conditions in respiratory distress cases. The report highlights the diagnostic challenges and emphasizes the need for a comprehensive approach in managing such complex clinical presentations.

1. **Case history and examination**

A 15-year-old female patient referred from multiple healthcare facilities, presenting with a one-week history of fever, progressive dyspnea, chest pain, and hemoptysis. Despite the nuanced absence of classical symptoms such as joint pain, weight loss, rash, photosensitivity, or hematuria, her clinical picture evolved from initial exertional dyspnea to a distressing state even at rest. Physical examination at presentation revealed pallor and mild respiratory distress, with vital signs indicating a respiratory rate of 22/min, pulse of 92 beats per minute, and blood pressure measuring 100/60 mmHg. Auscultation unveiled bilateral diffuse crepitation, predominantly on the right side of the chest. In contrast, per abdominal, cardiovascular, and neurological examinations yielded unremarkable findings.

1. **Methods**

The initial laboratory profile revealed a hemoglobin level of 6.5 gm/dL, total leukocyte count (TLC) of 6300/cumm, and a platelet count of 166,000/cumm. Biochemical parameters included a urea level of 31 mg/dL, creatinine at 0.9 mg/dL, an elevated erythrocyte sedimentation rate (ESR) of 120, and a C-reactive protein (CRP) level of 450. Urine analysis indicated numerous red blood cells and 2+ albumin. Serial chest X-rays shown in **Figure 1 and Figure 2**, unveiled progressive bilateral opacities in the middle and lower zones, coupled with bilateral pleural effusion apparent on chest ultrasound. Notably, pleural tapping did not yield evidence of infective effusion. As the patient's respiratory distress escalated, necessitating intervention, elective endotracheal intubation was performed.

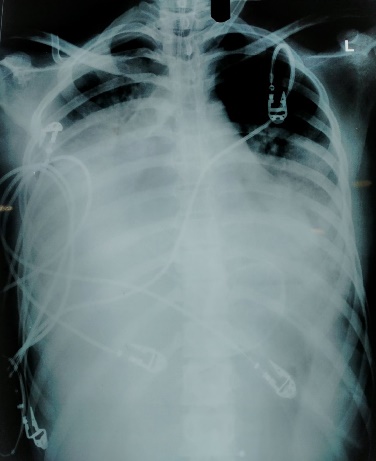


Figure 1: Chest X ray showing bilateral infiltrate more on right



Figure 2: Chest X ray showing progression of hemorrhage side

Subsequent high-resolution computed tomography (HRCT) post-intubation revealed diffuse patchy ground glass opacities in bilateral lungs, with right lobar consolidation exhibiting liquefaction and an air-fluid level. Further diagnostic endeavors included serological testing, which revealed an elevated myeloperoxidase (MPO) titer with a positive antineutrophil cytoplasmic antibody (ANCA) report. Conversely, tests for proteinase 3 (PR3), anti-glomerular basement membrane (Anti-GBM) antibody, double-stranded DNA (ds-DNA), and anti-histone antibody returned negative results. Notably, given the suspicion of pneumonia superimposed on diffuse alveolar hemorrhage, a sputum culture was sent, unraveling a multidrug-resistant Acinetobacter infection, sensitive to polymyxin B and colistin.

1. **Conclusion and results**

The patient's therapeutic regimen commenced with intravenous immunoglobulin (IVIg) and intravenous methylprednisolone pulse therapy (1gm daily) for five days to address the diffuse alveolar hemorrhage. Colistin, at a dosage of 4.5 million units twice daily for ten days, was initiated for the concurrent pneumonia. Over the course of her hospital stay, the patient received six units of blood transfusion. As her consciousness level gradually improved and chest findings ameliorated, she underwent successful extubation after nine days. Post-extubation, the patient was administered rituximab at dosage of 500mg escalating per hour and was subsequently discharged on an oral prednisolone regimen (40mg daily for two weeks). Follow-up care involved weekly visits for rituximab infusion over an additional three-week period.

This case emphasizes the complexities in diagnosing and managing diffuse alveolar hemorrhage (DAH) associated with Granulomatosis with Polyangiitis (GPA). The nuanced presentation, specific laboratory and imaging findings, and a successful multidisciplinary treatment approach underscore the need for heightened awareness and tailored strategies, especially in pediatric cases.

1. **Discussion**

Diffuse Alveolar Hemorrhage (DAH) is a rare and potentially life-threatening condition characterized by bleeding within the pulmonary vasculature, resulting in the accumulation of red blood cells in the alveolar spaces2. This case report highlights the complex presentation of a 15-year-old female who initially presented with symptoms mimicking severe pneumonia but was later diagnosed with DAH, unveiling an underlying association with Granulomatosis with Polyangiitis (GPA)7,8.

The initial challenge in this case was the absence of classical symptoms typically associated with GPA, such as joint pain, weight loss, rash, myalgia, or hematuria9. This underscores the diverse clinical manifestations of GPA, emphasizing the importance of considering atypical presentations, especially in pediatric patients. The progressive evolution of dyspnea, chest pain, and hemoptysis from exertion to rest further added to the diagnostic complexity, necessitating a thorough investigation8,9.

Laboratory findings played a crucial role in establishing the diagnosis. The elevated MPO titer and positive ANCA result were indicative of an autoimmune etiology, prompting further exploration into GPA10. Negative results for other autoantibodies like PR3, Anti-GBM antibody, ds-DNA, and Anti-histone antibody ruled out alternative autoimmune conditions, reinforcing the specificity of the association between DAH and GPA in this case10,11.

Imaging studies, including serial chest X-rays and HRCT, revealed the extent of pulmonary involvement with bilateral opacities and pleural effusion. The distinctive finding of right lobar consolidation with liquefaction and an air-fluid level on HRCT shown in **Figure 3,** post-intubation was noteworthy, contributing to the characterization of the disease course12. These imaging findings, coupled with the clinical progression, supported the diagnosis of DAH associated with GPA.

Figure 3: CT chest showing progression of hemorrhage



The subsequent detection of multidrug-resistant Acinetobacter infection further complicated the clinical situation, underscoring the potential difficulties in managing infectious complications in patients with autoimmune conditions. Consequently, antibiotics were prolonged for an extended duration. However, a multinational study conducted in the ICUs of Singapore, Thailand, and Nepal by Yin Mo et al.13 demonstrated that short-course treatment (lasting ≤7 days) was as effective as the conventional longer treatment (lasting ≥8 days) in terms of mortality or pneumonia recurrence within 60 days. This study proposes that tailoring antibiotic regimens to individual needs and shortening their duration could alleviate side effects and reduce the risk of antibiotic resistance, benefiting both well-resourced and resource-limited healthcare settings.

The multidisciplinary approach to treatment, involving intravenous immunoglobulin (IVIg) and intravenous methylprednisolone pulse therapy for DAH, colistin for pneumonia, and blood transfusions for severe anemia, exemplified the intricate balance required in addressing both the autoimmune and infectious aspects of the patient's condition.

**Consent**

A written consent was taken from the patient and patient’s parents, adhering to the journal's policy on patient consent.

**Conflict of interest**

The authors declare that they have no conflicts of interest.

**Data availability**

The data underlying this case report are available from the corresponding author upon reasonable request.

**Table of Figures**

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[Figure 1: Chest X ray showing bilateral infiltrate more on right 3](#_Toc172051449)

[Figure 3: CT chest showing progression of hemorrhage 5](#_Toc172051450)

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**Authors Contribution:**

The authors confirm contribution to the paper as follows:

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     + conceptualization
     + framing of the case report
     + implementation of the research plan
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