

A case of Pulmonary Vasculitis Provoked by the Treatment of Respiratory Infection

Jianbo Hong¹, Cheng Xiong¹, Mimi Zhou^{1*}, Yue Chen¹

¹ Department of Geriatrics, Hangzhou Wenzhong Hospital, Hangzhou, China

Email Address

1473454439@qq.com (Mimi Zhou)

*Correspondence: 1473454439@qq.com

Received: 18 February 2024; **Accepted:** 12 March 2024; **Published:** 10 April 2024

Abstract:

This was an advanced female with a history of COPD for over 20 years. She had been allergic to alcohol since childhood. One month ago, the patient suffered from respiratory symptoms with a high fever. Combined with an elevated level of WBC, positive antibody for Coxsackie Virus and rheumatoid factor (RF) detection, a diagnosis of infection in lower respiratory tract on her iconography. As a result, Cefoperazone was given for it, and a single dose of Methylprednisolone for her fever. Galactomannan (GM) turned out positive when the fever subsided, and Caspofungin had to be applied to it. A period of intermittent fever happened to her later, in which, fewer efficacy of antibiotics was achieved, but being sensitive to GM. Integrated with other clinical evidence, a “foggy” exudation was first found, distributing alongside her lung markings, on her repetitive CT scanning; and a diagnosis of pulmonary vasculitis was reasonably suspected, being followed by a small-dose GC therapy with the previous antibiotics discontinued. Her condition improved a lot since then. We thought that glucocorticoids therapy should be carefully chosen to deal with symptoms, in an aged patient due to its dualism.

Keywords:

Pulmonary vasculitis, Allergy, Glucocorticoids, Respiratory, Infection Aspergillosis, Antiseptic Therapy

1. Introduction

This was an 89-year-old female who was hospitalized with a complaint of recurrent cough and expectoration for over 20 years, being diagnosed as COPD. She had been allergic to alcohol since childhood. One month ago, she experienced an episode of accelerated respiratory symptoms with a high fever. Her white blood cell went up, along with a positive antibody for Coxsackie Virus and rheumatoid factor (RF) measurement. A diagnosis of infection in lower respiratory tract was made on her iconography, and Cefoperazone was initially chosen to kill the germs, together with a single dose of Methylprednisolone for the high fever. The galactomannan (GM) turned out positive while the fever subsided, and antifungal therapy (Caspofungin) had to be applied to the patient. A period of intermittent fever occurred later, during which, fewer efficacy of antiseptic therapy was achieved, but being sensitive to a

single dose of Dexamethasone [1]. There was a “foggy” exudation on her following CT scanning. Integrated with other clinical evidences, a diagnosis of pulmonary vasculitis was reasonably made and a small-dose GC therapy was orally used with the previous antibiotics being discontinued. Her condition improved steadily since then.

2. Case Report

This was a 87-year-old female who was admitted to hospital with a complaint of recurrent cough and expectoration for over 20 years, associated with exertional dyspnea. One month ago, an episode of accelerated respiratory symptoms emerged with a high fever (39.2°C), and her oxygen saturation (Sat O₂) dropped down to 88% once. There was a history of primary hypertension(grade III), and being sensitive to alcohol since childhood. She denied the past history of pulmonary tuberculosis. A few moist rales were heard on the bases of her lungs on auscultation. CBC: WBC $8.41 \times 10^9/L$, N 0.82. There was a positive RF result, along with a weakly positive antibody (IgM) for Coxsackie Virus-B type, and so was the galactomannan (GM) in her serum. The negative sputum culture for bacteria was present. Her lungs texture increased thickly, but no exudative focus was discovered on the pulmonary CT scanning (Figure 1).



Figure 1. Lungs texture being increased thickly, but no exudative focus discovered.

A combination of Cefoperazone and Caspofungin was applied to the treatment of low respiratory tract infection, but few efficacy was achieved for it [2]. And a period of intermittent fever occurred later, fluctuating from 37.3°C-38.2°C, with a relative good condition. For its etiology, a repetitive CT-scanning was carried out and found a “foggy” focus, exudative in nature, which distributing alongside the lung marketings on her left lung (Figure 2).



Figure 2. A “foggy” focus distributing alongside the lung marketings on the left.

The focus was different from classical infiltration or consolidation in imaging; instead, distributing alongside the lung markings and representing with a “foggy” exudation, so a diagnosis of pulmonary vasculitis was reasonably suspected on the basis of her history of being allergic to alcohol, sensitive to glucocorticoids, and a positive RF result. As a result, a small-dose GC therapy, Metrol® 4mg, qd, after discontinuing the cephalosporin mentioned above, was given orally for pulmonary vasculitis. The refractory fever subsided since then, and her focus on her left lung was disappeared on her iconography. Her situation improved steadily [3].

3. Discussion

This was an advanced female who was admitted to hospital due to her recurrent fever and respiratory infection, and the broad-spectrum antibiotics and glucocorticoids (GC) were then given intravenously to treat it. There were an elevated WBC associated with a positive galactomannan (GM) in her blood, then Caspofungin, as antifungal therapy, was applied to her condition, but fewer efficacy was achieved, along with a concomitant low fever since then. During which, Dexamethasone was once injected for her intermittent fever, but it relapsed again. Monitoring her pulmonary CT scanning dynamically, some features about pulmonary vasculitis were found for the first time [4], based on a positive RF result and supported by the fact that there was a quick response to GC for changeable morphology of her foci on her lungs, a diagnosis of pulmonary vasculitis was reasonably established, which was finally verified by the follow-up immune-suppressed therapy; suggesting that a precise diagnosis is essential to the subsequent treatment, leading to a better outcome.

Pulmonary vasculitis is a kind of necrotizing vasculitis with multi-system involvement affecting the systemic immune system, which may be related to infection, allergic reaction, autoantibodies and deposition of circulating immune complexes (CIC). The lungs have a rich vascular bed and maintains the largest contact area with the outside world through the respiratory tract, so the pulmonary blood vessels are easily attacked by many diseases. Vasculitis alone invades the lungs, which is rare in clinical practice, and is often combined with other organ damages. Therefore, the clinical manifestations of pulmonary vasculitis are complex and diverse, which are multi-disciplinary and cross-professional diseases [5], it can be acute or insidious, and it often takes months or even years from the onset of symptoms to diagnosis. In addition, clinicians do not know enough about pulmonary vasculitis to make diagnosis extremely challenging. The incidence of a disease, disability, fatality rate, recurrence rate, and the diagnostic rate of geriatric wards are very low. According to the etiology of vasculitis, it can be divided into primary vasculitis and secondary vasculitis. Vasculitis of unknown etiology is called primary vasculitis, and secondary vasculitis refers to vasculitis secondary to infection, drugs, malignant tumors, connective tissue diseases and so on. An early clinical symptoms of pulmonary vasculitis are not typical [4], most patients have non-specific symptoms, and long-term fever is its prominent performance, accompanied by fatigue, arthralgia and skin lesions. The symptoms of respiratory tract were not specific, but hemoptysis was suggestive. Cough and dyspnea often occur in granulomatous vasculitis [6]; Sinusitis and epistaxis supported the diagnosis of Wegener's granulomatosis and lymphomatoid granulomatosis. Allergic granulomatous vasculitis occurred with wheezing and paroxysmal dyspnea. Serologic tests are important for the diagnosis of vasculitis in the laboratory, which usually include blood routine, high-sensitivity C-reactive protein, liver and kidney function, erythrocyte settling rate, and cellular immunity: Lymphocyte subsets

(TBNK) were determined. Autoantibodies include rheumatoid factor, ANA antibody, ANCA antibody, anti-glomerular basement membrane antibody, complement level and cryoglobulin. ANCA is an antineutrophil cytoplasmic antibody, which can be divided into three types: cytoplasmic (cANCA), perinuclear (pANCA), and atypical (PR3-ANCA), and the titer of autoantibody is related to disease activity. The sensitivity and specificity of cANCA in the diagnosis of pulmonary vasculitis is as high as 90%, and the false positive rate is relatively low. Therefore, in the minor hospital, the condition does not allow the biopsy, which would be significant. Once the cANCA is positive, the diagnosis can be confirmed, avoiding the biopsy. Vasculitis cannot be ruled out when ANCA is negative, as seronegativity is present in some patients; and when the disease is inactive, seronegativity is also negative. Positive ANA and RF are seen in primary vasculitis. Other laboratory tests, including liver and kidney function, high-sensitivity C-reactive protein, and erythrocyte sedimentation rate, are usually variable in patients with vasculitis, but are not specific for diagnosis. Urinalysis is also very important, especially for being a large amount of microproteinuria, urine β_2 microglobulin, in the case of ANAs invading kidneys. On pulmonary CT scan, alveolar hemorrhage, ground-glass opacity, or fibrous bands (reticular shadow, honeycombing) are difficult to distinguish from other respiratory tract diseases [7]. The patient had early respiratory tract infection (Figure 1). Later into the state of “persistent mild fever”, because of it, clinical symptoms were atypical, and a negative ANCA, resulting in a difficult diagnosis. In order to further confirm the diagnosis, we carefully analyzed the medical records, lung CT images, combined with the new “exudative lesion” (Figure 2) on the film at the same time, plus a poor effectiveness to antibiotics therapy and a good responses to glucocorticoids; finally, with the help of a positive RF, a diagnosis of pulmonary vasculitis was suspended, consistent with our literature review in the China National Knowledge Network. Since the discontinuation of antibiotics therapy, with the assistance of a small dose of GC for one week, the mild fever in this patient subsided, and consequently, an improvement in total situation was achieved [8].

The patient began with “viral infection of respiratory tract” (a positive antibody for Coxsackie Virus), representing with high fever, and a dose of Methylprednisolone was given intravenously to deal with it. Considering a positive GM-test result after aborting a fever, Caspofungin was chosen to antifungal therapy and a period of intermittent fever occurred subsequently. Integrated with a new-onset “foggy” focus distributing alongside lung marketings on her iconography [9], a diagnosis of pulmonary vasculitis was reasonably suspected and finally confirmed by minor GC therapy. We thought that GC therapy should be carefully used in some conditions because of its dualism - the same knife cuts bread and fingers [9].

4. Treatment and Management

Treatment and management strategies play a crucial role in addressing pulmonary vasculitis provoked by respiratory infections in elderly patients. Considering the complexity and potential severity of the condition, a comprehensive approach is necessary [10].

4.1. Pharmacological Interventions

Pharmacological interventions form the cornerstone of treatment for pulmonary vasculitis associated with respiratory infections. These interventions aim to address the multifaceted nature of the condition by targeting symptoms, inflammation, and

underlying infections. Corticosteroids, such as prednisone or methylprednisolone, are often the first-line agents for managing pulmonary vasculitis. By exerting potent anti-inflammatory effects, corticosteroids help suppress the immune-mediated inflammation characteristic of vasculitis. They also play a crucial role in mitigating vascular damage and reducing the risk of disease progression. However, their use must be carefully monitored, particularly in elderly patients, as they are susceptible to adverse effects such as immunosuppression, hyperglycemia, osteoporosis, and gastrointestinal complications. Close monitoring of patients receiving corticosteroid therapy is essential to promptly identify and manage potential adverse reactions. In addition to corticosteroids, adjunctive immunosuppressive therapy may be warranted in cases of refractory or severe pulmonary vasculitis. Agents such as cyclophosphamide, azathioprine, or methotrexate are commonly used in combination with corticosteroids to achieve disease control and prevent relapses. These immunosuppressive agents target specific pathways involved in the inflammatory cascade, thereby dampening the aberrant immune response characteristic of vasculitis. However, their use carries significant risks, including bone marrow suppression, increased susceptibility to infections, and hepatotoxicity [11]. Therefore, careful monitoring of hematologic parameters, liver function tests, and infectious complications is essential during treatment with immunosuppressive agents. Moreover, biologic therapies, such as rituximab or tocilizumab, have emerged as promising therapeutic options for refractory pulmonary vasculitis. These agents target specific components of the immune system, such as B cells or interleukin-6, implicated in the pathogenesis of vasculitis. By selectively modulating immune responses, biologic therapies offer the potential for more targeted and effective management of vasculitic manifestations [12]. However, their use is often reserved for cases refractory to conventional therapy or those with significant treatment-related adverse effects. Close monitoring for infusion reactions, infections, and other adverse events is essential during biologic therapy. Concurrent antimicrobial therapy is crucial in cases of pulmonary vasculitis precipitated by respiratory infections. Broad-spectrum antibiotics are initially prescribed to target bacterial pathogens implicated in lower respiratory tract infections. Additionally, antifungal agents may be necessary if fungal etiology is suspected or confirmed. The choice of antimicrobial agents should be guided by the suspected pathogens, local resistance patterns, and the clinical response to therapy. Early initiation of appropriate antimicrobial therapy is vital to prevent secondary infections and optimize outcomes in patients with pulmonary vasculitis. Pharmacological interventions play a pivotal role in the management of pulmonary vasculitis associated with respiratory infections in elderly patients. A tailored approach, balancing the benefits of therapy with the risks of adverse effects, is essential to optimize treatment outcomes and improve the quality of life in affected individuals. Close collaboration between healthcare providers and vigilant monitoring of patients are paramount to ensure the safe and effective use of pharmacological agents in this population [13].

4.2. Antimicrobial Therapy

Effective antimicrobial therapy is integral in cases where respiratory infections precipitate pulmonary vasculitis. Prompt initiation of appropriate antimicrobial agents is crucial to eradicate pathogens, mitigate inflammation, and prevent disease progression. Broad-spectrum antibiotics are typically initiated empirically to target common bacterial pathogens implicated in lower respiratory tract infections. Agents such as amoxicillin-clavulanate, ceftriaxone, or levofloxacin are commonly prescribed

to cover a broad spectrum of potential pathogens. Concurrently, if fungal etiology is suspected or confirmed, antifungal agents like caspofungin may be warranted to address invasive fungal infections. Timely initiation and appropriate selection of antimicrobial agents are paramount to prevent further complications and improve patient outcomes. Close monitoring for clinical response, microbial sensitivity testing, and drug-related adverse effects is essential to optimize treatment efficacy and minimize the risk of antimicrobial resistance. Additionally, adherence to antimicrobial stewardship principles, including judicious antibiotic use and infection control measures, is crucial to mitigate the emergence of resistant pathogens and preserve antimicrobial efficacy. Collaborative efforts among healthcare providers, including infectious disease specialists and microbiologists, are essential to ensure evidence-based prescribing practices and enhance patient care in the management of pulmonary vasculitis [14].

4.3. Supportive Care

Supportive care constitutes a pivotal component in the holistic management of pulmonary vasculitis, prioritizing symptom alleviation and overall patient well-being. Oxygen therapy stands as a cornerstone intervention, ensuring adequate oxygenation levels to alleviate respiratory distress and maintain physiological stability. Concurrently, meticulous hydration management plays a vital role in preventing fluid imbalances and optimizing organ function, particularly in elderly patients or those with comorbidities. Beyond physiological support, symptomatic relief remains paramount in enhancing patient comfort and quality of life. Analgesic medications, such as NSAIDs or opioids, may be prescribed to alleviate pain associated with vasculitic manifestations or concurrent conditions like arthritis or myalgias. Additionally, adjunctive therapies such as physical therapy or relaxation techniques can complement pharmacological interventions, further improving symptom management and promoting mobility and function. Close monitoring of vital signs, including temperature, blood pressure, and heart rate, remains imperative to promptly identify any signs of clinical deterioration or disease progression [15]. Regular assessments facilitate timely interventions and adjustments to supportive measures, optimizing treatment outcomes and enhancing patient safety. Comprehensive supportive care encompasses a multifaceted approach tailored to the individual needs of patients with pulmonary vasculitis. By addressing symptoms, maintaining physiological stability, and promoting patient comfort, supportive interventions contribute significantly to overall treatment efficacy and patient satisfaction. Collaborative efforts among healthcare providers ensure the delivery of personalized supportive care, ultimately enhancing patient well-being and treatment experiences.

5. Conclusions

In conclusion, pulmonary vasculitis provoked by respiratory infections poses significant challenges in elderly patients, necessitating a multidisciplinary approach for optimal management. Timely diagnosis, appropriate pharmacological interventions, antimicrobial therapy, and supportive care are essential components of treatment. Close monitoring and regular follow-up are crucial to achieving favorable outcomes and improving the quality of life in affected individuals.

Conflicts of Interest

The authors declare that there is no conflict of interest regarding the publication of this article.

Funding

This research received no specific grant from any funding agency in the public, commercial or not-for-profit sectors.

References

- [1] Katsumata Y, Kawaguchi Y, Yamanaka H. Interstitial lung disease with ANCA-associated vasculitis. *Clini Medi Insights. Circ, Respir Pulm Med*, 2015, 9(Suppl1), 51-56.
- [2] Gomez-puerta, J.A.; Bosch, X. Anti-neutrophil cytoplasmic antibody pathogenesis in small-vessel vasculitis: an update. *Am J Pathol*, 2009, 175, 1790-1798.
- [3] Wang, H.H.; Zhang, X.X.; Zhang, F.M. Research progress of pulmonary vasculitis. *New Medicine*, 2004, 35(12), 759-760.
- [4] Zhu, J.; Zuripea. Abidullah, Ling, M. Clinical analysis of 361 cases of pulmonary vasculitis. *Chinese Journal of Practical Diagnosis and Therapy*, 2014, 28(10), 998-999.
- [5] Wang, P.; Liu, Y.; Shao, M.Q.; Chen, D.; Wang, C.L.; Li, D.Y. Predromal eosinophilic granulomatous polyvasculitis:a case report. *Chinese Journal of Experimental Diagnostics*, 2019, 27(4), 491-494.
- [6] Zhang, X.W.; Liu, J.Z.; Luo, C.F.; Liu, D.; Zhang, Y.C.; Pan, J.W. Rare CT Findings of antineutrophil cytoplasmic antibody associated pulmonary vassculitis. *Chinese Journal of Imaging*, 2013, 9, 702-705.
- [7] Jiang, H.D. Diagnosis and differential diagnosis of pulmonary vasculitis. *Diagnostic Theory and Practice*, 2013, 12(2), 132-134.
- [8] Li, R.R.; Gao, L.Y.; Cheng, X.X. Repeated infection of ANCA negative vasculitis was reported in 1 case. *Chineses Journal of integrative Nephropathy*, 2019, 20(6), 522-524.
- [9] Jennette, J.C.; Falk, R.J.; Andrassy, K, et al. Nomenclature of systematic vasculitides. *Arthritis Rheum*, 1994, 37, 187-192.
- [10] Ahmed, H.H.; Morcos, N.Y.; Eskander, E.F. et al. Role of dehydroepiandrosterone in management of glucocorticoid-induced secondary osteoporosis in female rats. *Exp Toxicol Pathol*, 2011, 8, 1-12.
- [11] Yasser, E.; Yasser, R.; Diletta, C. et al. Pulmonary vasculitis in Behçet's disease: reference atlas computed tomography pulmonary angiography (CTPA) findings and risk assessment-management proposal. *Sarcoidosis, vasculitis, and diffuse lung diseases: official journal of WASOG*, 2023, 40(3), e2023026-e2023026.
- [12] Fotios, D.; Elisavet, S.; Christina, T. et al. The Role of the Microbiome in Connective-Tissue-Associated Interstitial Lung Disease and Pulmonary Vasculitis. *Biomedicines*, 2022, 10(12), 3195-3195.
- [13] Kobina, D.; Donna, O.E.B.C, et al. Increased Hemoglobin Affinity for Oxygen with GBT021601 Reduces Pulmonary Hypertension and Lung Vascular

Inflammation in a Murine Model of Sickle Cell Disease. *Blood*, 2022, 140(S1), 5375-5376.

- [14] Oindrila, P.; Qin, J.T.; Eric, W. et al. Pulmonary vascular inflammation with fatal coronavirus disease 2019 (COVID-19): possible role for the NLRP3 inflammasome. *Respiratory Research*, 2022, 23(1), 25-25.
- [15] Stefano, P.; Corrado, I.; Salvatore, C. et al. Pulmonary Vasculitides: A Radiological Review Emphasizing Parenchymal HRCT Features. *Diagnostics*, 2021, 11(12), 2318-2318.



© 2024 by the author(s); licensee International Technology and Science Publications (ITS), this work for open access publication is under the Creative Commons Attribution International License (CC BY 4.0). (<http://creativecommons.org/licenses/by/4.0/>)