CASE REPORT
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Good's Syndrome Complicated with COVID-19 and Recurrent Pulmonary Infections: A Case Report

Wenjuan Xia, Mengqi Wu, and Fang He

Department of Respiratory and Critical Care Medicine, Anhui Chest Hospital, Hefei, China

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ABSTRACT

Good's syndrome (GS), a rare immunodeficiency disorder characterized by thymoma and hypogammaglobulinemia, presents diagnostic and therapeutic challenges due to recurrent infections.

We report a 53-year-old male farmer with GS complicated by recurrent pulmonary infections and COVID-19. Initial management focused on antiviral/anti-infective therapy and corticosteroids, but persistent hypogammaglobulinemia, B-cell depletion, and thymoma history were overlooked.

Diagnosis was confirmed upon integrating the thymoma history, immunological profiling, and bronchial alveolar lavage-next generation sequencing, revealing *Pneumocystis jirovecii* and Herpes Simplex Virus-1 coinfections. Treatment with intravenous immunoglobulin loading dose (2 g/kg), pathogen-targeted therapy (voriconazole, cotrimoxazole), and tapered corticosteroids achieved clinical remission, with immunoglobulin G (IgG) elevating to 6.35 g/L.

This case underscores the necessity of a "four-dimensional early warning system" integrating thymoma history, immune, imaging, and pathogen for timely GS diagnosis. Multidisciplinary collaboration and personalized regimens combining immunoglobulin replacement, precision anti-infectives, and immunomodulation are pivotal for optimizing outcomes in GS patients with complex infections.

Keywords: COVID-19; Good's syndrome; Hypogammaglobulinemia; Immunodeficiency; Recurrent infections

INTRODUCTION

Good's syndrome (GS) is a rare immunodeficiency condition characterized by the presence of a thymoma coupled with hypogammaglobulinemia, often leading to severe infections and autoimmunity. It is typically diagnosed in patients over 40 years of age, most frequently in association with thymoma.[1–3] Patients with GS typically present with recurrent infections due to significant deficits in both humoral and cellular immunity, including low levels of immunoglobulins (IgA, IgG, and IgM) and reductions in the number of B and $CD4^+$ T cells.[4,5] This syndrome is often associated with a variety of opportunistic infections, including bacterial, viral, fungal, and protozoal pathogens.[6–8] Diagnosis is typically confirmed through imaging studies revealing a mediastinal mass and laboratory tests showing hypogammaglobulinemia and reduced lymphocyte subsets.[9,10] A study in China pointed out that approximately 40% of GS patients are not diagnosed

Corresponding Author: Wenjuan Xia, MD;
Department of Respiratory and Critical Care Medicine, Anhui Chest Hospital, Hefei, China. China. Tel: (+86 138) 6595 8190, Email: wenjuanx616@163.com

promptly at tertiary hospitals, leading to treatment delays.[11]

The pathogenesis of GS remains incompletely understood, with several hypotheses proposed. These include the thymic dysfunction hypothesis, which suggests that thymoma interferes with the normal development of T cells, and the B cell dysfunction hypothesis, which indicates that the syndrome is associated with abnormalities in B cell function, leading to a significant reduction in immunoglobulin levels. Additionally, immunological tolerance disruption and potential genetic factors may contribute to the immune system's failure to effectively distinguish self from non-self, thus predisposing patients to infections and autoimmune disorders. Despite its clinical significance, the incidence of GS is extremely low, and the disorder is often overlooked due to its rarity.

The standard therapeutic approach for GS involves thymectomy and immunoglobulin replacement therapy to manage immunodeficiency and prevent recurrent infections.[12,13] Despite these interventions, patients often have a poor prognosis due to the high incidence of infectious complications and the potential for other paraneoplastic syndromes, such as pure red cell aplasia and agranulocytosis.[10,14] Research indicates that GS can be exacerbated by other conditions, such as bronchiectasis and granulomatous-lymphocytic interstitial lung disease, further complicating its clinical course.[15,16]

Due to the unclear etiology of GS, there has been limited progress in treatment. The primary challenge remains the insufficient recognition of GS. This report showcases a 53-year-old male with a history of postoperative thymoma and recurrent infections, who was ultimately diagnosed with 'GS. His case is notable because of its intricate clinical manifestations and the requirement for aggressive therapeutics. Through a detailed case presentation, we highlight the complexities of diagnosis, treatment strategies, and the long-term follow-up care required for patients with GS, contributing to a broader understanding of this condition within the medical community.

CASE REPORT

Previous Treatment History

A 53-year-old male farmer with surgically resected AB-type thymoma in 2020 presented with recurrent febrile episodes and pulmonary infiltrates over three distinct treatment phases.

Phase I (December 30, 2022–February 21, 2023): The patient initially presented to a tertiary A hospital with a fever (peak 39.8 °C) and nonproductive cough. SARS-CoV-2 infection was confirmed via nasopharyngeal swab reverse transcription-polymerase chain reaction (RT-PCR). Antiviral therapy with nirmatrelvir/ritonavir (Pfizer, USA), empirical antibiotic prophylaxis with ceftriaxone and vancomycin, and concurrent methylprednisolone (Sinopharm Rongsheng Pharmaceutical Co., China) were administered for COVID-19, community-acquired pneumonia, methicillin-resistant *Staphylococcus aureus*, and suspected hyperinflammation. Serial chest computed tomography (CT) revealed dynamic multilobar consolidations: baseline peripheral ground-glass opacities (GGOs) progressed to diffuse alveolar infiltrates by January 9, 2023, partially resolved by February 6, then relapsed with migratory peribronchial nodularity by February 21 (Figure 1). Despite transient clinical improvement, hypogammaglobulinemia and profound B-cell deficiency were documented but not investigated further.

Phase II (February 28–March 5, 2023):

Readmission to this hospital for recurrent fever (38.5–39.2°C) revealed new bilateral subpleural consolidations on CT. Immunosuppression was intensified with methylprednisolone (Sinopharm Rongsheng Pharmaceutical Co., China), though antimicrobial prophylaxis was omitted despite hypogammaglobulinemia. Transient defervescence was achieved, but emergent exertional hypoxemia (oxygen saturation (SpO_2) 88% on room air) signaled progressive immunocompromise.

Phase III (March 6–14, 2023):

Referral to another tertiary A hospital prompted bronchoscopic evaluation. Bronchoalveolar lavage (BAL) fluid analysis demonstrated lymphocytic predominance but no pathogenic organisms on cytology/culture. Organizing pneumonia was diagnosed histopathologically (Masson bodies in alveolar ducts), leading to corticosteroid monotherapy.

Treatment Course at Our Hospital

The patient was admitted to our tertiary immunology center on March 21, 2023, presenting with persistent pyrexia (38.5 °C peak) and progressive dyspnea

(modified Medical Research Council grade 3). We performed comprehensive immunological profiling, revealing profound hypogammaglobulinemia and lymphocyte subset abnormalities. Serial flow cytometry confirmed these findings at 2-week intervals, demonstrating persistent cellular immunity defects. High-resolution CT unveiled migratory consolidations with reverse halo signs in bilateral lower lobes (Figure 2), distinct from prior COVID-19 patterns. Bronchoscopy with BAL-Next-generation sequencing (BAL-NGS) identified opportunistic co-infections: α-herpesvirus 1 (657 reads), acute respiratory distress syndrome (ARDS)-associated viral sequences (11 967 reads), and *Pneumocystis jirovecii* (63 reads). No bacterial pathogens were isolated from quantitative cultures.

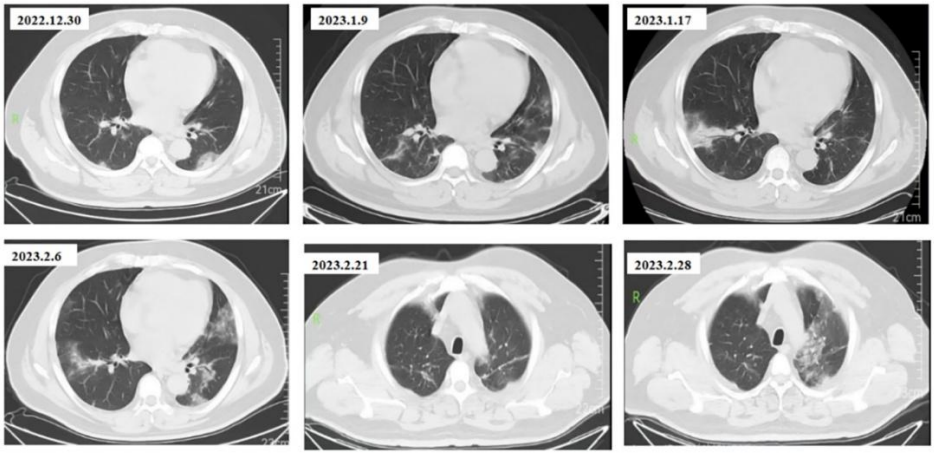

Figure 1. Chest computed tomography dynamics revealed recurrent pulmonary infections. Dynamic changes in chest computed tomography scans during treatment phases, showing progression from ground-glass opacities (2022.12.30) to diffuse alveolar infiltrates (2023.01.09), partial resolution (2023.02.06), relapsing peribronchial nodularity (2023.02.21), and new bilateral subpleural consolidations (2023.02.28), indicative of recurrent infections in Good's syndrome.

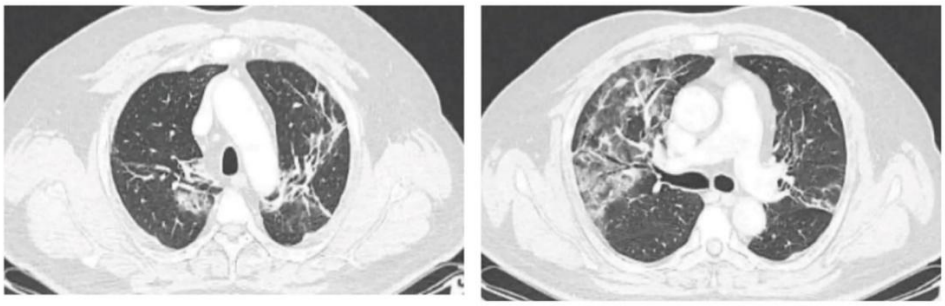

Figure 2. Reverse halo sign on admission computed tomography suggested immune-deficiency-associated pneumonia. Chest computed tomography obtained at the time of admission demonstrates migratory consolidations with reverse halo signs in bilateral lower lobes, which differ from the imaging patterns of previous COVID-19 infections.

Crucially, the diagnosis of 'GS was established through stringent criteria: 1) Histologically confirmed type AB thymoma (resection in 2020); 2) Adult-onset pan-hypogammaglobulinemia; 3) Absent B-lymphocytes; 4) Exclusion of other genetic immunodeficiencies via whole-exome sequencing. This contrasted with prior institutions' focus on infection management without addressing the underlying immunodeficiency.

Our therapeutic protocol addressed both immunodeficiency and active infections through antimicrobial therapy, including voriconazole (Pfizer,

USA) for *P jirovecii* pneumonia (PJP) prophylaxis, valacyclovir for Herpes Simplex Virus (HSV)-1 suppression, and cotrimoxazole as secondary prophylaxis. Immunoglobulin replacement was initiated with intravenous immunoglobulin (IVIG) (Guizhou Taibang Biological Group, China) for 5 days, transitioning to monthly maintenance. Methylprednisolone (Pfizer, USA) was tapered for over 10 days to mitigate inflammatory lung damage.

Treatment Experience at External Hospitals

On April 1, 2023, the patient was referred to a tertiary A Hospital for evaluation of sequelae related to GS and recurrent respiratory infections. Given his complex medical history, regular immunoglobulin infusions were recommended alongside a gradual tapering of steroid therapy. Despite ongoing anti-infective treatment at a local hospital, the patient continued to experience recurrent fever as the prednisolone dose was reduced to 16 mg daily. Follow-up chest CT scans revealed worsening bilateral lung lesions compared to previous imaging.

On April 20, 2023, the patient was transferred to another tertiary A Hospital for advanced diagnostic evaluation. Bone marrow aspiration and bronchoscopy with biopsy yielded no significant pathological findings. NGS of bronchoalveolar lavage fluid identified herpes simplex virus type 1, other viruses associated with ARDS, and *P jirovecii*. Based on these microbiological findings and the patient's compromised immune status, a comprehensive anti-infective regimen was initiated, including voriconazole, sulfamethoxazole-trimethoprim (Huazhong Pharmaceutical Co., China), doxycycline (Kaifeng Pharmaceutical (Group) Co., China), and the antiviral combination nirmatrelvir/ritonavir (Pfizer, USA). Concurrent anti-inflammatory treatment with dexamethasone (Zhejiang Xianju Pharmaceutical Co., China) and antifibrotic therapy with nintedanib (Boehringer Ingelheim, Germany) were also administered.

The patient's condition stabilized, and he was discharged on May 7, 2023, after achieving effective disease control. He was instructed to continue a three-week course of home-based anti-infective therapy. Starting June 1, 2023, a phased cessation of all anti-infective medications was initiated under medical supervision. Monthly immunoglobulin infusions (30 g) were prescribed, with a planned tapering of steroid therapy by September. By November 2023, no new pulmonary lesions were detected, and only minimal residual fibrotic strands remained (Figure 3). The patient demonstrated significant physical improvement, with stable IgG levels at 6.35 g/L, indicating a stabilization of immune function.

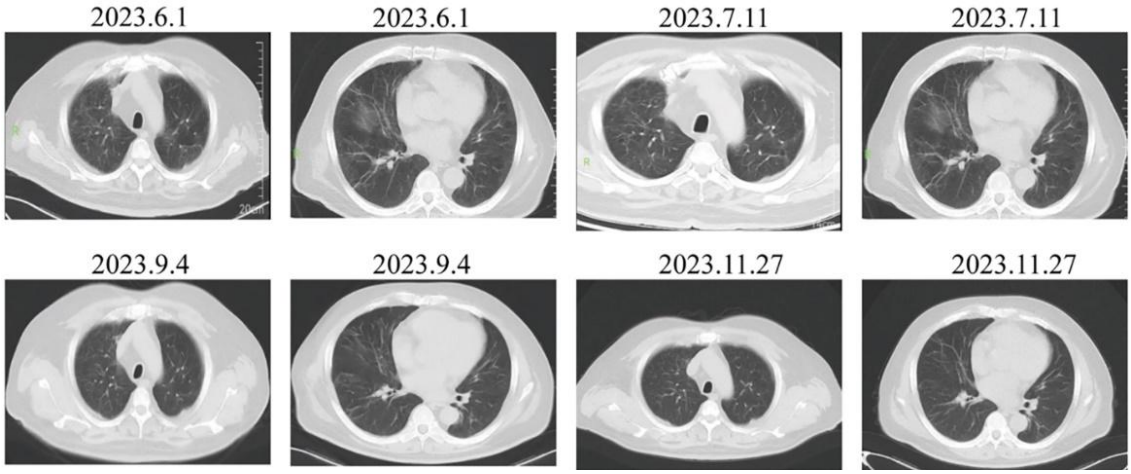

Figure 3. Follow-up chest computed tomography showed clinical remission. Serial chest computed tomography from June to November 2023 shows progressive resolution of pulmonary lesions after monthly intravenous immunoglobulin therapy. By September 2023, only minimal fibrotic strands remain, with no new consolidations, reflecting clinical response.

Post-IVIG stabilization (day 7 IgG 4.8 g/L), the patient was discharged with a tailored surveillance protocol: monthly lymphocyte subset analysis, quarterly immunoglobulin quantification, and low-dose CT surveillance. This precision diagnostic approach enabled transition from reactive anti-infective therapy to

proactive immune rehabilitation, ultimately achieving durable remission (6-month IgG 6.07 g/L, $CD4^+$ recovery to 412 cells/μL). The case underscores the imperative of comprehensive immunological evaluation in thymoma patients with recurrent infections, particularly when conventional antimicrobial strategies fail.

DISCUSSION

This case report describes a rare and compelling instance of GS in a 53-year-old male patient with a history of thymoma and recurrent infections. This report presents a detailed clinical trajectory of a patient with 'GS from COVID-19 infection to subsequent opportunistic infections, marked by recurrent fever, respiratory complications, and immunodeficiency, highlighting the complexity and diagnostic challenges associated with 'GS. The establishment of a "thymoma history, immune, imaging, and pathogen" four-dimensional early warning system helps reduce misdiagnosis. The report also underscores the importance of personalized treatment approaches, combining anti-infective therapy, immunoglobulin replacement, and immunomodulation to effectively control infections and stabilize immune function. This approach is especially relevant in the context of COVID-19, where immunocompromised patients face heightened risks of severe disease and complications.

Patients with GS primarily come from Europe and Asia, with a total number of cases not exceeding 400 to date.[17] In China, a systematic review of 47 cases reported by Dong et al[8] found that GS is nationwide distributed, with 83% of cases from the mainland, a mean age of 55.2 years, a peak range between 40–50 years, and a female predominance. The most common histologic type of thymoma is AB, and sinopulmonary infections are the main clinical manifestation. Globally, the prevalence is approximately 1/700 000, predominantly affecting middle-aged individuals with a median diagnostic age of 58 years and a male predominance (51%). Thymoma-induced disruption of thymic structure and function leads to aberrant T- and B-cell development, manifesting as universal hypogammaglobulinemia (100%), profound peripheral B-cell deficiency (95.2%), and reduced $CD4^+$ T-cell counts (71.3%). Thymomas are predominantly of WHO type AB (50%). Clinically, 92.6% of patients experience infections, with sinopulmonary involvement in 67.3%, and 51.2% exhibit autoimmune comorbidities. Treatment strategies primarily involve thymectomy and immunoglobulin replacement, yet the prognosis remains poor, with a 10-year overall survival rate of 53.7%. Active thymoma, infections associated with cellular immunity defects, and infections at critical sites are independent prognostic factors, underscoring the complex clinical phenotype dominated by immune dysregulation and infectious vulnerability.[17,18]

The diagnosis of GS primarily relies on immunological evaluations, including the measurement of serum immunoglobulin levels and the analysis of lymphocyte subsets.[19,20] During the COVID-19 pandemic, the patient contracted SARS-CoV-2, triggering complex immune responses and presenting significant therapeutic challenges. COVID-19 infection leads to a considerable decline in both the quantity and function of T cells. The total T cells, $CD4^+$ T cells, and $CD8^+$ T cells are markedly reduced in severe patients, showing a negative correlation with patient survival. Moreover, T cells exhibit functional exhaustion characterized by high expression of exhaustion markers such as *PD-1* and *Tim-3* during disease progression, which may impair their ability to effectively recognize and eliminate the virus, thus exacerbating the disease.[21] B-cell plays a critical role in generating neutralizing antibodies and regulating immune responses. However, severe and critical patients often exhibit B-cell lymphopenia, which may be associated with virus-induced excessive B-cell activation or apoptosis.[22] The immune deficiency inherent to 'GS renders patients highly susceptible to COVID-19 and more prone to developing severe or critical illness with a higher risk of death.[12,22–25] The initial diagnosis and treatment of this case reflect the doctors' insufficient understanding of GS. A critical review of his medical timeline revealed a diagnostic odyssey spanning two provincial hospitals over four months, where recurrent infections had been misattributed to COVID-19 sequelae and organizing pneumonia despite negative repeat SARS-CoV-2 RT-PCR tests from March 2023 onward. Notably, no immunologic reassessment was performed despite the patient's thymoma history and infection-prone course. The reasons include excessive specialization in the medical field and an over-focus on COVID-19. Three key diagnostic oversights occurred during the diagnosis of GS. First, the patient exhibited persistent hypogammaglobulinemia (IgG<3 g/L) during multiple hospitalizations, which, according to the Infectious

Diseases Society of America (IDSA) guidelines, should have prompted immunoglobulin replacement therapy. Second, despite a history of thymoma resection, a known precursor in 90% of GS cases, the thymoma-associated immunodeficiency was not considered. Lastly, the patient presented with progressive B-cell lymphopenia ($CD19^{+}$<1%) and an inverted CD4/CD8 ratio, forming a diagnostic immune phenotype; however, flow cytometry was not repeated to assess the impact of treatment. These diagnostic lapses led to a delayed diagnosis of GS, resulting in the subsequent development of recurrent secondary infections.

Despite receiving extensive antiviral treatments, the patient experienced an atypical recurrence of COVID-19 infection. The inability to produce neutralizing antibodies due to GS likely delayed viral clearance, highlighting the challenges faced by immunocompromised patients.[26] A recent case from Singapore demonstrated persistent infection, evidenced by the detection of the same SARS-CoV-2 strain in respiratory samples collected throughout the illness.[24] For immunocompromised patients enduring SARS-CoV-2 infection, particularly in patients with a history of thymoma, the presence of prolonged SARS-CoV-2 infection should prompt an evaluation for GS to facilitate early diagnosis and timely intervention. For this patient, failure to correct hypogammaglobulinemia and neglect of the basic immunodeficiency resulted in ineffective anti-infective treatment. Increasing the dose of methylprednisolone without monitoring T/B cell function further exacerbated immune suppression, leading to opportunistic infections. Additionally, the CT scan revealed migrating consolidation with a "reverse halo" sign, which differed from typical COVID-19 patterns, further hinting at the diagnosis of a severe immune deficiency rather than a simple COVID-19 infection. Through "immune deficiency etiology diagnosis + IVIG core treatment," we achieved clinical remission of GS combined with complex infections in this case. The subsequent maintenance treatment has confirmed the long-term effectiveness of the treatment plan, providing a diagnostic and therapeutic paradigm for similar cases.

The opportunistic infections in GS patients, including HSV and *P jirovecii* infections, should also be given attention due to the immunosuppressive state. HSV pneumonia may present as progressively worsening dyspnea and hemoptysis, whereas *P jirovecii* pneumonia may manifest as interstitial lung changes and ground-glass opacities. Both conditions can overlap with COVID-19 in terms of clinical symptoms and radiological features, which may pose a diagnostic challenge.[27,28] Chest CT is an important tool for diagnosing HSV, *P jirovecii*, and COVID-19 infections; however, differentiation requires the use of additional diagnostic methods, such as PCR testing for BALF for *P jirovecii*.[29] For HSV, the primary detection methods involve identifying its presence at the lesion site by viral nucleic acid testing and antibody testing in the blood.[30] Initially, the routine culture of BALF did not reveal any pathogens; however, we detected HSV-1 and *P jirovecii* through BAL-NGS and considered that in immunocompromised patients, traditional cultures have a high rate of missed diagnoses, and NGS is a crucial tool for identifying rare or mixed pathogen, especially when CT shows a "reverse halo" sign and routine cultures are negative.

This analysis compares the treatment regimens of four cases of ’GS, focusing on the unique challenges posed by COVID-19 co-infection (Table 1). In a report by Berzenji et al involving a male patient of similar age to our subject, chemotherapy, remdesivir, and sternotomy were administered, emphasizing antiviral and oncological strategies.[31] In contrast, our case prioritized immunomodulation and anti-infective strategies. Turaes et al[32] described an approach centered on immunoglobulin replacement therapy (IgRT) without surgical intervention, highlighting the benefits of conservative management. This strategy avoided antiviral treatments and hormonal therapies, likely tailored to the patient’s specific clinical manifestations and disease trajectory. In the case presented by Kwok et al, complex complications such as cytomegalovirus pneumonia and esophageal candidiasis were managed with broad-spectrum antibiotics, antivirals, and antifungals.[33] This approach prioritized infection clearance over mere immunological support. The case most analogous to ours was described by Duarte et al,[12] which also featured concurrent COVID-19 and ’GS. Their regimen included high-flow nasal cannula oxygen, prone position therapy, dexamethasone, and remdesivir, indicating a proactive approach to managing severe COVID-19 symptoms alongside intensive care support. This differed from our case, where the emphasis was placed on immunoglobulin replacement therapy and a careful reduction in hormonal treatments, reflecting a strategy attuned to long-term immune management.

Table 1. Summary of clinical data relating to five cases of Good's syndrome. The table summarizes key clinical characteristics, diagnostic approaches, and treatment strategies across five reported cases of Good's syndrome, with a focus on cases complicated by COVID-19 or other severe infections. The comparison highlights the variation in management strategies - ranging from chemotherapy and antiviral therapy to immunoglobulin replacement and conservative care. The present case emphasizes an individualized regimen of IVIG loading dose, pathogen-targeted antibiotics, and steroid tapering.

Reference	Age	Sex	Symptom onset	Key clinical features	Diagnosis	Treatment and outcome
Berzenji et al	55	Male	Past 6 months with a weight loss of 5 kg	Oral lichen planus, skin lesions, weight loss, and anterior mediastinal mass	Thymoma (Type AB), GS	Chemotherapy, remdesivir, sternotomy, no new infections
Turaes et al	57	Male	Chronic (several years)	Anterior mediastinal mass, persistent cough, recurrent infections, pneumonia	GS, Allergic pneumonitis	IVIG, no surgery
Kwok et al	53	Female	Progressive over 6 months	Progressive dyspnea, weight loss, fever, cough, depression, anxiety, bibasilar consolidations, microcytic anemia, leukocytosis, thrombocytosis	CMV pneumonia, esophageal candidiasis, thymoma (Type A), renal cell carcinoma (clear cell type), GS	Antibiotics (amoxicillin-clavulanic acid, azithromycin), antiviral (acyclovir), antifungal (fluconazole), IVIG, thymectomy, nephrectomy
Duarte et al	70	Female	Acute (1 day prior to admission)	Fever, myalgia, cough, dyspnea, fever, myalgia, headache, anorexia, and anosmia. Chest CT: peripheral ground-glass opacities.	COVID-19 with severe organizing pneumonia, GS	Dexamethasone, remdesivir, IVIG. Followed up for 6 months without new infections
This article	53	Male	Admitted on March 21, 2023 (acute presentation)	Thymoma, fever, immunoglobulin deficiency, chest CT: multiple patchy and streaky opacities	Thymoma, COVID-19, GS	Voriconazole, cotrimoxazole, valacyclovir, methylprednisolone, continued IVIG post-discharge, symptom relief.

CMV: cytomegalovirus; CT: Computed Tomography; GS: Good's Syndrome; IgRT: immunoglobulin replacement therapy; IVIG: intravenous immunoglobulin

Patients with GS are at heightened risk for severe COVID-19 due to their compromised immune response. The inability to mount an adequate immune defense may result in prolonged viral shedding, increased susceptibility to secondary infections, and exacerbation of pre-existing lung pathology. The case presented here aligns with these observations.

Additionally, distinguishing GS from other immunodeficiencies, such as X-linked agammaglobulinemia (XLA) and common variable

immunodeficiency (CVI), is necessary, as they have their specific clinical manifestations and management strategies. XLA is a B-cell deficiency disorder caused by mutations in the Bruton's tyrosine kinase gene, failing to produce mature B cells and immunoglobulins. Unlike GS, XLA patients typically exhibit normal T-cell function. However, due to the lack of antibody production, these patients are highly susceptible to bacterial infections, especially respiratory pathogens like Streptococcus pneumoniae and Haemophilus influenzae. Treatment primarily involves regular IVIG replacement therapy.[34] CVI is a heterogeneous group of disorders characterized by hypogammaglobulinemia, resulting from defects in B-cell differentiation and function. In CVI, the underlying issue often lies in the B-cell pathway, leading to low levels of immunoglobulins (IgG, IgA, IgM) and increased susceptibility to respiratory infections. While T-cell function is generally preserved in CVI, B-cell dysfunction results in an inability to mount adequate humoral immune responses to pathogens. Immunoglobulin replacement therapy is often effective in reducing infection rates for CVI, but patients may still experience autoimmune diseases and malignancies[35], which are less commonly seen in GS.

The unique immunological profile of GS leads to specific clinical challenges, including a more complex and broader spectrum of infections and more severe disease conditions. Furthermore, the management of GS patients can be complicated by the use of immunosuppressive therapies. This necessitates a more individualized and cautious approach to treatment, particularly in the context of infections like COVID-19. Understanding the unique aspects of GS can help clinicians deliver more effective care and avoid treatment pitfalls that might arise from conflating GS with other immunodeficiencies. Thus, for patients with "thymoma + recurrent infections," a multidisciplinary evaluation involving "infectious disease, immunology, and radiology" should be implemented to shorten the time to diagnosis. The establishment of a "four-dimensional early warning system" integrating thymoma history, immune, imaging, and pathogen for GS diagnosis is essential: For thymoma patients with IgG < 5 g/L and $CD19^+$ < 10%, GS should be highly suspected. Performing chest CT, BAL-NGS, and whole-exome sequencing helps increase the detection rate of pathogens. In terms of treatment, a combination of IVIG loading dose, pathogen-guided therapy, and fine-tuned steroid therapy should be used, rather than relying solely on anti-infective treatment. Only by this strategy can the clinical diagnostic challenges of GS be overcome.

This case analysis of a 53-year-old male with GS complicated by recurrent pulmonary infections and COVID-19 highlights the imperative to strengthen the correlation awareness among thymoma history, immunological indices, and infection spectrum. Multidisciplinary collaboration and the establishment of a "four-dimensional early warning system" integrating thymoma history, immune, imaging, and pathogen significantly enhance diagnostic efficiency. An individualized regimen combining IVIG loading dose, pathogen-oriented therapy, and steroid titration is recommended.

STATEMENT OF ETHICS

All procedures performed in this study were in accordance with the ethical standards of the Ethics Committee of Anhui Chest Hospital and with the Helsinki Declaration (as revised in 2013). Written informed consent has been obtained from the patient.

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CONFLICT OF INTEREST

The authors declare no conflicts of interest.

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Not applicable.

DATA AVAILABILITY

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

AI ASSISTANCE DISCLOSURE

Not applicable.

REFERENCES

1. Le Gatt P, Nguyen AT, Baaroun V, Rochefort J. Oral Lichen Planus in Patients With Good's Syndrome: A Literature Review. Cureus. 2023;15(2):e35177.
2. Sipos F, Műzes G. Good's syndrome: brief overview of an enigmatic immune deficiency. Apmis. 2023;131(12):698-704.
3. Kabir A, Alizadehfar R, Tsoukas CM. Good's Syndrome: Time to Move on From Reviewing the Past. Front Immunol. 2021;12:815710.
4. Ren S, Hu Y, Xiao Y, Zong D, Peng Y, Liu Q, et al. Good's syndrome combined with bronchiectasis: A case report and literature review. Zhong Nan Da Xue Xue Bao Yi Xue Ban. 2021;46(3):328-32.
5. Koo CW, Lo YC. Good's Syndrome: Thymoma with Acquired Immunodeficiency. Am J Respir Crit Care Med. 2023;208(3):322-4.
6. Chen J, Yang Y, Zhu D, Chen G, Wei S, Qiu X, et al. Thymoma with pure red cell aplasia and Good's syndrome. Ann Thorac Surg. 2011;91(5):1620-2.
7. Mathew A, Chengappa KG. Good's syndrome: Thymoma with hypogammaglobulinaemia. Indian J Med Res. 2020;152(Suppl 1):S209.
8. Dong JP, Gao W, Teng GG, Tian Y, Wang HH. Characteristics of Good's Syndrome in China: A Systematic Review. Chin Med J (Engl). 2017;130(13):1604-9.
9. Okusu T, Sato T, Ogata Y, Nagata S, Kozumi K, Kim SH, et al. Good's Syndrome Accompanied by Agranulocytosis Following a Rapid Clinical Course. Intern Med. 2016;55(5):537-40.
10. Akinosoglou K, Melachrinou M, Siagris D, Koletsis E, Marangos M, Gogos CA, et al. Good's syndrome and pure white cell aplasia complicated by cryptococcus infection: A case report and review of the literature. J Clin Immunol. 2014;34(3):283-8.
11. Ni J, Zhang J, Chen Y, Wang W, Liu J. Variable clinical characteristics and laboratory results in five patients with Chinese Good's syndrome (thymoma and hypogammaglobulinemia): an 8-year retrospective analysis in a university hospital in China. BMC Immunol. 2021;22(1):50.
12. Duarte M, Faria L, Patronillo C, da Costa Fernandes S, Seara V. A Case of Severe COVID-19 in a Patient with Good's Syndrome. Eur J Case Rep Intern Med. 2021;8(10):002976.
13. Tamburello A, Castelnovo L, Faggioli P, Bompane D, Brando B, Gatti A, et al. Good's syndrome, a rare form of acquired immunodeficiency associated with thymomas. Clin Pract. 2019;9(2):1112.
14. Paganelli R, Di Lizia M, D'Urbano M, Gatta A, Paganelli A, Amerio P, et al. Insights from a Case of Good's Syndrome (Immunodeficiency with Thymoma). Biomedicines. 2023;11(6).
15. Tachdjian R, Keller JJ, Pfeffer M. A Bad Case of Good's Syndrome. Infect Dis Ther. 2014;3(2):333-7.
16. Jensen ML, Bendstrup E, Hilberg O. Granulomatous-lymphocytic interstitial lung disease and recurrent sinopulmonary infections in a patient with Good's syndrome. BMJ Case Rep. 2015;2015.
17. Műzes G, Sipos F. [Good syndrome: a rare, unusual immunodeficiency condition]. Orv Hetil. 2023;164(22):859-63.
18. Shi Y, Wang C. When the Good Syndrome Goes Bad: A Systematic Literature Review. Front Immunol. 2021;12:679556.
19. Tolomeo M, Bonura S, Abbott M, Anastasia A, Colomba C, Cascio A. Good's syndrome and recurrent leishmaniasis: A case report and review of literature. Heliyon. 2020;6(9):e05061.
20. Luque-Luna M, Alamon-Reig F, Iranzo-Fernández P. Oral lichenoid lesions as a sign of Good's syndrome. Int J Dermatol. 2022;61(9):e345-e6.
21. Diao B, Wang C, Tan Y, Chen X, Liu Y, Ning L, et al. Reduction and Functional Exhaustion of T Cells in Patients With Coronavirus Disease 2019 (COVID-19). Front Immunol. 2020;11:827.
22. Gur I, Giladi A, Isenberg YN, Neuberger A, Stern A. COVID-19 in Patients with Hematologic Malignancies: Clinical Manifestations, Persistence, and Immune Response. Acta Haematol. 2022;145(3):297-309.
23. Pietroluongo E, Peddio A, De Placido P, Tortora M, Ottaviano M, Gelzo M, et al. COVID-19 in patients with thymic epithelial tumors with or without Good's syndrome: a single-center retrospective study. BMC Cancer. 2024;24(1):748.
24. Cos Esquius ML, López Montesinos I, Gimeno Martinez R, Eguía Núñez J, Caballero-Rabasco MA, Sánchez González B, et al. Severe COVID-19 pneumonia in Good syndrome with a favorable outcome. Clin Immunol. 2022;235:108789.
25. Maldonado-Domínguez ED, O Farrill-Romanillos PM. Paciente con síndrome de Good y COVID-19. Reporte de un caso clínico. Revista Médica del Instituto Mexicano del Seguro Social. 2022;60:474-9.
26. Wee LE, Tan JY, Oon LLE, Pena AMT, Quek JKS, Venkatachalam I, et al. Relapsing COVID-19 infection as

a manifestation of Good syndrome: a case report and literature review. Int J Infect Dis. 2023;129:236-9.
27. Pasula S, Vijayan R. Herpes Simplex Virus (HSV) Pneumonitis as a Late Complication of COVID-19 Infection: A Unique Case Report. Cureus. 2025;17(2):e79228.
28. Jeican, II, Inișca P, Gheban D, Tăbăran F, Aluaș M, Trombitas V, et al. COVID-19 and *Pneumocystis jirovecii* Pulmonary Coinfection First Case Confirmed through Autopsy. Medicina (Kaunas). 2021;57(4).
29. Wang H, Zhao B. Diagnostic value of bronchoalveolar lavage fluid metagenomic next-generation sequencing for pulmonary infections in patients with connective tissue disease: A retrospective study. Sci Rep. 2025;15(1):20042.
30. Nath P, Kabir MA, Doust SK, Ray A. Diagnosis of Herpes Simplex Virus: Laboratory and Point-of-Care Techniques. Infect Dis Rep. 2021;13(2):518-39.
31. Berzenji L, Yogeswaran SK, Snoeckx A, Van Schil PE, Wener R, Hendriks JMH. Good's syndrome and COVID-19: case report and literature review. Mediastinum. 2023;7:5.
32. Turaes AS, Alharbi WK, Alqurashi RK, Touman A, Bulkhi A. Persistent Fever and Cough in a Patient With Good's Syndrome: A Case Report. Cureus. 2022;14(5):e24996.
33. Kwok CT, Yeung YC. Good's syndrome presenting with CMV pneumonitis and oesophageal candidiasis: A case report. Respirol Case Rep. 2022;10(1):e0888.
34. Yıldırım İ, Topyıldız E, Bilgin RBG, Aykut A, Durmaz A, Edeer Karaca N, et al. X-linked agammaglobulinemia: ınvestigation of clinical and laboratory findings, novel gene mutations and prevention of ınfective complications in long-term follow-up. Am J Clin Exp Immunol. 2021;10(1):37-43.
35. Lee TK, Gereige JD, Maglione PJ. State-of-the-art diagnostic evaluation of common variable immunodeficiency. Ann Allergy Asthma Immunol. 2021;127(1):19-27.