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Case report

Case report: Antisynthetase syndrome with positive anti-PL7/SSA/RO52 antibodies

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ABSTRACT

Background: Antisynthetase syndrome (ASS) is a rare autoimmune disease characterized by the immune system attacking specific synthetase in the body. Due to the difficulty in clinical diagnosis, there is still a lack of effective treatment.
Methods: We report a case of a 50-year-old man who presented with progressive, symmetric limb weakness, starting from the lower limbs and gradually affecting the upper limbs. He was admitted to the intensive care unit (ICU) for treatment due to recurrent fever and coma. When he was admitted to the ICU, his limbs were almost unable to move, and the levels of creatine phosphokinase and muscle glycogen were significantly elevated (2449 u/l and 1857 ng/ml). The electromyogram showed myogenic injury, and the anti-PL7 antibody, anti-SSA antibody, and anti-Ro52 antibody were positive. Pathological biopsy of the left biceps brachii showed striated muscle necrosis and macrophage infiltration. He was finally diagnosed with ASS and received treatment with methylprednisolone (subsequently changed to prednisone) and traditional Chinese medicine (Buzhongyiqi Decoction and Shenlingbaizhu powder).
Results: After receiving 2 weeks of glucocorticoid and traditional Chinese medicine treatment, his muscle strength had basically recovered, reaching grade 5 in his limb muscles strength. During the 3-month follow-up period, his activity tolerance continued to improve.
Conclusion: We present a case of severe anti-PL7 positive ASS with positive anti-SSA/Ro52 antibody. The disease was relieved by glucocorticoid and traditional Chinese medicine treatment. This provides an effective approach for managing ASS.

1. Introduction

Aminoacyl-tRNA synthetases (aaRSs) are a group of enzymes responsible for catalyzing the binding of amino acids to their corresponding tRNA for protein synthesis [1]. In the last decade, these proteins have been found to be linked with various conditions such as cancer, nervous system diseases, infection reactions, and autoimmune diseases including Antisynthetase syndrome (ASS) [2]. ASS is a rare and diverse systemic autoimmune disease (SAID), characterized by the presence of anti-aminoacyl-tRNA synthetase (anti-ARS) autoantibodies, including anti-Jo1, anti-PL7, anti-PL12, anti-EJ, anti-OJ, anti-KS, anti-Zo, anti-YRS/HA antibody. This condition is

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accompanied by a wide range of clinical manifestations involving multiple organs such as muscle, lung, joint and skin [3]. It is generally believed that the etiology and pathogenesis of ASS are related to genetic abnormalities environmental factors and immune system dysfunction. One proposed mechanism suggests that aaRSs act as autoantigens which trigger abnormal immune responses leading to pathogenesis [2]. The characteristic features of ASS include interstitial lung disease (ILD), myositis, arthritis, "Mechanic's hands," Raynaud's syndrome, fever and rash [4]. Although ILD, myositis and arthritis form the classic triad of symptoms in ASS only about 19 % of patients present with all three at the onset of the disease [5]. The first set of diagnostic criteria for ASS was proposed by Conners et al., in 2010 based on expert opinion [6]. Subsequent definitions were put forth by Solomon et al. [7] in 2011 and Lega et al. [8] in 2015 respectively(Table 1). Regardless of which definition is used to diagnose ASS the presence of anti-ARS autoantibodies remains a necessary criterion.

Currently, the treatment of ASS has certain limitations. In recent years, Traditional Chinese medicine (TCM) has received increasing attention in the treatment of various diseases. Especially in the management of certain intractable diseases, TCM has demonstrated its unique efficacy and potential. Buzhong Yiqi Decoction is a TCM prescription that has the effect of strengthening the body and nourishing qi and blood. It is mainly used to treat symptoms such as spleen weakness and qi and blood deficiency. Shenlingbaizhu Powder has the effects of strengthening the spleen and nourishing qi, eliminating dampness and resolving phlegm, and is mainly used to treat symptoms caused by spleen and stomach weakness. This case discusses a patient with ASS who was treated with glucocorticoids and TCM.

2. Case description

A 50-year-old male patient was admitted to our hospital with a persistent fever ranging from 38 °C to 40 °C for 3 months and generalized muscle weakness. The patient had developed a fever without any obvious cause, with a maximum temperature of 40 °C, accompanied by muscle weakness. Pulmonary CT showed bilateral pneumonia and interstitial changes. He had received various antimicrobial agents, including ceftazidime-avibactam, ertapenem, vancomycin, tigecycline, polymyxin, fluconazole, and caspofungin at several hospitals. However, the patient's temperature continued to fluctuated between 38 °C and 40 °C, and symptomatic treatment with nonsteroidal anti-inflammatory drugs and dexamethasone (10 mg/day for 3 days) proved ineffective. He also experienced progressively worsening muscle weakness (limb muscle strength grade 0) and bladder weakness. Subsequently, he was referred to the infectious disease department of our hospital after October 28, 2023. On October 30, the patient developed a disturbance of consciousness and shortness of breath and was transferred to our department for further treatment.

Upon his first examination after admission to the ICU, the patient was lethargic (Glasgow Coma Scale was 13), short of breath, fever (41 °C), with an invasive arterial blood pressure of 95/50 mmHg. There was no rash, but his fingers were dry and desquamated. Neurological examination revealed decreased muscle volume of the extremities, slightly reduced muscle tone in both upper limbs, a tendon reflex of 3+ in the left upper limb, and 2+ in the right upper limb, bilateral Hoffmann sign (−), proximal muscle strength of the upper limbs graded as 0, distal muscle strength graded as 1, increased muscle tone of the lower limbs, a tendon reflex of 3+, lower limb muscle strength graded as 2, bilateral Barthel sign (+), and sensory examination was not fully coordinated. His examination findings upon ICU admission are shown in Table 2. A chest CT showed extracapsular interstitial changes in both lower lobes (Fig. 1). He had no significant history of high-risk diseases, travel, and previous or family illnesses. Table 2 shows the patient's laboratory findings, with normal ranges indicated.

After admission to the ICU, the patient diagnosed with a severe infection (urinary culture positive for carbapenem-resistant Klebsiella pneumoniae, count >100,000) and had a qSOFA score >2 (disturbance disturbance of consciousness, low blood pressure, and rapid breathing). We considered the patient to have sepsis. The patient received rapid fluid resuscitation, and was treated with polymyxin combined with imipenem and cilastatin sodium for the infection, along with mechanical ventilation. On November 7, the patient gradually regained consciousness but could only open his eyes and was unable to move his head. Muscle strength in the extremities remained at grade 1, and the patient continued to have a fever (41 °C). Autoimmune antibody spectrum testing revealed: anti-PL7 antibody (+) anti-recombinant RO52 antibody (+), anti-SSA antibody (++) and anti-nuclear antibody (−). Further examinations were conducted to identify the cause of the fever, including tests of cerebrospinal fluid, thyroid hormone, adrenocorticotropic hormone, and cortisol, all of which showed no significant abnormalities. A labial gland biopsy was performed (Fig. 2).

On November 24, the patient's muscle biopsy showed: striated muscle necrosis and macrophage infiltration (Fig. 3). Based on these

Table 1
Summary of available criteria for anti-synthetase syndrome.

Connors	Solomon	Lega
Anti-aminoacyl-tRNA synthetase autoantibody positivity plus one among: • Myositis (Bohan and Peter's criteria) • ILD by ATS criteria • Arthritis(clinic, X-rays, self-report) • Unexplained fever • Raynaud's phenomenon • Mechanic's hands	Anti-aminoacyl-tRNA synthetase autoantibody positivity plus (2 major criteria or 1 major plus 2 minor criteria) Major criteria: • Myositis(Bohan and Peter's criteria) • ILD by ATS criteria Minor criteria: • Arthritis • Raynaud's phenomenon • Mechanic's hands	Anti-aminoacyl-tRNA synthetase autoantibody positivity plus one among: • Myositis(overt orhypomyopathic) • ILD by ATS criteria • Arthritis or arthralgia Or two among: • Unexplained fever • Raynaud's phenomenon • Mechanic's hands

*ILD: interstitial lung disease; ATS: American thoracic society.

Table 2
shows the patient's laboratory results and indicates the normal range.

Variable	Upon admission to ICU	On admission	Reference range
Blood count and inflammation markers			
White blood cell count (x109/L)	10.98	5.43	3.5–9.5
Neutrophil (x109/L)	9.65	3.81	1.8–6.3
Lymphocyte (x109/L)	1	1.02	1.1–3.2
C-reactive protein (mg/L)	3.35	1.52	0–5
Procalcitonin (ng/ml)	16.83	0.21	0.-0.05
Interleukin-6 (pg/mL)	26.1		<7
Enzymatic detection			
Lactate dehydrogenase (U/L)	1664	593	120–250
Alanine aminotransferase (U/L)	2126	743	9–50
Aspartate aminotransferase (U/L)	3650	755	15–40
Phosphocreatine kinase (U/L)	2449	1767	50–310
Myoglobin (ng/ml)	1857	598.8	3–36
Hypersensitive troponin I (ng/ml)	0.09	0.007	0–0.05
Autoimmune antibody testing			
Antinuclear antibody	Negative	Negative	Negative
Anti-recombinant RO52 antibody	Positive(+)	Positive(+)	Negative
Anti-SSA antibody	Positive(++)	Positive(+)	Negative
Immune Cell Assays			
Total T lymphocyte count	281		723–2737
CD4+T lymphocyte count	174		404–1612
CD8+T lymphocyte count	111		220–1129
Natural killer cell count	45		84–724
B lymphocyte count	57		80–616

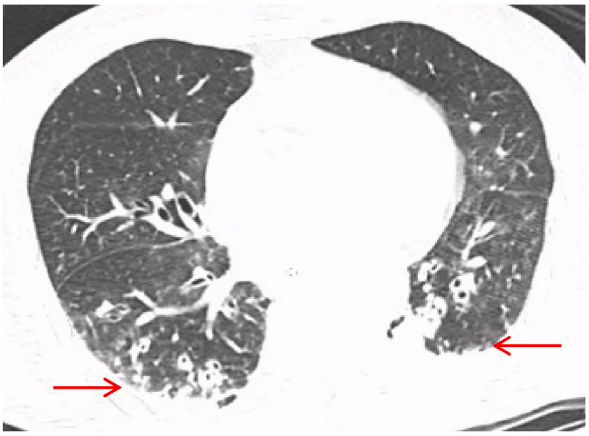

Fig. 1. Chest CT showed extracapsular interstitial changes in both lower lobes(red arrow).

pathological and clinical findings, we diagnosed the patient with ASS. The patient was treated with 40 mg of methylprednisolone sodium succinate once daily. Concurrently, compound preparations of Buzhongyiqi decoction and Shenlingbaizhu powder were administered. The formula consisted of Astragalus membranaceus (20g), Dangshen (30g), White atractylodes rhizome (10g), Fructus aurantii (10g), Rhizoma cimicifugae (10g), Chenpi (10g), Licorice (5g), Radix bupleuri (15g), Poria cocos (15g), White hyacinth bean (20g), lotus seed (20g), Common yam rhizome (30g), Fructus amomi (5g), Semen coicis (20g), Platycodon grandiflorum (15g), and Red dates (15g). All herbs were soaked in clear water for 30 minutes, boiled over medium heat, then decocted over low heat for 45 minutes, with the residue filtered out to obtain the clear solution. The patient was instructed to take 150 ml orally three times a day. Following this treatment, the patient's overall condition improved. His temperature gradually dropped to about 38 °C, blood pressure stabilized, norepinephrine was discontinued, all anti-infective drugs were stopped, and rehabilitation therapy was initiated (1 hour of limb function exercise daily). The patient's muscle strength gradually improved; he could autonomously raise his head, upper limb muscle strength increased to grade 3, and lower limb muscle strength to grade 1.

Following the diagnosis of ASS, we continued the patient on a combined treatment regimen of 25 mg/d prednisone and the aforementioned Chinese herbs. As a result the patient's mental status and muscle strength gradually improved. By week 2 of the combined treatment, the patient was fully conscious, with no difficulties in language expression or swallowing, and limb muscle strength had improved to grade 5. Our treatment plan included initiating therapy with 25 mg/d prednisone, followed by a reduction of 5 mg every 2 weeks until reaching a maintenance dose of 10 mg/d. The patient was eventually transferred out of the ICU on December 7.

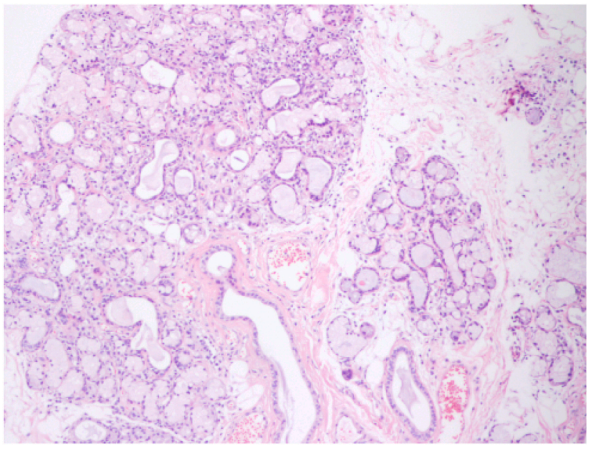

Fig. 2. The labial gland biopsy showed chronic inflammation, mild interstitial hyperplasia, and fewer than 1 lymphocyte focus, graded as grade 2 according to the Chisholm xlabial gland biopsies. *A lymphocyte focus is defined as at least 50 lymphocytes clustered within a 4mm tissue section of the labial gland.

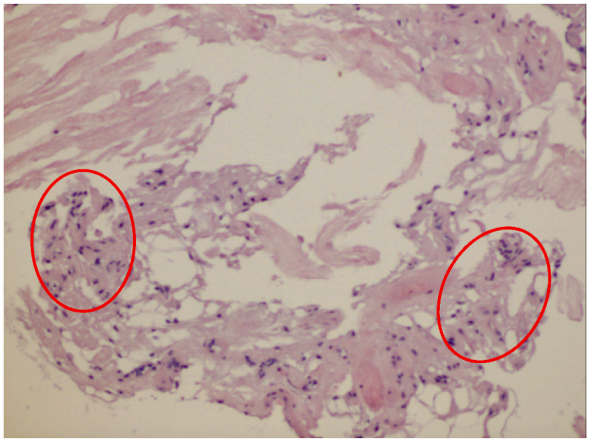

Fig. 3. A biopsy of the left deltoid muscle revealed striated muscle atrophy and degeneration, interstitial fibrous tissue hyperplasia, microfocal striated muscle necrosis, and macrophage infiltration.

3. Follow-up

During the 3-month follow-up, his activity tolerance continued to improve.

4. Discussion

Idiopathic inflammatory myopathies (IIM), commonly referred to as myositis, represent a diverse group of autoimmune disorders marked by persistent muscle inflammation. These conditions exhibit varying clinical manifestations, therapeutic responses, and prognoses [9]. Based on clinical and the identification of specific autoantibodies, IIM can be classified into four subgroups: dermatomyositis, inclusion body myositis, immune-mediated necrotizing myopathy, and ASS [10]. ASS is a prevalent subtype of IIM, typically distinguished by inflammatory myopathy, ILD, and joint involvement, though it may present with other symptoms such as fever, “Mechanic’s hands”, Raynaud’s phenomenon, and the presence of anti-aminoacyl-tRNA synthetase antibodies [11].

Some studies also suggest that isolated seronegative arthritis is a hallmark of ASS [12]. Muscle biopsy is considered the definitive diagnostic tool for IIM, revealing characteristic pathological features like perineurium necrosis and increased macrophage activity, which aid in confirming the diagnosis. As research into idiopathic inflammatory myopathies and myositis-specific autoantibodies progresses, these discoveries offer valuable insights for clinical diagnosis and treatment, ultimately enhancing patient outcomes and quality of life. Nevertheless, diagnosis and treatment must be tailored to the individual needs and circumstances of each patient.

Muscle weakness stands as the most prevalent clinical manifestation of IIM. Typically, it predominantly affects proximal muscles, including those of the shoulder (such as the trapezius and supraspinatus), upper arm (such as the biceps and triceps), and hip (such as the gluteus and quadriceps) [5]. Patients may exhibit symptoms like difficulty in ambulation and reduced upper limb strength. Among

anti-PL7 positive patients with asthma, myositis often accompanies ILD. Extrapulmonary manifestations may include Raynaud's phenomenon, Mechanic's hands, joint injury, pericardial effusion, and involvement of the esophagus or gastrointestinal tract [13]. A multicenter observational study of 18 anti-PL7 positive patients found that in addition to myositis, over half also presented with ILD, arthritis, pericarditis, fever, and Raynaud's phenomenon [14]. Anti-PL7 positive patients with asthma exhibit a higher incidence of ILD compared to those with other antibodies [15], and ILD is independently linked to mortality, suggesting a poorer prognosis for these patients [16,17]. Consequently, some individuals may experience hypoxia due to ILD, potentially progressing to pulmonary hypertension or even right heart failure [18,19].

The Anti-PL7 antibody targets threonyl-tRNA synthetase (ThrRS), an aminoacyl-tRNA synthetase that facilitates the aminoacylation of tRNA by transferring threonine. Within muscle tissue, ThrRS may inhibit Axin1 via the c-Jun N-terminal kinase (JNK) pathway, a downstream target of ThrRS, thereby playing a negative regulatory role in myogenic differentiation [2]. Anti-PL7 antibody frequently co-occur with other antibodies. A retrospective conducted in China revealed that anti-Ro52 antibody were present in 63. 3 % of 30 patients with anti-PL7 positive antibodies [20]. The anti-Ro52 antibody is an autoimmune antibody targeting ribonucleoprotein. Elevated levels of anti-Ro52 are often strongly associated with various autoimmune diseases, with Sjogren's syndrome being the most prevalent. Notably, increasing evidence indicates that the presence of anti-Ro52 antibody in patients with ASS is linked to rapidly progressive ILD [20–22]. The anti-MDA5 antibody, another autoimmune antibody, is detected in the serum of patients with follicular myositis. High levels of anti-MDA5 antibody are usually associated with follicular myositis, especially ILD related to dermatomyositis. The shared characteristic of anti-MDA5/PL7 positivity is the presence of ILD [23], and both are linked to an elevated risk of mortality [24].

The management of ASS presents significant challenges due to the paucity of evidence from large-scale clinical trials. To date, no dependable treatment has been endorsed by comprehensive expert consensus or guidelines. The primary approach to treating ASS involves immunotherapy, which encompasses corticosteroids, intravenous immunoglobulin(IVIG), immunomodulators (mycophenolate mofetil, cyclophosphamide, tacrolimus, and cyclosporine), biological agents (rituximab and tocilizumab), as well as other drugs and pulmonary supportive therapy [5,9]. For ILD, the initial treatment option may include high-dose glucocorticoids combined with IVIG, with biologics, antifibrotic agents (such as nivolumab or pirfenidone), and plasmapheresis being considered as adjunctive therapies [25]. IVIG is generally well tolerated and safe, yet its high cost remains a significant barrier to widespread use [26,27].

ASS parallels the TCM conditions known as "Bi Zheng Syndrome" or "Wei Zheng Syndrome", which are attributed to spleen and stomach weakness and a deficiency of qi and blood. The treatment strategy focuses on strengthening the spleen and stomach, replenishing qi, and nourishing blood, with formulations such as Shenling Baizhu Powder and Buzhong Yiqi Decoction being recommended. Research indicates that Buzhong Yiqi Decoction can effectively treat myasthenia gravis by inhibiting acetylcholinesterase [28], while Shenling Baizhu Powder shows promise in alleviating functional diarrhea caused by spleen deficiency in rats [29]. Hence, there is a pressing need for further development of therapeutics with potential efficacy in slowing the progression of ASS to ILD and enhancing patient outcomes. In this regard, TCM presents itself as a promising avenue deserving of thorough investigation.

5. Conclusion

The simultaneous presence of anti-PL7 antibody and anti-SSA/Ro52 antibody in patients with ASS is exceptionally uncommon. This caseindicates that an integrative approach combining traditional Chinese medicine and Western medicine could serve as a promising therapeutic strategy for ASS. Nonetheless, the underlying pathogenesis and treatment prospects for ASS still warrant further investigation.

Ethics statement

Written informed consent was obtained from the patient's family for the publication of any potentially identifiable images or data included in this article.

Guarantor statement

Ding Peng confirms full responsibility for the content of this manuscript.

Declaration of generative AI in scientific writing

Artificial intelligence has not been used in the writing process.

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Data availability statement

The data associated with our study has not been deposited into a publicly available repository yet and the contributions presented in the study are included in the article, further inquiries can be directed to the corresponding author.

CRediT authorship contribution statement

Peng Ding: Writing – original draft, Investigation, Formal analysis, Data curation, Conceptualization. **Yuan Zhou:** Investigation, Formal analysis, Data curation, Conceptualization. **Lijia Zhi:** Investigation, Formal analysis, Data curation. **Meijie Yang:** Data curation. **Kunlan Long:** Writing – review & editing. **Song Zhang:** Writing – review & editing, Investigation, Conceptualization.

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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